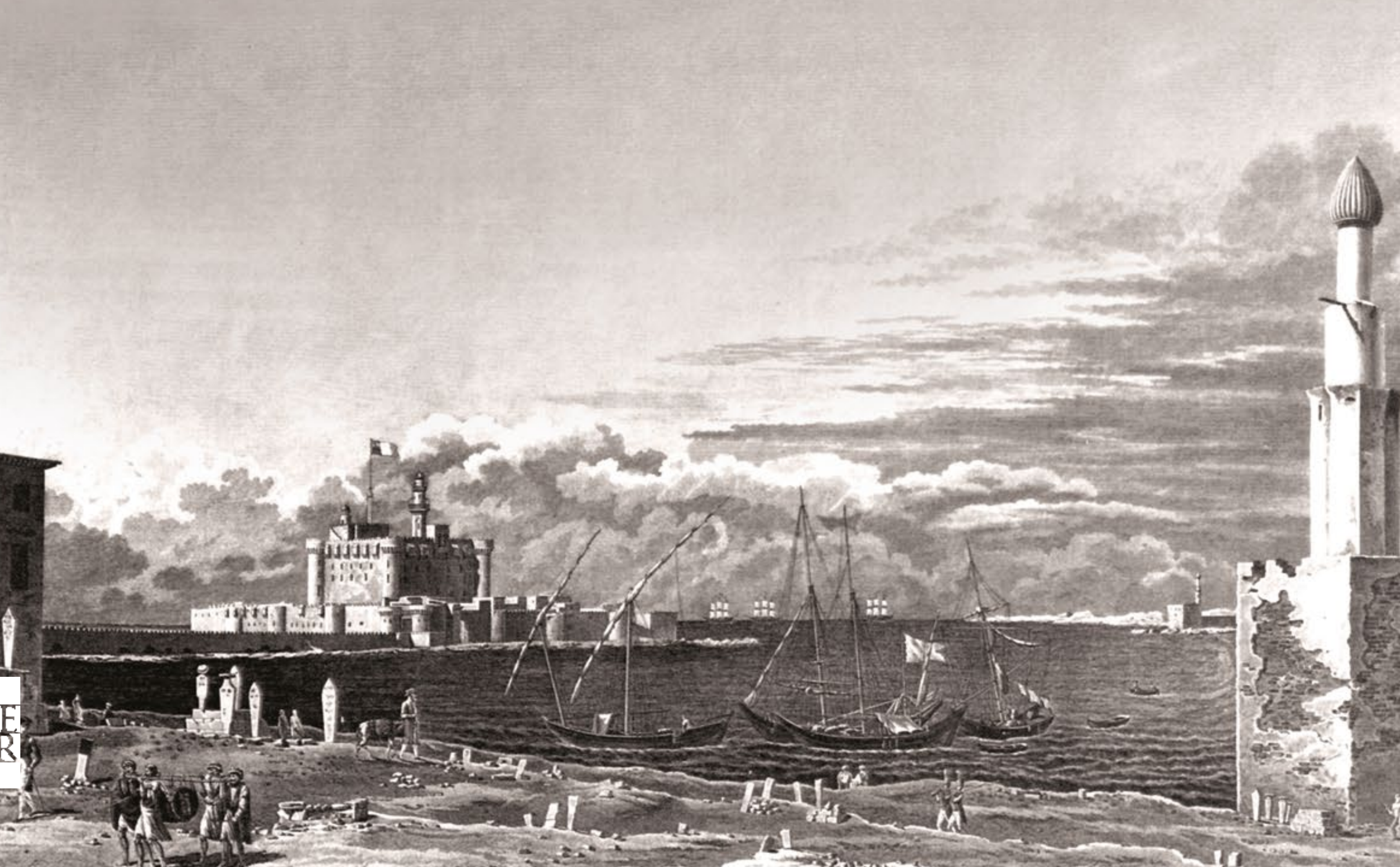
HELLENISTIC ALEXANDRIA

CELEBRATING 24 CENTURIES

Papers presented at the conference held on December 13–15 2017
at Acropolis Museum, Athens

edited by

Christos S. Zerefos
Marianna V. Vardinoyannis



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Wednesday 13 December 2017

Address by Mrs Marianna V. Vardinoyannis

UNESCO Goodwill Ambassador, President of *Marianna V. Vardinoyannis Foundatio*n,
Member of the Advisory Board of the Bibliotheca Alexandrina

Your Excellency,
Your Beatitude,
Ladies and gentlemen,

We are particularly honoured and moved to welcome you to this symbolic venue at the Acropolis Museum on the occasion of the 'Hellenistic Alexandria: Celebrating 24 Centuries' International Conference.

This day is a great moment for our Foundation, as we are embarking on an initiative of national significance on which we have been working for several months, culminating with this conference. Its aim is to draw the attention of researchers and the public to the Hellenistic world, particularly to Hellenistic Alexandria and its importance to global civilisation.

The idea for the conference was enthusiastically received by His Excellency, the President of the Hellenic Republic, Mr Prokopios Pavlopoulos, from the very first moment we brought it to him about two years ago. The idea is rooted in the heart of our Foundation's mission, which incorporates the values of culture, science and education and highlights the long friendship and historical ties that link Greece and Egypt.

Since Alexander the Great founded Alexandria in 331 BC, and with the establishment of the Ancient Library in the 3rd century BC under the patronage of Ptolemy I, to collect all the knowledge of the known world under one roof, this place has been associated with some of the greatest achievements in knowledge and culture, many of which continue to inspire awe in us all. This was because Ptolemy's vision became reality and his successors followed his example. With the contribution of ancient Greece, all the sciences flourished and the most important writings of the ancient world found a place in the Ancient Library.

The famed Pharos of Alexandria, one of the Seven Wonders of the ancient world, remains to this day its immortal symbol, which Strabo prophetically described as a mirror that reflected the light dozens of kilometres away. This light of the Hellenistic world, Hellenistic Alexandria, inspired generation after generation of scholars and scientists to reach us – 24 centuries later – here in Greece, where we respectfully pay homage to the grandeur of this massive legacy handed down to humanity. It played a role in all areas of learning, offering all that was great in human thought, modern science, culture and civilisation.

In the course of history, we are the generation that was fortunate to witness twenty-seven years ago in 1990, the historic meeting that took place in Aswan, Egypt, where the Declaration for the Revival of the Ancient Library of Alexandria was signed. With UNESCO at the helm of this undertaking, the first steps were taken to implement one of the greatest achievements in the history of the modern world. In the fifteen years of its operation, the Library of Alexandria – the Bibliotheca Alexandrina – has become a new beacon of knowledge for the entire planet. This constitutes a major contribution on the part of the Egyptian State to humanity and enjoys the complete support of H. E. the President of Egypt, Abdel Fattah el-Sisi. And we are truly grateful.

Since joining the Bibliotheca Alexandrina's first Board of Trustees, the work I follow and in which I participate makes me feel truly proud, not just as a Greek, but as a citizen of the world whose visions, discoveries, explorations and expressions found refuge in this colossal undertaking.

We wanted the light of the golden pages of the Hellenistic period and the historical ties between these two peoples to shine by establishing and funding the 'Alexandria Centre of Hellenistic Studies' at the Bibliotheca Alexandrina in 2008. Since that time, our Foundation, working through the Centre, has enabled students from all over the world to carry out undergraduate and postgraduate studies in history, literature, arts, archaeology, architecture and philosophy. At the same time, we have staged numerous events, lectures and seminars about the Library. Today's conference is a continuation of that work, as we seek to add another page in our partnership with the Library with an event of a commemorative as well as an interdisciplinary nature.

In preparing for this conference, we joined forces with the Alexandria Centre for Hellenistic Studies at Bibliotheca Alexandrina, the Acropolis Museum and the Mariolopoulos-Kanaginis Foundation for the Environmental Sciences, and invited distinguished scientists specialising in Hellenistic Alexandria. We are honoured that they are taking part in the conference, as they focus on the significance of the extraordinarily pioneering ideas of the Hellenistic years and the innovative climate prevalent of that era. The conference will address historic, as well as cultural and scientific issues, highlighting the impact of Hellenistic ideas on philosophy, art and modern science.

I would like to express my deepest thanks to H. E. the President of the Republic, Mr Prokopios Pavlopoulos, who placed the conference under his auspices, supporting it from the very first moment and who honours us today with his presence and his keynote address. His support of our effort was priceless; his personal contribution to crystallizing the philosophy of the conference invaluable; and his participation in the event reaffirms the national dimension of the undertaking with which he entrusted us.

I would like to express my sincerest thanks and highest respect for His Beatitude Theodoros II, Pope and Patriarch of Alexandria and All Africa, for being here with us today and for his blessing of our every step. His participation in our conference is a great honour for us and his contribution is valuable and so symbolic. The Patriarchate of Alexandria, founded by the Apostle and Evangelist Mark in AD 43, has a history in Egypt and Africa dating back 2,000 years, with a rich intellectual legacy, important missionary work and critical humanitarian activity. It is a major chapter in the history of Alexandria and is now represented by His Beatitude.

I would also like to give special thanks to the new Director of the Bibliotheca Alexandrina, Dr Mostafa el Feki. It is an honour and joy to welcome him to Greece and to have worked with him to stage this conference. I would like to wish him every success in this important mission he has undertaken at the Library and in achieving his visions. He can rest assured we will be his allies and enthusiastic supporters in this endeavour.

I want to extend a big 'thank you' to our co-organisers:

the Mariolopoulos-Kanaginis Foundation and its president, Professor Christos Zerefos, who, despite his heavy schedule and obligations abroad all these months, tirelessly headed our Organising Committee with enthusiasm and his well-known love for the sciences of antiquity, and was the soul of the organisational effort. And, the Acropolis Museum and its president, Professor Dimitrios Pandermalis, who has once again embraced one of our initiatives and is hosting it in this magnificent museum, while also taking part in the conference with his extensive knowledge.

I would like to thank all of those attending the conference and taking part with their talks, which will bring Hellenistic Alexandria to life for us. It is our special privilege to welcome them to Athens and share with them this undertaking, which we intend to make internationally known by publishing the proceedings.

A special thanks to the special members of the conference Organising Committee for their help in staging it and their valuable support for our work.

I thank you all from the bottom of my heart for being here with us today and honouring us with your presence, providing even greater impetus to our efforts and contributing in this way to their success.

According to the legend reported by Plutarch, Homer appeared in Alexander the Great's dream and led him to discover this blessed land – Pharos Island, in the port of Alexandria. With the certainty I feel that the legend is true, I would like to share with you in closing my deepest belief that Hellenistic Alexandria will continue to light our course and that the new Library of Alexandria will continue to serve as a depository for knowledge from time immemorial to the infinite future.

Thank you!

Address by the Honorable Dr Mostafa El Feki

Director of Bibliotheca Alexandrina

Your Excellency, The President of the Republic of Greece
Your Beatitude, the respected and blessed Patriarch of Alexandria and all Africa,
Ladies and Gentlemen,

It gives my colleagues and myself great pleasure to attend this important occasion in your beloved city of Athens, the capital of Greece.

While listening to all these speeches now, I couldn't help but feel the power of our history, and to appreciate that we all come from the same stock.

As history shows and geography proves, we are very close to each other. Greece and Egypt have always been united together. Our cosmopolitan Alexandria is the symbol of that. As you know it was founded by Alexander the Great, his successors carried on his message of civilization, and built up the city as we see it now.

I feel that during these days, whenever we use the terms 'globalization' and 'clash of civilizations', we should be reminded of the historical links between two nations like Greece and Egypt.

We always sense that the dialogue of civilizations, which is a central pillar in our quest for stronger collaboration and peace, was established through the Mediterranean centuries ago.

On behalf of the Bibliotheca Alexandrina, which is a representation of the cooperation between our two countries, I take this opportunity to thank Mrs. Marianna Vardinoyannis and her association for their support and to the Greek people as a whole.

At the end of the day, and because we believe in the message of the common civilization, we cannot talk about Alexandria without referring to the Greek contribution made towards its establishment and its decades of glory.

Now, I deeply sense the cosmopolitan spirit of this city, which has embraced Greeks and other nations and populations, such as Italians, Armenians, Jews, and so many others.

I firmly believe that the city will never gain back its identity and image unless those people who have left would come back home, and they are most welcome. As you know, human civilization does not believe in national or other barriers among humankind.

We always feel that all of you are welcome to claim back the sunny days we used to have on the land of this glorious city.

Ladies and Gentlemen,

On behalf of our President, His Excellency President Abdel Fattah El-Sisi and his government, I would like to convey Egypt's strong belief in the importance of our bilateral and historic relations, in the appreciation of how close we, the Egyptians, are to Greeks. I have always perceived that cooperation between our two countries as endless. In fact, we have never actually faced a serious dilemma in Egyptian-Greek relations throughout history. On the contrary, we have been supported by you on certain occasions, such as in the events that preceded the nationalization of the Suez Canal. It is definitely an extension of the common history between our two cultures.

Today, the Bibliotheca Alexandrina (The Library of Alexandria) is dedicated to working towards further strengthening these bonds of friendship. In this context, it is an honour to celebrate with you all '24 Centuries of Hellenistic Alexandria', which is the embodiment of a melting-pot of two nations.

Thank you, Mr President, and thank you all. I assure you that we will do our best to continue the cooperation between our institution and your distinguished country. Again, Thank you and I wish you all great success.

Address by Professor Ashraf Farrag

His Excellency, the President of the Hellenic Republic, Mr Prokopios Pavlopoulos
Mrs. Marianna Vardinoyannis, Goodwill ambassador of UNESCO, founder and president of the Marianna Vardinoyannis Foundation
Diplomat and political thinker, the Hon. Prof. Mostapha El Fekki, Director of the Library of Alexandria
Professor Dimitrios Pandermalis, President of the Acropolis Museum
Professor Christos Zerefos, The Academy of Athens

Ladies and Gentlemen ... Good Evening ...

It is my pleasure to talk to you tonight on behalf of Professor Essam El Kordy, President of Alexandria University, who apologises for not being able to attend Athens tonight due to unforeseen circumstances requiring his staying in Egypt. I convey to you his greetings and gratitude for the kind invitation to attend this very important conference and speak at the opening ceremony.

We are meeting today at this conference to celebrate together twenty-four centuries following the foundation of 'Hellenistic Alexandria', the cultural and scientific capital of the world. This unique model in human history that was a result of Egyptian-Hellenic (and Hellenic-Egyptian) cooperation since ancient times.

'Hellenistic Alexandria' emerged as a model for dialogue between civilizations, the mingling of cultures and knowledge, the science of East and West, in one source.

On the landscape of ancient Alexandria in the 3rd century BC, the dream of Alexander the Great was fulfilled, and from Alexandria began his great civilizational project to create a cosmopolitan city; a true global polis with a mixed universal population.

The result was a scion from which a cornucopia of knowledge emerged, with no similar example in the history of human thought; and the greatest boon from this scion was the ancient Library of Alexandria (Bibliotheca Alexandrina) and its Museum (Mouseion). This Museum, or the ancient University of Alexandria, was the offspring from the Library, as opposed to our modern times, whereby libraries derive from within universities.

The 'Mouseion', or the ancient university of Alexandria was the product of the great revolution in knowledge that took place in Alexandria in the 3rd century BC, and which was to become the destination of all the most famous scientists, thinkers and artists, induced there by King Suter from all over the world and encouraged to stay in Alexandria. This enlightened ruler provided them with all the comforts and placed in their hands everything they required to help them to think, create, invent, and innovate.

Suter, and then Philadilphos, devoted considerable resources to the acquisition of the most important and valuable books and documents. They also paid attention to science and scientists, allocating open budgets to thinkers and scientists to attend and work at the Museum. The accommodation included study rooms, offices, courtyards, roads, and gardens for the scientists and their students, all very equating to a modern university 'campus' environment. In addition, the Museum had a wonderful facilities and residential areas for the scientists and their families. It seems that all the costs were met for educating the children of the scientists, including their food and clothing.

As a result, 'Hellenistic Alexandria' was to become the cultural and scientific capital of the world without a rival. And thanks to the Library and its Museum, the era was one of progress, prosperity, invention, and innovation in all fields of knowledge and science.

Thus, we can see, Ladies and Gentlemen, that 'Hellenistic Alexandria' was a unique model of cooperation – Egyptian-Hellenic/Hellenic-Egyptian – a model for true dialogue between civilizations, and one which aims to promote peace and security among nations and peoples, and to fight ignorance and blind intolerance, to address radical thought and the shadow of terrorism.

Thank you very much.

Address by Professor Dimitrios Pandermalis

President of the Board of Directors, Acropolis Museum

Mr President of the Republic,

It was a great pleasure for the Board of Directors of the Acropolis Museum to accept the invitation of the 'Marianna Vardis Vardinoyannis Foundation' to host this conference, a conference about Alexandria, a celebrated city for which there is rich historical information but extremely limited archaeological evidence. Accordingly we welcome every new find and every new detail enthusiastically making this Conference all the more important for the field.

I would like to mention that in addition to the Museum's hosting of this significant event, we have also chosen to extend the Conference theme to our visitors: the video you enjoyed moments ago, is an Acropolis Museum production and will be shown to our thousands of visitors with its screening on the large video screen in our lobby up until Christmas. As is this Conference, the Museum is celebrating Alexandria. In this context I would also like to thank the filmmaker Costas Arvanitakis, for his cooperation and the intense work we undertook to produce the video, completing shoots within the 48 hours that we were in Alexandria. Of course there was considerably more work involved in producing the final product including the need to undertake on-site research about the correct interpretation of what we were saw in Alexandria, I won't tire you with many details, but I would like to mention two examples, which are interesting instances of Alexandria's art in the Hellenistic period.

Earlier you saw this mosaic floor (Figures 1 and 2). It consists of two pieces that belong to the same building. They were discovered in 1993, during the laying the foundations of Bibliotheca Alexandrina. Their quality is obviously

Figure 1

superb. They are most probably linked to the 'androns' (rooms for men) – at least this is what we concluded from the restoration we saw in the *Bibliotheca Alexandria* – and their subjects are very interesting: scenes from everyday life. The first offers a brief look into the *palaestra* in a scene that would have part of real life in Alexandria at the time. The bodies of the wrestlers are rendered in remarkable detail. One is black and the other is white, and all the features of their bodies are rendered with realism. Next to the wrestlers, is the basin where the wrestlers would wash after a fight.

The second part of the mosaic depicts a monumental image of a dog with particular characteristics. First of all, and most notable, is its intense gaze. The configuration of its snout is extremely interesting, and beside it there is an object, some sort of vessel, which the dog has probably knocked over. Several interpretations have been made about this object, but it is clearly a vessel with a special purpose that we have come upon in other findings. Coincidentally, we very recently had the opportunity to host two such vessels in the Acropolis Museum exhibition *The Oracle of Dodona*. One of those, which bore an inscription mentioning the *agonothetes Machatas Parthaios*, who hailed from a region in the northern part of Epirus, had been dedicated to the Oracle of Zeus in Dodona. Clearly the use of a similar vessel in a dedication to the Oracle indicates its specific significance for athletic contests. Examining the details of this find you observe that the handle is missing; however, restoration is possible by following the image depicted in the mosaic. The interpretation one might offer for this image is, of course, neither of a mythological nor of any other erudite nature. Once again, we have a depiction of an aspect of everyday life. It seems that the vessel in hand contained something that drew the dog's attention; the canine reached for it and, in doing so, knocked the vessel over. Hence its guilty sideways look towards the spectators. This is a living moment, an illustration capturing a moment of everyday life, and it is very characteristic of the art of Alexandria.

Figure 2

The second art work I would like to mention is this statuette of *Aphrodite* (Figures 3 and 4), an art work that was discovered in the greater region of Alexandria and seems to have been very popular in the ancient world – there are nine copies of it in Alexandria alone, while a study published in 1970 mentions the existence of 180 copies in all. Research has shown that the original, of which this is also a copy, dated from the Hellenistic era, while the one we see here dates from the late 2nd century AD. What is of particular interest is something that was discussed thoroughly in the research: of course, the statuette represents Aphrodite, but what is questioned is whether she is shown before or after taking her bath. Now, someone might ask: Does it matter? For purposes of interpretation, yes, it does.

Figure 3

Figure 4

Look at Aphrodite's sandal. This particular copy of the Bibliotheca Alexandrina features a unique element: under the sandal. We can see a set of fingers. The fingers belong to a second Eros, of whom only the feet have survived and who is trying to help Aphrodite put on her sandal. This is a very attractive image, which affords the goddess even greater prominence in the eyes of the viewers of that time.

These art works are but a small sample of the urban art of Alexandria. Alexandria was in fact the first major urban centre of antiquity. It has been estimated that about one million people used to live there during the late Hellenistic years, and Alexandria was the first instance of an ancient city functioning on the basis of a model similar to that of an organised modern city.

I believe that such art works render the art of Alexandria particularly appealing; and I believe that it was not by coincidence that while the entire Roman Empire was divided into provinces under the Senate, Egypt and Alexandria became the personal property of the Emperor.

I would like to take this opportunity to thank my colleague and academic Christos Zerefos, with whom we enjoyed an excellent collaboration. I would also like to mention that I was quite delighted and surprised: we've known each other for many years and I am aware that he is an expert in the natural sciences, but I had no idea that he is also a musician! (The composition you heard in the video was by Mr Zerefos.)

I would also like to thank the 'Marianna Vardis Vardinoyannis Foundation', the 'Mariolopoulos-Kanaginis Foundation', the Bibliotheca Alexandrina, and all my colleagues from Egypt, from Alexandria: Dr Mostafa El Feki, Dr Mohamed Kenawi, Mr George Kyriakos Mark, the architect Dr Mohamed Awad, and, of course, for the automaton you saw earlier, Prof. Tassios, who is with us, and Prof. Manolis Korres, who implemented the project.

Mr President, I think that the conference's success is a given. Your presence serves to show and underline the importance of this conference. And we all wish this conference all the best.

Thank you very much.

Why Hellenistic Alexandria?

Address by Professor Christos Zerefos

Academy of Athens

Your Excellency Mr President,
Your Beatitude Pope and Patriarch of Alexandria and All Africa,

The selection of the Conference title by its organisers was based on two criteria. Firstly, on the Egyptiot's sentiment and, secondly, on the great revolution in Sciences, Art and Letters which began in the Alexandria of the Ptolemies. Egyptiots (Greeks from Egypt) remember the August moonlight that was worshipped as the goddess Isis, showering all Egypt, the Nile and the country's north coastline. They remember the biological luminescence on the coastal areas of Egypt with the diffuse underwater green light from the aquatic organisms there. They remember glorious times extolled by great poets, artists and music composers. Many of us remember our youth. However, we also remember, according to Lucio Russo, the forgotten revolution in sciences which, unfortunately, had the same fate as the Hellenism of the Diaspora.

After the death of Alexander the Great, the vast empire that he created was ruled by the dynasties of his three generals – Ptolemy, Seleucus and Antigonus. The Ptolemaic Dynasty, with Alexandria as its capital, ruled Egypt, Cyprus, Cyrenaica, Phoenicia and Palestine. The Seleucid Dynasty, with Antioch as its capital, ruled Syria, Asia Minor, Mesopotamia and Persia. And, finally, the Antigonid Dynasty ruled the Macedonian kingdom and certain cities of Greece. It is worth noting that the Greek Diaspora was also followed by the diaspora of Art and Science throughout the former empire of Alexander the Great. From Marseilles to Syracuse, in Rhodes to Bactria, Greek civilization, as well as the technology that had been developed, mixed with that of the ancient civilizations of Egypt, Mesopotamia and India. The culmination of the Hellenistic spirit that triggered the renaissance and enlightenment of Europe traces its roots in Alexandria. It was there that the first university was established, where arts, letters and sciences were worshipped in the renowned premises of the Muses, the Museum. The first director of the Museum was Demetrius of Phalerum, but it is unclear who the last one was, after whom the Museum's activities fell silent. Knowledge was then transferred to Antioch, from where, following the Arabic conquest, it moved to the West via Spain and was diffused through the Ottoman and Arabic worlds during the Middle Ages.

If Samos saw the birth of the Pythagorean Theorem in 5th century BC, Alexandria saw the birth of Geometry by Euclid, as well as stereometry of conical sections by Apollonius and Theon. It was in Alexandria that Statics and System Mechanics were begun by Archimedes. It was in Alexandria that automatons sprang up, and Aristarchus' of Samos heliocentric Astronomy was spread. It was in Hellenistic Alexandria that Optics and Hydrodynamics were conceived by great scientists such as Archimedes, Euclid, Ctesibius, and many others. When the science of Optics was at its peak, there appeared one of the Seven Wonders of the Ancient World, the Lighthouse of Alexandria, whose fame was due to its mirror transmission system of light over a great distance, from either the sun or fire. Unfortunately, the catastrophic earthquake of AD 365 and the efforts to repair the Lighthouse some 1,000 years after its construction eliminated every trace of the renowned mechanism, which was also a government secret, as shown by the lack of sources interpreting this scientific wonder at that period. The science of indeterminacy in mathematics by Diophantus, as well as Pappus' theories, were also started in Alexandria. The city is also the birthplace of Physiology, as the foundation of Medical Science, by Herophilus, and his School developed the results of knowledge via osmosis from Pharaonic embalming to the creation of Anatomy as an experimental science. Pharmacology developed here to such an extent that, towards the waning of the Hellenistic period, Cleopatra gained profound insights into Botany and Pharmacology. The science of Geography and coordinates were born in Alexandria. Claudius Ptolemy, in now Imperial Alexandria, writes his famous 'Mathematical Structure', translated as 'Al Magest' (The Greatest) by Arab scholars centuries later. Arts continue the tradition of Classical Greece, while Music encourages instruments. Alexandria witnessed the first keyboard-wind instrument, the *hydraulis*, built by Ctesibius. Scenography, the Theater, and all aspects of advanced culture were to find no more fertile conditions for development than those of the Hellenistic Period.

Mr President, Your Beatitude,

The works of the anniversary Conference for the ‘24 Centuries of Hellenistic Alexandria’ are based on thirty-two presentations by the most distinguished scholars on issues of Hellenistic Alexandria covering the fields of History, Archaeology, Philosophy, Literature and Arts, as well as the Sciences of Medicine, Technology, Culture, Law and Environmental Sciences.

At this point, I would particularly like to stress the great importance of certain significant extreme environmental events in the development of the Hellenistic Age. These events will also be discussed in the Conference for the first time, together with historic events. For example, the Library, the Museum and the Lighthouse of Alexandria were destroyed by the huge tidal wave that destroyed Alexandria in AD 365. The fragments from the ruins of ancient Alexandria were illustrated by Napoleon’s engineer, Gratien Le Pere, who, when he landed at Alexandria in 1803, walked everywhere among the débris of ceramics, glass fragments, and marbles.

Le Pere writes that he encountered a ‘field of ruins’, where two small hills protruded. These had formed as a result of the collection of all sorts of fragments on the orders of Selym in 1517, as mentioned by Leo of Africa in his homonymous textbook. The same author also reports to have found eighty-eight mosques, six hundred guilds for textiles, thirty soap industries that imported oil from the Peloponnese, Crete and Syria, as well as small industries processing red leather from goat hides. He met 8,000 souls, and paced the trade bazaars and docks, with the port of Alexandria handling imports of wheat, rice, coffee, and other commodities from as far away as India. A warehouse-city without fresh water, however, an abandoned city in many regards. Approximately three hundred years after Leo, in 1833, Robert Curzon described a scene in a central street of Alexandria, which astonished him. He writes that he saw hundreds of half-naked men selling ‘moya’ – water to thirsty passers-by for a few coins. The famous underground water supply network in the city of the Ptolemies had run dry centuries ago.

Hellenistic Alexandria had almost vanished, not only in the mists of time but also in the depths of the sea: the results of the gradual submergence of those areas in the Rosetta region, which are now the underwater realms of the Greek, French, and other archaeological missions who have been working continually in the search for drowned evidence of Alexandria’s legendary past.

I hope that one day, today’s hints that many significant monuments of ancient Alexandria lie submerged outside its ports will be confirmed and once again radiate in the Mediterranean light, so that the grandeur of that glorious period of Greco-Egyptian civilization we are all so proud of, can once again be celebrated.

In conclusion, I would like to thank the Members of the Conference Organizing Committee, the various Foundations that have lent us their support, and especially the organizational secretariats of the Conference for their exceptional contribution to its success.

Address by His Beatitude Theodoros II

Pope and Patriarch of Alexandria and all Africa

Mr President, my friend,
Dear Children,

Today, Alexandria borrowed a felucca from the River Nile. And tonight, Alexandria is telling us: ‘Come, come to me, discover me, love me, perambulate me humbly.’ Together with the poor Egyptians, eating their pita bread and inviting you to join them: ‘fatteh – come, share it with me.’ This is Alexandria, dear President, dear children.

And I am glad because, a week ago, I was in the frozen St Petersburg and, as I was talking with the Mayor, I said to him: ‘Mr Mayor, look at all these statues that adorn this space. They are all from Hellenistic Alexandria.’ This is the city’s mystery and sacrament, this is her love. And it is a sacrament that invites us to discover her every day – for you cannot discover her if you do not love her.

Dear President, in that short film that was screened earlier, we saw the cemetery where our great benefactors have been laid to rest. Every Good Friday, all alone, I put aside my patriarchical staff, pick up a thurible and walk around the graves. ‘Mr Konstantinos’ – I went to him again this year – ‘I have not forgotten you.’ For you can never take farewell of Alexandria when you love her. And then, I put on my vestments, the few Greeks that are left here gather together, we all pick up the Epitáphios and circumambulate the church of Evangelismós. And I do the same from one church to the next, sounding the bells to make the Greek voice heard.

So, from the bottom of my heart, before I return to Alexandria, I want to extend to you my great, great gratitude.

Dear President, Your Excellency, you spoke as a true Alexandrine sage. ‘Dear Lord,’ I thought to myself while listening to your words, ‘I wish he would keep talking and never stop!’ Such is your love and wisdom. And upon my return to Alexandria, I will go to the Ptolemaic underground galleries at the Patriarchate, and I shall see Hypatia telling me: ‘Mr Theodoros, I am holding the cone and seek to support my theorems.’ I shall see the Ptolemies, their aqueduct underneath, prompting me: ‘Come, keep us company for History’s sake.’

Two months ago, I had a discussion with President Sisi, and he told me: ‘I love Greece, I love Cyprus. The triangle formed by our three countries must illuminate the world.’

Dear President, Father of Hellenism,

All we expatriate Greeks, who live all over the world and carry Greece in our hearts, carry its grandeur and convey it across the globe, are grateful to you.

Dear Marianna, lady of our throne,

You give hope to the children of the world, like I do to the children of Africa, the children of Egypt. But you also shed light on knowledge, on the sciences, and we thank you from the bottom of our hearts.

Dear Director, beloved friend,

The great Bibliotheca Alexandrina waves in salute to our library, the patriarchal library, with its 50,000 manuscripts, which will come very soon, with the help of the Greek State and our dear Egypt and your own library and the A. G. Leventis Foundation, revamping mathematics and philosophy. This entire building, which Dr Awad and we constructed with so much love and so much toil, over a period of three years. May you always be well.

Dear Christos, my dear Academic,

You, the Greeks of Egypt, the Egyptiótes, are the children of Egypt, who have drunk her water, who honour the arts and sciences but never forget that you were born in this beautiful country, our dear Egypt. And we thank you for never forgetting our beautiful country, the queen – now old, but always a queen. May you always be well and happy.

My friend Dimitris Pantermalis,

We thank you that the Acropolis Museum will be presenting our dear Alexandria.

And upon returning to Alexandria, my dear Mr President, I shall go to Abu Qir and I shall ask the waters: ‘Is King Alexander still alive?’ And the waters shall respond: ‘He is alive and well and ruling over the world.’

Thank you, my children.

Address by H.E. Prokopios Pavlopoulos

President of the Hellenic Republic

Your Beatitude,
Mrs Vardinoyannis – my friend Marianna,
Mr Pantermalis – my friend Dimitris,
Mr Zerefos – my friend Christos,
Mr Director of the new Library of Alexandria, the Bibliotheca Alexandrina,

Two years ago, in the summer of 2015, during what was a difficult time for both our country and me personally, as you can imagine, I received a visit to my office from Marianna (please, pardon the first-name basis, but this is how I truly feel), Christos and the Director of the Bibliotheca Alexandrina at the time, who asked me to consider the possibility of organizing this conference, which we are currently attending. For me, this was truly a means of escape and a way to draw strength, because it is through initiatives such as this one that one may see the power of Greece, the power of Hellenism – through Hellenistic Alexandria. Thus, from that point forward, we embarked on a journey that brought us to this destination, today's occasion, which is an end as well as a beginning, for I am certain that this conference marks the onset of many more in this direction. Probing into the history of Alexandria, its twenty-four centuries of uninterrupted cultural history, is a never-ending task. And one that begins today.

So, I would like to take this opportunity to thank the Marianna V. Vardinoyannis Foundation, the Acropolis Museum, Dimitris Pantermalis, the Mariolopoulos-Kanaginis Foundation for the Environmental Sciences, Christos Zerefos and, of course, the new director of the Bibliotheca Alexandrina who is here with us today.

Twenty-four centuries of history, history and culture, of a city that remains to this day, and will remain forever, one of the brightest jewels on the crown of world culture and the history of civilization. And even if it currently lacks in radiance, its glow from the past is leading us towards the future. For what transpired, as explained by Mr Zerefos, during that period, the Hellenistic period, in sciences and art, was the opening up that enabled us to get where we are today. And, if you will, to be able to go even further ahead from where we are today.

Many ancient cities had the misfortune of living in a myth, so to speak. They were discovered by accident and we don't know much about them. But about Alexandria, despite the tremendous destruction inflicted upon her by the earthquake, we know plenty. We know plenty, from the day she was built until the day that she collapsed. We learn plenty from what has been done and is yet to be done at the level of excavations, both terrestrial and underwater. We are fortunate enough to know how the city was built thanks to a compelling testimony: that of Arrian of Nicomedia in his Anabasis of Alexander, where he describes how Alexander built Alexandria in 331 BC – a part of Arrian's book that is well worth reading. How, when Alexander reached the Nile Delta he marched on westwards, between the Lake Mareotis and the island Pharos, to indicate the site where Alexandria would be built. And – could this be fiction? I don't think so, seeing as it was written by Arrian – how Alexander, having no other means to indicate the delimitation of the city walls, poured flour to draw the white line demarcating the walls of the first city of Alexandria. Thus, Alexandria was built in 331 BC by the great city planner Deinocrates of Rhodes. It was built to the west of the Nile Delta, between the lake Mareotis and the island Pharos, site of the ruins of the ancient Egyptian Rhakotis.

The good fortune of Alexandria does not limit itself to Alexander the Great. The good fortune of Alexandria also includes Alexander's successors, the Diadochi. And most of all, the Lagids and Ptolemy I, Soter, founder of the Ptolemaic dynasty and ruler of Egypt (323-285 BC) who, during the Wars of the Diadochi – also known as the Wars of Alexander's successors – was the keeper of Alexander's remains, a symbol of power at the time, which he carried to Alexandria. Since then, Alexandria became, during the time of the Lagids and for some time thereafter, the centre of all things left behind by Alexander the Great from his great conquest. Thus began the history of Alexandria, with the splendour of the Ptolemies of that time.

The city was built up quickly. We already know plenty about what took place there, what the city's major landmarks and monuments were. We know the significance of its port – the greatest port of antiquity, as Alexandria was also, at one time, antiquity's largest city in terms of population. We also know about the Pharos, the great lighthouse of Alexandria, said to have been designed by Sostratus of Cnidus. But, of course, as Mr Zerefos pointed out earlier, we do not know the secrets of this lighthouse, the light of which was visible from some thirty miles away, limited only by the curvature of the earth – which also goes to show the calculating capacity of the time.

We also know about the Library of Alexandria, this stunning structure, the first major treasure trove of knowledge, featuring some five hundred thousand papyrus scrolls of its time. One may easily understand, Mr Director, what the significance of the Library of Alexandria was and what a heavy burden we all carry, not only the people of Egypt but the entire humanity and especially we the Greeks, to restore, even symbolically, this library as a centre of constant emission of knowledge.

It is also known that Alexandria was the first cosmopolitan city that humanity has ever known. Such was the power of its cosmopolitanism, such was the power of assimilation by osmosis of people and knowledge, that the term 'Alexandrine' came to signify the lack of a localised origin of knowledge and Alexandria came to be identified as a place affording its inhabitants a special status, especially if they are interested in knowledge. And this went on for many years. And even today, when we describe someone as 'Alexandrine' (at least, in Greek) we are referring to his or her Renaissance-type attitude toward knowledge. Or we are referring to someone of particular significance in matters of the intellect in any way. Let us not forget, that the first person who comes to mind when we hear the word 'Alexandrine' is the great Greek poet Constantine Cavafy.

Alexandria brought together all the knowledge accrued since the time of Ionia, Athens and the Golden Age. That was where all this knowledge was synthesised, resulting in an explosion of the sciences and the arts. A boom, which actually marked the transition from antiquity and the birth of science to its subsequent development. That was the time of the greatest scientific discoveries, which still guide us to this day, in terms of scientific method.

I don't think that I could list everything that took place at the time – besides, I am not an expert. This is what this conference is for. And I see among you leading scientists, who I am certain shall help us embark on this great journey of discovering Alexandria and learning what it left behind for us, its legacy, and what we can achieve in the future. So, in view of their expertise, let it suffice for me to say that there are certain pieces of writing that have fascinated me since the time when I, too, mostly from the viewpoint of my discipline, was looking into what transpired in Alexandria at that time.

One of these reads, for example, which I would highly recommend, is the well-known study Science Awakening by the great Dutch mathematician Van der Waerden. Published in Greek by the Crete University Press (CUP) in 2010, the book's title brings to mind what Max Weber had said when he spoke of the birth of science in Ionia and Ancient Greece, pointing out how that was where and when the world left myth behind, or, in other words, when he spoke of the 'disenchantment of the world' (die Entzauberung der Welt). It is that same 'disenchantment of the world' that Van der Waerden proposes as the 'awakening of science'. Science was awakened at the time. It had already been created, but, over the course of Ionia and the Golden Age, it remained in a state of torpor or hibernation. It took the mediation of the Hellenistic age to awaken it; it took Alexandria.

In his book, Van der Waerden describes all the marvellous developments that took place at the time, in the field of philosophy – how philosophy was reborn, from Aristotle to Theophrastus – and, particularly, in the glorious field of the sciences, and, most importantly, of mathematics. For if we really want to prioritise things in the progress of humanity, we will find that the greatest breakthrough was effected in natural sciences and mathematics, primarily through the work of Archimedes, Apollonius, Aristarchus, and Eratosthenes. And in the discipline of astronomy, through the work of Hipparchus and, of course, Ptolemy himself, as is well known.

Before closing, I would also like to mention another book, by one of our own, a great Greek scientist, a great mathematician, a great Alexandrine. I am talking about the mathematician Dimitris Christodoulou.

Dimitris Christodoulou gave a lecture in 2012, in which he talked about mathematics in ancient Alexandria, focusing on the contribution of Archimedes and Euclid. Dimitris Christodoulou was, and still is, a mathematician who crossed over and beyond the narrow confines of mathematics, delved into the general theory of relativity and, of course, ventured into hydrodynamics – a field, which, as you know better than I do, is directly linked to the discipline of mathematics – and analyzed the contribution of Archimedes at that time. No other instance in the history of science saw greater progress in knowledge by a single man than the progress achieved by Archimedes: from the geometry of the sphere to hydrostatics, a discipline cultivated by Archimedes, not only at the level of theorems, but also at the level of proof. In order to truly grasp the importance of all these things, let us not forget that the 'Antikythera Mechanism', which is known to be based – at least, as per the prevailing opinion – on matters of hydrostatics was, in all probability, also a creation of Archimedes or his successors or, in any case, a mechanism that was created on the basis of the achievements of Archimedes at that time.

Through his book, Dimitris Christodoulou is showing us how important the thought of Archimedes was, one of the greatest representatives of the Hellenistic are, if I may say so, and how important the salvation of his work by the Library of Alexandria was; how that time witnessed the promotion of the science of mathematics, as it was later passed on to the hands of the Arabs during the Renaissance, and, as the science of mathematics progressed, as an instrumental tool in the service of all the natural sciences. For, as you well know, without mathematics, without geometry, the other sciences could not advance, at least not at the level of proving their accuracy and correctness, when we know the difference between mathematical logic and the factual logic of the natural sciences.

All this was born in Alexandria. As I said: a great explosion took place in Alexandria at the time, a 'big bang' of human knowledge. Knowledge, science, was created in Ionia and cultivated in Athens; but I am telling you for a fact: the great boom took place during the Hellenistic age in Alexandria. And it was the aftershock of that explosion that fertilised the entire course of sciences and the arts, all the way to the present day.

This conference marks the beginning of exploring this fascinating twenty-four-century-old history. Hence, its significance is self-evident. As I said in the beginning, I believe that this conference also marks the start of many more events in this direction. We are all fortunate to be here today. There will come a time, when a series of such conferences will be well underway, when we shall be unveiling and discovering Alexandria, not only at the level of its ruins, but also at the level of the knowledge it bequeathed us, that we shall look back to this day, when we were fortunate enough to be here and experience these moments; what is more, at such a difficult time, not only for our country, but for the entire region that is being sorely tried. And such events are precisely what we need in order to be able to become inspired during such challenging times.

Once again, I thank you all very much.

Part 1

Archaeology, History, Philosophy, Literature, Art, Cultural Heritage and Legal Issues

New data concerning the foundation of Alexandria

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Recent archaeological discoveries in Alexandria and its environs have led to a reconsideration of the conditions affecting the settlement of Greeks around Lake Mareotis. Beyond the myth of the new capital's foundation by Alexander the Great, certain realities appear to shed new light on the well-known and oft-cited ancient texts. In this article we intend to reinterpret the conditions at the foundation of Alexandria, with particular reference to the question of the city's population, based upon new data revealed by the interventions of archaeologists.

The discovery in 2008-2009 of a sanctuary to Bastet in the centre of modern Alexandria is of prime importance (Figure 1). The reader should refer to the article by

Figure 1. Location plan of the Boubasteion of Alexandria. C GI C. Shaalan.
© Archives CEAlex/CNRS. Publlished in Abdel el-Maksoud, Abd el-Fattah, Seif el-Din 2012: 428, Figure 1 (see *supra*, Note 1).

Figure 2. The Bubasteion of Alexandria, young boy seated. Alexandria, reserves of the SCA at Shallalat, inv. 334. Photo A. Pelle, © Archives CEAlex/CNRS. Published in Abdel el-Maksoud, Abd el-Fattah, Seif el Din 2012: 442, fig. 23.

M. Seif el-Din in this volume.[1] We will not repeat the content of her discussion, with which we fully concur, but we shall try to reflect upon the consequences of a discovery of such major importance on our knowledge of the state of the town of Alexandria just a few decades after its foundation. Indeed, this is one of the most significant new archaeological finds since the beginning of excavations in Alexandria. We should celebrate the urgent salvage intervention mounted by the Supreme Council for Antiquities; without this excavation in particularly difficult conditions, we would have known nothing of one of the oldest temples of the town, which dates from the first waves of immigration.

Most unexpectedly, this sanctuary is not dedicated to a Greek divinity but to an Egyptian divinity. The ancient sources tell us that Alexander himself chose the sites of the temples; this applied to the Greek temples and also the Egyptian, in that he selected the place where a temple to Isis was to be constructed.[2] This great Egyptian goddess had long since been adopted by the Greeks, and a sanctuary of Isis had been established at Piraeus some years before the foundation of Alexandria.[3] But what can we say of Bastet, the cat goddess of the Delta, whose cult had barely spread beyond the frontiers of Egypt especially at such an early date? This Bubasteion was in fact intended for Greek visitors as is demonstrated by the four *favissae* filled with ex-votos, the initial publication of which gives a good idea. These deposits held more than thirty statuettes of young boys and girls, mostly of limestone (Figure 2), one of marble with Greek inscriptions, a further thirty-odd statuettes of female cats in limestone and about 500 terracotta female cats. Some cats are alone, others are suckling kittens (Figure 3a-b) or playing with a duck. The first question to be asked concerns the nature of these Greeks who established a cult to a child-protecting Egyptian divinity in Alexandria when the city had just been founded. This discovery shines a new light on the peoples who settled in this new town. These Greeks arrived with their cults already well anchored in Pharaonic religious traditions, and thus they had been settled in Egypt for certain length of time.

We should be very glad of this exceptional discovery for its novel additions to the history of Alexandria and the city's settlement. At the same time, we regret that sufficient time was not granted to the archaeologists to fully explore this site, which has now disappeared beneath twenty storeys of modern building.

[1] On the excavations of the Bubasteion, see also M. Abd el-Maksoud, A. Abd el-Fattah, M. Seif el-Din, 'La fouille du Boubasteion d'Alexandrie: présentation préliminaire', in *L'enfant et la mort dans l'Antiquité, III. Le matériel associé aux tombes d'enfants*, proceedings of the international roundtable held at MMSH, Aix-en-Provence, 20-22 January 2011, A Hermary and C. Dubois (eds) *Bibliothèque d'archéologie méditerranéenne et africaine* 12. 2012: 427-446 (henceforth cited as M. Abd el-Maksoud, A. Abd el-Fattah, M. Seif el-Din 2012); M. Abd el-Maksoud, A. Abd el-Fattah, M. Seif el-Din, 'Foundation Deposit Plaques from Boubasteion' *Bulletin de la Société Archéologique d'Alexandrie* 49. 2015: 133-153. See also A. Abd el-Fattah, 'A Preliminary Report on Archaeological Works Carried on a Hellenistic Site at Kom El Dikka', *Bulletin de la Société Archéologique d'Alexandrie* 48. 2009: 25-49.

[2] Arrianus, Anabasis, Book III, I, 11; 'Therefore he (Alexander) was seized by an ardent desire to undertake the enterprise, and himself marked out the boundaries of the city, pointing out the place where the agora was to be constructed, where the temples were to be built, stating how many there were to be, and to what Greek gods they were to be dedicated, and *specially marking a spot for a temple to the Egyptian Isis'*.

[3] J.D. Mikalson, *Religion in Hellenistic Athens*, University of California Press. 1988: 143: foundation of a temple to Isis in Piraeus before 333/332 BC.

Figure 3a-b. The Bubasteion of Alexandria, young girl holding a cat nursing its young in the folds of her skirt. Alexandria, reserve of the SCA at Shallalat, inv. 205. Photo A. Pelle, © Archives CEAlex/CNRS. Published in Abdel el-Maksoud, Abd el-Fattah, Seif el Din 2012: 444, fig. 28a-b.

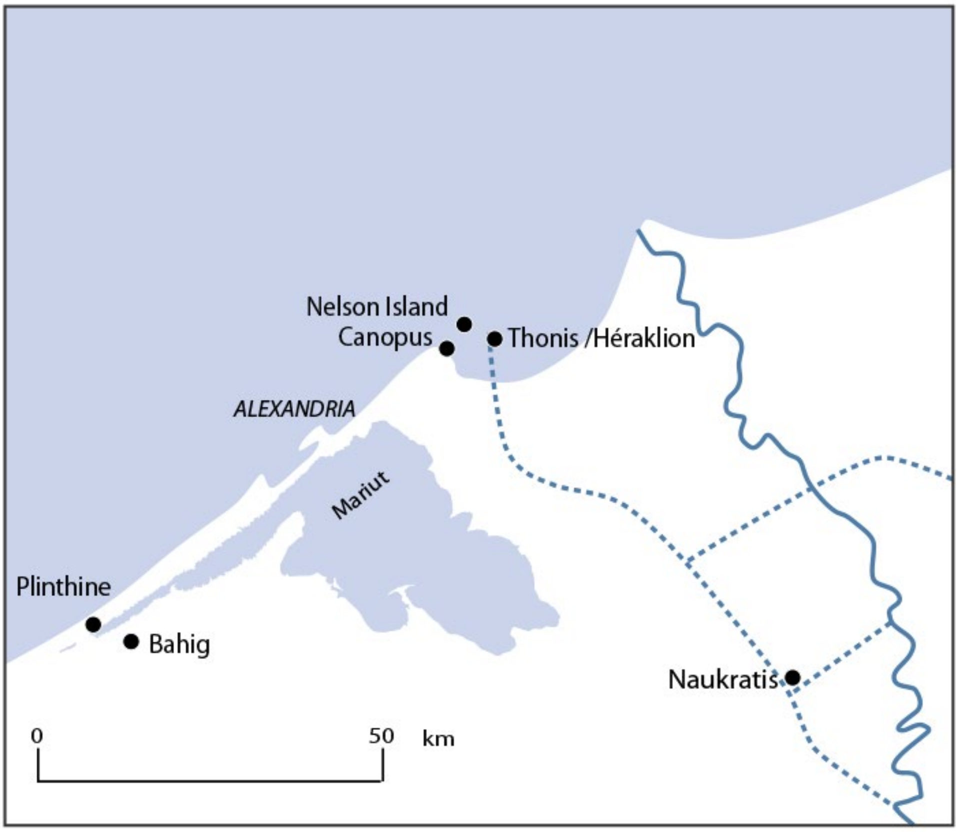

Figure 4. Map of the region surrounding Alexandria showing the sites of Nelson's Island, Canopus/Thonis, Plinthine, Kom Bahig and Naucratis. CGI Ismaël Awad, © Archives CEAlex/CNRS.

Recent discoveries around Alexandria

Excavations currently underway in the environs of Alexandria also demonstrate in a novel and sometimes unexpected fashion an occupation that dates back to the Classical and even Archaic periods. This is the case on Nelson's Island to the east and Plinthine to the west of Alexandria, without forgetting the other sites to the south of Lake Mariout, where excavations are just beginning, and even other unexcavated sites where the surface presence of pre-Hellenistic ceramics are evident (Figure 4). Are these just the signs of simple trade contacts? Nothing could be less certain: the large proportion of excavated and surface pottery reveals the presence of a Hellenised, if not Hellenic, population since the Archaic period, several centuries before the foundation of Alexandria.

Nelson's Island

For some 20 years an Italian mission led by Paolo Gallo has been excavating a large settlement on Nelson's Island, 30 km east of Alexandria.[4] This small island was part of the continent in antiquity and it has revealed intense occupation since the Archaic era. Excavations have unearthed traditional Egyptian burials with mummified bodies bearing amulets, but also graves of untreated bodies with a different orientation. The archaeological material that has been discovered includes amphorae from Chios dating to the 6th century BC. The imported Greek wine and the accompanying pottery ware betray the active presence of Greeks in the region, and more precisely in the nearby port of Heraklion. Underwater excavations are currently being conducted on the town of Heraklion-Thonis, at the mouth of the Canopic branch of the Nile leading to the Greek trading post established at Naucratis since the mid-7th century BC.[5]

Regarding the local cults, Gallo shrewdly notes that at Thonis the child-god Khonsou takes on the aspects of a young Hercules, and that further up the Nile, the Amun of Naucratis is associated with Zeus, and his wife Mut with Hera. He adds that Neith, originally from neighbouring Sais is perceived as a form of Athena. These parallels between Greek and Egyptian divinities are known to us from Herodotus but the archaeological

[4] P. Gallo, 'Une colonie grecque de la première période ptolémaïque près de Canope', in P. Ballet (ed) 2012. *Grecs et Romains en Égypte*: 48-49. Cairo, with notes 8 and 9, necropolis of the 26th dynasty; P. Gallo, 'Coloni greci a Canopo: l'Egitto senza Egiziani?', in A. Pontrandolfo, and M. Scafuro (eds) *Dialoghi sull'archeologia della Magna Grecia e del Mediterraneo. Atti del I Convegno Internazionale di Studi, (Paestum, 2016)*, Paestum 2017: 81-100. P. Gallo, 'Évolution des croyances et des pratiques funéraires dans les communautés grecques de l'Égypte pré-ptolémaïque (VIe-IVe avant J.-C.)', in M.-D. Nenna, S. Huber, and W. Van Andringa (eds) *Constituer la tombe, honorer le défunt* (Études Alexandrines 46) Alexandria 2018: 25-63.

[5] Fr. Goddio, 'Heracleion-Thonis and Alexandria, two ancient Egyptian emporia', in D. Robinson and A. Wilson (eds) *Alexandria and the North-West Delta*. Oxford 2010: 121–137.

evidence takes on a particular value in the light of the discovery of the Bubasteion at Alexandria.

Plinthine[6]

The ruins of Plinthine are located some 40 km west of Alexandria on the *tainia*, overlooking the sea to the north and the lake to the south (map Figure 4). The necropolis, set upon the crest of the *tainia*, has been known since the 20th century for its excavations of the Hellenistic hypogea carved into the calcarenite. Since 2012 an archaeological mission, initially directed by M.-Fr. Boussac and since the current year by B. Redon, has been excavating this site (as well as in the neighbouring Taposiris Magna) with astonishing recent results. The mission has set about exploring the highest part of the site, Kom el-Nogous, which covers an area of almost 3 hectares in the form of a horseshoe. The nature of this site was not understood until the latest excavation campaigns. In the 2018 campaign report,[7] the archaeologists describe how they have unearthed 'a dense occupation of the Saite-Persian period' (mid-7th century BC to the arrival of Alexander in 332) on the kom and surrounding areas, with housing and a wine press dated to the 7th century BC, while surface prospection indicates occupation since the New Kingdom (1500 to 1000 BC). They record that during the Archaic period, imported amphorae and other pottery sometimes reaches 60% of the ensemble of excavated material, raising the question as to the function of the site and the nature of its occupants. Who were these inhabitants with such a strongly Hellenised lifestyle?

Kom Bahig

The two hills of Kom Bahig sit to the south-west of Lake Mariout, some 50 km from Alexandria (map Figure 4 and Figures 5-7). They remained untouched from the end of antiquity and in 2017 prospection conducted by the Centre d'Études Alexandrines[8] led to the identification of surface shards dated to the end of the Ramesside period (20th Dynasty, 12th century BC) and from the beginning of the Third Intermediary Period (from the 13th to 8th century BC). In 2018 excavations on the eastern kom immediately revealed beneath the surface pottery material from the Late Period (probably dated to the Persian period, from the 6th century BC). Likewise, on the western kom excavations revealed deposits with amphorae from Chios, 'à la brosse' amphorae from Attica, and a vat from the 6th century BC. Pre-Ptolemaic buildings were unearthed on the summit of the hill. The first two excavation campaigns thus led to the identification of a site that was frequented roughly a millennium before the foundation of Alexandria, with Greek pottery becoming more plentiful from the 6th-5th century BC.

Naucratis

When one talks of Greek presence before the arrival of Alexander, one immediately thinks of Naucratis, the emporium situated on the Canopic branch of the Nile roughly 70 km south-east of Alexandria (map Figure 4). Greeks from Ionia, Caria and the nearby islands settled there from 630 BC under the reign of the pharaoh Psammeticus I, with the aim of trading with Egypt. In the following century the pharaoh Amasis, who understood the interest in channelling the exchange of wheat for imported products, confirmed the settlement of Greeks at Naucratis and a district was reserved and controlled for their use adjacent to the Egyptians, who lived in another part of the town.[9] For almost a decade a huge project to study the site and material has been conducted by the British Museum, which has resulted in numerous publications.

Two remarks need to be made regarding the large reservoir of Greek population that Naucratis represented: the authors of the article on the Bubasteion give as a parallel to the pottery found in the sanctuary of Bastet at Alexandria vases known from that very Greek settlement on the Canopic branch of the Nile. In addition, when Alexander the Great arrived in Egypt, he called upon a Greek from Naucratis to build the new capital that he had just founded, and bestowed upon him quite considerable power, as we shall see below.

* * *

Until new archaeological excavations within Alexandria itself manage to demonstrate the contrary,

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[6] B. Redon, M. Vanpeene, with a ceramological appendix by M. Pesenti, 'La vigne a été inventée dans la ville égyptienne de Plinthine. À propos de la découverte d'un fouloir saïte à Kôm el-Nogous (Maréotide)'. *BIFAO* 116, 2016: 303-324; Z. Barahona-Mendieta, M. Pesenti, B. Redon, 'Évolution des assemblages céramiques du kôm de Plinthine, de la fin de la Troisième Période Intermédiaire à l'époque saïto-perse: étude des deux contextes stratigraphiques du secteur 2'. *BCE* 26, 2016: 5-38; S. Dhennin, B. Redon, 'Plinthine on Lake Mareotis', *Egyptian Archaeology* 43, 2013: 36-38. M.-Fr. Boussac, S. Dhennin, B. Redon, 'Plinthine et la Maréotide pharaonique'. *BIFAO* 115, 2015: 15-35.

[7] On the 2018 campaign, see https://taposiris.hypotheses.org/plinthine/le-kom

[8] The excavation is supervised by G. Soukiassian and the material studied by A. Simony, whom I thank for her identification of the vases reproduced in this article. See M.-D. Nenna, 'Les actions du Centre d'Études Alexandrines en 2015-2016. Kôm Bahig', in L. Bavay, N. Michel (ed.) *Rapport d'activité de l'IFAO 2015-2016*, online: http://www.ifao.egnet.net/uploads/rapports/Rapport_IFAO_2015-2016.pdf: 291-302; M.-D. Nenna, 'Les actions du Centre d'Études Alexandrines en 2016-2017. Kôm Bahig', in L. Bavay and N. Michel (eds) *Rapport d'activité de l'IFAO 2016-2017*, online: http://www.ifao.egnet.net/uploads/rapports/Rapport_IFAO_2016-2017.pdf: 622-632.

[9] J. Yoyotte, 'Les contacts entre Égyptiens et Grecs (VII^e^-II^e^ siècles avant J.-C.): Naucratis, ville égyptienne'. *ACF* 1994-1995: 669-682. On the British Museum results, see, among others, A. Villing and U. Schlotzhauer (eds) *Naukratis, Greek diversity in Egypt. Studies on Greek pottery and exchange in the eastern Mediterranean* (British Museum Research Publication 162) London 2006.

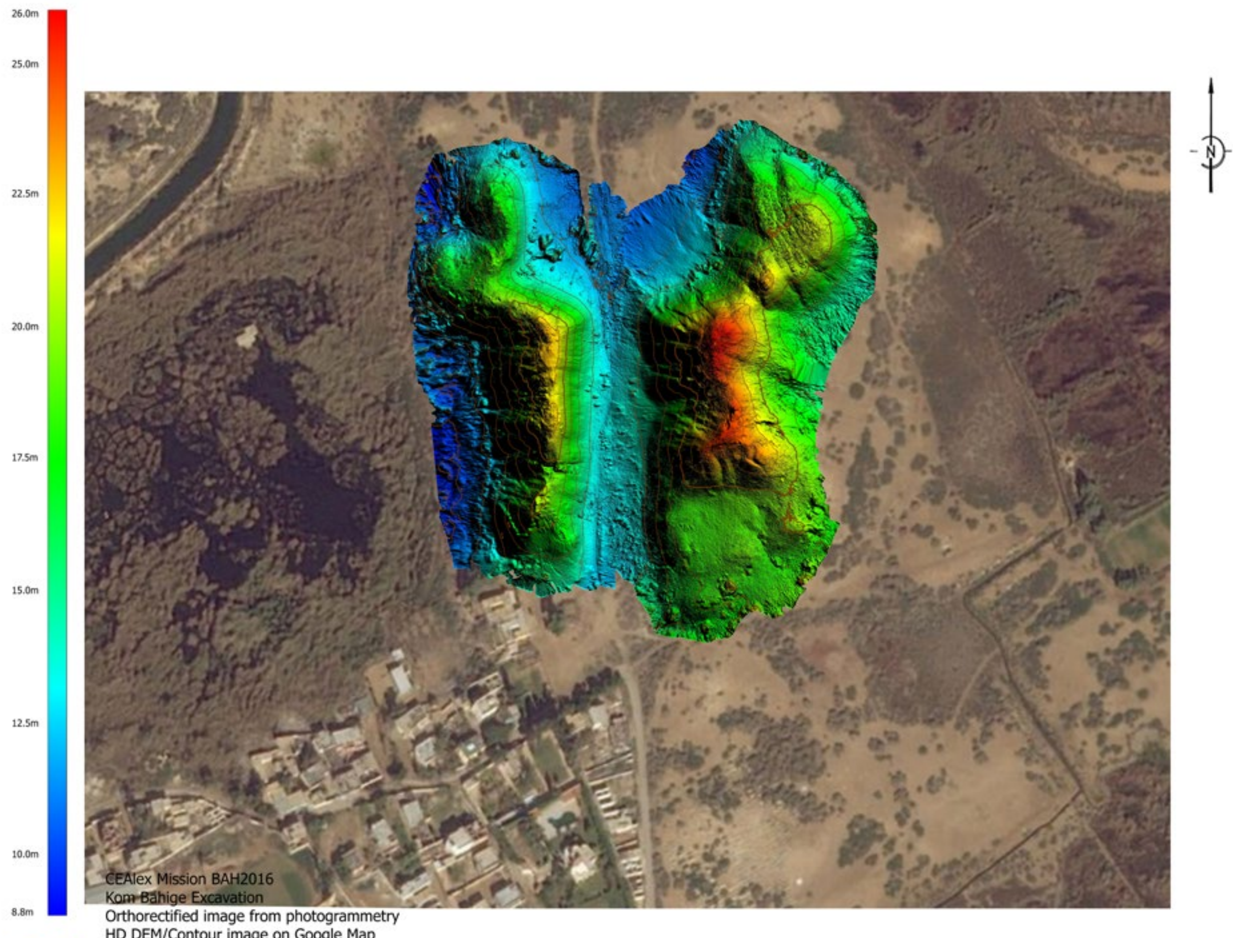

Figure 5. Kom Bahig. Orthophoto of the two koms.
Photogrammetry P. Soubias and M. Abdel Aziz, © Archives CEAlex/CNRS.

we can maintain that the site of the future capital was not occupied by Greeks before January 331. At the same time, a new inventory of the pottery found in Alexandria proves that sherds older than the foundation of the town are very rare and negligible in quantity,[10] which would tend to argue in favour of the sudden and simultaneous arrival of Greek settlers who had been established sometimes for two or even three centuries in places close to the newly-founded Alexandria.

Cleomenes and Canopus

To continue our discussion, we will leave behind the field of archaeology and turn to the key figure in the foundation of Alexandria, Cleomenes of Naucratis. As we shall see, this character, about whom we have hardly any biographical information, received scarcely any praise from his contemporaries or from posterity. With the death of Alexander in 323, Ptolemy I seized the satrapy of Egypt, to which Alexander had nominated Cleomenes some nine years previously at the end of 332 or beginning of 331. Ptolemy swiftly got rid of him, executing a person who more than probably was too well versed in Egyptian affairs. It appears that nobody mourned the sad fate of Cleomenes and, indeed,

[10] M. Venit, 'Early Corinthian Alabastra in Alexandria'. *The Journal of Egyptian Archaeology* 71, 1985: 185-187 with references to her thesis, *Painted Pottery from the Greek Mainland Found in Egypt, 650-450 B.C.*, New York, 1982. A re-examination of the provenance of these two Corinthian alabastra as part of a Franco-Italian CNRS programme, *Alexandrie avant Alexandre* (University of Turin/CEAlex) led us to review the entry journals of the Graeco-Roman Museum and the numbers do not correspond with the provenance put forward by M. Venit. Of course, recent excavations have revealed some extremely rare examples of pottery that are older than the city, such as the fragment of an Attic lekane lid dating to around 375 BC, but within Hellenistic era contexts showing that it is residual material: cf. J.-Y. Empereur, *Alexandrie redécouverte*. Paris, 1997: 50. See also the study by A. Abdel-Fattah, 'The question of the Presence of Pharaonic Antiquities in the City of Alexandria and in its Neighboring Sites (Alexandria Pre-Alexander the Great)', in Z. Hawas and I. Pinch Brock, *Egyptology at the dawn of the Twenty-First Century* II. Cairo, New York, 2003: 63-71. Paulo Gallo is preparing a monograph on the Aegyptiaka of Alexandria, showing how Pharaonic monuments, architectural elements, obelisks, sphinxes, etc. were brought from the great Pharaonic sanctuaries, mainly Heliopolis, by the Ptolemies and Roman emperors, but also that a good number of them are left-overs from the 19th century antiquities trade. Hauled to the harbour of Alexandria, certain pieces were subsequently abandoned by the dealers because of lack of means or the poor state of the pieces in question.

Figure 6. Kom Bahig. Excavation of the eastern kom in April 2018. The sherds of the demolition 10088 which seal this occupation are older than the Ptolemaic period and date to the Late Period. Photo J.-Y. Empereur, © Archives CEAlex/CNRS.

Figure 7. Kom Bahig, northern part of the valley between the two koms. The blocks of a dismantled temple. The most recent shards in the fill 20023, including Archaic Greek amphora fragments dating to the 6th century BC. Photo J.-Y. Empereur, © Archives CEAlex/CNRS.

contemporaries repeatedly recount his misdeeds, such as the Pseudo-Aristotle in *Oeconomica* (II, 1352) and Demosthenes in *Against Dionysodorus*, especially as regards the unprecedentedly high tax on Egyptian wheat and the auctioning of Egyptian wheat in Greek cities of the Mediterranean in an attempt to sell at the highest price. In the *Anabasis*, written by Arrian in the 2nd century AD and recounting the campaigns of Alexander up to his death, a very severe picture of Cleomenes is presented, treating him as ανὴρ κακός. The main source for this work was the now lost *Memoires* of Ptolemy I and if this latter did write of Cleomenes, which one might well presume, one can just as easily imagine that it was not in order to praise him.

We quote here a passage from the Pseudo-Aristotle, *Oeconomica*, II, 1352, which illustrates the actions of Cleomenes:

> 'When king Alexander commanded him to found a city near the Pharos and to establish there the mart which was formerly held at Canopus, he sailed to Canopus and told the priests and the owners of property there that he had come to transfer them. The priests and inhabitants collected and gave him a sum of money to induce him to leave their mart undisturbed. This he accepted and for the moment left them alone, but afterwards, when he had the material for building ready, he sailed to Canopus and demanded an excessive amount of money from them, which he said represented the difference to him between having the mart near the Pharos and at Canopus. And when they said they would not be able to give them the money he made them move to their city'.

This text is of interest in our discussion for more than one reason. Book II of the Pseudo-Aristotle's *Oeconomica* gathers several cases of financial extortion by tyrants and magistrates in the Hellenistic world, in Sicily, Asia Minor etc. The work tries to illustrate celebrated examples of cunning without always understanding the public interest in these measures, or indeed the *real politik* of the business world. The case of Cleomenes is paradigmatic: having shown how he obtained gifts from the priests of Sobek after one of his slaves was eaten by a crocodile, before recounting other demands for contributions from the Egyptian clergy and the clever dealing with the price of wheat from which he manages to extract a large profit, the episode concerning Canopus is enlightening on more than one point.

The author informs us unambiguously on two important points: 1) that Cleomenes, whom he qualifies as Satrap of Egypt, received the order from Alexander to build a city near the Pharos; 2) that it was not Cleomenes who commanded the removal of the inhabitants of Canopus to the new capital, but Alexander himself.

In the first instance, Cleomenes tries to execute the order he had received from his master and urges the priests and inhabitants of Canopus to move to the new capital. The monetary contribution that they offer is initially accepted as sufficient and he uses it not for personal enrichment but to buy construction materials. This first payment suits his purpose because it gives him time to lay out the urban framework with the architect Dinocrates of Rhodes, involving, aside from the walls laid out by Alexander himself, the streets, the size and ground plan of the building lots etc. Thereafter, once the urban site is ready to receive the first inhabitants, he fully executes Alexander's order and forces the merchants and priests of Canopus to come and settle in Alexandria.

In passing, we can note two points regarding the priests. 1) Their status is not specified. Are they Greek or Egyptian priests? One might ask the question as to the cults practised in the at least partially-Hellenised town of Canopus on the mouth of the Canopic branch leading towards the trading post of Naucratis. 2) In addition, we learn that the cults are instituted from the first moment of the foundation of Alexandria. This was a normal feature in the foundation of any new city and corroborates the passage in Arrian indicating that Alexander chose the site and number of temples,[11] as well as the venerable age of the sanctuary of Bastet, which as we have seen dates back to the last decades of the 4th century BC, and the age the temple to Isis that was planned at the very moment of the new city's foundation.

Modern historians have generally followed the unfavourable opinion of the ancients, although Cleomenes has known some defenders: an economist, A. Andreades,[12] a numismatist, G. Le Rider,[13] and a historian/epigrapher, P.M. Fraser. In this latter's survey of Alexandria published in 1972, he does not hesitate to qualify Cleomenes as 'an administrator of great vigour' (p. 6) and he develops the role of Alexander's man in the development of Alexandria during the nine years prior to the arrival of Ptolemy. 'Probably, then, Soter inherited from his late subordinate a city which was structurally well advanced, and had already been integrated into the economic life of the Aegean, and it is possible that the early prosperity of Alexandria, perhaps its very

[11] See Note 2.

[12] A. Andréadès, 'Antimène de Rhodes et Cléomène de Naucratis', *Bulletin de Correspondance Hellénique* 53, 1929: 1-18.

[13] G. Le Rider, 'Cléomène de Naucratis', *Bulletin de Correspondance Hellénique* 121, 1997: 71-93; G. Le Rider, 'Le monnayage d'or et d'argent frappé en Égypte: le rôle d'Alexandrie', in *Alexandrie: une mégapole antique* (Cahiers de la Villa Kérylos 9), 1999: 11-23; P.M. Fraser, *Ptolemaic Alexandria*, Oxford, 1972: 4-7.

survival, owed much to the predecessor whose memory posterity, and not least Ptolemy himself, so effectively damned' (p. 7).

Cleomenes was originally from Naucratis but not a citizen of Naucratis. This Greek emporium, which included an Egyptian quarter, would officially become a Greek city in the full sense under Alexander the Great, but Cleomenes chose not to become a citizen of his native city. Book II of *Oeconomica*, 1352, clearly names him Cleomenes the Alexandrian, Κλεομένης Ἀλεξανδρεύς. He drops the epithet, *of Naucratis*, and he becomes a citizen of Alexandria. Did he bring with him the other inhabitants of Naucratis, in a similar way that he displaced the merchants of Canopus? This forced removal of the inhabitants of Canopus towards the new capital may also have been the fate of the other Greek communities in the surrounding regions of Alexandria within a radius of some 50 km: 30 for Canopus, 40 for Plinthine, 50 for Bahig, and up to 70 for Naucratis, without mentioning other farther-flung settlements such as Hermopolis Parva, Sais and even Buto where the excavated archaeological material has demonstrated the presence of Hellenised populations. In a vast synoecism, these populations, obliged to leave the places where they had lived in the land of Egypt, where their families had been settled for several centuries, would go on to form the integral core of the Alexandrian citizen body, a closed circle inscribed within the new tribes and demes, although we do not know how the allocation was determined.[14] They would later on be quite distinct from the Greeks coming from other Greek cities, who would bear their own *ethnic* of origin.

A final point in the rehabilitation of Cleomenes of Alexandria: as Georges Le Rider has underlined,[15] nowhere is there any mention of funds being laid aside for the foundation of the new city. Taxes paid by the Egyptians continued to go to Babylon, as in the time of the Persians. Cleomenes was thus obliged to invent expedients in order to gather the necessary financial means to carry out the mission ordered by Alexander. The episode of the crocodiles and the Egyptian priests paying compensation, the taxes on Egyptian wheat exports and speculation on the price of cereals, the financial demands made upon the inhabitants of Canopus were all most probably invested in the colossal costs incurred in the construction of Alexandria. And when Ptolemy I seizes power in Egypt in 323 he finds a country that has apparently been well governed by the careful hand of Cleomenes. Moreover, he finds 8,000 talents in the public coffers, and not in the pockets of Cleomenes.[16]

The new archaeological discoveries demonstrate the presence of Greeks settled around the future site of Alexandria since the Archaic period. The Canopus episode illustrates the forced displacement of Greeks to the new foundation. Might this experience have been extended to other Greeks living in close proximity to the new capital? We shall see that despite the cruelty of such uprooting of populations, this procedure was not unknown in the history of this era and this region of the Mediterranean.

The foundation of Antioch in Pieria

We will quickly look at the conditions of the foundation of Antioch — Antioch in Pieria or *ad Orontes*, to distinguish it from the 14 other towns of the same name.[17] After his victory over Antigonus Monophthalmus, Seleucos I founded the city of Antioch, naming it after his father. In May 300 he destroyed Antigonia, the neighbouring town founded by his defeated rival and used the stones of its monuments and houses in the construction of his new capital. He moved the 5,300 inhabitants of Antigonia to Antioch.[18] Downey notes (p. 70), 'The traditional account of the founding of the city is modelled in some respects upon the account of the foundation of Alexandria'. Similar to Alexander at Alexandria, he begins by designing the outline of the city, the walls. 'Libanius gives a conventional picture of the laying out of the plan of the city, with elephants stationed to mark the sites of towers in the city wall, and the streets outlined with wheat' (Note 68). The king also decides which temples to build inside the town.

And so the new inhabitants come from the destroyed city of Antigonia as well as the surrounding area. Cretans, Cypriots, Argives and Heraclides (i.e. Peloponnesians), who were settled on Mount Silpius overlooking the new town, were all gathered together. Added to this mix were Jewish veterans of the Seleucid army, just as had happened at Alexandria with the Jews of Ptolemy I's war fleet, although in both cities they did not receive full citizenship since they refused to worship the Greek gods, but they were permitted to live within their own communities. The Syrians too could not become

[14] P. Fraser (previous note) suggests a territorial distribution (p. 38-39).
[15] See Note 13, article from 1997.
[16] Diodorus 18, 14, 1.
[17] G. Downey, *A History of Antioch in Syria from Seleucos to the Arab Conquest,* Princeton: Princeton University Press, 1961 (754 pages) and the abridged version, G. Downey, *A History of Antioch in Syria from Seleucos to the Arab Conquest*, Princeton: Princeton University Press, 1963 (297 pages). See also G.M. Cohen, *The Hellenistic Settlements in Syria, the Red Sea Basin, and North Africa,* Berkeley: University of California Press, 2006.
[18] Downey: 81, although it is unknown whether this was the citizens or the total population, women and children included. The author cites Flavius Joseph and John Malalas as well as Libanius.

citizens and they inhabited their own quarter, in the same way as the Egyptians at Alexandria.[19]

Antioch was founded 30 years after Alexandria. Its foundation appears to have been inspired by that of Egypt's capital and the ancient texts are more explicit as to the origin of the Greeks who were moved to the new capital. They had been settled in the surrounding areas and were obliged to leave their homes – in Antigonia and on Mount Silpius – in order to populate the royal foundation. One can imagine that same process was entailed at the almost military foundation of Alexandria with a similar displacement of peoples.

[19] As in Rakotis disctrict in Alexandria. On the meaning of Rakotis, see most recently A. Engsheden, 'Aux confins de l'étymologie. Rakotis, le nom indigène d'Alexandrie:, in Y. Gourdon, A. Engsheden (ed.) *Études d'onomastique égyptienne* (RAPH 38) 2016, Cairo: IFAO: 87-100. This latest interpretation does not seem to have found broad support from those who understand the term Rakotis as meaning building site, cf. M. Chauveau, 'Alexandrie et Rakhôtis: le point de vue des Égyptiens', in *Alexandrie: une mégapole antique* (Cahiers de la Villa Kérylos 9) 1999: 1-10.

The navy of Ptolemaic Alexandria

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Introduction

Following the death of Alexander the Great in 323 BC, his kingdom soon took the form of several competing and conflicting states. The relationship between the Hellenistic kingdoms was quite dynamic, which resulted in constant changes in the extent and limits of these kingdoms. During the first three decades of the Ptolemaic kingdom, the Ptolemies in Egypt had occasional conflicts with their neighbours to the east, the Seleucid Kingdom. Thus the eastern border of the Ptolemaic kingdom was the scene for several events which involved both the Egyptian army and navy.

During the reign of Ptolemy II Philadelphus (282–246 BC), the Ptolemaic kingdom reached its greatest extent, extending west as far as Berenike (present Beni Ghazi on the Libyan coast) and extending north as far as Byblos (present El Gbeil on the Lebanese coast). Moreover, the Ptolemies controlled several Islands in the Mediterranean including Cyprus (Hölbl 2001: 35-67). In order to manage and control this extensive region, the Ptolemies created one of the largest fleets known in antiquity. Moreover, the occasional conflicts gave rise to an obvious requirement for extra security at the Ptolemaic military docks and naval bases in Alexandria.

The Egyptian Navy under the Ptolemies

In the 1st century AD Appian of Alexandria mentions that the navy of the Ptolemies had 2,000 barges propelled by poles, and other smaller craft: 1500 galleys from ‘one and a halfs’, *hemiolia,* to ‘fives’, *penteres,* and warship gear for twice that number. The fleet also included 800 ‘cabin ships’, *thalamegoi*, with gilded stems and rams, and on board which the kings themselves went to naval combats (Fischer-Bovet 2014: 58). Thus Appian is speaking about a total of 4300 ships of different types including *hemiolia,* which were a type of a double-banked warship with up to 50 oars, and *penteres,* which were probably triple banked, and *thalamegoi* or cabin boats, which seem to have been a more elaborate type of warship used by the kings (Morrison 1995: 66-77). It is worth noting, however, that the cabin boats were also mentioned by Strabo (17.1.16) when he spoke about *Schedia,* the suburb or Alexandria. He states that *Schedia* has a station or a harbour for vessels with cabins τῶν θαλαμηγῶν πλοίων, which carry the governors when they visit upper Egypt.

Probably, the most detailed description of the Ptolemaic fleet comes from Athenaeus of Naucratis (2nd–3rd centuries AD) when he speaks about the warships in the fleet of Ptolemy II, which were greater in number than all other fleets. Athenaeus clearly states that the list he provides contains the largest types of ships in the fleet and not the entire fleet. He says that the fleet of Ptolemy II consisted of 2 ‘thirties’, 1 ‘twenty’, 4 ‘thirteens’, 2 ‘twelves’, 14 ‘elevens’, 30 ‘nines’, 36 ‘sevens’, 5 ‘sixes’ and 17 ‘fives’; and from the ‘fours’ down to half-decked triremes, *trimiolia* as they were called, he had twice as many as all the above put together. In addition to these, Ptolemy had further vessels located in the different islands and in the other cities under his dominion, and in Libya, all these totalling more than 4000 (Morrison 1996: 37).

Hence, according to Athenaeus, Ptolemy II had a total number of 4333 ships, which is very close to what Appian mentioned earlier – 4300 ships – except that Appian was not clear about the types of ships. So, the Ptolemaic fleet had more than 4000 ships, the majority of which were not stationed in Egypt but in other regions of the Mediterranean under Ptolemaic control.

The types and naming of classical and Hellenistic warships have been subject to much discussion over recent decades (Casson 1995: 97-135; Tilly 2004). However, it is generally believed that the warship type is identified by the number of oarsmen operating at one side of the ship (Casson 1996: 78-86). For example, a ‘six’ could have had either two levels of oars with three men on each oar, or it could have had three levels of oars with two men on each oar. However, it is known for a fact that there was no warship in antiquity with more than three levels of oars, so the variation was mainly in the number of oarsmen handling each oar. On the other hand, according to historical evidence regarding Hellenistic fleets in the Mediterranean, it is believed that no ship larger than a ‘ten’, *dekeres*, is known to have fought in battles. So all ships larger than the ‘tens’ were mostly used for processions or as flagships in battles but not for actual fighting (Morrison 1996: 255-277). Therefore, by looking at the Ptolemaic fleet, it is noticeable that the majority of ships, which were based in Egypt, were actually smaller in size than a ‘ten’. Out of the 333 warships that were based in Egypt 310 of them (93% of the fleet) were ‘nines’, ‘sevens’, ‘sixes’, ‘fives’, ‘fours’ and even smaller vessels, while warships larger than a ‘ten’, such as the ‘elevens’, ‘twelves’, ‘thirteens’, ‘twenties’ and ‘thirties’ numbered only 23 ships (7% of the fleet). These were the royal barges and flagships which were probably kept in the vicinity of the Ptolemaic royal quarters.

This raises the question of the whereabouts of the military harbour of Alexandria where the Ptolemies kept their warships.

The Military Harbour of the Ptolemies

The Eastern Port of Alexandria was meant to be the main centre of maritime activities in the Ptolemaic capital. However, it has been mentioned repeatedly in classical sources that the main problem with the Eastern Port was the narrowness of its entrance (Goddio 1998: 12-16). Strabo, for example, describes the entrance not only as being narrow, but also as containing a number of underwater and projecting rocks and reefs which ‘... at all hours, roughen the waves that strike them from the open sea’ (Strabo 17.1.6). Also Julius Caesar states that ‘... on account of the narrowness of the passage there can be no entry for ships into the Harbour without the consent of those who are in occupation of Pharos’ (Caesar, *De bello civili*, 3.112).

However, as a major city and the capital of a Hellenistic kingdom, Alexandria contained commercial, military and private harbours; each of them had different characteristics, yet, they all played an integrated role in the development of the city. The fact that the entrance of the Eastern Port of the city was relatively narrow made it easier to control and defend; therefore, it would have been suitable to accommodate warships. Moreover, since the Eastern Port oversaw the centre of the city and its emporium, it was also used by merchant vessels. That raises the problem of dividing the Eastern Port of Alexandria between such different uses. How could the security of the naval fleet be maintained while foreign merchant ships were roaming through the harbour?

In fact, there is no direct evidence available regarding the exact nature or location of the military harbour in Ptolemaic Alexandria. However, it is known, for example, that during the war that Julius Caesar waged on Alexandria in 48 BC, and after he burned most of the Egyptian fleet in the great port, the Egyptians were able to recall 22 ‘fours’, *quadriremes,* which were at that time guarding the mouths of the Nile, and they repaired five ‘fives’, *quinqueremes,* which were kept in the secret royal dockyards (Burstein 2007: 102). Hence, it is evident that the Nile mouths provided major stations for warships in the Ptolemaic period. Additionally, key towns on the Nile, such as *Schedia*, and *Naucratis* would have contained bases for smaller warships, like the *hemiolia* or even the *triremes.* Yet, the larger and heavier ships must have been kept in the main harbour of Alexandria.

The geophysical underwater surveys that were carried by the Institute European d’ Archaeologie Sous-Marine in the great port of Alexandria over the past two decades have revealed a wealth of evidence for the appearance of the port in antiquity (Goddio & Bernand 2004). The survey resulted in detailed mapping of the internal layout of the port, including the ancient quays and jetties which formed a number of internal harbours within the main port (Figure 1). Accordingly, it became evident that the Great Port of Alexandria included at least four internal harbours which could have accommodated both military and commercial vessels. Three of these internal harbours are located at the eastern side of the port of Alexandria and one is located at the western side of it. The discovery of a number of internal harbours confirms the textual and historical evidence that mentioned ‘hidden’ royal harbours and secret naval installations within the Eastern Port of Alexandria (Strabo 17.1.9; Morrison 1996: 137- 141). This leads to a discussion of a feature which was quite common in ancient harbours: the separation between the military and commercial sections of the harbour.

As early as the 5th century BC, there was a distinct separation between military and commercial harbours, such as in Piraeus and Carthage, where separate basins were dedicated to warships and to merchant vessels (Blackman 1982; 1995). Alternatively, there could be separate sections within the same harbour dedicated to warships and others dedicated to merchant vessels, such as in Syracuse and Alexandria (Gerding 2013: 535-541). Nonetheless, one of the main features of military harbours in antiquity were the shipsheds where warships were stored and maintained (Figure 2). It is believed that the Zea harbour in Piraeus contained 196 shipsheds, while the military harbour of Carthage housed 170 shipsheds mostly dedicated to *triremes* (Gerding 2013: 307-318, Rankov 2013: 420-485). However, unlike the case of Piraeus and Carthage, the Eastern Port of Alexandria was used for both military and commercial purposes. Yet there must have been some sort of internal separation between the internal harbours in order to guarantee the security of the naval fleet.

By looking at the layout of the port of Alexandria, and the submerged harbour installations which were discovered through underwater archaeological investigation, it becomes evident that the division of the Port between commercial and military is quite feasible. The Eastern Port of Alexandria contained at its eastern side three internal harbours. The first inner harbour, which corresponds with what Strabo (17.1.9) describes as ‘hidden’, had an area of about seven hectares with about 500m length of quays. Its entrance faced northwest and was protected from the north and the west by reefs and from the south by a 250m long jetty 250m (Goddio 1998: 18-21). The entrance of that harbour could not have been visible for ships entering

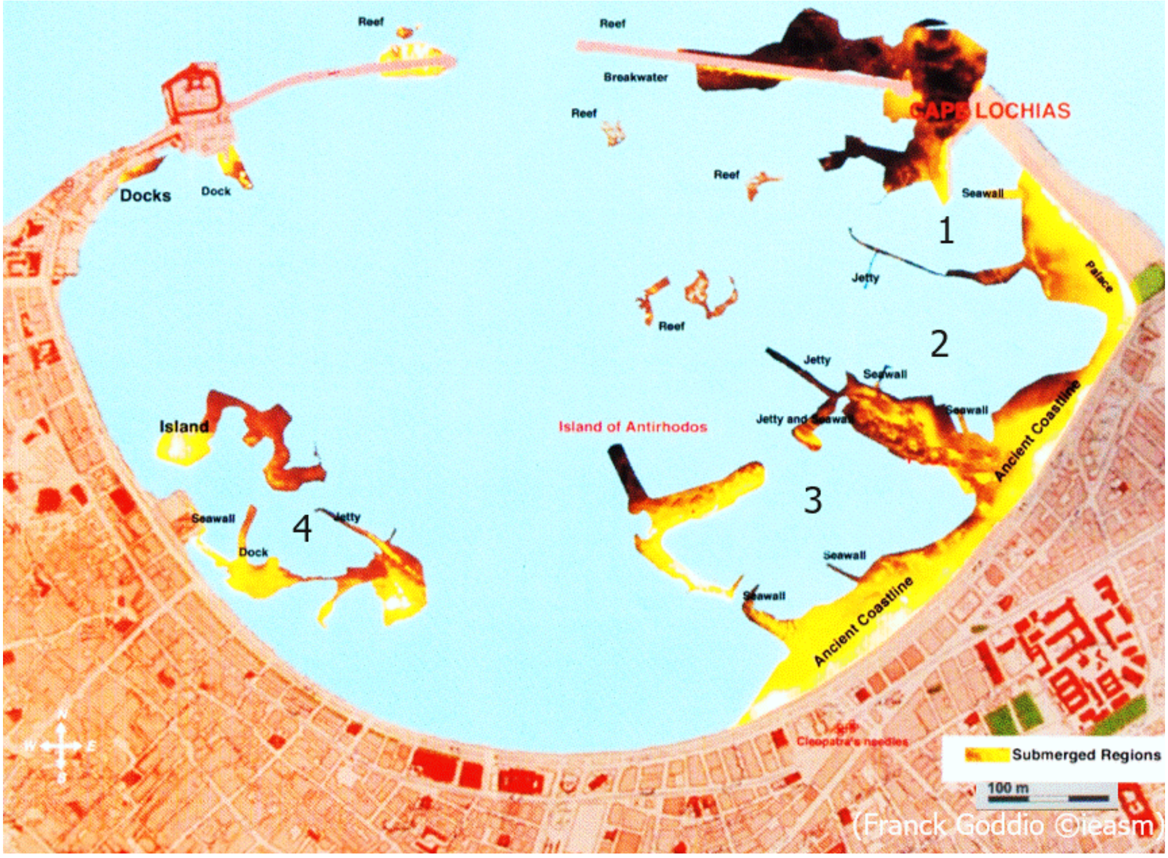

Figure 1. The Eastern Port of Alexandria. The underwater geophysical investigation revealed the remains of four internal harbours which were used for military and commercial activities (after Goddio and Bernand 2004: 147).

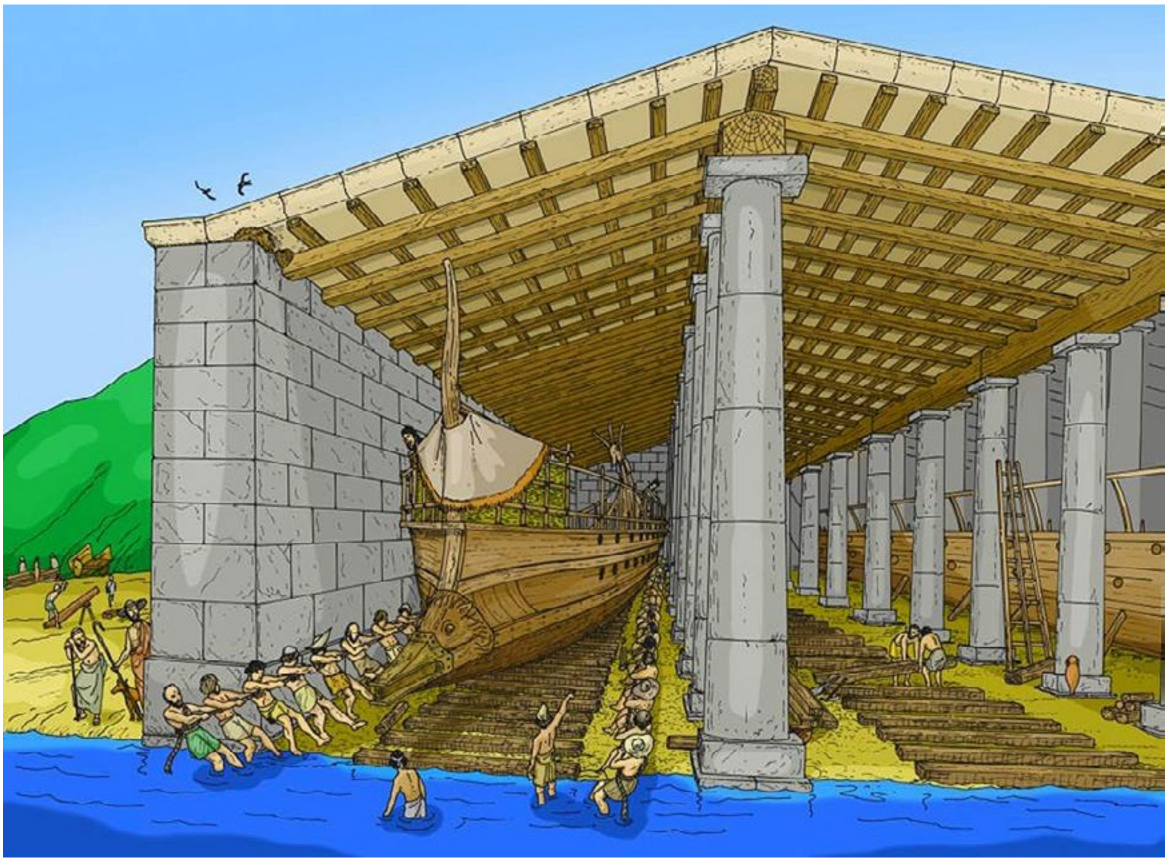

Figure 2. Artistic impression of shipsheds (drawing by Yannis Nakas).

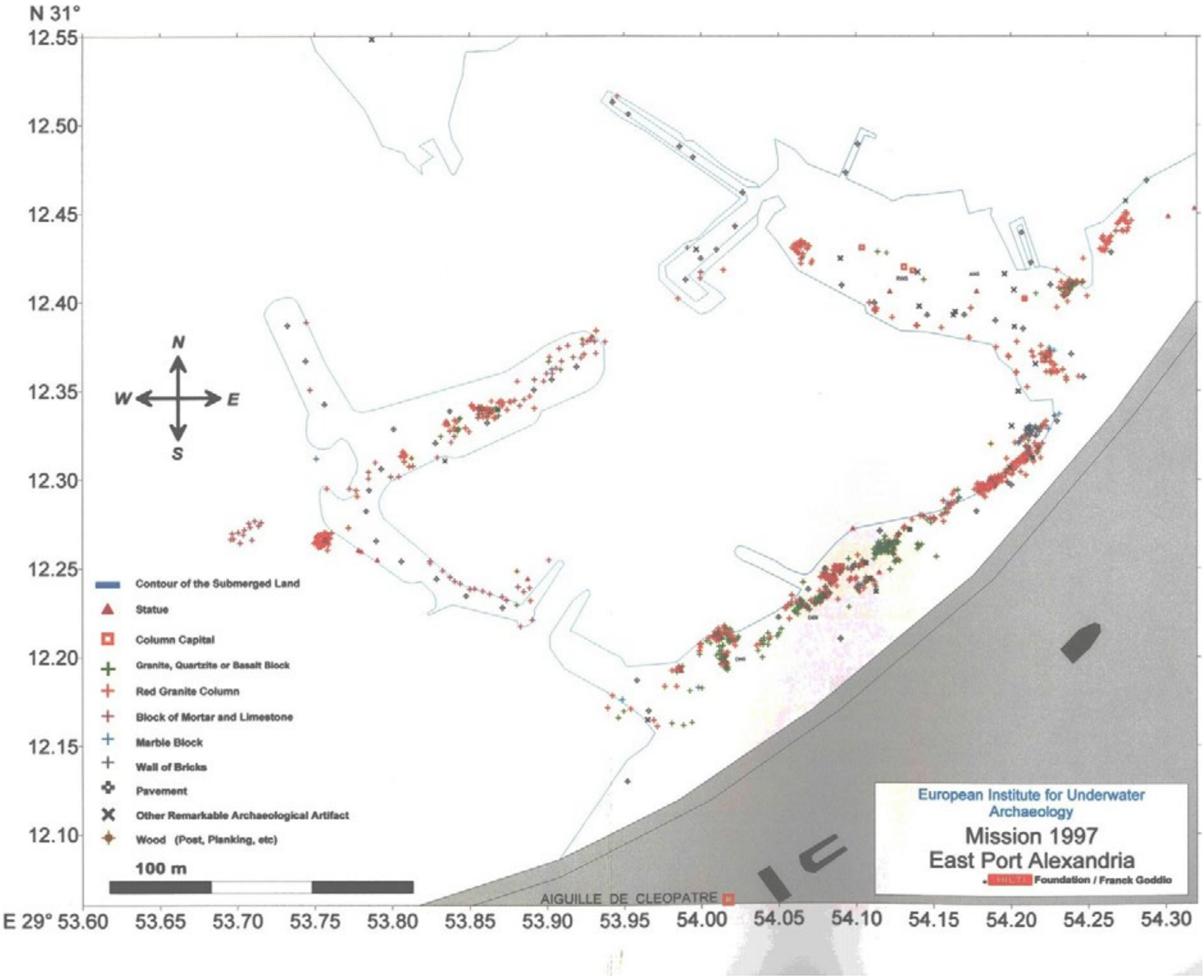

Figure 3. The third internal harbour had an area of about 16 hectares with about 1,250m length of quays and a concertation of archaeological remains including more than 500 granite columns (after Goddio *et al.* 1998: 51).

the Eastern Port since it would have been hidden behind the protruding reefs in the middle of the port. This inner harbour oversaw the Ptolemies' palaces, so it was probably used privately by the royal family.

The second inner harbour had an area of about 15 hectares with about 800m length of quays. It was enclosed by a jetty to the northeast, a peninsula to the southwest and the ancient shoreline to the southeast. The harbour also included a number of smaller quays made of limestone blocks and lime mortar.

The third inner harbour had an area of about 16 hectares with about 1,250m length of quays (Figure 3). It was enclosed by the ancient shoreline to the south-east, a 350m long peninsula to the north-east and the submerged island of Antirhodos to the north-west. Some parts of the island, which were paved with limestone, slope down gradually towards the seabed (De Graauw 1998). Moreover, the distribution of archaeological remains within the submerged inner harbours of Alexandria reveals that there is a particular concentration of remains, especially related to harbour structure and possibly shipsheds, around the shores of the third inner harbours. Such remains include paved quays and jetties as well as over 500 granite columns. Another feature which is clear in the third internal harbour is that it had two openings, the larger one is c. 90m and the smaller is c. 30m, which makes it easy to control and to secure (Goddio 1998: 12-52); a major feature in military harbours. Accordingly, it seems reasonable to suggest that the third and largest internal harbor could have been dedicated to the Ptolemaic fleet.

Extensive research of the Zea harbor in Piraeus established that the largest shipsheds recorded there measured c. 54m in length and 5.7m in width (Rankov 2013: 437-441). Accordingly, the largest internal harbour in Alexandria, with its 1,250m of quays could have easily accommodated 150-200 Shipsheds able to house trireme size warships or larger. Hence, going back to Athenaus list of warships, it can be inferred that out of the 310 operating warships that were based in Egypt, 200 warships could have been housed in the third internal harbour, while the rest, could have been based at the mouths of the Nile and elsewhere in Egypt. On the other hand, the royal ceremonial warships, such as the 'elevens', 'twelves', 'thirteens', 'twenties' and 'thirties', which numbered only 23 ships for the use of the royal family, could easily have been accommodated in the other two inner harbours, which overlooked the royal quarters during the Hellenistic period.

Nevertheless, the fourth internal harbour, which was located at the southern shores of the Pharos Island next to the *Heptastadion*, could have been exclusively dedicated to the trade and merchant vessels. This was also facilitated by the link between the eastern and western harbours of Alexandria through the openings of the *Heptastadion*, which allowed the movement of merchant vessels between the two harbours.

This whole establishment changed significantly under Roman rule. The *Classis Alexandrina* took over what was left of the Ptolemaic naval forces after Actium and the *Potamophylacia* took over policing the Nile (Pitassi 2012: 47-50). The numbers and sizes of warships decreased significantly, and the internal harbours within the Eastern Port of Alexandria were mainly used by merchant vessels, particularly the grain fleet. Under Roman rule, Alexandria ceased to be the capital of an independent kingdom, however, her glory and uniqueness persisted.

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Twenty years of underwater archaeological and geophysical surveys in Alexandria by the Greek Mission (1998-2017)

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Although submerged, the ancient remnants of Alexandria's Eastern Port have been marked on many old maps and charts; they have been recently attentively studied, but the eastern littoral of the Great City has been virtually ignored.

The Corniche, a coastal road initiated in the early 20th century at Chatby, and completed at Montazah in the late 1930s, had as a consequence the irrevocable destruction of most visible ancient remains in its path on land and in the adjacent shallows. The widening of that same road, planned for the end of the 1990s, was a threat to whatever had survived.

The survey proposed by the Hellenic Institute of Ancient and Mediaeval Alexandrian Studies, Athens to the Supreme Council of Antiquities of Egypt, was an 'emergency' action aimed to protect and study whatever could be saved *in situ*, while gaining a thorough understanding of what was doomed to be lost emerged as a priority.

After obtaining a concession from the Egyptian authorities, the Greek Mission, from 1998, has carried out twenty-nine campaigns. Over one hundred and forty scientists – mostly divers – consisting of archaeologists, historians, architects, draftsmen, geologists, geophysicists, restorers etc. have participated in these campaigns. The main sponsors have been the J. F. Costopoulos Foundation, Athens, the Ministry of Culture of Greece, the Honor Frost Foundation, London, Mr Ananda Krishnan from Kuala Lumpur, the Stavros Niarchos Foundation, Liechtenstein, Mr Antonis Nicolaras, Piraeus, the Psycha Foundation, Athens and individual members of the Hellenic Institute.

From 2013, the campaigns have been jointly conducted with the Mariolopoulos-Kanaginis Foundation for Environmental Sciences of Athens. The Department of Marine Geology of Patras University has contributed a geological survey encompassing the area researched by the Greek Mission as well as the immediate approaches of the Eastern Port.

Although this has been mainly an underwater survey focusing on the submerged remains, some trenches were opened on Chatby Beach, next to the Casino, and revealed a massive concentration of pottery sherds dating to the Early Byzantine period, while at Miami Island a hypogeum tomb dating to Hellenistic times was excavated.

Thus far the results have been most encouraging. The location of two important historical sites known from ancient sources – the Temple of Isis Lochias and the Mausoleum of Cleopatra VII – has been confirmed. A wealth of information linked to the royal Ptolemaic quarters, the necropoleis, stone quarries as well as to maritime activities, have greatly enhanced our understanding of the topography of this area known in antiquity as 'I pros Elefsini Thalassa.'

Although he was not an archaeologist Kamel Abul-Saadat can rightly be considered as the first of the pioneers in the underwater archaeological research of Alexandria. From 1960, when he started his dives with a snorkel and mask in the shallows of Ibrahimieh, until 1984 the year of his tragic death at Abu Kir, he attentively scrutinised the submerged ancient remains inside and outside the Eastern Port of Alexandria neighbouring the royal quarters and the Pharos,[1] Young Kamel understood the importance of the submerged ancient artifacts that scattered the sea floor. The map he drew, although crude, is surprisingly correct (Figure 1). He tried desperately to attract the authorities' attention to the material with repeated visits to the Director of the Graeco-Roman Museum and interviews in local papers. This finally lead to the raising of the anthropomorphic lid of a red granite sarcophagus from the waters off Silsileh Promontory at the end of 1962 by divers of the Egyptian Navy which arose some international interest.[2] Six years later Honor Frost an experienced diver knowledgeable in underwater archaeological research and Vladimir Nesteroff a marine geologist were delegated by UNESCO to Alexandria to check the Egyptian diver assertions.[3] Abul-Saadat dived with Honor Frost (Figure 2) on the ancient remains he had spotted in the vicinity of Quaid Bey Fort. Miss Frost returned to Alexandria and had the opportunity of

[1] Morcos 2000: 33-45; Halim 2000: 46-53.

[2] Now exhibited in the gardens of the Maritime Museum at Stanley.

[3] Miss Honor Frost had started her diving activities in the early 1950s; in 1963 she published a book with her diving experiences *Under the Mediterranean,* Routledge and Kegan, London 1963.

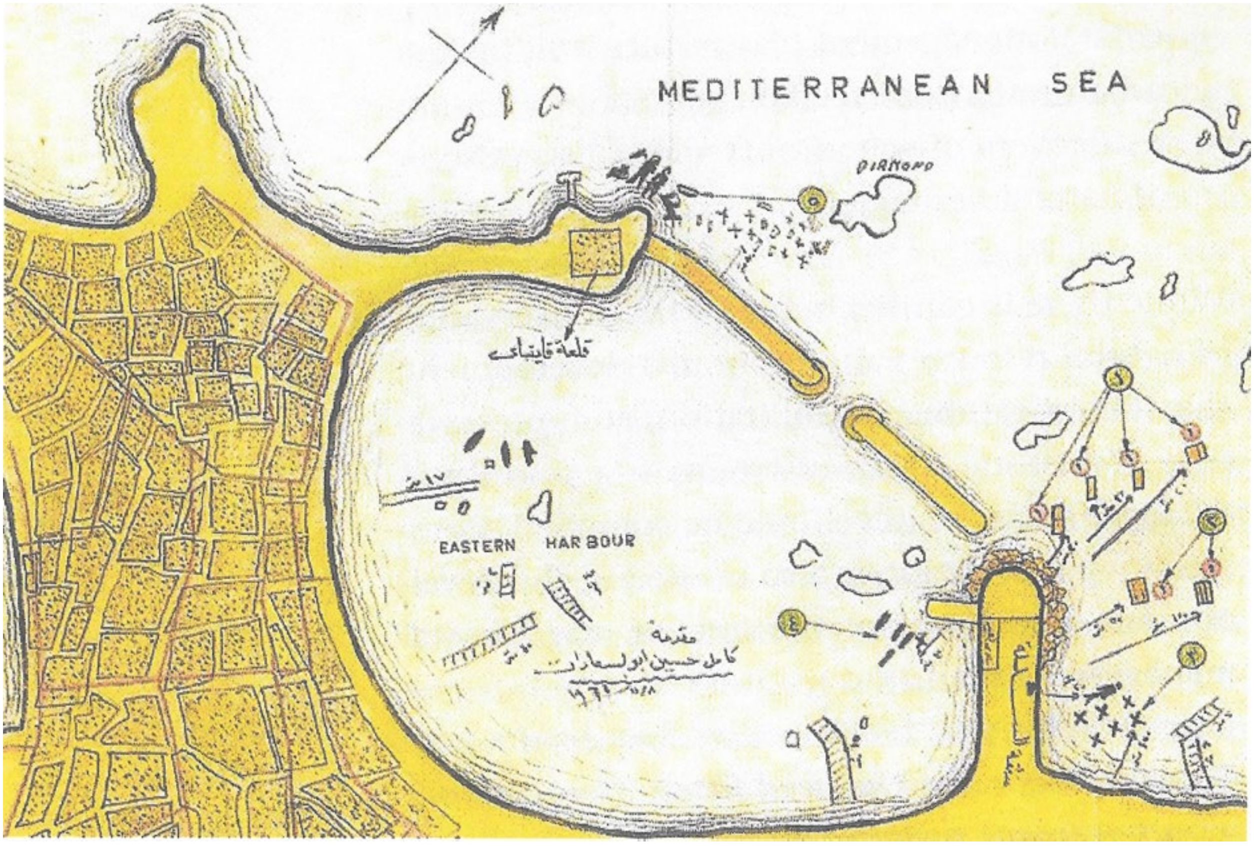

Figure 1. Original drawing by Kamel Abul-Saadat showing the position of his discoveries, plate 4 in Selim A. Morcos, 'Early discoveries of submarine archaeological sites in Alexandria', *Underwater archaeology and coastal management. Focus on Alexandria*, Coastal management sourcebooks 2, UNESCO Publishing, Paris 2000, pp. 33-45.

Figure 2. Kamel Abul-Saadat and Honor Frost after a dive off Quaid Bey (courtesy J.-Y. Empereur).

diving again on that same site with an experienced archaeologist-diver, Dr Jean-Yves Empereur.[4] It is in 1993 with the surveys of Dr Empereur on the area neighboring the site where once stood the Pharos and the foundation of the Centre d'Études Alexandrines that Alexandria's underwater archaeology starts as a scientific enterprise.[5] Then in 1997 the Egyptian Ministry of State for Antiquities established the General Department for Underwater Antiquities. It is during that same year that the European Institute for Underwater Archaeology headed by Franck Goddio initiated a survey in the Eastern Harbour.[6] Important

[4] Frost 1975: 126-129.

[5] La Riche 1996; Empereur 1998.

[6] Goddio *et al.* 1998.

Figure 3. Alexandrie Ancienne by T. Neroutsos in l'Ancienne Alexandrie, Etude Archéologique et topographique, Paris 1888.

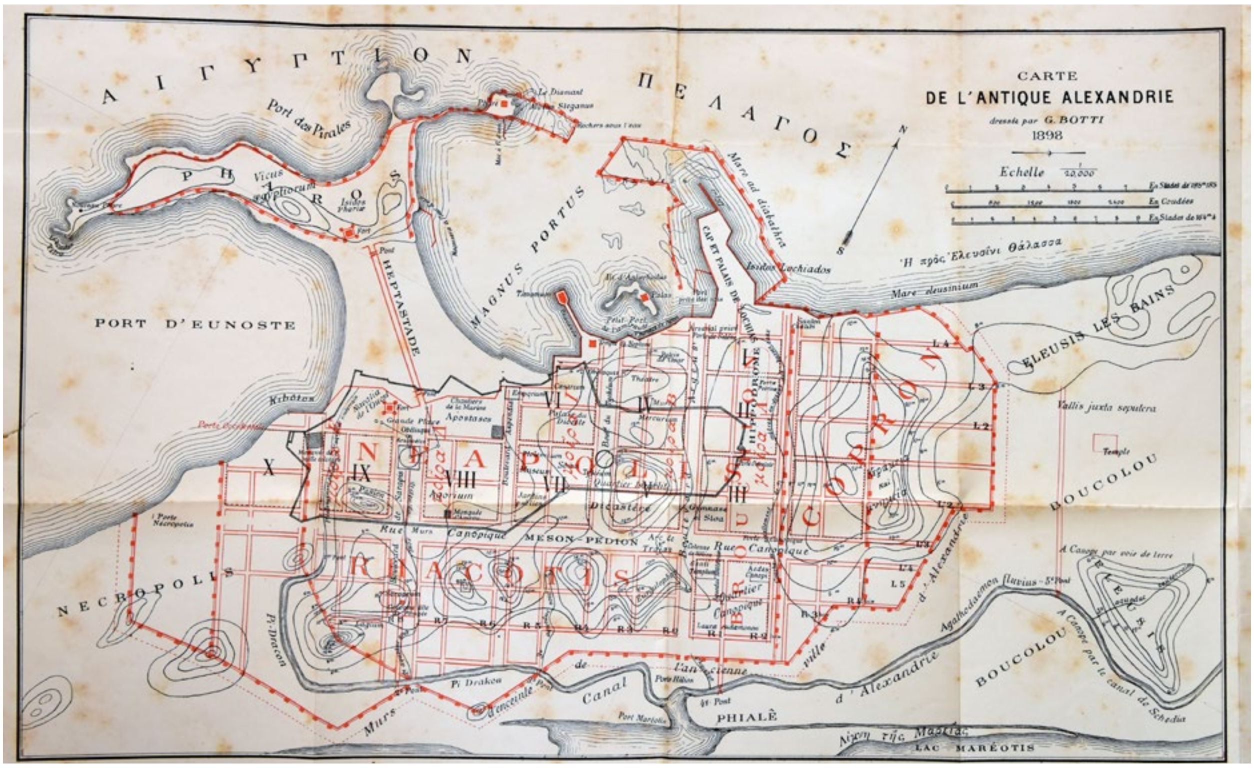

Figure 4. Carte de l'Antique Alexandrie by G. Botti in *Plan de la Ville d'Alexandrie à l'époque Ptolémaïque*, Alexandria 1898.

submerged remains that were visible and marked on old maps and charts were spotted; some were raised.[7] (Figures 3 and 4).

In 1998 the Greek Mission conducted its first underwater campaign, following the granting of a concession to the Hellenic Institute of Ancient and Mediaeval Alexandrian Studies for the survey of the eastern littoral of Alexandria. Twenty eight campaigns were to follow. Nowadays the area of the Greek Mission concession, known in antiquity as 'I pros Elefsini Thalassa',[8] *Mare Eleusinium*, Juliopolis and Nicopolis,

[7] Jondet 1921, pls XII and XXXVII; map in El Falaki 1872; map in Botti 1898.

[8] Athenaeus, *The Deipnosophists*, 982.

Figure 5. Map of the Greek Mission concession area. The eight subsites are marked with numerals as well as with an * for the site of the modern wreck with the cannons.

extends from the Silsileh Promontory up to Mandara Bay along 13.5km of littoral and covers a surface of 13.5 square kilometers (Figure 5).

As expected, in the vicinity of two important harbours, the Eunostos and the Megas Limin,[9] remains of maritime activities scatter the sea floor at several locations. However due to the rise of the Mediterranean sea level[10] and the subsidence of the coast, there is also a wide variety of submerged ancient remains ranging from extended paved surfaces, foundations of large structures, architectural elements, some of colossal dimensions, necropoleis, stone quarries and fish tanks carved in the rock.

During our 3rd, 4th and 5th campaigns, conducted respectively during October–November 1999, and in April, May and November 2000, marine geologists of the Patras University, mapped (Figure 6) part of the area with the use of side-scan sonar and bottom profiler devices.[11] Then in an attempt to better understand the subsidence phenomena, our campaigns of the years 2013, 2014, 2015 and 2016 were jointly conducted with the Mariolopoulos-Kanaginis Foundation for Environmental Sciences.[12] Starting from the westernmost point and moving eastwards, this

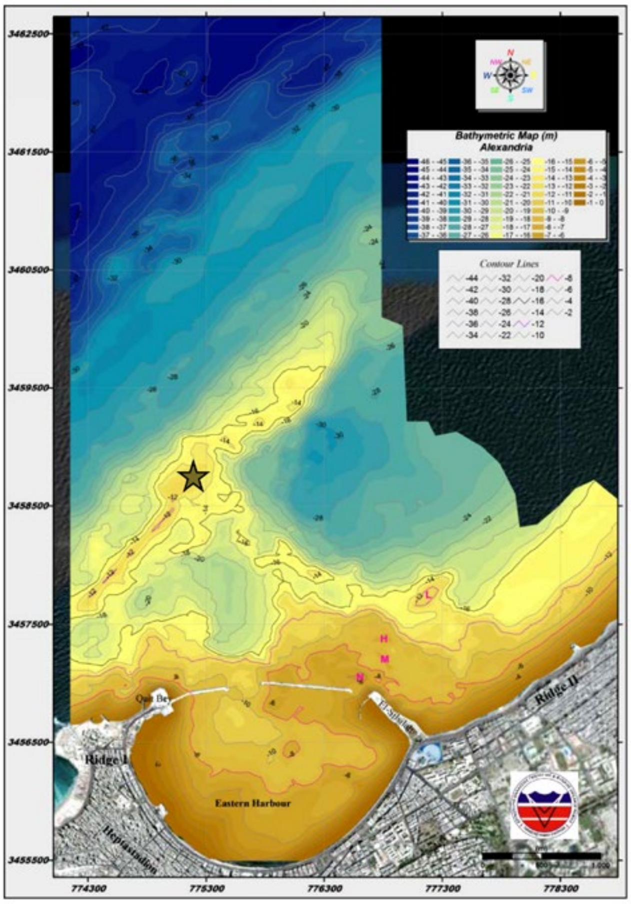

Figure 6. Map showing the side scan sonar survey conducted by the Department of Marine Geology of the Patras University in the wider area of the approaches of Alexandria Eastern Port.

[9] Eunostos is the port of the 'good return', today's main commercial harbor, while the Megas Limin, *Portus Magnus* of the Romans, Mina el Sharky during the Islamic period gradually fell in disuse.

[10] The Mediterranean Sea level rises by approximately one meter every 1000 years, starting from the melting of the glaciers some 10.000 years ago.

[11] A. Chalari, G. Papatheodorou, M. Geraga, D. Christopoulos and G. Ferendinos 2009: 191-212.

[12] Evelpidou N., Tzalas H., Zerefos Ch., Repapis Ch, *ENALIA* (in press).

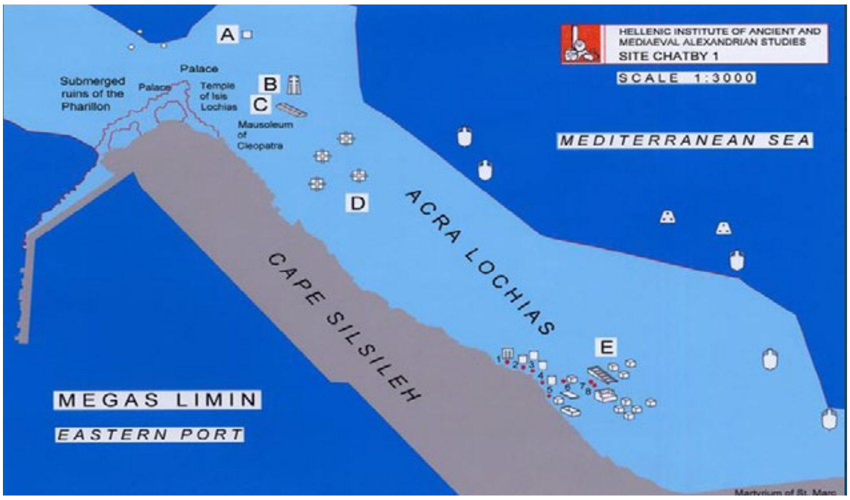

Figure 7. Map of submerged Akra Lochias based on the Greek Mission surveys.

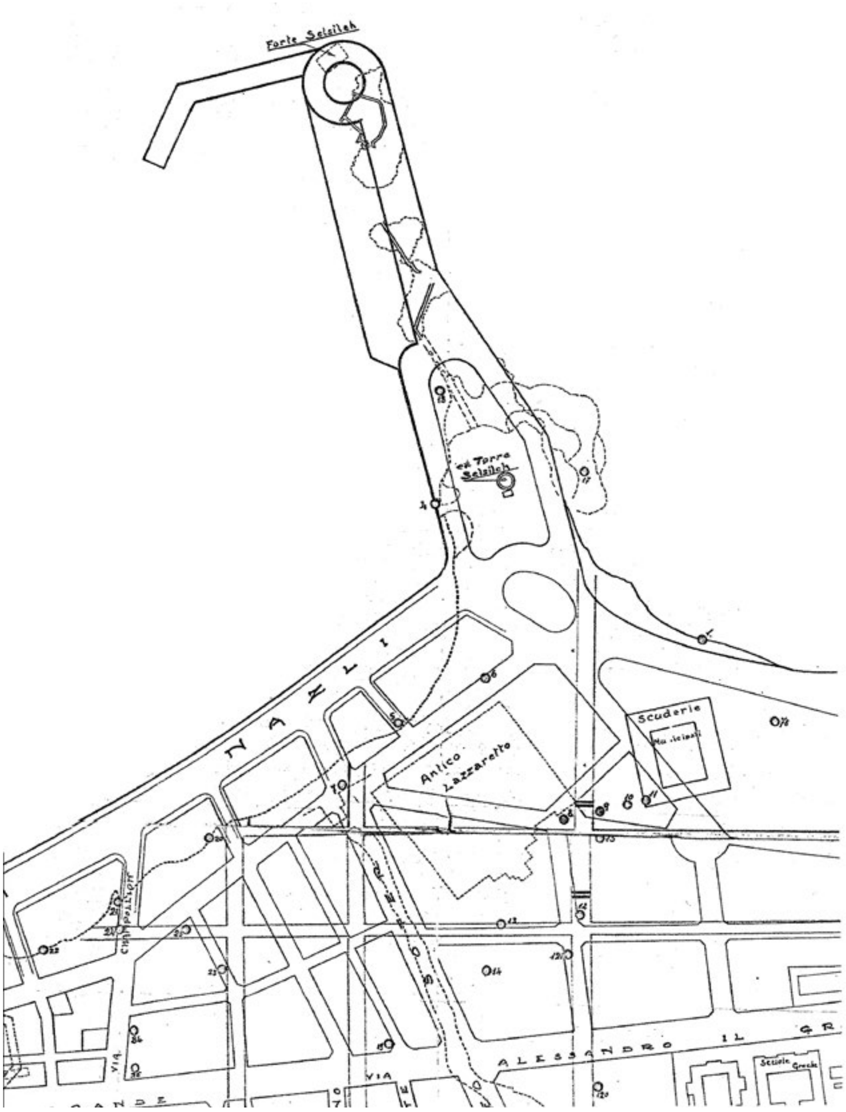

Figure 8. Map indicating the ancient remains of Akra Lochias and the modern Silsileh Promontory. A. Adriani, *Annuario del Muséo Gréco-Romano, 1932-1933.*

area has been divided into eight sub-sites numbered 1 to 8 bearing today's names of the suburbs where they are located and of a reef as shown on Figure 5.

At **Chatby 1,** nowadays submerged, once stood Akra Lochias which formed the eastern boundary of the Eastern Port and was part of the royal quarters (Figure 7 and 8). According to ancient sources a small temple dedicated to Isis Lochias, the Mausoleum built by Cleopatra VII, and a Palace stood on that headland.[13] At depths varying from 2m to 10m some 400 architectural elements of different sizes were found. It is difficult to ascertain which are *in situ* and which were brought at different times from the neighboring littoral and dumped there in a desperate attempt to keep above water level the gradually disappearing eastern breakwater of the port (see Figure 7 and Figure 8). It is witnessed on all maps of the 18th and 19th centuries that up to the early 20th century the Silsileh promontory was a not a unified wide surface, as it is today, but a series of minuscule islets, just at sea level, which were connected by narrow couloirs (earlier by wooden bridges) that allowed access to the derelict little fort on its tip.[14] It was only in the 1910s during the construction of the Corniche that this promontory was widened to its current dimensions by dumping heteroclite stones, including numerous ancient remains scattered on the neighboring coast.[15]

[13] Strabo, *Geography*, 28,9; Plutarch, *Lives. Anthony*, 74.1 and 77.

[14] See plan de la Ville d'Alexandrie, dressé par les services de la Municipalité, 1902, in Jondet Pl. L.

[15] The divers of the Greek Mission have repeatedly seen large broken ancient architectural elements in cavities under the eastern side of Silsileh Promontory, beyond the protective line of modern cement blocks which were dumped in the 1960s .

Figure 9. The Tower of the Pylon lying on the sea bed (photograph HIAMAS).

Figure 11. The monumental base lying on the sea bed (photograph HIAMAS).

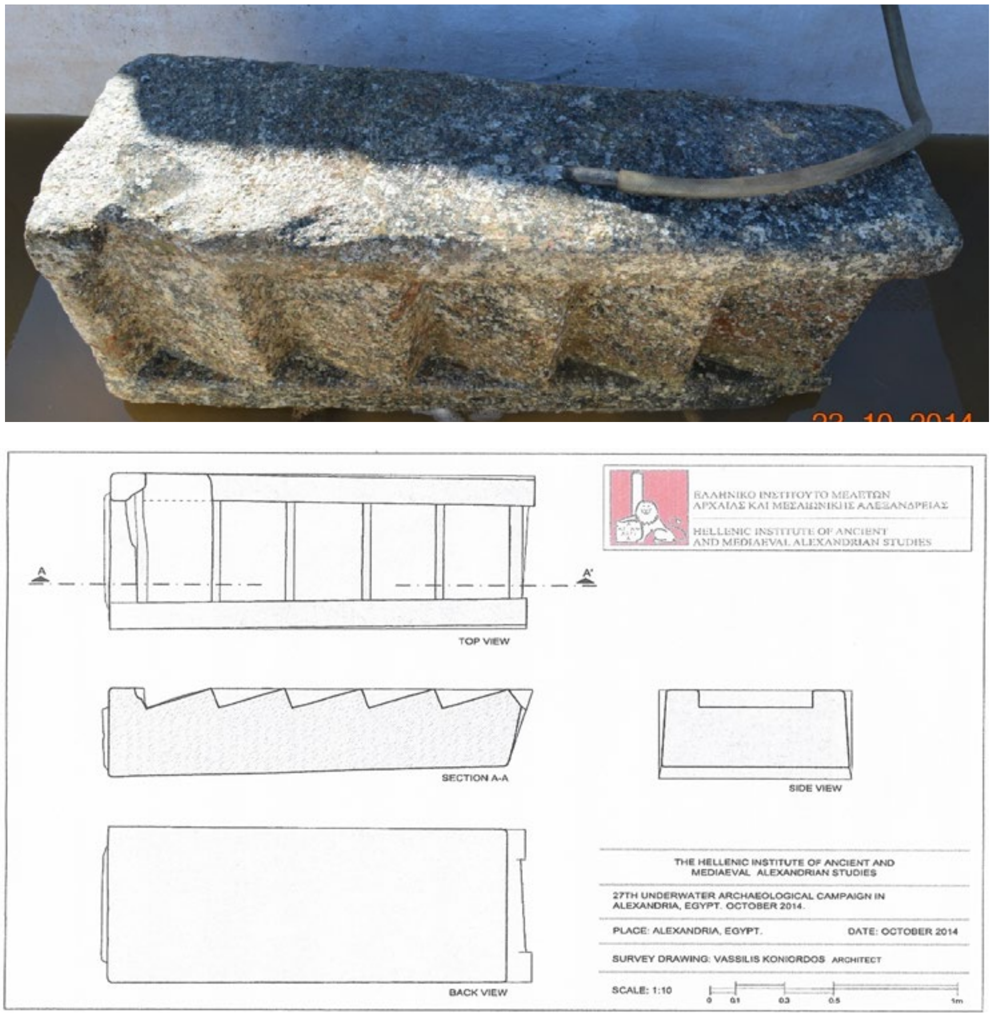

Figure 10. The monolithic flight of steps leading to the pylon (photograph HIAMAS).

We have also to bear in mind that the action of the waves, the swell, as well some intense tsunamis that hit Alexandria with tragic consequences have certainly affected the position of the scattered ancient remains.[16]

[16] As the tsunami of AD365, Ammianus Marcellinus. *Res Gestae*, 26.10.15-19.

Because of their weight, and because they were found at greater depths, we believe that the tower of a dwarf pylon (Figure 9) and its monolithic flight of steps (Figure 10), a monumental base (Figure 11) as well as the lintel of an oversized door (Figure 12), all made of red granite, lie very near to their original location. It is most probable

Figure 12. The oversized lintel while raised for study on a floating platform (photograph HIAMAS).

Figure 13. Raising an inscribed block of calcite, part of a Sed ceremony monument (photograph HIAMAS).

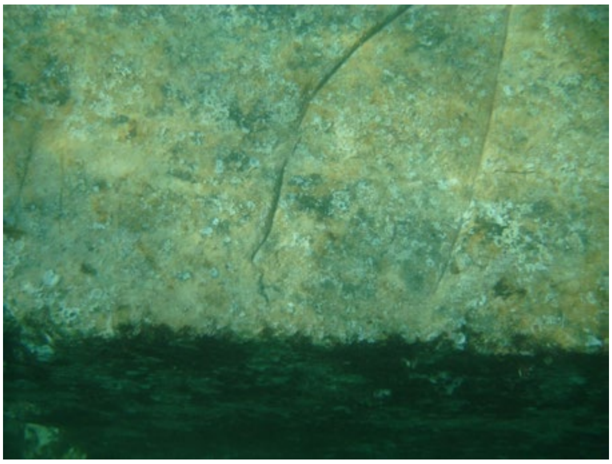

Figure 14. A block that formed part of a Sed ceremony monument, with a Pharaoh head wearing the white crown, raised for study (photograph HIAMAS)

that the pylon was part of the entrance of the Temple of Isis Lochias[17] and that the lintel could have been part of the monumental door of Cleopatra's mausoleum where she met her tragic death with Mark Anthony.[18]

It is difficult to ascertain if the seven large blocks of calcite, which once formed part of a Sed-ceremony monument, with pharonic representations and hieroglyphs (Figures 13 and 14), including the name of Amasis, a Pharaoh of the XXVIth dynasty, as well as an 8th made of red granite representing a headless torso, stood originally on Akra Lochias, or if they were brought from an unknown location in the town.[19] The same question as to their provenance arises for the remains of three mutilated 'naiskoi' made of black granite. Two, which are nearly complete, bear perforations in their lower part (Figures 15 and 16). Because of the rough opening of the hole – clearly shown in Figure 15 – it is certain that the 'naiskos' was re-used, lying instead of standing, as a tannery basin. This area, located just outside the eastern walls, was

Figure 15. A mutilated 'naiskos' with two perforations witnessing to its reuse as a tannery basin (photograph HIAMAS).

17 Fragaki 2011.The pylon tower as well as the monolithic flight of five steps are exhibited today at the Kom el Dikka archaeological site.
18 Plutarch, *Lives. Anthony*; Dion Cassius, *Hist. Rom. L I.8.*
19 Gallo 2010: 64-88.

Figure 16. A mutilated 'naiskos' and other architectural elements raised for study on a floating platform (photograph HIAMAS).

Figure 17. The pylon tower and its monolithic steps as exhibited at Kom el Dikka archaeological site.

used during Islamic times for such activities.[20] Besides those heavy artifacts which were raised up, photographed, drawn and studied, there are some 400 blocks and slabs that once pertained to imposing structures as well as some catapult stone balls and a few mediaeval stone anchors found at the eastern boundaries of that submerged promontory.

Except for the pylon tower and its flight of steps that went through a long conservation process and are now exhibited in the archaeological site of Kom el Dikka (Figure 17), all other architectural elements were placed again on the sea floor due to lack of space for a permanent exhibition.[21]

At **Chatby 2** we have traced a variety of submerged ancient remains, most of them foundations of buildings, but also paved areas, some architectural elements as well as a few stone anchors. The fact that in early Christian times there was a large complex of buildings that included the assumed *Martyrium* of Mark the Evangelist[22] is attested by two proto-Christian capitals (Figures 18 and 19), some *columelae* as well as

Figure 18. Raising a large byzantine capital from Chatby 2 sub-site (photograph HIAMAS).

Figure 19. A smaller byzantine capital raised from Chatby 2 sub-site (photograph HIAMAS).

[20] The area of Chatby and Ibrahimieh, extending outside the eastern walls was used in the mediaeval times for tannery activities.
[21] We are permitted to raise and store any artifact weighing 100 kg or less.
[22] Martin 2002: 45-49.

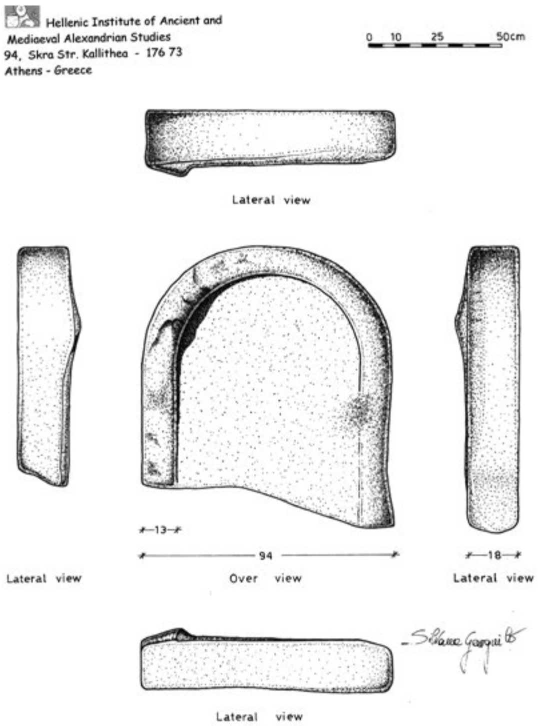

Figure 20. Drawing made of the 'Sygma table' (drawning by S. Gargiulo).

Figure 21. View of Alexandria on the Codex Urbinate 277.

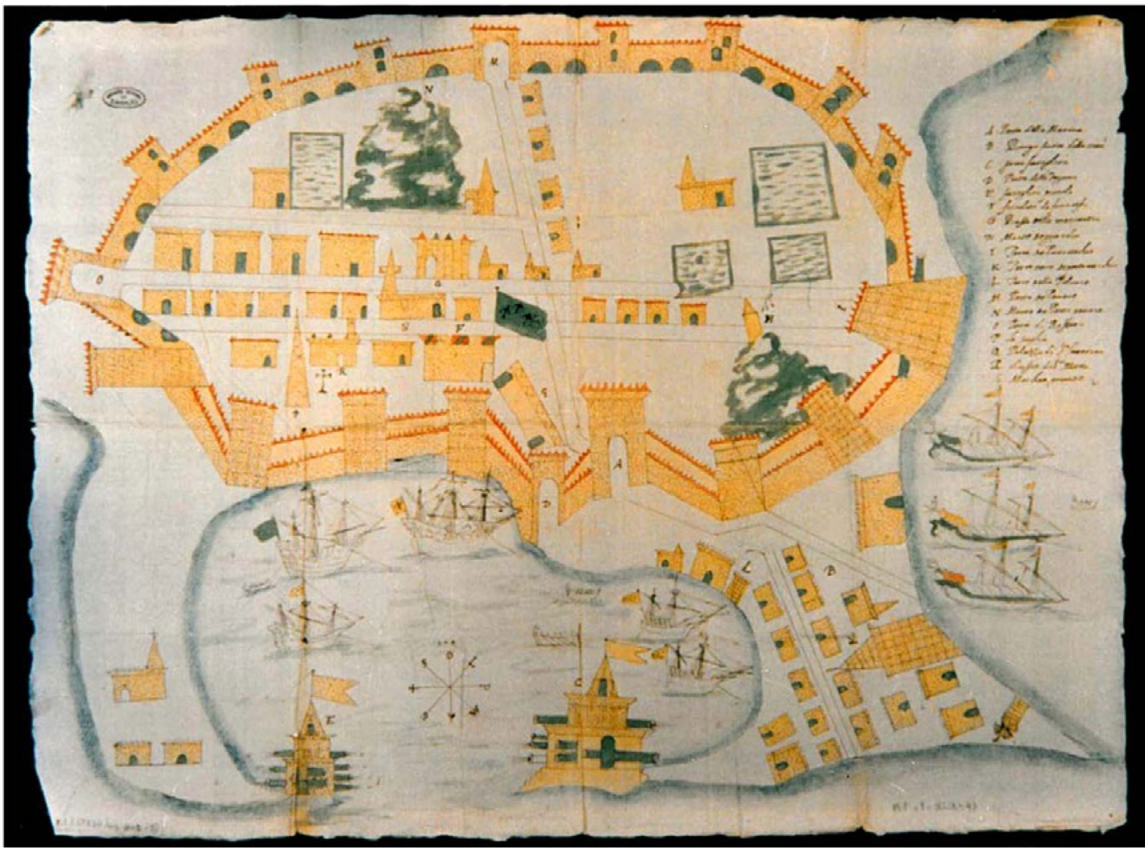

Figure 22. Plan of Alexandria from the Archivos General de Simacas.

a most interesting nearly complete 'Sygma table' made of red granite (Figure 20).

During our 5th campaign of November 2000 and the 6th of June 2001, two trenches were opened on the sandy beach, west of the Chatby Casino and a large quantity of pottery sherds were found, all dating to the early Byzantine period. The church built on the alleged *martyrium* of St Mark is represented on the earliest view we have of Alexandria, the Codex Urbinate 277 which dates to 1472 (Figure 21) as well as on the plan of Simacas dating to 1605 (Figure 22).[23]

There is an extended reef at the sub-site **Ibrahimieh 3** at a depth of some 12m and approximately 500m distant from the shore. The lead components of a large composite anchor dating to Late Hellenistic or Early Roman Times (Figure 23), as well as some 70 stone anchors of different shapes and sizes resulting from fishing activities in Islamic times were found entangled in the cavities of this reef.[24] Fifty were raised up, (Figure 24) conserved, drawn, photographed and studied; they are now stored at the Department of Underwater Antiquities (Figures 25a, 25b, 25c). This is one of the most extensive troves of mediaeval stone anchors in the whole of the Mediterranean.

Figure 24. Raising a stone anchor (photograph HIAMAS).

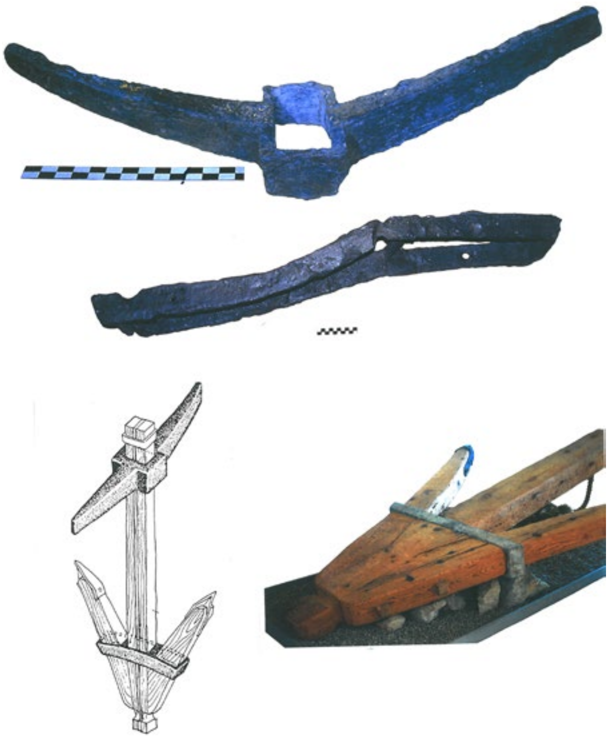

Figure 23. The composite anchor (photograph HIAMAS).

Between the above-mentioned reef and the shore lay, just under sea level, an extended stone quarry. This is sub-site **Ibrahimieh 3** that has been nearly totally reclaimed by the widening of the Corniche road. It was probably one of the largest stone quarries of Alexandria and its remains co-existed with a limited number of burials (Figures 26 and 27). As for all costal quarries there is a gentle slope towards the sea and the submerged depths at the time of our survey varied from half a metre on the littoral to some two metres at the deeper ends followed by a sudden descent into the sea of some 4 metres.

The original quarrying activities must date to ancient times, possibly to the Hellenistic period and may have continued during the Roman years with an intricate system of quarrying basins and canals for the sea transportation of the extracted blocks. As the quarry remains continue under and beyond the old Corniche that was opened in the early 20th century, it cannot be excluded that, as for other areas of the littoral, the quarrying activities were resumed at the time of Mohamed Ali, when cosmopolitan Alexandria started to develop.[25]

Sub-site **Sporting 5** has been partially affected by the recent Corniche widening as concrete blocks were dumped in the sea as buttresses to the action of the waves, covering some 10% of the visible foundations of

[23] Map of Alexandria from the Codex Urbinate 277 see Pl. 1, Jondet, G. *Atlas Historique*, Cairo 1921; For the plan of Simancas dating to 1605: plan from the Archivos General of Simancas, Valladolid, first published in Harry E. Tzalas, 'The two ports of Alexandria. Plans and maps from the 14th century to the time of Mohamed Ali', *Underwater archaeology and coastal management, Focus on Alexandria*, UNESCO Publishing, Coastal management source book 3, UNESCO Press, 200.
[24] Tzalas 2015: 103-113.
[25] Neroutsos 1872: 24.

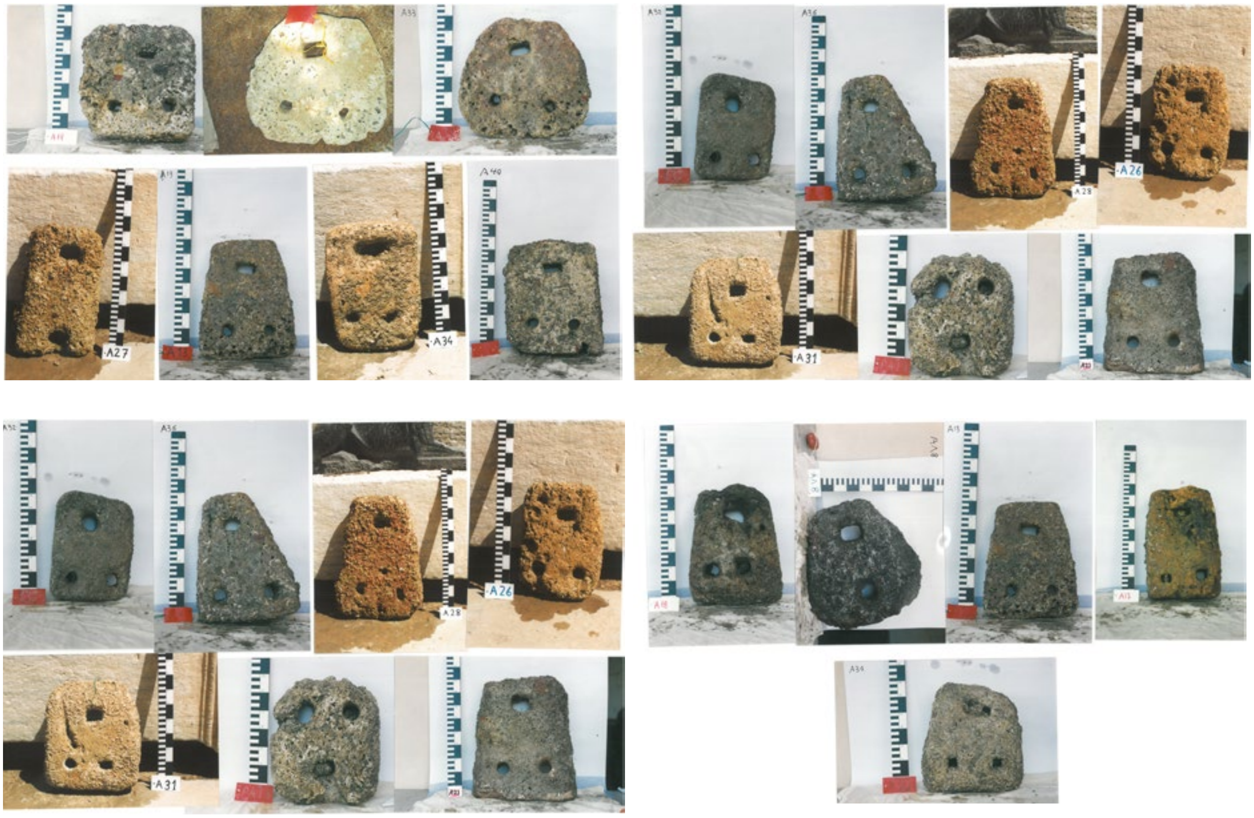

Figure 25. Stone anchors found on the Ibrahimieh Reef (photograph HIAMAS).

