

*Long-distance trade and the exploitation of arid landscapes in the  
Roman imperial period (1st – 3rd centuries AD)*



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A thesis submitted in fulfillment of the requirements for the degree of D.Phil. in Classical  
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## Abstract

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**Title of the thesis:** Long-distance trade and the exploitation of arid landscapes in the Roman imperial period (1st – 3rd centuries AD)

If as argued the Mediterranean consisted in Antiquity of a unity determined by similar environmental factors and crises which were mitigated through established networks of trade and exchange, the border regions of the Roman Mediterranean, particularly to the South and East, were characterised by a radically different environment. This thesis focuses on the development of three of the arid regions bordering the ancient Mediterranean, namely the Fazzan oases in the Libyan Sahara, the Eastern Desert of Egypt and the region of Palmyra in Syria. These arid regions have received considerable archaeological attention in recent years, and a review of them will highlight the factors which enabled these regions to interact with the Roman Empire through trading dynamics, but also through the development of local resources. Central questions within this thesis concern the extent to which the environment would have tailored the potential of these regions, and if the existence of trade routes and social networks both affected and were affected by settlement and exploitation patterns in the region. Trade was created by geographically much broader social requirements for foreign or exotic goods, yet was restricted by the possibility to pass through these regions. Developments were conditioned by the constant need for balance between the state as a power enforcing and representing peace and security and local entities, and what the local social organisation had to offer in term of rent and stability to the state as an institution.

After an introduction (Chapter 1) delineating the aims of the thesis, Chapter 2 defines influential theories and models that will be considered for this thesis, namely environmental factors, social networks and institutional economics. The archaeological evidence is then discussed in each relevant chapter: Chapter 3: The Libyan Sahara; Chapter 4: The Eastern Desert of Egypt; Chapter 5: Palmyra.

Chapter 6 discusses major factors that may work as explanations for the development of agriculture, the exploitation mineral resources, and trade in these regions. The choice of regions both inside and outside the Roman Empire also allows a discussion on the rise of economic activities linked to the imperial economy. As such, the thesis moves away from a romano-centric perspective and proposes to look instead for internal factors, such as the development of complex societies with organisational frameworks and social networks which enable them to overcome the challenges of their geo-climatic settings.

This study concludes that the developments identified in each chapter were not a factor of environmental changes but human agency. The state, or private individuals or communities successfully organised the resources necessary to integrate the regions into wider networks of intense trade in the imperial period. These concerned both physical infrastructure, and the development of far-reaching social networks.

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## Note on transliterations

The standardisation of Arabic names has always been problematic in scholarship, especially as different forms of transliterations have traditionally co-existed in the Indo-European languages used in this thesis. I have chosen an approach based on the transliterated forms of the Encyclopedia of Islam and used for the Fazzan project, except for diacritics since some names could not be directly verified in Arabic. Some variant names of important places and sites that have been extensively published are mentioned below though not all. Other variants were kept in the text (Qseir al-Qadim, Bu Njem), on the basis that a new name would only be confusing. Minor sites have been renamed when possible, and to the extent that the original form could be adapted or verified.

### Libya:

Spelling used in the text	Alternative spellings (not all are listed)
Aghram Nadarif	Aghram Nadarif
Ahoggar	Hoggar; Ahaggar
al-Qurayyat al-Gharbiya	Gheriat el-Garbia
Arq Zuma	Eghei Zuma
Aujila	Aujila
Bu Njem	Bu Ngem; Bu Nijim; Abu Najaym
Chott al-Jarid	Chott el Jerid; Chott el Djérid
Fazzan	Fezzan
Ghadamis	Ghadames
Gharyan	Gharian, Garian
Ghat	Gat
Ghirza	Ghirza
Hamada al-Hamra	Hamada el Hamra
Idalas	Ideles
Jarba	Djerba, Jerba
Jarma	Germa
Massak Sattafat	Massak Sattafat
Mizda	Mizda
Murzuq	Murzuk
Qasr ash-Sharraba	Esc-Sceraba
Saniat bin Huwaydi	Saniat ben Howeidi
Saniat jibril	Saniat Gebril
Sardalas	Serdeles
Taqallit	Tāqallit
Tarhuna	Tarhuna
Wadi al-Had	Wadi al Had
Wadi al-Ajal	Wadi al-Agial, Uadi el-Agial
Wadi ash-Shati	Wadi Ash Shati
Wadi Tanzzuft	Wadi Tanezzuft

Wadi Zizaw  
Zalla  
Zinkekra  
Zuwila

Wadi Zigza  
Zella  
Zinhecra  
Zawila

### **The Eastern Desert of Egypt:**

Spelling used in the text	Alternative spellings (not all are listed)
Abu Diyaba	
Abu Garida	Abu Gerida
Abu Maamal	Abu Mamel
Abu Qurayya	Abu Greya, Abu Kreyah
Abu Rashid	Abu Rashid
al-Aras	al Aras
al-Buwayb	Al Buwayb
al-Hamra	al Hamrah
al-Hayita	al Heita
al-Kanais	Kanais
al-Matula	al Matula
as-Saquia	Saquia; al-Saqqia
Bab al-Mukhaynig	Bab al Mukhaynig
Badia	
Berenike	Berenice
Bir Sirbakis	
Bir Umm Fawakhir	
Bukhalug	
Dayr al-Atrash	Deir al Atrash
Dayr al-Bahri	Deir el Bahari
Gabal Abu Marwat	Gebel Abu Marwat
Gabal al-Zait	Gebel el Zeit
Gabal Gasus	Gebel Gasus
Gabal Hafafit	Gebel Hafafit
Gabal Migif	Gebel Migif
Gabal Sid	Gebel Sid
Gabal Zabara	Gebel Zabara
Kab Marfua	Kab Marfu'a
Kompasi	Compasi / Daghbag (associated with)
Koptos	Coptos; Qift
Laqita (Phoinikôn)	Laqeita
Marsa Gawasis	Mersa Gawasis
Qattar	Qatar
Qseir al-Qadim	Qseir al Qadim, Quseir al Qadim
Qsur al-Banat	Qsur al Banat, Kusur el Banat
Samna	Semna

Sikait	
Umm Ash	Umm Esh
Umm Howaitat al Qibli	Umm Howeitat al Qibli
Umm Kabu	
Umm Rus	
Umm Saghilat	Umm Seghilat
Umm Sidri	
Wadi Abu Diyaiba	Wadi Abu Diyeiba
Wadi Abu Maamal	Ouadi Abu Maamel
Wadi al-Hudi	Ouadi el Hudi
wadi Balih	Ouadi Balih
Wadi Barud	Ouadi Barud
Wadi Dib	Ouadi Dib
Wadi Fatiri al-Bayda	Ouadi Fatireh al Bayda
Wadi Gidami	Ouadi Gidami
Wadi Maghrabiya	Ouadi Maghrabiya
Wadi Minayh	Ouadi Minayh, Wadi Menih
Wadi Nugrus	Ouadi Nugrus
Wadi Qattar	Ouadi Qattar
Wadi Umm Balad	Ouadi Umm Balad
Wadi Umm Huyut	Ouadi Umm Huyut
Zabargad	Zabargat

**Palmyra:**

Spelling used in the text	Alternative spellings (not all are listed)
Ad-Daw	Ed-Daw
Afqa	Efca, Efqa
Bir al-Umy	Bir al Umy
Dayr az-Awor	Deir ez Zor; Dayr al-Zawr; Deir Azzor
Jabal Abyad	Jabal Abyad
Jabal al-Husaynat	Jabal al Husaynat
Jabal al-Muntar	Jabal al Muntar
Jabal at-Tar	Jabal at Tar
Jabal Chaar	Jabal Shaar
Jabal Merah	Jabal Merah
Khirbat al-Bil-a'as	Khirbet el-Bil-a'as
Muhaiwir	Muhaywir
Qasr al-Hayr	Qasr al Hayr
Qasr as-Swab	Qasr as Swab
Qasr Khabbaz	Qasr Khubbaz
Sabkhat al-Muh	Sebhka al Muh, Sebkhata al Mouh
Umm al-Amad	Umm el Amad

Umm al-Qanat  
Umm al-Quwain  
Umm as-Salabih

Umm al qanat  
Umm el Quwain  
Umm es Selabikh

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## Chapter 1 Introduction

Under the Roman Empire, the Mediterranean can be argued to have been characterised by connectivity and regional interactions.<sup>1</sup> Some also say that the formation of a pan-Mediterranean state and peace played a significant role in the stability needed for favourable economic conditions and trade.<sup>2</sup> By the end of the first millennium BC, the trade and transport in luxury goods was organised by a growing merchant class driven by profit.<sup>3</sup> Large-scale trade, intensified by the increase in security, the reduction in transaction costs and the growth in consumer demand, fuelled the cost-effective transport of bulk goods across the Mediterranean.<sup>4</sup> Trade beyond the edges of the empire also flourished as the desire for luxury goods rose;<sup>5</sup> the imports increased due to the considerable profits that could be made, a topic that will be developed somewhat further in this thesis, but also because of the peaceful conditions in the Mediterranean. Similarly, foreign states as well as merchants in these states realised the economic, social and political interests at stake, permitting the development of sophisticated networks of trade spanning past the Eastern Desert of Egypt, deep into the Saharan desert, and to the Persian Gulf and India.

In this thesis, I propose to investigate these dynamics from a local and comparative point of view, focusing more specifically on arid landscapes along the edges of the Roman Empire. The chronological framework centres on the development and exploitation of three arid landscapes from the early days of the Roman Empire through the third century AD, although the pre-Roman situation will be discussed in order to understand later developments. Two case studies, the

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<sup>1</sup> Horden and Purcell 2000.

<sup>2</sup> Temin 2001; Hitchner 2005; Morley 2007; Silver 2007; Scheidel 2009.

<sup>3</sup> Harris 2007.

<sup>4</sup> Robinson and Wilson 2011.

<sup>5</sup> Young 2001; Parker 2002; McLaughlin 2010; Sidebotham 2011; Wells 2013a.

Eastern Desert of Egypt and Palmyra, were integrated into the Roman Empire at different stages. One case study, the Libyan Fazzan, remained outside the Empire but changed its political stance towards the Roman Empire in the second half of the first century AD. The chronology examined for the thesis – the first to third centuries AD – cannot be used as an absolute chronology, but as a period of increased activity and interaction with the Roman Empire for all three case studies during a period in which its socio-political structure did not substantially change. In 27 BC, the Augustan settlement established a provincial organisation and structure to the empire that remained the operative framework for more than three centuries, until the Diocletianic reforms.<sup>6</sup> By the end of the third century AD, the internal political frameworks of the Roman Empire and dynamics at the borders considerably changed and form an appropriate end point for discussions. Individual regional chronologies, however, are established for each of the case studies in their respective chapters.

No significant environmental change can be argued to have triggered the use of arid spaces in the Roman period: people lived in, exploited, and traded across deserts in antiquity. In recent years, people have begun to realise that movement across deserts or arid spaces was much more complex and frequent than imagined. Desert landscapes are very fragile, but the people inhabiting them and regularly crossing them generally know how to use them effectively.<sup>7</sup> The terms ‘desert’ and ‘arid’ could evoke the idea of a lack of inhabitation or ‘civilisation’, a well-known *topos* in the ancient literature,<sup>8</sup> but this was not at all the case for the three regions under consideration.

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<sup>6</sup> Bowman 1996a, 344.

<sup>7</sup> McDougall and Scheele 2012 for a broad overview of mobility across the Northwestern Sahara from antiquity to modern times; Gates-Foster 2012a for the multi-historic phases of paths in the Eastern Desert of Egypt; Riemer and Förster 2013 for movement in the desert in Egypt and East North Africa in antiquity; Guédon 2010; Guédon 2012 for travels across North Africa in Antiquity. Large projects, such as the Sealinks project (Dr. N. Boivin, University of Oxford), or the Trans-Saharan project led by David Mattingly are fine-tuning such large-scale movement issues.

<sup>8</sup> Desanges 1999a, 239; Liverani 2000a, 498.

Archaeological projects have produced considerable new data highlighting the scale of activity in and across the deserts in the Roman period from a regional perspective.<sup>9</sup> A few recent comparative works have also examined long-distance trading across the Roman imperial frontiers and via the deserts.<sup>10</sup> Yet there is a continued need to revisit and formulate wider studies on these areas, as our knowledge and data on these regions is constantly evolving, but also because different or new theoretical developments fuel new approaches to the data. The contribution this thesis makes lies in the theoretical debates it takes into consideration and its multi-regional approach with perspectives from regions inside and outside the Roman Empire.

Rather than looking to the centre of the Roman Empire, I propose instead to investigate the impact of Rome by focusing on arid regions, whether inside, or outside, the Roman Empire. The barren soils of desert regions means that considerable effort is required to inhabit and exploit these areas, particularly in order to expand the exploitation potential of the deserts and to sustain larger populations living in them. The changes brought about by the establishment of new infrastructure, such as wells, irrigation systems and cisterns, or paths drastically increased the ease of movement and exploitation of desert areas. The infrastructure will also highlight how humans have actively shaped and come to terms with their local environments.

I have chosen to examine three arid landscapes of the wider circum-Mediterranean as case studies, namely the Libyan Sahara (Chapter 3), the Eastern Desert of Egypt (Chapter 4) and Palmyra (Chapter 5). This does not mean they were the only arid zones in the circum-Mediterranean; each case study was chosen because of the light that it could shed on to the process of connectivity and interaction across deserts.<sup>11</sup> The Libyan Fazzan, with the Garamantes' capital

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<sup>9</sup> Mattingly 2003a; Mattingly 2007a; Mattingly 2010; Peacock and Maxfield 1997; Peacock and Maxfield 2001; Peacock and Blue 2006; Peacock and Blue 2011; Sidebotham 2008; Sidebotham 2011. Please refer to section 1.6 for a more detailed bibliography on the three case studies examined in this thesis.

<sup>10</sup> Savino 1999; Young 2001 for Egypt, Nabataea, Arabia and Syria; Guédon 2010 and 2012 for Egypt and Libya.

<sup>11</sup> *E.g.* Barker *et al.* 2007 which concentrated on the Wadi Faynan area (Jordan).

located near modern Jarma, is a key to understanding central Saharan trade networks, and the expanding commerce of the Roman Empire into a new region. The Eastern Desert of Egypt was the first point of contact for goods coming in from the Indian Ocean,<sup>12</sup> and was intensely exploited for its stone and precious ores. The Romans inherited this system from the Ptolemies and developed it further; their activities were supported by a complex system of control and transport logistics. In the Levant, the Palmyrenes organised the trade in eastern goods across the Indian Ocean, Persian Gulf, across the Parthian Empire and into Roman Empire via the Euphrates. Palmyra's territories included an urban centre (Palmyra), but also settlements mainly to the north and west of the city, and eastern lands used by nomadic groups. Each region developed settlement patterns, social networks and land exploitation systems that deserve individual attention.

Despite their broadly similar climatic conditions, and the impact of Roman trade, each of these areas was very different, in part, due to the inherent differences in physical landscape and environmental factors, but also because of their individual strategies for local development. Due to the harsh environmental conditions, inhabited spaces in arid lands relied on regional and trans-regional interactions and connections to a greater extent than those with a Mediterranean climatic types. It has been argued that the survival of marginal places, such as the Saharan oases, ultimately depends on their networks,<sup>13</sup> but this remain to be examined across the areas under study. It is my aim therefore to discuss variations within deserts or arid spaces in order to identify wider trends during the period examined.

## **1.1 Aims and questions**

In this thesis, I will examine whether it is possible to identify the key mechanisms which allowed for the peak in activities, whether the exploitation of physical resources or trade, in the arid

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<sup>12</sup> De Romanis 1996; Tomber 2008; Sidebotham 2011.

<sup>13</sup> Scheele 2010.

landscapes both inside the Roman Empire, or outside of it. The aim is therefore to explore several aspects: first, the environmental factors which defined the regions and influenced movement and economic activities; second, the organisation of trade; and third, the exploitation of the landscape, either mineral or agricultural. These elements will have to be examined with a discussion of the local socio-political structures. The use of different case studies both inside and outside the empire will serve to highlight wider mechanisms. Environmental models, institutional economics and social network theories will allow me to move between different factors, and test their relevance. In order to do so I synthesise and analyse the recent archaeological work on arid landscapes. I ask whether there is a detectable link between the development of arid landscapes and the increased demand for exotic goods and also whether the presence of infrastructure can be considered as being set up specifically to enable trade, rather than being a physical manifestation of sedentarisation, state formation or other processes. Furthermore, I examine how the local logistical dynamics and social patterns change or evolve. The interplay between the development of infrastructure (the basic physical structures and facilities for local societies, whether roads, buildings, or water retaining structure), the state and the economy is a complex question that remains on the table for debate, in particular for the Roman state and economy,<sup>14</sup> and aspects of this debate will necessarily have to be confronted.

The merit of a comparative approach is that it highlights local responses and actions in a wider context. It sheds light on the policy at the centre, the agency of the periphery, and the dynamics between the two. Instead of considering margins as peripheries of the Roman empire by placing them at the centre of the analysis we are able to gain new perspectives. There are of course also many limitations to this approach in the level of abstraction or succinctness in which some

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<sup>14</sup> Sidebotham 1986 and Young 2001, with different conclusions (the former sees an active state interest in commerce; the latter less so; Nappo forthcoming, on military protection in the Red Sea in the second century AD, and the Roman state's active protection of commerce. Wilson forthcoming on the Roman state and the Eastern Desert of Egypt. For the ancient Mediterranean: Scheidel 2009; Scheidel 2011; Wilson 2011.

aspects will have to be discussed, in the lack of evenness in the sources or archaeological evidence, or necessary reliance on much secondary literature. Nonetheless, I am convinced that the potential advantages of a comparative perspective outweigh the problems of comparison.

## **1.2 Definition of arid landscapes**

All three areas chosen as case studies are typically called deserts, that is to say landscapes or regions with little or no rainfall, with limited vegetation, and characterised by a moisture deficit on an annual basis, often due to temperature-induced evaporation. According to the Köppen-Geiger classification system, which remains the standard for climate classification,<sup>15</sup> the three regions (Fig. 1.1) are defined as *BWh*, hot deserts, which are currently the most common climate type on earth (14.2% of the earth's surface).<sup>16</sup> The aridity of deserts is usually classified depending upon rainfall, and following the Meigs classification of aridity, it is generally accepted that extremely arid lands may have no rainfall for 12 consecutive months, arid lands receive less than 250 mm of rainfall, and semi-arid regions between 250 – 500 mm.<sup>17</sup>

The Eastern Desert of Egypt is currently classified as extremely arid (Meigs type Ea24: extremely arid, no distinct seasons of precipitation are perceivable, the coldest month averages 10 – 20 degrees, the warmest temperature is above 30 degrees). Its annual average rainfall is 4 mm per year,<sup>18</sup> though the wadis (dried-up river beds, which collect rainfall and through which occasional flash flood flow) can be quite lush in November and December.

Fazzan receives approximately 17 mm of rainfall in an average year<sup>19</sup> and is similar to the Eastern Desert of Egypt in terms of aridity type (Meigs Ea24). This means that rainfall is unusual,

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<sup>15</sup> Peel *et al.* 2007.

<sup>16</sup> *Ibid.*, 1633.

<sup>17</sup> Van Nice and Lee 2011.

<sup>18</sup> Meigs 1966, 73 and Table 2 (2 inches); Monein 2005, 417.

<sup>19</sup> Capot-Rey 1953; Despois 1964, 3-30; Mattingly 1995, 8.

and when it happens, it is generally in the form of a rainstorm: it may not rain again for several years.

The region of Palmyra differs from the other two study regions as it is situated on the margins of several types of climate and aridity, and receives far more rainfall than the other two case studies: on average, it receives 136.7 mm of rainfall annually.<sup>20</sup> This average, however, is slightly misleading, as there are notable differences between the north and western parts of Palmyra and the eastern and southern parts of its territories.<sup>21</sup> Its climate is better classified as ranging between semi-arid to arid (Meigs types Sc14 and Sc13 for the western territories: semi-arid, winter season for precipitation, coldest month average temperature 0 – 10 degrees, warmest month average temperature above 30 degrees for the north and between 20 – 30 degrees for the west; and Meigs Ac14 to the east towards the Euphrates: arid, winter season for precipitation, coldest month average temperature 0 – 10 degrees, warmest month average temperature above 30 degrees). Palmyra's conditions are therefore climatically more complex in contrast to the Libyan Sahara or the Eastern Desert of Egypt, and could potentially have much to offer in terms of a wetter climate having affected its economic success. The possibility of climate change, and how it could have affected the arid spaces, will therefore need to be examined further in Chapter 2 (section 2.2.).

### **1.3 Structure of the thesis**

This thesis is divided into six chapters: an introduction (Chapter 1); a chapter on theories and models (Chapter 2); three case studies, the Libyan Sahara (Chapter 3), the Eastern Desert of Egypt

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<sup>20</sup> Sanlaville and Traboulsi 1996, 30.

<sup>21</sup> Grant 1937, particularly for ethnographic accounts on how locals adapt accordingly; Wirth 1971. This will be discussed in further details within the chapter on Palmyra.

(Chapter 4) and the region of Palmyra (Chapter 5); and a concluding chapter developing from the themes encountered in the thesis (Chapter 6).

Chapter 1 sets the aims of the thesis, and presents the general definition of the case studies examined. This initial chapter also delineates the structure of the thesis, the evidence taken in account, and provides a brief synopsis of the previous and current scholarship on each of the case studies.

Chapter 2 defines ways in which the geography and climate, social networks and institutions have been theorised, along with models that have been proposed. It is suggested that a combination of models and theories might be more suitable in order to understand developments in the arid regions.

Chapter 3 traces the development of southwestern Libya (Fazzan), which is the heartland of the Garamantes and part of the Sahara. The chapter details the organisation of the Garamantian kingdom, its trading networks, mineral resources and agricultural expansion. The material goods examined emphasise the extent of trading connections between the Garamantes and the Roman Empire, yet the sophisticated agrarian changes and social organisation also point to a complex society which was not simply dependent on trade.

Chapter 4 examines the archaeological evidence from the southeastern part of the Roman Empire and imperial province of Egypt. The Eastern Desert of Egypt was a landscape firmly controlled by the imperial authority. The chapter identifies the infrastructure in the region as well as the various types of exploitations of natural resources, such as decorative stones, precious ores and gems. It also discusses the organisation of trade, as well as the organisation of local food supplies.

Chapter 5 considers evidence from the region of Palmyra, located at the edge of the Roman Empire in the East. Inscriptions detailing caravans to the Persian Gulf provide ample evidence for long-distance social networks and give insights into the trading routes from the Indian Ocean and

the Persian Gulf via the overland route into the Roman Empire. I argue that the Palmyrene oasis's success relied not only on its strong social and commercial organisation, but also on the deliberate establishment of infrastructure in the city and along the desert route to the Euphrates, and on the successful management and development of its local territorial resources. The Palmyrenes also insured institutionally that Palmyra remained the main attractive market in the region.

Chapter 6 teases out the key elements which the comparative approach allows us to observe. The chapter brings together the evidence gathered from the case studies and argues that environmental factors cannot have been the principal factors for the success of the regions in the period examined. Instead, it proposes that several factors played a role in the development of the regions: pre-existing local socio-political factors; the development of social networks; the peaceful conditions in the Mediterranean which created a market demand; and dynamic exchange with partners willing to engage in trade. The chapter highlights both the economic boom the regions underwent, but also the different historical trajectories they experienced despite a similar market force, the Roman Empire. Institutional factors, in particular the maintenance of peace and security under the *aegis* of the state (whether Roman or Garamantian) constituted a determinant factor for the success of the regions examined.

The intensification of land use and exploitation of local resources in the arid case studies examined is therefore best seen as a result of what demand and long-distance trade engendered within the possibilities offered by networks and infrastructure, and by the institutions. I argue that both natural and anthropogenic actions had a role in the changes observed, but they are best explained if long-distance trade is the common determinant factor that brought economic success to these areas.

The exploitation of the regions and the long-distance trade via them were of particular importance, not only to the individuals involved, but also to some extent to the state, which was mainly interested in the profits derived from the trade. For all three case studies, the Roman period

is one of increased trade, and increased levels of activity and inhabitation in the arid margins, which was not superseded for a long time, or, in the case of the Eastern Desert of Egypt has never been superseded since. This can all be seen archaeologically and this thesis is therefore about why could the deserts in different regions of the empire, inside and outside its borders, with different social and political organisations, support all of this extra life at this time? What are the reasons that allowed the deserts to thrive?

#### 1.4 Evidence examined

This thesis incorporates a wide range of types of evidence — whether epigraphic, archaeological, or environmental. For each case study region I intend to review the current status of research, and to discuss the nature of the available evidence. The data differ widely, depending on the survival of material in each of these regions. Excavations and surveys remain the core set of evidence, but textual evidence is considered as well. My aim is to examine a spectrum of material evidence to gain the fullest understanding of the dynamics that govern the movement and exploitation of the three landscapes examined. The table below resumes the types of materials examined, but also points out the limitations in their analysis depending on their existence or preservation in each of the regions:

Region	Architectural remains	Epigraphic information	Ostraca	Rock art	Graffiti	Botanic/ faunal Evidence	Ceramic evidence
Libyan Sahara	X	not available	not available	X	(limited)	X	X
Eastern Desert	X	X	X	X	X	X	X
Palmyra	X	X	not available	X	X	(limited)	(limited)

Table 1.1 Type of evidence examined according to case study region (X = available).

The reason behind the choice of variety in materials examined (rather than simply concentrating on one class) is that the variety of data is also representative of the degree and types of economic specialisation in the regions examined, as well as the organisation behind them in each region. Though I do mention coins, I have chosen not to address numismatics, mainly as I cannot directly use coins as representative of local exploitative industries. Similarly while I do believe that the monetisation of an economy is fundamental for understanding economic developments, I cannot address this aspect on a comparative level. This is in part due to the fact that the Garamantes did not develop a monetised economy, at least not as far as we can tell. I do, however, include coins when they represent a trading item.

#### *Architectural remains*

Architectural remains are one of the basic tools for archaeological discussion on settlements and landscape habitation, as the presence and date of architectural remains can be used to investigate changes in landscape use. In the case of the Eastern Desert of Egypt for example, settlements, as well as architectural elements such as columns, can serve as an indication for the scale of quarrying and mining linked to production and demand, but also trading. The remains of structures meant to harness water form an important category to be investigated in the thesis, as they are used to determine the reliance on local water sources, but also highlight an increasing population or exploitation, as well as human agency in shaping local environmental conditions. These structures largely determine agricultural potential, but also the exploitation of mineral resources, and trade and movement through the landscape. Depending on whether they are meant to exploit the water table (wells, *foggaras/qanat*) or a hydrological network formed by rainfall (dams, cisterns), these structures can inform us on what environmental conditions were relevant or

necessary for local developments; their scale informs us both about the scale of exploitation of the landscape and the landscape's new carrying capacity in terms of population.

### *Epigraphic evidence*

Epigraphic evidence, other than *ostraca*, which are discussed below, is relatively scarce for the Libyan Sahara and, to some extent in the Eastern Desert of Egypt. In the latter, epigraphic records such as rock-carved inscriptions, building dedications, or travelers' graffiti form an important corpus of evidence.<sup>22</sup> In Palmyra, inscriptions by merchants provide excellent evidence for the long-distance trade and networks formed by the Palmyrene elite, and the level of wealth attained in the city. It is also the only such set of epigraphic evidence for the involvement of the local elite in long-distance trade networks across arid landscapes.<sup>23</sup>

### *Ostraca*

Ostraca (sherds from a broken ceramic vessel reused for the purpose of writing) were used both by state-driven institutions, such as the military, but also by private organisations or individuals. While ostraca have been commonly recorded on different sites in the Eastern Desert of Egypt,<sup>24</sup> there are no known ostraca from either Palmyra or Fazzan. At Bu Njem, on the Roman frontier, 188 ostraca were found in the military fort and form an important corpus of evidence to consider in order to discuss trade and interactions between the Romans and the Garamantes.<sup>25</sup>

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<sup>22</sup> Bernand 1972a; Bernand 1972b; Bernand 1977; Bernand 1984; Bingen and Cuvigny 1992; Bingen *et al.* 1997; Cuvigny 2000; Cuvigny 2005; Bülow-Jacobsen 2009.

<sup>23</sup> Will 1957; Gawlikowski 1983; Gawlikowski 1986; Gawlikowski 1994; Gawlikowski 1996; Yon 2002; Delplace and Dentzer-Feydy 2005.

<sup>24</sup> Bingen and Cuvigny 1992; Bingen *et al.* 1997; Cuvigny 2000; Cuvigny 2003a; Cuvigny 2005; Bülow-Jacobsen 2009.

<sup>25</sup> Marichal 1992.

### *Rock art and graffiti*

Rock art and graffiti abound in the Eastern Desert of Egypt and in the Libyan Sahara.<sup>26</sup> In the Eastern Desert, graffiti carved onto the walls of caves near main thoroughways between the Red Sea and the Nile give details of people travelling, mostly on their way to and from India, and accompanying high-value goods from the Indian Ocean ports to Alexandria. Personal names given in the inscriptions are the best evidence for the direct involvement of well-known Italian merchants who traded across the Indian Ocean.<sup>27</sup>

Rock art and graffiti are also known from Fazzan and the Libyan Sahara. Graffiti are of little use for this thesis, since the ancient Tifinagh, the script in which these are generally written, has not been sufficiently researched and published, and known deciphered examples mainly consist of personal names. Pictorial rock art complements the information from the graffiti, in that some contain direct evidence of contact between the coast and the Sahara, such as the rock art from the Wadi Zigza in Fazzan depicting a Roman ship alongside a local hunting scene.<sup>28</sup> At Palmyra, and within its territories, Safaitic graffiti also reveal the presence and movement of Safaitic-speaking nomadic groups. These pastoralists groups were mainly located in the Hauran, yet moved throughout Syria.<sup>29</sup>

### *Botanical evidence*

The use of botanical evidence in archaeological research has had a considerable impact in the interpretation of movement of plants and perishable goods across long-distances, and has

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<sup>26</sup> Le Quellec 2006; Le Quellec 2010; Bernard 1972a; Bernard 1972b; Bernard 1977; Bernard 1984.

<sup>27</sup> Meredith 1953; Tchernia 1992; Tchernia 2011, 62-72.

<sup>28</sup> Le Quellec 1987; Le Quellec 2006 for ships in the rock art of the Fazzan.

<sup>29</sup> Sartre 2005. 3,420 records of these graffiti found throughout the basalt desert are available by the Safaitic Database Online ([http://krcfm.orient.ox.ac.uk/fmi/iwp/cgi?-db=AALC\\_BDRS&-loadframes](http://krcfm.orient.ox.ac.uk/fmi/iwp/cgi?-db=AALC_BDRS&-loadframes)). (last consulted: January 2014).

revolutionised the way we conceive long-distance contact,<sup>30</sup> especially when details concerning the social networks are missing. Plants may be introduced either to increase agricultural potential, mitigate against disaster (*e.g.* drought-resistant species) or as a luxury item (cotton, silk, rice, *etc.*). Botanical evidence from all case studies show that plants travelled considerable distances.<sup>31</sup> In the case of the Libyan Sahara, the evidence has confirmed that contact between the Sub-Saharan and Saharan worlds did exist from an early date: pearl millet (*Pennisetum glaucum*, L.) and sorghum (*Sorghum bicolor*, L.) in the archaeological record in the last centuries of the first millennium BC at Jarma in Fazzan directly testifies to trading networks reaching the sub-Sahara. In the case of Egypt, the botanical evidence testifies to the interplay between the exploitation of mineral resources in the desert and availability of long-distance items traded through the desert, since Indian Ocean foods have been found further away from the main paths to the Nile, for instance at Mons Claudianus, an imperial quarry for decorative stone.<sup>32</sup> For Palmyra, the textile assemblages represent an important corpus of evidence with direct relevance to the city's long-distance commerce,<sup>33</sup> but botanical evidence is otherwise limited. Faunal evidence similarly brings vital clues to movement, contact and trade, as well as local consumption habits, and provide useful complementary evidence when available. In the case of the Libyan desert, while botanical information of sorghum and pearl millet provides details on the interaction between the southern and central parts of the Sahara, faunal evidence such as chicken can serve to highlight trade from the central Sahara to its southern edges.

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<sup>30</sup> *E.g.* Mbida *et al.* 2005; Grimaldi forthcoming for Indian Ocean to West African contacts as evidenced by Taro (*Colocasia esculenta*, L.).

<sup>31</sup> Van der Veen 1992; Van der Veen 1998; Schmidt-Colinet *et al.* 2000; Cappers 2006; Pelling 2008; Van der Veen 2010; Van der Veen 2011.

<sup>32</sup> Van der Veen 1998.

<sup>33</sup> Schmidt-Colinet *et al.* 2000.

### *Ceramic evidence*

Ceramic studies can inform us about the origin of traded goods, as well as their contents.<sup>34</sup> Ceramics are good geographic indicators, as both typologies and, to a lesser extent, clay fabric identifications are now well established.<sup>35</sup> As geographic indicators, they can also serve to help identify the possible networks of communication that led the object to be in its final location. The content of amphorae, mainly wine, olive oil, or fish-related, allows interpretations of consumer demand linked to social and personal preferences.<sup>36</sup>

In summary, the mosaic of evidence giving different insights in different regions allows the development of a composite picture of local life in the deserts and how it changed in the period examined. Some evidence pertains more directly to life and exploitation of the desert other to trade and movement. Here I have chosen to combine these two aspects, as I believe it would be a mistake to disconnect local phenomena from the wider circumstances which enabled or raised the possibilities of life in the desert.

## **1.6 Previous and current research**

### *The Libyan Sahara*

Initial work in the Libyan Sahara was undertaken by Italian teams in the 1930s,<sup>37</sup> followed by Ayoub and Daniels in the 1960s.<sup>38</sup> More recently, Mattingly's Fazzan and Desert Migrations Project (DMP) in the Wadi al-Ajal, as well as Cremaschi and Liverani's team's work near Ghat, at

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<sup>34</sup> Paterson 1982; Peacock and Williams 1986; Panella and Tchernia 1994.

<sup>35</sup> Peacock and Williams 1986; Bonifay 2004 for late antique ware in North Africa; Capelli and Leitch 2011 for work in progress in Tripolitania.

<sup>36</sup> Panella and Tchernia 1994.

<sup>37</sup> Pace *et al.* 1951.

<sup>38</sup> Ayoub 1967a; Ayoub 1967b; Ayoub 1968a; Ayoub 1968b; Daniels 1968; Daniels 1969; Daniels 1970a; Daniels 1970b; Daniels 1971; Daniels 1973; Daniels 1977.

Aghram Nadarif and other localities, have cast a wholly new light on the scale of Roman imports into the region of Fazzan in southwestern Libya.<sup>39</sup> Research, in particular by Mattingly's team, is still ongoing, and forthcoming volumes will no doubt continue to advance our knowledge of the Garamantian civilisation.

Early studies of long-distance trade through the Sahara mainly focused on the question of the trans-Saharan gold trade, often with little or no archaeological evidence.<sup>40</sup> The debate about the existence of trans-Saharan trade in part originated from Lhote's argument that the rock art showing chariots followed a natural geographic route to the Niger and that among Pliny's description of locations south of Fazzan there was a *flumen Dasibari*.<sup>41</sup> Lhote further argued that 'Dasibari' was linguistically similar to West African Songhai, and meant the great river.<sup>42</sup> The absence of Roman goods in sub-Saharan Africa was subsequently used as a counter argument against the idea of ancient trans-Saharan trade.<sup>43</sup> In 1982, Garrard re-opened the question of a gold trade before the Islamic period, arguing that the *mithqāl*, the Arabic gold weight used in Saharan commerce, was based on the Roman weight standard, implying on-going trade with sub-Saharan Africa in late antiquity. He furthermore argued that the beginning of minting at Carthage in the third century AD, presumably from gold coming in via the Saharan routes, would fit this scenario.<sup>44</sup> His argument was rejected by Kaegi on the basis that there is no known literary or

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<sup>39</sup> The archaeology of Fazzan is published in four volumes: Mattingly 2003; Mattingly 2007a; Mattingly 2010; Mattingly 2013; annual reports have been published in the journal *Libyan Studies*, including (but not limited to) Mattingly *et al.* 2006; Mattingly *et al.* 2008; Mattingly *et al.* 2009; Mattingly *et al.* 2010d; Mattingly *et al.* 2010e; Mattingly *et al.* 2011. For the Aghram Nadharif: Liverani 2000c; Liverani 2003b; Liverani 2005; Gatto 2010; Mori 2010.

<sup>40</sup> Gsell 1926; Lhote 1954; Salama 1958; Law 1967; Swanson 1975.

<sup>41</sup> Pliny, *Natural History* 5.37; Lhote 1954.

<sup>42</sup> Lhote 1954.

<sup>43</sup> Law 1967; Swanson 1975.

<sup>44</sup> Garrard 1982, 453-458.

epigraphic sources confirming this, and that the gold may have been reminted from Vandal gold.<sup>45</sup> The gold trade still remains a contentious issue, with most scholars maintaining that the gold trade did not occur before the Islamic period, and that trans-Saharan trade overall ought to be viewed as an Islamic phenomenon.<sup>46</sup> They have, however, not engaged with where the gold was sourced from or the potential role of the Garamantes in this trade.<sup>47</sup>

Most studies in the mid- to late-twentieth century have not considered the possibility of ancient trade solely within the Sahara, or between North Africa and the Sahara, as opposed to *trans-Saharan* trade, and the possibility that different networks are also multi-scalar.<sup>48</sup> Mattingly's work has shown that there was considerable trade between the Roman world and Fazzan: excavations revealed quantities of Roman goods in burial assemblages, while the most recent surveys show that Roman goods were also found in the Garamantian settlements.<sup>49</sup> The presence of Roman goods in settlements and burials highlights the fact that, rather than being traded onwards, the majority of Roman goods were consumed in Fazzan. Sub-Saharan goods in Fazzan show that the region was in contact with places much further south as well, for example, the region of Ghat, which is part of a natural geographic corridor to the sub-Saharan, and where settlements argued to be Garamantian have been found.<sup>50</sup> This means that we should consider the possibility that different *types* of goods were involved in different scales of transport and trade, rather than a monolithic, all-encompassing trans-Saharan model based on gold as earlier researchers imagined. Breaking down Saharan trade into short-, mid- and long-distance scales allows the analysis of more nuanced connections across the Sahara, and thus provides a more

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<sup>45</sup> Kaegi 1984.

<sup>46</sup> Brett 1978; Thiry 1995; Desanges 2004; Abulafia 2005; Lydon 2009.

<sup>47</sup> With the exception of Magnavita 2013.

<sup>48</sup> Wilson 2012.

<sup>49</sup> Fontana 1995; Mattingly 2003; Mattingly 2007a; Mattingly and Wilson 2010.

<sup>50</sup> Liverani 2005a; Gatto 2010; Mori 2010.

balanced model for trade and communication.<sup>51</sup> The idea in this thesis is to refine the concept by analysing further the actual evidence for movement and trade, but also different (multi-scalar or multiplex) types of networks. Although it is not yet possible to draw a complete picture of Saharan trade due to the scarcity of archaeological work in key regions outside the Libyan Sahara, one can begin to have a much more interesting and complex understanding of the nature of Saharan and trans-Saharan trade.<sup>52</sup> The quantities of Roman goods found in the Sahara have brought up the issue of large-scale trade between the Sahara and the rest of the Roman empire, but also created the need for a re-examination of the mechanisms of trade, and how they affected Roman North Africa. On the Tripolitanian *limes*, the forts have provided limited evidence concerning trade with Fazzan, and so only Bu Njem will be discussed. From the 1950s until the 1980s, one considerable obstacle to understanding the organisation of the *limes* has been the misidentification of fortified farms (*qasr*, pl. *qsur*) as being part of the official military structure. Goodchild and Ward Perkins associated fortified structures with the word *centenarium*, which they believed to stem from *centenarius*, the person in charge of manning this type of outpost.<sup>53</sup> Recently, the etymology of the word *centenarium* was more fully elucidated by Adams, who argued that the root of the word stems from *centenum* (rye) rather than any military term and that a *centenarius* denotes a granary.<sup>54</sup> Archaeological evidence shows that there were many such structures which support the identification of *centenaria* as defended granaries. This would imply a much more organised and settled landscape, and much less of a presence of the Roman military.

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<sup>51</sup> Wilson 2012.

<sup>52</sup> Liverani 2005; Mattingly and Wilson 2010.

<sup>53</sup> Goodchild and Ward Perkins 1949.

<sup>54</sup> Adams 2007, 550-554.

### *The Eastern Desert of Egypt*

Geological interest in the Eastern Desert, and its quarries, began in the nineteenth and early twentieth century.<sup>55</sup> The documentation of individual sites after the Second World War, when the various wadis between the Nile valley and the Red Sea corridor were surveyed, revealed the presence of many ancient settlements and mines.<sup>56</sup>

Recent archaeological works linked to a revival of interest in the Eastern Desert of Egypt and the Indian Ocean have been able to provide much greater details of the historical framework of activity.<sup>57</sup> Since the 1990s, several individual sites have been excavated, and excavations are still ongoing. The large granodiorite quarries at Mons Claudianus and Mons Porphyrites, along with several military forts, were explored.<sup>58</sup> Similarly, many quarries, whether for decorative stones or gemstones were documented along with rock art.<sup>59</sup> In contrast, only one Byzantine gold mining site, at Bir Umm Fawakhir, was properly documented,<sup>60</sup> although excavations and documentation of the Ptolemaic gold-mining site at Samut are now underway.<sup>61</sup> The site now recognised as Myos Hormos, the port from which Strabo in the late first century BC said that 120 ships left annually in contrast to the 20 in previous periods,<sup>62</sup> was originally excavated in the late

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<sup>55</sup> Wilkinson 1830; Floyer 1887; Schweinfurth 1897; Schweinfurth 1899; Baron and Hume 1902; Hume 1907; Hume 1909; Hume 1912.

<sup>56</sup> Raimondi 1923; Sandford 1928; Scaife 1934; Scaife 1935; Scaife 1936; Meredith and Tregenza 1949; Meredith and Tregenza 1950; Tregenza 1949; Meredith 1953; Tregenza 1955.

<sup>57</sup> Kaper 1998; Shaw 2002a; Shaw 2002b; Cuvigny 2003a; Tomber 2008; Sidebotham 2004b; Sidebotham and Harrell 2004; Sidebotham 2011; Cuvigny 2011a; Cuvigny 2012a. For a general short overview of the Eastern Desert of Egypt, see also Gates-Foster 2012b.

<sup>58</sup> Maxfield 2001; Peacock and Maxfield 1997; Peacock and Maxfield 2001; Maxfield and Peacock 2001; Maxfield *et al.* 2006; Cuvigny 2003a; Cuvigny 2005; Leguilloux 2006; also Klein 1988.

<sup>59</sup> Brown and Harrell 1995; Lazzarini and Cancelliere 1999; Rohl 2000; Harrell 2004; Harrell 2009; Sidebotham and Harrell 2004. For rock art, Morrow *et al.* 2002.

<sup>60</sup> Meyer 1997; Meyer 2000; Meyer 2007.

<sup>61</sup> Brun *et al.* 2013.

<sup>62</sup> Strabo, *Geography* 2.5.12.

1970s and early 1980s by Whitcomb and Johnson.<sup>63</sup> Further excavations between 1990 and 2000 by Peacock and Blue exposed the layout of the Roman harbour and settlement.<sup>64</sup> Berenike, located in the southernmost part of Egypt's Eastern Desert coast, has been excavated between 1994 and 2000, and again since 2006.<sup>65</sup> Sidebotham's many surveys both in the Eastern Desert and at Berenike have now been synthesised and published as monographs.<sup>66</sup>

### *The Palmyrene desert*

Traditionally, at least since Rostovtzeff's analysis of trade, Palmyra has been described as the archetypal 'caravan city',<sup>67</sup> a city that thrived through its involvement in long-distance trade. The urban topography of Palmyra has been thoroughly explored,<sup>68</sup> yet new missions within the last decade have focused on aspects of the Roman Palmyrene landscape. In the 1950s Schlumberger had identified hinterland settlements and landscape use in the territory northwest of Palmyra.<sup>69</sup> In 2008, a Norwegian team began recording the evidence for agriculture and habitation within the northwestern territories, following the model of the UNESCO Libyan Valleys Survey, and expanding on the work undertaken by Schlumberger.<sup>70</sup> Between 2008 and 2010, a Syro-Italian mission focused on the southwestern territories, and publications of their survey data is currently

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<sup>63</sup> Whitcomb and Johnson 1979; Whitcomb and Johnson 1982; Whitcomb and Johnson 1984.

<sup>64</sup> Peacock and Blue 2006.

<sup>65</sup> Sidebotham and Wendrich 1995; Sidebotham and Wendrich 1996; Sidebotham and Wendrich 1998; Sidebotham and Wendrich 1999; Sidebotham and Wendrich 2000; Sidebotham and Wendrich 2007; Sidebotham and Zych 2010; Sidebotham 2011.

<sup>66</sup> Sidebotham *et al.* 2008; Sidebotham 2011.

<sup>67</sup> Rostovtzeff 1932.

<sup>68</sup> Champdor 1953; Starcky and Gawlikowski 1985; Ruprechtberger 1987; Will 1992; Dentzer 1994, Crouch 1972, 1975; Baranski 1995; Degeorge 2001; on the agora, Delplace and Dentzer-Feydy 2005; Schmidt-Colinet 2000; Schmidt-Colinet 2010, Schnädelbach 2010; Hammad 2010.

<sup>69</sup> Schlumberger 1951.

<sup>70</sup> Anfinset and Meyer 2010; Meyer 2009; Meyer 2013; Meyer forthcoming 2014. Preliminary reports can also be found online <http://www.org.uib.no/palmyrena/index.htm>. (Last accessed: January 2014).

underway.<sup>71</sup> The more detailed study by the Norwegians will enable a discussion and an increased understanding of the role of the hinterland and local agriculture in supporting Palmyra's role as a central place within its territories. Moreover, a thorough re-examination of earlier data in the light of more recent studies also allows a reappraisal of the role of the infrastructure in the development of marginal areas coinciding with the rise in long-distance trade, and to what extent the two are related.

### *Comparative studies*

A few comparative studies have been undertaken on some aspects of the case studies addressed in this thesis.<sup>72</sup> Often these works have concentrated on specific sites or regions or asked different questions of the data to those posed in this thesis. Young's work, for example, draws on his examination of the Eastern Desert of Egypt, Palmyra and Nabataea, but is largely based on epigraphic sources with few archaeological details.<sup>73</sup> The Libyan Sahara has not been included in wider comparative studies concerning the imports of foreign luxury goods across the arid spaces around the Mediterranean,<sup>74</sup> and discussions of Saharan trade have remained isolated from wider discussion on the long-distance trade in Roman times. This may in part be due to the fact that until Mattingly's work,<sup>75</sup> the archaeological and literary evidence did not suggest a phenomenon on the

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<sup>71</sup> Morandi-Bonacossi and Iamoni 2012; data concerning the Roman period, Mior 2014.

<sup>72</sup> Wheeler 1954; Sidebotham 1986; Savino 1999; Young 2001.

<sup>73</sup> Young 2001.

<sup>74</sup> Wheeler 1954, 119-137. Mattingly 2002, esp. 185-189 on Wheeler's view of the Fazzan and why Wheeler's model of interaction between the Garamantes and Romans in which the Romans brought civilisation and economic transformation is no longer a model which can be believed.

<sup>75</sup> Mattingly 2000; Mattingly 2002; Mattingly 2003a; Mattingly 2007a; Mattingly 2008; Mattingly 2009; Mattingly 2010; Mattingly 2011; Mattingly and Wilson 2003; Mattingly and Wilson 2010; Mattingly and Edwards 2003; Sterry and Mattingly 2011; Mattingly *et al.* 2003; Mattingly *et al.* 2006; Mattingly *et al.* 2007; Mattingly *et al.* 2008; Mattingly *et al.* 2010a; Mattingly *et al.* 2010b; Mattingly *et al.* 2010c; Mattingly *et al.* 2010d; Mattingly *et al.* 2010e; Mattingly *et al.* 2011.

scale of that we can now recognise. Savino's analysis of frontier cities,<sup>76</sup> in particular Lepcis Magna and Palmyra, as case studies, mainly compares aspects of Romanisation, and includes Saharan trade among the potential factors that allowed Lepcis Magna to reach a level of wealth that, in many respects, is not comparable to that of other cities of the Roman Empire. The main evidence for trade and interaction between Lepcis Magna, or Tripolitania and Fazzan, however, mainly comes from Fazzan, and it is therefore on Fazzan that I wish to focus.

Young's analysis of Palmyra's trade and how imperial policy affected it, is the most comprehensive recent study to engage in the intriguing question of Palmyra's commerce with the East, its scale, and framework within a comparative perspective.<sup>77</sup> This work builds on previous research highlighting the role of a wealthy class and of a merchant community at Palmyra engaged in the trade with the Euphrates.<sup>78</sup> While Young provides an important historical summary of Palmyra's long-distance trade, his work remains mainly based on epigraphy. A further point of contention here is Young's general view of the *laissez-faire* attitude of the Roman state in protecting commercial interests.

Comparative studies are useful in that they can help identify broad patterns, but also differences that may not be so evident while working on single regional aspects. They also highlight the discrepancies of evidence available to those studying long-distance trade, while allowing reflections, however cautious they must be, on how biased our perspectives necessarily are: while archaeobotany for example has revealed contact between North Africa and sub-Saharan Africa, little such work has been undertaken at Palmyra, nor will there be such opportunity in the near future due to the current war.

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<sup>76</sup> Savino 1999.

<sup>77</sup> Young 2001.

<sup>78</sup> Esp. Will 1957; Teixidor 1984; Yon 2002 for the elite and Sommer 2005.

## **1.7 Conclusions**

In summary, this thesis moves on from earlier comparative studies in the range of materials and disciplines that it engages with, by including areas within and outside the Roman Empire and also because it seeks to approach the physical landscape and geography from a local perspective. It necessarily depends much on the previously published literature and archaeology, but allows a sharper picture of the structural differences behind trade and exploitation in the arid lands in the Roman era. This thesis will add to current research in Roman archaeology by evaluating landscapes in conjunction with recent work in such areas, and make the case for a wider phenomenon of development in the arid areas examined due to the dynamics of exchange and a demand for goods from outside the Roman Empire for Mediterranean markets, as well as the establishment of long-term infrastructures and social networks which enabled arid areas to engage in wider economic patterns, though with different regional trajectories.

## **Chapter 2 Theories and Models**

In the previous chapter I laid out the types of material evidence used in this thesis, the geography and climate of the regions studied, along with the previous and current research undertaken for each of the case regions. In this chapter, I will define some of the methodological and theoretical models that have influenced scholarship in ancient history and archaeology. These models include Braudelian approaches to history and geography, Central Place Theory in landscape archaeology, New Institutional Economics in history and particularly economic history, and network thinking in the broader social humanities. I propose to develop some of these concepts and frameworks to provide explanatory models for the developments observed in the regions examined. Concepts of connectivity, movement through and usage of the landscape underlie the analysis of the three case studies in this thesis. This analysis relies on the consideration of theories and models which have put an emphasis on geography, but also environmental and climate-related issues, which have become well studied topics dedicated to identifying changing climates and impact on societies. How climate and geography have affected the regions under study will be discussed in the individual case studies. Network models are then examined, as they are useful ways of investigating the connections between material evidence, nodes / places, but also individuals. The concept of the social network can also be used as a heuristic device to understand the varied interactions between places and people. Finally, I will examine a model emphasising the role of the organisations and institutions as the drivers behind

economic changes and prosperity, which has its origins in New Institutional Economics. Together these three aspects offer a complex and connected methodology for rethinking different communities's relationships within desert spaces, their economic activities, and also relationships with those around the desert spaces. Overall the main aim of this thesis is to place the people living or using the desert spaces at the heart of the analysis, and to shift away from the Mediterranean-centric approach that views desert areas as peripheral. The theories consequently offer a way of conceptualising the development of complex societies in these environmental areas in a way that acknowledges the agency of people and advocates their centrality to the development and maintenance of economic networks across harsh environments.

## 2.1 Geography in History

Historical approaches, at least until the mid-nineteenth century, often developed narratives centred on the analysis of the causality of events (*histoire événementielle*). The pre-World War II positivist attitude behind these historical approaches were heavily reconsidered in the mid-twentieth century, especially by Henri Pirenne, and the French *Annales* school pioneered by the historians Lucien Febvre and Marc Bloch.<sup>79</sup> In Le Goff's own words, the heir of the *Annales* school and founder of New History, "pour les fondateurs des *Annales*, il s'agissait de retrouver la synthèse historique et la perspective comparatiste, admirant la façon dont Henri Pirenne en avait parlé dans sa *Méthode comparative en histoire* au V<sup>e</sup> congrès international des sciences historiques, le 9 avril 1923."<sup>80</sup>

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<sup>79</sup> Carrard 1992; Horden and Purcell 2000, 540-543.