Figure 26. Air photograph of the Ibrahimieh quarry (photograph by K. Savvopoulos).

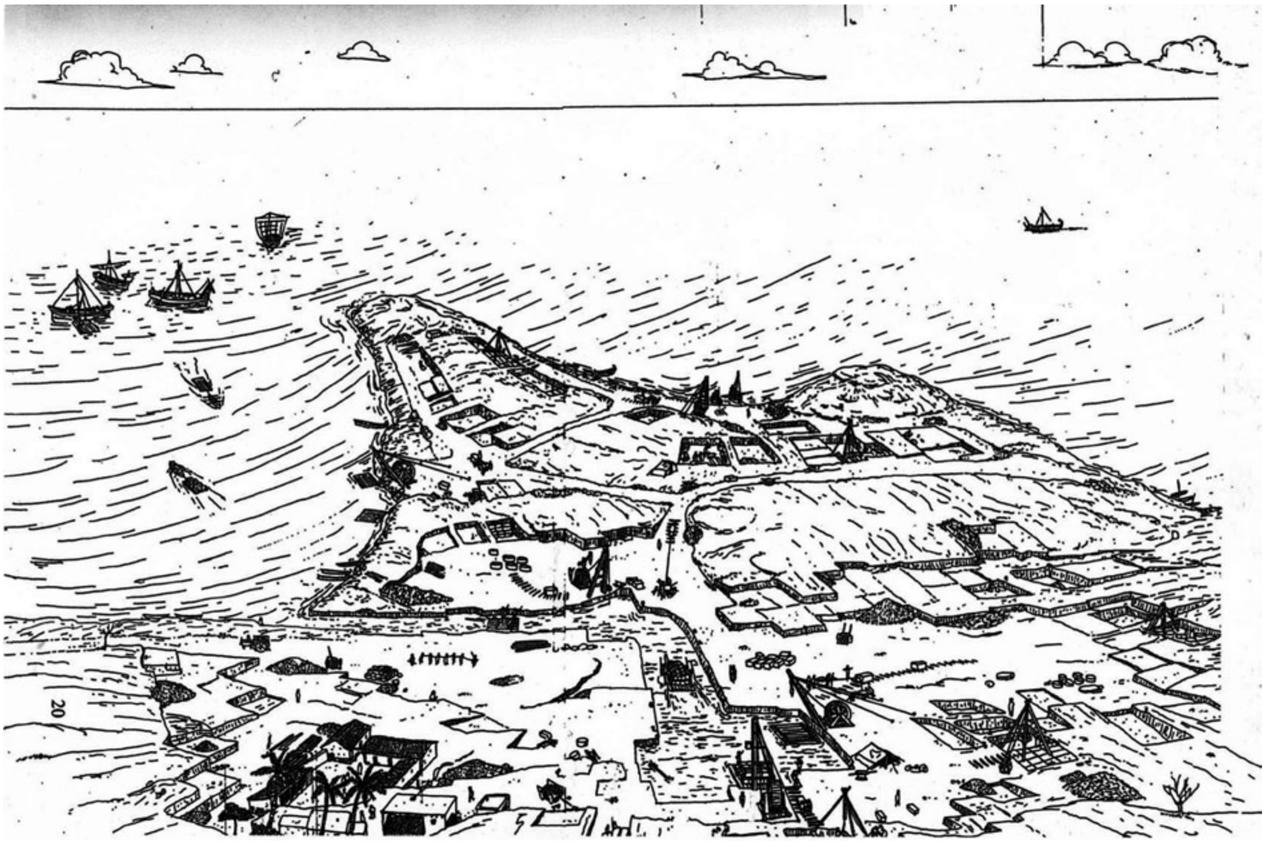

Figure 27. Artist impression of the Ibrahimieh quarry (drawing by Y. Nakas).

ancient structures. At a depth of some 2m, the lower structure of a paved rectangular building divided in three parts can be seen, as well as the remains of foundations of two semi-circular structures – part carved in the rock and part constructed – adjacent to its western end (Figures 28 and 29). The use of this complex has not yet been understood as the area was only superficially surveyed. It could well be possible that these structures are the remains of fish tanks.

El Hassan 6 is a reef located at some 500m north-east of Cape Silsileh, it represented in antiquity – with the El Nassar and other shoals in its vicinity – a hazard to navigation, as it protruded into the course of ships entering and sailing out of the Eastern Port. El Hassan, as well as the other eight adjoining reefs, are drawn as shoals on the earliest cartographic document we have of Alexandria, the Codex Urbinate made in 1472 (Figure 21). As nowadays the top of this reef lies at some 10m under sea level one wonders how in a matter of only 500 years such an important subsidence occurred! The rise of the Mediterranean Sea for those five centuries would not exceed 50cm and although it is most probable this late 15th century view draws on a yet older map, the subsidence is important and is different to the remaining submergence pattern of that littoral. The fact that El Hassan was slightly above sea level or slightly under, at least until late Roman times, is attested by a number of shipwrecks with their ballast and cargo of amphorae scattering the reef and its contour. A late Roman or early Byzantine partly-preserved iron anchor was also found raised and conserved (Figure 30).

Sub-site **Sidi Bishr 7** extends from the Bay of the Automobile Club and includes the promontory known as Bir Masaoud, where is located 'the devil's well', the ventilation shaft of a large hypogeum tomb (Figures 31 and 32) that was part of a now-submerged vast necropolis extending for some 200 metres into the sea. Eastwards it reaches the islet of Gezireh Gabr el-Khour now called Miami Island. Quarrying marks are noticeable all over Bir Masaoud promontory and its immediate vicinity witnessing to the fact that, at an undetermined period, all the area of this necropolis was used for stone extraction. On the islet a hypogeum tomb dating to Hellenistic times, with a courtyard, a burial chamber and steps, all carved in the rock was excavated (Figures 33, 34, 35).

There are here located very impressive deep couloirs, partly submerged, carved into the rock of the northern side of this islet (Figure 36a and 36b), and what is certainly a fish tank is visible at its eastern end (Figure 37). This fish tank is slightly submerged; just the rise

Figure 28. Foundations of submerged structures at Sporting (photograph HIAMAS).

Figure 29. Foundations of submerged structures at Sporting (photograph HIAMAS).

Figure 30. Late Roman/early Byzantine Iron anchor found on the El Hassan Reef, after conservation (photograph HIAMAS).

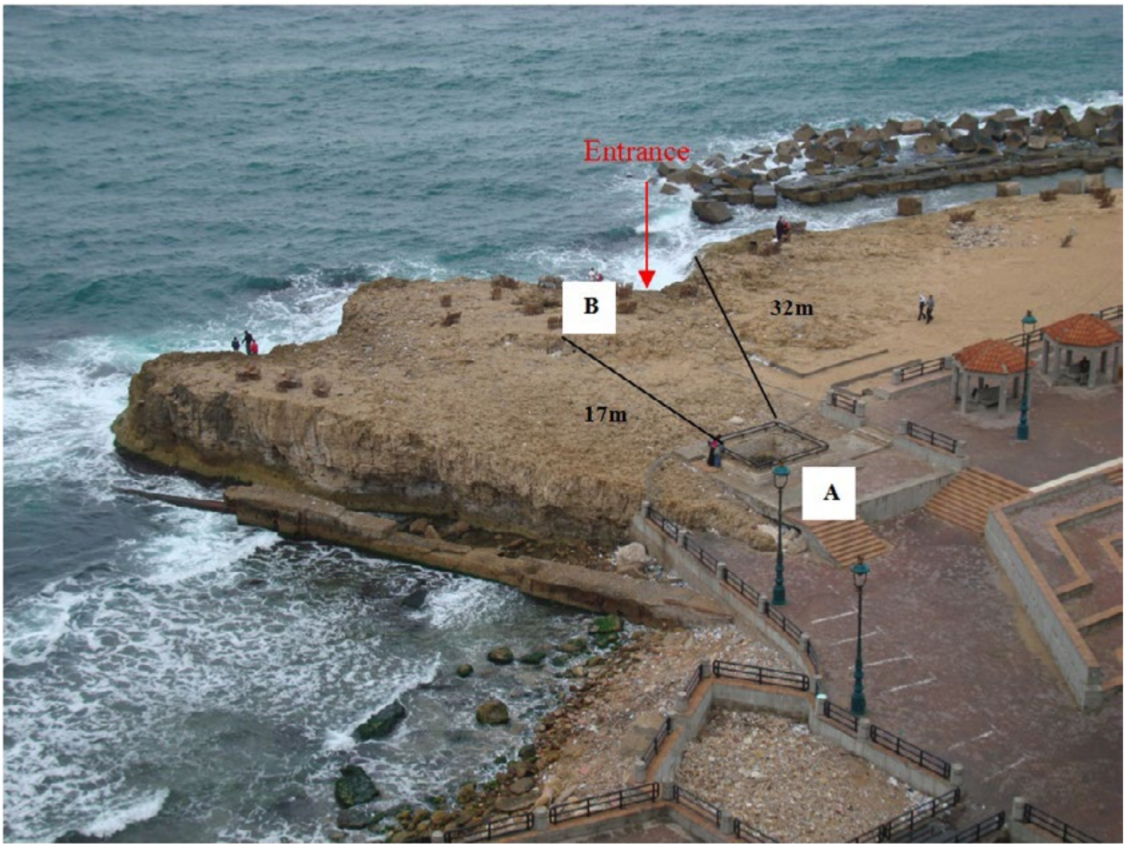

Figure 31. Bir Masaoud Promontory at Sidi Bishr: 'A' indicate the ventilation well and 'B' the tip of the promontory above the todays sea access of the hypogeum tomb (photograph by K. Savvopoulos).

Figure 32. Bir Masaoud Promontory at Sidi Bishr, sea access of the hypogeum tomb (photograph HIAMAS).

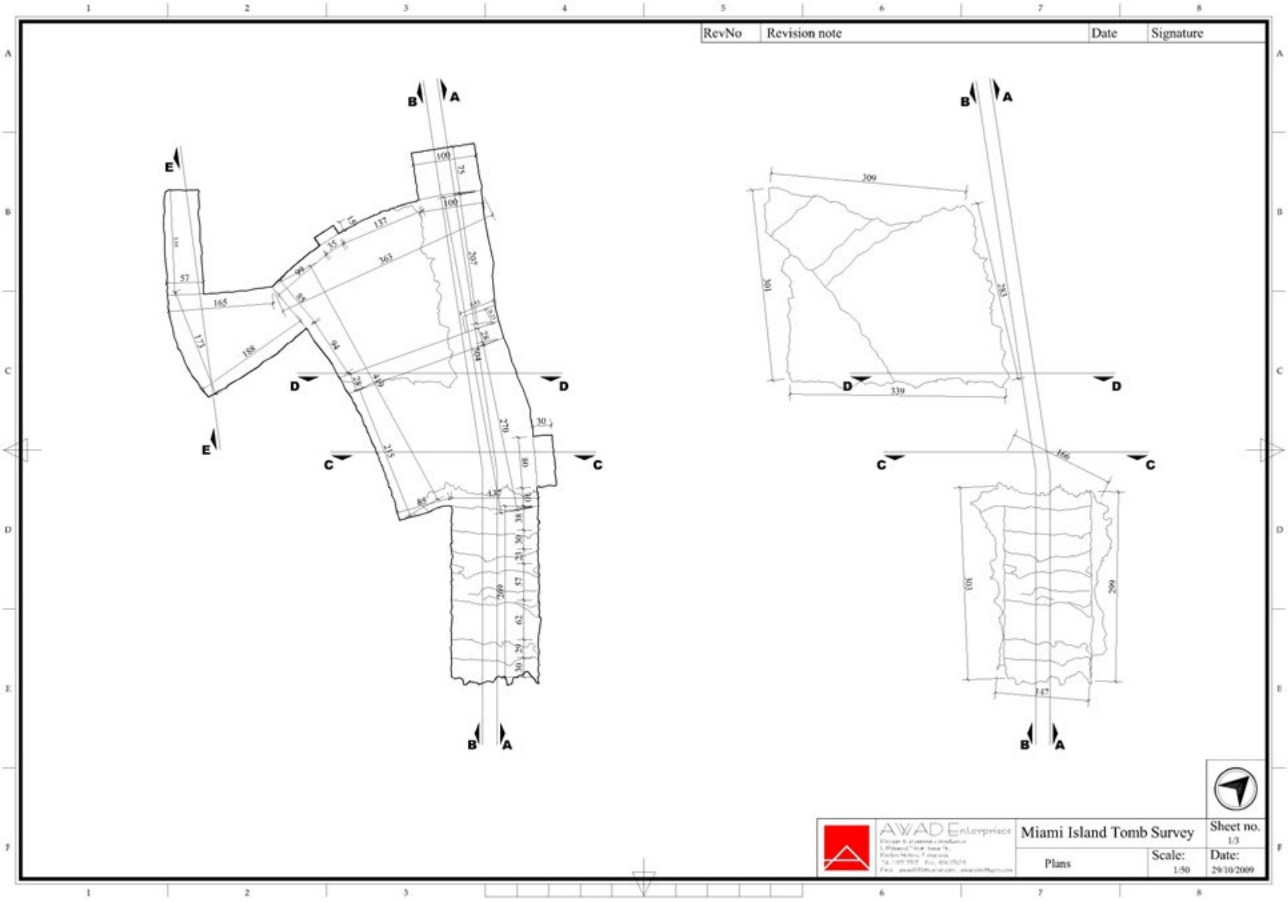

Figure 33. Gezireh Gabr el-Khour, plan of the excavated tomb (by Awad Enterprises)

Figure 34. Gezireh Gabr el-Khour, steps leading to the tomb after excavation (photograph HIAMAS).

Figure 35. Gezireh Gabr el-Khour, interior of the tomb during the excavation (photograph HIAMAS).

Figures 36a and 36b. Deep couloirs carved on Gezireh Garb el-Khour (photographs HIAMAS).

of the sea is noticeable. A hand grenade, made of clay dating to *circa* the 10th/11th century AD, was found in a pit containing numerous pottery sherds.

That islet, and the protective cove it forms with the littoral, is first marked on a map of the Portolan of Piri Reis, the Kitaby-l Bahariyeh (Figure 38 and 39), compiled in 1513.[26] Several small stone anchors and items of fishing tackle were found in the sea and raised.

Sidi Bishr is at some 10km distance from Cape Silsileh and the El Hassan Reef and its lack of significant submergence attests that there is no uniformity in the subsidence of the eastern Alexandrian coast.

The last sub-site **Mandara 8,** adjacent to Montaza promontory, was known in antiquity as Lesser Taposiris. It was recently dramatically affected by the dropping of large concrete blocks and is expected to be surveyed during one of our future campaigns.

[26] Piri Reis, *Kitab-I Bahriye*, The Historical Research Foundation, Istanbul Research Centre 1988.

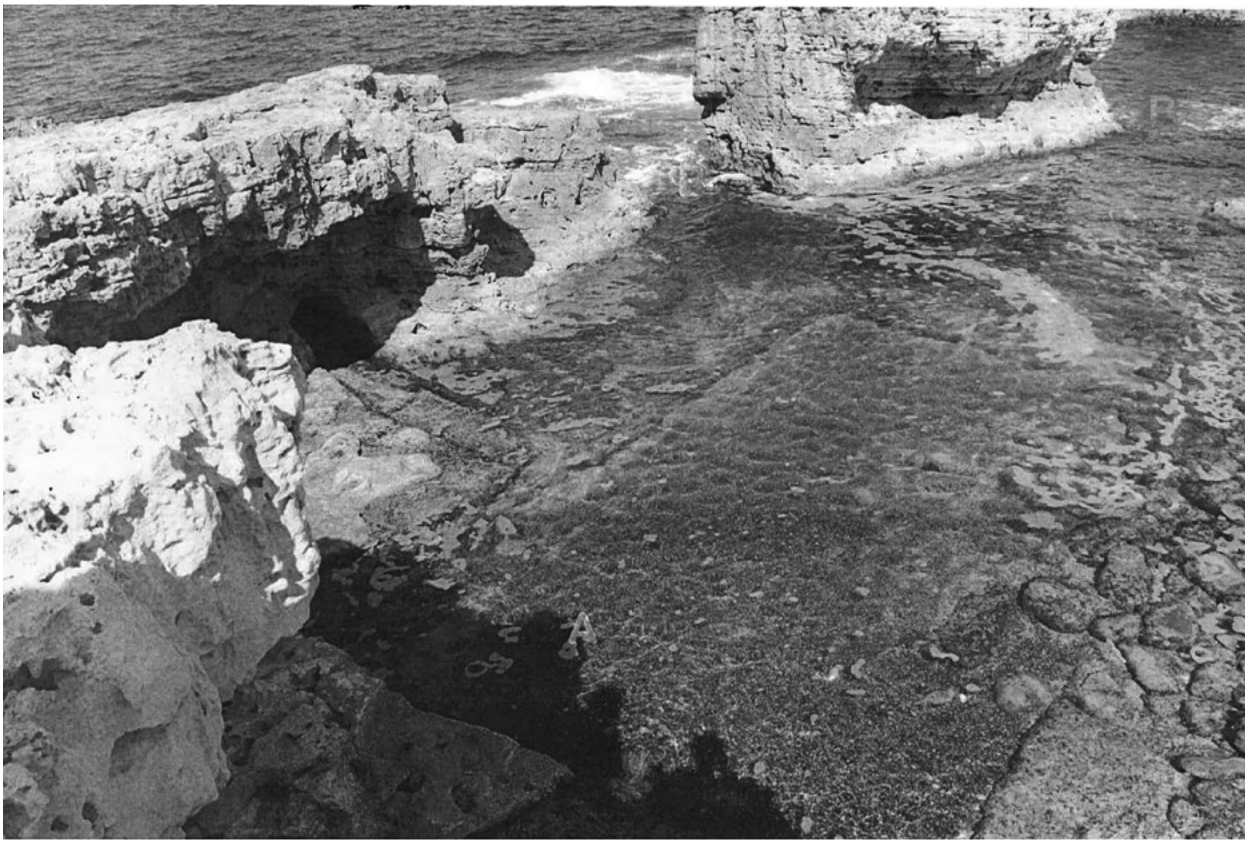

Figure 37. A fish-tank on Gezireh Gabr el-Kour (photogrpah by Niki Evelpidou).

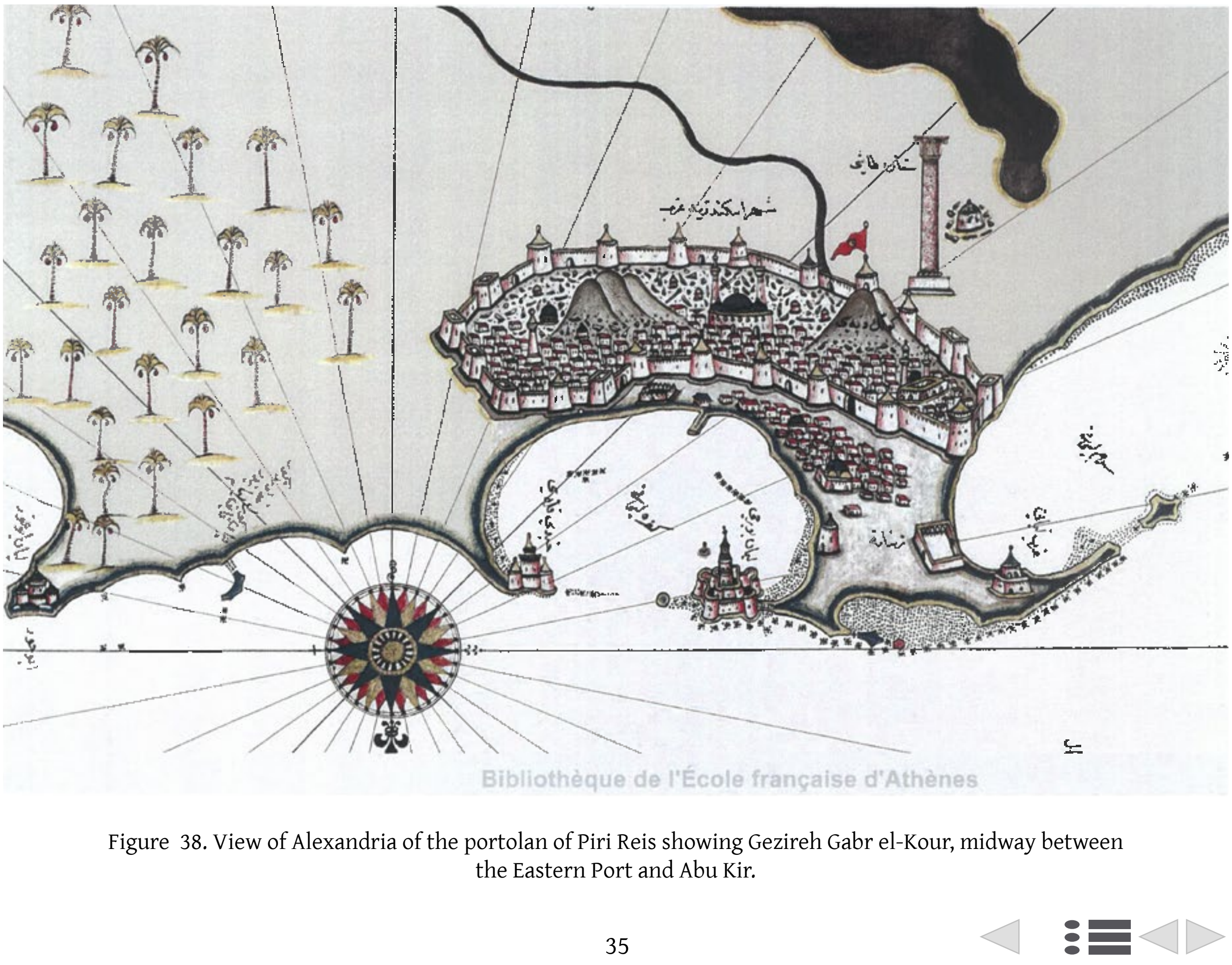

Figure 38. View of Alexandria of the portolan of Piri Reis showing Gezireh Gabr el-Kour, midway between the Eastern Port and Abu Kir.

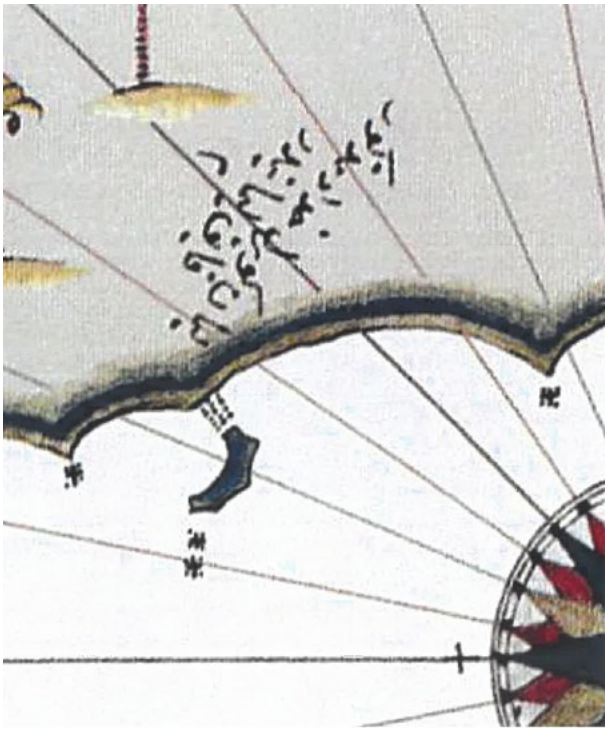

Figure 39. Detail of the view of the portolan of Piri Reis focusing on the cove formed by the islet of Gezireh Gabr el-Kour and Sidi Bishr littoral.

It should be stressed that in between all those eight sub-sites there are extended sea areas that have not yet been searched.

Before concluding we will report on a brief dive conducted during our 18th campaign of November 2008 on the site of a modern warship that probably sunk in the late 18th/early 19th century at a distance of some 2.900m off the coast of the suburb of San Stefano. We were asked by Alaa Mahrous, Director of the Department of Underwater Antiquities, to check the information provided by an unrevealed source stating that there were numerous cannon scattered on the sea floor. Our Chief-diver George Nomikos accompanied by two divers of the Department of Underwater Antiquities dived, spotted and photographed eight large iron cannon bearing heavy incrustation at depths of 23m to 26m. The sinking of that vessel might go back to the military operations that opposed the French expedition of Bonaparte and the British forces from 1798 to 1801 (Figure 5).

Abbreviations

ENALIA	The Journal of the Hellenic Institute of Marine Archaeology.
HIAMAS	The Hellenic Institute of Ancient and Mediaeval Alexandrian Studies.
IFAO	Institut Français d'Archéologie Orientale.
Loeb	Loeb Classical Library, London, Cambridge.

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Macedonian elements in Alexandria

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The Macedonians, living in a tribal Hellenic kingdom, preserving until the late classical period the ancestral way of life of the epic era,[1] managed through the leadership of two rulers of genius, Philip II and Alexander the Great, to be the groundbreaking factor that changed forever not only Greek but even World History. However it was a matter of vicious luck to contemplate them through the eyes of their enemies. Demosthenes, a sworn enemy, turned out to be our main source for Philip II. For Alexander, no one is to be found worthy to write down his Work and Days. Polybius, an Achaean who decided to join the Romans, condemned Alexander's Successors and the glorious Hellenistic Ecumene to be conceived as a deviant and declined world. Thousands of square kilometers of excavated land, millions of findings, thousands of inscriptions were needed, right at the beginning of the 21st century to change that view. Today, forty years after the discovery of the royal graves at Aigai,[2] perhaps we have reached the point of being able to recognise the Macedonian contribution in various fields.

Let us go to Alexandria, the city founded by Alexander himself.[3] The foundation of rationally-planned, well-organised cities, with modern and multilevel facilities for their inhabitants, in order to be the centres of financial growth and social reorganization, was Alexander's main political instrument. It is used continually by the Successors, in a more restrained way by the Ptolemies, and more powerfully by the Seleukids.[4] And to that very instrument is due the unprecedented success of the multilevel Hellenistic Koine. But that kind of politics was actually Philip's inspiration and that is exactly what Alexander praised as his father's major contribution in his speech to Macedonians at Opis: 'Philip found you vagabonds and destitute... he led you from the mountains down into the plains... he made you city dwellers and embellished your lives with laws and morals...' .[5]

In Alexandria and Egypt the most crucial Macedonian element, apart from the calendar, was the royal house, the Ptolemies themselves.[6] The rumour that Ptolemy I was not actually Lagos' son but Philip's II own son, was probably a convenient and useful story for the succession's struggle. Certainly, after the establishment of the Ptolemaic royal house, the link to the Temenids became official. According to Satyros[7] through his mother, Arsinoe, Ptolemy I was a descendant of Borkos, brother of Alexander I, offspring himself, like Philip and Alexander, from Temenos, grandson of Herakles and Deianeira, the daughter of Dionysos. Thus the Ptolemies became Heracles' and Dionysus' and of course Zeus' descendants and they entered as equals the Temenids' dynasty, which was absent from the political arena but celebrated in legend.

In the Canopus decree[8] and on the Rosetta stone[9] the priestly synod honoured the victories and praised the virtues of the Ptolemies. The kings are the protectors and defenders of the people, victors over the enemies, benefactors, fair and pious, gods' descendants. Actually these are exactly the traditional virtues of the Temenids as being recorded by their royal names: Amyntas, 'the defender', Alexander, 'the defender of the people', Perdikkas, 'the witty', Philip, 'he who loved the horses', fighting as a rider for his people.[10] The Ptolemies repeated the characteristic Macedonian name of Ptolemy, the 'warrior', founder of the dynasty, as if they tried to clone him. Surnames such as Soter, 'Savior', Euergetes, 'Benefactor', and Epiphanes, 'Illustrious', declare the virtues of the benevolent ruler,[11] Philadelphos, sister-loving, Philopator, father-loving, and Philometor, mother-loving, the relations of a family of gods much superior to the norm,[12] while the name of the founder-god and defender of the royal city,

[1] Hatzopoulos 2011.

[2] On the discoveries see Ανδρονικος 1984, on Aigai general recently Kottaridi 2013.

[3] Plutarch, *Lives*, Alexander 26, Arrian, *Anabasis of Alexander* 3. 1. 5, 3. 2. 1-2, Strabo, *Geography* 17. 1. 6, Pseudo-Kallisthenes, *Romance of Alexander* 1. 31, Diodorus Siculus, 17. 49. 2-17, 51. See also Mckenzie 2007: 37 ff. with literature.

[4] Coen 2013; 2006: 353-382 specially on Alexandria in Egypt.

[5] Arrian, *Anabasis of Alexander* 7. 9

[6] Cf. Dedication of Ptolemy I from Delos ith the signature: Ptolemy son of Lagos Macedonian IG XI [2] 161 B 26–27, Dedications of the Aitolians in Thermon mentioning Ptolemies as Macedonians IG IX I2, 56, Pausanias, 10.7.8; see also Bearzot 1992: 39–53.

[7] Satyros F.Gr.Hist. 631, F1 cf. Theocritus 17.27. See also Austin 2006: no 266.

[8] http://www.reshafim.org.il/ad/egypt/texts/canopus_decree.htm. Translation: S. Birch, *Records of the Past*, Series 1, Vol.VIII, (1876) London; Pfeiffer 2004.

[9] See translation of the Text: Simpson 1996: 258-271; Pfeiffer 2009: 84–108.

[10] On Temenids see Kottaridi 2011a: 2ff.

[11] See also Bringmann 1993: 8 ff. and Ma: 2003.

[12] A very interesting approach by Ager 2005: 1-34.

Alexander, returned once again as a surname during the crisis years.[13]

Typically Macedonian, particularly of the upper class, were the female names Berenike, 'the Victorious', and Arsinoe, 'the Ingenious'. The dynastic Temenidean name Kleopatra,[14] the 'glory of her father', will come from the Seleucids and dominate for more than a century. As in Macedonia[15] as well in Egypt, the king is surrounded by companions, royal pages, all sorts of officials, a famous bureaucracy, and a brilliant group of Macedonian engineers who have managed to turn the whole of the Arsinoitis prefecture in to a fertile and pleasant garden.[16]

By studying the rulers from the archaeological perspective, the key concept and the focal point is their palaces, their tombs, and of course their iconography. The tombs of the Ptolemies along with Alexander's 'Sema/Soma' are still mythical quests.[17] For the palaces, their 'basileia', which covered 1/4 or even 1/3 of the whole city,[18] we have almost[19] only the testimonies of the literary sources:[20] a huge complex of buildings in which each Ptolemy added his own piece,[21] containing the royal Oikoi, remote and secluded,[22] but also sanctuaries and courts of justice, banqueting rooms, gardens and walks, and as reference point the 'Great Peristyle',[23] an impressive façade, a monumental propylon,[24] and not far away a theatre[25] and a stadium. Thus the 'basileia' of Alexandria was, to a large extent, a public place. This particular political function applies to the Great Peristyle, and as it can be seen from the testimonies[26] that 'βασίλεια›, the palatial complex, becomes the place where the ruler and the folk meet.

After ten years of work, excavation, documentation, preservation and restoration in the palace of Philip II at Aegae,[27] we have gained a lot of knowledge concerning the building that was planned to be the architectural expression of the idea of enlightened leadership (Figure 1).

Although Aegae was actually a small city, in its dimensions the palace was an enormous building - three times the Parthenon - a building without private spaces, destined for public affairs and politics: monumental entrance, justice court, porticos, the sanctuary of Heracles Patroos at the Tholos, banqueting rooms where the king could host hundreds of guests at the same time and finally, at the centre, the archetypical Peristyle, where 8,000 people could be accommodated, place of the assembly of the Macedonians, the sacred Agora of Aegae.

The theatre is an integral part of the building complex of the palace at Aegae, while the sanctuaries are placed little further below and the acropolis little up to the hill.[28] The link between the theater and the sacred political and administrative centre will become emblematic and will brand the image not only of Alexandria and Pergamon but of all the royal cities of the Hellenistic Ecumene, since that very link offers the King the opportunity to organise processions, festivals and games to demonstrate his power, disseminating benefits and reinforcing the ties between him and the citizens.[29]

Even in this respect Philip II proved to be a pioneer: the marriage of his daughter Cleopatra with her uncle Alexander of Epirus, that took place during the traditional celebration of the beginning of the year in September 336 BC, gave him the opportunity to present himself as an 'Equal to Gods'. In the triumphal procession the statue of Philip was among those of the twelve gods. He followed dressed in white, the golden wreath on his head. So he met death.[30] The young companions rushed to proclaim Alexander as king in the Great Peristyle of the Palace of Aegae.[31] At that point begins the journey, to end with his heroic body resting in his temple in the Basileia of Alexandria.

After the restoration of the palace at Aegae, the Macedonian monumental architecture regains its lost face (Figure 2). As long as the study proceeds in depth, measurable influences and links appear.

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[13] Ptolemy X Alexander I (107-88 BC) and Ptolemy XI Alexander II (80 BC).

[14] See also Whitehorne 1994.

[15] Hatzopoulos 1996.

[16] Thompson 2003: 108 see also Thompson 2008: 30 with literatureerature and Thompson 1999.

[17] Chugg 2007; see also Kottaridi 1999b.

[18] Strabo, 17.1.8.

[19] McKenzie 2007: 68 ff. with literatureerature; see also Hoepfner 1971; Goddio 1998.

[20] Mainly: Polybius, *The Histories*, Book 15; Strabo, *Geographica*, Book 17; Lucan, *Pharsalia*, Book 10.

[21] Strabo, 17.1.8

[22] Strabo, 17.1.9

[23] Polybius, 15.25.3

[24] Polybius, 15.31.2

[25] Polybius, 15.30.6

[26] For a public feast in the palace of Alexandria see Theocritus, *Idyll* 15.

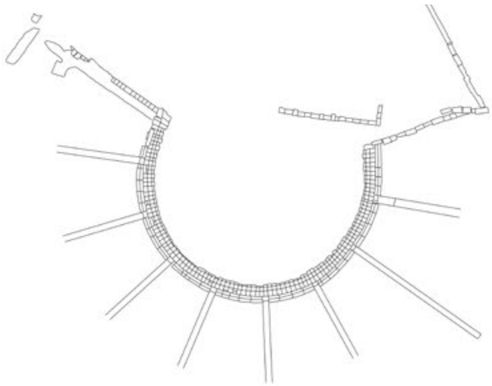
[27] Kottaridi 2011d and Kottaridi 2013: 213 ff.

[28] All these buildings were constructed in the framework of a great architectural project planned by Philipp II whose aim was to modernise and improve the entire image of the ancient city. See Kottaridi 2013: 21 ff ; Kottaridi 2002; Kottaridi 2011c.

[29] See the 'Grand Procession of Ptolemy Philadelphos', description in Athenaeus 5.197-203; Erskine 1995: 43-5; Thompson 2000.

[30] Diodorus 16, 91-94

[31] Arrian, Al. An. 25: Ἔτι δὲ αὐτῷ περὶ τὴν Φασηλίδα ὄντι ἐξαγγέλλεται Ἀλέξανδρον τὸν Ἀερόπου ἐπιβουλεύειν, τά τε ἄλλα τῶν ἑταίρων ὄντα καὶ ἐν τῷ τότε Θεσσαλῶν τῆς ἵππου ἄρχοντα. ἦν μὲν δὴ ὁ Ἀλέξανδρος οὗτος ἀδελφὸς Ἡρομένους τε καὶ Ἀῤῥαβαίου τῶν ξυνεπιλαβόντων τῆς σφαγῆς τῆς Φιλίππου. καὶ τότε αἰτίαν σχόντα αὐτὸν Ἀλέξανδρος ἀφῆκεν, ὅτι ἐν πρώτοις τε ἀφίκετο τῶν φίλων παρ› αὐτόν, ἐπειδὴ Φίλιππος ἐτελεύτησε, καὶ τὸν θώρακα συνενδὺς συνηκολούθησεν αὐτῷ εἰς τὰ βασίλεια. ὕστερον δὲ καὶ ἐν τιμῇ ἀμφ› αὐτὸν εἶχε, στρατηγόν τε ἐπὶ Θρᾴκης στείλας καὶ ἐπειδὴ Κάλας ὁ τῶν Θετταλῶν ἵππαρχος ἐπὶ σατραπείᾳ ἐξεπέμφθη, αὐτὸν ἀπέδειξεν ἄρχειν τῆς Θεσσαλικῆς ἵππου



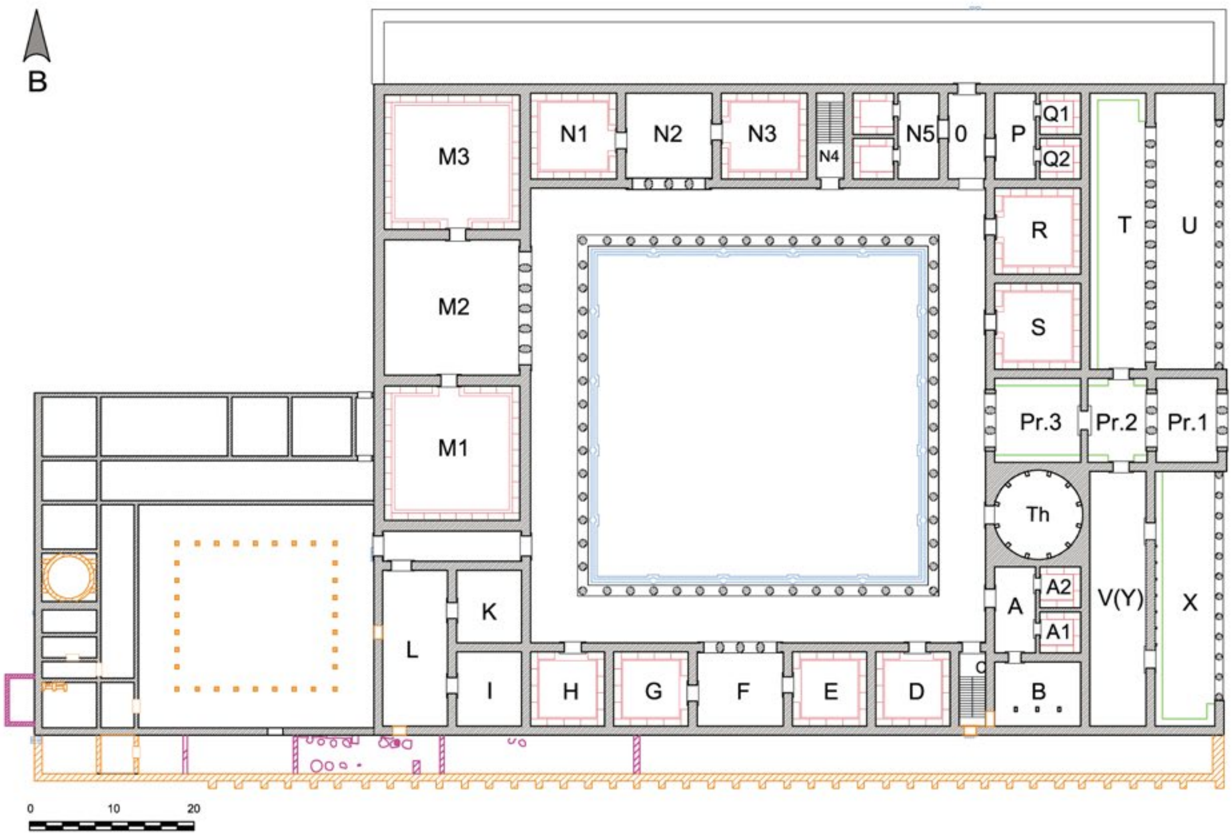


Figure 1. The palace of Aegae, plan (according to A. Kottaridi).

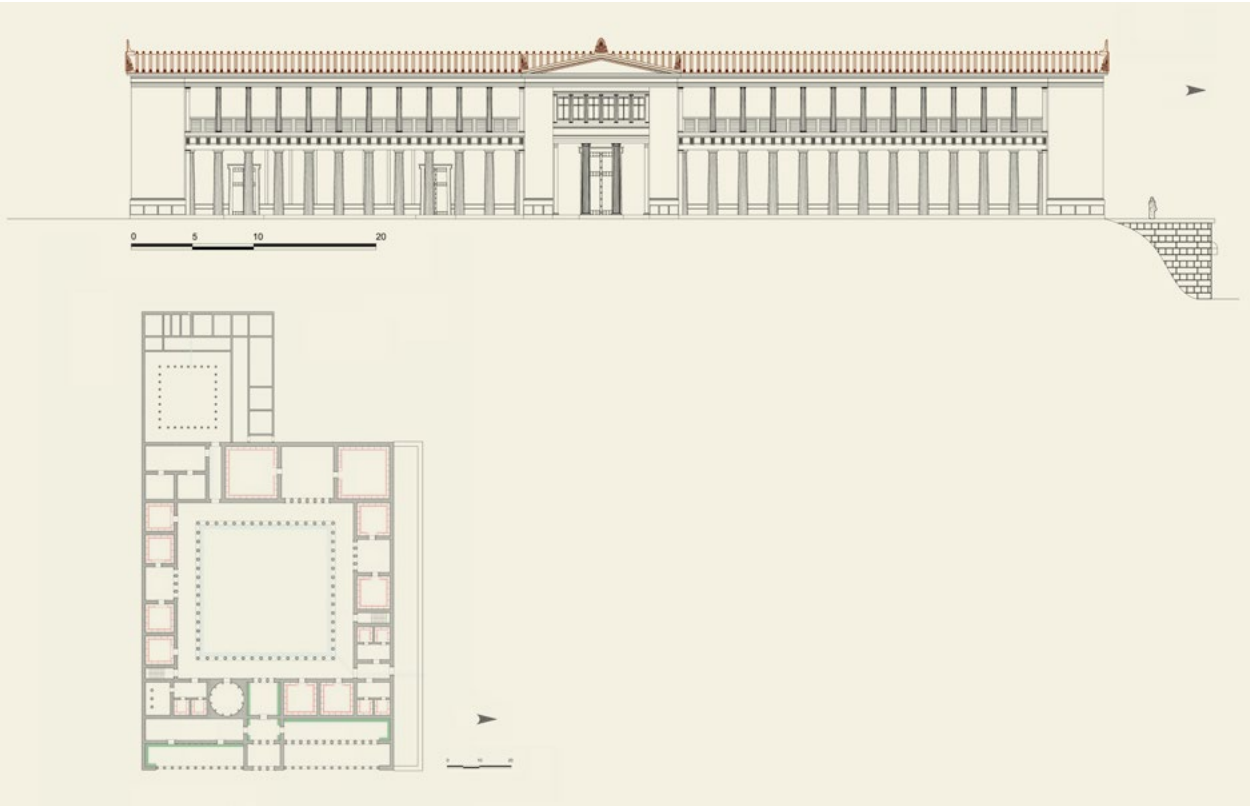


Figure 2. The palace of Aegae reconstruction (A. Kottaridi).

The link to the Pergamenian porticoes is clear and obvious.[32] In Alexandria, things are more obscure as the architectural remains for a direct comparison are still missing. However the two-storeyed porticos and the series of Macedonian windows on the facade of Aegae palace provide us with a clear insight into how some famous constructions such as 'the thalamegos', the riverboat and floating palace of Ptolemy IV Philopator, would look.[33] It is certain that the path from the strict geometry of Aegae to the dreamy baroque of the desert's city Petra[34] passes through the fertile encounter of Macedonian austerity with Egyptian charm in the ancient Delta.[35]

Before we turn to the iconography, one of the most famous components of Alexandria's royal building complex was the Museum[36] and the Library. The systematic study and cultivation of philosophy, the arts and the sciences is the main feature of the concept of enlightened leadership. Although Demetrios Phalereus, the first director of the Museum, was an Athenian, there is also a definite Macedonian inspiration and contribution. A shelter for philosophers and scholars, since the time of Archelaus, the Macedonian royal court became in the 4th cent. BC with Perdiccas III and his tutor Euphraios from Orei and then with Philip II, Alexander and Aristotle, the place where the platonic experiment succeeded. The royal school of Aristoteles at Mieza, an impressive 30,000 square metre gymnasium with a theatre and the neighbouring idyllic sanctuary of the Nymphs,[37] was in fact the incubator of the great men who created the Hellenistic Ecumene, among whom was Ptolemy I himself. Apparently here stands the direct ancestor of the idea of the Alexandrian Museum.

32 Although almost two hundred years later the Attalos' stoa in Athens presents many similarities to the two-storeyed porticos of the Aegae palace.

33 Description given by Kallixeinos of Rhodes quoted in Athenaeus 5.204d-206c. See Pfrommer 1996: 178 ff. fig 9, 10 with literature. See also the façade of the tomb at Leukadia (ancient Mieza). Πέτσας, Φ. Μ., 1996: Ο τάφος των Λευκαδιών. *Αθήνα*, 82: fig. 29.

34 McKenzie 1996: 109-126.

35 For the Macedonian influence on Ptolemaic architecture see recently Étienne 2015. For Macedonian influence in general see also Pfrommer 1996: 171-189.

36 '...τῶν δὲ βασιλείων μέρος ἐστὶ καὶ τὸ Μουσεῖον, ἔχον περίπατον καὶ ἐξέδραν καὶ οἶκον μέγαν ἐν ᾧ τὸ συσσίτιον τῶν μετεχόντων τοῦ Μουσείου φιλολόγων ἀνδρῶν.' Strabo, 17.1.8, see also Erskine 1995.

37 A building complex extended on 30.000 m^2 is partially excavated in the area of ancient Mieza near to the ancient theater. Until now it was related to Asclepieion or the agora of the city. But since it lies outside of the urban aria, as shown by recent surveys, it cannot be an agora. Built in the third quarter of the 4th century BC. In a form that seems appropriate for a gymnasium, it is very likely that this was the famous school of Aristotle. On Mieza in general see: Αλλαμανή-Σουρή, Β,. Κουκουβού, Α., Ψαρρά, Ε. 2009: Μίεζα, πόλη Ημαθίας, in *Το Αρχαιολογικό Έργο στη Μακεδονία και στη Θράκη* 23: 17-30

Fgure 3. The strophion from the tomb of Philipp II, archive of the Museum of Aegae.

Figure 4. Bust of a Ptolemy with strophion, Delos Museum, photo A. Kottaridi.

Following Alexander, Ptolemy, finally King, will become a pharaoh for his Egyptian subjects.[38] The Ptolemies who succeed him will follow his paradigm.[39] This fact caused the production of a whole series of royal images in the traditional Egyptian manner[40] which in time tend to acquire more and more realistic Hellenic-like features.

For all the successors, each Ptolemy is a Macedonian king and this is accurately and clearly recorded in the official depictions on the royal coinage[41] which portrayed the characteristic diadem, that is either a ribbon or the traditional strophion, and portrayed the chlamys. The strophion which (Figure 3) underlines the link to Heracles and declares his owner as a High Priest was found in a monumental version in the tomb of Philip II and refers to the iconography of the Temenids. It also appears in portraits of the Ptolemies,[42] some of which are of the type of Hermaic stele (Figure 4) associated with the royal cult in the Gymnasium. More rare is the ivy wreath, the thryrsus and the Dionysian mitre[43] which testify the link to Dionysus. From Ptolemy III Eurgetes' strophion grows the sun's rays, as he holds a trident in his hand, the sign of his naval supremacy.[44]

Ptolemy's I surname Soter, 'the Savior', the constant presence of the eagle and the thunder, and the frequent presence of the aigis, indicate the intention of the founder of the dynasty to be identified with Zeus, a gesture adopted by the dynastic descendants, regardless of their age. So in Rosetta's stone we read about Ptolemy VI Philometor. '... the lord of diadems... who has restored the civilised life of men ... the living image of Zeus, son of the Sun, Ptolemy, living forever...' The Ptolemies as Aigiochoi, as they appear on the coins can be imagined dressed like the Ptolemaic statues depicting Alexander wearing the Aigis,[45] while in the case of the chlamidophoroi, 'dressed with chlamys', we can recognise the typical Macedonian dress with the characteristic boots, which can be seen even in a heroic naked statuette of Philadelphus holding the club as Heracles.[46]

Another typical Macedonian element is the Kausia diadematophoros that is still in use until the end of the dynasty, even attested in an Egyptian-made statue[47] one of the last Ptolemies. Kausia[48] still reminds us of the characteristic clay figurines of children and teens, recalling the Macedonian rituals of passing to the status of manhood. The same ritual was celebrated for the royal prince in Alexandria followed by coronation in Memphis.[49]

The warlike character in the Ptolemaic iconography, at least on the coins, is limited to tiny symbols such as the helmet or Heracles' club. Philadelphus is depicted armed on the Gonzanga cameo, while on the Rhaphia stele Ptolemy IV

[38] Justinus 13.6; cf. Diodorus 18.14; see also Schäfer 2011: 74-83.
[39] Manning 2010: 92 ff.; Caßor-Pfeiffer 2008a: 21–77 and 2008b: 235–265; Minas-Nerpel: 1996: 51–78 and 1997: 87–121.
[40] Smith 1996: 203–213. See also Queyrel: 2002: 3–73; Guimier-Sorbets 2007: 163–173.
[41] Σβορωνος 1904, Mørkholm 1991.
[42] Cf. a portrait in Vienna in Dickins 1914: 300, fig 5, in Paris, Cabinet des medailles et antiques de la Bibliotheque nationale de France, inv. 1980-207 and in New York, Brooklyn Museum, 60.180 in Queyrel 2009: no.16 and no. 17, fig. 44-48 and 49-50.
[43] Cf. Portrait of Ptolemy III in Cairo Museum JE 39520 and in Paris, Louvre, Ma 4164, a portrait of Ptolemy VI in Washington, National Gallery of Art, 1942.11.1 in Queyrel 2002: fig. 64-66, 67-70, 72-75.
[44] Queyrel 2002: Figure 1-7.
[45] See Parlasca 2004: 341-362.
[46] London, The British Museum 38442, Smith 1996: fig.1
[47] Mid-first century BC, see Janssen 2007: 267 P1 with literature and Bothmer 1993: 220 fig. 17 .
[48] Kausia in Egypt see: Janssen 2007: 267 P 1-P 3, 273 Ma 1-Ma 3, 279-281 Nu 14- Nu 24, 284 Ka 1-Ka 2, 285-288 Si 1- Si 6, Si 10 - Si 15, 289-303 Tk 1 – Tk 126.
[49] Pfeiffer 2008b: 387–408.

presents himself as a Macedonian cuirassed rider wearing the Egyptian crown in an entirely Egyptian context.[50] Contrary to the Egyptian tradition, but according to the Macedonian one, inaugurated by Philip II in Phillipeion,[51] the Ptolemies dedicated in the great Egyptian sanctuaries statues of the members of their family, in a reinforced presentation of their strong family ties.

Notably the female members of the family share that powerful imagery since the time of Philadelphos. The portraits of the King-Gods, Ptolemy I and Berenice I, as well as the Divine-Siblings, Ptolemy II and Arsinoe II, appear in the most official version on the gold coins issued by the king.[52] Women are depicted on the second level: the hair held backwards, the diadem, the vale, the 'epiblema',[53] falling to the right and left of the neck.

The image is completed in the individual depictions on the coins of Arsinoe II Philadelphos, who will soon find her position among the gods: a diadem-wreath, the vale covering the small coil, and in the second level, above the head, the lotus flower as a pick of the sceptre that the queen holds in her left hand. The Amaltheia Horn, Arsinoe's typical symbol, indicates the benevolence offered by the Philadelphus goddess: euphoria, fertility, wealth, abundance.

Cleopatra I Syra (215-176 BC), daughter of Seleucid Antiochus III and royal bride in Egypt, appears in the same mode;[54] the same, but wearing just a diadem and not the high 'stephane', Berenice II.[55] Arsinoe III Goddess Philopator, (246/5-204 BC), wears the epiblema laid on the shoulders and thus revealing the classic headdress, her necklace and her dress which is a peplos.[56] The epiblema on the shoulders seems also to be represented in the depictions on the issues of Cleopatra VII, the Great.[57]

Cleopatra Thea, as wife of Alexander I Vallas (150-154 BC),[58] appeared in the traditional way, but also with a kalathos on the head, the Amaltheia Horn in the hand, combining the royal iconography with that of the goddess Tyche that is the popular urban deity of any city at the time. Next she is depicted alone as Queen Cleopatra Goddess Eueteria, or with her son Antiochus VIII Grypos as Cleopatra Goddess,[59] in the traditional Macedonian manner[60] but with Isis hairstyle.

On the coins we see just the heads of the queens but we can gain an idea of the whole royal attire and outfit of these depictions from the well-known relief of Homer's deification, where Philadelphus and Arsinoe II as Time and Ecumene crown Homer.[61] A heavy, high- belted peplos, and a vale covering the head corresponds to the well-known type of Hera Campagna,[62] a Hellenistic repetition of older peplophoroi, is repeated varyingly in some statues from Alexandria[63]

In order to justify the siblings' marriage referring to the Ptolemies, and sometime to other dynasties, Theocritus in his Praise of Ptolemy II Philadelphus (127-134) uses the example of the Sacred Marriage of Zeus and Hera. This reference is intensive and repetitive. An indicative fact is the application, four generations later, in the kingdom of Pontus of the images of the two Olympian gods on the reverse of the coins of Mithridates IV and his sister and wife Laodike.[64] I think the intention behind these iconographical preferences is quite clear: the ruling siblings should be understood as an earthly repetition of the divine couple.

Let us here make a quick flashback: the majestic iconographic type of peplophoros, wearing the vale, or 'epiblema', is crystallised in the fifth century BC among the sculptors working on the Parthenon.[65] Certainly the presence of the peplos, which is the typical dress of the Partenoi, 'the virgins', and especially the presence of the bridal veil, the epiblema, as a direct reference to the ritual of the Sacred Marriage, defines the role and characterises the depicted figure as its protagonist.[66] From the end of the 5th century BC until imperial times this type becomes an iconographic topos for Hera's[67] depiction, sometimes Demeter's[68] as well, while in the local ritual context it determines the depiction of other 'brides' of the Sacred Marriage.[69] Wife of the king of kings, patroness of the institution of marriage, but also the bride par excellence of the Sacred Marriage that is renewed every year,

[50] MA 2003: 190 fig.11.2
[51] See Schultz 2007: 205-233.
[52] Olivier and Lorber 2013: 49-150, with plates and literature.
[53] On the 'epiblema' see Kottaridi 2018, forthcoming.
[54] Cf. Golden Mnaion in London, British Museum CM 1978-10-21-1, Meadows 2001: 67-94.
[55] Oppen de Ruiter 2015.
[56] Cf. Picon and Hemingway 2016: 211-212, αρ. 136.
[57] Walker and Higgs 2001: 177-178 no. 177-186.
[58] Houghton 1988.
[59] Houghton, Lorber and Hoover 2008.
[60] Kottaridi 2018 forthcoming.
[61] London, British Museum 2191, Smith 1991: fig. 216. see also the depiction of the Ptolemaic queens on the oenocho; Thompson 1973, Manchester 1994.
[62] Paris, Louvre Ma 2283. see Linfert 1976: 160-163, LIMC IV.1, 675 no 134, s.v. Hera (A. Kossatz-Deissmann).
[63] Breccia 1931-1932: Pl. XXV fig 77 and 79.
[64] De Callataÿ 2009: fig. 39-44.
[65] On that see Kottaridi 2018 forthcoming.
[66] As it has been established in the iconography from the middle of the 5th c. BC and on. This is evident even if it appears in figures that are characterised by the scholars as 'matronnenhaft', Hera and Demeter. Indicative of this is the fact that the veil is always the garment of Virgin Athena, but also of the virgins 'canephoroi'. See discussion on the virgin peplophoroi of the Parthenon frieze, Roccos 1995, with extensive literature and many examples: 654 ff., with literature, Blundell 1998: 51. On the iconography of wedding ceremony in Athenian vase painting see Smith 2005: 1-32.
[67] See LIMC IV.1: 659-719, s.v. Hera (A. Kossatz-Deissmann); LIMC IV.2: Pl. 405-435.
[68] See LIMC IV.1: 844-892, s.v. Demeter (L. Beschi), with literature. LIMC IV.2: Pl. 363-599.
[69] See for example Athens, Nat. Museum n. 1783, votive relief of Echelos and Basile, found in Phaleron, *c.*410 BC.

'parthenos' and 'teleia' virgin and woman at the same time, Hera is always presented with the bridal costume, the costume that states the high peak time of the female. Owner of the sceptre, patroness of the institution of kingship, the queen of the gods is recognised as the source of legitimate authority and power.

It is not a coincidence that Kephissodotos chose exactly this iconographic type to represent goddess Eirene, the Peace.[70] A virgin and, at the same time, a mother of Ploutos, the abundance, Eirene guarantees the prosperity of the city from the Agora of Athens. A few years later a similar statue will be erected in the sanctuary of Eukleia at Aigai.[71] The Peplophoros of Aigai wears a chiton under the (Figure 5) characteristic peplos while a heavy vale covers her head. The face and the neck were worked separately and imposed to the trunk. The hair is gathered back in a small coil, while the three holes in the front of her head indicate the presence of a wide metallic diadem. Inlaid metal earrings completed the image. With the right hand she was probably holding a metal libation bowl, with the left a sceptre.[72] (Figure 6)

Unlike the goddess Eirene, the head of the Peplophoros of Aigai, despite the tendency to idealization, provides a completely different impression: the heavy outline of the face with its full cheeks, full chin, deep wrinkles on the neck and especially the loose flesh volumes above the mouth and around the jaw indicate a sense of a respectable but elderly woman,[73] even though wearing the peplos, the typical dress of virgins. (Figure 7) The statue is related[74] to a nearby pedestal holding the inscription: Eurydika Sirra Eukleiai.[75] This Eurydice[76] was the wife of Amyntas III, mother of Philip II and the two previous kings, Alexander II and Perdikkas III.

Figure 5. The peplophoros of Aegae, archive of the Museum of Aegae.

Another Macedonian queen the late archaic 'Lady of Aigai' is found wearing a chiton and peplos, an epiblema/cover-hood, even a diadem, as the golden straps and the textile remains indicates.[77] It became obvious that these are the persistent characteristics of the traditional attire of the Macedonian Queen, while the libation bowl and the scepter also found in the grave belonged to the royal repertoire starting from the archaic period, marking the queen's office as a high priestess.

Following the fashion and corresponding to the new needs, her attire links Eurydice, Queen Mother of Macedon, to the classical world of priestesses, the mythical bride-queens and finally to Hera herself. In 338 BC. Philip, glorified his victory in Chaeronea, founding in the most holy and public place of Greece, near the temple of Zeus, the Phillipeion,[78] where his mother's and Olympiad's statues were standing side by side with those of their spouses and sons. The

[70] Eirene , Dike, and Eunomia are the three Hours, daughters of Zeus and Themis, deities that regulate the succession of the seasons and guard the gates of heaven: Hesiod *Theogony* 901 ff. Apollod. Library 1.13. Pausanias (9.16.2) mentions: 'It was a clever idea of these sculptures to put Pluto in the hands of Tyche and thus to declare that she is his mother or his nourishment. Equally clever was the synthesis of Kephissodotus who sculped for the Athenians the image of Peace with Plutos in her embrace.' The traveller (1.8.2) determines the position of the statue in the Athenian Agora '(...) after the statues of the Famous Heroes [near the Tholos] are the statues of the gods, Amphiaraus and Eirene that holds the infant Pluto' (translation of excerpts, A. Kottaridi). See also Paus. 1.18.3. The most preserved copy comes from Rome (Villa Albani) and is located in Munich, Glyptothek 219: Vierneisel-Schlörb 1979: 255ff. Knell 2000: 73 ff. Zimmer 2002: 84 no. 7, with literature.

[71] On the find see Saatsoglou-Paliadeli 1987.

[72] On the reconstruction and the interpretation of the Macedonian peplophoros see Kottaridi 2018 forthcoming.

[73] It could be recognised as a portrait, see also Schultz 2007: 230 no. 65 'there is little reason to doubt that this image is a portrait'; in general on feminine portraits of the time see Dillon 2007 and 2010.

[74] See Kottaridi 2018 forthcoming.

[75] On the pedestal which I relate to the statue see Ανδρονικος 1984: 49 ff., and Saatsoglou-Paliadeli 1987.

[76] On Eurydice and her tomb at Aigai see Κοτταριδη 2001: 362 ff. and Kottaridi 2006: 155-168.

[77] Kottaridi 2012: 412-433.

[78] See Schultz 2007: 205-233 with literature.

Figure 6. Head the peplophoros of Aegae, archive of the Museum of Aegae.

Figure 7. The pedestal with the inscription, archive of the Museum of Aegae.

Figure 8.

Peplophoros of Aigai helps us to imagine Leochare's Eurydice, while the statue of Olympias perhaps echoes the gold medal[79] with its well-known imagery (Figure 8). Here, Olympias is depicted with the same hairstyle as Eurydice, wearing a diadem and a peplos, but she lifts her vale and 'reveals' herself in Hera's famous wedding gesture.

There is evidence of the posthumous cult of Amytas III. It is also possible for Philip II to be worshiped, even before his death,[80] and it is certain that Alexander was worshipped as a god by many of his subjects before he died.[81] Did the same happen for Eurydice? The unprecedented funeral praises addressed to her,[82] reinforce the likelihood. Alexander was said to have expressed the desire to honour Olympias as a goddess after her death.[83]

In any event the close iconographical connection between the official representations of the Temenid, Ptolemaic, Seleucid, Attalid and the other Hellenistic queens is more than obvious.[84] The vast new world emerging from the conquests of Alexander the Great, movable, mutable, multinational, needed urgent reference points and stable axes to be set up. Cities, nations, rulers had to proceed immediately to an osmosis through interaction. The network of new and old cities constituted the creative context in which the rulers, through a complex system of protection, redistribution and benevolence, emerged as a pole of security and social cohesion. In response, they were praised with divine honors, establishing the ancient concept of divine reign as a feedback to the authority system. The festivals, the rituals, and the religious celebration helped to create groups of people and communities. The new gods 'conversed' with the old ones and became part of the divine family through mythical generations, traditional rituals, and recognised symbols of the divine authority. The female members of the royal dynasties, who often move from one to the other as brides, have the same duties as the women of the Temenids:[85] to secure the continuity of the oikos, provide the dynasty successors and rulers to the people, to be queens, high priestesses, brides in the Sacred Marriage and more: living goddesses. In order to achieve this, at least when addressing their Greek and Hellenised subjects, they resort to the tested Macedonian stereotypes, as they were remodelled in the royal court of Philip II and Alexander the Great, taking in account of course the current developments in art and aesthetics.

The iconographic type of the Queen/High Priestess that was formulated during the great prosperity of the Macedonian kingdom, as a result of merging of the Macedonian tradition with Pan-Hellenic standards, resulted inbecoming in Hellenistic times a universal topos.

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[79] Yalouris *et al.* 1980: 103 ff.; Alföldi and Alföldi 1976-1990, I: 18, pl. 22.7-12 and pl. 23.1-2.
[80] See Fredricksmeyer 1979: 39-61 and Mari 2008.
[81] Fredricksmeyer 2003: 253-278.
[82] Kottaridi 1999a: 2001; 2006; 2007.
[83] Curt. 9.6.26 and 10.5.30.
[84] See also Kottaridi 2018 forthcoming.
[85] Kottaridi 2011b: 93-126.

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The early Greek presence in Alexandria

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Ministry of Egyptian Antiquities

In early Ptolemaic Egypt newcomers, mainly from Greece and Macedonia, settled in Alexandria. They joined their earlier Greek fellows from Ionia and Caria settled in Naucratis,[1] Memphis[2] and Canopus.[3] They formed the core of the Greek citizens of Alexandria beside other nations. The earlier 'Hellenes'[4] settled in the Nile Delta played an essential role in introducing the new residents to the worship of the Egyptian cat goddess Bastet under her Hellenised name Bubastis, the equivalent of Artemis.[5]

Their Greek identity is recognised through the children 'ex-votos' statuettes found *in situ*. The iconography, style and names are similar to their companions in the Greek world, especially in Attica. The Greek family's members offered ex-votives to the 'kourotrophos' goddess Bubastis, who had a protective function and a fertility character. Bubastis protected mothers and their children. This last aspect was very important to the new families in order to maintain their roots and culture in their new home Alexandria.

When Alexander the Great invaded Egypt and decided to establish a new city bearing his name, he himself marked out the main parts of the city: the location of the agora and the course of the city wall. He also decided how many sanctuaries should be there and of which gods, those of the Greek gods and of the Egyptian Isis.[6] Before Alexander left Egypt he chose the Greek architect Deinocrates of Rhodes to plan the city[7] and gave the financial handling of the project to Cleomenes of Naucratis. The latter was considerably involved in the settlement process of the city.[8] He used economic measures (grain taxes) and pressure on the Egyptian priests and people of the surrounding areas of Alexandria to force them to settle in the new city.[9] In 306/305 BC Ptolemy, son of Lagos, declared himself king over Egypt and made Alexandria his capital. He brought '*Xenoi*' mercenaries to serve in the Ptolemaic army.[10] Most of these soldiers were Greek,[11] came from Greek mainland: Attica, Peloponnese, Thessaly, Crete, from the Eastern Mediterranean (Ionia, Caria and Pamphylia), Macedonia, Thrace, and also from Cyrenaica.[12] Syrians, Jews and Arabs were added to their number.

However, very few material data can be dated to the early years of the foundation of Alexandria and therefore our information about how these people of different cultural backgrounds lived together with the native inhabitants in the city are scarce. The data are limited and based on the papyri and inscription documents found later in other regions in Egypt.

The discovery of the Boubasteion in Alexandria at the end of 2009/early 2010, whose foundation dates to the end of the fourth – early third century BC, partly highlights this obscure phase and offers some insights

[1] Pfeiffer, St. 2010. Naukratis, Heracleion-Thonis and Alexandria-Remarks on the Presence and Trade. Activities of Greeks in the North-West Delta from the Seventh Century BC to the End of the Fourth Century BC, in Robinson D.- Wilson A. (eds) *Alexandria and the North-Western Delta*. Oxford: 15-24; Redon, B. 2012. L'identité grecque de Naucratis. Enquête sur la fabrication de la mémoire d'une cité grecque d'Égypte aux époques hellénistique et romaine. *Revue des Études grecques* 125: 55-93; Villing 2015: 229- 246.

[2] Thompson, D. J. 1988. *Memphis under the Ptolemies*. Princeton.

[3] Gallo: 2013. Isola di Nelson VI. Rapporto della Campagna di scavo archeological 2011. Egittologia a Palazzo Nouvo. Studi e ricerche dell' Universita di Torino. A cura di P. Gallo: 23-28. Pl. I-X. Torino; Meirano 2013: 193-203 pl. I-XIII; Grataloup 2015 *:* 137-160.

[4] Thompson, J. D. 2001. Hellenistic Hellenes: the case of Ptolemaic Egypt, in Malkin I. (ed.) *Ancient Perceptions of Greek Ethnicity*: 301-322. Cambridge, MA.

[5] Hadzisteliou-Price, T. 1978. *Kourotrophos cults and Representations of the Greek Nursing Deities*. Leiden.

[6] Arrian III.1.5-2.2; Dunand, Fr. 2007. The religious system at Alexandria, in D. Ogden (ed.) *A companion to Greek Religion*: 251-263.

[7] Erskine, A. 2013. Alexandria in the Alexandrian Imagination, in Ager, S. and Faber, R. (eds) *Belonging and isolation in the Hellenistic World*: 169-183. Toornto; Howe, T. 2014. Founding Alexandria: Alexander the Great and the politics of Memory, in Bosman P. (ed.) *Alexander in Africa*: 72-91. Pretoria.

[8] Le Rider, G. 1997. Cléomène de Naucratis. *BCH* 121: 71-98.

[9] Pseudo-Aristote. *Économique* 33c; Legras, B. 2006. Kathaper ek palaiou. Le statue d Egypte sous Cléomène de Naucratis, in Couvenhes J. C. and Legras B. (eds) *Transferts culturels et politique dans le monde hellenistique, Actes de la table ronde sur les identités collectives, Sorbonne 7 février 2004*: 83-101. Paris; Lukaszewicz, A. 2012. Second Thoughts on the Beginnings of Alexandria. *Et et Trav*. XXV: 205-211 esp. 209.

[10] Peremans, W. 1980/81. Étrangers et Égyptiens en Égypte sous le Règne de Ptolémée 1er. *Ancient Society* 11/12: 213-226; Bagnall, R.S. 1984. The origin of Ptolemaic cleruchs. *BASP* 21: 7-20; El-Abbadi 2007: 41-46.

[11] Clarysse, W. 1998. Ethnic Diversity and Dialect among the Greeks of Hellenistic Egypt, in Verhoogt A. M. F. W. and Vleeming S. P. (eds) *The two faces of Graeco-Roman Egypt. Greek–Demotic Texts and Studies presented to Pestman P. W. :* 1-13. Leiden. Boston.

[12] Delia, D. 1996. All Army Boots and uniforms? Ethnicity in Ptolemaic Egypt. *Alexandria and Alexandrianism. Papers Delivered at a Symposium organised by the J. Paul Getty Museum and the Getty center for the History of Art and the Humanities, held at the Museum April 22-25 1993*: 41-43. Malibu.

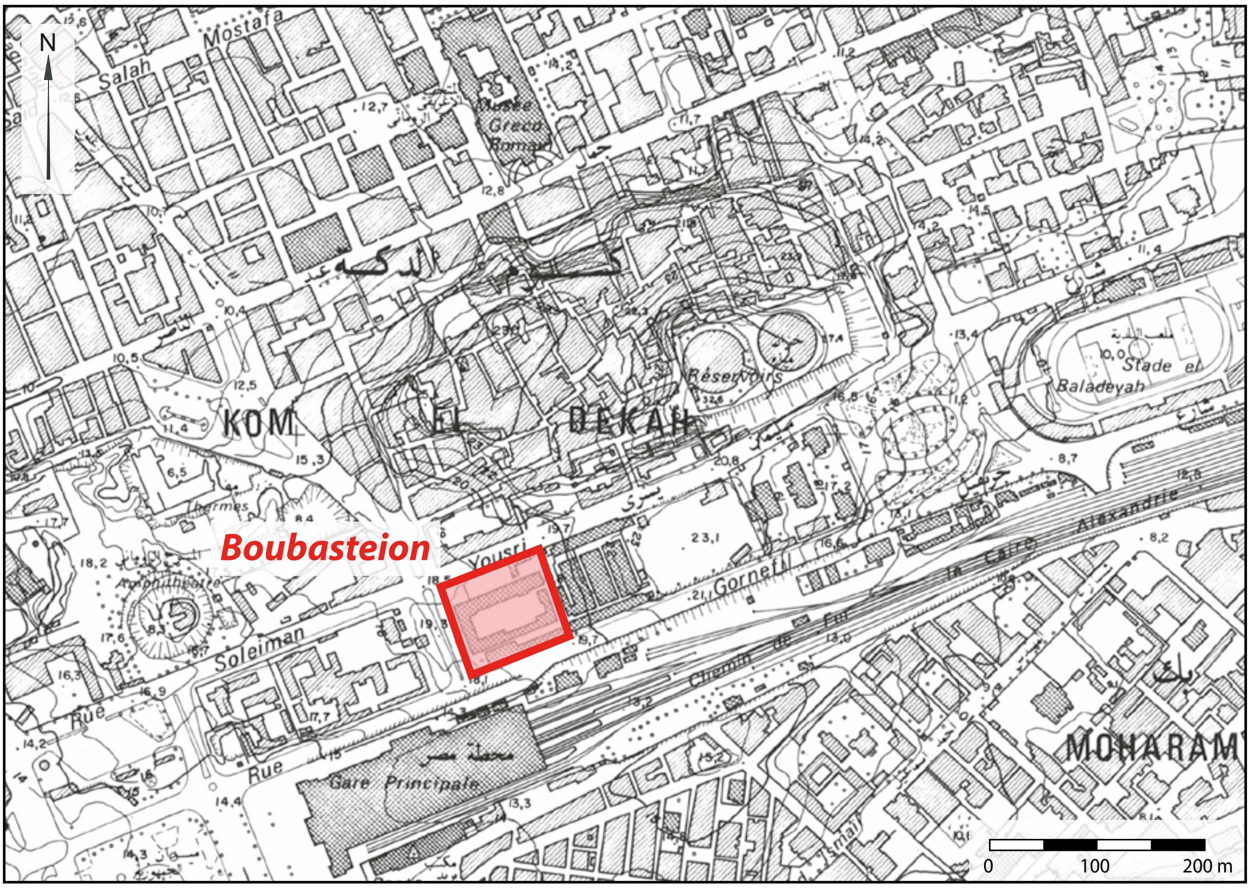

Figure 1. Modern site of the Boubasteion.

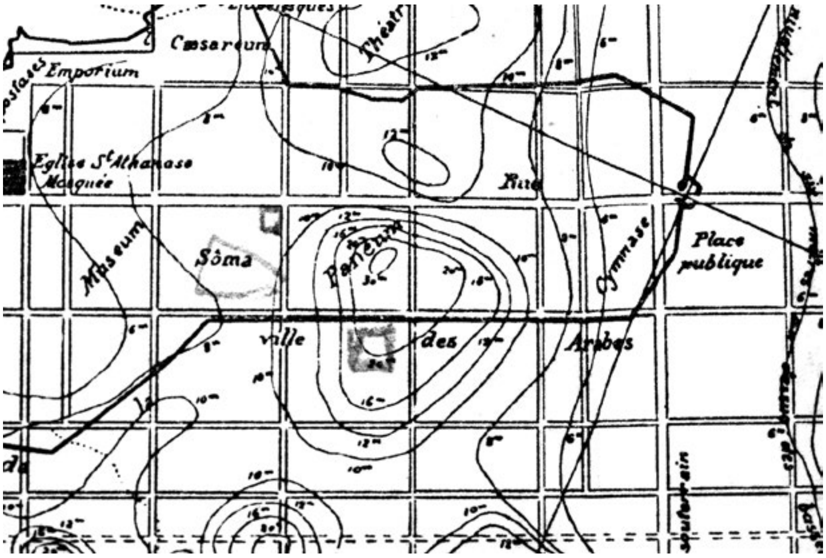

Figure 2. Mahmud Bey El-Falaki 's map.

into the real religious, social and cultural situation of the early Greek residents settled in the new capital of Egypt.[13]

This rescue excavation was conducted by an Egyptian team directed by Dr. Abd El Maksoud from the Supreme Council of Egyptian Antiquities at the modern site of Kom el Dikka 'Kom Damas' (Figure 1). According to the ancient map made by the great Egyptian engineer and astronomer Mahmoud Bey El Falaki, who worked in the service of Khedawi Ismail, the sanctuary lay precisely between the streets R2/L3[14] (Figure 2). The location of the temple on the southern border of the Panion[15] with gardens, water, marshy grounds and a wet natural environment, was a suitable place for worshipping the fertility cat goddess, who liked to live in such a fertile land. Panion as Strabo records was

[13] Abd El-Maksoud *et al.* 2012: 427-446; Gallo: 2016. See l Egitto Dei Romani E La Costa Alessandrina. Il Nilo a Pompei Visioni d Egitto nel mondo Romano: 63-87 esp. 65-66. Torino; Abd El-Maksoud *at al.* 2016: 34-37.

[14] El Falaki, M. 1872. *Mémoire sur l'antique Alexandrie, ses faubourgs et environs découverts, sondages, nivellements et autres recherches.* Copenhagen; Arnaud, J.- L. 2009. *La restitution d'un réseau viaire antique à l'épreuve du dessin informatisé d'Alexandrie,* in Empereur J.-Y. (ed.) (Alexandrina 3. Études alexandrines 18)*:* 373-399. pl. 12. Cairo.

[15] Sauneron, S. 1983. Les collines d'Alexandrie: *Villes et Légendes d'Égypte*: 199-225. Cairo.

Figure 3. Colum's drum.

Figure 4. Terracotta cat figurine.

Figure 5. Limestone cat statuette.

an artificial hill, from which one could see from the top the Serapeion temple and the sea.[16] Strikingly, none of the ancient historians mentioned the existence of this sanctuary in the city.[17]

The Egyptian goddess is named not in her traditional Egyptian name, but in its Greek version; instead of Bastet the Greeks called her Bubastis.[18] She was popular among native Egyptians at home and highly respected by the Greeks first of all because of her close relationship with Artemis. According to Herodotus she was the equivalent of the Greek goddess Artemis.[19] Identifying with local deities is something favoured in Hellenistic Egypt '*Interpretatio Graeca*'.[20]

Unfortunately, there is little to be said about the planning of this sanctuary but from the few architectural remains like limestone capitals and column drums one can assume that the sanctuary was built in its first phase according to a Greek order. Egyptian architecture features found *in situ* probably belong to the second phase of the temple's enlargement under Ptolemy III (Figure 3).

The artifacts of this sanctuary were found in five caches '*bothroi/favissae*'.[21] In sector B1 the first cache was covered with a sandy layer. It contained (469+1028 fragments) of terra cotta cat figurines, most of which were kept in a terracotta rectangular box while others were found scattered around it lying on the sandy ground (Figure 4). In close proximity (50) limestone cat statuettes (Figure 5), three terracotta children figurines, one small marble statuette of a boy and nine limestone children statuettes were uncovered (Figures 6-7). Other children statuettes (19) are found on the upper surface of this pit. In addition, the Tanagra's figurines from this '*bothros*', which appeared for the first time in a sanctuary

[16] Benech, Chr. 2009. Recherches sur le tracé des murailles autour d'Alexandrie, in Empereur J.-Y. (ed.) (Alexandrina 3. Études alexandrines 18): 410-445 esp. 404. Cairo.

[17] No wonder that Strabo did not mentioned it because like other Roman historians he did not respect Egyptian animal gods.

[18] Malaise, M. 2000. Le problème de l'Hellénisation d'Isis, in Bricault L. (ed.) *De Memphis à Rome Actes du 1er Colloque international sur les etudes isiaques Poitiers-Futuroscope, 8-10 avril 1999*: 1-19. Leiden; Quaegebeur, J. 1983. Culte Égyptiens et Grecs en Égypte Hellénistique. L'Exploitation des Sources, in Van 'T Dack E., Van Dessel P. and Van Gucht W. (eds) *Proceedings of the International Colloquium Leuven 24-26 May, 1982*: 303-324. Louvain; Idem. 1991: 117-127.

[19] Herodotus II 59,60,137-138, 158; Leger, R. M. 2017. *Artemis and her Cult*. Oxford.

[20] Pfeiffer 2005: 285-290; Idem, 2015. Interpretatio Graeca. Der 'übersetzte Gott'. Der multikulturellen Gesellschaft des hellenistischen Ägypten, in Lange M. und Rösel M. (eds) *Der übersetzte Gott*: 37-53. Leipzig; Lieven, A. von. 2016. Translating Gods, Interpreting Gods: on the Mechanisms behind the Interpretatio Graeca of Egyptian Gods, in Rutherford I. (ed.) *Greco-Egyptian Interactions Literature, Translation and Culture, 500 BCE-300 CE*: 61- 82. Oxford.

[21] Brulotte: 1994. *The Placement of Votive Offerings and Dedications in the Peloponnesian Sanctuaries of Artemis*. Ann Arbor.

Figure 6. Boy statuette (*Bothros* 1).

Figure 7. Girl statuette (*Bothros* 1).

at Alexandria, also proved their religious function.[22] A bronze coin bearing on the obverse the head of Alexander the Great with the elephant scalp and on the reverse an eagle standing on the thunderbolt belonging to the second serial (300-261 BC) and a fragment of a Rhodian amphora confirm the date of this cache.

Two points should be emphasised concerning the cats. First is the care, with which these terracotta figurines were deliberately stored in a box, is astonishing. Second, the absence of similar iconographical types in and outside Alexandria. The cats are not depicted in the traditional attitude of the Egyptian goddess Bastet but they are represented crouching on a plinth with outstretched forelegs, looking to the right or the left side with the head turned towards the viewer and frequently seizing a small prey in different ways. The prey is usually a small duck. The iconographical schema of an animal pursuing or attacking a victim was known in ancient Egyptian art and in Greece. Lion statues from the Athenian region are depicted placing either a bull or a deer beneath their forepaws.[23] This feature

[22] Kassab-Tezgoer, D. 2007. Tanagréennes d'Alexandrie. *Empereur, J.-Y.* (ed.) *Études alexandrines 13.* Le Caire.

[23] Richter, G. M. A. 1930. *Animals in Greek Sculpture*. London: 33–35; Vermeule, C. C. 1972. Greek Funerary Animals 450-300 B.C. *AJA* 76: 49-59, pl. 11-14, esp. 58-59 fig. 14; Woysch–Méautis, D. 1982. *La représentation des animaux et des êtres fabuleux sur les monuments funéraires grecs de l'époque archaïque à la fin du IVe siècle av. J.C.*: 65–67. Lausanne.

is widespread in Hellenistic and Roman art.[24] Cats were imported from Persia or Egypt, where they were a familiar pet since the Middle Kingdom, to Athens as exotic and luxury imports in the Era of Peisistratids. Their earliest attestation in Greece is on a relief from Themistokles' wall near the Kerameikos cemetery dated to 510 BC depicting a cat teased by a dog with the owners watching.[25] Later cats are frequently illustrated as favorite pets for children on the miniature vases called 'Chous', related to the 'Anthesteria' festivals.[26]

The limestone cats from the first and second caches are mostly female and are depicted in different attitudes either calm or alert or simply in a standing pose. These positions are already found in the cat from Naucratis, which could be considered as the prototype for the Alexandrian ones. However, the Naucratis specimen differs according to styles, qualities of carving and type of material from the cats in Alexandria.[27]

The second cache (sector B2) brought to light (106) limestone cats together with children statuettes (21) of different sizes and postures (Figure 8). They were placed on some local ceramic ware, mainly dishes and bowls, dated to the early to middle of the 3rd century BC (Figure 9).

The third cache contains 13 limestone cats (Figure 10) and only one a torso of a naked child. These female cats are distinguished by their large size and their maternal attitude. They are accompanied by kittens. This mother cat type is well known from the Late Period in Egypt especially in bronze figures.[28] They were placed also on some local ceramic bowls and dishes. On the surface of this '*bothros*' were collected some amphora shreds and stamped handles dated to the 2nd half of the fourth – beginning of the third century BC.

Particularly interesting are the children statuettes.[29] It is easy to recognise their gender, boys are always naked, while girls are wearing a short sleeved, belted long chiton with strips to hold it. The children are holding their favourite pets, usually a cat and a bird and, in one example, toys '*astragaloi*'.[30] They are either sitting or standing. When sitting they are depicted in the well-known 'temple boys' schema, attested in Egypt from where it spread all over the Mediterranean area (Cyprus, Lebanon and Greece).[31] They are around the

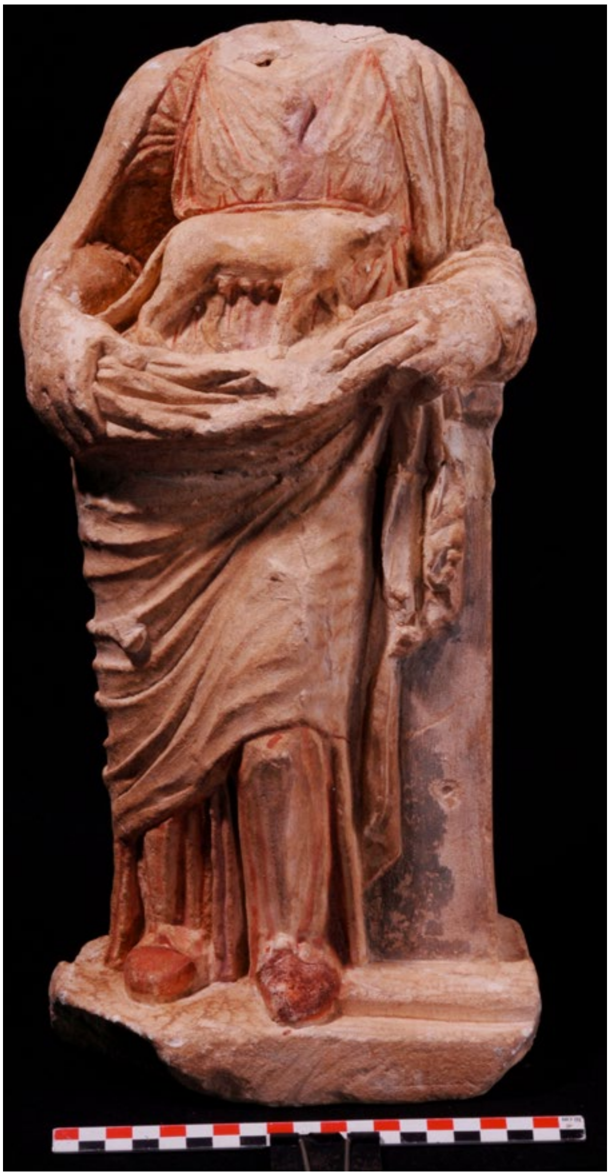

Figure 8. Young maiden statuette (*Bothros* 2).

[24] Daszweski, W. A. 1985. *Corpus of Mosaics from Egypt I*: 495 cat. no. 99 Figures 69-70 pl. 46, a-b; Zevi, F. 1998. Die Casa Del Fauno in Pompeii und das Alexandermosaik. *RM* 105: 21-65, esp. 36 pl. 16,1.

[25] Morizot, Y. 2004. Offrandes a Artemis pour une naissance. Autour du relief d Achinos, in Dasen, V. (ed.) *Naissance et petite enfance dans l'Antiquité..Actes du colloque de Fribourg, 28 novembre-1er decembre 2001*: 159-170. Fribourg.

[26] Hamilton, R. 1992. *Choes and Anthesteria Athenian Iconography and Ritual*. Ann Arbor; Ham, G. L. 1999. The Choes and Anthesteria Reconsidered. Male Maturation Rites and the Peloponnesian wars, in Padillia M. W. (ed.) *Rites of Passage in Ancient Greece: Literature, Religion, Society*: 201-218.

[27] British Museum Online Research Catalogue. http://www.britishmuseum.org/research.

[28] Langton, N. 1936. Notes on some Egyptian Figures of Cats. *JEA* 22: 115-120 pl. V-VII; Idem 1938. Further Notes on some Egyptian Figures of cats. *JEA* 24: 54-58III-IV; Idem, 1940. *The cats in ancient Egypt*. Cambridge; Quaegebeur 1991:125-126.

[29] Abd El-Maksoud *et al.* 2012: 427-446; Queyrel, F. 2014. *Le garçon du Cricket et les enfants d' Alexandrie*, in J.–Y. Empereur (ed.) *Alexandrina 4 l'honneur de Mervat Seif el-Din. Études Alexandrines* 32. Alexandrie: 131–161; Ghisellini, E. 2014. Lo 'Scultore di Boston': un artista attico ad Alessandria. Sul contributo di Atene alla formazione del linguaggio figurativo alessandrino. *BdA* 22-23: 1-21; Queyrel, F. 2016. La Sculpture Hellénistique. Tome I: Formes, Thèmes et Fonctions, in Nicolini, G. (ed.) *Les Manuels d' Art et d'Archéologie Antique*: 101, 308-311. Paris; Abd El Maksoud *at al.* 2016: 34-37.

[30] Papaoikonomou, Y. 1981. Les enfants aux astragales. *BCH* 105: 255-264. Esp. 259 fig. 2.

[31] Stucky, R. A. 1993. *Die Skulpturen aus dem Eschmun-Heiligtum bei Sidon. Griechische, römische, kyprische und phönizische Statuen und Reliefs vom 6. Jahrhundert vor Chr. bis zum 3. Jahrhundert nach Chr*. Basel; Beer, C. 1993. Temple-Boys: A Study of Cypriote Votive Sculpture Part 2.

Figure 9. Limestone cat (*Bothros* 2).

Figure 10. Limestone cat (*Bothros* 3).

age of infancy (six months to one year) since they are always sitting and leaning on one arm.

The types of the standing children resemble those found in Greek sanctuaries of different divinities[32] but are mainly related to the children marble group from the Artemis temple at Brauron.[33]

These statuettes represent the new offspring of the Greek immigrants and visitors, who either settled in Alexandria or passed through it and wished to make dedications to the Goddess.

No doubt Attica was the source of many of these votive statuettes, which were certainly carved in Alexandria by Greek craftsmen.[34] In fact, under Demetrius of Phaleron (317–307 BC) new laws forbade the erection of sumptuous tombs thereby preventing Athenian sculptors and artists from making a living. Therefore, they left by numbers the country and looked for another place to earn their life.[35] They came and settled in Alexandria under Ptolemy I 'Soter'. It is no wonder that the first generations of the Greek newcomers to Alexandria maintained close contact with their Motherland.[36] This strong connection between Alexandria and Attica is well known in other artistic domains, and in the political and commercial fields.[37]

Another cache found beneath the temple's ground are the foundation tablets. At the north-eastern corner of an outer wall a set of six foundation tablets was recovered ,[38] buried in a rectangular-shaped cavity delimited by roughly worked limestone blocks. They are made of glass except for one made of faience.[39] They bear text written in black ink, two pieces written in Greek, two in hieroglyphics, one piece in both languages and the

Functional Analysis. (Studies in Mediterranean archaeology 113). Jonsered.

32 Beaumont, L. A. 2012. *Childhood in Ancient Athens. Iconography and Social History*. London and New York; Steger, F. 2016. *Asklepios Medizin und Kult*. Stuttgart.

33 Kahil, L. L 1977. Artémis de Brauron Rites et Mystère. *Antike Kunst* Heft 2: 86-98; Themis: G.*1971. Brauron Guide to the Site and Museum*. Athens; Vorster 1983: 101-106. 125- 127. 196. 222 -224. 227-232; Rühfel, H. 1984. *Das kind in der griechischen Kunst*: 219-243. Mainz am Rhein; Raftopoulou, E.G. 2000. *Figures enfantines du Musée National d'Athènes*, München; Bobou, O. 2015. *Children in the Hellenistic world. Statues and Representation*. Oxford.

34 Ghisellini, E. 2013. Skopas' Echoes in Alexandrian Sculpture, in Katsonopoulou, D. and Stewart, A. (eds) *Skopas of Paros and his World*, Proceedings of the Third International Conference on the Archaeology of Paros and the Cyclades, Paros, 11–14 June 2010. (Paros III): 511-531. Athens.

35 Pfuhl, E. 1901. Alexandrinische Grabreliefs. *AM*: 26: 304; Retrief, F. B. 2005. Burial Customs. The afterlife and the pollution of death in ancient Greece. *Acta Theologica Supplementum* 7: 44-61 esp. 52; O'Sullivan, L. 2009. *The Regime of Demetrius of Phalerum in Athens, 317-307BCE.* Leiden.

36 Schmidt, St. 1996. Über den Umgang mit Vorbildern.Bildhauerarbeit im 4. Jahrhundert v. Chr. *AM* 111: 201-202. figs. 36-37; Idem. 2002 Grabreliefs im griechisch–römischen Museum von Alexandria. *Abhandlungen des deutschen archäologischen Instituts Kairo*. Ägyptologische Reihe, 17: 5-8; Idem. 2005: 267-278 esp. 272-273; Villing 2015: 235 fig. 12.7: fragment of Attic(?) grave stela probably from Naukratis note 74; Bergmann, M. Zwei Kinder mit Nilgans. Eine Kalksteingruppe aus Zagazig im Ägyptischen Museum Kairo. In press.

37 Habicht 1994: 140-163; Schmidt, St. 2004. Kunst am Hof der Ptolemäer. Dokumente und Denkmäler, in Bol: C. Kaminski and G. Magderna, C. (eds) *Fremdheit- Eigenheit Ägypten, Griechenland und Rom Austausch und Verständnis* (Städel-Jahrbuch. Neue Folge 19): 511-524. Stuttgart.

38 Abd El Maksoud *et al.* 2015: 125-134.

39 For a list of such foundation's tablets found in Ptolemaic Egypt see: Arveiller-Dulong V. and Nenna, M.-D. 2011. *Les Verres antiques du Musée du Louvre*. III: 343 figs. 563-564. Paris.

Figures 11-12. Foundation deposit's tablets (*Bothros* 4).

faience one left uninscribed (Figures 11-12). The text alludes to the second phase of the sanctuary, when the temple was rebuilt under Ptolemy III and Berenice II.[40] The text recorded that new architectural elements were added to the sanctuary: a temenos as an altar and a naos.

Following the example already set by Alexander the Great, the Ptolemies interacted with the Egyptian religious life using it as a tool of political propaganda.[41] As Pharaohs of the country they show a particular interest towards the Egyptian gods and their cults.[42] Their official activities in the religious sphere are highlighted by the reconstruction of sanctuaries all over the land and by the texts on the foundation's tablets found in many Graeco-Egyptian sanctuaries.[43] The reasons for their political and social behaviour towards the traditional Egyptian religion were surely to serve their own interests and to affirm their power and control over the priests.[44]

[40] Clayman, D. L. 2014. *Berenice II and the Golden Age of Ptolemaic Egypt*: 162-164. Oxford.

[41] Fischer-Bovet, Chr. 2016. Toward a Translocal Elite Culture in the Ptolemaic Empire, in Lavan, M., Payne R. E. and Weisweller J. (eds) *Cosmopolitanism and Empire Universal Rulers, Local Elites and Cultural Integration in the Ancient Near East and Mediterranean*: 103- 128. Oxford.

[42] Huss, W. 1994. Der makedonische König und die ägyptischen Priester. *Studien zur Geschichte der ptolemäischen Ägypten*: 140–163. Stuttgart; Gorre, G. 2009. *Les relations du clergé égyptien et des Lagides d'après les sources privées*. Leuven.

[43] Pfeiffer, St. 2015. *Griechische und lateinische Inschriften zu Ptolemärreich und zur römischen Provinz Aegyptus*. Berlin.

[44] Coppens, F. 2014. Designing the sacred in early Ptolemaic times. A continuum of concepts, in Frood, E. and Raja R. (eds) *Redefining the sacred Religious Architecture and text in the near East and Egypt 1000 BC-*


Figures 13-14. Ceramic bottles and jugs (*Bothros* 6).

The influence of the Ptolemaic queens was predominant also in the religious life. They played a leading role in establishing and constructing the sanctuaries. The texts on these tablets show clearly how Queen Berenice II was involved alone in the construction of sacred buildings in Alexandria.[45]The personal relationship between the queen Berenice II and the goddess Bubastis is confirmed by the mention of the 'Bubasteia' festivals in the Canopus decree.[46]

The fifth cache contained a collection of small local ceramic bottles and jugs. Some were found with the tablets while others were scattered above the cavity of the foundation's tables. They are made from alluvial clay, provided with one handle and dated to the second half of the third to the second century BC[47] (Figures 13-14).

In addition three Greek inscriptions inscribed on bases were found at the site, one red granite base dated to the reign of Ptolemy IV 'Philopator' and two marble inscriptions belonged to Roman era, one dated to the the reign of the Roman Emperor Antoninus Pius (AD 138–161).[48] The latter inscription obviously proves the goddess was worshipped in her sanctuary until the Roman period.

This precinct played an important role for the Greek community since the early period of the founding of the city. To please the Goddess, gifts were left in her sanctuary provided with inscribed messages for her. The Greek names recorded on the bases of the statuettes are mostlyfemale names such as: ΑΡΙΣΤΟΒΟΥΛΗ ,[49] ΧΑΡΙΝΗ, ΟΙΝΑ, ΑΡΑΤΑ , ΚΡΙΝΙCΑ , ΦΙΛΙΞΩ and ΦΙΛΥΛΛΙΩ. These female individuals were either daughters, mothers or

AD300: 107.

[45] Abd El- Maksoud *et al.* 2015: 125-144.

[46] Perpillou-Thomas, Fr. 1993. *Fêtes d'Égypte ptolémaïque et romaine d'après la documentation papyrologique grecque*: 74e. Leuven; Pfeiffer, St. 2004. *Das Dekret von Kanopos (238 v. Chr.). Kommentar und historische Auswertung*. APF Beiheft 18: 128-130. München.

[47] Ballet: 2017. Alexandrie, Cinéma Majestic Étude Céramologique du Remblai 117/119, in Empereur J.-Y. (ed.) *Alexandrie, Césaréum Les fouilles du Cinéma Majestic. La consommation céramique en milieu urbain à la fin de l'époque hellénistique. Études Alexandrines* 38: 33-120. Alexandrie.

[48] Abd El-Fattah *et al.* 2014: 149-177, Fischer-Bovet, Chr. 2014. *Army and Society in Ptolemaic Egypt*: 293. Cambridge; Paganini, M. C. D. 2017. Greek and Egyptian Associations in Egypt Fact or Fiction, in Chrubasik B. and King D. (eds) *Hellenism and the local communities of the Eastern Mediterranean 400 BCE-250 CE*: 131-154. Oxford.

[49] This name is also found on a gravestone from Hadra see: Breccia, Ev. 1924. Note Epigrafiche *BSAA* 20: 267-280 esp. 272 no.14; SEG 8 6703 date: unclear. Attica is the origin place for this name since a small temple dedicated for Artemis Aristoboule was discovered there see: Travlos, J. 1971. *Bildlexikon zur Topographie des Antiken Athen*: 121. Tübingen.

members of Greek families. They were votaries of the goddess[50] and played a leading role in the rituals.[51] Obviously girls were appreciated in the Alexandria Greek community.[52] Male names like ΦΟΡΜΙΩΝ, ΜΟΣΙΧΩΝ are mentioned too.[53]

Conclusion

To sum up, the material data of this sanctuary show one feature of the interaction at work in the early years of the new capital.[54] The Greeks with their open-minded mentality towards the foreign Egyptian gods and their cults, and for their own benefits too, played an essential part in adopting and realizing this interaction 's policy.[55] They accommodated and accepted quickly the worshipping of animal deities, first of all because they needed to increase their numbers in their new home. This could only be achieved through the productive ability of their female members. In order to fulfil their expectations and to survive all the dangerous diseases they addressed the goddess, who gave a special care to their offspring. Therefore they were a part of this Egyptian sanctuary.

Bubastis was a powerful popular goddess especially in Egypt, her home, and was of special importance and interest for the newcomers, who had to live in a new environment. Her association with the Greek goddess Artemis made it easier for the early Greek settlers to dedicate images of their children as ex-votos to her. Both deities had the ability to protect from death, to save as a '*Soteria*' their devotees from any kind of danger during childbirth, severe sickness, dangerous seafaring journey.

Other social and cultural reasons that attracted the Greek community, especially women, to fit in the new cultural environment, were the religious popular festivals. Sharing joy and happiness with the native Egyptians in drinking and dancing made their integration in the new multi-cultural society easier and faster. The 'Bubastaiae' were according to Herodotus hilarious and joyful celebrations with sexual activities, which is compatible with the Greek mentality and habits.[56]

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[50] Van Straten, F. T. 1981. Gifts for the Gods, in H. S. Versnel (ed.) *Faith Hope and Worship: Aspects of Religious Mentality in the Ancient World*: 65-104. Leiden. See also other cat statuettes with Greek inscriptions dedicated to the goddess: Wagner, G. 1983. Une nouvelle dédicace à Boubastis. *Annales du Service des Antiquités de l'Égypte*, 69 : 247-252

[51] La'da, C. A. 2002. Immigrant Women in the Hellenistic Egypt: the Evidence of Ethnic Designations, in Melaerts, H. and Mooren, L. (eds) *Le rôle et le statut de la femme en Egypte hellenistique, romaine et byzantine. Actes du Colloque International, Bruxelles-Leuven 27-29 Novembre 1997.* (Studia Hellenistica 37: 167-192). Paris-Leuven.

[52] Exposure of girls was practiced in the Greek world at that time see: Brulé: 1990. Enquête démographique sur la famille grecque antique. Étude de listes de politographie d'Asie Mineure hellénistique. *Revue des études anciennes* 3-4: 233-258.

[53] Both names of ΜΟΣΙΧΩΝ and ΦΟΡΜΙΩΝ are attested at Athens and in many deme in Attica see: Osborne, M. J. and Bryne, S. G. (eds) 1994. *A Lexicon of Greek Personal Names* II. *Attica*: 320-321; s. v. Moschion: A Stele of Moschion (from Rhamnos) with a dog, about 375 BC in the P. Getty Museum Inv. no. 73.AA.117 see: Vorster 1983: 12-13, 90; Grossman, J. B. 2001. *Greek Funerary Sculpture Catalogue of the collection at the Getty Villa:* 18-20 cat. no. 5. Los Angeles.

[54] Dunand, F. 1981. Grecs et Égyptiens en Égypte lagide. *Modes de Contacts et Processus de Transformation dans les Sociétés Anciennes. Actes du Colloque de Cortone (24-30 mai 1981), organisé par la Scuola Normale Superiore et l'École Francaise de Rome avec la collaboration du Centre de Recherche d'Histoire Ancienne de l'Université de Besançon*: 45-87. Pise-Rome.

[55] Already in the late period some dedications were offered to Egyptian gods by Greeks bearing Greek dedicatory inscriptions see: Weiss, K. 2012. *Ägyptische Tier-und Götterbronzen aus Unterägypten. Untersuchungen zu Typus, Ikonograpie und Funktion sowie der Bedeutung innerhalb der Kulturkontakte zu Griechenland.* Wiesbaden.

[56] Dunand, F. 2003. Fêtes et Reveil. Religieux dans les cités grecques à l'époque hellénistique, in Motte A. and C.M. Ternes (eds) *Dieux, fêtes, Sacré dans la Grèce et la Rome Antique. Actes du Colloque tenu à Luxembourg du 24-26 octobre 1999*: 101- 112. Louvain.

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Italian archaeology in Alexandria

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Introduction

Between 2012 and 2017, the authors conducted a detailed study project which was partly funded by Alexandria Centre for Hellenistic Studies in order to produce a book featuring the history of the Italian archaeological investigation in the city. The research was conducted through collecting rare unpublished and published martials from different archives in Italy, UK, and Egypt. The results were published in 2018 with the title *Unearthing Alexandria's Archaeology: The Italian Contribution*.

The archival survey, historical research, and archaeological description of the main Italian excavations in Alexandria from the 1890s to the 1950s were included in the publication. The Italian archaeological investigations in the city of Alexandria are presented through photographs of Evaristo Breccia, Achille Adriani, and some glass negatives of the Graeco-Roman Museum of Alexandria.[1]

Various Italians contributed to the fieldwork and production of drawings and plans of the most important sites in Alexandria, on which our knowledge is based. In contrast with the names of Botti, Breccia and Adriani which are celebrated, the names of many contributors have been forgotten. Among these the following may be mentioned: Giacomo Biondi, Gino Beghe, Antonio Gentili, Giuseppe Ramacciotti, Mariano Bartocci, Giovanni Dattari, Despina Sindiano, Michele Salvago, Orazio Abate, and Giovanni Peruto.

The volume also includes a description of the process of the earlier excavations of sites no longer present today. This gives scholars the possibility of imagining the reality of the sites and reconsidering architectural elements on the basis of the photographs provided.

Summary of the fieldwork at Chatby necropolis

The necropolis of Chatby lies in the centre of modern Alexandria. Nowadays, only a small portion of the site is still preserved.

[1] The volume contains 188 figurines of different sites of Alexandria that did not survive to our recent days and photographs of sites that still exist.

The first excavation at Chatby necropolis occurred in 1892, but Botti mentioned that the necropolis was identified by a certain Mr Joannidis.[2] There are no detailed reports of the excavations of those years. The permission for excavation was first assigned to Alexandre Max de Zogheb by the Graeco-Roman Museum. The dig uncovered a few graves. Botti mentioned the discovery of Hellenistic figurines at the 'open-air cemetery' at Chatby, as well as a Hellenistic rock-cut hypogeum. He also supervised the investigations of some funerary pits that had been uncovered by a non-archaeological dig.[3] In 1893, following Mr Joannidis' work, Botti surveyed the area and began his own excavation. This dig discovered three Hellenistic underground tombs.[4]

Breccia directed the first extensive excavation at Chatby between 1904 and 1910, although by that time the site had undergone partial destruction due to the levelling works related to the construction of a new quay in the Eastern Harbour. Breccia's work also included the recording of architectural features. He investigated the upper layers and the 'open-air cemetery'. Two of the Hellenistic tombs that had been identified by Botti were investigated in detail (Figures 1-3).[5]

In 1916, an excavation was led by Colonels Tubby and James under the supervision of Breccia. They re-opened an old excavation area with the intention of descending to the occupational phases related to the cemetery. Their work uncovered more graves and limestone structural remains.[6]

Adriani also conducted investigations at Chatby in the early 1950s; he documented two clusters of early Hellenistic tombs which were linked to the 'open-air cemetery' and the underground tombs.[7]

In 1981, Ahmed Abdel Fattah carried out an emergency excavation in the eastern part of the necropolis, where

[2] Botti 1898b: 96.
[3] Chugg 2007: 6; Botti 1898a: 53–54.
[4] Botti 1898b: 97; Botti 1899b: 44.
[5] Breccia 1912.
[6] Tubby and James 1918.
[7] Adriani 1956: 33–35.

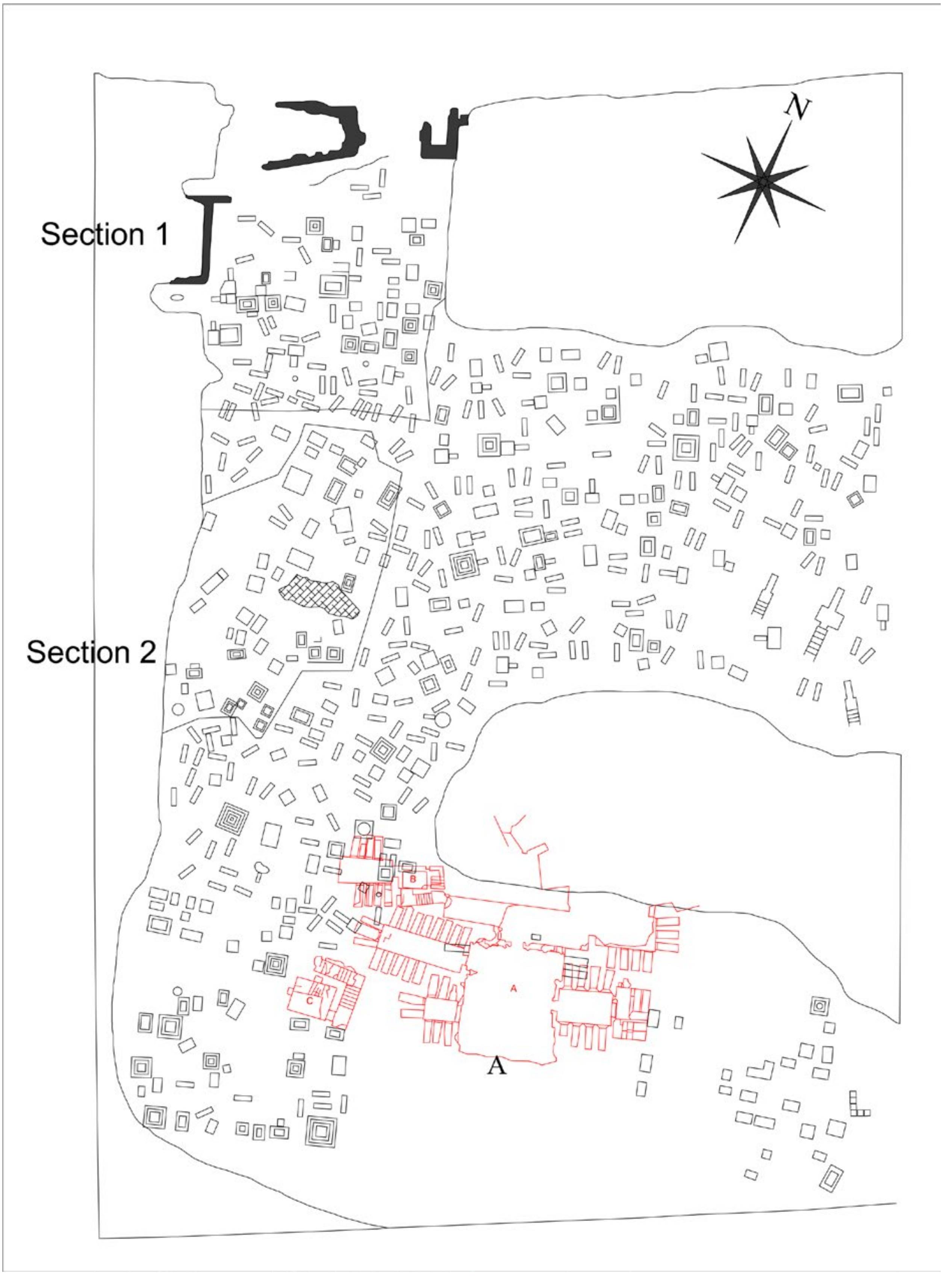

Figure 1. Chatby Necropolis, plan of Hypogeum A
(based on Breccia 1912, pl. A and Schmidt 2013, fig. 2 showing in red what remained of the vast necropolis).

Figure 2. Chatby Necropolis, Hypogeum A, 1960s
(Bonacasa Archive, Palermo University).

Figure 3. Chatby Necropolis, Hypogeum A, view of Hypogeum A (entrance), 1960s
(Bonacasa Archive, Palermo University).

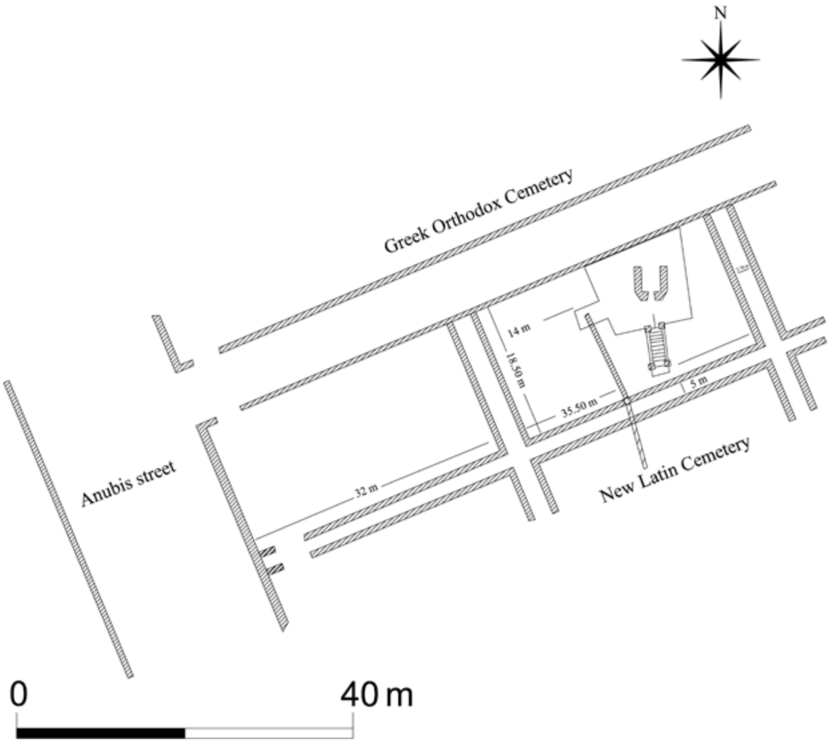

Figure 4. Chatby, location of the Alabaster Tomb (based on Adriani 1940, fig. 1, with modifications).

Figure 5. Chatby, Alabaster Tomb, after cleaning by Adriani's team, 1935 (glass negative, AlexMed).

several tombs had been damaged and destroyed by modern construction work.[8]

Between 2010 and 2014, Stefan Schmidt and Christoph Rummel, of the Bavarian Academy of Science and Humanities, cleaned, photographed, and recorded with a total station the three Hellenistic underground tombs.[9]

Investigations were also carried out at the site of the Alabaster tomb, which used to be within the limits of the Chatby necropolis. Its discovery is dated to 1907, when Breccia recorded the existence of large 'oriental' alabaster blocks surrounded by large walls; however, it was only in 1921 that he published this finding. Adriani worked in the area between 1935 and 1982 (Figures 4 and 5), and he exposed the remains of alabaster walls. He also reconstructed the structure.[10]

[8] Abdel Fattah 2015: 21–23.
[9] Schmidt and Rummel 2015: 54–56.
[10] Breccia 1908: 230–231; Breccia 1921: 70; Adriani 1966: 140.

Figure 6. Kom al-Chougafa Catacombs, entrance of the main tomb, 2012 (photograph, A. Dawestashy, AlexMed).

Summary of the fieldwork at Anfushi necropolis

This necropolis was constituted solely by six Hellenistic underground rock-cut tombs. It was first identified in the early nineteenth century by Alexandre Bourges Saint-Genis, a member of the French Commission of Egypt.[11] The tombs were briefly explored at that time, whereas the first excavation was conducted by Botti in 1901, following the uncovering of two tombs by the construction works for the Eastern Port. He published his findings but was unable to complete a detailed report due to his death in 1903.[12]

The investigations were reprised by Breccia in 1919 and 1920, when he detected four additional underground tombs.[13] The detailed recording of these tombs was carried out by Adriani in 1952, who fully described the structures and the findings.[14] Breccia also mentioned the presence of other structures, among which were a possible small quarry, and numerous Roman cisterns. However, he did not detail their location nor provide more information on them.[15]

[11] *Description de l'Égypte*, Vol. 2, ch. 26: 17–18.
[12] Botti 1902: 9–16.
[13] Breccia 1921.
[14] Adriani 1952.
[15] Breccia 1921: 67–68.

Summary of the fieldwork at Kom al-Chougafa

Kom al-Chougafa was first explored by Tassos Demetrios Néroutsos between 1874 and 1885, but the first extensive excavation was carried out by Botti in 1892.[16] Botti was responsible for halting the quarrying of the site. His work allowed for the identification of the Catacomb in 1900. Several tombs were recorded by Botti in 1892 and 1893. The investigation was halted due to lack of financing, and it was not until 1897 that Botti received further funding to continue his research. He explored the tombs in proximity to the Stadium.

Between 1941 and 1942, Alan Rowe conducted further investigations in the area. The Catacombs were cleaned, and Rowe identified the lower storey of the structure to have been part of an earlier Serapeum. He also argued that the tomb had been constructed for a wealthy lady and her family. Excavations outside the Catacombs allowed the finding of a funerary road, a children's cemetery, and a chamber that had stored more than 800 pottery vessels. He reprised some of Botti's work and completed the excavations. He also investigated the tombs within the Hall of Caracalla (Figure 6).[17]

In 1975, the excavations of the Graeco-Roman Museum conducted by Henri Riad detected two small Roman

[16] Néroutsos 1888; Botti 1898c.
[17] Rowe 1942a.

bath complexes that were located a few hundred metres south of the Catacombs.[18]

Summary of the fieldwork at the Serapeum

The site of the Serapeum was visited by multiple scholars before it was officially excavated. The Commission of the Napoleonic expedition had sent the geologist and mineralogist Déodat de Dolomieu and the artist, writer and diplomat Dominique-Vivant Denon to visit the site; they produced a site plan, drawings, and preliminary descriptions. The architect Charles Norry conducted the first survey; Saint-Genis and Gratien Le Père also visited the site.[19]

Mahmoud al-Falaki conducted the first excavation between 1863 and 1866. His work focussed on the northern and eastern parts of the mound, which had not been damaged by quarrying. His digs uncovered numerous architectural features, among them, collapsed columns and capitals, as well as foundation walls. He estimated the structure to have been massive (more than 180 metres in length) and suggested that the site had probably hosted the ancient Serapeum.[20]

Botti excavated part of the site between 1894 and 1898. His digs uncovered several architectural features, among which were the rock-cut pool, the large subterranean galleries, the south building, the Staircase of the East, the *arca* and the Isium.[21] One notable find of his campaigns were the remains of the Apis bull statue (Figure 7).[22]

Figure 7. Apis statue at the Graeco-Roman Museum in Alexandria (photograph, Judith McKenzie Archive, Manar al-Athar).

The second major archaeological excavation of the Serapeum was conducted by the Sieglin Expedition between 1898 and 1902. The expedition was financed by the factory owner Ernst Sieglin, while excavations were conducted first by Ferdinand Noack and later by Theodore Schreiber. The investigations focussed on the north structure, the temple of Serapis, the west and south structures, the east courtyard, and the east slope.[23]

Breccia also excavated at the Serapeum in 1905–1906, and in 1917–1918. During the former campaign, his work uncovered the remains of several statues, among which were three granite sphinxes.[24] Regarding the latter campaign, he published no detailed reports.

Alan Rowe investigated the Serapeum between 1942 and 1949. He was able to expand the previous digs and to excavate in more detail, which allowed him to clarify his predecessors' interpretations. He exposed architectural remains on the eastern side of the plateau, as well as the foundations of the enclosure wall, a Ptolemaic Nilometer, and the Roman temple of Serapis. He was able to differentiate between the Ptolemaic and Roman enclosure walls. The finding of the foundation plaques of Ptolemy II Philadelphus, Ptolemy III, and Ptolemy IV was pivotal for dating the complex.[25]

Summary of the fieldwork at Kom al-Dikka

David George Hogarth was the first official excavator at Kom al-Dikka. He worked in 1895. At the time, the site was occupied by the military fort of Cretin and partly by early Muslim tombs. Therefore, Hogarth opted to excavate the tunnels which ran from the east towards the centre of the mound. The tunnels led into a fired brick wall and two 'chimneys' made of the same material. One of the 'chimneys' was excavated; however, the investigation was halted due to difficult work conditions.[26]

In 1929, Breccia excavated in proximity to the modern limits of Kom al-Dikka, near the Nabi Daniel Mosque. The excavations uncovered many limestone blocks,

18 Riad 1975.
19 Sabottka 2008: 3–6.
20 Al-Falaki 1872: 54–55.
21 Botti 1897; Botti 1898a; Botti 1895.
22 Botti 1899a.
23 Sabottka 2008.
24 Breccia 1907.

25 Rowe 1942b; Rowe 1942c; Rowe 1946;
26 Benson and Hogarth 1895: 2, 18–22; Society for the Promotion of Hellenic Studies 1895: xxxix.

Figure 8. Kom al-Dikka, al-Bardissi Street excavation and view of part of Kom al-Dikka (glass negative, AlexMed).

fragments of marble, remains of large foundation walls, as well as other architectural features. When the excavation shifted to the nearby al-Bardissi Street, the remains of a section of the western colonnade of a main Roman street were exposed.[27]

Adriani excavated in the same area as Breccia between 1932 and 1934. He described in detail the colonnade that had been exposed by Breccia and the remains of streets and canals that his excavation had exposed; he also noted the finding of Arab graves in the upper layers. He dated the structures to the Roman period (Figure 8).[28]

Between 1933 and 1934, the excavations focussed on the south foot of Kom al-Dikka's hill. Several soundings were carried out to investigate the lower levels of the site. The remains of the Roman road were detected also in these soundings, as well as the remains of granite columns. Adriani identified this road as street L3 in al-Falaki's plan.[29]

Alan John Bayard Wace excavated at the site in 1947, mostly focussing on Hospital Hill (Mazarita) and the fringes of the fort.[30]

[27] Breccia 1932.
[28] Adriani 1934.
[29] Adriani 1940.
[30] Bard 1999: 149.

Since 1960, the Polish mission led by Warsaw University's Polish Centre for Mediterranean Archaeology has been excavating at the site. The first season was characterised by the discovery of the remains of some parts of the Imperial bath complex, among which were underground vaulted corridors and storerooms, and a small private bath to the south.[31] The following seasons began to uncover the nearby structures, such as the theatre portico, the cistern, the Roman theatre, and the domestic districts.[32] The auditoria of Kom al-Dikka were found at different times, the first in 1963 and the following three in 1980.[33] The Muslim cemetery in the western side of the site was also excavated.[34] The mosaics of the early Roman 'Villa of the Birds' were uncovered between 1997 and 1998.[35]

The excavations were carried out in association with planned conservation works.[36] These works focussed mostly on the bath complex, cisterns, theatre and its portico, domestic quarters, and auditoria. The structures were consolidated or rebuilt to create an archaeological park.

[31] Kiss 2007: 117; Rodziewicz 1991.
[32] Rodziewicz 1991.
[33] Kolataj and Majcherek 2003; Rodziewicz 1991; Kiss 2007.
[34] Kiss 2007.
[35] Majcherek 1999.
[36] Kolataj 1991.

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'Crumbs from the Table'— archaeological remains of Hellenistic Alexandria

Grzegorz Majcherek

Polish Mission excavating Kom el Dikka

The Hellenistic period is an era almost unanimously regarded as the quintessence of Alexandrian history. This exceptional past is commonly symbolised not only by its associated monuments, but also by inextricably-linked historical figures: Alexander the Great, Archimedes or Cleopatra. Clichés created in this way are anything but a modern invention; to the contrary, they played a similar, perpetuated role as early as in antiquity. One of the historiographers who fell for them was Ammianus Marcellinus, who in his 4th-century AD description of Alexandria ascribed the construction of the Pharos lighthouse and the Heptastadion to none other than Cleopatra, even though both these structures precede her rule by several hundred years.[1]

Perhaps the best measure of persistence of the myth of Hellenistic Alexandria, which isn't always in line with the facts, remains the media hullabaloo accompanying the discovery of a late antique complex of lecture halls by a team of archaeologists from the University of Warsaw. This discovery was incorrectly linked by certain media – in a completely natural fashion – to the Library of Alexandria. News releases speaking about finding the '*alma mater* of Archimedes,' or digging out 'the world's oldest university,' culminated in the most surprising headline: 'Library of Alexandria discovered'.[2] The Library was not unearthed at Kom el-Dikka, like the media wanted; what was found, however, were other monuments with equally-important meaning, encapsulating the cultural heritage of Alexandria just as well. They represent the only remains of an ancient academic complex worldwide.

This unique set of twenty-two lecture halls dates to the 5-7th century AD; they are situated along a monumental column portico, constituting a somewhat monumental frame of an entire district of public buildings.[3] An auditorium's standard plan is typically a rectangular room, sometimes ending in an apse or a slightly elongated exedra (Figure 1). The rooms were always equipped with two or three rows of stone benches situated along walls, and a monumental seat rising above them—often an actual *thronos*.[4] This elevated seat was taken by a lecturer, while students sat on the benches along walls. Such an arrangement is a solution fully evidenced by ancient sources, both written and iconographic.

Considering both the scale of the Alexandrian complex and its location in urban space, we can assume that the auditoria we discovered constitute the only known relics of the so called 'temenos of the Muses,' an urban educational institution situated by late antique written sources in the very heart of Alexandria.[5] An academic institution of this size is hardly unexpected. In contrast to rather common opinions, Alexandria – despite its ups and downs – remained a city where the intellectual life never stopped.[6] Ammianus Marcellinus, fully conscious of its unrivalled and centuries-old tradition, paints a certainly enthusiastic image of the city – a centre of academic life where, even in his times (*tamen ne nunc*), liberal arts were still cultivated.[7]

Kom el-Dikka, a site where this discovery was made, is situated near the very centre of both ancient and modern Alexandria; it takes up the space of two large quarters to the south of *Via Canopica*, the main artery of the ancient city. The vast majority of monuments discovered at the site belong to the late Roman period, constituting an enormous complex of public buildings, including imperial baths, a theatre, cisterns, porticoes, and the aforementioned complex of auditoria.[8]

Early Roman monuments are few and far between, whereas relics from the Hellenistic period – which interest us the most – are extremely rare and poorly preserved.[9] Such a situation is certainly frustrating, but even these exceptionally sparse findings provide quite substantial research potential. Let us try, then, to shortly present at least several of these finds and point out some related key issues.

[1] Ammianus XXII, 16: 9-10.
[2] Majcherek 2008: 191-192, n. 3.
[3] For detailed description of the auditoria complex see Majcherek 2007b; 2008 and 2010a.
[4] Majcherek 2007b.
[5] Zacharias. *Ammonius*, *PG* 85, coll. 1064.
[6] For the intelectual life in late antique Alexandria see Haas 1997; Watts 2006.
[7] Ammianus XXII.16.17-18., cf. also brilliant commentary by Bowersock 1996.
[8] For the topography of the site see Tkaczow 1993: 85-89, 94-100, 108-110; Tkaczow 2000.
[9] For the remains of the Hellenistic period architecture see Majcherek 1990: 77; Majcherek 1997: 27-29 and Rodziewicz 1976: 172-175.

Figure 1. One of the late Roman lecture halls uncovered at the Kom el-Dikka site (photo G. Majcherek, © PCMA).

One of the critical questions in Alexandrian archaeology, which, for many years, has been the subject of intense debate, is the reconstruction of the ancient city's urban planning scheme.[10] The objective of this article is not to delve into speculations based on historic sources, concerning the city-founding process itself, or the genesis – attributed to Dinokrates – of adapting a Hippodamian plan; it is rather to focus solely on data obtained from archaeological research.[11]

Although the broadly-defined topography of Alexandria, with the exception of several monuments (Serapeum, Caesareum, Heptastadion, etc.), is largely hypothetical, the basic street grid layout determined nearly 150 years ago by Mahmud Bey el-Falaki is generally unquestioned and remains – despite many objections – the fundamental system of topographical reference.[12]

The most heated debate concerns dating individual streets. Generally, Falaki's plan has a synthetic rather than diachronic nature. We cannot forget that not all streets identified by Falaki belong to the same period. Several streets were built during the Ptolemaic period, but many of them are certainly of Roman, or even Byzantine date. In certain areas of the city, it was observed that Roman streets were planned by crossing older ruins.[13] Such a phenomenon was noted by, among others, Noack at the R3 street he investigated.[14] No wonder then that such observations formed the basis of doubts raised by many researchers, including Hogarth, concerning the accuracy and value of Falaki's plan.[15] I won't delve deeper into this debate; I would rather focus on slightly different aspects of this discussion – that is on the orientation of the street grid itself, and on its additional internal divisions. The rapid urban development of a modern city drastically reduced the possibilities of obtaining new archaeological evidence; we are, therefore, confined to somewhat fragmentary, often even random data.

[10] For the discussion on the street grid of ancient Alexandria see Arnaud 2009; Caruso 1993; Fraser 1972; Grimm 1996; Mahmud Bey 1872; Tomlinson 1995.

[11] On the debate on Greek town planning see useful overview in Shipley 2005.

[12] See detailed discussion on the plan of ancient Alexandria, based on the analysis of archaeological evidence: Adriani 1966; Rodziewicz 1987; Tkaczow 2013.

[13] See similar situation at Kom el-Dikka, where the so-called Theatrical Portico was built in 4th century AD with no regard to the older structures, see Tkaczow 1993: 87-88.

[14] Noack 1900: 223, 239-252.

[15] Hogarth and Benson 1895.

Figure 2. Street R4, looking south. Late Roman phase (photo G. Majcherek, © PCMA).

The new version of the Ptolemaic city plan was created nearly 30 years ago. Its author – Wolfram Höpfner – based it primarily on previous reconstructions; however, at the same time, he introduced a completely new, ground-breaking idea, which was the division of large *insulae* marked by Falaki into considerably smaller units.[16] According to this new hypothesis, based largely on parallels from other Hellenistic cities, large *insulae* (278 x 310m, with interaxial dimension of 330m) were additionally divided by two smaller latitudinal streets and five longitudinal streets into smaller blocks covering six square house-lots sized c. 22 x 22 m.[17]

Kom el-Dikka excavations produced fresh information on this issue, prompting at least a consideration of this hypothesis.[18] The majority of early Roman buildings unearthed at the site were built along streets most probably planned as early as the Hellenistic period. The best example of such continuity is the R4 street, situated in the eastern part of the site.[19] Along the eastern edge of this nine-metre-wide street, underneath its surface made of large irregular stones, a series of sewers was preserved (Figure 2). Their course, marked by two manholes situated approx. 40m apart, was identified throughout the entire unearthed street fragment.

A series of drains built on top of each other reflects the subsequent four phases of use of adjacent houses G and H (Figures 3-4). The last, and the best preserved, belonged to the phase dated 5-7th century AD. The deepest (ca 4m a.s.l.) and simultaneously the oldest one was in use in the Ptolemaic and early Roman periods (2th century BC - 1st century AD).

The street itself remained in use until the end of antiquity; its width and surface adjusted to the subsequent level of use, but the course itself remained unchanged. Moreover, a street with identical orientation, although at a much higher level, survived even in the Islamic period. Due to the presence of the

[16] Höpfner 1990.
[17] Höpfner 1990: fig. 1; Höpfner and Schwander 1994: 240, fig. 228.
[18] Daszewski 1994; Kiss 1994.
[19] Street R4 was identified also further north, under present cinema Amir, cf. Adriani 1956: 1-10.

Figure 3. Sewer under the R4 street (photo G.Majcherek, © PCMA).

sewers, it was possible to determine that the R4 street was generally in use throughout all historical periods of ancient Alexandria; it is therefore possible that the continuation of Ptolemaic streets in the Roman period can be also hypothesised for at least some other side streets. The existence of such transverse streets dividing large *insulae* into smaller quarters was confirmed in several locations of the site (Figure 5).

A small east-west c. 5.50m wide street fragment was unearthed beneath the theatrical portico in the 1970s.[20] Sections of another parallel streets, approx. 4.80 -5.10m wide, were also identified in the central part of the site.[21] It was adjoined, on the north, by houses FA and FB, and, on the south, by the house FD, whose small fragment was found beneath the north-eastern corner of late Roman cisterns.[22]

Analysis of the location of building entrances on the eastern side of the R4 street, i.e. within the next *insula*, points to the existence of a similar side street in the same line.[23] It is possible that this street, placed between houses H and G, is a continuation of the *L'alpha* street, identified by Evaristo Breccia in the city's eastern part.[24]

If the distance between these two streets equals approx. 52-53m, and their disposition is regular and symmetrical, as expected, then a simple calculation proves that each of Falaki's basic *insulae* must have been split by four parallel streets, and not two, like in Höpfner's proposition (Figure 5).

Unfortunately, these findings still remain a hypothesis. This is because the E-W side streets we discovered were certainly in use in the early Roman period (1-3rd century AD), but we don't currently have any solid evidence

[20] Rodziewicz 1984: 34-35.
[21] Höpfner and Schwandner 1994, fig. 228, suggested a width of c. 6 m (20 feet) for secondary parallel streets.

[22] Majcherek 2011: 46; Majcherek 2012: fig. 2.
[23] Majcherek 1998: 34.
[24] Adriani 1966: 22, 63 (No. 11) and 269.

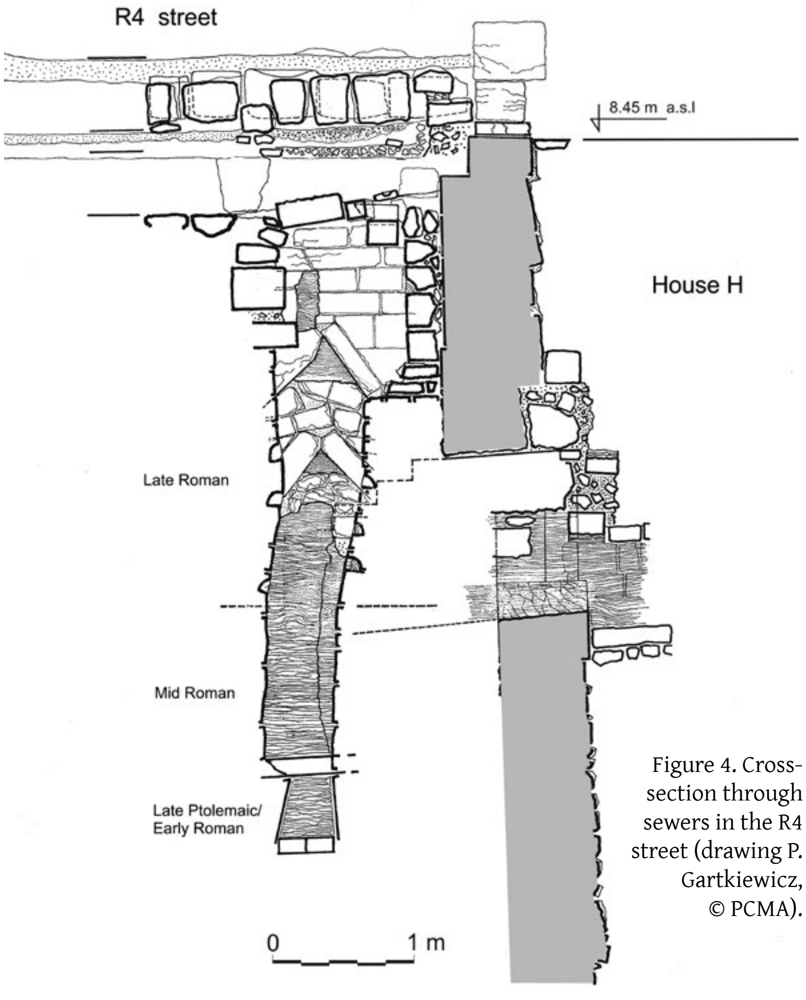

Figure 4. Cross-section through sewers in the R4 street (drawing P. Gartkiewicz, © PCMA).

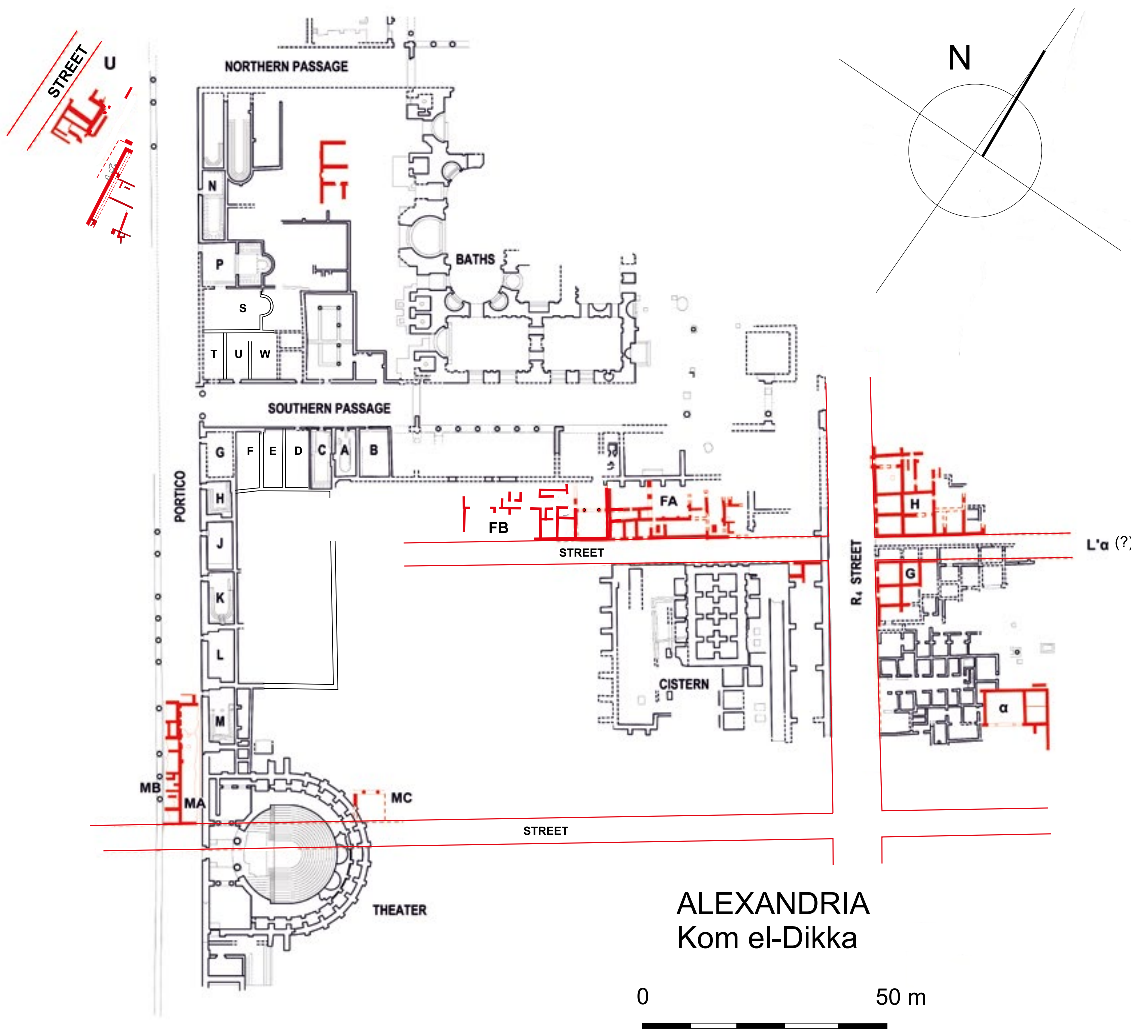

Figure 5. Kom el-Dikka, Late Antique plan with outline of Early Roman/Ptolemaic? streets (drawing W. Kołątaj, D. Tarara, © PCMA).

concerning their planning and use in the Hellenistic period. A certain premise confirming such possibility is the presence of Hellenistic walls unearthed within the area of houses H and FA.[25]

A similar orthogonal orientation, in line with Falaki's street grid, is also to be observed in case of the remains of a Ptolemaic building, unearthed in the early 1960s near the modern street of el-Horreya.[26] This orientation is further confirmed by the temple of Bubastis, dated 4-3th century BC, remains of which were quite recently unearthed by a team of Egyptian archaeologists to the south-east of Kom el-Dikka, in the area of a neighbouring *insula* between streets R4 and R5.[27]

It can, therefore, be assumed that the orthogonal Hippodamian grid was the proper plan for the entire city in the Ptolemaic period. However, data obtained from excavation in the north-western part (sector U) of Kom el-Dikka provides a slightly different view.

In that area, beneath a collapse of stone resulting from a fall of a huge wall, some unusual structures were found; they are poorly preserved, but very significant for this topic. They constituted, it would seem, a complex of separate rooms, probably used as shops (*tabernae*). The use of these structures generally falls in the early and middle Roman period (1st to 3rd century AD); however, analysis of the accompanying finds suggests that some of their fragments were built in the Ptolemaic period.[28] Similarly-dated structures were also unearthed within the last few seasons in the same sector, slightly further south-west. Next to a row of rooms similar to the ones mentioned, a large public latrine (*forica*) was found.[29]

[25] See above note 9.
[26] Riad 1967.
[27] Abdel -Maqsud et al. 2012.

[28] Majcherek 1992: 8-10.
[29] Majcherek 2015: 31-40; 2014: 24-37.

Nonetheless, the most telling is the orientation of all unearthed structures. All of them are placed according to the geographical orientation (N-S), thus differing from the aforementioned orthogonal street grid and other similarly-dated monuments, previously unearthed at the site. Their unique orientation is determined by the adjacent street. A small fragment of this diagonal, approx. 5.50-5.70m-wide street, was unearthed in the early 1980s in the very corner of the sector U.[30]

M. Rodziewicz, in the only in-depth study to date of the urban grid of Ptolemaic Alexandria, analysed, *inter alia*, similarly-oriented structures and streets unearthed in the area of the so-called Royal Quarter (Brucheion).[31] Near the current seat of WHO, slightly north of the L3 street, massive foundations from that period were unearthed, belonging probably to some public building, and an accompanying small section of a street with earthen surface.[32] Structures with the same orientation were found as early as the 1930s, slightly further east, on the Lochias peninsula.[33]

Therefore, it is tempting to accept the hypothesis, according to which this unique orientation can be ascribed to the entire Royal Quarter, which took up a large part of the city. According to Strabo's evaluation, it could take as much as a quarter or even a third of the total city area.[34] At the same time, a question appears: could it reach as far south from *Via Canopica* (L1)? It is rather improbable. Moreover, somewhere midway between the structures of the Royal Quarter and Kom el-Dikka, there are ruins of the Caesareum, recently studied by a team of French archaeologists. Although the orientation of this building – whose facade was once adorned by two obelisks known as Cleopatra's Needles – differs from the canon determined by Falaki's grid. At the same time, it does not follow the direction of remains found in sector U at Kom el-Dikka, nor those identified in the northern part of the city.[35]

This way or another, the reason for this orientation that follows cardinal geographical directions, described by M. Rodziewicz as 'solar,' remains unknown and constitutes a subject of debate.[36] Its existence, confirmed by archaeological studies in the described parts of the city, again raises the question of the possibility of changes in orientation of certain quarters of the city, which would take place between the Ptolemaic and Roman periods. To date, there is no evidence for the homogeneity and correctness of such a grid, which has been identified in isolated parts of the city, situated far apart. It is perhaps rather evidence for survival of and respect for local character of the area, situated inside *insulae*, bordered by Falaki's basic street grid.[37] It is quite probable, that in certain areas of the city this diagonal ('solar') grid survived even until the late 3rd century AD destruction.[38]

In Alexandria, like in entire Egypt, it is often difficult to separate Hellenistic and Roman monuments. As a matter of fact, if not for the chronological divide, such a distinction would be difficult to justify. They were made during a period, which is conventionally called Graeco-Roman for a reason.

Construction of the majority of residential houses unearthed at the site and used in the Roman period (1st to 3rd century AD) is dated at the turn of eras. Nonetheless, if the measure of assignment to a specific cultural tradition would be, e.g., the style of architectural ornaments, it is clearly rooted deep in the Hellenistic period. In this case, determining how far these houses' plans copied older models is a secondary matter, but this relationship is undeniable and clear. In many instances, walls of subsequent building phases were raised on top of the older buildings' walls, therefore repeating their orientation. As a result, despite individual differences, the general picture of this architecture, unearthed at our site, is no surprise; all houses draw heavily on the Hellenistic building tradition.[39] The primary element regulating house planning was always the central rectangular courtyard. Pseudo-peristyle, the best example of which is preserved in, e.g., building FA, remains the most common form of arrangement.[40] In the latter case, the builders used engaged columns with plain shafts, resting on simplified bases and topped with Doric capitals (Figure 6). Similarities with Alexandrian sepulchral architecture, noticed first by A. Adriani and later consensually by many researchers, are obvious.[41] The same method of planning and decorating courtyards is easily recognised, e.g., in the case of *hypogeum* No. 1 from the Necropolis of Mustafa Pasha.[42]

Extant plasters provide good evidence of house interior decoration. Perhaps the best-preserved example of painted plastering survived in house H (Figure 7). It is composed of plain, white orthostates in the lower part, and a red painted strip in the middle section, shaped to imitate masonry in *opus isodomum* technique.[43]

30 Rodziewicz 1991: 84-85, fig. 3.
31 Rodziewicz 1995.
32 Rodziewicz and Abdel Fatah 1991.
33 Adriani 1940: 38.
34 Strabo XVIII: 8.
35 Arnaud 2002: fig. 8.
36 Rodziewicz 1995.
37 Rodziewicz 1995: 230.
38 For the destruction of the city caused by Aurelian and subsequently by Diocletian see Milne 1924: 76-82; Schwartz 1953; Fraser 1993.
39 Majcherek 1995: 138; Majcherek 2007a.
40 Majcherek 2007a: 204-205. For the assumed peristyle type of house found at the Governement Hospital site see Rodziewicz 1995: 229.
41 Adriani 1936: 74-75.
42 Adriani 1936: 15-44.
43 Ling 1991:12-22.

Figure 6. House FA, pseudo-peristyle courtyard (photo G. Majcherek, © PCMA).

Figure 7. Late Ptolemaic/Early Roman plasterwork in the house H (photo G. Majcherek, © PCMA).

Such a decoration, known as Masonry Style, perfectly following the traditions of Hellenistic architecture, apparently survived also in the Roman period, and indicates the exceptional permanence of the wall decoration tradition present in the city. Alexandria itself provides many close analogies of this style's usage. Unfortunately, they do not come from residential houses, but from cemeteries. A similar decoration was found in both the Necropolis of Mustafa Pasha,[44] and in the Necropolis of Anfushi, dated 2nd century BC.[45]

The same tradition is also emphasised by other preserved elements of architectural decoration. Most of them are clear examples of stylistic permanence, representing the – visibly standing out – so-called 'baroque' style of the Alexandrian Corinthian order.[46] Although many of them belong to the Roman series, like, e.g., certain elements in the Villa of the Birds, others are certainly dated to the Hellenistic period.[47] The most characteristic relics include fragments of cornices decorated with long, narrow dentils and alternating flat, carved, square modillions.[48] These cornices were sometimes employed as lintels of doors and windows, or primarily, decorations of richly-ornamented *aediculae* (Figure 8).

Figure 8. Cornice with square hollow modillions, limestone. Inv. no. 162.05.08 (photo G. Majcherek, © PCMA).

During our excavation, we did not find any monumental capitals decorating public buildings, like the one known from the Graeco-Roman Museum collection, but significantly smaller ones, belonging to dwelling houses.[49] They represent all distinct forms of Alexandrian capitals.[50] Like the cornices, they are all made of soft limestone. Some of them even retained remnants of their original colours (Figure 9).

Figure 9. Alexandrian Corinthian capital, Type I, limestone. Inv. no. 205x (photo W. Jerke, © PCMA).

The presence of spolia was recognised in many architectural monuments uncovered at the site. This practice, as in the entire Roman world, was particularly common in late antiquity.[51] The best example of this phenomenon is the theatre/odeon unearthed at Kom el-Dikka. Many marble seats of the auditorium, and even fragments of architectural decoration, clearly come from older ruined buildings.[52] It is difficult to assess the degree to which the use of spolia should be seen as an economical choice or as an aesthetic one. The examples noted prove the existence of both of these motivations in equal measure. In the northern section of the stylobate of the theatrical portico, several drums of Doric columns were identified, used in foundations underneath the columns. On the other hand, in the monumental entrance to the imperial baths complex, two flanking Doric columns were used (Figure 10), clearly utilizing not only their structural properties, but also ornamental ones.[53] The number and clear concentration of column fragments, incorporated in the

44 Adriani 1936: 126-129.
45 Adriani 1952: 64-66, 107-110, figs. 35-36, 46.
46 McKenzie 1996; 2007: 92-95: Pensabene 1993.
47 Majcherek 2010b: 77, fig. 6.4.
48 McKenzie 2007: 88-89.
49 Ronczewski 1927; for a cohesive group of architectural fragments from the 'Chantier Finney' see Adriani 1940: 45-53, figs. 14-21.
50 McKenzie 2007: 83-88.
51 On spoliation in Late Antiquity see useful overview in Alchermes 1994, and Kinney 2001, with earlier bibliography.
52 Makowiecka 1969.
53 Majcherek 2016: 39- 40.

Figure 10. Western gate to the Late Roman bath complex (photo G. Majcherek, © PCMA).

late Roman structures situated in this part of the site, indicate that they could originate in an unidentified public building (temple, portico?), situated nearby and ruined and dismantled in that period. The Doric style could indicate dating such a hypothetical structure to the Ptolemaic period; however, we must remember that such attribution is purely hypothetical. A good example of such an older structure is the temple (*stoa?*) built in the Doric order, whose remains were found in the early 1960s about 100m north-east from the site, under the National Insurance Company of Egypt building.[54]

Exploring houses and other structures and layers, resulted in obtaining a substantial number of finds of the Hellenistic age. Not all of them come from contexts belonging to this period; to the contrary, most of them are of a secondary nature and were found in significantly later layers: Roman, Byzantine, or even Islamic. However, all of them are direct testimonies of daily life of the citizens of Alexandria during the era.

Alexandria was a great emporium and its role as a place of trade cannot be overestimated. Material evidence of this exchange is provided by archaeological finds, primarily amphorae used to transport wine and olive oil. It is telling that even with such a modest scope of research on the Hellenistic period at Kom el-Dikka, we managed to obtain a rather sizeable collection of stamped amphora handles. Most of the finds come from later layers, a fact which in turn proves the high incidence of imported amphorae, mainly from the Aegean area in the city. This assumption is confirmed by the enormous, several thousand examples of large amphora stamps collection kept at the Graeco-Roman Museum. As in that collection, the set of over 900 finds from Kom el-Dikka consists mostly of Rhodian amphorae, followed by vessels from Knidos, Kos and Thasos.[55]

As a matter of fact, the material obtained at the site contains nearly all categories of everyday objects including Hellenistic age pottery, oil lamps and glass.[56] Next to typical 'black-gloss ware' specimens made in various centres and represented by a series of typical forms: bowls, plates with stamped decorations, there are also many examples of imported Gnathia pottery.[57] Single finds of Hadra vases were even found in the fills and debris layers; their presence in a settlement environment is, naturally, purely coincidental.[58] Egyptian pottery is also well represented. In addition to a typical repertory of fine wares from this era, it's worth it to note that Alexandria produced jugs or

[54] Riad 1967: 87, columns from Kom el-Dikka and those from the National Insurance Company site were made of different kinds of limestone.

[55] Sztetyłło 1990; 1992a; 1992b.
[56] Młynarczyk 1997.
[57] For similar finds from other Alexandrian sites see particularly Morel 1995; Elaigne 2012: 29-33.
[58] Rodziewicz 1976: fig. 4:2.

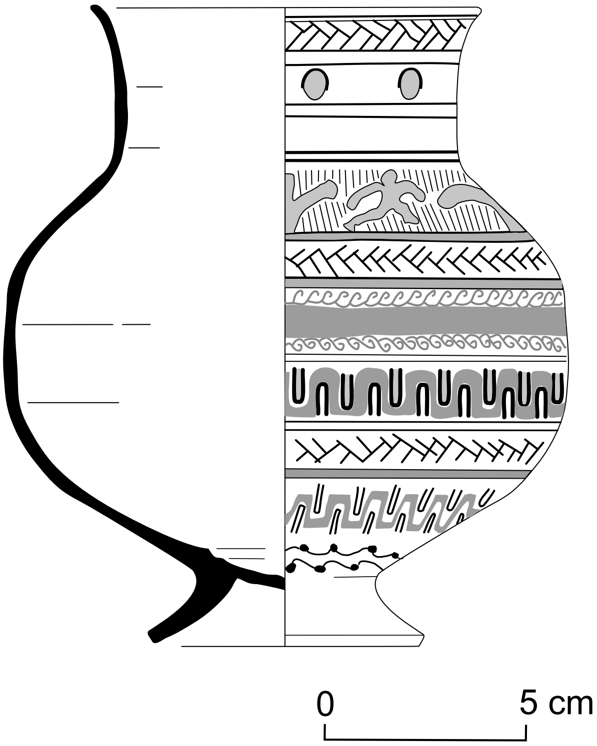

Figure 11. Late Ptolemaic painted goblet. Inv. no. 4341 (drawing G. Majcherek, © PCMA).

goblets with white and black painted decoration on a red slip (Figure 11). Such vessels were usually decorated with horizontal bands featuring geometrical patterns: e.g. cross-hatching, squared meander or guilloche. The band on shoulder often contains outline human figures. Similar figures were also painted within the base.[59]

Glass finds are extremely rare, however, singular examples of mosaic glass plaques or core-formed alabastra (Figure 12) found in varied contexts can be listed.[60]

It is not surprising that works of art are the least numerous group of finds, but certainly attract the most attention. It is telling that P.M Fraser, in his monumental 'Ptolemaic Alexandria', deliberately avoids studying the art of Hellenistic Alexandria. He justified this not only by his lack of competence, but also by the rudimentary state of research, which in his opinion practically prevented a firm attribution of objects to the Alexandrian milieu.[61]

Figure 12. Ptolemaic core-formed alabastron. Inv. no. 4698 (photo W. Jerke, © PCMA).

Inevitably, this leads us to the issue best defined by the famous, fundamental question posed by Frederik Poulsen: *'Gab es eine alexandrinische Kunst?'*.[62] This, by no means rhetorical, question was only one of the voices in the long debate about the existence of the 'Alexandrian style', begun by Theodore Schreiber in the 19th century, and one which in practice is still very much alive.[63] This debate is primarily marked by studies on sculpture conducted by many leading researchers, like Bernard Bothmer or Robert Bianchi and others.[64] Despite this long-lasting discussion, this issue is still far from solved. Currently, the term 'Alexandrian School of Art' is primarily dominated by the narration of the cosmopolitan nature of Alexandrian art.[65] I do not wish to duplicate all the arguments, but to present several pieces from several dozen found in our research, which hopefully could contribute to this discussion. And even if some of them are not representative of 'Alexandrian art', they are definitely examples of art found in Alexandria.

Ptolemaic art is perhaps best exemplified by several portrait heads made of hard stone: granite, granodiorite or basalt. The head of an older man stands out due to its particular expression (Figure 13). The expressiveness of the face is emphasised by the material itself; a vein of

[59] See Rodziewicz 1976: fig. 4: 6, for yet another example from Kom el-Dikka. For a collection of similar vessels including the so called Benaki goblet now in the British Museum collection, see Bailey 2011.

[60] A surprisingly small number of luxury glasses of the Hellenistic periods was found in Alexandria during regular excavations. For the finds from Kom el-Dikka see Kucharczyk 2016a and 2016b, with references to other Alexandrian sites.

[61] Fraser 1972: VII-VIII.

[62] Poulsen 1939.

[63] Schreiber 1885.

[64] see among others Ashton 2001; Bianchi 1988; 1996; Bothmer 1960; Savvopoulos and Bianchi 2012;

[65] for a detailed overview of the debate see Connelly 2014; Stewart 1996; Török 2011: 40-52.

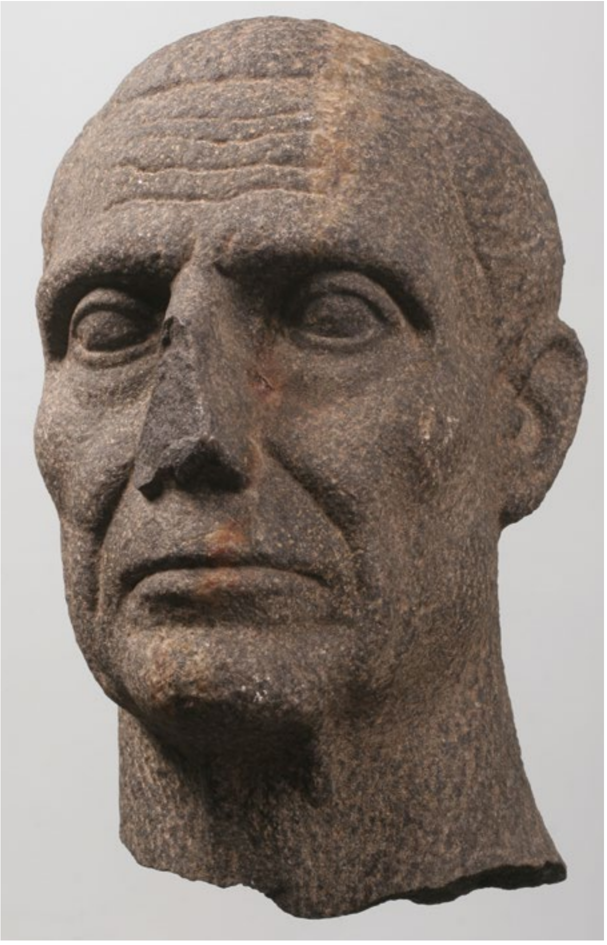

Figure 13. Ptolemaic portrait of a man, granodiorite. Inv. no. 4393 (photo M. Jawornicki, © PCMA).

Figure 14. Ptolemaic portrait of a man, basalt. Inv. no. 3859 (photo W. Jerke, © PCMA)

white feldspar crossing the temple and face gives it an additional, unplanned dramatic flair. The realism of the features is underlined by deep forehead wrinkles and vertical ridges running from the nose to the wide, tight lips. Short hair covers the head like a tightly fitted hat.[66]

Other heads (Figures 14-15) demonstrate the same stylistic features, but perhaps not in the same masterful fashion.[67] Back pillar fragments remained on all these examples, leaving no doubt that they once belonged to nearly life-size standing statues. All of these masterpieces exhibit a clear stylistic similarity to the group of sculptures from the Late Period, including portraits and sculptures of priests, officials and military leaders.[68] The most frequently cited example of this trend is the well-known sculpture of Hor-sa-hor, currently displayed in the Egyptian Museum in Cairo. It is probably a coincidence, but it is worth noting that

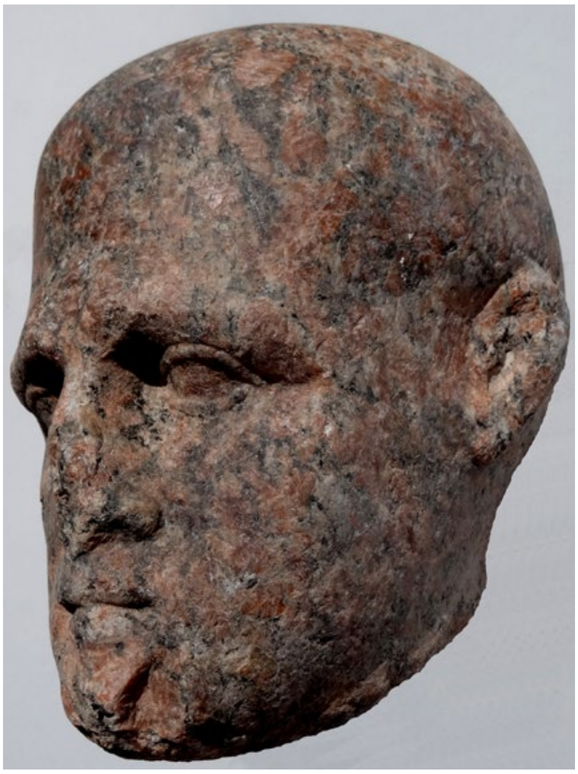

Figure 15. Ptolemaic portrait of a man, granite. Inv. no. 5272 (photo G. Majcherek, © PCMA).

[66] Kiss 2014.
[67] Kiss 1995.
[68] Bothmer 1960.

Figure 16. Portrait of Alexander the Great, marble. Inv. no. 4397 (photo M. Jawornicki, © PCMA).

this very sculpture was found in the late 19th century in the northern part of Kom el-Dikka.[69]

A completely different tradition is represented by the city's founder portraits, whose popularity is hardly a surprise in Alexandria. In addition to one portrait of Alexander the Great dated to the Roman period,[70] two other portraits from the Hellenistic period (2-1st century BC) were found at the site.[71] All these sculptures share rather typical, conventional iconographic features of the great conqueror's portraits. One of them is of particular interest (Figure 16), with its youthful appearance, long hair borrowed from Apollonian iconography, and other stylistic features that allow us to place it within the trend of Alexandrian art, reflecting the tradition based on the works of Praxiteles.[72]

All these quoted sculptures can be therefore be interpreted as expressions of a certain complex artistic tradition, borrowing from both the sources of Late Egyptian art, and from the achievements of classical Greek art. However, each of these trends seems to maintain a complete autonomy. The result is therefore not an artistic syncretism or fusion – one of the symptoms of the so-often-mentioned Alexandrian 'cosmopolitanism',[73] but rather a type of dualism (if not bipolarity), where each of the separated elements belongs to a different ethnic background.[74]

[69] Grimm and Johannes 1975: 19, no. 16.
[70] Kiss 1970; Kiss 1988: 24, figs. 31-32.
[71] Kiss 1988: 23-24, figs 28-30, no 3828.
[72] Kiss 1999.

[73] For the notion of 'cosmopolitan art,' dominating in the Alexandrian art studies in the first half of the 20th century, see Bothmer 1996; Grimm and Johannes 1975; Haggag 2013 and Lawrence 1925.
[74] This 'Two-Track,' model first postulated by Bianchi (1996), is currently the nearly commonly accepted model depicting the art of ancient Alexandria, cf. Connelly 2014. For the 'dualism' in Alexandrian art see also Haggag 2014.

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Believing in afterlife in Hellenistic and Roman Alexandria
A study of some funerary paintings

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When the Greeks – and particularly the Macedonians – settled in Alexandria, they brought with them their beliefs in an afterlife, as witnessed by their funerary architecture and iconography.[1] The more or less symbolic representation of the dead was made on sculpted or painted stelai, which marked the location of their tombs. We find them in the early necropoleis of Alexandria, such as that of Chatby.[2]

In Alexandria new funerary modes were developed in order to host the dead of the vast metropolis: each underground *loculus* was sealed by a plaque or by a pile of blocks, the surface of which was plastered and painted after each burial.[3]

Fourth – third century BC: Transposition of Attic and Macedonian funerary iconography

In Alexandria as in Greece we encounter the same types of representations:

- The warrior's banquet: on the outdoor frieze of the Macedonian tomb at Hagios Athanasios,[4] or, more rudimentarily, on painted or sculptured stelai, such as the stele of Philippos son of Attalos, in the Museum of Thessaloniki.[5]
- A woman with her maid, in Egypt the sculptured stele of Niko, on which a handmaid presents a cithara to her deceased mistress signifying the former's culture and privileged social status,[6] and the famous stele d'Hegeso, at the Kerameikos cemetery in Athens.[7]
- A man with his servant / squire, as on the painted stele now kept in the Louvre Museum.[8] The painted stele found at the Chatby necropolis figuring a man equipped with a lance and a sword, wearing a corselet and dressed in the Macedonian fashion. He is undoubtedly a horseman in the army of Alexander or of one of his successors. This representation of a Macedonian horseman closely resembles the charging trooper depicted inside the Kinch Tomb at Lefkadia.[9]
- *Dexiosis* Scene: two persons, one living and one dead are clasping their right hands bidding farewell. This theme is very often represented on sculptured stelai in Greece (dexiosis between two men)[10] as well as in Alexandria: spouses bidding farewell to each other, [11] or a mother with her son.[12]

Frequently seen in the Alexandrian necropoleis arranged in *loculi*, the shutting slabs of the *loculus* represent the doors which separate the dead from the living[13] (Figure 1). On a painted slab discovered during the Gabbari excavations conducted by the CEAlex, a painted sealing slab represents both the doors and the stele set up before them. It is on this stele that is depicted the husband bidding farewell to his departed wife (*dexiosis*)[14] (Figures 2-3). Two other examples of this composition on painted sealing plaques of *loculi* with the image of a stele set up before the closed doors of the tomb found in Alexandria are today kept at the Louvre.[15]

- A mother with her child (or children), in Macedonia as well as in Alexandria.[16]
- A child with his/her pets, as on the stele of Xanthos, from Pella: the naked boy is playing with a bird, while his dog is jumping in an

[1] Guimier-Sorbets 2002; Guimier-Sorbets 2006; Guimier-Sorbets 2016. I must particularly thank J.-Y. Empereur and M.-D. Nenna, successively Directors of the Centre d'Etudes Alexandrines (CEAlex-CNRS), as well as my Egyptian colleagues, thanks to whom this research has been made possible.
[2] Breccia 1912.
[3] Empereur 1998: 192-195 ; Guimier-Sorbets, Nenna and Seif el-Din, 2001: 172-192.
[4] At the end of 4th c. BC: Tsimbidou-Avloniti 2005.
[5] Thessaloniki Archaeological Museum, n° 2669: Kalaitzi 2010: 335, fig. 7.
[6] Alexandria, Graeco-Roman Museum n° 10228: *Gloire d'Alexandrie* n° 69.
[7] Athens, National Archaeological Museum, n° 3624: Kaltsas 2007: 328.
[8] Paris, Louvre Museum (inv. Ma3632): Rouveret and Walter 2004, n° 3: 45-46.
[9] Rhomiopoulou 1997: 36-38, fig. 34; Guimier-Sorbets and Morizot 2006: 123, pl. 52, 53.1.
[10] Stele found in Athens, near the Dipylon Gate, Athens, National Archaeological Museum, n° 2894: Kaltsas 2007: 329.
[11] Alexandria, Graeco-Roman Museum n° 24093: Schmidt 2003, n° 39.
[12] Alexandria?, Paris, Louvre Museum (n° Ma 3620); Rouveret and Walter 2004, n° 26: 91-92.
[13] GAB97.1019.2.3: Empereur 1998: 194-195; Guimier-Sorbets, Nenna and Seif el-Din, 2001: 172-173, fig. 4.5, 4.23.
[14] GAB97.1019.7.8: Empereur 1998: 194-195; Guimier-Sorbets, Nenna and Seif el-Din, 2001: 175-176, fig. 4.8, 4.25-26.
[15] Alexandria?, Paris, Louvre Museum (n° Ma 3619, Ma 3620): Rouveret and Walter 2004, n° 25, 26: 89-92.
[16] For Macedonia: Kalaitzi 2010; for Alexandria: Nenna 2010.

Figure 1. Alexandria, Gabbari painted plaque, GAB97.1019.2.3, CEAlex Archive.

Figure 2. Alexandria, Gabbari painted plaque, GAB97.1019.7.8, CEAlex Archive.

attempt to catch it.[17] This iconographic pattern is found several times in Alexandria on sculptured or painted *stelai* dedicated both to boys and to girls.[18]

Macedonian *stelai* had been influenced by Attic prototypes. The Alexandrian *stelai* borrowed the same iconographic types, be it on sculptured *stelai* or on painted plaques, which were certainly less expensive, but allowed the relatives of the deceased to express the same kind of tribute.

In the Greek world the warriors, by their bravery, obtained the status of heroes, which secured for them an afterlife of bliss in the company of the gods.[19] This privileged status is depicted on the façade of the Tumulus Bella tomb at Vergina: the dead, a warrior, is being crowned by a tall feminine figure, probably Nike.[20] Above the central door of the main façade of Hypogeum 1 in the Mustapha Kamel necropolis of Alexandria three

Figure 3. Alexandria, Gabbari painted plaque, detail, GAB97.1019.7.8, CEAlex Archive.

17 Pella Archaeological Museum nº 1980/454: Kalaitzi 2010: 330, fig. 2.
18 Alexandria, Graeco-Roman Museum (inv. 10981, 10988, 149, 150), Schmidt 2003, nº 4, 5, 28, 37; Louvre Museum (nº Ma 3643, Ma 3620, Ma 4203): Rouveret and Walter 2004, nº 214: 67-68, 87-88.
19 Guimier-Sorbets and Morizot 2006.
20 Andronikos 1984: 35-37; Guimier-Sorbets and Morizot 2006: 122, pl. 51.2).

Figure 4. Alexandria, painted plaque, University of Alexandria Museum, nº 1345, photo A. Pelle, CEAlex Archive.

Macedonian horsemen accompanied by two feminine figures make a libation on altars.[21] The heroic status of the warriors is thus highlighted, and the scene recalls the libations in honour of the dead performed by the living on the altar located in the centre of the courtyard.

At Vergina, as in Alexandria, these explicit representations are part of the cult due to the hero and confirm his privileged status. In Greece, as in Alexandria, this privileged status extends to a wider category of the dead, with the hope of a felicitous afterlife in the company of the blessed. These representations are 'active', for they express what the living wished for their dead and in the same time they help the deceased to obtain this new status after their death.[22]

Third-first century BC: adaptation of the traditional Greek iconography to the beliefs of the Alexandrians

The land of the blessed is described by Homer as a pleasant bright, shaded, fresh, airy and fertile place. In Alexandria and more generally in Pharaonic Egypt this is represented in the shape of a garden.[23] In the nº 5 tomb of Anfushi, which dates from the Ptolemaic period, the deceased is lying under a painted canopy set up in a garden, with palm-trees, other trees and various types of reeds, as can be seen in the funerary chamber 5.2 and in the *loculus* of the chamber 5.5.[24]

On two sealing plaques from *loculi* kept today in the museum of Alexandria University the painter aimed at expressing both the architectural frame which separates life from death and the deceased placed behind open doors in an open and bright setting: it is a garden under a blue sky where trees grow, a sure sign of fertility.[25]

On the first plaque[26] a child, a boy, is playing with his bird and his dog, which is a quite frequent scene. We can see the architectural frame painted in perspective and the trees which grow in this abode of the blessed (Figures 4-5). On another plaque, which is incomplete but can be restored, one can see a woman with her two children. The inscription formulates the farewell to these three deceased persons.[27] It is the same architectural frame seen in perspective, the woman and the two children placed behind open doors in a garden where trees grow in the background. The study of these painted plaques is being carried out in collaboration with Professor Mona Haggag.

These painted documents show how the Alexandrians adopted types inherited from Greece adapting them in order to better express their beliefs in a blissful afterlife represented in the shape of lovely gardens.

[21] Adriani 1936: 37, 109-112, pl. D; Guimier-Sorbets 2016: 215-216.
[22] Guimier-Sorbets 2002.
[23] Tricoche 2009.
[24] Adriani 1952: pl. XLIII.1, XLV; Guimier-Sorbets 2014: 152-154.
[25] Guimier-Sorbets 2014: 154-157.
[26] University of Alexandria Museum, nº 1345; Guimier-Sorbets 2012: 447-454; Guimier-Sorbets 2017.
[27] University of Alexandria Museum, nº 1346; Guimier-Sorbets 2012: 452-457; Guimier-Sorbets 2017.

Figure 5. Alexandria, painted plaque, detail, University of Alexandria Museum, nº 1345, photo A.M. Guimier-Sorbets.

First–Second century AD: A case of double iconography: the expression of belief in a felicitous afterlife according to both (Greek and Egyptian) religious systems

In the Roman imperial period Alexandrian society did not make much distinction between Greeks and Egyptians, who widely intermarried. The same blending is attested in the expression of beliefs on the afterlife. It can be seen in the painted iconography of two tombs in the necropolis of Kôm el-Shugafa dating from the end of the first or the beginning of the second century AD.[28]

The paintings had faded and nearly vanished when Dr Jean Yves Empereur discovered them. It became possible to see more with ultraviolet light, and with special treatments made by André Pelle, photographer in the Centre d'Études Alexandrines, with high resolution digital images. The two tombs, with a sarcophagus and a niche carved in the rock, have a similar iconography, even if they were executed by two different painters. Ultraviolet-light photography does not allow certain restitution of the original colours, and for this reason they are represented here in black and white.

In each niche, the three walls are divided in two registers: the painting of the upper register is Egyptian, while the lower one is in Greek style. The central wall shows, in the two tombs, both the embalming of Osiris by Anubis, and the abduction of Persephone by Hades (Figures 6-7).

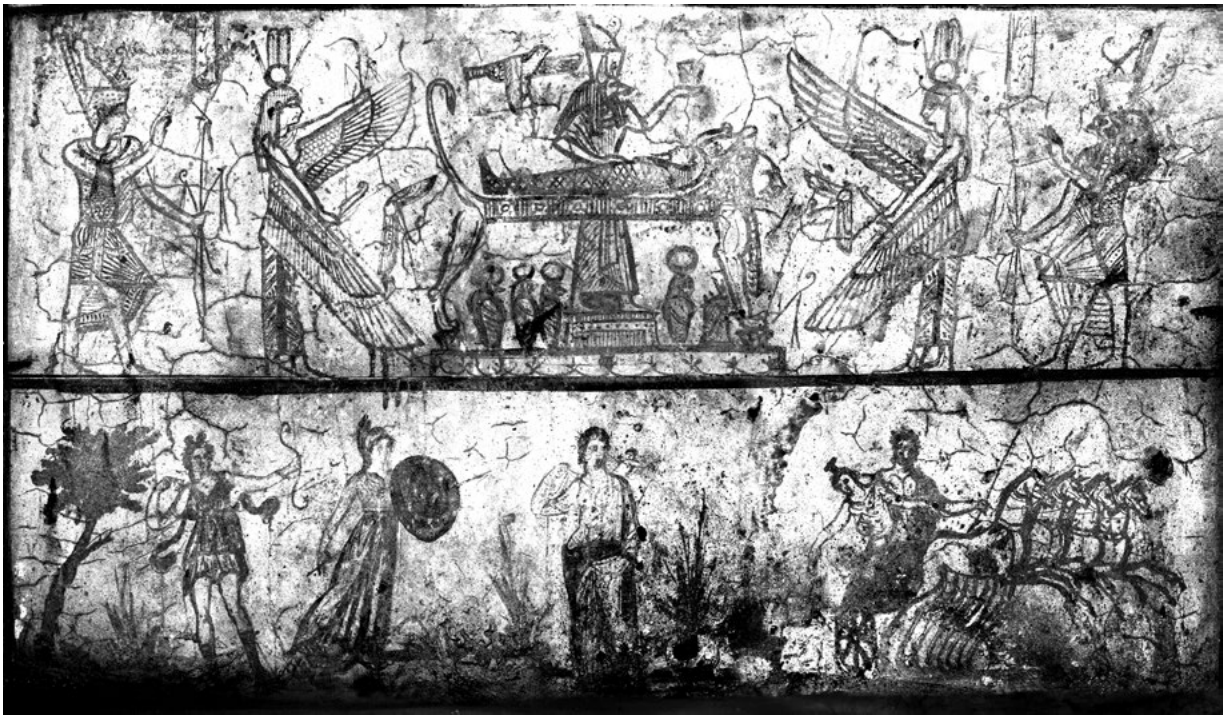

Figure 6. Alexandria, necropolis of *Kom al-Shuqafa,* Tomb 2, central wall, Greek and Egyptian registers, photo A. Pelle, CEAlex Archive.

[28] For the publication of this very rare paintings, studied in collaboration with Dr Mervat Seif el-Din: Guimier-Sorbets, Pelle and Seif el-Din 2015 (in French), and for an English translation: Guimier-Sorbets, Pelle and Seif el-Din 2017; and also, Guimier-Sorbets 2015.

Figure 7. Alexandria, necropolis of *Kom al-Shuqafa,* Tomb 2, central wall, Greek register, detail: abduction of Persephone, photo A. Pelle, CEAlex Archive.

In the Egyptian register, the central wall figures the traditional scene: the mummy of Osiris lying on a lion-bed, embalmed by Horus, under the protection of Isis and Nephthys. On the left wall, Thoth, with an ibis head, holds out an image of a falcon, Horus, to his mother Isis. Horus as pharaoh will follow his father as ruler of the earthly world. Osiris, who stands in the centre of the scene, will live on through his son and successor. On the right wall, mummified Osiris stands between two divinities seated on thrones. He is now, and for eternity, the ruler of the land of the dead.

What this register means is that after mummification, the deceased will survive, as Osiris with the dead, as Horus with the living.

In the lower register, the Greek one: on the left wall, Persephone is picking flowers with Athena, Artemis and Aphrodite as well as Eros. As in Ovid's text (*Metamorphoseis*), Aphrodite, goddess of love, is asking Eros not to let Persephone remain a virgin like Athena and Artemis. Eros is aiming an arrow against Hades. On the central wall: on the right part, the abduction of Persephone by Hades on his chariot with four horses; on the left, Artemis and Athena try to fight against the rape, but Aphrodite remains unperturbed by the event she has provoked. On the right wall: After her abduction, Persephone has become the wife of Hades and they sit enthroned as rulers of the underworld, the entrance of which is guarded by Cerberus. Hermes, the god of travel and dangerous journeys, has been watching over Persephone's passage into the underworld. He will do the same for the initiated dead, who will be gathered in close to Persephone (Figures 8-9).

The three Greek panels create a continuous narrative that expresses beliefs in a happy life in the world beyond through the myth of Persephone.

On the pillars, the head of Bes, the gorgoneion and a standard-bearer are protecting the dead. The dead are lying under the ceiling painted with an evocation of the garden of afterlife bliss (with flowers, garlands, multicoloured birds and a peacock in the centre).

Egypt under the Roman Empire was multicultural, and people fully recognised the powers of the gods, whether Greek or Egyptian. In the world of polytheism, these powers can be expressed simultaneously in several forms and through two religious systems, both recognised as 'effective'. Therefore, a strong belief in a joyous immortality was certainly expressed by the myths of both Persephone and Osiris in the same tombs in order to combine the cumulative effect of the two religious systems.

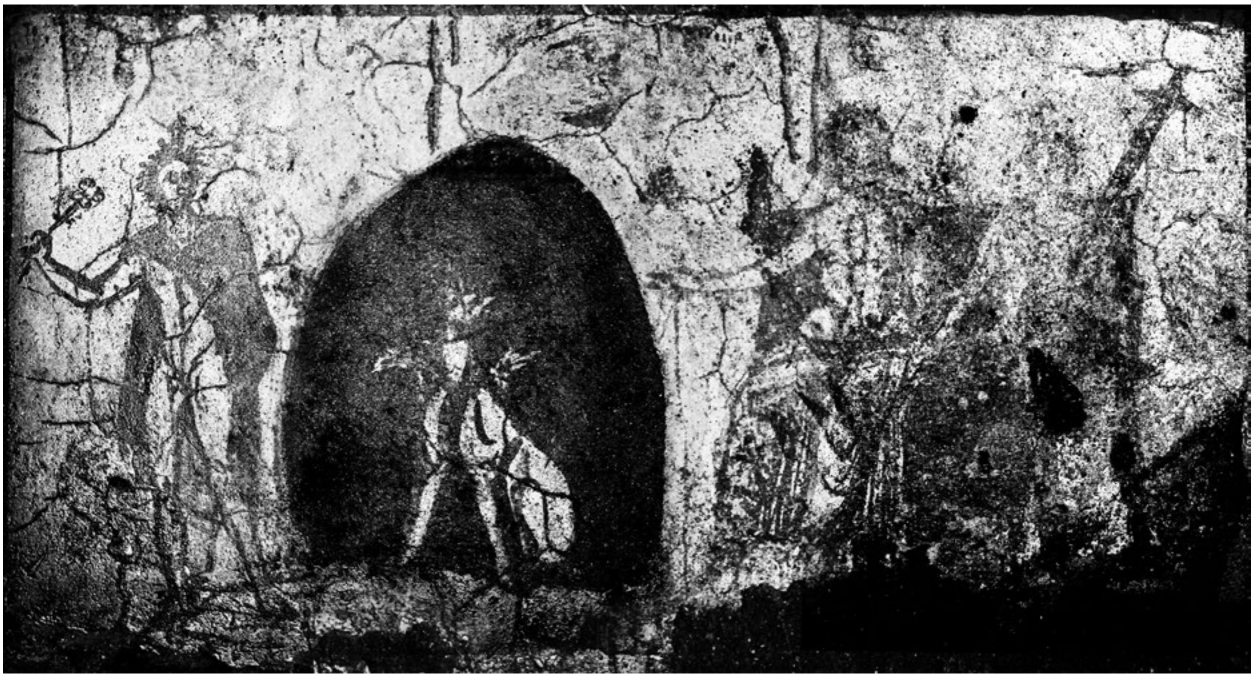

Figure 8. Alexandria, necropolis of *Kom al-Shuqafa*, Tomb 2, right wall, Greek register, Hermes, Cerberus, Hades and Persephone, photo A. Pelle, CEAlex Archive.

The hope of a felicitous afterlife was connected with Dionysiac-Orphic beliefs in Greece, particularly in Macedonia, but also in Sicily and Magna Grecia, as it has been established by the presence of Dionysiac-Orphic lamellae as well as of the Derveni papyrus in tombs.[29] Ceremonies of initiation certainly took place in Alexandria, whereas the progressive encounter of Greeks established in Egypt with beliefs in Osiris could only strengthen this hope, so deeply human, in a blissful afterlife.

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[29] Hatzopoulos 2006. I wish to thank Miltiades Hatzopoulos, scholar and lifelong friend, for the fruitful discussions that we shared and for his help with the English version of my paper.

Figure 9. Alexandria, necropolis of *Kom al-Shuqafa,* Tomb 2, detail: Persephone and Hades rulers of the underworld, Hades and Persephone, photo A. Pelle, CEAlex Archive.

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Graeco-Egyptian Elements in Alexandrian architectural mouldings

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In spite of the fact that none of Hellenistic Alexandria's monumental civil buildings has remained due to the various natural and human factors, some literary testimonies give us an idea of how fascinating the entire city appeared. Cemeteries of the ancient city have provided us with tangible material that indicates part of the architectural appearance of Alexandria. Comprehensive studies have dealt with the funerary art of Alexandria as indicative of the architectural characteristics of the city as well as the prevailing trends of its artistic production which proved to have passed through successive stages of development in respect of their stylistic features, execution techniques and religious connotations.

Throughout the last two centuries, excavations in Alexandria have yielded a considerable number of architectural remnants in different locations of the ancient districts of Alexandria. Three intriguing works carried out by Patrizio Penzabene (1993) and Barbara Tkaczow (1993 and 2008), took care to publish and classify a huge number of architectural elements. Their publications have opened the way for further future analytical studies to explore what can be known as the Alexandrian architectural styles. In 2015, Sara Mostafa delivered her MA thesis for the Alexandria Centre for Hellenistic Studies; the study is devoted to the architectural mouldings of Hellenistic Alexandria and also presents an analytical catalogue.

Our current paper introduces a re-investigation of those mouldings from two points of view; the first is the concept of an Alexandrian contribution to Hellenistic architecture which was and still is a subject of an endless series of discussions and disputations. The second view deals with the prominent appearance of Egyptian elements in the Alexandrian mouldings from the standpoint of their aesthetic effect and functional purposes.

In addition to a considerable number of fragments whose specific provenance we do not know other than having been discovered in Alexandria, the majority of fragments were found in places that do not give any details about their architectural context. A few pieces are well documented within buildings in the city centre that once had parts of their foundations preserved *in situ*.[1] We do not have any information about the ground plans of such buildings or the parts from which those pieces came from. Some areas of the finds indicate buildings of monumental nature which once had floor mosaics and tiled roofs and their fragments seem to have been fitted in a major architectural scheme of decoration.

However, very few pieces have come from the well-known cemeteries of the city. Although cemeteries were hewn in the rock, we have information of some superstructures that once completed the layout of Alexandrian hypogea but unfortunately they have all collapsed and disappeared. It is more probable that some of those fragments have come from those superstructures, or have been decorating doorways or niches inside.[2] Apart from the latter category, the only fact that we can deduce from the previously-mentioned group of fragments is that they represent the civil architecture of the city and not its funerary architectural atmosphere.

Limiting our research material on blocks which partially maintain their mouldings and can safely be dated to the Ptolemaic period, we realise that the finds came mainly from the *Basileion*, the royal quarter of the city, and the Kom El-Dikka archaeological park. The finds of the *Basileion* can be further categorised in three groups of buildings.

The first group came from one building known in modern literature as the Great Stoa dated to the reign of Ptolemy III (246-222 BC),[3] located, according to the El-Falaki map,[4] within the northernmost insula between R4–R3, L4-L3. It is a large limestone and marble building of two storeys which mixes Doric and Ionic orders in its colonnades.[5]

1 Such as the Great Stoa Building and the Chantier Finney complex, both in the palaces' area, see infra.

2 For those pieces see: Pensabene 1993: nos. 803, 811-813, 840, 868, 886, 888, 905, 912, 916, 922, 928-929, 931-933, 936, 939, 945, 948, 953, 972, 976, pls. 89, 91, 95, 92, 94, 96-100, 102-103.

3 Hoepfner 1971: 87 note. 170. Also known in literature as Chantier Politi, between Amin Pasha Fikri, Alexander the Great and Ali Ibrahim Ramez streets.

4 El-Falaki 1872: Map 1.

5 Adriani 1932-33: 67-69, nos. 29, 31, 33, 36-38, 73, figs. 16-18, 21; Botti 1902: 119-121 (considering the finds as remains of the great theatre); Borchardt 1905: 1-6, fig. 14; Breccia 1922-23: 6, pl. 2-5.I; Daszewski 1979: 104; Daszewski 1983: 60; Hoepfner 1971: 55-91, no. 6, pl. 13-23c; McKenzie 2007: 69, 83, figs. 91-94 with reconstruction of Doric and Ionic entablatures; Mostafa 2015: 294-295 with more details and dimensions; Pensabene 1993: 312-314, nos. 4-9, pls. 1-2, figs.

The second group is a complex of buildings which was discovered in the area known as Chantier Finney located, according to El-Falaki map, between R4-R3, L3-L2. The ruins, recovered between 1933-37, range in date between the end of the third and the second centuries BC.[6]

The third group represents submerged ruins of buildings that once stood at the shoreline of the north-eastern tip of Pharos Island. In this area around the citadel of *Qaitbay*, underwater excavations carried out by the team of the Centre d'Etudes Alexandrines formerly headed by Jean-Yves Empereur revealed a considerable number of huge architectural elements that had been parts of some huge public building/s, most probably the Pharos lighthouse of ancient Alexandria.[7] Albeit their huge number and gigantic sizes are clear, we still know very little about their mouldings as they are still lying underwater. A huge part of one architrave of red granite is distinguished by its three smooth fasciae, while the predominant architrave in Alexandria had two fasciae. [8] This difference can simply be interpreted within the hugeness of the architrave itself which gave chance for such an elaboration. [9]

The third group under investigation is outside the Basileion in the site of Kom El-Dikka within the domestic area found under the late Roman buildings where a number of Ptolemaic dwellings, abandoned by the end of the second century BC, have been revealed.[10]

Another area of investigation in respect of the types of mouldings of Ptolemaic Alexandria is the group of tombs that remained from both the eastern and western necropoleis. Although they mainly present the funerary architecture of Alexandria, they are considered as representative of the prevailing styles of the city's monumental buildings in general. The tombstones and the slabs used for closing the burial loculi were generally decorated in relief and/or coloured paintings with scenes and symbols of different types. These scenes were usually incorporated within architectural frames that illustrate the familiar styles of religious and funerary buildings known in Ptolemaic Alexandria.

General forms and Alexandrian particularities

Pioneer Greek architects were commissioned by the kings to construct the required edifices of the new city of Alexandria. The material available proves that those architects worked according to the norms of classical canons, to produce buildings in the mainstream of Hellenistic architecture. At the same time, they practised freedom to change the proportions and arrangements of their orders according to local requirements. The fragments, together with tombs and tombstones, make it possible to define specific cornice types as distinctively Alexandrian.

The Doric order in Alexandria

The Stoa Building provides examples of a finely executed Doric frieze which retains its triglyphs and metopes in the usual canon of classical Doric (Figure 1), [11] a cornice with cyma recta (Figure 2) and parts of an unfinished Doric cornice.[12] The Ionic architrave of this building has two fasciae (Figure 3) while its cornice has cyma recta, cavetto and rectangular dentils with wide viae. [13] Similar examples came from the domicile sector of Kom El-Dikka dated to the second and first centuries BC where we find simple Doric and Ionic cornices.[14]

It is apparent that in Alexandria, the use of stucco coating for limestone cornices or architraves resulted in mouldings of large dimensions that are noticeable in the simple articulation of the profiles (Figure 4),[15] especially in cavettos which are usually separated from the ovolos by one narrow plain strip.[16] The soffit of the corona is formed by a projection of the stalk in its lower edge.[17] The lower cornice begins with a cavetto, followed by an ovolo[18] or fascia.[19] Some examples retain

212-215, 316-317, nos. 19-21, pls. 3-4, figs. 219-220; foundations rediscovered: Rodziewicz and Abdel-Fattah 1991: 131-150; Tkaczow 1993: 145-148, sites 105-107b, 215-216, object 73, 218-220, objects 79-88.

6 Adriani 1935-39: 24-32, figs. 14-21, pl. 15-19; McKenzie 1990: 70-75, nos. 14-15, 72, nos. 7-13, pl. 201 a-c, 203 e-f, 204a, 205a-b, 208a, 209a, 209 d-e, 210b,d, 211a-d, 213a-d; McKenzie 2007: figs 112; 113 a-b; Pensabene 1993: 215, 496, nos. 826; 508-509 nos. 914-915, pl. 96, fig. 80; 513-514, nos. 942-943, fig. 8; 519, nos. 965-966, pl. 101, figs. 77, 82; 520 no. 968. Current location between Alexander the Great St. and Salah Mostafa St. (formerly El Sultan Hussein St.) to the east of Champollion St.

7 Notably the majority of those blocks are of Aswan's red granite. Other Egyptian hard stones like bazalt and porphyry are found in different locations in Alexandria indicating their use in important buildings of the city: Gans 1994: 448-453.

8 Gans 1994: 448.

9 Architraves with three fasciae occurred in tombstones such as in a sculpted stela (GRM inv. 19044) dated to the third-second century: Breccia 1910: 92-93; Nenna, 2010: 348; Schmidt, 2003: 99.

10 Rodziewicz 1976: 174-175.

11 Pensabene 1993: 313-14, no. 9, pl. 2, figs. 9a-b.

12 Adriani 1932-33: fig. 1.5; Pensabene, 1993: 312-3, nos. 4-9, pls. 1-2, figs. 4-9; 212-213. Currently in the garden of Kom El-Shogafa site.

13 Adriani 1932-3: fig. 4.21; Pensabene 1993: 313-14, cat. no. 9, pl. 2, figs. 9a-b. Currently in the garden of Kom El-Dikka site.

14 Examples from the domicile sector of Kom El-Dikka for Doric order: Tkaczow 2008: 232, nos. 642-643, 236, pl. 67, no. 660, pl. 71, 237, nos. 668-669, pl. 78, and for Ionic: Tkaczow 2008: 2010: 230, no. 631, pl. 65, 232, nos. 643-644, pls. 67, 233, no. 646, pl. 68, 236, no. 660, pl. 71, 237, nos. 668-669, pl. 73, 238, nos. 673, pls. 75-76.

15 From Kom El-Dikka see: Tkaczow 2008: 232, no. 644, pl. 67, 235, no. 657, pl. 71, 236, no. 660, pl. 71. From Hadra see: Pensabene 1993: 494, no. 803, pl. 89. From unknown location, also: Pensabene 1993: 494, no. 810, pl. 89.

16 Mostafa 2015: 116-117, nos. 8-9; Tkaczow 2008: 237, nos. 668, 669, pl. 73.

17 Mostafa 2015: 118-119, nos. 10-11; Pensabene 1993: 494, nos. 804, 806, pl. 89.

18 Mostafa 2015: 120, no. 12; Pensabene 1993: 493, no. 801, pl. 89.

19 Mostafa 2015: 121, no. 13; Pensabene 1993: 494, no. 803, pl. 89.

Figure 1. Doric cornice from the Stoa Building.

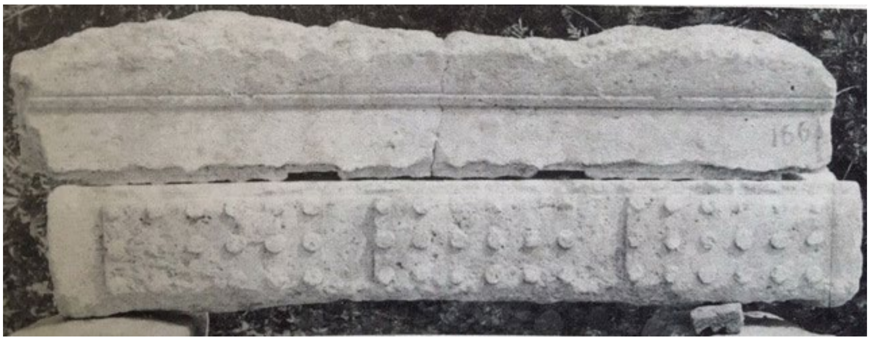

Figure 2. Doric cornice from the Stoa Building, after Adriani 1932-3. pl. 1.5.

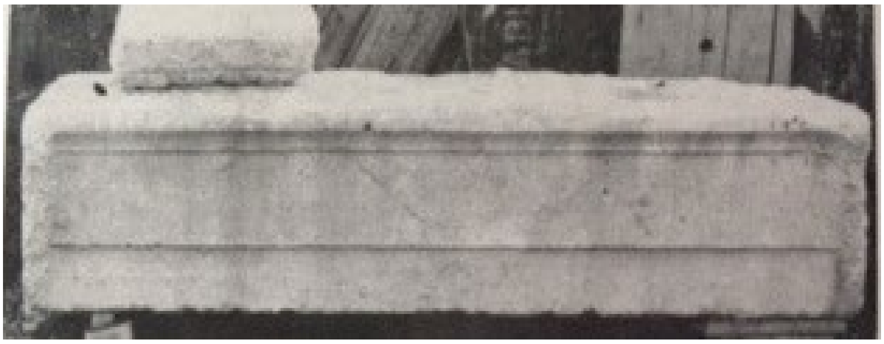

Figure 3. Ionic cornice from the Stoa Building, after Adriani 1932-3. pl. 4.21.

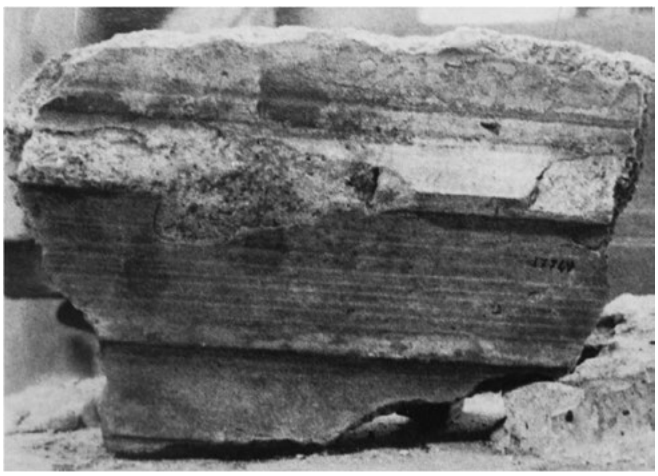

Figure 4. Fragment of a huge Ionic cornice with simple profile articulation, after Pensabene 1993. pl. 89, fig. 803.

Figure 5. Fragment of a cornice from Kom El-Dikka with its stucco coating maintained, after Tkaczow 2008. pl. A, no. 675.

Figure 6. The Doric doorframe of the Alabaster tomb.

Figure 7. The Doric order in the open court of Shatby necropolis, after Breccia 1912. pl. 11.6.

parts of their painted decoration motives (Figure 5).[20] A few others have their decoration in relief.[21]

The early tombs of the eastern cemetery are mainly Doric, the earliest of which is the alabaster tomb, Shatby and Mostafa Pasha tombs 1 and III which are dated to the first half of the third century BC if not earlier.[22] In the alabaster tomb, Doric appears in the mouldings of the doorway frame (Figure 6) which shows some Macedonian influence.[23] In Shatby, the Doric appears in the open court (Figure 7).[24] In the court of Mostafa Pasha tomb I (Figure 8), the columns are high with a relatively small diameter which caused the intercolumniation to be wide. The north and south friezes contain three triglyphs in each intercolumniation with wide viae occupied by square metopes (Figure 9), while in the east and west friezes there are two triglyphs in each intercolumniation with narrow viae and rectangular metopes (Figure 10). This difference in arrangement seems to be necessitated to allow passage through the rooms that lie behind the east and west sides of the court. It seems that in the Alexandrian architecture, there was no contradiction between utility and functionality of the building and the beauty of its external appearance.[25]

The general layout of Doric friezes in Alexandria and other Hellenistic centres was two triglyphs in each intercolumniation, of which the contemporary Mostafa Pasha great peristyle tomb provides the example (Figure 11).[26] In the same tomb I in Mostafa Pasha, instead of the pediment there is an attic wall with piers in low relief set over the axis of each lower column

[20] Mostafa 2015: 127, no. 19; Tkaczow 2008: 238, no. 675, pl. A.

[21] Mostafa 2015: 128, no. 20; Tkaczow 2008: 239, no. 682, pl. 77.

[22] For the dating of these tombs and the other Alexandrian hypogea, see: Guimier-Sorbets and Seif El-Din 1997: 335-410; Guimier-Sorbets 2010: 153-175; Venit 2002: 46-51.

[23] Adriani 2000: 65-67. For more on Macedonian traits: Miller 1982: 153-171.

[24] Breccia 1912: pl. 11.6; Chugg 2007: 197, who also notices Macedonian influence.

[25] '*All buildings must be executed in such a way as to take account of durability, utility and grace*.' Vitruvius, 1.2.2.

[26] This is the largest of Mostafa Pasha tomb complex, found in 1983-84 in rescue excavations carried out by Ahmed Abd El-Fattah, then in 1994 by Mieczyslaw D. Rodziewicz and excavated in 2003 by Nicola Bonacasa, see: Bonacasa and Minà 2015: 145-164.

Figure 8. The columns of the court of Mostafa Pasha tomb 1.

Figure 9. Three triglyphs in each intercolumniation in the north frieze of the court of Mostafa Pasha tomb 1.

Figure 10. Two triglyphs in each intercolumniation in the east frieze of the court of Mostafa Pasha tomb 1.

Figure 11. The Doric frieze in the court of the Great Peristyle Tomb in the necropolis of Mostafa pasha with two triglyphs in each intercolumniation, after Bonacasa and Minà 2015: fig. 1.

(Figure 12). This attic wall serves as a curtain wall for the staircase.[27] Using such a unique mixture of an attic wall, which is an Egyptian characteristic, above a Greek Doric entablature is distinctive to Alexandria.

Another Alexandrian particularity in the same entablature can be detected in the turning of the lower side of the architrave upward towards the court making effective perspective to give a sense of depth.[28] In the same sense, the piers turn outward to emphasise the depth (Figure 13). This illusionistic inclination in the Doric entablature appeared earlier in the slab of Helixo from Hadra/Ezbet Makhlouf cemetery which also provides the earliest example for a coffered ceiling in Alexandria.[29]

The finds of the Chantier Finney, being later in date than the Stoa building, slightly earlier than Kom El-Dikka domiciles, show variations of both Doric and Ionic. One fragment has the cyma recta separated from the cornice with an oblique strip.[30] The soffit has rectangular modillions with central groove then a cyma reversa. It has rectangular dentils separated by an ovolo, a strip, fascia and taenia. Under the triglyph there is the traditional regula with guttae. Another fragment (Figure 14)[31] has simple modillions with rectangular narrow spaced dentils together with the Doric cyma reversa with a cavetto under the cornice and astragal, it was probably part of an entablature of an aedicula.

A third level of mixing the two main orders is attested in other fragments from the same group where Ionic cornices combine the cyma reversa with cyma recta in addition to the Lesbian cyma.[32] This combination appears in three pieces of plaster from the same Chantier Finney group where the Doric cyma appears with the guilloche pattern and with triglyphs-metopes cornice.[33]

Within the Ionic traditional form, the profile of the thin cyma recta was predominant in Alexandria as in the entire Hellenistic east.[34] It was used in official structures from the third century BC, as in the fragments recovered from the Chantier Finney (Figure 15) where the cyma recta is carved in the stone while

27 The attic wall is repeated in Plinthine and Marina El-Alamein which are influenced by Alexandrian traits. Venit 2002: 51-53.

28 Venit 2002: 54.

29 Adriani 1938-39: 112-116, 125, pl. 14; Brown 1957: 51; Pagenstecher 1919: 42, no. 16, 74-78; McKenzie 2007: 110, fig. 181; Venit 2002: 112.

30 Adriani 1935-39: 49, no. 11, pl. 18.3; Hesberg 1980: 69b, n. 293; Pensabene 1993: 519, no. 965, pl. 101, fig. 77.

31 Adriani 1935-39: 50, no. 11, pl. 18.3,4 and fig. 17.1; Hesberg 1980: 69b, n. 293; Pensabene 1993: 519, nos. 965-966, pl. 101, figs. 77, 82.

32 Adriani 1935-1939: 51, no. 18, pl. 18.2; Pensabene 1993: 513-514, no. 942.

33 Adriani 1935-1939: 53, 51-53, nos. 4, 6-7, pls. 18.5, 19.1-19.4, no. 17, fig. 19; Pensabene 1993: 514, no. 943, fig. 80.

34 The cyma recta was also used in the fourth century BC Doric before the founding of Alexandria as in the temple of Athena and the stoa of Lindos. Pensabene 1993: 98.

Figure 12. The attic wall in place of the pediment in tomb 1 in the necropolis of Mostafa Pasha.

Figure 13. Illusionistic inclination in the Doric piers of tomb 1 in the necropolis of Mostafa Pasha.

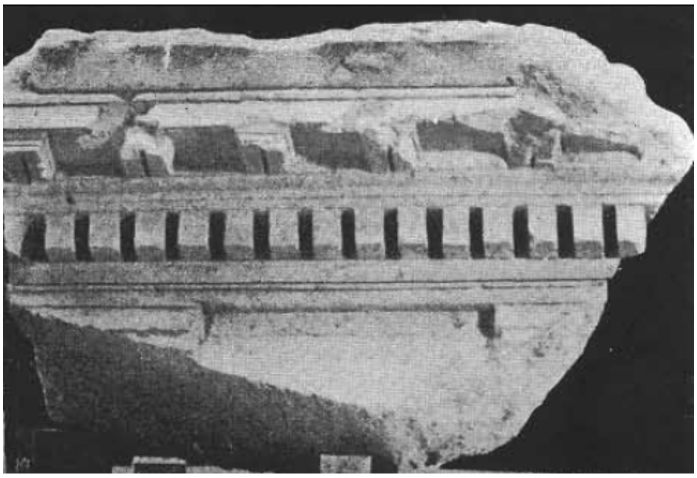

Figure 14. Fragment of an entablature from Chantier Finney with mixture of Doric and Ionic mouldings, after Adriani 1935-39: pl. 18.4.

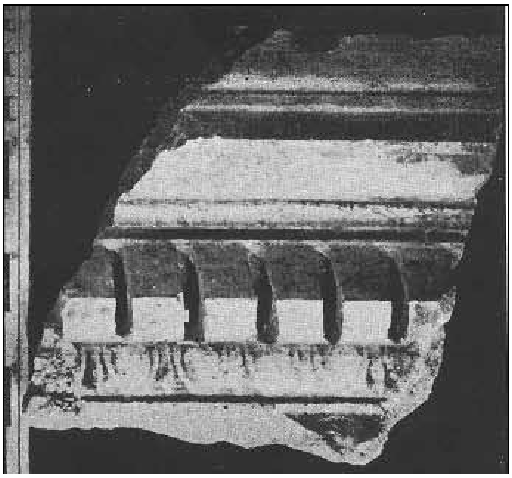

Figure 15. Fragment of an entablature from Chantier Finney with cyma recta carved in the stone and Ionic and Lesbian cymation painted over the stucco coating, after Adriani 1935-39: pl. 18.5.

Lesbian cyma is painted between the soffit and an Ionic cyma with astragal over an ovolo.[35]

Dentils of Alexandria

Examples of Ionic cornices that maintain parts of their dental friezes are numerous enough to provide an idea about the Alexandrian types of dentils. According to Vitruvius (*De Architectura* III, 11.), the height of dentils should correspond to the depth, the width should equal half of the height, while the distance between dentils should equal half or two-thirds of the width. Such an ideal form of rectangular dentils was used in the earliest Alexandrian tombs as in hypogeum 3 in Mostafa Pasha (Figure 16). In spite of its appearance in funerary architecture, we do not have any example of individual pieces that conform exactly to this canonical form. The majority of examples have different ratios. Rectangular dentils were either very close to each other,[36] or had more space in between.[37] In most of the cases the lower mouldings are a strip, or a cavetto or ovolo and a thin fascia.[38] One distinctive example represents the only cornice that has the ovolo placed above the dentils with the same lower mouldings.[39] Some examples maintain part of their friezes; one of them shows a strip and cavetto above the dentils, and an ovolo and strip below the dentils.[40] An additional cyma reversa appears in the frieze of one fragment.[41] Some examples have ovolo above and below the dentils.[42]

The most distinctive type of Alexandrian dentil is square and well-spaced. This type appears more frequently in funerary architecture such as in the necropolis of Anfoushy tomb II (Figure 17) and tomb V, room 4,[43] where the dentils are almost spaced as the width.[44] A fragment from Mostafa Pasha necropolis[45] and part of an angle corner of a cornice[46] are both dated to the late first century BC and all have square

Figure 16. Door of funerary room in hypogeum 3 in the necropolis of Mostafa Pasha showing the Vitruvian ideal form of dentils (H.3.5, D. 2, W. 2.3 cm).

dentils with the width of the spacing the same as their width. From Kom El-Dikka, a left-hand fragment of a segmental pediment with Egyptianizing decoration has also the same, square, equally-spaced dentils.[47]

The repertoire of tombstones and slabs from Alexandria provide earlier examples for the use of square dentils which have spaces the same as their width in a number of examples, the earliest of which is an early third-century stela decorated in low relief with a false door from Shatby cemetery (Figure 18).[48] A false door painted on another third-century loculus-closing slab in the burial chamber of the same Shatby tomb A is decorated with square dentils with spaces slightly narrower than their width. [49]

From the second century BC, a loculus slab from Mex (Figure 19), unfortunately destroyed after its discovery, had two friezes, *Doric* and *Ionic* whose dentils are square with viae that have the same width as the dentils.[50] Notably, the square dentils in the latter example are part of composition that reflects the Greek Alexandrian style of decoration where a long garland adorns the façade and below it, a short opened door is painted in perspective with a cymation in its lower part. Through the door, a person standing in perspective can be seen. Another second century stela from Gabbari cemetery (Figure 20)[51] provides the other face of the Alexandrian

[35] GRM inv. 25674. Adriani 1935-39: 53, no. 4, pl. 18.5; Pensabene 1993: 496-497, no. 826.

[36] Examples of rectangular dentils very close to each other are: Mostafa 2015: 130-131, nos. 22-23; Pensabene 1993: 495, nos. 816, 817, pl. 89; Tkaczow 2008: 230-231, no. 635, pl. 65.

[37] Examples of rectangular dentils with more space in between: Mostafa 2015: 135-136, 138-141, nos. 27-28, 30-33; Pensabene 1993: 496-497, nos. 820A, 821, 823, 824, 825, 831, pl. 90.

[38] Examples of the lower mouldings of dental cornices: Mostafa 2015: 133-136, 139-141, nos. 25-28, 31-33; Pensabene 1993: 496-497, nos. 819, 820, 820A, 821, 824, 825, 831, pl. 90; Tkaczow 2008: 230-231, no. 635, pl. 65;

[39] Mostafa 2015: 142, no. 34; Pensabene 1993: 497, no. 832, pl. 90.

[40] Mostafa 2015: 143-150, nos. 35-41; Pensabene 1993: 497-498, nos. 833-839, pl. 90-91.

[41] Mostafa 2015: 146, no. 38; Pensabene 1993: 498, no. 836, pl. 91.

[42] Tkaczow, 2008: 239, no. 979, pl. 76.

[43] Adriani 1952: 92-94.

[44] This trend again seems to have been continued into the Roman period as shown in Kom El-Shogafa cemetery.

[45] Adriani 1936: 161, no. 5, fig. 89.3; Mostafa 2015: 154, no. 45; Pensabene 1993: 498-499, no. 840, pl. 91.

[46] Adriani 1966: 192, no. 142, pl. 109, fig. 376; Mostafa 2015: 179, no. 70; Pensabene 1993: 505, 893, pl. 95.

[47] Tkaczow 2008: 239, 678, pl. 76.

[48] Breccia 1912: 22, no. 32, fig. 21; Schmidt 2003: 113-114, no. 73, pl. 23.

[49] Adriani 1938-39: 123-124, pl. 15; Adriani 1972: 183; Pagenstecher 1919: 86.

[50] Adriani 1956: 43-44, fig. 47.

[51] Empereur *et al.* 1998: 253, no. 195; Nenna 2010: 352; Pagenstecher 1919: 123; Schmidt, 1999: 16-18; Schmidt, 2003: 113, no. 71, pl. 23; Venit, 2002: 153,154.

Figure 17. Façade of main chamber of Anfoushi tomb II showing the Alexandrian type of dentils.

Figure 18. A limestone tomb stela from Shatby cemetery showing a quasi-opening door over which the frieze has the typical Alexandrian square dentils, after Schmidt 2003: pl. 23.

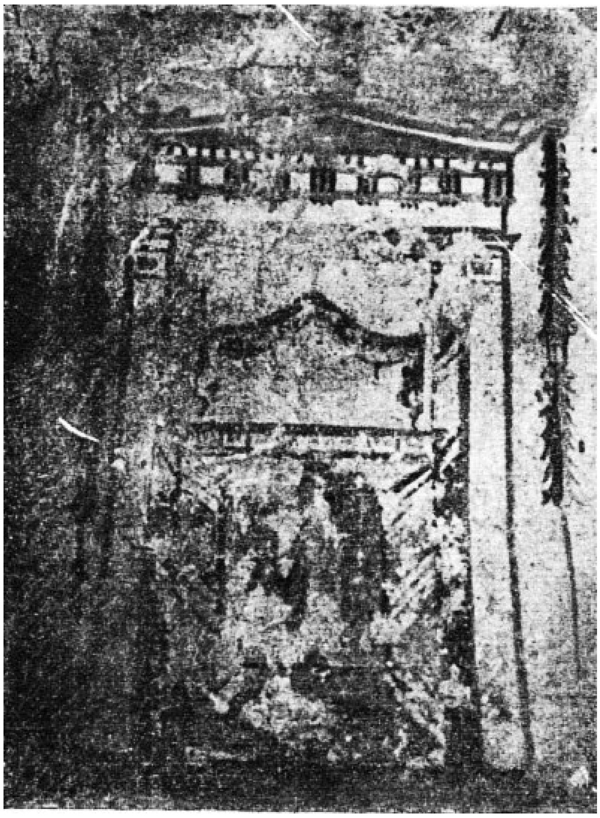

Figure 19. A limestone loculus slab from Mex with the Alexandrian square dentils within a Hellenistic decorative motives, after Adriani 1956: fig. 47.

decorative programme where the Greek deceased, clad in hymation, is depicted standing at a doubled entrance of an Egyptian temple. The outer façade is flanked by two composite columns, the right one has disappeared, supporting the architrave which is adorned by a huge winged scarabeus, then the Egyptian *Uraeus* frieze. The inner façade has its architrave decorated by the sun disk while the frieze has the typical Alexandrian square dentils. In spite of the fact that this stela which hosts the Greek dead boy is entirely Egyptian, the architect persists on inserting the square dentils into the Egyptian decorative program, probably denoting the deceased as a believer in the Egyptian funerary cult but when entering the Egyptian realm of death, he insists on his Alexandrian identity. The square dentils again appear in Gabbari in a loculus slab also from the

Figure 20. A stela from Gabbari with the Alexandrian square dentils within an Egyptian decorative motives, after Empereur 1998: 253, no. 195.

first century BC as the previous example.[52] It has the Egyptian temple façade, the side columns are papyriform and the architrave has two fasciae. The inner façade is characterised by the Alexandrian square dentils frieze.

These examples prove that throughout the Hellenistic period, the mouldings of the square dentils are one of the most important characteristics of Alexandrian architecture that have been found mixed with Alexandrian elements or/and Egyptian ones. It is also obvious that at the end of the Ptolemaic period, the square dentils replaced the elongated narrow ones not only in the mouldings of funerary architecture but also in civil buildings.

Mixing Doric, Ionic and Corinthian

In Hellenistic architecture, the mix between Doric and Ionic orders prevailed in almost all Hellenistic centres,[53] but in Alexandria even Corinthian elements were added to such a mixture. Hypogeum A in Shatby has the Doric order in the external façade while the interior mixes Ionic and Corinthian.[54] Hypogeum B of the same cemetery has a Doric entablature supported by Corinthian capitals,[55] a feature that did not occur in Greece. Notably the pediment has the Egyptian sun disc in the middle of the tympanum and apparently another curved pediment was above it. In tomb II of the Mostafa Pasha cemetery, the entrance of the small Kline chamber (room 4) is framed by two piers covered with stucco and painted in alabaster pattern and crowned with painted Corinthian columns. A loculus slab from Gabbari Tomb B1 also has Corinthian capitals for its architectural painted frame.[56] A second century BC terracotta lamp, found in Canopus, represents a façade of a gymnasion that has Corinthian capitals supporting an Ionic entablature.[57]

Examples of such a harmonious combination appear in fragments which derive from one of the earliest buildings in the city, the Stoa building, which as previously mentioned combines Doric and Ionic orders (see figures 1-3). Some of these fragments are parts of more than one Doric cornice that maintain some of their mutule and have cyma recta.[58] Two of them are unfinished.[59] Four pieces represent part of one Doric frieze with painted metopes [60] while two fragments are parts of painted Ionic architrave/s with two fasciae.[61] Interesting enough is one fragment of an Ionic cornice which has a large protruding band at its top margin followed by a strip and a cyma recta, rectangular fairly-spaced dentils are located between a cyma reversa and a large strip.[62] This particular fragment indicates that the official public building to which all the group of finds belonged had a Greek Hellenistic style free from any local influences. [63]

Modillions

Modillions are a decorative design of repeated projections in the lower sides or soffits of cornices. They present a major characteristic of Hellenistic mouldings that has its origin in Alexandria as they were exclusively found in the city and in places influenced

[52] Also disappeared. Habachi 1937: 284, fig. 12; Savvopoulos 2010: 60.

[53] Tomlinson 1963: 143-145.
[54] Breccia 1912: pl. 11, fig. 6.
[55] Breccia 1912: pl. 19, fig. 21.
[56] Guimier-Sorbet *et al.*, 2001: 202, 206-207, figs. 4.18, 4.29, 4.32-4.33.
[57] Breccia 1930: II, I, 73, no. 469, pl. 43.3; Empereur, J.-Y. *et al.* 1998: 113, no. 195.
[58] Pensabene 1993: 312, no. 4, pl. 1. 4. Now in Kom El-Shogafa; 312, no. 5, pl. 1.5; 313, no. 6, pl. 1.6.
[59] Pensabene 1993: 313, no. 7 (unfinished), pl. 1.7, fig. 212; 313, no. 8 (unfinished), pl. 1.8, fig. 212.
[60] Pensabene 1993: 313-314, no. 9, pl. 2, fig. 215, Kom El-Dikka.
[61] Pensabene 1993: 317, Nos. 20-21, pl. 4, 20, 21, Kom El-Dikka; Fragaki and Guimier-Sorbet 2013: 143-145, fig. 2, 6, 7.
[62] Pensabene 1993: 316-317, no. 19, pl. 3, fig. 219, Kom El-Dikka.
[63] Daszewski 1983: 67; Fragaki and Guimier-Sorbet 2013: 127-131.

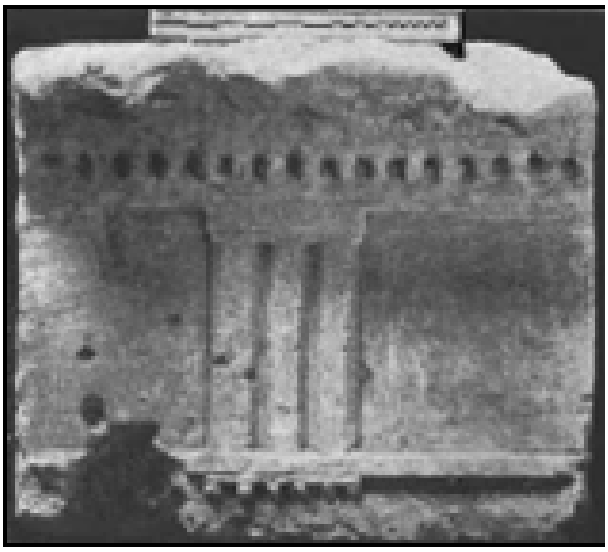

Figure 21. A fragment of a Doric cornice, probably of an aedicula, from the Chantier Finney, with modillions and dentils, after Adriani 1936: pl. 18.3, fig. 17.1

by its architecture.[64] Modillions are of two main types. Type 1 is characterised by a flat groove in the middle of the rectangular narrow unit. The lower surface is flat with splaying sides. The cyma recta is usually separated from the cornice by a strip.[65] Type 2 modillions are square and hollow without the central groove.

Although fragments of cornices decorated with modillions from Alexandria are relatively numerous, there are no indications about which of the two types preceded the other. Some fragments show one of the two types, others have the two types used alternately.[66]

The earliest evidence for the use of modillions in Alexandria[67] was found within a funerary context in a fragment found in tomb 3 at Mostafa Pasha which is dated to the second half of the third century BC.[68] The Chantier Finney building dated to the second century BC comprised four examples, one of them has the simple flat grooved type (see Figure 14),[69] the other is a fragment of a cornice of a broken forward entablature with square hollow modillions,[70] the third has the two types alternated,[71] the fourth (Figure 21)[72] is a fragment of a cornice probably of an aedicula that has a combination of simple grooved modillions, dentils and a Doric frieze. It has the cyma recta separated from the cornice with an oblique strip, the cyma reversa and rectangular dentils are separated by an ovolo, a Doric smooth fascia, taenia and regula with guttae. This entablature seems to have been supported by Corinthian capitals. Other fragments range in date from the late second to the early first century BC.[73] Some later pieces, almost from Kom El-Dikka, are dated from the first century BC to early first century AD.[74]

Variations in the two types

The two types witnessed various modifications and developments. In some cornices, modillions are accompanied and/or alternated with diamonds, sometimes grooved at the centre.[75] A combination of alternated simple and square hollow modillions with diamonds and dentils appear in other examples like in Tabiet Saleh (Trier tomb 3) from Gabbari.[76]

The spacing between modillions is sometimes elongated to accommodate another decorative moulding such as lozenges,[77] which appear in some fragments in place of modillions.[78]

Variations are also evident in respect of the mouldings below and above the modillions, but in the majority of examples the upper mouldings of the cornice consist of the usual Greek elements, the cyma recta separated from a smooth thin corona by a strip,[79] while the lower mouldings consisted of a flat ovolo and a strip which also bounds the frieze, or only a strip bounding the cornice and a fascia.[80] Some modillions were framed

[64] McKenzie 2007: 89.

[65] McKenzie 2007: 103.

[66] McKenzie 2007: 139-140.

[67] One of the earliest known examples of modillions was found out of Alexandria in the cornices of the sanctuary of Hermopolis Magna built in honour of Ptolemy III and Berenike II in front of the entrance to the enclosure of the temple of Thot which dates back to the third quarter of the third century BC. McKenzie 2007: 34, 158-160; Pensabene 1993: 100-107.

[68] McKenzie 1990: 64-5, 74, no. 14, 79, pl. 213e.

[69] Adriani 1936: 50, no. 16, pl. 18.4, fig. 18; Hesberg 1980: 70, n. 302; Pensabene 1993: 519, no. 966, fig. 82.

[70] Adriani 1936: 50, no. 14, pl. 15.4, fig. 17.4; Hesberg 1980: 70. d; Pensabene 1993: 508-509, 914, pl. 96, fig. 80.

[71] Adriani 1936: 50, no. 15, pl. 15.5, fig. 17.5; Hesberg 1980: 70. d; Pensabene 1993: 509, 915, pl. 96, fig. 80.

[72] Adriani, 1936: 50, no. 11, pl. 18.3, fig. 17.1; Hesberg 1980: 69b. B, note 293; Pensabene 1993: 519, cat. 965, pl. 101, fig. 77.

[73] McKenzie 2007: 80-89, 93-94, figs. 112-113a,b, 139-140, 150a,b-152; Mostafa 2015: 163-168, 171, 203-204, nos. 54-59, 62, 94-95; Pensabene 1993: 499-502, nos. 848, 853, 857, 859-860, 863-865, 871-872, pls. 92-93; Tkaczow 2008: 225-226, 228, nos. 604, 608, 623, pls.63-64.

[74] Mostafa 2015: 202, 205-206, nos. 93, 96-97; Pensabene 1993: 501-502, nos. 870, 873-874, 899, pls. 92-93; Tkaczow 2008: 233-239. Nos. 650-652, 658, 617, 647, 661, 663-666, 670-672, 674, 680.

[75] Mostafa 2015: 189-194, nos. 80-85; Pensabene 1993: 511-512, nos. 928-937, 974, 976 pls. 97-98.

[76] McKenzie 2007: 88-89, pl. 139; Mostafa 2015: 193, no. 84; Pensabene 1993: 512, no. 936, pl. 98.

[77] Mostafa 2015: 197, no, 88; Pensabene 1993: 522, no. 977, pl. 103.

[78] Mostafa 2015: 188-189, nos. 79-80; Pensabene 1993: 510-511, nos. 925, 930, pls. 97-98; Tkaczow 2008: 225, 227, nos. 604, 617, pls. 63-64.

[79] Mostafa 2015: 163-194, 197-198, 200, 206, nos. 54-85, 88-89, 91, 97; Pensabene 1993: 499-523, nos. 848, 853, 857,859- 860, 863-865, 868-874, 878, 885, 888-889, 893-896, 904, 912-913, 916, 924-925, 930-931, 934-937, 973, 976-978, 960, 962, pls. 92-98, 101, 103; From Kom El-Dikka: Tkaczow 2008: 225-228, 230, 232-233, nos. 604, 608, 617, 623, 634a, 640-642, 645, pls. 63-67.

[80] Mostafa 2015: 203-204, 206, nos. 94-95, 97; Pensabene 1993: 501-502, nos. 871-872, 874, pl. 93.

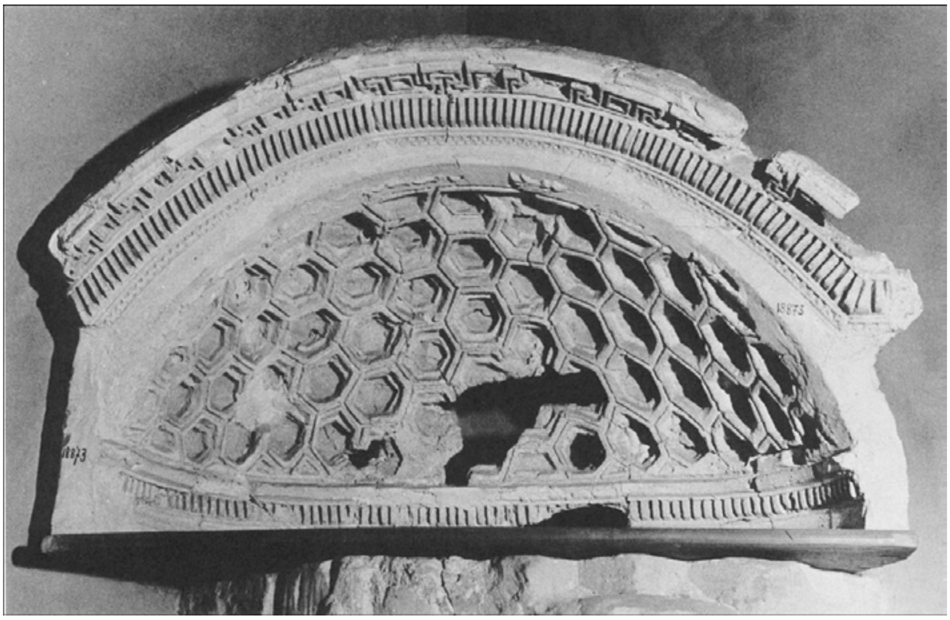

Figure 22. Semi-dome from Wardian cemetery decorated with hexagonal coffers, the soffit of cornice is decorated with double meander and dentils, after El-Fakhrani 1965: pl. 16.5.

by the outline of cyma reversa[81] or by a strip.[82] Other examples show a stick replacing the central groove.[83]

It is obvious that modillions were used mainly to replace the mutuli of the Doric entablatures.[84] Sometimes they appear with Ionic dentils over the frieze as on the Chantier Finney example (in figure 21), in which the entablature seems to have been supported by Corinthian capitals.[85] The use of Corinthian capitals to support a Doric frieze sometimes with dentils and a modillion cornice became characteristic of the Alexandrian form of the Corinthian order.

There was no standard technique for the arrangement of modillions above the metopes and triglyphs: in tomb B 26 in the Gabbari necropolis, the lintel of the entrance to the second burial chamber consists of eight triglyphs and seven metopes, two modillions above each metope and one modillion above each triglyph,[86] while examples of the same mixed style, one of unknown origin[87] and another from Hadra,[88] have the reverse arrangement, two modillions above each triglyph and one above each metope.

Modillions were used widely to decorate semi-domes which were common features in both funerary and secular Alexandrian architecture. Their characteristics can be detected in the rock-cut tombs of the city as well as in fragments of civil buildings. The Wardian cemetery from the late second or early first century BC yielded two fragmentary semi-domes that combine distinctive Alexandrian trends. One of them, almost complete (Figure 22)[89] combines the double meander in the soffit of its cornice with very narrow rectangular dentils, while the body of the semi-dome is decorated with hexagonal coffers. The other, made of stucco, has a thin cornice supported by very small modillions followed by a beam of a huge rectangular modillion with rectangular lacunar.[90] A fragment from the nearby cemetery of Gabbari, has the same combination of meander and hexagonal coffers.[91] Long and narrow dentils with square hollow modillions appear in fragments recovered from the Chantier Finney.[92] The example of a semi-dome from an unspecified location in the city centre provides a glimpse on how far these decorative elements were varied.[93] It has deep square coffers with a central diamond one. This alternated pattern recalls the façade of Tabiet Saleh tomb 1 from Gabbari which has the beamed modillions alternated with quadrangular frames or square modillions.[94] It

81 Mostafa 2015: 163-172, nos. 54-63; Pensabene 1993: 490-501, nos. 848, 853, 857, 859-860a, 863-865, 868, pl. 92; Tkaczow 2008: 232-233, 236-238, nos. 645, 650, 663-665, 672, 674, pls. 67, 69, 72-75.

82 Mostafa 2015: 173, 203, 205, nos. 64, 94, 96; Pensabene 1993: 501-502, nos. 869, 871, 873, pls. 92-93.

83 Mostafa 2015: 205, no. 96; Pensabene 1993: 502, no. 873, pl. 93.

84 Mostafa 2015: 200, no. 91; Pensabene 1993: 92, 514, 518-519, nos. 944, 960-965, pl. 99-101.

85 Depictions on coins of the Serapeum show a Doric frieze above Corinthian capitals. McKenzie 2007: fig. 70.

86 Callot 2003: Figs. 9-10, 15.

87 Mostafa 2015: 199, no. 90; Pensabene 1993: 518, no. 962, pl. 101.

88 Mostafa 2015: 200, no. 91; Pensabene 1993: 518, no. 960, pl. 101.

89 El-Fakharani 1965: 58, pl. 16.5; Mostafa 2015: 205, no. 96; Pensabene 1993: 520-521, no. 973, pl. 103.

90 Mostafa 2015: 198, no. 89; Pensabene 1993: 522-523, no. 978, pl. 103; 136.1.

91 Pensabene 1993: 523, no. 979, pl. 104.

92 McKenzie 2007: 80, 93, 94, pl. 112, 150, 152.

93 Botti 1901: 533, no. 56; Hesberg 1980: 71-72, pl. 7.1; Mostafa 2015: 197, no. 88; Pensabene 1993: 522, no. 977, pl. 103.

94 Adriani 1966: 154, no. 100 bis. It is also called Trier tomb because of the completion of its investigations by Trier University in the 1970s, see: Sabottka 1983: 196-197, 202-203, pl. 42.2.

Figure 23. The entrance to the tomb of Khnum-Hotep III at Beni Hassan, Middle Kingdom: Viewed 11 December 2017, travelwithsheila.com/beni-hassan.html. Public domain.

is noteworthy that Tabiet Saleh combines the modillion cornice with stylised Doric columns, while other examples also from Gabbari combine modillions with Corinthian columns.[95]

The dwelling sector in Kom El-Dikka also yielded two fragments of curved pediments from the late Ptolemaic period. The common Alexandrian mouldings in these fragments are evident in the use of simple modillions alternated with square hollow ones and with narrow dentils in the frieze.[96] The same site yielded four other fragments which are elements of arched cornices or lintels. Their mouldings were originally coated with painted stucco of which only light traces remain.[97] Additionally, two small fragments of one huge cornice, also found in Kom El-Dikka show traces of a long narrow flat grooved modillion which is supposed to have been alternated with square hollow modillions as usual in such huge cornices.[98]

Origins of modillions

In order to trace the origins of modillions it is important to look back into the origins of the classical mutuli. In the Doric order, having been the earliest order to be achieved in stone buildings in Greece after the transition from mud and timber architecture into stone masonry, the influence of timber prototypes is observed by the majority of scholars who have tackled this debate.[99] Classical sources emphasise that Doric stone structures were preceded by wooden ones. [100] The Doric entablature introduces evidence to the transition from wooden structures into stone ones.[101] Vitruvius (IV, 3.) was more direct in mentioning that the triglyphs emerged from the arrangement of wooden beams while the mutuli under the corona came out of the projection of the rafters.

It is Judith McKenzie who first referred to the origin of modillions as influenced by the roof beams of the ceilings of Egyptian tombs, giving an early example in the rock-cut tombs of Deir Rifa dated to the twelfth Dynasty.[102] Tombs in Beni Hassan in Middle Egypt provide other examples (Figure 23).[103]

Mouldings incorporating direct Egyptian elements

The earlier tombs of Alexandria bear evidence for the insertion of some Egyptian elements within the Greek funerary atmosphere of the city's underground burial places. The sphinxes in front of the entrance of the burial room in Mosata Pasha 1 are one instance (see: figure 8). The façade from Shatby (Figure 24)[104] and the closing slab of loculus no. 11 in Gabbari tomb B1b[105] which are characterised by the sun disk at the centre of their pediments, one in relief and the other painted, provide the earliest examples of such a feature which became characteristic of Alexandrian funerary architecture.

Throughout the third century BC, such Egyptian elements seemed to have been individual additions to express the particularities of the Alexandrian society as a society that incorporated Greek inhabitants neighboured by the Egyptians who held a deeply-

[95] Guimier-Sorbets *et al.*, 2001: 182-183, figs. 4.18, 4.19.
[96] Tkaczow 2008: 233, 239, nos. 647, 678, pls. 66, 76.
[97] Tkaczow 2008: 232-233, nos. 640-642, 648, pl. 66
[98] They seem to have been re-cut to fit into a triangular façade. Tkaczow 2008: 239, no. 680, pl. 76.
[99] Holland 1917: 137; Washburn 1919: 33-49; Robinson and Blegen, 1937: 320-321; Bowen 1950: 113-125; Kimball and Edgell 1972: 62-63; Kostoff 1985: 122-123; Rhodes 1987: 477-480; Curl 1992: 17-18; Jones 2002: 354.
[100] Euripides (Bacchae, 1214, 15.) mentions the fixing of a lion's head to the triglyphs of a house wooden frieze. Pausanias (V, 16, 1.) reported a wooden column that he has seen in the Heraeion of Olympia.
[101] Cook 1951: 50-52.
[102] McKenzie 2007: 88. Many detailed studies have related the Greek transition into stone architecture to the Egyptian influence. See: Jones 2002: 356-377; Pillet 1935-38: 65, fig. 3, 69-70, fig. 5-6; Kostof 1985: 120. Notable in this regard is the study of Demangel 1937: 421ff; Marquand 1890: 47-50; and Clarke 1886: 278.
[103] Fedak 1990: 55-56-286. In these examples the use of simple Doric columns is evident.
[104] Breccia 1912: pl. 19, fig. 21.
[105] Guimier-Sorbet *et al.* 2001: loculus 11, fig. 4.30.

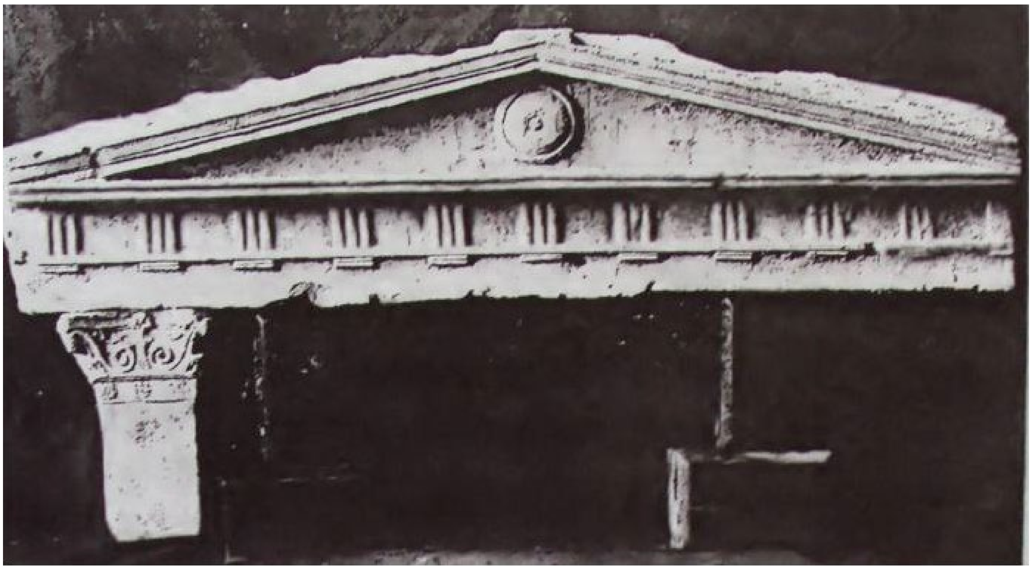

Figure 24. A Doric façade supported by Corinthian columns from Chatby cemetery with the Egyptian sun-disc at the centre of the tympanon, after Breccia 1912: pl. 19, fig. 21.

rooted history of funerary beliefs which were reflected profoundly in their funerary art. The third century Alexandrian architecture, both funerary and civil, looked generally Greek. Within the Greek-looking buildings, architects were free to create some new elements and designs that helped them to solve problems of space, material and function in order to produce buildings with a highly-aesthetic appearance. From this idea the Alexandrian particularities which we have noticed in the previously-investigated monuments and fragments were derived; These can be summarised as the optical refinements, mouldings of large dimensions with articulated profiles due to their plaster coating, the combination of Doric, Ionic and Corinthian elements including the cyma recta, reversa and Lesbian cymation in the same cornice, the square dentils and the replacement of mutule with modillions.

From the second century BC onward, Egyptian elements found their way into the decoration and mouldings of funerary architecture, the stela in figure 20 is but one of so many examples, as well as in fragments of non-funerary context, until they became part of the overall layout of the Alexandrian architecture.

The true Egyptian inspiration happened to appear mixed with the Alexandrian style in architectural mouldings of civil buildings constructed in limestone. This idea of interaction is supported by archaeological records where mouldings with Egyptianizing motives were found in different parts of the city. The Kom El-Dikka area provides us with two fragments which came from the Ptolemaic dwelling sector. They represent part of some huge limestone cornice decorated in relief with two types of naiskoi that were usually crowning Hathor's head. One (Figure 25),[106] has the naos with a rearing cobra inside, while the other (Figure 26)[107] has the sistrum-type naiskos. Hathoric capitals seem to have been used in other buildings of the Ptolemaic period as can be inferred from a second century BC lamp (Figure 27)[108] that takes the shape of a temple façade. The entrance, in which stands a half naked Aphrodite, has hathoric capitals supporting a frieze of Uraei and a curved pediment with the central sun disk. A third small fragment of stucco was found in the same dwelling sector of Kom El-Dikka (Figure 28) represents a narrow frieze decorated with griffins or Greek sphinxes with stylised palmettes.[109] Groups of 3 cobras are used in place of the triglyphs of the Doric frieze under a segmental pediment in Thiersch's hypogeum 2 at Gabbari. [110]

The cavetto cornice, which is Egyptian in origin, appears in a fragment of limestone Ionic dental cornice and frieze with traces of polychrome.[111] The concave profile of the frieze might have belonged to a curved Alexandrian pediment, since the Egyptian arched cavetto at the top of this frieze was only used with the curved pediments and was not found in Greek pediments. It recalls the Graeco-Egyptian types of portals of which one appears in Anfoushy tomb 2 (Figure 29) combined with a segmental pediment. As a matter of fact, this entablature in Anfoushy indicates a homogeneous mixture of Egyptian and Alexandrian mouldings. Egyptian mouldings are the solar sun disk in the middle of the pediment and the arched cavetto at the top of the frieze. Alexandrian mouldings are the

106 Mostafa 2015: 222, no. 113; Tkaczow 2008: 234, no. 654, pl. 70.

107 Mostafa 2015: 223, no. 114; Tkaczow 2008: 234-235, no. 654bis, pl. 70.

108 Breccia 1934: 16-17, no. 9, pl. 2.3; Empereur 1998: 249, no. 194; Mostafa 2015: 236, no. 127.

109 Tkaczow 2008: 240, no. 682b, pl. 77.

110 Thiersch 1900: 27-28, figs. 6-7; A complete drawing in McKenzie 2007: fig. 147.

111 Mostafa 2015: 148, no. 40; Pensabene 1993: 498, no. 838, pl. 91.

Figure 25. Fragment of a huge cornice from Kom El-Dikka area, decorated with a crown of Hathor with naos centered by a rearing cobra, after Tkaczow 2008: no. 654, pl. 70.

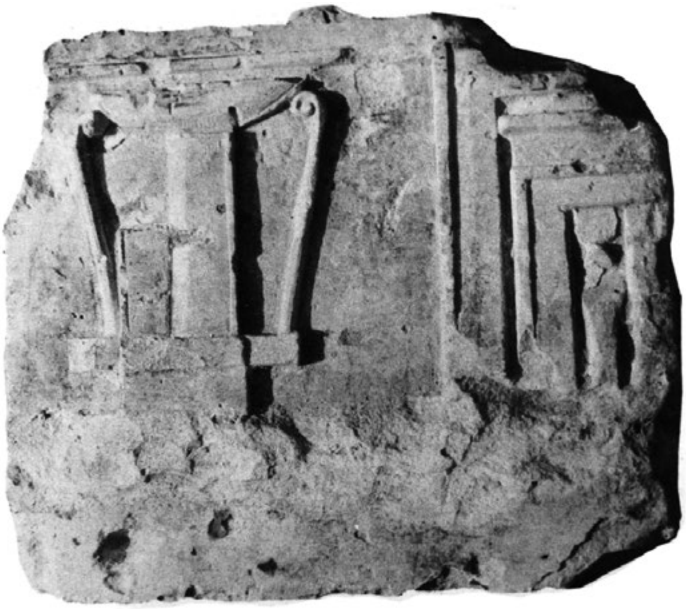

Figure 26. Fragment of a huge cornice (probably the same one as previous) from Kom El-Dikka area, decorated with a crown of Hathor known as the sistrum-type naiskos, after Tkaczow 2008: no. 654, pl. 70.

Figure 27. A fragment of stucco decoration from Kom El-Dikka showing a narrow frieze decorated with griffins and stylised palmettes, after Tkaczow 2008: no. 682b, pl. 77.

Figure 28. A second century BC terracotta lamp in the shape of an Egyptian style temple of Aphrodite, after Breccia 1934: no. 9, pl. 2.3.

curved or segmental pediment and the modillions as well as the square dentils.

It is noteworthy that the use of traditional architectural forms such as engaged columns or pilasters for the decoration of the interiors of buildings has been known in Greek architecture since the 5th century BC.[112] As could be inferred by the example of Anfoushy tomb 2, curved pediments, which have their origin in Egypt, incorporating friezes and cornices moulded in the

[112] McKenzie 1990: 88, 91 with other references; McKenzie 2007: 93.

Figure 29. The hall leading to the main chamber in Anfoushy tomb II with Egyptianised façade and paintings including Pharaonic crowns. Photo by: André Pelle, courtesy of the Centre d'Études Alexandrines.

Alexandrian style were used in Alexandria for door lintels and room façades. These features seem to have been the nucleus for the Alexandrian architects to create more complex forms inspired from local Egyptian traditions such as cavettoes, curved entablatures and broken pediments. Those new forms are looked at by modern scholars as baroque.[113]

These new forms can be reminiscent of broken pediments such as in a fragment dated to the late second, early first centuries BC.[114] It represents one of the two projecting sides of a concave entablature of a circular niche. Arched entablatures were also detected in two fragments in the Graeco-Roman Museum. [115] The soffits are decorated with alternated rows of coffers in the shape of two concentric hexagons and lozenges. The cornice has narrow elongated dentils with viae equal to the dentils' width. Hexagonal coffers are painted on the stucco ceiling of hypogeum 2 at Anfoushy and are dated to the same period. Concave, curved and arched entablatures survive in fragments found in the Chantier Finney area, [116] having the distinctive Alexandrian square hollow and flat grooved modillions.

Broken lintel and broken pediment

It has been positively argued that the idea of the broken entablature with broken pediment was inspired from the broken lintel in Egyptian temple entrances, of which the earliest example we know is the entrance of the great temple of Aten at Amarna. [117] Ptolemaic temples in Upper Egypt used broken lintels for their entrances regardless to which deity the temple is dedicated. The temple of Horus at Edfu and that of Hathor at Dendera are good examples. The temple-lamp in figure 28 is characterised by a broken lintel.

Examples of broken pediments from Alexandria can be detected in fragments of angle cornices found in the Gabbari cemetery. One of them (Figure 30) has a plain cornice separated from the cyma recta by a strip, the narrow-grooved modillions in the soffit as well as the narrow and elongated dentils are oblique and slightly trapezoidal because of their positioning in the right angle of a broken pediment facing the same composition in the lost left angle.[118] The dwelling sector of Kom El-Dikka also yielded parts of corners of pediments which are supposed to have been half or

[113] Those characteristics, in view of a group of scholars, form what is known as the Alexandrian baroque style of architecture. McKenzie 1990: 87-92; McKenzie 2007: 92-95.
[114] Pensabene 1993: 510, no. 923, pl. 97.
[115] Pensabene 1993: 522, no. 974-5, pls. 103, 134.
[116] McKenzie 2007: 112, 150a, b.
[117] McKenzie 2007: 200, 224; for a detailed view of Egyptian broken lintels see: Larkin 1994.
[118] Botti 1901: 532, no. 33; Mostafa 2015: 177-178, nos. 68-69; Pensabene 1993: 504-505, nos. 888-892, pl. 94-95. Fig. 132.1.

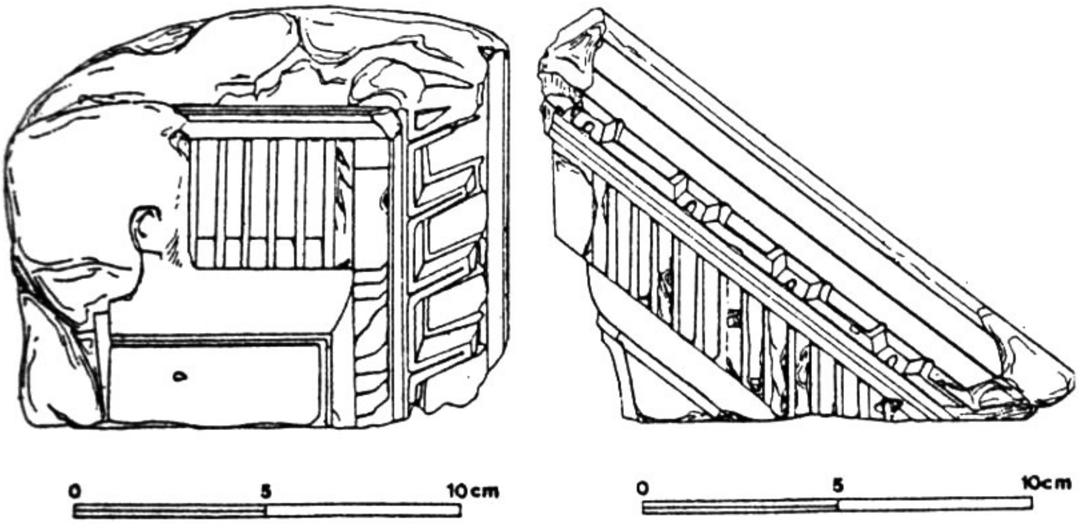

Figure 30. Right angle of a broken pediment from Gabbari, after Pensabene 1993: fig. 132.1.

broken ones. One of these Kom El-Dikka examples is two twin pieces remaining from the left angles of two different broken pediments and the right sides of the tympana, the soffits are decorated with square-hollow modillions, presumably alternated with flat-grooved ones.[119]

Conclusion

During the early decades of the foundation of the city, Greek architects were commissioned by the kings to construct the required edifices of the new city of Alexandria. The material available in hand proves that those architects worked according to the norms of classical canons to produce buildings in the mainstream of Hellenistic architecture. The third century Alexandrian architecture, both funerary and civil, looked generally Greek. Within the Greek-looking buildings, architects were free to create some new elements and designs that helped them to solve problems of space, material and function in order to produce buildings with a highly-aesthetic appearance. Hence stem the Alexandrian particularities which we have noticed in the previously-investigated monuments and fragments: the optical refinements, mouldings of large dimensions with simple articulated profiles, the combination of Doric, Ionic and Corinthian elements including the cyma recta, cyma reversa and Lesbian cymation at the same cornice, the square dentils, the replacement of mutule with modillions and the use of curved pediments as well as half and broken ones.

Throughout the third century BC, individual Egyptian elements such as the sphinxes, the solar sun disk and the curved pediments were added to the Alexandrian architectural styles to express the particularities of Alexandrian society as a society that incorporated Greek inhabitants neighbored by the Egyptians who held a deeply-rooted history of religious and funerary beliefs which were reflected profoundly in their architecture.

By the end of the third century and beginning of the second century BC onward, Egyptian elements increasingly found their way into the decoration and mouldings of funerary architecture as well as into fragments of non-funerary context until they became part of the overall layout of the architecture of Alexandria. The Egyptian curved pediment and broken lintel led to the use of more varied forms of entablatures like the broken and half pediments, which led to the creation of what can be termed as Alexandrian baroque architecture. This interaction of Graeco-Egyptian elements seems to have a more profound background of cultural and social changes that might have been accompanied by a change in the funerary and religious practices in the city. The religious content and connotations of the Egyptian elements used in architecture became more appreciated among the Greek inhabitants of the city if not adopted by the majority of them.

The strong Egyptian tradition and its prominent appearance in Ptolemaic arts in general was one of the reasons which led some scholars of the 19th century to believe that Alexandria, unlike the other Hellenistic centres, had no opportunity to introduce

[119] Mostafa 2015: 126-127, nos. 18-19; Tkaczow 2008: 236, 238, nos. 665, 672, pls. 72, 74.

its own artistic creations.[120] During the twentieth century, rescue excavations in the city and its environs yielded plenty of architectural fragments that constitute many aspects of the Alexandrian particularities which responded positively to Theodor Schreiber who was the first to speak of an Alexandrian school of art using the much disputed term of *Pan-Alexandrianism*.[121] Since then, the concept of the Alexandrian contribution to Hellenistic art has been a subject of comprehensive investigations.[122]

From the second half of the second century BC onward, more Egyptian elements were introduced into the decorative designs of Alexandrian entablatures of civil buildings as well as into the doorways and frames of niches inside the tombs. They created a new Egyptian atmosphere that is well integrated into an Alexandrian context.

Note on illustrations: photos without source in captions are by the author.

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[120] Brunn 1889: vol. 1, 595; Overbeck 1882: vol.2, 199; Mitchell 1883: 606.

[121] Schreiber 1885: 380- 400.

[122] For a detailed discussion of Schreiber's theory and the scholarly responses to it, see: Stewart 1996: 231-246.

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Alexandria in the 'Corpus of Ptolemaic inscriptions'

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This paper provides an overview of the epigraphic evidence from Alexandria (items of certified and probable Alexandrian provenance) that have been catalogued and studied in the Corpus of Ptolemaic Inscriptions project (CPI).[1] The Alexandrian section contains 85 items. Admittedly, given that Alexandria was one of the greatest metropoleis in antiquity, the number of surviving inscriptions is rather small. What does survive, however, provides telling evidence of a broad range of activity in both public and private spheres of life, which warrants renewed attention, especially since it can now be studied in relation to other kinds of material evidence, where necessary. A reconsideration of these inscriptions seems more than well merited now, given recent epigraphic research and new archaeological discoveries which have considerably enriched our understanding of the city since the publication of Fraser's *Ptolemaic Alexandria* (Oxford 1972).[2] In what follows, the collection of Alexandrian inscriptions will be presented according to categories of text, corresponding to sections of the CPI catalogue.

A small number of inscriptions offer valuable evidence for civic organisations and institutions, for which there is extensive papyrological information.[3] There has been much discussion about the foundation constitution, by Fraser and many others. It is a complicated issue, given that Alexandria did not possess a council (βουλή) at the beginning of the Roman period. If it originally had one, as seems certain, it must have been abolished, probably under Ptolemy VIII or possibly at the end of the Ptolemaic period. The epigraphic record does reveal that Alexandria possessed a body of elders (γερουσία) as well gymnasial institutions. There is also good deal of evidence in papyri for the organisation of the city's population into tribes and demes, whilst other papyri illuminate the problematic issue of obtaining Alexandrian citizenship, especially during the expansion of the city, in the later phases of the Ptolemaic period. The epigraphic record does not have much to add here.[4] Nevertheless, the inscriptions do draw attention to a series of public activities, mainly of a religious character, where Alexandrian citizens appear to have retained a key role, and these do merit further investigation.

A substantial proportion of the epigraphic evidence relates to the intense religious life of Alexandria, involving deities, kings, courtiers, priests, as well as other individuals.[5] Synods, sacred building activity, and other monumental dedications are featured, as well as more modest inscribed ex-votos and proskynemata. The first group of religious inscriptions concerns the initiatives undertaken by the Ptolemaic court to develop Alexandria's sacred topography and are often commemorated in temple foundation deposits and other above-ground epigraphic monuments. The Great Sarapeion, the 'cathedral' of Alexandria, dedicated to the so-called Alexandrian divine triad, Sarapis-Isis-Harpokrates, is a typical example. Archaeological evidence from the site dates the Sarapeion to the time of Ptolemy II, if not earlier. However, it was Ptolemy III who built the main temple structure, commemorated by 10 foundation deposit plaques – which were later found at the site – made of gold, silver, glass and Nile mud.[6] They are inscribed both in Greek and hieroglyphs, signalling the dual, Greco-Egyptian nature of Alexandria's principle god and this duality is also a feature of the monumental environment of the sanctuary (Figure 1).[7]

Another five bilingual plaques come from a major addition in the site, the Harpokrateion, built by Ptolemy

[1] The project is based at the Centre for the Study of Ancient Documents (CSAD), University of Oxford, and is funded by the Arts and Humanities Research Council of England and Wales and the John Fell Fund of the University of Oxford. The other members of the team are Alan Bowman, Simon Hornblower, Charles Crowther and Rachel Mairs.

[2] In *Ptol. Alex.* Fraser made extensive use of his own corpus of Ptolemaic inscriptions, compiled from the 1950s onwards and, numbering about 350 items, which forms the original basis of the current CPI project.

[3] Cf. *Ptol. Alex.* I: 93-101, summarised by Cohen 2006: 353-81.

[4] Cf. Bowman (forthcoming) analysis of epigraphic evidence, related to the civic institutions of Alexandria and other 'Greek cities' of Ptolemaic Egypt.

[5] Also extensively discussed by Fraser in *Ptol. Alex.* I, chapter 5.

[6] CPI 12. Βασιλεὺς Πτολεμαῖος Πτολεμαίου καὶ Ἀρσινόης, θεῶν Ἀδελφῶν Σαράπει τὸν ναὸν καὶ τὸ τέμενος (*'King Ptolemy son of Ptolemy and Arsinoe, gods Philometores, the temple and the sanctuary'*). Cf. Thompson (forthcoming), on Ptolemaic foundation deposit plaques,

[7] For a revision of the architecture in the Sarapeion, see McKenzie *et al.* 2004. For sculptural monuments found in the site, Savvopoulos and Bianchi 2012: 15-17 and nos. 1, 22, 23, 32, 34, appendix V, 1.

Figure 1. CPI 12. Great Sarapeion. Gold foundation deposit plaque of the temple of Sarapis.

Figure 2. CPI 18. Great Sarapeion. Gold foundation deposit plaque of the temple of Harpokrates.

IV. This was a shrine, attached to the main temple building of Sarapis, and it indicates the perpetuation of royal interest in the temple during the 3rd century (Figure 2).[8] Regarding its role in the sanctuary, the Harpokrateion is best understood in terms of cultural syncretism, where an Egyptian concept is dressed in what may be envisaged as a Hellenistic-Alexandrian semi-diaphanous 'peplos'. In fact, the shrine seems to have been a Hellenistic-Alexandrian interpretation of the Egyptian birth-house (*mamisi*) common in the Egyptian temple complexes of the Late (Pharaonic) and Greco-Roman periods, which are dedicated to the 'holy child' of a 'holy mother'.[9] In this case, the shrine is dedicated to Harpokrates (Horus the child, son of Isis and Sarapis) and here we face an inevitable parallelism between the Alexandrian triad and the Ptolemaic royal-divine triad, with Ptolemy IV as the royal divine child of a royal divine couple of Euergetai (Ptolemy III and Berenike II).

Regarding the rest of the city, new evidence from the reign of Ptolemy III suggests that there is much more to be learnt about royal strategems for engaging with religious practice in the first half of the Ptolemaic period, particularly with regard to Egyptian tradition. Excavations in the area of Kom el Dikka have surprised readers of Alexandrian archaeology by revealing a temple dedicated to Boubastis, the Egyptian cat goddess, known also as Bastet, protector of childbirth and motherhood. According to the foundation plaques discovered at the site, it seems most probable that Queen Berenike II was the founder of the sanctuary in favour of her husband,

[8] CPI 18. Βασιλεὺς Πτολεμαῖος βασιλέως Πτολεμαίου καὶ βασιλίσσης Βερενίκης θεῶν Εὐεργετῶν Ἁρποχράτει, κατὰ πρόσταγμα Σαράπιδος και Ἴσιδος ('*King Ptolemy son of King Ptolemy and Queen Berenike, to Harpokrates, by the orders of Sarapis and Isis*').

[9] Cf. Mamisi-shrines are included in the temple complexes of Edfu, Philae and Kom Ombo, cf. Arnold 1999.

Figure 3. CPI 16. Gold foundation deposit plaque of a temple of Isis.

Figure 4. CPI 23. Gold foundation deposit plaque of temple dedicated to Sarapis, Isis, and Gods Eupatores (Ptolemy IV and Arsinoe III).

Ptolemy III.[10] The excavations also revealed hundreds of *ex-votos* of children and cat statuettes. Many of them are inscribed in Greek, suggesting the widespread adoption of the Boubastis cult by Greek audiences. Nevertheless, the style of these statuettes of children recalls those of *ex-votos* in the sanctuaries of, Artemis, the Greek protector of motherhood and pregnancy, which date to the 4th century BC;[11] they indicate the means by which an Egyptian deity was introduced to the Alexandrian public, through the modification of Greek cultic practices. Indeed, the popularity of this syncretic cult of Boubastis may well explain the absence of representations of Artemis in Egypt, at least in this role.[12]

Royal involvement in sacred building projects continued in the reign of King Ptolemy IV. For as well as the Great Sarapeion, the King was also responsible for constructing at least two new temples in the city, dedicated to Sarapis and Isis (Figures 3-4). In the first case Ptolemy IV pays his tribute to the great goddess Isis, for being benevolent to him,[13] a concept concordant with Ptolemy IV's epithet, 'the beloved of Isis' in the so-called Raphia Decree.[14] In the second case, Sarapis and Isis are hailed as 'saviour gods', sharing the temple with the gods Philopatores, Ptolemy IV and Arsinoe III – a partnership, which will be discussed further below.[15] The saviour epithet for Isis and Sarapis appears to have been promoted at state level, perhaps in relation to major historical events, including Ptolemy IV's victory at the battle of Raphia (217 BC).[16]

The next group of inscriptions may be discussed in the context of the methodical development of religious life in Ptolemaic Alexandria 'under the royal *aegis*'. They involve a broad range of people: high ranking courtiers, priests, and people of different cultural backgrounds (e.g. Greeks, Egyptians and Jews). The headline formula, 'Ὑπὲρ βασιλέως' is common to these texts. Having no direct parallel in English, the formula has been translated in various was such as 'in favour of the King', 'for the King, or 'on behalf of the King'. Yet, the latter interpretation tends to be the less preferred option in recent studies, due to its rather stronger meaning, which might indicate a direct royal patronage of the acts described. In the course of a long debate, the majority of the scholarly community tends to agree that the 'Ὑπὲρ βασιλέως formula does not necessarily

10 CPI 13. Βασίλ(ι)σσα Βερενί(κη) [ὑπερ βασι]λέως (Π)τολ(εμαίου τοῦ (αὐ)τῆς ἀ(δε)λ(φοῦ) καὶ ἀ(ν)δ̣ρ̣ὸς καὶ τῶν τ)ούτων τέκνων, τὸν ναὸν καὶ τὸ τέμενος καὶ τὸν βωμὸν, Βουβάστει. (Text as transcribed in Abd el-Maksoud *et al.*, 2015). ('*Queen Berenike, in favour of king Ptolemy, her sister and husband, and their children, the temple, the sanctuary and the altar, to Boubastis*').

11 Cf. Bobou 2015: 57ff.

12 Of course, the immense popularity of Isis as protector of motherhood was apparently another decisive factor of the presumable absence of Artemis in Egypt in this role. Otherwise, Artemis is found three times in CPI, in dedications made exclusively by soldiers. In all cases, the name of Artemis is accompanied by epithets related to the homeland as well as to the profession of the dedicants. Hence, epithets Pergaia (from Perge in Pamphylia), Phosphoros (the light banner) and Enodia (the patron of gods) refer to cultic forms of Artemis from the area of Pamphylia in Asia Minor, while Soteira (saviour) comprise a common epithet of gods in dedications made by militants: respectively, CPI 289 (TM 5982), from Fayoum; CPI 341, (TM 6377), from Koptos; CPI 91 (TM 6367), from Kanopos) Much later, in the Antonine period, the name of Artemis Phosphoros appears next to this of Boubastis in the Alexandrian Boubasteion. Cf. Kayser 2015: no. 729

13 CPI 16. Βασιλεὺς Πτ[ολεμαῖος] Πτολεμαίου κ[αὶ Βερενίκης] θεῶν εὐεργε[τῶν, Ἴσιδι θεᾶι] μεγίστηι, ἀ[ντί πολλῶν] εὐεργεσιῶν εἰς [ἑαυτόν]. ('*King Ptolemy, son of Ptolemy and Berenike, gods Euergetai, to Isis, the greatest goddess, in return for many benefactions to him*'). See also following discussion on royal cults.

14 CPI 396 (TM 6082), l. 6: ἠγαπημένου ὑπὸ τῆς Ἴσιδος.

15 CPI 23. Σαράπιδος <κ>αὶ Ἴσ<ι>δος θεῶν Σωτήρων καὶ βασιλέως Πτολεμαίου καὶ βασιλίσσης Ἀρσινόης θεῶν Φιλοπατόρων ('*(The temple of) Sarapis and Isis, the saviour gods, and King Ptolemy and Queen Arsinoe, gods Philopatores*').

16 The gratitude of Ptolemy IV was further expressed through the circulation of a silver tetradrachm, depicting the jugate busts of Sarapis and Isis. Cf. Sfameni-Gasparo 2010: 62-63; Bricault 1999: 334–343.

Figure 5. CPI 9. Temple dedication to Sarapis and Isis.

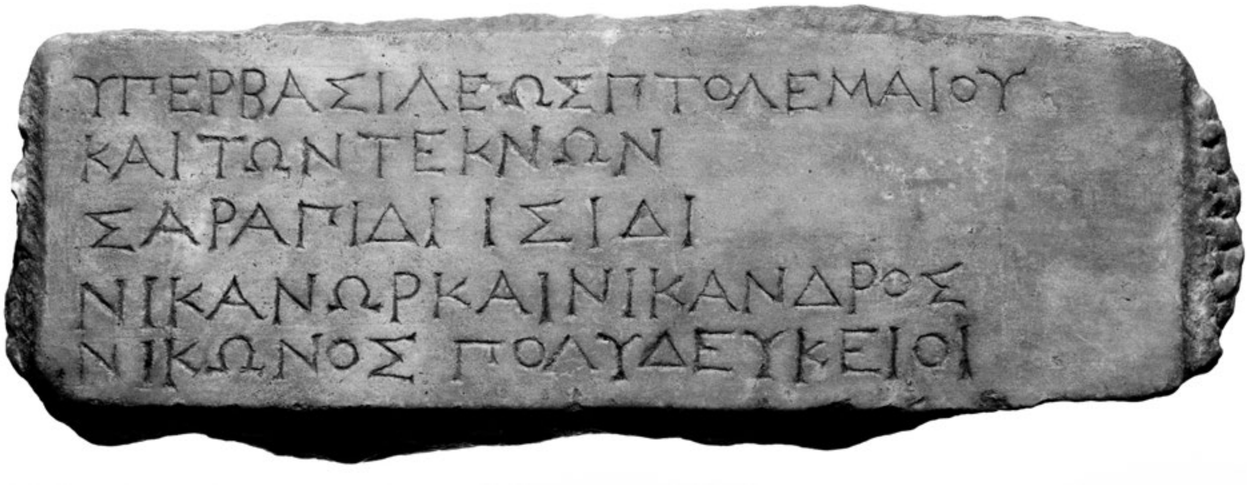

Figure 6. CPI 8. Dedication to Sarapis and Isis.

indicate the actual or direct involvement of Kings. Instead, it should be understood in rather symbolic terms, possibly as expressions of loyalty to the Crown and its policies.[17]

However, there is one example where the formula could possibly be also interpreted as an indication of royal patronage, due to the nature of activities as well as of the status of their protagonists. The text refers to the foundation of a sanctuary dedicated to Sarapis and Isis by Archagathos, governor of Libya during the reign King Ptolemy II, and his wife Stratonike (Figure 5).[18] Therefore, it provides evidence for the establishment of cultic branches for the worship of Sarapis and Isis around the city as early as the reign of Ptolemy II by prominent court figures acting as representatives of the King.

[17] For the interpretation of the formula as an act of loyalty, see *Ptol. Alex.* I, 115-116, and related notes in vol. II; for two recent reconsiderations of the "Ὑπὲρ βασιλέως' dedications, Fassa 2015; Caneva 2016.

[18] The inscription was found in the Mahmoudieh Canal, in the area of the Antoniades Gardens. CPI 9. Ὑπὲρ βασιλέως Πτολεμαίου, τοῦ Πτολεμαίου καὶ Βερενίκης, Σωτήρων, Ἀρχάγαθος Ἀγαθοκλέους ὁ ἐπιστάτης τῆς Λιβύης καὶ ἡ γυνὴ *vv* Στρατονίκη Σαράπιδι Ἴσιδι τὸ τέμενος. ('*On behalf of King Ptolemy, son of Ptolemy and Berenike, the saviours, Archagathos, son of Agathokles, the governor of Libya, and Stratonike, to Sarapis and Isis, the sanctuary*'). Archagathos was the son of the tyrant of Syracuse, Agathokles, who before his death sent his family to the court of Ptolemy I Soter. Archagathos seems to have grown up in the Ptolemaic court during the reign of Ptolemy Soter; his mother Theoxena was the daughter of Berenike I, from her first marriage to a general of Alexander the Great, Philip, who died in 318 BC. Cf. Moretti 1965: 173; Bagnall 1976. Fraser is more hesitant about this identification, *Ptol. Alex.* II, 427, n. 676.

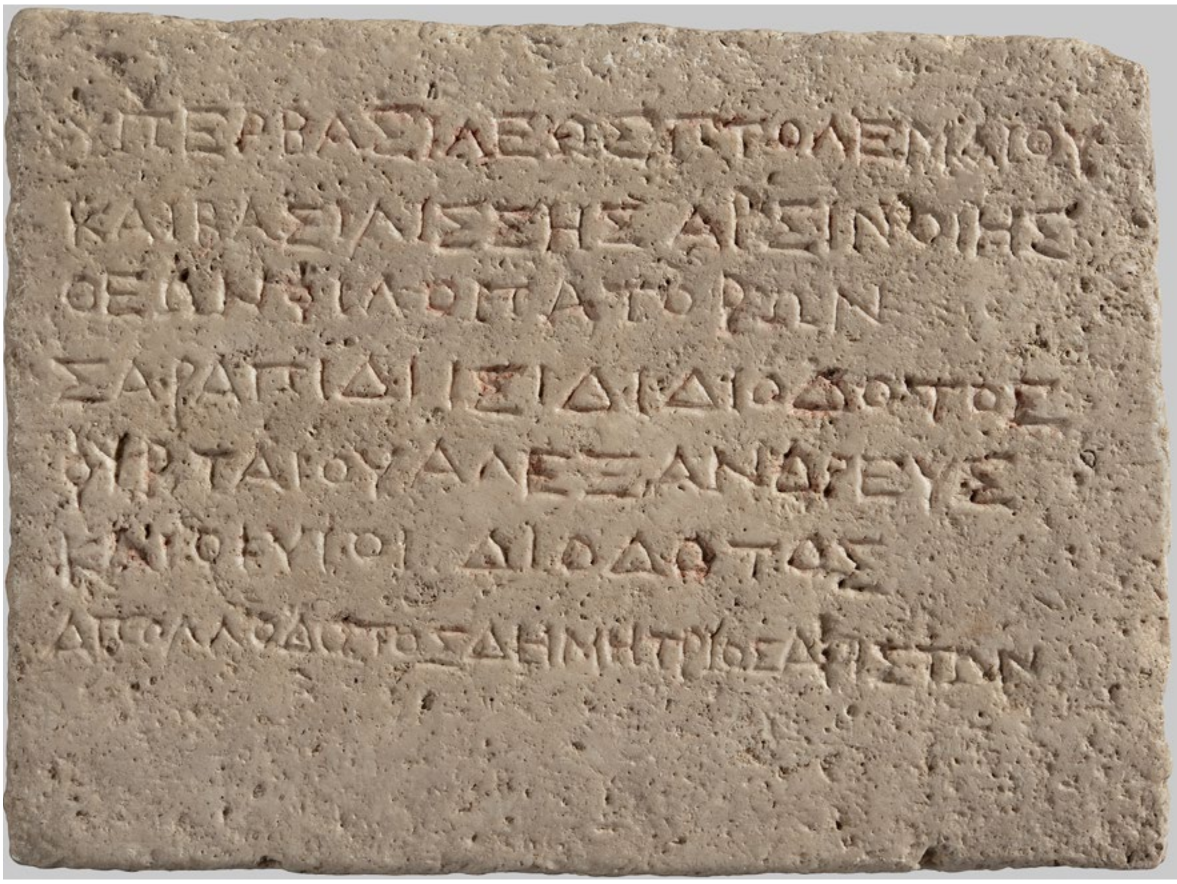

Figure 7. CPI 19. Dedication to Sarapis and Isis.

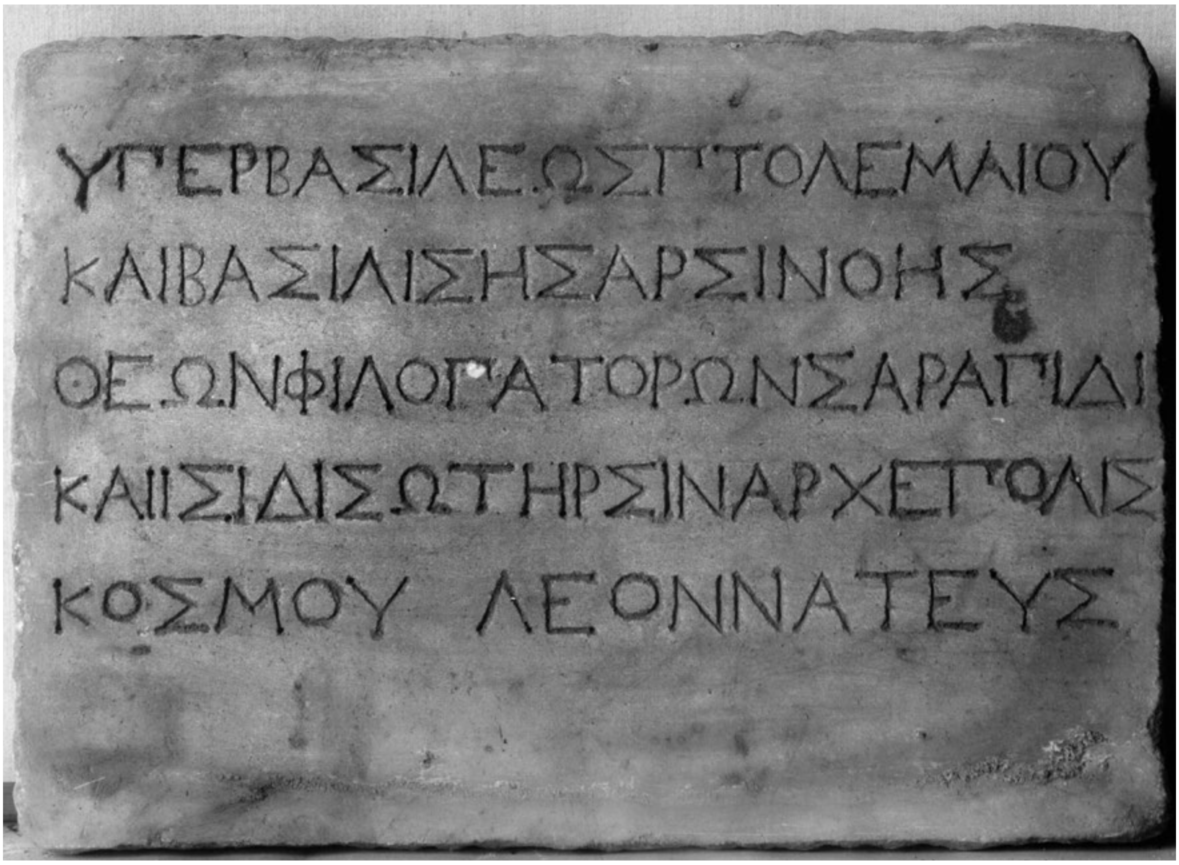

Figure 8. CPI 20. Dedication to Sarapis and Isis.

Figure 9. CPI 17. Dedication of an altar to Demeter, Kore and Dikaiosyne.

Yet it is not only high-ranking courtiers who act in agreement with royal policy on these matters. Civilians, members of the Alexandrian citizen body, also appear as dedicants in texts headlined with the ʽΥπὲρ βασιλέως formula, which as mentioned above, should be interpreted in terms of public proclamations of loyalty and adherence to the royal house and its policies. The earliest example of this kind is the inscription featuring the names of Nikanor and Nikandros, two Alexandrian citizens, members of the Polydeukeios deme, who make dedications to Isis and Sarapis in favour of an early Ptolemy (I Soter?) (Figure 6). Another two dedications to Sarapis and Isis by Alexandrian citizens survive from the reign of Ptolemy IV. In the first example, Diodotos and his sons are indentified simply as Alexandrians – no deme is mentioned –[19] while in the second instance Archepolis is identified as member of the Leonateus deme (Figures 7-8).[20]

Scholars in the past, Fraser included, have attempted to understand the differentiation in Alexandrian toponymics in terms of different stages or statuses of citizenship, although both the epigraphic and papyrological evidence seems inadequate to support such a model of graded citizenship.[21] As a matter of fact, the focus in the inscribed monuments seems to be not the toponymic *per se*, but on acts performed in favour of the king. Such acts marked their loyalty to the crown whilst contributing to the diffusion of the cults, ‘according to the will of gods and kings’, not only in Alexandria, but in the rest of the Egyptian *chora* as well.[22]

Finally, regarding dedications made ‘for Ptolemy IV’, we should briefly refer to another two examples. The first is the dedication of an altar to Demeter, Kore and Dikaiosyne (Justice) made by a family acting in favour of the royal couple Philopatores (Figure 9).[23] No exact provenance is certainly known for this plaque, and the text offers no explanation as to which purpose Dikaiosyne is included as a dedicatee. However, Demeter and Kore represent two of the earliest, as well as most prominent, divine residents of the city. The Thesmophorion of Alexandria, the sanctuary dedicated to them, situated in the Eleusis suburb on the east side of the city, was founded as early as the reign of Ptolemy I Soter, and attracted royal attention throughout the Ptolemaic period. One should be aware, however, of the risk of seeing Demeter’s cult in Alexandria as being traditionally Greek, given the close interconnection of this goddess with Isis, since the very beginning of the period. This association seems to have facilitated the incorporation of Egyptian elements into the monumental environment of the sanctuary which, as

[19] CPI 19. ʽΥπὲρ βασιλέως Πτολεμαίου καὶ βασιλίσσης Ἀρσινόης θεῶν Φιλοπατόρων Σαράπιδι Ἴσιδι Διόδοτος Φυρταίου Ἀλεξανδρεύς καὶ οἱ υἱοὶ Διόδοτος, Ἀπολλόδοτος, Δημήτριος, Ἀρίστων. (‘*On behalf of king Ptolemy and queen Arsinoe, gods Philopatores, to Sarapis and Isis, Diodotos, son of Phyrtaios, Alexandrian, and his sons Diodotos, Apollodotos, Demetrios and Ariston*’).

[20] CPI 20. ʽΥπὲρ βασιλέως Πτολεμαίου καὶ βασιλίσης Ἀρσινόης θεῶν Φιλοπατόρων, Σαράπιδι καὶ Ἴσιδι Σωτήρσιν, Ἀρχέπολις Κόσμου Λεοννατεύς. (‘*On behalf of king Ptolemy and queen Arsinoe, gods Philopatores, to Sarapis and Isis, the saviors, Archepolis, son of Kosmos, member of the Laonateus deme*’).

[21] Cf. discussion and note 42, below.

[22] The foundation plaques of the Harpokrates temple mention that the shrine was founded ‘κατὰ πρόσταγμα› (‘*by the orders*’) of Sarapis and Isis to the king. Hence the will of the gods seems to be conveyed by the Kings to the court and to the citizen body. See also the altar dedicated to Sarapis and Isis, the Saviour Gods, by an Alexandrian citizen, member of the Hephaistieus deme, in Philae complex, CPI 448 (TM 44051)

[23] CPI 17. ʽΥπὲρ βασιλέως Πτολεμαίου καὶ βασιλίσσης Ἀρσινόης, θεῶν Φιλοπατόρων, Ἀπολ<λ>ώνιος Ἀμμωνίου καὶ Τιμόκιον Κρισιλάου καὶ τὰ παιδία, Δήμητρι καὶ Κόρῃ καὶ Δικαιοσύνῃ. (‘*On behalf of king Ptolemy and queen Arsinoe, gods philopatores, (by) Apollonios son of Ammonios, and Timokion, daughter of Krisilaos, and their children, to Demeter and Kore and Dikaiosyne (Justice)*’).

in the case of the Great Sarapeion, included sphinxes and royal statuary in Pharaonic dress. [24]

The second example is a small votive, dedicated to the Egyptian god Anoubis, by a group of Egyptian priests (temple millers) (Figure 10).[25] In Anoubis we find a major Egyptian deity who seems to have been incorporated into Ptolemaic stratagems early on.[26] A temple dedicated to the god has yet to be found in Alexandria, nonetheless there is substantial evidence that the Anoubis cult was connected to the cult of Sarapis and Isis.[27] Regarding the priests, this is one of the rare cases in the capital where Egyptians – remarkably priests - dedicated to Egyptian deities in the Hellenistic *lingua franca*.

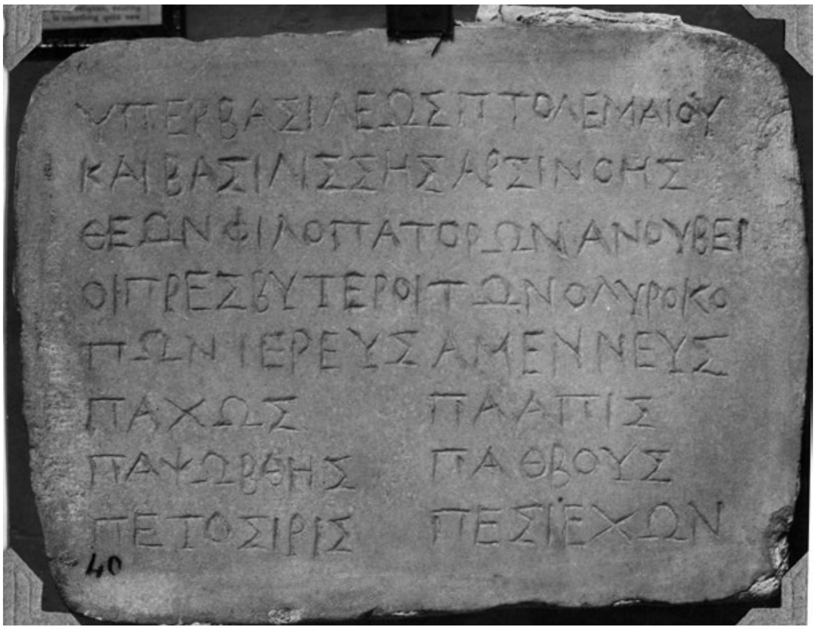

Figure 10. CPI 22. Dedication to Anoubis.