<sup>80</sup> Le Goff 1988, 40. "for the founders of the *Annales* School, the objective was to find a historical synthesis and a comparative approach again, as they admired the way in which Henri Pirenne had used it

Le Goff would eventually propose his own conceptual approach to history, a much more “global” history advocating both long-term and large-scale conceptual thinking (*histoire globale* or sometimes called *histoire totale*).<sup>81</sup> But others had paved the way.

Encouraged by Febvre, the French historian Fernand Braudel wrote an influential history of the Mediterranean that incorporated broader geography as a crucial element within historical writing, and used different historical time scales to analyse particular aspects of history.<sup>82</sup> Other authors, such as Henri Lefebvre, also introduced the spatial element into social theory: natural or absolute space for Lefebvre is shaped into a complex socio-spatial construction.<sup>83</sup> In the half a century following since Braudel and the *Annales* school made the case that history is embedded within a geography or geographies, the historical and archaeological research literature which has paid attention to the importance of a place’s geography is plentiful, and the different theories of spatial organisation will be discussed below.<sup>84</sup> Similarly, climate studies have become prominent and will be discussed next.

## **2.2 Climate as an environmental determinant?**

Ecology, environmental determinants, and climate change have been on research agendas since the 1970s, and archaeologists and historians alike have increasingly turned their attention to the role of climate and how it may explain economic patterns,

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in his *Méthode comparative en histoire* seminar at the Fifth International Congress of Historical Sciences, April 9th 1923.” (transl. author’s own).

<sup>81</sup> Le Goff 1978.

<sup>82</sup> Braudel 1949.

<sup>83</sup> Lefebvre 1974.

<sup>84</sup> On this vast topic, see esp. Horden and Purcell’s bibliographic essay to their Chapter 1: A Geographic expression (Horden and Purcell 2000: 530-537).

trade and the changes of use of landscapes in antiquity.<sup>85</sup> Climate change and its impact on the environment in antiquity remains a hotly debated topic in archaeology and history.<sup>86</sup> Some have ascribed the success of the Roman imperial period until the third century AD to exceptionally favourable climatic conditions, and defined this phenomenon as the “Roman Climate Optimum.”<sup>87</sup> It is necessary to distinguish the regions under examination from Mediterranean environmental models, since they are quite removed from what could be called a Mediterranean environmental or climatic epicentre. In the case of Egypt, favourable floods of the Nile (so rainfall and beneficial climatic circumstances from regions outside the Mediterranean region) which occurred before AD 155, and less good ones after AD 155 could have impacted Egypt’s agricultural productivity and wider population.<sup>88</sup> For arid landscapes, however, it has been argued that a wetter or more conducive climate could not be used as the sole explanation for the more intensive agriculture.<sup>89</sup> In the Libyan pre-desert for example, the UNESCO Libyan Valleys Archaeological Survey (ULVS) was designed, in part, to investigate whether farming in this region was made possible by climatic conditions more conducive to agriculture.<sup>90</sup> One fundamental conclusion was that human agency had a profound impact on the development of pre-desert zones. Indeed, the over-

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<sup>85</sup> Barker *et al.* 1996; Barker and Gilbertson 2000; Barker 2002; Liverani 2003a; Cremaschi 2003 in particular for Tripolitania and the Sahara. Greenland ice cores for example have also served as proxies for levels of economic activities and mining for silver in the Graeco-Roman world (Wilson 2002; De Callatay 2005).

<sup>86</sup> *Ibid.*; Barker 2002 for example cautions that mineral exploitation (copper) in the Wadi Faynan, Jordan, had more effect on the desertification of that area than perhaps natural climatic change (but see also Barker *et al.* 2007); Morley 2007 on ecology and economics; McCormick *et al.* 2012; Harris 2013.

<sup>87</sup> Büntgen *et al.* 2011; McCormick *et al.* 2012.

<sup>88</sup> McCormick 2013.

<sup>89</sup> Gilbertson 1996; Barker 2002.

<sup>90</sup> Gilbertson 1996.

exploitation of mineral resources and land erosion due to intensive agriculture were contributing factors in the reduction of the landscape's long-term use, and particularly affect semi-arid to arid regions, as wind erosion and salinity permanently alter their potential.<sup>91</sup> Individual regional scenarios must be taken into account, with single-solution answers with global repercussions probably an unlikely scenario. While it would be easy to simply subscribe to the notion that the Roman Climatic Optimum also enabled the deserts to bloom, detailed climatic studies of these regions would suggest a more nuanced situation with little to no real difference in the deserts. Consequently, it is important to look at the details, and not simply go with received wisdom. Each case-study chapter will therefore analyse what environmental, historical and archaeological records each have to contribute before reaching a wider conclusion.

### **2.3 A Mediterranean model?**

Horden and Purcell, in examining the Mediterranean in the *longue durée*, observe a regional unity created by a geography centered around the Mediterranean sea and its climatically similar regions. This attractive proposition has been suggested as a model for more arid spaces as well, such as the Sahara.<sup>92</sup> While Braudel emphasised the Mediterranean as a single region, Horden and Purcell prefer to understand it as a set of micro-regions.<sup>93</sup> These, they argue, were challenged by similar geo-climatic risks, crises and inequality of resources, which were overcome by the formation of networks of supply, trade, and exchange. One of the factors that characterise the desert regions examined is that climate would clearly have constituted a particular challenge, whether

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<sup>91</sup> Barker 2002; Hunt and el-Rishi 2011; Chesworth 2011, 32.

<sup>92</sup> Abulafia 2005.

<sup>93</sup> Horden and Purcell 2000, esp. 78.

for movement, inhabitation, or exploitation of natural resources. In contrast to the Mediterranean, often defined as a climate characterised by rainfall above the 200-250 mm of annual rainfall limit that enables the cultivation of crops without the reliance on irrigation (Fig. 2.1), the areas under examination are characterised by their location below 200 mm of average annual rainfall needed for dry-farming, and were dependent upon artificial irrigation.<sup>94</sup> This distinction between the areas studied and the Mediterranean is important since it suggests that our case studies do not sit easily within Horden and Purcell's theory of the production of similar staple agricultural goods and the formation of networks attempting to alleviate periodic and localised climatic crises by exchange and connectivity. In essence, desert regions are always in a state of climatic crisis when compared to the Mediterranean. Could it be argued that the intensity and reliance on their networks with external regions needed to be greater than the Mediterranean's? Desert regions could neither compete with the production of staple Mediterranean goods, nor could they develop a similar Mediterranean-type model of interaction and exchange. The Mediterranean model relied on maritime connectivity to help to alleviate these shortages through the cheap bulk transportation of staple food products. Desert regions neither possessed a climate suitable for the growth of Mediterranean crops (although they certainly did grow them, depending on the region), nor the same range of available transport (in particular related to sea and riverine transport). Consequently, this calls for alternative explanations for connectivity and its mechanisms in the regions under consideration. Individual assessment of locally available resources and local modes of operation is therefore needed.

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<sup>94</sup> Barker 1996, 4; Wilkinson 2000. It is generally accepted that 250 mm is the dry-farming limit for wheat, and 200 mm the limit for barley (Meyer 2013, 271).

## 2.4 Theories of spatial organisation

The study of people and their spatial organisation became a popular mode of archaeological enquiry, especially from the 1970s onwards. At that time it was seen as a major part of New or Processual archaeological approaches that aimed to look for spatial patterns within datasets.<sup>95</sup> In particular authors working on the centrality and interaction of places recognise the influence of three scholars and their spatial models: Von Thünen, Christaller and Lösch.<sup>96</sup> Von Thünen was originally interested in the distribution and location of space according to different agricultural produce and with respect to the city in order to minimise transport cost and maximise profits (Fig. 2.2 a and b). He proposed an ideal model for the distribution of agricultural lands in a flat, boundless, landlocked space with no riverine transport based on concentric rings around a main settlement.<sup>97</sup> In 1933, Christaller formalised a model that became known as Central Place Theory (CPT) to understand the hierarchies and interactions between cities and settlements, or production and distribution through markets, in terms of territory of influence, relative proximity between primary and secondary settlements, and the administrative relationship between the centre and the periphery (Fig. 2.3).<sup>98</sup> Lösch refined this model further by introducing the possibility that different regions had different densities of central places (Fig. 2.4).<sup>99</sup> More recently, Geographic Information

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<sup>95</sup> Clarke 1977. For urban size ranks, demography in the Roman world and spatial analysis (including further spatial models such as the use of Thiessen polygons, or Voronoi diagrams), see for example various chapters in Bowman and Wilson 2011. These are simply meant as examples, as a long review of the influences and ramifications of the development of spatial thinking are beyond the scope of this thesis.

<sup>96</sup> See esp. Fischer 2011 for a general synthesis.

<sup>97</sup> Von Thünen 1921.

<sup>98</sup> Christaller 1933.

<sup>99</sup> Lösch 1962.

Systems (GIS) has found great applicability in archaeological approaches and assisted what is coined ‘the spatial turn’.<sup>100</sup>

In principle, Central Place Theory (CPT) would seem a good model to keep in mind, since while arguing that landscape is important, socio-economic factors directly guide the organisation of settlements and hierarchies so as to facilitate movement, interaction and market exchange. CPT gained considerable popularity in archaeology where it has been used to understand the spatial organisation of a wide variety of different civilisations in terms of their settlement sizes, as well as their administrative, religious, and economic hierarchies.<sup>101</sup> In arid regions, the identification of the presence and centrality of urban (or larger) centres and settlements, along with more complex agricultural systems, could be useful to understand market forces.

As a highly abstract concept that models interaction between cities and settlements as geometric systems, however, Central Place Theory has been criticised when it comes to applying the theory to real rather than abstract landscapes.<sup>102</sup> One of its problems is that the hierarchy, location and interactions of settlements or cities are restricted and conditioned by the physical environment and by social practices.<sup>103</sup> While the centrality of places is recognised as a heuristic tool, I will not develop extensive

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<sup>100</sup> *E.g.* Petersen 1998; Locke 2000; Conolly and Lake 2006; Withers 2009 on the Spatial Turn, in which a place is defined “in Geography and History as social practice and of placing as a process in accounting for the uneven movement of ideas over space and time.” (Whiters 2009, 638).

<sup>101</sup> The literature on the topic is extensive, though here a few of influential examples: Johnson 1972; Evans and Gould 1982 (concepts and use); Sanders 1970 (Teotihuacan). In Roman archaeology, many landscape studies have been influenced by Central Place Theory as well, here a few as a bibliographic review would be out of place: Hodder and Hassall 1971, Millett 1990 (Britain); Kunow 1998 (Germania Inferior); Bekker-Nielsen 1989 (proposing a wider model of urban hierarchies); see also Bintliff 2002, and more recently Bintliff 2014, esp. 205-207.

<sup>102</sup> Clarke 1977.

<sup>103</sup> Evans and Gould 1982.

models based on it, but keep the principle in mind along with social practices and socio-political structures which may have impacted upon the centrality of places.

## 2.5 Network theory

Central Place Theory has remained an important influence on how to understand hierarchies of communications and interaction between places within a single state. Many scholars, however, have now turned to the study of networks in order to identify patterns of interaction or *connectivity* between materials, places or people.<sup>104</sup> Yet the two models are not necessarily at odds: CPT focuses on the centrality of interaction while network theory focuses on interaction itself and can include factors such as long-distance trade and other social factors not particularly adaptable to CPT models. Both models can be integrated and made complementary.<sup>105</sup> At the most simplistic level, networks put the emphasis on the connection/links (ties) between two or more phenomena (nodes) that one wishes to observe, whether things, places or people. As a model, network analysis is particularly helpful in mapping human interaction, degrees of interaction and remoteness or centrality within a system and can adapt to variables, particularly time and space.<sup>106</sup> Others have chosen to emphasise the social influence of networks of people onto the formation of identities or beliefs.<sup>107</sup> On a broader scale, networks can be multi-variate, multi-scalar, or “multiplex.” This approach, embraced by many recent contemporary social studies works which tend to focus on a more global perspective, characterises a society “by the superposition of its constitutive

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<sup>104</sup> Granovetter 1973; Wasserman and Faust 1994; Watts and Strogatz 1998; Borgatti *et al.* 2009; Knappett 2011; Malkin 2011; Malkin *et al.* 2011; Knappett 2013; Brughman *et al.* forthcoming.

<sup>105</sup> Nakoinz 2012.

<sup>106</sup> Borgatti *et al.* 2009.

<sup>107</sup> Malkin 2003; Malkin 2011; Malkin *et al.* 2011; Collar 2013.

socioeconomic networks.”<sup>108</sup> Highlighting the different networks, such as trade items, exploitation of natural resources, or ties between trader communities, help to draw out patterns in the socio-economic structure of a society or community.<sup>109</sup>

The more recent historical approach pioneered by Horden and Purcell also focuses on connectivity and exchange and allows for a mediation between regional spaces. Bruce Hitchner’s comparative analysis of the integration or disintegration of specific areas from available networks remains a striking example of how we can understand a region’s development within the possibilities offered by its network. The eighteenth-century Drome region in France could be both described as having a remarkable agricultural potential yet be a waste land due to the region’s lack of communicative infrastructure connecting it to other areas, and therefore markets to which the goods could be brought. Hitchner argued that the wealth displayed by villas and urban settlements in the Roman period could be attributable to the highly developed road system and the role of infrastructure and communicative networks.<sup>110</sup> Similar developments and integration can be identified in the more arid regions under discussion in this thesis, where the presence of better paths and increased transport logistics alongside regional trade are noticeable. The physical layout or geography of such networked connections will be examined in my analysis of the three case studies, as there is, in some instances, sufficient archaeological evidence to suggest preferred routes.

Another aspect of network organisation concerns the study of how people organise themselves, which in the case studies can be deduced through the locations of

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<sup>108</sup> Szell *et al.* 2010.

<sup>109</sup> On networks, trust and the Nabatean community at Puteoli, Terpstra 2013.

<sup>110</sup> Hitchner 2012.

settlement and transport infrastructures. Langton's observations of entomological behaviour have served to show that individual haphazard paths form a network and emergent collective.<sup>111</sup> A path to a node, when reinforced by frequency as well as other paths to the same node, naturally tends to be rerouted towards the shortest, most efficient paths (Fig. 2.5). Separate collectives will necessarily be conditioned by their initial individual paths, yet the network dynamics which help form what he calls the 'emergent collective' are always shaped by the collective. In the case studies, preferential trading routes through the deserts can be identified (Chapter 3, section 3.4; Chapter 4, section 4.4; Chapter 5, section 5.4), but perhaps surprisingly they are not necessarily the shortest as we will see. This again highlights the importance of human agency in the creation of networks and paths, whether or not they are made according to common and specific agendas.

An influential social study of the intensity of interaction and connectivity by Granovetter identified that social networks can be divided into *strong ties* and *weak links*.<sup>112</sup> The combination of these two elements are often discussed as forming a 'small world network'.<sup>113</sup> *Strong ties* tend to describe geographic closeness and frequent interaction, while *weak links* tend to have low degrees of interaction or function over long-distances (Fig. 2.6). Weak links also perform the role of attaching clusters of strong ties to the wider space under examination. This approach has been used with success in ancient history and archaeology, for example, in order to understand how the Greek civilisation and interactions between different city-states were shaped by social network factors and degrees of intensity rather than by more simple centre-periphery

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<sup>111</sup> <http://bendov.info/heb/sci/lang.htm> (in hebrew); See Malkin 2011, 31-32 for a discussion on Langton's model, network theory and how it fits within the study of ancient history.

<sup>112</sup> Granovetter 1973, 1361.

<sup>113</sup> Watts and Strogatz 1998.

modes of operation.<sup>114</sup> We may be able to understand how the geographic and climatically harsh conditions in these case-study areas create discreet small worlds: we will see the creation of distinct Garamantian, and Palmyrene societies (Chapter 3, section 3.8; Chapter 5, section 5.8), as well as communities within the forts and ports of Egypt's Eastern Desert (Chapter 4, section 4.8). When these places interact across greater geographic spaces, with the Mediterranean, the Persian Gulf or India, they form weak links across long distances. Network models allow us to think about how people engage in interaction; they might be less useful perhaps for elucidating why people did this. To understand this element, I will now turn to historical and socio-economic studies which serve to place the archaeologically or epigraphically observable networks into meaningful explanatory contexts.

## **2.6 Institutions and organisations**

All three case studies were either part of the Roman Empire at different times or experienced the influence of the Roman Empire and the supply demands for its economy. Traditionally, an understanding of small worlds of the desert communities would have been driven by a Romano-centric perspective or simply ignored as a topic for scholarly discussion. The works and demands of the Roman state and the Roman economy would have been given primacy in explanations of regional development. Instead, network approaches stress the importance of agency in both interactions and nodes. So while the Roman economy is of undoubted significance as a driver of interaction and in the creation of links between Fazzan, for example, and the Mediterranean, we also need to understand this interaction from a Garamantian

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<sup>114</sup> Malkin 2011.

perspective. We need to understand what made the link to the Roman world attractive for the Garamantes.

One of the fiercest debates concerning the ancient world has been centered on the nature and impact of the Roman economy.<sup>115</sup> Its origin is generally considered to be the applicability of post-industrial methodologies and standards of economic analysis to earlier historical phases, in particular Classical Antiquity. This debate is also sometimes called the “Bücher-Meyer controversy.”<sup>116</sup> The modernist perspective, eventually championed by Rostovzeff, was that the essential difference between ancient and modern economies is more a matter of scale than applicability of modern theories to the past.<sup>117</sup> The second school, referred to as ‘primitivists’ insisted that the past can only be interpreted in its own terms, and that the ancient world (Classical Antiquity) was largely a self-sufficient society. The most influential text on the opposing side of the debate has been that of Sir Moses Finley, *The Ancient Economy*.<sup>118</sup>

Although contemporary works are necessarily informed by the former debate, some have chosen to distance themselves from it and have searched for new forms of economic models.<sup>119</sup> I have already begun to demonstrate in the sections above, that in this thesis other factors, whether environmental or organisational, will be considered but this does not mean that I will not use more refined notions of Roman economy,<sup>120</sup> and

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<sup>115</sup> Hopkins, for example, described the debate around the ancient economy as an “academic battleground” (Hopkins 1983, ix).

<sup>116</sup> Based on the names of the two German scholars with opposing views at the turn of the nineteenth and beginning of the twentieth century (Reibig 2001).

<sup>117</sup> Rostovszeff 1926.

<sup>118</sup> Finley 1973.

<sup>119</sup> Horden and Purcell 2000; Yoffee 2005; Bang 2007; Bang 2008; Terpstra 2013. Also Manning and Morris 2005 for explicitly stating that we need to look at the social sciences for inspiration.

<sup>120</sup> Mattingly 2007b; Mattingly 2011c, 132-138.

whether it is also possible to find explanations within these. This I will return to in Chapter 6.

The role of societal organisation in the development of trade, commerce and the exploitation of goods has also been reviewed in economic history by Douglass C. North, who proposed New Institutional Economics (NIE) as a framework for understanding societies past and present.<sup>121</sup> This theory presents a middle ground between the opposing views of primitivists and substantivists. New Institutional Economics is informed by both sides yet produces an evolutionary perspective, recognising that the embeddedness of the economic sphere in the socio-political structure of earlier (and in some cases contemporary) societies must be taken into account. An appealing element in this approach is the inclusion of the constant institutional need to restrain violence and friction. At the most basic level, North *et al.* argue that “sustaining social order requires the development of a state organisation capable of limiting violence, and that social order requires that political and economic systems work in concert.”<sup>122</sup> This approach has its merits; for instance, as highlighted by Lo Cascio, it can “help understand the relationship of collaboration and competition between the emperor and the senatorial elite which can legitimately be considered one of the structural elements of the working of the empire as a polity.”<sup>123</sup> New Institutional Economics can also help understand, at a more regional level, the systems of socio-political and economic incentives (whether by taxation or trade) which must remain in balance for a society to remain stable. In short, the arguments developed by New Institutional Economics can offer a more convincing model of interaction between the Roman state and the different regions within the

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<sup>121</sup> North *et al.* 2009.

<sup>122</sup> North *et al.* 2006, 4.

<sup>123</sup> Lo Cascio 2007, 626.

Roman Empire. Combining NIE and networks also allows us, and indeed forces us, to think about the forces at play at both ends of the network link.

Moving beyond the traditional divide that has focused on Classical Antiquity, new approaches have emphasised the need for more sophisticated, complex economies. New Institutional Economics as an approach also brings the possibility to compare the structure of different states with different organisations within the same chronological timeframe, but also offers the possibility to discuss issues at a regional level. Rather than focusing on an imperial model only, New Institutional Economics gives voice to different states as actors behind the choices which influence their economic activities. One case study, Fazzan, was outside the Roman empire and a complex state in its own right. It can equally be said that Palmyra though technically inside the Empire, often acted as an intermediary between the Roman and Parthian states, and in the second half of the second century AD it increasingly exhibited state-like behaviour with resultant frictions and tensions between the city and the emperor as the official state representative. For each case study, it will be important to determine the extent to which the state or the local organisations were responsible for individual factors, in particular security, trade and exploitation of resources.

For eastern commerce through the Eastern Desert of Egypt and Syria, there has been a long-standing debate on the role of the Roman state in the long-distance trade and whether it took a pro-active stance or a policy of *laissez-faire*. One view has been that the establishment of facilities for long-distance commerce were of direct imperial interest.<sup>124</sup> At the opposite extreme, it has been argued that imperial policy had no interest or involvement whatsoever in the trade, with the exception perhaps of the taxes

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<sup>124</sup> Sidebotham 1986.

it could reap.<sup>125</sup> Identifying the interactions over time between the Roman state and the local regions from an institutional perspective will highlight how differently the Eastern Desert and Palmyra were treated and view the state's attitude as a response to local developments. I will argue that the Eastern Desert of Egypt and Palmyra's different experiences of economies and state interference have resulted from different regional policies and institutional interests.

For the relations between Fazzan and Rome, the institutional approach will highlight the opportunities offered by the restraint of violence to the state's power, but also how alliances resulting from negotiations between different states or societies enabled commercial networks to develop. This is particularly noticeable after the territorial conflicts between the coastal cities of Oea and Leptis Magna in Africa Proconsularis in the Tripolitanian region,<sup>126</sup> during which the Roman state intervened, settled the conflict, but also undertook a punitive excursion into Fazzan. After this event, no further serious friction with the Roman Empire is known and commerce developed. Under settled agreements a whole new class of people, namely merchants both in Fazzan and in the Roman Empire, and particularly in the Tripolitanian region, benefitted from the wider peaceful conditions, new trading potential, and markets eager for imported goods on either side of networks.

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<sup>125</sup> Young 2001.

<sup>126</sup> The region is often simply referred to as Tripolitania, as a result of its name given by Diocletian's reform (*Tripolitana*) (Mattingly 1995, xiv).

## 2.6 Conclusion

The regions of interest in this thesis were all connected places in which the transportation of goods was a vital component of their local activities. The most intellectually coherent model of such connectivity, that of Horden and Purcell, is however not entirely appropriate for explaining desert connectivity. Instead, in this chapter I have developed alternatives based upon networks and institutional economics emphasising the connections between places and the role that institutions play at both ends of the links to ensure their development and continuity. Within this approach, I recognise the fundamental importance of environmental factors in shaping local institutions and networks but do not simply fall back on them as the major explanatory mechanism. Instead, I give primacy to people as active agents of their own destinies.

In isolation no single theory offers such a comprehensive view on the nature of settlement location, trade and exploitations in the deserts examined. Geography and spatial analysis have been influential tools for understanding patterns, or networks of interaction. More recently, climate change has been included as an interpretation in changing dynamics: the Roman Climate Optimum has been identified as favouring cohesion and expansion of the Roman Empire, as well as weakening its structure in the third century AD. Yet an analysis based simply upon environmental factors would risk failing to explain the changing dynamics over time, even if favourable conditions were significant enough to explain changes in settlement patterns. Social choices in patterns of interaction surely govern more localised phenomena. Networks and New Institutional Economics both put emphasis on human agency but shed light on different aspects of it. Networks can help identify how the relationships between elements, people or places are structured; New Institutional Economics proposes an explanation for the forces

behind the careful balance between institutions and organisations, and thus seems a justifiable choice given the complex interactions between states, but also between states and individual regions.

## Chapter 3 The Libyan Sahara

### 3.1 Introduction

I will begin the analysis of the development of arid lands in the Roman period with an area in the central Sahara known as Fazzan, and which nowadays is located in the southwestern part of modern Libya. Over a thousand kilometres from the Mediterranean coast (Fig. 3.1), Fazzan would have remained geographically remote and isolated were it not for the trading networks that it managed to establish and sustain with the Mediterranean as well as other regions of the Sahara over centuries. Roman goods found throughout Fazzan represent one of the testimonies to the development of trade and demand for Mediterranean goods in the period examined.

During the period examined, the Garamantes had developed a kingdom that spanned over *c.* 250,000 km<sup>2</sup>, with an estimated population of *c.* 100,000 people living in the capital, large settlements, or small rural villages.<sup>127</sup> The sophistication of the Garamantian kingdom was dependent on pre-existent contacts over a wide geographical area along with the development of new contacts and alliances with the Roman Empire. The Garamantian civilisation was characterised by urbanisation and social competition in which trade played an important part, along with an increased specialisation in

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<sup>127</sup> Mattingly 2006; with an estimated 83,000 in rural areas and 9,000-15,000 in urban centres (Mattingly 2011, 86); Mattingly and Sterry 2013, Table 1 differentiate between towns (urban settlements of several hectares, either walled or unwalled), fortified villages or with *qsur* of up to 6 hectares, open villages (no outer enceinte or *qsur*) of 0.5-2 hectares, and isolated buildings or huts. Surveys of tombs in the Wadi Al-Ajal have confirmed a large demographic base and concluded that previous estimates of (diachronic) burials in the 60,000 to 120,000 range were largely underestimated. Five years of intensive surveying have shown that at least *c.* 250,000-500,000 burials would be more adequate in the Wadi al-Ajal alone based on the density of burials systematically recorded in two different areas (Mattingly *et al.* 2011, 100).

specific economic niches. These coincided with new mercantile network opportunities and a market demand from the Roman Mediterranean. The institutional perspective emphasises the importance of stable and peaceful conditions with violence limited to the state power; the creation of network links with the Roman Empire and markets of Tripolitania did not occur through better environmental conditions offering surplus, but with the state establishing the initial stable conditions of interaction under which trading links to markets could develop.

### **3.2 Environmental determinants**

Far from being a monotonous and monolithic region characterised by the vastness of its well known sand seas, the Sahara is a complex and varied region with contrasting landscapes. Sand seas, or *ergs*, alternate with mountainous regions and depressions where the presence of underground water sources enable the development of oases (Fig. 3.1). The geography of movement and inhabitation across the Sahara is therefore dictated by where the environment offers the least resistance and by the presence of water. Fresh water has always been abundant underground in the historic periods of the Sahara, but rarely occurs naturally on the surface.<sup>128</sup>

The region of Fazzan itself consists of three oasis belts, which from north to south are the Wadi ash-Shati, Wadi al-Ajal, and the Murzuq basin (Fig. 3.2). These form a major corridor of movement and inhabitation through the Sahara. The Murzuq Basin aquifer system, which covers 450,000 km<sup>2</sup>, runs under Fazzan and provides it with ample underground water resources;<sup>129</sup> yet these require knowledge of their presence as well as techniques to efficiently tap into them. As pointed out by Mattingly,

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<sup>128</sup> UNESCO 2005.

<sup>129</sup> UNESCO 2005, 39, and Fig. 3.

this aquifer may have been more easily accessible in the past, and may have enabled greater diversity in the local wildlife.<sup>130</sup> Access to the Mediterranean was challenged by natural geographical boundaries consisting to the west, of the Ubari and Eastern Erg (*Grand Erg Oriental*), and to its east, the Hamada al-Hamra (Red desert). Further northwest, the Chotts (salt lakes), especially the Chott al-Jarid, form further barriers separating the Sahara from the northern coastal regions.<sup>131</sup> To the southwest, the Ahoggar mountains dominate the landscape, while to the south, the Tibesti mountains form the next hurdle before one could eventually reach the wider plains surrounding lake Tchad. To the east, the Libyan desert extends further east into Egypt.

The Sahara's climatic conditions have remained more or less constant for the last five thousand years.<sup>132</sup> Based on tree rings of cypress (*Cupressus dupreziana*, L.) in the Wadi Tanzzuft in the Akakus region, Cremaschi *et al.* identified several wetter phases in this period, and a final onset of hyper-arid conditions in AD 450.<sup>133</sup> The rise and apogee of the Garamantian civilisation in Fazzan occurred during this drier period with recurrent rain phases (1570 BC to AD 450).<sup>134</sup> These conditions had existed for a long time before *c.* 1100-900 BC when places such as Zinkekra, on the promontory of the Massak Sattafat, offer evidence of the first Garamantian settlements.<sup>135</sup> Similarly, saline soils in Fazzan rendered agricultural exploitation challenging from at least the

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<sup>130</sup> Mattingly 2000, 165.

<sup>131</sup> Troussset 1974, 25. Although these lakes could be crossed on a seasonal basis, these passages were controlled by forts.

<sup>132</sup> Cremaschi 2006 *et al.*, 301.

<sup>133</sup> *Ibid.*

<sup>134</sup> Liverani 2003a; Cremaschi 2006 *et al.*, 302.

<sup>135</sup> Mattingly and Wilson 2010, 525.

sixth century BC onwards, since Herodotus already mentions that the Garamantes had to manure substantially in order to cope with salinity issues.<sup>136</sup>

In the case of Fazzan, there is no favourable climatic shift or climate optimum that allowed settlement and trade with the Mediterranean. Rather, these conditions existed much earlier, and while a wetter climate would have undoubtedly helped life in the desert, as we will see, it was the growth of the Mediterranean as a trading partner and the needs and wishes of the Garamantian people themselves that drove the changes.

### 3.3 Pre-Roman situation

Changes in crop cultivation represent the main archaeological evidence of trade and contact over the *longue durée*. The first change in cereal crops for agriculture in Fazzan consisted of a shift from hulled to free-threshing wheat crops in the late first millennium BC, at a similar date to the change in Egypt. This is in contrast to the Mediterranean, where the shift occurred in the early first millennium BC.<sup>137</sup> The shift to free-threshing wheat would have significantly lowered the labour requirements associated with harvest, and offered further possibilities for the development of other economic activities. Sometime in this period, domestic animals such as the pig also appear in Fazzan.<sup>138</sup> By the fifth century BC, the Garamantes of Fazzan are mentioned in the literary sources as one of the peoples living in the Sahara. Herodotus lists the peoples of the 'Libyan country' located at ten day's interval each from a journey

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<sup>136</sup> Herodotus, *Histories* 4.183: “Here live the Garamantes, a powerful people, who spread soil over the salt and then sow their seeds” can only be a reference to the substantial manuring needed for the development of agricultural lands.

<sup>137</sup> Pelling 2008, 57.

<sup>138</sup> Van der Veen 2006, 173; Grant 2006, 181.

beginning from Thebes.<sup>139</sup> Amongst them were the Ammonians living at Siwa; the Nasamones from Aujila; the Ethiopian-hunting Garamantes; the Atarantes, and Atlantes. It has been suggested that this passage, along with another Herodotean reference to young Nasamones travelling south from the oasis of Aujila, describes an early caravan route and stopping stages between the lower Nile and the Niger Bend (Table 3.1) and east-west connections in the first millennium BC.<sup>140</sup> The time spent travelling as suggested by Herodotus roughly corresponds to that described by medieval Arabic writers for stages on this route.<sup>141</sup> If so, then an established route crossing Fazzan must have first been established by the sixth century BC.<sup>142</sup> At that time, as implied by Herodotus, the central Sahara was regionally controlled by different groups.

<b>Indications of peoples in the Sahara and travel times (Herodotus, <i>Histories</i> 4.181-185)</b>	<b>Distances in kilometres between locations</b>	<b>Travel times given by medieval authors</b>
The region of Thebes to the Ammonians: 10 days	Nile-Siwa: 560 km	Nile-Bahariya-Siwa: 14 days
Ammonians to Nasamones: 10 days	Siwa-Aujila: 460 km	Siwa-Aujila: 10 days
Nasamones to the Garamantes: 10 days	Aujila-Zalla: 400 km	Aujila-Zalla: 10 days
	Zalla-Zuwila: 400 km	Zella-Zawila: 10 days
Garamantes to Atarantes: 10 days	Zuwila-Ghat: 540 km	Zuwila-Ghat: 15 days
Atarantes to Atlantes: 10 days	Ghat-Idalas: 570 km	
Atlantes to X-Y: 10 + 10 days	Idalas-Tassalit: 760 km	
Y to the 'Nile': 10 days	Tassili-Niger: 450 km	

Table 3.1. Locations and people mentioned in Herodotus' account of travels in the Sahara, and times compared to medieval information (Liverani 2000a, 504).

Changes in water management techniques also point towards network contacts to Egypt. The introduction of the *foggara*, an underground water channeling technology

<sup>139</sup> Herodotus, *Histories* 4.181-185.

<sup>140</sup> *Ibid.*, 2.32-33; Liverani 2000a.

<sup>141</sup> Liverani 2000a, 504.

<sup>142</sup> *Ibid.*, 512.

developed in the East,<sup>143</sup> was a fundamental development. It adumbrated a period of agricultural intensification through labour and time investments that were fostered by peace and organisation. *Foggaras* were probably introduced into Fazzan sometime in the second half of the first millennium BC.<sup>144</sup> Tunnels were cut into the rock at the piedmont of the *hamada* (rock plateau), where they could tap into the water table and bring water to lower-lying settlements and irrigated lands in the oases (Fig. 3.3). This implied a shift in the organisation and usage of the territory, with a greater time investment, reliance, and inhabitation of the oases rather than hilltop escarpments. The abandonment of the defensive positions point to increasing peace amongst the Garamantian people themselves, which was an important precursor to the growth of the Garamantian state. Indeed, in the period between 300 BC and AD 100, mudbrick settlements were built on the lower slopes of the plateau rather than on the hilltop, suggesting a change in lifestyle spurred on by greater security and a greater reliance on agricultural and pastoral activities, as well as continued long-distance contact, since the mudbrick technique itself was introduced either via the Mediterranean or the Nile Valley.<sup>145</sup> The agricultural specialisation also implied a shift in the social organisation of the Garamantes and the institution of more complex social structures offering local protection from violence and frictions. It also allowed (and actively encouraged) the production of surplus for redistribution. Although the *foggaras* of Fazzan remain to be dated with greater precision, their use and development can generally be dated from the

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<sup>143</sup> Wilson 2006; Reddé 2012.

<sup>144</sup> Mattingly and Wilson 2010, 526.

<sup>145</sup> *Ibid.*

second half of the first millennium BC onwards, following an introduction in the Egyptian western oases by at least the mid-fifth century BC.<sup>146</sup>

From the third century BC onwards, Mediterranean goods are found in the archaeological record of Fazzan, albeit in low quantities. Ceramics, such as imported black gloss fineware from the third to second centuries BC, or glass bowls dating to the late Hellenistic period (mid second - first century BC) point to contact with the Mediterranean world in the pre-Roman period.<sup>147</sup> Institutional alliances were formed with the Punic world: Chaspe, one of Hannibal's generals, led a unit which included the Garamantes.<sup>148</sup> Pliny also refers to carnelian, a Garamantian product and high-value precious red stone used for gems or jewellery (discussed below in section 3.6) as the 'Carthaginian stone',<sup>149</sup> presumably on the basis that the gem was exchanged for Mediterranean goods and entered the wider Mediterranean markets via the Carthaginian trading networks. This suggests that the establishment of new commercial and social networks went along with the establishment of alliances with the Carthaginians. This also allowed the Carthaginians access to a product with high market value. Demand for Garamantian goods such as carnelian on the Mediterranean markets was therefore not solely a Roman-era phenomenon and commercial ties and distribution networks would have been in place prior to Roman conquest. In the Roman imperial period, these commercial ties and nodes of exchange had to be re-appropriated and firmly re-established.

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<sup>146</sup> Wuttman 2001; Wilson 2006, 211; Mattingly and Wilson 2010, 526.

<sup>147</sup> Felici 2005, 242; Dore *et al.* 2007, 328; Hoffman 2010, 413.

<sup>148</sup> Silius Italicus, *Punica* 3.310-319. During the second Punic war the Garamantes distinguished themselves at Saguntum (Silius Italicus, *Punica* 1.414) and dealt a serious blow to the Romans during the first major Italian battle at Trebbia (Silius Italicus, *Punica* 4.445-4.452). See also Demougeot 1960, 210.

<sup>149</sup> Pliny, *Natural History* 37.92 and 37.104.

### 3.4 Routes, networks and infrastructures

The initial period of contact with the Roman imperial world was marked by conflicts and friction. Cornelius Balbus's campaigns against the Garamantes in 20 or 19 BC, during which Balbus seized oases, villages and tribes on the way to Fazzan, were an important precursor towards the eventual control of the edges of the desert, which inevitably led to closer connections with the Garamantian kingdom.<sup>150</sup> This also created a historical background of interactions from which networks eventually developed. Balbus' success in Garamantian territory did not imply that Rome took control of the area, but rather shows a state-driven pursuit of pacification through intimidation and military action.<sup>151</sup> Virgil's poetic lines, bracketing the Roman world with the Garamantes and the Indians, the inhabitants of the farthest limits of the known world, reflect the social awareness of the profound changes of the imperial era, and the expansion of geographic knowledge it brought about.<sup>152</sup> The lines allude to new political aspirations under Augustan Rome, but also present the Garamantian kingdom as a known 'powerhouse' in the Saharan world. Once the central nodes of authority mutually accepted the conditions of interactions, paths and conditions of exchanges could be established.

The itinerary undertaken by Balbus to reach Fazzan probably went from Sabratha via Cidamus (modern Ghadamis) to reach Jarma from the northwest,<sup>153</sup> and perhaps followed the earlier route towards Carthage. In AD 68, when Oea attacked the city of

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<sup>150</sup> Pliny, *Natural History* 5.35-38.

<sup>151</sup> Mattingly 1995, 115.

<sup>152</sup> Vergil, *Aeneid*, 6.791-796: "...Augustus Caesar, son of a god, who will again establish a golden age in Latium amid fields once ruled by Saturn; he will advance his empire beyond the Garamants and Indians..." (Loeb transl.).

<sup>153</sup> Pliny, *Natural History* 5.35-38; Desanges 1999b, 241.

Lepcis Magna over skirmishes related to territorial expansion,<sup>154</sup> the Garamantes became involved in the conflict and sided with Oea, which ultimately lost. Two other punitive excursions to Fazzan occurred as a result and altered the political relationship between the Garamantes and the Romans.<sup>155</sup> The excursions are the last references to institutional friction between the Garamantes and the Romans, and serve to show how institutional support was a necessary pre-condition for long-term commercial opportunities and the development of networks. The previous alliance between the Roman city of Oea and the Garamantes was not successful as Oea's action was not sanctioned by the Roman state, and had to be renegotiated.

Festus's expedition, which left from Lepcis Magna, may have led to the discovery of a faster route to Fazzan, the *iter praeter caput saxi*. It cut the journey to Fazzan by four days by crossing the Hamada al-Hamra,<sup>156</sup> perhaps passing through the area of al-Qurayyat al-Gharbiya before heading straight towards the Wadi ash-Shati, the first, northernmost oasis of the region. The modern road between the towns of Gharyan and Mizda is still called *Ras al-Hammada* (head of the rocks), and probably relates to the ancient *tariq al-Ras al-Hammada* which led from Tripoli to Murzuq.<sup>157</sup> Two other expeditions, those of Septimius Flaccus sometime after AD 76, and of Julius Maternus between AD 83 and AD 92, reached the areas well to the south of Fazzan, and hence demonstrate that the relationships with Fazzan were peaceful in this period. Both expeditions headed south of Fazzan, travelling several months through southern Libya and further south, and hence may even have crossed the Sahara. The route to Fazzan reaching the western side of the Garamantian oases was now firmly established. It has

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<sup>154</sup> Tacitus, *Histories* 4.50.

<sup>155</sup> Mattingly 1995, 71-72; Mattingly 2003, 84-85; Mattingly and Wilson 2010, 527.

<sup>156</sup> Pliny, *Natural History* 5.38; Desanges 1999b, 242.

<sup>157</sup> Tissot 1884, 718, and footnote 1.

also been suggested that the later permanent installation of cisterns and fortifications deep in the pre-desert on the routes to Fazzan indicated Roman control over routes (*itinéraires contrôlés*) to the Sahara and various oases.<sup>158</sup> This may have created nodes providing safety and water along new commercial routes, but this aspect would have to be confirmed with further archaeological data.<sup>159</sup> Simultaneously, territorial expansion and the intensification of agriculture and commerce around the cities of Lepcis, Oea, and Sabratha, and into the pre-desert valleys to the southeast of Lepcis,<sup>160</sup> reduced the buffer zone between the Roman Empire and the lands of the Garamantes. Increased wealth and production in the province would have also enabled the development of other economic activities, such as trade with Fazzan.

### 3.5 Organisation of trade

Though routes can be suggested, we know little about the social organisation of trade in contrast to the Eastern Desert of Egypt or Palmyra. The lack of text or epigraphic data from Fazzan implies a necessarily Romano-centric textual perspective, but Roman sources refer to a remarkable variety of items traded: precious stones, agricultural produce, animal husbandry, and wild animals obtained through the Garamantes' hunting expertise, to name a few economic activities which will be detailed further below.<sup>161</sup> If Pliny's statement concerning the wells covered by the Garamantes reflected a reality,

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<sup>158</sup> Rebuffat 1982a, 492-496.

<sup>159</sup> Though certainly not to the level of intensity, or with the same institutional support as the security network established by the Roman army in the Eastern Desert of Egypt (Chapter 4, esp. section 4.4).

<sup>160</sup> Mattingly 1995; Barker 1996; Ahmed 2010; Capelli and Leitch 2011.

<sup>161</sup> Pliny, *Natural History* 13.111 and 37.92; Lucian, *Dipsades* 2, Claudian, *Minor Poems* 28.20.23 Mattingly 2003, 85. Garamantian sources have not been able to provide us with much information as although *tifinagh* graffiti are known, the language is not fully understood, and graffiti have also not been systematically studied.

then the Garamantes had exercised tight control over routes, and previously preferred raiding and pillaging rather than trade. By the second half of the first century AD, this situation radically changed, possibly by the discovery of a faster route to the region, but most certainly by a change of political dynamics. A new institutional dialogue was opened between Rome and the Garamantian state, with new routes and nodes of interaction the outcome, which is reflected in the renewed evidence for reciprocal trade.

### *Animal trade*

The first recorded visit and organisation of trade from a Roman perspective seems to have been the expedition of Julius Maternus.<sup>162</sup> This event coincides with the appearance of the *rhinoceros bicornis* on Domitianic coins in AD 92 and Martial's mention of the display of a rhinoceros during games at the Colosseum. As *rhinoceros bicornis* is a species found around the modern Lake Chad area, and it has been suggested that Maternus' expedition reached there.<sup>163</sup> From a Roman point of view, transporting rhinoceroses from the southern parts of the Sahara must have been an extraordinary feat justifying their display on coins and in literature.<sup>164</sup> In practical terms, the rhinoceroses had to be transported across Fazzan, and this could not have occurred without the Garamantes' institutional permission as well as their support as a node within a network of transport logistics. Lucian, writing in the second century AD, mentions that the Garamantes were hunting ostriches, elephants, monkeys and wild asses.<sup>165</sup> Similarly,

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<sup>162</sup> Ptolemy, *Geography* 1.8.4.

<sup>163</sup> Martial, *De Spectaculis* 9; Beltrami 1987; Desanges 1999b, 241; Buttrey 2007; Mattingly and Wilson 2010, 527. It may not entirely be excluded a few animals roamed slightly further north of it too, but as with other animals, there is a general consensus that the aridification of the Sahara pushed animals out of the area.

<sup>164</sup> Desanges 1978a, 205-210.

<sup>165</sup> Lucian, *Dipsades* 2.

Claudian refers to the Garamantes as the tamers of wild beasts (*Garamas domitor ferarum*).<sup>166</sup> Rock art representations from the Wadi Zizaw, Fazzan (Fig. 3.4) match the descriptions given by the Roman sources. One scene represents various animals, including ostriches, cattle and Garamantes riding horses and camels, along with a man on foot, holding a bow. Interestingly, two ships are depicted in the upper right corner, and suggest that the depiction is the narrative of a hunting scene as well as onward trade. Rock-art representations of what seem to be Roman-era ships, identifiable as such due to details of the anchor and the double rudder, have been found in the Massak Sattafat (Fig. 3.4 a and b).<sup>167</sup> In the Wadi Zizaw scene, the association of the hunt and the ship could represent interaction between the Mediterranean and the Garamantian heartland, and perhaps even be a trading narrative, but in this instance historical details are lacking. Ostriches were an important constituent of the local economy: eggs were consumed on site, and eggshell used for bead making.<sup>168</sup> Feathers, eggshells and live animals could have been traded northwards as well.<sup>169</sup> The evidence from rock art thus supports, but does not entirely confirm, the hypothesis that the Garamantes were trading in animals. Elephants may equally have been included in the animal trade between the coastal cities of Roman Tripolitania and Fazzan.<sup>170</sup> Elephant tusk dedications are known from Lepcis and Oea, and Sabratha's *statio* at Ostia has an elephant as its symbol.<sup>171</sup> At

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<sup>166</sup> Claudian, *Minor Poems* 28, l. 20.

<sup>167</sup> Le Quellec 2006.

<sup>168</sup> Cole *et al.* 2007, 474-475; Hoffmann *et al.* 2010, 461 (Table 8.6) and 469-470.

<sup>169</sup> Ostriches are known at the Roman coastal sites of Qasr Garabulli, or Zliten, but these could have been local rather than imported (Le Quellec 1987, 45). Ostriches, and eggshells were sent onwards to the Bay of Naples and Rome: ostrich eggshells for example, were found in Pompeii, in the House of the Greek Epigrams (*Insula* V.1.18, Prof. Mark Robinson, pers.comm.), but certainly, these could be coming from a number of places.

<sup>170</sup> Aurigemma 1940; Floriani Squarciarino 1980.

<sup>171</sup> *IRT* 295, 235.

Lepcis Magna, a small altar bears an inscription relating to the dedication of live elephants by Porfyrius, probably in gratitude for his commercial fortunes,<sup>172</sup> and a magnificent sculpture of an elephant still greets the visitors to Lepcis' museum (Fig. 3.5).<sup>173</sup> Despite potential demand, a recognised expertise in hunting and delivering exotic animals to Roman markets, but also a gradual scarcity of elephants in North Africa, there is nevertheless no direct proof that these animals came from Fazzan rather than from anywhere else in North Africa, even though prehistoric rock art does show that elephants used to inhabit Fazzan (Fig. 3.6).<sup>174</sup> On the other hand, the giraffe was not a species native to Roman North Africa yet was found in Fazzan in the Pastoral period (Fig. 3.7), and was perhaps still present south of it. Giraffes were represented in rock art as being ridden and tameable, and, perhaps, suitable for onward trade if still present in the general region:<sup>175</sup> a butchered leg joint of a giraffe recently discovered in Pompeii shows that giraffes were exotic animals in demand.<sup>176</sup> Wilson has suggested that these sorts of animals were accompanied by beast hunters (*venatores*) from both inside and outside the Roman empire and who supplied the Roman market with their latest successful catch.<sup>177</sup> If so, names of Garamantian *venatores* are not known, although interestingly there are mentions of Garamantian charioteers from the Roman world. The

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<sup>172</sup> *IRT* 603.

<sup>173</sup> Wilson 2012. Although the publication discusses the elephant as an apotropaic symbol, an intaglio from Lepcis Magna with an elephant rising from a sea-shell intaglio may also allude to Tripolitania's commercial strength as well as animal trade (Henig 1984).

<sup>174</sup> Scullard 1974 for an overview. This aspect is also treated by Wilson 2012.

<sup>175</sup> Le Quellec 1987, 43. Le Quellec cites Morocco as another area known for giraffes. As with rock art in general it is not possible to be certain that these species had survived into the period examined, though it can equally not be excluded that, as with elephants in Roman North Africa, some still existed in perhaps much more limited quantities, or else imported from the south, as the rhinoceros.

<sup>176</sup> Ellis and Devore 2010, 5. Though again, other geographic areas could equally have supplied this specific example.

<sup>177</sup> Wilson 2012, 415.

Garamantes were renowned horse riders and charioteers, which is amply attested from rock art (Figs. 3.8 and 3.9).<sup>178</sup> Strabo also comments on the Garamantian kings' particular interest in horses, and that 100,000 colts were born or bred each year.<sup>179</sup> Whether these were traded is not known; on the other hand, skilled Garamantian *agitatores* (charioteers) perhaps won fame in Rome itself, and this aspect will be discussed in more detail in the following section.

*“Garamantian” slaves?*

Herodotus relates that the Ethiopian-hunting Garamantes were accustomed to raiding the areas to the south for slaves,<sup>180</sup> and this system of interaction between the Garamantian heartland and southern regions may indeed have been in place by Herodotus' time. The archaeological evidence does point to the presence of sub-Saharan people in Fazzan: a haematite lip-plug found on a female recently found in a first-millennium BC burial in Fazzan suggests a sub-Saharan tradition and probable origin for the deceased. The burial goods included a cowrie shell, another product of sub-Saharan origin.<sup>181</sup> Although the sub-Saharan accoutrements could point to import and use of sub-Saharan goods, it is also possible that the woman herself came from sub-Saharan Africa.

In the Roman period, and if we believe Ptolemy, relations between the 'Ethiopian' people and the Garamantes were complex. The king of the Garamantes is said to have accompanied Maternus on his journey, in order to establish order amongst

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<sup>178</sup> Mattingly 2003c, 88.

<sup>179</sup> Strabo, *Geography* 17.3.19; the number itself must be an exaggeration (Mattingly 2003c, 88).

<sup>180</sup> Herodotus, *Histories* 4.183.

<sup>181</sup> Mattingly *et al.* 2009, 119.

his Ethiopian subjects.<sup>182</sup> This has been suggested to be a reference to slave-raiding.<sup>183</sup> Whether a state visit to people over whom territorial claims were made or a slave-raid, from an institutional perspective this also suggests state-driven negotiations over peace and institutional claims to potential violence. Slaves could have been in demand in Fazzan for its dynamic agricultural economy, which will be discussed further in section 3.7. Slaves were probably used for domestic duties, agriculture and for large-scale projects such as digging the labour-intensive *foggaras*,<sup>184</sup> but were also a commodity that could be traded on further via Fazzan. While impossible to determine for sure the origin of slaves in Tripolitania, Fazzan may have been a source of at least some of them.<sup>185</sup>

From a Mediterranean perspective, it is not possible to distinguish between Garamantes sold into slavery for the Roman market, or sub-Saharan people which could have been traded onwards. It has been suggested on the basis of Roman needs, and numbers from the medieval period, that perhaps several thousand slaves could have been traded northwards each year.<sup>186</sup> One difference between the medieval and the Roman period, however, is that by the medieval period, Fazzan was no longer a state with a local seat of authority. The choice over who decided whether slaves would stay in Fazzan and therefore fuel its agricultural or local economy or whether they would be traded northwards would have been in different hands. A different local economy in

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<sup>182</sup> Ptolemy, *Geography* 1.8.4. Desanges 1978a, 197-213.

<sup>183</sup> Wilson 2012.

<sup>184</sup> Wilson 2006, 210.

<sup>185</sup> Some of the rural estates of Tripolitania depended on slave labour: Aemilia Pudentilla, for example, a second-century AD woman from Oea and wife of Apuleius, donated no less than 400 slaves on her estates to her children (Apuleius, *Apology* 93).

<sup>186</sup> Wilson 2012, 433-434 on the basis that the Roman Empire was in need of 250,000-500,000 new slaves on an annual basis, and that early medieval slave traffic reaching the Mediterranean was in the range of 3,000-5,000 slaves (Wright 2007, 39).

Fazzan may have also impacted the ability to bring in or trade in slaves; at the very least network dynamics were therefore different. Nevertheless, several references to ‘Garamantian slaves’ are known: a poem from Hadrumetum, a major port of *Africa Proconsularis*, refers to a Garamantian slave, which may well be a slave sold on by the Garamantes.<sup>187</sup> One ostrakon from Bu Njem also records the arrival of Garamantes with a fugitive slave, whom they presumably had the intent of selling, or claiming a reward for.<sup>188</sup> The ostrakon mentioning the fugitive slave suggests extensive collaboration between the Garamantes and the Romans, although this particular evidence offers little in support of slavery as an economic activity. Fentress’ research has shown that an increase in black slaves in the ancient world may be inferred from their representation in small bronzes and ceramic figures. The gradual shift in the representation of Africans from a typically regal appearance on Attic pottery to often grotesque and sometimes malnourished and maltreated children in Roman art may be associated with increased black slave populations.<sup>189</sup> Wilson further argues that the labour-intensive and dangerous *foggara* construction work in Fazzan would suit the hypothesis of an influx of a slave population, and proposes the following pattern: male adult slaves were kept to dig

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<sup>187</sup> Bücheler and Riese 1894, n. 183, 155-156; Desanges 1999a, 236. The skin colour of the Garamantian slave is described as pitch black (l.2: *et piceo gaudet corpore verna niger*) and may even indicate a sub-Saharan origin as suggested by Desanges 1999a. *Verna* means home-bred, though it could imply that the slave was brought in as a child, which would fit Fentress’ model. We do also know of a slave trader, or *mango*, from a Roman-period ostrakon from the island of Jarba (modern Tunisia), which has historically always been one of the outlets for Saharan trade. The ostrakon mentions a commercial transaction, as money is involved, together with a request involving the slave-trader. But no reference to the origin of slaves is mentioned in this example.