The period from the reign of Ptolemy V to the end of the Ptolemaic kingdom has been described as the dark age of Alexandrian epigraphy. Considering the large quantity of epigraphic evidence surviving from the Egyptian *chora*, as well as from the Aegean and Cyprus, this seems to be a paradox. Yet although it is impossible to deny the lack of epigraphic evidence in terms of being lost, we need to be aware that other parameters need to be taken into consideration, such as changes in public life, the general decline of the kingdom and the royal house itself; changes which came to be reflected in religious practice, and the royal initiatives and acts performed in favour of the royal house.

Sarapis, possibly the most emblematic Ptolemaic divine figure, seems to have fallen victim to these circumstances, losing both royal support and followers.[28] By contrast, Isis seems to retain, if not increase, her popularity, while royal attention to her appears to have augmented as well.[29] Isis is the recipient of a major dedication dating to the reign of Ptolemy XII New Dionysos – the only surviving epigraphic evidence of the kind from the last decades of the Ptolemaic period. It concerns the dedication of land by a wealthy Egyptian, called Nepheros, son of Babaus.[30] Nepheros and the Egyptian priests of Anoubis are currently the only Egyptian representatives in this collection of Alexandrian inscriptions. This seems to be consistent with the general impression deriving from other types of evidence: the Egyptians, presumably the largest of the ethnic groups in Alexandria appear to be silent (or muted) in the general Greek public ambience of the city during this period. But there are caveats. First of all, it needs to be noted that, Rakhotis, the Egyptian domestic quarter (the modern districts of Karmus and Anfuchi) is one of the least investigated areas of Alexandria, having been almost continuously occupied since antiquity. Even so, sporadic archaeological evidence suggests the existence of traditional Egyptian cultic forms there, as early as the reign of Ptolemy II.[31] Secondly,

[24] Cf. the discussion by Bianchi, in Savvopoulos and Bianchi 2012: no. 29.

[25] CPI 22. Ὑπὲρ βασιλέως Πτολεμαίου καὶ βασιλίσσης Ἀρσινόης, θεῶν Φιλοπατόρων, Ἀνούβει οἱ πρεσβύτεροι τῶν ὀλυροκόπων. ἱερεὺς Ἀμεννεύς. Παχῶς, Παᾶπις Παψώβθης, Παθβοῦς Πετοσῖρις, Πεσιέχων. ('*For king Ptolemy and queen Arsinoe, gods Philopatores, to Anoubis, (by) the elders of the temple--millers, Ammeneus, priest, Pachos, Paapis, Paosibthes, Pathbous, Petosiris, Pesiechon*').

[26] In the reign of Ptolemy II, grandfather of Philopator, a temple dedicated to Anoubis, Sarapis and Isis was founded in the area of Kanopos, where another Egyptian priest, Pasis, was in charge. Cf. dedication by sanctuary's founder, admiral Kallikrates of Samos, CPI 94 (TM 6505).

[27] Anoubis shares a portable altar with Sarapis and Isis, found in Hadra, CPI 85.

[28] Cf. Hölbl 2001: 112.

[29] This relationship is well illustrated in the most monumental way in the statuary of the period, among which we can distinguish two outstanding examples. The first is a colossal statue of Isis or of a queen dressed as Isis found in the water near Pharos Island in the 1960s. (cf. Walker and Higgs 2001: no. 24b). It was probably part of a group of colossal Ptolemaic statuary in the area, as indicated by the fragments of another six Ptolemaic statues, discovered in the 1990s by the Centre d'Études Alexandrines. Another impressive female head of Isis or a Ptolemaic queen with the characteristics of Isis, dating to the 2nd /1st centuries BC (Alexandria, Graeco-Roman museum 21992. Cf. Savvopoulos and Bianchi 2012: no. 38).

[30] CPI 27. 'Ὑπὲρ βασιλέως Πτολεμαίου, θεοῦ Νέου Διονύσου, καὶ τῶν τέκνων αὐτοῦ, θεῶν Νέων Φιλαδέλφων, Εἴσιδι θεᾷ μεγίστῃ Νεφερῶς Βαβαῦτος ἐκόμισα τὸν ἱερὸν τόπον τοῖς κυρίοις θεοῖς μεγίστοις. (ἔτους) κθʹ, Παχὼν{ι} κθʹ. ('*For king Ptolemy, the god New Dionysos, and his children, the gods new Philadelphoi, to Isis the greatest goddess, I, Nepheros son of Babaus, embellished the sacred place for the lords the greatest gods. Year 29, month Pachon 29*').

[31] Cf. the so-called Anfuchi Triad, a traditional Egyptian statue group, inscribed with hieroglyphs. It represents Ptolemy II, Ammon and

the absence of the Egyptians would be more or less expected in a Hellenophone context. Yet as well as these two examples, we find other inscriptions from all over the kingdom, and these, leave no doubt that there were Egyptians who chose to communicate in Greek in favour of their kings.[32]

The next group of inscriptions concerns another key feature of the religious life in Ptolemaic Alexandria involving the Ptolemies – their deification. By no means did the Alexandrian kings hesitate to include themselves in the pantheon of Hellenistic Egypt, or refrain from making themselves the subjects of public cultic expressions. Rather, their active promotion of the religious dimensions of royal authority led to the establishment of the cult of Ptolemaic divine kingship. It is difficult to give a summary appraisal of such a complex and all-encompassing phenomenon, which extended from the collective worship of the dynasty, to cults focussed on specific kings or couples, to its more diffuse expression in Egyptian and Greek customs and manners. Here, however, we are obliged to confine our attention to drawing out the aspects indicated by the evidence under examination.[33]

The collective dynastic cult of the Ptolemies encompassed the entire lineage of the dynasty, and was developed progressively during the Ptolemaic period, starting with the adoption of Alexander the Great as the symbolic founder of the dynasty. An ideology – an all-pervasive system of images, myths and public acts centred on him – became the fulcrum of dynastic worship in the city.[34] To that end nothing could support this ideological framework more than the body of Alexander itself, which would soon constitute the focal point of dynastic worship in the city. An eponymous priest, known as the Priest of Alexander, was placed in charge of the cult. During the Ptolemaic period this significant post was held by an eminent figure at court, usually a Greek, and on many occasions even a member of the royal family as well.[35] In the course of the third century BC the epithets of other Ptolemaic royal couples would be gradually added to the to the official title of Alexander an emine while in the years of Ptolemy IV Philopator, another decisive step occurred.[36] The Soma or Sema, a mausoleum for Alexander and the Ptolemaic Dynasty, was constructed in a prominent position in the Royal Quarter. Thus, the elevation of Alexander to symbolic 'primogenitor' of the Ptolemaic dynasty was monumentally represented within the topography of Alexandria.

A fragmentary synodal decree dating to the beginning of the reign of Ptolemy IX Soter II (112 BC) provides rare evidence for the development of the dynastic cult during the Ptolemaic period. The preserved text provides a list of major eponymous priests in charge of royal cults in Ptolemaic Alexandria, headed by the Priest of Alexander, namely Artemidoros, son of Sotion. Artemidoros is accompanied by his full title, which provides a detailed record of the royal Ptolemaic lineage from Alexander the Great onwards: 'the Priest of Alexander, and of the Gods Soteres, and the Gods Adelphoi, and of the Gods Euergetai, and of the Gods Philopatores, and of Gods Epiphaneis, and of God Eupator, and of God Philometor, and of and of God New Philoparor, and of God Euergetes (II), and of Goddess Euergetes (II) and of Goddess Philometor Soteira'.[37]

It is interesting that the title of Alexander's Priest may include Ptolemies who never inherited the kingship,

Arsinoe II. Alexandria Graeco-Roman Museum 11261. Savvopoulos and Bianchi 2012: no. 29.

[32] Cf. CPI 228 (TM 6086), CPI 238 (TM 8152) and CPI 252 (TM 6628), from Fayoum; CPI 132 (TM 104516) and CPI 172 (TM 6431), from the Delta area; CPI 310 (TM 6051) from Akoris; CPI 543 (TM 6429) and CPI 551 (TM 6391), of uncertain provenance.

[33] Cf. *Ptol. Alex*. I., 213-246; Chaniotis 2005: 436-437; De Callatay and Lorber 2011: 417-455.

[34] In addition, the cult of Alexander Ktistes (founder) was established by 291 BC and retained its autonomy for most, if not all, of the Ptolemaic period. Cf. *Ptol. Alex*. I, 215.

[35] In the years of Ptolemy I Soter, the Priest of Alexander was Menelaus, the king's brother (284/283 BC). In the years of Ptolemy IV Philopator it was the courtier Sosibios, notorious for his deadly conspiracies. Later, in the reign of Ptolemy VIII and Kleopatra III, the king and the queen themselves were priests of their own cult. Cf. Hölbl 2001: 287.

[36] By 272/271 BC the title of *Theoi Adelphoi* was added to the official titles of Alexander's Priest. Meanwhile, Ptolemy II elevated his parents to divine status in multiple ways, including dedicating the great Pharos Lighthouse to the *Theoi Soteres,* Ptolemy and Berenike. He founded the Ptolemaieia, which involved extravagant festivities in honour of his father Ptolemy I Soter, with impact beyond Egypt's borders. The so-called Great Parade of Ptolemy II Philadephos was possibly part of the Ptolemaieia festival, during which the statues of Alexander and Ptolemy were prominently displayed. The Great Parade was described by Kallixeinos (*FGrHist* 637F2= Athenaeus, 5.197c-203b; Rice 1983). In the years of Ptolemy III Euergetes, and after the successful outcome of the Third Syrian War, the title of *Theoi Euergetai* was also added. Finally, at the same time *Theoi Philopatores* and, for the first time, the *Theoi Soteres*, were included in the official titles of the Priest of Alexander, thereby creating a full genealogical list from the current dynastic ruler, reaching back to the symbolic founder. Cf. Hölbl 2001: 39-40 and 94.

[37] CPI 2. The Greek text reads: Βασιλευόντων Κλεοπάτρας καὶ Πτολεμαί[ο]υ, [θεῶ]ν Φιλομητόρων Σωτήρων, ἔτους ἕκτου Φαῶφι ἐπὶ ἱερέως Ἀρτεμιδώρου τοῦ Σωτίωνος Ἀλεξ[ά]νδ[ρου] καὶ θεῶν Σωτήρ[ων κα]ὶ θεῶ̣ν Ἀδελφῶν καὶ θεῶν Εὐεργετῶν καὶ θε[ῶν Φιλοπα]τόρων καὶ θεῶν Ἐπιφανῶν κ[α]ὶ θεοῦ Εὐπάτορο[ς καὶ θεοῦ] Φιλομήτορος καὶ θεοῦ̣ Νέοῠ Φ[ι]λοπάτορο[ς] καὶ [θεοῦ Εὐεργ]έτου καὶ θεᾶς Εὐεργέτιδος τῆς καὶ [Φιλ]ομή[τορος Σωτ]είρας, ἱεροῦ πώλου Ἴσιδος θεᾶ[ς] με[γάλ]η[ς μητρὸς θε]ῶν Κρατέρου τοῦ Κρατέρου,/ ἀθλοφόρου Βερενίκης Εὐεργέτιδος Δημ[....... τῆς ...]ου κ[α]νηφόρου] Ἀρσινόης Φιλαδέλφου Φιλα?[.... τῆς...] ου ἱερείας Ἀ[ρ] σιν[όης Φιλ]οπάτορος Χαρμι?......('*In the reign of Kleopatra and Ptolemy, the gods Philometores Soteres, the sixth year, Phaophi, when Artemidoros son of Sotion was priest of Alexander, and the gods Soteres, and the gods Adelphoi, and the gods Euergetai, and the gods Philopatores, and the gods Epiphaneis, and the god Eupator, and the god Philometor, and the god New Philopator, and the god Euergetes and the goddess Euergetis, also called Philometor Soteira, when the hieropolos (Sacred Foal) of Isis, the goddess, the Great Mother of Gods, was Krateros son of Krateros, when the Athlophoros of Berenike Euergetis was Dem(...)tes(...)ou, when the Kanephoros of Arsinoe Philadelphos was Phila(... daughter of...)ou, when the priestess of Arsinoe Philopator was Charmi(...)*').

Figure 11. CPI 30. Base of a statue of Arsinoe Philadelphos.

such as Ptolemy New Eupator, son of Ptolemy VI and Kleopatra II, who died at the age of 12 or 13 in 152 BC. On the contrary, the newly enthroned king, Ptolemy IX Soter II, is still absent from the list. Nonetheless, his mother and co-ruler, Kleopatra III, is featured at the bottom of the list, identified by the cultic epithets of both her uncle-cum-husband, Ptolemy VIII Euergetes II, and of her son, Ptolemy IX Soter II. Kleopatra III's mother, Kleopatra II, is also missing, even though she got married and shared the crown with both of her siblings, Ptolemy VI (Philometor) and VIII (Euergetes II). As a result, both Ptolemies VI and VIII appear as single, with no reference to their common spouse. Kleopatra II's difficult relationship with her daughter Kleopatra III– the living queen, who was of course also in control of the dynastic cult – might have been the reason behind such a major absence in the list, unlike all previous generations of rulers who appear as couples.

The synodal decree also includes the titles of priests, who presided over the worship of other individual rulers, or couples. The Athlophoros of Berenike was the priestess in charge of the cult of Berenike II, established by her son Ptolemy IV. The title, 'the contest-prize bearer', most probably refers to the victories of Berenike's horses in Nemea and Olympia.[38] Further on we find the title of Kanephoros, (the basket bearer), referring to the high esteem priestess in charge of the cult of the deified Arsinoe II Philadelphos; without any doubt the most widespread and enduring cult of an individual ruler.[39]

Indeed, there is substantial evidence for the cult of Arsinoe and the Philadephoi (including Ptolemy II) in the Alexandrian section of the Corpus of Ptolemaic inscriptions. A series of rather laconic dedications to Arsinoe II Philadelphos have been discovered in the city, indicating the wide popularity of her cult.[40] One of them merits more attention: an inscribed granite base of a statue of Arsinoe II, 'at the heart of the city' (Figure 11).[41] The dedicator was an Alexandrian civilian, Thestor, son of Satyros. The name of the deified Queen appears in the accusative, Ἀρσινόην Φιλάδελφον, in contrast to other dedications where the Queen is referred to in the dative, indicating that she is the recipient of specific acts. Scholars in the past have interpreted this inscription as an honorific dedication, probably marking the acquisition of citizenship by Thestor. For them, the plain *Alexandreus* toponymic may refer to a distinct group of citizens, perhaps of lesser status than the demsmen (full-right citizens), or else to an intermediate stage, prior to obtaining full membership of a deme. In the absence of further corroborating evidence, however, both interpretations remain open to conjecture.[42]

[38] Ptolemy IV also built a temple for Berenike 'the saviour' at the coastal area near Alexandria. Cf. *Ptol. Alex.* I. 238-239: Hölbl 2001.170ff.

[39] The cult was established after the Queen's death, by her brother-husband Ptolemy II. Deified Arsinoe II acquired her own temple in the city centre, the Arsinoeion, to which an obelisk of Nektanebo II from Heliopolis was transferred (Pliny, *NH* 36.14). Kallixeinos in the Great Procession also mentions that the parade passed in front of the Arsinoeion and the Berenikeion, temples dedicated to Ptolemy II's wife-sister, Arsinoe II, and mother, Berenike I (FGrHist, 627, F2, 202D). Another temple was built in the Cape of Zephyrium in the Kanopic region, in honour of Arsinoe-Aphrodite Euploia, protector of sailors. There are two dedications related to the latter form of Arsinoe cult. CPI 586 (TM 6275), perhaps from the Delta area, is dedicated to Aphrodite Akraia Arsinoe. The epithet Akra may well refer to both deities. Aphrodite was worshipped as protector of sailors in Cyprus under the epithet Akraia, while Arsinoe the official protector of the Ptolemaic fleet, had a temple in Akra (Cape) of Zephyrion, in Kanopos. The founder and first priest of her cult was the admiral of the Ptolemaic fleet Kallikrates, son of Boiskos, from Samos. In the second example, from Alexandria, CPI 33, we find Simon, son of Kallikrates in the role of the priest of Arsinoe 'New Aphrodite', indicating that the cult of Arsinoe-Aphrodite was a family affair for Kallikrates. Cf. *Ptol. Alex.* II, 385-386, n. 367; Bing 2003. For the establishment and diffusion of her cult, Hölbl 2001: 101-104.

[40] CPI 29-32.

[41] According to the first publication (Wescher 1864: 125), it was found in the area of the ancient Broucheion district (Royal Quarters). CPI 30. Ἀρσινόην Φιλάδελφον, Θέστωρ Σατύρου Ἀλεξανδρεύς. (*'(The statue of) Arsinoe Philadelphos, I, Thestor son of Satyros, Alexandrian'*).

[42] Cf. el-Abbadi 1962 for a critical overview arguing against the graded citizenship model; *Ptol. Alex.* I 38-43, 49-55, 128-9, including criticism of el-Abbadi, without however, providing any new evidence supporting the graded-citizenship model (II, 177, n. 24, 130, n. 100); also Bingen 2007, further against the graded-citizenship model.

Figure 12. CPI 32. Great Sarapeion. Altar dedicated to Theoi Adelphoi.

Seeing inscriptions in their rightful place, for the dedication of a particular statue for example, can help to clarify their role and meaning. Comparing inscribed statue bases found in Ptolemaic Egypt shows that honorific inscriptions always state or imply why the dedication was made, whether this be expressed in particular or in general terms. For example, a king is benevolent to his subjects, or an official has good intentions towards his king.[43] Yet the accusative case has an additional use in statue bases: it can serve to describe the actual medium to which it is related. Thus, in many inscribed bases we find the names of gods such as Hermes and Herakles written in the accusative, referring to the actual statues of the above-mentioned gods.[44] The same seems to apply to the statues of kings, whether appearing as deified or not, in that they are frequently referred to by name in the accusative, while the dedicants' names are in the nominative with no further information about the occasion of the dedication, as in purely honorific statues.[45] Furthermore, the accusative is also used in dedications for describing temple structures and other ritual paraphernalia, such as 'the temple and the sanctuary of Sarapis' (τὸν ναὸν καὶ τὸ τέμενος, CPI 012), and ex-votos (εὐχὴν) dedicated to deities such as Boubastis. Here we find that the inscription informs us that the statue presents Arsinoe Philadelphos, the deified Queen, and that it was dedicated (sponsored) by Thestor. In contrast to the above-mentioned interpretations, such an approach suggests that Thestor might have enjoyed a rather privileged status in Alexandria, as he has both the funds and the 'permission' to provide a divine royal statue in a sacred venue of the city centre, why not in the Arsinoeion.

The rest of inscriptions of this category are related to the cults of Ptolemaic couples in sacred venues of the city, under a *synnaos* (temple-sharing) arrangement. An inscribed altar found in the Great Sarapeion, which is believed to have been dedicated to Arsinoe II and her husband,[46] indicates a de facto status of *synnaoi* (temple-sharing gods) with the sanctuary's other principal deities (Figure 12).[47] Another dedication plaque found in the district of Victoria, on the eastern side of the city, suggests that patronage of a local sanctuary in the area was shared between the gods Adelphoi and Olympian Zeus, the head of the Greek Pantheon, and Zeus Synomosios (in the name of whom oaths are made).[48] Added to the *synnaos* status of Philadelphoi with the Alexandrian Divine Triad (cf. the Sarapeion) and Ammon (cf. the Anfuchi Triad)[49] this example confirms the flexibility at play during the development of the royal cult, being developed to the overriding common denominator of religious life of Alexandria, and Egypt, accommodating to the differences in cultural preferences and audience.

The establishment of royal cults for individual rulers that are adjoined to Greek deities continues in the reign of Ptolemy IV. An inscribed plaque celebrates the foundation of a temple dedicated to the 'Benefactor Gods' (Ptolemy III and Berenike II) and Hestia.[50] Both

[43] For instance, CPI 34, dedication of a statue group to Ptolemy V, his wife Kleopatra I, and the gods Philopatores (Ptolemy IV and Arsinoe III) by courtiers 'εὐεργεσίας ἕνεκεν τῆς εἰς αὑτοὺς καὶ τοὺς οἰκείους› ('*on account of their beneficence to them and their relatives*'). See also below for examples of honorific statuary, where the reason is clarified or implied by the relationship between the dedicant and the dedicatee (i.e. a doctor and the King respectively).

[44] For instance, CPI 374 (TM 104221), from Kerameia Madou. Ἀρχήβιος ε--, ἀνέθηκεν τόν Ἡρακλή , - - ἐπ' ἀγαθ[ῷ] ('*Archebios dedicated the (statue of) Herakles...for the benefit*); also, dedication to Apollo from Alexandria, possibly Ptolemaic, CPI 605 (TM 104031), l. 2-3: τὸν θεὸν καὶ τὴν ζωθήκην ('*the (statue of) god and the shrine*').

[45] Cf. CPI 417, from Elephantine (TM 53481). [Βασιλέα Πτολεμαῖο]ν καὶ βασίλισσαν Κλεοπάτραν, [θεος Φιλομήτορα]ς καὶ Πτολεμαῖον τὸν υἱὸν αὐτῶν, [Πελαίας Βιήγχιος] ἱερεύς καὶ πρῶτος στολιστὴς, [τῶν ἐν Ἐλεφαντίν]ηι καὶ τῶι Ἀβάτωι καὶ Φίλαις, ἱερῶν. ('*(The Statue of) king Ptolemy and queen Kleopatra, gods Philometores, and Ptolemy their son, I, Pelaias son of Bieghes, priest and first stolistes of the abaton of Philai and other sanctuaries of Elephantine*'); CPI 104 (TM 7266), from Kanopos. Βασίλισσαν Κλεοπάτραν θεὰν Εὐε[ργέτιν]. Διονύσιος Τροεξηνίο[υ?. ('*(The Statue of) Kleopatra Goddess Euergetes, I, Dionysios son of Troexenios*').

[46] Another small portable altar dedicated to the Theoi Adelphoi was found in the Western Harbour, CPI 31.

[47] CPI 32. Also, a granite statue of Arsinoe II as well as statues of two high priests of Ptah from Memphis, (responsible for the cult of Arsinoe in the *chora*) were discovered in the site of the Sarapeion. They would have provided a suitable monumental environment for the royal cult. Cf. Savvopoulos and Bianchi 2012, nos. 32 (Alexandria Graeco-Roman Museum 14941) and 34 (Alexandria Graeco-Roman Museum 17533 and 17534), and Appendix, I, 27806.

[48] CPI 15. Ὑπὲρ βασιλέως Πτολεμαίου, τοῦ Πτολεμαίου καὶ Ἀρσινόης θεῶν Ἀδελφῶν, καὶ βασιλίσσης Βερενίκης τῆς γυναικὸς καὶ ἀδελφῆς τοῦ βασιλέως θεῶν Εὐεργετῶν, {καὶ} θεοῖς Ἀδελφοῖς <καὶ> Διὶ Ὀλυμπίωι καὶ Διὶ Συνωμοσίωι τοὺς βωμοὺς καὶ τὰ τεμένη καὶ τὴν συνκύρουσαν αὐτοῖς γῆν Κλέων καὶ Ἀντίπατρος οἱ ἱερεῖς τοῦ Διός. ('*For king Ptolemy, son of Ptolemy and Arsinoe, gods Philadelphoi, and queen Berenike, the sister and wife of the king, gods Euergetai, to the gods Adelphoi, and Olympian Zeus, and Zeus Synomosios, the altars and the sanctuaries, and the land appertaining to them, Kleon and Antipatros, the priests of Zeus*').

[49] cf. for the Anfuchi Triad note 31, above.

[50] CPI 24.[Ὑπὲρ βα]σιλέως Πτολεμαί̣ο̣υ̣ [καὶ βασιλί]σσης Ἀρσινόη[ς], [τὸ τέμε]νος καὶ τὸν βωμὸν [τῶν] πανθέων καὶ εὐσεβῶν [θεῶν βα]σιλέως Πτολεμαίου/[καὶ βα]σιλίσσης Βερενίκης θεῶν Εὐεργετῶν <καὶ> τὸ τέμενος [καὶ τὸν βω]μὸν Ἡστ[ί]ας πανθέου.......ς

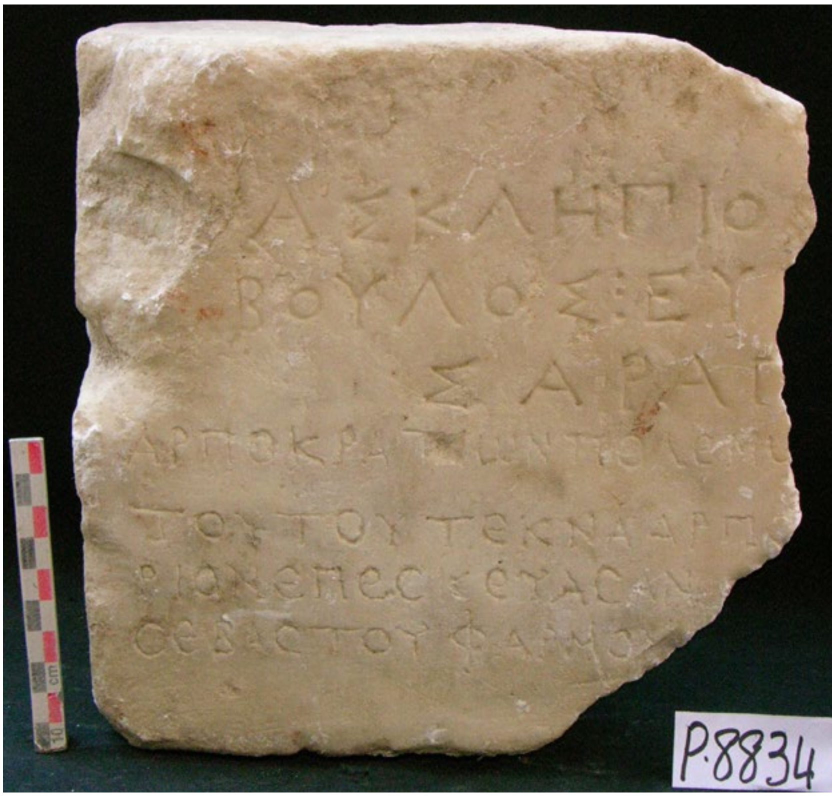

Figure 13. CPI 40. Great Sarapeion. Base of a statue dedicated to Sarapis.

Figure 14. CPI 41. Great Sarapeion. Base of a statue group (?) of Sarapis and Isis.

the royal couple and Hestia appear as *pantheoi* (all-divine); a unique epithet for the Ptolemaic period. In the case of Hestia, it would be difficult to trace any reason for her *pantheos* status since – at least in public – this Greek deity played a rather negligible role in Egypt. Still, Hestia was part of the group of Greek female deities who became assimilated with Isis, and the latter might appropriately be called Pantheos, as she had encompassed the identities of several Greek and Egyptian female deities.[51] Finally, in the foundation plaques of the temple dedicated to Sarapis and Isis mentioned above, (CPI 23), Ptolemy IV and Arsinoe III appear as *synnaoi,* the only known example of an

Ἀριστόμ<ε>νους......ΕΥ..... (‘*For king Ptolemy and queen Arsinoe, the sanctuary and the altar of the universal and pious gods, of king Ptolemy and queen Berenike, gods Euergetai, and the sanctuary and the altar of Hestia Pantheos, by ... son of Aristomenes*’).

[51] According to a Hymn to Isis from Narmouthis, CPI 281 (TM 6304-7), l.22, the Greeks would call her ‘Ἀφροδίτην, καὶ Ἑστίαν ἀγαθήν, καὶ Ῥεῖαν, καὶ Δήμητρα›.

inscribed monument where the Ptolemies claimed such an equal and direct divine partnership. At last, the above-mentioned synodal decree (CPI 2) also includes the eponymous of priest of Arsinoe IV, who also apparently received her own individual cult in the city.

Next, the catalogue includes a series of dedications made by individuals, which make no reference to the royal house.[52] Two exceptional cases, discovered in the Sarapeion, comprise the earliest (first half of the third century) but most prominent dedications of divine statuary, which survive from the sanctuary. One of them was crafted by an artist called Delokles (Figures 13-14).[53] As usual, the dedications provide no detailed information about the dedicants, apart from their patronymics, as well as a toponymic for one of them, Aristodemos, who is an Athenian.[54] Aside from this they offer no details about their status, whether they were courtiers, Alexandrian citizens, newcomers or visitors to the city.[55]

The rest of the dedications in this section cover a wide range of divine names from Alexandria's varied religious pantheon indicating that individuals were able to develop their own individual repertoire of divine representatives; or they might even encompass them all, confessing their faith to 'Θεοῖς πᾶσι καὶ πάσαις›,[56] including Sarapis, Isis, Osiris, Anoubis and Asklepios, as well as Herakles and Hermes who were commonly the patrons of gymnasia in Egypt. Of course, in the Ptolemaic conception of divinity, such deities are usually polyvalent, as compared to the traditional Greek or Egyptian religious systems. For example, Hermes appears alongside Sarapis and Isis in a dedication made by Libys and his family. Still, on the surface of the votive, Hermes is represented by the image of an Ibis bird, the animal manifestation of Thoth, Hermes' Egyptian counterpart, which stands on a caduceus the symbol of Hermes.[57]

Regarding religious expressions, we also need to consider the other residents of Alexandria, whose cultural heritage allowed for less flexibility in their religious modus vivendi. Such were the Jews of Alexandria, the third largest group of people living in the city. Epigraphic evidence suggests that they brought their own divine representative, the 'Ultimate God', to the Ptolemies for approval. Once the 'terms and conditions' of the crown had been met, they would build their own religious venues and express their traditional beliefs ῾Υπὲρ βασιλέως.[58]

Next, we turn to a small group of honorific inscriptions found on the bases of statues.[59] Two of these inscriptions concern the royal house and the figures that played a key role in the private, everyday life of the royal family. The first is the dedication made by Ptolemy III to his doctor, apparently for providing cure for the King or another member of the royal family. The second concerns Tryphaina, the *trophos* (nurse) of Ptolemy XII Auletes, who was also the sister of the high-ranking courtier, Ammonios. The other four inscribed statues in this group are dedicated to high-ranking courtiers, military people and civic officials: for example, there are dedications to Megamedes, a courtier member of the group of (King's) Protoi Philoi (First Friends);[60] to the chief-guard and chief-huntsman Ptolemy, son of Ptolemy, for his good will to Ptolemy V and Kleopatra I; to Gymnasiarch Lykarion, who also held a series key of civic offices such as *exegetes* (advisor) and was 'in charge of the city'; and another governor whose name is lost; finally we have an inscription from the last days of Ptolemaic Alexandria, dedicated to Marcus Antonius, 'ἀ̣μίμητον ἀφροδισίοις› (Figure 15).[61]

The last category of inscriptions to be reviewed from Alexandria covers the epigraphic evidence from the Alexandrian cemeteries.[62] The necropoleis of Alexandria represent the most well preserved category of archaeological remains in the city. As a result, they comprise a particularly rich source of information for

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52 CPI 37-53.

53 CPI 41. Δηλοκ[λῆς ἐπ]οί[ει]·Ἀριστόδημος Διοδ[..]ου Ἀθηναῖος, Σαρά[πι κ]αὶ Ἴσι. The patronym will be either Διοδ[ώρ]ου or Διοδ[ότ]ου. CPI 40. Ἀσκληπιόδ[..ος, Εὔ]βουλος ΕΥ[— — —], Σαράπ[ιδι or ει].

54 For the presence of Athenians in Alexandria see *Ptol. Alex.* II, 149, n. 206.

55 If Aristodemos was acting publicly as an Athenian representative, as is possible, this dedication could be based on the outcome of some matter related to the friendship between Athens and the Ptolemies. In the context of this friendship, Aristodemos' dedication could express the respect of Athens for Alexandria's emblematic deities, the most ambitious cultural project of the Ptolemies, while enabling the diffusion of the Sarapis cult – and whatever represents it in ideological terms - beyond the 'Alexandrian borders'; cf. Habicht 1992; Hölbl 2001: 23-24.

56 From inscribed altar dedicated to 'all gods and goddesses', by Pythogeiton, son of Neilon,most probably from Alexandria, CPI 580.

57 CPI 48.

58 There are two fragmentary epigraphic texts related to the foundation of synagogues in Alexandria: CPI 28 (37 BC). ῾Υπὲρ] βα̣σ̣[ιλίσση]ς̣ καὶ β[ασιλ]έως θεῶ[ι μεγάλωι ἐ[πηκό]ωι. Ἄλυπ̣[ος τὴν] π̣ροσε[υχὴν] ἐπόει, (ἔτους) ιε´ Με[χεὶρ ..]. ('*For Queen and King to the great god who listens to prayer, Alypos (?) made the synagogue. Year 15, Mecheir ..*'); CPI 25. (Hadra, 3rd - 2nd century BC). `Υπὲρ βασιλέως Πτολεμαίου καὶ βασιλίσσης.......][— — — θε]ωι ὑψίσ̣τωι [τ]ὸν ἱερὸν, [περίβολον καὶ] τὴν προσ[ευχὴν καὶ τὰ συγ]κύροντα. ('*... to the Supreme God, ... the sacred (precinct ?) and the synagogue and its appurtenances'*). Both follow the ῾Υπὲρ βασιλέως dedication model, common in pagan temples, except for the substitution of the term 'προσευχή' (for synagogue) instead of 'the shrine' or 'the temple'. Also, the divine nature of the Ptolemies is not acknowledged, as it would have conflicted with Jewish religion. Still, papyrological evidence suggests the familiarity of the Jewish community with the Ptolemaic divine epithets, indicating the permeability of the boundaries, in such a multi-faceted cultural environment (Cf. P. Tebt. 3 817, SB 1 4232, http://www.papyri.info/hgv/5396).

59 CPI 54-60.

60 Cf. Lanciers 2018, on honorific court titles, focusing on the case of Megamedes.

61 Meaning, '*inimitable in love affairs or inimitable lover*', CPI 60.

62 CPI 61-74.

Figure 15. CPI 60. Statue in honour of Marcus Antonius.

research into art, architecture, religion, burial habits and cultural identity of Greco-Roman Alexandria.

Of course, not all inscribed monuments from the necropolis could be included in the Corpus as they are very numerous, and often they merely indicate the name of the tomb occupant. So we have made a selection, based on historical and philological criteria, and the rest will be listed in an appendix. The selection includes some brilliant examples of metrical epigrams, which of course demand much more attention than a few lines. Perhaps we can consider two examples. The voices they convey can serve as an epilogue to this overview. The first inscription concerns the plight of an ordinary person who unexpectedly walks the μέλαιναν ὁδόν (the 'dark road' of death)[63]. Her name is Aline, she is a most beloved wife and mother, whose interest and care for the family extends beyond death. Her epitaph is an address to passersby:

> Although you are [only] herdsmen, you who pass along this road,
> and shepherds who pasture flocks of sheep,
> Nevertheless you, traveller, nurtured in the works of the Muses,
> **4** stop and address the tomb of Aline, and then go on your way.
> May your greeting be returned to you twice over. I have left at home
> three children and a grieving husband.[64]

The second epigram is an expression of farewell to another Alexandrian who also died unexpectedly at an early stage: a youth in his heyday, a beloved friend, a lively civilian in a glorious city. The readers of C. P. Cavafy, the great modern Alexandrian poet, may see in epigrams like this the 'candles' of inspiration for his historical hologram of Ptolemaic Alexandria, and the shadows residing in it:

> No more, Philoxenos, does your mother take you in her arms,
> in a lingering embrace of your lovely neck;
> Nor have you visited the glorious city in the company of the other young men,
> **4** rejoicing in the shady ground of the gymnasium.
> Instead, your father brought back your pale bones and placed them here,
> after Kaunos burned away your flesh in raging fire.[65]

[63] Extract from the metrical epigram of Stratonike. CPI 61.

[64] CPI 72. εἰ καὶ βουκόλοι ἄνδρες | ὁδὸν διαμείβετε τήνδε, | καὶ ποίμνας οἴων | φέρβετε μηλονόμοι, | ἀλλὰ σύ, Μουσείοις καμ[άτο]ις| τεθραμμέν' ὁδῖτα, | ἴσχε καὶ αὐδήσας |σῆμ' Ἀλίνης ἄπιθι. | χαῖρ' εἰπὼν δὶς [δ' α]ὐτὸς | ἔχοις τόδε· τέκνα δὲ λείπω | τρίζυγα καὶ ποθέοντα | ἄνδρα λέλοιπα δόμοις. Translation by Simon Hornblower.

[65] CPI 62. οὐκέτι δὴ μάτηρ σε, Φιλόξενε, δέξατο χερσίν, | σὰν ἐρατὰν χρονίως ἀμφιβαλοῦσα δέρην,| οὐδὲ μετ' ἀιθέων ἀν' ἀγάκλυτον ἤλυθες ἄστυ | γυμνασίου σκιερῶι γηθόσυνος δαπέδωι. | ἀλλά σου ὀστέα πηγὰ πατὴρ θέτο τεῖδε κομίσσας, | Καῦνος ἐπεὶ μαλερῶι σάρκας ἔδ<α>υσε πυρί. Translation by Simon Hornblower.

Appendix: List of Ptolemaic inscriptions from Alexandria in the Corpus of Ptolemaic inscriptions

CPI no.	Pr. Catalogue / publication	TM	Location	Date (BC)	Content
1	I. Alex. Ptol. 40	7092	Alexandria, Graeco-Roman Museum 45	Mid-3rd c.	Decree of the city of Alexandria
2	I. Alex. Ptol. 30	53707	Cairo, Egyptian Museum CG 9299	112	Decree of a priestly synod
3	I. Louvre 12	107200	Paris, Louvre unknown	3rd c.	Dedication to Hermes and Herakles
4	I. Alex. Ptol. 28	5975	Tübingen, Archäologisches Institut S 13 / 3945	163/145	Dedication of the seats of a gymnasium
5	SEG XXXIV 1532	104985	Alexandria, Graeco-Roman Museum 208	2nd c.	Document concerning the gerousia
6	I. Alex. Ptol. 32	5976	Alexandria, Graeco-Roman Museum 24045	112/111 or 76/75	Dedication to Zeus Soter and Hera Teleia
7	I. Alex. Ptol. 45	7166	Alexandria, Graeco-Roman Museum 169	99/30	Honorary decree of an association
8	I. Alex. Ptol. 1, I. Varsovie 43	6369	Warsaw, National Museum 198762	304/282 or mid-3rd c.	Dedication to Sarapis and Isis
9	I. Alex. Ptol. 5	6083	Alexandria, Graeco-Roman Museum 8597	283/279	Dedication of a sanctuary to Sarapis and Isis
10	I. Alex. Ptol. 6	107252	Alexandria, Graeco-Roman Museum 20	283/246	Dedication to saviour gods
11	I. Alex. Ptol. 38	107256	Location unknown	279/204	Dedication on behalf of a king and queen
12	A. Alex. Ptol. 13	6209	Alexandria, Graeco-Roman Museum 8357	246/222	Foundation plaques of the Sarapeion
13	Abd el-Maksoud *et al.* 2015	N/A	Alexandria (MoA stores)	246/222	Foundation plaques of Boubasteion
14	I. Alex. Ptol. 16	6479	Alexandria, Graeco-Roman Museum 32	246/222?	Dedication by Berenike II?
15	I. Alex. Ptol. 14	6381	Alexandria, Graeco-Roman Museum 36	246/222	Dedication of land and altars to monarchs and to Zeus
16	I. Alex. Ptol. 17	5973	Alexandria, private collection	222/204	Foundation plaque of a temple of Isis
17	I. Alex. Ptol. 22	6387	Cairo, Egyptian Museum CG 27581	222/204	Dedication to Demeter, Kore and Dikaiosyne
18	I. Alex. Ptol. 21	6210	Alexandria, Graeco-Roman Museum 10035	222/204	Foundation plaques of the temple of Harpokrates
19	I. Varsovie. 45	107254	Warsaw, National Museum 198744	216/204	Dedication to Sarapis and Isis
20	I. Alex. Ptol. 19	6535	Alexandria, Graeco-Roman Museum 17479	216/204	Dedication to Sarapis and Isis
21	I. Alex. Ptol. 23	6385	Formerly Alexandria, Private collection Puglioli	217? (222/204)	Dedication by Ptolemy IV Philopator
22	I. Alex. Ptol. 24	43668	Alexandria, Graeco-Roman Museum 40	216/204	Dedication to Anoubis
23	I. Alex. Ptol. 18	6691	Formerly Cairo, Private collection Farouk	216/204	Foundation plaque of the temple of Sarapis and Isis
24	I. Alex. Ptol. 25	107255	Alexandria, Graeco-Roman Museum 34	216/204	Dedication of a sanctuary and an altar to Hestia and the gods Euergetai
25	I. Alex. Ptol. 62	6533	Alexandria, Graeco-Roman Museum 17481	2nd c?	Dedication of a synagogue
26	I. Musée d'Alex. 40	6496	Alexandria, Graeco-Roman Museum 50	107/102?	Dedication on behalf of monarchs

CPI no.	Pr. Catalogue / publication	TM	Location	Date (BC)	Content
27	I. Alex. Ptol. 34	6424	Formerly Munich, Private collection von Bissing	52	Dedication to Isis
28	I. Alex. Ptol. 35	6425	Alexandria, Graeco-Roman Museum 48	37	Royal Edict about a synagogue
29	I. Alex. Ptol. 12	7033	Alexandria, Graeco-Roman Museum	279/268	Dedication to Arsinoe II
30	I. Alex. Ptol. 10	6602	Alexandria, Sarapeion, podium of Diocletian's column	279/268	Inscribed base of a statue of Arsinoe II
31	I. Alex. Ptol. 7	107253	unknown	279/268	Inscribed altar of Ptolemy II and Arsinoe II
32	I. Alex. Ptol. 8	6414	Alexandria, Graeco-Roman Museum 56	279/268	Inscribed altar of Ptolemy II and Arsinoe II
33	I. Alex. Ptol. 37	58448	Alexandria, Graeco-Roman Museum 33	270/222	Dedication to a Ptolemy
34	I. Alex. Ptol. 26	6418	Alexandria, Graeco-Roman Museum 54	204/193	Inscribed base of a statue group
35	I. Alex. Ptol. 39	107257	Alexandria, Graeco-Roman Museum 44	II	Dedication to Kleopatra II or III
36	I. Alex. Ptol. 31	6316	Alexandria, Graeco-Roman Museum 64	88/80?	Inscribed base of a statue of Ptolemy IX
37	I. Alex.Ptol. 60	103550	Alexandria, Graeco-Roman Museum 17521	IV-Iii	Dedication to Asklepios
38	Benaki 53	N/A	Athens, Benaki Museum	Late 4th c.?	Dedication by Kokalos on behalf of Nikanor
39	SB 1 412	93365	Athens, National Museum, Demetriou Collection 70	Late 4th c. /250	Dedication to Sarapis and Isis
40	I. Alex. Ptol. 4	5951	Alexandria, Graeco-Roman Museum 8834[a]	299/275	Dedication to Sarapis
41	I.Alex. Ptol. 2 b	5944	Alexandria, Graeco-Roman Museum 9025[a]	299/275	Dedication to Sarapis and Isis
42	I. Alex. Ptol. 57	6693	Alexandria, Graeco-Roman Museum 28	275/225	Dedication to Apollo
43	I. Alex. Ptol. 61	104505	Alexandria, Graeco-Roman Museum 8306	260/222	Dedication to gods (?) by Porres
44	I. Alex. Ptol. 53	5986	Formerly Cairo, Private collection Michaelidis	225/200	Dedication to Osiris
45	I. Alex. Ptol. 49	104506	Alexandria, Graeco-Roman Museum 10145	225/175	Dedication to Isis and other goddesses
46	I. Alex. Ptol. 50	103545	Alexandria, Graeco-Roman Museum 8	3rd c.	Dedication to Isis
47	I. Louvre 17	103909	Paris, Louvre MA 4761	134/133?	Dedication to Hermes and Herakles
48	I. Alex. Ptol. 55 bis	107267	Alexandria, Graeco-Roman Museum (?)	II	Dedication to Isis, Sarapis and Hermes
49	I. Alex. Ptol. 54	98606	Alexandria, Graeco-Roman Museum 20921	3rd /1st c.	Dedication to Anoubis
50	I. Alex. Ptol. 43	47693	Alexandria, Graeco-Roman Museum 63	2nd /1st c.	Dedication to a deity (?) and the *synnaoi theoi*
51	I. Alex. Ptol. 56	7146	Alexandria, Graeco-Roman Museum 5	99/30	Dedication of a statue to Isis (?) and the *synnaoi theoi*
52	I. Alex. Ptol. 59	103738	Alexandria, Graeco-Roman Museum 19078	unclear	Dedication of a statue
53	I. Alex. Ptol. 76	103542	Alexandria, Graeco-Roman Museum 19067	unclear	Dedication to a great god
54	I. Alex. Ptol. 15	6084	Alexandria, Graeco-Roman Museum 53	246/222	Honorific inscription by Ptolemy III
55	Ancient Society 44, 149 no.1	380605	Alexandria, MoA stores	217/204	Honorific inscription on the base of a statue
56	I. Alex. Ptol. 27	6315	Unknown	184/180	Inscribed base of a statue

CPI no.	Pr. Catalogue / publication	TM	Location	Date (BC)	Content
57	I. Alex. Ptol. 41	7136	Alexandria, Graeco-Roman Museum 52	120/100	Honorific inscription on the base of a statue
58	I. Alex. Ptol. 42	6670	Alexandria, Graeco-Roman Museum 19535	90/30	Honorific inscription on the base of a statue
59	I. Alex. Ptol. 33	7165	Alexandria, Graeco-Roman Museum 19016	60/59	Honorific inscription for Tryphaina
60	I. Alex. Ptol. 36	6366	Alexandria, Graeco-Roman Museum 10	28 Dec 34	Honorific inscription on the base of a statue of M. Antonius
61	I. Métriques 29	104055	Alexandria, Graeco-Roman Museum 119	3rd c. (225/200?)	Funerary epigram of Stratonike
62	I. Métriques 62	7135	Alexandria, Graeco-Roman Museum 140	3rd c. (250/200?)	Funerary epigram of Philoxenos
63	I. Métriques 63	7211	Alexandria, Graeco-Roman Museum 291	3rd c.	Funerary monument
64	I. Métriques 92	7183	Warsaw, National Museum 198834	3rd c. or 2nd ?	Funerary stele of Menneas
65	I. Métriques 30	104326	Alexandria, Graeco-Roman Museum 25770	3rd c. or 299/150	Funerary stele of Agathokleia
66	I. Métriques 28	47494	Alexandria, Graeco-Roman Museum 26015	299/150	Funerary epigram of Niko the Kretan girl
67	I. Métriques 31	7186	Alexandria, Graeco-Roman Museum 101	3rd c. (299/250?)	Funerary stele
68	I. Métriques 65	7139	Alexandria, Graeco-Roman Museum 156	2nd/1st c.	Funerary epigram of Nikolaos
69	I. Métriques 64	43990	Alexandria, Graeco-Roman Museum 26294	150/30	Funerary epigram of Ammonios
70	SB 5 7838	6282	Alexandria, Graeco-Roman Museum number unknown	2nd/1st c.	List of names
71	SEG XLI 1609	102570	Alexandria, Graeco-Roman Museum 25070	150/30	Funerary epigram of of Talous
72	I. Métriques 34	102895	Alexandria, Graeco-Roman Museum 24023	150/30	Funerary epigram of Diazelmis
73	AE 1988 454	282643	lost	unclear	Epitaph of Hermias
74	SEG LI 2116	383646	lost	unclear	Epitaph
75	I. Alex. Ptol. 44	47446	Alexandria, Graeco-Roman Museum 35	3rd c.	List of Asiatic names
76	CE 42 1967, 355	115834	England, private collection	240 ?	Petition (*enteuxis*)
77	I. Alex. Ptol. 29	44328	Unknown	180/148	Statue inscribed by the artists
78	I. Alex. Ptol. 47	104507	Alexandria, Graeco-Roman Museum 9408	2nd c. ?	List of names
79	I. Alex. Ptol. 48	6672	Alexandria, private collection	2nd c. ?	List of names
80	I. Alex. Ptol. 66	6497	Alexandria, Graeco-Roman Museum 3929	2nd c.	Signature of a sculptor
81	I. Alex. Ptol. 70	93851	Chicago, Field Museum 26766	2nd/1st c.	Fragment
82	I. Alex. Ptol. 46	58482	Alexandria, Graeco-Roman Museum 43	2nd/1st c.	Dedication to an association of land owners
83	I. Alex. Ptol. 65	107260	Vienna, Kunsthistorisches Museum Reg. no. 111 86L	220/30?	Granite base of statue of Dioskourides
84	I. Alex. Ptol. 71	103737	Alexandria, Graeco-Roman Museum 308	unclear	Fragment of inscription
85	I. Alex. Ptol. 55	107258	Alexandria, Graeco-Roman Museum unknown	unclear	Dedication on a portable altar

CPI 1-2: Civic decrees
CPI 3-7: Civic institutions
CPI 8-28: Dedications by and on behalf of the royal family
CPI 29: Dedications to the royal house
CPI 30-36: Inscribed statues and altars on behalf of the royal family
CPI 37-53: Dedications to deities by individuals
CPI 54-60: Honorific inscriptions for high-ranking individuals
CPI 61-74: Funerary monuments
CPI 75-85: Miscellaneous

Other inscriptions in the Corpus possibly from Alexandria

CPI no.	Pr. Catalogue / publication	TM	Location	Date (BC)	Content
550	OGIS 1 92	6390	Cairo Egyptian Museum CG 9232	205/180	Dedication of temple to Isis by member of Maroneus deme
566	SB 4 7326	6447	St Petersburg, Hermitage Museum (?	post 279	Dedication to Arsinoe II Philadelphos
580	I. Musée d'Alex. 106	7025	Alexandria, Graeco-Roman Museum 9	3rd c.	Dedication of an altar to all gods
583	I. Alex. Ptol. 51	104540	Alexandria, Graeco-Roman Museum 25804;	175/125	Dedication to Isis
588	I. Louvre 26	6317	Paris, Louvre number unknown	99/30	Dedication of an altar to Apollo and Kore
590	SB 4 7456	6459	Alexandria, Graeco-Roman Museum 22180	2nd/1st c.	Honorary inscription for Karadyses

Abbreviations

AE	*L'Année épigraphique*
CE	*Chronique d'Égypte*
CPI	Bowman, A., Crowther, C., Hornblower, S., Mairs, R., Savvopoulos, K. forthcoming, *Corpus of Ptolemaic Inscriptions* I. Egypt. Oxford.
CRAIBL	*Comptes rendus des séances de l'Académie des inscriptions at Belles-Lettres*
Benaki	Vlizos, S. 2004. Ελληνική κα Ρωμαϊκή γλυπτική από τις Συλλογές του Μουσείου Μπενάκη. Athens
BSAA	*Bulletin de la Société archéologique d'Alexandrie*
I. Alex. Ptol.	Bernand, É. 2001. *Inscriptions grecques d'Alexandrie ptolémaïque*. Cairo
I. Louvre	Bernand, É. 1992. *Inscriptions grecques d'Égypte et de Nubie au Musée du Louvre*. Paris
I. Métriques	Bernand, É. 1969. *Inscriptions métriques de l'Égypte gréco-romaine: recherches sur la poésie épigrammatique des Grecs en Égypte*. Paris
I. Musée d'Alexandrie	Breccia, E. 1911. *Iscrizioni greche e latine Service des Antiquités de l'Égypte. Catalogue general des antiquités égyptiennes du Musée d'Alexandrie*. Cairo
I. Varsovie	Łajtar, A. and Twardecki, A. 2003. *Catalogue des inscriptions grecques du Musée National de Varsovie*. Warsaw
JEA	*Journal of Egyptian Archaeology*
OGIS	Dittenberger, W. 1903-1905. *Orientis Graeci inscriptiones selectae.* Leipzig
Ptol. Alex.	Fraser, P.M. 1972. *Ptolemaic Alexandria*. Oxford
RFIC	*Rivista di Filologia e di Istruzione Classica*
SB	*Sammelbuch griechischer Urkunden aus Agypten*. Strassburg
SEG	*Supplementum Epigraphicum Graecum*
TM	Trismegistos (interdisciplinary portal of papyrological and epigraphical resources for Egypt, 800 BC-AD 800): http://www.trismegistos.org/

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From Macedonia to Ptolemaic Alexandria: the cult of Dionysos Pseudanor*

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Early in his reign, most probably in the year 279/8 BC, as a considerable body of evidence shows, Ptolemy II Philadelphos created a penteteric festival in Alexandria, the Ptolemaieia, in honour of his parents and founders of the dynasty Ptolemy I and Berenike I.[1] Connected to this festival was in all likelihood a grandiose procession,[2] which took place either during the first or, more probably, during the second Ptolemaieia, celebrated in the winter of 275/4 BC[3] and lasted, as we may assume, several days.[4] This memorable procession was described in detail by Kallixeinos of Rhodes (*FGrHist* 627) in the fourth book of his treatise on Alexandria, which was written under the reign of Ptolemy IV Philopator (221-204 BC) or somewhat later,[5] drawing from official records on the celebrations of the *Penteterides.*[6] We possess a substantial portion of Kallixeinos' account, namely the description of the section of the procession dedicated to Dionysos[7] and his followers, which is reproduced in the *Deipnosophistai* of Athenaios of Naucratis.[8] A particularly spectacular feature was a large statue of Dionysos carried in a wagon and escorted by priests, priestesses and various groups of maenads (198C-E):

> Μετὰ τούτους τετράκυκλος πηχῶν τεσσαρεσκαίδεκα, ὀκτὼ δὲ τὸ πλάτος, ἤγετο ὑπὸ ἀνδρῶν ὀγδοήκοντα καὶ ἑκατόν· ἐπὶ δὲ ταύτης ἐπῆν ἄγαλμα Διονύσου δεκάπηχυ σπένδον ἐκ καρχησίου χρυσοῦ, χιτῶνα πορφυροῦν ἔχον διάπεζον καὶ ἐπ᾽ αὐτοῦ κροκωτὸν διαφανῆ· περιεβέβλητο δὲ ἱμάτιον πορφυροῦν χρυσοποίκιλον. προέκειτο δ᾽ αὐτοῦ κρατὴρ Λακωνικὸς χρυσοῦς μετρητῶν δεκαπέντε καὶ τρίπους χρυσοῦς, ἐφ᾽ οὗ θυμιατήριον χρυσοῦν καὶ φιάλαι δύο χρυσαῖ, κασσίας μεσταὶ καὶ κρόκου. περιέκειτο δ᾽ αὐτῶι καὶ σκιὰς ἐκ κισσοῦ καὶ ἀμπέλου καὶ τῆς λοιπῆς ὀπώρας κεκοσμημένη, προσήρτηντο δὲ καὶ στέφανοι καὶ ταινίαι καὶ θύρσοι καὶ τύμπανα καὶ μίτραι πρόσωπά τε σατυρικὰ καὶ κωμικὰ καὶ τραγικά. τῆι δὲ τετρακύκλωι <ἐπηκολούθουν> ἱερεῖς καὶ ἱέρειαι καὶ †περσειστελεται[9] καὶ θίασοι παντοδαποὶ καὶ <αἱ>[10] τὰ λῖκνα φέρουσαι. μετὰ δὲ ταύτας Μακέται αἱ καλούμεναι Μιμαλλόνες καὶ Βασσάραι καὶ Λῆναι,[11] κατακεχυμέναι τὰς τρίχας καὶ ἐστεφανωμέναι τινὲς μὲν ὄφεσιν, αἱ δὲ μίλακι καὶ ἀμπέλωι καὶ κισσῶι· κατεῖχον δὲ ταῖς χερσὶν αἱ μὲν ἐγχειρίδια, αἱ δὲ ὄφεις.
>
> 'After these came a four-wheeled cart 14 cubits long and 8 wide, drawn by 180 men: upon this was a ten-cubit statue of Dionysos pouring a libation from a golden *karchēsion*, wearing a purple *chitōn* reaching to his feet and on top of that a transparent, saffron-coloured robe. Wrapped around him was a gold-spangled purple mantle. Set before the god was a Lakonian mixing-bowl of fifteen measures, and also a golden three-legged table, on which lay a golden censer and two gold *phialai*, full of cassia and saffron. The statue was covered with a canopy decorated with ivy, vine and other fruits, and attached to it were crowns and fillets and *thyrsoi* and drums and headbands and masks, satyric and comic and tragic. After the cart (there followed) priests and priestesses

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* This paper is a tribute to a great scholar, Rudolf Pfeiffer, whose monumental edition of Kallimachos remains fundamental for the study of Hellenistic poetry. I would like to thank an anonymous revewer for a number of useful comments and suggestions. Any remaining errors or inconsistencies are of course my own.

[1] Fraser 1961; Dunand 1981, 13.

[2] Fraser 1972 II, 738-739 n. 151; see recently Keyser 2014, commentary of F2, 27-35 and 2016 (where the extensive earlier bibliography on the matter can be found). Most scholars accept, I beleve rightly, that the grand procession was part of the Ptolemaia, but according to some (most notably Fraser 1972 I, 232 and Rice 1983, 182-187) the two should be dissociated.

[3] The date of the procession cannot be determined with certainty but it must fall between 279/8 and 271/0 BC. I believe that Foertmeyer 1988 has made a good case for 275/4 BC. Keyser connects the procession with the first Ptolemaia of 279/8 BCE. A minority view would place the event in the third Ptolemaia of 271/0 BC, after the end of the first Syrian war; see Dunand 13 with n. 4.

[4] Rice 1983, 35-36; Foertmeyer 1988, 91-94.

[5] On the date of Kallixeinos' account of the grand procession of Ptolemy Philadelphos see recently Keyser 2014, "Biblioraphical Essay" at the end of the chapter, where the rich bibliography on the matter is collected. Keyser places the activity of Kallixeinos in the first half of the 2nd century BC: "On the whole, it seems we can set Kallixeinos in the decades around 170 BC, perhaps in the range 190–150 BC."

[6] Athenaios, *Deipnosophistai* 197D: τὰ δὲ κατὰ μέρος αὐτῶν εἴ τις εἰδέναι βούλεται, τὰς τῶν Πεντετηρίδων γραφὰς λαμβάνων ἐπισκοπείτω.

[7] The cult of Dionysos was very popular in Hellenistic Alexandria; see Frazer 1972 I, 201-206.

[8] Athenaios, *Deipnosophistai* 5, 27-35, 197D – 203B; *FGrHist* 627 F 2.

[9] This unintelligible reading of the manuscripts was emended into ἱεροτελεσταί by E. Rohde; for further suggestions see the commentary of Keyser 2014 *ad loc*.

[10] Added by Wilamowitz.

[11] The manuscripts have Λυδαί, which is clearly out of place here. The correction was made by Wilamowitz; cf. the commentary of Keyser 2014 *ad loc.*

and [? text corrupt] and all sorts of religious groups and women bearing winnowing-fans. After these came Macedonian women called *Mimallones* and *Bassarai* and *Lēnai*, their hair flowing free, and some crowned with snakes and others with *smilax* and vine and ivy. Some of them held in their hands daggers, others snakes.'

The Penteteris was, in its conception, a purely Greek festival and the extravagant procession described by Kallixeinos was clearly inspired by religious processions organised in almost every part of the Greek world.[12] The main divinity of the procession is Dionysos, a god to whom the Ptolemies showed a particular devotion, for they considered him to be one of their ancestors.[13] There is, furthermore, ample evidence that Dionysos was worshipped in Macedonia from very early times and was revered by Alexander and his successors.[14] In the Roman imperial period Dionysos is attested as an ancestral god (πάτριος θεός) in Edessa[15] and there is evidence that processions honouring him were famous and very popular in Thessalonica[16] and probably also elsewhere.[17] In the Alexandrian procession Dionysos is shown, according to the prevalent perception, as the god of wine, feasting, revelry and the theatre. Yet it is particularly intriguing to find among the various dancing and revelling female followers the god, usually designated by the generic name of maenads or bacchants, parading alongside the better known *Bassarai* and *Lēnai,*[18] a group of women by the name of *Mimallones*, who are expressly identified by Kallixeinos as 'Macedonian' (Μακέται). The presence of Macedonian maenads in the procession should not surprise us. We know indeed that Macedonian women were fervent devotees of Dionysos and practised his revelries under the names of *Klodones* and *Mimallones.*[19]

The first Ptolemies, even though they reigned over Egypt, considered themselves Macedonians and were proud of their origin. It is significant that Kallimachos in his hymn to Delos (IV 167) designates Ptolemy Philadelphos simply as 'the Macedonian' (ὁ Μακηδών) without any other qualification.

A general, albeit not very accurate, impression of the appearance of the followers of Dionysos in the grand procession of Ptolemy Piladelphos can be provided by a group of small bronzes of late Hellenistic date representing Dionysos, a satyr playing the double aulos and two maenads in the Louvre (Figure 1). The statuettes were reportedly found in the region of the Nile Delta.[20] On the other hand, the Dionysos of this group, nude but for the small himation wrapped around his left shoulder and arm and the ἐνδρομίδες (light boots) he wears on his feet, is very different from the huge statue of the procession described by Kallixeinos. The costume of this statue is indeed noteworthy and deserves comment. We are told that the god wore a long chiton reaching to his feet and a κροκωτός, a saffron-dyed mantle. Both garments, but especially the κροκωτός, are typical of feminine attire.[21] The κροκωτός is furthermore associated with Dionysos in the context of festivities.[22] The statue displayed in the procession represented therefore Dionysos as an effeminate god (θηλύμορφος),[23] and probably youthful as well, as he appears in the *Bakchai* of Euripides.[24] An approximative idea of the appearance of this statue can, I think, be provided by the (probably about half a century earlier) relief figure of Dionysos on the marble base of a choregic tripod found in Athens, between the theatre of Dionysos and the monument of Lysikrates, on the ancient street of the Tripods, and kept in the National Archaeological Museum (inv. 1463) (Figure 2). The other two sides were adorned with Nikai. The base has been tentatively attributed to the workshop of Praxiteles and may be dated to the third quarter of the 4th century BC;[25] it was apparently famous and admired enough to be copied in later times, for a Roman copy of it exists in a private collection in Great Britain (Figure 3).[26]

12 On the religious nature of the Penteteris, its relation to similar Greek festivals and its peculiar features see Wikander 1992.

13 The Ptolemies claimed descent both fom Dionysos and from Heracles, as the Adoulis inscription attests for Ptolemy III (*OGIS* 54, ll. 1-5: Βασιλεὺς μέγας Πτολεμαῖος, υἱὸς βασιλέως Πτολεμαίου | καὶ βασιλίσσης Ἀρσινόης θεῶν Ἀδελφῶν, τῶν βασιλέω<ς> | Πτολεμαίου καὶ βασιλίσσης Βερενίκης θεῶν Σωτήρων | τὰ μὲν ἀπὸ πατρὸς Ἡρακλέους τοῦ Διός ἀπόγονος, τὰ δὲ ἀπὸ μη|τρὸς Διονύσου τοῦ Διός). The Dionysiac and Heraclean ancestry of the Ptolemaic dynasty is explained in a fragment of the Hellenistic historian Satyros of Alexandria (*FGrHist* 631 F 1), which has been preserved by a Christian author of the late 2nd century CE; see also Frazer 1972, II 739 n. 155. For a thorough discussion of this text see Perdrizet 1910, 217-226. On the devotion of the Ptolemies for Dionysos and their claim to descend from him see also Pàmias 2004, 192 and *passim*.

14 On the devotion of Alexander the Great and the Ptolemies for Dionysos see Perdrizet 1910, 227-230, who believes (p. 227) that Dionysos was originally a local Thracian god.

15 *EKM* 2, 1, 400.

16 On the cult of Dionysos in Roman Thessalonica see Edson 1948, 158-181. A phallic procession in honour of Dionysos is attested by a Byzantine text: Bakalakis 1983; Voutiras 2012, 566.

17 There is evidence for such processions in Edessa; see Voutiras 2012.

18 On the names Βασσάραι and Λῆναι for the maenads see Keyser 2014 *ad loc.* (198E 28). As we have seen above (n. 11) Λῆναι is a plausible, though not certain, conjecture by Wilamowitz to replace the rather unexpected reading Λυδαί of the manuscripts.

19 Ploutarchos *Alex.*, 2, 7: ἕτερος δὲ περὶ τούτων ἐστὶ λόγος, ὡς πᾶσαι μὲν αἱ τῇδε γυναῖκες ἔνοχοι τοῖς Ὀρφικοῖς οὖσαι καὶ τοῖς περὶ τὸν Διόνυσον ὀργιασμοῖς ἐκ τοῦ πάνυ παλαιοῦ, Κλώδωνές τε καὶ Μιμαλλόνες ἐπωνυμίαν ἔχουσαι, πολλὰ ταῖς Ἠδωνίσι καὶ ταῖς περὶ τὸν Αἶμον Θρῄσσαις ὅμοια δρῶσιν.

20 La gloire d'Alexandrie 1998, 270 no 213 (S. Descamps et P. Ballet).

21 Aristophanes, *Frogs* 46; *Lys.* 44, 51; *Eccl.* 332, 879. Cf. Aischylos, *Agam.* 239: κρόκου βαφάς δ' ἐς πέδον χέουσα (of Iphigeneia about to be sacrificed).

22 Kratinos fr. 40 Austin-Kassel; see Dover 1993, 40.

23 On Dionysos dressed in female clothes see Bremmer 1999, 184-188. Bremmer, *op. cit.* 185, rightly observes that in Sophokles' *Oedipus Rex* 212 Dionysos is said to wear the same garments as the maenads (Μαινάδων ὁμόστολον).

24 On the nature and the appearance of Dionysos in the *Bakchai* see Bremmer 1999, 193-195.

25 Praxitèle 2007, 91-92, 106-109 no. 15 (A. Pasquier), with extensive discussion and bibliography.

26 The copy was exhibited for a short period of time in the Antikenmuseum of Basel: Berger 1983; Praxitèle 2007, 91-92, fig. 64.

Figure 1. Group of bronze statuettes from Lower Egypt. Paris Louvre. Br 346 (Dionysos), Br 352 (satyr), Br 392 (maenad with *krotala*), Br 346 (maenad with tamburin).

Figure 2. Marble base of tripod with relief figure of Dionysos. Athens, National Archaeological Museum Inv. 1463.

Figure 3. Roman copy of the base fig. 2. Private collection or art market (after *Praxiteles* 2007, 91 fig. 64).

Interestingly the combination of a Dionysos of feminine appearance with a group of young women (virgins to be precise) recurs in a Macedonian legend, which must be related to the procession of Philadelphos, for it provides the reason for which the Macedonian maenads were known as *Mimallones*. The story is told by Polyainos, a writer of Macedonian origin who lived at the time of the Antonine emperors (see n. 36).

Polyainos, *Strategemata* 4, 1:

> Ἀργαῖος βασιλεὺς Μακεδόνων, Ταυλαντίων Γάλαυρος· Ταυλάντιοι στρατεύουσιν ἐπὶ Μακεδόνας. Ἀργαῖος, ἦν γὰρ αὐτῷ χεὶρ ὀλίγη, κελεύει τὰς παρθένους τῶν Μακεδόνων, ἐπειδὰν οἱ πολέμιοι προσάγωσι τὴν φάλαγγα, αὐτοῖς ἐκ τοῦ ὄρους τῆς Ἐρεβοίας ἐπιφανῆναι. οἱ μὲν δὴ προσῆγον· αἱ δὲ ἐπεφάνησαν καὶ κατῄεσαν ἀπὸ τοῦ ὄρους παρθένοι πολλαὶ θύρσους ἀντὶ δοράτων πάλλουσαι καὶ στεφάνοις τὰ πρόσωπα σκιάζουσαι. Γάλαυρος ἐξεπλάγη ἄνδρας εἶναι τὰς παρθένους ἀπὸ μακροῦ νομίζων καὶ τὸ ἀνακλητικὸν ὑπεσήμηνεν· Ταυλάντιοι δὲ ἔφευγον τά τε ὅπλα ἀποβαλόντες καὶ τὰ σκευοφόρα καταλιπόντες. Ἀργαῖος ἀμαχεὶ κρατήσας ἱερὸν ἱδρύεται Διονύσῳ Ψευδάνορι καὶ τὰς παρθένους, ἃς πάλαι Κλώδωνας ἔκληζον οἱ Μακεδόνες, αὐτὸς κλῄζειν ἔταξε διὰ τὴν μίμησιν τῶν ἀνδρῶν Μιμαλλόνας.

> ‘Argaios was king of the Macedonians, Galauros of the Taulantii. The Taulantii made an incursion into Macedonia. Argaios, whose force was small, directed the Macedonian young women, as the enemy formation charged, to show themselves to them from mount Ereboia. So the assailants charged; and the young women appeared and poured down from the mountain in a numerous body, brandishing *thyrsoi* instead of spears, their faces covered with wreaths. Galauros was intimidated, for he mistook from far away the young women for men, and he sounded retreat, whereupon the Taulantii fled, throwing away their weapons and also abandoning their pack-animals. Argaios, having thus won a victory without a fight, founded a sanctuary for Dionysos Pseudanor (the fake man); and he ordered that the young women, whom the Macedonians from old times called *Klodones* be named *Mimallones* for having imitated men.’

The use of women in men’s attire to surprise a more numerous enemy by giving the impression that a large military force is ready to attack is a quite common stratagem known in many variants and in different cultures. A Greek example is offered by Aineias Taktikos in his *Poliorketika*, written in the mid-4th cent. BC.

Aineias Taktikos 40, 4:[27]

> Σινωπεῖς δὲ πρὸς Δαταμᾶν πολεμοῦντες ἐπεὶ ἐν κινδύνῳ ἦσαν καὶ σπάνει ἀνδρῶν, τῶν γυναικῶν τὰ ἐπιεικέστατα σώματα μορφώσαντες καὶ ὁπλίσαντες ὡς ἐς ἄνδρας

> μάλιστα, ἀντὶ ὅπλων καὶ περικεφαλαιῶν τούς τε κάδους καὶ τὰ ὁμότροπα τούτοις δόντες χαλκώματα, περιῆγον τοῦ τείχους ᾗ μάλιστα οἱ πολέμιοι ὄψεσθαι ἔμελλον. βάλλειν <δὲ> οὐκ εἴων αὐτάς· πόρρωθεν γὰρ κατάδηλος βάλλουσα γυνή· ποιοῦντες δὲ ταῦτα τοὺς αὐτομόλους ἐφύλασσον μὴ διαγγελθῇ.

> ‘The people of Sinope, when at war with Datamas, were in danger and in want of men. They therefore made the fittest of their women look like men as much as possible and armed them accordingly, giving them instead of weapons and helmets buckets and similar brass utensils, and marched them round the walls in full view of the enemy. But they did not allow them to throw anything; for you can tell a woman from a distance by the way she throws. As they did this they kept a close eye on the deserters in order to avoid the divulgation of the stratagem.’

François Delpech collected and discussed a number of similar stories of women masquerading as men during military campaigns, including those of Polyainos and Aineias Taktikos, taking as a starting point the legendary accounts of the fall of Orihuela in medieval chronicles referring to the Muslim conquest of Visigothic Spain.[28] It is evident that this is a widespread theme that can be found in different periods and cultures. Yet there is an essential difference between most of these stories and the one transmitted by Polyainos, namely that the latter is in reality, as Delpech rightly remarks, a historicized version of a myth connected with the creation of a specific cult, that of Dionysos Pseudanor.[29] The existence of this cult in Macedonia has been recently confirmed by epigraphical finds, manumission records of the first half of the 3rd century AD found in Beroia.[30] In these inscriptions Dionysos Pseudanor bears the cultic epithets ἄγριος (wild, savage) and ἐρίκρυπτος (well hidden). Miltiades Hatzopoulos was able to show that the epithets and the story lead to the conclusion that Dionysos Pseudanor was a god connected to rites of passage involving young women transitioning from puberty to adulthood.[31] Such rituals are indeed known to have included travesty and change of sexual roles.

A notice in the *Etymologicum Magnum* on the meaning of the rare word *Mimallones* (p. 587, 53) informs us that the

[27] The text is that of the Budé edition by A. Dain (1967).

[28] Delpech 1998.

[29] Delpech 1998, 152.

[30] *IBeroia* 1, 53-56. For a discussion of these inscriptions see Hatzopoulos 1994, 63-72.

[31] Hatzopoulos 1994, 73-85; Bremmer 1999, 186; Mallios 2011, 258-259.

story explaining how and why they obtained this name was told by Kallimachos (fr. 503 Pfeiffer):[32]

> <Μιμαλῶνες>, γυναῖκες, παρὰ τὸ μιμεῖσθαι ἄνδρας· ἤτοι διὰ Μακεδονικὴν ἱστορίαν ἥτις κεῖται ἐν τοῖς Καλλιμάχου.
>
> 'Mimallones: women so called for imitating men;[33] this is according to a Macedonian story which can be found in Kallimachos.'

There is good reason to believe that the story was narrated in the great poetic work of Kallimachos, the *Aitia*, as Hemsterhuys rightly pointed out. Pfeiffer, who shares this opinion, comments in his edition in elegant Latin: '*Aetion est et cultus Dionysi* Ψευδάνορος *et* μετονομασίας *mulierum; Aetiis igitur potius fabula tribuenda est quam* Ὑπομνήμασι *(Schneider); etiam grammaticorum explicatio vocabuli et imitationes poetarum posteriorum de carmine ductae videntur; cf. fr. 734* Βασσαρίδες'.

Isaac Casaubon was the first to recognize, in 1589, that the story told by Kallimachos was in fact the same as the one transmitted by Polyainos.[34] The question that arises is how Kallimachos and, much later, Polyainos, came to know this local Macedonian story. The fact that the *Mimallones* took part in the grand procession of Ptolemaios Philadelphos proves that the Macedonians who settled in Alexandria after the conquest of Alexander the Great had brought with them their local customs and beliefs. Yet it seems improbable that Kallimachos came to know the Μακεδονικὴ ἱστορία on the creation of the cult of Dionysos Pseudanor and the renaming of the Macedonian maenads from Κλώδωνες to Μιμαλλόνες from oral tradition. It is much more likely that the learned poet and librarian of the Library of Alexandria had consulted one or more treatises on Macedonian local myths and traditions, like the Μακεδονικά of Marsyas from Pella.[35] The same could also be true of Polyainos. This well-educated orator of Macedonian origin, who lived in Rome and dedicated his treatise on stratagems to the emperors Marcus Aurelius and Lucius Verus in AD162, on the eve of the Parthian war,[36] could of course have heard the story in his youth. The inscriptions attesting the cult of Dionysos Pseudanor at Beroia in the 3rd century AD prove that it was familiar to the inhabitants of Macedonia in the Roman Imperial period. It is not clear, however, whether this old and traditional cult had been practised without interruption in Beroia since early times, or had been reintroduced in the 2nd or early 3rd century AD as part of a revival of traditional beliefs and customs in Roman Macedonia, for which the well-attested revival of the cult of Alexander the Great under Caracalla[37] provides a good example. In either case, it seems likely that the source of Polyainos was not a local oral tradition, but rather a literary text: possibly Kallimachos or perhaps a treatise on local Macedonian cults and customs.

[32] On the Μιμαλλόνες in Greek and Latin literature see recently Angiò (forthcoming). I would like to thank Prof. Francesca Angiò for sending me the manuscript of her article.

[33] This could be a paretymology; cf. Angiò (forthcoming) n. 4. For a different etymology of the words Κλώδωνες and Μιμαλλόνες, connecting them with woolwork, see Macurdy 1913.

[34] The reference is from Pfeiffer's edition of Kallimachos fr. 503.

[35] FGrHist 136; Heckel 1980. The etymological, or rather paretymological, explanation of the name *Mimallones* (see p. 6 and n. 33), strengthens the assumption that the source of Kallimachos and Polyainos was not oral tradition but a literary text. For etymologizing is a well known feature of ancient Greek and Latin literature; see Peraki-Kyriakidou 2002.

[36] Dihle 1989, 257.

[37] Gagé 1975.

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Hellenistic drama and Alexandrian culture

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Theatrical activity

Regarding dramatic poetry, the Hellenistic era is primarily a period of the great development of 'New Comedy' and, particularly, of Menander, whose influence was tremendous on the Roman and the European theatre.

The theatre of Menander, his novelties introduced in the texts and the production of the comic genre are well known and profoundly explored. In this paper therefore I would rather deal with a less known but important field for Alexandria and Hellenism: The era's dramatic production in tragedy and satyr play.

Hellenistic tragedy and satyric drama, though significant for the new trends they introduced in the history of the theatre, have fallen into oblivion and only fragmentary texts, or even only titles of their plays, have remained to us. Therefore little research has been conducted by scholars on Greek drama in the Hellenistic period, contrary to the detailed exploration of classical tragedy and of the works of the three great 5th-century tragic poets.

Nevertheless, in Hellenistic times dramatic performances continued to be very popular, following on the steps of Alexander the Great who during his campaigns in the East was accompanied by actors and musicians giving performances on various occasions.[1] After Alexander's death dramatic productions became a common activity in most cities of his successors' kingdoms.

As in classical times, in the Hellenistic period theatre was regarded as a universal form of both education and entertainment,[2] but above all the cornerstone of Hellenic culture and a prime instrument for its expansion, namely of Hellenization.

In this cultural framework theatres were considered as necessary public buildings and were built in every important city, such as, apart from Alexandria, at Babylon, Priene, Ephesus, Ecbatana, Seleucia, Antioch, Halicarnassus, and in Egypt, particularly, in Memphis, Panopolis, Ptolemais, Arsinoe, Oxyrrhynchus, and as far as Cyrene. Dramatic performances were organised in festivals. The performance of Greek drama in various places in the Hellenistic age points to a widely recognised Hellenic cultural heritage which was mainly athenocentric, but also formed a cultural present which combined cosmopolitan and multicultural elements with Hellenic cultural identity as its core.[3]

The development of theatrical activity and the remarkable popularity of the theatre in Hellenistic times were greatly facilitated by the creation of a new Hellenic cultural community who invested in the wide expansion of Hellenic education and cultural past also for political reasons. The Ptolemies and the Hellenistic rulers in general were significantly involved in dramatic production, a fact that reveals their profound belief in drama's cultural and political value, which also contributed to their political aims and royal propaganda. Thus festival names, such as the Ptolemaia in Alexandria and in Delos, were added to the traditional name of the Dionysia and reflected the Hellenistic kings' pursuit both to display their power and identify themselves with the Hellenic culture and tradition. For this same reason the dramatic actors, the so-called 'artists of Dionysus'[4] received massive support from the Hellenistic kings and as a return they often honoured rulers with decrees. These guilds of Dionysus' artists enjoyed a position of power and were granted 'personal safety', 'inviolability', and 'civic rights'.

It is worth noting that Ptolemy II Philadelpus, probably in the Ptolemaia of 275/274 BC, presented his Great Procession[5] with representations of Dionysus, Alexander, Ptolemy I and Ptolemy II, along with the vivid participation of the artists of Dionysus. This procession sheds light on Ptolemy's aspiration to present himself as the successor both of Alexander the Great and Dionysus in a merging of political power and culture.[6]

[1] Le Guen 2014: 360-361. Evidence by: Arrian *An.* 7.14.1 and 10, Plut. *Alex.* 72.1.

[2] Turner 1963: 120-121, with n. 3.

[3] Fountoulakis 2017: 79ff., 87ff., with bibliographical references on the creation of cultural identity and cultural memory.

[4] For actors' guilds and their importance in the Hellenistic age, see Ghiron–Bistagne 1976: 169 ff., 205 f.; Le Guen 2001; Pickard–Cambridge 1968: 279-305; Sifakis 1967: 99 ff., 136 ff.

[5] Of this Great Procession we are informed by Athenaeus (5, 196 a ff.) citing Callixeinos. Cf. Fountoulakis 2017: 95; Rice 1983; Webster 1956: 157-159.

[6] Interestingly, Alexander the Great was also often identified with Dionysus to promote a cultural ideology: Fountoulakis 2014: 118-119;

Revivals and new plays – The Pleiad

Despite the ambitious efforts of the Ptolemaic dynasty, the three great 5th-century dramatists, and especially Euripides, 'the most tragic of all',[7] ruled the era's theatres. Ptolemy III Evergetes borrowed from Athens the official text of the three classical tragedians' plays ordered by the politician Lycurgus approximately 330 BC[8] to avoid interpolations and corruption of the original text. These papyrus scrolls with the original texts show the importance attached to Greek tragedy by the institution of the Alexandrian Library, a sort of canon edition which led to the establishment of Aeschylus, Sophocles and Euripides as the classics of tragic poetry.[9] The works of these great poets became the main examples on which Hellenistic dramatists modelled their own plays.[10] Revivals of 5th-century and sometimes also of 4th-century plays are recorded in our sources of dramatic performances in the Hellenistic era.[11]

Apart from revivals, there is ample evidence for the production of many new plays attributed to the many playwrights of the period – more than 60 names are recorded.[12] Of these various names seven dramatists were distinguished as 'stars', masters of dramatic art, in the first half of the 3rd century, mainly under the reign of Ptolemy II (283-246 BC), and were called the Pleiad[13] after the seven daughters of the Titan Atlas who were placed by Zeus among the stars and became the Pleiades constellation.

Figure 1. Marble base at Tegea, Arcadia (*SIG*[3] 1080) commemorating revival of 5th- and 4th-century plays in the Hellenistic era (photograph: the French Archaeological School in Athens).

It was the memory of the Alexandrian Pleiad that in the 16th century AD made Ronsard and the French poets around him call themselves 'La Pléiade'.

Five names of the seven tragic poets of the Hellenistic Pleiad are certain, for they are recorded in almost all the relevant sources:[14] Homerus of Byzantium (Byzantius), Lycophron of Chalcis, Philiscus of Corcyra (Corcyraeus), Sositheus of Alexandria Troas and Alexander from Aetolia.[15] For the two other places different names are given by different sources, such as Sosiphanes, Dionysiades and Aeantiades (Figure 2).

The fact that from the large number of plays attributed to the dramatists of the Pleiad (for instance, Homerus Byzantius and Lycophron were credited with 45 and 64 tragedies respectively),[16] with only some few verses having survived (less than 500 hundred), seems to be mainly due to the literary demands of the admirers of classical tragedy, the Atticists. This literary group established the superiority of 5th-century drama and led to the disappearance of Hellenistic dramatic production and also of many other good Alexandrian verses. That was a significant blow to Hellenistic literature and culture.

Sources

The fragmentary texts of Hellenistic drama (both of tragedy and satyr-play) have survived in later authors, especially Athenaeus in his *Deipnosophists* (2nd to 3rd

Le Guen 2014: 271-274.

7 Arist. *Poet.* 13, 1453 a 30.

8 According to Galen, *Comm. II in Hipp. Epidem*. 3. 239-240.

9 Kotlińska-Toma 2015: 15; Nervegna 2014: 157-185, on the canon of the three great tragic poets in Greece and Rome.

10 Cf. Kotlińska-Toma 2015: 15; Xanthakis-Karamanos 2004: 298.

11 Indicatively, as inscriptional evidence found in Tegea attests (*SIG*[3] 1080), a pugilist actor won 88 victories in various cities, including the Ptolemaia in Alexandria, performing Euripidean heroes as well as tragic persons from post-classical plays: Xanthakis-Karamanos 2009, for a detailed discussion (here Figure 1).

12 Ziegler 1937: 1970f. A fair number of them are registered by Kotlińska-Toma 2015 *passim*.

13 Cf. Fountoulakis 2017: 95, 98; Kotlińska-Toma 2015: 49-113; Sistakou 2016: 64-69; Xanthakis-Karamanos 2004: 296-298.

14 For a complete list, see Xanthakis-Karamanos 2004: 297.

15 For titles of plays and texts, see Snell-Kannicht 1971, *TrGF* 1 99 (Sositheus), 100 (Lycophron), 101 (Alexander Aet.), 102 (Aiantides), 103 (Sosiphanes), 104 (Philiscus Corcyraeus), 105 (Dionysiades Mallotes). A good number of them are registered and discussed by Kotlińska-Toma 2015, *passim.* On Philiscus particularly, Kotlińska-Toma 2015: 166-74.

16 Suda o 253 (Hsch.): regarding Lycophron, Tzetzes in *Lycophr.* (p. 4, 20 Sch.) is undecided between 64 and 46 plays.

	Liber *Suda*	Scholia A	Scholia B	Choeroboscus	Tzetzes
		in Hephaestionem			
1	Homerus	Homerus	Homerus	Homerus	Homerus
2	Lycophron	Lycophron	Lycophron	Lycophron	Lycophron
3	Phili(s)cus	Phili(s)cus	Phili(s)cus	Phili(s)cus	Phili(s)cus
4	Sositheus	Sositheus	Sositheus	Sositheus	Theocritus
5	Alexander	Alexander	Alexander	Alexander	Nicander
6	Sosiphanes	—	Sosiphanes	Sosiphanes vel Euphronius	Aratus
7	Dionysiades	Dionysiades	Aeantiades	Aeantiades vel Dionysiades	Aeantiades

Figure 2. The names of the poets of the Pleiad as quoted by different sources.

century AD) and compilators, such as Stobaeus (5th century AD).

Evidence on the biographies of dramatists and the history of dramatic art in the Hellenistic era is provided by commentators and lexicographers, especially the Suda. This valuable 10th-century Byzantine encyclopaedia/dictionary contains the biographies of many Hellenistic playwrights.

Information on the performances of tragedies and satyr plays has come to us mainly from inscriptions.[17] Remarkable information is also given by works of art, such as sculptures, terracottas, frescoes, mosaics and so forth. They mainly represent dramatic characters with masks.[18]

The subjects of Hellenistic tragedy

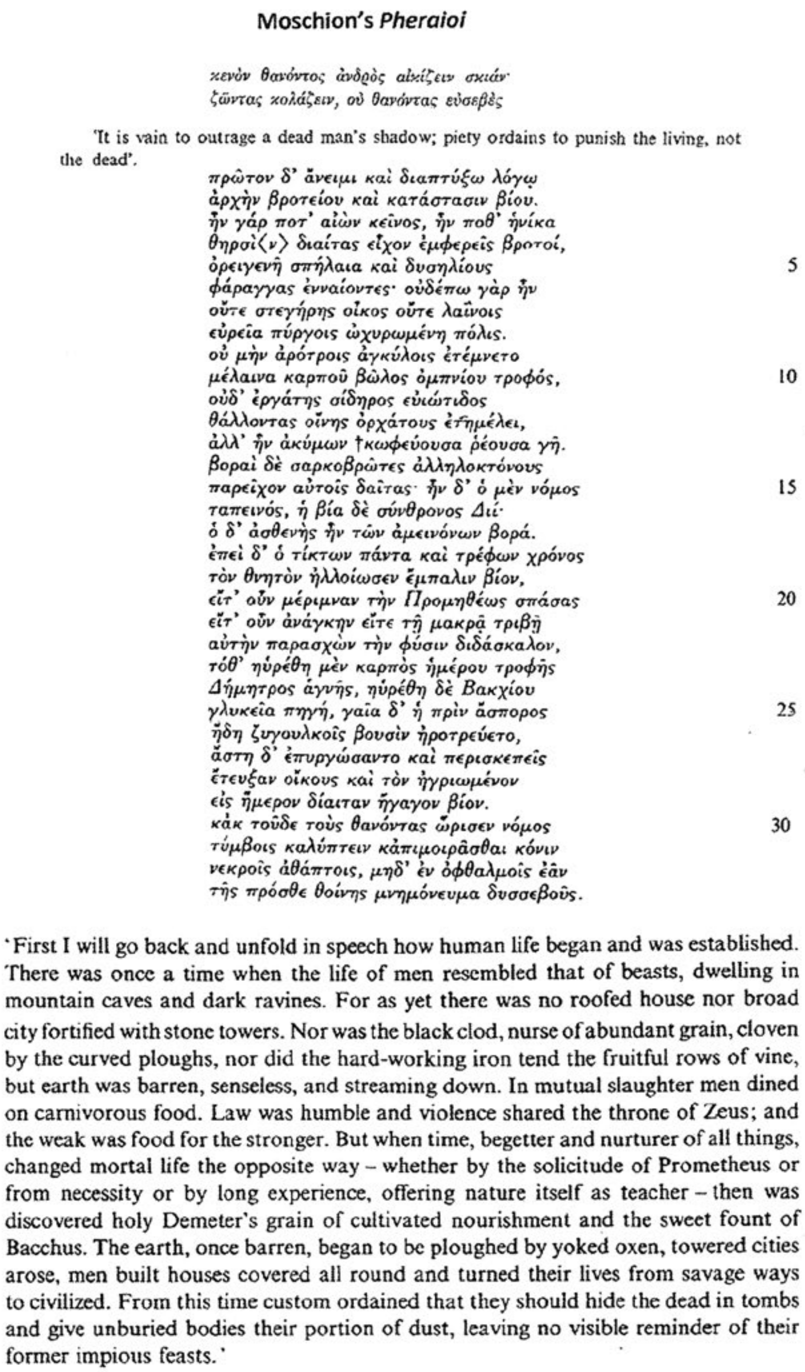
Various subjects were dramatised which were drawn both from the traditional mythological cycles, treated in the 5th and 4th centuries, and from historical events of earlier or recent history. Aristotle in his *Poetics* had observed that the finest tragedies were composed around a few houses, a few noble families.[19]

Accordingly, old subjects proved to be effective in the previous two centuries, such as the stories of Oedipus, Hippolytus, Heracles, Pentheus and Andromeda, and these continued to be treated in Hellenistic times.

Nevertheless, the age's dramatists showed a predilection for themes not treated by their classical predecessors. Such singular tragic titles, not occurring in other periods of dramatic art, were the *Kassandreis* ('Men of Kassandreia'), the *Marathonioi* ('Men of Marathon'), the *Symmachoi* (the 'Allies') of Lycophron, the *Aethlius* of Sositheus and others. Moreover, the *Orphanos* and the *Symmachoi* of Lycophron seem to have been plays of fictitious events and characters following on from Agathon's *Antheus*.[20]

The most famous of all, Lycophron's *Alexandra*, is the only Hellenistic play survived in its entirety.[21] It is a very strange composition, described by the Suda as an 'obscure poem'. It comprises of an extended monologue of 1474 iambics, a messenger's speech referring to Cassandra's prophecies uttered exactly on the day Paris' ships set sail from Troy. Cassandra, Priam's daughter, an alternative of Alexandra (like Paris-Alexandros), prophecies of the future sufferings of both Greeks and Trojans. The poem is entirely out of the established dramatic forms. It seems not to have been destined for a usual performance and is, rather, a dramatic monologue destined for reading, 'an anagnostikon drama' with many echoes, expressions and phrases received from Aeschylus' *Agamemnon* and Euripides *Troades*.[22] Its language is full of rare words, peculiar metaphors and references to well-known characters with enigmatic names. *Alexandra* comes under no definite literary genre and consists of a merging, an osmosis of styles, epic, lyric and dramatic, which is an artistic novelty of a very Hellenistic nature. The play develops as an expanded monologue speech, functioning as an independent tragic play with a unique, impressive role. A silver *kantharos* represents Cassandra in front of the sitting Lycophron, emphasizing the importance and popularity of this famous play.[23]

[17] Discussed by Sifakis (1967), especially the evidence on Delos and Delphi; Kotlińska-Toma 2015: 161ff., refers in particular to Hellenistic tragedians mentioned in inscriptions.
[18] Sifakis 1967: 53 ff.; Webster 1956; 1964, *passim.*
[19] 13, 1453a 17-23. For the themes of Hellenistic drama, cf. Kotlińska-Toma 2015: 4f., 23-32; Xanthakis-Karamanos 2004: 304-305.
[20] Arist. *Poet.* 9, 1451b 21-23.
[21] Recent good editions: Paduano, Fusillo and Hurst 1991; Hurst 2008; Hornblower 2015; On *Alexandra*, cf. also Xanthakis-Karamanos 2004: 298.
[22] For such echoes of earlier tragedy, Cusset 2002. A brief survey of the treatments of *Alexandra*, see Kotlińska-Toma 2015: 86-90.
[23] Bibliothèque Nationale de France: Kotlińska-Toma 2015: 88, fig. 3.



Moschion's *Pheraioi*

κενὸν θανόντος ἀνδρὸς αἰκίζειν σκιάν·
ζῶντας κολάζειν, οὐ θανόντας εὐσεβές

'It is vain to outrage a dead man's shadow; piety ordains to punish the living, not the dead'.

πρῶτον δ' ἄνειμι καὶ διαπτύξω λόγῳ
ἀρχὴν βροτείου καὶ κατάστασιν βίου.
ἦν γάρ ποτ' αἰὼν κεῖνος, ἦν ποθ' ἡνίκα
θηρσὶ⟨ν⟩ διαίτας εἶχον ἐμφερεῖς βροτοί,
ὀρειγενῆ σπήλαια καὶ δυσηλίους
φάραγγας ἐνναίοντες· οὐδέπω γὰρ ἦν
οὔτε στεγήρης οἶκος οὔτε λαΐνοις
εὐρεῖα πύργοις ὠχυρωμένη πόλις.
οὐ μὴν ἀρότροις ἀγκύλοις ἐτέμνετο
μέλαινα καρποῦ βῶλος ὀμπνίου τροφός,
οὐδ' ἐργάτης σίδηρος εὐιώτιδος
θάλλοντας οἴνης ὀρχάτους ἐτημέλει,
ἀλλ' ἦν ἀκύμων †κωφεύουσα ῥέουσα γῆ.
βοραὶ δὲ σαρκοβρῶτες ἀλληλοκτόνους
παρεῖχον αὐτοῖς δαῖτας· ἦν δ' ὁ μὲν νόμος
ταπεινός, ἡ βία δὲ σύνθρονος Διί·
ὁ δ' ἀσθενὴς ἦν τῶν ἀμεινόνων βορά.
ἐπεὶ δ' ὁ τίκτων πάντα καὶ τρέφων χρόνος
τὸν θνητὸν ἠλλοίωσεν ἔμπαλιν βίον,
εἴτ' οὖν μέριμναν τὴν Προμηθέως σπάσας
εἴτ' οὖν ἀνάγκην εἴτε τῇ μακρᾷ τριβῇ
αὐτὴν παρασχὼν τὴν φύσιν διδάσκαλον,
τόθ' ηὑρέθη μὲν καρπὸς ἡμέρου τροφῆς
Δήμητρος ἁγνῆς, ηὑρέθη δὲ Βακχίου
γλυκεῖα πηγή, γαῖα δ' ἡ πρὶν ἄσπορος
ἤδη ζυγουλκοῖς βουσὶν ἠροτρεύετο,
ἄστη δ' ἐπυργώσαντο καὶ περισκεπεῖς
ἔτευξαν οἴκους καὶ τὸν ἠγριωμένον
εἰς ἥμερον δίαιταν ἤγαγον βίον.
κἀκ τοῦδε τοὺς θανόντας ὥρισεν νόμος
τύμβοις καλύπτειν κἀπιμοιρᾶσθαι κόνιν
νεκροῖς ἀθάπτοις, μηδ' ἐν ὀφθαλμοῖς ἐᾶν
τῆς πρόσθε θοίνης μνημόνευμα δυσσεβοῦς.

'First I will go back and unfold in speech how human life began and was established. There was once a time when the life of men resembled that of beasts, dwelling in mountain caves and dark ravines. For as yet there was no roofed house nor broad city fortified with stone towers. Nor was the black clod, nurse of abundant grain, cloven by the curved ploughs, nor did the hard-working iron tend the fruitful rows of vine, but earth was barren, senseless, and streaming down. In mutual slaughter men dined on carnivorous food. Law was humble and violence shared the throne of Zeus; and the weak was food for the stronger. But when time, begetter and nurturer of all things, changed mortal life the opposite way – whether by the solicitude of Prometheus or from necessity or by long experience, offering nature itself as teacher – then was discovered holy Demeter's grain of cultivated nourishment and the sweet fount of Bacchus. The earth, once barren, began to be ploughed by yoked oxen, towered cities arose, men built houses covered all round and turned their lives from savage ways to civilized. From this time custom ordained that they should hide the dead in tombs and give unburied bodies their portion of dust, leaving no visible reminder of their former impious feasts.'

Figure 3. Fragmentary texts from Moschion's *Pheraioi*
(translation by Xanthakis-Karamanos 1980. 107, 1981. 411=2004. 132).

Some of the era's entirely new tragedies dealt with historical subjects: the *Cassandreis* and the *Marathonioi* of Lycophron, as well as the *Themistocles* and the *Pheraioi* ('Men of Pherai', in Thessaly) of Moschion. The *Pheraioi* of Moschion deserves some special attention in view of the two interesting fragmentary texts preserved from that play (Figure 3).[24]

The tragedy seems to have dealt with the murder of Alexander, the notorious tyrant of Pherae, the denial of burial rites to his body (possibly by his successor to the throne) and the strong opposition (possibly by an Athenian?)[25] to such an impious decision. The contrast between the cruelty of the dead tyrant, and the call from the application of religious and moral demands of the society, doubtless created powerful dramatic effects, as shown by the preserved, certain fragment: 'It is vain to outrage a dead man's shadow; piety ordains to punish the living, not the dead' (*TrGF* 1 97 F 3).

The longest and most remarkable of Moschion's texts, and probably one of the most significant in Hellenistic tragedy, seems also to belong to the *Pheraioi* in view of the coincidence of thought (*TrGF* 1 97 F 6).

The issues of man's early existence, of the value of culture and of the religious and moral principles are vividly treated. Moschion's Hellenistic erudition is clearly echoed, for his account reads like a summary of the various views of progress held from the Pre-Socratic philosophers onwards. Time, Necessity, and 'Nature', as well as long experience, are the forces creating cultural advance (vv. 18-22).

Following the traditional ralionalistic view Moschion tells how from the primitive stage, when the law was weak and violence supreme, man's intellect contributed to the rise of civilization by building fortified cities and establishing burial customs as a direct result of moral development (vv. 30-33). Moschion's voice is that of a highly refined and educated community. The erudition and the cultural development of Hellenistic society are clearly suggested in this significant text.[26]

[24] Both texts of Moschion's *Pheraioi* are commented by Xanthakis-Karamanos 1980: 105 ff., 120 ff.

[25] Since the burial custom is attributed to Athenians: Ael. *V.H.* 5.14; cf. Paus. 1.32.5, D.S. 4.65.9.

[26] On this text, Xanthakis-Karamanos 1980: 105-119, 1981: 410-417 (= 2004: 129-138).

Moschion's depiction as a skeleton on a well-known silver cup from the Roman villa at Boscoreale, with the skeletons of other famous Greek dramatic poets and philosophers, such as Sophocles, Euripides, Menander, Epicurus and Zeno,[27] bears testimony to his prestige among his contemporaries in the Alexandrian age. Moreover, a sculpture depicts him as a balding man with a thick beard.[28] Both artefacts attest to his great popularity in Hellenistic times.

The development of political and social themes, especially in historical plays, points to the political character of Hellenistic tragedy. Interesting political and moral ideas and concepts of everlasting value are expressed in the era's tragic fragments, such as the freedom of speech, the praise of boldness and courage, as well as the power of 'Fate' and the all-daring 'Necessity' in ruling human life.[29]

In the less well-known field of Hellenistic drama there is one clear and indisputable development: the revival of the almost disappearing satyr-plays. From classical age's dramatic production only one satyr-play survived, Euripides' *Cyclops*, although during the Great Dionysia in the 5th century BC approximately 300 satyr-plays were performed.[30] Sositheus of Alexandria in Troas, one of the Pleiad of Hellenistic dramatists is regarded as the restorer of satyric drama in Hellenistic times. In a remarkable epigram (*A.P.* 7, 707) Sositheus is praised for his important contribution to dramatic poetry to restore the archaic prestige of satyr-plays and is juxtaposed with Sophocles. The typically Hellenistic fusion of literary genres, such as of satyric stereotypes and romantic motifs, has been observed in the fragmentary texts from his play entitled *Daphnis* or *Lityerses*.[31]

Although the subjects and the material in 5th-century satyr-plays were taken from mythology, the Hellenistic satyric drama also dealt with parody of known contemporary figures, recalling Aristophanes. A characteristic example is that of the philosopher Menedemus.

The most famous poet of the Pleiad, Lycophron, laughs at the manner Menedemus organised his banquets, his symposia (*TrGF* 1 100 F 2-4): he offered very little food, of low quality, a small quantity of diluted wine, but a lot of philosophical talk (F 3) that went on until dawn (F 4):[32] 'they heard the cock's crow at dawn but they were not yet sated with discourse'. The end of Plato's *Symposium* is probably parodied in this scene of philosophical talk until dawn.

Lycophron's tone of mock-seriousness and ironical allusion to his friend Menedemus' feast is vividly expressed, providing a typical case of Hellenistic satire. The parody of Menedemus' entire School of philosophy has a parallel in Aristophanes' *Clouds*, with its smart parody of the Socratic School.[33]

Language

The language and style of Hellenistic drama moved away from the strict rules of the 5th- and 4th-century Attic dialect: non Attic forms,[34] formation not used by classical tragedians,[35] rare formations[36] and many words occurring for the first time,[37] all show the era's predilection for novelties in vocabulary and imagery and a well developed language.

As the Alexandrian grammarians formulated the koinē based on the Attic dialect, the dramatic production (tragedy, satyr-play and comedy) seem to have enriched the koinē language with new lexical formations.[38]

Hellenistic literature and classical scholarship

Greek language and education provided the primary means of 'paideia' in Alexandria, and Greek drama as a literary genre contributed to the expansion and support of public education. It should be emphatically noted that a remarkable number of Hellenistic poets had an important part in the establishment and development of classical scholarship in Alexandria. Of the Pleiad, Alexander the Aetolian (flour. 285-276 BC) was responsible for the classification of the tragic and satyric plays in the Alexandrian Library, and Lycophron of Chalcis (born *c.* 330-325) was entrusted, approximately 285 BC, with the arrangement of the

[27] A silver *skyphos* from the treasure of Boscoreale, Musée du Louvre: Moschion is regarded as ranking alongside the great tragedians and Menander: cf. Kotlińska-Toma 2015: 127f.

[28] The hands and head are reconstructed. The inscription MOSCHION is on the plinth. Museo Archeologico Nazionale di Napoli (inv. 6238; from the Farnese Collection): cf. Xanthakis-Karamanos 1980: fig. 13.

[29] For a detailed commentary, Xanthakis-Karamanos 1980: 157-158, 96-97, 126-127, respectively.

[30] Krumeich, Pechstein and Seidensticker 1999: 2. Cf. Kotlińska-Toma 2015: 43-45.

[31] A detailed discussion by Xanthakis-Karamanos 1994: 237-250 (= *Dramatica* 2004: 329-357).

[32] For a detailed commentary of the fragmentary texts, see Xanthakis-Karamanos 2004: 329-357; cf. Kotlińska-Toma 2015: 46; Sistakou 2016: 86-87.

[33] Xanthakis-Karamanos 2004: 357.

[34] E.g. αἰετὸς in Sosith. *Aethlius* (*TrGF* 1 99 F 1), οἴνη in Mosch. 97 F 6 v.12. See Xanthakis-Karamanos 1980: 109.

[35] Such as στρηνιῶ in Lycophr. *Menedemus* F 2. See Xanthakis-Karamanos 2004: 338-339.

[36] E.g. ἀγκύλος Mosch. 97 F 6 v.9. See Xanthakis-Karamanos 1980: 108-109.

[37] E.g. στεγήρης Mosch. 97 F 6 v.7. See Xanthakis-Karamanos 1980: 108. In Lycophron's *Alexandra* 328 *hapax legomena* are traceable: Kotlińska-Toma 2015: 89 and n. 123.

[38] Fountoulakis 2017: 99, with references, has aptly argued that not only vocabulary but also the exchange of ideas, imagery, etc, which dominated the communities' collective consciousness, constructed a cultural *koinē* language.

comic poets and wrote the earliest treatise on comedy in nine volumes.[39]

For this merging of poetry and classical scholarship the phrase 'a poet and at the same time a scholar', attributed to Hellenistic authors,[40] is very eloquent. Callimachus of Cyrene, perhaps the greatest of Alexandrian poets, was certainly the most significant and industrious bibliographer. In 120 volumes he registered the most distinguished authors of all literary genres: dramatists, epic and lyric poets, legislators, philosophers, historians, orators and miscellaneous writers were included in Callimachus' pioneer work, being 'a list of the most distinguished authors and their works'. Callimachus' list provided the model for the establishment of classical authors, for the canon of authors ever since, and the Hellenic heritage linked to our modern world.

For this fusion of poetry and classical scholarship it should be added that the principal directors of the Alexandrian Library, such as Zenodotus, Apollonius of Rhodes (Rhodius), Eratosthenes, Aristophanes of Byzantium (Byzantius) and Aristarchus of Samothrace were distinguished commentators of classical texts, the founders and pioneers of classical studies in Alexandria[41] and the known world. A papyrus text from Oxyrhynchus has been preserved with the names of the Library's directors (Figure 4).

The Museum of Alexandria played a major role in the age's intellectual life. Moreover, for the interplay between tragedy and the other Alexandrian literary genres, it is worth noting that the tragic concepts were expressed also in the works of the era's most famous writers: in the Callimachean poems some major issues of tragedy, such as the conflict between man and gods, the family crisis, and the citizen's opposition to his *polis*, are depicted in the *Bath of Pallas*, the *Hymn to Demeter* and in the *Aetia* respectively. Apollonius of Rhodes incorporates tragic figures into his epic narrative and Euripides' *Medea* is his dominant tragic model.[42]

The head of the Library was tutor to the prince regent, and the many writers and poets whom the Ptolemies supported all also engaged in scholarly work in the Library, classifying the texts and in most cases extensively editing them. The intellectual circle of the Museum and the Library worked both to preserve classical tradition and cultural memory in Alexandria, an area of cosmopolitanism and multicultural elements.

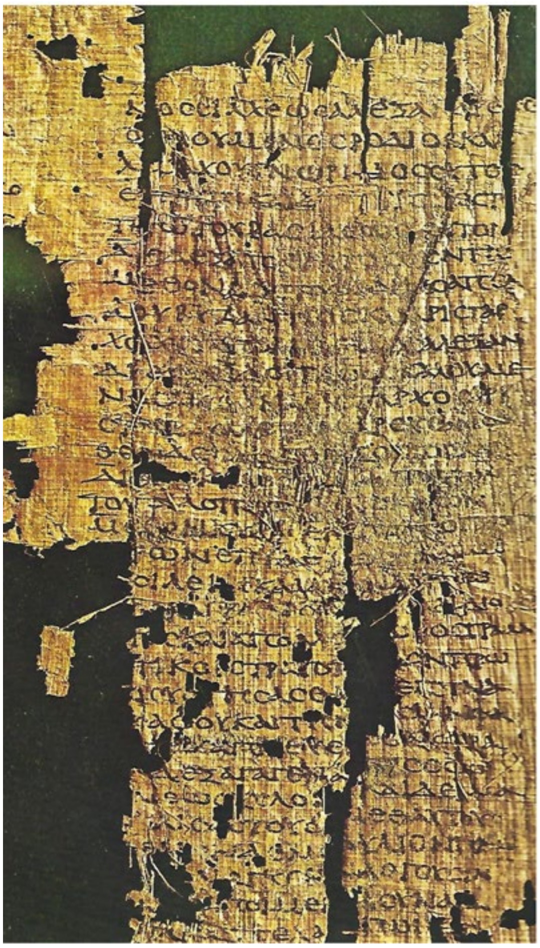


Figure 4. Papyrus text from Oxyrrhynchus with the names of the Alexandrian Library's Directors (Dublin, Trinity College Library, reproduced from the *History of Hellenic Nation*, vol. 5. 310, Ekdotiki Athinon 1974).

This cosmopolitan and multicultural dimension is distinctly echoed in the *Exagogē* of Ezekiel, a play by a Greek-speaking Jew who dramatised in Greek the story of Moses and the Jewish Exodus from Egypt. This extensive tragic text of 269 verses[43] provides a typical case of cultural syncretism, since it combines Jewish history and the conventions of Greek tragedy with a clear reception of Aeschylus, and especially of the *Persae*. Ezekiel permeated his poetic work with the concepts of divine activity, morality, and justice drawn from the Aeschylean treatment. For the Jews the Exodus marked the birth of their nation; for the Hellenes the victory at Salamis, as dramatised in the *Persae*, marked the beginning of the greatest period of their history, the Periclean Age. Greek and Jewish thought coexist in perfect harmony in Ezekiel's *Exagoge*, and proves the tremendous influence of Greek tragedy and Greek language on multicultural Alexandrian society.

[39] Sandys 1967 I: 121-122; Pfeiffer 1968 remains the classic monograph on Hellenistic scholarship.
[40] Strabon XIV 657 on Φιλιτᾶς 'ποιητὴς ἅμα καὶ κριτικός', XVII 838 (on Callimachus) 'ποιητὴς ἅμα καὶ περὶ τὴν γραμματικὴν ἐσπουδακώς'. For Alexandrian scholars and the preservation of dramatic poetry, see, recently Sistakou 2016: 25-30.
[41] Sandys 1967 I: 124ff.
[42] Cf. Sistakou 2016: 223-224.

[43] For detailed discussion: Jacobson 1983, Lanfranchi 2006; cf. Xanthakis-Karamantos 2001: 223-239 (= *Dramatica* 2004: 405-423).

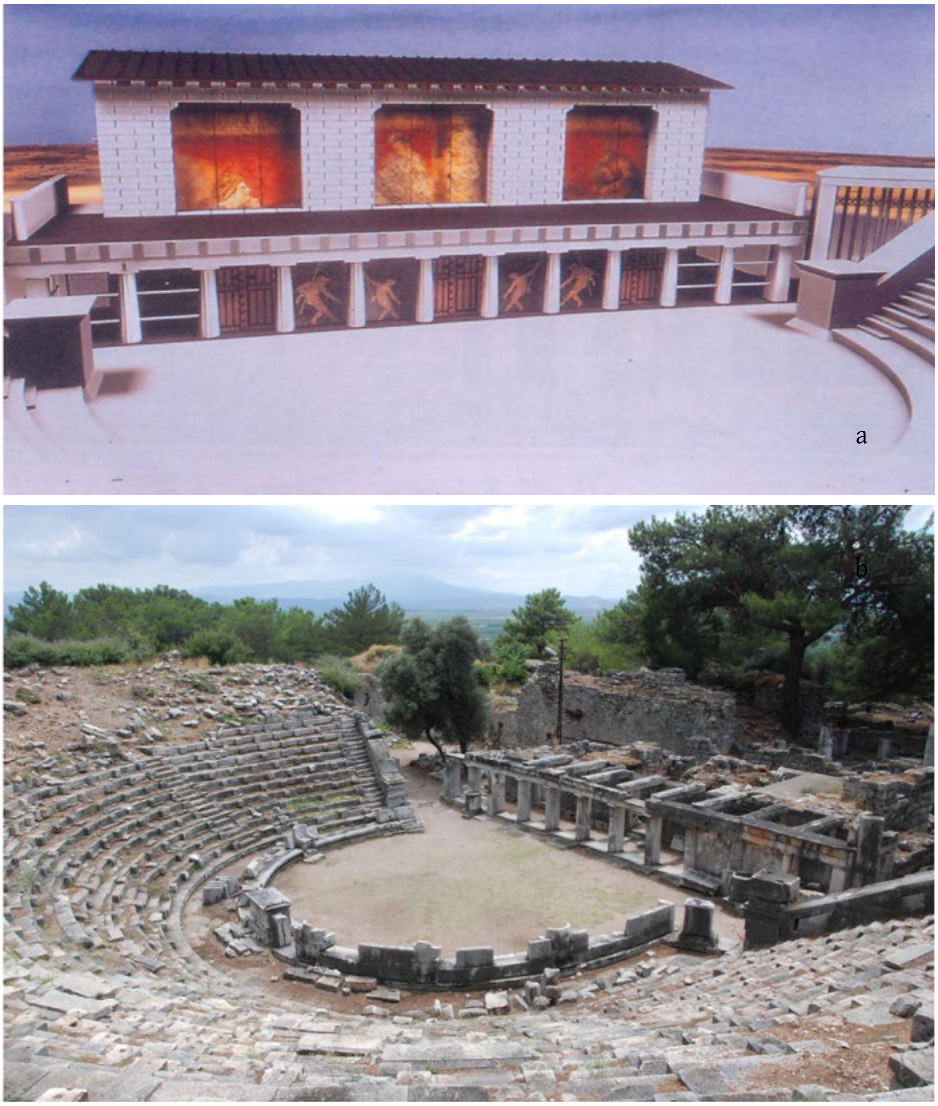


Figure 5. (a) The theatre of Priene, one of the most significant in Hellenistic times, as reconstructed. The raised stage is obvious; (b) The same theatre as preserved.

Staging

In Hellenistic times the way of staging underwent remarkable change. The chorus ceased to sing odes relevant to the dramatic action, as happened in classical drama, and sang 'interludes', as attested in Aristotle's *Poetics* (18, 1456 a 25-32). The Menandrean drama shows that in Hellenistic times the structure of a play was divided into acts, as in the modern theatre. The acts replaced the traditional division into episodes and choral odes of 5th-century tragedy and comedy.

Because of this remarkable novelty the chorus remained in the orchestra of the theatre only in the *entr'actes*, singing their interludes, and had no contact with the actors who performed the play. The only exceptions concern the Hellenistic era's many revivals of classical tragedies, where the chorus could hardly have been eliminated from the main action of the play.

Such a lack of contact between the chorus and the actors led to a radical change in theatre building, which brought about remarkable alterations in the practice of the performance itself: a two-storey stage, the so-called raised stage, was erected, which comprised: a) the 'proskenion' or the frontage of the ground floor which was divided by pilasters and the spaces between them were filled with wooden planks called 'pinakes', adorned with painted decorations, which could be easily replaced; b) the roof of the 'proskenion', which was called the 'logeion', where the actors performed their dramatic acts.[44]

The background of the 'logeion' was the 'episkenion', namely the frontage of the second floor, called the 'skene'. On the 'logeion' there were also large ornate 'thyromata', used as entrances to the 'logeion'. In order to facilitate a kind of communication between actors and chorus, in some cases stairs were attached to the 'logeion' from the side of the orchestra. Among the most important Hellenistic theatres are those of Priene and Ephessus (Figures 5 and 6).

[44] See Kotlińska-Toma 2015: 249-254.

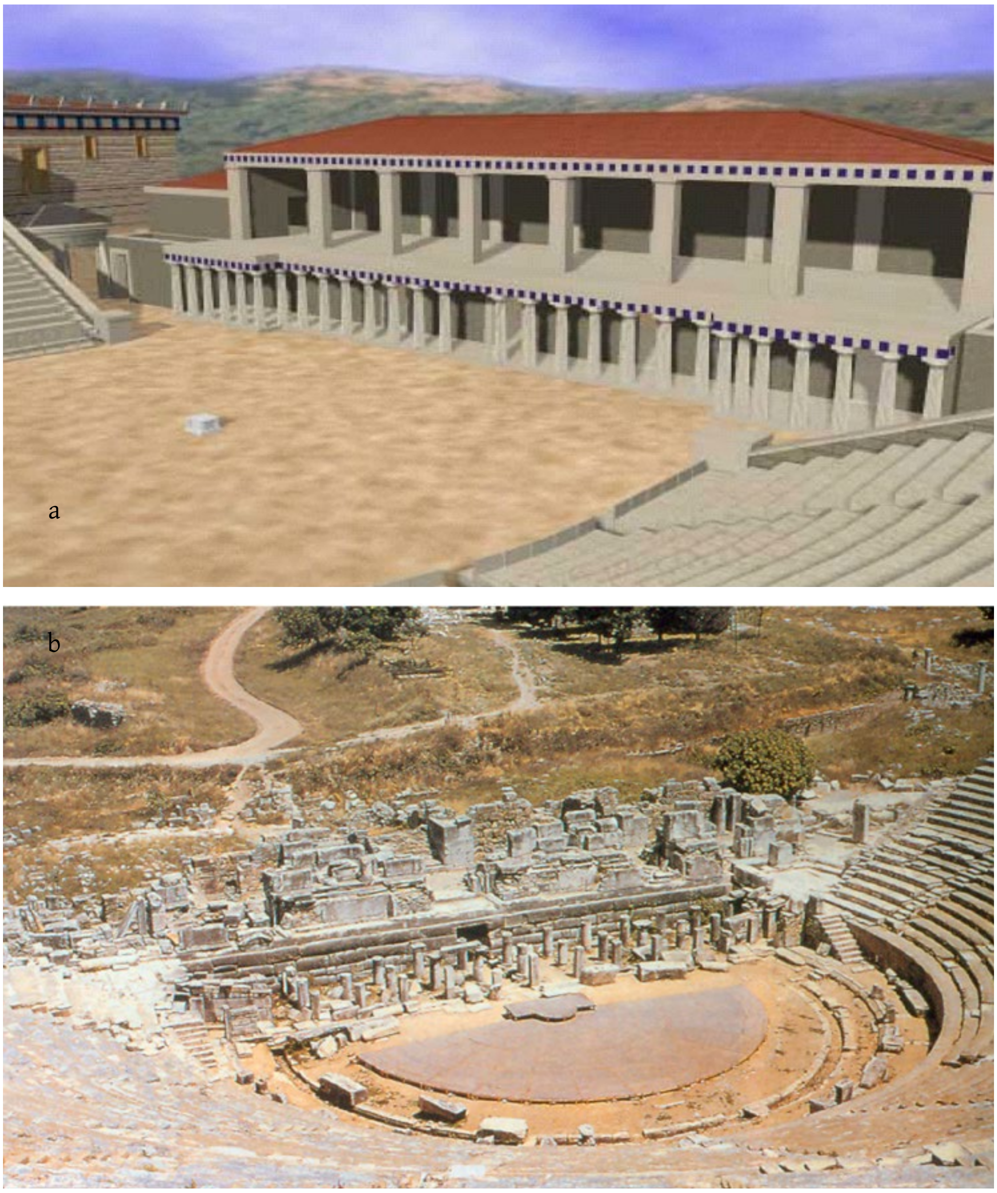


Figure 6. (a) The theatre of Ephessus as reconstructed. The raised stage is obvious; (b) The same theatre as preserved.

The high stage seems to have been raised late in the 4th or, more likely, early in the 3rd century BC.[45] The majority of theatrical buildings were built between 300 and 260 BC, the period of the Hellenistic Pleiad and an era of prosperity and stability for the cities. Regarding the actors' costumes two remarkable modifications are distinct in the Hellenistic period: masks and the high-soled shoes, the so-called 'cothornoi'.

Tragic masks played an important role in Hellenistic dramatic performances. A new type of tragic mask, with a high forehead covered by a tower of hair, the 'onkos', predominated throughout this period. The 'onkos', which can be clearly seen in many Hellenistic pictures, emphasised the distinction between the heroic past represented in tragic plays and the ordinary people of the present; it made the characters look archaic, dignified and stately, corresponding to Aristotle's characterization of tragic heroes as 'spoudaioi', superior, significant, elevated, serious (*Poet.* 2, 1448a 1ff.).

Such costume elements as masks with high forehead combined with the 'cothornoi', and high-soled shoes, disguised the reality of the human image. The difference between the real face of the actor and the unrealistic appearance of the mask can be seen in many representations on mosaics and frescoes. The interest for the individual actor and the contrast with his mask is depicted on two frescoes from Herculaneum, showing a tragic actor shortly after having taken off his mask, while his hair is still disheveled. His servant kneels near the actor's female tragic mask with a high 'onkos' and long hair (Figure 7). A similar contrast is achieved also

[45] On possible dates of the introduction of the high stage, see, indicatively: Webster 1970: 22, 109-110; Pickard–Cambridge 1956: 69ff., 194-195, 213-214; 1968: 196 (on the raised stage in relation to the introduction of the 'onkos'-mask).

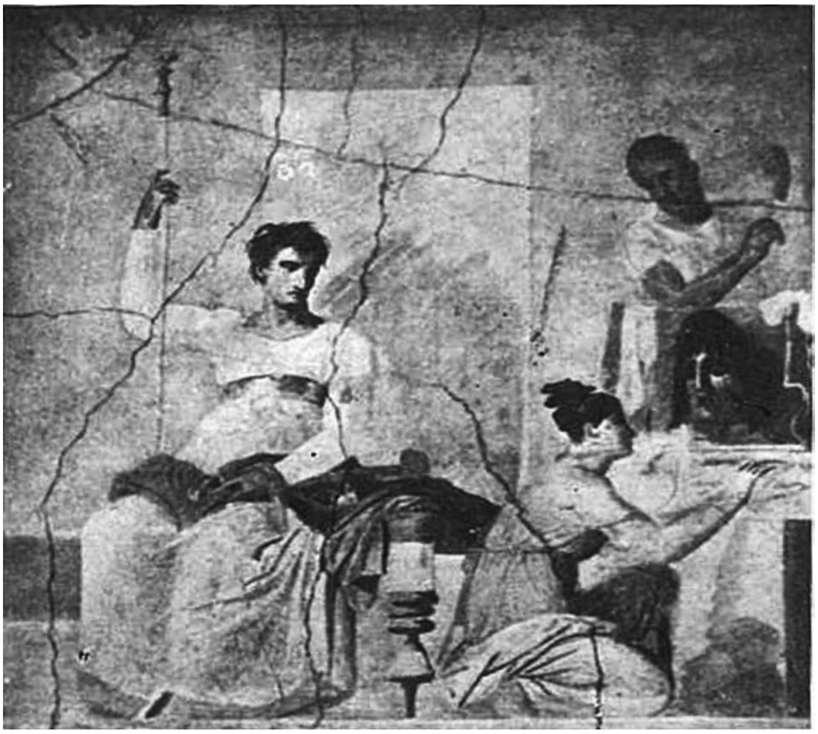


Figure 7. Actor looking at his 'onkos'-mask
(fresco from Herculaneum, Naples Museum, no. 9019).

in another fresco from Herculaneum, depicting a tragic actor or a tragic poet contemplating an 'onkos'–mask, and possibly considering whether it suits a character in his play (Figure 8).[46]

Figure 8. Actor looking at his 'onkos'-mask (fresco from Herculaneum, Naples Museum, no. 9036).

In conclusion

Despite the significant lack of texts, Hellenistic drama, either as revivals of classical 5th-century plays, or with the great production of new ones, often dealing with new and unique themes, and with the wide expansion of theatres in many cities, retained its political and social importance.

New forms of dramatic poetry, with a fusion of literary genres, appeared, such as the *Alexandra* of Lycophron, older forms were restored and flourished, as happened with satyr-plays, and a completely new field of study, classical scholarship, was born and supported by the Hellenistic poets, such as Lycophron, Callimachus, Eratosthenes and Apollonius Rhodius, the majority of them being Directors of the Alexandrian Library. This was the origin of Humanities in our world.

In a period of cosmopolitanism and multicultural societies, Hellenistic dramatic production succeeded in removing the athenocentric character of 5th-century drama. It promoted with erudition a Hellenic cultural identity, destined to exert a remarkable influence on the later periods of the Roman and Byzantine Empire. From Athens we move to Alexandria, and through the Renaissance to Modern Europe.

This is the fundamental contribution of the Hellenistic era to Hellenization and the history of culture.

[46] Thus Kotlińska-Toma 2015: 70.

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The Alexandrian cradle of philological science

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History tends to advertise mainly the geopolitical aspect of the charge launched by the Macedonian army leader, yet well-informed historians know that the cultural consequences of his military feat were equally, if not more, sensational. The Macedonian javelin (*sarissa*) paved roads and paths in a world that held new challenges and action theatres for Greek *Leitkultur*; at the same time, however, the victorious Macedonian phalanxes shifted eastwards the centres of developments within a new order of things. And in the aftermath of Alexander's death in 323 BC, in the geopolitical scene of his Successors, it was Ptolemaic Alexandria that was historically destined to become the permanent cultural capital of the new Alexandrian, or, rather, Hellenistic world. The inspiration belongs to Alexander himself, who cast the foundational stone on the banks of the Nile, but the brilliant continuity belongs to his general, Ptolemy, son of Lagos (367-283 BC), and his successors, who, for at least two centuries, added lustre to the city that received the scepter of intellectual hegemony from classical Athens.

If there is such a thing as an 'enlightened' monarch, Ptolemy Philadelphus, who succeeded his father, Ptolemy of Lagos, in 283 BC, is certainly one of the brightest, not only because he lit the famous and wondrous lighthouse on the port islet, but also because he understood that scholarship and science progress spectacularly when their servants are given the possibility to lay down the cares of everyday life. And it was for this reason that he came up with (it was probably him and not, according to another view, his father) the idea of a 'Royal Research Foundation' which was traditionally called 'Museum'. The building was part of the palace complex, it had lecture halls and discussion clubs and it housed those who excelled in letters and science, providing them with comfortable accommodation, free meals and full tax exemptions.

The Library was also set up inside the palace complex and it is likely that members of the Aristotelean Peripatos, scholars and naturalists with experience from the library of the great philosopher of Stagira, and advanced on the path of 'library management', contributed to its organization. It is certain, in any case, that the research traditions of the Athenian Peripatos irrigated the spiritual life of Alexandria in as much the same way as the Nile did for its dense population. Another smaller library was built outside the palace walls. Given that the third ruler of the Alexandrian Kingdom, Ptolemy Euergetes (born between 288 and 280 BC), was also artful, studious and a bibliophile, in the first half of the 3rd century BC the Library could boast an unprecedented collection of hundreds of thousands of papyrus rolls acquired by means fair or foul, even with raids on the ships that docked at the city port. With the passage of time, the Library came to host almost the entirety of the literary production from the preceding centuries of Greek intellectual and scientific production – an achievement and an ark of knowledge which had a Catalogue of its own and was run by distinguished scholars who also had the educational responsibility for the young successors to the throne. There was no precedent for such synergy of monarchal generosity and first-line scientists and scholars, nor was there a sequel until Renaissance Florence in the 14th century.

The Museum and the Library, like the 'Ivory Tower' of modern imagination, was a researcher's haven. At the same time, it was also the place where the immense concentration and organization of knowledge created a sense of the historicity of the Greek cultural achievement. Homer's epics, the basic and insuperable intellectual staple diet of the Greek-speaking world, the great poets of dramatic, tragic and comic, repertoire, the brilliant stars of lyrical poetry, the long line of prominent elegiac poets – everything and everyone, placed on the functional and, above all, also available to the general public, shelves of the Library, consolidated and commemorated the mighty legacy of the Greek spirit. The Museum scholars laid down the 'canon' of the most important creators in all generic areas (epic, drama, lyrical poetry, elegy, etc.) and thus initiated the concept of 'classic' and of the 'classical' author.

The community of the Museum provided its resident scholars with excellent opportunities for exchanging ideas and having high-order discussions. As one might expect, in the inner circles of this institution noble rivalry among peers also had the necessary points of friction, the 'five minutes of academic hatred', thus anticipating the familiar whims of *odium academicum*. The most peculiar aspect of the Museum community soon became the target of satirical malice, and one such malicious person, obviously positioned *extra muros*, sang in venomous verse about its internal affairs: *'many are those who are fed in crowded Egypt, some guys who scratch the papyrus and squabble day and night in the cage of the Muses'.*

The concentration and classification of the Greek literary wealth in the Alexandrian Library, as well as the group of scholars on the Museum's premises, constitute the birthplace of philology as a formal science. The practice of the philological study of literary texts had, of course, its precursors. The increasing time distance from the works of the classical period and, mainly, from Homeric epics gradually demanded more and more the explanatory intervention of scholars, most of whom simultaneously had their own shares in the poetic stock market. At the beginning of the Hellenistic period, and before the Ptolemies donated the Museum and the Library to the faithful of the letters, Philitas from Cos (born around 320 BC) is referred to as the first 'poet and critic', a statement crediting Philitas with the status of a literary scholar. It seems that Philitas practised this talent mainly on the text of Homeric epics, from which he drew rare words (the so-called 'glossae') and expressions, most probably in order to use them in his own poetry, and perhaps in order to clarify their meaning for the sake of Homeric poetry readers. Apparently, the 'critic', the one side of two-natured Philitas, wrote something like a 'dictionary of rare words and expressions'. It is particularly interesting that Philitas was the personal teacher of young Ptolemy Philadelphus, who was born in Cos.

If the second Ptolemy who reigned in Egypt developed a love for scholarship through his teacher, another student of Philitas', Zenodotus, who came from Ephesus, inherited a particular philological interest in Homer from the same teacher. We would not err far from the truth if we claimed that Zenodotus, whose heyday was around 280 BC, is the first editor of the *Iliad* and the *Odyssey*, in the sense that he was the first to systematically examine and collate the existing manuscripts of the two epics in his endeavor to arrive at the original form of the Homeric text, eliminating verses he considered spurious and often proceeding to corrections by conjecture – roughly, the 'job description' of modern editing industry. It is also likely that he was the first to divide each of the Homeric epics into 24 books. He also applied his critical interest to other poetic texts, such as those by Hesiod, Anacreon and Pindar. It is important to say that systematic textual criticism, as it is practised by modern editors of classical texts, begins with Zenodotus, the first director of the Alexandrian Library.

The same office was also held by Aristophanes of Byzantium (*c.* 257-180 BC), who may have been a disciple of Zenodotus' at a very early age. If this is the case, then the student spectacularly surpassed the teacher's performance. Aristophanes promoted textual criticism as well as the editing technique to high levels of 'professionalism', and more specifically, his philological activity on the Homeric text attests rare judgement, insight and sound conservativism. He added new signs-symbols for his editing judgements and interventions and he systematically studied issues pertaining to punctuation and accentuation. Like Zenodotus, he included Hesiod and the lyrical poets in his agenda but he also supervised the first edition of Pindar's 'Collected Works', classifying the poet's overall production in 17 poetry books. He is also credited with a complete edition of Euripides' dramas, as well as the first critical edition of Aristophanes' comedies. His erudition and multifarious scholarship kept the Alexandrian Museum flourishing and productive in times when the Hellenistic Kingdom of Egypt was not at its best from a social and political point of view. And if the salary received by the Library director had additional perks, his secured livelihood is one of the reasons we can think of as an explanation for the ample time he dedicated to his indefatigable philological activity.

Aristophanes had approximately 40 students, all of whom were philological excellences, but the best among them was Aristarchus (*c.* 217-145 BC), who originated from Samothraki and became the fifth, after Zenodotus, director of the Library. Rather *sui generis* and invariably shabbily-dressed, he tirelessly kept up his teachers' tradition of Homeric studies without neglecting, as other Museum scholars did not either, Hesiod and the lyrical poets. His studies covered the entire range of philological research, from textual criticism and etymology to issues of grammar and metre, but he claimed a totally unique distinction as the author of interpretative, running commentaries, in other words, as a philologist who, venturing beyond his traditional 'technocratic' duties, moved towards *literary* criticism. We do not know whether, according to our information, he actually wrote 800 such commentaries on various authors (48 of them concerned Homer), but if this is true, then neither the motive of a director's salary nor the reasonable margin of a human lifetime spanning around 70 years suffices to explain the miracle.

As we mentioned above, in the Alexandrian Museum there was a harmonious mingling of natural scientists and scholars. The co-habitation was not so impressive at a time when knowledge, despite the spectacular developments in its various fields, had not yet assumed the form of absolute and strictly defined specialization, as we know it today. In other words, the 'two cultures', according to C. P. Snow's terminology, could converge into the activities of one person. Such a personality was Eratosthenes from Cyrene (*c.* 275-194 BC), who also served as the Library director and constituted a university all by himself, since his research and published work covered philology, poetry, philosophy, ethnography, astronomy, geography and mathematics. The 'package' looked, indeed, very enviable and it may actually have been out of sheer envy that some of his contemporaries called him the 'Beta' (Second), meaning that he delved into everything but always came second.

The Museum and the Library were, as noted, the birthplace of philology as an established and methodologically mature science. However, their halls and study rooms fostered the maturity and excellence of a long line of literary figures who descended directly from the combination of poetic and scholarly endeavour (initiated by Philitas) and left a rich modern heritage recognised nowadays in the type of the so-called 'scholar-poet', namely someone who combines philological alertness, sometimes fussiness, with poetic sensitivity-imagination. Perhaps the most prominent 'scholar-poet' of this kind was Callimachus from Cyrene (*c.* 305-240 BC), who did not become director of the Library but drew up the first Catalogue (*Pinakes*) of its contents. The amalgam of scholarship and poetry in his work (of which, unfortunately, a substantial part failed to survive) is perhaps one of the most graceful and charming products of the spiritual and intellectual climate nurtured by the Alexandrian Museum; and if those actively involved in matters literary could have known him first-hand, then he might have been as famous as the other Alexandrian mogul of Modern Greek literature.

Hellenistic Alexandria, with its Museum and Library, is exemplary and instructive from another aspect as well. The first Ptolemies, all of whom were pupils of powerful philologists and librarians, understood that by shielding the best in every field of knowledge from everyday-life turbulence, they were giving them the space and time necessary to excel and make their mark in arts, literature and sciences. The political lords of this kind have not always been the rule, and this is definitely not so nowadays. Another late-day Ptolemy, the one who was nicknamed by the Alexandrians themselves 'Kakergetes' (= 'Malefactor', naturally instead of 'Euergetes' [Benefactor]) and 'Fyskon' (= big-bellied), in 145 BC forced Aristarchus and other significant residents of the Museum to leave Alexandria. This was the first major crisis in the history of a great educational institution – and it was caused by the passions and intrigues of politics, which often happens to bring 'malefactors' rather than 'benefactors' to the fore. The forced departure of the great Aristarchus, who died a little later in Cyprus, left a vacancy at the post of the library director, which was filled by an appointed ... army captain. For the latter, however, as Cavafy might have put it, History would not spare even a slight footnote; and a 'big-bellied man' would not be enough to cast a shadow over the unparalleled glamor of Hellenistic Alexandria, which, with its intellectual lighthouse, continues to illuminate the cultural path of the West in so many ways.

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Egyptian and Egyptiote literature as a bridge between two cultures

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The Egyptian Greek (Egyptiote) writers watched the literary production of the Arab *litterateurs*, with whom they coexisted on a daily basis. Panos Patrikios, in his article entitled 'From New-Egyptian Literature: Poetry and Poets of Egypt', published in the periodical *Pharos*, refers to Egyptian poetry and its flowering. This researcher seems to have known the course and evolution of Egyptian poetry.

He believes that the Turkish yoke was responsible for spiritual decline in the country.[1] In the same article he gives some examples of the names of great writers and poets, such as Hafez Ibrahim, Aisha Hahnem Altaimuraia, Ahmad Shawqi, and others. However, the 'prince' of poets, Ahmad Shawqi, is of particular importance and interest, and, rightly, as he was a great poetic genius: 'Shawqi believes in God as the King of the Word, and does not hesitate, although being a Muslim, to refer to the ancient gods of Egypt and the Gentiles, from whom the artisans and the wise men were inspired'. And he continues to emphasise the religious effect on Ahmad Shawqi's poetic work. Indeed, religion plays an important role. It is not only the religious but also the philosophical elements that are projected in his poetic work. There is also an ancient Greek motif that can be distinguished in its verses:

> Shawqi is a religious person, and, especially in his strong faith and dedication to the eternity of the spirit, he is deeply affected by the philosophy of Plato, who considered God as the ultimate, incorporeal infinite and irreversible Notion.
>
> He has preserved in his soul the light that the beautiful glimpses of the ancient Greek spirit gave him, and that is why his poetry exudes archaism (αρχαϊσμός), and sometimes one thinks that his voice emanates from the depths of distant centuries rather than the throat of a human being of today's 'cosmopolitan and heavily damaged society'.[2]

Indeed, one notes the ancient as well as today's Greece in his poetry. Shawqi was one of the Arab poets who expressed his admiration for Alexander the Great, the founder of Alexandria. In his poetic work he expresses his sympathy for ancient Greece:

> Alexander builds himself in Egypt
> Something that the Kings did not build
> And the chiefs. A city that gathered
> The crowds of wise (men and women)
> And students. A harbour glorified for many years
> And candlelight of the letters
> That sent into its land the light of
> Learning.[3]

There were some in the Greek-Egyptian readership who reflected that interest, not only in ancient Arabic, but also in contemporary literature. An example is the Egyptian writer and translator Elisavet Psara, who has included in *Xwtikes Flogeres*, one of her books, translations of ancient poems into modern Arabic: one called 'The Nile' and another entitled 'What is Love':

From what time does the Nile, in the villages roll?
And in the cities with abundance, do you scatter your waters?

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[1] He himself underlines that: "Η ποίησις, ὁ ὡραῖος καὶ εὐγενικὸς αὐτὸς καρπὸς τῆς σκέψης καὶ τοῦ ρυθμοῦ, ἄνθισε στὴ νεότερη Αἴγυπτο εὐθὺς μετὰ τὸ ἐθνικὸ καὶ πνευματικό της ξύπνημα ποὺ ἄρχισε στὴ δεύτερη πεντηκονταετία τοῦ περασμένου αἰῶνος. Ἦταν ἡ ἐποχὴ ποὺ ἡ Αἴγυπτος, ὕστερα ἀπὸ τὴν ἀπονέκρωση καὶ τὸν πνευματικὸ μαρασμὸ ποὺ ἔφερε ἡ βάρβαρη διοίκηση τῶν Τούρκων, ἄρχισε νὰ αἰσθάνεται τὴν ἀνάγκη τῆς ζωῆς, τῆς ἐλευθερίας καὶ τοῦ πολιτισμοῦ σὲ ὅλες της τὶς μορφές. Ὑπὸ τὴν πίεση τῆς Εὐρωπαϊκῆς ἐξελίξεως, ὁ τόπος ἄρχισε νὰ αἰσθάνεται τὴν ἀνάγκη πνευματικῆς τροφῆς, συνέβαλε δὲ πολὺ στὴ λογοτεχνικὴ κίνηση καὶ ἰδίως στὴν καλλιέργεια τοῦ ποιητικοῦ ταλάντου τῶν Αἰγυπτῖων ἡ Συριακὴ Μοῦσα, ἡ ὁποία διαφύλαξε μ' ἀγάπη τοὺς θησαυροὺς τῆς παλαιᾶς Ἀραβικῆς λογοτεχνίας καὶ τοὺς μετέδωκε στοὺς νεοτέρους Αἰγυπτίους, κι ἔτσι βαθμιαίως τοὺς δημιουργήθηκαν τὰ καλλιτεχνικὰ ρεύματα καὶ ἡ χώρα αὐτὴ ἀπόκτησε τοὺς πρώτους της ποιητὲς ἐμπνευσμένους ἀπὸ τὰ ἰδανικὰ τῆς ἰδιαιτέρας των ζωῆς καὶ περιβάλλοντος.› Βλ. Πάνος Πατρίκιος, ‹Από την νεο-αιγυπτιακή λογοτεχνία: Ποίησις και ποιηταί της Αιγύπτου›, Ο *Φάρος* 2 (124), έτος 6º, (Φεβρ. 1926), σ. 39.