<sup>188</sup> Marichal 1992, 109, n.71. Ostrakon 90 also mentions *publici nigri*, black slaves, but their origin is not cited.

<sup>189</sup> Fentress 2011. These need not necessarily all come from sub-Saharan Africa; we know from the *Periplus Maris Erythraei* that slaves were part of the cargo imported from Indian Ocean routes; Meroë was probably also an important source of slaves (Desanges 1999b, 245).

*foggaras* in the Garamantian heartland, while child slaves were sold into the Mediterranean markets.<sup>190</sup> An inscription at Rome, designating as “Garamlus” someone who was in all likelihood a child, could serve in favour of this argument.<sup>191</sup> Children were well suited to being transported long distances through the desert: being smaller they consumed less water and food, and minimised risk associated with transport (revolt). Children could also be sold at high price, since they had a longer life-span than adults, and adapted more easily to the Roman world.

Several references to Garamantian women from North Africa mention them not as slaves but as wives, showing their incorporation into the local social fabric: one Sittia Garama, is wife of a *sacerdos*, from Lambaesis; a Publiae Aeliae Garamantiae, is wife of a *magister* from Novaricia (*Mauretania Caesariensis*).<sup>192</sup> The most interesting inscriptions perhaps show that some Garamantes made dedications, attained prestige and perhaps even reached the status of freedmen at Rome through their skills as charioteers. One inscription refers to a *Garamantinica Gentinica* but also to the *agitatori* of the *factio prasinae*, one of the four traditional horse-racing factions at Rome.<sup>193</sup> Another refers to a Marcus Nutius Marci, a *libertus* and *agitator* of the *factio Garamantinicae*.<sup>194</sup> The association of these Garamantes at Rome with horse-riding and chariot-riding skills are particularly resonant with Garamantian activities and skills.

### *Material goods*

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<sup>190</sup> Fentress 2011; Wilson 2012.

<sup>191</sup> ICUR-04, 12641. The inscription simply says ‘Garamlus’, a diminutive form for Garama or Garamantius (?).

<sup>192</sup> *CIL* 8.3308; *CIL* 8.20453.

<sup>193</sup> *CIL* 6.10058.

<sup>194</sup> *CIL* 6.10065a. Would this imply that Marcus Nutius is the latinised name of a Garamant who has taken on the name of his patron?

Imported ceramics found in Fazzan must serve as proxies for the export of Garamantian goods that have to some extent remained archaeologically invisible. They are also indicators of favoured trading connections, or trading groups. Tripolitanian amphorae make up the majority of the imported amphorae after the second half of the first century AD.<sup>195</sup> Goods were not only consumed at the capital, Garama, but also throughout the Wadi ash-Shati, the Wadi al-Ajal and the Murzuq basin, as indicated by continuous finds across settlements.<sup>196</sup> This is also the case at Aghram Nadarif, though lesser quantities have been found, which could suggest a different relationship with settlements in the Akakus region.<sup>197</sup> As far as current research can show, between 28% and 36% of the Wadi al-Ajal amphorae assemblages are Tripolitanian.<sup>198</sup> Tripolitanian I, II and III are attested in Fazzan; Tripolitanian I and III, generally considered to be olive oil containers and II (a fish or wine container), are also found at Aghram Nadarif.<sup>199</sup> It is possible that amphorae, though originally made for maritime transport, were adapted to overland transport in order to overcome the heat and the exposure problems that desert journey entailed. It has recently been noted that a majority of Tripolitanian amphorae in Fazzan were of a slightly smaller and more compact shape, which has been suggested as

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<sup>195</sup> Mattingly and Wilson 2010.

<sup>196</sup> Sterry and Mattingly 2011 in particular for the identification of Garamantian settlements in the Murzuq basin.

<sup>197</sup> Liverani 2005, 67-68. Roman amphorae within household unit AN1-3 made up to 3.9% of the inner room pottery fragments (diagnostics and non-diagnostics), 6.27% of those in the outer room and 14.69% of the goods kept in the lane for storage. Wilson 2012, 438 expresses doubts over whether the region was part of the Garamantian territory.

<sup>198</sup> Dore *et al.* 2007, 308. This statistic covers fieldwork by Charles Daniels until 1977 and fieldwork by the Fazzan project until 2001. See also Leone 2013 for the amphorae assemblages from G1-G4 excavations at Old Jarma.

<sup>199</sup> Felici 2005.

an adaptation to donkey packsaddles.<sup>200</sup> If so, this would further suggest the adaptation of shapes to a specific market niche and transport logistics.

Fineware is also common at Jarma, with Italian sigillata making up to 58% of it.<sup>201</sup> At Saniat bin Huwaydi, a cemetery close to the Garamantian capital, a particular group of Italian Sigillata finewares was brought to Fazzan as a single group. Indeed, finewares with stamps from known Late Pisan producers were found in closely related tombs, and this close grouping had *graffiti* that indicated that a probable network of Tripolitanian merchants had obtained them and used them to trade with Fazzan.<sup>202</sup>

Glassware was imported in considerable quantities to Fazzan, and the chronological range of over *c.* 2,000 fragments and over 100 imported glass items shows that glass was taken into the desert from the first to fifth/sixth centuries AD, with the largest quantities of glass dating to the late first- to early second-century AD contexts.<sup>203</sup> Large vessels seem to have been preferred over small containers, which is peculiar since large, open vessels are more difficult to transport than smaller objects, such as *ungentaria* which are commonly found in the Mediterranean but are rare in Garamantian assemblages.<sup>204</sup> The obvious explanation is that the trade was based on demand, or the choice made by the Garamantes which had social implications in Fazzan. It is precisely the fact that the shapes were difficult to transport that made them particularly precious. On the other hand, these choices in glass may indicate that

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<sup>200</sup> Michel Bonifay, pers. comm.

<sup>201</sup> Dore *et al.* 2007, 308.

<sup>202</sup> Mattingly *et al.* 2010c, 322; Mattingly and Wilson 2010, 522. The *graffiti* included Libyan names written in Latin.

<sup>203</sup> Hoffmann 2007; Hoffmann *et al.* 2010, 412; Hoffmann 2013.

<sup>204</sup> Hoffmann 2013. It is also possible that small and especially fragile objects (in contrast to *unguentaria* or *balsamaria* which are nevertheless sturdy) did not survive as well in the archaeological record.

secondary glass workshops in the coastal cities imported glass, and shaped it according to specific orders, perhaps according to Tripolitanian merchants engaged in the trade with Fazzan.<sup>205</sup> Some of the material, however, did seem to form part of pre-made batches which may have been imported into Tripolitania;<sup>206</sup> as elsewhere in the Mediterranean, the import of batches of already-made glass and ingots for local secondary workshops can often be complementary.

The specificity of objects or goods traded between Garamantes and Romans point to an organised trade in which the demands of either side were known and products manufactured to suit, as perhaps in the case of glass and amphorae. This shows both knowledge and agency of both sides in shaping a particular aspect of the trading network. Wealth and production along the coast established Tripolitania as the closest Mediterranean centre engaging in trade with Fazzan, but it was reinforced by the establishment of commercial networks based on trust and adaptation to specific commercial demands.

### **3.6 Extractive industries**

Although the Garamantes did not exploit their mineral resources to the same scale or extent as Rome (as, for example, in the Eastern Desert of Egypt), high-value minerals were exploited, and traded with, the Mediterranean region. Precious stones, such as carnelian, are often surface picked and formed a convenient commodity for long-distance trade. Stones could be carried over considerable distances before being

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<sup>205</sup> On maritime trade in glass in the Mediterranean and primary versus secondary glass workshop distribution, Wilson *et al.* 2012.

<sup>206</sup> Hoffmann 2013, 417.

transformed outside Garama, the Garamantian capital, both a market place and the centre of control and redistribution.

### *Carnelian*

Carnelian was a regional precious stone which could be easily surface gathered or extracted, reddened by fire to increase its red/orange hue and made into beads. It is thought that the stone came from northern Fazzan in the Jabal al-Hassawana area (Fig. 3.9), possibly the *Mons Gyri* mentioned by Pliny.<sup>207</sup> A few carnelian beads were found at Saniat Jibril, near Garama (Fig. 3.10), with both burial assemblages and the debitage percentiles (44% of raw material fragments) pointing to an active carnelian industry.<sup>208</sup> The second-century AD evidence from Saniat Jibril includes raw carnelian, semi-processed carnelian (reddened by fire) and unfinished products, including beads, cabochons and intaglios and shows that the primary processing of the stone took place on-site, as did the production of manufactured goods. The proximity of this village to the capital suggests some form of control over this resource and that the workshops were mainly specialised in fulfilling a market demand. Carnelian was popular throughout Fazzan, and is often found in funerary assemblages, especially necklaces. The excavations at the 'Royal Cemetery' have shown a distinction between what was available to the wider community and to the upper elite and kings. Although dated to the fourth century AD and later (and hence slightly outside the scope of this thesis) far

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<sup>207</sup> Pliny, *Natural History* 5.35-38; Lefranc 1986, 309-310; Mattingly *et al.* 2003, 358; Mattingly *et al.* 2003, 358 further suggest that it would still fit the description of the location in Pliny and Strabo (Pliny, *Natural History* 37.92; 37.104; Strabo, *Geography* 17.3.11) as being in the Nasamonian mountains, since Jabal al-Hassawana is at the border between the Garamantian and Nasamonian territories.

<sup>208</sup> Mattingly *et al.* 2010b, 189-190; Cole 2013. Cole (Cole 2013, 456 and Fig. 17.2) also notes the presence of banded agate, a mineral which occurs naturally with carnelian and whose magnificent coloured bands (brown / white) come out when heated with sugar water.

bigger stone beads there demarcate the higher social status of the tomb owners, and social control over access.<sup>209</sup> Carnelian production was important prior to contact with Rome, and in demand both in Fazzan and in the Mediterranean. Like with slaves, the Garamantes probably only increased production in the face of growing internal as well as Mediterranean demand.

### *Amazonite*

Amazonite is thought to originate in the northern Tibesti region (Fig. 3.9), where a quarry site was found. The mineral composition of amazonite from a site named Arq Zuma has been found to match samples recovered at Jarma.<sup>210</sup> The presence of much less debitage debris at Saniat Jibril indicates that the first processing stage occurred at its point of origin, and that only the final shapes were made in Fazzan.<sup>211</sup> This has important repercussions concerning the establishment of relations with other Saharan populations, since the exploitation of stones would imply complex socio-political implications with local inhabitants, and suggests that the Garamantes had frequent connections, if not control, over the Tibesti region. The region is still inhabited by the indigenous Toubou, which have been suggested as being the ‘Ethiopians’ Herodotus referred to.<sup>212</sup> Amazonite was equally a highly valued commodity in the Roman Empire, to the extent that it was intensively quarried for in several locations in the Eastern Desert of Egypt (Chapter 4, Section 4.6).

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<sup>209</sup> This cemetery by the Garamantian capital also features tombs, *stelae* and offering proportionally much larger than examples at other cemeteries (Mattingly *et al.* 2011).

<sup>210</sup> De Michele and Piacenza 1999; Mattingly *et al.* 2003, 358; Mattingly and Wilson 2010, 527.

<sup>211</sup> Mattingly *et al.* 2010b, 189-190; Cole 2013, 460.

<sup>212</sup> Chapelle 1982, 33-37.

## *Gold*

The Saharan gold trade in Roman times remains a contentious topic. As mentioned in the introduction, Swanson and Law had categorically rejected the possibility of gold trade in the Roman period, but Garrard's arguments have re-opened the debate on the existence of a late Roman trade in gold.<sup>213</sup> But would there have been any Garamantian implication in a gold trading network? Gold has been found in very few burials in Algeria and Libya, and no gold sources are known in the Garamantian heartland. Gold ornaments, however, have been found in excavations.<sup>214</sup> In 2010, fifteen tombs from the Late Garamantian cemetery Taqallit (TAG012) revealed that all tombs were systematically robbed, with only ceramic objects left in the corners of the tombs. Nonetheless, tomb TAG012-T6 yielded a fragment of a gold sheet with repoussé decoration, suggesting that gold was available even to smaller communities.<sup>215</sup> The presence of gold in Garamantian tombs, along with beads, may in part explain the thoroughness of the robbing of a somewhat modest village cemetery outside the Garamantian capital. In the Algerian Sahara, gold was found in the fourth- to fifth-century AD tomb of Tin Hinan in Tamanrasset, in the Ahoggar region. The tomb of Tin Hinan, whose gold bracelets alone weigh 1.7 kg, suggests the availability of gold objects in the area,<sup>216</sup> but also a demand for gold or golden objects in the Sahara itself. Gold, if traded in the Roman or late Roman periods, is generally thought to have come from the Niger bend,<sup>217</sup> as it did in the Islamic period gold trade, but there are other

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<sup>213</sup> Garrard 1982, 453-458.

<sup>214</sup> Mattingly *et al.* 2003, 356 and Fig. 9.21; Mattingly 2010, 4. Mattingly *et al.* 2013, 96 and Fig. 3.36 for a 12-cm circular gold rosette ornament recovered at Jarma by Ayoub's excavations.

<sup>215</sup> Mattingly *et al.* 2010d, 98.

<sup>216</sup> Baistrocchi 1989; Mattingly 2003a, 229.

<sup>217</sup> Garrard 1982; Kaegi 1984.

sources which may need further consideration. One possibility is that gold, which could have originated from the Roman Empire, was used as bullion in exchange for Garamantian goods. Wilson and Magnavita have more recently re-introduced the possibility of a southwestern route for gold.<sup>218</sup> Magnavita's work at Kissi, on the Niger bend, has shown that from the fourth century AD onwards, gold was produced, at a time when Mediterranean imports are also found on site.<sup>219</sup> If so, then the Garamantian kingdom may have been the closest central node where these goods could have been found, and where gold would have been in demand. But if the trading network and demand for gold was present during the fourth century AD onwards, can the same be true in earlier periods, was it established at an earlier date or are we seeing a shift towards new sources of gold? Yet an origin of gold external to the Saharan region may not be the only or exclusive scenario. Gold has equally been located in several areas in the Ahoggar (Fig. 3.9).<sup>220</sup> These gold occurrences are surface gold deposits which are found in the sand (Fig. 3.11); could they have been handpicked or dry panned in earlier periods? The proximity of these goldfields to the tomb of Tin-Hinan at Abalessa and generally southwest of the Akakus and on the path towards the Niger bend is striking, and these sources, if they were known, could have been the origin for the gold from Tin-Hinan's tomb. Were these sources used and traded? The trading networks certainly did not stop at the limits of Ghat and Aghram Nadharif: the tomb of Tin-Hinan

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<sup>218</sup> Wilson 2012; Magnavita 2013.

<sup>219</sup> Magnavita 2013.

<sup>220</sup> Data from the Ministry of Energy and Mining of Algeria. ([www.mem-algeria.org](http://www.mem-algeria.org), last consulted May 25<sup>th</sup>, 2010). Ken Norris, pers.comm. 2011. Ken Norris was Chief Operating Officer, GMA Resources (2006-2010). Main gold fields are in the Tirek-Amessmessa area, some 400-460 km southwest of Tamanrasset; at Tiririne-Hanane, 450 km east of Tamanrasset; and at Abegui, south of Tamanrasset, where current total gold yields are estimated at over 100 tonnes *per annum*. GMA currently exploits the Tirek-Amessmessa gold veins. Surface weathering exposes the gold veins, which literally outcrop at the surface and are strikingly noticeable from the surrounding sand.

contained carnelian,<sup>221</sup> which as we have seen, could have had a Garamantian origin. Tin-Hinan's dress was also strikingly close to the Garamantian traditional wear, as was her taste for red ochre; her tomb also shows some cultural affinities with tombs in Fazzan.<sup>222</sup> Did these connections, which are past the third century AD and hence beyond the scope of this thesis, develop once the northern trading networks were disrupted or were they in place from a much earlier period? Most of what we have seen so far suggests early contact and long-distance ties which expanded and strengthened through opportunity.

A handful of Roman coins, including silver *denarii* were found in Saniat Jibril,<sup>223</sup> a production centre, and it is possible that occasional coins were melted and made into ornaments.<sup>224</sup> Five silver rings (and a fragment), found in the Royal Cemetery by the capital also suggest an appreciation for silver artefacts, but whether silver was produced from geographically-local sources rather than simply imported as bullion is unclear.<sup>225</sup> The presence of a silver mine, known at least from the eleventh century AD, is three-day's march from Tsawa in the Wadi Utba. This would have been within the southern territories under control of the Garamantes, and points to the exploitation of local silver resources, should they have been known this early on.<sup>226</sup>

The extent to which gold and silver were systematically exploited (if at all), as opposed to importing bullion, by the Garamantes remains unclear. Whether they had the knowledge of how to exploit gold and silver ores is not possible to prove so far, but

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<sup>221</sup> Lhote 1984, 118.

<sup>222</sup> Mattingly 2003a, 229.

<sup>223</sup> Tagart and Mattingly 2010, 476-480.

<sup>224</sup> Mattingly *et al.* 2003, 356; Tagart and Mattingly 2010, 476-480.

<sup>225</sup> Mattingly *et al.* 2011, 94.

<sup>226</sup> Mattingly *et al.* 2003, 356.

there was a clear demand for it, and the Garamantes had the geographic opportunity to obtain it from sources closer than the Roman Empire. Consequently, it is likely that if such sites were known and they were easier to exploit than to obtain bullion by trade, they would have been. Surface deposits could have potentially granted them the possibility of exploitation. Goods made from carnelian or amazonite surface deposits show an interest in mineral exploitation. The Garamantian use of gold and silver as a raw material for ornamental purposes points to the sophistication of the Garamantian civilisation, and their economic ability to command demand in precious ores. Once accustomed to being able to obtain gold and silver objects, these goods became markers of social status.

### *Alum*

Alum, the mordant used for colouring textiles, and also for softening and tanning leather, was exploited in the area of Aghram Nadarif (which means ‘City of alum’), Ghat and Sardalas (Figs. 3.12 and 3.13).<sup>227</sup> One of the peculiarities of textiles found in the Fazzan is their bright colours. Although the majority of alum probably stayed in the region for the production of leather and coloured textile, it may have been traded onwards towards the Mediterranean and other North African textile-producing areas. Alum is recorded in the AD 202 list of taxed items at the provincial border at Zarái (near Sétif, Algeria), and it has been suggested that the alum could have been from a Garamantian source,<sup>228</sup> although there is little to date to confirm this hypothesis.

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<sup>227</sup> Mattingly *et al.* 2003, 360.

<sup>228</sup> On North African textile production and colouring, see Alfaro Giner 1994. On alum in the Mediterranean, Borgard *et al.* 2005. In the Islamic period, Kawar (Bilma), between the Fazzan and Kanem, became one of the most important alum producers of the Mediterranean with Egypt, and its alum was renowned for its purity (Lombard 1978, 148-149; Vikør 1982). Although other sources, such as the

## *Natron*

The presence of natron deposits in Fazzan, by the Dawada lakes of the Erg Ubari, northeast of the Garamantian capital, suggests that glass beads could have been produced in the region rather than imported from the Mediterranean.<sup>229</sup> Bead-making requires several stages of processing which at the early stage involves the acquisition of minerals or the transformation of minerals. Glass beads are also commonly found in Fazzan and represent 40% of the beads recorded from Charles Daniels' excavations, and 20.5% of the raw material assemblages.<sup>230</sup> In the Roman and Byzantine empires, glass production was a two-stage business.<sup>231</sup> The first stage was the primary manufacture of raw glass in large kilns by heating sand with natron as a flux. The principal source of natron in the Roman empire was in the Wadi Natrun area of Egypt, though other sources were known in antiquity.<sup>232</sup> Raw glass, either of a blue or greenish colour was produced in slabs weighing perhaps 8–10 tons each, and sometimes up to 25 tons, and subsequently broken into pieces which could be shipped to secondary production centres.<sup>233</sup> Garamantian settlements were recorded by Lake Truna, where natron export was undertaken by the Dawada people in more recent times. Garamantian pottery and local clay sources also indicate an active local pottery centre in this area; they point to

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Lipari Islands, may not be excluded, Troussel's suggestion (Troussel 2005, 366) that the alum mentioned in the Zaráï tariff might be of Garamantian origin remains an open hypothesis.

<sup>229</sup> Mattingly *et al.* 2003, 358-360.

<sup>230</sup> *Ibid.*, 189.

<sup>231</sup> Foy and Nenna 2001.

<sup>232</sup> Pliny, *Natural History* 31.46.106–109 and Dotsika *et al.* 2009 for example for natron sources in Greece.

<sup>233</sup> Nenna 2007, 127–128. Different colours could be produced at the secondary centres by re-heating the glass whilst adding other chemical such as antimony. Secondary centres could be as far as India and Sri Lanka, as attested by the *Periplus Maris Erythraei* (chapters 7, 10, 49).

knowledge transfer, and appropriation of techniques to local needs.<sup>234</sup> A similar transfer of knowledge through the networks of interaction with the Mediterranean may be postulated for glass production.

There is sufficient evidence so far to show that the Garamantes travelled far in their commercial ventures to find the sources of materials to be processed and made into ornaments or jewellery. The geography of the exploitation of these resources points to the establishment of long-distance contacts with specific locations and suggests the development of a sophisticated organisation able to maintain contact and organise transport requirements. The rise of Garamantian power was accompanied by the growth and crystallisation of complex trading networks, territories of influence as well as political alliances, and a socio-political organisation capable of exerting its power over a vast geographic space.

### **3.7 Agriculture and pastoral industry**

Habitable oases in the Sahara rely on elaborate irrigation systems to bring fresh water to the surface in order to sustain life, as well as grow crops and develop animal husbandry. As a rough comparative figure, in the 1960s, when cultivation was undertaken in the oasis depressions without the help of modern irrigation, a population of *c.* 79,000 relied on 2,700 ha of cultivated land and 1,200 ha of palm groves.<sup>235</sup>

In the northern Wadi ash-Shati oasis, agricultural development was linked to the construction of wells made of mixed stones and mud brick, an imported construction technique.<sup>236</sup> Another key development that raised the agricultural potential of Fazzan

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<sup>234</sup> Mattingly *et al.* 2007, 152.

<sup>235</sup> Mattingly 2003b, 2.

<sup>236</sup> Mattingly *et al.* 2007, 152; Mattingly and Wilson 2010, 526.

was the introduction of *foggaras*, underground water channels that transported water to low-lying settlements in the Wadi Al-Ajal and Murzuq basin. *Foggaras* allowed the cultivation of land, the diversification of crops, and eventually the rise from a subsistence economy to one of surplus production and trade beyond the possibilities of the natural oases fed by the underground aquifer. Increasing the carrying capacity of the land therefore demanded water technology. Although *foggaras* were introduced in the pre-Roman period, the peak of Garamantian civilisation corresponds to the peak of their use, and agricultural intensification in the Roman period, when small rural villages are attested less than a kilometer apart in the main oases.<sup>237</sup> Aerial photographs showing hundreds of lines of spoil rings in the Wadi al-Ajal emphasise their extensive use at various sites in Fazzan in the Garamantian period. Over 600 *foggaras* have been recorded in Fazzan.<sup>238</sup> While this may seem a surprisingly high number, the Touat region of Southern Algeria relied on at least 2,000 km of *foggaras* to feed some 40,000 inhabitants – that is to say, an underground infrastructure ten times longer than the infrastructure of the contemporary Parisian metro.<sup>239</sup> The continued reliance on *foggaras* in Fazzan is seen by the frequent addition of new branches, or by the consolidation of *foggaras* in what seems to be the later phases of their usage, perhaps as the water table declined.<sup>240</sup>

That date palms were seen as a vital constituent of the Garamantian agricultural economy is known from the ritualistic deposition of date stones in many early Garamantian tombs in the Garamantian heartland.<sup>241</sup> Palm trees are the quintessential

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<sup>237</sup> Mattingly and Sterry 2013.

<sup>238</sup> Wilson and Mattingly 2003.

<sup>239</sup> Capot-Rey and Damade 1962, 99-119; Scheele 2010, 285.

<sup>240</sup> Mattingly *et al.* 2010e, 113-116; 127-131.

<sup>241</sup> Mattingly *et al.* 2010d, 100-101.

staple of oasis agriculture. Dates are a major source of protein and food for humans and animals alike, and a single tree can produce up to 100-200 kg per year.<sup>242</sup> Date palms consume little water, provide shade and wind shelter for more fragile crops and cope well with high levels of salinity. There is however a direct relationship between increased soil salinity from irrigation and overexploitation and the steady decline in production.<sup>243</sup> While dates are eaten, the branches are used for fuel for domestic ovens and for ceramics, metals, or glass kilns; trunks can be used as a building material for houses. At Zinkekra, male flower strands were found separated from the trees, which also raises the question and possibility of early artificial pollination in Fazzan.<sup>244</sup> Although in this instance, the find could also be explained by the consumption of flowers and date pollen or by their accidental deposition amongst palm fronds cut for building material, nevertheless artificial pollination to increase date production in the valley remains a possibility.<sup>245</sup> In the Roman period and in the Empire, dates were grown primarily in the Levant, but coastal Tripolitania and the inland oases were also known as major date-producing areas.<sup>246</sup>

As shade providers, date palms were also a crucial element for the development of a sophisticated oasis-based agricultural system. To this day, palms are usually set around and in individual plots of land (depending on the amount of shade wanted) and fed by water canals which can be opened or shut. That we are dealing with a fully

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<sup>242</sup> Zohary *et al.* 2012, 131.

<sup>243</sup> Alhammedi and Kurup 2012.

<sup>244</sup> Van der Veen and Westley 2010, 514.

<sup>245</sup> *Ibid.*

<sup>246</sup> Pliny, *Natural History* 18.51.188-189; Herodotus, *Histories* 4.32 for Aujila; Trouset 2005, 366. Pliny, *Natural History* 13.111: “*Interior Africa ad Garamantas usque ad desertas palmarum magnitudine et suavitate constat*” (The inland parts of Africa up to the land of the Garamantes and the deserts, have date palm trees oases, whose dates are reknowned for their size and sweetness).

developed form of oasis agriculture in Fazzan, with shaded and well-watered plots, is further confirmed by the finds of fruit such as grapes which needed to be protected from excessive winds and heat, and by weed species usually found in cultivated fields which required ample water.<sup>247</sup>

The appearance of pearl millet (*Pennisetum glaucum*, L.) and sorghum (*Sorghum bicolor*, L.) in the archaeological record of Jarma in the first to fourth centuries AD testifies to contact with the sub-Saharan, where the plants originate,<sup>248</sup> and suggests trade or at least contact, since both species are known for their very low ability to spread naturally.<sup>249</sup> Sorghum and pearl millet have a low water requirement, making them good supplementary fodder crops. Both pearl millet and sorghum are summer crops and allowed bi-annual harvests in Fazzan, a major step towards food stability, and the production of a surplus for wider markets.

Herodotus's comment, "here live the Garamantes, a very numerous tribe of people, who spread soil over the salt to sow their seeds in"<sup>250</sup> clearly refers to the problems of evaporite salts in the irrigated agriculture of Fazzan. Barley, one of the most salt-tolerant species of grains, and sorghum, which is also salt-tolerant, helped the Garamantes overcome some of the challenges posed by salt saturation. These species also allowed for more crop diversification and a better exploitation of the local land resources, with crops requiring more water closer to the *foggaras*, while lands further away, or with higher salt contents, could be turned into fields for salt- and drought-resistant crops. It is also possible that the later rise of agricultural settlements in the

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<sup>247</sup> Van der Veen and Whestley 2010, 515 and 519.

<sup>248</sup> Pelling 2008, 58.

<sup>249</sup> <http://www.fao.org/ag/agp/agpc/doc/gbase/data/pf000319.htm> for sorghum;

[http://www.tropicalforages.info/key/Forages/Media/Html/Pennisetum\\_glaucum.htm](http://www.tropicalforages.info/key/Forages/Media/Html/Pennisetum_glaucum.htm) for pearl millet.

<sup>250</sup> Herodotus, *Histories* 4.183.

Murzuq depression, from the end of the third century AD onwards, may have alleviated the agricultural pressure on the Wadi al-Ajal and helped the population escape the agricultural Malthusian trap by providing the Garamantes with new agricultural lands, less affected by the overexploitation of the Murzuq aquifer and increased salinity due to long-term agricultural use. But for the centuries examined here, it shows that despite pre-existing and challenging local conditions, the Garamantes had found multiple, both complementary and innovative, solutions to successfully cope with the arid environment.

Cotton, which was introduced either in the pre-Roman or the Roman period, was grown in Fazzan from at least the second to the sixth centuries AD.<sup>251</sup> Contrary to sorghum and pearl millet, cotton requires considerable water and labour, and can only have been grown through managed irrigation, and a substantial labour force,<sup>252</sup> which further reinforces the idea that cheap labour, perhaps in the form of slaves, must have been available. Ideal germination and growing conditions require temperatures of at least 25 – 30 degrees,<sup>253</sup> with the highest yields obtained in arid areas under irrigation, making Fazzan an optimal region for cotton growing, since the *foggaras* ensured a constant supply of water, while the natural climatic conditions, in particular the extreme heat, were ideal for cotton growth. The import and growth of cotton in the desert was presumably because of its ideal climate and a market for its products. The presence of cotton in Fazzan hints at a possible specialisation in a crop that was cultivated on the basis of its high commercial value rather than for subsistence; it could be used locally, was easy to dye, and could also be potentially sold within markets in Fazzan. Cotton

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<sup>251</sup> Pelling 2008; Van der Veen 2011, 89.

<sup>252</sup> Pelling 2008, 58-59.

<sup>253</sup> Van der Veen 2011, 89.

could also have been trafficked onwards the Roman world, where cotton was a high value crop much in demand: it was also imported via Palmyra and the Eastern Desert of Egypt as we will see, but also produced in the oases of Roman Egypt.<sup>254</sup> A high economic return must be the only reason for the cultivation of cotton in arid areas, where water remained a precious resource.

### *Pastoralism and animal husbandry*

Archaeozoology provides some information pertaining to the introduction or presence of animal species and animal husbandry in the Sahara. The published animal assemblage from Charles Daniel's excavations is dominated by the presence of sheep or goats.<sup>255</sup> A relatively high number of cattle bones was also recorded, a reminder of Herodotus' comment on the fact that the Garamantes were cattle herders.<sup>256</sup> Equids, donkeys and camels are attested,<sup>257</sup> along with pigs, which are not native to Africa,<sup>258</sup> and were introduced in Fazzan from the Mediterranean or Egypt from at least c. 700 BC – 400 BC.<sup>259</sup> Chicken was a common species in the Roman world, found in the Tripolitanian pre-desert.<sup>260</sup> Chicken are attested at Jenne-Jenno in Mali between AD 500-850, and may have spread via Fazzan.<sup>261</sup> Chicken finds at Kirikongo, Burkina Faso would also confirm the introduction of the chicken from the north in the first half of the

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<sup>254</sup> Gradel *et al.* 2012. See also the chapter on Palmyra for cotton and textile production.

<sup>255</sup> Between 76% and 96% at Jarma (Holmes and Grant 2013, 495).

<sup>256</sup> Herodotus, *Histories* 4.183; Westley 2010.

<sup>257</sup> Westley 2010.

<sup>258</sup> Albarella *et al.* 2006 on current research on pig DNA and tracing origins. Research on the movement of pigs is still very recent.

<sup>259</sup> Van der Veen 2006, 173; Grant 2006, 181 and table 16.1.

<sup>260</sup> Van der Veen *et al.* 1996, 252. A chicken (*Gallus domesticus*) may have been found at Zinkekra (Westley 2010, 522).

<sup>261</sup> MacDonald and Edwards 1993; MacDonald and MacDonald 2000; MacDonald 2011.

first millennium AD.<sup>262</sup> The presence of these animals points to sophisticated animal husbandry, wealth, and contact and exchange with the Mediterranean and the sub-Saharan world over several centuries at a period when the Garamantes were at the heart of a wide network of contact, trade and exchange, receiving pigs from the north and passing chickens on to the south. Through their networks, the Garamantes successfully shaped their local environment to meet their demands and prosper.

### **3.8 Structure and agency**

It is important to stress here that the development of networks across and beyond the Sahara were long-standing, and initially developed by the Garamantes without Rome; it came to include the Roman Empire as circumstances developed and mandated it. The analysis of the various economic activities of Fazzan provide evidence for a complex society in full control over how it wished to manage its local resources and developed its ability to sustain a stable agricultural lifestyle despite harsh climatic conditions. The Garamantes were able to produce surplus, specialise in economic niches, and knew how to utilise knowledge from long-distance ties to the Mediterranean and sub-Saharan Africa in order to develop new technologies, crops and goods and exploit new markets. But how was Garamantian society organised? We can begin to identify market forces and urban centres within the network of settlements across Fazzan which would have pulled agrarian resources and served as redistributive centres for different types of goods. Along with the development of long-distance commerce, the Garamantian state shows signs of urbanisation which created gravitational market forces attracting agricultural resources to its urbanised areas, the growth of specialised local crafts

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<sup>262</sup> Dueppen 2011. This also reinforces Magnavita's point concerning connections to Niger bend connections before the Islamic period (Magnavita 2013).

production in urban centres, as well as an influx of long-distance goods used as social status markers and for social competition.

Roman literary sources refer to the structure of the Garamantian civilisation, with Garama (modern Jarma) as a centre of royal authority and a *metropolis*, but also with mention of several other *oppida*.<sup>263</sup> Archaeological field surveys have now provided exceptional evidence for the nature of settlements linked to the structure of the socio-political organisation of the Garamantes, but also to the development of urbanisation (Fig. 3.14).<sup>264</sup> Field surveys within 18 km<sup>2</sup> of the ancient Garamantian capital for example revealed a hierarchical organisation of settlements. The population was organised around Garama as a major urban centre of at least 7.5-9 hectares, and 16 “satellite” settlements which included villages and hamlets, though other large urban centres with extensive field systems can be identified as well.<sup>265</sup>

Recent analysis of satellite imagery followed by land surveys in the Murzuq basin revealed further settlements with extensive irrigated field systems. It confirms that Garama also controlled settlements (and not just vast sandy territories) beyond the Wadi ash-Shati, with at least 156 settlements now identified in the Murzuq basin (Fig. 3.14).<sup>266</sup> These showed evidence of agricultural fields around them: so far at least 30 km<sup>2</sup> of agricultural lands have been recorded. The *foggaras* here followed a design slightly different from the Wadi al-Ajal, suggesting introduction and adaptation to the relatively low levels of change in elevation rather than simple emulation of the

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<sup>263</sup> Pliny, *Natural Histories* 5.35-37; Ptolemy, *Geography* 4.6.12; see esp. Mattingly 2003c, 86-87 on Roman sources.

<sup>264</sup> Mattingly and Edwards 2007 for a diachronic catalogue of the over 900 sites (prehistoric to Islamic) sites recorded by the Fazzan Project; Sterry and Mattingly 2011; Mattingly and Sterry 2013.

<sup>265</sup> Mattingly 2011b, 86.

<sup>266</sup> Mattingly and Sterry 2013.

technologies used in the Garamantian heartland. The similarities in settlement types in the area, namely mudbrick *qsur* (fortified buildings) with enclosed or unenclosed settlements, and Roman-date pottery (first—fifth centuries AD) have been interpreted as a period of Garamantian colonisation of the landscape by oasis farmers.<sup>267</sup> The conspicuous presence of Roman ceramic goods continues to reinforce the argument that trading with the Roman world formed a not-so-negligible part of Garamantian economic activities. AMS dating of mudbrick suggest that the main chronology of sites falls between the third and sixth centuries AD.<sup>268</sup> If so, this implied the creation of new clusters within an expanding network of Garamantian civilisation, which successfully escaped a Malthusian agricultural trap despite arid conditions. The evidence for technologies, and developments in Fazzan points to human agency as a main factor of change.

Garama was not the only ‘large’ urban centre: Qasr ash-Sharraba, another urban centre in the Murzuq basin, covered 15-18 hectares.<sup>269</sup> It has been demonstrated that these two towns were comparable to small towns in Roman North Africa in the imperial period,<sup>270</sup> an accomplishment all the more astonishing given the very different nature of environmental challenges. The organisation of Garamantian life according to a hierarchy of settlements reflects a socio-political choice, and is what Central Place Theory would expect of more developed states within a landscape with similar possibilities.

At the heart of the changes observed was a complex society able to maintain urban centres, and a social organisation which structured agrarian life around

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<sup>267</sup> Sterry and Mattingly 2011, 113.

<sup>268</sup> Mattingly and Sterry 2013, 510.

<sup>269</sup> Mattingly and Sterry 2013, esp. Table 2.

<sup>270</sup> *Ibid.*

settlements and villages in the oases. Such peaceful conditions perpetrated the development of a wide agrarian base and the production of surplus and secondary economic activities enabling the region to engage in long-distance trade via its developed network. Urban lifestyles, and difference in availability of exotic goods suggest the rise of elite groups with social competition, and people able to thrive within institutional possibilities.

### 3.9 Synthesis

Between the first and third centuries AD, the oases of Fazzan in the Libyan Sahara witnessed a society in full bloom. Long-distance contact across the Sahara predated the Roman phase, as seen by crops, animals, technologies or even military alliances. One reason for the development of Fazzan was the pre-existing natural availability of groundwater enhanced by a decision to build *foggaras* or wells to intensify agriculture, and dynamic relations and contacts to import new crops. The construction and maintenance of *foggaras* reflect substantial labour requirements, most likely provided by the availability of cheap slave labour, and encouraged by a centralised authority. Agricultural production became increasingly sophisticated by the Roman period, and further testifies to economic success and wealth. *Foggaras* enabled the expansion of Garamantian agriculture,<sup>271</sup> and also the generation of surplus and thus the wealth necessary for trade. Indeed, the introduction, and development of cotton production testify to increased surplus and wealth enabling the Garamantes to switch valuable arable land to the production of cash crops. Climatic fluctuations, in this case, did not seem to be a bother. Water technologies provided security from climatic

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<sup>271</sup> Wilson with Mattingly 2003, 235-265; Mattingly with Wilson 2003.

challenges, and allowed the production of crops for a surplus economy, as well as cash crops such as cotton for both local use and export. In short, the pre-Roman evidence points to the rise of a society which moved from basic subsistence agriculture, slave-raiding and hunting to a complex society with urban centres, and developing rural communities far from its centre. The Garamantes were able to diversify, enable the production of surplus, and therefore to engage with and benefit from the Mediterranean market.

In the second half of the first century AD, a new network connecting the Libyan Sahara with Roman Tripolitania is in place, as shown by amphorae, glass, and other items from Roman North Africa widely used as funerary items in Garamantian tombs. Although Fazzan continued to entertain relations with other parts of the Sahara and sub-Saharan world, the North African connection, identified through these goods, represented a new market particularly savvy for goods produced and redistributed by the Garamantes. The continued reliance on their pre-existent networks to the south can also be seen in the development of other industries, such as the exploitation of mineral resources, the travels and range of far-away goods imported from the south and southwest, including crops, minerals and precious ores, animals and slaves. The evidence therefore points to sophisticated networks of strong internal ties within the Garamantian society, and weak-tie alliances and trade networks reaching into the Roman and Saharan worlds. Despite the limited evidence of who the investors or trade operators were, or how the social network operated, the archaeological evidence presents us with a picture of a complex society engaged in intense exchange with other regions, in particular the Roman Empire, in which the Garamantes retained full control over choice of items imported and exported.

## Chapter 4 The Eastern Desert of Egypt

### 4.1 Introduction

I will now turn to the development of arid regions inside the Roman Empire, and in this chapter focus on the Eastern Desert of Egypt. In contrast to the Nile valley, the Eastern Desert represented a radically different landscape. Jongman, in the introduction of his chapter on Early Roman Consumption for the *Cambridge Economic History of the Greco-Roman World*, described the new and most important Roman quarry in the Eastern Desert as such:

“Mons Claudianus is a desolate quarry site in the mountains of the eastern Egyptian desert. Dry, hot and inhospitable, it looks like a settlement on Mars. It rained perhaps once in a decade, but not in between. No one would ever choose to live here, if it were not for the grey stone (granodiorite) that was used in the grandest of Rome’s imperial building projects.”<sup>272</sup>

Of course, the Eastern Desert was not a settlement on Mars, but its arid environment was constantly as hot and dry as Fazzan’s, where people actively chose to live. In fact, several groups such as the Agriophagoi, Moschopagoi or Barbaroi are known to have lived in the Eastern Desert in the Roman period, though still relatively little is known about them archaeologically for the period examined.<sup>273</sup> In the Eastern Desert, however, the landscape was radically

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<sup>272</sup> Jongman 2007, 592.

<sup>273</sup> Barnard and Duistermaat 2013; See De Romanis 2002 and Cuvigny 2003d, 351-352 for tensions with these groups. See also Thomas 2011 for the maritime groups along the Eastern Desert coastline.

differently organised. I will therefore first examine environmental factors and assess the pre-existent infrastructure before discussing the situation in the first three centuries AD. This requires a detailed examination of the different types of economic activities in the Eastern Desert, in particular long-distance commercial networks and the exploitation of decorative stones, ores and gems. The Eastern Desert's agricultural potential will also be considered, along with networks of supplies remediate to local needs. Structurally, the Eastern Desert was part of a province under imperial administration,<sup>274</sup> and institutional aspects will also have to be examined.

#### **4.2 Environmental factors**

The Eastern Desert of Egypt, as its name indicates, is located to the east of the Nile, Egypt's corridor of life and agricultural resources. In contrast to the Western desert, a sand desert with occasional depressions where oases could form and serve as a basis for agriculture and urban development, the Eastern Desert is essentially a long mountainous desert with high peaks and sharp, rocky escarpments with little to no flat spaces or terraces to establish an agricultural base.<sup>275</sup> From the modern entrance to the Suez canal until its border with Sudan, the *c.* 206,000 km<sup>2</sup> of Eastern Desert are characterised by a waterless high sandy plateau extending east of the Nile for *c.* 80-170 km, and a formidable barrier of pre-Cambrian formations of granite, schist, granodiorite and other metamorphic

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<sup>274</sup> Bowman 1986; Bowman 1996a and 1996b.

<sup>275</sup> Morrow and Morrow 2002, 11.

rocks, with peaks up to 2,200 meters (Fig. 4.1).<sup>276</sup> This mountain range, which runs north-south parallel to the Nile and the Red Sea, is criss-crossed by a capillary network of flat, sandy wadis caused by eroding flash floods that have carved their way to the Nile or the Red Sea. As a consequence, the narrow wadis are the only corridors of east-west travels between the Nile and the Red Sea. There the wide flat coastal strip allows the presence of settlements with harbours wherever the coral reefs offer a break for ships to reach the shore.

Current climatic conditions make the Eastern Desert one of the driest places on earth. Excavations at Sodmein, a cave by the Red Sea, have shown that prehistoric inhabitation on the coast was reliant on a wetter climate, and stopped with the onset of current climatic conditions *c.* 5,400 years ago.<sup>277</sup> The annual rainfall average for Qseir al-Qadim (Myos Hormos) on the central part of the Red Sea coast stands at 4 mm, though the rainfall regime of the Eastern Desert is mainly characterised by torrential flashfloods occurring in between long dry periods.<sup>278</sup> While recent studies have shown that the Nile benefitted from a higher average of floods in the imperial period before AD 150, the Eastern Desert was not affected by these changes: the majority of its drainage basins flow towards the Nile rather than the opposite.<sup>279</sup> Flashfloods drain water away rather than permit groundwater renewal. The Nubian groundwater aquifer, which nowadays is between 10 and 120 m thick, runs under the Eastern Desert and can still be

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<sup>276</sup> Baron and Hume 1902. The mountain range continues well into Sudan, and outside the provincial frontier of the Roman Empire.

<sup>277</sup> Vermeersch 1994.

<sup>278</sup> *Ibid.*

<sup>279</sup> McCormick 2013 on Nile floods; Monein 2005 on drainage basins in the Eastern Desert of Egypt.

reached at a depth of 4 to 40 m.<sup>280</sup> The presence of *hydreumata* (deep circular water-points) and wells throughout the Eastern Desert show that the groundwater was tapped into. Wells on the Myos Hormos route vary from 3 to 25-30 m in depth.<sup>281</sup> The developments of the Roman period were therefore not directly dependent on a Roman Climate Optimum, but on freshly tapped groundwater resources, even if in the long term groundwater recharge may have developed into a problem.

Literary sources, in particular Strabo and Aelius Aristides described the landscape in Roman times as waterless and parched: those crossing the desert, says Pliny, had no other choice than carrying their own water.<sup>282</sup> Pliny further adds that the hotness of the climate even prevented earlier travellers from crossing the desert by day.<sup>283</sup> These dry conditions may have hindered the possibility of sustained inhabitation. *Qalts*, geological depressions in the hard rock close to wadis sometimes retain water in quantities sufficient to swim in them,<sup>284</sup> and could be used as temporary way points to replenish water for people and animals. Yet transient and temporary use aside, these were by no means permanent resources to sustain long-term irrigation, and hence prevented the creation of long-term settlements. The roughness of the landscape and high mountain peaks implied that wadis were generally preferred as paths. But the location of sites and settlements

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<sup>280</sup> Monein 2005, 422.

<sup>281</sup> Reddé 2003, 40.

<sup>282</sup> Strabo, *Geography* 17.1.45; Aelius Aristides, *Egyptian Discourse* 36.32.

<sup>283</sup> Pliny, *Natural History* 6.26.104.

<sup>284</sup> Sidebotham 2003, 90-91 and fig. 9.5.

in the Eastern Desert of Egypt were generally dictated by their function rather than any climatic factor, and water brought to the site if needed.<sup>285</sup>

### 4.3 Pre-Roman Situation

Despite its climatic conditions, the Eastern Desert had a long history of periodic mining and quarrying. Yet habitation was transient rather than permanent. Galena, a lead sulfide mineral used for kohl, was exploited at Gabal al Zait in the northern area of the Eastern Desert by the second millennium BC.<sup>286</sup> In the Middle Kingdom, two expeditions to the Eastern Desert are known: one under Mentuhotep III (1957-1945 BC), and one under Mentuhotep IV (1945-1938 BC). Under Ramses IV, some 8368 men were tasked to haul the stones from the *bekhen* (basanite) quarries in the Wadi Hammamat back to the Nile Valley.<sup>287</sup> This expedition (1163-1156 BC) also coincides with the oldest known geological map, known as Turin Papyrus, in which an area of *c.* 75 km around the Wadi Hammamat is drawn along with the locations of gold and silver mountains.<sup>288</sup> The map also features a well or cistern, an indication that by the New Kingdom the water resources in the Eastern Desert were harnessed in order to exploit mineral resources. At Medinet Habu, the mortuary temple of Ramesses III, a relief

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<sup>285</sup> For example, *O.Claud.* 769-787 are lists of water distribution for individual quarry sites at Mons Claudianus, one of the Eastern Desert's main quarry areas: sites (see section 4.6) were chosen for the chromatic range requested for imperial project.

<sup>286</sup> Castel and Soukiassan 1989.

<sup>287</sup> Christophe 1949.

<sup>288</sup> Harrell and Brown 1992.

providing details on the origin of gold and silver sources counts the Eastern Desert amongst its districts.<sup>289</sup>

Although mineral exploitation was of clear interest in the Pharaonic period, passage through the desert for sea travel was also another element: Hatshepsut's (1473-1458 BC) Dayr al-Bahri temple relief and inscriptions provide the most detailed information on Pharaonic expeditions to the Land of Punt. These expeditions crossed the desert to reach the coast, where ships were preserved in narrow galleries, such as at Marsa Gawasis.<sup>290</sup> Early exploitation and travels were limited and occurred from the Nile to the coast with no apparent permanent settlements in the Eastern Desert itself. The harbours at Berenike and Myos Hormos were founded in the Ptolemaic period sometime in the third century BC. Strabo attributes the creation of Berenike to Ptolemy II Philadelphus (283/282-246 BC), who encouraged trade of ivory, elephants, and spices to the Horn of Africa and India.<sup>291</sup> These goods passed through the desert, and reached the Nile through Edfu (Apollonis Magna).<sup>292</sup>

In 150 BC, an interest-free loan informs us that five merchants were sailing to the land of Punt; hence travel and use of the area were not reserved to government officials as it had been in the Pharaonic period; by the Ptolemaic

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<sup>289</sup> Edgerton and Wilson 1936; Klemm and Klemm 1995.

<sup>290</sup> Bard and Fattovich 2007.

<sup>291</sup> Strabo, *Geography* 17.1.45. Pliny, *Natural History* 6.33.138 adds that the name Berenike was given in honour of his mother. Although Myos Hormos was functioning in the second century BC, its foundation date is unknown (Brun 2003b, 189). Peacock and Blue (Peacock and Blue 2006, 3) propose that Myos Hormos was probably found around c. 275 BC, at the same time as Berenike was founded.

<sup>292</sup> De Romanis 1996, 125. As pointed out by De Romanis on the basis of Ptolemaic inscriptions on the path to Edfu, Strabo's assertion that the path to Berenike went via Koptos in the Ptolemaic period is anachronistic.

period private merchants were now also allowed to cross the desert and sail for profit.<sup>293</sup> This was regulated by the state: merchants were taxed at a 25% - 50% tax rate.<sup>294</sup> An inscription from 130 BC gives further information on the administration of the Eastern Desert: Paos, *strategos* of the Thebaid region was in charge of both the exploitation of mineral resources of the Eastern Desert and the security of those who carried frankincense through the desert.<sup>295</sup> This corroborates with continued evidence for mining gold or quarrying for decorative stone in the Ptolemaic period.<sup>296</sup> By Strabo's time, so by the late first century BC, 120 ships were leaving for India from Myos Hormos alone, in contrast to the Ptolemaic period when only 20 did so.<sup>297</sup> Thus a system of government control of trade linked to the exploitation of mineral resources already existed in the Ptolemaic period, but the increased traffic, we will see, necessitated better infrastructure. The desert's richness in minerals and the paths to the coast were already known and used well before the Roman period. Both the state and private individuals were allowed to cross the desert in order to sail for profit. Following its conquest, Egypt came under Roman rule.<sup>298</sup>

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<sup>293</sup> Wilcken 1925; Pr aux 1978, 377-378; Sidebotham 2011, 34.

<sup>294</sup> Fraser 1972, 150; Sidebotham 2011, 34. Contrary to what Fraser thought, it is now generally accepted that the customs dues were not a discouragement to trade, but that the creation of a new state taxation system actively encouraged business ventures (Bowman 2010, 103).

<sup>295</sup> *I.Pan* 86. De Romanis 1996, 132-133.

<sup>296</sup> Klemm *et al.* 2001; Brun *et al.* 2013.

<sup>297</sup> Strabo, *Geography* 2.5.12.

<sup>298</sup> For Egypt under Roman rule, Bowman 1996b.

#### 4.4 Routes, networks and infrastructures

Patterns of usage of the Eastern Desert were already established in the pre-Roman period. In the Roman period, the choice of wadis used as paths to cross the Eastern Desert of Egypt (Fig. 4.2), mainly in the southern part of it, were further reduced whilst traffic increased.<sup>299</sup> The northern areas and the major stone quarries were reached from Qena, while trade passed via Koptos to reach the harbours of Myos Hormos and Berenike. Traffic on the northern paths were linked to imperial quarrying activities, and protected with individual forts at 25 km intervals. Forts were also associated with quarries and were equipped with substantial animal lines and stables which assisted transport logistics.<sup>300</sup> The southern path bifurcated at the oasis of Laqita (Phoenicon) to reach the harbour of Myos Hormos for the northern path, and Berenike for the southern one. In the Ptolemaic period, the harbour of Berenike had been reached from the city of Apollonis Magna / Edfu on the Nile, and the new path from Koptos meant a longer route for those wishing to reach Berenike. The choice of this over more efficient and shorter paths can only be explained by an institutional choice affecting network dynamics.<sup>301</sup> The state's initiative, control and management of movement through the Eastern Desert prevailed over the shortest geographic route, which was shut down. In the Ptolemaic period trade passed via Edfu, though this was no longer the case in the Roman period.<sup>302</sup> Recent excavations at Samut, a Ptolemaic fort and gold mine

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<sup>299</sup> For a general comment, see Gates-Foster 2012a on the paths and their continuous use throughout different historic periods.

<sup>300</sup> Maxfield 2001; Hirt 2010, 24.

<sup>301</sup> As seen in Chapter 2, Langton's model of ants and paths shaped by the collective assists in part as a heuristic device in order to explain the choice against the shortest path.