[2] He comments that: 'Ahmad Bey Shawqi, without any doubt, is the greatest poet of modern Egypt and poetic work is the brightest and noblest manifestation of literary regeneration of this country. He is the head of a school that followed and continue to follow, for many years, Egyptians poets, because it is the first that mapped out new ways of expression more suited to the modern spirit, but without depriving his poetry of the magnificent evocative rhythms that produced such great art from the great poets, in the years when the Arabic spirit grew rich, and, in particular, the temptation of the Byzantine dynasty, the gold of these Arabs [...] Of the philosophical poetry and cosmogonic idioms that characterise much of his work, Shawqi is a true believer in God, and in this point, especially in the flames of faith and dedication, Shawqi is effected deeply by Plato's philosophy, which considered God as the ultimate, incorporeal and irreconcilable source, without end.' See Ibid: 42.

[3] Ibid: 43.

You have descended from heaven, or your soul
From the waters was formed, of the divine Paradise?
And from what source did you grow, or even rainy torrents,
Or what kind of flood did you flood the plains?
Which machine the dress you weave for so many years?
Do your banks wear and where will they live forever?
Giving water and feeds the fields with your broad waters
And do not strain the good that your embrace pours.
From your waters you scatter gold is born
And drown with this earth, and it becomes more fruitful.
If a human being can take a divine form
To God would fit the omnipotence.
You scatter in our country of happiness the gifts
And from your hands rolls life, rich in the country.
You are the roots of Upper Egypt's culture
And her plants are cruel because you are raining
Songs let me knit for you play and trance
Because my heart loves you, deep, honestly.[4]

Psara, who, did not know Arabic, as she confessed herself,[5] however was interested in Arabic literature and mainly poetry, ancient and modern. She also tried to go deeply into traditional Egyptian songs. She comments on the poetic production of the Arabs, emphasizing that it is great and rich and deserves our admiration.

She also considers that nature and the environment have a very important role in Arabian poetic life and that nature has richly endowed Arabs with highly poetic qualities. Arabic life has a great and close relationship to poetry.[6]

Psara divided Arabic poetry into two eras, pre-Islamic, known in Arabic as al-Shᶜir al-Jahili, and Islamic. She also claimed that there were no written poems in the pre-Islamic era, with the exception of the 'Mulallaqāt', that is, those extraordinary poems the Arabs kept in Kaaba. She seemed to know the spiritual movement of the place.

Poetry played a very important role in the life of Arabs. Edward Said commented on the poetic production of the Arabs, pointing out that this poetry was created by a completely different and strange (for Europeans) people, under very different climatic, social and historical conditions than those understood by Europeans. Poetry, impregnated as it is by prejudices, beliefs, superstitions, can only be truly understood after long and laborious study.[7]

The journal *Nea Zwi* published a summary of a series of lectures in French by Wassef Bey Ghali, on Arabic poetry, which mentions its general rules. Its authenticity is further emphasised by the fact that it of pure Arabic production, and that it has not been influenced by foreign factors.[8]

Arab society in the past was a militant and poetic society. The poet held a prominent place in society. In pre-Islamic society, verse and sword played central roles in people's lives. A poet held an important role in his society. He represented the language that would both defend and sing its country's glory. On the poet's position in Arab society, Ghali notes: 'The poet was originally surrounded by great respect. He was a holy person, a cantor of its glory, the guardian, the defender of his blessing, praising its glory and the glory of its inheritance; for the verses represented the only memory of Arab pre-Islamic history. He spoke against the sarcasm of the opposing poets, and was the agent of peace when he defied war with harmonious censorship. The show of a great poet was celebrated in an historic event! The neighbouring tribes, friendly, came with a great show of congratulations to the gentle folk that gave birth to the great man; and they feasted.'[9]

On 'Mouallaqāt', the great poetry of the Arabs, he writes: 'There are seven poems that they named Mouallaqāt and all pre-Islamic poems that are the classics of the Arabs. These poems were formally made known to the poets of all times, apart from a few exceptions, which they take as examples.'[10]

Several scholars have commented on the attitude of Islam towards poetry. Many, especially Westerners, felt that Islam negatively affected poetry. They also claim that Prophet Muhammad's own attitude was negative. This negative attitude of the Islamic religion made the Arabs focus their interest in the *Quran*, thus abandoning

[4] Ελισάβετ Ψαρά, *Ξωτικές Φλογέρες: (Διαλέξεις – Μεταφράσεις)*, Τυπογραφείον του Εμπορίου, Αλεξάνδρεια, 1954: 37.

[5] She notes in a lecture: 'Καὶ ὅμως οὔτε ἐγνώριζα, οὔτε καὶ τώρα γνωρίζω τὴν ὡραία αὐτὴ γλῶσσα μὲ τόσο πλούσια φιλολογία.' See, ibid: 51.

[6] Ibid: 100-101.

[7] Edward W. Said, *Οριενταλισμός*, ό.π.: 158.

[8] 'Καὶ πρῶτα τί εἶν' ἡ Ἀραβικὴ Ποίηση; Τὴ χαρακτηρίσανε: Ἡ ὁρατὴ εἰκόνα ἀληθειῶν, πράγμα ποὺ φανερώνει κατανόηση πολὺ ὑψηλὴ τῆς ποίησης: Εἰκόνες αἰσθητές, πραγματικῶν αἰσθημάτων καὶ ὄχι φκιασιδωμένων μὲ ἀλήθειες ἢ μὲ ψέματα. Ἀκόμα τὴ χαρακτηρίσανε μὲ πολὺ λυρισμό, ὅπως τῆς ταιριάζει. [...] Τέλος ὁ Ἔμπν Χαλοὺν [Χαλντούν] ὁρίζει τὴν ποιητικὴ τέχνη ἢ τὴν τέχνη νὰ κάνει κανεὶς στίχους, ἢ πιὸ σύντομα τὴν ποίηση, γιατὶ οἱ Ἄραβες δὲν ἀναγνωρίζουν γιὰ ποιητικὰ παρὰ τὰ ἔργα μὲ στίχους: Ὁ στίχος εἶναι τὸ εἰκονισμένο λεκτικὸ μὲ μέρη ἰσομετρημένα καὶ ρυθμισμένα, ἀνεξάρτητα τὰ μὲν ἀπὸ τὰ δὲ καὶ σχηματισμένα σύμφωνα μὲ τοὺς ἰδιαίτερους κανόνες τῶν ἀρχαίων Ἀράβων. [...] Πρέπει λοιπὸν γιὰ νὰ γίνει κανεὶς ἄξιος τοῦ τίτλου τοῦ ποιητοῦ νὰ γράφει εἰκονισμένη γλώσσα, τηρώντας ὄχι μόνο τοὺς κανόνες τῆς μετρικῆς, ἀλλ' ἀκόμα ἀκολουθώντας ἀκριβέστατα τὴν πραγματικὴ διάταξη τοῦ ποιήματος ἢ τοῦ λόγου ποὺ τοῦ χαράξανε οἱ ἀρχαῖοι ποιηταί. Κ' ἔτσι, πράγμα ἀνήκουστο, ἡ φαντασία καὶ τὸ θέλγητρο φαίνονται ἐξορισμένα ἀπὸ τὸ βασίλειο τῶν Μουσῶν. [...], ἀλλ' ἕνα πράγμα εἶναι ἀναμφισβήτητο, τὸ μόνο ποὺ μᾶς ἐνδιαφέρει, πώς ἡ Ἀραβικὴ Ποίηση τίποτα δὲν χρωστᾶ στοὺς Ἕλληνες, οὔτε στοὺς Ρωμαίους, οὔτε σὲ κανένα.› See, Wassef Bey Ghali, 'Η αραβική ποίηση›, translated by K. N. Κωνσταντινίδης, *Νέα Ζωή*, 9 / 2, 1914: 177-178.

[9] Ibid: 181.

[10] Ibid: 181.

poetry, because they had to devote themselves to their new religion and their Sacred Book.[11]

Elisavet Psara published in her poetic collection *Myrwmena Vradya* some poems by the Egyptian poet Ahmed Rasim, for example the one entitled 'Absence, Densities, and Ahmad also said why'. This poet wrote in French. It is remarkable that C. P. Cavafy also took note of his poetic work, as I will explain later. This excerpt from one of his poems is characteristic:

> This is the sweetness of mangos smashing
> On the statuette's body
> Where the grace of God left them to fall ,
> They are scorching intoxicating mildew,
> Where, in my memory
> I tremble, Pious as a forbidden shroud.

In Greek Egyptian publications there are many and frequent references to contemporary Arab poets and writers, such as Ahmad Shawqi, Hafez Ibrahim and Halil Mutran. G. Pierides, in an interview with the poet Halil Mutran, refers to the ignorance of Egyptian Greeks concerning Arab literature, but he underlines that this ignorance has diminished thanks to the French translations of many modern writers.[12]

A large number of Greek Egyptians interested in Arab literary production relied on translations in foreign languages, mainly in French. An example is Elisavet Psara. Mutran says: 'I can say that the birth of the Arabic poet begins from Samy Pacha. Then came Ismael Sabry Pasha, Hafez Ibrahim and Shawqi. These three poets have already taken one more step forward, but they have been hesitant to say that they did not dare to overcome the great tradition'.[13]

The erotic element is also an essential feature of Arabic life and hence of Arab poetry. 'Liopyri', from the poetry collection of Psara, is a characteristic erotic poem:

> Young are happily leaving themselves
> To the flamboyant celebration of feasts,
> The bee leaves the red lily
> With golden drops of pollen.
> That's how Chloe and Daphne
> Loved each other.
> Ahmad came with Fatima
> Around them the spring made it flourish
> And the buds opened in the meadows.[14]

Intellectual and scholarly people among the Greek communities, and especially in Egypt, studied systematically the rich Arab literary production. Tsirkas in his article 'The Anti-War Feeling in demotic Egyptian Poetry' does not conceal his admiration for traditional Egyptian songs; he even considers that demotic songs express the true feelings of people.[15] At the end of his article, Stratis Tsirkas commends the useful contribution of the Alexandrian poet Cavafy to the readers of his study on Egyptian poetry, because in this way the reader will be able to feel and approach the spirit of the Egyptian people.[16]

Besides sympathy for Arabs in general and Egyptians in particular, Tsirkas spoke the Arabic language, which enabled him to study literary texts in the original. Tsirkas translated a folk song, but he does not tell us his source, nor mention its title. An excerpt from this poem is translated by the himself:

> I wish we were hiding
> As the month of recruitment passed
> I wish we were hiding in the oasis!
> The officer liked him and gave him a sword
> Where the children of Rum do not have such,
> The officer liked him and gave him a *khaki*

[11] On the attitude of Islam towards poetry, he comments: '῞Οταν ἦρθεν ὁ ἰσλαμισμός, ἡ ποίηση γιὰ ἕνα διάστημα παραμελήθηκε. Οἱ Ἄραβες εἶχανε βρεῖ στὸ Κοράνι καινούρια τροφὴ γιὰ τὸν ἐνθουσιασμό τους. Τοὺς ἐμάγεψεν ἡ γαλήνια ὀμορφιά, ἡ εὐγένεια, ὁ ρυθμός, τὸ θεῖον αὐτῆς τῆς ἁρμονικῆς γλώσσας, ποὺ δὲν ἦταν οὔτε στίχοι, οὔτε πρόζα, ἀλλὰ κάτι τί ἀνώτερο καὶ ἀπροσδιόριστο ποὺ τοὺς κατέθελγε καὶ τοὺς ἐθάμπωνε. Ἀργότερα, ἕνα δόγμα ἐκήρυξε τὸ Κοράνι ἀδημιούργητο, τὸν αἰώνιο τύπο τῆς φιλολογικῆς ὀμορφιᾶς, τόσο πού, ὅπως λὲν οἱ σχολιασταί, οὔτε οἱ ἄγγελοι, οὔτε οἱ ἄνθωποι θὰ μποροῦσαν νὰ γράψουν μιὰ φράσιν ἰσάξια μὲ ὁποιαδήποτε τοῦ ἱεροῦ βιβλίου! Καὶ φυσικά, ὁ ποιητὴς ἄν ἔπεσε πιὰ ἀπὸ τὸ βάθρο του, ἔπαυσε νὰ ἔχει τὴν ἱεροσύνη ποὺ ἦταν πιὰ ἀπὸ τώρα καὶ στὸ ἑξῆς ἄχρηστη· δὲν ἦταν πιὰ ὁ ὑπερασπιστὴς καὶ ὁ προστάτης τῆς φυλῆς του, κι ἀκόμα χειρότερα τὸν ἔβλεπαν μὲ κακὸ μάτι. Πράγματι δίκαια ἢ ἄδικα λένε ὅτι ὁ Προφήτης εἶχε κατσαδιάσει τὴν ποίηση καὶ τοὺς ποιητὰς καὶ στὸ Κοράνι ὑπάρχουν δυὸ τρία ἐδάφια ποὺ ἐξηγοῦνται ὡς μομφὴ γιὰ μερικοὺς ποιητές. Ἐπίσης οἱ διάδοχοι τοῦ Μωάμεθ ἐνθάρρυναν τὴ μελέτη τοῦ Κορανίου εἰς βάρος τῆς ποίησης. Σ' αὐτὴ τὴν ἐποχὴν ἐξάλλου τῆς θρησκευτικῆς μανίας, τὰ πνεύματα εἶναι πιὸ προκατειλημμένα ἀπὸ τὴ θρησκεία, τὸ μυστικισμό, τὸν προσηλυτισμό, τοὺς πολέμους καὶ τὶς κατακτήσεις παρὰ ἀπὸ τὴν τέχνη καὶ τοὺς στίχους. Μ' ὅλα ταῦτα δὲν εἶναι ὅλως διόλου καταδικασμένη.' See, ibid: 182.

[12] 'Τόσο στὴν Ἀλεξάνδρεια, ὅσο καὶ στὸ Κάιρον, βγῆκαν γαλλικὰ περιοδικὰ μὲ σκοπὸ νὰ μᾶς δείξουν ὅτι ἡ Αἴγυπτος ἔχει καὶ αὐτὴ τὴ σημερινή της φιλολογία, ὅπως ἔχει τὴ σημερινὴ της ζωή. Τὴ σπουδαιότερη ἐργασία τὴν ἔκαμε τὸ Μεσὰζ Ντ' Ὀριάν, τὸ ὁποῖο πρὸ δυὸ ἐτῶν ἐξέδωκε ἕνα ὀγκῶδες τεῦχος, γιὰ τὴ σύγχρονη ἀραβικὴ διανόηση. Οἱ δικοί μας καὶ οἱ ξένοι ποὺ εἶχαν τὴν περιέργεια νὰ διαβάσουν ἢ καὶ νὰ ξεφυλλίσουν μόνο τὸν τόμο ἐκεῖνο ἔμειναν κατάπληκτοι. Εἶδαν πὼς ὄχι μόνο εἶναι ζωντανὸς ὁ ἀραβικὸς λαός, ἀλλὰ ἔχει καὶ συνείδηση τῆς ἀποστολῆς του. Ἐκεῖ μέσα συνάντησα καὶ τὸ ὄνομα τοῦ μεταρρυθμιστοῦ τοῦ Κορανίου Ἄμπντελ Ράζεκ, ἐκεῖ τοῦ ποιητοῦ Σάουκι βέη, ἐκεῖ καὶ τοῦ Χαλίλ βέη Μουτράν, τοῦ πλέον προοδευτικοῦ, κατὰ τὴ γνώμη τῶν εἰδικῶν, Αἰγυπτίου ποιητοῦ' See, Ανώνυμος, 'Σημειώματα', *Αλεξανδρινή Τέχνη* 2 (Φεβρ. 1930): 77.

[13] Ibid: 77.

[14] Ελισάβετ Ψαρά, *Θάλασσες*, Τυπογραφείον του Εμπορίου, Αλεξάνδρεια. 1960: 9.

[15] He writes himself characteristically: '῞Οπως τὰ δικά μας δημοτικὰ τραγούδια, ὅπως τὰ σέρβικα, τὰ ἰσπανικά ρομαντσέρος, τὰ γιαβανέζικα χάι κάι, καὶ τὰ μπλιοὺς τῶν νέγρων τῆς Ἀμερικῆς, τὰ δημοτικά Αἰγυπτιακά τραγούδια καθρεπτίζουν καλύτερα ἀπὸ κάθ' ἄλλο λογοτεχνικὸ ἢ καλλιτεχνικὸ εἶδος τὰ αἰσθήματα τοῦ λαοῦ τῆς χώρας ποὺ τὸ τραγουδεῖ'. Βλ. Στρατής Τσίρκας, 'Το αντιπολεμικό αίσθημα στη δημώδη αιγυπτιακή ποίησι', *Πολιτισμός* (Δελτίον Ειρηνιστικών Ενώσεων Αιγύπτου) 12-13 (Σεπτ. – Οκτ. 1937): 27.

[16] Ibid: 27.

Which the children of Rum do not have.[17]

It is also worth noting that most of those that come into contact with demotic poems do not mention their sources, except for Elisavet Psara.

Eugene Michaelides, in an article, commented on the Arab ignorance of modern Greek culture by the Arab readership in general. The main reason was that Greek writers who lived in Arab countries, and who did not know Arabic, except for the working class who knew some Arabic for business reasons, wrote in the Greek language.

There were also no translations that would allow the Arab readership to study Greek literature. However, there are exceptions in very few periodicals and newspapers, such as the *Egyptian Greek* ('Egyptiwtes Hellin'), which was bilingual (Greek and Arabic) and *La Semaine Egyptienne* (in French). At this point, we quote an excerpt from the article by Michaelides, underlining:

> 'Today's generation of the Indigenous Egyptians from the great and multilateral action of Hellenism to all Egypt until the last limits of Sudan, they do know only the word 'baqal', which means a certain dose of contempt and sarcasm! This name philologically means grocer, frankly many of them they usually allegorically giving the meaning of the adventurers, the workers and the thieves. Saying today's generation, we do not mean those indigenous Egyptians, whom are living in dark and wet slums, and who in the slightest nod of personnel tramp armed with walking stick, brick, with bottles, and with what lies they will screw it up and destroy everything! [...].It is the generation of this kind, which is equipped with a certificate of higher education and study, which comes from Europe, America and Syria, to transmit the light of knowledge to the inhabitants of the country, irrespective of nationality and social class'. [18]

Speaking of this particular educated generation of Egyptians, Michaelides had in mind the great Arab writer Taha Husain. This scholar was one of the greatest Arabs, of Egyptian origin, writers, who dealt systematically with ancient Greece and ancient Greek literary production. Eugene Michaelides, in an article titled 'Taha Hushen and Antigoni in Arabic,' published in Panegyptia, writes, praising the Arab writer:

> 'For us the Greeks, Taha Hushen is an extraordinary figure. He is a philhellene and perhaps the only Egyptian, who loves and admires the ancient Greek. This language has been learned by many by listening'. [19]

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17 Ibid: 25.

18 Ευγένιος Μιχαηλίδης, 'Ο Αιγυπτιώτης ελληνισμός και το μέλλον του (1800-1926)', *Ο Φάρος* 7 (129) (1 Ιουλ. 1926): 203. It is noteworthy that Taha Hussein in a meeting with some scholarly Greeks of Egypt showed great interest in the establishment of a section of Modern Greek Literature "Ἡμεῖς εἴμεθα προθυμότατοι νὰ ἱδρύσωμεν ἕδραν νεοελληνικῆς φιλολογίας καὶ τέχνης, ἀρκεῖ καὶ τὸ Πανεπιστήμιον Αθηνῶν νὰ ἔπραττε τὸ ἴδιον ἱδρύων ἕδραν Ἀραβολογίας'. Taha Hussein, a well-known philhellene, dean of School of Philosophy in Cairo University at the time, did not hesitate to express his love for Greek culture and Greek philosophy. G. N Kontogiannis was thrilled by the fact that this Arab scholar is trying to create a link that can unite the universities of Greece and Egypt, a feature that would also contribute to the study of the culture of the two countries. At this point Kontogiannis writes: 'Στὴν Ἑλλάδα μας σοφοί ἐπιστήμονες σαν τον Taha Housain, καταπληκτικοί ἄνθρωποι σαν καὶ αὐτὸν, ποὺ ἂν καὶ δὲν εἶδαν ποτὲ τὸ φῶς τοῦ ἥλιου γαλουχοῦνται μὲ τὸν κλασσικό ἑλληνικό πολιτισμὸ καὶ μεταφράζουν τὴν *Ἀντιγόνη*, ἀποθεοῦνται καὶ στεφανοῦνται. Ἕτσι θὰ ὑμνηθῇ ὁ Taha Housein ποὺ θυμίζει ἕναν νεώτερο Ὅμηρο'. Βλ. Γ. Ν. Κοντογιάννης, 'Η πνευματική επικοινωνία Ελλάδος και Αιγύπτου', *Παναιγύπτια*, αριθ. 4 (455) (22 Ιαν. 1938): 8.

It is also worth mentioning what Taha Hussein emphasises in his work Qadat al-Fikr ('οι Ηγέτες του Σκεπτικισμού'): 'What was the basis of Greek life in ancient Greece and its first contact with culture? And in its first contacts with culture? On what basis was Arab life based on the nomadism of the Arabs? And in its first contacts after Islam? On Poetry! And we can only say on poetry. The Arabs and the Greeks are absolutely like each other in this area. You can look for their philosophers, wise men, politicians and social life managers in antiquity and Jahilyiah you will find only the poets. You can look for their philosophy, their religion, their different systems, their search for the liveliness of their minds and their feelings, and you will not find poetry. Poetry is the first dominant phenomenon for these two nations. [...] The poets are the leaders in the various nations [...]. would there be the Hellenic Civilization that created Socrates, Aristotle and created Aeschylus and Sophocles, who also created Phideas and Pericles without Greek antiquity where the poetry of Homer and his descendants dominated; Would there be Islamic Culture, where caliphs, scientists and genius men appeared, without the Arab Jahilyyiah, where Emr'u el-Qais, al-Nabiba, , al-Asa (al-Acasha), Zuhair and others who do not know their value? as there is a difference between Jahilyiah of Arabs and Greek antiquity. The Arab Jahilyiah has only influenced the Arabs and Islamic civilization and little has surpassed that. That's why the Arab poets of Jahilyiah are only Arab poets nothing more anything less. While ancient Greek civilization has influenced the Greeks, the Romans, the Arabs, has also influenced mankind in ancient times and the Middle Ages, and now affects modern humanity and will continue to influence it for a long time (as long as Allah wants). That's why the poets of Ancient Greece were Greeks, but they belong to all mankind at the same time'. ‹علام كانت تقوم الحياة اليونانية في بداوة اليونان وأول عهدها بالحضارة؟ وأول عهدها بالحضارة؟ وعلام كانت تقوم الحياة العربية في بداوة العرب؟ وأول عهدهم بالاسلام؟ على الشعر! ونستطيع أن نقول على الشعر وحده. فالعرب واليونان يتشابهون في هذه الجهة تشابهاً كاملاً، تستطيع أن تبحث عن فلاسفتهم وحكمائهم وقادتهم وساستهم ومدبرى أمورهم الاجتماعية أيام البداوة فلا تجد الا الشعراء. ثم تستطيع أن تبحث عن فلسفتهم ودينهم ونظمهم المختلفة وحياة عقولهم وعواطفهم فلا تجدها الا في الشعر. الشعر اذن هو أول مظهر من مظاهر الحياة الاجتماعية القوية لهاتين الأمتين. [...]واذن فالشعراء هم قادة الفكر في الأمم [...]. وهل كانت توجد الحضارة اليونانية التى أنشأت 'سقراط' و 'أرسطاطاليس' والتي أنشأت 'ايسكولوس' و ' سوفوكليس' والتي أنشأت 'فيدياس' و'بيركليس' لو لم توجد البداوة اليونانية التي سيطر عليها شعر 'هوميروس' وخلفائه؟ وهل كانت توجد الحضارة الاسلامية التي ظهر فيها من ظهر من الخلفاء والعلماء وأفذاذ الرجال لو لم توجد البداوة العربية التي سيطر عليها امروء القيس والنابغة والأعشى وزهير وغيرهم من هؤلاء الشعراء الذين نبخثهم أقدارهم ولا نعرف لهم حقهم؟ غير أن هناك فرق كبير بين بداوة العرب وبداوة اليونان. بداوة العرب أثرت في العرب وفي الحضارة الاسلامية ولم تتجاوز الحضارة الاسلامية الا قليلا، واذن فشعراء الجاهلية العربية عرب لا أكثر ولا أقل.أما بداوة اليونان فقد أثرت في اليونان وأثرت في الرومان وأثرت في العرب وأثرت في الانسانية القديمة والمتوسطة وهي تؤثر الآن في الإنسانية الحديثة وستؤثر فيها إلى ما شاء الله واذن فشعراء البداوة اليونانية يونانيون ولكنهم ملك للإنسانية كلها'.

Βλ. Taha Housain, *Qadat al-Fikr*, al-Hilal, Κάϊρο, 1925: 6-8.

19 Ευγένιος Μιχαηλίδης, 'Ο Τάχα Χουσέν και η *Αντιγόνη* εις την αραβικήν', *Παναιγύπτια* 22 (4 Ιουλ. 1931): 9. He also writes about the Egyptian Taha Hussein 'Δὲν γνωρίζουμε τὸν ἄνδρα προσωπικῶς. Παρακολουθοῦμεν ὅμως τὰ γραφόμενά του καὶ τὸν θαυμάζουμεν. Εἰς τὸ πρόσωπόν του ἐκτιμῶμεν τὴν πνευματικὴν ἀνεξαρτησίαν, τὴν διαυγῆ καὶ εἰλικρινῆ σκέψιν, τὴν ἠθικὴν ταόλμην καὶ παρρησίαν καὶ τέλος τὴν μεγαλοφυΐαν'. Βλ. στο ίδιο: 9.

Then, with great admiration, he speaks of the translation of Sophocles Antigone's tragedy:

> 'Sophocles is inimitable in his tragedy. But Taha Hushen is admirable in his great efforts, as he interpreted the civilised spirit of the Greek wise man. This is not a comparison. On the contrary! It is fair admiration'.[20]

It is noteworthy that Taha Husain himself was a great supporter of classical studies in Egypt. He considered that there were extensive references to Egypt in ancient Greek literature and especially in ancient Greek poetry.[21]

Some Greek Egyptian writers came in direct contact with the Arabic literature, because they knew the Arabic language. Most of them, however, studied Arabic literature from translated works such as Elisavet Psara, as it was cited above, who confesses in an article published in the Panegypia, that the ignorance of the language of the original has never hindered her engaging with the literary production of the place where she is. She emphasises the importance of translation, which has been very useful to her work.[22]

Also she mentions the names of important poets of the pre-Islamic period (al-ᶜasr al-Jahili), such as Imr'u el-Kais, Zoehir, Lebid, and others. She also mentions the venue (agora) where the poetic contest took place, the Okaad trade show (ᶜOkadh).[23]

Therefore, Psara seems to have thoroughly studied the Arabic literature, not just modern but also pre-Islamic, as it is reported in the prominent poems al-Muallaqāt, the poems hung on the Kabba because they won in the poetic contest, organised by the various Arab tribes. These poems, 'written on sheets with golden letters, which were called, Muddhapat, in other words gold-plated, and dangled with the honorable position on the walls of the Kaaba, the club of the philological association, where the poetic races took place'.[24]

These poetic epics were of paramount importance to the Arabs. They are the greatest and most beautiful poems written by Arabic poets from antiquity to the present day. The ancient Arabs were famous for three things: military organization, hospitality and literary talent[25] particularly, poetry developed very much because rhymes were used in order to comment on important historical events but also to describe everyday life[26] . In ancient Arab society poetry occupied a prominent place in the consciousness of the nation, where the sword and the verse were ultimately the main weapons in dealing with the enemy.

About the poetic contest that was organised in the Agora of ᶜOkādh, the archimandrite Elias Dip. [27] in an article entitled 'On Arabic Poetry,' notes that 'a poetic nation in history was also distinguished by the Arabs.' Even the Arch. Elias tried to divide the poets chronologically, depending on the period in which everyone lived, while criticizing the decline of some poets who used poetry to earn profit.[28]

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20 Στο ίδιο: 9.

21 Taha Husain, *Mustaqbal al-Thaqafah fi Misr,* έκδ. Dār al-Maᶜarif, Κάιρο, ²1996: 21.

22 She even points out that: ''Η ἄγνοια τῆς Ἀραβικῆς γλώσσης –καθὼς καὶ τῶν ἱερογλυφικῶν– δὲν ἀπετέλεσε ἐμπόδιον ἱκανὸν νὰ μὲ ἀποτρέψει ἀπὸ τὸ μαγευτικὸ αὐτὸ ταξίδι ποὺ ἐπεθύμησα νὰ κάνω μέσα στοὺς ἀνθισμένους λειμῶνες τῆς ποιήσεως ξένων λαῶν και μακρυσμένων ἐποχῶν. Εἶχα γιὰ πολύτιμους ὁδηγοὺς στὴν περιπλάνησίν μου αὐτὴν τὰς ἀρίστους τεχνικὰς μεταφράσεις διαπρεπῶν Ἀραβιστῶν, ὅπως οἱ Epiphanius Wilson, Henry Baerlein, Auguste Cour, Wacyf Boutros Ghali, Lyll, Etienne Delecluse καὶ ἄλλους, ποὺ μ' ἔβαλαν ὀ ἐπικοινωνίαν μὲ τὸ φλογερὸ αἰσθημα καὶ τὴ ζωηρὰν φαντασίαν τῶν Ἀράβων ποιητῶν, τῶν ὁποίων τὸ ἔργο ἔχει τόσην ὀμορφιὰ, καὶ τόση ποικιλία'. see. Ελισάβετ Ψαρά, ''Αραβες ποιηταί και ποιήτριαι', *Παναιγύπτια* αριθ. 9 (411) (27 Φεβρ. 1937): 6.

23 Ibid: 7. Every year, a poetic contest lasting one month was held every year in Mecca, among Arab poets. This contest was held publicly at the middle of the encounter of all tribes and all the Arab populations who went there every year with numerous pilgrims' caravans whose overcrowding gave Mecca a reputation equal to that of the ancient Delphi to the Greeks. The poets presented their best work and the prize was given to the one who unanimously judged that he deserved it in relation to his comrades. Happy the one who was winning! His name was engraved in the columns of the temple and upon his return his tribe yielded the triumphal values. J. J. Marcel, 'Lapoése arabe, commentée sous Bonaparte', *La Semaine Egyptienne* 5 – 6, (28 Février 1928): 20. Ibid: 20.

24 Ελισάβετ Ψαρά, ''Αραβες ποιηταί και ποιήτριαι', op. cit..: 6-7.

25 J. Marcel, 'La poése arabe, commentée sous Bonaparte', ό.π.: 20.

26 Ibid: 20.

27 Ηλίας Διπ., 'Περί της αραβικής ποιήσεως', *Νέα Ζωή* 2 (Οκτ. 1904): 20.

28 Also mentions: ''Αφ' οὗ ὅμως οἱ τυχοδιῶκται καὶ κόλακες ἐξηυτέλισαν αὐτὴν καταστήσαντες προσοδοφόρον τέχνην, καὶ χαμαιζήλως ταπεινώσαντες ἐνώπιον τῶν κραταιῶν τυράννων καὶ τῶν πλουσίων, ἔκτοτε κατέστη καταπεφρονημένη εἰς τὰ ὄμματα τῶν ὑψηλῶν προσώπων, καὶ δὴ τῶν βασιλέων, οἵτινες ἠγάπων μὲν νὰ ἐγκωμιάζωνται καὶ ἡδονικὴν ᾐσθάνοντο ἐπὶ τῇ ἐξυμνήσει αὐτῶν ὑπὸ τῶν κολάκων ποιητῶν, δῶρα καὶ τιμὰς ἐπ' αὐτοὺς ἐπιδαψιλεύοντες, ὡς ταπεινὴν ὅμως καταστᾶσαν τὴν ποιητικὴν τέχνην ἀπεμάκρυνον τῶν οἰκείων καὶ αὐστηρῶς ἀπηγόρευον τοῖς υἱοῖς αὐτῶν τὸ στιχουργεῖν. ''Ηθικὴ αὕτη κατάπτωσις τῆς ποιήσεως ζωγραφίζεται ἐναργέστατα ἐν τῷ προοιμίῳ πινδαρικῆς τινος ᾠδῆς ἐν ᾧ ὁ ὑψιπέτης ποιητὴς ἀποτεινόμενος πρὸς τὸν Θρασύβουλον, υἱὸν τοῦ Ξενοκράτους τοῦ Ἀργαντίνου λέγει, ὅτι οἱ μὲν πάλαι ποτὲ γεγονότες ὑμνῳδοί, ὅσοι μάλιστα ἐπὶ τοῦ τῶν καλλικόμων Μουσῶν ἐποχούμενοι δίφρου τῇ καλλιφθόγγῳ ἐχρήσαντο φόρμιγγι, οὐ χαλεπῶς τοὺς μελιφθόγγους τῶν παίδων ὕμνους ἐτόξευον, εἴτις αὐτῶν ἔσχε καὶ ὥραν ἀπανθοῦσαν τῷ κάλλει, καὶ ἐπὶ τὴν εὔθρονον Ἀφροδίτην τὴν μνήμην παραπέμπουσαν. [...]. Οὐ γὰρ ἠξίουν αἱ ἀπαλόχρους ᾠδαὶ προκύπτειν, κρίσματι ἀργυρῷ ἐψιμμυθιωμένα τὰ πρόσωπα ἄχουσαι. Νῦν δ' ὅμως ἔπεισι λέγειν ὃ ὑπ' Ἀργείου ἀνδρὸς πάλαι ποτὲ οὐ πόρρω τῆς ἀληθείας ἐκτετόξευται ἔπος, χρήματα, χρήματα ὁ ἀνήρ'. Στην υποσημείωση αναφέρει και μερικά αποσπάσματα του Πινδάρου:
'Οἱ μὲν πάπαι, ὦ Θρασύβουλε',
'φῶτες, ὅσοι χρυσαμπύκων'
''Ες δίφρον Μοισὰν ἔβαινον'
'Κλυτᾷ φόρμιγγι συναντόμενοι',
'Ρίμφα παιδείους ἐτόξευον μελιγάρυας ὕμνους'
''Όστις ἐὼν καλὸς εἶχεν Ἀφροδίτας'
'Εὐθρόνου μνάστειραν αδίσταν ὀπώραν'
''Α Μοῖσα γὰρ οὐ φιλοκερδὴς',
'Πω τότ' ἦν, οὐδ' ἀργάτις'·
'Οὐδ' ἐπέρναντο γλυκεῖαι'
'Μελίφθογγοι ποτὶ Τερψιχόρης'
''Αργυρωθεῖσαι πρόσωπα,'

Such a wording, casts our attention on why many Greek Egyptians have found great interest and charm in ancient Arabian poetic production rather than in the modern one.

Pelion Zagra refers to pre-Islamic poets such as Zuhair, Imre'u el-Qais and al-Nabigha al-Zubiani, highlighting the Admiration for their poetic work. For him, these particular poets and others of ancient times are real poets[29] in contrast with those of modern times. By nature, the Arab was a poet. Probably the development of this art has contributed to the conditions of his life, the constant wars between the Arab tribes, the fighting, the eros and other factors.[30]

The fact that most Arabs did not write but merely compiled the verses (we can say that they used to learn the poems by heart), was the reason that much of the Arabian poetic production was lost. Some foreigners, however, believed that Islam and Muslims also played a negative role in this matter. They claim that the Muslims did not show the proper interest in pre-Islamic poetic production. This fact was one of the main reasons why several pre-Islamic poems were lost.

Zagra comments on this:

> 'The Arab philologists, for fear that the intellectual diamonds of their tribe would be extinguished, gathered and called upon *Rawy* (narrators) and asked everyone what they remembered and noted them down. But many fanatical quranists who despised everything pre-Islamic refused to help this sacred purpose and so, undoubtedly, a lot of the literary creation got lost after their death. [...] Except for the fact that Rawy themselves in different circumstances, added or deleted some verses. Even the philologists made a lot of changes, corrected their language and destroyed their literary production'.[31] He also mentioned, that, 'Imr'u al-Qais as poet is considered the greatest of all the pre-Islamic. The first Arab prose writer and the most fanatic enemy poet, Mouhammad, was so frightened of him that he called him guidance in the fire of hell. The European critics who have studied his work have admired its greatness, the magnificent power which is unfolding in the sweetness of the verse, full of the joy, beauty, and youth.[32]

Another reference to old Arab poets is in the periodical (Eiconografimeni Anatoli) and in particular in the article 'Amru Ibn Kultum: Arab Poetry' by Nikos Parisis[33] However, we observe that there are misspellings in the name of the poet, as his name is Amru ibn Khulthūm, namely Amru ibn Koulthum.

Psara also commented on the downfall of Arab poetry in the Islamic era. She criticizes the attitude of Islamic religion towards poetry. She writes: 'The Qur'an has reduced the poetry. Religious fanaticism does not leave any place for anything else.'[34] According to Psara, although the Qur'an has succeeded in destroying poetry, or, honestly, it has 'sacrificed it ,' it has given the Arabs other virtues:[35]

> 'This same Quran gave to them the unbelievable fighting power, the stormy torrent, the incredible contempt of the miseries and death, all of these steel trumpets who made them masters of the world. Rapid warriors, uneducated, knew how to conquer, but they were not in a position to appreciate the treasures they had conquered. They did not understand their value and destroyed them. Blinded by fanaticism, they sought to exterminate what foreign gods there were, and so among other things they destroyed the famous Library of Alexandria'.[36]

Thus, the image of a barbaric religion is presented. A religion that emphasises violence and overlooking the spirit. Psara seems to be influenced by the various translated studies that refer to the issue of the Quran and Poetry, but also by the fact that the Arabs burned the Library of Alexandria. So she thought that after the Arabs' fanaticism had decreased, they wanted to climb higher and they did it. She claims that the Arabs realised that the material gains they obtained were not able to fulfill their high expectations. That's why they began to exploit and draw on the spiritual treasures of the conquered peoples to cultivate their spiritual life.

Indeed, the Arabs have made use of the translations of the spiritual heritage of other peoples, especially the Greeks, in various fields, astronomy, medicine,

'Μαλθακόφωνοι ἀοιδαί.'
'Νῦν δ' ἐφίητι, τὸ τ' Ὤργείου φυλάξαι'
'Ρῆμα τῆς ἀληθείας ἄγχιστα βαῖνον,'
'Χρήματα, χρήματ' ἀνήρ...' (Πίνδ. Ἴσθμ. Β. 1-17). Βλ. στο ίδιο: 19-20.

[29] He emphasises himself by pointing out the following: 'Κι ἀνέφερα τοὺς τρεῖς αὐτοὺς μονάχα γιὰ ἰσόπαλους γιατὶ παρουσιάζουν τραγούδια μὲ θέμα μὲν διάφορο ἀλλ' ἴσης κάπως δύναμης κι ἀξίας, ὑπάρχουν ὅμως κι ἄλλοι πολλοὶ καὶ πιὸ τρανοὶ ἀκόμα ὅπως μας τὸ δείχνει τὸ ἔργο τους ποὺ μέρος γιὰ ὁλάκερο σώζεται ἴσαμε σήμερα καὶ τοὺς ἀναδείχνει ἀληθινοὺς ποιητὲς μ' αἴσθημα καὶ φλόγα μέσα τους ποιητική, ὄχι στιχοπλόκους σὰν τοὺς δικούς μας τοὺς περισσότερους σημερινοὺς τῶν σαλονιῶν, τοὺς μή μου ἅπτου ἀπ' τὴ μιὰ μεριά, τῶν σοκακιῶν καὶ τῆς ταβέρνας τοὺς ρεζίληδες ἀπὸ τὴν ἄλλη. Νὰ ἰδοῦμε ὢς πότε θ' ἀνεχόμαστε τοὺς στιχουργοὺς γιὰ ποιητὲς κι ὅλες τὶς ἔμμετρες σάχλες ποὺ κατεβάζουν τ' ἀερισμένα τους κεφάλια γιὰ ποιήματα'. Βλ. Πήλιος Ζάγρας 'Η αραβική ποίηση: Προϊσλαμική εποχή', *Σεράπιον* 1909-1910, μέρος Β΄: 57.

[30] Ibid: 58.

[31] Ibid: 62.

[32] Ibid: 63 – 4.

[33] Νίκος Παρίσης, 'Αμρ Εμπν Χουλτουμ, Αραβική (Ποίησις)', *Εικονογραφημένη Ανατολή* 3 (Αυγ.–Σεπτ. 1925): 40.

[34] Ελισάβετ Ψαρά, ''Αραβες ποιηταί και ποιήτριαι' μέρος 2ον, *Παναιγύπτια* αρ. 10 (412) (6 Μαρτ. 1937): 6.

[35] Ibid: 6.

[36] Ibid: 6.

philosophy. We can say that the Arabs translated a number of works that would actively help them to advance on a spiritual level as well. But, according to Psara, ‘poetry was their greatest achievement’.[37]

Psara’s views are unsustainable because Islam was not an obstacle to poetic production. All Islam did is to forbid some kinds of poetry. It forbade those that are opposed to its religious rules. However, we must emphasise that poetry dominated the Arab cultural life during pre-Islamic and Islamic periods. It should be noted that during the pre-Islamic period poetry was an important tool that helped record the various events of Arab life.

Regarding the attitude of Islam towards poetry, there are many clues that emphasise its favor for this literary genre. The Quran dedicates an entire Shu^{c}ara to ‘al-Shu^{c}arā’, meaning ‘Poets’, where it gives its own version of the poets: ‘(224) And the poets! Followed by those who shone in error unconsciously. (225) Do you not see how they roam in every valley to spread injustice and unfairness? (226) And these others say they do. (227) In addition to those who believe and are good at and often commemorate Allah and have been justified after having been wrong. But those who have done wrong will learn how they will be on their way’.[38]

Prophet Mouhammad said: ‘Some poetry has wisdom’.[39] He also told the Muslim poet Hassan ibn Thabit: ‘Libel them by your verses and the Archangel will be with you.’ The Qur’an condemns the vulgar and obscene logic of some poets, the way that is contrary to the morality of the Islamic religion. But in the case where poetry respected and respects the moral regulations of religion, it was part of what the Prophet mentioned, ie, ‘Some poetry has such kind of wisdom’. This had as its main objective the ‘Islamization’ of poetry in order to serve the religious ideology and religious beliefs of Islam as a religion that sought integration primarily in an Arab society.

Psara also studied in detail the work of a very important poet of the pre-Islamic (al-Jahyliah) era, the Antara (^{c}Antara), whose work is full of war and heroic stories. She does not hesitate to express her admiration for the pre-Islamic Arab poet. She even praises his work and at the same time undermines a work written in the Islamic era. There is, however, intense romance in his poems. Psara even compares his work with the famous Thousand and one nights:

> Antar’s romance is far superior to the Thousand and one nights written five hundred years later, which is the work of a decadent plot of various fairy tales. The feelings of the heroes in the Thousand and one nights are much inferior, the motivations of the acts are lowly. The prosperity, the deceit, the love, the cunning, the immorality and the cowardice dominate from end to end this work in which we no longer meet the diamonds found in the works Of the good times. If we accept the opinion of Epiphanius Wilson, the Romance of the Standard and the Thousand and one nights are faithful images of the two places where they were written’.[40]

According to Psara, therefore, the worlds described in the two works differ from one another in terms of their ideals and their perception of life.[41]

The main purpose of the comparison was to prove that Arab pre-Islamic literature is superior to the Islamic.[42]

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[37] He writes: ‘Ἀλλ᾽ ἡ κατάστασις αὐτὴ δὲν διήρκεσεν ἐπ᾽ ἄπειρον. Κυρίαρχοι πιὰ τῆς γῆς οἱ Ἄραβες, θέλησαν νὰ κατακτήσουν καὶ τὸ βασίλειον τοῦ πνεύματος. Ὁ φανατισμός των ἐχαλαρώθη. Δὲν καῖνε πιὰ τὰ βιβλία. Τὰ μεταφράζουν, τὰ μελετοῦν, τὰ κατατρώγουν κυριολεκτικῶς. Ἡ ποίησις τώρα ξαναζεῖ σὲ μιὰ ὑπέροχη ἄνθησι, καὶ ἡ δίψα τῆς μαθήσεως τοὺς ἔκαμε νὰ ριφθοῦν μὲ πάθος στοὺς Ἕλληνες συγγραφεῖς. Διαβάζοντας Ἀριστοτέλη, Εὐκλείδη, Πλάτωνα’. see. Ibid: 6. Psara ignores the role played by Arabs in human history. It also ignores their contribution to various disciplines such as mathematics, astronomy, chemistry, etc. It also ignores their role in the translation of the Greek heritage into Arabic and their role in the dissemination of Greek culture.

[38] Το Κοράνι, σούρα ελ-Σου’αρά (26), μέρος 19^{ο}: 562 (η μετάφραση υπέστη μερικές επεμβάσεις από τον γράφοντα της ανά χείρας διατριβής).

[39] T. Abdulra’ūf, (επιμ.), *Sahīh al- Bukhāri*, έκδ. al- Dār al- Dhahabyiah: 1261-1263. On the same subject, Arab scholars disagree with each other. An Arab scholar Mustafa al-Shakāh mentions: ‘We confess that the flame of poetry has disappeared and its eloquence has disappeared during the mission (of Mouhammad). The recitation of poetry disappeared in the way they used to compose it and recite it before it was sent Mouhammad’. M. al-Shakāh, *al-Adab fī Maukib al-Hadarah al-Islamyyiah: Kitāb al-She^{c}ir*, 1st vul.., έκδ. Dār al-Kitāb al-lubnani, Beirut, 1974: 91. O Ibn Salam al-Jamhi mentions: ‘ It came to Islam and the Arabs dealt with the Jihād and the conquest of Persia and Byzantium. This was a matter of poetry and recitation’. Mouhammad ibn Salam al-Jamhi, *Tabaqat Fuhul al-Shu^{c}arā,* reviewed.: M. M. Shaker, vul.. 1st, Al-Madani, Cairo: 25. The second view is taken by Shawqi Daif, who believes that poetry was boiling in the Islamic era. Shawqi Daif, *Tārikh al-Adab al-Arabi: al-^{c}Asr al-Islami*, Dār al-Ma^{c}arif, Cairo, ^{20}2002: 42. In the end, we can say that although Islam excluded certain kinds of poetry, such as poetry of wine and vulgar liturgical and satirical poetry, it introduced other species that are incompatible with religious and moral regulations.

[40] Ελισάβετ Ψαρά, ‘Άραβες ποιηταί και ποιήτριαι’ (μέρος ΙΙ), *Παναιγύπτια* αρ. 20 (422) (15 Μαΐου 1937): 11.

[41] Στο ίδιο: 11.

[42] Ο αρχιμανδρίτης Ηλίας, ο οποίος γράφει μια σειρά άρθρων με τίτλο ‘Περί της Αραβικής Ποιήσεως’, τα οποία είναι δημοσιευμένα στο περιοδικό *Νέα Ζωή*, συγκρίνει τη σχέση της ‘αρχαίας’ αραβικής ποίησης με τη σύγχρονη: ‘Καὶ ὅσον ἀφορᾷ μὲν εἰς τὴν σύγχρονη Ἀραβικὴν ποίησιν ἰστέον, ὅτι αὕτη ἐν πολλοῖς μὲν ἁμιλλᾶται πρὸς τὴν ἀρχαὶαν ὑπὸ ἔποψιν καθαρότητος γλώσσης, γλαφυρότητος, δυνάμεως καὶ ἁδρότητος λόγου, ποικιλίας τρόπων καὶ σχημάτων, καὶ κάλλους φράσεως τε καὶ ἐννοιῶν· ὑπερτερεῖ δ’ αὐτὴν: α) ὡς ἐν ἀχρηστίᾳ τιθεμένη ὡς τὰ πολλά, τὰς ἀπηρχαιωμένας λέξεις ὡς καὶ τοὺς πεπαλαιωμένους τῆς συντάξεως τρόπους· β) βαίνουσα ὁσήμερα βραδέως μὲν ἀλλ’ ἐπιτυχῶς πρὸς τὴν διαρρύθμισιν τοῦ διανοεῖθαι καὶ ἐκφράζεσθαι κατὰ τρόπον Εὐρωπαϊκὴν τινα χροιὰν ἔχοντα ἐπαισθητῶς καλλύνοντα καὶ ἐξωραΐζοντα αὐτήν, καὶ γ) τὸ καὶ σπουδαιότερον, ὡς εἰσαγαγοῦσα καὶ προσθεῖσα εἰς τὴν Ἀραβικὴν φιλολογίαν κλάδον πολυτιμώτατον τέως αὐτῇ ἄγνωστον, τὸν δραματικὸν λέγω, τῆς

The same researcher expresses her admiration for the great Arab poet al-Motanabbi. This poet was a very important figure of his time.[43]

She also notes a few poets from Andalusia, such as Mouhammad ibn ^{c}Abbad, Abou al-^{c}Atahyiah, while not forgetting to mention one of the greatest names, Abu Ferras (Abou Ferās), She also gives us a sample example of his poetic work, 'Gazela'

> Inside your chest a gazelle nestled
> And in the meadow of my heart it grazes
> And from my tears' springs is watered
> Like crystal clear cool water[44]

Although pre-Islamic Arab poets have attracted the sympathy of Elizabeth Psara, we find that particular reference is also made to Islamic poets such as Ahmad ibn Mouhammad al-Tahmani, AbdulSalam ibn Raghban (AbdulSalam ibn Raghban) and Ibn Moataz.. while preaching the authenticity of Arab poetry in relation to philosophy. She considers that the poetic production of the Arabs is the birth of their imagination, that their poetic production is a creation of their own environment. Elizabeth Psara is also referring to the translations of Nikolaos Mavri, who, as she notes, lived in the villages of Egypt for many years and had the opportunity to relate to indigenous Arabs. This gave him the opportunity to learn about the ethos and customs of the villagers and to study their songs and poetry in general.[45] Mavri's experience with the locals was a great source for his work. Such an experience

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καινοτομίας ταύτης συντελεσθείσης διὰ τῆς ἐκ τῶν διαφόρων ευρωπαϊκῶν γλωσσῶν μεταφράσεως τραγῳδῶν καὶ κωμῳδιῶν τινων, κατὰ τι δὲ καὶ διὰ τῆς συγγραφῆς πρωτοτύπων τούτων, ἀτελῶς προφανῶς καὶ οὐχὶ ὡς δεῖ ἀνταποκρινομένων πρὸς τὰς τῶν λοιπῶν πεπολιτισμένων ἐθνῶν. Καὶ οὕτως ἡ σύγχρονος ποίησις, ἀφ' ἑνὸς μὲν τηροῦσα τὸν θεμελιώδη χαρακτῆρα τῆς ἀρχαῖας, ἀφ' ἑτέρου δὲ τέμνουσα νέαν ὁδὸν ὁμαλωτέραν, ὡραιοτέραν καὶ μάλλον ἐπαγωγόν, ὡς συνενοῦσα τὸ ὠφέλιμον μετὰ τοῦ ἡδέος, θεωρεῖται δικαίως ὡς πρόοδος καὶ ἀνάπτυξις τῆς πρώτης, οὐχὶ καταργοῦσα καὶ διασείσουσα αὐτὴν ἐκ βάθρων, ἀλλὰ τελειοποιοῦσα καὶ καλλύνουσα'. Βλ. Ηλίας Διπ., 'Περί της αραβικής ποιήσεως', *Νέα Ζωή* 1 / 7 (Μάρτ. 1905): 120-121.

43 He emphasises himself by pointing out the following: 'Τὸ ἐνδότερο ἀπὸ ὅλα αὐτὰ τὰ ὀνόματα ἀνδρικὰ καὶ γυναικεῖα εἶναι ὁρισμένως τὸ τοῦ Motannabi. Ἦταν ἕνας μεγάλος ὀνειροπόλος ποὺ στὴν ἀρχὴ φαντάσθηκε πὼς θὰ μποροῦσε νὰ γίνει ἀρχηγός κράτους δορυκτήτωρ Μέγας Ἀλέξανδρος ἴσως. Ἔπειτα ἀπεπειράθη νὰ γίνει ἀρχηγός θρησκείας. Κ' ἐδὼ ἀποτυχία. Τέλος ἀπεφάσισε να γίνει μεγάλος ποιητής. Ἐδῶ ἐθρίαμβευσε. Τὸ λαμπρότερο ἀστέρι στὸν πολυάστερο οὐρανό τῆς Ἀραβικῆς ποιήσεως εἶναι χωρὶς ἀμφιβολία ὁ Motannabi'. See ibid: 6. Αυτός ο μεγάλος Άραβας ποιητής έχει απασχολήσει αρκετούς Αιγυπτιώτες. Ο αρχιμανδρίτης Ηλίας στο άρθρο του 'Περὶ τῆς ἀραβικῆς ποιήσεως' γράφει: 'Τοῦ ἐνδόξου τούτου ποιητοῦ ἡ ποίησις εἶναι ἀριστοτεχνικὴ ὑπὸ ἔποψιν λέξεως τε καὶ ἐννοιῶν. Ἡ φράσις αὐτοῦ εἶναι ἐξεζητημένη, συνεπτυγμένη καὶ περιεκτικὴ. [...] τὰ δὲ νοήματα αὐτοῦ εἶναι ὡς ἐπὶ τὸ πλεῖστον πρωτότυπα μετέχοντα ὕψους, βάθους καὶ ἀμιμήτου ἁδρότητος. Αἱ δὲ ᾠδαὶ αὐτοῦ ἐν συνόλῳ γέμουσι σύν τῇ ποικιλίᾳ τῶν ὑποθέσεων αὐτῶν, παντοίων σοφῶν ἀποφθεγμάτων καὶ γνωμῶν'. See. Ηλίας Διπ., 'Περί της αραβικής ποιήσεως', *Νέα Ζωή* 1 / 5 (Ιαν. 1905): 70. Μας δίνει ο ίδιος μερικά παραδείγματα από διάφορα ποιήματά του. Αξιοσημείωτον όμως είναι το γεγονός ότι τα συγκρίνει με λογοτεχνικά αποσπάσματα αρχαίων Ελλήνων λογοτεχνών: Για παράδειγμα:

Ἐμοῦ δὲ μέμψιν ἀποτρέψαι ἱκανὸν
ὃ κέκτημαι πάντων κτημάτων ἄριστον,
Ἤγουν τὸ πεφυκέναι ἐλευθέριον
το συγκρίνει με το εξής απόσπασμα του Πινδάρου:
Οὐκ ἔραμαι πολὺν ἐν μεγάρῳ πλοῦτον
κατακρύψαις ἔχειν·
Ἀλλ' ἐόντων εὖ τε παθεῖν καὶ ἀκοῦσαι
φίλοις ἐξαρκέων,
Πολυπόνων ἀνδρῶν (Νεμ. Ά , 44)
Ένα άλλο:
Βεβαία μὲν καὶ ἀσφαλὴς ἔστιν ὁδὸς
Προόδου, εἶ γε φύσις, ἔνεστι τινι.
Ἡ δὲ τῆς τέχνης κέλευθος ὀλισθηρά
Το συγκρίνει με το εξής πινδαρικό απόσπασμα:
Τὸ δὲ φυᾷ κράτιστον ἄπαν
Πολλοί δὲ διδακταῖς
Ὤρουσαν ἐλέσθαι (Ολυμπ. Θ', 152)
Επίσης του ίδιου:
...σοφός ὁ πολλὰ εἰδὼς φυᾷ
μαθόντες δὲ λάβροι
παγγλωσσίᾳ κόρακες ὥς (Ολυμπ. Β', 154)
και του Σοφοκλῆ:
Ἄπαντα δυσχέρεια, τὴν αὐτοῦ φύσιν
ὅταν λιπών τις δρᾷ, τὰ μὴ προσεικότα (Φιλοκτ. 898).
Ενώ το παρακάτω απόσπασμα του ίδιου Άραβα ποιητή:
Γυνὴ φιλότιμος θανάτῳ ἕλοιτ' ἂν
Σύζυγος εἶναι μᾶλλον ἢ ἀνδρὶ τινι,
Ὅν ἃ ἡγοῖτο ἑαυτῆς ἀνάξιον.
Ἡδῦς γὰρ βίος αἱρετώτερος παντί
Ζωῆς ψυχρᾶς, ἀχάριστος καὶ ἀτερποῦς.
Ὑγεία δὲ καὶ ἥβη ὄργανα εἰσι
Τῆς εὐζωΐας, ἣν δ' ἀποπτῶσί τινος
Οἰχόμενοι, καὶ οὗτος ὤχετ' ἀπιών.
Συγκρίνεται με αυτό του Ευριπίδη:
Κᾂν μὲν τάδ' ἡμῖν ἐκπονουμέναισιν εὖ
Πόσις ξυνοικῇ μὴ βία φέρων ζυγὸν
Ζηλωτὸς αἰών εἰδὲ μὴ θανεῖν χρεών (Μηδ. 245).
Ενώ για τους παρακάτω στίχους:
ὁπόσας δὲ ἱππέων ἴλας προσβαλών
Σύν τοῖς ἐμοῖς ἰππεῦσιν ἐγκατέλιπον
Βορὰν θήριοις, οἱς ἐτρέφοντο ποτὲ
Λευκόστικτ' ἀντιτάξας ἵππων μέτωπα,
Ἐφ' ὧνπερ αἰονεὶ ἀπετετύπωντο
Αἱ ἀρεταὶ τῶν δεσποτῶν ἐμρανιδῶν
Οἰσπέρ ἀπὶ τῶν νώτων εἶθιστο αὐτῶν
Ἐπικαθῆσαι ἀκλονήτως, ὡσπερεὶ
Αὐτοὶ γε τούτων ἀπετέλουν τὰς δορὰς
....
Καὶ ὡσανεὶ οἱ ἵπποι μὲν πεφύκασι
Τοῖς τούτων ἐπιβήτορσιν ὀχήματα
Οἱ δὲ τῶν νώτων 'κείνων ἐπιβήτορες
Ο εν λόγω μελετητής σε μια υποσημείωση για τους παραπάνω στίχους γράφει:
'Νομίζει τις ὅτι ὁ ποιητής, γνώστης ὢν τῆς ἐλληνικῆς μυθολογίας ὑπαινίττεται τὸν μύθον τῶν Κενταύρων. Ἐξ οὔ ὡς καὶ ἐκ τῆς καταπληκτικῆς ὁμοιότητος μεταξῦ τῶν ἰδίων αὐτοῦ καὶ τῶν Ἑλληνικῶν γνωμῶν. ἰδίως ἐν τῷ ''Ἣν δὲ ἐμὲ δάκῃ τις ἄφις... κλ.π' ὡς καὶ ἐν ταῷ 'ὁμοίῳ προσπελάζει ὅμοιος ἀεὶ', ἀγεταὶ τις νὰ πιστεύσῃ, καὶ δικαίως ὅτι ὁ ''Αλμουτανάbbη' ἦτο κατὰ τι τουλάχιστον γνώστης τῆς Ἑλληνικῆς παιδείας ἐστω καὶ ἐκ τῶν ὑπαρχουςῶν ἤδη ἐπὶ τῆς ἐποχῆς αὐτοῦ ἐκ τῆς Ἑλληνικῆς εἰς τὴν Ἀραβικὴν μεταφράσεως'. See. Ibid: 70 – 72.

44 Ελισάβετ Ψαρά, ''Αραβες ποιηταί και ποιήτριαι', *Παναιγύπτια*, αρ. 12 (414) (20 Μαρτ. 1937): 21.

45 Ibid: 5. These Egyptian demotic songs have 'as their forerunner we can consider the pre-publication in Panorama periodical in the years 1928-1929 part of the introduction and a small part of the anthology of Egyptian folk songs by Nicholas Mavris (1899-1978), which is to be published in 1932, initially in French, titled *Contribution à l' étude de la chanson populaire égyptienne,* and two years later, in a more popular form, in Greek. The example of Panorama follows in the early 30's Panegyptia and the monthly Greek-Arabic newspaper Egyptiotes Helin, showing the increased interest of the community audience on the subject'. Μανώλης Μαραγκούλης, *'Καιρός να συγχρονισθώμεν':Η Αίγυπτος και η αιγυπτιακή διανόηση (1919-1939),* Gutenberg, Athens, 2011: 28.

gave him the opportunity to hear directly from the mouth of the native.

Egyptian Greek writers also showed great interest in popular Arabic songs, especially the Egyptian ones. There are several translated excerpts of this kind, especially those published in magazines. These folk songs provoked the Egyptians' interest. Mavris writes, addressing the director of the Papyruses: 'Since you are of the opinion that the readers of the beloved people of Panaigyptia have an interest in the Egyptian folk songs, I will send you a few of them.' [46]

An example is a lullaby where a mother praises the characteristics of her child:

> Like a chicken's mouth, it's your mouth
> It wants the candy
> And I myself will do it
> It's very small your mouth
> It wants to eat almonds
> I can make or break my own
> Like Quail's mouth, it is your mouth
> It wants to have pomegranates
> I will cleanse that.[47]

Egyptian Greek writer Georgios Theotokas writes an article on the position of the Greek people in the Arab world.[48] Cavafy also does not conceal his interest in Arab-Egyptian language, and he even points out that:

> ' In fact the works of the Greek writers in Egypt have been known to the Egyptian Arab colleagues, for example, by some studies. The labor of Egypt, note is made mainly of scholars not passersby Egypt, but grown up and restored therein and where some of the Egyptiote were born. Of course at least part of their work will have something from the Egyptian environment. We hope, added Cavafy that the Greeks of the Egypt, that they know Arabic, should be made aware of the modern Arabic literature of Egypt in the Greek world, at least in the main'.[49]

The Arabs showed particular interest in the Greek letters, as a result of the political direction of the caliphate, especially during the time of Alassia. Eugene Michaelides writes in 1925 in Faro the article 'Pages from Arabic Philology: Philosophy and Metaphysics in Arabic,' underlining the fact that Arabs have been influenced by Greek philosophy. He expresses his opinion strongly, considering the Arabic philosophy to replicate the Greek one. One cannot deny the influence of Greek philosophy on the Arabic one . It should be noted, however, that the Arabs at that time had shaped the influence by the Greek spirit

The intellectual Arabs think very highly of the ancient Greek poet Homer. In an article titled 'Pages from Arabic Literature: Sliman Al-Bustan (1856-1925)', in the same periodical, Michaelides states: 'The Arabs, the translators, either directly or indirectly, all of them armed by Greek artefacts, have desisted the effort to translate the Iliad for reasons that are unjustified,. 'O Sliman Al-Mustanis was redeemed 1904 for the first time in Arabic Philology by an extra translation of the Iliad. [...] He further explains the truth, forbidding them to translate the Iliad into their Arabic'.[50]

The Arabs attached great importance to Greek culture, focusing on the philosophy, which was the Sufi and Arabic weapon, mainly cUlamāu al-kalām (philosophers or intellectuals of speech) against those who adopted different opinions, mainly religious. On the contrary, there was no interest in poetry. Various Arab and foreign scholars have tried to interpret that.[51]

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[46] Νικόλαος Μαυρής, 'Αιγυπτιακά δημοτικά άσματα', *Παναιγύπτια* αρ. 18 (7 Μαΐου 1931): 11.

[47] Νικόλαος Μαυρής, *Αιγυπτιακά δημοτικά τραγούδια*, Εκδοτικός Οίκος Α. Κασιγόνη, Έρευνα, Αλεξάνδρεια, 1934: 13. Επίσης Νικόλαος Μαυρής, 'Αιγυπτιακά δημοτικά άσματα', ibid. p.11.

[48] ' The Greek wandering around the Arab world welcomed by the people there with all welcome and hospitality. This is what I saw during my visit to Egypt and eastern Jordan. When they ask you about your nationality and know that you are 'Greek', you see the joy of their faces and shake you with affection and love. When you tell them that we are friends, they immediately answer that the Arabs and the Greeks are not friends but are brothers and have heard such statements from the clerics on the day I visited their temples. This policy is not a courtesy, but is a result of the friendly relations between Greece and the Arabs from time immemorial. We will still see the signs of this passion in our time, proving that we have made our country beloved by our Arab brethren and we must maintain that friendship as our most precious Something in us [...] Many Arab writers wanted to have a spiritual relationship with our modern country, and I adopted this in my many conversations with authors, professors and journalists in Egypt. They want to be aware of our spiritual and artistic lives. They are interested in knowing our plays and are urging us to send them to Cairo with our national theater and hope that this will be as soon as they wish. The transfer of Greek books into Arabic and in finding a connection and relationship between our teachers and their teachers to identify and research and told me some students of the Faculty of Arts, they ask the bodies of our associations to enable them to study our Greek language...'
'Arab wa Younanyoun', *Δελτίον Κέντρου Ελληνικών Σπουδών* (υπό την αιγίδα του Βασιλικού Γενικού Προξενείου της Ελλάδος εν Αλεξάνδρεια), (May – Jan. 1960): 2-3. The article is written by G. Theotokas, published in Vima (April 24, 1960), but it is worth noting that the 'Deltion of the Center for Greek Studies' was a four-language one, and there are also some Greek literary issues published in Arabic, as well as some poems by Cavafy and other Greek poets. Ali Nour, 'Kwafis', *Δελτίον Κέντρου Ελληνικών Σπουδών*, (Nov. 1962): 1-2.

[49] Κ. Π. Καβάφης, *Τα πεζά (1882-1931)*, φιλολογική επιμέλεια Μ. Πιέρης, Ikaros, Athens, 2003: 152.

[50] Ευγένιος Μιχαηλίδης, 'Σελίδες εκ της αραβικής φιλολογίας', *ο Φάρος* 6 (116), 4th year, (30 Ιουν. 1925): 115-116.

[51] ويؤكد عبد الفتاح رجب محمد إلى ‹ حضارة اليونان قد أثرت في التفكير العربي، إذ أن المنطق الإغريقي أثر في الحياة العقلية في العصر العباسي . أن الأثر اليوناني على الفكر العربي كان واسعاً عميقاً في الفلسفة والعلوم الرياضية والطبية، بينما كان ضيقاً (...) في الأدب ويرجع ذلك إلى أن الأدب اليوناني كان وثنياً يعتمد على عبادة الأبطال، والذوق العربي ذوق مسلم لا يقبل هذا النوع من الأدب الوثني، كما أن العرب لم يهتموا بالمسرح والشعر اليونا ني›.
Abdulfattah Rajab Mouhammad notes: 'The culture of Greece has influenced Arab ideology, because Greek logic has influenced the ideological life during the Abbasic era. The Greek influence on Arab ideology was broad and deep in philosophy, mathematics and medicine, while it was limited in literature, because Greek literature was idolatrous and based on the hero's worship, and the Arab-Muslim

Mouhammad Abasa notes in his article 'The translation in the Middle Ages' ('Al-tarjama fi al-ᶜOsour al-Wowsta'

'Arabs have been influenced by Persian and Hindu literature through translations and have not been influenced by Greek literature works because they were far from their feelings, and some of them were also contrary to Islamic doctrine. '[52] Jihād Fadel refers to the opinion of Professor Jaber Cassour in the work of Naqd Thaqafat al-Takhallouf (The Critique of the Culture of the Backwardness), which describes the possible causes of the absence of an Arabic Translation Secretariat of Greek poetry by the fact that Arabs considered themselves the best poets and that they did not need foreign poetry.[53]

Ibn al-Ather in the work of al-Mathal al-Sa'er underlines that Arab poets such as Abu Nawas, Muslim ibn al-Waled, Abu Tammam, al-Buhturi, al-Mutanabi, and others knew nothing of Greek poetry.[54] There is, however, a clear preference for ancient Greeks and, in general, the charm exerted on Arabs by ancient Greek

mentality did not accept such idolatrous literature. Also the Arabs did not show interest in Greek theater and Greek poetry'.

Abdulfatah Rajab, *al-Rauāfid al-Khariyyjiah li-Harakit al-Tarjama ᶜind al-ᶜArab wa al-Muslimīn wa Athāruha fī al-Fikr al-ᶜArabi al-Islāmi hata Nihāyiat al-ᶜAsr al-ᶜAbbasi al-Awal,* Φιλοσοφική Σχολή, Πανεπιστήμιο Omar Al-moukhtar, Libya , χχ: 3.

52 The Arabs were influenced by the literature of the Persians and India through translations, while they were not influenced by the Greek literature to distance themselves from their feelings and opposed some of its themes with the Islamic faith.

Abasa Mouhammad, *al-Tarjamah fī al-ᶜUsūr al-Wostā,* περιοδικό *Hawlyyiat* al-*Turāth*, nu.. 5, 2006, Algeria: 2.

53 'يقول الناقد الكبير أنه كانت هناك نزعة عربية ترى الاستغناء بعلوم العرب وأشعارهم عن علوم الأوائل أو علوم الأعاجم. ذلك أن الشعر العربي وحده، بوصفه ديوان العرب، ظل منبع الفخر المطلق والقمة التي لا يمكن أن يصل إليها أي إبداع شعري مغاير' لذا لم يقبل العرب من أهل النقل على معرفة الشعر اليوناني، وظلت معرفة أمثال 'هوميروس'، وهو كبير شعراء اليونان، محصورة في دوائر هامشية محدودة جداً من بيئات الترجمة، أو أصحاب الملل والنحل، او من كتبوا عن 'الأثار الباقية من للقرون الخالية'. هكذا – يضيف الدكتور جابر عصفور – ظل الشعر اليوناني غائباً عن العرب، وظل شاعر مثل هوميروس سجين دائرة ضيقة من المترجمين عن اليونانية أو السريانية، ومن المعروف للمختصين أن 'الإلياذة' كانت منتشرة بين الخاصة في بلاد فارس والكلدان في زمن الدولة العباسية، ذلك أن ثاوفيليس الذي نظمها بالسريانية كان منجم الخليفة المهدي، وقد نقل ابن أبي أصيبعة رواية توكد معرفة حنين ابن اسحق بشعر 'هوميروس' وإنشاده له، وقد ذكر البيروني هوميروس 'المتقدم عند اليونانيين في الشعر'، وعده كامرئ القيس عند العرب، (...)، وفي ما عدا هذه الدائرة الضيقة للمترجمين ومن في حكمهم (...)، لم يحفل التراث العربي بشعر أجنبي، انطلاقاً من الإيمان الذي غلب على أهل النقل، واشاعوه لدى الذين تابعوهم، من أن العرب أشعر الأمم، وأن ارتقاء شعرها يغنيها عن شعر غيرها من الأمم، احجام مبرر. ومن العودة إلى المقدمة، التي كتبها سليمان البستاني لإلياذة هوميروس، التي نقلها إلى العربية شعراً نجد أن البستاني عرض للأسباب التي جعلت العرب، أو المترجمين السريان يومها، يحجمون عن نقل هوميروس وملحمته إلى اللغة العربية. رد البستاني هذه الأسباب إلى ثلاثة، أولهما الدين، وثانيهما إغلاق فهم اليونانية على العرب، وثالثهما عجز النقلة عن نظم الشعر العربى. عن السبب الأول، وهو الدين يقول البستاني أن المسلمين لم يختلفوا عن نصارى أمم أوروبا (...). فقد أحجموا عن ترجمة هوميروس إلى لغاتهم لأن شعره تشيع فيه الوثنية والبدع والخرافات. وما قيل في النصرانية قبل نشوئها يصدق على الإسلام في قرونه الأولى، إذ لا ريب أن أئمة الأمة لو فرضنا وقوفهم في ذلك الحين على محتويات الإلياذة لما ارتاحو إلى بثها بين العامة، لئلا تكون من مفسدات الإيمان. [...] ولا شك أن ما يقوله البستاني هنا يقع في محله. لقد وجد العرب أنهم أحوج إلى العلوم منها إلى الشعر والأدب الأجنبي. إذ ليس في لغات الأرض لغة يربو شعرها على الشعر العربي ويزيد شعراؤها عدداً على شعراء العرب، [...]. فهذا كان من دواعي تقاعدهم عن الإقبال على شعر الأعاجم(...). أما السببان الآخران اللذان حالا بنظر البستاني دون نقل الإلياذة إلى العربية في تلك الفترة، فأولهما أن مترجمي الخلفاء لم يكونوا عرباً وإن تفقهوا بالعربية فلم يكن يسهل عليهم نظم الشعر العربي، وهم إنما كانوا بنظر العرب علماء أكثر منهم أدباء [...]. أما السبب الآخر فهو أن شعراء العرب لم يكونوا يحسنون فهم اليونانية فلم يكن فيهم من يصلح لتلك المهمة. ويبدو أن العرب يومها لم يغنهم عن شيء لا نقل هوميروس ولا أي أدب يوناني آخر لإنعدام أي فائدة من هذه الآثار اليونانية الأدبية. [...] من كل ذلك يتبين لنا أن العرب في العصر العباسي لم يهتموا بنقل الشعر اليوناني، على الخصوص، إلى اللغة العربية. (...)، كما كان لديهم شعور عميق بأن فضيلة الشعر مقصورة عليهم دون غيرهم. حتى لو كان لدى الأقوام الأخرى شعر، فإن شعرهم أعلى مرتبة منه بما لا يقاس. فالعرب متميزون عن غيرهم بالشعر. وإذا كان لدى الأمم الأخرى شعر، فإن شعرهم لا يستفاد منه عربياً ولا يفتقر إليه، على حد تعبير ابن الأثير في كتابه ‹المثل الثائر›. ولا نعتقد أنه كان بإمكان هوميروس لو نقله التراجمة السريان يومها إلى اللغة العربية أن يؤثر في حركة الشعر العربي، وأن ينظم الشعراء العرب على غراره ملاحم أو غير ملاحم. فلكل أمة طرائقها وأساليبها في القول التي تختلف في قليل أو كثير دى سواها'

'The great critic points out the fact that there is an Arabic strong direction that considered the Arabian sciences as well as their poetry a lot. This was the reason to confer the sciences of pioneers or aliens (al-ᶜAjam). Because Arabic poetry itself as the Diwān of Arabs was the source of all pride, it was the top that no other poetic creation could achieve. That is why Arabic translators were not interested in getting to know Greek poetry. This made the knowledge of Homer, who was the greatest Greek poet, confined to narrow circles of the translational environment, or al-Milal wa al-Nihal's alumni or those written by al-Aāthar al-Baqyyiah min al-Qurūn al-Khalyiah. Thus, adds Dr. Jaber Assfur, the Greek poetry remained unknown to the Arabs, and Homer remained confined to narrow circles of translators who translated from Greek or Syriac. The Iliad was known among the select people in Persia and Chaldea during the Caliphate of Abbasides. Because the Theophilus who translated it into Syria was the astrologer of the caliph al-Mahdi. Ibn Abi Usaibi'a that Hunain ibn Ishaq asserts that he knew Homer and recited his poetry. Al-Bairuni also mentioned Homer and considered him to be 'the pioneer for the Greeks in poetry' and placed him in the position of Imri'u el-Qais for the Arabs. [...]. Apart from the narrow circle of translators and their own, the Arabic heritage did not have any foreign poetry, because the translators had a faith in them that they conveyed to the later: that the Arabs are the best poets and that their poetry he did not need any poetry from other nations. This attitude was understandable. Incidentally, in the introduction by Swlaiman al-Bustani about Homer's Iliad, which translated it into Arabic in a rhyme, we notice that al-Bustani mentions the reasons that made the Arabs or Syrian translators at that time , not to translate Homer and his epic into the Arabic language. Al-Bustani attributes this fact to three reasons: religion, lack of knowledge of the Arabic language for the Greek language, and the inability of translators to compose poetry in Arabic. As for the first word, namely religion, al-Bustani emphasises the fact that Muslims were not different from the Christians of Europe [...]. They have ruled out the possibility of translating Homer into their language because his poetry was full of idolatry, myth and superstition. What was done at the beginning of Christianity is also identified with the case of Islam in the first centuries. There is no doubt that the Umma groups, if they were looking at the Iliad, would not be left to be conscious about spreading between the masses. What al-Bustani mentions is valid in its entirety. The Arabs realised that they needed more in the science of science than in foreign literature and foreign poetry, because there is no language among them that is plagued by any language that has poetry better than Arabic or poets more than Arabs. [...].This was one reason that made the Arabs not approach the poetry of strangers. While the other two reasons, in al-Bustani's view, prevented the Iliad's translation into Arabic at that time, the first was that the Caliphian translators were not Arabs and their knowledge of Arabic did not facilitate them to compose Arabic poetry . That's why the Arabs considered them scientists, not poets. The other reason was that the Arabs did not know the Greek language, so there was no one among them who could do this job. It also seems that the Arabs at that time did not consider the translation of Homer or any other Greek literature to be useful either, because none of them would be useful to them. It seems from all this that the Arabs did not care to translate Greek poetry into Arabic, during the Abyssinian era. [...].They also had a deep sense that only those who possess the virtue of poetry, even if the other nations that have poetry believed that they did not equal their poetry because their own is superior. The Arabs stand out from the Others through poetry. Even if the other nations have poetry, this poetry did not serve anything in Arabic terms, and there was no need, as Ibn al-Athīr points out in Al-Mathal al- Tha'ir. We do not believe that Homer would affect the Arabic poetic stream if the Syrians had translated it into Arabic and that the Arabs would be composed like he did or something else because each nation has different ways and a different style in the reason that make it different more or less of the other nations'. J. Fadel, 'Limādha Lam Iunqal Homerus Qadīman ila al-Arabyyiah', Al-qabas, Kuwait, 29.10.2012.

54 Ibn al-Ather, *al-Mathal al-sa'īr fī Adab al-Katib wa al-Shaᶜīr,* 1ος τόμ., επιμ.: M. Abdelhamed, Cairo, 1939: 311-312.

literature is obvious. One of the well-known names we find in Arabic literature is that of the great epic poet Homer, whom the Egyptian poet Ahmad Nassim (1878-1938) [55] also greatly appreciates. Greek Philosophy and science were also within the scope of the interests of Arab intellectuals and scientists. Ihsan cAbbas in his study titled Greek Characteristics in Arabic Poetry (Malamih Yunanyyiah al-Shicer al- arabi) explains the reasons for this particular preference:

a) The Arabs believed they possessed the poetic genius and the ability of expression and did not have the need to know the literature of other peoples. The cosmopolitanism that followed the many conquests and the expansion of the Islamic caliphate meant that the Arabs came in contact with other nationalities. But some of them have been accused of ignorance in various areas. Obviously for this reason the Arabs did not want to admit their need to become acquainted with the literary production of other countries because they believed that such recognition would deprive them of the only characteristic feature of their poetic virtue.

b) b) Greek poetry, either epic or lyric, is based on a pagan heritage, which is in direct contrast to the monotheistic beliefs of Muslim Arabs.[56]

Al-Jahidh (159-255 AD) mentions in his work The Zoo (al-Hayiawan) that the virtue of poetry belongs exclusively to Arabs and to those who speak their own language. At the same time, it underlines that poetry cannot be translated from one language to another because it degrades its composition, frustrates its measure, looses its beauty and admiration is lost. The same view was adopted by Sulaiman al-Mantiqi, who lived in the 4th century, claiming that in translation the glow of poetry quenches, its meaning is mixed up and its poetic preamble changes. On the same line, Kundamah ibn Jacafar (died in 327 AD) who believed that the translation of Greek poetry into Arabic made it lose its poetic form[57]

For the Arabs, Homer was the greatest poet of the Greeks. They compared him with Imra'u el-Qais. The same is true of the historian Shamsueldin al-Shahri (died in 1288):

> 'Homer was the most ancient poet for the Greeks and he held a prominent place among them. For them it was like Imr'ulqais for the Arabs. He lived after Moses' time, peace to be up on him, five hundred sixty years later. He had written many wisdom and fine poems, and all the poets who came after then followed him. From him they got and learned, for them he was a good example. [...]. He has a stunning stature with a beautiful look, brown hair, a big head with small shoulders and a quick walk, and a small spot on his face. He died at one hundred and eighty-six years. He was one of the big ones that Plato and Aristotle put him in the top positions. He always refers to Homer as his predecessors and followers, because of his poetic genius, his perfect knowledge, the solidity of his wisdom and the integrity of his opinion'.[58]

Homer, as the Arabs imagined him. The image is published by Abbas Ihsan in the book of Malāmih Yunanyyiah fī al-Shecir al-Arabi.

In Arabic sources there are extensive references to Homer as well as to other ancient Greek poets. References to Homer appear in the work of al-Bairuni (died in 1048) titled Tahqiq maa lil-Hend min Maqulah Maqbulah fī al-cAql au Mardhulah,[59] Abu al-Faraj, Abu al-Faraj ibn Hendu) (died 420),[60] to Ibn al-Qifti in the work of Tārīh al-Hukamā,[61] al-Sharistani (479-548) in the work of al-Milal wa al -Nothing. In this particular work he refers generally to the ancient Greeks and makes a special reference to Homer describing him

[55] احييت تبيان هوميروس في امم كان امرؤ القيس فيها رب تبيان
أخلاق قوم تراءت في قصائدهم فاظهرت كيف كانوا منذ أزمان
هذي قوافيك في الإلياذة ابتسمت عن لؤلؤمودوع في خير ديوان
طالعت فيها إلى أن خلت ناظمها من فرع عدنان أو من نسل قحطان
وقلت للنفس يا نفس ارقصي طربا من شعر هومير لا من شعر حسان

You raised Homer's eloquence to people
where Imri'u el-Qais was the superlative of eloquence
The Ethos of People Appearing in Their Poems
and shows how it was in the past
Studying them thought they had composed them
someone who comes from cAdnan or Qahtan
They were eaten in my soul: the soul danced in frustration
from Homer's poetry and not from Hassan's poetryhttp://www.poetsgate.com/poem 132915. html

[56] Ihsan ^{c}Abbas, *Malamih Yunanyyiah fī al-She^{c}ir al-^{c}Arabi'*, έκδ. al-Mu'assasah al-^{c}Arabyiah lil-Derasāt wa al-Nashr, Beirut, 1993^{2}: 27-28. He argues for his claim that the Arabs did not translate any of the great literary works of the Greeks, of course we mean poetry in the specific case that the translators and critics of Aristotle's work 'On Poetics' as Abi Beshr ibn Yunus ibn Matta, o al-Farabi, o ibn Sina, ibn Rushd and Hazim al-Qartajanni, could not understand this particular project because they had no translated examples explaining the meaning of epic and tragedy. Ibid: 28.

[57] Ibid: 26.

[58] 'كان أقدم الشعراء اليونانيين وأرفعهم منزلة عندهم، وكان يجرى عندهم مجرى امرئ القيس في شعراء العرب، وكان زمانه بعد زمان موسى عليه السلام بنحو خمسمائة سنة وستين، وله حكم كثيرة وقصائد حسنة جليلة، وجميع شعرائهم الذين أتوا بعده على مثاله احتذوا، ومنه أخذوا وتعلموا، وهو القدوة عندهم، .....وهو معتدل القامة حسن الصورة، أسمر اللون، عظيم الهامة، ضيق ما بين المنكبين، سريع المشية، بوجهه آثار جدرى، مهزارا (...)، مات وله مائة وثمانون سنة. وهو من الكبار الذين عدهم أفلاطن وأرسطو وغيرهما من العظماء في أعلى المراتب وكان أرسطو لا يفارق مكان ديوانه، ويستدل هو ومن تقدمه وتأخر عنه بشعره لما كان يجمعه من الحذق في قول الشعر مع إتقان المعرفة ومتانة الحكمة، وجودة الرأي'
Al-Shahrzuri Shasueldin, *Nuzhat al-Arwah wa Rawdat al-Afrāh fi Tārikh al-Hukamā wa al-Falāsiphah,* κριτική επιμ. Khurshīd Ahmad, εκδ. Majlis Da'erat al'Ma;arif al-^{c}Othmanyiah, Hidaabad, Ινδία, 1976: 227-228. Επίσης Ibn Fatik al-Mubashir, *Mukhtāral-Hikam wa Mahasin al-Kalim,* επιμ. Abduerahman Badawi, Cairo, ^{2}1980: 29-30.

[59] Al-Bairuni, *Tahqiq maa lil-Hend min Maqulah Maqbulah fī al-^{c}Aql au Mardhulah,* Majlis Da'irat al-Ma^{c}arif al-^{c}Othmanyiah, Haidarabad, Ινδία, 1958: 32, 75, 189.

[60] A. ibn Hendu, *Al-Kalim al-Rauhanyyia fi al-Hikam al-Yunanyyiah,* επιμ.: Mostafa al-Demishqi, έκδ. al-Taraqqi, 1900: 90.

[61] Ibn al-Qiftī, *Tārīh al-Hukamā*, κριτική έκδοση Lippert Julius, εκδ. Dietericipsche Verlagsbuchhandlung, 1908: 96-97.

صورة أوميرس كما جاءت في مخطوطة برلين رقم 785 .Qu

as a great poet mentioned by Plato and Aristotle. For al-Shariristani, Homer holds a very high place in the world of poetry, as his work is used as a model for the perfection of knowledge he provides, the completeness of wisdom, the quality of opinion, and the possibility of speech.[62]

The interest of Egyptian writers in the Arab world was not limited to poetry, but was also extended to the Arabic novel. The effort of G. Agissos. in this field it is worthwhile as he translated in Greek the study of I. Kratsovskis titled 'The Historical Novel in Modern Arabic Literature'. He also transcribed in Greek all the Arabic names of the writers mentioned in the work. According to the scholar, the Arabic novel has its roots in the pre-Islamic period, with the example of the story of the great warrior and poet Andrea ibn Shaddād..[63]

Cavafy had a personal relationship and contact with Arab artists such as Ahmad Rasim.

Hala Halim refers to Cavafy's acquaintance with the Egyptian poet Ahmad Rassim, stressing that Cavafy expressed his enthusiasm for his poetic work. Manolis Halvatsakis interviewed by the Egyptian poet Ibrahim al-Jayyiar, who personally knew Cavafy, asked if Cavafy was interested in Arabic writers. And the Egyptian friend of the poet replied: 'Of course he wanted them to get to know him. I know he met with the poet Shawqui in the Athenian. An irrigation engineer Technical Deputy Director Mahmud Sami brought them in contact. They were together for half an hour and spoke in French. Not about Arab poetry or about their work, as expected, but about Moliere, whom Shawqi admired, as Cavafy had told me. '.[64]

Takis Tsakonas wrote a poetic collection titled Arapica Songs. It seems that 'Mr. Tsakon has red poems of Arabic poets, probably and in the original, since he is an Egyptian; he even reads 'Omar K[h]ayam, and perhaps any other Eastern poets, Persians, Arabs of Spain. 'His collection seems to have been influenced by the environment he lived in'.[65]

In conclusion se note that although many Aigyptiotes showed great interest in the ancient Arab literary production and they also interested in the modern literature, that they got known mainly through translation. On the other hand the Arabs were focused on the ancient Greek literature. The translation of the Greek literary texts started in the 19th century. Before that, in the Middle Ages they focused on the translation of scientific texts and philosophy for religious purposes.

62 Al-Sharistani, *Al-Milal wa al-Nihal,* επιμ. Amir Mahanna & Ali, 1ος τόμος, έκδ. Dār al-Ma'refa, Beirut, 31993: 428-429.

63 The writer mentions: '"Ενα ἀπὸ τὰ γνωστότερα μυθιστορήματα αὐτῆς τῆς σειρᾶς εἶνε τὸ Σίρετ Ἀντάρα, ἐποποιΐα μὲ κέντρο τὸ ἱστορικὸ πρόσωπο ἑνὸς προϊσλαμικοῦ ἥρωα ποιητῆ, ποὺ ἡ λαϊκὴ δημιουργικότης τὸν μετέβαλε σὲ μυθικὴ μορφή. Ἡ παράδοσι ἀποδίδει τὸ ἔργο στὸ δημοτικώτατο φιλόλογο τοῦ ή αἰῶνα Ἀλ-Ἄσμαϊ, μολονότι ἡ μορφωμένες τάξεις τῆς Ἀνατολῆς δὲν τὸ ἔχουν σὲ πολλὴ ὑπόληψι γιὰ τὸ λαϊκό του χαρακτῆρα, ἐν τούτοις γι' αὐτὸν ἀκριβῶς τὸ λόγο οἱ Εὐρωπαίοι ἐπιστήμονες τὸ θεωροῦν πολύτιμο. Πρῶτος ὁ Caussin de Percevale ἐπρόσεξε τὸ ἔργο· τὸ χαρακτήρισεν ὡς ἀραβικὴ Ἰλιάδα καὶ τὸ ἔκρινε μὲ πολὺ ἐνθουσιασμό'. See, ibid: 67.

64 Robert Liddell, *Καβάφης: Βιογραφία,* op. cit. pp. 189-190.

65 ''Ἀπὸ τὰ διαβάσματα αὐτὰ καὶ ἴσως καὶ ἀπὸ τὴν ἐπίδραση τοῦ περιβάλλοντος, διεμόρφωσε ἕνα pastiche ποιητικό, ποὺ θὰ μποροῦσε ἴσως νὰ ἀγγίξῃ τὴν ποίηση, ἂν ὑπῆρχε καὶ διάθεση πραγματικὴ καὶ ἔμπνευση καὶ ἂν κατώρθωνε ὁ κ. Τσάκωνας νὰ ἐκφρασθῆ κάπως καλλιτεχνικώτερα καὶ πιὸ προσωπικὰ'. See, ibid: 788.

From Alexandria to Venice: remembrances of Alexandria in the cultural treasures of Venice

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The medieval man construed the stealing of holy relics as a pious act, pleasing to God, since their ownership strengthened his faith and their possession acted as a shield against evil. Hence, the practice of stealing holy relics – the *translationes* – was treated as sacred theft (*furta sacra*) and the removal of the relic from its original location was ideologically vindicated each time with the aid of the appropriate interpretative tools. In fact, over time, a prescribed procedure of theft had been artfully devised, a model with commonly shared traits, such as the consent of the saint to the transfer, the difficulties which the removal of the relics entailed, etc. Early on, the holy relics of saints and their collection had aroused the interest of the Venetians, not only because they were regarded as priceless evidence of Christian piety, but rather because they served, as means of political propaganda, the political aspirations of the *Serenissima*.

The tendency, which the Venetians had manifested already since the 9th century to assert their independence from the Byzantine Empire, as well as the western powers, had rendered the stealing of the relic of Saint Mark from Alexandria and its transfer to Venice imperative. Having achieved political and economic autonomy, the Venetians needed to become ecclesiastically independent from their neighbouring cities, acquire their own patron saint and turn his relic into a religious symbol. Hence, the stealing of the relic of the saint is subsumed under this ideological framework. According to the Venetian propaganda, the theft of the relic of the saint, who is believed to have preached the Gospel in the Venetian lagoon on his way to Aquileia, was a divine mission, since the relics of saints had to be safeguarded in secure localities, owned by genuine Christians and not faithless Muslims or schismatics. From then on the story is familiar. In 828 two Venetian merchants stole the body and justified their deed on the grounds that Alexandria and the entire land of Egypt had been seized by the Saracens; therefore, the relic had to be transferred from a land governed by the perfidious to a Christian territory. Aided by the Greek guards of the church, they placed the relic into a basket concealed beneath vegetables and pork, since the sight of the meat would keep the Muslims away, and after they secretly switched the body with that of Saint Claudia, they managed to move the container to their vessel and transfer it from Alexandria to Venice.

With the *translatio* of the relic of Saint Mark to the city of the Doges, the two worlds of Alexandria and Venice, despite the relatively large geographical distance separating them, were curiously linked with each other and the bonds that were established have left their remembrances on cultural treasures preserved in the *Serenissima*. These remembrances I will attempt to present in this brief paper.

In the representations of scenes from the life of Saint Mark, and particularly the episode of the translation of his relic, which is preserved in the basilica of Saint Mark in Venice, Alexandria with its landmark – the Pharos – occupies a central position. Classified as one of the Seven Wonders of the Ancient World, the Pharos of Alexandria dates back to that glorious era of Hellenism, during which the Greek language was spoken ubiquitously '*carried as far as Bactria, as far as the Indians*', to recite the famous verse by the Alexandrian poet. According to travelling and chronographic sources, during the Middle Ages, possibly in the late 11th century, a *qubba*, namely a dome with gallery, was added to the Pharos, signifying its conversion into a mosque. The Pharos was preserved in the ensuing centuries in this architectural form until its collapse caused by earthquakes in the 15th century. It appears that the monument with the dome was known to the pilgrims of the Holy Land, and based on their accounts the architectural shape had possibly spread to the West, as evidenced by the depictions of the Pharos with the *qubba* at the basilica of Saint Mark.

The topographical emblem of Alexandria is illustrated on a mosaic of the church of Saint Mark that dates from the 12th century and depicts the Martyrdom of the saint, who was tied with ropes by the pagans and was dragged and pilloried through the streets of Alexandria until he died of his injuries. In the representation the Pharos with the dome is shown behind the figure of the saint. According to the scholars of the mosaic the bright red ring which appears on the upper part of the monument denotes the atmospheric optical phenomenon of the halo caused by light's refraction and reflection as a result of the fire that burned inside the structure (Figure 1). Also the red colour at the top of the building, indicating the light that burned and lighted the surrounding area at night, is depicted in the Pharos included in the later mosaic beneath the

Figure 1. Martyrdom of Saint Mark (Favaretto, Il Faro di Alessandria a San Marco, op.cit.: 52).

Figure 2. *Translatio* of the relic (Basilica of Saint Mark, Zen Chapel).

Figure 3. Chapel of Saint Isidore (*Quaderni della Procuratoria*, op.cit., pp.86, 2, 93).

Ascension Dome. The Pharos is illustrated at the side of the saint, who is portrayed writing his Gospel. To the following 13th century dates the mosaic that occupies the presbytery of the church and depicts the translation of the relic, but instead of the Pharos Alexandria is schematically indicated by a gate with two turrets on either side with the inscription ALEXANDRIA written in majuscule letters in the centre. Another mosaic, which is preserved in the Zen Chapel of the basilica of Saint Mark, with the representation of the Pharos, dates also to the 13th century. The mosaic illustrates the arrival from Alexandria in Venice of the vessel that carried Saint Mark. The Pharos is shown in the centre with a flight of stairs that reach the sea, whereas to the left is depicted the boat with the Venetian merchants lowering its sails, as their vessel had already entered the port, and to the right the saint is pictured healing the cobbler Anianus. Alexandria is indicated by arches and the majuscule inscription ALESANDRIA (Figure 2). The Pharos is also depicted with stairs reaching down to the sea on a mosaic of the Chapel of Saint Isidore, in which the journey of the saint from Alexandria to the island of Chios unfolds, with Alexandria being suggested by its symbol, the Pharos (Figure 3). Another mosaic representation of the Pharos, which is not preserved today and which originally embellished the facade of the church of Saint Mark, can be discerned on a painting by Gentile Bellini dating from the 15th

Figure 4. Gentile Bellini, *Processione di Santa Croce.*

century, kept at the Gallerie dell'Academia. In Bellini's painting *Processione di Santa Croce* the Pharos is shown as the landmark of Alexandria between the boat that translated the relic and the Muslims that converse with the merchants on the coast (Figure 4). The Pharos takes the form of an obelisk in the *Pala Feriale* painting signed by Paolo Veneziano and sons, an exquisite work of Venetian art dating to 1345 held at Saint Mark's Museum. The scene depicts Saint Mark healing the cobbler Anianus. Before the imposing Pharos Christ is shown standing next to the seated figures of the saint and Anianus (Figure 5). Finally, in later periods, particularly during the Renaissance, the iconography of the Pharos takes imaginary forms depending each time on the disposition of the artist. These cases include a tapestry (*arazzo*) of the mid 16th century that belongs to the collection of tapestries on display at Saint Mark's Museum. The work, based on the design by a Flemish master who worked in Florence, governed at the time by the Medici, illustrates a scene from the cycle of the miracles of Saint Mark, in which he liberates a possessed man. The Pharos is noticed in the background, near the sea, behind the figure of the saint, taking an unrealistic architectural form since it comprises two cylindrical structures, the one on top of the other. However, the connection that was established between the Venetians and the seventh wonder of the ancient world is not limited to these depictions. In 1909 the German archaeologist Hermann Thiersch, in his treatise on the Pharos, which includes drawings of the monument based on the various descriptions of earlier scholars, maintains that the architectural form of the famous Campanile at Saint Mark's Square in its original phase had been influenced by the shape of the Pharos, as though it continued to silently defend the sacred relic of the saint with its presence (Figure 6).

Apart from the representations of the Pharos, references to the city of Alexandria and its founder are encountered in various cultural treasures of Venice preserved in its libraries and the renowned State Archives of the city, one of the most significant archival repositories in Europe. Among the printed and archival treasures two maps of Alexandria and two documents are notable. The first map comes from the six-volume *Terrarum Orbis Civitates*, dating from 1597, held today at

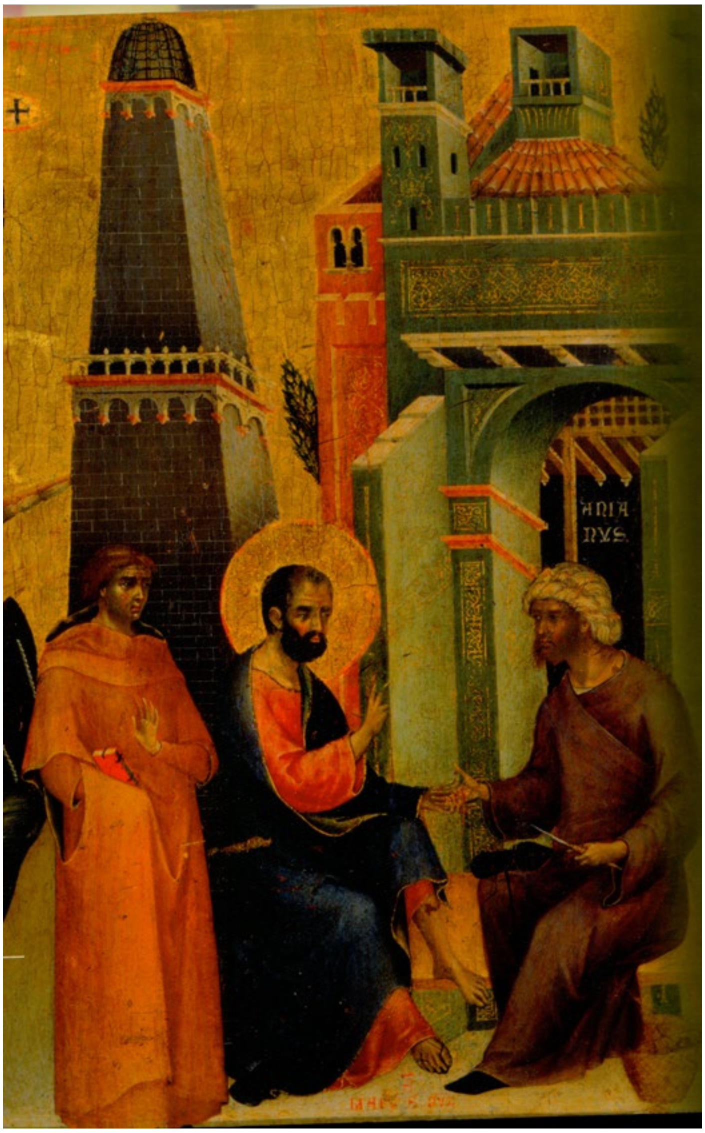

Figure 5. Paolo Veneziano, *Pala Feriale* (*Venezia e l'Egitto*, mostra e catalogo, op.cit.: 56).

Figure 6. The *Campanile* of Saint Mark and the drawing by Thiersch.

Figure 7. Map of Alexandria, 1597 (*Venezia e l'Egitto*, mostra e catalogo, op.cit.: 86).

the Venetian Monastery of San Francesco della Vigna (Figure 7). Alexandria is depicted as a major commercial centre of Egypt, with its old and new harbour, its squares, dwellings and monuments, including the church of Saint Mark. The second representation of the harbour of Alexandria is a drawing that dates back to the 18th century, kept at the Museo Correr. The 'Fort of Quaitbay', that was built over the ruins of the Pharos, is visible (Figure 8). Noteworthy archival evidence safeguarded at the State Archives of Venice includes nine documents concerning Michalettos Papadopoulos of Crete, who had engaged in commercial activities in Egypt during the early decades of the 15th century. Interesting archival testimonies to the presence and the activity of the Cretan entrepreneur in the Land of the Nile are contained in the unpublished letters which he had sent in 1419 from Damietta to the Venetian consul in Alexandria, in which he reported on the moves of the Despot Theodore I Palaeologos in the Peloponnese (Figure 9).

I will conclude this brief contribution on the cultural assets in Venice that pertain to Alexandria, referring to two more invaluable treasures which are associated with Alexander, the founder of the city. The first is the relief embedded into the wall on the north side of the basilica of Saint Mark, and the second is the illuminated manuscript of the 14th century, the so-called *Romance of Alexander*, attributed to Pseudo-Callisthenes, which is kept at the Hellenic Institute of Byzantine and Post-byzantine Studies. Brought to Venice from Constantinople as spoil of the Fourth Crusade, the relief set into the external side of the basilica of St Mark depicts the Ascension of Alexander the Great, a representation that, in the minds of the Byzantines, is entwined with imperial ideology. Alexander, having supernatural powers and aspiring to conquer the kingdom of heaven, is depicted idealised as an instigator and creator of world hegemony. On the relief he is portrayed as a Byzantine emperor wearing the *loros* crossed over his chest and hemispherical crown, and standing on his chariot, which is schematically rendered. He is flanked by two griffins, while he holds in his hands poles ending in vultures (Fig 10). The second precious relic, the *Romance of Alexander*, consists of fictional stories of the adventurous life of the Macedonian ruler and

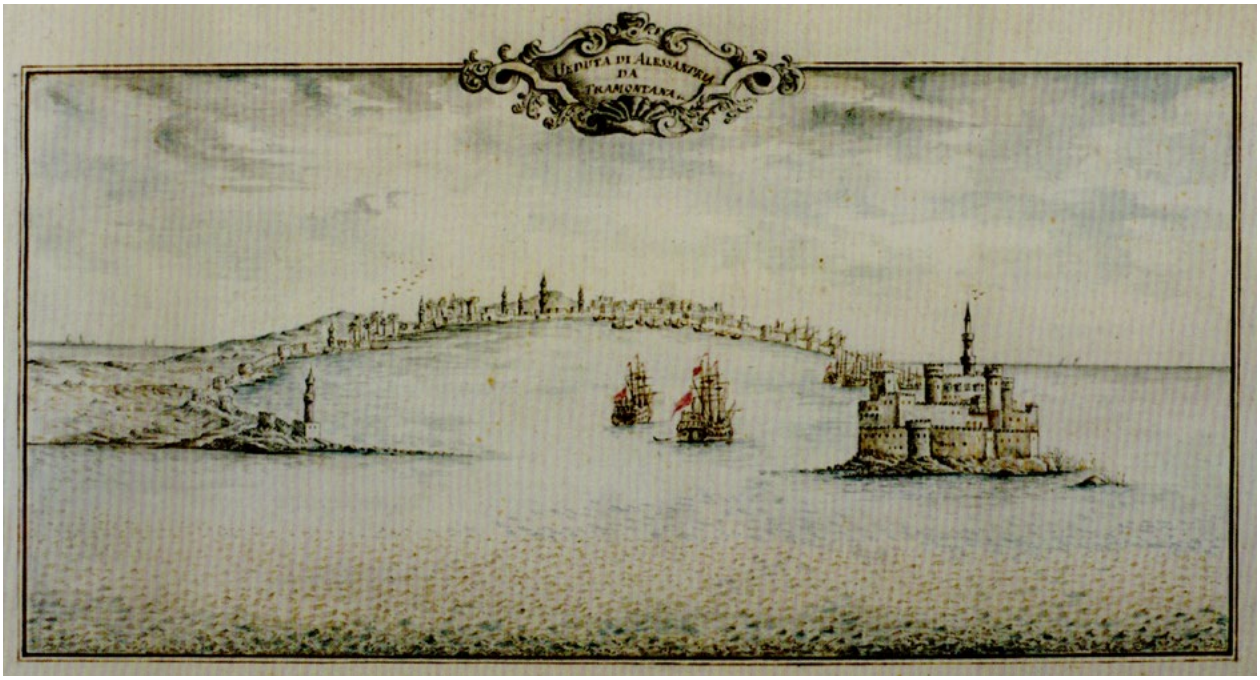

Figure 8. Map of Alexandria, 18th century (*Venezia e l'Egitto*, mostra e catalogo, op.cit.: 88).

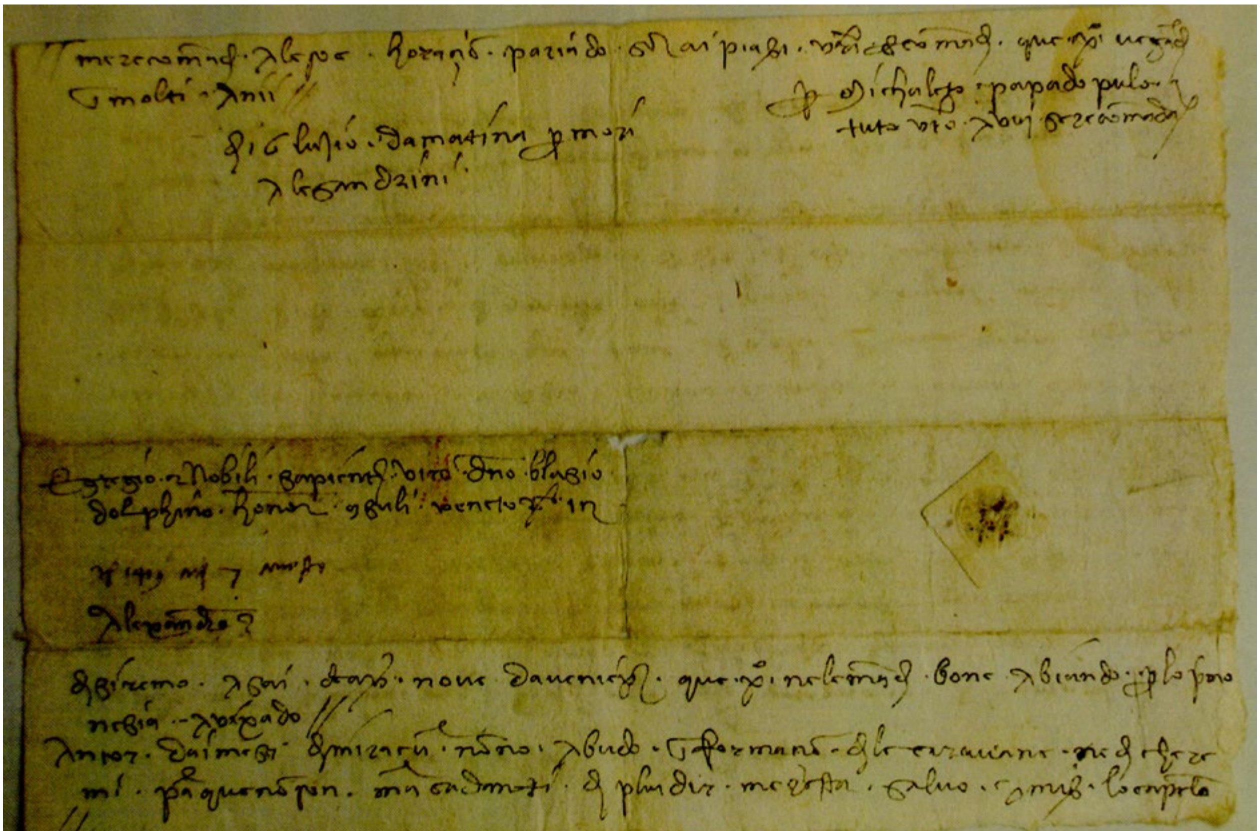

Figure 9. Letter of Michalettos Papadopoulos to the Venetian consul (Archivio di Stato di Venezia, *Archivio Papadopoli*, b.281).

Figure 10. The Ascension of Alexander the Great (Basilica of Saint Mark, external side).

is decorated with 250 ornate miniature paintings, most of which cover the whole surface of the page, with numerous western and eastern elements, also showing Alexander as a Byzantine emperor (Figure 11). The *Romance of Alexander* was particularly widespread during the Middle Ages and was translated into many languages (Latin, Syriac, Armenian, Serbian, Ethiopian, etc.). In 1529 the story of Alexander the Great in verse version, known as *Rimada*, was first printed in Venice, edited by Demetrio Zeno, whereas the popular book written in the vernacular and in prose exerted great influence on the populace, being published in 60 editions and read by many generations of Greeks during the Ottoman occupation. It is obvious that the printed book has largely contributed to the cultivation of the notion of the ecumenical character of Alexander and also that Venice with its printers, particularly the Greek ones, played a decisive role in the propagation of this ideology.

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Figure 11. *The Romance of Alexander the Great*, 14th century (Hellenic Institute of Venice).

The destruction of libraries in the course of history and the international law on the protection of cultural property in the event of armed conflict

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For the Protection of Cultural Property in the Event of Armed Conflict

Introduction

The aim of this presentation is to highlight the issue of the international legal framework on the Protection of Cultural Property against its destruction, either deliberately or as a collateral damage, in times of war and conflict.

Throughout history, libraries and archives have been frequent targets during armed conflicts for several reasons. Sometimes, their destruction was simply a collateral damage, since they were located in the wrong place at the wrong time. Often, in the chaos of wartime, they became convenient targets for looters and other opportunists. Worst of all is when they have been deliberately targeted, as part of a concerted effort to eradicate a community's collective knowledge and memory, something that can be described as 'cultural cleansing'. Historical records provide several examples of deliberately destroyed emblematic libraries, such as indicatively:

- The Library of Alexandria: Ancient and modern sources identify four possible occasions for its partial or complete destruction: Julius Caesar's fire in 48 BC, the attack of Aurelian in AD 270-275, the Decree of Coptic Pope Theophilus of Alexandria in AD 391 and the Muslim conquest of Egypt in AD 642 (Figure 1).
- The Imperial Library of Constantinople: Much like the library of Alexandria, ancient and modern sources identify several occasions for its partial destruction. The Imperial Library of Constantinople was completely destroyed in 1204 by the knights of the Fourth Crusade, while its contents, including rare Byzantine manuscripts, were burned or stolen;
- The archives containing the Maya Codices of Yucatan, which were destroyed in 1562 by Bishop Diego de Landa, a Franciscan monk and conquistador, during the Spanish conquest of Yucatan in Mexico.

Interestingly, several centuries later, the 20th century witnessed some of the worst destruction of libraries and archives during armed conflicts. We indicatively mention the destruction of:

- The Library of the Catholic University of Leuven in Belgium, burned in 1940 by Nazi occupation troops (Figure 2).
- The National Library of Cambodia, which was burnt in 1979 by the Khmer Rouge.
- The National and University Library of Bosnia and Herzegovina in Sarajevo, which was completely destroyed in 1992 by the Bosnian Serb Army during the Siege of Sarajevo (Figure 3).
- The Iraqi National Library, as well as the University Libraries of Baghdad, which were damaged and destroyed during the 2003 Iraqi War.
- The Mosul Public Library in Iraq, completely destroyed by the so-called Islamic State in 2015.

Following the reference to the last three library destructions in Sarajevo, Baghdad and Mosul, one can see that, as was the case in antiquity, culture has moved over the last decades, to the front-lines of wars as a means to foster more violence, hatred and vengeance. Quite recently, we have witnessed an unprecedented 'cultural cleansing' which targets mainly archaeological sites of the greatest importance for humanity, cultural property of significant importance and value, as well as places of worship belonging to religious minorities. Recent conflicts in Mali, Libya, Yemen, Iraq and Syria have demonstrated that the protection of cultural heritage is much more pressing than ever before (Figure 4).

The international legal framework on the protection of cultural property in armed conflict:[1] a brief overview

Protection of cultural property in armed conflict is governed by international humanitarian law. The

* The views expressed by the author are strictly personal and do not engage the Ministry of Foreign Affairs of Greece. See report by Papathanassiou, A., Chairperson of the Intergovernmental Committee for the Protection of Cultural Property in the Event of Armed Conflict, to the Sixth Meeting of States Parties to the 1999 Second Protocol UNESCO, December 2015, viewed 8 February 2016, http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/CLT/pdf/Report_Chairperson_FINAL_ENG.pdf

[1] Henckaerts, J. M. and L. Doswald-Beck 2005. *Customary International Humanitarian Law.* Cambridge: Cambridge University Press I: 127-138. See also, a complete review of the international legal framework on the protection of cultural property in armed conflict in 'International Committee of the Red Cross (ICRC): Study on Customary International Humanitarian Law (IHL)', viewed 8 March 2017, https://www.icrc.org/en/war-and-law/conduct-hostilities/cultural-property. See, also, 'ICRC Study on Customary IHL- Rules 38-41', viewed 8 November 2017, https://ihl-databases.icrc.org/customary-ihl/eng/docs/home

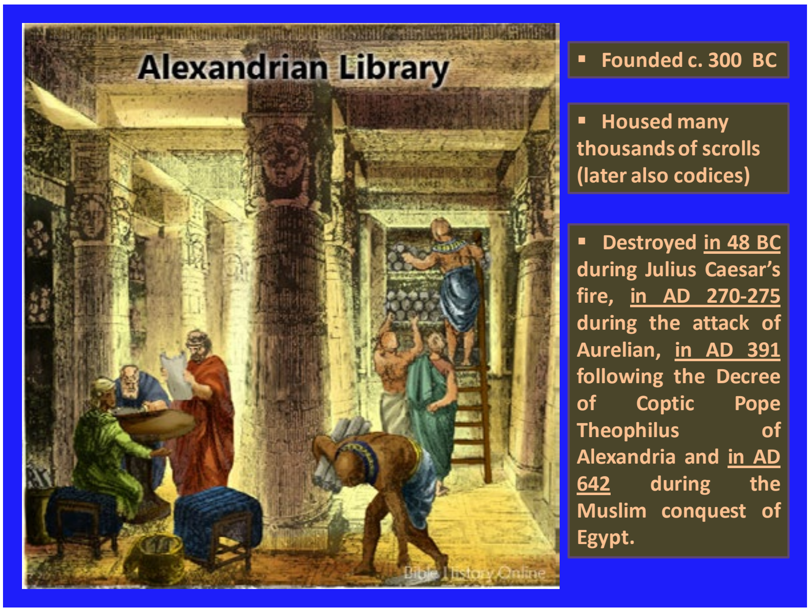

Figure 1. Short destruction history of the Alexandrian Library.

Figure 2. Destruction of the Library of Leuven in Belgium.

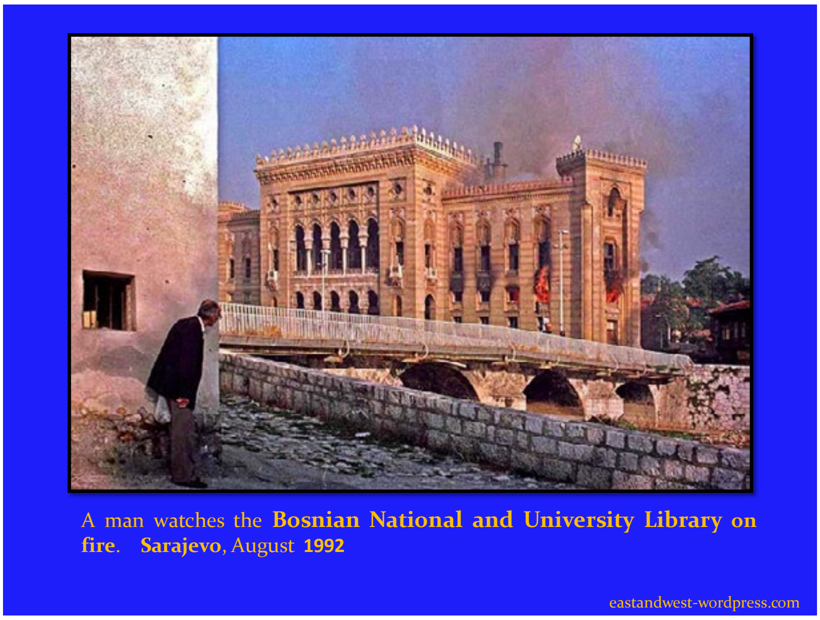

Figure 3. The Bosnian National and University Library on fire.

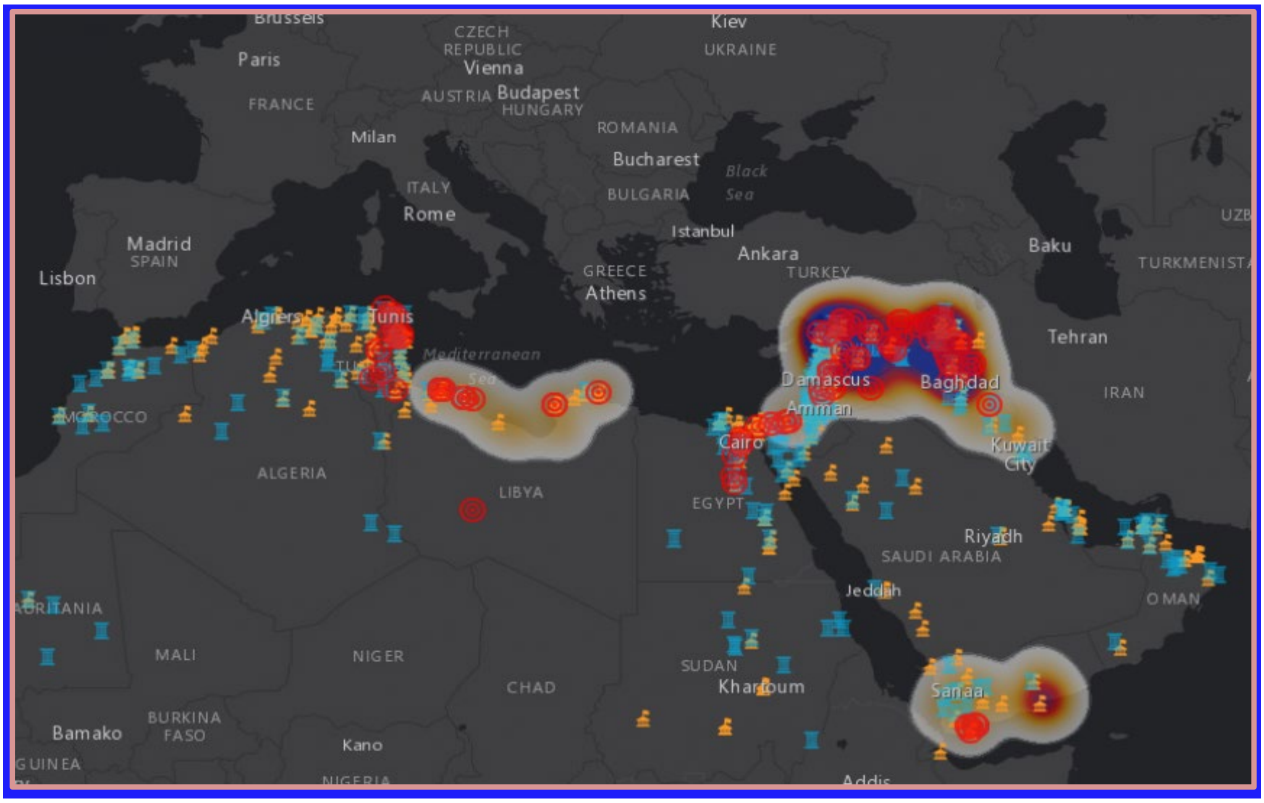

Figure 4. Map of cultural sites under threat.

pertinent rules of international humanitarian law are found in several multilateral treaties and in customary international law. The centerpiece of the relevant treaty-law is the 1954 Hague Convention for the Protection of Cultural Property in the Event of Armed Conflict, together with its two Protocols. In 1954, and as a consequence to the massive destruction of cultural heritage during the Second World War, a 'Convention for the 'Protection of Cultural Property in the Event of Armed Conflict' was adopted at the Hague, as the first international treaty dedicated exclusively to the protection of cultural heritage in the event of armed conflict. The 1954 Hague Convention contains a definition of 'cultural property' that covers both movable and immovable cultural property, including both libraries and archives. It further creates a specific emblem to identify protected cultural property – the blue shield (Figure 5) – and provides for a system of 'general' and 'special protection' of cultural property. Under the 1954 Hague Convention, each State must safeguard its own cultural property in the event of armed conflict. This can be done, for example, by moving such property away from potential or actual military action or, in the case of historical sites, by avoiding placing military objectives near them. Civilians and civilian objects are not to be made the object of a direct attack. Parties to an armed conflict are not allowed to direct hostilities against cultural property and must avoid incidental damage to such property. Using cultural property for military purposes is prohibited.

The Hague Convention does, furthermore, recognise situations where an attack on cultural property may be lawful, namely if such property has been turned into a military objective and an attack would be required by 'imperative military necessity'. It is therefore obvious that the Hague Convention reflects the approach that cultural property is 'civilian' property and, as such, should not be attacked, with the exception of having become a military objective.

The 1954 Hague Convention was adopted together with a Protocol, the First Protocol, aiming at preventing the export of cultural property from occupied territory and requiring the return of such property to the territory of the State, from which it was removed.

In addition to its protection under the 1954 Hague Convention and its two Protocols of 1954 and 1999, cultural property in the event of armed conflict is also specifically protected by the 1977 Protocol I (international armed conflicts) and the 1977 Protocol II (non-international armed conflicts) additional to the Geneva Conventions of 1949 for the protection of war victims (Additional Protocols I and II). In accordance with article 53 of Additional Protocol I and article 16 of Additional Protocol II,[2] only military objectives are

[2] The provisions in these instruments supplement those contained in the 'Regulations respecting the Laws and Customs of War on Land', which are annexed to the homonymous Hague Convention of 1907

Figure 5. Distinctive emblem of the 1954 Hague Convention.

to be made the object of attack. Civilians and civilian objects, among them cultural objects as being civilian objects, should not be attacked. Cultural property in the event of armed conflict is specifically protected as well by the Statute of the International Criminal Court of 1998.[3]

It should also be noted, in passing, that two other international treaties in the context of international cultural property law, which contain a broader definition of 'cultural property'[4] and protect both cultural property and the world heritage, are also applicable in peacetime as well as in armed conflict, namely: the 1970 UNESCO Convention 'on the means of prohibiting and preventing the illicit import, export and transfer of ownership of cultural property' and the 1972 UNESCO Convention 'on the protection of the world cultural and natural heritage'.[5] In particular, the 1970 Convention, in its article 11, considers as illicit the export and transfer of ownership of cultural property under compulsion, arising directly or indirectly from the occupation of a country by a foreign power, while the 1972 Convention provides for a world heritage site to be included in a List (the List of World Heritage in Danger) at the outbreak of, or in case of potential danger of, armed conflict.[6]

The destruction, however, of cultural property in the course of the conflicts that took place at the end of the 1980s and the beginning of the 1990s highlighted the necessity for a number of improvements in relation to the implementation of the Hague Convention. A review of the Convention was initiated in 1991 and resulted at the adoption of a Second Protocol to the Hague Convention, in March 1999. The Second Protocol is additional and supplementary to the Convention and this supplementary character is distinguished from any form of amendment to the Convention.[7]

It is also noteworthy that, even where a State is not party to one or other treaty regulating the protection of cultural property in armed conflict, it remains bound by obligations imposed by the customary international law of armed conflict and the content of this customary international law mirrors to a large extent the rules embodied in treaty form in the 1954 Hague Convention and its two Protocols.

The new elements introduced by the 1999 Second Protocol to the 1954 Hague Convention

The new elements introduced by the Second Protocol, which at the same time reflect the new developments

(Convention No. IV). They contain fundamental principles which are recognised as being principles of customary law. Article 27 of the said Regulations, in particular, stipulates that 'all necessary steps must be taken to spare, as far as possible, buildings dedicated to religion, art, science or charitable purposes, historic monuments, (...) provided they are not being used at the time for military purposes. (...) It is the duty of the besieged to indicate the presence of such buildings (...) by distinctive and visible signs, which shall be notified (...) beforehand'.

[3] See article 8 (2) (e) (iv) of the Statute of the International Criminal Court.

[4] See also, International Committee of the Red Cross (ICRC), 'Practical Advice for the Protection of Cultural Property in the Event of Armed Conflict', viewed 7 September 2017, https://www.icrc.org/en/document/practical-advice-protection-cultural-property-event-armed-conflict-guidelines#.VN3K8yinG31

[5] O'Keefe, R. 2006. *The Protection of Cultural Property in Armed Conflict.* Cambridge: Cambridge University Press: 312.

[6] See paras 179-180 of the 'Operational Guidelines of the 1972 UNESCO Convention'.

[7] Toman, J. 2009. *Cultural Property in War: Improvement in Protection. Commentary on the 1999 Second Protocol to the Hague Convention of 1954 for the Protection of Cultural Property in the Event of Armed Conflict.* UNESCO. World Heritage Series:185, viewed 20 October 2016, http://publishing.unesco.org/details.aspx?Code_Livre=5120

in international law on the protection of culture in the event of armed conflict, are the following:

- *The broadening of the scope of application of the protection*, since the Second Protocol contains a specific Chapter on its application in armed conflicts not of an international character occurring within the territory of one of the Parties. While the Hague Convention makes just a simple reference to armed conflicts not of an international character, the Second Protocol further elaborates on this specific issue. This is very important, if one considers that modern conflicts have drastically changed over the last few years with the introduction of new actors in conflict zones, such as trans-national armed terrorist groups, in particular Al Qaeda and ISIL, and the main issue is that international humanitarian law needs to evolve further to comprehensively adapt to these new dynamics. As an indication, the armed conflicts which occur at present in Syria, Iraq, Yemen, Libya and earlier in Mali and Afghanistan, as well as in other regions, constitute, in principle, conflicts not of an international character.
- *The strengthening of the obligation to respect cultural objects by introducing the concept of the 'military objective'.* According to the Second Protocol, military objective means an object which, by its nature, location, purpose, or use, makes an effective contribution to the military action and whose total or partial destruction, capture or neutralisation, in the circumstances ruling at the time, offers a definite military advantage. The introduction of this concept is extremely important, as confirming the principle that cultural objects are primarily 'civilian goods' and, as a consequence, their destination is neither to enhance military efforts nor to be used as military objectives. An example to be avoided is the case of the world's best-preserved 'Crusader Castle', the 12th-century 'Krac des Chevaliers', in Homs province, Syria, that was bombed by the Syrian air forces themselves in 2014, because it was used to dislodge rebel fighters who had based themselves therein (Figure 6).
- *The criminalization of specific acts against cultural property*, committed intentionally and in violation of the Convention or the Second Protocol,[8] as well as the introduction of a system of effective enforcement at the national level. For the most serious violations of the Second Protocol, States Parties have the obligation to adopt such measures, as may be necessary, to establish as criminal offences under their domestic law these serious violations and to make them punishable by appropriate penalties.[9] Furthermore, for the most serious of them, as for instance the attack against cultural property under enhanced protection, the Contracting Parties shall, pursuant to the principle of 'universal jurisdiction', either prosecute or extradite[10] the alleged offender who is present in their territory, even if the latter is not their national or the offence is not committed in their territory.[11] It is clear, however, that the Second Protocol builds to a large extent on Additional Protocol I to the Geneva Conventions of 1949 and the Statute of the International Criminal Court.[12]
- *The creation of the Intergovernmental Committee for the Protection of Cultural Property in the Event of Armed Conflict*, which constitutes the monitoring mechanism of the Second Protocol. It is composed of 12 States which are elected by the Meeting of States Parties to the Second Protocol for a four-year term and are eligible for immediate re-election only once. The Committee acts in close co-operation with the UNESCO Director General.
- *The establishment of a new system of protection of cultural property, the 'enhanced protection'*, which is a kind of 'immunity' enjoyed by a specific cultural object or property in the event of armed conflict.[13] A cultural property under enhanced protection, as well as its immediate

[8] Article 15: Serious violations of the Protocol:
(1) Any person commits an offence within the meaning of this Protocol if that person intentionally and in violation of the Convention or this Protocol commits any of the following acts:
a) making cultural property under enhanced protection the object of attack;
b) using cultural property under enhanced protection or its immediate surroundings in support of military action;
c) extensive destruction or appropriation of cultural property protected under the Convention and this Protocol;
d) making cultural property protected under the Convention and this Protocol the object of attack;
e) theft, pillage or misappropriation of, or acts of vandalism directed against cultural property protected under the Convention.
(2) Each Party shall adopt such measures as may be necessary to establish as criminal offences under its domestic law the offences set forth in this Article and to make such offences punishable by appropriate penalties. When doing so, Parties shall comply with general principles of law and international law, including the rules extending individual criminal responsibility to persons other than those who directly commit the act.

[9] See in 'Preventing and Repressing International Crimes: Towards an Integrated Approach Based in Domestic Practice. Report of the Third Universal Meeting of National Committees for the Implementation of International Humanitarian Law', 2013, viewed 18 September 2015, https://www.icrc.org/en/publication/4138-preventing-and-repressing-international-crimes-towards-integrated-approach-based

[10] See articles 15-21 of the 1999 Second Protocol.

[11] Articles 16 (1) (c) and 17 (1) of the 1999 Second Protocol.

[12] Article 8 (2) (e) (iv) of the International Criminal Court's Statute states that '(...) intentionally directing attacks against buildings dedicated to religion, education, art, science or charitable purposes, historic monuments, hospitals and places where the sick and wounded are collected, provided they are not military objectives (...), constitutes a war crime, regardless of the classification of the conflict'.

[13] It was established in reaction to the limited success of the system of 'special protection' introduced by the 1954 Hague Convention.

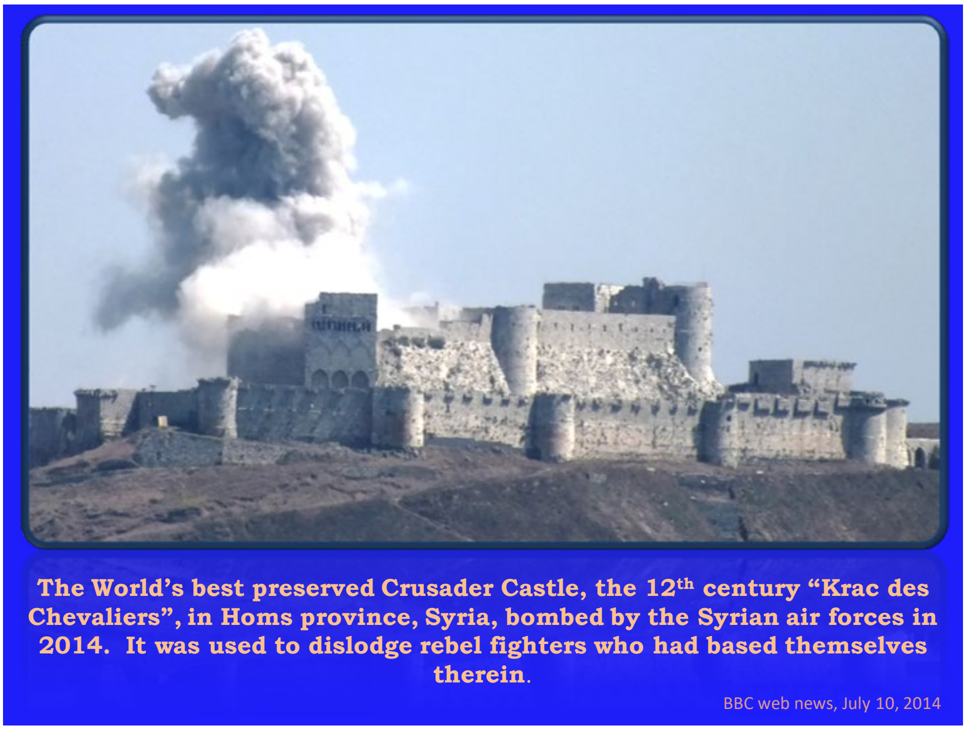

Figure 6. Bombardment of the castle Krac des Chevaliers, in Homs/Syria.

surroundings, must not be used for military purposes or to shield military sites. For achieving the granting of enhanced protection for cultural property under their jurisdiction or control, the State Parties should submit to the Committee a specific request. The Committee examines in each particular case, whether the following three conditions are met cumulatively:

- the site is of the greatest importance to humanity;
- it is protected by adequate domestic legal and administrative measures recognizing its exceptional cultural and historic value and ensuring the highest level of protection; and
- it is not used for military purposes or to shield military sites and a declaration has been made by the Party which has control over the cultural property, confirming that it will not be so used.

- *The specification of the obligation for the safeguarding of cultural property in time of peace* by taking preparatory measures, such as the planning of emergency measures for protection against fire or structural collapse and the preparation for the removal of movable cultural property. The taking of preventive measures in time of peace is extremely important, not only in the event of an armed conflict, but equally for the protection of cultural property in the event of unforeseeable natural disasters.
- *The establishment of a trust fund* for providing financial or other assistance, first in support of preparatory or other measures to be taken in peacetime and, second, in relation to emergency, provisional or other, measures to be taken in order to protect cultural property during periods of armed conflict or of immediate recovery after the end of hostilities.

In the context of taking emergency measures for immediate recovery after the end of hostilities, Mali was granted, upon its previous request to the Committee of the Second Protocol, financial assistance in 2012,[14] in order for this country to restore a significant number of its national cultural property, including a national library and precious archives, which were seriously damaged by Islamic revolutionary forces which had taken control over the northern part of this country.

It should be noted that a Party to the Second Protocol may request from the Committee *international assistance* for cultural property under enhanced protection as well as assistance with respect to the preparation, development or implementation of the laws, administrative provisions and measures necessary for the preparation of a request for the granting of enhanced protection.[15] In this context, the Committee granted,

14 A sum of 40,500 $US from the fund.

15 Article 32 para. 1, in connection with article 10 of the Second Protocol.

in December 2016, international assistance to Mali,[16] with respect to the preparation of its relevant request for the granting of enhanced protection to one of its emblematic monuments, the Tomb of Askia,[17] as well as to Libya,[18] for the taking of emergency restoration measures in relation to damaged archaeological sites and museums located in its territory.

It should also be underscored that, in accordance with article 32 (2) of the Second Protocol, 'A party to the conflict, which is not a Party to this Protocol but which accepts and applies its provisions (...), may request appropriate international assistance from the Committee.' This could have been the case with regard to Syria and Iraq, which, although not being Contracting Parties to the Second Protocol, have the possibility to request international assistance by the Committee, at any time, subject to the above mentioned condition. From December 2014 through December 2016, the Second Protocol Committee made at least five specific requests to Iraq and Syria to ratify the Second Protocol and two requests to take advantage of article 32(2) for being granted international assistance. Unfortunately, despite the numerous appeals addressed by the Committee, no reply has been received yet.

Recent developments in the context of the protection of cultural property in armed conflict[19]

A) The introduction of a *new Distinctive Emblem for Cultural Property under Enhanced Protection (Figure 7).* Unlike the Hague Convention, which provides for the use of a Distinctive Emblem for the recognition and protection of cultural property in the event of armed conflict, the Second Protocol does not provide for the use of a specific emblem for the marking of cultural property under Enhanced Protection. To remedy this problem, the Committee of the 1999 Second Protocol decided that there is a need to create a specific distinctive emblem based on the 'Blue Shield' to mark properties under enhanced protection; it introduced a model distinctive emblem and decided on a relevant amendment of the Operational Guidelines of the Second Protocol. The new distinctive emblem was introduced in December 2015 by the Meeting of the Parties to the 1999 Second Protocol. This is the 'Distinctive Emblem for Cultural Property under Enhanced Protection'. The adoption of the new emblem represents undoubtedly an important challenge, because it will encourage wider recognition of cultural properties that benefit from this special status under international humanitarian law. In addition, the new emblem will contribute to the effectiveness of Article 12 of the Second Protocol, which foresees the immunity of cultural property under enhanced protection, by raising awareness of the military for better protecting cultural property under enhanced protection in times of armed conflict, including occupation.

B) The establishment of Synergies. Synergies between the 1954 Hague Convention and its Second Protocol, on the one side, and the 1970 UNESCO Convention, on the other.[20] The said synergies were established in 2015 for raising awareness of the need to protect cultural heritage in conflict areas. They aim particularly at the training of the military, police forces and customs officials, in particular as to the protection of cultural property against its illicit trafficking and trade, when deriving from of armed conflict areas. Synergies between the 1999 Second Protocol and the 2003 UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage are equally under way with the aim to protecting intangible cultural heritage in times of armed conflict, including occupation.[21]

C) Resolution 2199. The adoption by the United Nations Security Council of Resolution 2199 (2015) (Figure 8), which was issued under Chapter VII of the UN Charter and strongly condemns the repeated deliberate attacks against cultural property, in particular in the Syrian Arab Republic and Iraq. Resolution 2199 (2015) represents a landmark in the recognition of the direct linkage between the destruction and pillage of cultural heritage and the financing of terrorism.[22] Most importantly, it highlights the side consequences of the destruction of cultural heritage in Iraq and Syria, namely the looting of antiquities and their illicit trafficking and trade in order to finance terrorist acts. As to this specific issue, it is reported by reliable sources that a large number of artefacts illegally taken from armed conflict areas end up in antiquities markets in countries

[16] A sum of 35,000 $US from the fund.

[17] Mali was granted enhanced protection for the Tomb of Askia on an exceptional basis, in accordance with articles 11 (8), 32 and 10 (b) of the Second Protocol.

[18] A sum of 35,000 $US from the fund.

[19] Papathanassiou, A. 2017. Protecting cultural property in the event of armed conflict: new challenges and recent developments in the context of UNESCO. *Art Antiquity and Law*, 22 3: 257-272.

[20] UNESCO documentation, viewed 18 August 2017, www.unesco.org/.../synergies/synergies-between-the-1999-second-protocol- to-the-1954-hague-convention-and-1970-convention/

[21] Johannot-Gradis, Ch. 2013. *Le patrimoine culturel matériel et immatériel: quelle protection en cas de conflit armé ?* . Shulthess 709.

[22] The Security Council Resolution 2199(2015) of 12 February 2015, states, among others, that: 'The Security Council {...} 17. Reaffirms its decision in paragraph 7 of resolution 1483 (2003) and decides that all Member States shall take appropriate steps to prevent the trade in Iraqi and Syrian cultural property and other items of archaeological, historical, cultural, rare scientific, and religious importance illegally removed from Iraq since 6 August 1990 and from Syria since 15 March 2011, including by prohibiting cross-border trade in such items, thereby allowing for their eventual safe return to the Iraqi and Syrian people and calls upon the United Nations Educational, Scientific, and Cultural Organization, Interpol, and other international organizations, as appropriate, to assist in the implementation of this paragraph'. It has also to be noted that the direct linkage of the illicit trafficking in works of art with the financing of terrorism is equally underlined in preambular paragraph 23 of Security Council Resolution 2253 (2015).

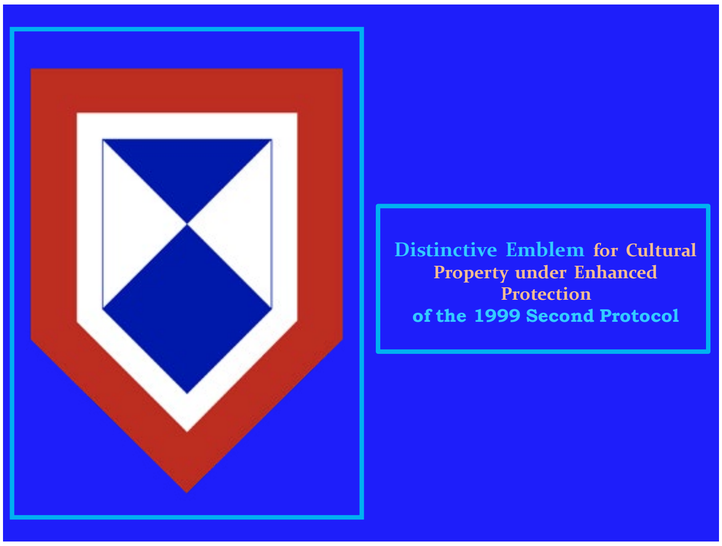

Figure 7. Distinctive emblem of cultural property under enhanced protection.

Figure 8. Security Council Resolution 2199 (2015).

Figure 9. International Criminal Court. conviction of Al Mahdi-Al Faqi.

neighbouring the territories under ISIL/DAESH's control.[23] Auction houses have also been reported to sell on the open markets artefacts originating from ISIL/DAESH's controlled regions, accompanied by false documentation, while the Internet usage has immensely enlarged the possibilities of this illegal trade, through on-line sales.

D) Convictions. The conviction, on 27 September 2016, by the International Criminal Court of Ahmad Al-Faqi Al-Mahdi for war crimes related to the destruction of protected cultural heritage in Mali under article 8(2)(e)(iv) of the ICC Statute.[24] Ahmed Al-Faqi Al-Mahdi was sentenced to nine years imprisonment and this was the first case related to destruction of cultural heritage handled by the ICC and the first case in front of the ICC to consider the actions of a terrorist movement linked to Al- Qaeda (Figure 9).

E) The Military Manual. The launching of the 'Military Manual' on the protection of Cultural Property in the event of armed conflict. Over the past decade, deliberate attacks against cultural heritage have been used by terrorist groups as a weapon of war in order to destabilise populations and hurt societies at their core over the very long term. This strategy has been associated with the use of new technologies and communication tools in order to maximise its impact. We see cultural diversity in all its forms being targeted, as well as institutions and professionals working to sustain free thinking and freedom of opinion. In such a framework, it is obvious that military forces must strengthen their tools, behaviours and skills and take into account the protection of heritage in difficult circumstances as an integral part of sustainable strategies to build peace and security.

23 Al-Azm, A., Al Kuntar, S. and B. Daniels 2014. ISIS Antiquities Sideline. *The New York Times*, viewed 3 December 2016, http://www.nytimes.com/2014/09/03/opinion/isis-antiquities-sideline.html?_r=0; see also, Erciyes, C. 2014. Islamic State makes millions from stolen antiquities, *Al Monitor*, 02.09.2014, viewed 10 September 2016, http://www.al-monitor.com/pulse/security/2014/09/turkey-syria-iraq-isis-artifacts-smuggling.html#

24 Article 8(2)(e)(iv) of the ICC Statute states that '(...) intentionally directing attacks against buildings dedicated to religion, education, art, science or charitable purposes, historic monuments, hospitals and places where the sick and wounded are collected, provided they are not military objectives (...)' constitutes a war crime, regardless of the classification of the conflict.

On 5 December 2016, the 'Military Manual', the first international training tool of this kind, was launched by Irina Bokova, the UNESCO Director General, at UNESCO Headquarters. The manual is intended to serve as a practical guide to the implementation by military forces of the rules of international law for the protection of cultural property in armed conflict. It combines a military-focused account of the relevant international legal obligations of States and individuals with suggestions as to best military practice at the different levels of command and during the different phases of military operations, whether by land, sea or air. It also includes best practices, preparatory measures in identifying, moving, and preserving cultural objects during military operations as well as legal resources for cultural property protection.[25]

F) Action strategy. The adoption by UNESCO of a strategy 'for the reinforcement of the Organization's actions for the protection of culture and the promotion of cultural pluralism in the event of armed conflict',[26] followed by the elaboration of an *Action Plan* for its implementation. This document sets the path for the Organization's work through two key objectives: on the one hand, strengthening Member States' ability to prevent, mitigate, and recover the loss of cultural heritage and diversity as a result of conflict; and, on the other hand, incorporating the protection of culture into humanitarian action, security strategies and peace building processes. When the General Conference of UNESCO, at its 38th session, in November 2015, adopted the Strategy, it further requested the elaboration, in coordination with Member States and relevant actors, of an Action Plan for its implementation. The Action Plan[27] that was subsequently developed focuses on the development of training tools, capacity building for national law enforcement, armed forces and the legal sector on cultural property protection and illicit trafficking of cultural objects, integration of these elements in UN peace-keeping operations, including police and civilian components, risk assessment and emergency planning for heritage in areas at risk.

In addition, a high number of devastating disasters over the course of 2017, including hurricanes in the Caribbean region and earthquakes in Mexico, have underlined the extreme vulnerability and exposure of culture and the lack of planning in place to protect it. In the face of these challenges, the need was recognised for new and more effective approaches by UNESCO. On 14 November 2017, the 39th session of the UNESCO General Conference adopted an 'Addendum'[28] to its strategy for the Reinforcement of the UNESCO's action for the Protection of Culture and the Promotion of Cultural Pluralism in the Event of Armed Conflict, concerning emergencies associated with disasters caused by natural and human-induced hazards. In doing so, a significant step was taken to reinforce the protection of culture and cultural heritage in emergencies resulting from natural disasters.

The Addendum's objectives are aligned with those of the main strategy and constitute an integral component of UNESCO's emergency preparedness and response policy. It fills a critical policy gap in that it adapts the international Disaster Risk Reduction policy framework to the cultural domain as a whole. In addition to providing means of protecting cultural heritage from disasters, it looks at the role of culture, in its broader definition, in strengthening resilience and fostering social cohesion for a more sustainable recovery. Consequently, the Addendum sets the path for the Organization's work through two key objectives: on the one hand, strengthening Member States' ability to prevent, mitigate and recover the loss of cultural heritage and diversity as a result of disasters caused by natural and human-induced hazards; and, on the other, incorporating the consideration for culture into the Disaster Risk Reduction sector and humanitarian action related to disasters by engaging with the relevant stakeholders outside the cultural domain.

G) Resolution 2347. The adoption by the Security Council of Resolution 2347 (2017)[29] focusing on the targeted destruction of cultural heritage in armed conflict areas. This is a very important development, because it represents the first time that the Security Council has adopted a Resolution exclusively devoted to the overall issue of the protection of cultural heritage in the event of armed conflict, without necessarily focusing on Iraq or Syria, or the financing of terrorism, as was the case with its previous resolutions 2199 (2015) and 2253 (2015). In Resolution 2347 (2017), the Security Council recalls all its previous relevant Resolutions, takes note, among others, of the UNESCO strategy for the reinforcement of the Organization's actions in the event of armed conflict, notes with grave concern that the ISIL, as well as Al Qaeda and associated entities, are generating income from engaging in the illegal excavation, looting and smuggling of cultural property, which is used to support their recruitment efforts and strengthen their

[25] *Military Manual* on the protection of Cultural Property in the event of armed conflict. Viewed 20 September 2017, http://unesdoc.unesco.org/images/0024/002466/246633e.pdf

[26] A strategy 'for the reinforcement of the Organization's actions for the protection of culture and the promotion of cultural pluralism in the event of armed conflict'. Viewed 20 November 2016, http://en.unesco.org/heritage-at-risk/strategy-culture-armed-conflict

[27] An action plan for the implementation of the strategy. Viewed 20 November 2017, http://en.unesco.org/heritage-at-risk/strategy-culture-armed-conflict

[28] Addendum to the strategy. Viewed 20 December 2017, https://en.unesco.org/.../addendum-unesco-strategy-reinforces-protection-culture-and-natural-disasters

[29] Viewed 19 January 2018, http://undocs.org/en/S/RES/2347(2017)

terrorist attack, condemns in the strongest possible terms the unlawful destruction of cultural heritage in armed conflict situations and calls upon member states to adopt specific measures in order to prevent and counter trafficking in cultural property illegally appropriated notably by terrorist groups. In addition, resolution 2347 (2017) stresses on the central role of UNESCO, UNODC and INTERPOL in preventing and countering illicit trafficking in cultural property and encourages bilateral, regional and international cooperation specifically in crime prevention, cross border cooperation and information exchange. Most importantly, Resolution 2347 introduces in its operative part[30] the concept of 'Safe Havens' for movable cultural property in danger and encourages member states to take preventive measures to safeguard their state owned cultural property, including through documentation of this property, in a network of safe havens in their own territories.

Figure 10. Destruction by ISIL of ancient temple of Baalshamin in Palmyra.

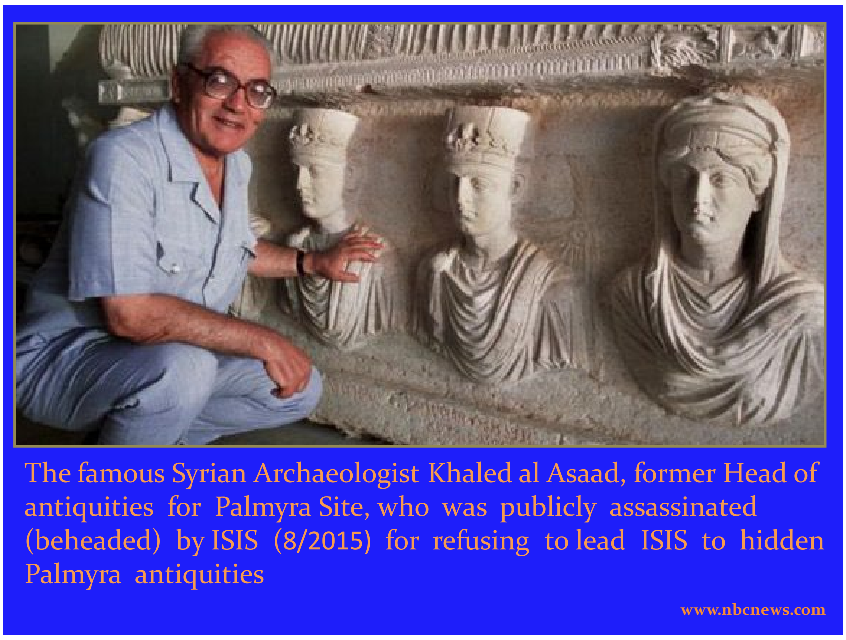

Figure 11. The famous Syrian archaeologist Chaled- al-Asaad.

Concluding remarks

Over the past decade, deliberate attacks against cultural heritage have been used by terrorist groups as a weapon of war (Figure 10) in order to destabilise populations and hurt societies at their core over the very long term. This strategy has been associated with the use of new technologies and communication tools in order to maximise its impact. We see cultural diversity in all its forms being targeted, as well as institutions and professionals working to sustain free thinking and freedom of opinion. The persecution of individuals (Figure 11) on cultural or religious grounds, combined with the deliberate destruction of their heritage, institutions as well as knowledge or information, can be described as 'cultural cleansing'. This form of multi-faceted abuse of culture, linked with aggressive propaganda is a key feature of modern wars, especially in intra-State conflicts involving non-State actors. It also highlights how the destruction of cultural heritage has become a security issue.

We have all observed that the rules of international humanitarian law are not respected and the rules concerning cultural property are no exception. In light of the above, it is more than obvious that there is an imperative need to enlarge and rethink traditional approaches to protect heritage and to connect the dots between cultural, security and humanitarian aspects, in full respect of the mandate and prerogatives of every actor.

[30] Operative paragraph 16.

We will conclude by underlining that it is significantly important for states, and non-state actors as well, to understand that they have a common responsibility to protect cultural heritage in times of peace and war, as it reflects the life of the community, its history and identity. While human life is more important than objects, it is nevertheless essential to abide by rules protecting cultural property, as it constitutes the collective memory of humanity and symbolises human life itself.

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Is the possession of the Parthenon Marbles lawful according to the contemporary English law?

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The issue of the possession and, respectively, the repatriation of the Parthenon Marbles remains a controversial topic with numerous pro and contra arguments.

An American writer, Merryman, in his foundational work *Thinking about the Elgin Marbles*, which appeared in 1985, upholds the notion that from a legal point of view, the British Museum is in equitable possession of the Marbles. He states that 'under the international law of that time, the Ottomans were entitled to give Elgin the right to remove the Marbles'. Moreover, he admits that although the scope of the initial firman was limited, the final removal of the monuments was ratified by the Sultan and therefore it was thus validated.

What surprises us in these arguments, however, is that Merryman invokes international law, but he bases it only on one principle: that of ownership, i.e. whether the Ottomans truly allowed Elgin to acquire ownership of the Marbles. Even if this is so, Merryman himself admits that 'Under the new international law it might be argued that the Ottoman permission to remove Greek antiquities was illegal, thus clouding Elgin's title to the Marbles'. 1 Merryman makes thus a contradistinction between 'old' and 'new' international law, which, nevertheless, obscures the picture to a dangerous degree and generates an artificial confusion.

Furthermore, Merryman's admission is critical, because it generates, in accordance with English law, questions regarding the liability of the possessors through omission for the following reason:

> In English law, as in our law, it is accepted that criminal liability originating in omission presupposes a duty to be acted upon, knowledge of the circumstances and extent of this duty and the actual ability to fulfill it.[2]

This duty emanates either from the law, or from contract or a hazardous situation caused by the perpetrator accused (even without fault) or from the voluntary assumption of care for a third party,[3] whilst in some cases omissions following an act for which the person committing the omission has no responsibility may establish liability. Liability may also be established through the so-called 'continuing act doctrine'. In all these cases, it is accepted that commission by omission is established.[4]

Are there circumstances, in the matter of the Marbles, that establish a duty to act according to the English law in force? The rules of international law currently in force are extremely explicit. More specifically:

i. Even though the provisions of the ICC on former Yugoslavia obviously provide for individual criminal liability for the destruction of cultural property in the context of armed conflict and not in time of peace, the notion exists that the vandalism of cultural goods may be regarded as an international crime either on the base of customary law or on the base of the law created by the ICC regarding the former Yugoslavia. A research project is already investigating whether the case-law of the ICC may be applied to crime committed in time of peace, so that it may be implemented either by national courts of the ICC for actions within their respective jurisdictions (European University Institute Florence).

ii. Leaving these matters aside, the UNESCO Declaration concerning the Intentional Destruction of cultural Heritage (October 2003) signed in the wake of the destruction of the Bamiyan Buddhas by the Taliban is even more important. The declaration emphasises that:
    - Cultural heritage is an 'important component of the *cultural identity* of communities, groups and individuals, and of *social cohesion*, so that its intentional destruction may have adverse consequences on *human dignity and human rights*.'

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1 'Under the new rule it might be argued that the Ottoman occupation of Greece and the ottoman permission to remove Greek antiquities were *illegal*, thus clouding Elgin's title to the Marbles.' (Merryman 1985: 1900, fn. 64).

2 Ashworth (2006), *Principles of Criminal Law*, 5th edn: 113.

3 Dressler (2001), *Understanding Criminal Law*, 3rd edn: 102; Ashworth, op.cit.: 45.

4 'Commission by omission': Dressler, op. Cit.; Simester and Sullivan (2007), *Criminal Law, Theory and Doctrine*: 69 ff.

- ‘States should take all appropriate measures [including, therefore, criminal punishment] to prevent, avoid, stop and suppress acts of intentional destruction of cultural heritage, wherever such heritage is located’ (Art. III.1), and ‘When conducting peacetime activities, States should take all appropriate measures to conduct them in such a manner as to protect cultural heritage’ (Art. IV). Furthermore ‘A State that intentionally destroys or intentionally fails to take appropriate measures to prohibit, prevent, stop, and punish any intentional destruction of cultural heritage of great importance for humanity, whether or not it is inscribed on a list maintained by UNESCO or another international organization, bears the responsibility for such destruction, to the extent provided for by international law’ (Art. VI), and ‘States should take all appropriate measures, in accordance with international law, to establish jurisdiction over, and provide effective criminal sanctions against, those persons who commit, or order to be committed, acts of intentional destruction of cultural heritage of great importance for humanity, whether or not it is inscribed on a list maintained by UNESCO or another international organization’ (Art. VII).

This is to say that the destruction of cultural heritage in time of peace establishes the criminal liability of the individual or the state that allowed or did not avert the act irrespective of the place in which it was committed and the law in force in the country it was committed. Thus, the Declaration, which expressed the repulsion of the international community at the destruction of the Bamiyan Buddhas, as Fishman remarks, ‘buttresses the position adopted in the ICTY case law that transnational norms may in some instances cabin states’ discretion over disposal of cultural property’ and ‘diminishes the state’s ability to act as a gatekeeper over what shall and shall not be treated as cultural property’.[5]

The following inferences may be drawn from the above:

- The UNESCO Declaration seeks to establish the legal duty of protecting cultural heritage in time of peace. Its purpose is to produce written law, in addition to the pre-existing customary law, establishing an obligation to act.
- As per Merryman’s own admission, perpetuating the present situation is illegal by today’s standards. Furthermore, it violates the UNESCO Declaration which induces all states to ‘take all appropriate measures to prevent, avoid, stop and suppress acts of intentional destruction of cultural heritage’ since the British Museum omits to ‘take all appropriate measures’ for remedying a vandalism, which, if committed in our times, would be no different to the crimes of ISIS and the Taliban. Therefore, according to English law itself, the perpetuation of this illicit situation raises issues of criminal liability through omission.

If Greece were currently occupied, by the Taliban let us say, and Elgin removed, with the conqueror’s consent, exactly the same marbles, would this be tolerated by the international community? Would it not violate international criminal legislation? Does it not constitute ‘vandalism’? Does it not constitute ‘looting’? The artisan Lusieri himself, who had been tasked with the removal of the Marbles, admitted ‘I have even been obliged to be a little barbarous’,[6] and Merryman acknowledges that ‘it is undeniable that Elgin’s removals caused serious harm to the structure of the Parthenon’.[7]

Bribery and PoCA

But it is Merryman himself, who, admittedly in conjunction with later legal developments, provides the most essential argument in favour of the Marbles’ return. Merryman accepts that Elgin bribed the Ottomans in order to obtain the necessary permission[8] with numerous gifts in both Athens and Constantinople. Merryman mentions that some of the gifts were given with full transparency and in conformity with the then prevalent customs and were thus legal according to the then applicable law, whilst others were given ‘under the table’ in order to secure a more favourable treatment, which he would not otherwise have had.[9]

Of course Merryman concludes that these multiples bribes, which he considers to be indisputable, are not a significant legal consideration and that the permissions of the Ottoman authorities were legal, irrespective of their motives, since they were later ratified either expressly or by implication from conduct indicating acquiescence.

Irrespective of the validity of this argument, Merryman’s position is inadmissible. The main and simple reason is that the Proceeds of Crime Act has come into force in England. The Act provides that bribery is one of the acts

5 Fishman (2010), *YJIL*: 365 (Fishman, too, is an opponent of the return of the Marbles!).

6 Merryman, op. Cit.: 1884.
7 Merryman, op. Cit.: 1909.
8 Merryman, op. Cit.: 1901.
9 W. St Clair (1983), *Lord Elgin and the Marbles*, 2nd edn: 93 ff.

on which the legalization of property from criminal activity is predicated and therefore the proceeds of bribery are the proceeds of crime.

Bribery, which was in most cases conceived as passive bribery, has been a punishable act in England for centuries, and was usually confused and conflated with the crime of blackmail. Hence, the state official who demanded a material benefit by blackmailing in order to perform an act that was part of his duties was punished. As Lindgren writes, blackmail of this sort has been punishable in England for 700 years, although the act under the name of bribery appeared in the mid 16th century.

Judge Noonan mentions the case of Warren Hastings, Governor in the British Colony of Bengali in India, as the first indisputable court-case of bribery in the modern sense, which occurred in 1800, that is 12 years before the looting of the Marbles by Elgin. This is particularly important because it means that already at the time of the Marbles' removal the act of bribery was punishable under English law.[10] Which, however, according to Lindgren (op.cit.), exhibits elements of blackmail.

Further laws on bribery existed in England since ancient times. According to an English decree which remained in force from 1384 until 1881, judges were forbidden from receiving 'robe, fee, pension, gift, nor reward of any but the King, except reward of meat and drink, which shall be no great value'.

Similarly, the First Statute of Westminster, the fundamental English law on extortion in force between 1275 and 1968 contained the following provision: 'No Sheriff, or other officer of the King, shall take any Reward to do his Office, but shall be paid of what he takes of the King'.[11] We may safely deduce from the above that during the removal of the Marble an act of bribery took place, in the sense the term had in English law then in force, by an English state official since, in addition to the gifts given with transparency, further gifts were given, which were undoubtedly and directly related with overcoming the Ottoman opposition to the removal of the marbles and obtaining the relevant permission.

Furthermore, we may infer from the Hastings case that (a) the act of bribery was punished even if the act was committed abroad (although of course in this case it was committed in a colony) and (b) that, even if we accept that the provisions we mentioned referred to passive rather than to active bribery (embracery), in this particular case the imputability in accordance with the English law then in force was adequately established because:

- Elgin's active bribery constituted an act of participation in passive bribery (since it cannot be seriously claimed that Elgin was blackmailed to take the marbles!) and passive bribery was punishable according to English law.
- The Marbles remain the proceeds of crime originating in the passive bribery of the Ottoman authorities.

What remains to be examined is whether the active bribery in a foreign country by an English state official was punishable at that time, or whether the participation of an English state official in the passive bribery of a foreign subject was punishable by the English law then applicable.

Furthermore, according to PoCA:

- Every crime, and therefore bribery ('all crimes' approach), is considered to be a predicate crime for establishing laundering.
- If the predicate crime was committed abroad the imputability of laundering is not affected, since the legalization of the proceeds took place on British soil (S.340 (2) b) (Archbold 2006: 33-29), where the Marbles are presently kept
- It is inconsequential whether the criminal act took place before the law came into force, as long as the legalization was committed after the enactment of the law.

Further elements of the PoCA include:

- All benefits resulting directly or indirectly from criminal conduct (S. 340, Nos 3 & 9), and encompassing every form of property moveable or immovable, material or incorporeal/ intangible, is regarded as property from criminal conduct ('criminal property).
- An act of legalization is deemed to consist not only in the use of the criminal property but also in the passive possession of that property (PoCA, Section 329, Archbold 2006: 33-13).

From the above it may be inferred that even if the possession of the Marbles is not subject to PoCA, it is tainted with the moral stigma which alludes to the German 'theory of stigma' (*Makeltheorie*), according to which any object that originates in a criminal act has reduced value and hence the acquirer has fallen prey to fraud, even if, according to civil law, he is obtaining ownership.[12]

[10] Noonan, Jr. (1984), *Bribes: 393 ff.*
[11] Lindgren, op.cit.: 1704, with further references.
[12] Mylonopoulos (2016), *Criminal Law, The Special Part*, 3rd edn: 465 (in Greek).

Finally, we should ignore the following legal dimension of the matter. A clear distinction is drawn in the bibliography between countries in which cultural property originates, for example Greece, Egypt, Mexico, India, Guatemala, Peru, Cambodia, the so-called 'source nations' or 'export countries' who place interdictions on the export of antiquities and make demands for their repatriation, and the countries that are interested in buying such cultural property, i.e. Germany, Britain, Scandinavia, USA, Switzerland, and the market nations and import countries that oppose the interdictions. The countries that comprise each group exhibit certain common features: the 'export countries' usually have a low per capita income, they have a high degree of political and economic dependence, are devoid of extensive industrial infrastructure but possess a rich cultural past. On the contrary, the 'import countries' are financially robust with a flourishing industry but are devoid of a rich cultural past.

Moreover, the two groups are marked by an interesting inverse relationship in another important cultural indicator, scientific technological knowledge: the 'import countries' generate knowledge (products of the intellect) and enact strict legislation for the protection of intellectual property, whilst being interested in obtaining cultural property originating in the 'export countries'; the 'export countries', in their turn, do not produce 'know-how' that is so essential to their development and hence they pursue its acquisition, with the consequence that they do not have legislation that protects the products of the intellect adequately, or if they do, such legislation is the product of intense external pressure (Greece).

We nurture no illusions: the matter of the return of the Marbles is principally political. However, if we wish to be members of a cultural family that takes law seriously, the principles and rules of domestic and international law must be applied uniformly for all or they will be applied selectively for a few.

Part 2

Science, Medicine, Technology and Environment

A very brief introduction to Hellenistic Alexandrian technology

T. P. Tassios

Hellenic Society of Philosophy; Society for the Study of Ancient Greek Technology

Ancient Greek technology had been advancing since Mycenaean times, and, in particular, into Classical times. Aristotle (*Politics*, 1255.6, 35) predicated a political utopia based only on the advent of automatic and robotic machines, in order to eliminate oppression of rulers and slave-owners. This 'technological revolution' was indeed conceived during the Hellenistic period, mainly in its *alma terra*, Alexandria.

Hellenistic Technology

In the Hellenistic era, ancient Greek technology reached its zenith based on the earlier innovations of the Greek engineers employed by Alexander the Great during his campaigns: tunnelers, urban planners, hydraulic engineers, and so on. This military example shows the very positive role that the enlargement of the scale of public affairs would play in the field of technology.

Before attempting to explain the great upsurge in technology from the end of the 4th century BCE until the 1st century CE, the main technological achievements of this period should be outlined:

Summary description of technological achievements in the Hellenistic period

a) Technical works
- Specialization in major land-reclamation projects, such as that of Lake Ptechon (Euboea), which was the first contracted work in history with a capitalist B.O.T. system (Build-Operate-Transfer). The Ptolemies also dried up a large portion of Lake Mareotis so that Alexandria could be extended.
- The multi-centered arch bridge in Rhodes (*c.* 316 BCE) and the corbeled bridge in Eleftherna (middle of the 4th century BCE), prior to the Roman development of the arched bridge.
- The 'Lighthouse' (a tower *c.*100 m high, in Alexandria, Figure 1), most likely with an internal installation for the mechanical lifting of large quantities of fuel.
- Pergamon's four aqueducts that brought 2000 m3 of water to the city each day, through a triple pipeline and siphons under 15 atm. of pressure.

b) Shipbuilding
- The characteristic example is the gigantic ship Syracusia, with its massive tonnage, that Hieron sent as a gift to Prolemy III. A similar magnification trend is observed in the Thalamēgos (yacht) of Ptolemy IV (Figure 2). Similarly, the total number of ships of the Ptolemaic fleet (4300?) was also excessively large.

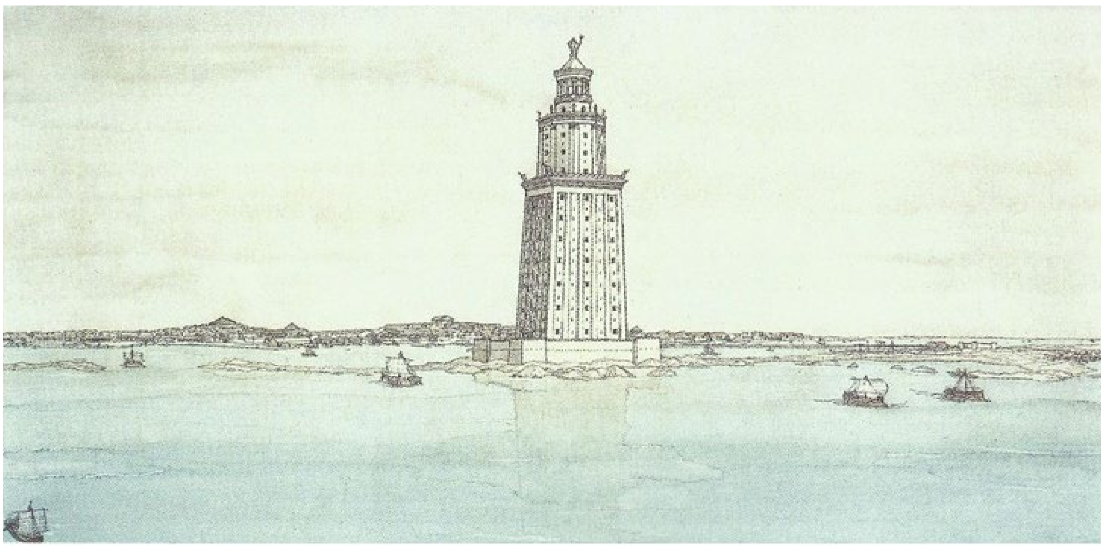


Figure 1. The Alexandria Lighthouse
(from Grimm, G. 1948. *Alexandria, die erste Koenigstadt der Hellenistischen Welt*: 28, Abb. 23. Philipp von Zabern).

Figure 2. The *Thalamēgos* (yacht) of Ptolemy IV (from Pfrommer, M. 1996. Roots and Contacts: Aspects of Alexandrian Craftsmanship, in: *The J. Paul Getty Museum: Alexandria and Alexandrianism*: 178, fig. 9. The Getty Museum).

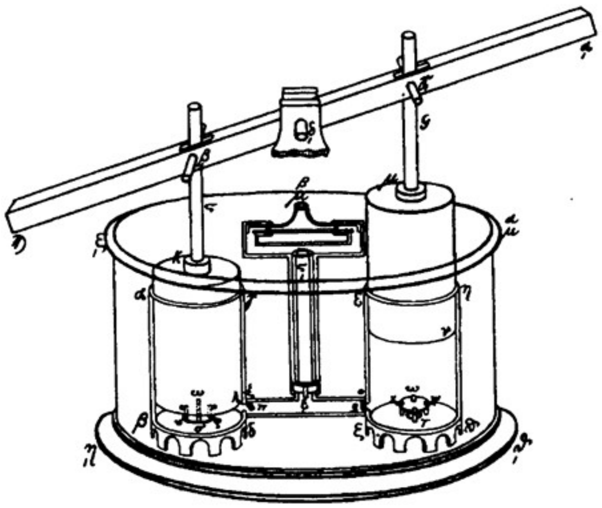


Figure 3. Ctesibius' two-stroke piston (from Schmidt, W. 1899. *Heron-Druckwerke und Automaten Theatren.* Teubner).

c) Military technology
  - 'Helepolis', the multi-storied, armored, mobile siege tower (40-60 m high), known to have been used by Dionysius the Elder at Syracuse, but mostly by Demetrius Poliorkētēs.
  - Invention of catapults with a spring and pressurised air (Ctesibius, 285-222 BCE) and the theoretical and experimental research of Philo of Byzantium (c. 250 BCE) on catapults with torsional springs.

d) Machinery
  - ***Pumps*:** Ctesibius' two-stroke piston (Figure 3), the 'drum' and 'chain' of Philo of Byzantium (to whom we also owe the first water-powered chain-pump, Figure 4), as well as the Archimedean screw-pump.
  - ***The huge cranes*** with which Archimedes (287-212 BCE), from behind the walls of Syracuse, grabbed the Romans' giant mobile siege towers, and destroyed them (Figure 5).
  - ***Automaton:*** The Greeks' myths became a reality – now, not only the gods had *automata*. Philo of Byzantium and Heron of Alexandria (*c.* 1st century CE) wrote books 'On Automation', nowadays preserved in their entirety, while Athénaeos (5.198f) describes how the 4 m statue of Nisa (270 BCE) would stand up, pour a libation, and sit down again, most probably by means of a cam and two gears.
  - ***Gearwheels:*** In roughly the same period, Aristotle refers (in his *Mechanics* 848a) to the transmission of motion through tangent circular wheels, and to their applications. Shortly after, Ctesibius would use gears in his water clock, and Philo's pumps appear to have made similar use of them; just as odometers later (Figure 6).
  - Steam power: Heron's aeolopile rotated by means of steam (Figure 7). Even though there is no evidence of its practical application, the transmission of motion from one axle to another by means of a belt was already known in Philo's hydraulic pumps (Figure 4). Therefore, it was only a matter of time

Figure 4. The 'drum' and 'chain' of Philo of Byzantium (from Tassios, T. P. *et al.* 2016. Animation production: *Did the Ptolemies have steam-powered water pumps?*, Athens, Prod. DEPA (freely available on the Internet).

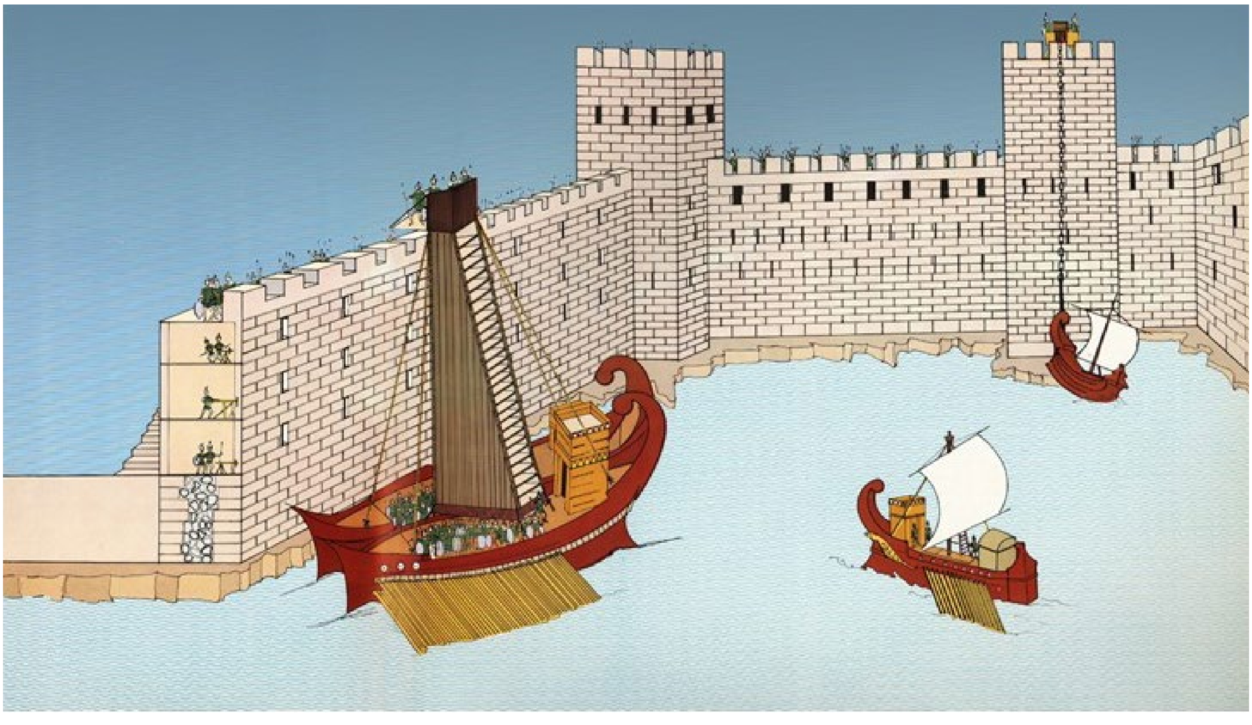


Figure 5. The huge cranes with which Archimedes grabbed the Romans' giant mobile siege towers (from Ekdotikē Athenōn 1971. *History of the Greek Nation*. Athens).

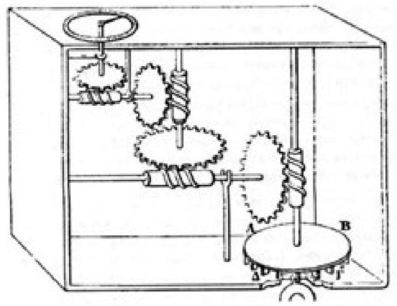


Figure 6. Gearwheels (from the EMAET model collection [construction: D. Kriaris]).

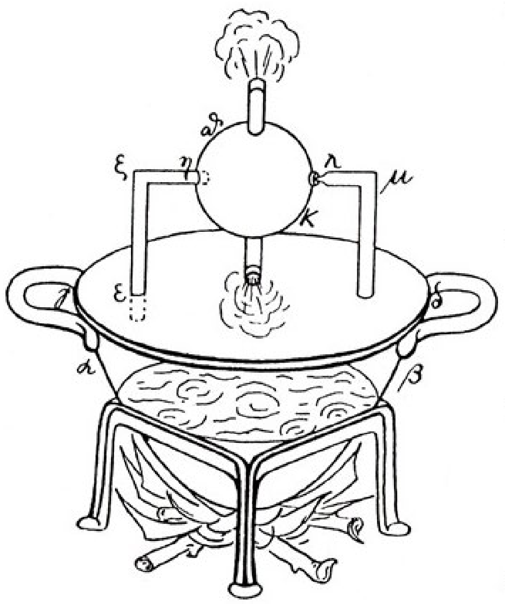


Figure 7. Steam power (Schmidt, op cit).

until rotation (with the aid of steam) would be transmitted (by means of a chain) to a pump (Figure 8). After all, Heron himself had already designed the transmission of a wind-rotor's circular motion to Ctesibius' two-stroke pump.

e) Agriculture
   - An indicative example of developments in this field is the olive screw-press, an invention of Heron (Figure 9).

f) Metal-working
   - All metallurgical technologies had already (since the 4th century BCE) reached their peak. Metal-working had at its disposal, then, various alloys for various applications, from the production of statues to weaponry, and from the manufacturing of well-made domestic utensils to gearwheels. The basic

Figure 8. Steam power (from Tassios, T. P. *et al.* 2016. Animation production: Did the Ptolemies have steam-powered water pumps?, Athens, Prod. DEPA (freely available on the Internet).

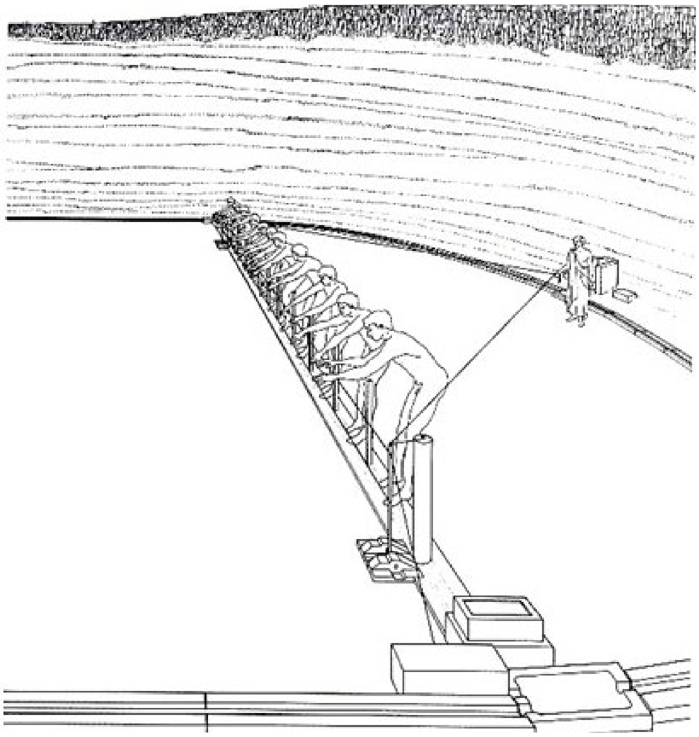



Figure 9. The *hysplex*, the instrument that allowed stadium athletes to start at the same time (from the EMAET model collection [construction: S. Miller]).

techniques were casting or hammering of metal sheets, but the metal lathe was also utilised.

g) Chemistry

- Following the basic principles of chemical transmutation, which had been introduced already by the pre-Socratic philosophers and the Stoics, empirical chemistry of processing metals, precious stones, and dyes of all kinds (through a huge variety of reagents) was initiated by Volos from Mentes, outside Alexandria (c. 200 BCE), and culminated in Alexandria itself, between the 1st century BCE and the 4th century CE.

h) Scientific instruments

One should certainly not expect to find an ancient Greek text describing technology's 'intention' to serve Science. However, we have evidence of the production of useful artifacts for scientific measurements:

- Measuring time: 'water-clocks.
- Odometer (similar to today's taximeters).
- Astrolabes of all sorts.
- Precision balances.
- Surveying instruments, e.g. the level, dioptra, etc.
- Medical instruments: surgical and orthopedic implements (by physicians such as Andreas, Nymphodorus, inter alia), as well as the special sphygmometer of Herophilus (also a physician) in Alexandria (*c.* 300 BCE).
- 'Globe-making' (spheropoeia): simple figurative replicas of the sky with fixed celestial bodies (Cicero, On the Republic 14.22), or completely functional models, i.e. the second planetarium of Archimedes, which Cicero describes in detail, and, of course, the 'Antikythera Mechanism'.

H. Von Staden's view (Yale University) is interesting in this respect: 'The parallels between Erasistratos' model of the heart, and central features of the new Alexandrian mechanical technology, are *striking*' – a reference to the two chambers and valves of the heart, and Ctesibius' pump.

i) Artifacts for Culture

Just as technology served every kind of need that could not be met by natural means, it was logical (especially during the Hellenistic period) that technology would also serve the needs of people in **communication and culture** in general. It is, however, surprising that, in a significant portion of the current international bibliography, these marvelous technical discoveries are undervalued by ideological characterizations such as 'amusing contrivances', although they constitute exceptional technological achievements – even with today's knowledge.

Indicative examples include:

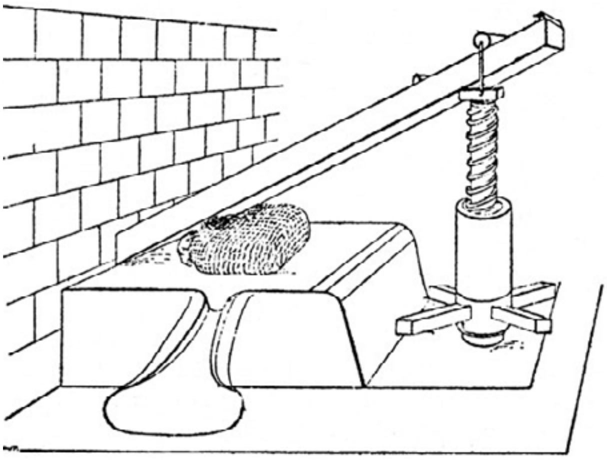


Figure 10. Heron's olive screw-press (B. Gille 1980).

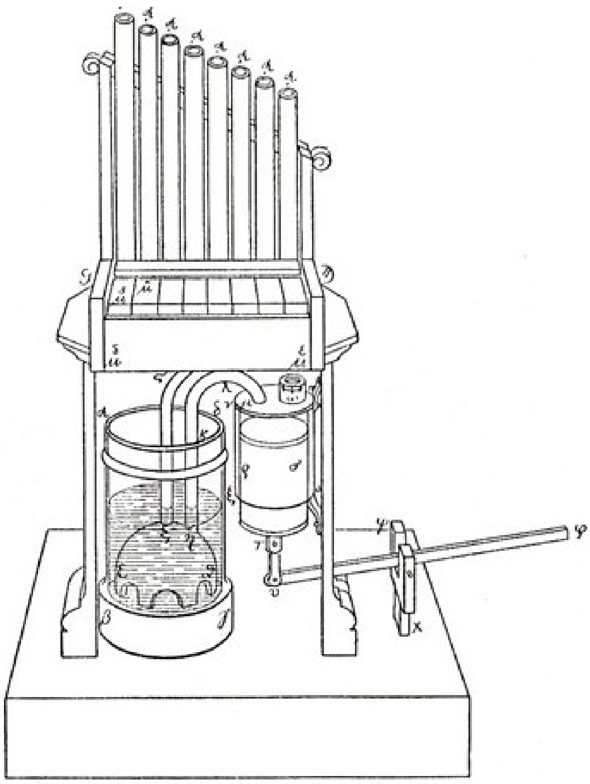


Figure 11. Ctesibius' *Hydraulis*, the musical instrument that functioned with compressed air (from Schmidt, W. 1899. *Heron-Druckwerke und Automaten Theatren*. Teubner).

- ***Athletics***: The *hysplex*, the instrument that, by means of a torsional spring, allowed racers in the stadium to start at the same time (Figure 10).
- ***Music***: Ctesibius' *Hydraulis*, the musical instrument (Figure 11) that functioned with compressed air that was conveyed (by means of keys) to the appropriate pipes (like those found at Dion).
- ***Automatic theater***: The *seven-minute* long automatic theater of Philo and of Heron, which worked without any external interference thanks to a highly

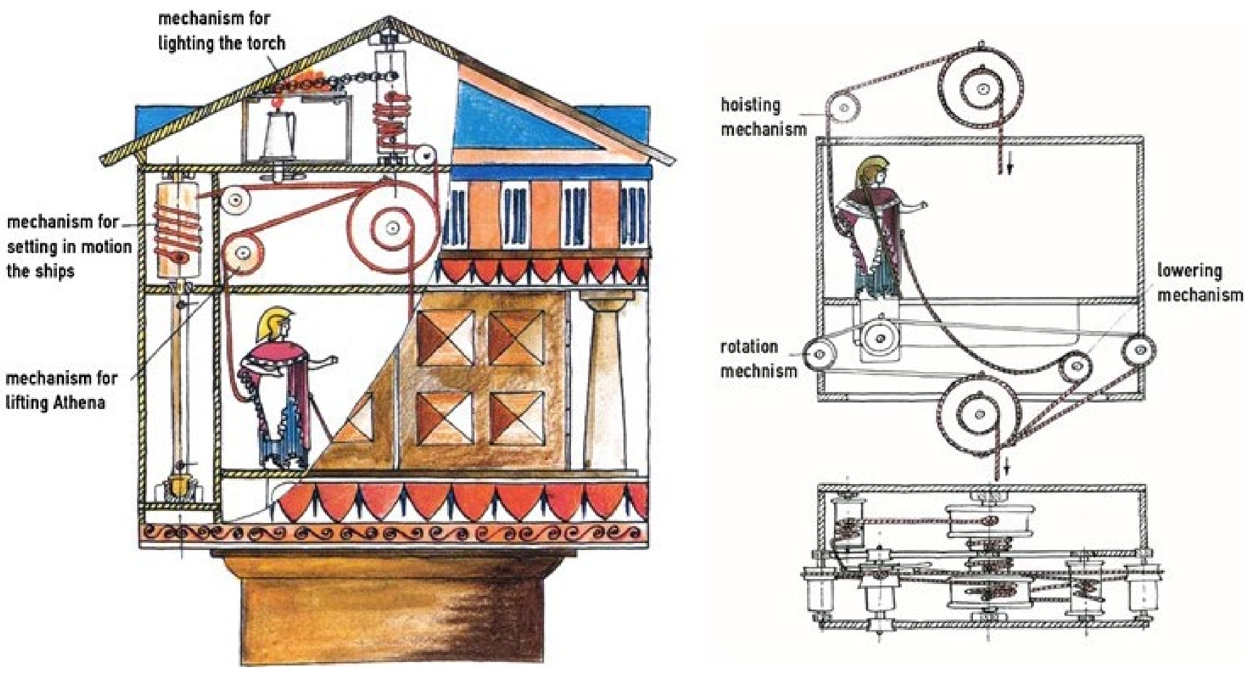


Figure 12. The *seven-minute* long automatic theater of Philo and Heron (from the EMAET model collection [constr.: K. Kotsanas]).

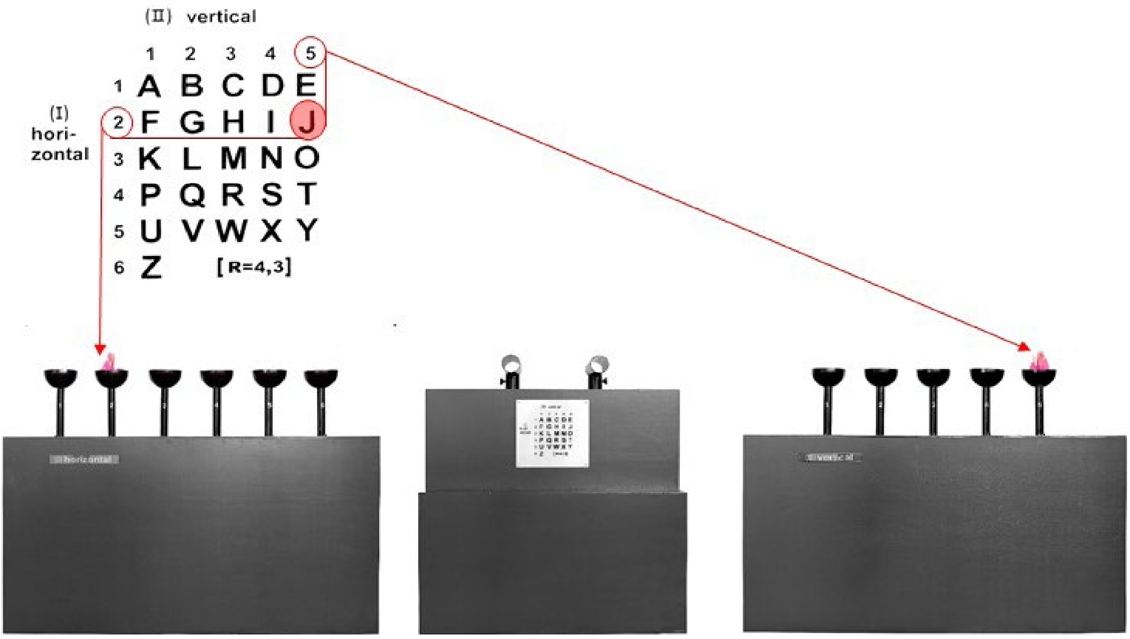


Figure 13. Early means of telecommunications (from the Herakleidon-EMAET collection [design: T. P. Tassios]).

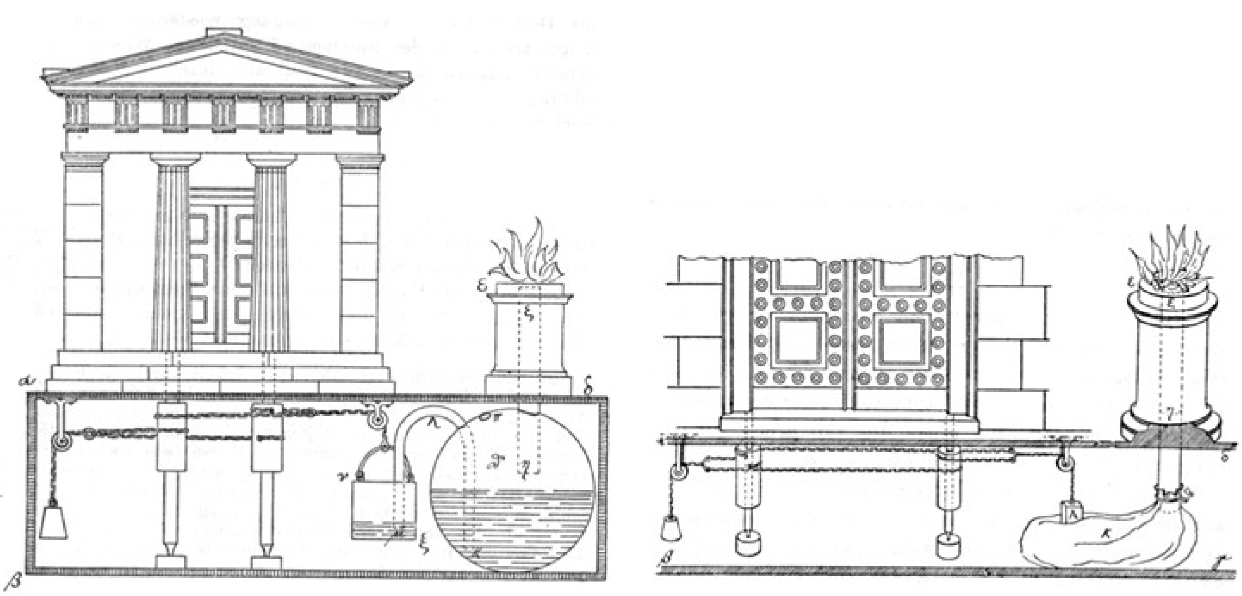
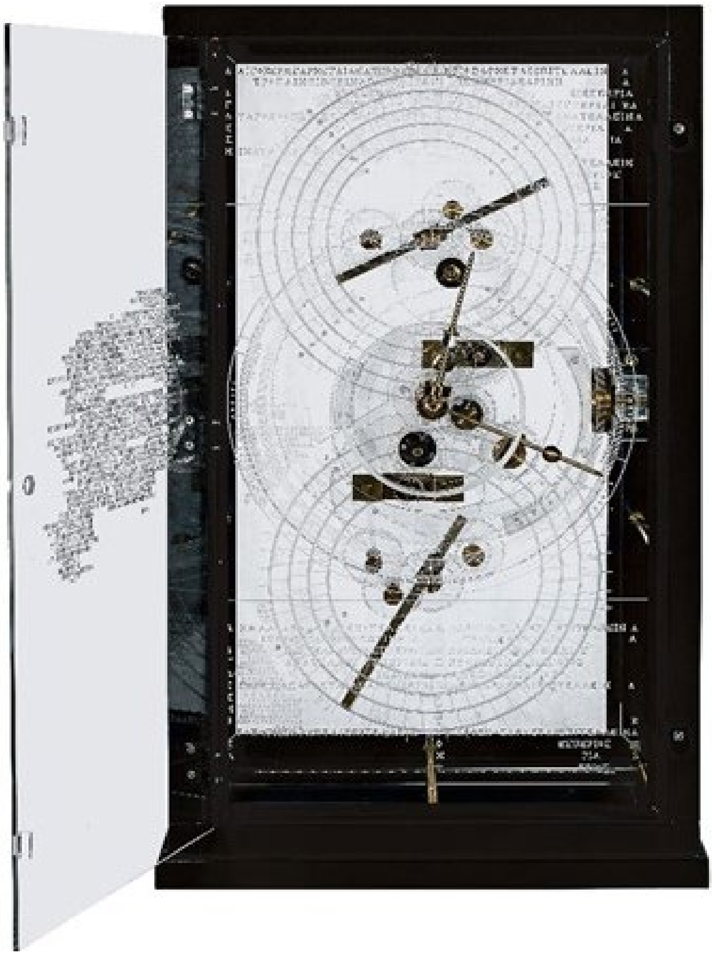


Figure 14. Automatic opening of temple gates (from Schmidt, W. 1899. *Heron-Druckwerke und Automaten Theatren*. Teubner).

intricate **internal winding of** thin rope, approximately 100 m long (Figure 12).

- ***Telecommunications***: The hydraulic telegraph of Aeneas Tacticus, and the 'pyrseia' of Cleoxenos and Democleitos (Figure 13): transmission of a digital visual sign by means of torches (Polybius, *History* X, 43-47).
- Religion: Automatic opening of temple gates, once the believer lit a flame at the outer altar (Hero, Pneumatics, A, 38), occurred thanks to the expansion of heated air (Figure 14).

Despite the extreme brevity in quoting the above technological achievements of the Hellenistic period, it becomes evident that the multitude of artifacts, and,



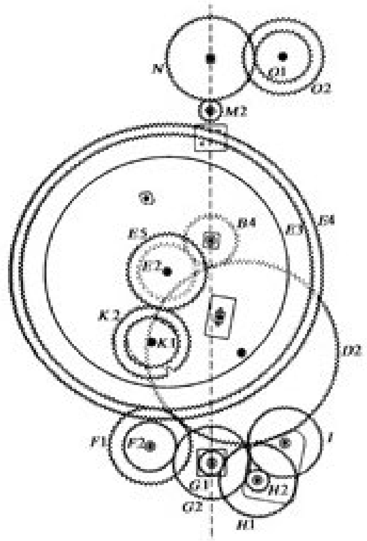


Figure 15. The Antikythera Mechanism (from the Herakleidon collection).

especially, the range of needs they served, are *highly characteristic features* of the period; it was a clearly technophile period in the history of mankind – one which culminated in the first analog computer, the Antikythera Mechanism (Figure 15).

Economy and technology in the Hellenistic world

Economy, a science with which people can increase what is useful to each one.

Xenophon, *Oeconomicus*, 6. 4-5

When Philotas, inventor of another water-pump in Alexandria (2nd century BC), proposed that the authorities should 'adopt' the use of his machine, he was acting in both an economic and a technological spirit. Wage labor of citizens (or occasionally slaves) in ancient Greece, one of the features of modern economics, was observed more in the technical occupations that required skill. In the homes of the ruling class in Alexandria, it seems that personnel were normally paid in cash. Pliny mentions two Greek essays on bee-keeping: one by Aristomachos and another by Philistos. Of interest are the extensive lending activities in Rhodes during its heyday. Contrary to the practice of the Classical period, now the names of the great military engineers are publicly known: Polyeidos, Diades, Charias, Epimachos, Hegetor, Diagnetos, Kallias, and others, many of whom were also authors of books. The financial aspect of their profession is characteristic. Diodoros (14.41.3) writes that Dionysios the Elder attracted engineers by 'compelling them with high wages'. It is proposed by certain scholars that Ptolemy III, in order to curb the growth of the Pergamene library, prohibited the export of papyrus from Egypt and contributed – unwittingly – to the development of parchment technology in Pergamon. What is more, mass organization of pottery workshops is observed during this era – for example, the five kilns concentrated in Macedonian Euia (Polymylos).

These few examples of technical activities with a specific financial objective, ought also to be associated with the broader economic significance of the extensive trade of products (in the quasi-unified Hellenistic world) that presupposed their own specific technologies. In this respect, commerce in the Seleucid kingdom should be mentioned separately.

Etiology of this technical apogee

To what can this florescence of Greek technology in the Hellenistic period be attributed? An answer to this question can be proposed only through logical inferences.

Reasonable maturation of Technology

It has been argued that Hellenistic technology consisted of an acceleration and an extension of the ancient Greek technical phenomenon, and not an explosion. The development and ripening of ancient Greek technology in the course of the centuries is reasonable, provided, of course, that the ambient conditions permitted this continual maturation. In fact, the conditions of the Hellenistic period not only allowed but also encouraged this ongoing development.

Let us note a further element of this continuity: the numerous scientists and engineers who moved from Greece to Alexandria and Pergamon (sometimes taking entire libraries along with them).

Fertilization of Technology by Science during the Hellenistic period

An initial positive influence of the newborn Greek science on technology, was observed already during the 6th century BCE. Plato himself made crystal clear the great potential of this fertilization of technology by science when he said: 'If someone were to separate arithmetics, measuring, and weighing from all the arts, what remained of each would become paltry' (*Philebus,* 55E).

And the perspicacious Vitruvius, three centuries later, would confirm the fortunate wedding of Greek science with technology, saying (1, 1.17-26): 'Aristarchos, Philolaos, Archytas, Apollonios, Eratosthenes, Archimedes, and Scopinas have bequeathed to posterity many machines, which were devised and manufactured on the basis of numbers and natural laws' – that is, in today's terms, on the basis of Science!

The productive role of the great libraries of Alexandria, Pergamon, and Antioch, has its place precisely here: knowledge was now exploited in an aggregated fashion. T. E. Rill notes that Alexandria's 'established reputation as a center for these studies [i.e. of science and technology] seems to have served *to draw* successive generations of students to this city'.

Such a broader educational climate turned the Hellenistic metropolises into greenhouses of scientific and technical development – by the standards of the time, of course. Therefore, we are perhaps justified, for instance, in associating what Strato of Lampsacus wrote about the elasticity of gases, with the inventions of Ctesibius' air-powered catapult and Hero's *aeolopile*. While the artihmetization of music (chiefly by Archytas) made the manufacture of stringed musical instruments a simple application of geometry, so did the knowledge of the Archimedean spiral enable the construction of his eponymous screw pump. The conception of the helicoidal ore-washeries at Laurion seems to have a similar origin.

Philo of Byzantium would propose an algebraic formula (of experimental origin) for determining the diameter of the catapult's twisted 'rope' as a function of the cubic root of the weight of the projectile to be launched.

Notwithstanding their unavoidably fragmentary nature, these facts indicate that Hellenistic technology was 'irrigated' to a sufficient degree by Science, itself systematically cultivated in the Museum of Alexandria.

The evergetism of the Greek kings

A striking shift in the ways that kings acquired prestige is observed with Alexander's successors: They all persistently supported the development of letters, science, and technology; established great libraries; and were themselves surrounded by scientists.

The Ptolemies, in particular, believed that they would gain fame through new scientific and technical activities. Eratosthenes (by royal command) sought to measure the meridian arc of the earth (the famous Syene experiment). Philo (*Ballistics* 50.24-6) notes that technicians in Alexandria possessed rich resources, since their kings loved fame *and* technology. And the construction alone of the Lighthouse of Alexandria implied the solution of numerous scientific problems, multi-year research, and continuous funding. As for the man who constructed it, Sostratos of Cnidus, he would record his king's name on the base of his enormous work. The Library and the Museum presupposed initiative as well as constant royal funding. During the Roman period, however, when the Library was almost destroyed (J. Caesar, 45 BCE, Aurelian 270 CE, the fire of the Serapeum 391 CE – before Omar 641 CE), and the Museum demolished, this prolific wedding of science and technology could no more be discerned.

The Cosmopolis

It is assumed that the small scale of the Greek city-states before Alexander the Great was not so conducive to the gathering of scientists, the concentration of funds, and the unimpeded circulation of goods across borders. However, in the Hellenistic world (and for long periods of time), a relaxation of the aforementioned constraints – partly at least – was seen in an extensive geographic area characterised by a common language (koinē) and a (more or less) common mindset and lifestyle among the ruling classes.

What is more, during this era, many people living in the new atmosphere of the pax hellenica appear to have been interested in the 'here-and-now' issues of life. Even the scientist and engineer writers of the period were not aristocrats or generals, but rather sons of trade practitioners (Ctesibius' father was a barber, Hero's father was a cobbler, etc.).

Finally, the great development of chemistry during the Hellenistic period, focused on 'dyeing', counterfeiting and the adulteration of gold, silver, and precious stones (from processed rock crystal), and of porphyry. There was a multitudinous clientele with a mind for easy money or at least with a taste for 'faux bijoux'. The 'Cosmopolis' of the Stoics was perhaps not very far from the reality of the era.

For all of the above reasons, a clear encouragement to develop practical activities (and, therefore, technology) seemed to make sense. The great florescence of technology in the Hellenistic period, particularly from the 3rd to the 2nd centuries BCE, may, therefore, be better understood by the combination of the four factors just outlined.

Royal catasterisms: Arsinoe II and Berenice II translated to the stars*

Dee Clayman

City University of New York

Background

Throughout history mankind has been looking up at the glorious panorama of stars above and organizing them into patterns that we call constellations. Imposing order on the stars aided farmers who used the movements of the constellations to mark the seasons and sailors who used them to navigate the featureless sea. We do not know when the Greeks first started naming constellations. Homer mentions four incidentally in *Odyssey* book 5 when Odysseus is steering his raft at night after his departure from Circe's island (*Od.* 5.271-275),[1] and there are four on Achilleus' shield (*Il.* 18.485-89),[2] but the first systematic account of them for which there is a shred of evidence is Hesiod's *Astronomia* (fr. 288-293 M-W).[3] This was a hexameter catalogue of stars and constellations as well as tales, apparently brief, about their origins. Only a few fragments and testimonia survive, but Tzetzes tells us in his commentary on the *Works and Days* (*Op.* 384) that it explained how Zeus transformed five daughters of Atlas into the star cluster called the Hyades, as they mourned their brother Hyas who was killed by a snake in Libya (fr. 291 M.-W.).

In the 5th century Panyassis described how Heracles ascended to the heavens as the so-called 'Kneeling Man' (Hyginus *Astr.* 2.6.1), but it was not until the 3rd century BC that catasterisms became a veritable genre when Eratosthenes of Cyrene, third Librarian at Alexandria, brought them together in his *Catasterismoi*.[4] This was a prose catalog of a familiar Hellenistic type and the two epitomes of it that are still extant suggest that it was not a major literary achievement. Though Eratosthenes was a mathematician, astronomer and a poet who found ingenious ways to please his royal patrons,[5] it was his older contemporaries, Aratus and Callimachus, who realised the full potential of catasterism as court poetry.

Callimachus on *Arsinoe's Apotheosis*

The best-known Hellenistic catasterism is Callimachus' 'Lock of Berenice', but it was not his first. This was *Arsinoe's Apotheosis* (fr. 228 Pf.) which Callimachus celebrated in a poem that must have been written shortly after her death in 268 or 270 BC.[6] The title and first verse are preserved by the *Diegeseis* which tell us that the queen, who was the wife and sister of Ptolemy Philadelphus, was snatched up by the Dioscuri: φησὶν δὲ αὐτὴν ἀνηρπάσθαι ὑπὸ τῶν Διοσκούρων (X 10-13).[7] The extant fragments are few, but they show that the poem was mainly concerned with the discovery of Arsinoe's death by her late sister, Philotera, who was unaware of it because she was absent at the time on a visit to Demeter (fr. 228.44-45 Pf.). The fragments also specify the location in the sky where the Dioscuri ultimately deposit Arsinoe: ἀστερίαν ὑπ' ἄμαξαν 'under the starry Wagon' (fr. 228.5). We know from Homer (*Od.* 5.273) and Aratus (*Phaen.* 27) that this Wagon is the constellation Ursa Major. When we look for her on a star chart, however, Arsinoe does not appear under the Wagon or anywhere else. What we find under the Wagon is the constellation of the Maiden, Virgo, who holds a gleaming ear of corn (στάχυς, *Phaen.* 97) (Figure 1).

Aratus *Phaenomena*, 96-136

The catasterism of Virgo is described by Callimachus' contemporary Aratus of Soli in his astronomical poem, the *Phaenomena*, which contains descriptions of 48 constellations based on a prose account by Eudoxus of

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* Grateful thanks to Prof. Christos Zerefos, Chair of the Organising Committee, and the Marianna V. Vardinoyannis Foundation for their generous support of 'Hellenistic Alexandria: Celebrating 24 Centuries', where this paper was first presented. Thanks also to the colleagues whose penetrating questions helped me improve this expanded version.
The following texts are used below: *Lock of Berenice*, Harder 2012: fr. 110-110f; *Apotheosis of Arsinoe*, Pfeiffer 1949-53: fr. 228; Aratus' *Phaenomena*, Kidd 1997.

1 The Pleiades, Bootes, the Bear, which is called the Wagon, and Orion.

2 The Pleiades, Hyades, Orion, and the Bear which is called the Wagon.

3 The title generally appears as *Astronomia*, as Athenaeus 11.491C, who is uncertain about the authorship, but Pliny NH 18.213 refers to an *Astrologia* which appears to be the same work.

4 The standard modern edition is Pàmias i Massana and Zucker 2013. *Catasterismoi* is a modern title; the original is unknown.

5 An example is Eratosthenes' poem on the duplication of the cube which is addressed to Ptolemy III Euergetes (Fraser 1972: 408).

6 In addition to Pfeiffer's text, see also Lelli 2005: 98-102, 151-195. On the controversy surrounding the date of Arsinoe's death and the history of the question, see Carney 2013: 104, with notes 192-194.

7 This is echoed in the fragments where Philotera addresses her deceased sister ὦ δαίμοσιν ἁρπαγίμα, 'Oh snatched by the gods', fr. 228.46 Pf. The *Diegeseis* is an incomplete prose summary of Callimachus' collected works compiled in the 1st-2nd century AD. The text is in Pfeiffer 1949-52.

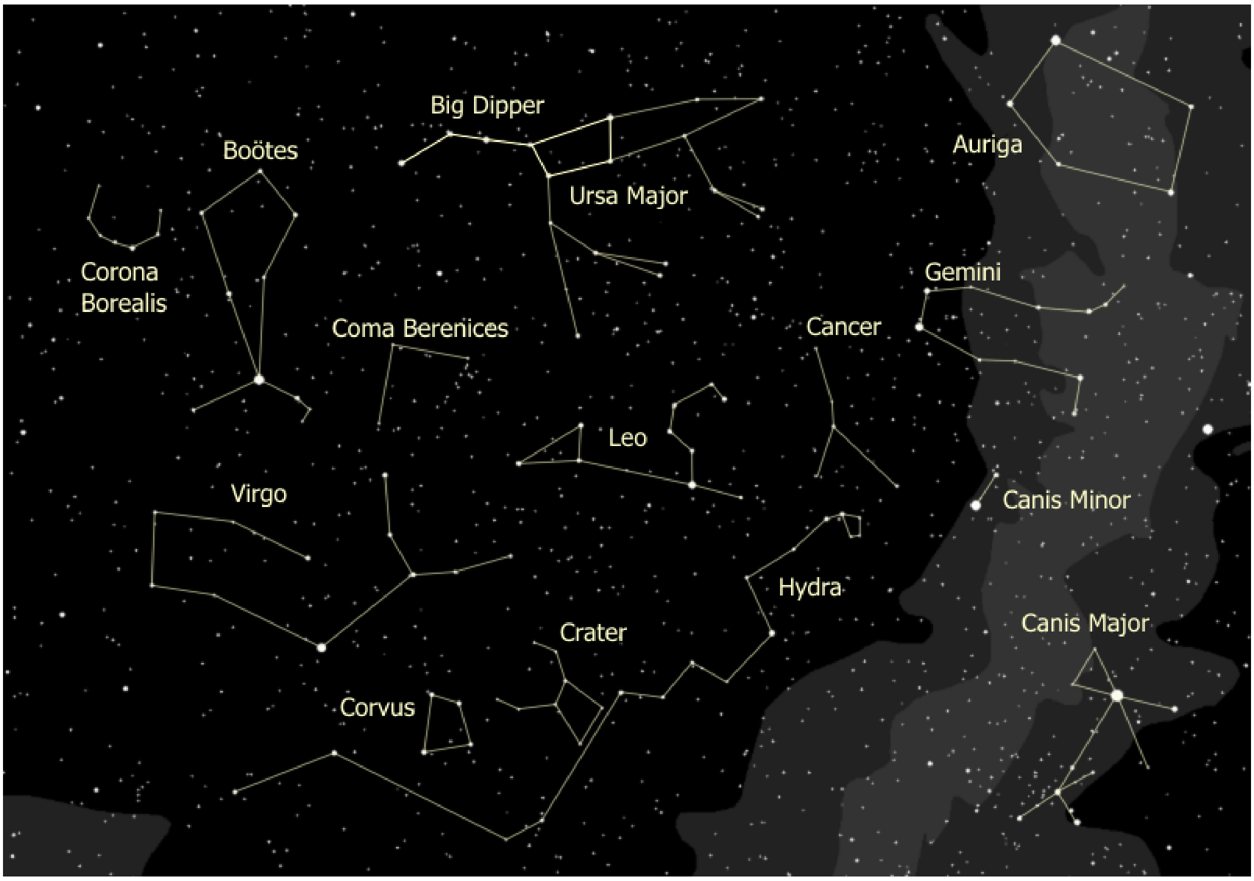

Figure 1. Northern sky in spring (courtesy of Randy Culp, rocketmime.com).

Cnidos.[8] Aratus treats most of the constellations briefly, but the catasterism of the Maiden, Parthenos, who becomes the constellation Virgo, is by far the longest at 30 verses (96-136). Its beginning and end are carefully marked out and articulated within the sequence of the other constellations,[9] and it stands out from the rest on account of its literariness and its dramatic qualities.[10] Like Callimachus' *Apotheosis*, it contains reported dialogue of a vivid, emotional character that is absent from the rest of the *Phaenomena*.[11] It has attracted more modern discussion than any other passage in the poem on account of these qualities and also because it can be read as a response to Hesiod's treatment of Dike (*Op*. 213-273) and his Five Ages of Man (*Op*. 109-201).[12] This passage and the prologue, which will be discussed below, are the only places in the *Phaenomena* where Aratus engages so closely with Hesiod.[13]

Briefly, Aratus tells the story of Parthenos, Virgo, whom he calls the daughter of Astraeus or, he says, maybe of someone else (*Phaen*. 98-99).[14] This sly hint encourages the reader to ask who the alternative father might be and Aratus gives us a clue, 'Men used to call her Dike (Justice)' (*Phaen*.105). Since Hesiod identifies Zeus as the father of Dike in *Theogony* 901-902 and *Op*. 256 he could also be the father of Parthenos. Like Heracles, Persaeus and the Dioscuri, who also became constellations, Parthenos/Dike has both human and divine fathers, one of whom may be Zeus. On the basis of this alone she has the minimum qualification for catasterism.

But there is also 'another story' that she actually lived on earth where she did not 'reject the tribes of

8 In addition to Kidd's edition of the *Phaenomena*, see Martin 1998, Erren 1971, and Maas 1898. Fragments of Eudoxus have been collected in Lasserre 1966. Martin 1998: LXXXVI-XCV alone is sceptical of Eudoxus as Aratus' source.

9 The episode is introduced in this way: ἀμφοτέροισι δὲ ποσσὶν ὕπο σκέπτοιο Βοώτεω/ Παρθένον, 'under both feet of Bootes, you can see the Maiden' (*Phaen*. 96-97), and it concludes: Παρθενος ἐγγὺς ἐοῦσα πολυσκέπτοιο Βοώτεω, 'Parthenos being near far-seen Bootes' (*Phaen*. 136).

10 'Many critics sense the marked quality of this passage', Van Noorden 2009: 260 nt. 23; and Schiesaro 1996: 23, '[it is] so evidently different from the rest of the *Phaenomena*'.

11 Examples of reported dialog include *Phaen*. 123-126, where Dike rants at assembled members of the Silver Age and Callimachus fr. 228.47-51 Pf., where Philotera anxiously begs Charis to find out why fires are burning in her Alexandria.

12 On the attention paid to the Dike passage by modern scholars, Gee 2013: 23. In nt. 7 she lists 19 studies of it, excluding her own.

13 Volk, 2010: 200.

14 Before Aratus the constellation Virgo apparently had no mythology, and the identification of Hesiod's Dike with the constellation Parthenos is 'a striking innovation', Gee 2013: 27.

ancient men and women, but took her seat among them though she was immortal, and they called her Dike' (*Phaen.* 100-105).[15] This is not Hesiod's Dike, who was never personified in this way, but the description suits Arsinoe very well.[16] She was, of course, human, but was deified very likely during her lifetime, and certainly after her death.[17] Her father, Ptolemy I, was deified after his death by his son, Philadelphus, and given the *epiklesis* 'Soter', which he shared with Zeus.[18] This is but one expression of a dynastic claim later made explicit in the Adulis decree (OGIS 54) which the third Ptolemy, Euergetes I, posted after his return from the Third Syrian War in 245 BC. It states baldly in the opening lines (4-5) that he is a descendant on the paternal side from Heracles son of Zeus and on the maternal side of Dionysus son of Zeus. The claim clearly extends beyond himself to his predecessors and may be taken as an authorised genealogy. Arsinoe, then, like Dike, is to be understood as the offspring of Zeus.

In Aratus' account Dike's life on earth represents a golden age before there was war, 'when the ox and plough together with Dike herself, Queen of the people (πότνια λαῶν), giver of good things, supplied their every need' (*Phaen.* 108-113). This role was not at all typical of Hesiod's Dike, but it fits Arsinoe well. Πότνια (*Phaen.* 112) can be used equally of human queens and goddesses, and the lavish generosity of the Ptolemaic royal couples, their τρύφη, was a trait they liked to emphasise.[19]

Then, Aratus continues, in the silver age Dike began to withdraw and to rebuke men for their evil ways (*Phaen.* 123-126). She prophesises in lurid detail the coming of war with its related bloodshed, and finally, in the Bronze Age, she abandons mankind altogether and flies up the heavens (*Phaen.* 129-134).[20] This is the time, Aratus says, when banditry took hold and men first tasted the flesh of oxen at the plough (*Phaen.* 131-132). In Arsinoe's lifetime this could describe the coming of the Chremonidean War (268?-262 BC).[21] This conflict pitted a coalition including Egypt, Athens, Sparta and other Greek cities against Antigonus Gonatas, ruler of Macedonia. Athens was Antigonus' principal target, and we know from an inscription from Rhamnus (SEG 24.154) that Antigonus used pirates to supplement his naval operations against the city. On more than one occasion Antigonus' men systematically burned Athenian crops and pillaged the countryside. Poetically put, his armies were feasting on the oxen of the field that Dike warns of in Aratus' poem.

Arsinoe herself died suddenly at the start of the war, and this could explain the prophetic tones in which Dike speaks of it in Aratus' account. She warns the current 'silver' generation about a time soon when there will be discord among men. In her own words: 'There will be wars and hostile blood / for men and suffering will be set upon evils' (*Phaen.* 125-26).

Just at the time of Arsinoe's death or immediately afterwards, Chremonides, an Athenian archon, proposed a decree in the Athenian assembly urging other Greek states to join the alliance which had Egyptian support: 'In accordance with the policy of his ancestors and his sister Ptolemy is openly zealous for the common freedom of the Greeks,' i.e. for the independence of Athens and others from Macedonian control (*IG* II^2 687.16-18). The reference in the decree to the king's ancestors is not unprecedented in Hellenistic inscriptions, but the reference to the king's sister is extraordinary. It has sometimes been used as evidence of Arsinoe's political power and/or an effort to promote the interests of her son by Lysimachus, but even without pushing the evidence this far, it certainly associates her personally with the war.[22] As it happened, she died at the war's inception and a poet viewing in retrospect the context of her sudden death might be inspired to portray it as a self-determined response to the violence that followed.

Aratus says she flew to the heavens, where now she can be seen near conspicuous Bootes (*Phaen.*134-136), where she holds in her hand a gleaming ear of corn (*Phaen.* 97).[23] The constellation Bootes is the ploughman and provides a suitable agrarian environment for Arsinoe for whom cornucopias overflowing with fruits and grains are a significant iconographical feature.[24] Her namesake in Hesiod had nothing to do with agriculture. In his Golden Age food springs up spontaneously

15 On reading the story that follows as the 'other story', see Van Noorden 2009: 258 and nt. 20.

16 Hesiod's *Eoeae* (fr.1.5-7 M.-W) portrays gods and female mortals mingling at banquets and in councils in the Heroic Age , but this was an occasion to impregnate them with a race of demigods, not a sharing of social status.

17 Arsinoe and Philadelphus received cult as the *Thoi Adelphoi*, the Sibling Gods, on or before 272/1, just before Arsinoe's death, see Fraser 1972: 216 and nts. 208 and 219. For discussion of the cults established by Philadelphus after her death and her assimilation to Aphrodite, Demeter and Isis, see articles in Malaerts 1998; Plantzos 1991-92; Hauben 1989; Tondriau 1948; and below.

18 When and by whom Ptolemy I was first called Soter is controversial and the evidence is slender. It is often claimed that the Rhodians gave him both title and cult after he helped relieve them from a siege by Demetrius Poliorcetes in 304 BC, but this date and occasion for the title are not supported by inscriptions. See detailed discussion with bibliography on the Ptolemaic *epikleseis* in Muccioli 2013. On Zeus as a key figure in Alexandrian court myth, see Hose 1997.

19 On Ptolemaic τρύφη, Ager 2005: 23-27, and bibliography in nt. 140.

20 Dike's departure from the society of men alludes to the exit of Nemesis and Aidos (Retribution and Shame) in Hes. *Op*. 197-200.

21 On the Chremonidean War, see Huss 2001: 271-281, with extensive bibliography. The exact dates of its beginning and end have been much debated.

22 For a balanced discussion of the meaning of the decree for the role of Arsinoe II in external politics, see Carney 2013: 91-95.

23 Or 'hands', Martin 1998: 6 and Schiesaro 1966: 14 nt. 10.

24 On Arsinoe's double cornucopia on gems, coins, and oenochoes, see Planzos 1991-92.

without human effort (Hes. *Op*. 117-119).[25] This dream of food without labor is understandable in rocky Ascra, Hesiod's hometown, where nothing would grow. The difference highlights Egypt's fertility and suits Arsinoe who was sometimes identified with Demeter.[26]

Arsinoe's ascent to the stars is a well-documented Ptolemaic conceit. Not only is Callimachus' poem on the subject very clear about it, but the Mendes Stele tells us that in the month of Pachon, in the 15th year of Ptolemy's reign 'this goddess ascended to heaven'.[27] This may be a conventional statement announcing her death in an Egyptian idiom,[28] but her mortuary temple, built, although not completed, by Philadelphus, was anything but conventional. Pliny reports that the architect Timochares used magnetised lodestone in the vaults of the ceiling so that Arsinoe's iron statue would be seen to float in mid-air (Pliny HN 34.148).[29] This seems to suggest that she had literally ascended to the heavens.

When Callimachus wrote his own *Apotheosis of Arsinoe* he was in Alexandria already in the midst of his long career as a court poet there. His epigram 56 G-P (= AP 9.507), which praises Aratus for his style and deft use of Hesiod, is proof of Callimachus' admiration for the poet, but there is no evidence that they had met personally or that Aratus himself was ever in Alexandria. It is necessary, then, to consider when and why Aratus would have invited his readers to align Arsinoe with Virgo.

We do not know exactly when Aratus lived, but the four *Vitae* preserved among the manuscripts of the *Phaenomena,* supplemented by a short notice in the Suda, indicate that he was resident for a long time in Pella, where he went at the invitation of the Macedonian king Antigonus Gonatus and whom he had met when they were both studying philosophy in Athens.[30] It is said that the initial invitation was a commission to write a poem celebrating Antigonus' marriage to his niece Phila II (276 BC), but he stayed on to write the *Phaenomena* there (*Vitae* 1, 3, 4), also at the king's behest (*Vita* 1).[31] Since Antigonus was in more or less continual conflict with Philadelphus, Pella would not be a place to honor a Ptolemaic queen, and it may be the case that an original version of the poem composed in Pella presented the constellation Virgo in the same brief way that it treated all of the other constellations.

Aratus did not stay put in Macedonia, however, but was also resident at the court of the Seleucid king Antiochus II (*Vitae* I, III).[32] Relations between Antiochus and Ptolemy were as tense as those between Antigonus and Ptolemy, and after the anomalous end of the Chremonidean War, Philadelphus tried to defend his hegemony in the Aegean against his Seleucid rival. This new conflict, known today as the Second Syrian War, ended with a negotiated settlement in 252 BC which Philadelphus celebrated by sending his daughter Berenice Phernophorus, also known as Berenice Syra, to marry Antiochus.[33] Just as Aratus had been invited to Pella to write a poem in celebration of Antigonus' marriage, Antiochus could have invited him to celebrate his own marriage to a Ptolemaic princess. This would be a suitable occasion for Aratus to honor the bride by reworking his treatment of Virgo into a cameo, inviting readers to imagine Arsinoe II translated to the heavens.[34] Philadelphus, who was Arsinoe's divine image-maker and founder of her cults, would have been particularly gratified.

Callimachus' 'Coma Berenices'

The revision of a well-known poem by inserting an episode honoring a Ptolemaic queen has a precedent in Callimachus' *Aetia*, which concludes with the 'Lock of Berenice' (frr. 110-110f Harder). The story he tells is that this 'new' constellation was discovered by the

[25] The first to notice this discrepancy was Norden, 1893: 426, who attributed Aratus' modification of Hesiod to Stoic influence. For more recent discussion, see Solmsen 1966: 126 who sees, instead, a reference to the agricultural sections of the *Op*. (383 ff.) and an idealization of peasant life that is typical of Hellenistic poetry. Also see Schiesaro 1996: 13-14 on the moral dimension of Aratus' introduction of agriculture into the golden age.

[26] In addition to the cornucopias there were streets in Alexandria named Arsinoe Karpophoros ('bearer of bounty') and Arsinoe Eleusinia after Demeter's principle festival and the name of an Alexandrian suburb (Fraser 1972, vol. 1: 237-239). In an Appendix, Schiesaro 1996: 26 also notes how Ptolemaic queens were all associated with Demeter. He suggests that the whole of the Dike passage is a moral lesson that was directed at Antigonus.

[27] N. 33, Sethe 1904 vol. II: 40 quoted by Selden 1998: 312 nt. 143.

[28] How the newly dead become stars is described in detail in Egyptian astronomical texts *e.g.* on the ceiling of the Osireion at Abydos (Selden 1998: 340-344, with other examples).

[29] This gives added significance to Aratus' description of the Maiden's departure: ἔπταθ' ὑπουρανίη (*Phaen*. 134) 'She flew up under the sky'. Kidd 1997: 230 notes that Aratus is thinking of the constellations as attached to the under-surface of the sky, as opposed to Homer's ἐπουράνιοι, the gods who live above the sky (*Il*. 6.129, etc.).

[30] Texts of the *Vitae* are in Martin 1974: 6-22. The *Suda* entry is 3745 Adler.

[31] Although the *Vitae* contain different details and some contradictions, it is generally thought that they derive from a single source, Martin 1998: XI.

[32] *Vita* III cites the astronomer Dositheus of Pelusium as a reliable source for this information. He was a student of Conon, whom Callimachus features in his 'Lock of Berenice', and a correspondent of Archimedes. Since Aratus wrote a poem dedicated to Phila II, who was the daughter of Seleucus I and sister of Antiochus II, and stayed in Antioch for 'some time,' Martin 1998: XXXVII-XXXVIII is inclined to think that the poet may have gone first to the court of Antiochus and later to Pella in the entourage of the queen, but there is no evidence for Aratus' itinerary.

[33] Huss 2001: 287.

[34] Arsinoe II was not the birthmother of Berenice Syra, but rather her aunt and step-mother. Her birthmother was Arsinoe I, who was exiled by Philadelphus following accusations that she was plotting against him (Schol. Theoc. *Id*. 17.128). Berenice and her siblings were later adopted by Arsinoe II posthumously. See Fraser 1972, vol. 1: 347 and 369.

astronomer Conon in 245 BC after the queen dedicated it in fulfillment of a vow that she had made for the safe return of her husband, Ptolemy III, from the Third Syrian War. The lock was placed in the temple of Arsinoe-Zephyritis, and promptly disappeared. The Lock recounts what happened next: he was swept from the temple by Zephyr, placed in Aphrodite's chaste lap, i.e. dipped in the sea, and still damp, rose at dawn to take his place among the constellations (fr. 110.52-56 Harder).

This poetic complement to the young queen apparently existed in an independent version that was circulated as an occasional poem (*P.Oxy*. 2258) before being incorporated as the conclusion of the much longer *Aetia*.[35] The poem's restructuring over the course of the poet's life has been plausibly reconstructed by Peter Parsons, who modified an earlier model proposed by Rudolf Pfeiffer.[36] Essentially he argues on the basis of papyrus fragments and the *Diegeseis* that Callimachus wrote the first two books of the *Aetia* with an original prologue earlier in his career, then later added books 3 and 4, beginning and ending with poems for Berenice, for which he composed a new prologue (fr. 1 Harder) and a new epilogue (fr. 112 Harder).

While papyrus fragments have contributed little or nothing to our understanding of the composition of the *Phaenomena*, it is clear that its text was remarkably fluid in its earliest stages. Its fame in antiquity and its subject matter produced an abundance of ancient commentaries and scholia beginning soon after Aratus' lifetime.[37] Among them is a complete commentary by the astronomer Hipparchus of Nicaea from the middle of the 2nd century BC that contains quotes from an even earlier commentary by Attalus of Rhodes. Also extant are many later scholia and fragments of commentaries yielding insights into the chaotic state of the vulgate text before it was edited in Alexandria in the 1st century, probably by Theon of Alexandria.[38] This Alexandrian edition stabilised the text and is the basis of our modern editions, although another edition, now known as φ, appeared in the 2nd or early 3rd century AD with a new introduction and additional scholia.[39] Then, as a final challenge to our understanding of the editorial process, the two editions and their related scholia cross-contaminated each other.

It is not possible to disentangle revisions the poet himself may have made to the text in his own lifetime from those that resulted from ancient editing. It is significant, though, that Hipparchus' early (2nd century BC) commentary lacks a prologue altogether. It simply ignores the elaborate prologue to Zeus, which is a canonical part of the modern text, and begins directly with line 19, where Aratus starts a discussion of the axis on which the heavens whirl around the earth. We can only speculate on the reason why, but Vita II has relevant information, 'Some say about the prologue that the one in place now is not by Aratus, but was added later. They say that the true one is this: "Ancleides, sacred offspring of [my] hosts".'[40]

Martin has assembled evidence in ancient commentaries and scholia of a debate about the authenticity of the prologues and sees in them an attempt to discredit an original Zeus Prologue by those who wanted his work to be less Stoic.[41] This fails, however, to account for Ancleides who is unknown to us, but if this prologue were authentic, would have been recognizable to Aratus' audience. In fact, 'sacred offspring of my hosts,' suggests that he was a son of Antigonus, Aratus' host in Pella. A human addressee is a standard feature of didactic texts, 'indeed one of the fundamental elements for establishing the didactic agreement between author and reader' (Schiesaro 1996: 23). Hesiod addresses his *Works and Days* not only to the Muses but to his brother Perses, and there are ready parallels in the Hellenistic period in Nicander's *Theriaca* 1-7, addressed to a one Hermesianax and *Alexipharmaca* 1-11, to a Protagoras.[42]

The address to Ancleides, however, is not the prologue that we read in our modern texts; in fact, it is not the prologue that was known to Cicero (*Arat.* 1), Virgil (*Ec.* 3.60), Ovid (*Met*. 10.148) or Germanicus (*Arat.* 1-2). This is an elaborate hymn to Zeus with strong Stoic coloring:

> Let us begin with Zeus, whom we men never leave unspoken. Filled with Zeus are all highways and all meeting-places of people, filled are the sea and harbors; in all circumstances we are all dependent on Zeus. [5] For we are also his children, and he benignly gives helpful signs to men, and rouses people to work, reminding them of their livelihood, tells when the soil is best for oxen and mattocks, and tells when the seasons are right both for planting trees and for sowing every kind of seed. [10] For it was Zeus himself who fixed the signs in the sky, making them into distinct constellations, and organised stars for the year to give the most clearly defined signs of the seasonal round to men, so that everything may grow without fail. That is why men always pay homage to him first and last.

35 A discussion of the evidence is in Harder 2012, vol. 2: 799-800.
36 See Harder 2012, vol. 1: 2-8 for the details.
37 Martin 1956 is an indispensable guide through this thicket of ancient scholarship.
38 Martin 1956: 196-204.
39 Martin 1956: 38-125.
40 13-16, Vita II. A variant of this dedication substitutes Antigonus' name for Ancleides, and a fourth version of the prologue simply addresses the Muses: 'Speak to me Muses, of the far-famed sun and moon', Martin 1956: 18.
41 Martin 1956: 13-18, 133-139.
42 These are both common names and the individuals referred to here cannot be identified.

[15] Hail, Father, great wonder, great boon to men, yourself and the earlier race! And hail, Muses, all most gracious! In answer to my prayer to tell of the stars in so far as I may, guide all my singing.

Phaen. 1-18 (Trans. Kidd)

Martin and others have uncovered telling links between this prologue to Zeus and the text of the *Phaenomena* itself and there is no doubt that it is the authentic work of Aratus.[43] The connections are especially strong between the prologue and the Myth of Dike.[44] In addition to its Stoic message, it is, like the Dike passage, a tribute to Hesiod, especially the *Works and Days*, which also begins with an elaborate prologue addressed to the Muses, who are asked to hymn their father Zeus (*Op*. 1-2). An aretology of Zeus' terrifying powers follows (*Op*. 3-9), which is, in effect, the hymn.

Martin himself characterises the prologue to Ancleides as 'apocryphal' in contrast to Aratus' authentic prologue to Zeus,[45] but taking a clue from the subtitle of his chapter 'Les vestiges d'une préface antique',[46] I would argue that the address to Ancleides was not intended as a polemical correction to, and substitute for, the Zeus prologue, but rather it is the relic of an older version of the prologue that Aratus himself reworked later in his career. Even with so many scholia and the wreckage of multiple ancient commentaries there is no way to reconstruct Aratus' original prologue, but it seems at least possible that it followed Hesiod in combining a shorter dedication to Zeus with an address to the human Ancleides. In the revised version Ancleides was removed by the poet, but copies of the earlier version were still circulating and puzzling his commentators until the text was stabilised by Theon in the 1st century.

If Aratus reworked the prologue of his *Phaenomena* we are bound to ask why, and it may be significant that the first line of the final form of the prologue precisely echoes the opening verse of Theocritus' 17th *Idyll*:

Ἐκ Διὸς ἀρχώμεσθα, τὸν οὐδέποτ' ἄνδρες ἐῶμεν / ἄρρητον

Phaen. 1-2

Let us begin from Zeus whom we men never allow to be / unmentioned

and

Ἐκ Διὸς ἀρχώμεσθα καὶ ἐς Δία λήγετε Μοῖσαι

Theoc. *Id*. 17.1

Let us begin from Zeus, and let us end in Zeus, Muses

Hellenistic poets routinely echo each other's work and it is difficult if not impossible to determine who is citing whom. Sometimes the citations are read as criticism, sometimes as homage, but they are generally taken to be meaningful one way or the other.[47] Although the usual cautions apply in this case, it is significant that Theocritus' 17th *Idyll* is an unabashed encomium to Ptolemy Philadelphus. Aratus could have revised his prologue with a new first verse that reminded readers of *Id*. 17.1, pointing to Philadelphus at the same time that the catasterism of Virgo/Dike was expanded to evoke the memory of Arsinoe II. The close relationship of Aratus' Prologue and the Myth of Dike suggests that each was written with the other in mind. Schiesaro (1996: 18) explains how the Myth of Dike 'balances and completes the initial Proem to Zeus', and how the two are a 'diptych rather than autonomous entities'. In the same way Callimachus added a new prologue to the *Aetia* when he expanded it with two new books ending in the catasterism of Berenice's Lock.

Two Ptolemaic queens in the heavens

Callimachus is very specific about the placement of Berenice's Lock in the heavens. It is located between Virgo and savage Leo next to Ursa Major, with slow Bootes following (fr. 110d.65-67 Harder).[48] The two queens are side-by-side in the heavens, both beneath the Wagon, i.e. Ursa Major. They also shared other iconographical features that suit their new identity as constellations.

Just as the stars were guides for sailors, Arsinoe and Berenice were associated with the Cyprian Aphrodite whose care was the safety of men at sea. The Temple of Arsinoe-Aphrodite at Cape Zephyrium, where Berenice's Lock was dedicated, was a gift to Arsinoe from the admiral Callicrates of Samos and is celebrated in epigrams by Callimachus, Hedylus and Posidippus, which make this connection clear.[49] Berenice later played this role herself at another shrine where she was worshipped as Berenice Sozousa, Berenice 'the Savior'.[50] The care of sailors is a responsibility that she shared with the Dioscuri, and Arsinoe with the Cabiri, who are often associated with

[43] Martin 1956:18 and 1998: LI.
[44] See below.
[45] Martin 1956: 17-18, 133-139.
[46] Martin 1956: 133-139.

[47] See Köhnken 2001 on the challenges of interpreting the intertextual references of Hellenistic poets and Fantuzzi 1980 on establishing the priority of the first verses of Theocritus *Id*. 17 and the *Phaenomena*. It is especially difficult in this case because the general sense of 'beginning from Zeus' appears a number of times in much earlier Greek poetry where it suggests a sympotic setting. For a listing see Fantuzzi 1980: 163 nt. 1, who argues on internal evidence that Aratus is prior. Erren 1967: 10-16 is convinced that Theocritus was earlier; Gow 1952 vol. 2: 327 and Ludwig 1965: col. 27 are agnostic on the question.
[48] Hyinus *Astr*. 2.24 locates the Lock simply 'near Virgo.'
[49] On the temple of Arsinoe Aphrodite in Callimachus, *Ep*. 14 G-P = Athen. 7.318B, Hedylus 4 G-P = Athen. 11.497D, Posidippus 12 G-P = P. Firmin-Didot, 13 G-P =Athen. 7.318D, and 39 AB. On the temple's dedication to the maritime Aphrodite, see Bing 2002-2003: 245 and Robert 1966: 201-202.
[50] Zenobius 3.94 in Fraser, vol. II: 388 nt. 385.

the Dioscuri, and whose shrine at Samothrace was the site of a rotunda dedicated by Arsinoe and a great propylon, built by her husband.[51] And just as farmers looked to the stars for information about the seasons and weather, both queens were associated with Demeter. They are both depicted carrying cornucopias, Berenice's a single and Arsinoe's a double, on their coins and on faience vases (*oenochoae*); and there are other types of evidence as well.[52]

On the vases, Arsinoe is also associated with Agathe Tyche and the Egyptian Isis, who was identified with Demeter as early as Herodotus 2.59.[53] Datable evidence of Arsinoe's connection to Isis can be found on the Pithom stele (264/3 BC) where she wears Isis' characteristic dress with a fringed, knotted mantle and her corkscrew curls.[54] Berenice, as well, is called 'Isis mother of the gods' in a contemporary papyrus (PPetr. iii col. 2.6). Her own Lock recalls the lock of Isis which the Egyptian goddess dedicated in her temple at Coptos as a sign of mourning for her husband/brother Osiris. Her tears fell into the Nile beginning the annual cycle of flooding that fertilised the wide river valley and guaranteed Egypt's prosperity.[55] It is not an accident, then, that Egyptian star charts show Isis, who appears in the heavens as a constellation in the shape of a giant hippopotamus, in the same area of the sky as Virgo and Berenice's Lock.[56] She is holding in chains the foreleg of Seth, god of chaos, which covers roughly the same celestial territory as Ursa Major.

In an unprecedented literary coup, Callimachus and Aratus commandeered the very heavens to dignify their royal patrons and place them in that coveted space between the merely human and the divine. Thanks to them the two queens are on permanent display with Heracles and the Dioscuri in a veritable tableau of Ptolemaic iconography – always alight in the night sky doing their essential jobs: guiding sailors safely through the sea, informing farmers of the seasons and the weather, and inspiring mankind to live in justice and peace.[57] In short, they are revealed as guarantors of universal order, like Isis, rising and setting with the sun, the moon, and the stars. Who could look at the night sky and doubt their power? Or doubt the power of the poets and the poetry that put them there?

[51] Berenice's coins often have the stars or the pointed hats (*pilei*) of the Dioscuri on their obverse e.g. Svoronos 972, 979, 988 and 989. On Arsinoe's rotunda at Samothrace, see McCredie 1992.

[52] For Arsinoe II and Demeter, see the references in nt. 19 above. On Berenice, see Clayman 2014: 84-89; Pantos 1985; 1987.

[53] Plantzos 2011: 389-396, and on the *oenochoae*, Thompson 1973: 57-59. Arsinoe is shown making a libation as she stands beside an altar inscribed with the names of Agathe Tyche, Arsinoe Philadelphos and Isis.

[54] Plantzos 2011: 391-396, who answers the objections of Bianchi and others who are not convinced that these garments are distinctive to Isis.

[55] Clayman 2014: 100-102.

[56] Selden 1998: 343-344.

[57] A political reading of the Dike myth such as the one offered here by no means contradicts an ethical/philosophical one such as that outlined e.g. by Hunter 1995. Aratus' poetry is multi-layered, and giving his patrons central positions in the stoic cosmos could certainly be construed as the highest compliment.

Abbreviations

AB	Austin, Colin and Bastianini, Guido (eds) 2002. *Posidippi Pellaei quae supersunt omnia.* Milano: LED.
AP	Beckby, Hermann (ed.) 1957-1958. *Anthologia Palatina*. München: Heimeran.
G-P	Gow, Arthur S. F. and Page, Denys (eds) 1965. *The Greek Anthology: Hellenistic Epigrams.* Cambridge: Cambridge University Press.
IG	*Inscriptiones Graeci*. 1903- . Berlin: Berlin-Brandenburgische Akademie der Wissenschaften.
M.-W.	Merkelbach, Reinhold, and West, Martin (eds) 1999. *Fragmenta Hesiodea*. Oxford: Oxford University Press.
OGIS	Dittenberger, Wilhelm (ed.) 1903-1905. *Orientis graeci inscriptiones selectae*. 2 vols. Leipzig: Hirzel.
Pf.	Pfeiffer, Rudolf (ed.) 1949. *Callimachus.* 2 vols. Oxford: Clarendon Press.
P.Oxy.	*The Oxyrhynchus Papyri* 1898- . London: Egypt Exploration Society.
P.Petr.	Mahaffy, John and Smyly, J. G. (eds) 1891-1905. *The Flinders Petrie Papyri*. Royal Irish Academy.
SEG	*Supplementum Epigraphicum Graecum* 1923- . Leiden: Brill.

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Antikythera Mechanism as evidence for Hellenistic technology excellence

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Introduction[1]

Philosophy, science and technology have changed human life radically over the last three to ten thousand years, and especially over the last two hundred years. We consider all new technological applications as very natural and self-evident. Every day many new ones appear, some of them unexpected and often very successful. All of these technological applications are based on scientific applications, i.e. computers and the Internet, with all its applications.

The Antikythera Mechanism (AM) also represents the oldest known planetarium; it had dials for the planets and pointers that show the position of every planet in the sky for a given time. The instrument has a user's manual with instructions, as all scientific instruments do. The manual is written on copper sheets that are the 'doors' of the mechanism and has instructions on how to use it.

The AM is an excellent example of Hellenistic technology, a technology based on science developed at the Museum and Library of Alexandria, with some roots in science as established by Archimedes. The mechanism is the oldest known computer working with gears that perform calculations with integer ratios, with rational numbers using trains of gears appropriately designed. It has several accurate and complicated calendars, based on the: solar year, the Egyptian calendar, the four-year Olympiad period, and its double, the *octaetiris*, and the 19-year calendar cycle proposed by Meton, with *epirotic* months (a Corinthian Doric calendar).

The AM is the epitome, compendium, and best example of Greek philosophy. This paper will discuss how humans conceived the idea of constructing such a mechanism and how they managed to construct a mechanical cosmos; the role of causality, the notion of the laws of physics and modelling will also be presented and discussed in relation to the mechanism. The role of Pythagorean philosophy in the development of the mechanism, the notion that the Cosmos 'is' mathematics (i.e. that it can be described properly by physics and mathematics) will also be discussed.

The AM proves that Greeks had advanced technology and even 'nanotechnology', advanced ways to perform mathematical calculations using gears programming the train of gears, i.e. to create computers. The mechanism is the forefather of all technology. The bits and bytes of all computers, automations and robots of today have their roots deep in the AM and Alexandrian science and technology. The mechanism has the optimal size that can work without breaking. If it were any larger then the use of bearings would have been a necessity.

The achievements of science and technology, the advanced visions of the ancient philosophers, raise the basic question of how man has made incredible advances, philosophical, scientific; how we have built computers and the Internet; how medicine heals so many diseases; and how humans went to the moon. But how did science and science-based technology begin? How did science and philosophy develop? To make a flashback, we should turn to legendary personalities, such as the demi-god Prometheus, who gave fire to humans, or Orpheus, the legendary king and scientist who tamed nature through science, or Thales, who set out the basis of theoretical mathematical reasoning with proofs of theorems and predicted eclipses with mathematics, the laws of periodicities of eclipses, based on observations over centuries if not millennia; and, of course, Plato. Plato, to show the importance of science, refers to the Pythia giving an oracle on how Athenians, and humans in general, can mitigate dangerous situations, such as the typhoid that killed half the population, including Pericles, the creator of Athens, and how liberating humanity from disease and hunger can be achieved via science based on mathematics. Thus, the Oracle at Delphi Pythia, in the words of Plato, proposes that philosophers should solve the famous mathematical Delian problem, that is, the doubling of the volume of the cubic altar of Apollo in Delos, using a ruler and compass, i.e. with theoretical geometry! Plato wants to stress the importance of science based on mathematics. Apollo does not ask for offerings and

[1] ' Pythagoras' doctrine is that mathematics has the maximal power to describe and understand nature and he always referred to numbers, as for example the periods of celestial bodies.' Plutarch

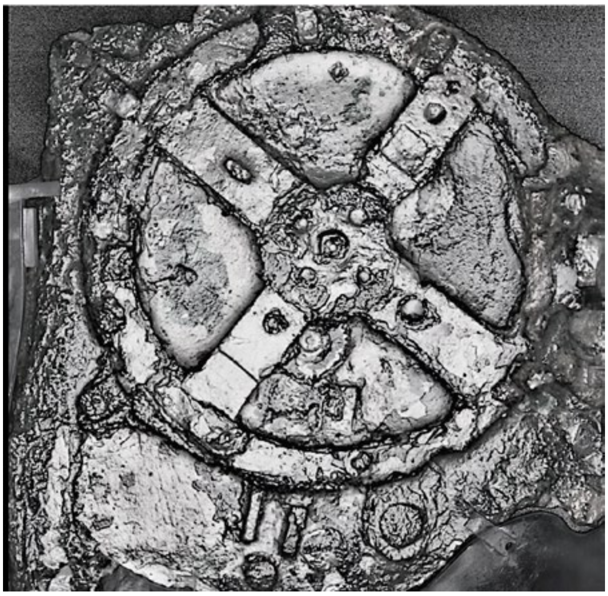

Figure 1. The 'sun gear'.

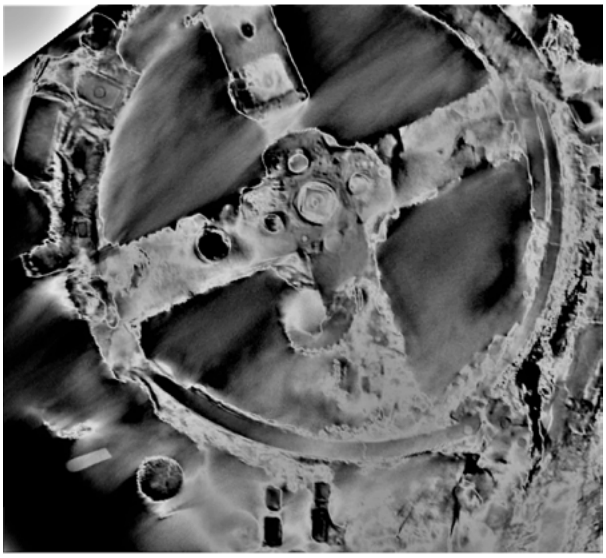

Figure 2. CT scan of the largest gear, the 'sun gear'.

sacrifices, but tells us to sit down at our desks and research centres and universities to become better at school and then in science. Plato says emphatically, using the words of the god Apollo, that science will provide solutions to all the problems of humanity.

Eudoxus gives a wonderful example of divine curiosity that guides humans to science and philosophy, leading men to study the cosmos and the prediction of celestial phenomena that the AM predicts. This important component of progress, the god-given curiosity of humans, is described by Plutarch in a passage concerning Eudoxus, who says, 'Let me go to the Sun, provided what I will understand of what the Sun is made, even if this way I will be burned like Phaethon'.[2] Phaethon was the mythical figure who travelled to the sun and was burned. The description of Phaethon shows in fact that it was a comet destroyed as it heats up approaching the sun. Divine curiosity is a gift humans have that enables them to study and understand nature under the guidance of *Anange* (Necessity), that urges humans from problems to solutions. Solutions to problems of humanity become more and more scientific for the Hellenistic period, centered at Alexandria.

The Antikythera Mechanism, an automatic machine that imitates the cosmic phenomena, is the result of many generations of scientists who began to study natural phenomena and predict some of them by using mathematics and gears that could perform calculations. The mechanism is the distillate of natural philosophy, the result of an excellent combination of theoretical reasoning, causality, with laws of physics, mathematics and engineering. During the 2nd century BC, science and technology in the Greek world inherited by Alexander is at its apogee. All the great scientists of the era – Epicurus, Straton, Zenon, Euclid, Eudoxus, Eratosthenes, Apollonius, Aristarchus, Ctesibius, Archimedes, Philo, Hipparchus, and later Hero, Ptolemy, and Pappus – worked and advanced science, technology and philosophy at the Museum and Library of Alexandria, where 400,000 books helped to establish the grandeur and legacy of Alexandria.

In this cultural, scientific and technological environment the AM was conceived and developed, representing an astonishing example of Hellenistic Alexandria, among many other technological inventions. Over the decades, weapon and shipping technology continuously improved, in parallel with many other applications similar to the mechanism.

What is the Antikythera Mechanism?

The AM is our oldest known example of a computer. It is a complex astronomical instrument, a dedicated astronomical computer, a mechanical cosmos, and a portable planetarium. The name of the instrument was originally called 'sphere' (automatic, mechanised celestial sphere) at the time of Archimedes (early 3rd century BC) and sometime later (3rd century AD, and thereafter) it went under the name of 'tablet', PINAKIDION (ΠΙΝΑΚΙΔΙΟΝ) in Greek, which means 'little table' (tablet). The mechanism is on display at the National Archaeological Museum in Athens. The mechanism is the dream of any astronomer of that time or even of today, as it predicts all celestial phenomena.

[2] 'Non posse suaviter vivi secundum Epicurum.'

It is a remarkable clockwork instrument that works with gears that were carefully designed, cut and assembled. It was made by some Greek 'philosopher', probably during the second half of the 2nd century BC, somewhere in the Greek world. It performs appropriate astronomical calculations with carefully designed bronze gears that accomplish the 'programmed' mathematical operations to predict astronomical phenomena.

It shows the position of the sun and moon in the sky; it gives dates in several calendars and possibly hours as well. It shows the age (phase) of the moon, with an ingenious method that is a good approximation of Kepler's second law, using an equivalent of a two-term Fourier series; it gives the perigee and apogee of the moon; it predicts solar and lunar eclipses. It also probably gives the position of the planets using the same mathematical method with various combinations of gears, what we call today planetary gears. We have discovered a set of gears, which are interpreted as planetary gears, that predicts the motion and position of Jupiter, using an equivalent of Fourier series with two terms.

Is the Antikythera Mechanism a computer?

The mechanism is really a computer. It is a device that has been programmed to do some calculations. It receives some input. The input parameters are longitude, latitude, time. Several constant parameters are permanently in the device. The period of the year, the period of eclipses (*saros* cycle), the periods of the moon, of the planets. Even the distances of the planets are in, as if one knows the retrograde motion and time, between stationary points that are frequently mentioned in the computer manual, it already has the appropriate distances of the planet in astronomical units (the distance of the earth to the sun). The mechanism is a mechanical, special-purpose digital computer based on the *unary* arithmetic representation, and not the binary, as with most computers.[3]

Every computer is, and has to be programmable. The AM is programmed with gears to perform calculations. The programmer designs the machine with appropriate gears with a number of teeth and in an appropriate train of gears, which, as they turn, provide the output with pointers on scales, six circular and two spiral, divided in appropriate divisions, in days, months or degrees, and possibly one more divided in hours.

The gears were designed to perform appropriate mathematical operations to predict all the then-known astronomical phenomena. It really is a realistic clockwork cosmos, with the moon following Kepler's second law. The mechanism was probably very striking in appearance, with ornaments like a Rococo clock, as the style of that era was similar. We can imagine that it was made of gold, silver and precious stones. In the manual we can read 'little golden sphere' (ΧΡΥΣΟΥΝ ΣΦΑΙΡΙΟΝ, 'chyssoun sphaerion'), probably a reference to the pointer of the sun, and again something like 'little silver sphere', which perhaps refers to the pointer of the moon.

The AM is much more advanced than any other ancient device, for example astrolabes. It has many similarities with the clocks of the Byzantium and the Arabs, and the astronomical clocks that appeared in western Europe for the first time around the 14th century.

The Pythagorean view of the cosmos at work in Alexandria

The study of the mechanism permits us to understand much better the way humans used science in antiquity, and one of our conclusions is that the advancement of mathematics, physics (and mechanics in particular), astronomy and engineering is much higher than estimated so far by the scientific community, even by specialists.

To imagine that one can predict natural phenomena, and conceive the construction of such a machine, a computer, an automaton, is a great step for humanity: one that was only possible with the notion of causality with its natural extension of the laws of physics expressed with mathematics and the practice of modelling natural phenomena.

The Antikythera Mechanism is the epitome, the best example, of Greek philosophy, the 'natural philosophy' of the Greek philosophers, mainly Ionian, the Pythagoreans, who, at the time of the construction of the mechanism, represent the mainstream concepts of the philosophy that spread all around the Mediterranean, with Alexandria being at its centre.

The AM, by producing the movements of celestial bodies, predicts the phases of the moon and eclipses, is apposite for a civilization that has developed and practised:

a) The notion of determinism (all events have a cause).
b) The notion of the laws of nature ('celestial law that sets the stars in their position'/ ΟΥΡΑΝΙΟΝ ΝΟΜΟΝ ΑΣΤΡΟΘΕΤΗΝ – Orphic Hymns).
c) That the laws of nature are expressed with precision only with appropriate mathematics (Pythagoras' axiom that the elements of nature are mathematical in essence, or nature started with mathematics (Πυθαγόρας τῶν ἀρχῶν τὰ

3 Ioannis Kontos, Emeritus Professor of Artificial Intelligence, personal communication, 2017.

στοιχεῖα ἀριθμοὺς καλεῖ – Diogenes Laertius, *Vitae philosophorum*).

d) That natural phenomena can be understood and interpreted with the laws of physics, with Pythagoras' understanding of the importance of laws of physics when discovering the laws of vibration, experimenting with a chord by using mathematics (Πυθαγόραν περὶ τὸ ἀριθμητικὸν εἶδος αὐτῆς· τόν τε κανόνα τὸν ἐκ μιᾶς χορδῆς εὑρεῖν – Diogenes Laertius, *Vitae philosophorum*).

e) And that occasionally certain phenomena can be predicted by the laws of nature.

To construct such a mechanism, a civilization has to have developed what is now called 'modelling' in science, i.e. in reality to conceive, develop and put into operation the doctrine of Pythagorean philosophy, that everything can be properly described by mathematics that the laws of physics have to be expressed with.

This scientific reasoning inside the AM, which is accurately written in the gear trains of the mechanism, make it an excellent instrument for teaching an introduction to science (the notion of causality, the laws of physics, the importance of mathematics and modelling), and, in fact, we use the AM today in schools for this purpose with relevant lectures and exhibitions.

The prediction of eclipses

The mechanism predicts both solar and lunar eclipses and shows the result on two dials: one spiral dial that shows the time during a 'Saros'[4] cycle, lasting 18 years, 11 days and 8 hours, and an 'Exeligmos' cycle of 54 years and 1 month.

Another great surprise is the fact that the mechanism predicts not only the time of an eclipse, but it additionally predicts where every eclipse is visible. The time of the eclipse is shown by the eclipse pointer on a spiral scale that lasts 223 months, and an ancillary pointer on a small circular scale that adds 0, 8, or 16 hours to the indication of the time, depending upon which 223 year cycle is in effect. One has to add 0 hours for the first 223 months, 8 hours for the next 23 months and 16 hours for the last 223 months of the 54 year and one month's period. The position of the moon in the sky is visible too on the front face of the mechanism, with the ecliptic, divided with the zodiac and in 360 degrees, and this shows the part of the earth where the eclipse is visible. The position is also visible on the scale of the phases of the moon.

[4] The Greek historian Abydenus, who lived sometime between the 4th century BC and 4th century AD, and the chronographer Georgius Syncellus provided a definition of 'saros' (in Greek meaning sweeping or scanning). The term was introduced into western European science by Halley.

Calendars and social life in antiquity

Since the dawn of humanity, people have understood that their lives depend on the weather and climate. Humans understand that weather depends upon the season of the year. Food gatherers have to move from one region to another depending on the crops that are available and with the changing seasons; the same applies for pasture lands and shepherds have to move with their herds. Hunting,[5] and especially fishing, strongly depend upon the phases of the moon. It is no coincidence that the menstrual cycle of women is so close to the synodic period of the moon;[6] probably related to the fact that selectively only women with a cycle locked and with appropriate phase with the lunar cycle could hunt effectively and eventually survive. Calendars based on the sun and moon have been developed to regulate social life and develop astronomical calendars based on causality and mathematics.[7] Civilization comes with the study of the cosmos, as Plato states, and we become humans, develop civilization, as we watch the sky, we admire the celestial bodies, we wonder, and from our efforts to understand what they are we develop civilization.

The oldest known record on a bone, with 29 marks, is possibly a representation of some 'lunar calendar' that dates to the 35th millennium BC from South Africa.[8] A similar, more spectacular, item is the painting that appears in the cave La-Tete-du-Lion, in France, that represents the lunar cycle, together with several star patterns, probably Aldebaran in Taurus, the Pleiades, and dates from the Solutrean epoch, *c.* 20,000 BC.[9]

Greek calendars are also very old. There are indications from archaeoastronomy of the existence of solar calendars in Greece as early as 6000 BC at Sesklo and Dimini[10] (Thessaly), as the megaron and acropolis of both these small towns are oriented towards sunrise and sunset, respectively, of the summer solstice: this is probably the earliest known calendar. Similar finds come from the Aegean,[11] where the numbers of repeating patterns on terracottas give astronomical numbers related to lunisolar calendars and even the *octaetiris*, an eight-year calendar that shows leap years and the synodic period of Venus. The months of a lunisolar year have been noted already from at least the Late Bronze Age,[12] around 1370 BC. Tablets from Knossos show eight names of months, and from Pylos (1200 BC) we have another six months, which shows an advanced calendar with a sequence of named months,

[5] Penteriani *et al.* 2011: 413-430; Poisson *et al.* 2010: 268-281.
[6] Cutler 1980: 834-839; Law 1986: 45-48; Zimecki 2006: 1-7.
[7] Ruggles 2015: 15-30.
[8] Naidoo and Webb 1987: 294; see also Graham-Mineola 2002.
[9] Rappenglück 1999: 391; 2015.
[10] Moussas 2017.
[11] Tsikritsis *et al.* 2015; Moussas 2014: 129.
[12] See Samuel 1972 and Hannah 2005.

with similar patterns of the names of the months from calendars of Classical times which are better known.

Every Greek city state has different names for their months, although all follow the same cycle. Two lunisolar calendars are in use in Greece: the *octaetiris* and the *metonic* cycle or *enneakaidecaetiris* (19-year). The *octaetiris* has eight tropical (solar) years, equal to 2921.93754 days, which is equal to 99 synodic lunar month or 2923.528230 days, 107 sidereal (with respect to the stars) lunar months, equal to five synodic periods of Venus around the sun, as we see the planet from the earth, or 13 Venus sidereal periods. The *octaetiris* is an excellent calendar, which any farmer or sailor could easily follow, as one can have a sign on the horizon, indicating that when Venus rises or sets, usually at the longest distance from the sun, it is the beginning of *octaetiris*.

The *octaetiris* was the calendar used for the Olympic Games on the Antikythera Mechanism, and it was in use probably from prehistoric times, although historical sources attribute this calendar to Eudoxus (407 BC - 335 BC), and Censorinus attributes this calendar to older times and Cleostratus of Tenedos (520 BC - 432 BC). Indications from ancient vases show that *octaetiris* was in use from prehistoric times and the Olympic Games prove that it was in use from at least 776 BC. This eight-year period consists of five years with 12 months and three years with 13 months. Every eight years an extra three months are added and one extra month of 30 days is added during the 3rd, 5th and 8th year of this calendar.[13] These three months correct the difference between the lunar year that consists of six months of 29 days and six months of 30 days, taking into account the period of the moon that has 29.5 days approximately and the solar year with 365.25 days. The difference between the solar year and the lunar year is approximately 11 days (365.25 – 6 x 29 + 6 x 30 = 365.25 – 354 = 11.25 days). The addition of an extra 13th month every three or two years makes the *octaetiris* consistent with both the solar and lunar calendar, and predicts the phases of the moon with an accuracy of 1-2 days in a period of 8 years. The *octaetiris*, a lunisolar and relatively accurate calendar, was used by Christians for Easter up until the 13th century, when it was replaced gradually by a new *paschalion*, based on the calendar of Meton. Both the *octaetiris* and the *metonic* calendar feature in the Antikythera Mechanism.

Venus has a 5:8 resonance with the earth and the sun. This resonance of 5:8 exists in some ancient vessels, and the eight-year period used by ancient Greeks was adopted as the basic period by some rulers. This 5:8 resonance is commonly used in, music and dance, for Greece and elsewhere. I suggest that the *octaetiris* was the Minoan calendar.

The *octaetiris* period features in the AM (the Olympic dial and the moon dial) and was the period that king Minos ruled by on Crete. To keep the proper calendar, the Greeks sacrificed seven boys and seven girls at the beginning of the *octaetiris* in mythical times, as the myth of Theseus describes. It seems that it was a pan-European calendar. Similar sacrifices are known in Scandinavia, and near ancient Uppsala there are several artificial hills that mark the horizon and where a royal 'observatory' plotted the lunisolar *octaetiris* calendar, observing the rise of the moon, Venus and the sun. The sacrifices there included 8 young men, 8 male animals of various species (8 bulls, 8 stallions, 8 rams, 8 dogs, etc.). These sacrifices stopped when Christianity became the dominant religion, and in 1084 the mid-winter sacrifices also ceased.[14] Similar mid-winter sacrifices were also practised until recently by native American Iroquois to keep a calendar.[15] It seems that to keep good calendars sacrifices were common for both prehistoric and modern communities.

The most useful lunisolar calendar is the *metonic* cycle, developed or refined during the 5th century BC at the astronomical observatory located behind the speaker of the Pnyx, one of the ancient parliaments of Athens called the *ecclesia*, the popular assembly of some 6000 citizens. This shows the significance of astronomy and the need for a good calendar to regulate economic, social, and political life. This calendar was developed, and probably refined, by the astronomer Meton in Athens, as there are indications that a 19-year calendar was in use in prehistoric Greece. The *metonic* calendar is a 19-year cycle, equal to 235 synodic months, of which 7 *embolismic* or intercalary months added at the end of years of 13 months. The *epirotic* calendar revealed within the AM is the first complete *metonic* calendar known with the sequence of all months.

Both the *metonic* 19-year and *octaetris* 8-year calendars are found within the AM. The *metonic* calendar has the following names of months: Finikaios, Kreneos, Lanotropos, Machaneus, Dodekates, Ekklious, Artemisios, Psydreus, Gemelius, Agrianios, Panamos, Peleos; these are all probably from an *epirotic* calendar. Epirus calendars belong to Corinthian family of calendars, calendars with cities under the influence of Corinth, which in turn belong to the larger category of Dorian calendars. It is hard to identify the calendar of the mechanism with a particular city. Very few ancient calendars are known, and these are incomplete. Corinth's calendar is also incomplete, perhaps because the Romans devastated the city, as happened at Athens.

[13] Hannah 2005: front cover.

[14] Henriksson 2003; and Henricksson pers. com. (2009).

[15] Blau 1964: 97-119.

Seven months of the AM calendar coincide with the calendars of Corfu, Taormina, Bouthroton (now in Albania), Dodona, Ambracia and Rhodes; four months equate with Heraclea, and three months are common with the Spartan, Macedonian, Sicilian and Seleucian calendars; two months with Corinthian (only a few months are known), and one common month with Athens, Ephesus, Smyrna, Miletus, Athens, as well as with tens of other Greek cities across the Mediterranean. It has to be noted that we do not know a few months of the calendars of only a few Greek cities in the Mediterranean, including the main Greek region. It is difficult to interpret the use of this Epiros calendar to pinpoint the city where the AM was in actual use. Perhaps it reflects the origin of the rich person who had in his possession this very expensive mechanism. Perhaps the owner of the mechanism was a rich man from Epirus who was in a very rich city, for example Rhodes.

Callippus (370 BC - 300 BC), the successor of Meton, studied and worked at the Academy of Plato, under the guidance of Eudoxus, and continued astronomical worked with this friend of Aristotle's, and modelled the motion of all celestial bodies, the five planets, with four spheres for every one, and three concentric spheres for the sun and moon. Callippus created what he believed to be an even more accurate calendar than Meton's, one that extended to 76 years, i.e. four times the *metonic* cycle, less by one day. This 76-year calendar is based on the assumption that the length of the year is 365¼ + 1/76 days, based on his measurements and calculations. With this 76-year period the lunar phases are repeated at the same day and hour. Callippus establishes this as a new long, accurate calendar, the *callippic* cycle of 76 years. The first period began at the summer solstice of 330 BC. This 76-year calendar was also adopted by the AM and predicted the phases of the moon to one hour. The 76-year calendar is considered by some as the 'great year' (megas eniautos), for example Aëtius in *De placitis reliquiae (Stobaei excerpta)* says that the 'great year' is the *octaetiris*, or the *metonic* or *callipic* period, or a 61-year period, as Eonopedes and Pythagoras believed, while others held that it was the time taken for all the planets to return to the same place,[16] in a line with the sun; Heraclitus calculates this value to be 80,000,000 years.[17]

Figure 3. The lunar dial. The moon is the hollow hemisphere, where originally a small sphere represented the moon.

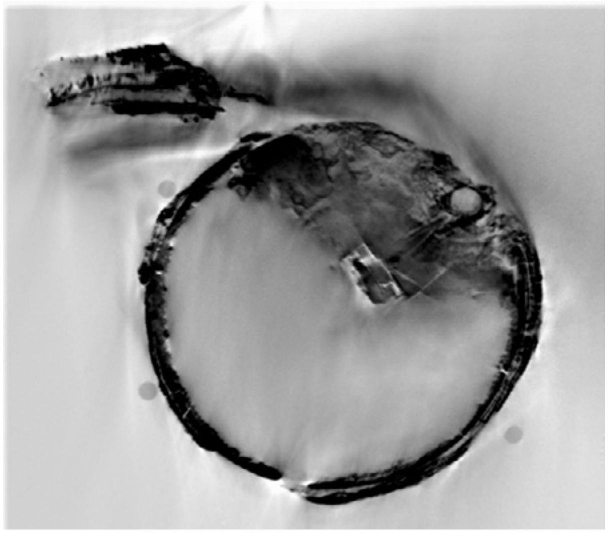

Figure 4. The lunar gear that rotated the moon, so that it changes phases during the month. The dial of the moon, a semispherical structure is also visible.

The solar and lunar dials

The solar dial is circular with two concentric discs of the solar year divided into 365 days and 12 months, with the Greek version of the Egyptian months Pachon, Pauni, and Epiphi. The other months (Thoth, Paophi, Athyr, Hoiak, Tubi, Mechir, Phamenoth, Pharmuthi, Mesori) are missing, as the dial is broken and only a quarter remains in fragment C, the third largest. The pointer of the sun was probably a small golden sphere that turned during the year, the ecliptic, which has the zodiac divided into the 12 zodiacal signs in Greek with names and in 360 degrees. The names of the zodiac mentioned mainly in the manual are: Krios Aries, Tauros Taurus, Didymoi Gemini, Karkinos Cancer, Leon Leo, Parthenos Virgo, Chelai Libra, Skorpios Scorpio, Toxotes Sagittarius, Aigokeros Capricorn, Hydrochoos Aquarius, and Hychtheis Pisces.

It is possible that the sun had a variable speed, following Kepler's second law, with the gear in fragment D (the

[16] Aëtius in *De placitis reliquiae (Stobaei excerpta)*: Τὸν δέ γε μέγαν ἐνιαυτὸν οἱ μὲν ἐν τῇ ὀκταετηρίδι τίθενται, οἱ δὲ ἐν τῇ ἐννεακαιδεκαετηρίδι, οἱ δ' ἐν τοῖς τετραπλασίοις ἔτεσιν, οἱ δ› ἐν τοῖς ἑξήκοντα ἐν οἷς Οἰνοπίδης καὶ Πυθαγόρας.

[17] Ἡράκλειτος ἐκ μυρίων ὀκτακις χιλίων ἐνιαυτῶν ἡλιακῶν.

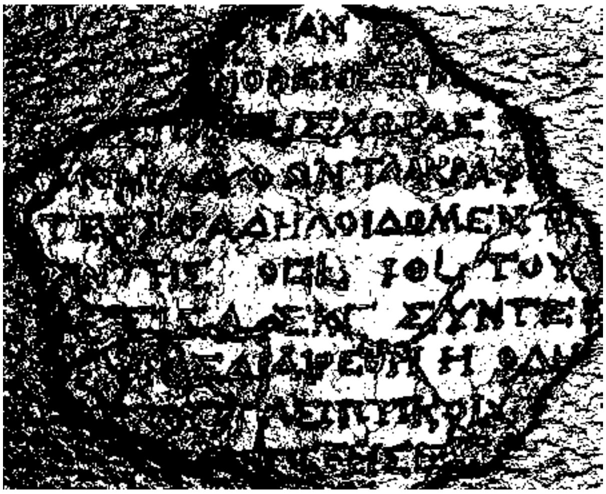

Figure 5. Part of the 'user manual' with the laws of physics used to predict the phases of the moon, the *Metonic* and *Callippic* cycles, and the *Saros* cycle for eclipses.

one that my study suggests represents the planet Jupiter).

The prediction of the phases of the moon

The moon, that enigmatic body, has been widely used for millennia to measure time and regulate lives, with so many activities dependent on its phases. The phases and months of a Greek calendar that lasts 19 years, are represented in Meton's cycle, the calendar we still use today to determine Easter.

Another totally unexpected function of the AM is that the lunar dial follows Kepler's second law, the moon moving at variable velocity: faster at perigee – the closest position of the moon to the earth; and slower at apogee – the most distant position of the moon. The moon in the AM was probably a small silver sphere fitted in a hollow hemisphere of copper at the end of the conical axis that was turned by of gears, one of them cylindrical, and indicating just how advanced and complicated the mechanism actually was. The moon in the mechanism moved around the earth in one *synodic* month, and at the same time the little silver moon rotated to show the lunar phases: new, first quarter, full, etc.

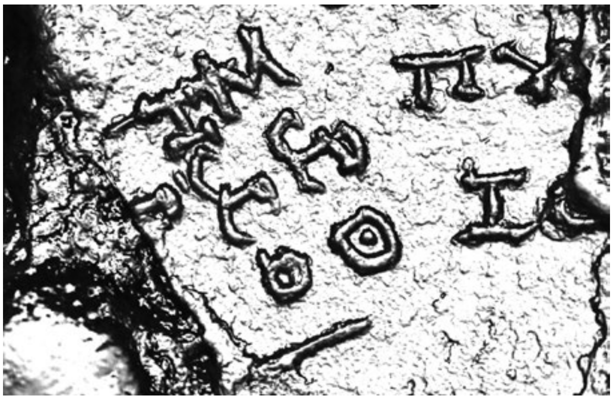

Figure 6. The prediction of eclipses of the moon and sun, that will take place at the 9th hour. Part of the 'user manual' of the device; the 'laws of physics' for the prediction of the phases of the moon and eclipses, as they understood them at the time.

The variable speed of the mechanism is produced by a combination of four gears, all with the same number of teeth. Two of the gears are parallel, one on top of the other, but slightly offset, eccentric, with the eccentricity of the moon's orbit around the earth. These two gears are linked by a pin fixed in one gear and fitted inside an elongated hole cut along a radius. As one gear turns it forces the other to turn too, but as they are offset the distance varies, the speed, which is equal to the distance (which varies during the turning) times the angular speed of the first gear, is variable, reproducing realistically the motion of the moon. This mechanically reproduced motion of the gearing is very close to the one predicted by Kepler's second law, to an accuracy of *c.* 0.2 to 0.4%.[18]

The Olympic dial

Another great surprise revealed within the AM was the Olympiad dial and circular display, lasting 4 years, with indications of important Greek festivities and games: Olympic (assumed to have begun in 776 BC), Pythian, Isthmian, Nemean, and, probably, Halieian (Alieian). The games, in general, included theatrical, musical, poetical and other artistic competitions, having an important social and even political influence in the Greek world and later for the Roman Empire as well.

The user manual and the planets

The AM, like with all scientific instruments, has a 'user manual' with instructions (perhaps how to open it, set it up, what one might expect to see within this mechanical cosmos, how to use it properly). It also likely described an extensive astronomical compendium containing the laws of physics, as understood at the time, to predict eclipses, solar and lunar, and the phases of the moon, as well as the motions of all the five known planets. From the manual of the 'computer' it is evident that, for the first time, the Greeks knew the very long periodicities of the planets, of the order of 500 years: 462 years for Venus and 442 years for Saturn. The emphasis is on the forward- backward motion (retrograde) of all the planets, with many details that are evident despite the fragmented text.

[18] Gourtsoyannis 2010: 540-544; 2012: 285-289.

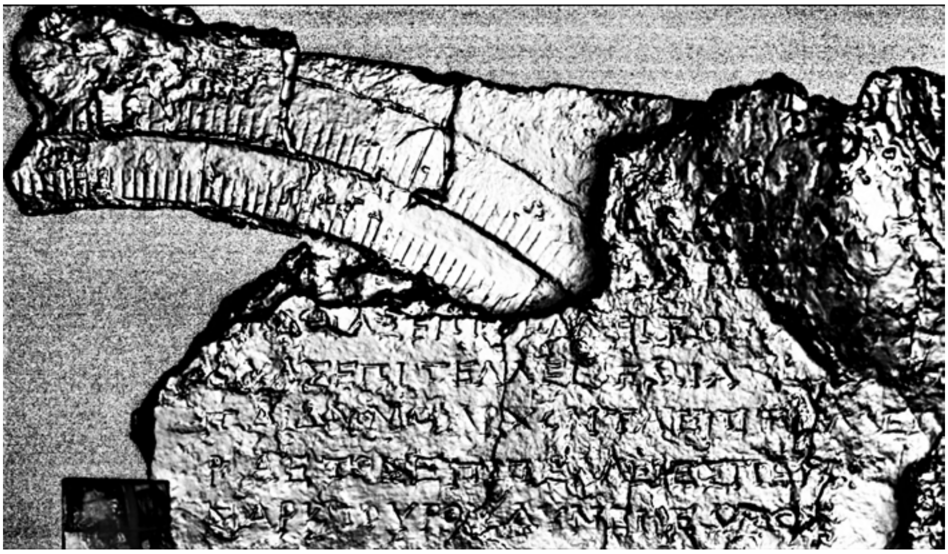

Figure 7. Part of the scale of the year, and the scale of the zodiac.

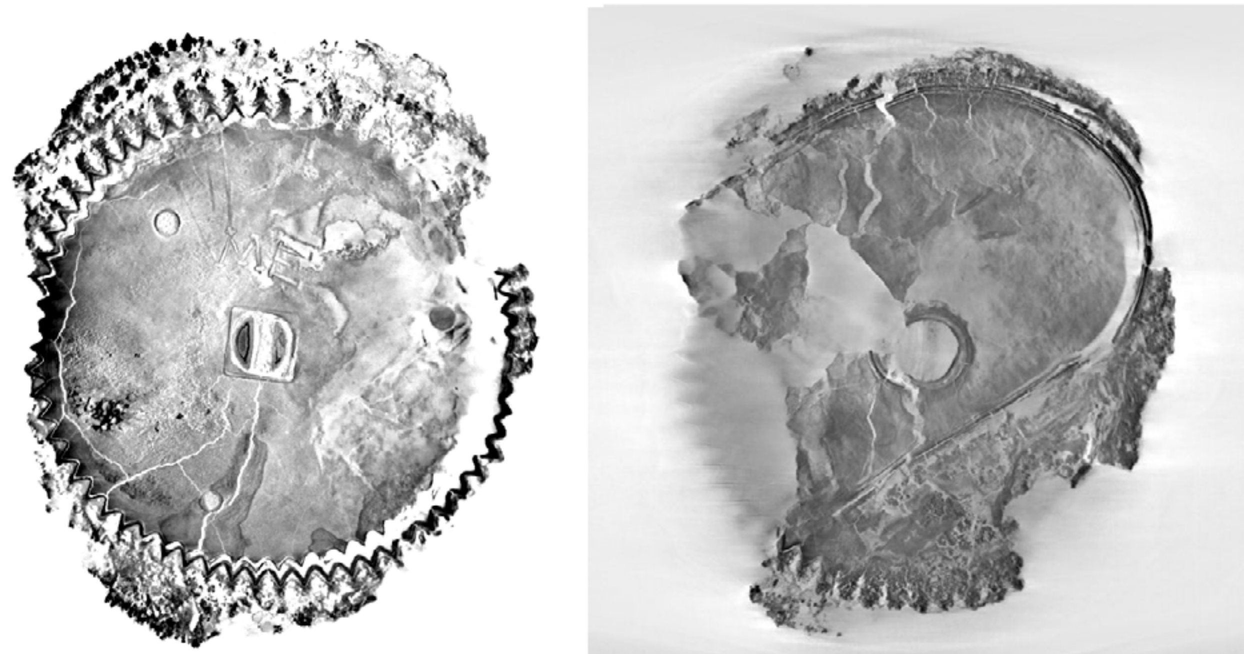

Figure 8. The planetary 'gear' of Jupiter. It turned and a pointer attached to it performed an epicycloidal motion.

In the remains of the mechanism some 20% of the front plate has survived (including about 90 degrees of the zodiac and a very important part of the so-called *parapegma*, a series of 36 rising or setting of stars at sunrise or sunset that mark correctly the date of the year, every 10 degrees on the ecliptic or 10 days apart). Of the back plate, about 25% has been saved, giving approximately 33% of the *metonic* cycle, sufficient to ascertain: all the *epirotic* months of this 19-year lunisolar calendar, which is the traditional Greek calendar, i.e. the same used for Easter and other events today; almost all of the four-year, or, more correctly, the 8-year calendar of the Olympic and other important Greek games; 33% of the *saros* scale, the eclipse calendar of 18 years, 11 days and 8 hours; over 50% of the auxiliary dial of 0.8 (Θ) or 16 (Iς) hours that have to be added to the indication of the helicoidal (spiral) dial of eclipses – however, unfortunately the sign for zero is missing, which was probably 'o' (omicron, the first letter of the term *OUDEN*, meaning *not one*, for zero). Approximately another 20% of the back cover door has been saved, with a part of the astronomical compendium.

The texts of the manual are written on all available plane surfaces on copper sheets that comprise the two covers of this double-faced astronomical clock. This includes not only the doors of the mechanism that protect the instrument when in transport, but also the plates with the dials. Some of the sheets of copper the manual was written on have been partly lost, perhaps still at the bottom of the sea – where the archaeologists currently diving there will eventually rescue them – but there is still sufficient material to enable us to understand many characters and interpret much of the text from the remaining fragments, despite the rust.

The text is written in almost classical capital Greek letters (serif type), which have been dated, based on the form of the letters to around 150 to 100 BC.[19] The size of the letters is extremely small, *c.* 1.2 mm to 3.0 mm. They were inscribed with a chisel with two blades, one with a straight cut and the other with a semicircle, which allowed the experienced craftsman to form these capital letters at ease, making them extremely uniform, in a serif style with a stroke at the end of the letters, making the unequal letters appear equal in size. The language is the common Greek of the time, close to the Attic dialect, which was common for scientific texts of that era.