<sup>302</sup> Cuvigny 2011b, 4.

along the path to Edfu/Apollonis Magna have confirmed much the same: no Roman-period activity is recorded, at least not until the second half of the third century AD, after the general departure of the army from the Eastern Desert.<sup>303</sup> A flurry of graffiti in the Wadi Minayh (Figs. 4.4, 4.5 and 4.6) or at al-Buwayb point to the fact that the longer Berenike - Koptos itinerary was now in use, as early as 4 BC.<sup>304</sup> The facilities along the route were not optimal, and paths may not have been well marked. This, if we believe Strabo, would explain why early merchants had to rely on navigation by the stars in order to find their way through the desert,<sup>305</sup> something which the later, well-established paths with many landmarks must have rendered entirely obsolete. The use of rockshelters indicate that security and facilities for travellers were inadequate at this early date: they are usually small and hidden away (Figs. 4.4, 4.5 and 4.6). By AD 50, Pliny gives the impression that travels between Berenike and Koptos were now organised:<sup>306</sup>

“From Koptos the journey is made by camel, stations being arranged at intervals for the supply of fresh water. The first Hydreuma is twenty-two miles from Koptos; the second is on a mountain, one day's journey away; the third is at a second Hydreuma, eighty five miles from Koptos; the fourth is in the mountain; the next to that is at another Hydreuma, Apollonis, one hundred and eighty-four miles from Koptos; after which, there is another on a mountain. There is then another station at a place called the New Hydreuma, two hundred and thirty miles from Koptos. The next is called Old Hydreuma or the

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<sup>303</sup> Brun *et al.* 2013; J.P. Brun *pers. comm.*

<sup>304</sup> Bernand 1977, n. 64a and b.

<sup>305</sup> Strabo, *Geography* 17.1.45.

<sup>306</sup> Pliny, *Natural History* 6.26.102-104. “*a Copto camelis itur, aquationum ratione mansionibus dispositis: prima appellatur Hydreuma XXXII, secunda in monte diei itinere, tertia in altero Hydreumate a Copto LXXXV, deinde in monte; mox ad Hydreuma Apollinis a Copto CLXXXIII, rursus in monte; mox ad Novum Hydreuma a Copto CCXXXVI. est et aliud Hydreuma Vetus — Trogodyticum nominatur —, ubi praesidium excubat deverticulo duum milium; distat a Novo Hydreumate VII. inde Berenice oppidum, ubi portus Rubri maris, a Copto CCLVII p. sed quia maior pars itineris conficitur noctibus propter aestus et stativis dies absumuntur, totum a Copto Berenicem iter duodecimo die peragitur.*”

Troglodytic, here a fort holds watch by a place capable of having two thousand persons. It is seven miles from the New Hydreuma. After leaving it we come to the city of Berenike, harbour of the Red Sea, which is two hundred and fifty-seven miles away from Koptos. The greater part of this distance is generally travelled by night, on account of the extreme heat, the day being spent at the stations; it takes twelve days to perform the whole journey from Koptos to Berenike.”

Pliny does not give further details on the security or the organisation of the travels, yet the logistics alone provided greater safety from risk. In one instance however, Pliny refers to a *praesidium*, or fort, and hence a military presence, by a place capable of having 2,000 travellers stop.<sup>307</sup> In order to cope with large needs at specific times, cisterns to store the water from the wells had to be built. An inscription likely to be Augustan lists the names of soldiers involved in building cisterns (*lacci*) at Kompasi and Apollonos, so the state supplied a new form of support other than security: water.<sup>308</sup> Between 76/77 and 79/81 AD, the path to Berenike was further improved upon. The decision to build fortlets, or *praesidia*, along with wells is attested by dated dedications at Didymoi, Aphrodites and Sikayt,<sup>309</sup> and clarifies why Pliny had not mentioned these stops. These fortlets were accompanied by wells, and substantial cisterns; at the time of Pliny's description, only five wells were found along the journey to Berenike. The emphasis of the dedications is on water and security, as exemplified in the dedication at Sikayt:

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<sup>307</sup> Pliny, *Natural History* 6.26.103.

<sup>308</sup> *ILS* 2483; De Romanis 1996, 219-224; Bagnall *et al.* 2001; Cuvigny 2011b, 5. The list of soldiers is followed by the mention "*Per eosdem qui supra scripti sunt / lacci edificati et dedicati sunt: Apollonos hydreuma VII k. Ianuar. / Compasi k. Augustis / Berenicide XVIII k. Ianuar. Myoshormi idus Ianuar / castram (sic) aedificaverunt et refecerunt.*"

<sup>309</sup> Bagnall *et al.* 2001; Brun *et al.* 2011; *I.Did.I.*

In the 9th year of Imperator  
Caesar Augustus Vespasianus  
L. Iulius Ursus, prefect of Egypt returning from  
Berenike, gave instructions for a well to be sought in this place  
When it had been found, he ordered a fort and  
cisterns to be constructed under the direction of his agent  
M. Trebonius Valens, prefect of the desert region  
of Berenike<sup>310</sup>

At Didymoi (Fig. 4.7), the fort was originally constructed with two internal cisterns. By the last decade of the first century AD, two additional cisterns were built, in AD 88-92, and after 96 AD, more than tripling the total capacity of water,<sup>311</sup> which could be either used by the army or sold to caravans.

Indeed, we now know that the water provisions at the fort were not for the military alone, but that it was sold to transporters and commuters to the Red Sea: a recently discovered ostrakon at the fort of Xeron has a narrative describing a journey between Koptos and Berenike, and supplies specific information about water for sale at each of the forts along the route.<sup>312</sup> Would additional cisterns have been constructed not only for increased traffic, but so that the sale of water at each of the forts would have partially subsidised military infrastructure and presence in the Eastern Desert? The embeddedness of military activity, imperial interests and trade usually renders sharp distinctions difficult to make, but the evidence presented is clear; water from the military forts was sold to private individuals.

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<sup>310</sup> Transl. Bagnall *et al.* 2001, 326: "*Anno (leaf) VIII (leaf) Imp(eratoris) / Caesar(is) Aug(usti) Vespasiani / L. Iulius Ursus pr(aefectus) Aegy(pti) vac. rediens a / Bernic(ide) hoc vac. loco vac. ydreuma vac. quaeri praecepit / hoc cum esset vac. Inventum vac. praesidium et / lacum aedificari iussit cura(m) agente / M.Trebonio Valente vac. pr(aefecto) mont<i>s / Bernicidis.*"

<sup>311</sup> Brun and Reddé 2011, 23 and 43. The cisterns could now hold 380 m<sup>3</sup> of water ( 380,000 l) instead of 120 m<sup>3</sup>. At Iovis (Dios), the external 50 cm-high trough measures 7 m by 2m, which implies that it could hold some 7,000 l of water for animals at a single time (E. Botte, *pers. comm.*).

<sup>312</sup> *O.Xeron* 995; Cuvigny and Bülow-Jacobsen 2013, 38. The ostrakon remains to be published in detail.

These forts with their wells dramatically eased movement across the desert by providing security and water to traders along the way. Increased water resources meant a significant reduction in transport costs through the desert since the weight and space needed for water along the journey could now be allocated to more goods. Travel no longer occurred with the help of the stars: forts and wells regulated the established paths and served as fixed and regular markers in the landscape. The following table provides a summary of forts and water stations given by Pliny, the Antonine Itinerary and the Peutinger table, along with a synopsis of the situation shortly after the AD 77 campaign, such as known from the dedications mentioned above.<sup>313</sup> Other forts were built subsequent to the AD 76/77 campaign. Dios for example, which is indicated on the Antonine Itinerary compiled in the late second-early third century AD, was dedicated in AD 115.

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<sup>313</sup> The forts had certainly slightly different frequencies of usage and different chronologies of renovations over time. At Didymoi, for example both the stratigraphy and the ostraca point to a hiatus between *c.* AD 150 and AD 176/177 when the fort was reconstructed (Cuvigny 2012b, 2).

Pliny, <i>Natural History</i> 6.26.102-103	Vespasian (post AD 77)	Antonine Itinerary	Peutinger Table
Koptos	Koptos	Koptos	Cenoboscio
1. Hydreuma	1. Aphrodites	1. Poeniconon	1. Diospoli
2. Hydreuma (Kompasi?)	2. Kompasi	2. Dydime	2. Phenike
3. Apollonis Hydreuma	3. Didymoi	3. Afrodito	4. Dydymos
4. Novum Hydreuma	4. Xeron	4. Kompasi	5. Affrodites
5. Hydreuma Vetus	5. Apollonis Hydreuma	5. Iovis (Dios)	6. Conpasari
Berenike	6. Novum Hydreuma	6. Aristonis	7. Dios
	7. Hydreuma Vetus	7. Falacro	8. Xeron
	Berenike	8. Apollonos	9. Philacon
		9. Cabalsi	10. Apollonos
		Berenike	11. Cabau
			12. Cennonydroma
			Berenike

Table 4.1: Increasing number of stations for water and forts over time along the Koptos-Berenike route according to literary sources, and the archaeological situation under Vespasian (left to right).

The military presence along the route from Koptos to Myos Hormos has been studied in depth.<sup>314</sup> We see a clear increased presence of the military as the representative of the state in the Eastern Desert, and the army clearly oversaw security issues along the route to the harbours of Berenike and Myos Hormos.

The Koptos Tariff of AD 90, dating to after the forts and new cisterns enhanced the routes to Myos Hormos and Berenike, provides further information about new regulations for the paths across the desert. Movement across the desert was not only established and controlled by the military, a new range of people and items

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<sup>314</sup> Zitterkopf and Sidebotham 1989; Cuvigny 2003; Cuvigny 2005; Cuvigny 2011; Cuvigny 2012a.

were now taxed as well in order to subsidise the local infrastructure. The Tariff lists taxes for entering the desert according to professions, materials or animals:<sup>315</sup>

“From the precept of... how much is payable for the duties owing to the *arabarch* of Koptos, according to the judgment he has written on this stele by Lucius Antistius Asiaticus, prefect of Mount Berenike:  
for a helmsman of the Red Sea, eight drachmae;  
a ship’s lookout, ten drachmae  
a guard, five drachmae  
a sailor, five drachmae  
a shipbuilder’s servant, five drachmae  
an artisan, eight drachmae  
prostitutes, one hundred and eight drachmae  
women arriving by ship, twenty drachmae  
women of the soldiers, twenty drachmae  
a ticket for camels, one obol  
a seal for a ticket, two obols  
per outward journey for each ticket of a man going up, four drachmae  
all women going up, four drachmae  
an ass, two obols;  
a covered wagon, four drachmae  
a mast, twenty drachmae;  
a funeral procession going up and down, one drachma four obols

As the list shows, not all were taxed: military, transport personnel, traders or locals are not mentioned, an indication that the Koptos Tariff was an addition to another set of taxes that concerned merchants or others using the paths. Those who did were guards, sailors, boat captains, women and prostitutes, hence both people who were previously not using the paths and those who were not previously taxed. Their presence is a reflection of the growth of the ports on the coast and the increase in ships sailing to t

he East. Rates of pay were probably according to time spent in the desert or benefits expected, and could reach substantial sums: in contrast to the five to ten drachmae men had to pay to enter the desert, prostitutes were taxed at 108 drachmae per entrance, so more than twice what a civilian at the Mons Claudianus

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<sup>315</sup> *OGIS* 674 = *IGR* 1183; Bernand 1984, n. 67; Cuvigny 2003, 273-274 and 374-375; transl. Young 2001, 49-50.

quarry was paid in a single month.<sup>316</sup> As we know from the ostraca, prostitutes remained in the desert for several months at a time in order to make sufficient profit after paying the entrance tax.<sup>317</sup> Could the Koptos Tariff represent a means of supporting the maintenance cost of the new road infrastructure by taxing the increasing number of people passing through the desert for reasons other than trade? Control of the movement in and out of the desert and the adequate payment of taxes would have been further aided by the switch to a single entrance via Koptos.

Only one further path was added later on in the period examined. The *Via Hadriana*, undertaken in the second century AD would have facilitated movement along the coast and between the harbours of Myos Hormos and Berenike. The path had to be entirely cleared from rocks and new watering facilities as well as resting houses were set up.<sup>318</sup> The structures and facilities meant for coping with the environment, be it climate or security, were entirely paid for by the state and set up by the military. This state-led development was concerned with enhancing revivalling points and security in the Eastern Desert, thus the network of infrastructure which regulated the passage through the desert. Yet routes and access were militarised and the movement across the landscape entirely controlled by the state.

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<sup>316</sup> Cuvigny 1996, 144.

<sup>317</sup> *O.Did.* 411 for example is from a pimp complaining that he made the mistake of sending a girl to Didymoi for 60 drachmae, before he received a better offer of 88 drachmae (Cuvigny 2003, 388). Prostitutes were sometimes hired on a monthly basis, with soldiers pooling money to do so (Cuvigny 2003, 383 and 388).

<sup>318</sup> *IGR* 1.1142; Sidebotham *et al.* 2000.

## 4.5 Organisation of trade

In contrast to Fazzan, ostraca and graffiti found in rockshelters provide considerable information about the social networks of the Indo-Roman trade via the Eastern Desert, which even involved the highest levels of Roman society. Ostraca show that even the emperor and his entourage were indirectly engaged or profiting from the Indian Ocean trade through their slaves. Several ostraca from Berenike dated between AD 40-45 and AD 70, for example, refer to the travels to Berenike of Epaphrodeitos and his contractors, while he always identified himself as belonging to the wider *familia caesaris*, as “slave of Aeimnestos slave of Caesar.”<sup>319</sup>

Amongst the graffiti are also the names of members, or slaves, of prominent Italian families from the Bay of Naples or the vicinity of Rome. The Peticii, from the famous wine-producing area of Minturnae in Campania, handled long-distance commerce with North Africa, as well as trade with India via the Red Sea and the Eastern Desert of Egypt.<sup>320</sup> The name of Gaius Peticius is known from a graffito from a sanctuary of Pan in the Wadi Hammamat, on the Koptos - Myos Hormos road to the Red Sea, where the majority of graffiti date between AD 9 and AD 238.<sup>321</sup>

The Annii family was similarly well connected and had considerable interests in the Indian Ocean trade. A Lysas, slave of Annius Plocamus, is known from a graffito dated to AD 6 amongst those found in a cave shelter at Wadi

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<sup>319</sup> Bagnall *et al.* 2000: *O.Berenike* 84-88; see also Bowman 2010, 106; and esp. Nappo and Zerbini 2011. Another example is that of Zethos, slave of Tratos, slave of Caesar (*O.Berenike* 106).

<sup>320</sup> Tchernia 1992, 296.

<sup>321</sup> *Koptos à Kosseir* 121; Tchernia 1992, 298-300.

Minayh (Fig. 4.4),<sup>322</sup> and could be the same Lysas whom Pliny mentions being blown off course to Sri Lanka in the course of a sailing voyage to India.<sup>323</sup> The family was sufficiently wealthy to build the basilica Anniana in Puteoli in the last quarter of the second century AD, we hear of a meeting in the *curia basilicae Augusti Annianae*.<sup>324</sup>

The Calpurnii can be associated with a particular niche market within the Indian Ocean and Red Sea trade, the pearl industry. Several Calpurnii are known to have been involved in maritime trade, as for example L. Calpurnius Capitolinus, who built the Capitoline temple which is still standing in Puteoli. Eastern Mediterranean traders, in particular from Alexandria, Asia Minor and Syria, dedicated a statue to Capitolinus in Puteoli, along with one for his brother C. Calpurnius.<sup>325</sup> Tantalisingly, the name of Laudanes, slave of Calpurnius Moschas, is also found amongst graffiti carved in the *paneion* in the Wadi Minayh in the Eastern Desert, on the Koptos - Berenike road.<sup>326</sup> Laudanes was supervising the transport of luxury goods, which may have included items such as pearls. At Rome, most pearl sellers known to us were located on the Via Sacra, with a *margaritarius* also attested in the *Velabrum*, perhaps by the Porticus

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<sup>322</sup> *Pan du désert* 65.

<sup>323</sup> Pliny, *Natural History* 6.4; Tchernia 2011, 62-63.

<sup>324</sup> Pliny, *Natural History* 6.84; D'Arms 1974, 107-108; De Romanis 1996, 247-250; Tchernia 2011, 63. Annii in Puteolan inscriptions: *CIL* 10.1782 and 1784; in the Sulpicii archive: *TPSulp.* 46, 53, 57, 121.

<sup>325</sup> *CIL* 10.1797; Gianfrotta 2008, 74-75; Tchernia 2011, 64.

<sup>326</sup> Gianfrotta 2008, 75.

Margaritaria,<sup>327</sup> but more to the point, several Calpurnii are known on the Via Sacra: L. Calpurnius Antiochus, L. Calpurnius Rufus, and L. Calpurnius Strato.<sup>328</sup>

Could the Calpurnii pearl traders have had a competitive advantage or larger margin of profit, as slaves of members of the wider family were engaged in obtaining goods such as pearls from their source of origin? Admittedly, there is no direct evidence that proves this was necessarily the case, but familial networks implying trust and social ties offered a lessened risk. If the wider family integrated to a certain degree its activities of transport and sale to individuals (a process known as vertical integration), this could have reduced transaction costs, and provided a competitive advantage for all members of the family.

We can trace familial networks of merchants implicated in the Indo-Roman and the Eastern Mediterranean commerce. In the case of the Calpurnii, the family network or business is attested at every stage of the chain: the agents of the Calpurnii are known from the Wadi Minayh on the route to Berenike, while the family is attested at the ports of Naples, Puteoli, Ostia/Portus, and on the Via Sacra in Rome. This may suggest vertical integration and a particular interest in the pearl business by the Calpurnii, although it is likely that this was just one interest within a larger trading and investment portfolio.<sup>329</sup>

The majority of evidence for the social network and the activities of Italian families dates to the first half of the first century AD. The harbours of Berenike and Myos Hormos, however, flourished into the second century AD as well. By

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<sup>327</sup> Monteix 2013; Papi 2002.

<sup>328</sup> *CIL* 6.33872; *CIL* 6.37804; *CIL* 6.9545-9549; *CIL* 10.6492. Rome also served as an important centre of redistribution for the empire, and the retail trade in pearls from Rome to other cities is mentioned in an inscription in Aquileia in which the retailer specifies that he is “*negotiator margaritarius ab Roma*” (*ILS* 7603).

<sup>329</sup> On vertical integration in the Roman world, Silver 2009 and Broekaert 2012.

this time, there is also evidence of Palmyrene merchants and *naukleroi* on the Red Sea and the Nile, which may indicate some shifting in the networks of economic power and influence in the Eastern Desert. This will be examined in more detail in the following chapter.

These commercial enterprises required substantial local logistics, a wide network of financial backing and the control of local movement of goods via an agent. The second-century AD Muziris papyrus (named after Muziris, the Indian port the vessel was going to), which discusses a cargo worth *c.* seven million sesterces, suggests a trading investment which only the wealthiest could afford.<sup>330</sup> Recent recalculations for the cargo of the Hermapollon have estimated that the total weight of the cargo must have been at least 625 tons.<sup>331</sup>

On a logistical level, the size of the ship's cargo implied considerable traffic through the desert. We can estimate, on the basis of loads that camels and donkeys generally carry, that some 8,000 - 8,500 donkey- or 3,000 - 3,500 camel-trips had to make the journey to Berenike and back again only to offload the cargo of this particular ship (independently from loading).<sup>332</sup> As both donkeys and camels were used, the number of animals carrying goods through the desert obviously lies somewhere in between. This was just for one ship and the greatly increased numbers of ships to the East would have resulted in many more animals

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<sup>330</sup> Rathbone 2000, Tchernia 2011, 15, and 302 footnote 32 for the more recent bibliography on *P. Vienna G 40822* (SB XVIII 13167).

<sup>331</sup> De Romanis 2012, 89.

<sup>332</sup> 8,333 donkeys or 3,188 camels to be exact if we use 195 kg for camel loads: Adams 2007, 82; 75 kg for donkeys (Lytle 2010, 273, n.72). In India, donkeys often carry twice the legal limit (50 kg). (<http://www.animalaidunlimited.com/programs/donkeys/>) (last consulted: january 5<sup>th</sup> 2014); Adams 2007, 58 suggesting 150 kg seems too high; Maxfield's 45 kg seems low (Maxfield 2001, 159). Sidebotham cites 70-90 kg for a donkey (Sidebotham 2011, 91).

and people on the route through the desert. The increased presence of the state, via the army, must have been linked to increased commerce, but also the need to oversee the intense traffic, with the purpose of reducing the possibilities of violence, friction, predation and any other incidents.<sup>333</sup>

Trade via the Eastern Desert also had to pass through established paths for a specific reason: state taxation on foreign imports. The Muziris papyrus shows that not only private individuals benefitted from trade, so did the State: the papyrus mentions that a 25% tax (*tetarte*) was levied in kind on all Indian Ocean goods.<sup>334</sup> The tax was probably farmed on behalf of the state, by tax collectors such as Annius Plocamus, of whom Pliny also says that he had bought the vectigal of the Red Sea from the *fiscus*.<sup>335</sup> The analysis of ostraca also shows that a *quintanensis*, a customs officer, delivered *laissez-passer* documents at the customs gate at Berenike on the Red Sea.<sup>336</sup> Control of the goods travelling via the desert were therefore tightly controlled by state officials.

#### 4.6 Extractive industries

Rome's interest in the Eastern Desert led to the assimilation of the Ptolemaic sites, a pattern reminiscent of what happened in other ore-rich regions, such as the Northwestern Iberian Peninsula and in Britain, where, for example, the

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<sup>333</sup> De Romanis 2002.

<sup>334</sup> Rathbone 2001.

<sup>335</sup> Pliny, *Natural History* 6.24.84 “[...] *Anni Plocami, qui Maris Rubri vectigal a fisco redemerat*[...]”

<sup>336</sup> Nappo and Zerbini 2011.

gold mining districts were swiftly taken under Roman control and worked.<sup>337</sup> Two inscriptions refer to the extractive industries of the Eastern Desert overall in the early Roman period.<sup>338</sup> The first inscription, from the Wadi Semna, is dated to the fortieth year of Augustus (AD 11).<sup>339</sup> It mentions Publius Juventus Rufus as being in charge of all the quarries and mines of the regions, including emerald and topaz, and also pearls, by which it must mean the pearl fisheries. Another inscription, from Wadi Hammamat and dated to the fifth year of Tiberius' reign (AD 18-19), also mentions Publius Juventus Rufus as the person in charge of emerald and topaz mining, as well as pearls and all quarries of Egypt.<sup>340</sup> The exact nature and types of extractive industries in the Eastern Desert as implied by the inscriptions, however, leave room for debate: the term *metalla* is commonly used in the Roman world for mines and quarries, though it has been suggested that the term *latomoi* used in place of *metalla* in the second inscription is meant to specify stone quarries specifically.<sup>341</sup> I will first examine the evidence for decorative stone, and then turn to the other minerals which were exploited in the Eastern Desert.

#### *Quarrying for decorative stone*

Quarrying for stones has a long tradition in Egypt, dating back to Pharaonic time, and many areas were exploited for colour and stone in Egypt (Fig. 4.8). From the early Roman Empire onwards, coloured decorative stone and

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<sup>337</sup> Lewis and Jones 1970 for Northwest Spain; Jones 1980; Wilson 2007, 109-113 for an overview of sources of gold, Britain and export of innovations from Spain to Britain.

<sup>338</sup> On the specific title ἐπίτροπος τῶν μετάλλων / *procurator metallorum* which is only recorded in these two inscriptions, Hirt 2010, 109-112.

<sup>339</sup> *I.Pan* 51.

<sup>340</sup> *Koptos à Kosseir* 41. Also Hirt 2010, 109-113.

<sup>341</sup> Hirt 2010, 111.

marble became a *sine qua non* status symbol. Used in big architectural projects, it was almost an essential element of any imperial building. Different types of decorative stones and marbles were imported into Rome from a wide variety of quarries in the empire.<sup>342</sup> But the most exotic, and therefore expensive, decorative stones came from quarries in the Eastern Desert of Egypt and represented a strong statement of political power at Rome. Greywacke, or *bekhen*, from the Wadi Hammamat quarries had been reserved for pharaohs and divinities and for the dynastic portraiture of the Ptolemies, and was used for imperial portraiture early on.<sup>343</sup> Augustan examples of *bekhen* sculpture include a portrait of a Julio-Claudian prince identified as Gaius Caesar, the son of Agrippa and Julia, adopted by Augustus in 17 BC (Fig. 4.9).<sup>344</sup> These were strong visual and institutional reminders of the fact that Egypt was now imperial-owned and part of the Roman Empire.

As early as Augustus, the prospection and opening of new quarries equated to the creation of signature imperial 'marbles': the *Augusteum*, the *Tibereum* and the granite from Mons Claudianus, which in all likelihood began being quarried under Claudius,<sup>345</sup> were the property of the emperors. The colour of these granodiorites, which come in variations of mottled black and white, was distinct from the *bekhen* and came to be used in imperial architecture as the visual

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<sup>342</sup> On quarries and stone transport in the Roman world in general, Russell 2013.

<sup>343</sup> Lucas and Rowe 1938; Pergola 2002.

<sup>344</sup> De Nuccio and Ungaro 2002, n. 20.

<sup>345</sup> Pliny, *Natural History* 36.55; Fant 1993, 150; Peacock 1997; Hirt 2010, 12. Geologically speaking, these 'marbles' consist of a variety of hardstones (*E.g.* Mons Claudianus: Tonalite Gneiss; Mons Porphyrites: Andesite / dacite porphyry; Umm Balad: Quartz diorite); the Romans did not differentiate and used the term *marmor* for any stone that could take a polish (Dodge and Ward-Perkins 1992, 13). Colours for decorative stones are generally referred to by the names given by Italian stonecutters and I will be following this tradition when referring to colour.

representation of the imperial institution. A number of new sites were quarried, opened or scouted for: an inscription at one of the northernmost quarry sites from Mons Porphyrites records its successful discovery in AD 18 by a prospector named Gaius Cominius Leugas, and provides the earliest epigraphic date for quarrying in the Eastern Desert after the formation of the new imperial province. The black porphyry stele (Fig. 4.10) bears the dedication of a *temenos* to Pan and Serapis by Leugas after the discovery of several different types of stone types, ranging from black porphyry to polychrome stone in the Mons Porphyrites area.<sup>346</sup> Often minor sites were quarried for their varieties of colours, and workers migrated from sites accordingly. An ostrakon of unknown date, for example, carried the request of a certain Ischyras to another worker, asking him to come immediately with tools since he had found a stone which had to be exploited "for their interest and that of the *curator*."<sup>347</sup> Overall, at least seventeen different main quarry sites located within 50 km of each other, and sometimes producing veins with different colours, were used in the three centuries examined (Fig. 4.11):

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<sup>346</sup> Rengen 1995; Lazzarini 2004, 84.

<sup>347</sup> *O.K.551* discussed in Cuvigny 2003b, 372.

	<b>Quarry or location</b>	<b>Main type of stone</b>
1	Badia	Black and white granite
2	Bir Umm Fawakhir	Black and white granite
3	Mons Claudianus	Black and white granite
4	Wadi Abu Maamal	Black and white granite
5	Wadi Barud	Black and white granite
6	Wadi Fatiri al-Bayda	Black and white granite
7	Wadi Maghrabiya	Black and white granite
8	Wadi Qattar	Black and white granite
9	Wadi Umm Balad	Black and white granite
10	Wadi Umm Huyut	Black and white granite
11	Wadi Umm Saghilat	Black and white granite
12	Wadi Hammamat	Bekhen (basanites) (green/metal)
13	Wadi Umm Ash	Green serpentinite
14	Mons Porphyrites	Red, pink, green porphyry
15	Wadi Abu Garida	Red porphyry (variety)
16	Wadi Umm Sidri	Red porphyry (variety)
17	Wadi Umm Towat	Black and white porphyry

Table 4.2. Decorative stones quarried in Roman times in the Eastern desert (After Harrell and Storemyr 2009).

Mons Claudianus's quarry was the largest of the quarries with at least 130 individual quarrying locations.<sup>348</sup> Its granite is associated with imperial building activity at Rome, especially in the second century AD.<sup>349</sup> The extensive quarries at Mons Claudianus perhaps produced between 400 and 500 columns over two to three centuries, and employed at least a thousand people.<sup>350</sup> The columns at Mons Claudianus revealed that the workers knew the requirements of specific imperial

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<sup>348</sup> Maxfield 2001, 155.

<sup>349</sup> esp. Hirt 2010 for the administration of these imperial quarries.

<sup>350</sup> *Ibid.*, 178. This broadly matches the 300 columns from Mons Claudianus that I was able to trace (297, based on numbers given by Röder 1992 and Peacock *et al.* 1994. Table 7.3 in Maxfield 2001 suggests many more, but no numbers are given). Concerning population estimates, an ostrakon at Mons Claudianus lists 917 people receiving water (Maxfield 1997, 122-134).

orders in advance, and were carved accordingly.<sup>351</sup> Columns, and other objects such as bathtubs and basins, were dressed on-site to reduce their weight and facilitate their transport.<sup>352</sup> Mons Porphyrites, the other substantial imperial quarry, equally began operating in the early first century AD. It remained small-scale in its early phases until the late to mid-second century AD when a fort and further buildings were added, and experienced a peak of activities in the second to early third century AD.<sup>353</sup>

Other quarry sites produced columns that were mostly of smaller size and probably meant for decoration, such as Wadi Barud's *granito bianco e nero* or of *Breccia Verde d'Egitto* (Wadi Hammamat) found in Rome,<sup>354</sup> thus testifying to the smaller quarries' role in producing rare and fine elements for architectural use. From the lesser known quarries, the Wadi Atalla dog (from a site near Umm Ash) (Fig. 4.11) remains the most striking example of where the colour and texture of the stone imitate the animal's fur and illustrates the search and exploitation of these rich polychrome sources which became the esthetic standards of the time. Veneers from the Eastern Desert were used for the floors of the Domus Tiberiana,<sup>355</sup> as well as in the *curia senatus* (porphyry), and were likely to be used on other imperial building projects, especially baths.<sup>356</sup> In Pompeii several decorative stones from smaller quarries have been identified: the Wadi Barud variety was found in the Terme del Sarno at Pompeii, Umm Ash type in a tavern

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<sup>351</sup> Peacock and Maxfield 1997, 213.

<sup>352</sup> Maxfield 2001, 155.

<sup>353</sup> Maxfield and Peacock 2007, 414-424.

<sup>354</sup> De Nuccio and Ungaro 2002, n.110 and 113. For the Italian name for colour and type, see footnote 336.

<sup>355</sup> Maxfield 2001, 148.

<sup>356</sup> Corcoran and DeLaine 1994, 269.

on the via Stabiana, and Wadi Maghrabya on the pavement of the house of *M. Fabius Rufus*.<sup>357</sup> That these stones were sold for private use is difficult to establish based on these cases. The aforementioned locations were all probably built after the earthquake of AD 62 and might have been constructed re-using material coming from an imperial building. The identification of these decorative stone types in Pompeii, however, allows us to date these quarries with greater precision, since they must have been in operation before AD 79, and probably before the AD 62 earthquake.

Most quarrying areas were a considerable distance from the Nile, *c.* 150 km in some instances. The Eastern Desert quarries were the second remotest from water-borne transport after Docimium in Anatolia, which lies some 220 km from the sea, but which was also an imperial quarry.<sup>358</sup> Yet the Eastern Desert was the most difficult area to extract stone from, given the difficulty of transporting stone to the Nile, and the climate. As pointed out by Russell, the Eastern Desert quarries were exceptional and ‘anomalies’ as most quarries were generally within a 25 km reach of the Mediterranean sea or rivers, or else were meant for a local urban market.<sup>359</sup> The high transport costs resulted in high prices for the end products: the decorative stones from the Eastern Desert quarries were the most expensive ones in the Roman Empire,<sup>360</sup> due in part to the quarrying and transport logistics. But imperial demand here alters expected distribution/transport cost model: imperial control over the Eastern Desert quarries significantly lessened the cost of shipment and transport since the imperial bureaucracy could requisition transport,

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<sup>357</sup> Lazzarini and Cancelliere 1999.

<sup>358</sup> On the economics and regional differences in stone trade, see esp. Russell 2013.

<sup>359</sup> Russell 2013, 80-81.

<sup>360</sup> Corcoran and DeLaine 1994, 267.

but this still left the wages for workers and overseers as the main overhead.<sup>361</sup> Imperial demand simply took precedence over remaining costs.

Following from the early period in which Publius Rufus was named in charge of all extractive industries, the organisation of quarries fell under the responsibility of a *procurator metallorum*.<sup>362</sup> The internal organisation of wages was arranged by *tabularii*,<sup>363</sup> the food administration by a *centurio frumentarius*.<sup>364</sup> At Hermoupolis Magna, on the Nile, an inscription on an architrave informs us of the existence of a *hospitium tabulariorum Porphyritis et aliorum metallorum*, used by administrators of the Mons Porphyrites and Mons Claudianus quarries, and perhaps also gem and gold mining sites.<sup>365</sup> At Isola Sacra (Ostia), the *Ratio Marmorum* or imperial marble bureau counted the following amongst its imports: *marmor claudianum, marmor porphyrites, lapis basanites* (Wadi Hammamat),<sup>366</sup> and it is from there presumably, that the marbles made their final way to the building site.

For the quarries themselves, certain ostraca contain dated lists of specialists sent to individual quarry locations, and give an impression of the intrinsic organisation of the quarry.<sup>367</sup> Quarry sites were scattered and so required

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<sup>361</sup> Peña 1989. Cuvigny 1996, 144 for wages at Mons Claudianus.

<sup>362</sup> Hirt 2010, 108. At least four quarrying district (Mons Claudianus Tiberiane, Mons Porphyrites, and Mons Ophiates can be shown to have been under the responsibility of Chresimus, *procurator metallorum* and *libertus augusti*.

<sup>363</sup> Cockle 1996; Maxfield 2001, 153.

<sup>364</sup> Cockle 1996; Maxfield 2001. These functions are known elsewhere in the empire: a *centurio* was present at the marble quarries at Carrara and *tabularii* at the Dacian mines.

<sup>365</sup> Cockle 1996, 26. The architrave also has the individual names of people that used the *hospitium*, such as one Diadumenus.

<sup>366</sup> Fant 1993, 163-167.

<sup>367</sup> *O.Claud.* 731-748 concern the deployment of personnel to specific quarries for example.

a high level of organisation to fully exploit them, and required specialisation.<sup>368</sup> The ordinary workers are not part of the work lists - only specialists and overseers are mentioned - implying that the team numbers (and hence population) at any time at Mons Claudianus were substantially higher. While most workers were sent in as teams on a single site, prospectors, engineers, and workers travelled between sites according to current needs. Although we hear of Jewish prisoners sent by Titus to the quarry sites in AD 70,<sup>369</sup> the ostraca make it very clear that the work force was on the whole both specialised and paid.<sup>370</sup>

Sites were in use year-round: ostraca point to continual inhabitation, while papyri indicate seasonal transport that made effective use of the appropriate climate for long-distance travel. Seasonality is important for the effective use of desert landscapes, especially for long-distance travel, when bearable temperatures and water availability become decisive factors. The transport of large columns demanded considerable administration and requisitions of animals.<sup>371</sup> The transport of the 50-foot column mentioned in *P.Giss.69* necessitated some 110 camels or 220 mules,<sup>372</sup> and large quantities of food and fodder for the animals.<sup>373</sup> A well-developed organisation and networks of communications and supplies

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<sup>368</sup> See esp. Bülow-Jacobsen 2009, 11-14.

<sup>369</sup> Josephus, *Jewish War* 6.418. The situation seems to change past the third century AD with an influx of condemned workers: Eusebius of Caesarea (end of the third to early fourth centuries AD) comments on the condemnation of Christians specifically to the porphyry quarries in the Thebaid. Similarly Athanasius, writing in AD 357, mentions the condemnation to this area of 26 bishops, 2 presbyters and 40 laymen.

<sup>370</sup> Cf. Cuvigny 2000 on workers, members of the *familia Caesaris* and advance payments; Bülow-Jacobsen 2009 on specialists in the quarries.

<sup>371</sup> Peña 1989 on the transport of columns and food requisitions.

<sup>372</sup> Maxfield 2001, 159.

<sup>373</sup> *P.Giss. 69* for example records a request for barley by the *strategos* of Heptakomia for the transport of a fifty-foot column (Peña 1989, 127).

were established in the Eastern Desert, in order to cope with the large orders meant for imperial projects.

### *Mining ores*

Quarrying for decorative stone was not the only extractive industry in the Eastern Desert of Egypt. Ores, in particular copper, gold, galena and lead were mined in the Eastern Desert and possibly since the fourth millennium BC, in particular along the northern edges of the Eastern Desert mountain ranges.<sup>374</sup> Gold seems to have been one of the Eastern Desert's most sought-after minerals from earliest times.<sup>375</sup> So far, some two hundred and fifty sites and ancient gold-working settlements have been recorded in the Eastern Desert (Fig 4.13).<sup>376</sup> Mining for precious ores is thought to have been initially sporadic, but seems to have intensified during the New Kingdom, and again in the Ptolemaic period.<sup>377</sup> Roman period mining, however, is rarely discussed in a comprehensive manner, and is thought by non-Roman specialists to have been reduced 'almost to zero' in the Roman period.<sup>378</sup> No excavations or surveys have so far produced better dates for the potential Roman sites mentioned by early explorers, but a few preliminary remarks can be made about gold mining during the empire.<sup>379</sup>

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<sup>374</sup> Castel and Soukiassian 1989; Pouit and Castel 1999, 131.

<sup>375</sup> Klemm and Klemm 1989; Klemm and Klemm 1994; Klemm and Klemm 1998; Klemm *et al.* 2001; Klemm and Klemm 2002.

<sup>376</sup> Klemm *et al.* 2001, 643.

<sup>377</sup> Klemm *et al.* 2001.

<sup>378</sup> Klemm *et al.* 2001, 656.

<sup>379</sup> Tregenza 1955; Meredith 1958. Documenting gold mining sites can be a hazard to the site themselves: the 2012-2014 surveys at the Ptolemaic gold-mining site at Samut have also resulted in Bedouins appearing with bulldozers, weapons and metal detectors, and destroying the site.

Two types of mining occurred in the Eastern Desert. Probably the earliest method was the exploitation of the gold found in alluvial deposits in the many wadis of the Eastern Desert.<sup>380</sup> The later, more labour-intensive, way involved following the gold-bearing veins into the hills, either by open cast or by digging underground galleries that followed the mother lode (main gold vein) and minimised the time spent removing the overburden. This method, however, required skills and a greater organisation of the workforce. Diodorus Siculus, who uses Agatharchides of Cnidos as his source for the Eastern Desert of Egypt, describes forced labour.<sup>381</sup> As it refers to gold mines of the second century BC, it cannot realistically serve to describe Roman-period activity.<sup>382</sup> These sources of gold, were, according to Agatharchides of Cnidos, easier to mine than veins in other gold mining districts outside Egypt, as the gold could be picked apart from its surrounding granitic or quartzite rock:

"The gold-bearing earth which is hardest they first burn with a hot fire, and when they have crumbled it...they continue the working of it by hand; and the soft rock which can yield to moderate effort is crushed with a sledge by myriads of unfortunate wretches. And the entire operations are in charge of a skilled worker who distinguishes the stone and points it out to the labourers: [...] the physically strongest break the quartz-rock with iron hammers, applying no skill to the task, but only force."<sup>383</sup>

The introduction of the rotary hand mill to crush gold has been attributed to a change in technology in the Roman-period,<sup>384</sup> although newer technologies such as ore-stamps and water-lifting devices did not appear at larger gold mining sites.<sup>385</sup>

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<sup>380</sup> Klemm *et al.* 2001.

<sup>381</sup> Diodorus Siculus, *Bibliotheca Historica* 3.12-14.

<sup>382</sup> Gustafson 1994.

<sup>383</sup> Diodorus Siculus, *Bibliotheca Historica* 3.12-14.

These technological improvements were based on the use of a constant water flow as a force,<sup>386</sup> and as such were unsuitable for use in the deserts.

The relatively smooth absorption of Egypt into the Roman Empire could have facilitated the continuation and further development of mining works in the Eastern Desert, and as we have seen the logistical infrastructure would have permitted such a development. On the other hand, the recent survey of Samut in 2013-2014, a gold-mining site on the path between Berenike and Apollonis Magna suggests that the site was exploited *c.* 260-220 BC, but not in the Roman period. The site was occupied sporadically after the departure of the Roman army from the Eastern Desert, sometime in the second half of the third century AD, and more permanently after the third century AD.<sup>387</sup> This survey confirms that travels along the path to Apollonis Magna did not occur in the Roman period, and suggests that access and exploitation of mining sites might not have been permitted in the first three centuries AD. That the imperial administration did not sanction gold-mining operations in parts of the Eastern Desert is one possibility. It has been suggested that gold mines were more numerous than quarries in the Early Roman period, were for profit, and that perhaps “their yield offset losses incurred by the imperial government from quarrying activities.”<sup>388</sup> This entirely remains to be demonstrated with archaeological data. Nonetheless, a clear-cut answer might not be presently possible. The following two tables give a synopsis

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<sup>384</sup> Klemm and Klemm 1989, 233.

<sup>385</sup> Wilson 2007.

<sup>386</sup> Greene 2000; Wilson 2002; Wilson 2007.

<sup>387</sup> Cf. Brun *et al.* 2013; Brun pers. comm.

<sup>388</sup> Sidebotham 2011, 172. Sidebotham does however include beryl and emerald mining in this category, for which we do have better documentation (see the following section).

of sites, but also of the problem of what has been considered a gold mining site or not:

	Site
1	Abu Fas
2	Abu Zawal
3	Alfawa NW/ Kompasi
4	Atalla
5	Attut
6	Baramiya
7	Bukhalug
8	Dunqash
9	Aridiya
10	Galli
11	Ghuzza
12	Hamash
13	Malga
14	Persou
15	Sibrit
16	Siqdit
17	Sukkari
18	Umm Garriat
19	Umm Rus
20	Wadi al-Amboot
21	Wadi Dabab

Table 4.3 Gold-mining sites mentioned in the Barrington Atlas (Talbert 2000, Map 80 and Keenan *et al.* 2000, with data last revised in 1994).

	Site	Date
1	Umm Howaitat al Qibli	Ptolemaic
2	Abu Garida	Ptolemaic; Early Roman
3	Daghabag/Kompasi	Ptolemaic; Roman (?)
4	Umm Rus	Roman
5	Bukhalug	No date provided
6	Bir Sirbakis	No date provided
7	Bir Umm Fawakhir	Byzantine

Table 4.4 Gold sites mentioned in Sidebotham *et al.*'s chapter on Eastern Desert gold mining (in chronological order) (Sidebotham 2008 *et al.*, 213-226).

The sites generally given as gold mining sites have not received full publications and the differences in published data sets reveal considerable discrepancies (see also Fig. 4.13).<sup>389</sup> The organisation of gold mining, therefore,

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<sup>389</sup> Klemm *et al.* 2001 do not cite the names of Roman sites they mention on their map (Fig. 9).

remains to be properly assessed before consideration of their wider significance. Bir Umm Fawakhir, where the settlement showed some Roman activity, was mainly used in the Byzantine period.<sup>390</sup> This mining town, of no less than a thousand inhabitants, gained prominence perhaps once the better Wadi al-Sid gold source, located just south of the site, was abandoned after being fully worked out.<sup>391</sup>

Silver mining in Egypt in the Ptolemaic and Roman periods is a similarly difficult topic. If gold was mined in the Roman period, then we should consider that silver was mined as well? The Turin papyrus mentions a mountain where both gold and silver are found, and mining in the Pharaonic period is implied. This mountain has been possibly identified with Gabal Sid, located 4 km from Wadi Hammamat, and whose ores contain 20% silver and 80% gold.<sup>392</sup> It was also on the main Koptos – Myos Hormos route. Other sites have also been reported as containing silver: Wadi Aradia and Gabal Gasus have been found to yield the same quantity of silver as gold; an average of 12 gr per ton.<sup>393</sup> This evidence would go against the claims that Egypt had no silver sources, but further research will have to clarify the extent to which it was mined, separated from the gold or processed in Roman times.<sup>394</sup>

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<sup>390</sup> Meyer 1997.

<sup>391</sup> *Ibid.*

<sup>392</sup> Goyon 1949, 27. The gold and silver content of the ore were indicated by the Egyptian Mining Company which was currently working there. See also Lucas 1928 and Gale and Stos Gale 1981 for work on silver analysis from Ptolemaic silver objects, and possible Eastern Desert attribution.

<sup>393</sup> Barron and Hume 1902, 260.

<sup>394</sup> Manning considers that "(Ptolemaic) Egypt had no native silver" (Manning 2008, 11). This may be true to the extent that it had very little of it.

Ore mining in general is notoriously difficult to date, and is further complicated by the fact that main ores may have been mined in combination with other ores, and there is often no ready way to determine the extent to which this was the case for a particular period. Galena for example remained in use for making kohl in the Roman period, and balsamaria still containing galena have been recovered from Roman forts in the desert, but they do not provide information on the origin of the galena.<sup>395</sup> Similarly, the Eastern Desert of Egypt is particularly iron-rich. The iron exploitation areas are often characterised by haematite, iron carbonate and barite veins which have been said to have been mined extensively in Roman times in the Eastern part of the valley.<sup>396</sup> Iron sites mentioned in the literature include Wadi Gidami, Gabal Abu Marwat, Abu Garida, Wadi Dib.<sup>397</sup> Published sources for iron are imprecise, and further research will be needed to clarify the extent of iron mining. What is certain, however, is that much iron would have been needed in the Eastern Desert for tool-making since granodiorites are particularly difficult to quarry, as is reflected in the ratio of smiths per quarry workers recorded in the ostraca.<sup>398</sup> To this needs to be added the quantities of iron needed for nails and others items necessary for architecture, and in particular naval architecture. The excavations at Berenike have recorded substantial quantities of metal fragments,<sup>399</sup> but the provenance of the metal, is to

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<sup>395</sup> These kohl containers were found in several forts in the desert, with a clear increase towards the end of the second century AD: they represent 11% of the glass assemblage in the first quarter of the century, but reach 40% at the end of the second century (Brun 2003, 385).

<sup>396</sup> Barron and Hume 1902, 31.

<sup>397</sup> *Ibid.*, 86. Bir Salah is also recorded as having iron slag, though its diagnostic pottery is dated to third-fourth century AD (Sidebotham 1996, 183).

<sup>398</sup> Peacock and Maxfield 1997, 199-200; Bülow-Jacobsen 2009, 14.

<sup>399</sup> Hense 2007. In the 2000 season, 2,400 slag fragments were recorded (Hense 2007, 211).

date unknown. Certainly, the *Periplus Maris Erythraei* also records that brass, tin, copper and lead were also being shipped out to India along with iron, which unless from the Eastern Desert, would have had to be imported from outside the province.<sup>400</sup>

### *Quarrying Gems*

Gems formed the third type of exploitable resource found in the Eastern Desert. Gems can be collected at the surface or through open-cast mining, but in the Roman period, emeralds and amethyst were also mined underground, which means that high profits were expected for such a substantial endeavour. These underground works have not yet been fully explored, but some are at least 100 m long.<sup>401</sup> The construction of multi-storeyed buildings testifies to the intensification of the mining industry in the Roman period (Fig. 4.14).<sup>402</sup> An ostrakon recently found at Didymoi also documents the fact that the Roman army at times relied on emerald workers as courriers,<sup>403</sup> which would suggest that the mines were imperially owned rather privately worked out.

Several types of precious stones were mined (Fig. 4.15). Peridot, or *topaz*, did not technically originate in the Eastern Desert, since it came from St John's island, an island off the coast of Berenike, yet it was under the control of the same

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<sup>400</sup> *PME* 6, 7, 8, 28, 49, 56.

<sup>401</sup> Visit to Sikait in 2010.

<sup>402</sup> Sidebotham *et al.* 2008, 238.

<sup>403</sup> *O.Did.* 329, 484; Bülow-Jacobsen 2001, 121.

administrative district and as such has to be included.<sup>404</sup> The table below offers a succinct overview of known gem mining sites in the Roman period:<sup>405</sup>

	Stone	Location
1	Amazonite	Gabal Hafafit
2	Amethyst	Wadi Abu Diyaiba
3	Amethyst	Wadi al-Hudi
4	Beryl	Umm Kabu
5	Beryl	Wadi Nugrus
6	Beryl	Kab Marfua
7	Emerald	Gabal Zabara
8	Emerald	Wadi Sikait
9	Emerald	Gabal Umm Harba
10	Emerald	Wadi Abu Rashid
11	Emerald	Wadi Gimal A+B
12	Peridot	Zabargad (St John's Island)

Table 4.5 Gem mining sites in the Eastern Desert of Egypt exploited in the Roman period.

Amazonite was quarried at Gabal Hafafit. Two trenches two metres deep and one metre wide could be dated to the Roman period based on ceramic evidence. The quarry site was therefore smaller than the Pharaonic Gabal Migif quarry, yet more importantly the quarry tapped into much larger crystals, up to 25 cm large.<sup>406</sup> Amethyst was mined in at least two locations, Wadi al-Hudi, which is close to the Nile, and in the Wadi Abu Diyaiba, a site approximately halfway between Myos Hormos and Mons Claudianus. The growth in importance of mines at Wadi al-Hudi may have been propelled by reduced activities at the earlier Wadi Abu Diyaiba mines in the second and third centuries AD. In terms of surface area, Wadi Abu Diyaiba was a larger gem mining area. Between 400 and 500 trenches have been identified over 3 km<sup>2</sup>, which suggests that it was an important amethyst

<sup>404</sup> *SEG XX*, 670; Bernand 1977, 121.

<sup>405</sup> Shaw *et al.* 1999; Sidebotham *et al.* 2008, 277-302.

<sup>406</sup> Harrell and Osman 2007, 27-28. The crystal size, compared to the 5 cm-crystals at Gabal Migif, may be another indicator of active Roman prospecting and exploitation of the most important amazonite veins. Gabal Migif may not have been considered profitable.

mine in the early empire.<sup>407</sup> Ceramic evidence points to its main occupation in the first century BC - first century AD, and the shift to the Wadi al-Hudi may have potentially been the diminishing returns and high organisational costs at Diyaiba.

The Eastern Desert of Egypt was the only source of emeralds in the ancient Mediterranean.<sup>408</sup> Egyptian emeralds are referred to by Strabo and Pliny,<sup>409</sup> and while several different locations were mined for emerald, they are all within the district of Gabal Zabara, c. 90 km northwest of Berenike (Fig. 3.5), and c. 15 km from the Koptos - Berenike path. Some of the emerald mining sites have been surveyed, and five settlements have been identified with emerald mining activities so far: Wadi Gimal A and B, Wadi Nugrus, Sikait and Zabara.<sup>410</sup> Three sites also produced beryl, a slightly lighter green stone (Fig. 4.15): Umm Kabu, Wadi Nugrus and Kab Marfua.<sup>411</sup> In this general area (between Nugrus and Sikait), the springs of subsurface water and several *qulut* (natural depressions holding rainwater) would have also been a key element for the development of the mining settlements.<sup>412</sup>

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<sup>407</sup> Sidebotham and Harrell 2004, 13.

<sup>408</sup> It has been suggested that emeralds were mined at the Habachtal in Austria, but no conclusive evidence before the medieval period has been discovered. Oxygen isotope analysis, however, would be able to distinguish the two Mediterranean sources (Giuliani *et al.* 1998) but this has to my knowledge not been attempted.

<sup>409</sup> Strabo, *Geography* 17.1.45; Pliny, *Natural History* 37.64-69.

<sup>410</sup> Shaw *et al.* 1999. See also Sidebotham *et al.* 2004a for Sikait.

<sup>411</sup> On Kab Marfua, see esp. Sidebotham *et al.* 2005.

<sup>412</sup> One of the *qulut* was said to be sufficient for the water needs of 20 people for a season of a French Project in 1900; two natural springs by Sikait produced per day, in the twentieth century c. 50 l of freshwater and 10 l of freshwater respectively (Sidebotham 2011, 93).

Peridot, known as *topazus* was mined in Ptolemaic and Roman times alike, but may have been mined as early as 1500 BC.<sup>413</sup> Given the inhospitable nature of the island, which has neither vegetation nor any fresh water sources,<sup>414</sup> it may well be that the gemstone was mined on a periodic basis only. Peridot was mined in open casts, and the eastern slope of Peridot Hill, the most productive flank of the southernmost hill on the island, must have been a fruitful source: to this day, peridot from the island is known to reach up to 20 cm across.<sup>415</sup>

Egypt and especially Alexandria were renowned for jewellery. This can in part be attributed to the presence of sources of precious stones located within the province, and the fact that the gems could feed into a corridor and movement of goods towards Koptos and Alexandria. The popularity of gemstones reflected in the Fayum portraits (Fig. 4.16) probably correlates with the intensification of activity in the second to third century AD at some sites.<sup>416</sup> Comments, such as that by Clement of Alexandria, that amethysts, emeralds, peridots and jasper were among the stones that “silly women” wore on chains and necklaces, show that such gems were sought after and exploited in AD 200,<sup>417</sup> while criticism on mundane fashions may serve as a generalised indicator of popularity, hence of demand and available supply.