The planetarium

Man began to notice the differences in the motion of the planets very early in his history,[20] and gradually to develop advanced mathematical means to model and predict the motion of the planets. Astronomy was already important at the time of the first European texts of Homer and Hesiod. The first scientific description of the heavens in human history is made by the pre-Socratic philosophers with the introduction of geometry. A sphere for the firmament, with the fixed stars, that returns around the earth in one day, is a very natural element that many cosmologies have. To this, the Greeks added a rotating sphere for every planet and conceive models of the cosmos with concentric spheres around the earth. The Pythagoreans, at the time of Socrates, with Philolaus (*c.* 470-385 BC), a student of Pythagoras himself, introduced a non-geocentric model, with the planets moving on homocentric spheres around a central 'fire', probably because they understood that the distances between the planets vary with time. Philolaus puts the 'fire' in the centre of the cosmos (the solar system) and the earth moves around it, as do all the planets, including the sun. So the Pythagoreans[21] introduced a non-geocentric model with eccentric orbits for the earth and every planet. Pythagoras and his disciples probably knew well all these motions and periodicities, and he even created the musical scale – taking into account the resonances and periods of the planets. Certain men at that period were already aware of all the parameters of the retrograde motions of the planets, which were probably known since prehistoric times,[22] and the periodicities of planets are found depicted in the form of repeated patterns with exact numbers on ancient terracottas (e.g. the 'frying pan' vessels of the 4th and 3rd millennia BC from Greece). Additionally, the Pythagorean musical scale, the music of the spheres[23] that even Kepler and his followers knew, was in use as late as the 19th century AD.

The first fully mathematical model known, with many details, is the one that incorporates 27 homocentric spheres by Eudoxus, to which Callippus adds seven more. These spheres did their best to imitate the motions of the planets as seen from the earth, with each sphere rotating around an axis through the centre of the earth. The Eudoxus model uses three spheres for the sun and moon, and for every planet four spheres; the celestial sphere that accounts for the daily rotation of the earth; the ecliptic sphere for the yearly trajectory of the earth around the sun; the planetary sphere for the trajectory of this planet around the sun; and one more for the inclination of the planet to the plane of the trajectory of the earth around the sun.

The Antikythera shipwreck

The AM was been found in a huge ancient shipwreck[24] that sunk probably around 60 to 80 BC, as the archaeologists estimate from the coins found. It foundered near the little Greek island of Antikythera, between the Peloponnese and Crete, at a location on the sea-route between Asia Minor, the Greek mainland, the Aegean Sea in general, and Italy. Most probably the large vessel was on its way to Rome laden with Greek treasure, either 'official' war loot or merchandise. The ship was a very prestigious craft, covered with sheets of lead on very thick planks (14 cm), with massive copper nails some 40 cm long, many of which have been recovered by the archaeologists. In the literature, the only ship that can be compared to this one was the *Syrakossia*, or *Alexandria* (*Alexandris*), a legendary ship that Archimedes designed and instructed the ship-builder Archias of Corinth to construct on the orders of Hieron II, tyrant (king) of Syracuse, to be delivered

[19] Char. Kritzas, pers. com. (2006).
[20] Tsikritsis *et al.* 2015.
[21] Simplicius Aristotelis quattuor libros de caelo commentaria: Κατεγνωκότες οὖν τῆς τῶν ἀνελιττουσῶν ὑποθέσεως οἱ μεταγενέστεροι μάλιστα διὰ τὸ τὴν κατὰ βάθος διαφορὰν καὶ τὴν ἀνωμαλίαν τῶν κινήσεων μὴ ἀποσώζειν τὰς μὲν ὁμοκέντρους ἀνελιττούσας παρῃτήσαντο, ἐκκέντρους δὲ καὶ ἐπικύκλους ὑπέθεντο· εἰ μὴ ἄρα ἡ τῶν ἐκκέντρων κύκλων ὑπόθεσις ὑπὸ τῶν Πυθαγορείων ἐπενοήθη, ὡς ἄλλοι τέ τινες ἱστοροῦσι καὶ Νικόμαχος καὶ Νικομάχῳ κατακολουθῶν Ἰάμβλιχος.
[22] Tsikritsis *et al.* 2015.
[23] Joannes Laurentius De mensibus writes on planets and musical notes: Πάντας τοὺς ῥυθμοὺς ἐκ τῆς τῶν πλανήτων κινήσεως εἶναι συμβαίνει· ὁ μὲν γὰρ Κρόνος τῷ Δωρίῳ, ὁ δὲ Ζεὺς τῷ Φρυγίῳ, ὁ δ' Ἄρης τῷ Λυδίῳ καὶ οἱ λοιποὶ τοῖς λοιποῖς κινοῦνται κατὰ τὸν Πυθαγόραν πρὸς τὸν ἦχον τῶν φωνηέντων· ὁ μὲν γὰρ Ἑρμοῦ τὸν α , ὁ δ' Ἀφροδίτης τὸν ε , ὁ δ' Ἥλιος τὸν η , καὶ ὁ μὲν τοῦ Κρόνου τὸν ι , ὁ δὲ τοῦ Ἄρεος τὸν ο, καὶ Σελήνη τὸν υ, ὅ γε μὴν τοῦ Διὸς ἀστὴρ τὸν ω ῥυθμὸν ἀποτελοῦσιν· ὁ δὲ ἦχος τῶν ῥυθμῶν ὡς ἡμᾶς οὐκ ἀφικνεῖται διὰ τὴν ἀπόστασιν.
[24] I. Svoronos 1903; Weinberg *et al.* 1965: 3-48; Kaltsás *et al.* 2012; Christopoulou *et al.* 2012).

as a gift to Ptolemy III in Alexandria. The ship, probably 120 m long (Aelian says 400 feet in length), with a capacity of some 2000 tons, boasted eight towers for archers: she could carry 1940 men. Besides being well equipped generally, other features included a gigantic catapult and armour-plating around the hulls for stability and safety. She was eventually delivered to Alexandria around 240 BC. Syracuse had a long and very good name for ship-building. Dionysius, tyrant of Syracuse, was celebrated for his *tetrereis* ('fours') and *pentereis* ('fives'), the latter being his own invention. The Antikythera vessel is similar, probably in many ways and certainly in terms of its construction with lead armour-plate.

As noted, the Antikythera shipwreck was a very large vessel, at least 40-50 m long and some 9-12 wide, with a minimum of 300 tons. The specialist diver Admiral I. Theofanides, who dived there many times on training exercises, insists that the ship was around 60 m long and that part of the wreck has now fallen into a chasm to a depth of some 125 m.[25] A section of the ship was roofed with huge tiles of Corinthian type (70 cm long).

The remains of the bottom of the ship cover an area of *c.* 45 m x 10, as the various excavations and finds show.[26] These finds consist of a conglomerate containing several statues and other artefacts. The wreck was discovered in April 1900 by sponge divers from Syme, and six months later the first underwater archaeological research began. Some 118 years later, this fascinating and rewarding long-term research project is still revealing wonderful results, as it will continue to do for at least another century. What is more, a new and similar shipwreck has been discovered a few tens of metres away, and this, too, will provide many significant finds.

Probably more than 100 fine Parian marble statues were on the ship, together with, at least, another ten or so bronzes, including the expressive 'Antikythera Philosopher', estimated to have been cast around 240 BC; the figure is probably a Cynic philosopher, the very wise *Bion* of Borysthenes (*c.* 325-246 BC), holding a 'pen' (chisel) in his left hand, with which to inscribe on a waxed tablet. Another bronze, known as the 'Antikythera Youth', is probably Paris giving an apple to Venus, or even holding the Antikythera Mechanism itself? Many more broken parts of bronze statues, including a boxer, have been found in the past, and, especially, during the very successful recent campaigns. An eye witness in 1901, when the Symian divers, with the help of the Greek navy, were trying to rescue the heavy antiquities from the sea floor, said that a huge piece of statuary, probably a rendition of the 'Laocoön Group' with his children and serpents, was so massif that the rope (with a diameter of *c.* 10 cm) broke and sank into a chasm, waiting for modern archaeologists to salvage it one day.

Astronomical clock

A very important question is whether the AM was also actually a clock with continuous motion and showing the hour. An answer is provided based on certain Greek texts that describe automata and similar clocks that predate the Antikythera find, such as the famous clock of Archimedes. The motion of these Greek clocks was regulated by a float inside a prismatic container of water, where the level of water increases at a constant rate. Water drips into the prismatic water container, and, as the level goes up, buoyancy lifts the cork floating in it, as Hero describes, with the float rising at the same constant rate. The float is linked to a weight by a string or chain, similar to a cuckoo clock. The chain (or string) is fixed around a gear or a cylinder, similar to a bicycle. The other end of the chain is a counterweight. All this apparatus (float-weight-chain-gear-counterweight) moves as the level of water increases. This type of automata is described in Greek texts, e.g. that of the Alexandrian philosopher, and renown mathematician, Hero, mostly celebrated as an engineer for such work.

The assumption that the AM was designed to be static is not very logical. The mechanism is the most advanced artefact we have from ancient times, and much more advanced that we could have imagined. If the Greeks had continuously working clocks, then is it possible they would have manufactured such an advanced and extremely expensive clockwork system that lacked actual motion? Improbable! Proclus states that small instruments like this (known as tables or tablets) showed continuously the motion of the sun, thus they are clocks.[27]

Use of the Antikythera Mechanism

What uses did the AM have? The device would have been used by astronomers, philosophers in the universities of the time, the philosophical schools, by rulers and wealthy individuals to display and impress friends and rivals, by military leaders at land and sea, by geographers for the making of accurate maps, by travellers, and, naturally, by ships' captains. I argue that the excellent maps, which improved greatly from the era of Alexander, benefitted from such devices,

[25] I. Theofanides, pers. com. (2007).

[26] A Simosi, pers. com. (2017). On 18 February 2016, Brendan Foley gave a talk entitled 'New Underwater Research at Antikythera', at the American School of Classical Studies at Athens (http://www.ascsa.edu.gr/index.php/News/newsDetails/videocast-new-underwater-research-at-antikythera).

[27] Πρόκλου, Υποτύπωσις αστρονομικών υποθέσεων: «Τούτων δὴ οὖν ηὑρημένων δυνατὸν ἔσται σοι καὶ πίνακα ποιῆσαι δεικνύναι δυνάμενον ἀδιαλείπτως τὴν τοῦ ἡλίου κίνησιν».

as did the geographies of Eratosthenes, Hipparchus, and, especially, the eight-volume geography of Claudius Ptolemy, referencing thousands of cities with coordinates that are relatively accurate, despite the fact that the coordinates show systematic deviations for many reasons, including a larger value for the earth's perimeter. All these excellent maps cannot be created from measurements taken during eclipses, as this is technically extremely painful and practically impossible. It is difficult to have thousands of well-trained scientists all over the world at the right time of the eclipse.

The measurement of the longitude of a point on earth is possible using machines such as the AM and appropriate astronomical tables. Seafarers, until recently, and before the GPS era of course, could only calculate longitude and latitude using similar astronomical observations and methods, and students of naval, and particularly military schools are still taught these astronomical methods to determine coordinates, especially in war situations when GPS satellites are cut off or jammed electronically.

In brief the possible uses of the Antikythera Mechanism might have included: astronomical computer; astronomical instrument; to impress friends; calendaric mechanism; meteorological instrument, to predict weather with the *parapegma*; festival date determination (Olympic, Pythia, Nemea, Isthmia, etc.); teaching device; anaphoric clock; mechanical universe; planetarium; to measure geographic latitude and longitude; cartography; for navigation; clock.

Automata and the existence of other similar mechanisms

The mechanism, which is the first known computer, is really based on the same principles of science that Pythagoras or Plato describe: the laws of physics expressed via mathematics. The Greeks had mechanisms, automata, and advanced weapons, such as ballistic machines. It is known that the ballista and the *polybolos*, a Greek repeating ballista created in the 3rd century BC, were constructed by Dionysius of Alexandria, an engineer with first-hand experience from Rhodian workshops (which it seems were the best). The inheritance and heritage, the legacy of Archimedes in science, especially in mathematics and technology at the time of the construction of mechanism, was already prodigious. It is no surprise that Archimedes' screw-pump has revolutionised agriculture worldwide, especially in Africa, where it is still at work. The same applies for inventions concerning clock-making and functioning. The escapement of clocks, usually considered to be a much later invention, which regulates them, is described by Philo of Byzantium,[28] who lived and worked in Alexandria, in his work *Pneumatics*. Philo's escapement is based on a system of turning and counterweighted receptacles that, when filled with water, or when a sphere drops, their weight makes them tip and this in turn triggers an action; this can be controlled at a constant rate. We know that the famous clock of Archimedes (287 BC - 212 BC) had such a mechanism, not as an escapement, but to trigger an automaton every hour. Ctesibius (*c.* 285 BC - *c.* 222 BC), who lived and worked in Alexandria, where he was probably a disciple of Philo, describes many interesting machines, including clocks. Alexandria has been for centuries the centre of science, mathematics, technology and philosophy. It is almost certain that Archimedes, who also lived and worked for a period at the Museum of Alexandria and the Library, and who was a contemporary of Ctesibius, must have interacted for a long period with – and both were probably students of – Eratosthenes (276 BC - 195 BC), who was older, and with whom Archimedes exchanged several extremely interesting letters.

It is well known from the literature that ancient Greek clocks had several automations, as is evident from the study of Archimedes' instrument,[29] or the clock of Gaza, as described by Procopius in his book *De Aedificiis* (Peri ktismaton). Numerous automata were developed by the Greeks over the centuries, including water-regulated clocks. The earliest examples mentioned in the literature are those of Plato and Aristotle, followed by a seemingly more advanced clock designed by Ctesibius, and the famous automata engineered by Hero of Alexandria and Vitruvius.

From the Antikythera shipwreck, the archaeologists discovered one statuette the same size as the mechanism that rotates around itself. It is possible that this statuette was an automaton that rotated every hour and showed the time on a scale, like the Ctesibius device.

Greek automata, like Archimedes' clock, operate with weights, strings or chains and a float, and also with little spheres that drop in a scoop-like mechanism that trigger every hour an automated action of some kind. Similar machines existed in Asia Minor, such as the Islamic castle clock designed by al-Jazari, and in the West there were European medieval monumental clocks, towers in central squares, churches and city halls.

A team of archaeologists under the guidance of the Greek Ephorate of Underwater Antiquities (A. Simosi, T. Theodoulou, D. Kourkoumelis and B. Foley) have

[28] Lewis 2000: 343-369.
[29] Heiberg (ed.) 1972.

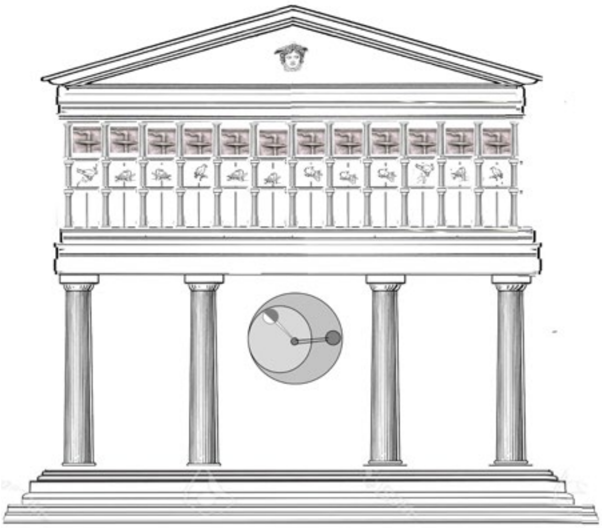

Figure 9. A drawing of the famous 'Gaza Clock' that performs several automations to show the time, with 12 doors opening during the day, birds singing on the hour every hour, and 12 lights that show the time at night.

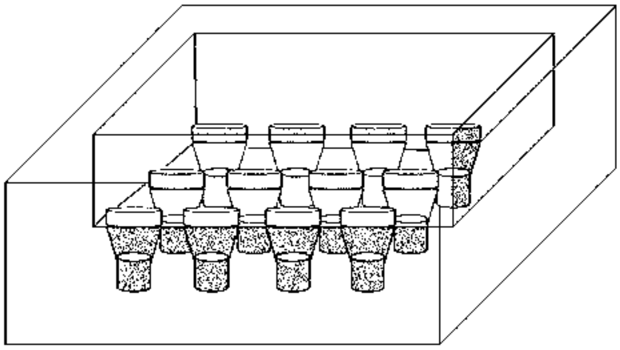

Figure 10. The 12 conical 'valves' used for automations of the mechanism. The structure of a stone of uncertain function discovered by archaeologists working on the underwater Antikythera site, which perhaps triggered 12 actions at given times.

discovered many new important finds. Of particular importance is the rectangular curved and hollow stone construction with a system of 12 parallel holes (3 x 4). These parallel holes start like conical valves (?) and become cylindrical as they exit the rectangular construction. Every one of these conical cylindrical holes is similar to the valves of many of the automata designed by Hero, or the valves of every car. If every valve (?) had a conical tap attached to a string with a length proportional to the time the automation had to operate, and all strings were attached to a turning axis, then every valve (?) could open at a predetermined time. If the length of the strings is proportional to the hour selected to trigger it, say every hour, then an action could start on the hour, as the Gaza clock does, for example (see below).[30]

Computer tomography has recently been undertaken on this artefact at the Evgenidion Hospital of the University of Athens, and we have studied the internal structure of the carved stone, with its filling of unknown material, and the conical holes (valves?). In the filling (sand), the CT scans reveal a string made of dense material, probably metal.[31]

Archimedes was the first to study mechanics with mathematics, like the levers, that he uses in his clock for automations. This clock is described in three books, and in detail is several Arabic ones, referred to as the Archimedes clock. At least ten authors, Greek and Roman, describe the spheres of Archimedes. Pappus, Proclus, Sextus Empiricus, Cicero, who gives four detailed descriptions, Martianus Capella, Ovid, and Tertullian. Sextus states that he admires not the wooden parts of the complex automaton, but the creator Archimedes, who gives automatic motions for the sun, moon and the other stars (planets). Unfortunately Archimedes' book on automatic celestial sphere making is now lost.

Archimedes' works are considered to be of great importance. The historian John Skylitzis (1040-1101 AD), when writing his biography of the Byzantine Emperor Leo the Philosopher, says that he had read Archimedes' works, which he understood to be amazingly difficult and readable only by specialist scholars. It was this very impenetrability that helped bring about the ultimate loss of Archimedes' books (as well as scientific books by others): his readership was so restricted that libraries would not hold them and they seem to have been rarely copied.

Although the Antikythera Mechanism, and other 'tablets', were made of expensive materials (i.e. gold, ivory, ebony, silver, etc.), it is clear from ancient books that there were cheaper constructions available (wooden versions for example), although probably these were simpler versions of the mechanism. Scientists required more basic instruments, with fewer functions, intended for a particular use. Such devices were used, inter alia, by the military, geographers, and perhaps even the captains of large ships, as well as philosophers, teachers, and astronomers in their schools (i.e. the ancient universities of the ancient age), as Cicero tells us in his description of Posidonius' philosophical school on Rhodes, where the great philosopher studied.

[30] Special thanks are due to A. Simosi, B. Foley and colleagues, the Aikaterini Laskaridis Foundation, and especially P. Laskaridis, for continuation of the underwater archaeological excavations and the new finds from Antikythera.

[31] The possible function of the item presented here reflects a working hypothesis of the author.

The mechanised celestial spheres of Archimedes are of great importance.[32] They probably predicted not only the positions of celestial bodies realistically, but perhaps also those eclipses based on the periods of Saros and Exeligmos, in combination with the celestial map based on Meton's cycle, showing the actual regions on earth where every eclipse is visible. Cicero writes that Gaius Sulpicius Gallus put in motion the mechanical sphere and the moon began to turn many times around the earth, before finally returning back to the same position with respect to the sun.[33] The time taken was supposedly realistic and the moon periodically entered into earth's shadow when the three bodies were aligned. (Although at this part of the Archimedes' book eight pages were missing.) Equally important is the description of the sphere of Archimedes in a theological book by Lactantius (*Divine Institutes*), in which he describes it as a model of the cosmos, where the sun and moon move with variable speeds that imitate realistically the actual universe that turns too. Equally important is Ovid's description of Archimedes' mechanised cosmos with the earth being a small sphere at the centre of the universe at equal distances from the stars. Very interesting is the description of the sphere given by Cladian (Claudius Cladianus). The poem referred to the laws of nature, influenced by the Orphic Hymns, in which Jupiter sees the transparent sphere of Archimedes. The author describes Jupiter's surprise when he sees the cosmos in a sphere of glass made by Archimedes. Jupiter laughs and wonders how humans managed to mimic his work, with the cosmos in a fragile sphere, and how the old man of Syracuse was able to reproduce the laws of nature on earth, how he knew the distances of the planets (gods), and which secret power directs the motions of the stars as in reality. In addition, how did the philosopher get the zodiac to make its yearly cycle, and the moon to change its phases each month, and how the mind of a man could imitate the heavens and nature. This description, although in the form of a poem, manages to describe somehow Archimedes' great mechanical sphere.

A few years ago an ancient gear (dated around 230 BC) was found in the agora of the Greek city of Olvia in Sardenia. This ancient gear has been studied by G. Pastore,[34] who presented his first talk on the artefact to the university of Athens. Introducing Prof. Pastore, the present author named the item 'Archimedes' gear'. This gear probably belongs to an advanced geared instrument made at the time of Archimedes.

A similar device to the Antikythera Mechanism is the PINAX (table) that describes Proclus, which gives information on the construction and operation of the 'table' (mechanical universe), giving the positions of celestial bodies and predicting perigees and apogees, which is also what the AM does for the moon.

Also very impressive was the solar (and possibly mechano-hydraulic) monumental clock designed by Andronicos of Cyrrhos, the renowned architect and astronomer, who built the enormous octagonal 'Tower of Winds' in Athens,[35], 12 m high, with nine solar dials around the faces and one on a cylindrical construction at the southern part, while inside there was a water-regulated mechanical clock, possibly an anaphoric device, that showed the position of celestial bodies, the sun and moon and possibly also the planets. On the floor of the internal part of the building there are several grooves that possibly accommodated the chains for the motion of the pointers of the celestial bodies. A very impressive description of an anaphoric clock, a clockwork cosmos with the planets made of precious stones, covered by a glass dome, is provided to us by Argestius Cromatius, of Rome, in which he records that his grandfather payed 200 pounds of gold for it.

Part of an astronomical machine is the 'Disc of Chevroches' (Nièvre) in France, which has been studied by the archaeologist F. Devevey[36] and his colleagues. The curved disk features the names of the zodiac and the months in Greek, giving both their names, the Roman months we use today and the Egyptian ones. The item is dated probably around AD 230 and was found in a Roman villa, perhaps of Alexandrian origin.[37] The centre of the disc is offset and the shape is convex, probably part of a sphere. Other similar objects of apparent astronomical use have been found in various regions of Europe, such as the large anaphoric clock from Austria, and which feature Greek and/or Latin inscriptions, and which are estimated to date from the early centuries AD.

A similar clockwork mechanism was housed in the famous 'Gaza Clock', described by Procopius, that was a decorative animated clock in the Gaza agora, probably dating from the Alexandrian Hellenistic era, and bearings the name of its benefactor – Timotheus.[38] The Gaza clock occupied a three-storey building and at certain times represented mythological scenes of Theseus, Phaedra, Hippolytus, and the 3rd book of Iliad, performed automatically every hour via a clockwork system. Among the features was a Medusa, in the middle of the building, that opened and closed her eyes. Every hour the clock struck the hour in a sequence of six tomes, and some large statues moved and performed some act; during the night a light moved

[32] For an excellent review of the work of Archimedes, see Wright 2017 125-141.

[33] Berryman 2009.

[34] Pastore 2006-2010: 552-556; D'Oriano, Rubens and Pastore: 2010: 1777-1813.

[35] Noble and de Solla Price 1968: 345-355; Efstratios, Manimanis and Mantarakis 2006.

[36] Devevey *et al.* 2006; Devevey 2009.

[37] A. Tselikas, pers. com. (2009).

[38] Amato and Maréchaux 2014.

and in succession stopped behind one of 24 different doors.

Another remarkable clock with automata is the one constructed during the 1st century AD by Apollonius Tyaneus and situated next to the Hagia Sophia cathedral and the palace in Constantinople. It is described in the *Book of Ceremonies* during the reign (AD 913 - AD 959) of the Emperor Constantine VII the Porphyrogenetus. This 1st-century AD clock had figures that moved every hour, just like the Gaza example.[39] The Apollonius Constantinople clock is described by the Arab commentator Hâroûn-ibn-Yahya, who lived in the City for a time.[40] He describes the clock as a: 'building in which twenty-four small doors open, each (measuring) one span square; there is one for each of the hours of the day and night. When an hour ends, a door opens by itself...[41] This clock was in the part of Hagia Sophia known as the 'Horologion', which was also an astronomical observatory.

All these above examples demonstrate that the theoretical and practical knowledge at the time of the construction of the AM was available for the construction of such a mechanism.

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Gigantic and structurally sound: the lighthouse on the island of Pharos and the minarets of western Islam

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Ibn Al-Sayj's description of the lighthouse and other accounts

Ibn Al-Sayj was an architect from Malaga (1132-1207), and is said to have built 25 mosques and 50 wells.[1] His text is considered the most accurate description of the lighthouse of Alexandria, as it was in the mid 12th century, fourteen centuries since its construction.[2] Other Arab scholars have described this architectural marvel, counted in antiquity among the seven wonders of the world; at least twelve other descriptions in Arabic are known in fact.[3] The oldest is from the 9th century, the last, after its total collapse, dates to the 14th century, when Ibn Batuta, from Tangier, assessed that it was a complete ruin.[4]

Ibn Al-Sayj, from Malaga,[5] was making his Hajj (pilgrimage to Mecca) when he arrived in Alexandria in 1165. His boat escaped shipwreck as a result of a terrible storm, driving the ship far from the coast while approaching its destination. Thanks to the providential intervention of rescuers from the city, the ship finally reached port. Getting to Alexandria by sea was full of hidden dangers, because of the shallow waters of the coast, rich in shoals and reefs, the violent winds, which blow into sudden storms, and due to the dense mists in the area surrounding the delta of the Nile. The lighthouse built on the island of *Pharos* was thus crucial for leading sailors safely to harbour.

The tower was built in early 3rd century BC, soon after the foundation of Alexandria, thanks to Sostratus of Cnidus,[6] as proved by a later literary source (*Sostratus of Cnidus, son of Dexiphanes, on behalf of mariners, to the Divine Saviours*).[7] The tower was exceptionally high, due to the absence of reliefs on the coast. This is clearly stated in a papyrus found in the Serapeum of Saqqarah[8] that reports the epigram of Posidippus of Pella (*c.* 310 - *c.* 240 BC): 'This savior of the Greeks, the guardian of Pharos, was built by Sostratus of Cnidos son of Dexiphanes: because in Egypt there is no place high up on islands, but the bay welcoming the ships is at sea level.'[9]

It was during his long stay in Alexandria that Ibn Al-Sayj visited and measured the famous construction. Like other medieval travellers, he was aware that the tower was an ancient construction, as testified by the inscription still visible on the walls: 'On the wall next to the sea facing south [our north], there is an inscription in ancient letters, of which I do not understand the meaning. It is not written with ink, because the letters worked in stone are large and black, set in blocks of limestone. The sea and the sea air have corroded the blocks; however the letters of the inscription have remained in relief thanks to the hardness of the stone.' The perception of that immense construction as a *unicum* created by other civilizations, may well have raised interest in studying it to penetrate its secrets.

Ibn Al-Sayj's text gives a great deal of useful information on the exterior of the lighthouse. The construction was composed of three parts (Figure 1): a cuboid unit, slightly tapering, 30.6 m wide at the base and *c.* 70 m high; the second had an octagonal shape (side of the octagon 6.9 m) and was *c.* 34 m high; the third was circular and *c.* 9 m high. The total height was thus 113 m. These measurements highlight the structural approach of the lighthouse. In fact the first body, square, with a moderately truncated-pyramidal shape, can be considered an imposing substructure that supported the upper octagonal tower. The third body visible in the 12th century must have been rebuilt, but also in ancient times a lantern must have existed to host the light source. The reduced size of the third body can justify the fact that in some representations only two volumes appear.[10]

The interior structure is described as well. From the entrance door, raised above the rocky ground on which

1 Asin Palacios 1932: 196.
2 Asin Palacios 1933; 1935. The description was unknown to Thiersch.
3 Asin Palacios 1933, *passim*.
4 Ibn Batuda visited the lighthouse for the first time in the year 1326. The tower was damaged but still accessible. When he returned in 1349 the lighthouse was no longer accessible. Asin Palacios 1933: 281.
5 His complete name was Abdulhachah Yúsuf ben Mohàmed el Balawi, better known under the nickname of Benaxeij. See Miguel Asin Palacios 1932: 195. his name is used in this paper as mentioned by Asin Palacios in his 1932 article.
6 The quite lively discussion on the role played by Sostratus of Cnidus in the construction of the lighthouse is provided in Meeus 2015.
7 Lucian, *How to write History*: 62. Lucian possibly refers to an earlier source; see Strabo, *Geography*, XVII, 1,6.
8 *Papyrus Didot*, GLP 104 a. Date c. 161-159 BC.
9 See Hellmann 1999: 109-111.
10 For selected iconography of the lighthouse in antiquity, see Empereur 1999.

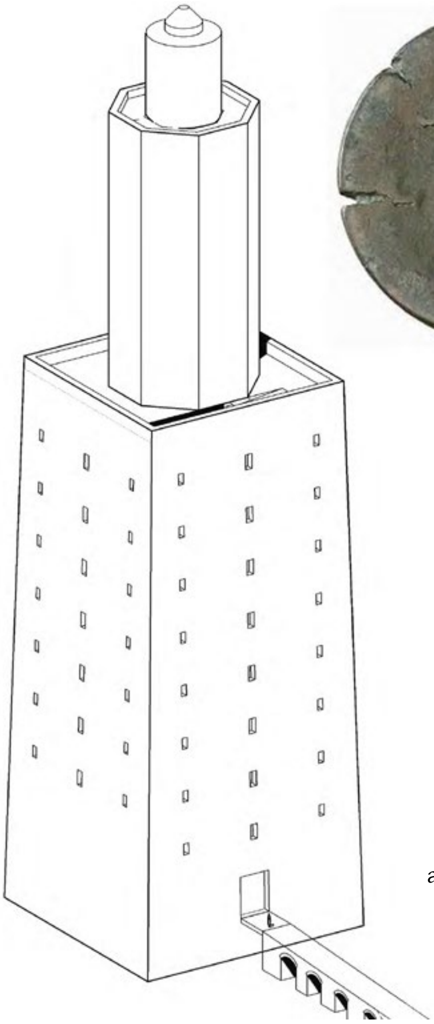

Figure 1. Diagram of the lighthouse of Alexandria according to the measures given by Ibn Al-Sayj. Above on the right: coin of Antoninus Pius depicting the lighthouse of Alexandria.

The sense of marvel generated by the lighthouse is also recorded in an earlier text by Edrisi from Ceuta, published in 1154.[14] His description is also quite detailed, and focuses particularly not only on the overall gigantic dimensions, but also on the functional and construction concept. 'On y remarque le phare fameux qui n'a pas son pareil au monde sous le rapport de la structure et sous celui de la solidité; car indépendamment de ce qu'il est fait en excellentes pierres de l'espèce dite caddzân, les assises de sec pierres sont scellées les unes contre les autres avec du plomb fondu et les jointures tellement adhérentes, que le tout est indissoluble (....). On y monte par un escalier large, construit dans l'intérieur, comme le sont ordinairement ceux qu'on pratique dans le tour des mosquées.'[15] The description continues with details of the ramp, which is noted to have been lit by windows. Then he adds a most useful piece of information: 'cet édifice est singulièrement remarquable, tant à cause de sa hauteur qu'à cause de sa solidité'.[16]

The fascination with the tower both for its layout and construction characteristics is evident, as no other tower at the time of Edrisi was comparable to it, although, only few years after the publication of his *Description of Africa and Spain*, new and immense mosque towers were started by the Almohads (1147-1269), a new dynasty of rulers, founded by the reformist Ibn Tumart, who succeeded in conquering the Maghreb and Al-Andalus in a short time as a result of religion-based armed struggle.

the lighthouse stood out, a corridor led to an upper floor crossing several rooms to the left and right; only after this did one come to realise that the core of the structure was hollow.[11] The cavity must have been similar to a well going through the height of the tower and is to be considered a most important component of the construction.[12] Starting from the level of the cavity a ramp ran up to the top of the cuboid unit; along its path were displaced 31 rooms. The ramp was naturally lit by windows and was covered with stone lintels.[13] To reach the top of the tower there was a spiral staircase, ascending into the octagonal unit.

The minarets of western Islam

The first monumental Almohad tower was built in 1158 for the congregational mosque of Kutubiyya, in Marrakech (Figure 2). This cuboid construction still preserves its original structure, only a few alterations having been made mainly at the interior of the lantern.[17] The tower is 12.8 x 12.8 m at the base and 55.3 m high, excluding the 15.8 m high lantern. The walls

[11] '*...Nos dimos cuenta de que el interior del Faro estaba hueco.*' Asin Palacios 1933: 286.

[12] The cavity is even more clearly referred to in Yaqut al-Hamawi's text (Wüstenfeld 1866-1873, I: 263): '...la escalera da vueltas en derredor de una cosa comi un pozo vacío, el cual suponen que es mortal, pues que si algo se arroja en él, no se sabe el fondo.' (Trad. Asin Palacios 1933: 277).

[13] 'No hay alli escalera alguna, sino tan sólo una rampa, que poco a poco se eleva, y que con un gran giro, da la vuelta. A tu derecha encuentras el espesor del muro, que no sabemos cuánto sea, y a tu izquierda la cuesta o rampa giratoria , en el cual están las cámeras antes mencionadas.' Asin Palacios 1933: 277.

[14] Edrisi, *Déscription de l'Afrique et de l'Espagne*.

[15] Edrisi, *Déscription de l'Afrique et de l'Espagne*: 166.

[16] Edrisi, *Déscription de l'Afrique et de l'Espagne*: 166.

[17] The lantern has a brick shell built inside the stone masonry lantern. The present author would like to thank Hasna Hadaoui for making it possible to visit the minaret and for providing me with the excellent survey realised in 1984 by Mohamed Bel Abd.

Figure 2. The minaret of the Kutubjyya mosque in Marrakech (1158 AD).

are vertical and have an elaborate decorative pattern, like the minaret of the great mosque in Córdoba.[18] However, unlike the Cordovan tower, whose interior is entirely occupied by two flights of stairs, the interior of the Kutubiyya minaret is massive, with the exception of seven superimposed square rooms in the centre of the tower (Figure 3). The solid construction has a single ramp ascending counter clockwise around the central vaulted rooms. The Kutubiyya is not only important for being the eldest of the Almohad monumental minarets, but it is also exceptionally well preserved, permitting a visual understanding of a model which is impossible to achieve from the other two examples – Seville and Rabat.

The Kutubiyya minaret is built in stone, roughly coursed in the walls (large irregular stones, with an average height of 20-25 cm, mixed with smaller ones) and smaller stones placed radially for the vaults. Stone is also employed to generate the elaborate exterior decoration. The spiral ramp is made of straight stretches that change direction at right angles. It is 1.38 m wide and is covered by inclined barrel vaults and cross vaults at each change of direction. The final stretch, which leads to the terrace at the top of the cuboid volume, has a straight flight of stairs. A second staircase, even steeper, rises to the lantern from the terrace. The rooms at the centre of the tower all have the same *c.* 3.40 x 3.40 m square plan. Windows light the ramp and are generally situated also in front of the doorway to the central rooms.

This gigantic minaret might have been intended as a symbol of the Almohad rule and their reformist religious approach.[19] The tower was certainly influenced by the Almoravid tower of the Ali b. Yusuf Mosque, promptly demolished by the Almohads when they came to power,[20] but the dimensions express the will to emphatically characterise the cityscape as well as the landscape around the city. This gigantic tower was to become a visual reminder of Islam triumphing over Christian Spain.[21]

The second monumental tower is the 'Giralda' in Seville. The tower was completed in 1198 as the minaret of a new congregational mosque built by Abu Ya'qub Yusuf, the second Almohad ruler. The architect was Ahmad b. Bâso, an active Almohad architect.[22] The tower was altered in 1568 when it was converted to a belfry (Figure 4). The exterior architecture and the interior structure of the original tower are still discernible, although the interior has been renewed. The cuboid volume of the tower measures 13.6 x 13.6 x 67.7 m,[23] and is built of brick masonry upon a stone masonry foundation.[24] A spiral ramp, 1.38 m wide and similar to the Kutubiyya example, but covered with horizontal cross vaults, ends at a flight of stairs that leads to the top of the cuboid volume. The centre has six superimposed rooms, lit by the windows opened on the ramp (Figure 3).

The third example is the 'Tour Hassan' in Rabat, started in 1196 and remaining unfinished in 1199. The tower

[18] The tower in Córdoba was built by the Umayyad caliph 'Abd al-Rahman III between 951 and 958. It measured 8.5 x 8.5 m at the base and was 47 m high. See Bloom 2013, 146-148. This tower, now incorporated in the 16th-century belfry, is considered to be the model of the decorative pattern used in the Almohad towers, as well as for the lantern placed above the cuboid tower.

[19] Bloom 2013: 167.
[20] Typically Almohads demolished any Almoravid architecture, with the possible exception of the *qoubba* and the timber *minbar* of the mosque of Ali b. Yusuf, masterpieces of Almoravid architecture and art linked by the Cordovan school.
[21] Bloom 2013.
[22] Mayer 1956: 42.
[23] On the exterior, the visible Almohad structure is 51.8 m high. The 67.7 m height excludes the original lantern, as deduced from a recent survey of the tower. I would like to thank Alfonso Jiménez Martín for providing me with the recent drawings.
[24] Tabales *et al.* 2002: 175-176.

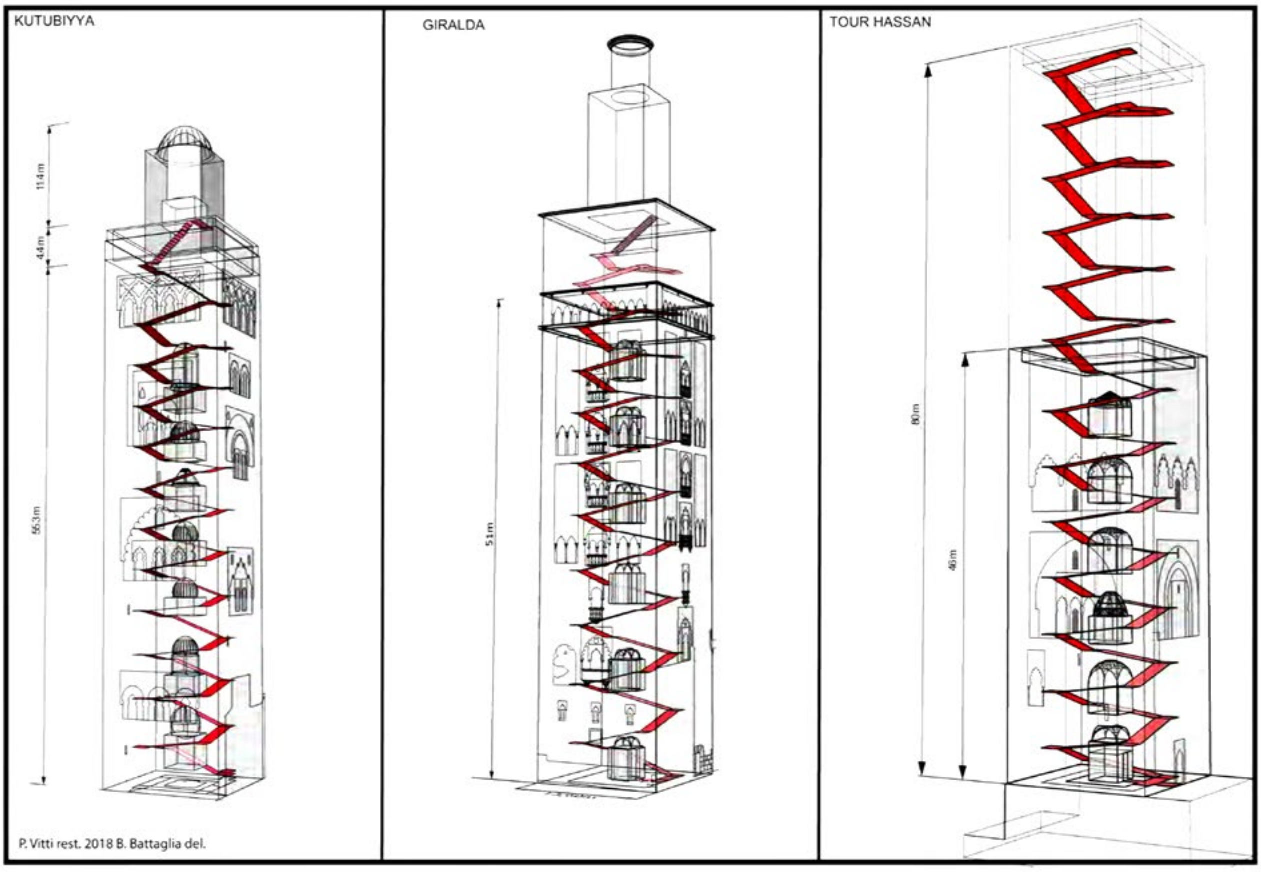

Figure 3. Diagram of the three Almohad minarets in Marrakech, Seville and Rabat, showing the internal spiral ramp and the central superimposed rooms.

belonged to an immense mosque that was located at the site where the army ranged against the Christians was organised (Ribat = Rabat). It had thus a conspicuous political and religious significance. The coursed masonry construction of the minaret reproduces the same layout as the two previous monumental towers, but with even bigger proportions. The base is *c.* 16 x 16 m and rises to 46 m; despite being unfinished we can estimate an original height of *c.* 80 m (Figure 5). The structural concept is based on a massive construction around a core made of superimposed rooms (six chambers covered by elaborated vaults) with a spiral ramp 1.92 m wide running around the rooms. The ramp is covered by inclined barrel vaults generating cross vaults at the corners, where the corridor changes direction at right angles (Figure 3). Windows to light the ramp follow the usual pattern, with wide openings in front of the entrances to the central rooms and slits at the corners. The vaults are generally built with bricks.

According to J. Bloom, Almohad minarets appearing in the Maghreb in the 12th century were not influenced by the cuboid towers in Syria,[25] where the earliest mosque tower had been erected in the Great Mosque of Damascus.[26] Also inspiration from the famous tower in Kairouan (rebuilt in 836) is considered unlikely.[27] The origin is likely to be the neo-Umayyad tower in Córdoba.[28] However, as our description of the Almohad towers makes clear, their structure is markedly different from the one in Córdoba. Apart from the decorative pattern of the façades of the three Almohad minarets, their dimensions and interior structures have analogies with the lighthouse of Alexandria. In common they have a massive construction, with a series of cavities at the centre of the tower, and a wide ramp lit by windows, leading to the top of the cuboid structure.

The analogy between minarets and the lighthouse is not new to scholarship. Thiersch already suggested that there was a formal link between the three superimposed storeys of the Alexandria lighthouse and minarets, particularly those in Cairo. His observations addressed the form of the towers, with scarce interest in the structural and functional layout. As it happened, his understanding of the structural layout of the lighthouse was completely unrealistic, since it did not correspond to the building technology of the early 3rd century.

[25] Bloom 2013: 135.

[26] Built before the middle of the 9th century. Bloom 2013: 197.

[27] Bloom 2013*:* 137.

[28] See *supra* n. 20.

Figure 4. The Giralda in Seville (completed 1198 AD).

Figure 5. The Tour Hassan in Rabat (left unfinished in 1199 AD).

His cross-section of the lighthouse depicted, in fact, a building made of vaulted rooms where there is no trace of the massive construction, which is typically found in Hellenistic building. It is thus time to reconsider his argumentation, and compare the lighthouse and the mosque towers on the basis of the structural concept of the former's construction, which leads us directly to the Almohad towers.

An interesting point made by A. Lezine recalls that ancient lighthouses, heavy and strong towers, must have influenced the structural model of some mosque towers. Lezine noticed in fact that the lighthouse of Syllectum (Salakta, Tunisa) might have been a possible model for the tower in the congregational mosque of Kairouan, started in 836 and consisting of a tapering cuboid volume, superimposed by two smaller ones, with vertical walls. The lighthouse is not preserved, but a mosaic discovered in Ostia, in one of the shops of the so-called Piazzale delle Corporazioni, shows a construction made with superimposed cuboid volumes, which resembles the mosque tower (Figure 6).[29] The Kairouan tower is a massive construction with a spiral staircase and is 24 m high.

In a moment of such cultural ferment, such as the one under the Almohad dynasty, it would not be surprising that the model of the immense Hellenistic lighthouse in Alexandria inspired the minarets. Such a hypothesis would seem to be upheld by the descriptions of the Andalusian travellers who record technical details, lacking in earlier texts. For this reason it is possible to argue that architects embarking upon construction of the Almohad gigantic minarets took the example of the *Pharos*: the same cuboid form of the lower unit, massive construction around a central empty core, a ramp leading gently to the top, illuminated by windows on all sides. Two possible differences between the Hellenistic and the Almohad towers are that the *Pharos* had only a central cavity and the ramp led to the top, while the towers had a series of superimposed rooms

[29] Lézine 1967: 48.

Figure 6. Detail of the mosaic in Piazzale delle Corporazioni, Ostia Antica, depicting a lighthouse with the inscription mentioning the port of Syllectum (CIL XIV, 4549, 23).

with the ramp ending on a staircase leading straight to the terrace. This difference results from different functional needs. In the *Pharos* the cavity and the ramp served as a means of raising the fuel for the fire of the lighthouse and any other material needed for military purposes. No such use was envisaged in the minarets.

The architectural model of the lighthouse of Alexandria

The lighthouse of Alexandria was not meant to be an ordinary construction. Scholars have highlighted the functional rationale behind the height of such an immense building. It is likely, in fact, that it resulted from the need to make the light visible at *c.* 40 km from the coast.[30] The tower served also as a military outpost, to identify and protect against enemies approaching the city.[31] However, as far as the military function is concerned, a lower construction would have worked equally well.

Rather, it is likely that the construction illustrated the interest of Hellenistic rulers in works of immense grandeur, as a means to display power. One should not forget that it was possibly Alexander the Great who generated the prototype for immense structures with the ephemeral pyre created to commemorate the death of Hephaestion.[32] The trend for gigantic structures in the aftermath of Alexander's death was made possible by the financial resources available to the monarchs, as well as to contemporary scientific achievements. A well-known precedent for the Alexandria lighthouse could have been the movable timber tower built by Demetrius Poliorcetes during the unsuccessful siege of Rhodes – the *helepolis*, reaching the considerable height of 100 cubits (c. 45 m). New scientific knowledge therefore made possible architectural achievements on a scale unknown earlier.

The starting point in planning the Alexandria lighthouse must have been its location, on the edge of an island delimiting the harbour, and the need to have the source of light placed at more than 100 m from the ground. Looking at the proportions of the different units of the building, as discussed above, the construction appears like an immense tower reinforced by a buttressing structure occupying two-thirds of the lower portion. In theory the idea could have been for a square cuboid tower measuring 17 x 17 m and 100 m high, to which the buttressing masonry would be added, slightly inclined in order to be thicker at the base (Figure 7). However, the unit above the buttressing structure, instead of being square (like the lanterns of the cuboid minarets), was given an octagonal form. This shape is likely to have resulted not from structural needs, but to orient the faces according to the eight main wind directions. The late Hellenistic 'Tower of the Winds' in Athens is a visual record of how this octagonal volume must have looked.[33]

According to M. van Berchem, the Qâit-Bây Fort, built sometime between 1477 and 1479, was built on the ruins of the lighthouse.[34] In fact the dimensions given by Ibn Al-Sayj substantially coincide with those of the fort, making it possible to argue that the position and orientation of the two buildings coincide. Since the fort is aligned with the cardinal points, it is plausible that

[30] For the scientific knowledge indispensable for the calculation of the height of the tower, see Russo 2003. Russo highlights the relationship between the height of the lighthouse and the visibility of the light from the horizon, which depends on the curvature of the earth.

[31] The tower was indispensable for the defence of the city. From the tower, not only could enemies be sighted, but also the defences must have prevented access to the harbour. The two functions of the lighthouse were connected; the lighting system indicated the entrance to the port, but could also be used for warnings in the event of an attack.

[32] The pyre of Hephaestion, according to Diodorus Siculus (XVII, 110-118), measured one *stadium* and was 130 cubits high (183 x 183 x 58 m). The brick structure was built by dismantling the walls of Babylon, for a stretch of 10 *stadia*.

[33] Kienast 2014.

[34] Max Van Berchem 1894, I: 478.

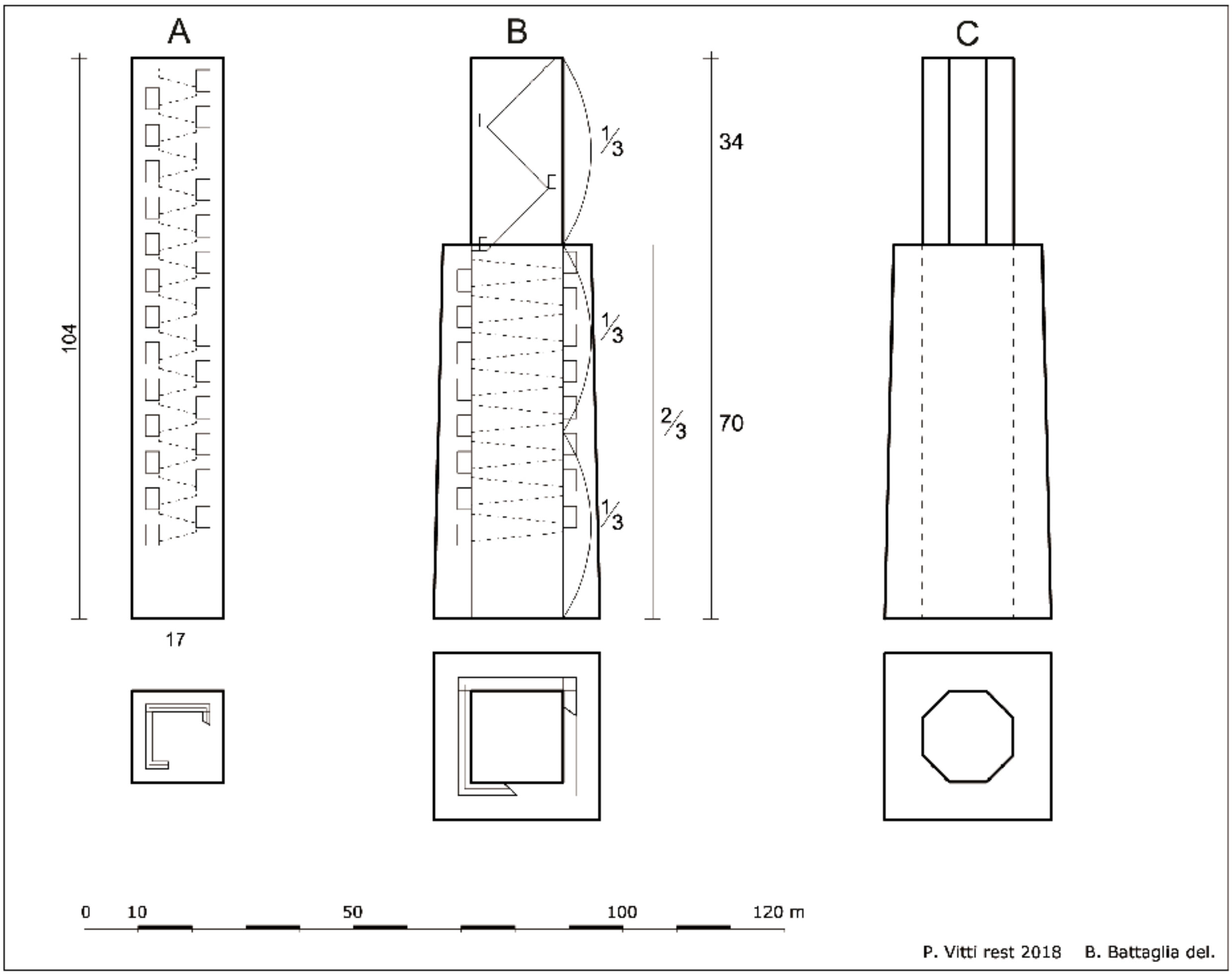

Figure 7. Diagram showing the possible model that generated the superimposed volumes of the Alexandria lighthouse: A) square tower 17m wide and 104m high; B) reinforcement of the square tower for 2/3 of its height with a buttressing structure; C) Octagonal shape of the second unit to show the direction of the winds.

the eight faces of the octagonal tower faced exactly the eight main wind directions.[35]

Leaving aside the general layout of the tower, we shall now turn our observations to construction matters. Monumental architecture in the Hellenistic period had necessarily to rely on dry masonry construction. The use of mortar, especially in early 3rd century, was rare. We now have evidence of mortar in the construction of the Mausoleum of Belevi, but nonetheless its presence is of secondary importance to the mechanical behaviour of the building.[36] Slightly earlier gigantic buildings, such as the Mausoleum of Halicarnassus, show that monumentality was achieved through ashlar masonry to create a massive structure. According to the studies of Jeppesen, the Mausoleum was made of a massive amount of stone blocks creating a volume of about c. 32 x 38 x 45 m, within which was the small funeral chamber.[37] The Alexandria lighthouse must have been similarly conceived: a massive masonry structure for the first unit of the building with the ramp running into it, without breaking up the massive volume of the construction. This facilitated the overlapping of the volumes, one on top of the other. However, one element is totally different from any other Hellenist gigantic construction: the presence of the central cavity. This element was substantial to the lighthouse, both in terms of construction and use.

The central cavity was described with astonishment by Edrisi and Ibn al-Sayj. Medieval travellers from Maghreb were acquainted with solid towers that only housed

[35] Thiersch was sceptical about the possibility that the statue of Zeus, frequently shown in ancient depictions of the lighthouse on top of the tower, could have worked like the *giralda* on the top of the tower in Seville. See Thiersch 1909: 90.

[36] Heinz 2017: 374-387.

[37] Kristian Jeesen, *The Maussolleion at Halikarnassos: reports of the Danish Archaeological Expedition to Bodrum*, vols. 4 and 5. The stones were pillaged by the Knights Hospitallers of St. John for the construction of the Hospitaller Castle in Bodrum.

the staircases (and not a ramp) to reach the top; thus the Hellenistic tower with the ramp and the central empty well must have appeared exceptional.[38] From the description of Ibn al-Sayj it can be deduced that the well did not start until a first stretch of ramps reached a higher level. It should also be considered that the main gate was high above the ground, making a bridge necessary to access to it.[39] It is thus clear that the lower part of the tower was somehow a base, housing only a few rooms[40] and cisterns. The latter were indispensable for an isolated building with a military function and hosting different kinds of mechanisms that used water. Above this base the cavity started, without windows,[41] as did the ramp, lit by openings along its course.

The central cavity made it possible to hoist the materials necessary for operational needs, including, of course, the fuel for the light. From the entrance corridor an opening onto the roof could have connected the lower level of the gate with that of the cavity, in order to lift any material to the upper part of the tower without using the ramp.

Given the considerable width of the ramp, one might well ask if the cavity was really necessary for the functionality of the lighthouse, given that donkeys could have easily brought materials up. The use of the cavity was, however, extremely relevant to the construction process of the tower, since it was instrumental for lifting the heavy blocks used for such constructions. For instance, those used in the mole of the Hellenistic phase of the harbour of Rhodes measured *c.* 0.70 x 1.40 x 0.50m,[42] weighing some 800 kg. Such heavy blocks could not be transported by a single animal; their transportation depended on wagons and on being lifted by ropes and cranes. Given that the lighthouse was at the edge of the island, and because of its height, scaffoldings and external ramps to ease transportation of materials – the two typical features used to build immense constructions – were unlikely. Considering also that the walls of the first unit were not vertical, materials could be lifted only from the inside. The internal ramp provided an easy, quick and safe access for workers, since it was wide enough to have people and animals going up and down at the same time. Finally, we must not discard the hypothesis that the internal void also saved on construction material and time.

Building the lighthouse of Alexandria

Earthquakes and violent tsunamis have been recorded in Alexandria since the 3rd century AD.[43] The lighthouse was exposed not only to weathering caused by the elements and the sea, but also to violent shocks, which repeatedly damaged the structure. Many parts were rebuilt, after partial collapse, over the centuries. The final collapse occurred only in the mid 14th century, some sixteen centuries since its construction, showing the remarkable quality of the construction.

The resistance of the lighthouse was largely linked to the building technology used in its construction and on the continuous maintenance and prompt repair of any damage occurring on exceptional occasions or with ordinary aging. Admiration for the quality of the masonry emerges in the descriptions in the Arabic sources. The tower was built with the local white calcareous tuff square blocks. Horizontal faces, smoothed for a perfect levelling of the load-bearing faces, made it possible to distribute the vertical loads along the contact surface of the blocks, thus transferring properly the weight from the top of the tower to the rocky ground of the island. Blocks were assembled one close to the other, not to leave cavities between the vertical joints.

Ashlar building technique was also employed in earlier times, but in Hellenistic architecture there was an increase in the quality of construction, responding to new demands for solidity in military architecture or in innovative monumental architecture. The introduction of ballistic devices and other siege engines, as well as the improvement of the penetrating power of projectiles – taking advantage of the elastic property of some materials – made fortifications more vulnerable. This resulted in higher structural resistance of the masonry of city walls. The new building solutions created the empirical knowhow necessary to achieve other types of buildings.

This new approach in military architecture is documented in a considerable amount of examples. Recent archaeological research on the east mole of the 'Great Port' of Rhodes is a good example of massive walls entirely built with stone ashlars (Figure 8).[44] The final stretch of the wall shows an impressive 4 m-thick section, reinforced by buttressing walls, together with two immense square towers. The first tower is located at the start of the buttressed wall and is 17.50 m wide. The second is located at the end of the mole towards the sea and is 20 m wide. This uncommon dimension shows that the tower rose to a considerable height (possibly 50 m), and, being located at the mouth of the port, is

[38] See *supra* and nn. 13 and 14.

[39] 'La puerta del Faro se alza a cierta altura sobre el nivel del suelo. Para llegar a ella hay construído un andén o camino, largo de 100 passos, y, [para sostenerlo], una bóveda de arcos, semejante a un puente, por debajo de los cuales piuede passar un jinete, y aunque levante la mano, no llega a tocar el techi de los arcos mayores.' Trad. Asin Palacios, Asin Palacios 1933: 285.

[40] Ibn al-Sayj refers to 19 rooms along the route from the gate to the start of the spiral ramp.

[41] Edrisi is very clear on this point. See *supra* n. 14.

[42] I would like to thank Caterina Manousou-Ntella for generously offering me this information, together with a plan of the 'Mole of the Windmills'. For the fortification of the mole, which is an exemplary Hellenistic military construction, see Manousou-Ntella 2016: 499-506.

[43] See Zerefos in this volume.

[44] Built after Demetrius Poliorcetes' failure to conquer the city in 306 BC. See Manousou-Ntella 2016: 499-500.

Figure 8. Tower Π1 on the East mole of the Port of Rhodes (by courtesy of C. Manousou-Ntella).

likely to have been a lighthouse. It is worth noticing that both towers had an empty core,[45] which might have corresponded to interior timber floors.

Another even more compelling example can be found in the Ptolemaion in Limyra. This building, built entirely in stone, is dated to the first part of the 3rd century BC. It is linked to the euergetism of Ptolemy II, thus resulting from the patronage of the same king sponsoring works in sanctuaries in Samothrace ('Great Gods'), in Olympia, in Kos, Didyma, Cnidos, and of course the lighthouse of Alexandria. It has been recently highlighted that in Limyra the blocks were not only carefully assembled but the bonding between the stones was ensured by a massive number of metal and timber elements, such as clamps and dowels.[46] It can thus be envisaged that stones employed in the construction of the lighthouse were similarly connected horizontally with metal clamps and vertically through dowels (of metal and, possibly, timber), in order to guarantee considerable resistance to any horizontal force.

This great attention to the construction of the Alexandria lighthouse is recorded in the Arabic accounts[47] and also confirmed by the on-going archaeological underwater survey. The latter is particularly relevant to our study since the seabed around the fort investigated by the team led by Jean-Yves Empereur is disseminated by thousands of architectural and sculptural elements. Some elements come from other buildings in the city, but most must have belonged to the lighthouse, especially those having clamps marks.[48] The archaeological

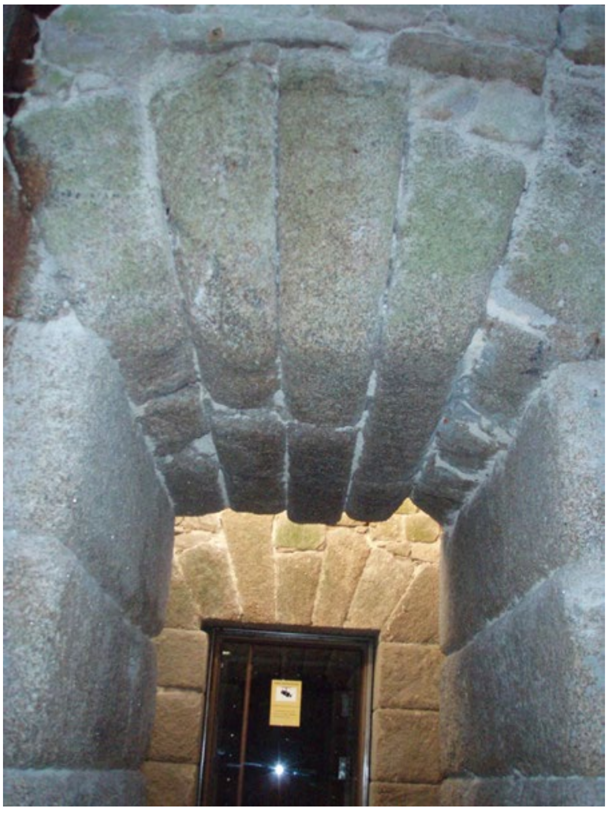

Figure 9. View of the Roman dry-masonry wall inside the Torre d'Hercules in La Coruña.

[45] The end tower has walls *c.* 5 m thick, and the interior is divided by a wall to create two cavities, spanning some 10 m.

[46] 7.5 x 7.5 x 8 cm wooden dowels cast with lead were used to bond the blocks in the core of the structure (Stanzl 2016: 212).

[47] See the above description by Edrisi: 'les assises de sec pierres sont scellées les unes contre les autres avec du plomb fondu et les jointures tellement adhérentes , que le tout est indissoluble.' See note 17.

[48] Empereur 1999: 64-73.

research team has recovered an impressive amount of the lead[49] used to fix the iron clamps and dowels.

In the 3rd century BC, buildings composed of different parts, set one above the other, were made of dry stone masonry and had massive structures, with limited interior cavities. This structural conception leads to the rejection of the proposal advanced by Thiersch in his hypothetical reconstruction of the interior of the lighthouse, where the tower is depicted with many vaulted rooms and corridors. No structural conception like this was employed in construction earlier than the Roman period, when arches and vaults made it possible to reduce the amount of material and concentrate the stresses on load-bearing walls. An example of this different structural layout is offered by the remnants of the *Torre d'Hercules*, a Roman lighthouse in La Curuña, Galicia. The tower has lost the exterior wall and the spiral ramp that climbed to the top. However, the core of the Roman construction is still preserved, incorporated into a later reconstruction. It is made of ashlars, forming a cross, and with flat arches connecting the chambers and the spiral ramp (Figure 9). This structural layout results in cavities within the interior volume of the tower.

The only vaulted chambers that can be supposed in the lighthouse of Alexandria are the cisterns. They must have been typically located at the bottom of the tower, as in other Hellenistic architecture. In fact, burial chambers, bridges and cisterns, were always located in the lower part of buildings, or buried deeply into the ground, in order to avoid the instability generated by the thrust on the abutments.

Conclusions

As discussed, Arabic descriptions are a useful, if not exclusive, tool for understanding the structural layout of the Alexandria lighthouse. No iconographic record from Hellenistic or Imperial times can in fact be used in terms of helping us to understand its internal distribution and construction concept. Analogies with Roman lighthouses are also unhelpful, since, while adopting the external concept of superimposed volumes of the Hellenistic prototype, they had a different structural layout. As documented in the Torre d'Hercules in La Coruña, or in the Tour Magne in Nimes, Roman lighthouses were conceived with many internal voids. The masonry was designed to direct the flow of stresses on selected masonries, making it possible to increase hollows inside the solid construction. If anything, gigantic Hellenistic dry masonry constructions were based on massive structures with few interior cavities. This is reflected in the Arabic texts describing the massive ashlar masonry of the lighthouse, with the only cavities being the internal ramp, the few rooms, and, of course, the central cavity – very much the exception for Hellenistic construction.

It is likely that when the Almohad architects started conceiving a new model for the minarets of their congregational mosques they copied and adapted the structural layout of the *Pharos* of Alexandria, a still-extant example of a gigantic tower. The lighthouse was well known, since Alexandria was on the route from the west to Mecca. It dominated the city and during stop-overs in the city it could be visited and described. The minarets in Marrakech, Seville and Rabat were all based on the same massive structure, with a ramp running around a series of superimposed rooms, thus resembling very closely the *Pharos*. The proportions of these minarets differ from those of the lighthouse,[50] possibly because of being made of mortared masonry, or, simply for being lower (Figure 10). These minarets may be thus considered the only visible testimony of the interior layout of the *Pharos.*

To conclude, it is worth underling that the unprecedented monumentality of the Almohad minarets was, similar to the Alexandria lighthouse, a landmark visible at some distance, and both a reminder and a symbol of dynastic and religious power: a symbol that persists today as a model for minarets in Morocco.

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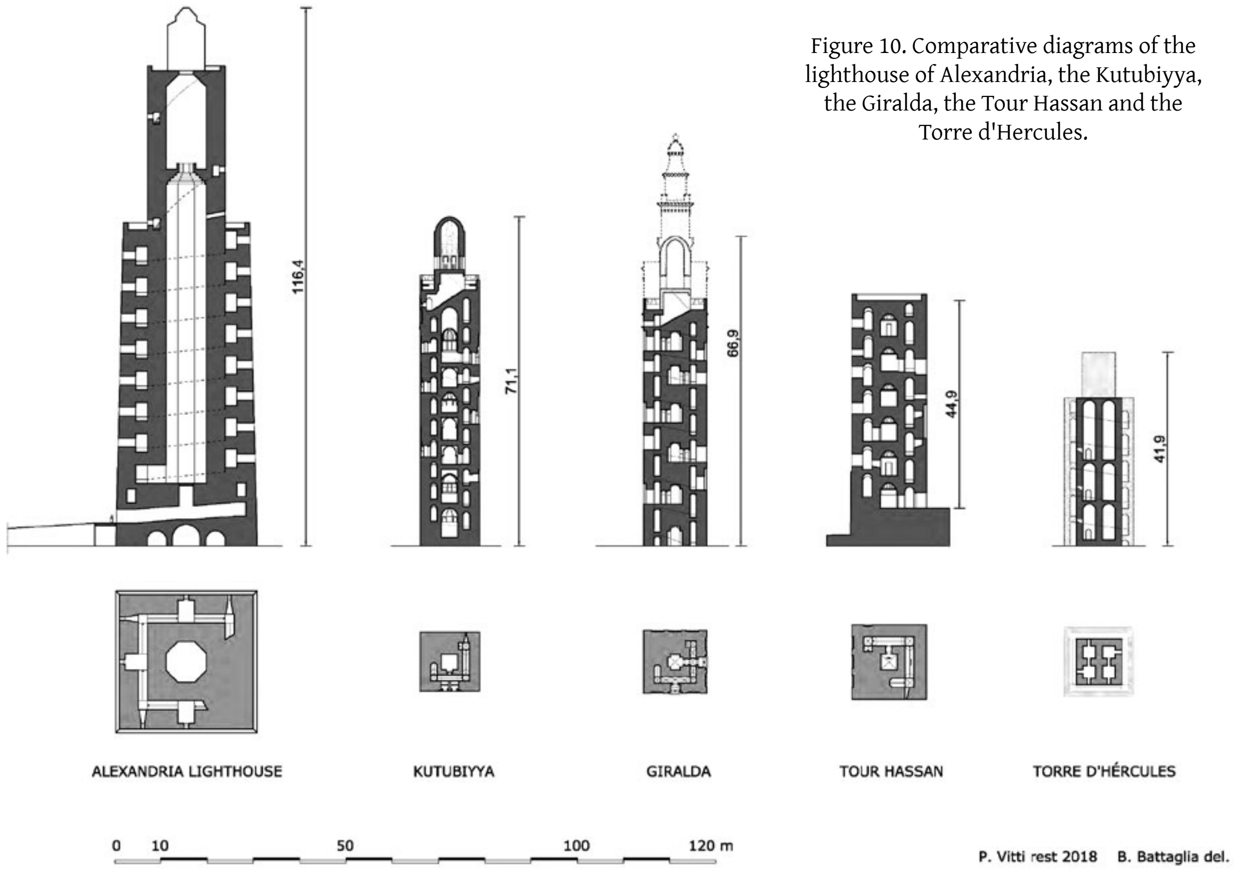
[50] In the Kutubiyya and Giralda the height is 4.3 times the base, against 1/2.8 for the cuboid volume of the Alexandria lighthouse (1/3.8 if the height is considered including the octagonal volume).



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Philon's automatic servant. A reconstruction with a description of S. Economopoulos' air-valve mechanism

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We know ancient automatic machines almost exclusively from Greek writings on mechanics by Ktesibios (Κτησίβιος), Philon of Byzantium (Φίλων Βυζάντιος), Heron of Alexandria (Ήρων Αλεξανδρεύς), as well as by Vitruvius.

The *Hodometer* or *Odometer* described by Heron (Dioptrika Ch. 34) and Vitruvius (Book X, Ch.9) was a gear mechanism mounted on the frame of a vehicle to transmit the rotation of a certain wheel to a horizontal disc with vertical holes made in equal intervals along its periphery. Due to the form of the gears the disc moved instantly and only by one interval, each time the wheel had completed a sum of 400 rotations. Since the wheel's radius was 2 feet, 400 rotations corresponded to one mile. To count the number of miles during a day-trip a metal ball had to be placed in each hole from the start. During the trip the balls fell one-by-one into a metal vessel. Their quantity was sufficient for a day-trip only, so that every morning the mechanism had to be adjusted to the beginning.

In his book Πνευματικά (*Pneumatica*), Heron describes machines working with air, or steam pressure, and their mechanics, as well as hydraulic devices, such as, for instance, H*ydraulis* (Ύδραυλις), a musical instrument invented by Ktesibios. While some of these applications were to a certain degree automatic, the construction and function of devices properly conceived as automata is the subject of his book Αυτόματα (*Automata*). Heron's automata were able to perform their tasks with help from air vacuum or overpressure. They sometimes operated for practical purposes, or more frequently for entertainment, intellectual pleasure and the exercise of creativity in the field of mechanics (mechanical fountains, vessels pouring and mixing wine, musical instruments, singing birds, articulated animals, etc.). The force of the steam was also known and applied, but again for non-industrial purposes. Pneumatic works connected with the sacred area were of special importance, for example the *Spondeion* (Σπονδείον), a vase used for libations, described by Heron in the same book (1.21). It poured out the sacred water after a coin was inserted into a receptacle. Another automatum, was the *Perirrhanterion* (Περιρραντήριον), a large sacred water basin on a tall stand for ritual purification (1.32), letting water flow out when the door-leaves of an Egyptian Temple were opened.

The entertainment technology (art of wonder-making, Θαυματοποιική, a name with a broader meaning in Platonic dialogs), was also the study of automatic mechanisms based on combinations of rollers, wheels and strings, culminating in Heron's book on automata-making. In this book some older inventions, made in the 3rd century BC, such as the mechanical theatre, are also described.

The fascination of Greeks and the Romans for mechanical wonders was great. In addition to the various machines for war purposes, there are these technical works of 'entertainment' which greatly contributed to the technological progress of later times.

After the fall of Rome, the tradition of automata was lost in western Europe, but was preserved by the Byzantines in their palaces in Constantinople, and from the 9th to the 13th centuries by the Arabs in Baghdad, where noteworthy automata were being made, for example a silver tree with singing birds, not dissimilar to the one shown in 946 by Luitprand of Cremona in Constantinople.

During the Crusades, westerners were introduced to the old legacy of automata, and not long afterwards (*c.* 1250) one of them created an amazing automaton in the form of a tree for Mangu Khan (Rockhill 1900: Ch. 16).

When the Mongols, led by Hulegu Khan, a grandson of Genghis Khan and brother of Kublai Khan, invaded Baghdad in 1258, the tradition of mechanical inventions in this city was disrupted, but scion of it must have been taken by them to their capital in China. Marco Polo, hosted there by Kublai Khan in 1266, noticed a system of serving drinks (*Travels*, Bk 1, Ch. 62) and sixty years later Friar Odoric of Porderone, noticed a similar device (Yul 1866: 130). There was also a musical instrument decorated with mechanical birds performing a dance while it played.

Figure 1a. The Servant before the instalment of the locomotion powering counter-weights.

Figure 1b. the Servant with her dress.

Soon after these times automata were again being made in the West, to became a major field of artistic and mechanical creation during the Renaissance (clocks, etc.), and still more so from the 17th to the 19th century, with achievements reaching the highest summits of perfection and performance, for instance the mechanical trumpeter of the Deutsches Museum (Wolf 2011; 2012).

As mentioned above, one of the earliest and greatest creators of automata was Philon of Byzantium, or *Philo Mechanicus*, the famous Greek mathematician and author of many books, who was active in the last quarter of the 3rd century BC. He was a pupil of Ktesibios, the highly esteemed engineer and inventor who was the dominant scientist in Alexandria from *c.* 270 to 230 BC. After visiting great centres of technological progress, the island of Rhodes among them, where he frequented workshops inventing war machinery. Having acquired a unique combination of theoretical and practical knowledge, Philo continued Ktesibios' scientific work in Alexandria. Apart from his business as consultant to powerful patrons, he published books on mechanics, engineering, artillery, ballistics, fortifications, army communications and automatisation.

With the necessary reservations in terms of some of the details, the editorial division of his work into books has been convincingly restored: I) Εισαγωγή (introduction); II) Μοχλικά (levers, mechanisms); III) Λιμενοποιικά (harbour engineering); IV) Βελοποιικά (artillery engineering); V) Πνευματικά (compressed air engineering); VI) Αυτοματοποιικά (engineering of automata); VII) Παρασκευαστικά (engineering and issues of defense); VIII) Πολιορκητικά (siege tactics and technology); IX) other topics.

During his tenure in Alexandria, Philon created an automaton, the mobile statue of a young lady who served wine from a jag. According to a surviving Arabic translation of the original Greek description, a set of two air-tight vessels, two air tubes, two air valves, one wine pipe, one water pipe and a mechanism of levers and bars were all hidden inside her body and arms. Precious materials, like silver and gold, are mentioned, but most probably wood was used for the sculptured parts.

The operation was rather simple: when a cup was placed in the palm of her left hand, the mechanism inside shifted to a new position of equilibrium, causing the first air valve to let air into the larger vessel and thus enable wine to flow down into the mouth of the jug via the wine pipe hidden inside the servant's right hand and the jug's handle. As wine poured into the cup, smoothly increasing the weight and the lowering of the hand at the same time, the mechanism's motion closed the first air valve and thus stopped the flow of wine. Immediately thereafter it opened the second air valve and thus restarted the water flow. When the ratio of water to wine reached 1:2 the second valve was also closed. Once the cup was taken from the servant's hand, the mechanism's counterweight immediately returned the unloaded arm to its start position and thus enabled the whole procedure to be repeated.

In November 2016, Professor Theodosios Tassios, already very familiar with ancient technology and its study, asked the author for his contribution to an improved remake of Philon's automatic servant. He also stressed the importance of locomotion in the way described by *Heron of Alexandria*. Thus, the design of a wheeled base was discussed, powered from a falling weight pulling a string wrapped round the base's drive axle, the motion's acceleration being controlled by a special device.

At the same time the engineer Spyros Economopoulos undertook the fine mechanics of the vessels and the valves.

The following month the author studied the details of the statue, including locomotion, other body motions and all relevant mechanisms. Finally he developed a series of designs in a scale of 1:1. He also decided to fashion the statue in a more realistic way, including its articulated limbs, and to undertake himself the wood carving and construction.

It took 800 hours to reach a nearly finished state, while another 100 hours are still needed for the last touches. Despite its unfinished state, the automaton, with a mechanical improvement by Demetrios Korres and a fine dress by Sylvia Koutrouli, is temporarily being exhibited in the Beijing Museum of Technology.

Description (Figures 2-5)

The wooden female figure, made of 14 main parts, is 173 cm tall and features almost realistic human anatomy. She is properly articulated and mounted on a slender box-like vertical shaft with a wide three-wheeled base and a flat, waist-high, top. A pivot on the shaft's underside enables small left or right turns during operation, while another pivot on its top enables slight turns of the torso. The motion and steps of the legs and feet, based on pendulum principles, and generated from the rotation of the propulsion wheel situated between the feet, looks almost natural, although they carry no weight.

Wheels, shaft, feet, legs, thighs, torso, neck, head, arms, forearms, and hands are wooden and (excluding fingers) always hollow, so that weight is reduced as much as possible and the required interior spaces for the mechanisms are made. The body-wall thickness for all these parts varies: 8mm for the centres of the thighs, and the whole length of the shaft; 1.2 cm for the legs, torso and arms; 2 cm for the heels, knees, hips, shoulders, ankles, wrists, and flanges along some structural joints, e.g. along the contour of the back of the torso, which is movable, so that all mechanisms and instruments housed in it are easily accessible.

Tilia wood was selected for nearly all the parts, being soft and easily workable, with only a slight grain and a density of 550 kg/m^3. It is available in planks, 33-38 cm wide and 5, 8, 10 or 12 cm thick. Only a few small components, such as the bottom and the wide flat top of the shaft, as well as the diaphragm-like base of the torso, are of pine timber.

In order to reduce the part removed from the inner side of the thighs and legs for the sake of the shaft, the latter is only 13 cm wide, so that the contours of the limbs, perceptible under the servant's skirt as she stands or moves, remain unaffected, no matter from which point of view she is observed.

The propulsion mechanism described by Heron performs as follows: a thin rope wound around the

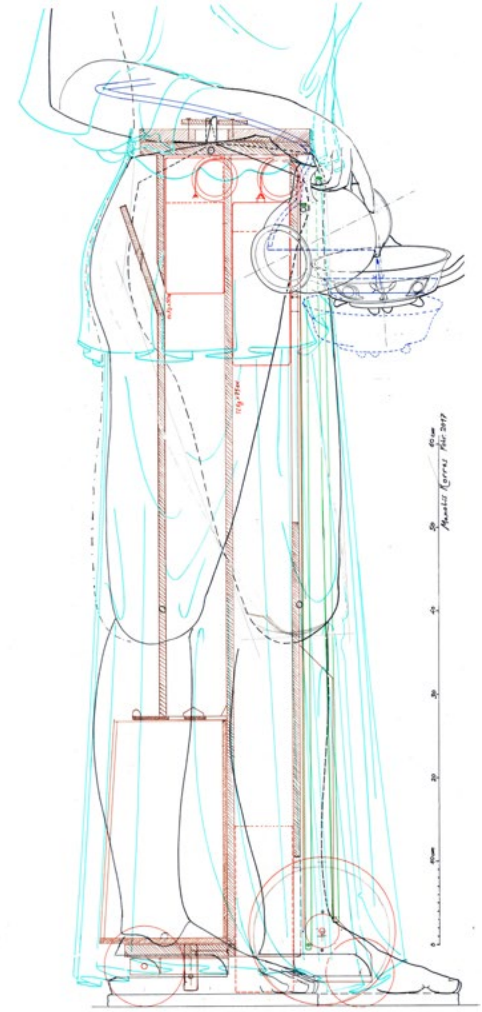

Figure 2. Side-view with axial section, showing supporting shaft and locomotion mechanisms. Hand drawing (February 2017, partially revised).

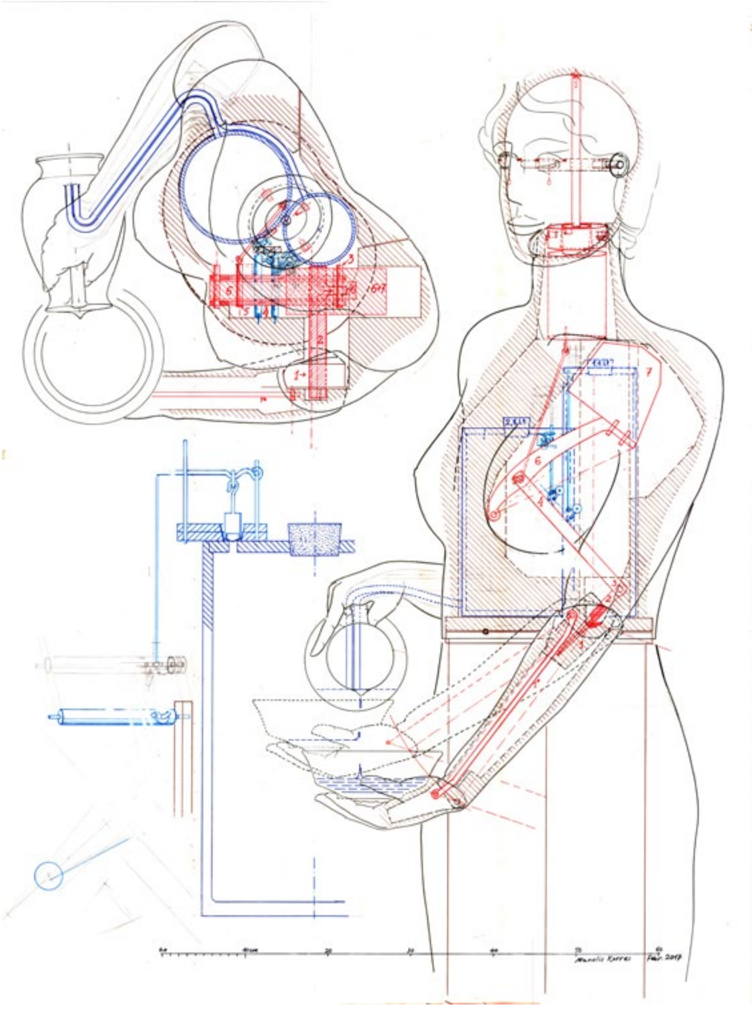

Figure 3. Vertical-oblique section and view of upper part, showing mechanisms. Hand drawing (February 2017, partially revised).

propulsion wheel's axle, after passing over a pulley installed on the top of the shaft, is pulled down by a counter-weight sliding inside the shaft. To avoid any undesired acceleration a speed stabilizer was introduced: the space under the counter-weight is filled with legumes, which can be discharged from an adjustable opening into the container required to store them for further recharging of the shaft.

To improve this system in our servant, the shaft was divided into two parallel halves, with only one of them working with a speed stabilizer, so that the mass of the legumes is reduced to its half and the accumulated active length of shafts, and with this the range of locomotion, is increased by 50%, reaching a travel distance of some 4 m. For this, the drum-like part of the propulsion wheel's axle is subdivided into two sections, having diameters corresponding to the different active lengths of the shaft's divisions, so that the two ropes, having the same number of active windings, perform in tandem.

The step length (Ls) of the servant, *c.* 51 cm (nearly an ancient cubit), defines the propulsion wheel's diameter (Dpw = *c.* 16.3 cm (*c.* 9/16 of one ancient foot – 29.4 cm). Each of the two long rods converting this wheel's rotation into a normal gait, begins from a crank pin (ca) placed at one end of the propulsion wheel's axle and ends at a crank pin (ch) inside the corresponding thigh, at a horizontal distance (Lch = *c.* 11 cm) from the hip. The eccentricity of ac results from the equation: Eca = (Lch x Ls):Hh, with Hh being the distance of the hip from the ground).

Despite the simplicity of the above definitions and ratios, the trajectories of knees and heels, fairly resemble those of human legs, due to the specific distribution of the wooden limb's articulated masses.

The left hand

In order to make the palm of the hand independent from the forearm's changing slant, so as to prevent the cup's

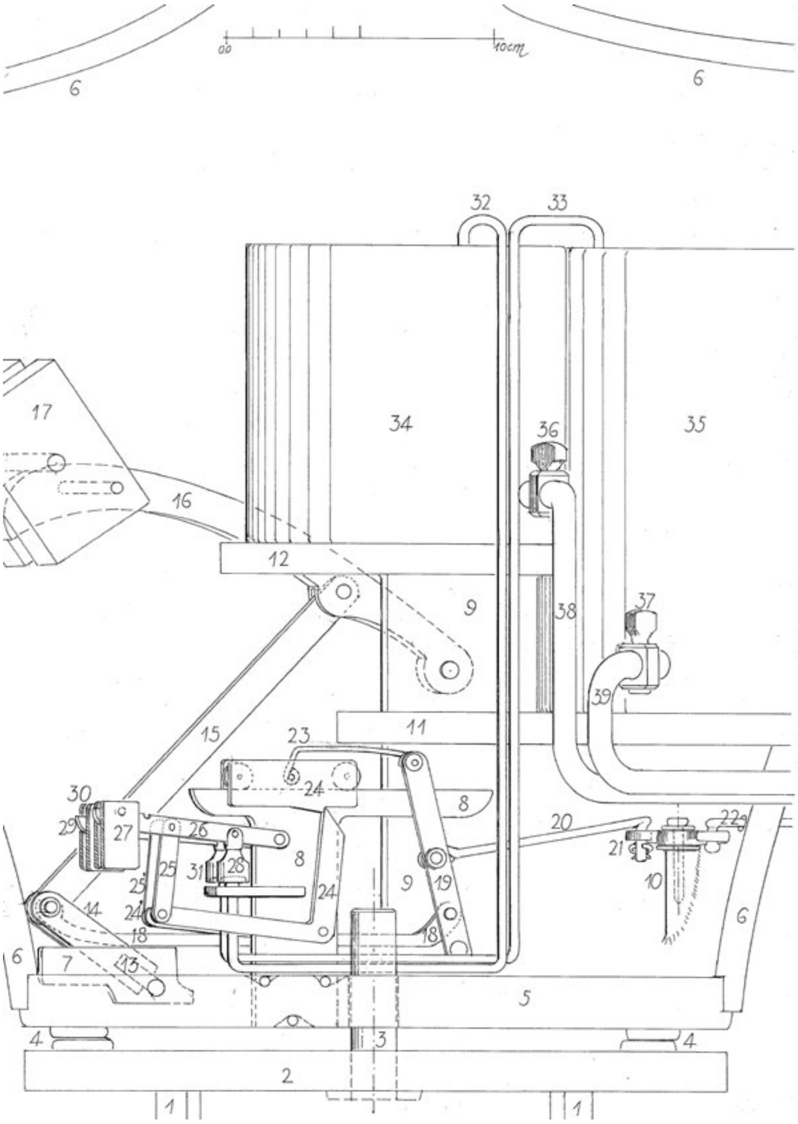

Figure 4. Transversal section through the torso, showing mechanisms. Hand drawing. June 2017.

contents from spilling, the palm is linked to the forearm, like the end of an articulated parallelogram whose second-long side is a bar housed inside the hollowed wrist and forearm. A slightly inclined torsion bar forms the left arm's ankle-pivot and transmits the left hand's and forearm's lowering or rising onto a mechanism inside the torso. This mechanism is again an articulated parallelogram, proportional to that of the forearm but in exactly the opposite direction, so that a counterweight fixed at its uppermost end could be in balance with the mobile parts, including the cup, quite independently from the forearm's slant. Since, instead of such an imbalance a rather progressive dominance of the counter-weight is desired, the later has been given a well-calculated backward eccentricity, so that the forearm's slant increases with the loading of the palm and decreases with unloading. This eccentricity combined with all other geometrical characteristics of the mechanism, ensures that the accumulating load of a 400-gr cup and 125 ml of wine and water moves the part activating all phases in the automaton's performance, over a sufficient length without exceeding the given limits in the forearm's allowed positions.

Figure 5a. The head, as in 28/7/2017.

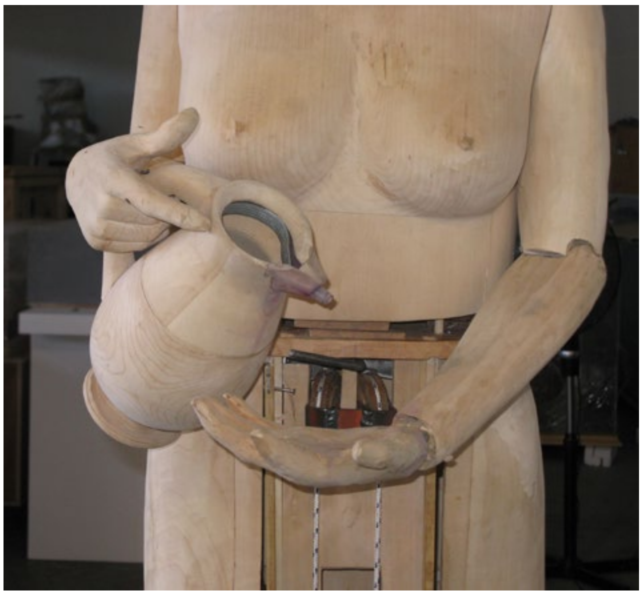

Figure 5b. The middle parts, as in 28/7/2017.

Figure 6a. The supporting shaft, preliminary state, partially revised. To the left the container of legumes.

Figure 6b. The supporting shaft, final state: iron axle-plate and wooden lateral wheels. The container of legumes is housed in the recess of the lower part of the shaft.

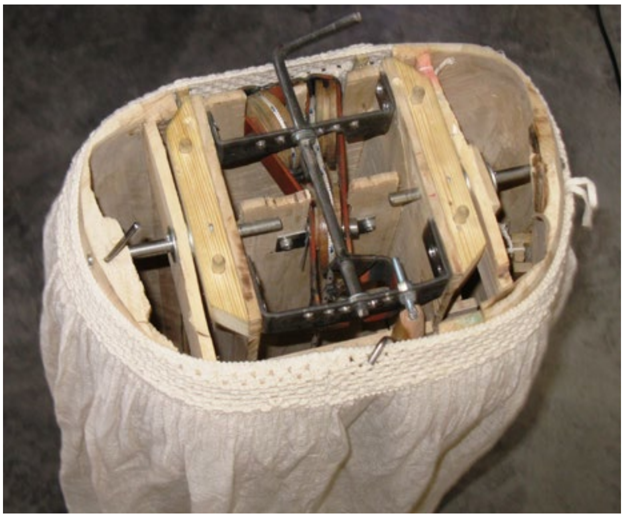

Figure 7a. The lower half (with a long white skirt by Sylvia Koutrouli). The flat top of the supporting shaft is temporarily removed so that the upper end of thighs and shaft are exposed. Left and right the upper ends of the thighs. lock and release drop mechanism of the locomotion powering counterweights. Sheaves and ropes of the counterweights (as in 28/7/2017).

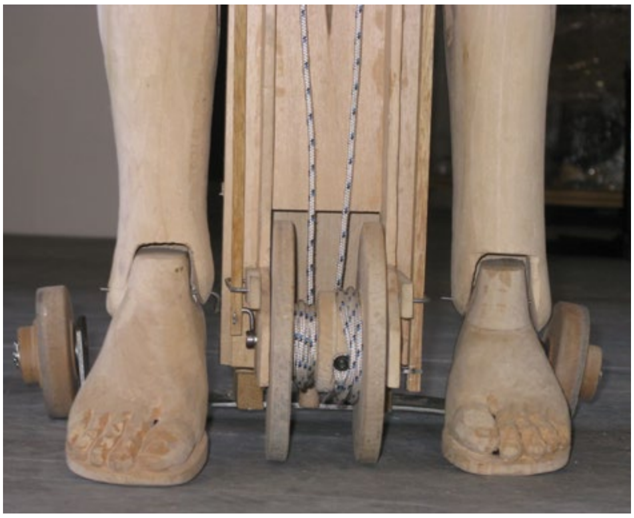

Figure 7b. The Servant's middle parts, as in 28/7/2017.

Figure 8a. the torso interior from behind, after removal of its back.

Figure 8b. the torso interior from behind, after removal of its back, detail.

The right hand

Since the act of pouring a liquid from a jug held by a human hand is always accompanied by the continually increasing tipping of the vessel, the servant's right hand is properly fashioned to operate in exactly this way: it turns inwards and downwards, bringing itself and the jug well away from the forearm's axis. Therefore, within the limited space inside the forearm, an elongated and bulky counter-weight is housed to act against the moment of force resulting from the said eccentricity.

Hand synchronization

For the synchronization of the hands a transversal mechanism combines their mechanisms. It consists of (from left to right) a nearly horizontal rod, a nearly vertical lever-distributor, a slender rod, a horizontally acting lever and a cord. The horizontally acting lever, installed immediately behind the torso to the right, has sockets at either end and a fulcrum in the middle. The cord, discretely passing through holes in both the torso and the right forearm, connects the lever with the counter-weight inside the forearm. The slender rod links the horizontal lever with the socket of the lever-distributor. This socket is one of a number of such sockets prepared in advance along the lever-distributor to enable adjustments and selections (e.g. how far the right hand turns).

Reservoirs, tubes, valves and pipes

Both pipes (one for wine, one for water) start from the torso interior and follow the same path: through two subsequent holes they pass inside the right forearm before, keeping well off the elongated counter-weight, they reach a channel inside the wrist and the palm, from which, they discretely pass inside the hollow handle of the jug to end – also discretely – inside the jug's lip.

In the drawings of the author, the hydraulic system is also included as well as the pneumatic system, but always in a rather sketchy manner with little attention to fine detail. However, the author quite soon abandoned any intension to elaborate them further, as, in the meantime, his colleague Spyros Ekonomopoulos, a gifted mechanical engineer kindly accepted the proposal to carry out this part of the project.

Therefore, all that follows is a summary of Spyros Ekonomopoulos' own contribution:

The vessels, one for 1.8 l of wine and one for 0.9 l of water, made of stainless steel (instead of silver in the original), occupy the rear-upper part inside the torso. Their wide round mouths at the top have well-fitting lids with a circular recess and a thin seal, making them air-tight. A special thin leaf-spring provides the necessary force to keep each lid in position (and its seal sufficiently compressed). A tap near the base of each vessel receives the upper end of its pipe. The tap ensures the avoidance of any leakage while the device is not in use and enables emptying if needed.

The air-valve mechanism consists of a vertical flat T-shaped chassis with a sliding pair of cams on the top, two L-shaped pawls as cam-followers on either side, each following the corresponding cam, two valve-levers likewise on either side, each being lifted (through a short rod) by the corresponding cam-follower, and two valve-caps suspended from the levers above the valves – the ends of the air-tubes, held in vertical position by a bracket fastened at the chassis-shaft. The valve's closing air-tightness is secured through the perfect flatness

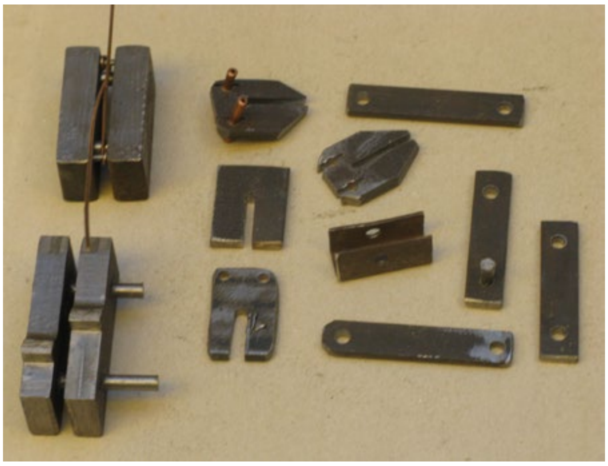

Figure 9a. Parts of the air-valves' mechanism

Figure 9b. Parts of the air-valves' mechanism

of the valve mouth and the softness of a tiny leather cushion housed in a recess of the bottom of the cap. To regulate the push-down of the caps, movable weights are suspended near the extremities of the valve-levers.

The sliding of the pairs of cams follows the motion of the hands and thus of the lever-distributor (see above) by means of a tiny and bent rod. The performance of the L-shaped pawls (cam-followers) is based on the special form of the cams: their underside contains one flat tooth like those of a ratchet, made to push the top of the pawl in only one direction (to the right), until it is released (i.e. free to return to its closing state) due to the form of its path (arc of a circle), as contrasted to the strait path of the cam. The distance over which a cam pushes a pawl of a given effective length (r) is controlled by the radial size of the tooth-pawl contact (tp). In the present case, properly adjusted values of tp control the 2:1 or 1:2 water wine ratio. The specific sequence of the flow of both wine and water is simply regulated by the differing position of the teeth along the corresponding cams.

Finally, the duration of the different motions in all mechanisms, being interconnected and identical with that of the flows of wine and water, is the result of many factors and parameters, including the diameters of the pipes and tubes, the mass of each particular body part or mechanical component, the distances, eccentricities, etc.

Acknowledgment

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The Hellenistic mathematician Archimedes and his Renaissance admirer Kepler

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Introduction

The Roman architect Vitruvius tells us the famous story of how Archimedes detected the fraud of the goldsmith who had been asked by king Hieron II of Syracuse to create a golden crown (*De architectura* IX, preface): 'Though there were indeed many wonderful and various inventions of Archimedes, this invention I shall describe seems to have come about also by infinite skill among all inventions.'[1] He found the solution while enjoying his bath: 'He sprang with joy out of the bath and went home naked and loudly declared that he had found what he was looking for. Running, he repeatedly cried in Greek "I have found it, I have found it".'[2]

Of course, his body had displaced a certain quantity of water according to its volume. Now he transferred the experience with his body to a nugget. This analogical thinking enabled him to reveal the fraud of the goldsmith: gold is heavier than silver. If there is a gold and a silver mass having the same weight, the gold needs less volume, and will displace less water. The physician and writer Walter Ryff illustrated the event in 1547 (Ryff 1547: leaf A 1 v°):

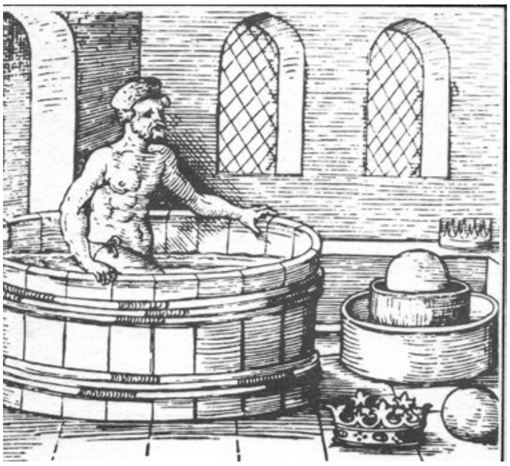

Figure 1. Archimedes in his bath; Ryff, W. 1547. *Vom rechten verstandt Wag und Gewicht etliche Büchlein*: leaf A 1 v°. Nuremberg: J. Petreius (courtesy of the Staatsbibliothek zu Berlin–Preußischer Kulturbesitz).

Archimedes, in a pair of trunks, is seen leaving the bath, although Vitruvius explicitly told us that Archimedes was naked when he ran home and cried 'I have found it'. Obviously a naked old man was not so attractive on the back of the title page of Ryff's treatise. A harmless historical misrepresentation!

Archimedes's analogical thinking is worth studying more diligently. We will discuss two mathematical examples before dealing with Kepler's similar methods.

Archimedes: analogy and prediction

Our first example concerns the area of a circle and the surface of a sphere. In his *Measurement of the circle* Archimedes proved the following theorem (*Dimensio circuli* proposition 1):

> 'The area of any circle is equal to a right-angled triangle in which one of the sides about the right angle is equal to the radius, and the other to the circumference of the circle.'

Let r be the radius of the circle. In modern terms the theorem says that the area of the circle is equal to $r\frac{2\pi r}{2}$. This is obviously true.

In his famous letter to Eratosthenes called *Perì tôn mechanikôn theoremáton éphodos*, that is, in his *Approach related to mechanical theorems*, Archimedes explained how he found the surface of a sphere by means of this theorem regarding the area of a circle. He carefully distinguished between the notion of *ephodos* in the title of the treatise and the notion of *tropos*, method, in the treatise itself (Knobloch 2000: 83). Archimedes had made the acquaintance of his countryman during his sojourn in Alexandria.

He presumed an analogous theorem by increasing the dimension of the three ingredients circle, triangle, circumference of the theorem on the circle by one (Archimedes 1910-1915 II: 446f.). Thus he considered a sphere instead of a circle, a cone instead of a triangle, the surface of a sphere (boundary) instead of the circumference of a circle (boundary). Hence the analogous theorem reads:

> 'The volume of a sphere is equal to the volume of a cone with base equal to the surface of the sphere and height equal to the radius.'

[1] 'Archimedis vero cum multa miranda inventa et varia fuerint, ex omnibus etiam infinita sollertia id, quod exponam, videtur esse expressum.'

[2] 'Exsiluit gaudio motus de solio et nudus vadens domum versus siginificant clara voce invenisse, quod quaereret; nam currens identidem Graece clamabat *heureka*, *heureka*.'

Let us call this cone 'cone 1' so that $V_{sphere} = V_{cone\ 1}$.

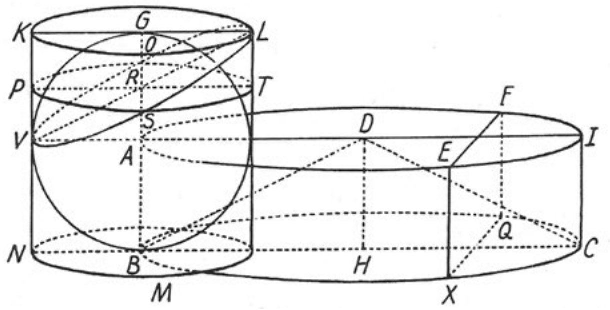

Figure 2. The volumes of a sphere and of a certain cone; Kepler, J. 1960. *Gesammelte Werke*, vol. IX *Mathematische Schriften* (ed. Fr. Hammer: 24. Munich: C. H. Beck'sche Verlagsbuchhandlung).

The question was whether he could justify this hypothesis. Fortunately he knew another valid theorem that combined the volume of a sphere with that of another cone. Let us call it 'cone 2':

'The volume of a sphere is four times as great as the cone with base equal to a great circle of the sphere and height equal to its radius' or $V_{sphere} = 4 \times V_{cone\ 2}$.

The height of both cones is equal to the radius of the sphere. They differ only by their bases. While in the first case the base of cone 1 is equal to the surface of the sphere, the base of cone 2 is a great circle of the sphere in the second case. Hence if the analogous theorem should hold, the factor 4 of the second equation must belong to the size of the base so that Archimedes concluded in the letter to Eratosthenes:

> 'The surface of the sphere is four times as large as a great circle in it.'

This is indeed theorem I, 33 of his treatise *On the sphere and cylinder*. Archimedes needed 13 theorems to prove it by means of rotating polygons, that is, by means of conical surfaces (*De sphaera et cylindro* I, theorems 21-33). In other words Archimedes used analogies in the context of discovery. The validity of a theorem analogous to a known, valid theorem presupposed the validity of another theorem about the surface of the sphere.

Archimedes: analogy and transgression of limits

In his treatise *Sand-reckoner* (*Arenarius* I, 4-5) Archimedes reports about the heliocentric world system of Aristarchus:

> 'The sphere of the fixed stars, situated about the same centre as the sun, is so great that the circle in which the earth revolves bears such a proportion to the distance of the fixed stars as the centre of the sphere bears to its surface.'

There can be no doubt that Archimedes understood what Aristarchus wanted to say. In comparison with the distance of the fixed stars, the orbit of the earth around the sun is very small, a point, so to speak. This distance is so large that the circumference of the orbit does not play any role. Yet he behaved like a senior primary school teacher saying:

> 'The centre of the sphere has no magnitude. Hence there is no ratio of this centre to the surface of the sphere.'

Strictly speaking Archimedes was right in saying this. The notion of quantity was at stake here. For Aristotle had defined (*Metaphysics* V, 13):

> '*Posón* (quantity) is called what can be divided into parts being in it (*diairetón*).'

Hence indivisibles are non-quantities by definition. According to Euclid (*Elements* I, definition 1) a point like the centre of a sphere is an indivisible. There are two types of quantities:

> '*Plêthos* is a multitude which can be numbered (*arithmetón*).'

> '*Mégethos* is a magnitude which can be measured (*metretón*).'

Aristotle always spoke in the mode of possibility, that is, something can be done. Moreover magnitudes can have a ratio. Euclid had explained when this is the case (*Elements* V, definition 4):

> 'Magnitudes are said to have a ratio to one another which are capable, when multiplied, of exceeding one another.'

An arbitrary multiple of a non-quantity, of an indivisible, does not produce a divisible magnitude. Nevertheless Archimedes developed his integration theory that contradicted these insights, using again an analogy. He explained it in his letter to Eratosthenes (Archimedes 1910-1915 II: 438-447). He compared the volumes of a circular cylinder, a cone, and a sphere whereby the diameter of the sphere was the common height of cylinder and cone. Cone and cylinder had the same base:

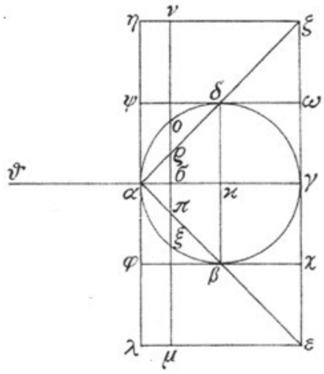

Figure 3. Archimedes's integration theory (Archimedes 1910-1915 II: 441).

Archimedes considered an arbitrary, vertical section through the three bodies of the cylinder, the sphere, and the cone, thus getting three circles. Using the mechanical principle of equilibrium he argued by geometrical reasoning that the section of the sphere (a circle) and that of the cone (another circle) taken together, suspended on the left side of the balance, counterbalance the section of the cylinder (a third circle) that remains at its place: the sum of the areas of the first two circles equals the area of the third circle. This applies to all of such triples of circles. Hence, Archimedes concluded: sphere and cone suspended in their centre of gravity on the left side counterbalance the cylinder that remains at its place.

We recognise that the Archimedean *trópos* (method) of the Éphodos (Approach) consisted in a transfer of the structure of quantities to non-quantities or indivisibles, that is, in an analogy. The sections of areas (straight lines) or bodies (circles) are weighed by means of the doctrine of centres of gravity and statics. Archimedes explicitly said that: the circles fill up (*sympleroûn*) the cylinder, cone, sphere (Archimedes 1910-1915 II: 442); and that the segment of a parabola or a triangle consists of (*synésteke*) (parallel) straight lines (Archimedes 1910-1915 II: 436). The circles or lines leave no gaps in the solid or area.

There was no idea of a summation or of infinitesimals (Becker 1966: 109; Netz, Noel 2007: 191, 204). It was a transfer from the finite to the infinite using the measure axiom in both cases. Hence Archimedes transgressed limits in four respects: he violated methodological prescriptions mixing geometry and mechanics; he used non-mathematical objects, that is, non-quantities; he replaced Aristotle's mode of possibility by an action really carried out, admitting actual infinity and indivisibles; he violated the axiom named after him: Let *a* and *b* be two arbitrary real numbers. Then there is always a natural number *n*, such that *na* is larger than *b*.

One might ask whether Archimedes was entitled to do that: he justified his method by saying that he found mechanically, but that he demonstrated geometrically.

Kepler in the tradition of Archimedes

In 1615 Johannes Kepler published his most important work, the *New solid geometry of wine barrels especially of the Austrian one which has the most suitable shape of all: and briefest and completely unparalleled use therein of the cubic gauging rod. A supplement to the Archimedean solid geometry has been added*[3] (Kepler 1615). A bilingual Latin-English edition has just been published (Kepler 2018).

In our context the first part entitled *Solid geometry of curved regular bodies* is especially interesting. Its first section mainly deals with Archimedes's plane and solid geometry. It interprets his demonstrations using new methods that turned Kepler into one of the forerunners of calculus. He considered the area of a circle, the volumes of a cone, a sphere, a spheroid, of parabolic and hyperbolic conoids. Its second section entitled *Supplement to Archimedes* investigates the *Solid geometry of figures that are closest to the conoids and spheroids*, that is, the volumes of ideal, mathematical apples, lemons, and spindles. Kepler surpassed by his results the results of his famous Greek predecessor.

What is at stake here is Kepler's use of analogies. To that end let us consider theorem VII of the first section. It generalises Archimedes's theorem on the surface of a sphere. Archimedes demonstrated it in his treatise *On the sphere and cylinder* (*De sphaera et cylindro* I, theorems 42 and 43):

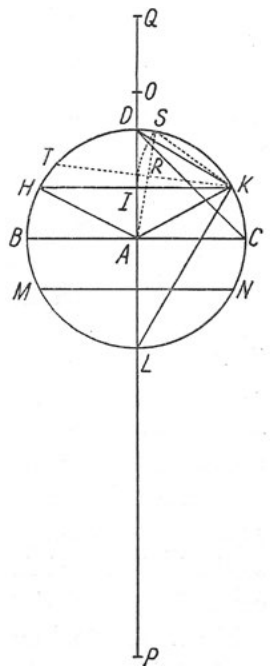

Figure 4. The surface of any segment of a sphere (Kepler 1960: 21).

[3] *Nova stereometria doliorum vinariorum, in primis Austriaci, figurae omnium aptissimae, et usus in eo virgae cubicae compendiosissimus et plane singularis. Accessit stereometriae Archimedeae supplementum.*

> 'The convex surface of any segment of the sphere is equal to the plane of a circle whose semi-diameter spans the width of the segment from the pole to the base.'

Kepler commented (Kepler 1615: 21): 'See the demonstration in Archimedes. But the analogy will bring about you the first confidence.'[4] What did he mean by that? He considered two special, extreme cases (the whole sphere and the hemisphere) and generalised the result, calling such an incomplete inductive reasoning analogy. It brings confidence so that the validity of the theorem becomes probable.

In the case of the sphere, the connecting line *DL* from the pole *D* to the base, that is, to the point *L* is equal to *2r*. Hence the area of the corresponding circle will be equal to $(4r^2)\pi$. This quantity is equal to the surface of the sphere, the theorem is valid in this case.

In the case of the hemisphere the connecting line *DC* is equal to $\sqrt{2}\pi$. Hence the area of the corresponding circle will be equal to $(2r^2)\pi$, hence to the surface of the hemisphere. The theorem is also valid in this second special case.

Theorem VII is an instructive, perfect example for Kepler's notion of analogy that he had defined in his *Optics* (Kepler 1604: 92): 'For the geometrical voices of analogy must serve us. I love indeed analogies most of all, my most reliable masters, they know all secrets of nature. They have to be considered especially in geometry, when they – though by most absurd designations – comprehend infinitely many cases which are inserted between the extreme cases and the middle, and when they make clearly evident the whole nature of every thing.'[5]

We have to accept that Kepler's notion of analogy differed from ours. Hammer was wrong when he criticised Kepler's terminology in the case of theorem VII (Kepler 1615: 486). Even Kepler's critical reader, Paul Guldin, liked this reasoning saying (Guldin 1635-1641 IV: 327): 'And in order to say as matters lie that analogy does not at all displease but it is beautiful and worthy of Kepler. Yet, in my judgement these analogies are more of service to the invention of things than to the demonstration. Kepler acknowledges exactly this and adds for this reason: See the demonstration in Archimedes.'[6]

We see that Kepler, too, just as Archimedes did, transgressed limits. He did not restrict the use of analogies to the context of discovery but used them also in the context of justification. Later on when he discussed the relation between certain cylinders and the so-called conjugated conical frustums he even said (Kepler 1615: 107): 'This is the invincible demonstration by analogy. But since the geometers are less accustomed to analogies, let us try a more laborious and completely geometrical demonstration.'[7]

When Kepler used analogies in the context of discovery he used the same analogy as Archimedes in his *Approach* in order to replace circle, triangle, circumference by sphere, cone, surface, and that of course without being aware of this letter to Eratosthenes. First of all, by theorem II, Kepler explained the meaning of Archimedes's theorem that the area of a circle is equal to a certain right-angled triangle (Kepler 1615: 15):'For me the meaning seems to be this.' ('Mihi sensus hic esse videtur').

This is a rather cautious formulation. Later on he is less cautious and speaks about 'the laws by which Archimedes expanded the area of a circle into a rectangular triangle in theorem II' ('legibus [...] quibus Archimedes Theorem II. explicavit circuli aream in triangulum rectangulum'), as if his interpretation were a matter of fact (Kepler 1615: 49).

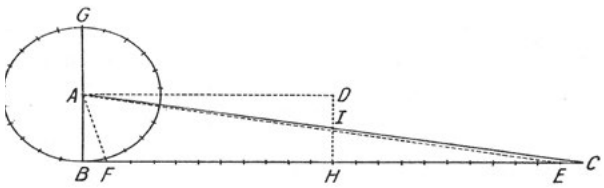

Figure 5. The area of a circle (Kepler 1960: 15).

His interpretation reads as follows (Kepler 1615: 15): 'The circumference of the circle *BG* has as many parts as points, namely, infinitely many. Each of these is regarded as the base of any isosceles triangle with the sides *AB*, so that there are infinitely many triangles in the area of the circle.'[8]

The circumference of the circle is straightened out into the straight line *BC* so that the bases of these infinitely many triangles or sectors are therefore all supposed to

4 'Demonstrationem vide apud Archimedem. Primam vero fidem tibi faciet analogia.'

5 'Oportet enim nobis servire voces Geometricas analogiae: plurimum namque amo analogias, fidelissimos meos magistros, omnium naturae arcanorum conscios: in Geometria praecipue suspiciendos, dum infinitos casus interiectos intra sua extrema mediumque, quantumvis absurdis locutionibus concludunt, totamque rei alicuius essentiam luculenter ponunt ob oculos.'

6 'Et ut dicam quod res est, nullo modo displicet illa analogia, sed est pulchra et Keplero digna: Analogias tamen istas iudico magis servire inventioni rerum, quam demonstrationi, quod ipsum agnoscit Keplerus, et ideo addit: Demonstrationem vide apud Archimedem.'

7 'Haec est demonstratio inconvincibilis per analogiam, sed quia Geometrae minus assuefecerunt se ad analogias, age operosiorem et plane Geometricam tentemus demonstrationem.'

8 'Circuli *BG* circumferentia partes habet totidem, quot puncta, puta infinitas; quarum quaelibet consideratur ut basis alicuius trianguli aequicruri, cruribus *AB*: uti ita triangula in area circuli insint infinita, omnia verticibus in centro *A* coeuntia.'

be on the one straight line *BC*, arranged one next to the other. Their common height of these triangles is *AB* that constitute, taken together, the right-angled triangle *ABC*. Kepler presupposes a one-to-one correspondence between the parts and the points of the circumference. He does not say that the parts are points, although this is an unavoidable consequence. He calls the bases 'arbitrarily small'. But the similarity between Archimedes's use of indivisibles in his integration theory and Kepler's interpretation is obvious.

When Kepler calculated the volume of a completely symmetric, mathematical apple he claimed to use the same laws as Archimedes (Kepler 1615: 49). Guldin rejected this claim saying (Guldin 1635-1641 IV: 325): 'For he did not reach the mind of Archimedis.' ('Non enim assecutus est mentem Archimedis'). It might be called the artifice of the history of science that, in reality, Archimedes and Kepler were brothers in mind.

This insight becomes even more obvious if one considers how Kepler realised the transfer from the two-dimensional to the three-dimensional case discussed above: 'The volume of a sphere is equal to the volume of a cone with base equal to the surface of the sphere and height equal to the radius.'

Archimedes had used a global replacement: He replaced the triangle by a cone. Kepler used local replacements: He replaced the 'infinitesimal' triangles by infinitesimal cones. His main idea was a transformation of the geometrical objects. Kepler argued with regard to figure 2 (Kepler 1615: 23):

> 'Because, by analogy to what has been said in theorem II, the body of the sphere potentially contains in it infinitely many so-to-speak cones with their vertices in the centre of the sphere, whereby the bases, taking the place of points, stand on the surface.'[9]

When the bases are taking the place of points they must be equal to points. These bases constitute, taken together, the base of the cone, that is, the infinitely many indivisibles constitute, taken together, a quantity. This is exactly the same idea Archimedes had used when he explained his integration theory.

Kepler's approach was heavily criticised by his contemporary Alexander Anderson, who, in 1616, published a small booklet against Philipp van Lansberghe's measurement of the circle (Anderson 1616). He rejected Kepler's claim that he used the same laws as Archimedes. He rejected Kepler's expansions and transformations, which were, as he said, alien to Archimedes. Yet, he could not know Archimedes's dealing with indivisibles. Guldin cited and partly repeated Anderson's criticism in the fourth book of his monograph *On the centre of gravity* (Guldin 1635-1641 IV: 330f.) but defended Kepler to a certain extent.

He spoke of Kepler's *nova inventio*, new invention, even of Kepler's *nova demonstrandi ratio*, new method of proving, which could not be accepted at once by all (Guldin 1635-1641 IV: 224f.). He summarised the evaluation of Kepler's achievements and proceeding as follows (Guldin 1635-1641 IV: 322): 'The essential reproach was that he had not looked in the least after the purity and exactness of geometry, that he had assigned much to analogies and conjectures, that he had not always scientifically concluded and that moreover he had obscurely presented all his results. But I excuse this man well known to me in all aspects.'[10]

Obscurity was indeed a rather subjective reproach. It is worth mentioning that Archimedes was criticised by many authors of the 17th century, including Guldin, exactly for the same reason, that is, because of his alleged obscurity. In 1604 Christoph Clavius said in his *Practical geometry* that the writings of Archimedes were a bit too obscure (*paulo obscuriora*), because of the brevity aspired to (Clavius 1604: 118). Guldin wrote the whole fourth book of his work *On the centre of gravity* to this end. He called this book *Archimedes illustratus*, The illustrated Archimedes, and explained (Guldin 1635-1641 IV: 297): 'Finally, we call this book "Illustrated Archimedes" because of the clear and perspicuous demonstrations which we substituted for the too obscure Archimedean demonstrations.'[11]

Epilogue

Let us summarise the results of this comparison. Archimedes used analogies in the context of discovery. Kepler used analogies also in the context of justification, employing a generalised, own notion of analogy. Both scientists transgressed limits, thus distinguishing themselves by outstanding creativity. One might cite the modern graph theorist Steve Butler, who had said (Beineke 1986: 325): 'Though analogy is often misleading, it is the least misleading thing we have.'

And it seems to be appropriate to remind ourselves of the English number theorist Godfrey Harold Hardy's saying (Hardy 1969: 81): 'Archimedes will be remembered

[9] 'Corpus enim sphaerae ad analogiam eorum, quae dicta sunt theor. II. potestate in se continent infinitos velut conos, verticibus in centro sphaerae coeuntes, basibus, quarum vicem sustinent puncta, in superficie stantibus.'

[10] 'Summa erat eum puritati geometriae et accurationi minime consuluisse, Analogiis et Coniecturis multum tribuisse, non scientifice semper concludisse, et insuper sua Omnia obscure proposuisse. Verum ego hominem mihi bene notum in omnibus excusatum habeo.'

[11] 'Hunc librum denique vocamus "Archimedem illustratum" propter demonstrationes claras ac perspicuas quae obscurioribus Archimedeis substituimus.'

when Aeschylus is forgotten, because languages die and mathematical ideas do not. "Immortality" may be a silly word, but probably a mathematician has the best chances of achieving whatever it may mean.'

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Ancient Greek optical instruments and the Pharos of Alexandria: insights on its functions and technology

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Introduction to ancient optics

Astronomy is part of every culture from prehistoric times. Humans admire and study the sky initially by naked eye, they observe the motion of the stars, the sun, moon, and planets. They notice the changes of the seasons, the yearly change of the altitude of the sun, the changes of the position of sunrise and sunset. Eventually they develop various instruments, poles, simple *stelae*, buildings and cities according to various astronomical orientations. These astronomical observations probably lead to the development of reasoning, to the notion of causality and, with it, the laws of physics that are described by appropriate mathematics to predict properly nature, to 'save the phenomena'.[1]

Based on ancient Greek texts and actual finds, it is evident that they not only mention lenses and mirrors of various types, but they also even study nature with scientific methods, experimental and theoretical, as in Euclid's work *On Catoptrics*.[2] Perhaps the most famous quotation on the use of lenses in antiquity is the one in Aristophanes, who mentions that Greeks can buy from a pharmacy lenses to light fires,[3] and can falsify the minutes of a court from a distance by using a lens.[4] By addressing the use of lenses in a comedy, it is most probable that Aristophanes refers to something known to the general public. Several lenses and many mirrors are exhibited in Greek and other archaeological museums,[5] but there are many more important ancient texts about optics, especially mirrors.

The science of optics was called *catoptrics* by the Greeks, as was initially the study of mirrors, called 'catoptra' (Κάτοπτρα) in Greek. Optics becomes a science, mainly in Alexandria, probably before the time of Euclid. Euclid's *Catoptrics* explains theoretically the phenomena of reflection, multiple reflections and the formation of images, reversed, magnified, etc. Euclid explains why certain mirrors reverse the image, making it left- or right-handed, or inverse, up and down. He also explains why images appear diminished and warped in convex mirrors and how they can be seen in concave mirrors.[6] Another very important theoretical study is the one on burning mirrors by Diocles (*c.* 240 - *c.* 180 BC),[7] of which an Arabic translation exists. It proves that ancient scientists treated optics purely theoretically, using geometry without involving the eye of the observer or vision.

According to some scholars,[8] Greek philosophers' texts explain the nature of vision as rays of light emitted from the human eye. However, this belief is based on a misunderstanding, since Greek texts simply mention the mathematical method to draw lines to study and understand vision. The confusion is probably due to the use of term *opsis* (όψις) which has three meanings at least a) the eye, b) the vision, and c) the rays of light and the straight lines used in the theory of optics.[9]

That optics are to be considered as part of geometry is proven by the lack of any reference to vision or to the human eye, whereas lines are used to explain the phenomenon. This is ascertained by the almost

[1] In Heraclides Ponticus (*c.* 390–310 BC) τὴν γῆν καὶ κύκλῳ κινουμένην, τὸν δὲ οὐρανὸν ἠρεμεῖν Ἡρακλείδης ὁ Ποντικὸς ὑποθέμενος σώζειν ᾤετο τὰ φαινόμενα; Eudemus (270-300 BC), the oldest historian of science, mathematician, astronomer and student of Aristotle who edited his teacher's books before publication, writes σώζειν τὰ φαινόμενα and it is repeated by Plutarch (46-120AD) in his book *On the Face in the Orbit of the Moon*, ... φαινόμενα σῴζειν...

[2] It is suggested by O'Conor and Robertson that the text cannot be attributed with certainty to Euclid, rather its contents are a mixture of work dating from Euclid's time, together with work which dates to the Roman period. It has been argued that the book may have been compiled by the 4th-century mathematician Theon of Alexandria.

[3] Aristophanes, *Clouds* (Strepsiades: 'Have you seen the transparent stone that you can buy from the pharmacy to light up a fire?' Socrates: 'yes, you mean the glass (lens), you can use it to melt and delete from a distance the writings of your suit in the court.').

[4] The minutes of proceedings of the court were written on tablets covered with a thin layer of wax that *Strepsiades* could delete from a distance by focusing the sun's rays onto the layer of wax.

[5] Twyman 1942; 1952, 2nd edn. *Prism and Lens Making*, Hilger.

[6] Irby (ed.) 2016, *A companion to science, technology, and medicine in ancient Greece and Rome*, London, John Wiley and Sons.

[7] Toomer 2012. *Diocles, On Burning Mirrors: The Arabic Translation of the Lost Greek Original* (Vol. 1). Springer Science and Business Media.

[8] Neugebauer 1975, *A History of Ancient Mathematical Astronomy In Three Parts*. Berlin: Springer-Verlag.

[9] Thibodeau 2016, Ancient Optics: Theories and Problems of Vision, in: G Irby (ed.) *A Companion to Science, Technology, and Medicine in Ancient Greece and Rome* (1st Edition): 130-144. London, John Wiley and Sons.

identical sentences used by Euclid and Heron of Alexandria,[10] reported by Medaglia and Russo[11] on the geometry of vision. Euclid in his *Catoptrics* states: 'let us draw straight lines from the eye that deviate as the distance increases', and even introduces the solid angle as a cone.[12] Geminus of Rhodes (1st century BC) and Theon of Alexandria give the same geometrical description, almost the same sentence. Heron in his book *Definitiones*[13] says that light rays are straight lines that deviate from the eye and the same thought is repeated by Geminus in his *Fragmenta optica*[14] (Evans and Berggren 2006).

Geminus and Heron divide *optics* into three parts, as (a) *optic*, (b) *catoptric* and (c) *scenographic*.[15] Geometrical optics is used for reflection of light on surfaces such as water, metallic plates, and also for refraction in crystal and lenses. Light follows straight lines or at times is refracted as in lenses (ἀκλάστους, τότε δὲ κατὰ δυομένας, ὥσπερ ἐπὶ τῶν ὑέλων). Spectroscopy (Ἴρις) is the study of colours that appear in air, water, shadows, or around the rays of the sun. Scenography is the study of the images of buildings in three dimensions, i.e. projective geometry and descriptive geometry. They are suitable and important for design, architecture, engineering, and in art to show diminution of size with distance. Claudius Ptolemy (2nd century AD) has written five extensive books about optics, on mirrors and reflection, and we can conclude that it was a very detailed study on a science that was very advanced during Hellenistic times.

Ancient lenses

Ancient lenses have been studied and presented mainly by archaeologists. Sines and Sakellarakis (1987) present lenses from prehistoric Greece found in Knossos. J. M. Enoch (1998; 2000) presents a lenticular crystal man-made object, considered as simply ornamental. Giovanni Pettinato (Willach 2008) believes that this Assyrian lens discovered by Sir John Layar in 1850, was possibly used for the magnification of objects. Ancient lenses are described by Irby-Massie and Keyser (2002) in their book on Greek science of the Hellenistic era. Russo gives an account of ancient lenses from various sites in his book the *Greek scientific revolution* (2013). Russo reviews the scientific presentations regarding lenses in antiquity and discusses Ptolemy's text, where tables with refraction angles of different mediums are given and even discusses the possible existence of telescopes in antiquity.

The Archaeological Museum of Heraklion in Crete, Greece, exhibits more than 20 lenses, some dating to *c.* 2000 BC, which are intact and in good condition. Their focal lengths range around some tens of cm. The visual image that these lenses produce is reasonable, more than just acceptable. Despite the distortion of their refractive properties, the lenses produce visual images that can be useful and suitable for practical purposes. For example, the magnification produced by a lens may be used for engraving and working with small objects, such as the construction of jewels and seals, like those found in prehistoric Greece, as mentioned by Sines and Sakellarakis.

Another 20 magnifying lenses with handles made of copper are held in the Archaeological Museum of Rhodes. They are believed to date to the 8th century BC. Most probably these were lenses used in a workshop. Measurements of their focal lengths showed that more than one or two of these lenses provide the same magnification and thus we can probably conclude that they could have been meant for sale, possibly even to mitigate presbyopia, the aging eye condition. Around 40 lentoid, lens-like crystal objects, found by Schliemann at Troy are now in the Pushkin Museum, Moscow. These are assumed to be meant probably for the decoration of a royal ceremonial suit, or something equivalent. However one of the lenses is definitely a lens having good quality image depiction. All these lenses are converging lenses, one with a spherical and one with a plain surface. Some lens-like objects are real lenses used for magnification[16] and perhaps others are just for decoration.[17] At least two or three very impressive lenses that are suitable for aiding myopia, near-sightedness or short-sightedness, have been on display at the exhibition of objects from Vergina at the Archaeological Museum of Thessaloniki.

The use of magnifying lenses is evident from the details of seals dating to many historical periods, including the Hellenistic period in Alexandria. A recently discovered seal from a ring of the 15th century BC from Pylos

[10] Heron of Alexandria (1900) *Opera quae supersunt Omnia. Mechanica et catoptrica*, L. Nix and W. Schmidt (eds). Leipzig: B. G. Teubner.

[11] Medaglia and Russo 1995. Sulla prima 'definizione' dell'Ottica di Euclide. *Bollettino dei classici*: 41-54.

[12] Eucl. *Opt.*: 'Let it be established that visual rays move along straight lines from the eyes and produce some distance between one another; 2) and that the shape inscribed by the visual rays is a cone that has its vertex at the eye and its base at the limits of the things being seen; 3) and that those things are seen against which the visual rays fall, while those things are not seen against which the visual rays do not fall...'

[13] Heron, *Definitiones*: Ὅτι ὑποτίθεται ἡ ὀπτικὴ τὰς ἀπὸ τοῦ ὄμματος ὄψεις κατ' εὐθείας γραμμὰς φέρεσθαι, καὶ τοῦ ὄμματος περιφερομένου συμπεριφέρεσθαι καὶ τὰς ὄψεις, καὶ ἅμα τῷ ὄμματι διανοιγομένῳ πρὸς τὸ ὁρώμενον γίνεσθαι τὰς ὄψεις.

[14] Geminus, *Fragmenta optica*: Ὅτι ὑποτίθεται ἡ ὀπτικὴ τὰς ἀπὸ τοῦ ὄμματος ὄψεις κατ' εὐθείας γραμμὰς φέρεσθαι καὶ τοῦ ὄμματος συμπεριφερομένου συμπεριφέρεσθαι καὶ τὰς ὄψεις καὶ ἅμα τῷ ὄμματι διανοιγομένῳ πρὸς τὸ ὁρώμενον τὰς ὄψεις γίνεσθαι. ὑποκείσθω τὰς ἀπὸ τοῦ ὄμματος ὄψεις κατ'εὐθείας γραμμὰς φέρεσθαι διάστημά τι ποιούσας ἀπ'ἀλλήλων.

[15] Geminus and Heron say exactly the same, using the same phrase.

[16] Sines and Sakellarakis 1987. Lenses in antiquity. *American Journal of Archaeology*: 191-196 (holding that the lenses are for magnification).

[17] Plantzos (1997) suggests that lense-like objects are just for decorative purpose.

proves that humans managed to make incredible details. The fingers of one of the warriors depicted on the seal are accurately displayed with an accuracy of 0.2 mm, i.e. half the diameter of a human hair, with details visible only through photography techniques, such as photomicroscopy.[18]

The theory of optics flourished in the Hellenistic Period and continued to develop in Roman times, as proven by Heron and Ptolemy, who lived in Alexandria. In this period refraction is clearly understood on a theoretical basis. Euclid in his book *Catoptrics* described the theory of the construction of images from spherical mirrors, giving details on left- and right-handed images from spherical mirrors, as well as on the size of the image, thus providing a mathematical explanation as to why the image from the smaller spherical mirror is also smaller. Heron of Alexandria in his *Definitions* explained how refraction happens as the rays of light following straight lines enter from one transparent medium to another denser medium, i.e. water, glass, films or membranes.

Ancient mirrors

The Greeks use three terms of mirrors: Κάτοπτρον, Ἔσοπτρον and Ἔνοπτρον. In Greek Ἔσ, Εν means inside, Κάτ means against, οπτ means to look and –τρον, means and implies an instrument: so these three terms mean an instrument to look through or against. According to Greek mythology the first mirror was made by Hephaestos (Vulcan) for Dionysus, as described by Proclus in *Platonis Timaeum commentaria*. The construction of a convex mirror is described by Agathias in *Historiae*, who states that a convex mirror focuses the rays of the sun on a point (αἴγλη, focal point).

The use of bronze mirrors was well known in Minoan and Mycenaean civilizations. Corresponding artefacts are held in the archaeological museums in Crete and the National Archaeological Museum at Athens. Some terracotta shallow vessels found around the Aegean Sea and mainly in the Cyclades, where the so-called 'frying pan' vessels of the 4th and 3rd millennia BC, peculiar containers for liquids that were painted black on the inside, could have been filled with water and used as mirrors.[19]

Apollonius in his work *Apotelesmata* gives a description of how to construct a metallic mirror alloy using copper, mercury, silver, gold, lead, tin and crystal.[20] Mirrors had many applications. Naturally they were meant and used for cosmetics, to mirror oneself, but also for reflecting light, as in the case of the Pharos of Alexandria, possibly to observe images of astronomical objects, and even for hunting and trapping animals, as Athenaeus states many times in his book *Deipnosophistae*.[21]

According to literature, the first scientists to understand the physics and mathematics of reflection were Pythagoras and his followers, as stated by the so-called Pseudo-Galenus (Galen of Pergamon, 2nd century AD) in his book on the history of science (*De historia philosophica*).[22] He refers to how Democritus and Epicure studied the formation of images produced by reflections on mirrors, plain or spherical, and how the images thus produced are inversed. Plato in *Theaetetus* uses the expression ὥσπερ εἰς κάτοπτρον ἢ ὕδωρ (as in a mirror or water), referring to an image produced by reflection. Aeschylus in the play *Agamemnon* says that we use mirrors made of the chemical element copper (κάτοπτρον εἴδους χαλκός), hence mirrors to be used in a theatrical play must have been common place, known to all. It is evident that there were mirrors made of various materials. Aristoteles[23] in his treatise on colours refers to various colours of various mirrors, and we can conclude that he had in mind mirrors made of water in a container with black interiors, polished black stones, copper, silver, or even gold. Hence, mirrors were not used only by the very rich. Familiarity with reflections and on the formation of images must have been more common than thought.

A very important description of astronomical observations with a set of mirrors used as a telescope to observe celestial objects is given by Flavius Arrianus (*c.* AD 85 to *c.* 160) who wrote the history of Alexander the Great (*Alexandri anabasis*) in his *Fragmenta de rebus physicis* ('About Physics'), where he refers to Democritus, the teacher of Hippocrates using a 'telescope' to observe planets and then he observed their images and managed to understand the constituents of the comets. The philosopher Apollonius in his book *Apotelesmata* states that we cannot know everything that happens on earth at all latitudes and the sky unless we use a mirror to see clearly.[24] The great mathematician and astronomer Eudoxus wrote a popular astronomy

[18] Davis and Stocker 2016. The Lord of the Gold Rings: The Griffin Warrior of Pylos, *Hesperia* 85: 627-65.

[19] Tsountas 1899, Κυκλαδικα II, ArchEph, 74–134; Coleman 1985, 'Frying pans' of the Early Bronze Age Aegean, *American Journal of Archaeology* 89: 191–219; Papathanassoglou and Georgouli 2009. The 'frying pans'of the early Bronze Age Aegean: an experimental approach to their possible use as liquid mirrors. *Archaeometry* 51(4): 658-671; Tsikritsis, Moussas and Tsikritsis 2015, Astronomical and mathematical knowledge and calendars during the early helladic era in Aegean 'frying pan' vessels, *Mediterranean Archaeology & Archaeometry* 15(2).

[20] 'For the construction of a mirror… take copper, mercury, silver, gold, lead, tin and crystal in equal quantities and you can construct any type of mirror, with a similar texture as glass…'

[21] '…if you put a mirror and a noose in front of it before quails when in mating season, they run towards the mirror and get caught in the noose.'

[22] Pseudo-Galenus, *De historia philosophica*.

[23] Aristoteles *De coloribus*, 'in water the image is rather water-like, and in mirrors it has the colour of the mirror'.

[24] Apollonius, *Apotelesmata*.

book entitled *Phenomena and Mirrors* (Φαινόμενα και Ένοπτρον), where he gave a description of the sky.[25] One can assume that he used the word mirror in the title mirror for a book that describes the sky, since observation of the sky was done by means of mirrors.

Philosophers observing comets[26] realise that they contain gases, jets of gases, which make them rotate. Another astronomical use is mentioned by the influential philosopher Aristoteles.[27] In his book *De Mundo* (Περί Κόσμου) when referring to the spectrum of light (Ίρις), he writes that Iris appears in the reflection of a part of the sun or moon when it is in a 'humid' and 'hollow' cloud. The same description of observations of *spectra* seen with mirrors is given by Posidonius in his book *Meteorologica*, in a description given by Diogenes Laertius. Apollonius of Laodicia in his astrological book *Astrologia Apotelesmatica* says that we use mirrors as a telescope to see clearly objects in the sky and on the ground.

Plutarch in his book *De facie in orbe lunae* stresses that concave mirrors can be used to light fire, while convex mirrors cannot. Plutarch uses the term concave mirror in his *Moralia* on *De Pythiae oraculis*, where he states that one can have distorted images using plain and concave mirrors, in fact he refers to imaginary images (φασμάτων) and real images (εἰδώλων). An even more interesting observation goes back to Thales observing an eclipse using a mirror. The earliest predicted eclipse, according to Greek literature, is given by the so-called Pseudo-Plutarchus in *Placita philosophorum*, in the section on eclipses of the sun,[28] where it is written that Thales first predicted the eclipse of the sun by the moon, and underlines that during the solar eclipse one can see the earth-like nature of the moon (i.e. the irregularities of the moon's mountains). Lucianus in his book *Hippias*[29] says that children study the theory of optics concerning the reflections on mirrors and astronomy.

The theory of multiple reflections is studied in Euclid's *Catoptrics*. Euclid[30] describes geometrically the reflection of light on a spherical mirror without the use of the eye, and this proves that the notion of rays emitted by the eye is a misunderstanding of earlier interpreters (see also O'Connor and Robertson 2003). He takes the sun as a source of light to have parallel beams of light and describes the focusing of these lines (rays). Not surprisingly, Archimedes[31] constructs hexagonal mirrors that he can move (in four variable angles, probably two for every hexagonal mirror and two angles for the system of all mirrors together) remotely and direct them from a distance, regardless of the position of the sun, using strings to focus at a target in the way done today (i.e. N.A.S.A. for the James Webb Space Telescope).[32]

Anthemius describes focusing light in mirrors, using seven convex mirrors, like the cluster of mirrors used by Archimedes. Possibly a system similar to the mirrors in the Pharos.[33] The Byzantine philosopher and historian Michael Psellus (*c.* 1017 - *c.* 1096) in the book *Oratoria minora* adds to the description that Archimedes' mirrors could focus automatically and set fires burning at a distance,[34] and he adds that (cat) optricians and engineers have not only to follow the appropriate education but theoretical proofs as well.[35] Psellus adds that mirrors made of glass with a layer of tin are much better, as the anomalies of the surface of glass are very small and tin doubles the reflectability of the mirror, and that all smooth bodies reflect light and this shows that the theory of reflection was taught during Christian times in Byzantium.[36]

The theory on the applications of hexagonal mirrors is given by Anthemius of Tralles (*c.* AD 474-533 or 558), an excellent mathematician and renown architect in Constantinople, the capital of the eastern Roman Empire, who designed and constructed, together with Isidorus of Miletus, Hagia Sophia (AD 532-537) at the time of Justinian. Anthemius wrote an important work *On surprising mechanisms* (Περὶ παραδόξων μηχανημάτων), in which he gives theoretical proofs of theorems concerning reflection of mirrors. Anthemius describes the burning mirrors of Archimedes (without mentioning the great mathematician) with multiple reflections on many hexagonal mirrors, moved remotely with a system of strings and blades used to light fires at a distance.[37]

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25 Dicks 1970. *Early Greek Astronomy to Aristotle*. Cornell University Press.