The Eastern Desert remains the only district in the Roman Empire with such intensive gem mining with settlements entirely dedicated to this one

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<sup>413</sup> Meredith 1952, 106; Keller 1990, 120.

<sup>414</sup> Keller 1990, 124.

<sup>415</sup> *Ibid.*

<sup>416</sup> On the Fayum portraits, Walker 2000.

<sup>417</sup> Clement of Alexandria, *Paedagogus* 2.12.

activity.<sup>418</sup> The gem industry in the Eastern Desert seems to follow much the same pattern of prospecting and state control, with intensive mining and settling of gem-rich areas, as decorative stones. In fact, the evidence of gem miners being occasionally used as messengers for the army would confirm it.<sup>419</sup> These quarrying and mining activities were made possible by the imperial administration and the wider Roman market, and went far beyond the scale of operations that other societies living in the arid environment, such as the Garamantes, were capable of orchestrating or obtaining.

In summary, gold was probably the mineral with the longest standing history of exploitation, and ancient sources point to a long mining history. For the Roman period, the gold mining evidence is less than clear, and economic activities linked to it cannot be pointed out; nor is there sufficient evidence to assess whether mining truly offset the costs of imperial quarries.<sup>420</sup> Much the same is the case for metals: evidence of metal working at the ports of Myos Hormos and Berenike does point to a considerable level of ore consumption,<sup>421</sup> and while the sources in the Eastern Desert would seem the most appropriate ones to provide the busy ports, the evidence is so far inconclusive with respect to origin.

#### **4.7 Agriculture and pastoral industry**

There is no sign that large-scale agriculture to sustain settlements was ever considered in the Eastern Desert of Egypt. Most of the evidence for food

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<sup>418</sup> Shaw *et al.* 1999; Shaw 2002a; Shaw 2002b.

<sup>419</sup> *O.Did.* 329, 484; Bülow-Jacobsen 2001, 121.

<sup>420</sup> Sidebotham 2011, 172.

<sup>421</sup> Sidebotham and Wendrich 2000; Peacock and Blue 2006.

consumption, as will be shown below, clearly points to food distribution networks rather than local production. The army had to be supplied by monthly deliveries of wheat, barley and other goods by private contractors from the Nile, such as the Nikanor family. Single sites in the Eastern Desert could require up to 132 artabas or more of wheat, while the larger sites such as Berenike may have required up to 2,000 camel loads per month alone.<sup>422</sup> On a local level, families such as the Nikanor family were engaged in transport through the Eastern Desert and employed sub-contractors when needed. The Nikanors, based in Koptos, operated in the Eastern Desert for at least sixty years, between 6 BC and AD 62.<sup>423</sup> Their archive, which consists of 88 ostraca,<sup>424</sup> proves to be one of the richest sources of information on transport and its mechanisms for the Eastern Desert at this period. The ostraca consist of receipts that state that the goods have arrived at their destination, giving the name of the location, the name of the individual receiving the goods transported and the date.<sup>425</sup> Their transport services were hired for small and large quantities alike, and the firm was involved in monthly deliveries of supplies to various settlements and forts, such as Apollonos Hydreuma, which is recorded in one instance to have received *c.* 36 camel loads of wheat.<sup>426</sup> Evidence from the forts also shows that soldiers and individuals in the Eastern Desert often sent orders for wheat, or water, or wine supplies on a private account. Larger sites had *centuriones frumentarii* who were in charge of the organisation of the import

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<sup>422</sup> Ruffing 1993, 6 and with a low population estimate for Berenike (1,200 inhabitants).

<sup>423</sup> Adams 2007, 221.

<sup>424</sup> *Ibid.*

<sup>425</sup> *Ibid.*, 222.

<sup>426</sup> *Ibid.*

of food and fodder in great quantities.<sup>427</sup> This is the case at Mons Claudianus, where we know of a certain Pancratios, a *centurio frumentarius*, in the second or third century AD.<sup>428</sup>

The study of amphorae provides further information concerning consumption and drinking supplies: all point to a network organising imports into the desert from the Nile valley.<sup>429</sup> The Eastern Desert produced no wine: wine consumption required and relied on its extensive transport. The size of amphora dumps at even small forts with perhaps 30 residents, show that the equivalent to 750 litres to 2,250 litres of wine were consumed per year there. Including the Egyptian amphorae, the quantity of wine estimated from the pottery dumps is considered to be low (25 to 75 l per person per year), in comparison to Italy (350 to 400 l per person per year).<sup>430</sup> This estimate translates to a litre of wine per person per week or two weeks, which is considerable given the transport needs, and the wine was probably diluted to a greater extent than elsewhere (one may not want to drink heavy wine in this hot a climate). Larger sites, such Mons Claudianus, with over 900 inhabitants, would have consumed proportionately more (extrapolating numbers would give 22,500 l to 67,500 l of imported wine per year for Mons Claudianus alone). The wine imports were thus clearly extensive. We could continue this exercise by calculating quantities of wine for the forts on the Quseir – Koptos route, and include the other larger settlements of

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<sup>427</sup> Hirt 2010, 174.

<sup>428</sup> Maxfield 2001, 151 and Table 7.1.

<sup>429</sup> Tomber 2007.

<sup>430</sup> Brun 2007, 522.

900 to 1,000 people (such as Mons Porphyrites) into the calculations,<sup>431</sup> but this would only reinforce the idea that the logistics involved in the transportation of wine supplies into the desert were substantial. The forts and quarries in the Eastern Desert in the Roman imperial period created new market opportunities for a much wider area, for producers along the Nile valley but also on the Mediterranean coast.

The amphora imports from some well excavated forts along the Eastern desert routes shows the predominance of Egyptian sources of wine for consumption at the forts. The amphorae dumps at the forts of Maximion, Didymoi, and Krokodilo suggest that the majority of wines (99%) consumed on site were of Egyptian origin, mainly from Lake Mareotis and Aswan.<sup>432</sup> Local Egyptian sources represented at Mons Claudianus are varied, but the main sources represented are from Koptos and the Thebaid region.<sup>433</sup> At Mons Claudianus, the geographic spread of imports is more pronounced than at other sites, and include amphorae from Tripolitania, Baetica, Gaul, Italy, Cilicia and the Aegean.<sup>434</sup>

Let us now examine the archaeobotanic evidence for consumption. At Mons Claudianus, as on other sites, the preservation of the faunal and botanical evidence is remarkable. As a whole, the evidence is mainly constituted of staple foods of a wide-ranging variety, testifying to a relatively healthy and varied diet, but also to the fact that the majority of food was imported into the Eastern

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<sup>431</sup> This combination equates to 118,750 to 356,250 l per year for the forts and these three sites alone. This is only suggestive; we have to account for some fluctuations and reduced activity during certain periods.

<sup>432</sup> Brun 2007, 505.

<sup>433</sup> *Ibid.*, 522.

<sup>434</sup> Peacock and Maxfield 2006, table 1.16.

Desert.<sup>435</sup> At military forts, pork consumption was important,<sup>436</sup> but at Mons Claudianus fish products (including shark) and donkeys are attested, with pork still being a major contributor.<sup>437</sup> A wide range of fruit and vegetables, which along with dates, olives, grapes, figs, sebesten and water melon indicate that they were part of the regular diet, yet the wide range of these Mediterranean agricultural goods were not produced in the Eastern Desert. No substantial field systems, such as those in Fazzan, or in other arid or semi-arid areas of the Roman Empire,<sup>438</sup> have been found. Gardening and small-scale production of herbs and plants is attested, as at Sikait, where stone boxes with wooden trellis were found in the household courtyards.<sup>439</sup> Rarer items were those from further afield, such as lemons, cucumbers and lotus originating from India, or mulberries, from Persia.<sup>440</sup> The availability of these items may be explained by the high wages at Mons Claudianus offered by the imperial administration,<sup>441</sup> but also the proximity of the site to the routes for these products.

The evidence from forts such as Didymoi, Maximion and Krokodilo suggests the particular dynamics of local supply networks. Most of the animals

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<sup>435</sup> Esp. Van der Veen, 1998, Table 1 for Mons Claudianus. Ostraca found at forts generally provide details of special requests, or “shopping lists”: at Didymoi, Valerius the brewer wants a sheaf of asparagus, and one of chard, and so does Vibius (*O. Did.* 76).

<sup>436</sup> Pig bones constitute almost half of the deposits examined at Krokodilo and Maximion: Leguilloux 2003, 552.

<sup>437</sup> Van der Veen 1998, 104. The unusual level of donkey consumption must be linked to the high numbers of donkeys needed to transport of stone products.

<sup>438</sup> *E.g.* Barker 1996 for field systems in the semi-arid to arid parts of Roman Tripolitania; Newson 2000 for water supply systems in the Syrian Black Desert or Barker *et al.* 2007 for field systems in the Wadi Faynan (Southern Jordan).

<sup>439</sup> Sidebotham *et al.* 2008.

<sup>440</sup> Van der Veen 1998, 106.

<sup>441</sup> Van der Veen 1998; Cuvigny 1996, 144.

consumed at the forts were pigs brought in at a tender age for consumption.<sup>442</sup> Goats and sheep at the forts were in general adult animals, in comparison to the coastal sites, where the animals were slaughtered more frequently and at a younger age.<sup>443</sup> Ostraca show that the settlement at Persou was well provided with vegetables or other garden products, and hence traded these with Krokodilo for pigs and chicken, creating a local small-world network of supplies between two sites.<sup>444</sup>

The archaeological evidence shows that settlements in the desert relied almost entirely on external resources. Settlements and structures were not spatially distributed in the landscape in order to harness the albeit relatively scarce resources necessary for subsistence: the settlements were located in places to protect movement or supply Rome with specific ores or decorative stones. Food came from both the Nile and the Red Sea; barley, wheat, wines, vegetables and meat came from the Nile, while seafood in the form of fish, and shellfish were transported from the Red Sea as far as the forts closest to the Nile.<sup>445</sup> All these relied upon the substantial transport infrastructure developed during the Roman period by the imperial administration.

#### **4.8. Structure and agency**

In the Eastern Desert of Egypt, the presence of settlements and the transport infrastructure were entirely dictated by the state and imperial interests. The

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<sup>442</sup> Leguilloux 2003, 552-553; Leguilloux 2011. One to two year-old pigs represented 43% of the assemblage at Krokodilo and Maximion, 46 % at Didymoi (Leguilloux 2011, 169-170).

<sup>443</sup> Leguilloux 2003, 559.

<sup>444</sup> Cuvigny 2003c, 380-381.

<sup>445</sup> Van der Veen 1981, esp. Table 1.

evidence for the exploitation of mineral resources shows that the nature and location of settlements and quarries were dependent on particular decorative stones and colours in tune with the demands of imperial representation, architecture, and tastes at Rome. Precious ores, and the extraction of gold in the Roman period remain difficult to discuss, as Roman period sites have not been sufficiently published. Gems on the other hand were exploited to significant levels. That miners were at times commissioned to serve as courriers for the army shows the interplay between this economic sector and that of the military. Another document testifies to the interplay between the administrative networks of the Eastern Desert and imperial trading interests: a declaration of a camel owner from Soknopaiou Nesos tells us that on order of the prefect the camel owner had to simultaneously rent one of his camels for hauling a porphyry column, and another one for the caravans (*poreiai*) which were going to Berenike.<sup>446</sup>

Civilians were not allowed to cross the Eastern Desert of Egypt without permits: permits were issued on ostraca along with the location of the final destination, and gave details on the number of travellers (men or women) and the number of animals (donkeys or camels).<sup>447</sup> This also included the imperial caravans, and imperial slaves (or those working for them) going to Berenike. They had to carry documents to justify waivers for (presumably) all the Eastern desert taxes: the slaves of the *familia caesaris* and their contractors had let-pass documents to show to the *quintanensis* (custom-gates officer).<sup>448</sup> In fact, these

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<sup>446</sup> *P.Lond.* II 328 (163p) ; Cuvigny 2012b, 7.

<sup>447</sup> For examples of permits at Didymoi: Cuvigny 2012c, 117-121.

<sup>448</sup> Nappo and Zerbini 2011. In one instance (*O.Berenike* 186), the names of the actual transporters were left blank, but the reference to Epaphroditos slave of Aeimnestos slave of Caesar was included.

documents strengthen the hypothesis that the emperor and/or his entourage derived profits from the Eastern trade,<sup>449</sup> but also highlights another peculiarity of the Eastern Desert's organisation, in contrast to trade via Palmyra or to the Fazzan. As the emperor and his entourage can be shown to have also had interests in the safe conduit on goods through the Eastern Desert, it may also provide a further explanation, though not the only one, for the local strong security conditions.

The settlements of the Eastern Desert of Egypt are characterised by their striking lack of local means of subsistence, in particular agrarian resources. This lack of evidence for local agriculture is further backed by the numerous ostraca describing either the revictualling of forts and settlements with state supplied goods brought by private contractors or private letters asking relatives from the Nile valley to arrange for goods to be sent. At the forts, attempts were made to have a steady and available supply. Some vegetables and crops were grown on a small-scale and at times exchanged for other goods, but there is no sign that these ever allowed self-sufficiency or even surplus despite the substantial development of Roman-era settlements: all were externally provisioned.

There is little evidence that indigenous populations of the Eastern Desert were agents of change and/or had choices in economic activities. Local activities were monitored: fishermen's activities on the Red Sea, for instance, were tightly regulated, as suggested by a permit granted to Pakubis Ichthyophagos to move his ship from Myos Hormos to Philoteras.<sup>450</sup> Three main ethnic groups are known to have resided within the Eastern Desert, the Agriophagoi, the Moschopagoi and the

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<sup>449</sup> Nappo and Zerbinì 2011, 65.

<sup>450</sup> Thomas 2011, 217-218.

Barbaroi, but in the second century AD, references to them still indicate conflicts.<sup>451</sup> In fact, it has also been suggested that one of the reasons behind the construction of Trajan's canal may have been security issues in the Eastern Desert.<sup>452</sup> As shown by dedications, the prefect could order the establishment of as many *praesidia* or cisterns and wells as deemed necessary to provide security, but this did not stop local incidents. Nevertheless, post AD 176 and up to the eventual departure of the army from the Eastern Desert in the mid-third century AD, the interactions with the groups inhabiting the desert became more complex. Three ostraca from Didymoi show that the *barbaroi* were given food and wine supplies and that the military was interacting with a chief (?) or *hypotyranos* of the Barbaroi; while another ostrakon mentions that a group of *barbaroi* attacked a small group of travellers and hit them.<sup>453</sup> Excavations at Xeron further testify to the changing dynamics. Ostraca probably dated to c. AD 264 contain an order for food deliveries to over 150 individuals whose uncommon names (Baratit, Engosarek, Inknet, or Sogod) suggest that local groups present in the area were now receiving food allocations,<sup>454</sup> perhaps in order to avoid hostilities? A number of factors have been advanced as consequence of the post AD 250 changes and the decline of activities in the Eastern Desert; the departure of the army, perhaps linked to the Empire-wide crisis, competition from Trajan's canal, and the silting of Myos Hormos. These factors were most likely interrelated, yet in relation with

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<sup>451</sup> *I.Pan.* 87 celebrates a victory over the Agriophagoi; see Cuvigny 2003d, 351-352.

<sup>452</sup> De Romanis 2002.

<sup>453</sup> *O.Did.* 41-43 refer to *hypotyrannoi* making request; *O.Did.* 44 to an attack by *barbaroi*, while *O.Did.* 45 refers to a group of *barbaroi* with children and animals which stayed overnight by the fort.

<sup>454</sup> <http://www.ifao.egnet.net/archeologie/praesidia/>. (last consulted: 15 january 2014).

the Eastern Desert itself, the departure of the army removed the factor of stability and security of the paths. Once it departed, the delicate small-world networks of supplies between individual places was also gone, making life in the desert for the majority again largely unbearable.

#### **4.9 Synthesis**

The exploitation and economic activities of the Eastern Desert have now been well documented. The intensity of activities in the Roman imperial period cannot easily be linked to a favourable climate. None of these activities were linked to close agricultural sources of produce to maintain local settlements and a more clement climate for producing these. Food supplies were mainly imported from markets outside the Eastern Desert, and organised by the imperial administration. Decorative stones and gems seem to have a broadly similar chronology; they undergo an active period of prospecting, with official involvement, in the first century AD and peak in the second century AD. The level of productivity in the Eastern Desert as identified by the variety of decorative stone types and the number of sites exploited required a substantial organisation in order to ship in supplies of staple foods and fodder for the animals, as well as water, and wine. The changes relied on the management and development of pre-existing paths, the creation of structures harnessing water by the new ruling power, and the establishment of security networks through the permanent presence of a string of forts along the main paths crossing the desert. They were direct results of the imperial government and its interest in the quarrying of stones, gems, and the protection of trade. The maritime opportunities of the Indian Ocean trade in particular required substantial (private and imperial) logistics in land transport to

load and offload the cargoes; and in return the Roman state reaped substantial foreign import taxes from the trade, a topic I will return to in Chapter 6 (section 6.6).

The Eastern Desert of Egypt was entirely controlled and managed as a closed region of commercial transit and exploitation of natural resources. The scale of traffic, which had increased from the Ptolemaic period, required better protection and more efficient logistics to cope with the traffic in the desert. Yet activities in the Eastern Desert can only be understood within the security afforded by local networks and the wider socio-political context and the opportunities offered by the wider markets of the Roman Empire, Indian Ocean trade and state control.

Some of the activities may have subsidised the presence of the army in the desert; but how funds were allocated is not known. Nevertheless, some factors hint towards subsidised costs, in particular for the construction of forts and water facilities along the paths: a recent ostrakon shows that individual forts sold water to caravans, and also the Koptos tariff which raises a tax on travels by specific groups in the Eastern Desert. The presence of settlements and forts in turn promoted small world informal networks, such as those linked to small-scale local cultivation.<sup>455</sup>

Although some forts of the Eastern Desert were abandoned, some built later, or re-used, the systematic excavations and surveys of the fort seem to confirm that the last forts of the Eastern Desert were abandoned *c.* AD 250.<sup>456</sup> Gradual siltation

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<sup>455</sup> *E.g.* Places like Persou exchanged its vegetables with Krokodilo, which seemed better supplied with chicken and pigs (Cappers 2006, 380-381). Didymoi was supplied with vegetables locally grown at Phoinikon (Cuvigny 2012b, 6).

<sup>456</sup> Cuvigny 2012b, 2. Didymoi for example is abandoned between *c.* AD 150-170. Both Didymoi and Dios have their last phases of military occupation around AD 250.

of the harbours of Myos Hormos and Berenike was a problem, especially in the the third century AD; Myos Hormos stopped functioning, although Berenike experienced a revival between the fourth and sixth century AD.<sup>457</sup> Without the military networks, and those concerned with the Indo-Roman trade, and due to growing local safety issues after the second half of the second century AD, the Eastern Desert entered a phase of decline.

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<sup>457</sup> Sidebotham 2011, 185, and 256-282.

## Chapter 5 Palmyra

### 5.1 Introduction

In this chapter I will turn to the Eastern part of the Roman Empire, to the city of Palmyra and its territories. In what follows, I will first set out the main geographical characteristics of the area as well as local environmental factors. I will begin with the evidence for the development, nature and organisation of trade based on epigraphy and archaeological investigations. In particular, the development of a social network to access new markets and simplify trading logistics will be assessed. Earlier examinations of Palmyra's economic success were mainly based on a set of inscriptions that recorded the caravan trade to the Euphrates;<sup>458</sup> these will be examined and contextualised within the wider changes occurring in the city and its hinterland as evidenced by the archaeology of the region. The extractive industries, as well as the agricultural and pastoral developments will be next. I will therefore set out the arguments, and frame the city's activities within its geo-climatic context, social networks and available local resources, before discussing local institutions and associations, and Palmyra's position within the Roman Empire.

### 5.2 Environmental factors

Palmyra lies in the northern part of the Syrian Desert, some 200 km from the Mediterranean coast (Fig. 5.1). Palmyra's remoteness and local geo-climatic settings

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<sup>458</sup> Rostovtzeff 1932; Gawlikowski 1983; Teixidor 1984; Gawlikowski 1988; Gawlikowski 1994; Gawlikowski 1996; Young 2001; Yon 2002; Yon 2012.

have been emphasised throughout the centuries, whether by ancient, or modern authors. The contrast of Palmyra's geographic duality, between its local water resources and surrounding aridity, and its unique position between the Roman Empire (Mediterranean) and Parthian Empire (Euphrates) is most famously described by Pliny:

“Palmyra is a city famous for its location, for the richness of its soil and its pleasant springs, and its fields surrounded by a vast sea of sand, and as though removed by the natural order from other lands, and enjoying a separate lot between two empires; that of the Romans and that of the Parthians, in times of discord, it is always the first concern of both sides.”<sup>459</sup>

Modern descriptions of the city, also often called the “Bride of the Desert” by tourists and local promoters, chose to highlight the isolated and arid characteristics of the site:

“Palmyra is in modern Syria in the middle of the desolate Tadmorean Desert. All around are natural barriers, dry and bare mountains to the north, west and southwest (the Lebanon and Anti-Lebanon mountains, cutting off the Mediterranean coast), while to the east and south are dry flatlands, with the volcanic basalt desert of the Hauran merging into Jordan and to the southeast into Iraq and then Saudi Arabia.”<sup>460</sup>

As geographically isolated as it may seem, the region of Palmyra represented in Roman times the southernmost corridor of passage between the Mediterranean and the Euphrates. Though c. 150 km away, a breach in the Lebanon and anti-Lebanon mountain ranges provides relatively easy access to the Mediterranean sea; the river Orontes offers swift transport to several Syrian cities, as well as to Antioch and Seleucia Pieria, Antioch's port on the Mediterranean. The city itself is protected by a small mountain range to the west of city, known as the Palmyrides (Fig. 5.3), which also supplies it with water through natural orographic water drainage.<sup>461</sup>

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<sup>459</sup> Pliny, *Natural History* 5.88: "*Palmyra urbs nobilis situ divitiis soli et aquis amoenis vasto undique ambitu harenis includit agros ac velut terris exempta a rerum natura privata sorte inter duo imperia summa Romanorum Parthorumque est prima in discordia semper utrimque cura.*"

<sup>460</sup> Dienst: <http://depts.washington.edu/silkroad/cities/syria/palmyra/palmyra.html> (last accessed october 2013).

<sup>461</sup> Sartre 2000, 660.

The city's territories to the west receive rainwater which collects in the Ad Daw plain after it comes down the western slopes of the Anti-Lebanon mountains. Surplus water naturally drains towards to the southern part of the city and forms the salt lake known as Sabkhat al-Muh (Figs. 5.2 and 5.3). The *sabakht* and its rich flora in turn form a natural point of attraction in the landscape for a wide array of wildlife. Palmyra's territories therefore benefitted not just from rainfall, but from water from a much wider hydrographic network, and very specific geographic conditions. The city and its immediate agricultural lands mainly depended on perennial local groundwater: its main source was a geo-thermal groundwater source called the Afqa spring which only stopped delivering water in the 1990s.<sup>462</sup> Its water was sulphurous and reached the surface at 29°C but could be used and drunk once it had cooled and settled.<sup>463</sup> Palmyra originally sprung around this source, with its gardens to the southwest (Fig. 5.5). The city developed to the north, and reached an estimated 50,000 - 60,000 inhabitants in the Roman period.<sup>464</sup> The same groundwater source was later tapped into by other *qanats*, which delivered water to other parts of the city as well as the new oasis gardens that developed in the Roman period.

Wetter conditions with a 6% difference in rainfall compared to the modern period have been inferred for the Roman period in the Levant on the basis of annual data gathered from speleothems in the Soreq cave (Israel).<sup>465</sup> At Palmyra, a silty organic

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<sup>462</sup> Carle 1923; Hammad 2010, 11. The source only stopped delivering water in the 1990s due to overexploitation. This water source, which is located in depth in secondary and tertiary geologic layers, is of meteoritic origin and rises to the surface through artesian phenomena (Vaudour *et al.* 1997, 14).

<sup>463</sup> Yoshimura *et al.* 2006; Yon 2009.

<sup>464</sup> Savino 1999, 69-75, proposes 60,000 revised from 200,000 inhabitants by Crouch 1972, 75; Meyer 2013, 270 suggests 50,000 inhabitants. Smith accepts 40,000-60,000 people in the city and 250,000 with the hinterland (Smith 2013, 81).

<sup>465</sup> Bar-Matthews 1998; Issar 2003, 25.

layer has been dated to between 1860 +/-70 and 1930 +/-30 BP (calibrated with OxCal: AD 2-337 at 95.4% and AD 3-131 at 95.4% respectively).<sup>466</sup> Vaudour *et al.*'s analysis of sediments from Palmyra did not provide any conclusive evidence of a Holocene pluviometric optimum. Whether the silty layer mentioned above corresponds to a slightly wetter climate, or a soil layer resulting from cultivation (and irrigation), the authors caution that if the local inhabitants may have benefited from a slightly wetter climate, this event could only have been brief and of low intensity.<sup>467</sup>

The importance of identifying and discussing micro-regions has already been established earlier in this thesis, and also directly concerns Palmyra: the area of Palmyra is generally included into what is commonly referred to as the Syrian Desert. Yet the 'desert' territories were only established through a political and administrative decision of the Syrian government of the 1940s, and included all areas below the 200 mm rainfall line.<sup>468</sup> The overview of Palmyra's varied, but also perennial groundwater water resources would tend to suggest a much more complex local environmental situation.

Palmyra's territories are also at the confines of different climatic and rainfall regimes which range from arid to semi-arid. The average annual rainfall recorded for the entire region of Palmyra is 136.7 mm, below the accepted dry-farming limit of 200-250 mm needed for cereal cultivation.<sup>469</sup> Yet this average is relatively meaningless. To the northwest, the Palmyrides mountain range receives the greater part of rainfall in the region, and its average rainfall is still to this day above the 200 mm threshold (Fig. 5.4). Consequently, and in response to its varied territories resources, the city could chose to invest in the territories best suited to agriculture or pastoral economies, and which

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<sup>466</sup> Sakaguchi 1987, context 47.

<sup>467</sup> Vaudour *et al.* 1997, 19.

<sup>468</sup> Jaubert *et al.* 1999, 20.

<sup>469</sup> As recorded between 1946-47 and 1988-89 (Sanlaville and Traboulsi 1996, 30).

mainly lay directly by the city, and to its west (Fig.5.6). On the other hand and as we will see, the pursuit of mixed pastoral/agricultural economies along with water management through the creations of cisterns and dams reduced the Palmyrenes' direct dependency on rainfall in the city through water catchment technologies in the hinterland.<sup>470</sup>

### 5.3 Pre-Roman situation

The archives from Kanesh, Mari and Edmar hint at the regional importance of Tadmor (later known as Palmyra) during the second millennium BC, when it may already have been a node on a trade route.<sup>471</sup> The record of the Assyrian king Tiglath-Pileser I (1115-1077 BC) defeating the Arameans at Tadmor suggests that the region was much coveted, most probably for its strategic geographic location and local resources.<sup>472</sup> The arrival of the Arabian Bene Qedar tribe in the area in the seventh century BC is said to have changed the local dynamics. The Qedarites are credited with the introduction of the camel to the region.<sup>473</sup> Longer transhumance patterns of these camel herders have been argued to have been another fundamental element of Tadmor's developing commercial fortune.<sup>474</sup> Long-distance trade with the Persian Gulf or from the Southern Arabian peninsula has a long-standing history in the region, in which the Euphrates generally served as a platform of exchange. Documents from the kingdom of Hindanu, located on the right hand side of the Euphrates by the Syro-Iraqian border, confirm the

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<sup>470</sup> Schlumberger 1952.

<sup>471</sup> Klengel 1996. Josephus tells us that the city that became known as Palmyra in Roman times was originally called Tadmor (Josephus, *Antiquities of the Jews* 8.154).

<sup>472</sup> Teixidor 1984, 7-8; Will 1992, 27-29; Abdallah 1996, esp. 134; Savino 1999, 49.

<sup>473</sup> Savino 1999, 49.

<sup>474</sup> Seland 2010.

arrival of caravans of several hundred camels coming from Southern Arabia.<sup>475</sup> Assyrians were also accustomed to hauling large cargoes of goods between Babylon and Armenia.<sup>476</sup>

Although Strabo, writing before 7 BC, shows no sign of knowing the oasis when commenting on trade passing further to the north,<sup>477</sup> we now know that Palmyra had developed its urban centre in the Hellenistic period: recent magnetometry survey along the southern part of the city and subsequent sondages have confirmed Hellenistic contexts.<sup>478</sup> Appian relates that Mark Antony failed to sack the city in 41 BC because the Palmyrenes transported all their belongings across the Euphrates,<sup>479</sup> but this comment does not preclude the presence of physical structures. It has been argued that the successful retreat of the Palmyrenes to the Euphrates implies that they were perhaps already involved in long-distance movement.<sup>480</sup> The entrance to the temple of Bel still aligns with the Hellenistic town rather than with the later Roman period town (Fig. 5.7),<sup>481</sup> and the earliest inscription in Palmyra, from 44 BC, testifies to the worship of Bel, with the dedication of a statue,<sup>482</sup> and hence to the likely presence of an urban centre. The inscription in Dura Europus celebrating the dedication of the temple of Bel in 33 BC by Palmyrenes potentially suggests trade links to the Euphrates in the second

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<sup>475</sup> Liverani 1992, 212.

<sup>476</sup> Herodotus, *Histories* I.194.

<sup>477</sup> Strabo, *Geography* 16.1.27.

<sup>478</sup> Al-As'ad and Schmidt-Colinet 2006-2007; Schmidt-Colinet and As'ad 2013.

<sup>479</sup> Appian, *Civil Wars* 5.9; Sartre 2000, 660; Young 2001, 136; Hekster and Kaiser 2004.

<sup>480</sup> Matthews 1984, 16; this is contested by Isaac (Isaac 1990, 141-142) and Millar (Millar 1993, 321) who believe the reference is slightly anachronistic and the wealth of Palmyra described by Appian refers to that acquired by Appian's time (c. AD 95-165). See also Savino 1999, 52; Young 2001, 136.

<sup>481</sup> Dirven 1999, 48.

<sup>482</sup> PAT 1524 = Inv. XI, 100; Hammad 2010, 9; Smith 2013, 61.

half of the first century BC.<sup>483</sup> It would consequently appear that sometime between the end of the first century BC and the early first century AD, Palmyra had gradually developed an urban centre with connections beyond its territories, in particular to the Euphrates. Peace in the Mediterranean, and with the Parthians in 20 BC, now opened up an era of opportunities for the Palmyrenes, who could now further develop their networks across the region.

#### **5.4 Routes, networks and infrastructures**

Palmyra was the easternmost city of the Roman Near East, and the last city before reaching the frontiers of the Empire. To the southwest lay Damascus and Heliopolis, to the west and northwest, Emesa, Epiphania and Apamea from which traffic and goods could be funnelled via the river Orontes to Antioch and Seleucia Pieria, and from there reach the wider Mediterranean (Fig. 5.1). To the east, one reached the Euphrates at Dura-Europus, some 230 km away, or Hit, which was 400 km away.

Palmyra's official incorporation into the Roman Empire is a debated issue; it was most likely firmly incorporated into the Empire by the time of Vespasian.<sup>484</sup> Palmyra's western territories, however, were delineated at the beginning of the first century AD. Its western civic boundaries, confirmed between AD 11 and AD 17 by the Roman *legatus pro praetore* Creticus Silanus, incorporated the area to Khirbat al-Bil-

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<sup>483</sup> PAT 1067 referring to the dedication of the temple in the necropolis; Edwell 2008, 36.

<sup>484</sup> The official incorporation of Palmyra into the Empire has been much debated, though is generally thought to have occurred within the first century AD (Bowersock 1973, 135-136; Gawlikowski 1994, 28; Whittaker 1994, 54-55; Young 2001, 136-137; Sartre 2005, 511; Edwell 2008, 47-48). An early first-century AD date of incorporation around the time of Germanicus' visit is made more explicit by Bowersock 1973, and Smith 2013, 24. Millar 1993, 34-5 and 84, remains more neutral suggesting a certain Roman influence under Tiberius and integration into the province of Syrian by the time of Vespasian.

a'as, some 75 km to the northwest, and extended perhaps towards Qasr al-Hayr, located to the southwest and in the direction of Damascus (Fig. 5.2).<sup>485</sup> The routes from Palmyra to Epiphania and Emesa led towards other large urban markets of the Roman Empire (Fig. 5.1). A contributing factor to the importance of Emesa for trade was its position on the Orontes river, hence connecting it to a string of cities and potential markets. It has been suggested that the rise and decline of Emesa followed that of Palmyra since its role as an *entrepôt* for Palmyra gave it its prosperity;<sup>486</sup> Emesa's fortune was presumably not only linked to its trading activities with Palmyra, but also to the city's own agricultural resources.<sup>487</sup> Most recent works, however, have established that from the Severan period onwards at least, the main route from Palmyra to the Mediterranean was toward Epiphania and not Emesa. The joint Syrian-Italian geoarchaeological mission which surveyed the west of Palmyra's oasis between 2008 and 2010 discovered 16 Roman milestones, some of them still bearing readable inscriptions which remain to be published.<sup>488</sup> The road, which was paved, was identified 12 km west of Palmyra onwards, and crossed the Ad-Daw plain. This route is also the one indicated in the *Tabula Peutingeriana*, with the intermediate stops and distances between Palmyra and Apamea.<sup>489</sup> The road by the way of Epiphaneia connected the main centres and markets

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<sup>485</sup> Schlumberger 1939.

<sup>486</sup> Seyrig 1959.

<sup>487</sup> Seyrig 1959, 189; Gatier 1996, 432-434. By the Diocletianic period, Emesa had a dam capable of delivering 1,800 l of water per second to its 1,000 ha of gardens. Although the date of the dam has been debated, with suggestions ranging from the Bronze Age to the fourteenth century AD, Kamash has established a Diocletianic date based on Talmudic references and the style of construction (Kamash 2009, 69-70).

<sup>488</sup> The Syro-Italian mission has actually recovered 11 of them. The other five, still along the same road, were identified by the Norwegian mission (Palmyrena Project). Magnani *et al.* forthcoming.

<sup>489</sup> *TP* Frag. X. Cfr. Also Schlumberger 1939b.

of the province of *Syria Coele*, namely Antioch and Apamea, with Palmyra,<sup>490</sup> and fully integrated Palmyra as a city within the road network of the Roman Empire.

The Orontes river funneled traffic towards Antioch and the wider Mediterranean. Antioch was a major market, and served as an important outlet for goods to be sold in the Mediterranean. The city had the advantage of functioning in symbiosis with Seleucia Pieria, its port city on the Alexandria-Rome sailing route,<sup>491</sup> and being of administrative importance. Palmyra was in part tied to Antioch due to the social and administrative network of the taxation system: although an agent was in charge of controlling the situation at Palmyra, the person responsible for the *tetarte* resided at Antioch.<sup>492</sup> This factor aside, there is little evidence concerning the movement of people or goods between Palmyra and other coastal markets.<sup>493</sup> Nevertheless, western Mediterranean and maritime motifs and patterns used by sarcophagus workshops from Tyre and Sidon, and found in funerary architecture at Palmyra, point to connections to these coastal cities well-known for their purple-dyeing industry;<sup>494</sup> bronze sculpture and purple dyed items must also have been imported from coastal workshops outside the

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<sup>490</sup> Three possible routes connected Apamea with Antioch (Castellana 2001).

<sup>491</sup> Arnaud 2005, 130. Antioch is eight days away from Alexandria, while the Alexandria-Narbonne route could be undertaken in only 20 days under good conditions (Arnaud 2005, 133).

<sup>492</sup> *AE* 1947, 180 = Inv. X.113; Delplace and Dentzer-Feydy 2005, III.01.

<sup>493</sup> A mosaic in the museum of Bosra from southern Syria (Dayr al-Adas) and dated to the seventh century AD shows a camel herder with several camels carrying goods. This may be the only known visual representation of a caravan (if one) in the Near East.

<sup>494</sup> Macheboeuf 2007; Schmidt-Colinet 1992, 65-88, with reference to maritime motifs such as a cherub riding a dolphin with a parasol on one of the most monumental tombs at Palmyra (tomb n. 36); also Will 1995, 33-34 for how it fits within local architecture. These cities were also known for their purple dyes, an item imported into Palmyra according to the Palmyrene Tariff (Matthews 1984, I. 16 and P. 137 and note below).

Palmyrene territory, as they are recorded in the Palmyrene Tariff along with local import taxes.<sup>495</sup>

The trade route from Palmyra toward Damascus and Heliopolis and into Syria followed the topography of the Lebanon and Anti-Lebanon mountain ranges. Pliny the Elder reports that the distance between Palmyra and Damascus was 176 Roman miles or 261 km, though gives no specific details on the road.<sup>496</sup> The Peutinger Table shows eight way-stations and gives a total distance of 212 Roman miles (or approximately 313 km).<sup>497</sup> A portico donated by five Palmyrene brothers at Nazala (Qaryatein) between Palmyra and Damascus show Palmyrene involvement in this community along the way to Damascus.<sup>498</sup> Their presence and involvement in this locality could have also represented an advantage for Palmyrenes travelling towards the region of Damascus due to a new connection to a local social network.

The Euphrates could be reached via three main routes: one to the north, via Sura, one straight east to the Euphrates via Dura Europus, and the southernmost, longest route via the desert towards Hit (Fig. 5.8). The northern route reached Sura on the Euphrates via the towns of Arak and Resafa. This corridor of travel had been in use since at least the second millennium BC.<sup>499</sup> In AD 75, a milestone established by the *legatus pro praetore* Ulpus Traianus formally marks the road joining Palmyra to Sura,<sup>500</sup> and at the

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<sup>495</sup> CIS II, 3913. Matthews, 1984, 180 (P. 128-129) for bronze statues being imported and taxed half their value by weight for one, or two the weight of one statue; *Ibid.* (P. 137) for the tax on purple-dyed goods and Matthews, 1984, 176 (l. 16) for purple-dyed fleece taxed eight asses.

<sup>496</sup> Pliny, *NH* 5.88: “Palmyra [...] abest a proximo vero Syriae litore CCIII et a Damasco XXVII propius.”

<sup>497</sup> *TP* (Frag. IX) and Mior 2014 on the detailed stations and way to Damascus according to the Peutinger Map.

<sup>498</sup> Millar 1993, 299.

<sup>499</sup> Teixidor 1984, 20; Bauzou 1989, 212.

<sup>500</sup> Matthews 1984, 161.

same time confirming that Palmyra's territories were formally Roman and within the wider network of roads joining urban centres in the region. On the way to Sura were other Roman towns with good agricultural lands, including the town of Resafa which relied on a dam of 480 m in width and 3 m in height in the Roman period for urban and agricultural purposes.<sup>501</sup> The Syrian survey of *qanats* also revealed that a belt of *qanats* broadly dated to the Roman period in this area, but imprecise dates prevent any further discussion of the agricultural potential of these areas north of Palmyra.<sup>502</sup> The shortest route to the Euphrates from Palmyra was due eastwards to Dura Europus, 220 km from Palmyra (Fig. 5.1).<sup>503</sup> An inscription of Palmyrenes dedicating a sanctuary in 23 BC to Bel and Yarhibol outside the city of Dura Europus provides the earliest evidence of a community or group of Palmyrenes at Dura Europus.<sup>504</sup> Dura's existence relied mainly on the safety needs of the Seleucids, and its commerce probably remained regional.<sup>505</sup>

The pioneering work in aerial photography by Poidebard in the 1930s established that a route from Palmyra to Hit via the desert was used by the caravan traders.<sup>506</sup> While much shorter routes to the Euphrates could have been taken, the longer desert route to Hit was most likely the preferred one (Fig. 5.7).<sup>507</sup> Some 400 km from Palmyra, Hit was more advantageous for several reasons. The desert route meant avoiding populated areas which could have reduced the speed of travel, but also the taxes and administrative delays at each of the cities along the Euphrates. It also meant avoiding the softer and wetter ground around the Euphrates to which camels are

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<sup>501</sup> Calvet and Geyer 1992, 120; Kamash 2009, 61 and 68.

<sup>502</sup> Lightfoot 1996.

<sup>503</sup> Gawlikowski 1983; Teixidor 1984, 20-23; Dirven 1996.

<sup>504</sup> Teixidor 1984, 21.

<sup>505</sup> Sommer 2005, 93.

<sup>506</sup> Poidebard 1934.

<sup>507</sup> Gawlikowski 1988, 169.

particularly unsuited, since they are prone to diseases in wetter climates, and this would constitute an additional risk for any caravan.<sup>508</sup> While the northern Euphrates is rocky and difficult, if not impractical, to sail,<sup>509</sup> Hit had the further advantage of having a spring of bitumen, which was used to waterproof shallow rafts which could transport goods down the river. Other cities could be avoided, but Hit was a necessary transshipment point for rafts going down the Euphrates.<sup>510</sup> Goods could be transferred onto Palmyrene rafts made from skins, as known from an inscription of AD 269 relating to the *askonautopoiioi* or raft-makers of Palmyra.<sup>511</sup> Each expedition carried rafts to be built upon arrival at the Euphrates, and sold or brought back after use. A typical raft, called *kalak*, and known to have been used on the Euphrates from the eighth century BC until fairly recently (Fig. 5.9), could carry up to 35 tons of goods, people and animals, or the equivalent of 179 camel loads.<sup>512</sup> Such expeditions on rafts were already undertaken by the Assyrians, as described by Herodotus:

“the biggest (*kalak*) can carry a good 5,000 talents (at least 125 tons). Each has on board a donkey, the larger ones several. After arriving at Babylon and disposing of the cargo, the frames of the boat...they auction off, load the hides on the donkeys, and walk back to Armenia.”<sup>513</sup>

In the Roman period, the Palmyrenes also benefitted from a wide social network organising logistics further south, and a wider transhumance patterns by local camel

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<sup>508</sup> Grant 1937, 42-43; Seland 2011, 403; for diseases in wetter climates, Adams 2007, 55. This is also why camels were not used much along the Nile.

<sup>509</sup> Casson 1971, 4; Agius 2008, 114.

<sup>510</sup> Hammad 2010, 140. While other bitumen sources were used previously, Hit's bitumen source became famous from 2,000 BC onwards (Carter 2012, 362).

<sup>511</sup> Seyrig 1963, 163-166; Rougé 1986.

<sup>512</sup> Casson 1971, 4-5 and Fig. 1. On traditional boats of the Euphrates: Agius 2008, 111-140. The camel load is based on estimates given by Adams 2007, 82.

<sup>513</sup> Herodotus, *Histories* 1.194. Herodotus actually describes another type of boat, the *quffa* and assigns it the capacity of *kalaks*. On Herodotus' s confusion between the *quffa* and the *kalak*, Casson 1971, 6-7.

herders. Rafts could swiftly bring goods to the markets on the Persian Gulf, and for the sailing season to India. Local strong ties probably assisted the local logistics of transshipment, while camels herds and herders could arrive separately in order to transport goods back to Palmyra. Most of the iconography suggests that camels were used as transport animals for the longer caravan route to the Euphrates and Persian Gulf.<sup>514</sup> Funerary reliefs of merchants portray them with camels (Fig. 5.10), while other reliefs portray camels in processions (Fig. 5.11).<sup>515</sup> Traditionally, camel herders in the region have migrated southwards in the winter: by the time of the return season from India, these would have been present in the Persian Gulf area and ready to bring goods back to Palmyra.<sup>516</sup>

Both the route to Hit and the stations leading from Palmyra to Hit are rapidly passed over in publications,<sup>517</sup> yet it is worthwhile to review the infrastructure along the route, as the long journey through the Syrian desert would have put a substantial burden onto the merchants needing to cross it. It is consequently essential to understand the benefits of that route and the organisation of logistics and the potential evidence for infrastructure. The following section, therefore, examines what we know about the Palmyra-Hit road and whether or not there was a coherent system of infrastructure designed to aid travel and the large-scale transportation of goods along this route.<sup>518</sup>

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<sup>514</sup> Although processions show donkeys as well as camels on the temple of Bel and at the sanctuary of Allat (Seyrig 1934, 159-165 and Drijvers 1995b, 119).

<sup>515</sup> Will 1992, 94-102.

<sup>516</sup> Seland forthcoming.

<sup>517</sup> Teixidor 1984, 24-25; Young 2001, 148.

<sup>518</sup> A key issue in research of Palmyrene trade to the Euphrates is that access to these sites has generally been prohibited by the Syrian and Iraqi governments.

### *Infrastructures on the Palmyra-Hit path*

In the 1930s and before much disruption of the desert by motorised transport, a path c. 8-20 m wide and visible for c. 270 km from Giffa to Qasr Amij was discovered by air in the Syrian Desert and to the southeast of Palmyra.<sup>519</sup> Along the stretches of path examined, rocks were pushed to the side in order to clear a wide track facilitating movement across the landscape. Although not paved, such paths are not uncommon in the Roman period: the *Via Hadriana*, which ran along the Red Sea in the Eastern Desert of Egypt, is similar: the road is very wide, varying from 8.6 m to 46.5 m at its widest point and features cairns along to the side as well.<sup>520</sup> While most Roman roads were paved, this was not necessarily the case, especially in the desert landscapes, where paths were sufficient, and even preferred, especially for camels. The clearance of rocks on the route to Hit not only affected the speed with which the camels could walk across the landscape, but also averted possible incidents caused by an animal skidding and shifting its load, which would have halted the caravan until the load could be properly placed again.<sup>521</sup> Such an incident would have caused major delays, but potentially also security issues, since the caravans were never entirely safe from roaming bandits.<sup>522</sup> The presence of this track, which implies the clearance of an area equal to somewhere between 4.8 and 7.2 km<sup>2</sup> of stones, implies frequent passage and perhaps even the clearing of the path. The creation of a path meant less risk of getting lost or losing time searching for directions and hence reduced transport cost, yet it demanded the guarantee of security and water: nineteenth-century caravans to the Euphrates were in extreme

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<sup>519</sup> Gregory and Kennedy 1985, 195, 16.5-19.2 m; Kennedy and Riley 1990, 80-81 mention 8-15 m.

<sup>520</sup> Sidebotham *et al.* 2000, esp. 122.

<sup>521</sup> Grant 1937, 42-43.

<sup>522</sup> Drijvers 1995a, 31-42; Delplace and Dentzer-Feydy 2005, 249, Annexe 31.

danger if they deviated from the established path in order to avoid thieves and brigands.<sup>523</sup> While the path cannot be closely dated, it may be postulated that it was cleared sometime after the rise of Palmyra as a major settlement between the end of the first century BC and before the peak in the caravan traffic along the road in the second century AD. Following Poidebard's work, individual places and parts of the road were examined by Sir Aurel Stein, who documented forts along it.<sup>524</sup> As a whole, it can be said that the structures were generally between 38 and 90 km apart, hence one or two-days travel between each stop if we estimate that camel caravans in the region generally covered 35-45 km in a day.<sup>525</sup> It is, however, possible that further stations existed but have not yet been recorded, as the area has generally been prohibited to modern travellers. The evidence remains dubious, as earlier works have generally tended to assign ancient structural evidence to the Roman period,<sup>526</sup> and no detailed map of the locations of sites can be done, as precise coordinates of the sites have not been recorded. The sites along the route will now be examined in sequence starting from those located closest to Palmyra and ending with these located closest to Hit.

#### *Umm al-Amad (Gennaes)*

The first site reported along the road is Umm al-Amad, 22 km south east of the city of Palmyra, with few visible remains: column drums and a well still mark the site. One of the columns at the site bears a dedication from AD 145 of several statues to Soades in

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<sup>523</sup> Seland forthcoming. The nineteenth-century caravans crossed the Syrian desert further north.

<sup>524</sup> Gregory and Kennedy 1985.

<sup>525</sup> Potts 1988, 155 gives the following speed of caravan: 3.8 km per hour. Caravans would travel 10-12 hours a day.

<sup>526</sup> A problem also reinforced by bedouins themselves who have generally always referred to most ruins as 'romani' (Geyer 2004, 299).

Palmyra, Vologesias and at a *kataluma* (private inn) called Gennaes, which must be Umm al-Amad itself.<sup>527</sup> This inscription is important, both for establishing that the route to the Euphrates could have made use of way-stations such as Gennaes by AD 145, but also that places specifically referred to as inns or lodgings existed along the path by the time of the inscription.<sup>528</sup>

### *Umm as-Salabih*

Umm as-Salabih is the second reported way-station on the Palmyra to Hit road, some 115 km from Palmyra (c. 93 km from Gennaes), and where some of the traffic may have continued towards Dura Europus.<sup>529</sup> Some building remains were found on the ground, while air photography identified a main U-shaped complex with a large courtyard and rooms along three sides of the structure. An inscription from AD 225 records the name of a *strategos* of Ana and Gamla,<sup>530</sup> and implies that the detachment made use of the way-point on their way to or from the Euphrates. A building complex dated to the second to third century AD associated with the road between Palmyra and Epiphania has parallels with Umm as-Salabih's complex on the basis of the similarities

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<sup>527</sup> Matthews 1984, 167. The association of Umm al-Amad with Gennaes is generally accepted as such (Healey 1996, 35). Soades is well known from other inscriptions: one from the temple of Baalshamin stating that he saved a caravan from great danger, another, from the Sanctuary of Allat, states that he fought against Abdallat Eeithenos and his brigands which had attacked the caravan (Gawlikowski 1988, 168; Gawlikowski 1994, n. 15). For *kataluma* as an inn, see the next footnote.

<sup>528</sup> The Greek definition in Liddell and Scott 1996, 899 is that of a lodging or inn. *Kataluma* is the usual term in Syria to refer to inns or caravanserais (Schousboë 2011, 281). Sartre's suggestions (Sartre 2000, 661) that goods could escape taxes by being stored in caravanserais such as Gennaes outside the city would only be possible for petty commerce, since Gennaes would therefore be open to commerce passing through, and hence also a fairly visible place. There is no doubt, however, that smuggling probably occurred on a regular basis.

<sup>529</sup> Poidebard 1934, 109-110.

<sup>530</sup> Cantineau 1933, 179-180; Young 2001, 159.

in layout.<sup>531</sup> The architectural complex there, suggested to be a *mansio*, is built with mud-bricks, with walls standing up to a height of at least 2 m, with arched doorways, plastered walls and vaults.

### *Qasr as-Swab*

Qasr as-Swab is located 170 km from Palmyra on the way to Hit and 55 km from Umm as-Salabih, so a long day's march away.<sup>532</sup> The main settlement consisted of several buildings clustered around a fort (A) on the northern part of the site (Fig. 5.12). A rectangular building (68 m by 53 m) to the south of the nucleus of the settlement may well be a lodging with stables: its large open central courtyard is lined with a row of identical rooms (4 m by 3.80 m each) on the north western and north eastern sides.<sup>533</sup> The external enclosure to the building indicates an animal stable.<sup>534</sup> Qasr as-Swab is also associated with a dam, though its date has been debated, with suggestions ranging from the Bronze Age to the Islamic period.<sup>535</sup> One argument in favour of a Roman foundation date is the setting up of similar water-retaining structures in the Near East in the Roman period, as discussed by Kamash, who has re-assigned dams thought to be of later periods to the Roman period.<sup>536</sup> The peak of activity in the Roman period, the manifest intent to improve facilities to give access to water and food along the road to Hit, and presence of other Roman-period dams that can now be more precisely dated (see below, Qasr Khabbaz), could speak in favour of a Roman date of origin for Qasr as-Swab.

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<sup>531</sup> Mior 2014.

<sup>532</sup> Gregory and Kennedy 1985, 214.

<sup>533</sup> *Ibid.*, 211-214; Dentzer 1994, 62.

<sup>534</sup> Kennedy and Riley 1990, Fig. 37.

<sup>535</sup> *Ibid.* Genequand 2001, 24 could not visit the site and verify whether the site has Umayyad-period buildings due to its location close to the Iraqi border.

<sup>536</sup> Kamash 2009, Chapter 4.

### *Qasr Halqum*

Qasr Halqum is located 45 km from Qasr as-Swab, hence a day's journey.<sup>537</sup> The fort itself has been assigned a post-Diocletianic date due to its square corner towers and intermediate bastions,<sup>538</sup> but an inscription mentioning Palmyrene reapers harvesting shows that the Palmyrenes harvested agricultural lands in the area in Roman times.<sup>539</sup>

### *Muhaiwir*

Stein records a Roman *castellum* at Muhaiwir approximately 45 km from Qasr Halqum and 187 km away from Hit. The site may have had sufficient water resources not to need to invest in any substantial cisterns or dams, since a number of wells were recorded near to it.<sup>540</sup>

### *Qasr Amij*

Qasr Amij consists of a walled enclosure 21.2 m by 22.86 m. The site relied on a dam and a cistern 34.75 m by 36 m by at least 0.9 m deep, so capable of collecting at least 1125 m<sup>3</sup> of water.<sup>541</sup>

### *Qasr Khabbaz*

Qasr Khabbaz near Wadi Zazuya is located one day's journey from the last oasis before Hit, Kubaisah (38.4 km) and hence a two-day journey to the Euphrates.<sup>542</sup> The fort,

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<sup>537</sup> Gregory and Kennedy 1985, 218.

<sup>538</sup> *Ibid.*, 210.

<sup>539</sup> Matthews 1984, 162-163.

<sup>540</sup> Gregory and Kennedy 1985, 201, 208 and 218.

<sup>541</sup> *Ibid.*, 198.

made of squared limestone blocks, with round corner towers as well as semi-circular interval towers on the north, west and southern sides, measures *c.* 29 x 29 m, and is still *c.* 4.57 m high.<sup>543</sup> The fort overlooked the wadi and relied on a dam 36.6 m long and 8.23 m wide, which could hold *c.* 2.5 million litres of water, and was connected to a reservoir via a set of sluices.<sup>544</sup> Stein dated the fort to the Severan period, though Bell considered it Islamic.<sup>545</sup> A photograph by Gregory and Kennedy (Fig. 5.13), however, clearly identifies the adjoining dam as a stepped dam, which is a Roman invention, and generally associated with Roman sites.<sup>546</sup> Such dams may have been used later in the Islamic period, but its location would strongly suggest a Roman date of origin for its construction.

### *Kubaisah*

Kubaisah is a 50,000 palm-tree oasis with numerous springs *c.* 20 km from Hit. It must have been the last stop before reaching the Euphrates.<sup>547</sup> Although no Roman-period remains have been recorded there, the oasis was a natural stopping point, due to its water and food resources, and important grazing grounds for the animals.

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<sup>542</sup> Kennedy and Riley 1990, 212 cite that it is 50 km from the Euphrates. They include the fort in their section of small forts with external towers, but note that "... [the fort] has never had any informed study made of it and is included solely on the basis of its location and Stein's instinct" (Kennedy and Riley 1990, 195).

<sup>543</sup> Gregory and Kennedy 1985, 185-195; Kennedy and Riley 1990, 212.

<sup>544</sup> Gregory and Kennedy 1985, 189-195.

<sup>545</sup> Bell 1911, 121; Gregory and Kennedy 1985, 194-195.

<sup>546</sup> Kamash mentions a dam in the area (Kamash 2009, *in passim* 68) by which she probably means the one at Qasr Khabbaz, though she does not list it in her table (Table 4.1).

<sup>547</sup> Bell 1911, 177 (especially on the date-palm grove); Gregory and Kennedy 1985, 185.

### *The creation of infrastructure*

Dating of the various stations that have been recorded along the Palmyra-Hit road is circumstantial, but a closer examination shows that some of the stations can be tentatively dated to the Roman period. Several arguments are in favour of a route which went through fixed road stations on the way to Hit. The first is that for transport reasons, travellers necessarily had to stop at 35-45 km intervals, that is to say, the distance that caravans usually covered on a daily basis. The second is the presence of the station at Gennaes, which, as described above, has an inscription by a well-known Palmyrene merchant trading and travelling to the Euphrates, and who was honoured at Palmyra and major trading centres on the Euphrates. The inscription specifically refers to Gennaes as a *kataluma*, a private inn for travellers. Could only one such accommodation really exist in AD 145, when the dedication was made? Instead it is much more likely the other way-points had a *kataluma* as well. This evidence of private investment contrasts with that of the Eastern Desert of Egypt, where no similar mentions have been found, and where the army was clearly in charge of way-points (forts). Thirdly, the AD 225 inscription at Umm as-Salabih confirms that a station or way-point existed well over a hundred kilometres into the desert. Finally the presence of dams would point towards Roman-period investments in logistical infrastructure at the time of a peak of activities in the region. It is possible that the path was used later as well; though the establishment of the evidence for the first individual stations, and perhaps even dams, occurs within the second and third centuries AD.

To conclude, the presence of a well-equipped and safe path could have been a key component of the city's wider economic engagement in the Euphrates and Persian Gulf. Due to the travel restrictions imposed on the area and the current war in Syria, however, no fieldwork has been possible to refine the chronology of the structures along the way

to Hit. Consequently it can only be suggested that the path and structures along its way show signs of development by the second century AD which would have assisted Palmyrene trade, and provided greater security and safety. In contrast to the Eastern Desert of Egypt, where the paths and structures were clearly built by the military, the interplay between private structures and military presence demonstrates that it was not just the state who was responsible for the provision of infrastructure along such trade routes. However, though in more limited way, the presence of private facilities and suggests that there was sufficient movement along the route to make such facilities, along with dams and other road infrastructure, worthwhile.

## **5.5 Organisation of trade**

Palmyra's involvement in trade with the east is epigraphically well attested and it seems appropriate to examine these before I compare their contents with the archaeological evidence. Thirty-four dedications to individuals who assisted with or protected caravans returning from the Euphrates and the Persian Gulf are the most important piece of evidence for long-distance trade via Palmyra.<sup>548</sup> The dedications are dated between AD 19 and AD 260, though fifteen alone, so almost half of them, were dedicated between AD 131 and AD 161.<sup>549</sup> The location of these dedications changed over time: the earliest were found in the sanctuary of Bel, and the latest on the main colonnaded street. Twenty, so the majority of inscriptions, dated from AD 81 to AD 199, came from the agora.<sup>550</sup> Five came from the sanctuary of Bel, Baalshamin, Allat

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<sup>548</sup> Gawlikowski 1994.

<sup>549</sup> Teixidor 1984, 52-53; Young 2001, 144, and 166; chronological gaps coincide with times of war with the Parthians.

<sup>550</sup> Delplace and Dentzer-Feydy 2005, inscriptions VI.01-VI.20.

and Umm al-Amad, and six, dating between AD 193 and AD 262-268, were located on the Colonnaded Street.<sup>551</sup> The location of these inscriptions is important for understanding the civic representation of the trade and the social status of its investors. They were situated in public places for prestige and to catch as much attention as possible from the city's inhabitants, while the city's physical entrepôts, which will be discussed later, were probably located outside the city itself and away from a viewing public.

The inscriptions allow us to understand Palmyra's geographic areas of commercial interest and social networks. They suggest that the city's commercial attention shifted from the more northerly towns of the Euphrates, away from Seleucia (Seleucia-Ctesiphon), from where we have the earliest trading reference in AD 19, and from Babylon, towards the Persian Gulf cities of Vologesias and Spasinou Charax (Fig. 5.7). It may well be that the shift southward occurred as a combination of change of political importance, commercial strategy, and the transshipment of goods onto rafts for quicker and cheaper transport to further markets.

One of the distinguishing characteristics of the inscriptions is their bilingual or sometimes trilingual nature, which portrays a strong sense of both local identity and culture, and of involvement in a wider cultural milieu. The inscriptions are typically in Greek and Palmyrene Aramaic, and occasionally include Latin. The usage of the Palmyrene dialect in public dedications constitutes a distinguishing characteristic of the local epigraphy. A conscious linguistic separation of Palmyra from the Roman world may have assisted control over trade, preventing non-Palmyrene speakers from easily engaging in the local social network, which formed the backbone of the city's

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<sup>551</sup> Delplace and Dentzer-Feydy 2005, 215.

dominance in trade with the east; as such, language was probably a very subtle and powerful tool of control.

The inscriptions from the agora and the colonnaded street of Palmyra highlight the importance of travels to the mouth of the Persian Gulf, and to the maritime routes of the Indian Ocean (Fig. 5.14). The two earliest inscriptions on trade from Palmyra, dedicated in AD 19 and in AD 24, point to the city's initial connections with Babylon and Seleucia.<sup>552</sup> Vologesias and Spasinou Charax, however, quickly superseded these cities as final destinations: indeed the majority of inscriptions name these two places as the departure points of the returning caravans.<sup>553</sup> The connections to these cities at the mouth of the Persian Gulf were of interest to both the Palmyrenes and the Romans as early as AD 19, when Germanicus, on a visit to Palmyra, sent a Palmyrene envoy called Alexandros to the city of Spasinou Charax, and to another ruler, probably the king of Elymais.<sup>554</sup> Inscriptions mentioning Soades refer also to his co-citizens established at Vologesias, implying that a resident merchant community of Palmyrenes directly managed the logistics of trade on the Persian Gulf.<sup>555</sup>

Within the Persian Gulf, the presence of Palmyrenes determined the success of their commercial enterprises. On the island of Kharg, *c.* 25 km off the coast of Iran and 44 km from the Gulf of Hormuz, several *necropoleis* and funerary reliefs of Palmyrene influence could suggest a possible community of Palmyrenes on the island.<sup>556</sup> The best attested connections are to the isle of Tylos, modern Bahrain, where a Palmyrene was

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<sup>552</sup> Rostovtzeff 1932, 796-798. Though Gawlikowski (pers. comm.) remains dubious about the identification of Seleucia with Seleucia on-the-Tigris (other possibilities would include Seleucia on-the-Euphrates, Seleucia on-the-Belus, or in keeping with the Aramaic text, Karkha di Bet Selokh).

<sup>553</sup> Young 2001, 126-129.

<sup>554</sup> Cantineau 1931, 139-141, n.18; Gawlikowski 1994, 28; Healey 1996, 33.

<sup>555</sup> Drexhrage 1988, n. 17.

<sup>556</sup> Ghirshman 1959, 3, although the evidence remains controversial (Steve 2003).

satrap in AD 131 and also honoured at Palmyra.<sup>557</sup> Two other Palmyrenes are known as archons here as well.<sup>558</sup> One of the tombs of the Janussan cemetery on Bahrain may also be that of a Palmyrene official.<sup>559</sup> While residing and assisting the king, these Palmyrenes would also have provided traders with important social connections, and presumably promoted Palmyrene interests. By the second century AD, Palmyrenes relied on the island as a port of call for Palmyrene vessels on their way to India. Access to Bahrain would also have given them direct access to its pearl market: the island was already famed for its pearls by the time of Pliny,<sup>560</sup> and may have been an important pearling centre.<sup>561</sup>

Palmyrene merchants began to trade directly with India rather than via intermediaries. This is known from inscriptions. For example, a dedication from AD 157 is by a group of merchants who went to Scythia (Northern India) in the boat of Honaino, son of Haddudan.<sup>562</sup> Another inscription, also from AD 157 again mentions merchants coming back from Scythia on the ship of Beelaios Kyrou, while a third has recently been reinterpreted as mentioning the land of Kushan, which would imply a maritime voyage as well, but also demonstrates the ownership of seafaring vessels by the Palmyrenes.<sup>563</sup> The funerary relief of Julius Aurelius Marona (Tomb n.150) of AD

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<sup>557</sup> Young 2001, 144; Delplace and Dentzer-Feydy 2005, VI.04.

<sup>558</sup> Ingholt 1932, 278-292; Gawlikowski 1994, 29; Gawlikowski 2005, 189. The satrap's power may have extended over parts of Eastern Arabia as well.

<sup>559</sup> Lombard and Salles 1984, 140; Potts 1990, 147; Healey 1996, 36.

<sup>560</sup> Pliny, *Natural Histories* 6.148.

<sup>561</sup> The Persian Gulf had a long-standing tradition of pearl fishing dating back to the Neolithic. Currently, the world's oldest known find of a pearl in an archaeological context comes from the southern tip of the Persian Gulf (Umm al-Quwain), and is radiocarbon dated to 5547–5477, 5410–5235 BCE. (Charpentier *et al.* 2012).

<sup>562</sup> Inv. X.96. Gawlikowski 1994, n. 20; Bin Seray 1996; Delplace and Dentzer-Feydy 2005, 178, VI.09.

<sup>563</sup> Inv. X.91 and 95. Cantineau 1933, 187; Gawlikowski 1994, n.24; Bin Seray 1996. Delplace and Dentzer-Feydy 2005, VI.14 for the inscription reinterpreted as saying Kushan (rather than Choumanes).

236 shows a merchant with a ship in the background, expressing the Palmyrene merchant's interest in maritime trade or even ownership of a sea-going vessel (Fig. 5.15).<sup>564</sup> The inscriptions and perhaps also the tomb relief, attest to Palmyrene ownership of ships on the Persian Gulf, and direct sailing to India. Ships headed from the Persian Gulf to the Indian ports of Barygaza, or Muziris, to obtain the typical goods described in the *Periplus Maris Erythraei*.<sup>565</sup> Furthermore, these inscriptions emphasise the role of the social network in organising logistics at major transshipment points. The fact that the majority of the caravan trade inscriptions name Spasinou Charax as origin is a sign of the growing role of the Persian Gulf in trade and of the presence of merchant communities providing support to both the overland and maritime merchants. Indeed sailors using the Persian Gulf were aided not only by the closer proximity to India but also by easier navigation in the Gulf.<sup>566</sup> As argued by Seland, goods coming in via Palmyra reached the Mediterranean at the beginning of the sailing season (April), while those coming through the Eastern Desert only arrived in Alexandria towards the end of the sailing season (August), and this provided the longer Persian Gulf-Palmyra-Rome route with a competitive economic advantage.<sup>567</sup>

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<sup>564</sup> Bin Seray 1996; Gawlikowski 2005, 55. Though in this specific case, there is no direct reference to the Indian Ocean or the Persian Gulf, and while it may attest to ownerships of ships in the Persian Gulf (Young 2001, 128) it cannot imply that 'many' owned ships (*Ibid.*), but certainly that some did, and that overall there was an interest in maritime trade, whether in the Persian Gulf, Indian Ocean, Red Sea or even the Mediterranean. It is unlikely that Marona's ship was for sailing the Euphrates as the known boat building tradition consists of rafts and mainly flat-bottomed and small ships to cope with shallows and rocks, and difficult sailing conditions (Agius 2008, 114 and esp. 111-140 on pre-Islamic ship construction techniques on the Euphrates); *contra* Smith 2013, 78 fig. 3.9, the 'long oars, perhaps for navigating along the Euphrates' are not oars but double rudders, a standard feature of Roman-era (mainly Mediterranean?) maritime ships.

<sup>565</sup> Casson 1989.

<sup>566</sup> Sanlaville 1989, 23; Seland 2010.

<sup>567</sup> Seland 2010.

One further point attesting to the development of social networks outside Palmyra has to do with its presence and probable commercial interests in the Eastern Desert of Egypt. The maritime interests of Palmyra are particularly important to understand, as they are indicative of a realisation that maritime trade was of prime importance in the Roman Empire, and a key to controlling Indian Ocean trade. It was also a realisation of a source of profit into which the Palmyrenes could tap into through their sophisticated usage and control of their social network within Indian Ocean commerce. An inscription from Koptos reveals that a wealthy investor by the name of Zabdallas built a propyleion with three porticoes:

Ἰον Ζαβδάλα Σαλμά-  
 νου καὶ Ἀνεΐνα Ἄδρια-  
 νῶν Παλμυρηνῶν  
 ναυκλήρων Ἐρυθραιῶν,  
 ἀναστήσαντα ἀπὸ θεμελίου  
 τὸ προπύλα[ι]ον καὶ τὰς στούας  
 τρεῖς καὶ τὰ θυρώ[μ]ατα ἐκ και-  
 νῆς, τὰ πάντα ἐκ τῶν ἰδίων  
 αὐτοῦ φιλοκαγαθίας χάριν  
 [Ἄ]δριανοὶ Παλμυρηνοὶ συν-  
 ἔμποροι τὸν φίλον.<sup>568</sup>

The inscription holds further important information: the dedication specifies that it was given by “the merchants from Hadriane Palmyra”, but it also mentions the “Palmyrene ship owners on the Red Sea” which implies two different organisations (with individuals who could of course belong to either or both).<sup>569</sup> The presence of Palmyrenes on the Red Sea, at Berenike is known through the discovery of a temple with the statue base of Hierobol, but also Palmyrene dedications, albeit associated with

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<sup>568</sup> Zabdallas Salmanou, also (called?) Aneinas, of the ship owners of the Red Sea from Hadriane Palmyra, who has set up anew from the foundations the propylaea and the three stoas and the chambers, entirely from his own funds, the merchants of Hadriane Palmyra (set this up) to their friend, for his friendship and distinction (translation adapted from Young 2001, 80).

<sup>569</sup> SEG 34.1593= I.Portos 103. Bingen 1984; Young 2001, 80-81.

the military.<sup>570</sup> However, Palmyrene commercial interest might be further attested on the Nile and beyond Koptos: an inscription with Palmyrene writing on the left hand side found at Denderah, so on the Nile, displays the name of a Palmyrene, along with the mention of merchants:<sup>571</sup>

[? Ἰούλ(ιον) Αὐρ(ήλιον) [Z.....]  
 Μακκαί[ου/ον?..... οἱ?..... ]  
 καὶ ἔμπο[ροι? .....]  
 τὸν παρα[κομίσαντα ? τήν]  
 συ[νοδίαν .... ]

Denderah was an important resting place after an almost 40 km difficult journey upstream when the navigators in the sailing season had the full power of the flood against them and little or no northerly wind to help counter the current.<sup>572</sup> Once one passes the Denderah bend, one could wait at Denderah for better wind conditions to sail up the Nile. Palmyrene presence at Denderah would imply that the Palmyrenes also operated along the Nile, and thus not only within the Red Sea or Eastern Desert alone.

In short, the Palmyrene social network as attested epigraphically was implicated in strategic locations on the Euphrates, Persian Gulf / Indian Ocean and Red sea, including places which necessitated overland transport via Egypt and Syria (Fig. 5.14).

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<sup>570</sup> *OGIS* 639; Sidebotham and Wendrich 1996, 198; Sidebotham 2011, 65-66. The first inscription, dated to 215 AD, was dedicated by Palmyrene archers, while the second inscription was dedicated by the prefect and the second-in-command of the *Ala Thracum Herculiana*, a cavalry division which had been stationed at Palmyra until c. 185 AD, at which point it was transferred to Koptos. Several dedications are known from the Eastern Desert of Egypt, such as the one at the fort at Didymoi from the early third century AD (Cuvigny 2012, 48-49: *I.did.5.*).

<sup>571</sup> *CIS* II.3190. “Julius Aurelius... (son of?) Makkai (or Makkaios?) ... and the merchants ... bringing a caravan..” The last two lines which have been suggested as reconstruction represent perhaps too much of a reconstruction to be sure that the reference is to a caravan (*sunodia*) coming to Denderah. For the translation, see Clermont-Ganneau 1903; Young and McLaughlin cite *naukleroi* for this inscription (Young 2001, 81; McLaughlin 2010, 105), but the original text does not mention this; it must be a conflagration with the inscription from Koptos mentioned above (*SEG 34.1593= I.Portes 103*).

<sup>572</sup> J. Cooper, pers. comm.

The Palmyrenes also had ships (Fig. 5.15), and local social networks of support at local transshipment points.<sup>573</sup> Through their social network and their weak long-distance ties, the Palmyrenes developed several competitive advantages (Fig. 5.16) by taking over different phases of the process of bringing goods from the point of origin to the selling point by developing their presence along the Euphrates, and the Persian Gulf and Indian Ocean, a term known in economics as vertical integration. Yet the development of activities in the Red Sea and Egypt, which implied taking over a similar trade in another geographic area, are representative of another model of economic expansion: horizontal integration. This strategy consists in acquiring additional business activities at the same level of the value chain in a similar industry, such as developing trade in the Red Sea in parallel to that of the Persian Gulf.

That a Palmyrene merchant community network existed perhaps in the Mediterranean is less clear.<sup>574</sup> Military inscriptions aside, few inscriptions of Palmyrenes are known. A Palmyrene is known on the island of Cos, though it is not entirely clear whether or not he is a merchant.<sup>575</sup> A Palmyrene community also existed in the city of Rome, as known from several altars found in the area of the temple of Sol at Porta

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<sup>573</sup> Although this is no proof against the argument that circumnavigation of Arabia was not regular (Salles 1996, 253-254), it shows that Palmyrene presence around the Arabian Peninsula, suggesting that regular circumnavigation should not be excluded.

<sup>574</sup> Terpstra 2011, 103-105, 254 with further bibliographic references. See also Terpstra 2013, 152-160 for Palmyrenes in Rome. Terpstra has also convincingly argued that the Nabataean mercantile network, for example, can be traced along the Aegean and in Italy, but remains cautious in the case of Palmyrenes.

<sup>575</sup> Dirven 1996, 50 and footnote 55. A container found with Palmyrene script in Qana, on the Arabian Gulf, mentions Achaea, and it has been suggested that it alludes to potential connections between Palmyrene merchants, and a network of merchants in Achaea, Greece. (McLaughlin 2010, 105). I have not been able to verify this, but the fact that we know of a trader going to Spasinou Charax named Zabdibol, son of Aachei (Delplace and Dentzer-Feydy 2005, VI.01) might suggest an alternative explanation, namely that Achaea is simply a Palmyrene personal name.

Portese,<sup>576</sup> next to the Tiber river and opposite Rome's fluvial warehouses, in particular the Horrea Galbae. An altar which has both a Latin and a Palmyrene dedication by Tiberius Claudius Felix, his wife and his son. The last line of the Latin dedication, *Calbienses de coh(orte) III* possibly refers to the third *cohors* (court/warehouse) of the Horrea Galbae, Rome's major fluvial warehouse on the left bank of the Tiber, which is characterised by three long rectangular warehouses.<sup>577</sup> If so, Tiberius Felix was a worker at the *horrea*, and could have developed this to his advantage, yet we have no proof of it. In the Transtiberim district (Trastevere), almost directly across the *horrea*, a further two Palmyrenes commemorated the consecration of the Temple of Bel, one of whom, C. Licinius N., may be related to a C. Licinius Flavius known from the Palmyrene Agora.<sup>578</sup> Yet the connection between the Palmyrenes and the city of Palmyra itself is never explicitly made; whether we may identify a diaspora trading community in the Mediterranean is therefore unclear. While some Palmyrenes may have invested in carrying goods towards Rome, it is more likely that the bulk of goods were simply funneled towards the main trading centres of the Levant and the wider Mediterranean; though so far not enough evidence is available to ascertain either. The Palmyrenes' main concerns and commercial activities seem centered on the organisation of the transshipment areas and safe transport of goods from India into the Mediterranean.

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<sup>576</sup> Savage 1940, 53-54. These consist of a bilingual Flavian altar dedicated to *Sol sanctissimus* (Latin) / Malakbel and gods of Palmyra (Palmyrene) (*CIL* 6.710 = 30817); a second-century AD relief and bilingual dedication to Bel, Yaribol, and Astarte (*IG* 14.972); and a relief and bilingual dedication dated to AD 235, and dedicated to Aglibol and Malachbel (*IG* 14.971). The cessation of dedications here in the third century AD was caused by the foundation of Aurelian's sanctuary of Sol (Savage 1940, 54).

<sup>577</sup> Savage 1940, 53; C and G are often interchangeable and Savage's interpretation hinges on the fact that *C(G)albienses* his interpretation is debated (Houston 1990, 190).

<sup>578</sup> Will 1992, 83-84.

### *Commercial warehouses at Palmyra*

Although we do not know the exact scale of traffic between Palmyra and the Euphrates, it may be postulated that the caravans travelling to the Euphrates could be in the size range of those of the Ottoman period, when caravans of about 5,000 camels travelled to the Euphrates.<sup>579</sup> By the ninth century BC, caravans of several hundreds of camels laden with frankincense were already undertaking the journey between Southern Arabia to the capital of Hindanu on the middle Euphrates.<sup>580</sup> The two inscriptions from AD 157 mentioned above naming two separate Palmyrene ships coming from India imply that several hundred tons of goods were transported to the Persian Gulf, regardless of how much we believe was sold onto local markets on the Persian Gulf, urban markets along the way, or transported back to Palmyra from India. The more recent re-interpretation of the graffito from Tower tomb 70 in Palmyra as the customs due of one fourth (*tetarte*) rather than four interest loans,<sup>581</sup> would further argue for sizeable caravans coming through. The sums mentioned in the graffito, dated to sometime between the end of the first century AD and first half of the second century AD, amount to a total of *c.* 90 million sesterces, which would represent the amount of the tax obtained from the arrival of caravans with cargoes worth some 350 million sesterces.<sup>582</sup> In contrast to the Red Sea trade, as will be elaborated in the next chapter (section 6.6), it represented a smaller fraction of income to the Roman state, but nonetheless represented an important income to the state, and certainly a large income to the elite of an entirely atypical provincial town. Despite not being able to compete with the tonnage of maritime vessels and the Red Sea / Eastern Desert traffic, the *tetarte*

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<sup>579</sup> Seland forthcoming.

<sup>580</sup> Liverani 1992, 212.

<sup>581</sup> De Romanis 2004; De Romanis 2006.

<sup>582</sup> Tchernia 2011, 16.

income from Palmyra shows that caravans to the Euphrates had quite valuable cargoes.<sup>583</sup>

Incoming goods would have required safe and large entrepôts. Despite the reference to Palmyra as the caravan city *par excellence* in the Roman Empire,<sup>584</sup> the potential location, function and details of buildings serving as entrepôts for long-distance trade have not been much discussed, and few have made a note of these structures. From aerial photographs from the 1930s, Dentzer suggested that at least 15 substantial square or rectangular buildings could be identified, and were characterised by an internal row of small, identical and individual cells, possibly on all four sides of the structure, and which opened only onto a large courtyard occupying almost half of the entire surface of the buildings (*c.* 40%).<sup>585</sup> These buildings were furthermore characterised by a single wide entrance.<sup>586</sup> One of the structures (n. 555) was excavated, and the material evidence could establish a Roman date: in this instance, the building had two phases, and the second phase had a *terminus post quem* of AD 260 based on coins and ceramics.<sup>587</sup> The buildings are mainly located outside the urban perimeter of Palmyra itself, in the northern quadrant of the city (Fig. 5.17), on the route towards Epiphania, Emesa, Antioch and the Mediterranean. Traffic to the Euphrates could have also departed from there, since the saline lake to the south-east formed a natural

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<sup>583</sup> Similarly, one inscription (discussed below in section 5.8) mentions that a caravan leader paid 300 gold denarii to get a caravan out of troubles, which indicates that the value of the caravan's cargo was probably considerably more than that (Inv. III, 28 = *CIS* II, 3948).

<sup>584</sup> Rostovtzeff 1932.

<sup>585</sup> Dentzer 1994.

<sup>586</sup> *Ibid.*

<sup>587</sup> *Ibid.*, 48.

boundary which could not easily be crossed.<sup>588</sup> The buildings generally range from 35 m by 35 m to 75 m by 75 m, (the largest structure is 130 m by 170 m). The widest building, n. 528 (Fig. 5.18) is particularly impressive due to its size, 130 m by 170 m, with a courtyard surface covering 76% of the interior space; its individual cells remain 8 m deep, similar to smaller structures (c. 5-9 m). The shape of the structures allowed for activity inside the courtyard but control of movement into the building through a narrow entrance way. Inside were small individual rooms that could be used for temporary storage of goods. A few likely options are to be considered: the goods could be agricultural, pastoral, but also luxury goods from the East. These options are not at all mutually exclusive: harvesting, sheering sheep, and trading occurred at different times of the year. The configuration of these structures would have allowed the owners (whether communal or individual owners) to use, or rent, as many rooms as desired.

The levels of organisation implied by such structures, and also the trade itself, suggest that investors might have financed the building and maintenance of specific spaces that could then be used at their convenience or let out according to need.<sup>589</sup> The shape and room layout of the structures would seem ideal for such division and rental of spaces (if wanted) according to the needs of both the original *entrepôt* owner or investor, and individual merchants. Several other advantages may be considered: the security provided by communal, guarded spaces, and a simplified taxation process both for traders and the tax agents' local collector. Palmyrene *entrepôts*'s might be compared to those of harbours and port cities, where generally there is a need for structures meant for loading/offloading substantial quantities of goods at a single time.

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<sup>588</sup> Hammad 2010, 141-142. Similarly, camel stables in villages in Roman Egypt were also always located on the outskirts of the property close to the road (Adams 2007, 89 and *P. Iand.* VII 142 ll.7-12).

<sup>589</sup> We know for example from the Murecine tablets, documents from the Bay of Naples, that spaces were rented as individual storage areas within warehouses (Camodeca 1992; Andraeu 1999, Chapter 6).

The Palmyrene structures identified by Dentzer suggest the presence of substantial warehouses on the outskirts of the city, which supported the Palmyrenes in their endeavour to be a focal point of economic attraction and the main market in the region. This would seem to suggest Palmyra's central place in the local hierarchy, but also the presence of individuals with greater wealth perhaps also benefitting from the structures established and individual merchants making profits on a smaller scale.

### *Items traded*

The fact that the major trade routes ran towards the Persian Gulf and the Indian Ocean strongly suggests that the types of goods that were imported into Palmyra were the typical imports from India and the Arabian Peninsula, such as silk, cotton, pearls, pepper, frankincense, or other goods mentioned in the *Periplus Maris Erythraei*.<sup>590</sup>

Excavations in the tower tombs in Palmyra have revealed one of the richest collections of textiles from the Roman period, and provide insights into the types of textiles imported into the Roman Empire.<sup>591</sup> Over two thousand fragments of more than five hundred items of clothing are known from nine tower tombs alone.<sup>592</sup> Textiles aside, the tower tombs from Palmyra offer a rather limited idea of the other types of goods imported into the city. A variety of materials have been found in the tower tombs: linen, wool, different types of silk and cotton, of different qualities and weaving styles, are preserved due to the dry climate and the darkness in which they were kept. It is unlikely that these textiles represent purely elite assemblages, although some of the finer textiles

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<sup>590</sup> Casson 1989.

<sup>591</sup> Pfister 1934; Schmidt-Colinet 1995b; Stauffer 1996; Schmidt-Colinet and Stauffer 2000; Stauffer 2007.

<sup>592</sup> Schmidt-Colinet 1995b, 47; Schmidt-Colinet and Stauffer 2000, 1. Stauffer 2000, 247-248.

were woven with gold or purple threads, dyed with kermes, and came in a wide variety of colours (purple, red, green, yellow, blue, and brown). Some (a minority) were even made from cashmere, which was most likely imported from Mongolia.<sup>593</sup> Silks and cotton had origins in India and China, attesting to the existence of, and reliance on, networks of trade reaching both regions.<sup>594</sup> The presence of only partially degummed silk (silk was degummed before weaving in Chinese finished products) in silk damasks shows that some silk came in unfinished and thus was sometimes imported as raw material, hence in bales, and that some silken textiles were manufactured in Syria, most likely at Palmyra itself.<sup>595</sup> In the Roman world white silk could be sold for 12,000 denarii per pound.<sup>596</sup> The lightness, value, and small pack size of silk made it an ideal commodity for Palmyrenes to invest in and to transport across long-distances.

Along with silk and cotton, pearls were amongst the most precious items imported from the Euphrates and the Persian Gulf, in particular from Tylos (modern Bahrain) and Spasinou Charax. These fed into the greater Roman Mediterranean pearl market, and supplied a sophisticated network of known pearl sellers who handled pearls in Rome and the provinces.<sup>597</sup> Like silk, the lightness and value of pearls made them particularly well suited to profitable long-distance trade. However, while the pearl trade was an important aspect of regional trading dynamics, archaeological finds are rare; pearls usually disintegrate with time. Palmyrene busts from the second-century AD

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<sup>593</sup> Rather than Iran or Afghanistan where cashmere-producing sheep are also known. (*Ibid.*, 10).

<sup>594</sup> Schmidt-Colinet 1995b, 47.

<sup>595</sup> Stauffer 2000, 248.

<sup>596</sup> In contrast to pepper for example, which cost between 4 and 15 denarii, depending on the variety, and which was mainly imported in bulk via the Red Sea. These prices are based on Diocletianic prices: *Edictum de Pretiis Maximis* XXIII 1–2 (white silk) and XII, 28 (pepper). On the basis of the Muziris papyrus, De Romanis has argued that the cargo of the Hermapollon contained, amongst other goods, 544 tons of pepper alone (De Romanis forthcoming).

<sup>597</sup> Carter 2005; Schörle forthcoming.

often represent women with bead or pearl (or pearl-like) necklaces and earrings (Fig. 5.19).<sup>598</sup> Julia Domna's portrait with particularly large earrings on the Severan Tondo from Berlin (Fig. 5.20) may be both a reminder of pearls as an elite status marker but also the pearl routes (whether via the Persian Gulf or the Red Sea). Spasinou Charax, the most common destination on the Persian Gulf for the Palmyrene caravan trade, was perhaps a major intermediary pearl market for the Persian Gulf and Indian trade during the Roman period, as suggested by the continuation of a pearl market tradition in the Sassanid and early Islamic periods in the nearby town of Ulla.<sup>599</sup> Yet Palmyrenes also had direct access to Bahrain, one of the areas of origin of pearls. Bypassing an intermediary market place, implied that they could have stronger control of the buying and selling price of pearls.

Slaves may also have been traded, although, as was the case in the Sahara (Chapter 3, Section 3.5), this has left little archaeological evidence. They were probably traded east to west and/or west to east, although there is insufficient evidence to make further claims.<sup>600</sup> The exotic nature of foreign-born slaves was probably an attraction for trade going either way. Slaves were exported to India, as made explicit in the *Periplus Maris Erythraei*, and some could have been exported via Palmyra.<sup>601</sup> In fact, slaves are mentioned in the AD 137 Palmyrene Tariff, and were taxed at a rate of 22 *denarii* for

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<sup>598</sup> For the manufacture of pearl fakes as a result of the intensification of trade across the Eastern Desert and Palmyra, Schörle forthcoming. It is however impossible without concrete (and hence unlikely, as pearl very easily disintegrate) archaeological proof to disentangle what may have been beads, pearls, or indeed fakes.

<sup>599</sup> Carter 2005, 144; Schörle forthcoming.

<sup>600</sup> We know for example of an Osrhoenian selling a slave he had brought from the Euphrates to Tripolis, on the coast, in AD 251 (Rey Coquais 1978, 55). Another document from the region (other than the Palmyrene Tariff discussed further below) is a sale contract for a slave (*P.Dura* 28) from an Edessene woman to the wife of an Edessene working in the garrison, and is thus not very useful.

<sup>601</sup> *PME* chapters 8, 13.

their import and export, though different taxes applied to veteran slaves (10 *denarii*) and 12 *denarii* for a slave bought at the market itself in order to be sold onwards.<sup>602</sup> As the Tariff testifies, Palmyra had a slave market where slaves were sold for local use and for export.<sup>603</sup> The comic tale of the travels of the philosopher Apollonius of Tyana, who passed through the border town of Zeugma on his way to India may reflect a wider regional reality of the imperial period. Philostratus, writing in the third century AD, noted that Apollonius was supposedly invited to pay taxes for his virtues (moderation, righteousness, virtue, self-control, courage and discipline) by a customs guard believing these to be the names of female slaves rather than actual virtues.<sup>604</sup> The fact that the guard pointed to a tablet containing the tax rate indicates that this was typical imperial policy at the borders, but the literary tale cannot be used to determine the direction of the trade in slaves, nor does give it further information about the nature of taxation.

Slave-trading over long distances had a natural logistical advantage because slaves did not require animals (and their supplies) to transport them, and they could also carry their own water and food. Similarly, the majority of goods visible in the archaeological and literary record, consisted of light, easy-to-transport items, showing that great care was taken over the choice of items to trade. It would have been relatively easy to carry substantial quantities of cotton or silk on camels, along with other small, high value items, such as pepper, gems, diamonds and medicinal plants, such as *lycium*.<sup>605</sup> It is possible that the Palmyrene traders made choices not only based on their budgets but also according to their local and regional market distribution possibilities. A

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<sup>602</sup> Matthews 1984, 176, 179.

<sup>603</sup> Lines 4-8 of the Tariff: Matthews 1984, 175-176; Teixidor 1984, 246.

<sup>604</sup> Philostratus, *Life of Apollonius of Tyana*, 1.20.

<sup>605</sup> Millar 1993, 309.

part of any cargo also had to consist of water and food supplies, but could have been partially alleviated by the presence of inns or stations along the road to Hit.

Another valuable trading item would have been purple-dyed products, which have been found in tower tombs: both of silk and wool. The Palmyrene Tariff,<sup>606</sup> which refers to the regional economy, suggests that wool or cloth travelled between Palmyra and important Mediterranean purple-dye centres such as Tyre and Sidon. Palmyra sent wool and silk to be dyed in coastal workshops which sent it back to Palmyra, since the Tariff refers to unspun purple wool.<sup>607</sup> Purple-dyed silk has also been found at Palmyra,<sup>608</sup> which was obviously the closest point of import of silk for the coastal workshops. A close economic relationship between Palmyra and the coastal manufacturing industry is also suggested by the emulation (Tomb 36) of sculpture/relief patterns attributed to sarcophagus workshops of Tyre and Sidon.<sup>609</sup>

The tombs and cemeteries of Palmyra have been the focus of much research.<sup>610</sup> They have, however, been thoroughly robbed through time. In excavated tombs, it has been observed that the skulls were separated from the body parts, presumably to remove jewellery from the neck area,<sup>611</sup> and only ceramic, lamps, small glass items, and in rare

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<sup>606</sup> Teixidor 1984, 86; Matthews 1984, 176-180.

<sup>607</sup> Stauffer 1996, 425.

<sup>608</sup> *Ibid.*

<sup>609</sup> *Ibid.*; see also Schmidt-Colinet in the same volume. Purple in the Mediterranean was mainly produced from the tinctorial gland of three species of sea snails, the *Murex brandaris*, *Murex trunculus* and *Purpura haemastoma*. These could not easily be preserved and purple therefore constituted a coastal industry (Macheboeuf 2007).

<sup>610</sup> Wiegand and Krencker 1932; Will 1957; Gawlikowski 1970 for the initial classification of tomb types; Ingholt 1928; Colledge 1976; Ploug 1995, Sadurska and Bounni 1994 on sculpture; Seyrig 1939, Gawlikowski 1986. For an extended bibliography, Saito 2005, 151-153.

<sup>611</sup> Saito 2005, 156.

instance bronze artifacts, and leather containers (tomb ML 1-1) have been recovered.<sup>612</sup> Textiles asides, few items, such as a pearl earring with 14 pearls, or the presence of a cowrie shell in the tomb of Zabda clearly alludes to commerce with the Indian Ocean.<sup>613</sup> In the associated relief, the deceased is depicted reclining on a couch, covered in textile embroidered with either beads, or pearls, a clear sign of wealth.<sup>614</sup>

To conclude, the archaeological evidence at Palmyra provides further information concerning goods obtained in the long-distance trade, and complements the epigraphic data. The involvement of local elites in the organisation of caravans to conduct trade with the East and the scale of the social network in place throughout the Euphrates, the Persian Gulf and the Eastern Desert of Egypt, however, certainly favours the idea that trade depended on complex networks, with weak long-distance ties to Palmyra and the creation of local strong ties. Palmyra's position of strength in the region arose through its successful establishment of a social network at various breaking points and transshipment areas. This allowed Palmyrenes as a community to expand economic activities following different types of strategies of economic integration in order to tap into new markets. Palmyra could not directly compete with the commercial flow coming in via the Eastern Desert in terms of quantity, but it could through its successful management of transport logistics become of regional and supra-regional economic importance. It could also provide the Mediterranean with goods earlier than those travelling via Egypt (*cf* p. 164). The investment of the Palmyrenes in the Red Sea trade routes further shows the commercial engagement of Palmyrene merchants in new geographic areas and their ability both to recognise and exploit other commercial

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<sup>612</sup> *Ibid.*, 156-157.

<sup>613</sup> Witecka 1994, 72-73 for pearls; cowrie shell: Michalowski 1960, 201 (Fig. 224) and cat. 46, 202.

<sup>614</sup> Michalowski 1960, 179, Fig. 197.

opportunities. It is perhaps worthwhile to stress here the private and more local (Palmyrene) nature of the trade in contrast with the Eastern Desert, in terms of individuals who traded, but also invested in infrastructure.

## 5.6 Extractive industries

Palmyra's extractive industry was entirely aimed at supplying its local and regional markets. In contrast to the Libyan and Egyptian case studies, no precious ores or minerals were relatively locally available to supply supra-regional markets.<sup>615</sup> Palmyrene wealth, most visible in Palmyra's lavishly decorated streets, its agora, temple and colonnaded street favoured intensive building activities and the development of an economic sector linked to the quarrying of stone.<sup>616</sup> The quarries that supplied the city with hard limestone, the most common material used for buildings, and architectural elements such as columns, were located around 15 km north-east of Palmyra, where some unfinished block samples were found *in situ* in the quarries.<sup>617</sup> Its quality was poor, with coarse, grainy, uneven crystals and black mica veins.<sup>618</sup> These were in use between the first and third centuries AD; a settlement nearby shows that quarry workers resided on site.<sup>619</sup>

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<sup>615</sup> The exploitation of stone in Palmyra represents a more classic Central Place Theory model in which goods of the hinterland are fed just into local markets.

<sup>616</sup> On the economics of stone quarrying and stone trade in the Empire overall, Russell 2013. As noted by Russell, most stone quarries were within close reach of the Mediterranean Sea or rivers, with the exception of places like Palmyra, where quarries were only really meant for their local urban markets (Russell 2013, 80-81).

<sup>617</sup> Bounni and As'ad 1989, 128.

<sup>618</sup> Dodge 1988, 223.

<sup>619</sup> Schmidt-Colinet 1995b.

Salt was the other important local extractive activity and a locally available natural resource, an advantage and resource many other cities, villages or inland towns did not have. Salt was produced by Palmyra's saline lake, the Sabkhat al Muh,<sup>620</sup> a former palaeolake of about 510 km<sup>2</sup> located to the south east of the city.<sup>621</sup> Salt production is attested from the Bronze Age onwards, and continued to be exploited in different historical periods, after the gradual decline of the city at the end of the third century AD, in the early Islamic period,<sup>622</sup> and into the twentieth century (Fig. 5.21). In the early twentieth century, Musil reported that the main source of Palmyrenes' income was salt gathered in the nearby salt lake, and was exchanged for money or cereals in the cities of Hama or Homs.<sup>623</sup> Salt was an important economic resource for Palmyra: salt was vital for food preservation and animal husbandry, for adequate water and mineral retention. Salt was equally a crucial component in the leather-tanning and textile-dyeing processes which are well attested at Palmyra through the textiles discussed above, the Palmyrene Tariff and funerary reliefs, and can help explain Palmyra's regional importance in these two industries. The edges of the salt marshes also hosted a wide range of fauna and flora, and were vital grazing grounds, as saltbush (esp. *atriplex halimus* L) and salsola plants (esp. *salsola vermiculata* L) provide excellent, if not necessary, natural fodder for camels.<sup>624</sup> It has also been shown that in the marginal regions of Syria, mixed barley / salt bush agriculture increases animal feed locally available, and that the nitrogen in saltbush stimulates animal growth.<sup>625</sup>

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<sup>620</sup> Hammad 2010, 77-78.

<sup>621</sup> Sakaguchi 1987.

<sup>622</sup> Al-Mas'udi VIII, 398.

<sup>623</sup> Musil 1928, 146. Also Wirth 1971, 445.

<sup>624</sup> A camel's diet needs to be rich in salt, and these two plants constitute a natural source of salt for camels (Cattaneo *et al.* 2005, 182).

<sup>625</sup> Gintzburger *et al.* 2000.

Salt was important enough to the local economy that the city ensured a fair and stable market price: in the Roman period, salt production was regulated by the city.<sup>626</sup> As such, the city exerted a state-like monopoly on salt. The antecedent of the Palmyra Tariff,<sup>627</sup> (which is reproduced in the Palmyra Tariff), written in AD 58/59, concerned the regulations and dues of the city's water sources and salt pans.<sup>628</sup> Salt had to be sold to the city at one Italian *as* per *modius* of sixteen *sextarii*, and anyone not declaring the salt was liable to a fee of two *sestertii* per *modius*.<sup>629</sup> The sale of salt only within the city market also implied that the city controlled or regulated aspects of the urban economy, whether manufacturing textiles and leather, or food preservation.<sup>630</sup> If on average, one may estimate that individuals require between 20 kg to 30 kg of salt per year, for personal needs, salting goods and for animals, we may envisage that Palmyra would have required *c.* 800 t to 1,800 t of salt annually to cover its local needs.<sup>631</sup> It could be sold or exchanged with the direct hinterland of the city, to the settlements involved in sheep, goat or camel rearing, who would have also needed salt for animal husbandry and increased production.<sup>632</sup> As such, the exploitation of salt was a connective element between the urban Palmyrene economy and the wider agricultural and pastoral

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<sup>626</sup> Salt production is also being studied by Paola Mior as part of her doctoral thesis (Mior 2014).

<sup>627</sup> Teixidor 1984, 78-82; Matthews 1984, 172, 177-8, 180. Salt exploitation is actually known from the Bronze Age onwards from the Mari tablets (Hammad 2010, 15).

<sup>628</sup> Bounni 1989, 256.

<sup>629</sup> Matthews 1984, 178.

<sup>630</sup> Cato, *de Agricultura* 162,1 for example, states that half a *modius*, or 5 kg of salt, are needed for a ham. These numbers may be slightly exaggerated (Giovannini 1985, 376).

<sup>631</sup> Giovannini 1985, 377, estimates an annual need of 30 kg of salt per individual. In the eighteenth century, Swiss districts with no locally available salt relied on foreign imports and had to bring in no less than 20-25 kg of salt per inhabitant (Giovannini 1985, 377).

<sup>632</sup> Pliny, *Natural Histories* 31.88 on the role of salt for the increased quality and production of milk for sheep and cattle. Aristotle, *Historiae Animalium* 8.10.596, estimates that 100 sheep require a *medimmos*, or 60 kg every five day.

hinterland. Salt may also have been a vital commodity exchanged with various nomadic groups between Palmyra and the Euphrates for whom salt for animals and for preserving goods would have been a necessity.<sup>633</sup>

### **5.7 Agriculture and pastoral industry**

The efficient management of local water sources was a significant factor in the success of Palmyra. The city and its territories relied on several water supplies. The city and its oasis garden were supplied from thermal springs: high levels of fluorite found in the teeth of skeletons indicate that the Palmyrenes relied heavily on their geo-thermal water source.<sup>634</sup> The hinterland relied on water collected from the wider drainage basin; the northwest and southwest territories on rainfall harnessed by means of *qanats*, cisterns, wadi-walls or dams; the east on wadi dams along the route to Hit.

#### *Oasis Agriculture*

Palmyra's urban water system has only recently begun to receive scholarly attention.<sup>635</sup> Hammad's careful study of Palmyra's water system shows that the city's expansion phases were linked to its water resources and the development of infrastructure that could enhance it. The location of the city, and buildings within it, was intrinsically linked to the availability of suitable and irrigable lands for the development of an oasis-based agriculture, whose water supplies remained enmeshed with those of urban needs

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<sup>633</sup> Bloch 1971; Delrue 2008 for North Africa.

<sup>634</sup> Yoshimura *et al.* 2006.

<sup>635</sup> Yon 2009; Hammad 2010. See also Crouch 1975, Michalowski 1977, 110-120 (about the altars and the manutention of the spring) and and Piacentini 2001-2002.

in the city (Fig. 5.5).<sup>636</sup> As arable land was at a premium, the urban part of Palmyra on the land least convenient for irrigation.<sup>637</sup>

The authors who discuss water sources in Palmyra tend to aggregate the terms ‘*qanat*’, ‘aqueduct’, and even ‘*foggara*’ making it difficult at times to understand the exact nature of Palmyra’s water resources.<sup>638</sup> The essential difference between a *qanat* and an aqueduct is that a *qanat* (or *foggara*, as it is called in North Africa) (Fig. 3.3) is dug into the ground from where its water is tapped, and is characterised by circular openings (*naqqabat*) at frequent intervals (5-10 m) that are used for maintenance and are a key construction feature. An aqueduct, however, is characterised by the creation of built structures, usually a channel that directs underground water and with few surface openings (*putei*), for maintenance, but these are not a construction feature. Based on the available photographic documentation, there is only one aqueduct in Palmyra, and several *qanats*, all of which remain to be studied in more detail in order to understand the city’s water supply, but also the chronology of its water supply.<sup>639</sup>

The city’s main water source was geo-thermal groundwater which reached the surface at 29°C.<sup>640</sup> This water was tapped at two different locations, at the western edge

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<sup>636</sup> Crouch 1975; Piacentini 2001-2002; Hammad 2010, esp. 66-68.

<sup>637</sup> Hammad 2010, 66-68.

<sup>638</sup> Despite being the most lucid writer about Palmyra’s water sources, Hammad himself refers to Abul Fawares and Bir al-Umy as *qanat* and aqueduct within the same sentence (Hammad 2010, 34). Anadol (2008, 61) mistakenly calls wells *foggaras*, the North African term for *qanat* (as explained in Chapter 2, Section 2.3.2); Smith calls *foggaras* ‘underground chain series of wells’ (Smith 2013, 71), which is obviously wrong since the *naqqabat* were not wells, but construction and maintenance features.

<sup>639</sup> In addition to known water-relating structure, Paola Mior has recently successfully identified a new set of *qanats* on satellite imagery well to the west of the city, and probably fed agricultural lands (Paola Mior, pers. comm.).

<sup>640</sup> Carle 1923; Hammad 2010, 11.

of Jabal al-Muntar,<sup>641</sup> where it was tapped through a tunnel and called the Afqa spring. Palmyra originally developed around this spring, with its gardens to the southwest, and the city to the north (Fig. 5.5). It was accessed by an 800 m-long tunnel and appears to have mainly served the south of the city.<sup>642</sup> At the western edge of Jabal al-Husaynat, the same geo-thermal source was tapped by a 1200 m-long *qanat*, Umm al-Qanat, and which may have been built by the first century AD.<sup>643</sup> The expansion of the water supply probably followed the growth of the city. Beyond the two local sources of water, Palmyra drew water from the wider hinterland. Jabal at-Tar to the West of the city delivered water via the Abul Fawares aqueduct and Bir al-Umy *qanat*.<sup>644</sup> The sources of both lay respectively 12 km and 11 km away from the city.<sup>645</sup> The Bir al-Umy entered the city from the north and surfaced in the northernmost part of the city, where the storage structures were located, and was thus perhaps also an important part of the infrastructure for long-distance trade. Two further northern part of one or two *qanats*, generally referred to as *qanat* al-Garur also later served the northern parts of the city.<sup>646</sup>

The city authorities exercised tight control over the city's water resources. We know from the Palmyra Tariff that the use of water from two sources was charged at the substantial fee of 800 *denarii* per year.<sup>647</sup> This substantial fee was to maintain and invest in the development of its water supply. This may seem high, but water infrastructure, particularly of *qanats* / *foggaras*, was very expensive to maintain: to cite a modern

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<sup>641</sup> *Ibid.*, 10-11. It was probably used since the Bronze Age, and stopped functioning in 1993 due to overuse (*Ibid.*).

<sup>642</sup> Hammad 2010, 10.

<sup>643</sup> Hammad 2010, 17-18.

<sup>644</sup> Hammad 2010, 37. Fig. 70's caption and illustration of the alignment of *naqqabat* (individual openings and spoil rings) clearly shows that Bir al-Umy is a *qanat* and not an aqueduct.

<sup>645</sup> Piacentini 2001-2002, 526.

<sup>646</sup> Hammad 2010, 35-36.

<sup>647</sup> Teixidor 1984, 75-76; Matthews 1984, 177; Stoneman 1992, 58.

example, in 1962 a settlement in the Tit region of southern Algeria had to spend half a million Francs on the yearly maintenance of its main *foggara* alone.<sup>648</sup> Four inscriptions from Palmyra reveal the role of Hierobol as the protector of the Afqa spring, and the attention paid by the inhabitants to the spring.<sup>649</sup> One in fact even refers to building or rebuilding around the main Afqa spring and its reservoir, and to the curator specifically in charge of its structural management and maintenance.<sup>650</sup>

Given Palmyra's extensive agricultural production and animal husbandry in its northern and western territories, and based on the principles of Von Thünen's spatial organisation, it can be suggested that the surrounding ring of arable lands and oasis gardens were probably preferentially kept for horticulture, vegetable, fruit and other more delicate crops requiring the shade of the oasis's palm trees. The vast Ad-Daw plain to the west could be kept for other agricultural produce, such as cereals, and pastoral activities (but not only) to the higher mountain grounds to the northwest (Fig. 5.2).

### *Activities in the Hinterland*

Agricultural, along with pastoral activities are now well attested in Palmyra's western territories, where water was more readily available (Section 5.2). Two inscriptions on a column at Khirbat al-Bilaas mention the boundaries of Palmyra's territory with those of either Emesa or Apamea. One of the inscriptions uses the term *arva*, fields, thus

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<sup>648</sup> Scheele 2010, 286 estimates it at about 75 000 euros.

<sup>649</sup> Piacentini 2001-2002. The term 'curator' or rather person in charge of the spring is *rbnwt 'yn*, translated into the Greek term ἐπιμελητής, itself a translation of the latin term *curator* (curator, person in charge).