26 Moussas 2014, Early Greek astrophysics: the foundations of modern science and technology. *American Journal of Space Science* 1(2): 129.

27 Aristoteles, *De mundo*.

28 Pseudo-Plutarchus, *Placita philosophorum*: 'On solar eclipses. Thales first predicted a solar eclipse as the moon covering the sun and he understood that the moon is of earthly nature as he observed it with a mirror.'

29 The theory of light rays' reflection and the theory of mirrors, and even astronomy.

30 Fire can be lit using sunrays and concave mirrors.

31 Diodorus Sicasulus in his *Bibliotheca historica*: '... the old man [Archimedes] used a set of hexagonal mirrors that can move is all directions [four angles] using blades to focus together and direct the light of the sun at will to burn the Roman fleet...'

32 Gardner *et al.* 2006. The James Webb space telescope. *Space Science Reviews* 123: 485-606.

33 'Better concentration of light with four or five 'burning' mirrors...'

34 'He made a mirror for me that from a distane burns to ashes an object automatically.'

35 'The student of optics and automata or anyone that learns together with the basic four disciplines ... without the use of theoretical principles ...'

36 Michael Psellus, *Opuscula psychologica, theologica, daemonologica*: 'Every object that receives light reflects it. and especially smooth surfaces, like coins, mirros and water.'

37 *On surprising mechanisms* by Anthemius of Tralles, whose manuscript tradition depends entirely on the opening bifolium of the Vat. gr. 218 (critical editions in MGM, 78–87, and CG, 349–59):

The Pharos of Alexandria

The lighthouse of Alexandria, the *Pharos*, was considered one of the Seven Wonders of the World. The light could be seen on the sea from some 300 *stadia* away (ca. 50km) guiding sailors to the harbour.[38] This remarkable building was particularly well built, since it has been standing from 280 BC until AD 1350,[39] withstanding all natural extreme events until it was completely ruined by an earthquake. For 1630 years this building remained a masterpiece of architecture and technology. Its use was not restricted to aid navigation, but also as a military outpost, being a tower located at the entrance of the port.

The precise starting date for the construction of the lighthouse is unknown. We know that it was started and finished in the decade 290-280 BC, i.e. during the reign of Ptolemy I Soter (305/4-282 BC) and completed by the son and successor of Ptolemy II Philadelphus (284-246 BC), the great monarch who connected his name with the brilliant buildings of the Museum, a multidisciplinary school, as well as the great Library of Alexandria. The name 'Lighthouse' (Pharos) was provided by the homonymous islet Pharos delimiting the port of Alexandria, on which it was built. Since then lighthouses were called 'Pharoi'. Arabs named it 'El-Manara' (the Lighthouse) and it served as model for many minarets built in similar fashion. In this way, some Arabic (Muslim) minarets preserved the form and the name (el manara – minaret) of the lighthouse of Alexandria.[40]

On the side facing the sea was a huge inscription with metal letters and with each letter having a height of 50 cm,[41] which, according to Lucian (2nd century AD) recited: 'Sostratus of Cnidos, the son of Dexiphanes, to the Divine Saviours, for the sake of them that sail at sea'.[42] The 'Divine Saviours' must be interpreted as Ptolemy I Soter and his wife Berenice (as Zeus Soter and Hera), who, by the end of the construction, had already been deified by their successor, Ptolemy II. Lucian writes also that Sostratus had the letters bearing his name covered with gypsum, to obscure them and the name of the King painted thereon. His account highlights the very exceptional reference of Sostratus instead of the king. According to Pliny the Elder (1st century AD) Sostratus was the construction's architect.[43] Pliny refers to the 'magnanimity of Ptolemy to let Sostratus of Cnidos, the architect, engrave his name on the monument'. Other sources state that he was also a military general and diplomat[44] and his skills as a scientist must not be underestimated, given the exceptionality of the lighthouse. Strabo, who omits the dedication to the 'Divine Saviours', reports the inscription as follows: 'Sostratus of Cnidos, friend of the kings, dedicated it to the safety of travellers'.[45] Many people assume that an epigram written by Posidippus of Pella, a famous poet from the beginning of the 3rd century BC, in praise of the beginning (or the completion) of the lighthouse, is another reliable source confirming Sostratus as the builder of the tower.[46]

The architecture of the 'Lighthouse'

What was the architectural form of the 'Lighthouse'? Today we can represent the edifice based on a plethora of relevant iconographic and literary sources. The lighthouse is depicted on stone sarcophagi (there are three in Copenhagen's Glyptotec), mosaics and coins. A glass vase from Begram (Afghanistan) shows a tower topped by an immense statue and tritons at the corners. These tritons appear also on the coins of the *Pharos*. They are over-dimensioned compared to the proportions of the tower, thus they cannot be considered merely sculptural decoration, but, more likely, they must have been one of the exceptional features of the lighthouse. Since the coast of Alexandria is frequently hidden by sudden hazes, we can suggest that a pneumatic mechanism emitted a sound from horns held by the tritons. In oil lamps discovered in Egypt we have confirmation of what appears also on Roman coins (from Domitian, Trajan and Hadrian times, up to the end of the 2nd century AD), i.e. that many windows opened onto the exterior.

The first scientific attempt to reconstruct the architecture of the building was offered by Hermann Thiersch in 1909.[47] His exterior reconstruction still remains extremely accurate and new studies have not offered any important addition to the general layout of the tower. The lighthouse consisted of three sections, with different dimensions. The first section occupied about half of the total height of the building, with dimensions of its base being a cuboid (30.6 m) some 70m high. This section was slightly pyramidal and rested on a platform 10m high. A second section was octagonal and 34 m high. The last section was circular and 9 m high. The total height was 113 m.

'To facilitate reflection (and focusing) assume hexagonal mirror ABCDF and four similar mirrors next to it adjacent ot the edges of the hexagonal AB, BC, CD, DE, EF, FA ... the mirros are directed using metallic blades and strings ...' See also Acerbi 2011, The geometry of burning mirrors in Greek antiquity. Analysis, heuristic, projections, lemmatic fragmentation. *Archive for History of Exact Sciences* 65(5), 471–497. https://doi.org/10.1007/S00407-010-0076-8.

[38] Josephus (Titus Flavius Josephus, 1st century AD), b. J. IV 613.

[39] Thiersch 1909. *Pharos, Antike Islam und Occident – Ein Beitrag zur Architekturgeschichte*. Leipzig: G. Teubner. See also Vitti in this volume.

[40] See Vitti in this volume.

[41] The dimensions are reported by many Arabic sources. See *infra*.

[42] Lucian, *Quom. hist. sit. scrib*. 62.

[43] Plinius, *Naturalus Historia*, 36, 18.

[44] Meeus 2015.

[45] Strabo, *Geographica* XVII, i,6.

[46] Hellmann 1999: 109-111, and Vitti in this volume.

[47] Thiersch 1909.

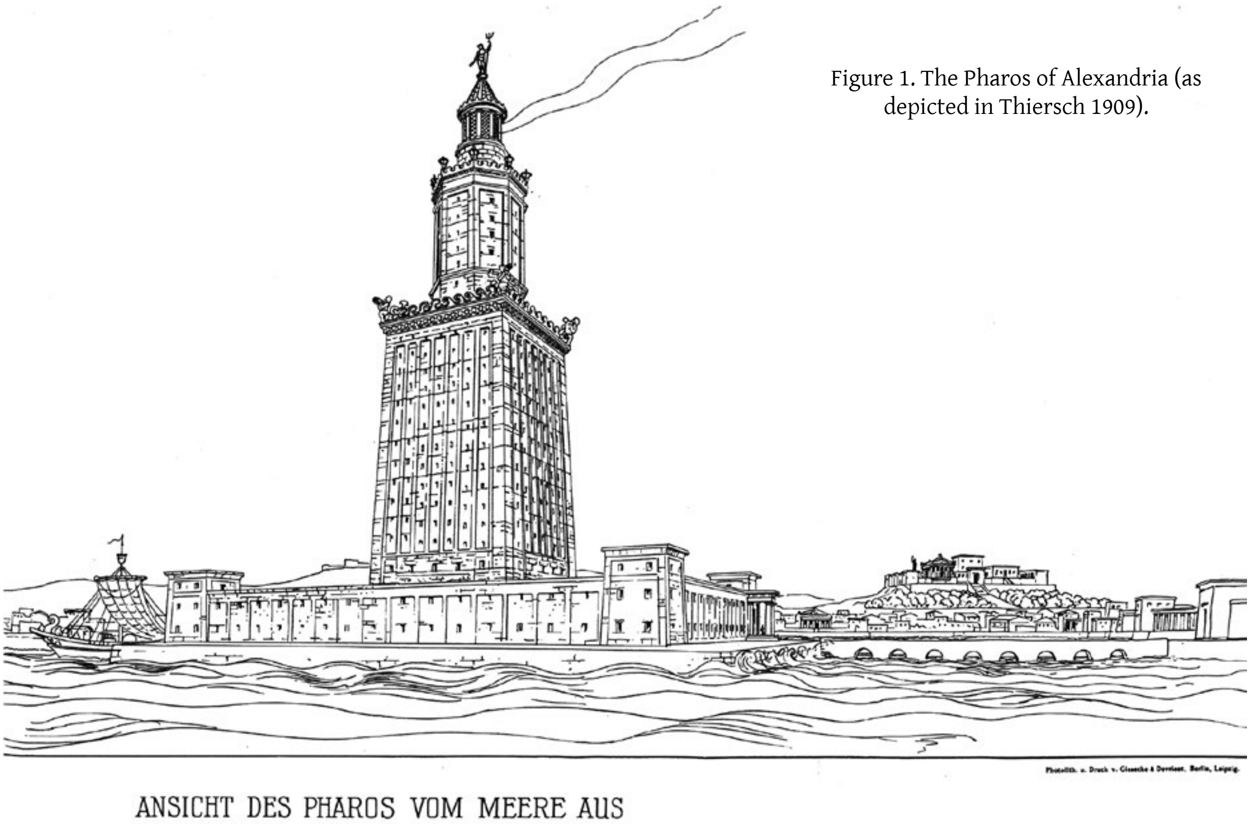

Figure 1. The Pharos of Alexandria (as depicted in Thiersch 1909).

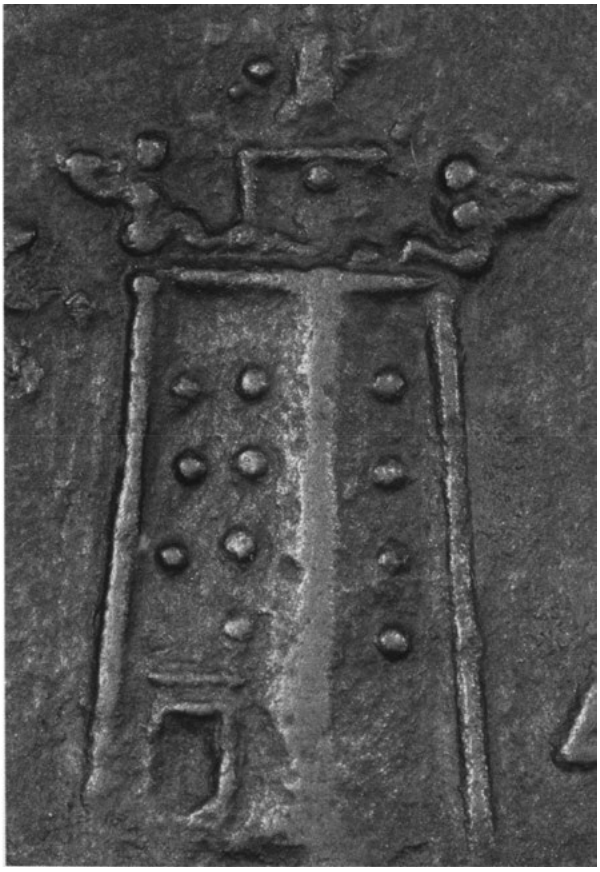

Figure 2. Coin of Antoninus Pius depicting the Lighthouse of Alexandria.

The above-mentioned measurements are referenced by later Arabic sources. However, while we have many descriptions of the building and its interior, there are no sources referring to the mechanism on the top that emitted light. Descriptions of the interior remain difficult and our understanding of where and how the mechanism was located and functioned is still quite confused. Thiersch himself attempted to give a graphic reconstruction of the lighting system with reflecting mirrors, based on the Arabic accounts, but his interpretation is less persuasive than his understanding of the exterior architecture.[48]

What we know from the interior is that the centre of the tower was hollow, having a well-like void, which extended through the height of the construction.[49] Many rooms were located from the main gate to the top of the cuboid volume. They were accessible by means of a ramp, wide enough for two horsemen to cross along the ramp. This void must have been relevant to the lifting of any material necessary to the tower, including both the fuelling of the light source, the possible feeding of the pneumatic alarm with water and wood, and, of course, all the military material used for the defence of the harbour and the city (Figures 1 and 2).

[48] Thiersch 1909: 89-96.

[49] An explanation of this cavity is given in Vitti in this volume.

Descriptions by travellers

The descriptions of historians and travellers are important because they give an opportunity to observe the lifetime of the monument, the damage that it suffered, mainly because of earthquakes, and generally many elements relating to the lighthouse. In parallel, when comparing the descriptions to archaeological findings (coins, mosaics, etc.), they provide appropriate elements for the restoration of its form. From 300 BC until 30 BC, Alexandria was a Greek city. From 30 BC until AD 390 it belonged to Rome, from AD 390 until 640 to Byzantium, and from AD 640 it was conquered by the Arabs, with the famed lighthouse already then 670 years old.

Throughout the years, the height of the building, the lack of maintenance and the climatic and geological conditions ruined it. Rain and earthquakes damaged at first the third section, as it appears on currency minted in Alexandria by Domitian in AD 90. It seems that the island called Pharos, upon which the lighthouse was built, was eroded and this is the reason it collapsed. Procopius of Gaza states that the emperor Anastasios, in AD 500, asked the architect Ammonio to repair the lighthouse and the seabed of the harbour that has been washed away. In 870, the Arab Yakoubi of Baghdad, a civil servant in Egypt, refers to the good appearance of the Pharos, but four years after that an earthquake took place and destroyed the third section. In 874, the Sultan Ahmet Ebn Tulun tried to repair it again, mainly its destroyed dome. In the middle of 10th century, the Arab historian and geographer Ali al-Masud tells the story of the decay of the lighthouse and Alexandria from the earthquakes and related calamities. He lists the damages, the fears of the population, and the consequences for the city.

Al Muqaddisi, in the year AD 1000, writes in his *Guide to Alexandria*:

> 'Al-Iskandariyya (Alexandria) is a delightful city on the shores of Bahr El Rumi [the Greek Sea]. It is headed by an impregnable fortress; it is a prominent city with a remarkable group of respectable citizens. The residents' drinking water comes from the Nile, which reaches them during the period of floods via an aqueduct which fills their tanks... The city was founded by Dhu al-Qarnayn [Alexander the Great] and, indeed, has an admirable citadel... The Pharos of Alexandria has firm foundations on a peninsula and one may approach it from a narrow street. Its bases have been placed firmly in a rock and water rises to the lighthouse from the west side. The same applies with the fortress of the city with the exception that the lighthouse is on the peninsula, where there are 300 buildings, some of which only a mounted knight can approach. A visitor is accepted provided he is using the right watchword. The lighthouse is at a higher level than all the cities along the coast and it is said that a mirror was used there, with which they could see every ship which left the coast, or that approached from anywhere on the sea from every point. A guard observed day and night and as soon as he saw a ship, he informed the governor, who would send birds to inform other guards on shore so that they would be on standby.'

For the 12th century we have descriptions from two famous Arab travellers, one of which being Moor Al Idrisi, a Mauritian from Spain, who, in AD 1115, toured the Mediterranean and Egypt and was impressed by the Pharos, about which he wrote the following:

> 'For the famous illuminated tower, there is nothing like it in this world in terms of the harmony of its construction and its stability. It is built from a wonderful stone called al-kadhdhan and we highlight the fact that the stones were joined by molten lead, and they were so solid that in its whole it was unbreakable, despite the fact that the sea from the north side wildly attacked the building. The distance between the lighthouse and the city is 1mile by sea and 3 by land.
>
> Visitors could get to the top by a spacious staircase built in the interior, as spacious as those that exist in traditional minarets. The first section ended about halfway to the top and from this point the four sides of the building become narrower. In the interior and under the staircase there were rooms. In all the sections of the lighthouse there were windows providing the necessary lighting. This building is extremely important in terms of its height and resilience. It is very useful because it shines day and night like a lighthouse for sailors and travellers throughout the year. The sailors know the light [of the lighthouse] and adjust their courses accordingly, since it is visible from a distance of a day's sail by sea [100 miles = 182 km]. At night it looks like a shining star, while in the day you can recognise its smoke.'

Even more detailed is the description by the Arab traveller Abu Hagag Yusef Ibn Mohamed el-Balavi el-Andalusi,[50] who visited the lighthouse in AD 1166 and recorded the following:

> 'The lighthouse rises from the edge of the island. The building is square, with its sides approximately 85 m. The sea surrounds the lighthouse except from the east and south sides. The length of its base is 65 m and the platform rises above the sea surface

[50] Asin Palacios 1932. El Abecedario de Yúsuf Benaxeij el Malagueño. *Boletìn de la Academia de la Historia*, tomo C, cuaderno I, enero-marzo: 195-228.

at an equal height. However, the platform is wider on the sea side due to its construction and has a steep slope like a mountainside. As the height of the platform increases, the width narrows. In this side it is firmly built, the stones are well formed and well placed, and elongated with a finish rougher than anywhere else in the building. This section that I have just described is recent because from this side the ancient construction was replaced.

On the wall to the sea, i.e. on the south side, there is an inscription that I cannot read. It is not a normal inscription, because the shapes of the letters are made from black stone. The combination of the sea and the air has corroded the stone behind the letters, and the letters protrude. The letter 'A' has length a little more than 54 cm. The top of 'M' protrudes like a big hole in a boiler made of copper. The other letters are generally the same size.

The door of the lighthouse is high. A slope level with a length of approximately 183 m leads up there. This uphill path is supported upon a series of curved arches. My partner went under one of the arches and raised his hand to touch it but he could not reach it. There are 16 arches like these, each one of them reaching a higher height, until they reach the entrance, with the last one being very tall [this may be the scale we see in the coins].'

They explored the ruins on the island:

'We entered approximately 73 m after the entrance. We found a closed door on our left that we did not know where it led. After 110 m we found an open door. We entered through that door and found ourselves in a room, which was followed by another room and then another. In total there were 18 rooms along a corridor that are connected with each other. Then we realised that the lighthouse was uninhabited. Moving forward for another 110 m we counted 14 more rooms, left and right. After 44 m we found 17 more rooms. Finally, after walking 100 m, we reached the first floor [of the lighthouse]. There was an uphill level that gradually climbed around the cylindrical core of this huge building. On our right, there was a wall that was not very thick and on our left was the side of the building that we had already explored. We entered a corridor with a length of 1.6 m, the roof of which was built with stones that were carefully smoothed; two of my partners could not enter.

When we reached to the top of the first floor, we counted the height from the ground with a piece of rope, to the end of which we hung a stone: it was 57.73 m; the parapet was 1.83 m high. In the middle of the platform of the first floor, the building continued upward with an octagonal shape, with a width of its side of 18.30 m, and 3.45 m from the parapet. The wall was 1.5 to 2 m thick; the number I wrote in my initial notes is not very clear, but next to the point that I have written down the length of the rope, I wrote details with ink that are clear. This is very weird...but I am sure it was 2 m. This floor is higher compared to its base. Entering that floor we reached the middle of the upper floor. We measured again with the rope and found that it was 27.45 m from the first level.

In the middle of this platform above the second level, the building continued upwards in a cylindrical form with a perimeter of 75.20 m. We entered again and climbed 31 stairs to reach the third level. The height of the third level was measured by the rope and was 7.32 m. In the platform of the third level there is a window with four doors and a dome. Its height is 5.49 m, and with a perimeter of 36.60 m. The parapet has a height of 46 cm, and only 1.51 m. separates it from the wall of the window.

Briefly, the building that we explored had 67 rooms; the first we found with its its door closed, which we heard led to the sea underground. The height of the lighthouse, according to these dimensions is 96.99 m, and from its base to the sea is 9.15 m; the visible part under the surface of the sea is approximately 1.83 m.'

In approximately AD 1200, Ibn Jubayr, in his famous *The Trip*, states:

'First of all is the beauty of the place of the city with its broad buildings, to an extent which we have not seen in any country or city with larger roads, higher buildings, or older and richer. Its cosmopolitanism is incredible and its markets are perfectly full, and in abundance and festive. The noteworthiness is its placement; how it is built either below or above the earth; its buildings are so old and so resilient. A remarkable thing with the construction of the city is that the buildings that are located beneath the surface of the ground are like those that are above the ground, and are even better and more solid, because the waters of the Nile enter underground beneath the houses. We saw marble columns and slabs in height, size and of insurmountable brightness. On some major roads the colonnades ascend high and cast shadows on the sky. The reasons for these building colonnades' erection are not known and no one can provide an explanation in relation to them. Perhaps in ancient times these columns supported buildings that were reserved for philosophers and the elite class of the time. Perhaps these buildings served for astronomical observations as well. One of the greatest miracles that can be seen in the city

> is the Pharos, built by the great and glorious God with the hands of those who foretell and determine the fate of others, as mentioned also in the Koran [x.v.75, *Koran*], which served as a guide for travellers. This is because without the Pharos, which appeared from a distance of 70 miles from the sea, nobody could find the city of Alexandria.'

In the 14th century, Al Makrizi in his three volumes entitled *Al-Khitat* (The Plans of the Cities) also describes the knowledge which was available in his time and refers to the oldest major destruction of Alexandria in the 3rd century AD from an earthquake and tsunami. Finally, Al-Asyuti also wrote a travel/geographical treatise, especially referring to the earthquakes that hit the Middle East.

An intense earthquake in AD 1303, followed by a tidal wave, totally destroyed the Pharos (Shaw *et al.* 2008). The lighthouse collapsed in AD 1349, as referred to by Ibn Battuta: 'After visiting the lighthouse, in 750 [Hegira], I noticed that the state of devastation of the lighthouse was such that no-one can either enter or reach the entrance'. That was the end of this wonder of the world. For more than 150 years the building was ignored, up until the 15th century, when sultan Kait Bey used the material of the lighthouse to build a fortress and the small lighthouse that exist to this present day.

After the large earthquake in the 3rd century AD, which Al-Makrizi describes, and especially after the huge tsunami which struck Alexandria, it seems that the submersion/collapse of large areas of ancient Alexandria accelerated. In a recent scientific work, Shaw and his colleagues calculated that the height of the tsunami created by the earthquake described by Al-Makrizi exceeded 20 m in height.

Such a phenomenon seems to have also occurred in the 12th century, and which Jalal Al Asyuti notes in his memorable work on the history of Egypt and Cairo as the year 702 (Hegira); this was the largest earthquake that took place and the destruction was the greatest in all Alexandria's history. As Al-Asyuti records: 'The sea rose up reaching the middle of the town, it drowned livestock and people, while ships were moved onto land and countless houses, countless people disappeared beneath the ruins'. It is usual here to refer to Al Makrizi's work *Al-Khitat* (The Plans of the Cities), in which he states that there was a large earthquake at the time of Constantine, son of Constantine, and sea rose and struck several points and locations, and many churches in the city of Alexandria and 17 towers of its walls collapsed. Al Makrizi continues: 'The sea has since continued ceaselessly swallowing little by little whole sections of the city.' The same author also refers to the description of an earlier historic visitor to Egypt, who provides an interesting picture of the old city, writing that 'the sea thrashed the city and it ended up in the sea... "Can you not see", said the visitor, "the buildings and their foundations submerged in the sea to this day with the naked eye?"'

Al Makrizi also mentions the Mamluk Sultan Baibars (AD 1260-1277), the first of the Mamluk Sultans to be interested in Alexandria. He visited it four times. Every time he left monuments that historians recorded and reported. His first visit took place in AD 1262. On his second visit, early in AD 1265 (664 Hegira), he ordered the removal and cleaning of the sandy sediments that had almost filled whole segments of the channel of Alexandria. In his fourth visit (AD 1274), the sultan restored and repaired the lighthouse. Al-Souyouti also mentions that the facade of the lighthouse on the sea side had collapsed and that the strand/dock (Al-Rasif) of the region that was contained within the 'hands/arms' of the lighthouse, was ready to fall.

Sultan Baibars continued to care for the fort of Alexandria. In his second term of governing, in 702 (Hegira), there was a powerful earthquake that struck a large number of the monuments of the city. The most important of all the monuments was the famous lighthouse, its walls and fortifications. Al Makrizi mentions that from its walls 46 'banda' and 17 towers were destroyed. It was then that the Sultan wrote to the governor asking him to rebuild it and he did. He also ordered the repair sections of the lighthouse that had collapsed (with about 40 balconies) in 703 (Hegira). It appears, however, that the damage was serious and that the repairs did not help and they collapsed again. This is evidenced by the references Ibn Battuta makes on his trip there in AD 1325. Indeed, Ibn Battuta mentions that he saw that one of the sides of the lighthouse had fallen. 25 years later, when he visited the city again, in 1350, he saw that the fallen remains were so extensive that one could not enter or even climb its gate. In summary, historical sources indicate that at least two natural events in the 3rd and the 12th centuries AD were direct causes of the acceleration of the lighthouse's destruction, along with many parts of ancient Alexandria.

Accounts of the optical systems of the lighthouse

In the previous paragraphs we briefly presented historical and architectural accounts as described by Greek, Western, and Arab travellers and other scholars. Now we present what can be found relating to the actual mechanism of the lighthouse: historically, through legends, and present knowledge.

The research includes ancient philological or historical sources from the construction of the lighthouse (297 BC) until its destruction (AD 1354), based on Greek (Hellenistic), Roman, Byzantine and Arabic evidence.

Our research focuses specifically on Arabic sources and on the descriptions of travellers and others who refer to the great lighthouse, most of which come from the West. Finally, a discussion concludes as a fourth aspect by considering modern sources, mostly from the 19th and 20th centuries.

The existing ancient sources on the lighthouse are incomplete, and unfortunately the number of references to the mechanism are minimal. None of the ancient sources, the historical or philological texts, etc., make any description or reference that may suggest a direct knowledge or contact with the mechanism. It is evident that almost everyone, or at least everyone who referred to the lighthouse, reproduced other people's opinions or descriptions. Even ancient Chinese scholars provide descriptions of the Pharos from accounts of travellers – even those who never left China (Vorderstrasse 2012). Clayton and Price conclude that 'regardless of the visibility distance, everyone agreed that the light [from the Pharos] was coming from a huge fire in the base, with its flames reflected by mirrors from the top of the building'.

Strabo (1st century BC) and Plinius (1st century AD) both described the 'tower' and its architecture as having extraordinary 'marbles', and as having a mechanism with a 'mysterious mirror' that sent out the light over a great distance, and, according to the legend, the mirror could detect enemy ships. Iosipos is more cautious, claiming that the rays reached 300 stadia (34.5 miles or 48 km). Lucian and Plinius refer to a distance of 300 miles. Statius says that at night the great lighthouse looked like the moon.

It is important to highlight that any visible distance must be dependent on the height of the building, so the statement by Iosipos concerning the distance of 300 stadiums (48 km) seems the most reliable, since it refers to the distance from the horizon: 'We should also think that, as with modern lighthouses, the visibility limit is defined by the height of the building. In order for the light to be seen at such a great distance, a reflector is necessary and it is proved from Arab historians that a reflector existed'.

Looking at the Arabic sources, a large number of the scientific works of the ancient Greeks survived and were translated into Arabic over the last two centuries of the first millennium and endured until 1200. During these 500 years, large amounts of knowledge were absorbed by Arabic culture. This process was very important as many disquisitions by Greek scientists were lost in their original form.

Al Idrisi, who visited Alexandria in AD 1154, wrote that 'The [lighthouse] is really remarkable both for its height and its resistance. The fact that it shines during the day and the night... is very useful for the sailors travelling all the year. The sailors know the light and adjust their routes accordingly since it is visible in a distance of a day's sail (100 miles = 182 km). At night it looks like a shining star, while in the day you can recognise its smoke.'

The descriptions by al Maasudi, an Arab historian and geographer, and Al Bagdadi, Abudelfa and Kwarizmi, who translated many works by Greek engineers and scientists, are, sadly, incomplete: all say very little about the mechanism.

At a recent lecture at the Tareq Rajab Museum, Professor Roshdi Rashed talked about an unknown Greek manuscript, translated into Arabic in AD 902. This rare manuscript is a translation of a Greek one concerning a code, and explores incendiary mirrors. The lecture by Professor Roshdi was entitled 'Incendiary Mirrors' and was given in the context of cultural events organised by the Institute of Dar al Athar al Islamiyyah. Roshdi said, among other things, that he recently discovered the manuscript and that it is an example of Greek and Arab geometry, which developed, the latter as a successor of the former, introducing the definitions of reflection and dioptric. 'There is a copy of the manuscript in Kuwait, which was copied later during the 14th century in Cairo, and was somehow transferred to India', says Roshdi.

This is very interesting, since it covers a large gap in the existing knowledge. Roshdi said that he discovered the manuscript while seeking 'the ancient applications of geometry [for the mirrors] and their meanings in earlier centuries, as incendiary mirrors were very much in the spotlight during the 3rd and 2nd centuries BC. The manuscript [he continued] is a Greek disquisition for the incendiary mirrors and belonged to a library established by kings and caliphs during the 9th century. The subject of the manuscript was a proposal about the way light could be collected and transmitted.' Roshdi revealed that the Arabic manuscript is a translation of Greek manuscripts following the principles formulated by Archimedes, which were written down between AD 125 and 180 and were subsequently lost. Roshdi claims that 'Archimedes consolidated two studies on optics, exploring incendiary material, creating a whole new field of mathematics, connecting hyperbola and parabola with optics. With the combination of these two fields of mathematics, a new theory arose stating that from a determined distance we can direct the reflected sun rays.'

All of the above-mentioned reveal that the research into incendiary mirrors did not stop from its first discovery by Archimedes and continued with Arab scientists, such Al Kindi. During the 8th and 10th centuries, the Arabs studied these theories concerning directed solar rays.

Al Kindi (died AD 873), lover of antiquity and admirer of Greek science, translated many Greek works and wrote a study on optics. Its later Latin translation 'influenced Islam and the West in terms of optics during the Middle Ages'. Ibn Sahl used some of the translated (into Arabic) Greek texts. However, he claims that while the Greeks studied combustion by means of mirrors, he was the first to study combustion via refraction. The fact that he studied the ancient Greeks is evident, as he referred to the parabolic mirrors used by Greeks.

An ancient Arab scholar, the geographer Al Muqaddisi (also el-Mukaddasi or al-Maqdisī, 945/946-991), in his book *Guide to Alexandria* [p. 104], states that a mirror was used as a telescope at the top of the Pharos, with which they could see every ship passing by at a distance. Here we have a similar detailed description of a telescope made of a mirror of glass from another book *The Itinerary of Benjamin of Tudela*,[51] a Jewish geographer (born at Tudela (AD 1130) in the Kingdom of Navarre and dying in Castille in 1173). In his book, he notes: 'On the top of the tower there is a glass mirror. Any ships that attempted to attack... the city, coming from Greece or from the Western lands, could be seen by means of this mirror of glass at a distance of twenty days' journey, and the inhabitants could thereupon put themselves on their guard.' Benjamin continues, describing how a Greek captain destroyed the telescope so that they could not see Greek and other boats travelling in the Mediterranean, and thereafter the Greeks could recapture Crete and Cyprus.

Another source is Al-Hassan al-Haytham (Abū ʿAlī al-Ḥasan ibn al-Ḥasan ibn al-Haytham),[52] called Ptolemaeus Secundus (AD 965-1040). He studied optics at Cairo. His studies include the eye, lenses of all sorts, and especially cylindrical mirrors. It is very probable that the Pharos had a 'cylindrical' mirror used as a telescope. This type of cylindrical mirror could have been paraboloidal, probably combined with a hyperboloidal one, inspired by the works of Archimedes. Al-Hassan al-Haytham wrote four books, but only one survived. One book summarised optics based on the two books of Euclid and Ptolemy. Other works included a *Treatise on Burning Mirrors* and one on the *Nature of Sight and How Vision is Achieved*.[53] Three more treatises entitled *Treatise on Spherical Burning Mirrors*, *Treatise on Parabolic Burning Mirrors* and *Treatise on the Burning Sphere* are known. These medieval scientific books on optics are very important and they show that, based on Alexandrian philosophers, the works of Euclid, Diocles, Apollonius, Archimedes, Heron, Ptolemy and other medieval, mainly Islamic/Arabic, scientific texts continued developing optics and other branches of the sciences. Some of these books mention the optical systems of the Pharos, and this proves that there were advanced optical systems within the Pharos itself for observing ships at sea and for directing the light out over the Mediterranean.

Roger Bacon, in the 13th century, referred to a mirror used to look at sections of British coasts (Albert Van Helden *et al.* 2010). If this is true, we could argue that Bacon's reference for such important information may well refer back to an ancient study, not forgetting that the lighthouse ceased to exist in 1349. Hence, long before the destruction of the lighthouse there were rumours concerning the mirrors and magnifying glasses it housed. The identification of the mirrors of the Pharos with those defined by Archimedes is impressive. However, a question arises: how is it possible that the mirrors of the Pharos could have been constructed by Archimedes, since its construction was completed in 280 BC, the year Archimedes was born? There is another theory that the mirrors were positioned there later by Archimedes during his 20-year stay in Egypt. Unfortunately, no ancient source confirms this theory and the relevant references are not reliable.

The polymath Giambattista Della Porta[54] (1535-1615) in the book *Natural Magic* (1589) describes the telescope of the Pharos. This is reported by Reeves[55] in her book *Galileo's Glassworks: the Telescope and the Mirror*, suggesting the possible use of a telescope at the top of the Pharos, perhaps made with the combination of a mirror and a lens. In an English version of Della Porta's *Natural Magic*, a chapter is dedicated to how lights might be used over a very great distance by using a parabolic mirror obliquely (book 7, Chapter XVI, 'On strange glasses'). From its English version of 1658 we read the following: 'I will speak about marvellous and at the same useful things that happened in ancient times but we still believe in them. I am referring to the lens of Ptolemy, or maybe the telescope, which someone could see from a distance of approximately 600 miles [!] whether the approaching ship were friendly or hostile, and also read the smallest letters from a great distance.'

[51] *The Itinerary of Benjamin of Tudela*, The Project Gutenberg EBook, critical text, translation and commentary, M. Adler (ed.) 1st edition 1907. London: Oxford University Press.

[52] Rashed 2007. *The Celestial Kinematics of Ibn al-Haytham, Arabic Sciences and Philosophy*. Cambridge: Cambridge University Press; Rashed 1968, Le Discours de la lumière d'Ibn al-Haytham (Alhazen), Traduction française critique, *Revue d'histoire des sciences et de leurs applications 21*, 3.

[53] *Alhacen's theory of visual perception*: a critical edition, with English translation and commentary, of the first three books of Alhacen's *De aspectibus*, the medieval Latin version of lbn al-Haytham's *Kitab al-Manazir*, A. Smith (ed.) 2001. *Transactions of the American Philosophical Society* 91(4 and 5): 14.

[54] Giambattista della Porta, *Magiae naturalis libri XX in quibus scientiarum naturalium, divitiae et deliciae demonstrantur*, Napoli: Horatium Salvianum, 1589; 1658 English version, *Natural Magick by John Baptista Porta a Neapolitane in Twenty Books*. London: Della Porta 1957; *Natural Magic*. Basic Books. See also Della Porta 1999. *De refractione optices parte: libri novem... Ex officina Horatii Salviani, apud Jo. Jacobum Carlinum, & Antonium Pacem*.

[55] Reeves 2009. *Galileo's Glassworks: the Telescope and the Mirror*. Boston: Harvard University Press.

In this text, it is claimed by Temple that 'Porta described the construction of a telescope many years before Galileo, without giving any details'. Guidonis Pancirolli and his publisher Heinrich Salmuth will later refer (1599) to the subject, in their work published 10 years after the work by Battista. In that work, the words by Giambattista are reproduced, but without any historical proof. The Latin title referred to the history of many memorable things used by the ancients and lost over time.

Temple highlights that the only thing we know concerning the telescope is that it existed from ancient years. The proof of this is a letter by Tito Livio Burattini, written in 1672 to the French astronomer Ismael Boulliau, in which Burattini wrote that 'In Ragusa [Dubrovnik, a coastal town in today's Croatia], on a tower, there is an instrument that helped the citizens of the city to see ships at a distance of 25-30 miles, and the guard of the instrument attributed its construction to Archimedes'. G. Libri included Burattini's letter in his work published initially in Paris in 1835. He claims that this fact has been verified and the whole issue proves, in his opinion, the existence of ancient instruments. There is no historic proof except for Libri's belief in its existence. Burattini says: 'For my part, I still believe that this instrument is used in the same way as in the Lighthouse of Alexandria during Ptolemy's kingdom, used to see ships from a distance of 50 or 60 miles away.' Temple claims that Burattini implies more things: 'On the other hand, Burattini refers to the possibility of the existence of a telescope at Cavtat, south of Dubrovnik in Croatia, where a part of the Lighthouse of Alexandria might have been conserved, when, after an earthquake, this part fell into the sea, broke into pieces and some of these pieces were retrieved by divers.'

It is interesting to observe the historical retrospective that Bonaventure Abat makes in 1763, concluding that the object or instrument featured in the lighthouse was a mirror, not a lens. He says the following:

> 'We read in many authors that Ptolemy placed in the tower of the Lighthouse of Alexandria a mirror through which you could clearly see anything that happened in Egypt, out to sea as well as inland. Some authors say that through the mirror hostile ships could be seen at a distance of 600 miles. Others say that the distance was about 100 leagues [400 km]. But everything that has been said about this issue looks like a worthless fairytale... There are many famous scientists who believe that if this were true it would be the result of a miracle, or a work of the Devil himself. Among others, Athanasius Kircher, referred to events [thus]... "Experience has taught me that a great number examined by non-philologists are considered as possible, but when considered when by philologists turn out to be the opposite. I suspect that Ptolemy's mirror belongs to this category as well..."'

Bonaventure refers to Paul Arese, Archbishop of Tortonne, who in his work *Museo Settaliano* says: 'Ptolemy could see ships at a distance of 600 miles approaching the port of Alexandria. But this was not because of his good vision but because of the use of a crystal or glass... However the existence of the crystal is doubtful because of the earth's curvature'. He highlights that if such a crystal like existed it would be such an achievement that references to it would exist. Bonaventure concludes that all the relevant sources include dubious details, but highlights that 'the knowledge of the ancients concerning mirrors and lenses is older than we think today'.

The astronomer Francois Arago claimed that the lens or the crystal mentioned by previous authors suggests a common reflective mirror. It should be highlighted that this is the first time that a scientist in a relevant field (astronomer) is referring to an instrument and not just 'fire'.

It is surprising that, while there is a plethora of relevant literature concerning Alexandria and the lighthouse, there are no credible references concerning its mechanism. The recordings claiming that there was a fire at the top of the lighthouse visible from great distance are simplistic for one major reason: from where exactly did they supply of raw materials for such a huge fire that burned 24 hours nonstop (during the day one could see the smoke, and during the night the fire) in a country like Egypt where there was no timber? The references claiming that they burned reeds or animal dung are not realistic. Reeds do not have the capacity to maintain a great fire as they burn rapidly and produce a lot of smoke. Concerning animal dung, on the one hand there would need to be vast amounts and on the other it would pollute all Alexandria!

Clayton and Price observe: 'There is another interesting issue concerning the logistics of the undertaking that is not calculated before. To maintain a fire always lit, someone would need a huge amount of fuel, wood or coal and Egypt is not a country that had timber. A potential solution might be dried animal dung (which is used still today in houses) but in this case the quantity needed would be a problem'. As a result, timber would have to be imported from other regions at huge cost. Even if we accept this point of view, there is a bigger problem concerning the conditions in the interior environment. A fire as huge as that entails huge risks for the people feeding it, as they would not be able to get close enough and the building itself would burn as well. The section where the fire was supposedly contained was a small room, and had a height of 9 m and was 7 m in diameter. How would it be possible in a small room like that to burn a huge fire visible at a distance of 30 miles, approximately 50 km, without destroying the whole building?

The mechanisms in the lighthouse were complex, especially the one that made the statue at the top turn, following the rotation of the sun even when it had set. This means that there was a rotation mechanism synchronised with a clock, otherwise the sun's movement could not be calculated. Where was this mechanism? Maybe in the base of the statue which was at the same time the ceiling of the third floor where supposedly the huge fire raged? How can we prove the coexistence of such a delicate and complex mechanism and the huge fire? It could be that at the top of the lighthouse there was a mechanism consisting of lenses and mirrors that reflected the small (in terms of its dimensions) fire, which was burning in the third section or below that. This view has tended to become more accepted in the last few years and seems to equate with the other details we know about the lighthouse. For instance, many people refer to a large fire without describing it – suggesting that very few ever reached the top of the lighthouse to describe the fire, and how it was fed and maintained. Was that because it was forbidden to enter that room in order not to reveal the secret? This is possible, as in that section there were precious mirrors, made of crystal, and all the automatic mechanisms that made the statues move. Most probably, there was a team of people there who maintained the fire and the automatic mechanisms. Unfortunately, there is no proof of this, only speculations. Furthermore, since all sources provide descriptions by others, it is only natural for them to describe something that they have been exposed to. How can there be light without a fire? How can you construct such a fire without a burning pyre?

Concerning the third floor, E. M. Foster writes: 'The third floor was cyclic. Above that was the fire. The light is an enigma as it seems that its limited space was shared by the fire on the one hand and some very sensitive instruments on the other. How large was this fire that every account states is not known'. Early lighthouses were nothing more than pillars that used burning pyres from wood or coal in an open fire (Davenport Adams 1870), which is not the case for the Pharos, since the light source was inside the building and smoke would definitely make the upper building part uninhabitable and also impair the light emitted. Moreover, the transport of fuel material would be a tedious and extremely expensive task, since wood is rare in Egypt.

Accounts from *Science* magazine (1885; 1886 and 1893) on lighthouse illuminance in the 19th century provide information that, apart from gas lamps, widely used at that time, oil lamps were traditionally used in lighthouses. Oil lamps, along with candles, were also the main means of illumination in antiquity and produce significantly lower smoke than open pyres. Illumination measurements of ancient oil lamps by Moullou *et al.* (2012; 2015) concluded that large clay lamps used in ancient homes could provide up to 30-40 lumens luminance with olive oil as fuel and a cotton wick. Although the illumination power seems low for a lighthouse, the type and structure of the wick, as well as the size of the lamp play an important role in the final light output. Furthermore, in 1790, the Cordouan lighthouse in Gironde, France, used parabolic Argand oil lamps along with a rotating Fresnel lens to project light to a distance of 11 km.

Anderson (Science 1893) in his study on lighthouse illuminants stated that a Mr J. R. Wingham used a long focus lens to amplify the 8500 candle power gas burner light source (calculated to 300 lumens) 270 times, so that the light beam was apparent at a distance of 11 km. Other accounts state a 70-times amplification using a lens. However, to reach 50 km one needs a much stronger light source or a very concentrated light beam. Contemporary lighthouses use 250W halogen lamps that have a luminance of 4000 lumens in conjunction with Fresnel lenses. That is more than 13 times the luminance that gas burners used in the 19th century and 100 times more than an ancient oil lamp. Even if we assume that a cylindrical wick was invented, such as that used for the Argand oil lamp in 1780, which provided roughly 6-8 times more illumination than traditional oil lamps, it seems impossible to suggest that the artificial light source could reach the aforementioned distance of 50 km by any means. However, even with the means provided at that time, artificial light could travel at much greater distances than ancient travellers were used to, adding to the marvel of the Pharos. Taking into account that Heinle and Leonhardt (1989) point out that ships in antiquity rarely travelled at night, the light of the Pharos could have acted mostly as daytime signage, using the sun's rays to direct light over a long distance.

Visitors to the Alexandria lighthouse speak, for instance, of a strange 'mirror' towards the top that caused a greater admiration, even more than the lighthouse itself. Why did this mirror not crack and what was it? Was it a reflector to maintain the fire during the night? Some authors claim that it was made out of glass or transparent stone and reveal that anyone who sat underneath could see ships with their own eyes. Was it a telescope? Is it possible that Alexandrian school of mathematics and engineering had invented the telescope and the knowledge was lost with the destruction of the lighthouse? The only thing that is certain is that the lighthouse was equipped with all the latest scientific innovations of the time and was a place where any theories developed in the Museum on the other side of the gulf could be applied.

Foster focused on the reflection of the light. But from where did he acquire all this information? Since he did not provide any references it is hard to know. Agreeing with Foster, Clayton and Price say: 'The conclusion is that the intensity of the fire was coming more from the reflection of light than from the fire itself. During the day the reflection was stronger using the rays of the sun'. The sun, of course, does not remain relatively in the same spot, but moves cyclically on the horizon. Thus the reflector must have followed the orbit of the sun and was automatically rotating!

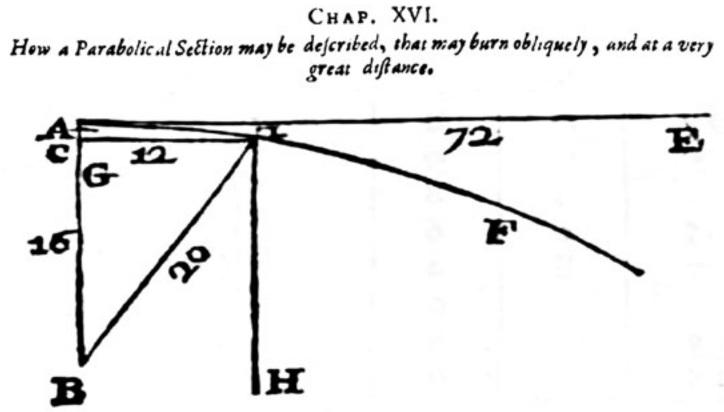

Figure 3. Theoretical study of how to describe a parabolic section that can burn obliquely and at very great distances.

All of the above suggests that possibly there was not a huge fire on the top of the lighthouse but an instrument, a reflector, that was very sophisticated in relation to the other instruments. As L. Russo claims: 'The only descriptions that survived are from Arab historians who visited the lighthouse when it was not working, so we do not know much about its technology. We do not know, for instance, its lighting system. However, we can imagine that the reflector was constructed based on a parabolic mirror, since the theory of parabolic mirrors was developing at the same time as the construction of the lighthouse. While we cannot prove the existence of scientists, as such, involved in the design of the lighthouse, it is no coincidence that the first reflector in the history was invented in Alexandria in the first half of the 3rd century BC, at a time when men were initially intrigued by the 'scientific theory' behind the construction of such mechanisms.' And the same author continues: 'Because a ray of light with a steady direction is not useful for the orientation of ships, we can assume that the reflector of the lighthouse was rotating. This could explain the cylindrical shape of the top that is observed in all the lighthouses that we know today'.

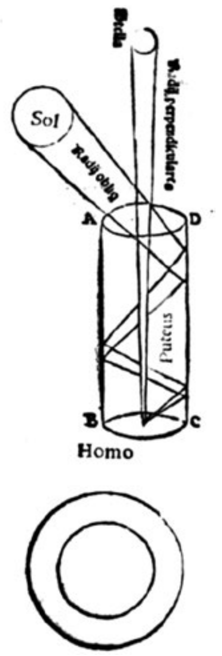

Figure 4. Theoretical study of a 'cylindrical', or a hyperbolic mirror. These can be used in types of telescopes. The principle of fiber optics is implied by this study (after Potamianos 2000).

Thus instead of a huge fire we can conclude that at the top of the lighthouse there was an instrument, a rotating reflector that was equipped with crystals of some kind. Of course, if we accept the rotating reflector, there are then more issues to be solved, for instance how did it rotate?. There is no way that workers could actually have turned it by hand as the room had a diameter of only 7-7.5 m, and this room included the fire, the reflection mechanism, and a small staircase.

We have no clear information on the type of reflector, and so we are obliged to speculate. The reflector could have been a large concave mirror, spherical, conical or paraboloid, well polished, perhaps even silvered to make it more reflective. There is a speculation that the mechanism employed many small lenses or an array of Fresnel-type lenses even. It is big step to suggest that a type of Fresnel lens was discovered back then, but the hypothesis that there were many small lenses should not be rejected (Figures 3 and 4).

The 'telescope' at the top of the Pharos could have been constructed using a mirror, a parabolic mirror, or an hyperbolic cylindrical mirror, as there are scientific texts that study these types of optical instruments. Another optical system was in use probably to direct the light in the appropriate directions. The reason for using a cylindrical mirror is that the quality of reflection at very large reflection angle is better than at small angles, especially if the anomalies of the metallic mirror are large. This type of reflection is in use at space telescopes working at very small wavelengths, for X-rays. They were used for the first time by ROSAT[56]

[56] Sumner *et al.* 1989. Susceptibility of soft X-ray grazing incidence telescopes to low energy electrons, *Monthly Notices of the Royal*

Figure 5: Hypothetical mirror system of the Pharos
It consists of two sets of concentric mirrors. One set of parabolic mirrors and one set of hyperbolic mirrors. The use of a quasi-cylindrical mirror (hyperbolic or parabolic) gives better reflection for a given quality of the mirror surface. The combination of a parabolic and a hyperbolic mirror gives better focusing. The light source is at the bottom. The light is guided to the top. A conical mirror can shed the light parallel to the sea. The conical mirror can be shaped so that it directs the light in some directions only, not 360º. An angle of some 200º is sufficient to direct the light to the sea all around Alexandria, taking into account the shape of the coast of Egypt, if the light was sufficient or to be visible up to 300 km, with appropriate conditions of temperature and humidity.

to observe the cosmos in X-rays. A similar system of mirrors would have been suitable for the Pharos to focus the light from the fire at the base to the top, to be then redirected with a system of mirrors, perhaps conical like the one suggested by H. Thiersch in 1909, and ancillary mirrors for the direction of beams along the surface of the sea. In fact, if the beams of light are directed towards the smoke above the Pharos, or even better towards some nearby clouds, then the light from the lighthouse becomes visible at much greater distances than the actual height of the building permits. This type of reflection of light at a height makes the lighthouse visible at very great distances, as much as 300 km, as mentioned by some authors and that otherwise seems more than simply exaggeration.

Astronomical Society 238: 1047-1054.

Multiple reflections in cylindrical mirrors, parabolic and to hyperbolic, like the ones suggested in this study, were in use in antiquity, as a work by John Peckham, an Archbishop of Canterbury and important scholar who taught at Oxford, indicates. In his book, published two centuries after his death in Venice, entitled *Perspectiua communis* (Common Optics/*Perspectivness*), contains a study of multiple reflections of light inside a cylinder. The use of parabolic geometry in buildings is also evident in the Byzantine Empire, since the version of the Hagia Sophia in Constantinople, designed by Anthemios and Isidoros and inaugurated in AD 537, used parabolic window sills to direct the sun's rays onto the huge gilded dome, so that it would appear as if 'floating' above the church. Unfortunately the dome was destroyed 20 years later by an earthquake, but simulations by Potamianos in his book *Light in the Byzantine Church* (2000) illustrate the theories (Figure 5).

Concluding remarks

Historical sources provide proof that the science of optics was advanced in ancient Greece and consequently in Ptolemaic Egypt. The science of *catoptrics*, as it was called by Euclid of Alexandria, as well as archaeological finds in several museums across the world provide evidence that lenses and mirrors were used commonly at that time, and the general population had good knowledge of their uses. Complex optical instruments that used multiple reflections, possibly even telescopes, are mentioned in the texts of ancient Greek philosophers.

It is quite probable that the Pharos of Alexandria, one of the Seven Wonders of the World, was equipped with such optical instruments in the manner indicated. The heart of the system could have been a magnifying mirror, which seems to have been designed as a burning mirror. Both types of such catoptric instruments were well known to Hellenism. Pythagoras is already said to have made optical experiments with a concave mirror (see *Scholia graeca ad Aristophanis Nubes* v. 750, Schneider, Eclogae physicae I, 406 and note 261). Other relevant passages from Plato, Lucrez, Plutarch, and Olympiodorus have been compiled by W. Schmidt in his introduction to Heron's *Catoptrics* (*Heronis Alex*, Opera II, 1: 31ff.). In addition there is a rich collection of diverse pieces on mirroring in this same work by Heron (2nd century AD, W. Schmidt, II, 300ff.), although preserved only in Latin translation. This, in turn, is followed by the *Katoptrik*, based on Euclid and edited later, which also speaks directly for the design of focal mirrors.

The present study combined observations from travellers, texts on the knowledge of science by the ancient Greeks, as well as contemporary science to support the argument that travellers' accounts of the

Pharos' characteristics and functions, which were considered as exaggerations by most historians in the past, have a sound basis, considering all of the facts stated. The lighthouse could project sunlight through a complex automaton that followed the sun's rays to a distance that reached 50 km or more. At night this distance would be reduced to 10 km if advanced optics were used, and we support the fact that instead of burning wood, such as other scholars suggest, the Pharos had a light source fuelled by oil that allowed it to be placed inside the tower with minimal smoke emission. The light from this light source, could be amplified by a system of parabolic and hyperbolic mirrors and focused to project it to a distance of 10 km, equivalent to most 19th-century lighthouses, using sophisticated oil lamps and Fresnel-type lenses. The optical system could also function as a telescope, projecting false images into the interior of the building, as a *camera obscura*, supporting the accounts that the users of the Pharos could detect ships from far away and warn the city of approaching enemies.

By considering all of the above, the Pharos of Alexandria was truly a wonder of the ancient world. The combined knowledge of science, optics and architecture culminated in a structure that all travellers marvelled at: from the year it was built, until its final destruction by earthquake in the 14th century AD. As Agatha Christie wrote in her short story *The Hound of Death*, 'The supernatural is only the natural of which the laws are not yet understood'. In this way, the advanced ancient technologies existing in the Pharos, and the loss of information from one generation to another, have augmented its status as a magical wonder across centuries.

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Space – Time – Matter – Motion: John Philoponus: a prelude to Galileo, Descartes and Newton

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Late Hellenistic times – John Philoponus

John Philoponus was a late Hellenistic Neoplatonist philosopher and theologian, born in Alexandria (AD 490-570) of Christian parents. He was a student of Ammonius, the son of Hermias (AD 440-520), director of the philosophy school of Alexandria, and himself a student of Proclus, the director of the school of philosophy in Athens. Ammonius taught the works of Aristotle and Plato and tried to unify their philosophical ideas. Some of his ideas and teachings on Aristotle were preserved in written form by Philoponus. In that period the Christian authorities of Alexandria permitted and funded the teaching and research of the ancient Greek philosophers under the provision of forbidding *proselytism* in pagan religions. The Alexandria school of philosophy, therefore, was a highly active institution, with many students and a rich syllabus.

From 2006 the Polish archaeological mission under Grzegorz Majcherek, in the area of Kom el-Dikka, Alexandria, excavated more than 20 'classrooms', some of them found to have been reconstructed after the earthquake of AD 535. It is possible, even, that Philoponus taught in these same classrooms (Sorabji 2014).

Philoponus' main philosophical work, his commentaries on Aristotle, were published before AD 529, the year of closure of Athens' school of philosophy by the emperor Justinian. Subsequently, Philoponus studied and published works exclusively on theological matters; however, by using, as much as possible, logical arguments based on the Aristotelian theory of categories, he diverted from the prevailing dogmas of Christianity in terms of the Holy Trinity (Council of Chalcedon, AD 491), proposing that God, Son and Holy Spirit were different and unique entities, and could not be of one substance (*omousios*), accepting only one possible nature, 'mia physis', for each member of the Holy Trinity.

For this he was brought before the court by Justinian in AD 582, opting to renounce some of his ideas to conform with the Council of Constantinople. The orthodox Church decided, some 100 years after his death, on anathema for Philoponus for his views on the Trinity; the anathema was only removed in 1990 by the Council of Constantinople.

Philoponus was the author of several books on his theories relating to astronomy, mathematics, meteorology, and various physical phenomena. Among his more important existing works on physics, especially relating to space, time, matter and motion, include: A commentary on Aristotle's 'posterior analytics'; a commentary on Aristotle's physics (Philoponus' most important commentary, in which he challenges many of Aristotle's theories on time and space, etc.); and *On the Eternity of the World against Aristotle* – a refutation of the philosopher's doctrines of the 'fifth element' and the infinity of motion and time – amounting to at least eight books.

John Philoponus' commentaries against Aristotle

Commentating on Aristotelian theories relating to physical phenomena, Philoponus broadly rejected Aristotle's ideas, proposing his own alternative explanations.

Space-time

According to Philoponus, time is a one-dimensional continuum, having a beginning and an end. Time can be measured and it defines the motion of bodies. Space is defined by empty or void three-dimensional extensions between bodies. Space also has a beginning and is finite. It can be measured (its distances, areas and volumes) and the geometry is described by the axioms of Euclid. Voids or vacuums do not exist in nature. Philoponus refers to the earth's atmosphere, were we live, but it is a very useful general concept.

Matter

According to Aristotle, matter has an intrinsic existence through a primordial substance ('pemtousia', which permeates all space) and the various materials are just different manifestations of this substance ('prime matter'). Philoponus' teachings on matter reject Aristotelian 'pemtousia' and accept a particular substance for each material body, having a place and extension that displace space ('sômatikón diástêma'). Matter has the tendency to move and is heated by fire and light and external forces, and can be transformed by fire.

Motion of bodies due to external forces

The most important contribution by Philoponus to the study of motion is the rejection of the Aristotelian answer to the basic question of why bodies continue to move after the influence of an external force has stopped. Aristotle argues that bodies displace the 'aether' or the 'medium', inside of which they move, and this medium occupies the empty space behind the moving body and propels the body in forward motion. Philoponus rejects this, using various striking and logical arguments, proposing instead that the moving force or cause imparts (transmits) an immaterial kinetic energy to the body (endotheisa aylos kinitiki energeia) which moves the body until this energy is exhausted. This very original idea comes from the influence of light on bodies that have been heated and then cool.

Philoponus proposed a law of motion establishing a relation between the velocity of the body and the difference between the driving force and the friction due to the medium. He proposed various experiments for the motion of bodies inside media at different rates of friction and calculated the corresponding velocities. He also proposed that even in a perfect void (vacuum) any imparted kinetic energy will be eventually exhausted.

Motion of bodies due to gravity

Philoponus employed experiments and real observations to assess the motion of free-falling or ejected bodies under the influence of their weight (i.e. under the earth's gravitational field). He observed that bodies of various weights fall from the same height at almost the same rate of time in various media with small frictional effect. This, again, conflicted with Aristotelian thinking, i.e. that the bodies of different weights fall at different rates. Philoponus' results, of course, are precursors of Galileo's own experiments and Newton's laws of motion in gravitational fields (and ultimately today's observations on the principle of general relativity.

Modern times: Galileo Galilei and the modern era of physics and science in general

The modern era of physics and scientific method in general can be said to have started with Galileo Galilei (Pisa, 1564-1642), who introduced the scientific method of logical criticism of hypotheses, supported by careful design and execution of verifiable experiments. His methods replaced the use of the laws of logic only, accompanied by authoritative arguments, a method followed by almost all the previous ancient and medieval philosophers who studied the physical world. In introducing his methods, he had to construct new instruments specially designed for his experiments. It is well known that his teachers studied in detail and published works on the theories of Philoponus. Galileo himself refers and credits the importance of Philoponus for his theory of motion.

Galileo Galilei studied, among many other physical phenomena, the motion of bodies as influenced by gravity and on inclined planes, as well as the motion of the pendulum. He found that free-falling bodies took the same time to fall from the same height, independent of their weight (today's equivalence principle of general relativity), and that in the motion of the pendulum the square of the period is proportional to the length of the pendulum.

For the motion of bodies on inclined planes he found that the distance covered in time T, is proportional to the time square T^2. For zero inclination of the planes, he proposed that without friction and external driving forces the bodies will indefinitely move with constant speed. Also he conjectured that the laws of motion are independent of the observers moving with constant speed. This is the famous Galilean relativity principle, precursor to Einstein's special and general theories of relativity .

René Descartes and Isaac Newton

A contemporary of Galileo, *René* Descartes (La Haye, 1596-1650) was the creator of western modern philosophy and rationalism (*Le Discours de la méthode*) and predecessor of Spinoza and Leibniz, who contributed greatly also to the creation of modern mathematics and physics. His unification of geometry and algebra, as well as his studies on analytic geometry and calculus, had a strong influence on Isaac Newton, who constructed precise mathematical descriptions of physical laws.

Descartes, in his *Principia Philosophiae* (1644), presents a mechanistic explanation of the universe, and in terms of our theme of motion he proposed the law of conservation of momentum for free rectilinear motion, which Newton accepted as the first law of mechanics, the law of inertia, in his *Principia Mathematica* (1687).

The culmination of the notions of Descartes and Galileo came with Isaac Newton (Lincolnshire, England, 1642-1726), considered one of the greatest scientist-philosophers, who developed the basis of modern mathematics and infinitesimal and integral calculus. He also proposed the fundamental laws of physics (mechanics and universal gravitation), in the form of differential equations, according to which all physical phenomena can be studied and will produce predictions for the outcomes of experiments.

Newton studied and proposed explanations for almost all physical phenomena known to his time and gave predictions for new phenomena. His main discoveries are the universal attraction of all bodies, Newtonian theory of gravitation, by which he explained in precise mathematical terms the motion of the planets, comets and any body moving in the field of gravity. His laws of dynamics were based on the fundamental equation of motion that force is equal to the mass of the moving body times its acceleration. All the ancient philosophers believed that velocity was proportional to external forces. Newtons theories were based on the works of Galileo, Descartes, Hooke, and others; he was also aware of the work of the subject of this short paper: John Philoponus.

Medieval and Renaissance precursors to the laws of motion

Going back in time from Galileo, Descartes and Newton in relation to physics and the theories of motion, the important figures are Giovanni Pico della Mirandola (Mirandola-Modena, Italy, 1463-1494), Jean Buridan (Flanders, 1295-1363), and Avicenna (Bukhara, Samanid Empire, AD 950-1037).

Giovanni Pico della Mirandola (Italy, 1463-1694) was a Renaissance neoplatonist philosopher, known for his humanist manifesto (*On the Dignity of Man*). He was a critic of Aristotelian physics and philosophy. In physics he was influenced by John Philoponus and his thoughts on space, time, matter and motion, and essentially he propagated and supported his ideas of impetus theory.

Jean Buridan created impetus theory, which states that all bodies are equipped with internal tendency to preserve their motion once caused by some external force. Buridan was also influenced Philoponus, of whom he was aware.

Avicenna was a great Persian philosopher and specialist on medicine. He wrote in his *Great Encyclopedia of Medicine*, the basis of medical knowledge and teaching for centuries, that bodies have the tendency to move once subject to the force of external causes, and if there is no friction they should continue to move for an indefinite time.

This contrasted with Philoponus' thinking that, even in a vacuum without friction, moving bodies will stop moving at some point. This is closer to the thoughts of Galileo, Descartes and Newton (the law of inertia), and is correct by today's accepted and experimentally verified laws of motion.

Conclusions

John Philoponus, more than ten centuries before Galileo, Descartes and Newton, proposed new fundamental ideas about the dynamics of motion for bodies under the influence of external forces or under the influence of gravity.

From all the above, it seems clear that Philoponus was a pioneering philosopher of independent mind, who went against the authorities of his times, not only in terms of theology, where most of the modern studies of his works have appeared, but also in physics. It is only over the last forty year or that the community of the history of science has been actively engaged in the study of this important figure, and there are now translations in English of all his existing published works, from Latin, Greek, Syrian and Arabic sources. There are already more than 500 articles and publications on Philoponus' theories on physics, and many more will surely appear.

We refer below to the main summary articles on his works, as well as some important books relating to his ideas on physics. His works occupy an important place in Richard Sorabji's extensive editorial project on Aristotle.

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Hellenistic medicine and the Library of Alexandria: its influence in the west and the east

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Historical bases of Western Medicine

Hippocrates divided medicine into three branches: Physics, Surgery and Dietetics, a classification that holds well today. At the time, Medicine was actually part of Physics, and, hence, the term 'physician'. The two major medical schools in Greece were located on the island of Kos and across the straight at Cnidus, on the tip of the opposing peninsula. Hippocrates was the first to introduce logical reasoning into Medicine, founding what is today called evidence-based medicine. In Ancient Greece, the relationship between patient and doctor was sacred and physicians knew the healing power of the patient's trust to her or his physician.

As we go back in time, we realise that most of medicine practised in antiquity, and a large part of Medicine practised today, was, and is, based on the placebo phenomenon. Shapiro and Shapiro wrote in their book of 1997, entitled *The Powerful Placebo: From Ancient Priest to Modern Physician*, that 'The history of medical treatment is the history of placebo effect, as most medical interventions were nothing but placebos – that is, inert'. And this holds true still. Most of the so-called 'psychosomatic' disorders, which are very common, can be 'cured' or ameliorated if the patient has a good, trusting relationship with her or his physician.

We humans have an expanded neuronal system that is present in all social beings, which directs touch and other sensory stimuli from the peripheral sensors all the way to the reward system of the brain. This is the basis of the loving mother-child relationship, which is gradually expanded to family members, the tribe, the community, the country, and so forth, leading to social cooperation and the remarkable success of our species on this planet. These social sensory-reward neuronal systems are present in both the mother and the child and resonate with each other, explaining the phenomenon of empathy, a key social property that is both emotional and cognitive. Through empathy, we communicate with each other and develop social systems of fairness and justice, which are important in our social relationships and in our remarkable progress. The fine book on the *Placebo Effects* by Fabrizio Benedetti describes the biology behind the placebo phenomenon. He writes: 'placebo and placebo-related effects are related to self-regulatory processes that have emerged as a defense mechanism of the organism during evolution.' We all have a placebo neuronal network in our brains, which basically involves two major systems, those of empathy and reward. The emotional and cognitive empathy and reward systems develop into a wider compassion neural network.

The ancient hospitals, called the Asklepeia, such as the one on the island of Kos, were built in specially chosen scenic locales and frequently included theatres for the entertainment and 'teaching' of the patients. These compounds generally consisted of two parts. In the first, the patients were psychologically prepared for the treatment, while in the second, considered a 'sacred area', they were taken to sleep overnight. The God, Apollo or Asklepios, would come to visit them during their sleep, and heal them. The next morning, they would wake up healthy.

During the Axial Age of humanity, Hippocrates brought reason to Medicine and, thus, allowed experience and evidence to infuse real Science into the Art of Medicine. Doctors were taught to evaluate symptoms and signs logically and to come up with a diagnosis and a management plan that was based on science. Evidence-based Medicine was already advanced at the time of Socrates, during which doctors were already becoming too specialised. As Plato informs us in *Charmides*, Socrates notably said that 'as you ought not to attempt to cure the eyes without the head, or the head without the body, so neither ought you to attempt to cure the body without the soul. And this, he [Socrates] said, is the reason why the cure of many diseases is unknown to the physicians of Hellas, because they are ignorant of the whole, which ought to be studied also; for the part can never be well unless the whole is well.' And, of course, this is an absolutely and perennially correct statement.

It should be noted that at the time there was intense interaction between Medicine and Philosophy. Generally, people with emotional problems would go to philosophers to ask for help, whereas people with bodily disorders would go to physicians.

Fundamental Greek health and medicine concepts

Pythagoras was the first to understand what complex systems are by observing the 'harmony' of the Cosmos (Table 1). What he said was that the world was in a harmonious dynamic equilibrium, which is threatened or disturbed by disturbing forces, and brought back into balance by adaptive, reestablishing forces. This is a concept that pertains to all known complex systems. Pythagoras's student Alcmaeon, who was a physician, expanded this concept to humans and called the dynamic balance 'isonomia'. Now we call this balance 'homeostasis', a term derived from the Greek and coined by Walter Cannon at the beginning of the 20th century. Homeostasis is threatened or disturbed by stressors, which may be physical or emotional, on one side, and reestablishing or adaptive forces on the other.

Stress, a term coined by Walter Cannon, is a state in which homeostasis is actually threatened or perceived to be so. For we perceive stress and can express it simply by saying 'I am stressed'. Generally, stress and the adaptive response are meant to be a time-limited, acute, adaptive phenomenon, which helps the organism defeat the stressor and return to normal. Nowadays, however, we may suffer from 'chronic' stress, a situation, in which the stress system, instead of helping, damages the organism. Thus, acute and chronic stress should be viewed as two completely different phenomena, with different *sequelae* on the mind and body of humans.

There is a host of human stressors, including, among others, the following: daily hassles, work-related stress (e.g. Effort Reward Imbalance, ERI), job loss, low socio-economic status, life transitions, natural or unnatural catastrophies, starvation or obesity, deficient or excessive exercise, bereavement, addictions, acute or chronic disease, etc. In fact, both acute and chronic diseases are stressors for the human organism.

The development of scientific health concepts in the Western world started with Hippocrates, who suggested that 'a harmonious balance of the elements and qualities of life is health; disharmony is disease', a concept true then and true now. He also said '*Nouson Physeis Iatroi*' (*vis medicatrix naturae*), which means 'it is Nature that heals the disease', a statement that is absolutely correct. Many healing processes that go on within us are inherently ours; the physicians and the psychiatrists only help.

Aristotle called the state of a psychological and physical balance 'eudaimonia'. Then there were three groups of philosophers – Stoics, Skeptics, Epicureans – who suggested that 'ataraxia', or imperturbability of mind, is a supreme human goal. Epicurus added to it the concepts of 'aponia' (no pain) and 'hedone' (by which he also meant 'eudaimonia', just like Aristotle). Aristotle and the Epicureans believed that 'eudaimonia'

Pythagoras (580-489 BC)	**The *Harmony* of the *Cosmos***
Alkmaion (c. 500 BC)	**The intellect is based in the brain** **Health is the equipose of opposing forces: *'Isonomia'***
Empedocles (500-430 BC)	Matter consists of essential elements and qualities in opposition or alliance to one another
Hippocrates (460-375 BC)	A harmonious balance of the elements and qualities of life is health-Dysharmony is disease ***'Nouson physeis iatroi =Vis medicatrix naturae'***
Aristotle	Unity of mind and body, "***Eudaimonia***"
Stoics/Sceptics	***Ataraxia*** (imperturbability of mind, equanimity)
Epicurians (341-270 BC)	***Ataraxia*** (imperturbability of mind), ***Aponia*** (no pain) and '***Hedone***' (tranquil, non sensual pleasure) as desirable states ***'Eustachius' = Good balance, Carpe diem= seize the day***
Library of Alexandria (300 BCE-400 CE)	***The modern bases of Human Anatomy and Physiology*** ***Herophilos, Erasistratos***
Thomas Sydenham (AD 1624-1689)	Symptoms and signs of a disease arise also from the reaction of the patients' system
Claude Bernard (1813-1878)	The ***'milieu interieur'***
Walter Cannon (1871-1945)	***Homeostasis/Stress*** Bodily responses to emotions ***Fight or flight (and freeze) reaction***
Hans Selye (1907-1982)	The **general adaptation syndrome (the stress syndrome)** ***Diseases of adaptation, Distress*** vs. ***Eustress***

Table 1. Development of health concepts.

was the final goal of humans, which could be attained by practising the core virtues and by becoming progressively wiser.

The Library of Alexandria and world medicine

The Library of Alexandria was founded and thrived in Hellenistic times and influenced Western Medicine from 300 BCE to 400 CE (Table 2). We describe in brief the stages of western and world medicine and the role of the Library, as it evolved over time. In the beginning, we had Ancient Greek Medicine (up to 500 BCE) and the Asklepieia as healing places. There were more than 400 Asklepieia all around the Mediterranean basin, suggesting that the idea had been adapted by many different nations. Subsequently, we have Hippocratic or Classic Greek Medicine (500 to 200 BCE), which is evidence-based medicine. Then comes the era of Hellenistic Medicine (300 BCE to 400 C) – in which the Library played a crucial role – with the physicians Herophilos, Erasistratos, Galen, Aretaeos and Soranos as the most prominent representatives of the era. All these physicians-scientists were influenced by what was learned in Alexandria, produced new knowledge and spread it throughout the Roman Empire and beyond. After Hellenistic Medicine, comes Byzantine (or Eastern Roman) Medicine (400 to 1400 CE). The first modern hospital was founded in Constantinople around 430 CE. During this time we have developments in Judaic, Arabic and Armenian Medicine, with many physicians making significant contributions to Western Medicine.

Interestingly, Hellenistic Medicine passed on to India and subsequently to China as 'Yunani Medicine', which means Ionian medicine, i.e. Greek Medicine. Thus, through the Silk Road and other interactions between East and West, we had concepts of Western Medicine going to the East (India, China, etc.) and *vice versa*. What we call Modern Medicine dates from 1400 CE onwards. Eastern Medicine, i.e. Indian and Ayuvedic Medicine, Traditional Chinese Medicine and Acupuncture, is now influencing Western Medicine in a major way. Indeed, over the past 60 years, we are witnessing an increasing influence of all these Eastern types of medicine on Western Medicine.

The Library of Alexandria was conceived and founded by Ptolemy I Soter (367-283 BCE), who was the general of Alexander who took over the kingdom of Egypt after the latter's death. Ptolemy had a friend, the philosopher Demetrius Phalereus (350-280 BCE), who assisted the former with the conception of the Library of Alexandria. Ptolemy I, one of Alexander's *Hetairoi*, had received an excellent education by Aristotle, who was the teacher of Alexander and his childhood friends in Macedonia. The son of Ptolemy I, Prolemy II Philadelphus (309-246 BCE), who was educated by Philitas of Kos, completed the Library, Museum, and the Serapeum of Alexandria.

In the 4th century BCE, the centre of medical thought and practice was no longer Kos, the island of Hippocrates, but the great centre of Greek learning at Alexandria. The Ptolemaic rulers gave lavish financial support to the Library and Museum of Alexandria, which attracted students and researchers in all fields. Medical research in the Alexandria Library and Museum became renowned. The research conducted at the Library and Museum of Alexandria was important not only because it corrected many ancient misconceptions about the body, but also because the doctors reached their conclusions by dissecting human corpses, a practice that had been outlawed in the Greek ancient world on religious grounds. In contrast, the dissection of corpses was regular practice in Egypt. There were two philosophers that facilitated Greek physicians

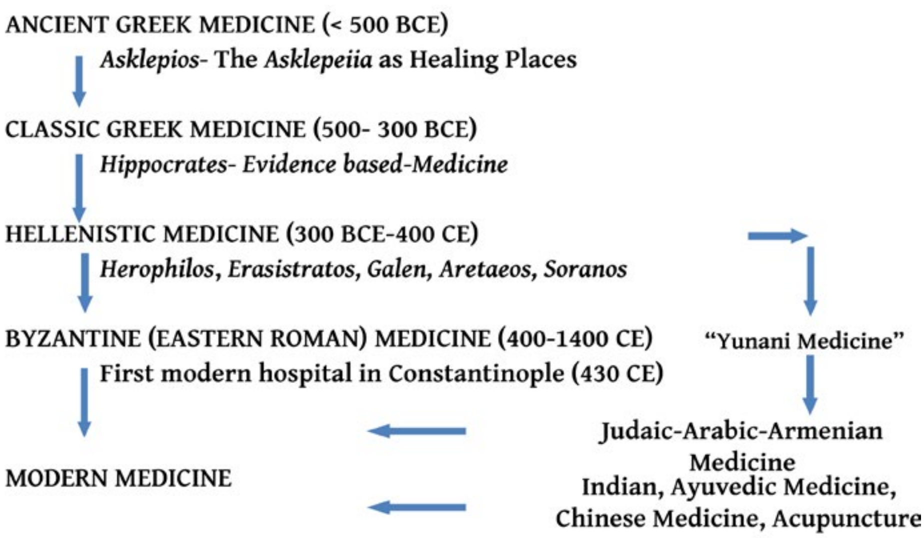

Table 2. Evolution of Western Medicine.

in corpse dissection. First, Plato who had taught that the soul was an independent immortal being, which carried the body as a mere envelope and instrument, to be discarded at death – a belief held today by many religions. Second, Aristotle, who had declared that the soul constituted a higher value than the whole organism (an emerging property of a complex system), implying that after death nothing remained but a physical frame without feelings or rights. Therefore, one could justly claim a dead body for dissection and anatomical study.

There were many famous physicians being educated and working at the Library and Museum of Alexandria. Its most influential medical investigators were Herophilos of Chalcedon and Erasistratos of Ioulis (the island of Kea). Our knowledge of their work is derived from later commentators of the Roman period, such as Celsus and Galen. Herophilos is remembered primarily for his contributions to the study of human anatomy, on which he composed several treatises, including *On Dissections*. He performed a careful study of the brain, which he recognised as the centre of the nervous system. He described the liver, the eye, and the male and female reproductive organs. He gave a complete scientific description of the pulse and its clinical use. A number of the terms he coined passed into anatomical vocabulary, either directly or via their Latin translations. For example, Lenos Herophili (the wine-press of Herophilos), retina (from rete = net), hypophysis (= undergrowth), and many more.

Erasistratos made remarkable progress in anatomy, describing the brain even more accurately than Heropholus. He distinguished the cerebrum from the cerebellum and determined that the brain was the origin of all nerves. He distinguished sensory from motor nerves, and was the first to dispel the notion that nerves are hollow and filled with *pneuma* (air). Instead, he suggested that they are solid, consisting of spinal marrow. (And, indeed, they are surrounded by myelin just like the nerves of the spinal cord). In his account of the heart and its function, Erasistratos distinguished between pulmonary and systemic blood circulation, and thus influenced William Harvey on his major findings about circulation.

It is worth mentioning an example of how Erasistratos helped cure Antiochos, the son of Seleucos I Nicator, King of Syria. Antiochos was severely ill, and when other physicians failed to help him Erasistratos was called in by the king to examine his son. While he was examining the patient, Stratonice, a young wife of the elderly king, walked in the room. Erasistratos then realised from the quickening of the sick man's pulse and from the flush of his cheeks, that the illness was psychological rather than physical, and that Antiochus's passion for his inaccessible stepmother was at the root of the problem.

Galen himself, who had spent time at the Library of Alexandria, wrote the following in his book *On Anatomical Procedures*: 'Let it be your serious concern not only to learn accurately from books the shape of each bone, but also to carry out a keen visual examination of the human bones... This is very easy at Alexandria... [and] for this reason, if for no other, try a visit to the city.'

However, there were also people who were negative towards the Medicine of the Library of Alexandria. For example, Aulus Cornelius Celsus (*c.* 25 BCE - *c.* 50 CE), who publicised a rumor that the anatomists used living people, most likely condemned criminals, in vivisection. Hard to believe, but you never know. A Christian of Berber origin, Tertullian (full name Quintus Septimius Florens Tertullianus, *c.* 155 - *c.* 240 CE), one of the early Church Fathers who did not make it into sainthood, called the anatomists of Alexandria the 'Butchers' of Alexandria. Then came the destruction of the Library. We do not know exactly when it happened, but it was a tremendous loss for Medicine and for humanity.

And, in closing, it does us well to remember something that Epictetos said, or rather suggested: 'Be equanimous, and remember not to believe easily'. There is much we do not know about the Library of Alexandria, but for sure its malevolent destruction and the consequent loss of the majority of its books, has been detrimental to the progress of humanity.

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Palaeoclimatic conditions during the Hellenistic period in the Eastern Mediterranean

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Documentary and natural proxies for the Mediterranean

The Mediterranean region provides a uniquely rich body of long instrumental climate data sets, going back as far as 350 years (Luterbacher *et al.* 2012). Prior to direct meteorological instrumental observations, indirect indicators from terrestrial and marine natural archives and documentary evidence are used to characterise environmental and climate conditions and variations over the past centuries (Figure 1; Bradley 1999; 2015). The Mediterranean region offers an unusually rich combination of natural archives (terrestrial and marine proxies, including tree-rings, speleothems, lake, river and marine sediments, pollen records and boreholes) as well as documentary evidence across time and space, making it possible to reconstruct climate in past centuries to millennia, including extremes and socio-economic impacts prior to the instrumental period. The natural proxies are sensitive to multiple climate signals (e.g. precipitation, temperature, sea-level changes, sea surface temperature and water circulation and pH) and the length of their records vary. Proxies also have different temporal resolutions (from seasonal, such as tree-rings, to multi-decadal, such as marine sediments) and represent climate conditions of various parts of the year (Luterbacher *et al.* 2012). Sensitivity, reproducibility, local availability, dating uncertainties and continuity throughout time periods can also differ between the proxy records (Mann 2002).

Tree-ring proxies are an important source of highly resolved, absolutely dated information about past climate. They are widespread and well replicated, and they can be statistically calibrated against overlapping instrumental records to produce validated reconstructions and associated estimates of uncertainty in past climate variability at an annual resolution (Smerdon *et al.* 2017). The majority of tree-ring proxy records reflect seasonal/sub-annual rather than annual climate variability. For moisture-sensitive trees, the climate response can vary across regional scales. In Mediterranean regions winter, spring, and hydrological year (October-September) precipitation usually dominate moisture variability and tree-ring formation, whereas continental and mesic forests reflect summer or growing season precipitation (Smerdon *et al.* 2017).

Figure 1. Examples of documentary and natural proxies for Palaeo climate and environmental research in the Mediterranean (Bradley 1999: 2015).

During the past decade, speleothems have emerged as one of the highest-quality archives now available for continental climate variability. Speleothems are cave mineral deposits (stalagmites, stalactites) that form when calcium carbonate precipitates from degassing solutions as they seep into limestone caves. Speleothems may be annually banded or they contain compounds that can be radiometrically dated. Stalagmites in particular can now yield precisely dated and highly resolved records of either precipitation or other variables related to the hydrological cycle. This climate archive can potentially provide long records (103-104 years) at temporal resolution as high as annual, reflecting a seasonal signal, with very precise chronologies (e.g. Cheng *et al.* 2009). Currently, numerous absolutely dated, well-replicated stalagmite $\delta^{18}O$ records with decadal to centennial resolution exist from the Eastern Mediterranean and Middle East (Bar-Matthews *et al.* 1997; 1999; Cheng *et al.* 2015; Fleitmann *et al.* 2007; 2009; Flohr *et al.* 2017).

Marine and lacustrine sediment cores play an important role in the reconstruction of past hydroclimate variability over the last two millennia. Mediterranean lakes record past changes in climate and water balance via a range of proxy indicators preserved in their sediments. A fundamental distinction can be made between open and closed lakes and thus lakes with and without surface outflow, respectively. Lakes in drier Mediterranean regions lose water mainly through evaporation from the lake surface and may become hydrologically closed and their waters saline (Roberts and Reed 2009). At times of negative water balance, the area of a closed lake shrinks, water levels fall and salinity increases, while the opposite occurs at times of positive water balance. Lake records are of great value primarily in reconstructing fluctuations in climate over multi-decadal and longer timescales (Fritz 2008).

Apart the natural proxies, there is also the potential in the wealth of textual evidence, as one moves back in time from the Byzantine, to the Late Roman, Roman and Greco-Roman periods, available for several areas of the Mediterranean. Such testimonies range from direct observations of climatic or environmental phenomena, to the indirect testimony of records of famine, plague, taxation records, etc. – especially suggestive when they are not entirely local (e.g. Garnsey 1988; Little 2006; McCormick 2011; 2012; 2013; McCormick *et al.* 2012; 2013; Manning *et al.* 2017, and references therein; Sallares 1991; Stathakopoulos 2000; 2004; Telelis 2004).

Luterbacher *et al.* (2012) highlighted the need to study the proxy archives in an integrative way and discussed the importance of multiproxy studies to disentangle the complex relationships between climate, land use, sea-level changes, human interactions, vegetation and forests in the Mediterranean. Further, a network of temporally highly resolved palaeoclimatic records from historical, palaeoecological and archaeological archives is needed and the combined information is of major relevance for our understanding of climate sensitivity, environmental response, ecological processes and human impact (Luterbacher *et al.* 2012; Mensing *et al.* 2018). Within the next sections, we will discuss some of these aspects related to proxy based temperature and hydroclimate reconstructions of the Eastern Mediterranean with focus on the Hellenistic period. The Hellenistic period covers the period of Mediterranean history between the death of Alexander the Great in 323 BC and the emergence of the Roman Empire as signified by the Battle of Actium in 31 BC, and the subsequent conquest of Ptolemaic Egypt the following year (Encyclopædia Britannica 2013).

Temperature conditions during the Hellenistic period in the Eastern Mediterranean

Luterbacher *et al.* (2016) provided a new 2150-year-long, summer mean temperature reconstruction for Europe and the Mediterranean. Nine annually resolved tree-ring width and density records as well as documentary records from central Europe were used in a Bayesian hierarchical modelling (BHM) framework. In Figure 2 we use the same data and method as in Luterbacher *et al.* (2016) but include additional tree-ring data from Slovakia and Albania which show a significant correlation with the Eastern Mediterranean summer conditions and rerun the temperature reconstructions for the region (Figure 2).

Figure 2 presents the last part of the Hellenistic period in the context of the past 2000 years. Results show that the last decades of the Hellenistic period were characterised by rather warm conditions (with respect to the reference period 1961-1990) followed by a cooling trend around 50 BC. The associated uncertainties are rather high (of the order of ± 1°C).[1]

The reconstructions presented in Figure 2 do not allow a further regionalization within the Eastern Mediterranean. Regional climate is the result of the interaction of large-scale dynamics with orography and physical properties at the regional and local scales. High density palaeo data sets support accurate representation of climate variability across space, and yield richer reconstructions of climate processes ongoing in the study area. Additional palaeo-climatic information that resolve temperature for the Hellenistic period is scarce. In a recent approach, Weiberg *et al.* (2016) presented a socio-environmental history of the Peloponnese (southern Greece) during the

[1] There is only one tree-ring proxy information available from the whole Eastern Mediterranean. Thus the reconstruction for the Hellenistic period almost entirely depends on tree-ring information outside the region and it should thus be interpreted with caution.

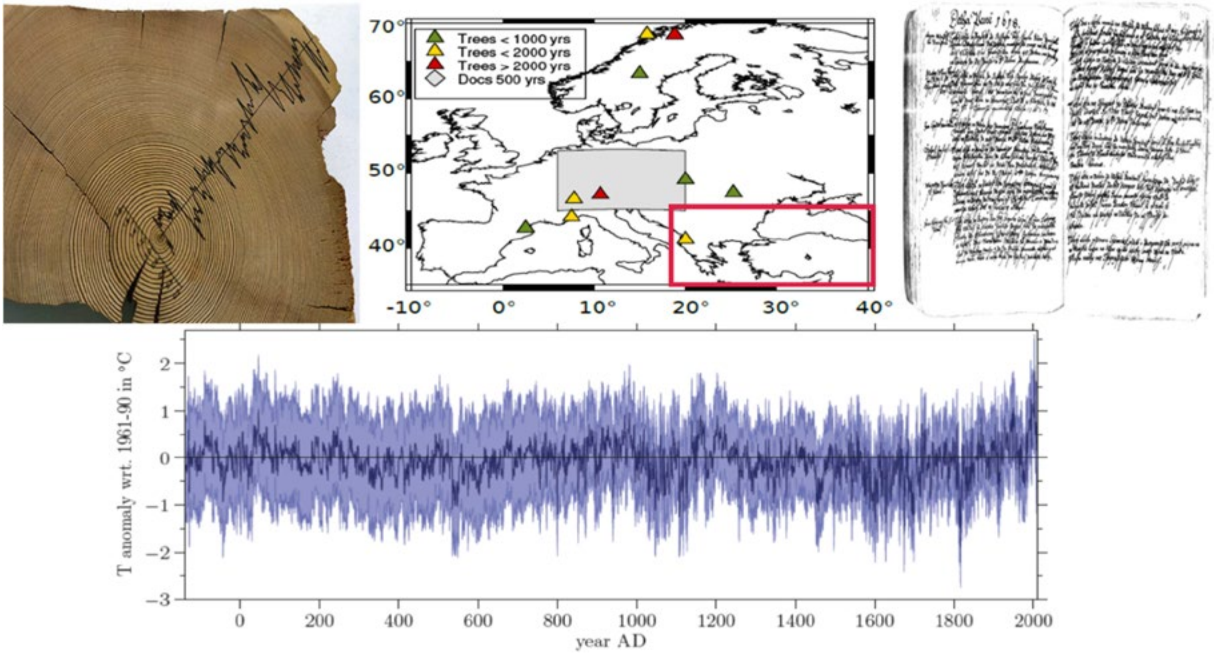

Figure 2. Tree-ring proxies and documentary evidence (upper panels left and right) and spatial distribution of proxy records used in the > 2000 years summer temperature reconstructions for the Eastern Mediterranean. (Lower panel) Bayesian Hierarchical Modelling (Luterbacher *et al.* 2016) based Southeastern Mediterranean (averaged over the red box) summer temperature anomalies (with respect to the 1961-1990 climatology) and the 95% confidence intervals (blue shading) over the period 137 BC to AD 2003.

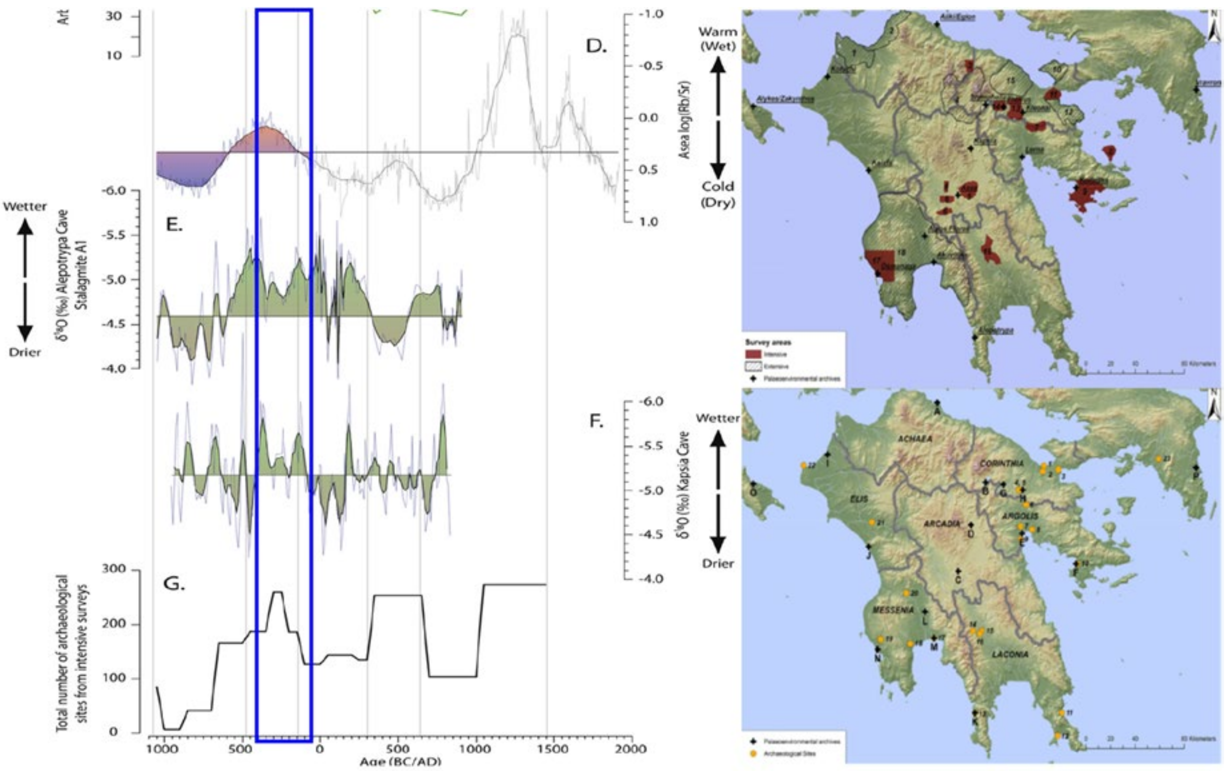

Figure 3. (Top right): Map of Southern Greece and the geographical regions of the Peloponnese, with available palaeoenvironmental archives (letters) and archaeological sites (numbers) cited in Weiberg *et al.* (2016). (Bottom right): Areas covered by intensive and extensive archaeological field surveys, visualised in combination with palaeoenvironmental records and geographical regions (left): An overview of evidence for climate variability (D and F), archaeological sites identified in archaeological surveys (G), D. log(Rb/Sr) from Asea (Unkel *et al.* 2014). Black line (and colour shading) 30 point running average; E. log(Rb/Sr) from Stymphalia Lake (Heymann *et al.* 2013). Black line (and colour shading) 30 point running average; F. $\delta^{18}O$ from Alepotrypa Cave, Stalagmite A6 (Boyd 2015). Black line (and colour shading) 5-point running average. G. Total number of archaeological sites identified in intensive surveys. The Hellenistic Period is marked in the blue box (from Weiberg *et al.* 2016).

Holocene including a better understanding towards an integrated understanding of the past. The Peloponnese (Figure 3) was an important centre for the establishment and evolution of ancient Greek civilisation, and the history of the peninsula comprises a wide spectrum of early farming communities, palatial economies, and city-states that produced sanctuaries and urban centres, including such as those of Mycenae and Olympia (Weiberg *et al.* 2016). The Peloponnese is also well documented in historical sources, both documentary inscriptions and the literary works of ancient authors. Additionally, the environmental changes and its climate variations during the past millennia have been studied from multiple sources using geochemistry, sedimentology, stable isotopes, charcoal, pollen and diatom records from lakes, lagoons, wetlands and speleothems (see Weiberg *et al.* 2016 for an overview). Weiberg *et al.* (2016) combined archaeological, palaeoenvironmental, and palaeoclimatic data and analyses the interactions between humans and the environment over the last 9000 years, thus including the Hellenistic period.

Local socio-political processes were likely always the key drivers behind the diverse strategies that human societies took in times of changing climate (Weiberg *et al.* 2016). Their findings reveal considerable chronological parallels between societal development and palaeoenvironmental records, but also demonstrates the ambiguities in these correspondences. Figure 3 shows the geographical regions of the Peloponnese with available palaeoenvironmental archives and areas covered by intensive and extensive archaeological field surveys cited in Weiberg *et al.* (2016). The Figure supports the finding above, that Hellenistic period was rather warm followed by cooler conditions. Figure 3 also illustrates environmental and climate evidence derived from lake sediments, pollen and speleothems distributed over the Peloponnese. Weiberg *et al.* point to the fact that large-scale agricultural and settlement intensification during the Hellenistic period occurred during rather humid conditions (Figure 3, left), while the decline in rural settlements started at the end of the Hellenistic period/ start of the Roman period is likely associated with a drier climate. During the Hellenistic period, Weiberg *et al.* (2016) observe shifts in the focus of intensive rural settlement and land-use from the east coast to the west Peloponnese that coincide with the longer-term persistence of more favourable (wetter) climatic conditions in the western part of the Peloponnese as compared to the inland regions and, possibly, the eastern coast. New evidence will be available in a few of years from the German Sonderforschungsbereich 1266 (TransformationsDimensionen - Mensch-Umwelt Wechselwirkungen in Prähistorischen und Archaischen Gesellschaften). The project aims to reconstruct environmental changes and their influence on the cultural development in the region around the Gulf of Corinth during the Bronze Age/Iron Age transition based on a complementary study of sedimentary and archaeological archives (I. Unkel, University of Kiel, pers. comm, February 2018).

Hydroclimatic conditions during the Hellenistic period in the Eastern Mediterranean

Water availability in the Mediterranean is a crucial constraint on societies and ecosystems. Especially important in this context is the identification of historical extreme events – including both floods and droughts – that severely stressed human or natural systems. Our understanding of variations in hydroclimate (including extreme events, flooding, and decadal periods of drought) is limited because of a paucity of modern instrumental observations that are distributed unevenly across the globe and only span parts of the 20th and 21st centuries (Smerdon *et al.* 2017). In this section, we discuss the available proxy data that resolve hydrological changes for the Eastern Mediterranean back to the Hellenistic period and highlight the contemporary understanding of how these proxies are interpreted as hydroclimate indicators. Tree-ring based local and regional precipitation reconstructions for the Mediterranean are too short and do not span the period back to the Hellenistic period. Speleothems, however, have been collected in three different regions of Turkey and several records cover more than 2000 years continuously and at high temporal resolutions (sub-annual to pentadal; Fleitmann *et al.* 2009; Göktürk *et al.* 2011; Figure 4). The Uzunturla record in northwestern Turkey shows a rather dry period at the end of the Hellenistic period (Figure 4). A long record from Sofular Cave (Fleitmann *et al.* 2009), covering more than 2000 years continuously, shows a long-term decrease in precipitation and effective moisture respectively. However, this record does neither indicate wetter nor drier conditions during the Hellenistic period (Figure 4). A stalagmite from the Kocain Cave in southern Turkey shows wet conditions during the study period (Figure 4). All three speleothem time-series from Turkey reveal multi-decadal droughts and wet episodes that are however not synchronous across space and time (Figure 4). Further southeast, a stalagmite from Soreq Cave in Israel was analyzed at very high resolution. Based on studies of the modern water-carbonate system in Soreq Cave, $\delta^{18}O$ calcite values are interpreted to relate to changes in the amount of winter and spring precipitation and, on shorter timescales, to changes in seasonality (Bar-Matthews *et al.* 1996). The record does not indicate specifically wet or dry conditions during the Hellenistic period. Only from approximately AD 100 to AD 700 there is a clear tendency towards drier conditions (Orland *et al.* 2009) and supported by evidence for a drop of 10-15 m in the level of the Dead Sea between *c.* 100 BC and AD 700 (Bookman *et al.* 2004). Recently Flohr *et al.* (2017) published a new 2700-year-long speleothem record from Iraq. The authors suggest that the Gejkar stalagmite is an accurate recorder of fluctuations in effective moisture. The record reflects

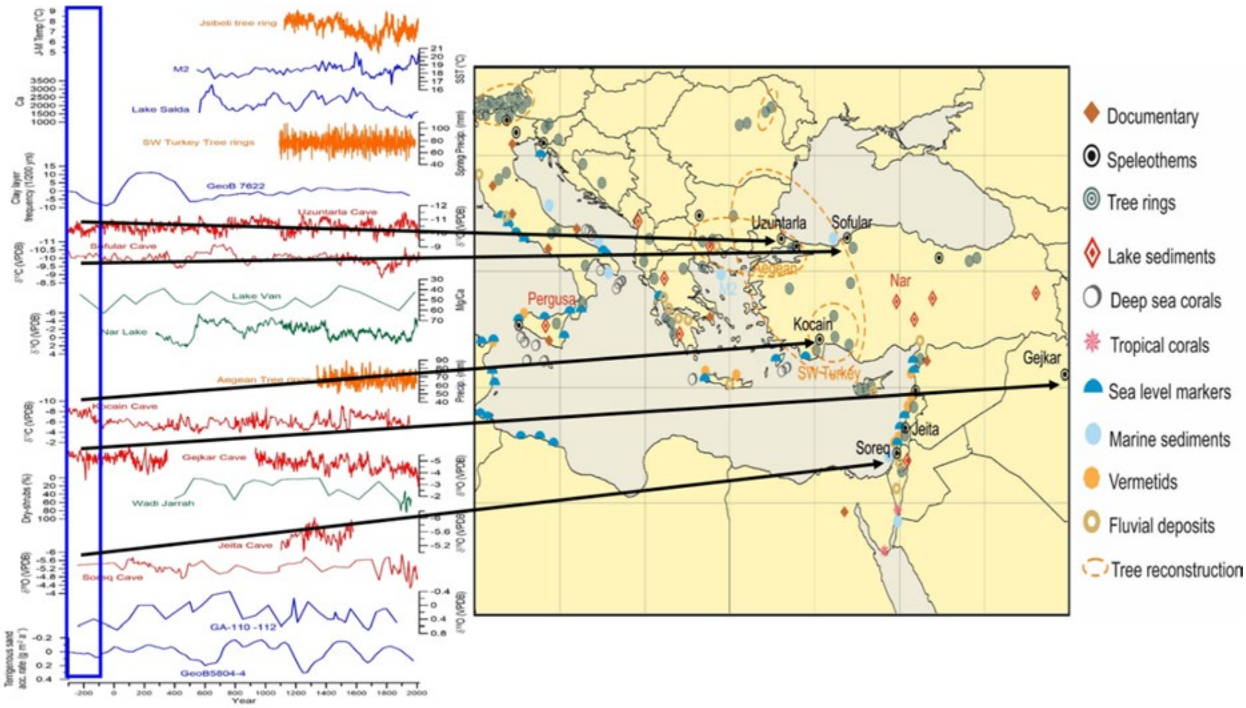

Figure 4. Natural proxy based environmental and hydroclimate variations at various locations in the Eastern Mediterranean going back to the Hellenistic period (blue box). Black arrows indicate speleothem based hydroclimate reconstructions. Locations of additional marine and terrestrial proxies with seasonal to multidecadal resolution covering the last at 600 years are also shown (right) from Luterbacher *et al.* 2012, updated; Flohr *et al.* 2017; Xoplaki *et al.* 2016; 2018).

agricultural droughts, which are of major importance for societies in the Fertile Crescent (Flohr *et al.* 2017). Generally, wetter conditions prevailed between *c.* 400 BC and *c.* AD 100 supported by independent evidence from the Middle East during this time interval (McCormick *et al.* 2012). Some of the sediment records from the Eastern Mediterranean have sub-decadal sampling resolution and may provide insights into higher-frequency climate variability, including Lake Van in Turkey. This record does not show a clear tendency for wetter or drier conditions during the Hellenistic period (Figure 4).

Summarised, the few speleothems and lake sediment proxies from the Eastern Mediterranean do not indicate a wide spread synchronous dry or wet phase during the Hellenistic times. The data coverage presented here for the Hellenistic period is, however, insufficient for characterizing hydroclimate and its associated dynamics because of its multidecadal to centennial variability and highly regionalised spatial signature.

Volcanic influence on the Nile variability during Ptolemaic times

Egypt provides an exceptional historical laboratory for the study of social vulnerability and response to abrupt hydroclimatic shocks (Manning *et al.* 2017). As the longest-lived successor to Alexander the Great's empire, the Ptolemaic state was a major force in the transformative Hellenistic era (Manning *et al.* 2017). The Ptolemaic Egypt period (BC 305-30) has the largest archive with contemporary documentation (Manning *et al.* 2017). The papyri provide precise measurements of Nile summer flood heights and qualitative assessments of the flood extent, augmented by inferences from rupturing of dikes and indicative evidence, mostly mentioned in multiple documents (Manning *et al.* 2017). The Nile is fed by monsoon rainfall in Africa's equatorial plateau and the Ethiopian Highlands. Before 20th-century damming, the monsoon rains caused flooding in the summer months. From early June on, the Nile level began to rise in Aswan at the southern border of Egypt. The highest levels were reached from August and September and the water then receded by the end of October, when the sowing season concluded (Hassan 1981; 1986; 1997; Manning *et al.* 2017). Egypt's prosperity was strongly tied to the annual cycle of the Nile summer flooding, with Nile failure often associated with major human impacts through its many millennia of recorded history (Manning *et al.* 2017). Strong tropical volcanic eruptions impose natural, short-term energy imbalances on the climate system, resulting in strong near-surface global cooling and changes in the hydrological cycle. Instrumental and model results indicate that strong tropical eruptions lead to reduced rainfall in equatorial zones, including the Ethiopian highlands where the Blue and the White Nile have their sources (Iles *et al.* 2013; Manning *et al.* 2017; Oman *et al.* 2006; Zambri and Robock 2016; Figure 5).

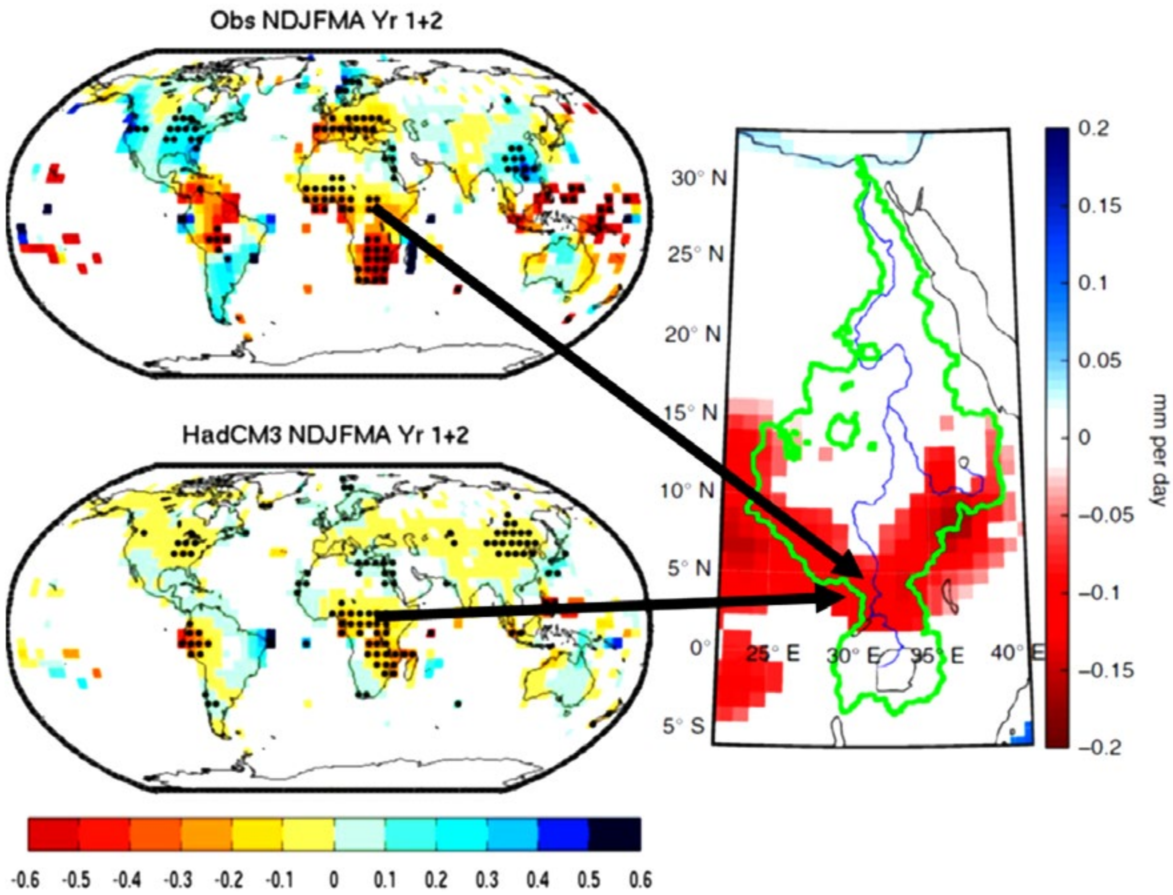

Figure 5. Average precipitation response to major volcanic eruptions for years 1 and 2 (mm/day) for observations (top left) and the HadCM3 model ensemble mean (bottom left). Stipples indicate significance at the 90% level. Both the observations and model results are spatially smoothed (right) response of the Nile watershed (outlined in green) after explosive volcanism expressed as change of precipitation in mm/day. The black arrows show the source regions for the Nile (from Iles *et al.* 2013 and Manning *et al.* 2017).

Such eruptions may have resulted in Nile flood suppression and poor harvests in the past. Families distributed land in geographically dispersed individual shares to hedge against the risk of Nile failure. External territories also helped buffer Egypt against Nile failure (Manning *et al.* 2017). Figure 6 shows the volcanic activity derived from ice cores for the period 300 BC to AD 200 (Sigl *et al.* 2015), with strong tropical eruptions indicated in red dots. The figure also provides ancient Greek papyri from the Ptolemaic era such as P. Edfu 8 from the mid 3rd century BC mentioning Nile failure for 3 years, and the invention of an irrigation 'machine' that would water the whole Nile valley and 'save' Egypt from famine. A prominent peak in volcanic activity is also found 46 and 44 BC (explosive eruption of Mt Etna, Italy) suggesting a multi-year or lagged response, with revolt onset in some instances plausibly delayed or potentially prevented by short-term coping strategies, such as Cleopatra's release of state-reserved grain during documented Nile failure.

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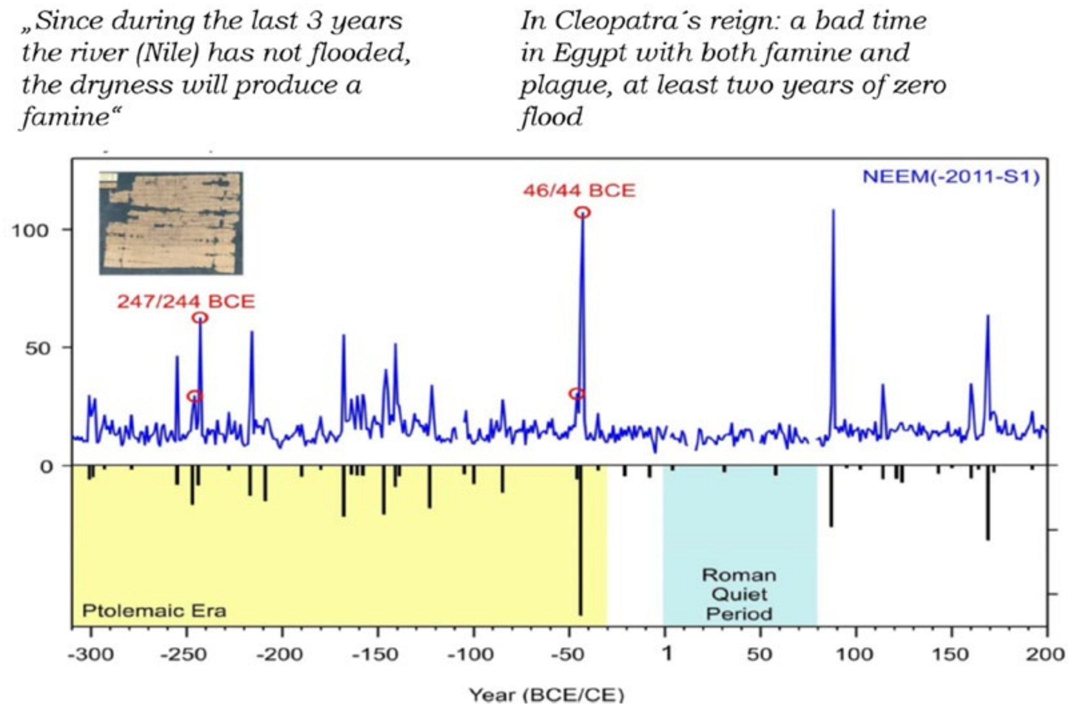

Figure 6. Volcanic activity (Ice-core-indicated dates of maximum aerosol forcing from volcanic eruptions with time-integrated (i.e. cumulative forcing estimates for the Northern Hemisphere), 300 BC to AD 200 (Sigl *et al.* 2015) with strong tropical eruptions in red dots. This piece of papyrus (top left) from the mid 3rd century BC describes a period of famine in Egypt that occurred when the Nile River failed to flood for several years in a row associated with famine. It was collected from the Egyptian city of Edfu (image: Department of Papyrology, Institute of Archaeology, University of Warsaw) (courtesy Prof. Manning, Yale and Department of Papyrology, University of Warsaw; Manning *et al.* 2017).

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A tentative methodology of sea-level change based on fish tanks from Hellenistic Alexandria, vis-a-vis, the submerged el Hassan rock provide a new look for subsidence estimates

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Introduction

The aim of this paper is to provide a new look towards understanding the subsidence rates offshore Alexandria using a shipwreck and Roman fish tanks as sea-level change indicators. Coastal settlements and harbors that were constructed in antiquity provide important knowledge regarding sea-level changes over the past millennia. Two types of correlations provide data on past sea-levels. The first type are structures which must have been above sea-level during their use, but are now submerged, and the second are coastal structures that were built taking into account the sea-level of that time. The functional height of an archaeological structure is determined by its particular elements, taking into account the local average sea-level, the type of construction, its use and the local tidal range. The ancient habitation in the Mediterranean has left plentiful data along its shores and it is clear that some archaeological constructions provide valuable information about the magnitude of relative sea-level changes since antiquity (Zerefos *et al.* 2015). During the last century, many scientists have investigated the use of archaeological indicators in the study of relative sea-level changes. One of the advantages of archaeological constructions is related to their antiquity. Where accurate vertical relationships between archaeological constructions and the biological sea-level were possible, the relative sea-level trends since antiquity have been precisely reconstructed in some Mediterranean locations (Marriner and Morhange 2007).

Morhange and Marriner (2015) categorise shipwrecks as sea-level indicators in the 'submerged structures' and point out that such remains provide an indication of the direction of sea-level change, but are generally low-precision indicators for the amplitude of movement. However, Porqueddu *et al.* (2011) have used remains of shipwrecks in combination with other sea-level indicators to reconstruct the relative sea-level change in Olbia Gulf (Sardinia, Italy). In a similar manner, Sivan *et al.* (2001) discuss Holocene sea-level changes along the Mediterranean coast of Israel.

At the same time, the examination of Graeco-Roman fish tanks in Alexandria (Egypt), and their potential use as markers of the palaeo-sea-level at the time of their construction, is a method commonly used to understand the sea-level changes during that period. Fish tanks, in particular, are considered as highly reliable archaeological indicators because they have a relatively precise relationship with sea-level during their construction period, between the 1st century BC and the 1st century AD (Higginbotham 1997). For example, fish tanks have been widely used in the reconstruction of sea-level changes on the Tyrrhenian coast of Italy by Schmiedt (1972), Pirazzoli (1976), Lambeck *et al.* (2004) and Evelpidou *et al.* (2012).

The artificial Roman fish tanks were constructions, carefully crafted, in order to provide a suitable environment for fish. The fish were either kept until they were distributed on the market or were 'farmed' for future consumption, or were limited to contributing to their owners' elegant environment (Giacopini *et al.* 1994). Fish farming was widespread between the 1st century BC and the 2nd century AD. Plato reports that fish farming was applied along the Nile banks. The Egyptians built large enclosures which were often integrated into religious buildings and royal palaces (Besta 1921). Fish farming, during the time of Columella, was spread to less robust areas of Roman society and was not associated only with wealthier society.

Regarding the rest of the Mediterranean region, fish farming was found in the Hellenistic city of the Libyan Pentapolis (Yorke and Davidson 2017), in Israel (Sivan *et al.* 2001; 2004; Galili *et al.* 2005; Galili and Arenson 2014), in Cyprus and Crete (Davaras 1974; Lambeck *et al.* 2004; Mourtzas 2012a, b), and, of course, along the Italian coasts.

Fish tanks can provide information on past sea-levels. However it is important to clarify the function of individual architectural features in order to calculate functional heights in relation to sea-level. The outer break-wall of the tank cannot provide accurate data on relative sea-level because: a) the top is not directly connected to the sea-level; and b) there is a variety of architectural types (Carre *et al.* 2011). The analysis, however, is more accurate when it is limited to data deriving from foot-walks, channels and mid-tidal gates. Foot-walks are narrow paths along the internal tanks. Initially they were used for maintenance purposes and therefore considered to be above sea-level. Unfortunately, these constructions are not very common and only indicate the direction of sea-level change. The measurement of the position of foot-walks in relation to present sea-level provides data only on level change ranges. The channels were used to fill and empty the basins with water. They may correspond to the average sea-level when they operated as sluice gates, but may also be elevated stable gates. *In situ* closing gates, which are precise indicators, are extremely rare due to their initial position in the wave breaking zone. The metal *cataractae* along the channels or between the tanks were operating in grooves drilled into the rock. These *cataractae* were located in the tidal range and therefore their indicators may be particularly useful, if interpreted correctly, for assessing the palaeo-sea-level. In conclusion, archaeological indicators of sea-level change should be used with great caution in fish tanks. Corrections regarding the tide and atmospheric pressure do not overcome these uncertainties.

In this context, we combine information from historical maps and field data from the coastal zone of Alexandria to deduce subsidence rates during the Late Holocene.

Study area

The study area is located in the coastal zone of Alexandria from the Silsilah promontory to the Abou Kir promontory (Figure 1). Alexandria was built on a long coast-parallel ridge of Pleistocene age, which runs from the southwestern part of the city to Canopus, the modern town of Abou Kir. The ridge, called Abu Sir, reaches a height of 35 m in its west part and 6 m in Abou Kir, and is formed of poorly to moderately cemented sandy carbonate, known as kurkar formation (Butzer 1960; Stanley and Hamza 1992; Hassouba 1995).

Analysis of hourly tide-gauge observations in Alexandria over ten years (1996-2005) showed that the sea-level variation is a combination of only +/- 20 cm elevation due to astronomical tide and up to 1 m elevation under the effect of meteorological factors (El Geziry and Radwan 2012; El Geziry 2013).

The mean sea-level between the daily readings of high and low water level during the period 1898-1906 has been set as the mean sea-level (m.s.l.) datum at Alexandria Harbour and was found 33.8 cm above the zero of the installed tide gauge (Dawod 2001). The m.s.l. for the period 1944-1989 was calculated at 40.0 cm (Frihy 1992) and for the period 1974-2006 at 47.9 cm (Said *et al.* 2012) above the zero of the installed tide gauge. The prevailing winds in Alexandria blow northwest, as was the case in antiquity (Stanley and Bernasconi, 2006). These authors note that the mean wave height is about 2 m, while large waves reach 4 m. According to Chalari (2007), the maximum wave height during winter is 5.5 m, in spring 4 m and in summer 3.3 m. Waves of 4 m height have a return period of one year, while 8 m waves have return periods of 100 years according to Aelbrecht *et al.* (2000). In contrast, storm waves of 7.6 m height were calculated to occur with a return period of 50 years while larger than 8 m height occur with a return period of 100 years (Iskander 2013); Shah-Hosseini *et al.* (2016) state that storm waves higher than 9 m occur every 100 years.

According to Frihy (1992), the subsidence rate in Alexandria over the last 60 years is 2 mm/yr, while Frihy *et al.* (2010) consider Alexandria as relatively stable over the long-term, with subsidence rates of 0-0.5 mm/yr. Dawod (2001) estimated the rate of the relative long-term mean sea-level rise for the period 1944-1999 to be 1.7 mm/yr, while other researchers provide values in the range of 1.6 mm/yr to 2.9 mm/yr for various periods of observation (Chalari *et al.* 2009). For the East Harbour, the rate of the long-term relative mean sea-level rise for the 2300 years since the founding of Alexandria is estimated from archaeological evidence to be close to 2.9 mm/yr (Stanley and Bernasconi 2006). Subsidence rates of Mid to Late Holocene age at seven archaeological sites along the Nile Delta coast, based on core stratigraphy, range from 0.9 to 4.3 mm/ year, varying irregularly from the west to the east coast and averaging to ~2.5 mm/year (Stanley and Toscano 2009).

Alexandria fish tanks

Several fish tank installations have been noted on the coastal zone of Alexandria, as shown in the map (Figure 2). Fish tanks can also be recognised in satellite images of the littoral area *c.* 3 km from the east end of the Maamourah Bay towards Abou Kir promontory when comparing them to the Breccia (1926) description and Bartocci (1925) map. Of the three fish tanks studied in detail, Miami (Figure 3), Montazah and Abou Kir, the Montazah feature is very well preserved and the only one recognised as such long ago (Abd el-Maguid 2015). The fish tank installations along the coastal zone of Alexandria suggest that, in Roman times, the city played a commercial role in the export of fresh fish. Catching fish from inside the tank was easy. Once caught, fish could be transported along short distances in nets, trailing in the water or by boat (Plinius, Naturalis

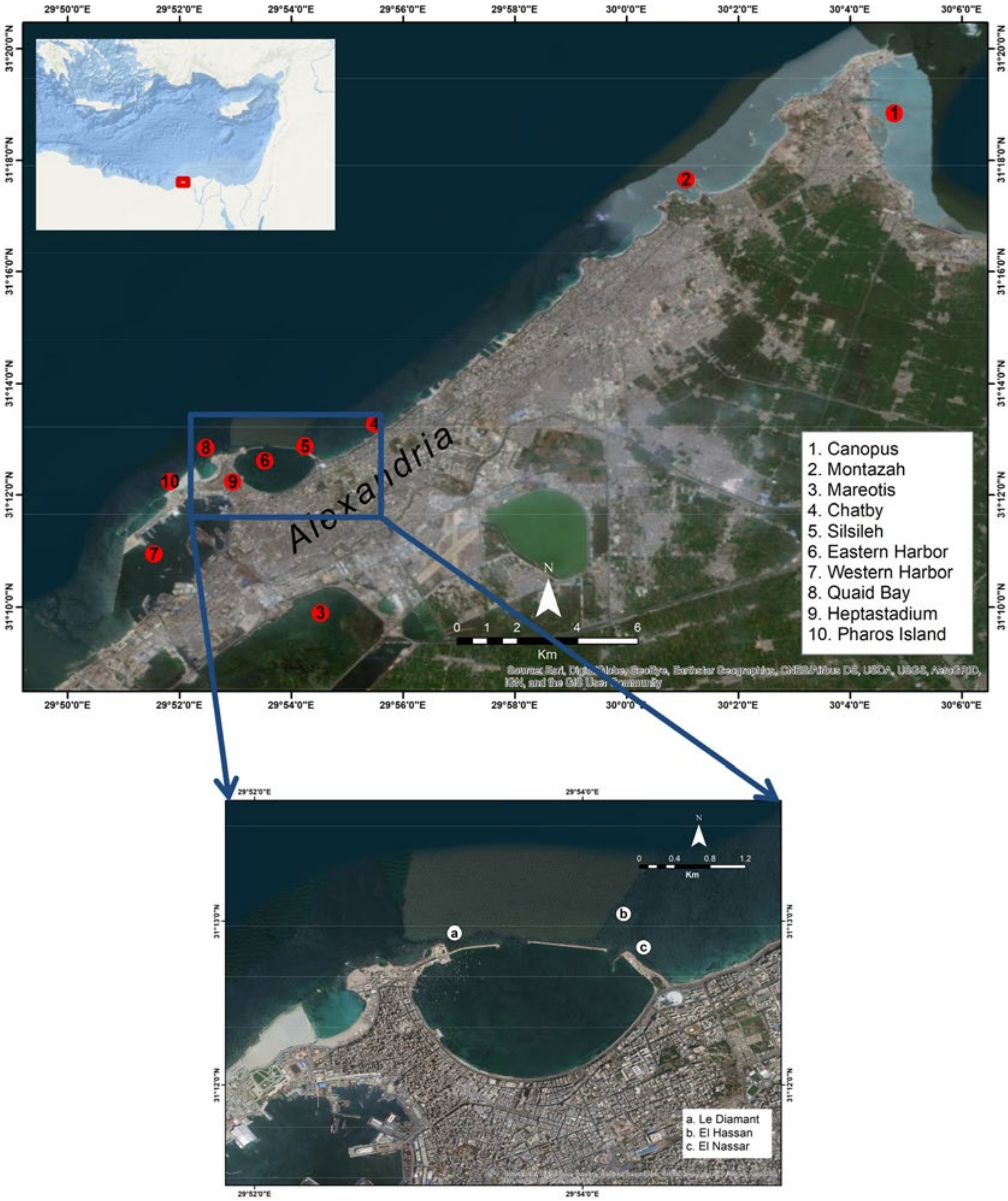

Figure 1. Location of the study area and sites mentioned in the text.

Historia Naturalis IX). For longer distances, and to ensure the health of the fish, boats equipped with live tanks could have been used (Macrobius, Saturnalia III). Athenaeus of Naukratis (Deipnosophistae, V, 208) describes a ship, the 'Syrakousia', built by Archimedes at the behest of tyrant Hiero II of Syracuse (3rd century BC), which had a tank for live fish built into the bow, constructed of lead and wood. It was filled with sea water and fish were kept there, alive, during the trip. During the construction of the airport at Fiumicino in 1958-59, a boat with a live tank (navis vivaria) was unearthed near what was the entrance to the Claudian harbor of Rome (e.g. Boetto 2006). In a wrecked ship of the 2nd century AD, discovered off the coast of Crado in northeast Italy, a lead pipe that ends in a hole through the hull is presumed to be part of a pump (not discovered) to renew the water in the stern, so keeping the fish alive while travelling to the fish markets (Beltrame *et al.* 2011).

Vessels such as these could land on the protective moles of most seaside fish tanks and simply transfer the catch to the pond. Piers and moles would have facilitated the transfer of fish into the enclosures as well as their transfer to market. A boat like that could have been used to transport live fish from Alexandria to Europe.

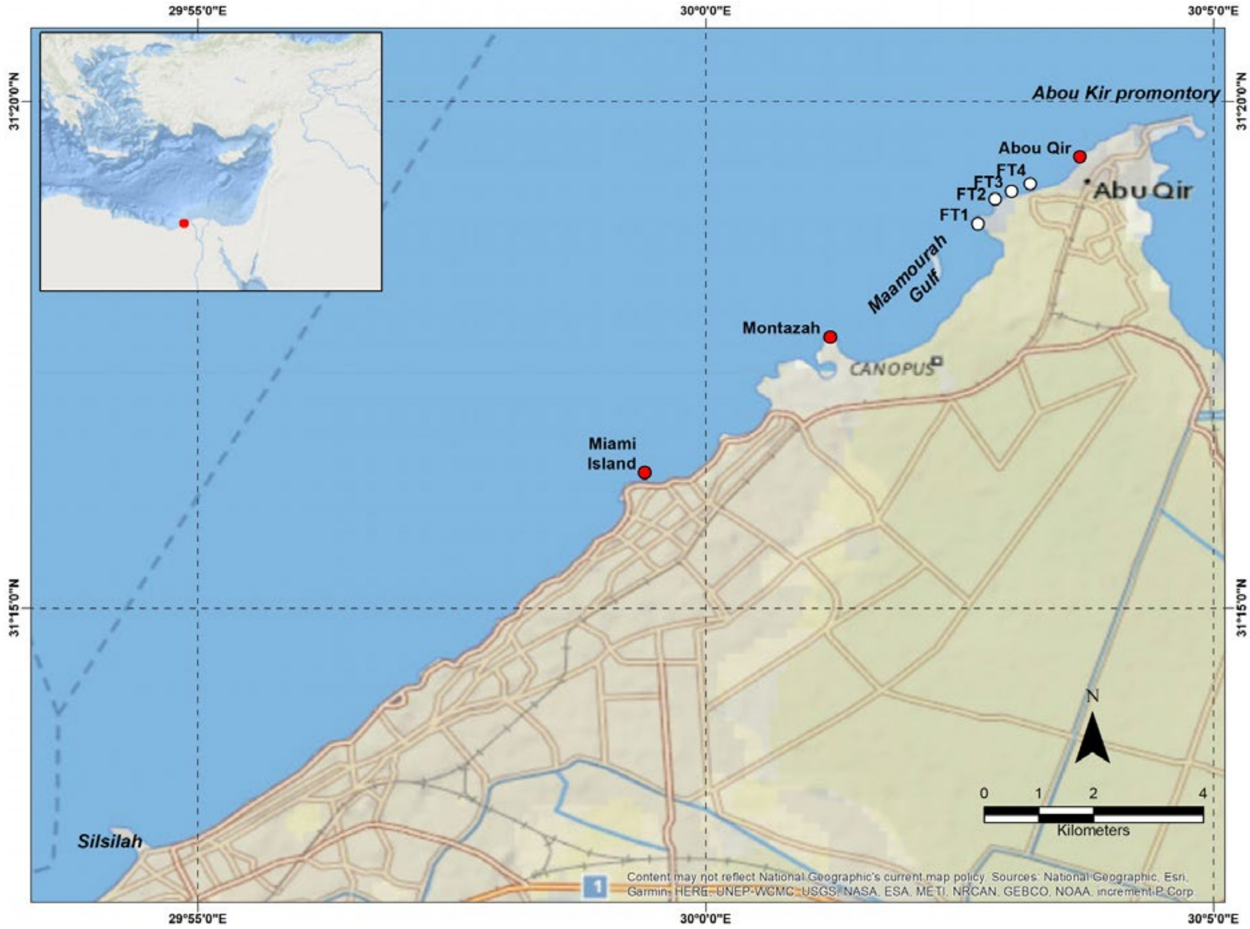

Figure 2. Greco-Roman fish tanks in the Alexandria coastal zone, used as sea level indicators. Miami, Montazah and Abou Kir fish tanks have been used as sea-level indicators based on the measurements of their morphological characteristics. FT1-4 are fish tanks recognised by satellite images but are not studied as they are located in a military area.

Figure 3. Miami fish tank.

According to Breccia (1926), 'Né forse si fa ipotesi troppo ardita ammettendo che Alessandria anche in questa come in altre manifestazioni della vita e dell 'arte, specialmente della vita lussuosa, abbia offerto a Roma il modello e l'esempio.' In other words, would it be too bold to assume that Alexandria, in this, as in other manifestations of life and arts, especially in terms of luxurious living, has provided the model for Rome?

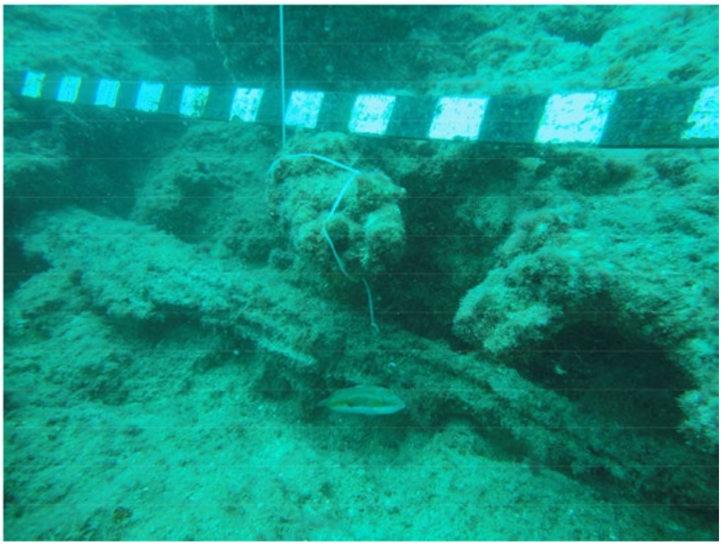

Figure 4. A piece of timber from a wrecked ship found at the El Hassan reef at a depth of 10 m, which has been ^{14}C dated.

El Hassan submerged reef

Remains of several shipwrecks have been noted during HIAMAS (Hellenic Institute of Ancient and Mediaeval Alexandrian Studies) surveys on the seabed and the contours of the El Hassan. Of particular interest are the remains of ship wreckage, as it bears witness to the submergence of the reef. The wreckage is modern, as attested by a structural timber wedged in the bed rock of the El Hassan (Figure 4). This piece of timber is 1.35 m long, 0.16 m high and 0.10 m wide, found wedged in a rock cavity, firmly stuck at 29° 54.285' E and 31° 13.225' N, at a depth of about 10 m. This structural piece was likely a floor rider or a floor frame, positioned between the keelson and the keel of the ship.

Figure 5: The map of the *Codex Urbinate* 277 (1472), depicting the present 12 reefs as protruding features.

The ages obtained with ^{14}C AMS, were between 143 ± 20 ^{14}C yr BP (cal AD 1719-1780) and 197 ± 23 ^{14}C yr BP (cal AD 1735-1806) with a probability of 95.4%.

Based on the aforementioned, there is a possibility that, in the late 18th century AD, the tip of El Hassan was at a depth not exceeding 2-3 m (Zerefos *et al.*, in press). This analysis suggests a subsidence of the order of 6 m in about 200-250 years, or about 2.5 - 3 cm/year. This observation is consistent with the earlier map of Codex Urbinate (1472) showing the reef as shoal, or even above sea-level. In fact, three reefs, El Hassan, El Nassar and Le Diamant, are shown as shoals or above sea-level in earlier maps. On the map of the Codex Urbinate 277 (1472), now kept in Biblioteca Apostolica Vaticana, these reefs are depicted as large rocks protruding above the m.s.l. (Figure 5); however, now El Hassan and El Nassar lie about 7-8 m below m.s.l., and Le Diamant reef is about 1-2 m below m.s.l.

Discussion

Based on the hydraulic characteristics of the studied fish tanks, and having utilised the most appropriate and well-preserved features, the relative sea-level changes since the Roman period have been estimated. We have assumed that tide, wind and air pressure in Roman times were similar to the present. Based on the interpretation of the functionality of the fish tanks, and during their operational period, it seems that sea-level has risen by *c.* 70 cm over the last 2000 years in this relatively stable part of Alexandria. Findings from the studies of the fish tanks agree qualitatively with data from other relatively stable areas around the Mediterranean, such as in studies of ancient harbors and coastal installations in the Western Mediterranean

(Blackman 1973; Morhange *et al.* 2001). For Fréjus, in France, Morhange *et al.* (2013) report a RSL rise of 40 ± 10 cm since Roman times, consistent with a recently published Roman sea-level of -32 to -58 ± 5 cm for the northwestern Mediterranean for the same period. For the Tyrrhenian coast of Italy, Evelpidou *et al.* (2012) report that local sea-level during the Roman period did not exceed 58±5 cm below present sea-level. In Israel (Sivan *et al.* 2001; 2004; Galili *et al.* 2005; Anzidei *et al.* 2011), relative sea-level has been relatively stable since about 4000 years BP, when it reached its present level, with possible fluctuations not exceeding 0.5 m. Goiran *et al.* (2009) obtained an age of 2115 ± 30 14C yr BP (230-450 cal. AD) on a mole in the ancient harbor of Portus in the Latium region, situated on the right bank of the mouth of the Tiber, indicating a former sea-level of 80 ± 10 cm below modern m.s.l.

On the other hand, at El Hassan there is a noticeable offshore subsidence of the order of 2.5-3 cm/year for the last 200-250 years. The question arises if there are other geological triggers for such subsidence. The recorded periodic instability that affects this region results from readjustment to down warping (sediment compaction faulting, isostatic lowering) of the thick underlying sedimentary sequence (locally exceeding 4 km). The thin Holocene cover of unconsolidated deposits overlies Quaternary and Tertiary sequences of Nile Delta origin that, in turn, are superimposed on Mesozoic sedimentary units (Said 1981; Schlumberger 1984). This sector is periodically affected by earthquake tremors (Kebeasy 1990; England *et al.* 2015), growth faulting (Stanley 2005) and tsunamis (Guidoboni *et al.* 1994; Shaw *et al.* 2008; Vale *et al.* 2014; England *et al.* 2015). Generally, the low-lying region of the Nile Delta is subjected to significant differential subsidence, but to date none of such size has been reported. According to the comprehensive catalogue of Ambraseys (2008) and the corrections to other derivative catalogues by Ambraseys and Synolakis (2010), there are no significant local earthquakes in the past 250 years. No similar changes have been reported in the neighbouring coastal zone. Stanley and Toscano (2009) measured land subsidence at seven archaeological sites on the Nile Delta margin that do not exceed 4.3 mm/yr on average, for the last 4 millennia. Based on cores studded across the Nile Delta plain, Marriner *et al.* (2012) deduce subsidence rates from 0.03 to 4.5 mm/yr, and note the highest in the Manzala, Burullus, Idku, and Maryut lagoons, with 88% of the subsidence values <2 mm/yr. Recent interferometric synthetic aperture radar (inSAR) measurements (Bouali 2013) suggest rates of up to 12 mm/yr in Mansoura and 10 mm/yr in Ras El Bar, but show Alexandria to be relatively stable. Our measurement is much higher than inferred from onshore measurements.

While our measurement from the El Hassan is provocative, we are led to the conclusion that this subsidence, less than 1 km seaward from the mouth of the harbor, must be due to submarine sediment compaction. If our analysis is qualitatively correct, and similar rates of subsidence have been ongoing for the last millennium, a part of ancient Alexandria may lie buried in coastal sediments.

Conclusions

Numerous fish tank installations exist in a relatively short stretch of coastline in Alexandria (Egypt). Based on the interpretation of the functionality of the fish tanks during their operational period, taking into account mainly the best-preserved features, we suggest that sea-level has risen by *c.* 70 cm over the last 2000 years in the study area. On the other hand, findings at El Hassan reef, indicates a subsidence of the order of 6 m in about 200-250 years. This is based on a structural timber wedged in the bed rock of the El Hassan. This piece of timber found at -10 m was dated between 143 ± 20 and 197 ± 23 C yr BP. No reported earthquake can explain such a rate of tectonic subsidence.

Taking into consideration the geomorphological and tectonic regime of the area, and the sea-level rise over the last 200 years in the study area, we conclude that there are subsidences offshore due to submarine sediment compaction.

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Zerefos Ch., Evelpidou N., Tzalas H., Synolakis K. and Repapis Ch., in press. *Geophysical phenomena and the littoral Alexandria.* Treatise. Athens: Academy of Athens.

Hellenistic Alexandria : Celebrating 24 Centuries presents the proceedings of a conference held at the Acropolis Museum in Athens, on December 13–15, 2017, and includes high-level dialogues and philosophical discussions between international experts on Hellenistic Alexandria. The goal was to celebrate the 24 centuries which have elapsed since its foundation and the beginning of the Library and the Museum of Alexandria. The conference was divided into two parts, to include in the first part archaeology, history, philosophy, literature, art, culture and legal issues and in the second part science, medicine, technology and environment. A total of 28 original and peer-reviewed articles point to the importance of the brilliantly-original ideas that emerged during the Hellenistic age and the curious modernity of the whole atmosphere of the time. The range of presented topics covers a variety of new data on the foundation of Alexandria to comparison between Ptolemaic Alexandria and Ptolemaic Greece through philosophy, culture and drama to the forgotten revolution of science, medicine and the prevailing climatological and geophysical conditions throughout the Hellenistic Period. The conference and its proceedings were co-sponsored by the *Marianna V. Vardinoyannis Foundation*, the *Acropolis Museum*, the *Alexandria Center for Hellenistic Studies at Bibliotheca Alexandrina* and the *Mariolopoulos-Kanaginis Foundation for the Environmental Sciences*.

The Publication also celebrates the 10th anniversary of the Alexandria Center for Hellenistic Studies, a joint collaboration between the Bibliotheca Alexandrina, the Vardinoyannis Foundation and the University of Alexandria. Scholars from around the world follow the Center's programme in various specialisations, ranging from history-literature-art, to archaeology and architecture-philosophy, and science.

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