<sup>650</sup> *PAT* 1919 1.1 and 3-5 « During the curatorship of the spring [...] he built the building of the spring and the wall that is in front of the water's reserve and the wall that is outside, and made the wall of bricks » (transl. Piacentini 2001-2002, 532).

specifically referring to agriculture in this general area.<sup>651</sup> Four altars found in the midst of cultivated fields in the Ad-Daw plain to the west of Palmyra, and dedicated to Baalshamin, the rain-bringing divinity, may further suggest extensive agriculture in this area (Figs. 5.2 and 5.6).<sup>652</sup> Cereal production, such as wheat and barley, which has been documented in the more northern settlements, seems an obvious candidate for the wide Ad-Daw here in order to feed the urban, but also rural populations. The recent surveys by the University of Bergen which have re-evaluated the evidence gathered by Schlumberger in the 1950s and documented the settlement patterns in the northwestern territories of Palmyra have shown that settlement sites were only 3 to 5 km apart.<sup>653</sup> Small rural settlements consisting of clusters of smaller and larger buildings with a large central courtyard and enclosures in the Jabal Chaar, Jabal Marah and Jabal Abyad developed first century AD and lasted into the seventh century AD.<sup>654</sup> The archaeological evidence for the inhabitation of the area includes clusters of buildings of various sizes (Fig. 5.22), interpreted either as small settlements or estates, enclosures and cisterns along with catch-arm cisterns.<sup>655</sup> Analysis of mud bricks from one of the settlements confirms the presence of a large amount of pollen from domesticated barley and confirms cereal culture in the area. The discovery of eggs of trichuris worms further suggests both manuring and a mixed pastoral and agricultural lifestyle.<sup>656</sup>

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<sup>651</sup> AE 1939, 178 and 179. Seyrig interprets the inscription as *fine[s inter Epiphaniam et] arva civitat[is Palmyr]enorum* while Balty argues that Apamea owned these territories (Seyrig 1959, 190; Balty 1977, 118). Matthews 1984, 162 proposes either *Hemesenorum* or *Apamenorum*, with a preference for the latter, on the basis that there is not enough space for the letters in either *Palmyrenorum* or *Hemesenorum*.

<sup>652</sup> Seland and Meyer 2012.

<sup>653</sup> Schlumberger 1951; Anfinset and Meyer 2010; Meyer 2013, 271.

<sup>654</sup> Anfinset and Meyer 2010, Meyer 2013.

<sup>655</sup> Anfinset and Meyer 2010.

<sup>656</sup> Meyer 2013, 274.

Olive agriculture was part of the local economy. Palmyra's long-standing olive production may in part be reflected in the variety of its olives, as Palmyra seems to have more species than anywhere else in Syria.<sup>657</sup> One face of a bronze *tessera* from Palmyra names the god Bel as the protector of olives.<sup>658</sup> Olive oil was also produced in the surroundings of Palmyra, such as at Fourqlous, one of the stops towards Epiphania, where olive oil presses or mills have been recorded.<sup>659</sup> While Bounni believes that the protector god of olives known as Gad Mishiya testifies to the fact that olive trees were the principal cultivation of the city,<sup>660</sup> the documented evidence is too scant to come to wider conclusions. Olive oil may have been one of the staple goods produced within the territories of Palmyra. In AD 130-131, a statue was dedicated to Male Agrippa for providing olive oil to the city and troops on the occasion of Hadrian's visit to the city, but this could have been either from his own property or imported. The Tariff mentions both the import and export of olive oil, with different prices according to how many bags a camel or donkey would be carrying, but no price difference between import or export.<sup>661</sup> Given the mention of pine nuts in the Tariff, pine forests must have been

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<sup>657</sup> <http://ressources.ciheam.org/om/pdf/a73/00800334.pdf> (last consulted: 15 January 2014).

<sup>658</sup> Du Mesnil du Buisson 1962, 21, 23; though this may scarcely be enough to justify Raschke's claim (Raschke 1978, 840) that it testifies to the importance of olive oil production at Palmyra. Olive-oil or terebinth press beds close to the temple of Baal could attest to a Roman-period exploitation, but as far as I am aware, they have not been studied.

<sup>659</sup> Février 1931, 131.

<sup>660</sup> Bounni 1989, 258.

<sup>661</sup> Teixidor 1984, 74; Matthews 1984, 172, 176-177, although the text seems corrupt concerning the tax amounts (13 and 7 *denarii* have been implied). There also seems to be a monthly tax for olive oil (Matthews 1984, 177).

located within Palmyra's wider territories, and constituted a particularly attractive economic resource.<sup>662</sup>

Raw materials for the textile industry in Palmyra, in particular wool, would have been produced locally from goats and sheep, which were brought into the city for shearing. The Palmyrene Tariff exempts from taxes the sheep which are brought into the city's territory for shearing, testifying to the importance of weaving and textile production to the city.<sup>663</sup> The Tariff also tangentially refers to economic activities in the hinterland, as references to leather-making or grazing rights suggest that pastoral activities included sheep and goat-herding, but also cattle or other grazing animals. The Tariff specifies that local grazing was tax-exempt, but animals brought into Palmyrene territory for the purpose of grazing were subject to tax and could be branded by the tax collector.<sup>664</sup> This is a clear reference to transhumance patterns into Palmyrene territory, to Palmyra's role as a central market place, but also to the city's and the community's conscious management of their environmental resources.

Women on funerary reliefs are often represented with a spindle and distaff, or more rarely with what may be balls of wool.<sup>665</sup> These items highlight textile production as an important local economic activity. This local pride in weaving is also displayed prominently through the emulation of known textile motifs into motifs carved into the

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<sup>662</sup> Matthews 1984, 179 and lines 191-193. The Tariff specifies that pines for sale are to be taxed as dried produce, as in other cities.

<sup>663</sup> Matthews 1984, 180; Bowersock 1989, 74; Millar 2006, 289 also directly refers to central place theory with respect to these activities: "Palmyra was [...] like any other Graeco-Roman city, the "central place" of an agricultural hinterland."

<sup>664</sup> Matthews 1984, 180. Later references to grazing rights highlight the continued importance of transhumance in the region: in the middle of the sixth century AD, a dispute about grazing rights within the territory of Palmyra was solved by claiming that the territory belonged to the Roman Empire (Procopius, *de Bellis* 2.1.3).

<sup>665</sup> Cussini 2005, 37.

tomb architecture of Palmyra.<sup>666</sup> Along with importing cotton and silk, weaving these specific fibres (rather than just weaving, which was a common activity) could have become one of the specialties of Palmyra. This may be seen in items which have been found to be woven as finely as silk. Undoing imported silk textiles and reweaving them is known for example from Alexandria,<sup>667</sup> but in Palmyra some textiles were emulating Chinese silk patterns in woollen garments.<sup>668</sup> These could have been sold onwards with high profits. Interestingly enough, women are represented with the spindle and distaff in the first and second centuries AD, but no longer in the third century,<sup>669</sup> perhaps in accordance with a wish to distance oneself from the textile industry items as a status marker or perhaps because of a diminishing trade in textiles? Indeed, Stauffer and Schmidt-Colinet also observe that the majority of textiles found in tombs date mainly from the first and second centuries AD.<sup>670</sup>

The area of agricultural production of the city may have extended much further, and not solely to the north and west. A Palmyrene inscription from Qa'ara, a depression some 200 km southeast of Palmyra and on the Palmyra-Hit route mentions reapers from the city "at the boundaries"; Matthews suggests this may well be related to wadi-agriculture in the winter months.<sup>671</sup> Wadis present the advantage of preserving thicker

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<sup>666</sup> That architectural motifs were inspired from textile and not vice-versa is known from the fact that many patterns are known from textiles at a much earlier than the date at which they appear in Palmyrene architecture (Schmidt-Colinet 1996, 418).

<sup>667</sup> Pliny, *Natural History* 6.54 for silk reweaving in Alexandria.

<sup>668</sup> See Stauffer 1996.

<sup>669</sup> *Ibid.*, 38.

<sup>670</sup> The chronology of the textiles follows that of tower tombs. With changing burial practices, we may also be losing the archaeological visibility of textiles at Palmyra.

<sup>671</sup> Matthews 1984, 162-163. At least seven harvesters are mentioned. GoogleEarth shows an abundance of wadis between Palmyra and Hit with clear wadi wall lines and agricultural exploitation. In the 1960-1970s, the Syrian government forced Bedouins to settle, and the wadi agriculture may be a result thereof.

and richer, siltier soil deposits; the retention of water in wadi beds in humid years therefore allows for crop production, such as cereals. This may also have included grazing and fodder for the passing caravans. In either case, these inscriptions are important as they provide evidence for the growth of agricultural areas along the trade routes.

As remarked previously, the western territories benefitted from higher rainfall, which could be harnessed to the city's advantage: inscriptions mention fields and agriculture in the western boundaries of Palmyra, rather than just pasture land (Section 5.7.1).<sup>672</sup> Around Qasr al-Hayr al-Gharbi, the investment in water structures appears to have been more substantial, in the form of an artificial lake served by a dam.<sup>673</sup> The Harbaqa dam, on the Wadi al-Barde, 68 km south west of Palmyra, is one of the most impressive Roman dams of the region (Fig. 5.10); 365 m wide and 10 m high in its Roman phase,<sup>674</sup> it provided the surrounding area with a massive water supply throughout the year, and enabled Palmyra to be agriculturally self-sufficient. A first-century AD settlement nearby and a small garrison supplied with wells and cisterns from the fourth or fifth century AD suggest that the construction of the first phase probably occurred sometime in or after the first century AD, and perhaps before the fort which was evidently self-sufficient in terms of water.<sup>675</sup> The lake created by the dam,

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(Prof. C. Meyer, pers. comm.). Itinerant harvesters were often used for seasonal works in the Roman Empire, for example at Maktar in North Africa (*CIL* 8.11824).

<sup>672</sup> Matthews 1984, 162; Seland 2012.

<sup>673</sup> *AE* 1939, 180. Poidebard 1934, pls 32-34; Schlumberger 1939, 200; Schnitter 1979, 24; Matthews 1984, 162; Calvet and Geyer 1992, 81. The main fort there though is early Islamic.

<sup>674</sup> Kamash 2009, 56. Its Roman date had been disputed by Genequand 2006 who had redated it to the Umayyad period. Kamash re-establishes its Roman date, showing clearly that there are two phases to the dam, one Roman, one Islamic.

<sup>675</sup> In this aspect I follow Kennedy and Riley 1990, 70-71, with the exception that they did not distinguish between the Roman and Umayyad phases for the dam (see previous footnote).

could collect over 5 million m<sup>3</sup> of water, sufficient to water some 5,000 ha of fields.<sup>676</sup> Its main aim was most likely to supply Palmyra with additional primary food resources. The area watered by the Harbaqa dam could supply sufficient barley for 14,000 to 15,000 adult males doing hard manual labour,<sup>677</sup> so hardly enough for a minor part of Palmyra's urban population.<sup>678</sup> Of course other crops, including cash-crops must also be taken into account. The installation of water retention systems, small aqueducts, and particularly reservoirs with water-catchment arms throughout the hinterland, both built and cut into the bedrock, as observed by Schlumberger and more recently by the Syrian Norwegian project, are therefore important features of the northwestern landscape, because these water-retaining structures were a main asset for mitigating against annual irregularities in rainfall, and for the development of agricultural resources. They would have compensated in case of water shortages, assisted the production of surplus for drier years, and allowed for the expansion of the carrying capacity of the city and a larger urban population. It is therefore important to insist here that Palmyra's economic activities could not have been sustained without the stability of resources afforded by the developments of its hinterland.<sup>679</sup>

The presence of cotton in the textile assemblages at Palmyra, as we have seen earlier, raises the question of origin, and import of the crop itself as a cash crop. The Indian origin of cotton that was found at Palmyra has been established both on the grounds of colour patterns and also on the spinning technique.<sup>680</sup> Finished products and

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<sup>676</sup> Meyer 2011.

<sup>677</sup> Meyer 2013, 270.

<sup>678</sup> Though by the lowest urban estimate, it represented the needs of a third of the urban population, the remain still having to be supplied from the urban oasis garden, the Ad-Daw plain or other territories.

<sup>679</sup> Anfinset and Meyer 2010, 1.

<sup>680</sup> Stauffer 2007, 358.

yarn were, therefore, imported into the empire for further elaboration, such as purple-dyeing.<sup>681</sup> But was cotton also grown in Palmyra? As discussed in the chapter on the Libyan Sahara, there is growing evidence that cotton was developed as a lucrative cash crop in oases, as their climatic conditions were ideal (Chapter 3, Section 3.5). Cotton was grown in Mesopotamia from the end of the seventh century BC, and we know that by the thirteenth century, Syria was one of the leading cotton exporting countries in the Mediterranean, with the best cotton grown in the region between Aleppo and Hama.<sup>682</sup> While little is known concerning Palmyra, cotton was grown in more recent times in the area of the Harbaqa dam.<sup>683</sup> The possibility that cotton, along with linen, was grown at Palmyra cannot be excluded; so far it is not possible to elucidate the question.

## **5.8 Structure and agency**

### *Local families, clans and tribes*

Kinship-based associations formed the core element of the Palmyrene's social organisation. Seventeen clans, or tribes as referred to at Palmyra are known to date, with almost 100 known familial affiliations.<sup>684</sup> Despite continued references to these separate ethnic genealogies and ancestries throughout the imperial period, the

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<sup>681</sup> *Ibid.*, 328.

<sup>682</sup> Lombard 1978, 68.

<sup>683</sup> Cotton remained Syria's main agricultural export, and represented until recently a c. 270 million dollar industry (Issa 2006).

<sup>684</sup> Smith 2013, Table 2.1 (familial associations) and Table 2.2. (clans or tribal associations). On the term tribes, and what tribalism means at Palmyra, see esp. Smith 2013, 33-54 and his elaborate discussion on how seeing tribal systems as a evolutionary stage towards state formation is unhelpful for understanding Palmyra's civic structure. Smith's stance is that Palmyra's socio-polical structure must be understood as a hybrid model of 'tribal' and 'state' governance, rather than to see tribal governance as an evolutionary step towards state formation.

Palmyrenes also made a conscious, communal decision to work in unison, and to regulate interactions with the communities in the hinterland. The hybridity of this model of local governance has been most recently highlighted by Smith,<sup>685</sup> and forms a characteristic which distinguishes Palmyra from other Roman urban communities. The first inscription referring to a common governance of local resources dates to 10 AD, and refers to the Tadmorean community regulating local trade and movement via a tax on camels brought into the city.<sup>686</sup> As we have seen previously in the case of the Garamantes, the rise of a community and creation of a developed urban centre at Palmyra had occurred in pre-Roman times; the prosperity in the Roman period was due to successful local economic developments, and the integration of Palmyra into the empire.

Despite the large number of familial associations and clans, the epigraphic record highlights the prominence of four main clans, which embedded their socio-political influence within religion, through four different sanctuaries. Peace and collaboration between kinship groups was a major stepping stone towards the development of Palmyra. Indeed, social negotiations between tribes/clans are attested in the early part of the first century AD: an inscription from AD 21 between the Bene Gaddibol and the Bene Komare, for example mentions peace between the Bene Komare and the Bene Mattabol.<sup>687</sup> Second-century AD inscriptions continue to emphasise affiliations despite communal dedications:<sup>688</sup> the tribes/clans set up four statues together

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<sup>685</sup> Smith 2013, 13-14, but also Sommer 2005a; Sommer 2005b.

<sup>686</sup> *PAT* 2636; Smith 2013, 56-57.

<sup>687</sup> Teixidor 1984, 7.

<sup>688</sup> *Ibid.*; *contra* Dirven 1996, 49, who claims that the AD 21 inscription is the only example of the tribes dedicating together.

to Aelius Boras for establishing peace in the territory of Palmyra.<sup>689</sup> A dedication from AD 199 to Ogeilo, son of Makkai for his help to merchants and involvement in military expeditions against the nomads still contains the mention of the four tribes.<sup>690</sup> Wider peaceful relations with the hinterland are perhaps less evident to highlight epigraphically, but the spread of agricultural activities, the appearance and continued presence of settlements in the hinterland and the successful commercial enterprises to the Euphrates relied on peaceful interactions and stable conditions enabling Palmyra to hold control over the local situation and local market.

### *The civic institutions of Palmyra*

Although the exact date of Palmyra's incorporation into the Roman empire and Syrian province remains debatable, its process of integration occurred throughout the first century AD. Despite territorial boundaries established in the early imperial period, institutional changes within Palmyra might have occurred slightly later. By the latter part of the first century AD, Palmyra had adopted the institutional framework of the Greek *polis*: the earliest evidence for the *boule* (Council) and the *demos* (People) is a trilingual dedication set up in AD 74 at Palmyra.<sup>691</sup> A few individual council members are explicitly named, and referred to as *synedros*.<sup>692</sup> Decrees of the *boule* and *demos* occurred also with the reference to the four clans/tribes of the city (αἱ τέσσαρες

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<sup>689</sup> Ingholt 1932, 278; Delplace and Dentzer-Feydy 2005, annexe 1 (8/6/1/334).

<sup>690</sup> *SEG* 7, 139; inv. X.44; Delplace and Dentzer-Feydy 2005, 184-185, VI.18.

<sup>691</sup> On *demos* as 'civitas' referring to the wider community rather than a political assembly, Smith 2013, 58. Roman cities in Syria generally had a hellenistic form of government, although Kennedy also suggests that the magistrates of Palmyra were more closely supervised by the Syrian governor (Kennedy 1996, 720).

<sup>692</sup> Sartre 1996; Smith 2013, 127 rejects the argument that the *synedros* was not a council member.

φυλαί),<sup>693</sup> and tribal affiliations continued to be expressed into the third century AD, and constitute an element which renders the nature of Palmyra's civic expression unique.

The care given by the Palmyrene elite's to their local resources through institutional offices, such as the curatorship of water,<sup>694</sup> reduced frictions over local resources but also consolidated the city's social fabric, and ensured continued urban growth and economic success. Wider economic relations with the hinterland were created and stimulated through the city's incentive through the creation and of an economically competitive local market: the Palmyrene Tariff explicitly exempted villagers from Palmyra's hinterland from taxes in clear contrast to those from outside the city's boundaries. The official and institutional nature of this specific document is reinforced by a list of official positions, which includes the president of the council (*proedros*), secretary (*grammateus*) and members of the council responsible for local taxation (*dekaprotoi*). Similarly, the local market at Palmyra was also controlled by the *agoranomos*, attested through inscription dated between AD 193 to AD 266.<sup>695</sup>

The creation of a post with military connotations sanctioned by the council and assembly is again an unusual feature of Palmyra's later institutional structure, and an unusual development for any Roman city. The protection for the Palmyrene caravans was originally a private concern, unlike in the Eastern Desert, and given as a responsibility to a synodiarch, the leader of the caravan.<sup>696</sup> In the second century AD, tensions and security issues are mentioned. An inscription from AD 144 thanks Soades

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<sup>693</sup> The dedication to Ogeilo discussed above for example, mentions both the *boule* and the *demos*, as well as the four clans/tribes (*SEG* 7, 139).

<sup>694</sup> *PAT* 1919 1.1 and 3-5 « During the curatorship of the spring [...] he built the building of the spring and the wall that is in front of the water's reserve and the wall that is outside, and made the wall of bricks » (transl. Piacentini 2001-2002, 532).

<sup>695</sup> *PAT* 1398 (AD 193); *Inv. III. 7* (AD 266).

<sup>696</sup> Rostovtzeff 1932, 805-808.

for hiring a large armed force and launching an attack against Abdallat Eeithenos (or Ahitaya, depending on the transliteration) and the band of robbers he had gathered in the Palmyrene territories who had organised a raid on a caravan.<sup>697</sup> The risks of predation were substantial: in one instance, in AD 193, Taimarsu, the leader of a caravan on its way back from Spasinou Charax, had to pay 300 gold *denarii* (the equivalent of 2.16 kg of gold) to help a caravan out of difficulties with local nomadic tribes.<sup>698</sup> Did re-occurring attacks and security issues lead to the institutionalisation of security? Security seems to have become a civic concern by the end of the second century AD. Two closely dated inscriptions provide hints. In AD 198, the Council and People honoured Aelius Boras and referred to him as τὸν στρατηγὸν τὸν ἐπὶ τῆς εἰρήνης, the strategos responsible for establishing peace.<sup>699</sup> In AD 199, a further dedication by the four tribes thanking Ogeilo for his help to merchants, discusses his involvement in expeditions against the nomads (τάς κατά τῶν νομάδων στρατηγίας). The official sanction of both actions suggest the establishment of an official post dealing with the security of the city's eastern territories in order to protect the city's commercial interest.<sup>700</sup> This unusual post was sanctioned by the Roman governors, and therefore sanctioned by the Roman state, however 'uncomfortable' the state might have been with the delegation of such powers.<sup>701</sup> The presence of a dedication in the eastern territories of the city in AD 225 at Umm as-Salabih by the Roman military, however,

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<sup>697</sup> Drijvers 1995a, 31-42; Delplace and Dentzer-Feydy 2005, 249, Annexe 31.

<sup>698</sup> Inv. III, 28 = *CIS* II, 3948; Teixidor 1984, 17-19; 47; Gawlikowski 1994. On the sum and carrying gold *denarii*, De Romanis 2004, 59-61.

<sup>699</sup> *SEG* 7.138. Ingholt 1932, 278-289; Young 2001, 161-162. The term implies peace established within the city's wider territories towards the Euphrates, as the inscription is a dedication from merchants returning from the Euphrates.

<sup>700</sup> Young 2001, 161-163 as the post being a military one and evidence of an independent Palmyrene military.

<sup>701</sup> As argued by Young (Young 2001, 164).

shows that the interplay between city and territorial security and Roman military action is less than straightforward. Nonetheless, by AD 225 the much wider socio-political events took precedence over local territorial concerns.

*Institutional crisis: Palmyra's claim to an empire*

The defeat of the Parthians and the establishment of the Sassanian monarchy in AD 224, which was hostile to Rome and even made territorial demands, would eventually have significant repercussions on the fate of Palmyra.<sup>702</sup> Stable and peaceful conditions in the Roman Empire, and with its neighbour, had ended.<sup>703</sup> The Sassanian's *de facto* aggressive stance against the Roman Empire, resulted in direct threats towards the Palmyrenes, while Rome's losses propelled Palmyra into decision-making processes which led it to consider its own independent ambitions in the face of regional instability. Sassanian campaigns against the Romans and military successes by AD 240, followed by the sack of Antioch in AD 252/3, would have altered the local perception of the Roman state being capable of maintaining protection and safeguarding local institutions from violence.<sup>704</sup> The capture and death of the emperor Valerian in AD 259/260 further created a power vacuum, and instability in the socio-political influence over the region. Despite displaying a loyalty to the Roman Empire, through the rise of difficulties in the East, Palmyra increasingly had to take firm action against violence

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<sup>702</sup> Herodian, *Roman History* 6.2.6-7.

<sup>703</sup> Cassius Dio, *Roman History* 80 3, 1-4; Millar 2004, 195. Edwell 2008, 149-153.

<sup>704</sup> See esp. Millar 2004, 196-197 on the inscription by Shapur I at Naqsh-e-Rustam in Iran which relates all events and especially defeats of the Romans or Roman cities taken (including those in Syria, Cilicia and Cappadocia) from a Sassanian perspective between AD 240 and AD 260 (capture of Valerian).

and friction in the East which should have been the state's remit. The Palmyrenes's initial reaction to the shifting dynamics included mitigating against a rising Sassanian threat through an embassy by Odenathus.<sup>705</sup> The embassy, sent also with the intention to protect Palmyra's commercial assets, and perhaps also representing the Roman state (Odenathus was a Roman senator) was a complete failure, as the Sassanians rejected Odenathus's embassy and threatened violence against the city itself.<sup>706</sup>

Odenathus' recovery of the East through successful military campaigns increased Palmyra's socio-political role and influence in the Near East; it can be argued that the city now effectively acted as an allied state rather than a provincial city as it had been earlier.<sup>707</sup> The murder of Odenathus in AD 266, and the death of Gallienus in AD 268, resulted again in local and empire-wide instability. Through attacks on the headquarters of the *Legio III Cyrenaica* at Bostra, the invasion of Egypt, Odenathus' wife Zenobia and her son displayed aggressive behaviour but did not yet directly threaten the emperor or the structure of the Roman Empire.<sup>708</sup> Coinage minted at Antioch in AD 271, however, no longer recognised Aurelian as emperor and were issued with the attribution of the title of *augusti* to both Zenobia and Vallabathus, and full imperial titulature for Vallabathus.<sup>709</sup> These imperial ambitions, originally created through wider unstable

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<sup>705</sup> *Fragmenta Historicorum Graecorum* 4.187. For the uncertain date of the event, Hartmann 2001, 135-137.

<sup>706</sup> On the other hand, an inscription mentioning the *collegia* of leather workers and raft-makers thanking Odenathus's son, AD 257/8 (Seyrig 1963, 159-166, and Gawlikowski 1985, 254, and n. 5) becomes perhaps difficult to interpret if all commercial movement to the Euphrates or ambitions thereof had stopped.

<sup>707</sup> Young 2001, 176-177. Zosimus specifies that Odenathus's troops used to defeat the Persians in AD 261 consisted of the combination of Odenathus's own troops as well as Roman forces (Zosimus, *Historia Nova* 1.39).

<sup>708</sup> Young 2001, 179.

<sup>709</sup> Millar 1993, 172; Smith 2013, 180.

conditions and a power vacuum in the East, compromised Palmyra's institutional position within the structure of the Roman Empire. Aurelian's campaign against Zenobia and her defeat put an end to Palmyra's claim to the Empire, but it did not entirely resolve the ambitions of Palmyrene's elite in keeping an important regional role. The failure to convince the prefect of Mesopotamia to usurp imperial power resulted in a second campaign against Palmyra, which reduced its elite's ability for further action, but also destroyed the city's social structure: this probably had a more direct impact on Palmyra's economic role as a central place within its direct territories. Some post AD 273 inscriptions shows the continuation of urban life at Palmyra; one individual (who had assisted Aurelian during the attack on the city) achieved the higher senatorial rank within the Roman institution.<sup>710</sup> But overall, while violence by the state became necessary, it also resulted in the cessation of trade. The annihilation of the upper echelon of Palmyra's local social structures put an end to any possibilities to revive the sophisticated mercantile network to the East.

## **5.9 Synthesis**

In this chapter, I have attempted to set out the factors accounting for Palmyra's rise and economic success. The trigger to the original expansion of the city was the rise of an urban center around which wider territorial activities revolved through the establishment of local institutions and associations. This went hand in hand with the organisation of the infrastructures necessary to develop the city's agricultural resources and also other economic activities, such as extractive industries to supply the city and hinterland with building material and salt resources for consumption, animal husbandry,

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<sup>710</sup> Gawlikowski 1971, 412-421; Young 2001, 183.

leather tanning, and textile dyeing. The trade to the East was extensively organised. This is most clearly seen in the establishment of a path with stations and water-retaining structures such as cisterns and dams along the way to Hit, which enabled greater stability and also security to the local flow of traffic. Second, the establishment of a social network of Palmyrenes located on the Euphrates, at the mouth of the Persian Gulf and on islands of the Persian Gulf, and finally in the Eastern Desert of Egypt, consolidated wider control over trade in the region. The local nodes at transshipment points reduced the cost of transactions, transport, and risk factors by developing trust within the local small worlds, and can be argued to represent two different types of economic integration, namely horizontal and vertical integration. These enabled the Palmyrenes to be competitive on a supra-regional scale. Palmyra's socio-political fabric remained that of a hybrid system of clan or tribal affiliation and Roman city institutions based on the hellenistic *polis* model. The full integration of Palmyra into the urban network of the East allowed it to benefit from access to the markets of the Eastern provinces. The decline of Palmyra and the disappearance of its social network throughout the main nodes of the Indo-Roman trade routes was a more direct consequence of its actions to disrupt the wider socio-political structure of the Roman Empire which could no longer guarantee local protection against violence. As a direct consequence of its claim to the Empire, the retaliations by the recognised imperial authorities (as in the emperor himself) permanently disabled the local social structure which had previously enabled its economic success. Without its elite and merchant leaders, the city's long-distance economic activities fell into terminal decline.

## Chapter 6 Concluding discussions

### 6.1 Introduction

In this thesis, I have deliberately taken an approach initially focused on the landscape and territory to see how people dealt with and managed resources in order to develop their societies or communities. The three case studies clearly highlight how differently people responded to local conditions despite similar climatic constraints. I will return to the environmental factors in this chapter, both geographic and climatic in the context of the case studies, but a climate optimum seems a less likely reason for success in the period examined than human agency. I will then review the evidence at the start of the period of interest in this thesis in order to define the initial situation and how small world network as defined in Chapter 2 were either formed or in the process of formation.

Peaceful conditions throughout the Mediterranean, but also beyond it, created favourable conditions for bordering regions to develop under new alliances with Rome. Here the New Institutional Economics approach to violence and how societies restrain it and control it has offered a meaningful way to highlight interactions between the established power and local institutions, but also between different institutions in power. Different sectors and factors of the Roman economy provided an incentive to foster the development of small worlds and networks in the arid regions examined. Agency and stable political situations on both sides of the trading systems were a necessary condition for long-distance trade between large market centres and regions of supply. Eventually, the continuous rather than sporadic reliance on long-distance weak ties became fundamental elements for the growth of the local communities, if their overarching state institutions backed them. If not, and with the rise of frictions in the

border regions, the deserts reverted to small insular and disconnected spaces with little contact to the wider world. While the case studies have shown individual trajectories but in each case the institutional support was fundamental for their development.

## **6.2 Environmental factors**

A considerable variety of regional geographic differences and factors come in to play for the establishment or usage of centres of economic activities in the arid regions examined. For one, the umbrella term ‘arid’ or ‘desert’ regions does not do justice to these landscapes,<sup>711</sup> and local geographic conditions must be highlighted in order to understand the sustained development, exploitation, and settlement patterns they underwent. The region of Fazzan is characterised by long oasis depressions caught between vast sand seas, salt lakes and mountainous plateaux. In the Eastern Desert, the western high plateaux, the mountain range and the coast created contrastingly different habitats and resources. Palmyra’s territories included a plain irrigated by a vast hydrographic network, an oasis fed by thermal springs, a mountainous plateau with a higher rainfall patterns, and arid steppes. If, as argued by Horden and Purcell, micro-regions define the ancient Mediterranean despite a clear geo-climatic unity, then arid regions can be said to be better defined by their micro-regions and geographic discontinuity.<sup>712</sup>

In contrast to the Mediterranean, the arid environment more severely restrains the possibilities of the sedentary lifestyles of the complex societies who inhabited these landscapes. Yet the social changes that occurred in the three study regions cannot claim to be the direct results of clement environmental conditions or climate-induced change

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<sup>711</sup> Barker and Gilbertson 2000.

<sup>712</sup> Horden and Purcell 2000; Horden 2013.

which would have impacted the viability of deserts in antiquity. For one, there is no question that the onset of arid conditions in the regions examined occurred at least around *c.* two thousand years before the period examined. The arid to hyper arid conditions were, therefore, already a defining factor of life in those lands. While small climatic fluctuations have been observed in the Mediterranean during the first three centuries AD,<sup>713</sup> these have not happened in the arid regions examined. Here, human activity mainly relied on the groundwater resources whose eventual decline across the *longue durée* was more likely linked to over-exploitation, long-distance networks and changing political dynamics than climate change.

The *longue durée* usage and sustainability of the territories examined was mainly dictated by the geography of perennial water resources, and where the orographic nature of the terrain allowed for the concentration and thus most efficient water access. Both Fazzan and the region of Palmyra had ample local water supplies and settlements flourished in plains or depressions along the edges of the mountainous chains where water could be easily tapped. Mattingly's research in Fazzan has not only established that the landscape was densely occupied throughout the main oases belts of the Libyan Sahara, but also that hierarchies of settlements developed around the Garamantian capital and at least another major town in the Murzuq basin.<sup>714</sup> In the region of Palmyra, the hinterland began to be settled in the first century AD and was accompanied by the development of wells, cisterns, dams, and *qanats*. It is particularly striking that these phenomena started in the Roman imperial period and lasted well into the seventh century AD.

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<sup>713</sup> McCormick *et al.* 2012.

<sup>714</sup> Mattingly and Sterry 2013.

In the case of the Eastern Desert of Egypt and the rise of numerous quarrying settlements and forts between the first through third centuries AD, the location of settlements was not dictated by water but by minerals or by the paths under state control. Central Place Theory cannot be used in this instance: the location of settlements was entirely dictated by imperial wish and not by a wider market economy. The orographic nature of the terrain which accumulated water in the wadis and fed the wadi's watertable partially assisted water collection, which was harnessed with *hydreumata* and wells. The crystalline rocks and hard limestone of the Eastern Desert otherwise prevented seepage and much aquifer recharge, and caused flooding hazards instead.<sup>715</sup>

Changes in the post-AD 150 flooding patterns of the Nile could have affected Egypt's agricultural lands,<sup>716</sup> but these did not have a direct impact on the Eastern Desert. Its drainage basins were not affected by fluctuations of the Nile and epigraphic documents have highlighted the extent to which water had to be continually imported. The lack of sufficient perennial water sources hindered the Eastern Desert's development over the *longue durée*, as the local aquifers could only provide limited amounts of water for limited communities.<sup>717</sup> Bedouin communities still inhabiting the desert show that small scale transit is only possible for limited numbers of people.<sup>718</sup> What is remarkable, therefore, is the scale of logistics implied in exploiting the Eastern

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<sup>715</sup> Monein 2005.

<sup>716</sup> McCormick 2013. Wilson 2013, 265 raised the question whether the effects of the Antonine plague could be in correlation with poor floodings and a subsequently weakened population. Whether the Antonine plague affected the settlement populations in the Eastern Desert however is another question which can be raised, but not presently addressed.

<sup>717</sup> Monein 2005, 423.

<sup>718</sup> Hobbs 1989. In contrast, the Fazzan and Palmyra still have a settled population with an urban centre and agricultural terrains under exploitation.

Desert, involving the military, and transforming its corridors of transit in order to accommodate an entirely different scale of traffic than what the landscape could naturally support.

In contrast to the Mediterranean, each of the three regions stood under fairly constant ecological and climatic stress. This factor alone almost imposes a natural carrying capacity in the landscape. In order for the communities in these landscapes to grow above the carrying capacity of the land, they had to develop around strategic water points or features, and find means of accessing water. In each of the case studies, it has been demonstrated that communities developed innovative means of tapping or harnessing water resources, whether with wells, subterranean water channels such as *foggaras* or *qanats*, or water-retaining structures such as dams and cisterns. While these technologies were most likely introduced in the regions in the period preceding the Roman era, there is no doubt that in the Roman period the construction of such features clearly intensified to unprecedented levels, that in some instances, did not re-occur until modern times. Each technology was carefully chosen and adapted to the specific local environmental conditions, but the technologies themselves reached these areas through network contacts. This would suggest that such networks and the institutions that could organise contact as well as labour were of fundamental importance. I will therefore turn to organisations and institutions next.

### **6.3 The initial situation - Organisation and local institutions**

The creation of networks and weak-tie systems was a necessity for the development of larger settlements and societies with varied economic activities including, but not limited to, agricultural production. Although connectivity and long-

distance trade has been identified in all of the case study regions in the pre-Roman period, it is in the Roman period when these links are at their most intense.

An overview of the case-study regions in the pre-Roman era illustrates many precursors to their later development. Both in Fazzan and in Palmyra, communities developed locally; in Egypt, the Ptolemies intensified activities in the Eastern Desert as well. Here it is important to reiterate that the creation of communal systems and even more complex societies occurred before the Roman period of control over these areas. To return to a concept discussed in Chapter 2, Langton's ants and the emergent collective model, societies and groups remain shaped by initial patterns of interactions and network dynamics; too often this factor is forgotten or dismissed. In each of the case studies, the formation of networks can be shown to be rooted in contacts prior to the Roman period; there is therefore nothing exceptional in terms of contacts in the Roman period, except perhaps in terms of intensity. Networks and paths were at times re-routed in Roman times, though the paths were not necessarily the path of least resistance through the landscapes: institutions and/or the state deeply influenced or controlled the routes that were used. Through network dynamics, these communities were also able to find the resources and technologies in order to overcome Malthusian environmental traps, and integrate new areas of supplies.

In Fazzan, the Garamantes had inhabited and controlled the territories of the oases for a millennium before the period focused on in this thesis. Archaeobotanical evidence points to long-term and long-distance contact, which is linked to a search to mitigate local climatic conditions by the import of new crop species that were both drought- and salt-resistant, and also allowed a biannual harvest and hence more regular food supplies. Stable communities had formed within the second half of the first millennium BC and developed under a monarchic system, with a capital city. Fazzan dynamically interacted

over long-distances, whether through warfare or negotiations, in order to obtain crops to overcome geo-climatic difficulties, but also increasingly for luxury goods and precious stones in the Roman period. The import of *foggara* technologies, or mud brick construction, in particular for wells in the northern Garamantian oasis, shows the essential reliance of the system on long-distance weak links for new technologies, which could be applied on a wider scale under new economic incentives, such as the one offered by developing mercantile ties to the Roman Empire and its demand for Garamantian goods. The growth and re-assertion of Roman power in northern Africa, especially Tripolitania, resulted in changes in the networks. Fazzan grew through the opportunities that long-distance offered, under Roman incentive, but the Garamantes were also clear decision-makers in how they chose to interact, what they wished to exchange, and how they organised their lifestyles within this new landscape of opportunity.

In the case of Egypt, the Roman Empire inherited with the Eastern Desert of Egypt a long tradition of exploitation of mineral resources and long-distance overseas trade from the Red Sea ports dating back to the era of the Pharaohs. Most of these operations, however, were seasonal and grew in importance in the Ptolemaic period. At the start of the Roman era, the paths and especially structures on the way to the coast were not sufficient for the rising numbers of travellers making it through the desert to the harbours of the Red Sea. Shelters were mostly hidden, and water for larger caravans had to be carried along, which further complicated travel logistics and increased the number of pack animals needed. The conscious decision to dig wells and reducing the risk of predation, as shown epigraphically and archaeologically, enabled an increase in

traffic that fed into a new intensity in maritime commerce.<sup>719</sup> Yet no centre of any socio-political power ever formed in the Eastern Desert, only local administrative centres staffed by incomers to the region oversaw the local logistical aspects of trade and exploitation of mineral resources, and forwarded goods to markets and centres of socio-political power. From the pre-dynastic period onwards, the Eastern desert was a place temporally visited and used. Crucially, unlike Fazzan and Palmyra, there was no environmental niche where populations could concentrate.

Palmyra from around the time of its incorporation into the Roman Empire sometime between AD 11 and AD 75, had already formed an urban centre based on strong community ties between its main family clans, often simply referred to as ‘tribes’. As most recently highlighted, an important aspect to Palmyra’s development was the formation of local institutions and a community organised on a Greek *poleis* model.<sup>720</sup> In particular, the establishment of water and salt as communal goods enforced a strong community with a central organisation around the city’s agrarian and pastoral resources.<sup>721</sup> It is possible that Palmyrenes had already developed early social networks with the people of the Euphrates, as a community of Palmyrenes was established there in the pre-Roman era. Yet there is no evidence of permanent contacts and establishments beyond Dura-Europus before AD 19. The creation, maintenance, and continued development of the social network system around the long-distance trade to the Euphrates and India, was a clear Roman-era development. Like in Fazzan and in the Eastern Desert, this growth was fuelled by Rome’s fascination with, and demand for,

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<sup>719</sup> Bagnall *et al.* 2001.

<sup>720</sup> Edwell 2008; Smith 2013.

<sup>721</sup> Water: Teixidor 1984, 75-76; Matthews 1984, 177; Salt: Teixidor 1984, 78-82; Matthews 1984, 172, 177-8, 180. The legislation of water and salt are part of the former legislations incorporated into the Tariff.

exotic goods. It was the wealth of Rome and the stable conditions of the *pax Romana* that allowed the formation of long-distance ties.

By the first century AD, each case study region had different social systems and organisations whose core fabric was already established.<sup>722</sup> Three very different societies used the desert areas for different economic activities, and managed it in different ways. The Garamantes and Palmyrenes were initially independent political entities and had their centres of socio-political power in the desert areas examined. The Eastern Desert, however, was always administered as a regional territory within Egypt, and no local communities had any executive or socio-political power to influence the use of this area. The incentive for development was stimulated by the wealth of the empire, the demand for luxury goods, and depended on imperial demand for decorative stone, a wider market for precious stones, and finally, as I will discuss below, the taxation system linked to the wider imperial budgetary practices and needs.

Organisation and coordination, though very different in nature (whether monarchic – Fazzan; imperial – Roman Egypt; or communal - Palmyra) in all cases were dependent on a strong internal interdependence and small world systems. A characteristic of all regions is that they each had pre-existing communities who used or lived in the deserts. In each case there were route ways through, ways of living, and demands for trade items that were informed by the wider social networks. Where there was settled life in the deserts, these networks could be used to gain technology or food types that enabled the societies to overcome the basic carrying capacity of their local environments. What the Roman period brought was opportunity: the opportunity to

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<sup>722</sup> Some works, in particular that of Mattingly's, have emphasised the different, or 'discrepant experience' that single regions had under the umbrella of the Roman empire, highlighting in particular local agency in the experience of the empire (Mattingly 2011c: 213-218).

develop social and commercial networks, and the opportunity for local societies to evolve or obtain new goods under peaceful conditions.

#### **6.4 The development of the *pax romana*: stability, security and safety**

With the end of the Civil Wars and the conquest of Egypt in 31 BC creating a pan-Mediterranean Roman state, a stable and organised Mediterranean was established. Internal peace was a necessary pre-condition as the Roman Empire could now turn to the consolidation of alliances and the establishment of security in the border regions of the Mediterranean. Here the institutional approach sheds light on the changing dynamics, which though not directly related to local management of individual regions, affected them. With the exception of the Eastern Desert of Egypt, which came under Roman jurisdiction with the rest of Egypt following its conquest, the negotiation of peaceful conditions did not necessarily occur as a smooth transition: they lasted well into the second half of the first century AD. Several incursions into Fazzan, initially by Balbus in 20/19 BC, marked the first Roman state-led initiatives against the Garamantes: in contrast to the Numidian era, the relations between the Roman Empire and Fazzan were uneasy. Pliny's statement concerning the paths and wells the Garamantes used marks a turning point in the relationship between Fazzan and the Roman Empire. The archaeological record concerning imports in Fazzan shows a clear increase of Roman goods from the 70s onwards, when the Garamantian implication in the frictions between Oea and Lepcis Magna demanded a Roman incursion into Fazzan. Institutional peace had to be re-established. Peaceful long-term 'negotiations' (however aggressive they may have been) ensured stability and commercial opportunities for Tripolitania, whose goods represent a large share of Fazzan's imports from the Roman

Empire. Stability resulted in economic opportunity in Tripolitania, as highlighted by the developments in the hinterland of Lepcis Magna and in the Tripolitanian pre-desert. These developments also greatly expanded Tripolitania's trade potential and it became geographically the closest market with surplus to Fazzan; a weak link was now established connecting the Garamantian small world network to that of Tripolitania and the Roman Empire.

In the East, Pompey's campaigns had established the Euphrates as a symbolic boundary between the Romans and the Parthians.<sup>723</sup> Yet, successive defeats of Crassus in 53 BC and Antony from the late 40s to the early 30s BC and the Civil Wars surely contributed to general instability in the region until a peace settlement was reached between Augustus and Phraates IV of Parthia in 20/19 BC.<sup>724</sup> The embassy in AD 19 to Spasinou Charax by an agent of Germanicus, which happened during the visit of the latter to Palmyra, marks the continuation of diplomatic contact and, perhaps, the establishment of commercial opportunities.<sup>725</sup> This event incidentally coincided with Palmyra's first known merchant inscription on the Euphrates and is followed, five years later by a second one.<sup>726</sup>

The extent to which internal Mediterranean peace was a common factor through the regions examined has been highlighted in the various chapters by the extent of commercial activities and goods, but also mineral resources which were funnelled through these regions in order to reach the wider Mediterranean. Since the factor of peace and security has been established we may now turn to aspects of the different Roman economies at stake and how our regions come into play.

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<sup>723</sup> Edwell 2008, 9.

<sup>724</sup> Dio Cassius, *Roman History* 54.8.1–4; Suetonius, *Life of Augustus* 21.3; Edwell 2008, 33.

<sup>725</sup> Edwell 2008, 36–41.

<sup>726</sup> *CIS* II, 3924; *CIS* II, 3915; Gawlikowski 1994.

## 6.5 Roman economies and the regions examined

The debates concerning the Roman economy have had a long-standing history, which I have chosen not to directly engage with in detail. Nevertheless, since much of the results of this thesis are tied to economic aspects, it is worthwhile to return here to this discussion. This is all the more pertinent as it helps inform the discussion, particularly where it draws upon the perspectives from New Institutional Economics. I have already shown that an institutional perspective has much to offer in terms of analysis and in this chapter have returned to some elements of economic thinking.

Mattingly suggested that when speaking about the Roman economy, in fact we should distinguish between *different* Roman economies.<sup>727</sup> In this thesis, I have attempted to recognise plurality and we should whenever possible differentiate economies, as much as we must focus on regional economies. Mattingly distinguishes an imperial economy, provincial economy, and extra-provincial/extra-empire economy (Table 6.1). The imperial economy concerns governance, taxation, the army, mining, and state supplies; the provincial economy relates to local markets and networks, rural as well as manufacturing activities; and the extra-provincial economy wider transactions across provincial and imperial boundaries.<sup>728</sup>

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<sup>727</sup> Mattingly 2007b.

<sup>728</sup> *Ibid.*, 221-222.

<i>Economic Structure</i>	<i>Location</i>	<i>Economic mechanism</i>	<i>Archaeological correlates</i>
<b>Imperial economy</b>	Empire-wide and beyond the frontiers	Taxation, imperial exploitation of land, labour, resources, redistribution, largesse salary commitments	Monetisation focused on military needs, tax gathering; long-distance movement of commodities to frontier provinces or Rome, military bias in distribution patterns
<b>Provincial economy</b>	Within provincial borders, often Localised round major towns	Free market economy, embedded economies, response to taxation, monetisation	Local market distribution of locally produced goods, spread of monetisation to smaller market centres, etc.
<b>Extra-provincial economy</b>	Empire-wide and beyond frontiers	Free market economy, response to opportunities of imperial supply, gift exchange	Inter-provincial movement of goods to local markets, consumption of imported goods on civilian sites

Table 6.1. Different Roman economies (Mattingly 2002, Table 1).

So far, we have looked at three different landscapes from a regional perspective. The range of their economic activities within different sectors of the economy (agriculture, mining, and trade) have been detailed at length in the various chapters; but we may now also synthesise the different influences at stake in the case-study regions (Table 6.2):

<i>Location</i>	<i>Main representative economic structure</i>	<i>Economic mechanism</i>	<i>Archaeological correlates</i>
<b>Eastern Desert of Egypt</b>	Imperial economy	Taxation, imperial exploitation of land resources	Military forts and distribution; infrastructure controlling goods to be taxed; settlements and quarrying/mining evidence
<b>Palmyra</b>	Provincial economy with an extra-provincial and extra-empire economy	Local market economy; response to taxation, and geographic opportunity with respect to demand in foreign goods	Local market distribution of locally produced goods; inter-provincial and extra-provincial movement of goods
<b>Fazzan</b>	Extra-imperial and extra-provincial economic aspects	Exchange	Movement of goods to local markets, consumption of imported goods on civilian sites; redistribution to other markets

Table 6.2. Main Roman economic influences for the regions examined.

The Eastern Desert case study region falls neatly with the category of imperial economy and its attributes as described by Mattingly. The landscape is dominated by the exploitation of mineral resources used for imperial representation, mainly at Rome, and by systems facilitating the control and supervision of the payment of taxes. Both aspects fell under the responsibility of the Roman army. The distribution of food supplies and other goods with the exception of trade items going to the ports was largely supplied, controlled and regulated by the army, with no or little market supply systems.

Despite Palmyra's unusual yet characteristic involvement in long-distance trade, economically the region represents an example of a more typical provincial economy, with a central local urban market and a city-hinterland mode of interaction based primarily on the supply of agricultural products to the city, but also with extractive industries supplying goods to Palmyra as a major central market place. However, Palmyra clearly took advantage of its geographic location and its ability to obtain foreign luxury goods cheaply and more quickly than other regions of the empire through direct import and price control in the regions outside the empire. The city thrived on the competitive advantage of having both a local economy and one linked to extra-imperial activities. It can be suggested that Palmyra's trading activities extended into the province and the Levant in general, and perhaps into the Mediterranean, although unlike the Nabatean networks which are well documented in the Mediterranean,<sup>729</sup> we do not have much evidence beyond Egypt and the Nile for the Palmyrenes (Chapter 5, section 5.5).

Fazzan was never part of the Roman empire, but the published archaeological

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<sup>729</sup> Terpstra forthcoming. I have, as discussed in Chapter 5 section 5.5, a slightly less optimistic opinion concerning the evidence of a mercantile connection between Rome and Palmyra even if Palmyrene workers are attested within the commercial sector (warehouses) in Rome.

evidence particularly highlights a new facet of extra-imperial activities, and the dynamic new exchange opportunities it represented for Rome and the provinces. The widespread evidence of Roman goods in Fazzan makes it clear that we are not discussing gift exchange between political entities but actually non-monetised commercial exchange between an entity with a monetised economy (the Roman Empire) and an entity without a monetised economy (the Garamantian Empire). The distribution of Roman goods throughout the capital and also satellite settlements indicates that there was widespread consumption of Roman goods throughout Fazzan, and a re-distribution system, perhaps via secondary market places at larger villages or even towns such as Qasr ash-Sharraba in the Murzuq region. For Aghram Nadharif and the region of Ghat, there seems to be a difference of opinion as to whether the area can be considered as properly Garamantian by full annexation or exhibiting a relative poverty in contrast to Fazzan heartland as a result of Garamantian domination over the region.<sup>730</sup> While this debate is important in its own right, in terms of exchange and evidence of Roman extra-imperial activities, we may only say that the re-distribution of Roman goods within the wider central Sahara was probably entirely under Garamantian control.

I will now turn to a very specific topic within the imperial economy: taxation, and how we might be able to review the state's attitude.

## **6.6 Border regions and the Roman imperial economy: taxation**

One specific topic within the differing types of Roman economies, and more

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<sup>730</sup> Mattingly 2013, 506 argues for “a relative poverty of the Wadi Tanzzuft oasis settlements [...(as a)] in part at least a consequence of Garamantian hegemony, exploitation and domination of the trade networks [...]” (*contra* the opinion of the Italian mission which discuss the region as entirely Garamantian in the period examined, e.g. Liverani 200c; Liverani 2003b; Liverani 2005b; Gatto 2010; Mori 2010; Gatto and Mori 2012).

specifically within the imperial economy, is the role of taxation in relationship to imperial budgetary needs in order to run the wider Roman Empire.<sup>731</sup> Though I might seem to digress somewhat, it will become apparent how the territories examined cannot be fully understood without discussing taxation and what Rome expected from Palmyra and the Eastern Desert in terms of taxes and its imperial economy. For one, though without being able to delve into a lengthy topic, we may already say that this thesis has shown that there are more diverse and sophisticated ways of economic thinking about border regions than the model with tax-exporting regions and border tax-absorbing regions Hopkins had suggested in 1980.<sup>732</sup>

Concerning the trade to Fazzan, neither the evidence from Fazzan nor from Tripolitania offer any evidence to substantiate any claim on how trade to Fazzan was taxed or what amount of fiscal revenues were derived from it. We simply do not know what external taxation rate North Africa was submitted to and whether a 25% tax on foreign goods was applied to all regions beyond the frontiers.<sup>733</sup> What we can say, is that given the evidence for taxation elsewhere, it is highly unlikely that trade from Fazzan, given its now recognised scale, was not taxed in some way. The examination of the variety of economic and commercial activities linked to trade with the Roman Empire should also provide a basis to argue that this trade, far from being sporadic, must in all likelihood have been taxed by the state; we just do not have evidence in order to discuss

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<sup>731</sup> Taxation is often discussed more broadly as part of the Roman economy, but I am following Mattingly's definition, and the fact that the raising of revenues was part of the imperial economy (Mattingly 2011, 138).

<sup>732</sup> Hopkins 1980.

<sup>733</sup> It is now well established that the Zarai tariff from Algeria was not a customs tax (Trousset 2005). One document from Bu Njem mentions a soldier being sent *ad fiscum*, but does not give any further detail (Marichal 1992, 108, n. 26). For Britain, Strabo stresses that including Britain into the empire was not considered in his time, since the Romans had more to gain from tax revenues than from Romans ruling over the Britons (Strabo, *Geography* 2.5.8).

its mechanism.

For Egypt, two different calculations have been proposed concerning the taxes reaped by the state from the Red Sea trade. Based on different evaluations of the total value of the cargo on the *Hermapollon* mentioned in the Muziris Papyrus, the customs revenues from the imports from India via the Red Sea alone would amount to somewhere between 230 million sesterces according to Wilson, and 4,410 million sesterces according to Sidebotham.<sup>734</sup> Wilson bases his calculation on the assumption that the cargo mentioned in the Muziris Papyrus represents the total value of the consignment on the *Hermapollon*, and that 100 ships left Egypt on an annual basis. This (let us say low in comparison with Sidebotham's) estimate is based on Strabo's assertion that 120 ships left for India from Myos Hormos alone.<sup>735</sup> Sidebotham, on the other hand, estimated that the 3.5 ton cargo mentioned in the Muziris Papyrus represents a fraction of a cargo, and bases his calculations on 150 ships with a 75-ton carrying capacity, a capacity within the middle to low range of normal merchantmen vessels crossing the Mediterranean.<sup>736</sup> Whittaker, though highlighting the importance of Indian commerce to Rome and to the imperial network, remains sceptical of high maritime traffic and disbelieves Strabo's comment that 120 ships left annually; he does not, however, give any estimate of how many did.<sup>737</sup>

A further element in this discussion should be the evidence for taxes in Palmyra. The re-interpretation of the graffito from Tower tomb 70 in Palmyra as the customs due

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<sup>734</sup> Wilson forthcoming; Sidebotham 2011, 218 gives a total sum of trade of 17.64 billion drachmae, of which 25% would make 4.41 billion drachmae, or 4410 million sesterces (one drachma being equivalent to one sestercius: Bowman 1986, 237).

<sup>735</sup> Strabo, *Geography* 2.5.12.

<sup>736</sup> The medium-range merchant vessels' capacity was between 75-200 tons (Parker 1992, 26).

<sup>737</sup> Whittaker 2004, 169-171.

of one fourth (*tetarte*) rather than four interest loans,<sup>738</sup> would further argue that the taxes were either controlled or collected in kind at Palmyra. The sums mentioned in the graffito, dated to sometime between the end of the first century AD and first half of the second century AD, amount to a total of *c.* 90 million sesterces, which should represent the amount of the *tetarte* obtained from the arrival of caravans with cargoes worth some 350 million sesterces.<sup>739</sup>

The numbers given by Wilson and Sidebotham might represent a basis from which to evaluate the relevance of trade passing through the regions of the Eastern Desert of Egypt and Palmyra to the state. Arguably, the numbers that will be produced might seem extremely crude, but they might serve as a valuable first approach. Obviously fluctuations, disruptions, and other elements which will bias the numbers presented must be kept in mind. One known factor is that after AD 174, and perhaps by AD 227, the *tetarte* was replaced by the *vectigal octavarum* (12.5%), mentioned in a law of Severus Alexander.<sup>740</sup> This could be because the state could no longer guarantee the safety of commerce,<sup>741</sup> but equally that the Antonine Plague drastically affected the number of those who could have invested or were engaged in the trade with the East, and that lowering the tax would have been an state incentive to revive it.<sup>742</sup> In any case, I therefore suggest that irrespective of other fluctuations, the tax income suggested by Wilson and Sidebotham should also be halved for the early third-century budget

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<sup>738</sup> De Romanis 2004, 2006.

<sup>739</sup> Tchernia 2011, 16.

<sup>740</sup> *Justinian Codex* 4.65.7; De Romanis 1998, 51.

<sup>741</sup> Wilson forthcoming: “the most reasonable explanation would be that the reduction was an acknowledgement by the state of its inability to maintain previous levels of protection for shipping and caravans.”

<sup>742</sup> Equally there is no drastic evidence of change or disruptions in the Eastern Desert forts before AD 215.

estimates. So far, the numbers for high and low annual imperial budget estimates for AD 150 and AD 215, originally calculated by Duncan-Jones, have been tabulated as following:<sup>743</sup>

	<i>AD 150</i>		<i>AD 215</i>	
	<i>Low figure</i>	<i>High figure</i>	<i>Low figure</i>	<i>High figure</i>
ARMY	643	704	1,127	1,188
OTHER IMPERIAL SERVANTS	75	75	75	75
CONGIARIA	44	44	140	140
BUILDING PROJECTS	20	60	20	60
OTHER	50	100	100	150
TOTAL	832	983	1462	1614

Table 6.3. Low and high annual imperial budget for AD 150 and AD 215 in millions of sesterces (Duncan-Jones 1994, Table 3.7).

On the basis of the estimates in Table 6.3, I would like to consider what the regions under study have to offer in term of imperial budget estimates. I fully recognise that these were only small parts of the Roman Empire and acknowledge here the fact that the estimates are necessarily approximate and stretch out diachronically annual incomes which would have fluctuated. While I could have chosen here to discuss the income from taxation in terms of the army budget alone, this would have precluded a discussion of the meaning of the overall estimate. So first, let us consider the tax income from the *tetarte* through Palmyra and the Eastern Desert in terms of the army's budget, which takes into account the switch from the *tetarte* to the *vectigal octavarum*:

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<sup>743</sup> Duncan-Jones 1994, 33-46 and Table 3.7. For a more recent discussion of the imperial budget, Mattingly 2011, 132-138; Mattingly keeps Duncan-Jones' estimates (Mattingly 2011, Table 5.1). Hopkins 2002, 199 and footnote 14 had warned that Duncan-Jones bases his estimate on the cost of the army, but more or less agreed with his estimate.

		<i>AD 150</i>		<i>AD 215</i>	
		<i>Low figure</i>	<i>High figure</i>	<i>Low figure</i>	<i>High figure</i>
		HS 643 m	HS 704 m	HS 1,127 m	HS 1,188 m
EASTERN DESERT OF EGYPT	Low estimate (HS 230 m / 115 m)	35%	32%	10%	9%
	High estimate (HS 4410 m / 2205 m)	685%	626%	195%	185%
PALMYRA	(HS 90 m / 45 m)	13%	12%	3%	3%

Table 6.4. Income from the import tax in percentiles of the annual imperial budget for the army (after Duncan-Jones 1994, Table 3.7) High and low imperial budget estimates according to Wilson forthcoming and Sidebotham 2011 (\*numbers are rounded to the lower decimal; \*\* HS: Sesterces m: million).

In terms of the entire annual imperial budget, we obtain the following percentages (Table 6.5):

		<i>AD 150</i>		<i>AD 215</i>	
		<i>Low figure</i>	<i>High figure</i>	<i>Low figure</i>	<i>High figure</i>
		HS 832 m	HS 983 m	HS 1462 m	HS 1613 m
EASTERN DESERT OF EGYPT	Low estimate (HS 230 m / 115 m)	27%	23%	7%	7%
	High estimate (HS 4410 m / 2205 m)	530%	448%	150%	136%
PALMYRA	(HS 90 m / 45 m)	10%	9%	3%	2%

Table 6.5. Income from the import tax in percentiles of the annual imperial budget (after Duncan-Jones 1994, Table 3.7).

The tables (Table 6.4 and Table 6.5) comparing estimates of import taxes versus imperial budget bring out several factors to consider. First, that Sidebotham's estimate, which is considerably higher than Wilson's, must be ruled out. Sidebotham's figure is implausible in terms of state revenues, as regardless of high or low annual imperial budget estimates, it is several times the entire estimated annual imperial budget. His calculation is based on the lowest tonnage capacity for Mediterranean average merchant vessels, rather than the higher tonnage ships capable of resisting Monsoon-strength winds.<sup>744</sup> The problem in Sidebotham's calculations lies with the 3.5-tonnage estimate of the cargo mentioned in the Muziris papyrus. In recent re-evaluations of the Muziris

<sup>744</sup> On sailing, winds and Indian-ocean ships, see Beresford 2013, esp. 213-236.

Papyrus, it has been shown that the Muziris papyrus represents in fact the value of a cargo of at least 625 tons.<sup>745</sup> Given the problems of Sidebotham's reading of the data and the recent re-evaluation of the Muziris papyrus, Wilson's more modest estimate based on 100 ships a year remains a more trustworthy calculation. Although it is a low estimate (if we keep in mind Strabo's numbers), it may nevertheless compensate for some annual fluctuations due to ship loss, disruption of trade or other incidents. Even with a high estimate of the annual imperial budget, the income derived from the Eastern Desert of Egypt and Palmyra made up a substantial percentage of the state's annual budget – possibly up to a third - in the second century AD. This helps understand the substantial investment by the state in the Eastern Desert of Egypt and tolerance of an unusual, but effective infrastructure and organisation in Palmyra. With an additional, unknown, amount likely to come into the imperial coffers from the trade across the Sahara, the true extent of the contribution of these arid regions can be envisaged. This makes the collapse of the amount raised in the third century AD all the more dramatic, with obvious consequences for the imperial economy as a whole.

One might even say that these numbers are perhaps too high, caused substantial fluctuations in the budget on a year basis in case of disruptions (and too risky) in terms of overall budget, which might have been higher than the estimate used. Although deserving of further research, within the limitation of this thesis this is not possible. Let us say that the calculations do not include the considerations of the *tetarte* income from

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<sup>745</sup> Morelli 2011; De Romanis 2012. The argument that the Muziris papyrus represents the whole cargo rather than a fragment of it has significant corollary repercussions, since previous discussions now need to be reviewed (*e.g.* Whittaker 2004's discussions of Roman economy based on the trade with India and more specifically the Muziris Papyrus). This is not the place to do so, but as an example, such statements as "if the total valuation of the cargo calculated for the Muziris papyrus [...] is anywhere near typical, the capital investment required for so many ships each year [Strabo's estimate], even allowing for a huge added sale value, would have been quite simply impossible" (Whittaker 2004, 171) are no longer valid.

Petra or from other borders. If income reaped from Petra was somewhat equivalent to Palmyra's, it would imply that the three commercial influxes (Eastern Desert, Petra, Palmyra) made up between 12% to 50% of the annual imperial budget for AD 150 and AD 215 respectively. This simply is an unreasonably high percentage and would represent a risky scheme for a state, especially for the second century AD. Would it be possible that the foreign trade bubble would risk throwing the imperial economy out of kilter? It is much more likely that the annual state income estimates are too low. What they do highlight, however, is the importance of commerce through the desert regions for the Roman state regardless of their territorial exploitation, whether agricultural or mineral.

The implications for the state and its policies concerning eastern commerce has been an important debate,<sup>746</sup> and what we can say is that the taxes reaped from it make it unlikely that the Roman state would have disregarded or jeopardised the safety of these commercial transactions.<sup>747</sup> Young had dismissed direct imperial interest on the basis of insufficiently clear data for the involvement of the emperors in commercial transactions via their freedmen or imperial slaves.<sup>748</sup> The evidence for their involvement via imperial slaves which held special *laissez-passer* documents to cross the desert make it indisputably clear that there was imperial commercial involvement.<sup>749</sup> For the Red Sea, Nappo has also established that the State acted to protect its interests in the second century AD, in particular through the deployment of a fleet and the installation of a unit

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<sup>746</sup> Sidebotham 1986 maintained that the state was invested in protecting the trade; Young 2001 that the state was not directly invested in supporting the trade, and only reactively protected its revenues.

<sup>747</sup> *Contra* Young 2001.

<sup>748</sup> Young 2001, 61 *contra* Sidebotham 1986, 136. Young argues that the imperial slaves mentioned in the Nikanor archive and on amphorae stamps could as pointed out by Casson simply be involved in local government (Casson 1989, 38).

<sup>749</sup> See Chapter 4, section 4.5; Bagnall *et al.* 2000; Bowman 2010, 106; Nappo and Zerbinì 2011.

in the Antonine period on the Farasan islands.<sup>750</sup> The calculation of the state's income taxes strongly supports this perspective, but also highlights the scale of the economic importance of individual regions to the state in terms of the proportion that it contributed to the imperial budget. They emphasise regional socio-economic diversity with more localised market economies in the Roman Empire,<sup>751</sup> and provide perhaps a basis for an explanation as to why the Roman state's interest and military actions were more focused on protecting the Eastern Desert and Red Sea interests (hence also Petra's) than on Palmyra's: the imperial income derived from it was at least double, if not more. In fact, access onto Egypt's redistributive markets and commercial networks is what attracted the Palmyrenes to develop new commercial opportunities via the Eastern Desert. But, to return to my argument: rather than a *laissez-faire* attitude, we must envisage different levels of state interest and state investment in a given region, and evolution and change over time. The institutional relationship between the state and different regions as well as the state's needs evolved with changing policies.

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<sup>750</sup> Nappo forthcoming. On the inscriptions: Phillips *et al.* 2004; Villeneuve 2007.

<sup>751</sup> Mattingly 2007b.

## 6.7 Centrally and locally informed development

Following on from some aspects of the Roman imperial economy, I will now address the significance of local communities inside and outside the Roman frontier in the generation of trade and the exploitation of arid margins, and how these activities impacted on the forms of societies that existed.

In the Eastern Desert of Egypt, the exploitation of local resources and trade were generally under tight control from the Roman administration. From the first to third centuries AD, the Eastern Desert of Egypt was an entirely controlled space. State-run operations employed either the military, for the routes to the coast, or Nile-valley civilians for the stone quarries. Even at Berenike, daily aspects of life were entirely under Roman administrative control, for example over two hundred ostraca from the rubbish dumps revealed that the fresh-water supply to the city were regulated by the Roman military.<sup>752</sup> This control included movement in and out of Berenike by a *quintanensis*, a customs officer. The highly militarised and controlled Eastern Desert would have left little opportunity for the development and social mobility of indigenous groups, and there is no evidence so far that any group was integrated to any great extent into the wider economy generated by the Indian Ocean trade. On the other hand, it must be said that we know relatively little about the various autochthonous groups which may have inhabited the Eastern Desert, amongst which the Ichthyophagi (fish-eaters) on the coast and peoples broadly and variably referred

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<sup>752</sup> Sidebotham 2011, 71.

to in the ancient literature as Troglodytes, Blemmyes, Colobi, Megabaroï and Arabs.<sup>753</sup> The ostraca from the forts mainly discuss the activity of local groups external to the military and commercial networks if they posed a threat. It is possible, however, that the need for food supplies engendered small-scale trading possibilities, such as for the fishing communities.<sup>754</sup> Yet the establishment of passes shows that, if anything, these groups were fairly disempowered and restricted in their movements. Could the transport needs through the desert have altered the local lifestyles, especially of coastal communities? The evidence concerning local inhabitants at Berenike in particular highlights the composite and transitory nature of its occupants, which included people originally from the Nile Valley, Palmyra, India, Axum, or South Arabia evidently there for trading purposes,<sup>755</sup> and who were in need of local transporters. Yet the evidence for private transport of incoming goods suggests that it was undertaken by people residing outside the Eastern Desert, and mainly from the Nile valley. Unlike Fazzan and Palmyra, where developments were driven by local agency, the exclusion of local people from the economic life of the region, if indeed it was the case, would have had a considerable impact on the development potential of the area in the *longue durée*. We are, however, in possession of a few hints concerning the logistics of transport. If we return to the Hermapollon cargo, and try to

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<sup>753</sup> Strabo, *Geography* 17.1.53. See Barnard 2005; Barnard 2009; Thomas 2009; Thomas 2012; Power 2012 on the third-century AD Blemmye occupation, and the Koptos - Myos Hormos path as the dividing line between Blemmye occupation and Saracen group in Late Antiquity; Dijkstra 2012 on Blemmyes and Noubades in the Eastern Desert from the fourth-century onwards. Most of the appellations in the ancient literature however are rather vague, and probably not particularly trustworthy for the period I am interested in here. For a broad diachronic perspective, Barnard and Duistermaat 2013, and esp. Bintliff and Barnard 2013.

<sup>754</sup> Thomas 2011 and 2012, esp. on the Pachubis Ichthyophagoi's activities as a fisherman. For Red sea fish as part of the Eastern Desert worker's diet (Van der Veen 1998, Table 1).

<sup>755</sup> Sidebotham 2011, 68-86.

evaluate logistics, it may draw out the scale of trade, and the fuzziness of any details that we have on those who operated it. Travels to and from the Nile to unload and reload the 625-ton cargo vessel, would have required at least 3,200 camel loads each way, a calculation which is independent from whether we believe that no empty return trips were ever made, and whether wares therefore stayed in entrepôts at Berenike for up to six months. A minimum of 15 contractors such as the Nikanor family, who owned as many as 30 camels, would have been needed to handle transport logistics for a single ship in just half a year or a year, depending on whether we believe travels were concentrated around the sailing season.<sup>756</sup> In any case, the annual estimated offloading of ships required a substantial amount of animal traffic. An estimate might therefore give an indication of both local loading and unloading needs: the annual breakdown into animal loads implied over at least half a million to well over a million return trips through the Eastern Desert of Egypt regardless of the port of entry and the destination of the cargo. The numbers could be higher, and probably even double, if loading and unloading, which occurred several months apart, implied two annual return trips. Even keeping in mind that ships coming in from the Arabian peninsula often carried ballast, and that ballast would imply less tonnage carried through the desert than tonnage arriving on the Red Sea, there is no doubt that the scale and intensity of traffic must have been exceptional.

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<sup>756</sup> See also Chapter 4, section 4.5. Depending on whether we assume empty return cargoes. Adams 2007,80 for average camel load (*c.* 430 lbs, translated as 195,45 kg) and Adams 2007,82 for the number of camels owned by the Nikanor family. The calculation breaks down as 3,197 camel loads (not including camels for food provisions or some space for water) = slightly over 7 one-way trips for 15 contractors with 30 camels each ladden with 195,45 kg, and 14 total including the round trip, which can be made in about 168 days non-stop (Berenike - Koptos being a 12-day journey), so roughly in five and a half months. Ships had to be loaded for a July departure, and unloaded from November onwards, so at half-year intervals (see Beresford 2013, esp. 213-236).

The traffic of over 120 ships in the Roman period, already in contrast to 20 in the Ptolemaic period, implied considerable growth in transport through the desert. Unfortunately this cannot easily translate into similar travels or trading scales for the Palmyrene desert or that between Fazzan and North Africa. In fact, I would argue that the particular development of infrastructure in the Eastern Desert had as much to do with high revenues (and costs) derived from the Eastern trade goods as with the intensity of transport traffic funnelled into the very narrow corridors in which traffic was permitted. The conditions in the first three centuries AD encouraged a local and regional transport industry which did not survive once disruptions in the wider economic trends occurred.

In any case, the Eastern Desert's trajectory contrasts with the social developments of the societies at Palmyra and in Fazzan, where local communities were at the heart of change and development. As I have shown, both regions experienced a demographic increase mainly characterised by urban communities surrounded by many rural villages and towns, but also acquired greater wealth, attested in the archaeological or epigraphic record through imports / exports of luxury items, and which in the case of Palmyra, can also be linked to a sophisticated social network. Regarding the former point, it is important to highlight the extent to which such a settled, hierarchical landscape encouraged specialisation, surplus, and market opportunities and that it is a clearly Roman phenomenon for all region, even if the intense inhabitation of the landscapes continued much past the third century AD in Fazzan and Palmyra. These pattern, although predicted at times by Central Place Theory, show that models alone are insufficient to understand local dynamics which must be studied individually and in details.

With regards to the latter point, foreign goods were also available to a wider

portion of the communities of Fazzan, rather than just the controlling elite who, presumably, resided in the urban centres. For Palmyra, it is difficult to establish the extent to which the hinterland had access to foreign luxury goods; certainly, it cannot be excluded that goods were re-distributed and also sold in the urban markets at Palmyra. By contrast, the Eastern Desert of Egypt presents no evidence so far of any substantial indigenous settlements in the region. Indigenous populations in the Eastern Desert were most likely small, dispersed and politically fragmented; they are mainly mentioned in terms of tensions with the Roman authority.

At Palmyra, the evidence points to the enforcement of social cohesion via communal organisation of civil life in the urban community, but also with those dwelling in the hinterland villages. The development of the water capacity available to the city and its hinterland, whether through aqueducts or *qanats*, was regulated by the city council and its appointed curator. The creation of agricultural lands fed by *qanats*, the development of settlements in the hinterland, and perhaps also by the Roman-phase Harbaqa dam, enabled sufficient agricultural resources to maintain the large urban population. Palmyra's urban community reinforced the links to its wider hinterland through the creation of forces of attraction of resources. This mainly takes the form of a waiver of taxes for agricultural and pastoral products, which encouraged settlers to supply Palmyra's market rather than that of its neighbouring cities. Similarly, the city monopoly on salt reinforced the reliance on Palmyra as a central place and centre of a small world system, in particular for pastoral groups reliant on salt for animal husbandry. As argued by Sommer, friction was also avoided by the establishment of peaceful terms with nomadic groups,<sup>757</sup> and this institutional aspect is important: inscriptions make it more than clear that even in peaceful times, any

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<sup>757</sup> Sommer 2005.

insecurity or friction could be costly.<sup>758</sup>

## 6.8 Networks and different ways of thinking through networks

The long-distance social networks along with a dependence on wider economic systems, in particular a Roman market demand, can be considered a common incentive for local developments in all three areas examined. Despite expected regional differences, the comparative approach highlights a series of outcomes that were as much dependent on local conditions and agency as on the stimulus of Roman demand, or Roman provincial, extra-provincial, or imperial economies. Different ways of thinking through networks could also be developed and synthesised (Table 6.6):

<i>Fazzan</i>	<i>Eastern Desert of Egypt</i>	<i>Palmyra</i>
Developments of networks to the coast and the sub-Sahara both Garamantian state-driven and with initial Roman state “incentive”; civilian networks amplify and expand through the stimulus of Roman demand; multi-directional expansion with the capital as centre; relations with new nodes need to be institutionally established on a state-level	Amplification of trading network channelled through a new administrative and provincial centre; Roman state-organised changes to the local supply and movement networks; civilian and military networks; internal reinforcement of the supply system through the simple creation of new nodes by the institution (forts, settlements, etc)	Amplification of trading networks; networks develop through Palmyrene rather than Roman state action; civilian network expansion through the creation of new nodal points outside Palmyrene territories and within established commercial trajectories; relations with new nodes are to be institutionally established on city-level with probable state-support

Table 6.6 Schematic representation of the organisation of networks.

Fazzan entertained weak-tie systems of trade and mineral supply over considerable geographic distances, which can equally be said of the Palmyrene network. For Fazzan, this, however, was inherently linked to the structure of its society, and matters

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<sup>758</sup> Inv. III, 28 = CIS II, 3948 (caravan having to pay 300 gold *denarii*); Delplace and Dentzer-Feydy 2005, 249, Annexe 31 (caravan attacked by robbers).

of centre-periphery relations between the capital of the state and its subordinate regions, as well as commercial developments. Of the three regions, and throughout the three centuries examined, Fazzan remained the administrative centre and socio-political force with executive power throughout the central Sahara. In terms of structure, the Eastern Desert of Egypt and Palmyra were at the periphery, or at the edge of the socio-political or administrative centre that was Rome. Nonetheless, for Fazzan, the continuous interaction with the Roman Empire reinforced alliances and commercial networks based on mutual trust, and created geographic shortcuts to the closest sources of Roman goods. This considerably facilitated transport logistics and gave rise to new dynamics of interaction. Pre-organised batches of ceramics, and special-made glass vessels shows that Roman traders were carefully selecting or having objects made for the specific market of Fazzan and in payment for the goods the Garamantes could provide, just as much as the Garamantes made a selection of what goods they wished to acquire in exchange for theirs. The trade in animals may also have fed into the pre-existing network, along with an organisation of animal traders and specialists in coastal North Africa, along with some trade in precious stones. When compared to the operations in the Eastern Desert of Egypt, both in terms of mineral exploitation, or in commerce, however, it is evident that the scale of operations were much smaller. The range of geographic areas exploited for stones, perhaps even precious ores in the Sahara, imply ties with regions beyond the Fazzan oases, and represent other networks, and another aspect of the Garamantes's complex social relationships over considerable distances.

The Eastern Desert networks can also be shown to have evolved in intensity through pan-Mediterranean market opportunity, but also locally within the possibilities offered by the restricted mobility along the wadis. The Eastern Desert

was crossed by people involved and organising long-distance weak-tie trading systems, but none of these originated from the Eastern Desert. The supply needs for the military, for the stone quarrying industry and Indian-ocean related transport needs created complex and sophisticated networks of small-scale, or ‘strong tie,’ social interaction. Ostraca which were sent from site to site, and which often are letters with requests for goods from families and friends, show the degree to which the inhabitants of the Eastern Desert relied on communication and exchange within the established routes in order to make their lives bearable. In contrast to the settlements of the Fazzan or Palmyrene hinterland which were relatively independent through agricultural production, the Eastern Desert sites were entirely dependent on external provisions. Local small worlds of strong ties between communities and forts were established to reinforce the system. Ostraca repeatedly show that the less equipped forts made requests for supplies to the closest better equipped forts. A striking example of small-world network is that of communities at forts better supplied with local water that could grow vegetables and serve as small markets and supply centres within the network. These forts also served as washing places for the dirty laundry of less well supplied forts.<sup>759</sup>

The Eastern Desert networks had much to do with allowing a Roman (and mainly Nile valley) population to live in the Eastern Desert and exploit its mineral resources. The same was the case for the networks related to the forts, which were established to allow transport networks to move goods through that space. As they were internal to the Roman state’s operation, these networks brought little in terms of

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<sup>759</sup> <http://www.ig1.ku.dk/~bulow/Iovis07.pdf>: both the forts of Dios and Zeron send their dirty laundry to Kompasi. In *O.Dios* inv. 382, Sarapias asks for her laundry to be sent back to Dios even if not yet washed, as she has got “nothing left to wear.”

identity formation to life in the Eastern Desert. This is an important distinction which differentiates the networks of the Eastern Desert from those of Palmyra and Fazzan shows the necessity to analyse each regional contexts individually.

Palmyra's commercial networks developed within a geographic trajectory beyond its territories and the Roman Empire, with the creation of new organisational clusters in transshipment areas according two economic models, horizontal integration and vertical integration, through which competitiveness and profit grew by taking over other parts of the supply line of Indian Ocean goods.<sup>760</sup> The merchant inscriptions demonstrate a clear expansion of a commercial network from Palmyra and spreading eastward through vertical integration, then westwards through horizontal integration, with the formation of new clusters connected to Palmyra for economic reasons. These developed under peaceful conditions and increasingly reached into the Persian Gulf, the Indian Ocean, the Red Sea, and ultimately the Nile through communities at Koptos and at Denderah on the Nile. This development happened in conjunction with the creation of an established path which featured regular stopping points with dams and private inns (*katalumata*) at places such as Gennaes, but also with the creation of a security force ensuring the safety of the caravan. However successful, these network strings were difficult to maintain after the arrival of the Sassanians on the Euphrates. With the increasingly tense relations between Rome and the Sassanians, the network system was destroyed once Zenobia and the Palmyrenes represented a direct institutional threat to the imperial system. The security of the institution took precedent, and Palmyra's thriving foreign commerce came to an end.

As a summary, it is clear that because networks are reliant upon local agency for their development and maintenance, even within a similar historical timeframe or

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<sup>760</sup> On vertical integration in the ancient world: Silver 2007; Brokaert 2012.

institutional context (that of the Roman Empire), different networks do not behave or impact local contexts in similar ways. This equally has important consequences for their longer-term continuation beyond the temporal scope of this thesis. While it is not possible to fully develop this perspective in the following section a few observations will be made about how the case study networks changed in to the post-Roman period.

### **6.9 Changing times, changing networks?**

In Egypt, a series of external factors led to the local contraction of activities and decline in the Eastern Desert in the third century AD. Explanations range from the 3rd-century AD crisis, attacks of the Blemmyes, and the siltation process at Myos Hormos, or even earthquakes, which deprived the Eastern Desert of at least one of its harbours.<sup>761</sup> A partial change in commercial routes in the Red Sea and across the Indian Ocean with the rise of Aksumite and Arab middlemen in the 3rd and 4th century AD has also been suggested.<sup>762</sup>

The departure of the army, around AD 250, dismantled what had been the backbone of the networks through the Eastern Desert. The final phases of occupation at the fort at Xeron curiously document food allocations to Eastern Desert groups.<sup>763</sup> The reasons for these allocations are so far unknown, but one possibility is that the

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<sup>761</sup> De Romanis 2002; Peacock and Blue, 2006, 174-175 on the decline of Myos Hormos; Sidebotham 2011, 259-260; Wilson forthcoming. Sidebotham (Sidebotham 2011, 260) notes that Epiphanius relates that Mani (AD 215-277), the founder of Manicheism, made part of his fortune through trade via Berenike, but this is not the case. Epiphanius (Epiphanius, *Paranion* 66.1.7– 12) clearly states that it was Scythianus, a predecessor to Mani, who made his fortune through Berenike.

<sup>762</sup> Nappo 2010, 345; Sidebotham 2011, 261. On sixth century AD Red Sea wars and changing dynamics in the Red Sea, see also Bowersock 2013.

<sup>763</sup> <http://www.ifao.egnet.net/archeologie/praesidia/> (last consulted: 15 january 2014).

army could no longer guarantee stable local conditions, and therefore had to rely on local groups whose allegiance was won over through food allocations. Alternatively, this could suggest a transitioning of the army out of the region through capacity building in the local environment, perhaps much like today's (albeit failing) transitioning attempts in Iraq and Afghanistan. In any case, this phenomenon implied increased social possibilities and temporary food safety and security for these peoples. This would also further strengthen the argument that the state cut import taxes in the Red Sea, which were reduced from 25% to 12.5%, came as a consequence of the state's inability to fully guarantee security in the Eastern Desert.<sup>764</sup> This solution could have been envisaged as a 'stimulus package' meant to encourage trade and try to make up for economic downturn. Most network and local activity dropped, with the exception of some stone quarrying. The siltation of Myos Hormos' harbour by the third century AD, whether as a result or a consequence, further escalated the Eastern Desert's contraction of activities. Commercial transactions went northwards, and it is possible that this situation did not evolve until state action under Anastasius and Justinian restored commercial possibilities in the region.<sup>765</sup> The networks of the Eastern Desert collapsed because of their imposition on the desert: rather than being embedded in the desert life, they relied on external factors controlling them. Unlike the Garamantes of Fazzan, who could reorientate towards new ties, the system collapsed as a whole.

Palmyra's commercial networks never recovered from the changes in circumstances in political matters linked to Zenobia's revolt. By the time the city

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<sup>764</sup> De Romanis 2002; Wilson forthcoming. Could the Antonine Plague, as discussed earlier, have also affected the number of investors, and even Nile people involved in the trade?

<sup>765</sup> Nappo 2009. In the southern Red Sea and Indian Ocean, religion increasingly became a new factor of cohesion and network formation arising from the former mercantile connections (Seland 2013).

could recover, continuing frictions between the Roman and the Sassanian empire had changed the landscape of opportunity that the peaceful and prosperous first centuries had created. Nonetheless, Palmyra's rich local resources enabled the continuation of local agriculture and settlement activity. In this period of retrenchment, the city and hinterland reverted to a more standard local economy similar to that any provincial town with agricultural activities and local or regional market opportunities offered by agricultural surplus, textile production, and the exploitation of local saltpans.

There is no evidence that regular contact between Fazzan and Tripolitania stopped until the fourth century AD. The third-century AD evidence supports continuous regular Garamantian movement through the border region of Tripolitania. The fort of Bu Njem, whose inscription dates the construction of the fort and the arrival of the *Legio III Augusta* to the 24<sup>th</sup> of January AD 201, was occupied at least until AD 259.<sup>766</sup> The ostraca from that period mention Garamantes on several occasions. In one instance, the Garamantes are recorded as bringing a fugitive slave, and a few donkey-loads of barley. In fact, some ostraca would even suggest close collaboration: ostrakon 28 records four soldiers being sent on an expedition with the Garamantes (*missus cum Garamanti[bu]s*).<sup>767</sup> Past the third century AD, several events which affected Tripolitania also disrupted the connections between the coast and Fazzan. The Austrian destructions of AD 363-366 in the Lepcitanian territory probably affected the stability and commercial potential of Lepcis and the Tripolitanian coast, and hence the weak tie connecting the Roman and Garamantian worlds. Later ceramics, from the fifth to sixth century AD, such as Keay 62 suggest a preferential route towards Tunisia, and thus the creation of a new tie, though to a

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<sup>766</sup> Rebuffat 1972-1973.

<sup>767</sup> Marichal 1992, 145.

different region.<sup>768</sup> The excavations at the Garamantian Royal Cemetery and the settlement developments in the Murzuq basin show continued wealth and a dynamic economy between the fourth and the sixth centuries AD,<sup>769</sup> a sign also that the drying out of the Sahara had no sudden effect on the Garamantes. Their prosperity happened independently from Tripolitanian disruptions and suggests that the disruptions to the Garamantes' northern connections had relatively little impact at the centre, other than those linked to one commercial network. The severance of one of Fazzan's ties would not have altered the other long-distance networks it had created, except perhaps in intensity. It may be that as a result of the problems to the north, Fazzan's commercial attention southwards grew. Could the appearance and archaeological visibility (without negating the possibility of earlier arrival) of new Garamantian and North African items in sub-Saharan such as the chicken, the dromedary, and other northern goods by the Niger bend, be an indication of an evolving relationship and increased interaction with the south, but also the west in the later period as a result of a shift of commercial interest? The find of textiles, or carnelian in Kissi, along with other northern imports in the fourth to sixth centuries AD,<sup>770</sup> and the development of gold mining as a new economic activity also suggest perhaps new regional dynamics.<sup>771</sup> This is also hinted at by the evidence in the Ahoggar region, as Tin-Hinan's funerary assemblage is highly suggestive of potential trading ties with the Garamantes. The development of settlements and agricultural lands in the Murzuq basin, the wealth displayed in the Royal Cemeteries, indicate continued prosperity, and southwards expansion at time when pressure and conflict afflicted the northern networks.

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<sup>768</sup> Mattingly *et al.* 2010e, 40-41 and Figs 9-10.

<sup>769</sup> Mattingly *et al.* 2011.

<sup>770</sup> Magnavita 2013.

<sup>771</sup> *Ibid.*

Changes which occurred post AD 250 can be summarised as such (Table 6.7):

<b>Post AD 250 disruptions / Troubles with the Mediterranean networks</b>		
Fazzan	Eastern Desert	Palmyra
<p>Re-orientation of networks to the south and east; development of new network clusters in the Murzuq basin tied to agricultural exploitation of new territories.</p> <p>Economic activities in sub-Saharan Africa tied to changing dynamics and intensity of interaction?</p>	<p>Removal of the army, collapse of mercantile activity through the Eastern desert.</p> <p>Rise of nomadic activities; collaborations to fill the transport logistics gap; Blemmyes causing disruptions</p>	<p>Power largely destroyed in revolt; drastically different geo-political situation</p> <p>Networks were not reoriented</p> <p>Return to an economy of a provincial town with agricultural activities continuing in the hinterland rather than one embedded within the imperial and extra-provincial economies</p>

Table 6.7. Schematic table of post-AD 250 changes linked to networks and local economic changes.

In sum, we are again seeing differing local reactions to network disruptions or failure. Of the case studies, Fazzan is the only region which fared relatively well in the *longue durée*. As it was outside the Roman empire, it could be postulated that Fazzan was stable enough to re-orientate its networks and decide to build up new commercial relations with areas to the south of Fazzan as those with the north declined. In contrast, instability within the Roman Empire had an impact on the other two case study regions. With the removal of the institution of the army in the Eastern Desert, the Eastern Desert networks collapsed in the second half of the third century AD. The army was permanently gone, Myos Hormos was in disuse, and the majority of quarries were abandoned, yet elements of the former network did linger on with Mons Porphyrites still being quarried, probably into the fifth century AD.<sup>772</sup> Berenike also recovered somewhat and there is again evidence of activity from the fourth to

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<sup>772</sup> Maxfield 2001, 165.

sixth centuries AD, though probably on a more reduced scale.<sup>773</sup> Palmyra was destroyed by its own institution (the Roman state) as the city represented an institutional threat. Its networks were severed, and it shared with the Eastern Desert of Egypt the fate of general regional instability.

## 6.10 Synthesis

Arid lands are defined as much by micro-regions and diversity in terms of landscapes, as the Mediterranean. In such circumstances however, and in contrast to the Mediterranean, crises and climatic fluctuations cannot be understood as the underlying factor enabling the development of networks of exchange and connectivity: these regions were under constant climatic hardship. This was also not a sudden and rapid case of climate change and aridity: Fazzan and the Eastern Desert of Egypt already had been arid for a long time. If the role of climate change is still a much debated topic, and an important factor to consider for the Mediterranean, it is less directly so for the case studies regions examined, even if we must remain cautious not to over-simplify environmental models for arid regions.<sup>774</sup> Climate change occurred before the region examined, and if slight variations are known during the period covered, it mattered more for territories largely dependent on rainfall for the establishment of their agricultural systems. In Fazzan and Palmyra, the geography of perennial and natural subsurface water sources created focal points of human activity, and these in the *longue durée* were more likely to develop *weak tie* networks through contact and exchange. Societies living in the regions learnt to exist within the

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<sup>773</sup> Sidebotham 2011, 259-275.

<sup>774</sup> Barker and Gilbertson 2000.

environment. Networks came out of basic survival needs, but they allowed people to discover and use new water technologies and food species to alleviate some of the challenges of desert life, and increase the carrying capacity of the region. Despite commonalities with Palmyra (being institutionally under the Roman Empire) and Fazzan (being hyper-arid), the Eastern Desert did not have suitable water collection points of a size suitable for the development of settlements, and water had to be carried into the desert. This did not help to foster the nucleation and development of local tribes and consequently settlements of any size were artificially implanted communities of soldiers and traders from the Nile valley and beyond. Once water collection facilities were utilised these cisterns and *hydreumata* allowed artificial small worlds to develop, though these were created entirely for the benefit of the institution and by the institution.

By the Roman imperial period, the areas under examination had already developed long-distance contacts and exchange, and acquired their local socio-political structures. Yet peaceful (both internal and external) conditions enabled the development and the strengthening of ‘small world’ systems and closer links to the economic hub of the Roman Mediterranean market. Local and also institutional agency, were key factors in the maintenance of peaceful and prosperous conditions, yet both occurred within the limits offered by socio-political dynamics. Even within the Roman Empire, the different trajectories and economic scales must be emphasised, as there were clear implications as to whether imperial involvement or local communities governed local developments.

In this thesis, I hope to have effectively shown the merits of synthesising and comparing three different regions with broadly similar geo-climatic conditions which have experienced the influence of Rome at different levels. Different theoretical

approaches which continue to influence history and archaeology were introduced. None I believe need to be understood in isolation; in fact the opposite is true, this thesis has shown that when combined, landscape models, network theory and institutional economics are powerful approaches to the complex questions that historical landscapes pose. Network and institutional theories can help explain what landscape models may not entirely succeed on their own. It has been amply documented throughout the thesis that connectivity was not a phenomenon restricted to the Mediterranean shores: the case-study regions are just as much characterised by connectivity in the period examined. In fact, this highlights that human agency is important in shaping the environment rather than. Even in challenging environmental conditions such as the arid landscapes, we can observe an intensification of trade and activities linked to the exploitation of local resources under state-sanctioned peace and stability.

The comparative and regional approach has had the further merit of drawing out important conclusions in terms of how provincial / regional, imperial and extra-imperial economies were embedded but were also very different from one region to the other. It has become evident that far from being peripheral, the regions examined were also central to the Roman state in terms of taxation and state budget.

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# ILLUSTRATIONS

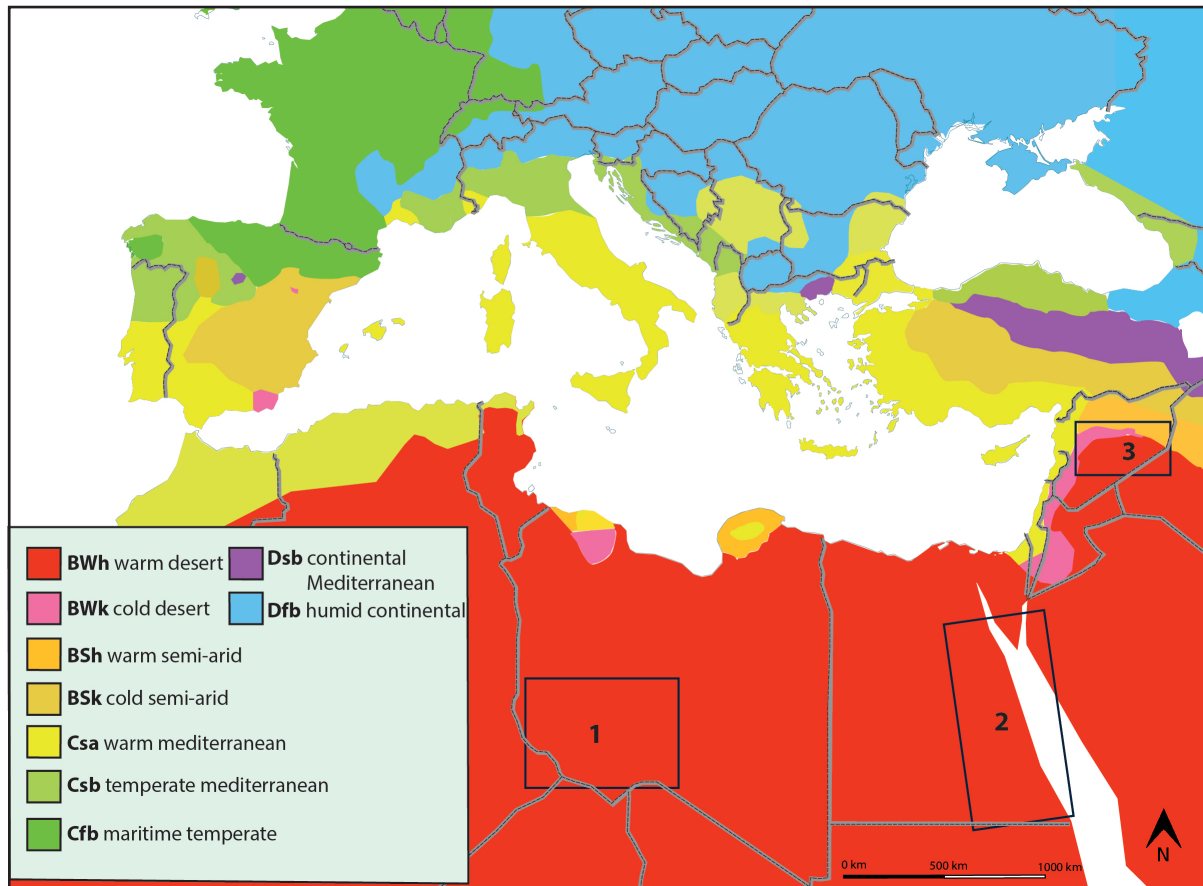


Fig. 1.1. Map of the Köppen-Geiger climatic classification system showing the contrast between the Mediterranean region and areas examined in this thesis: 1) Fazzan region in the Libyan Sahara, 2) Eastern Desert of Egypt, 3) Palmyra and its territories (Map: author, after Peel *et al.* 2007).

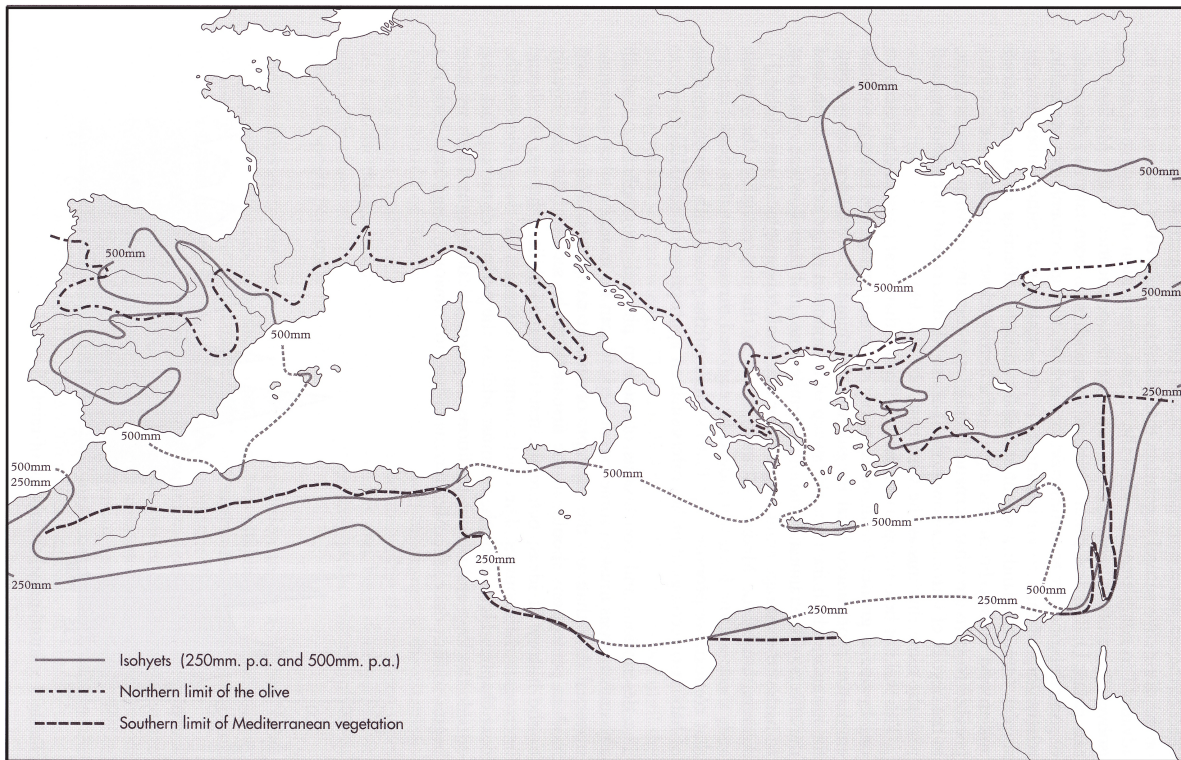


Fig. 2.1. Map of the Mediterranean region showing limits of olive agriculture and rainfall needed for dry-farming (250 mm) (Horden and Purcell 2000, Map 1).

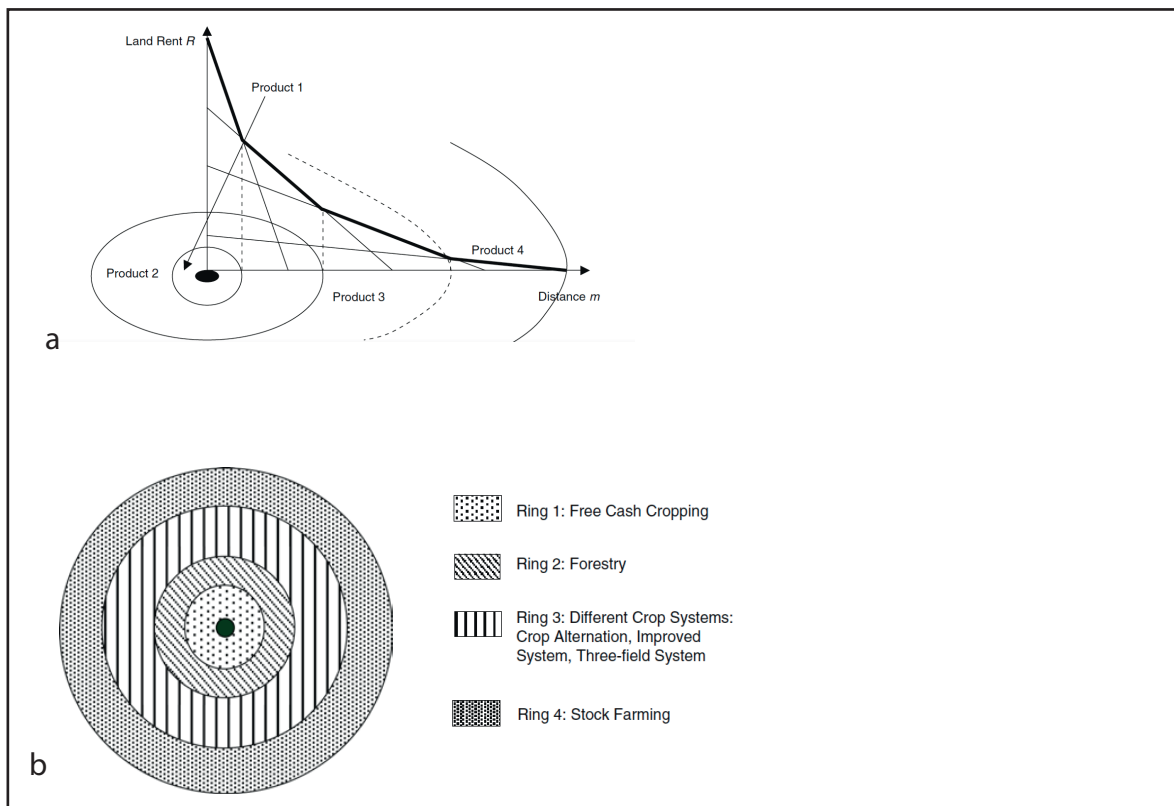


Fig. 2.2. a and b. Principles of land rents and cost of transport for different products based on von Thünen's rings (Fischer 2011, Figs. 20.1 and 20.2).

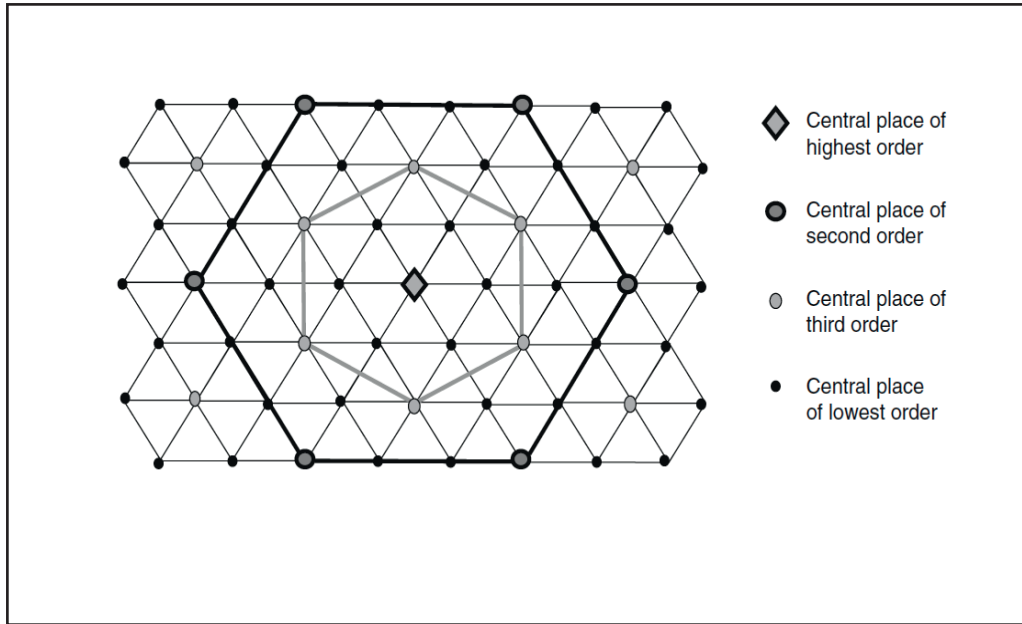


Fig. 2.3. Christaller's hierarchical model of Central Places (Fischer 2011, Fig. 20.7).

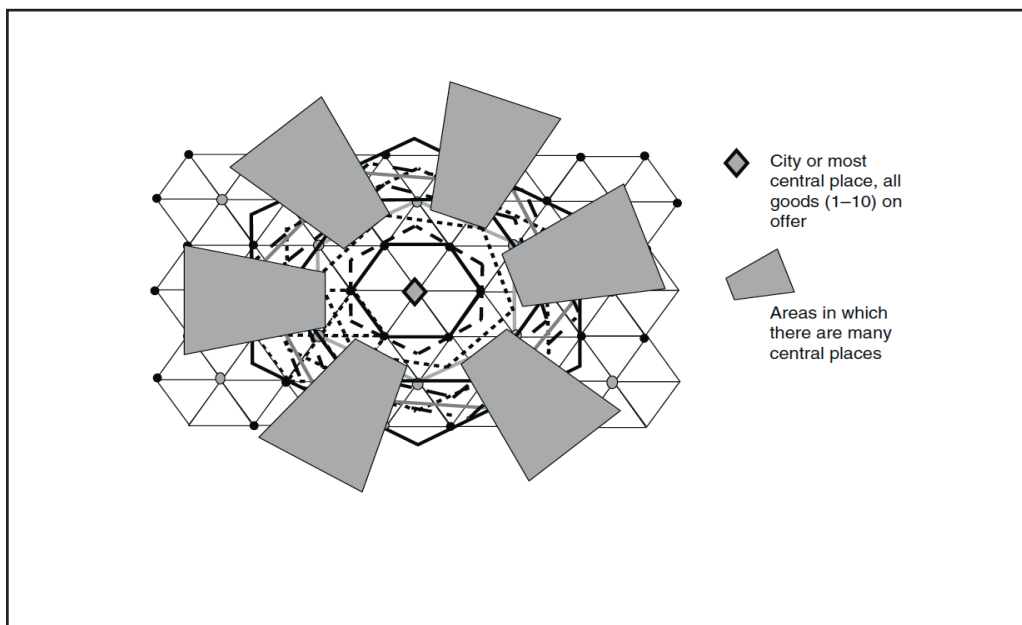


Fig. 2.4. Lösch's system of hierarchies with higher and lower concentrations of cities (Fischer 2011, Fig. 20.13).

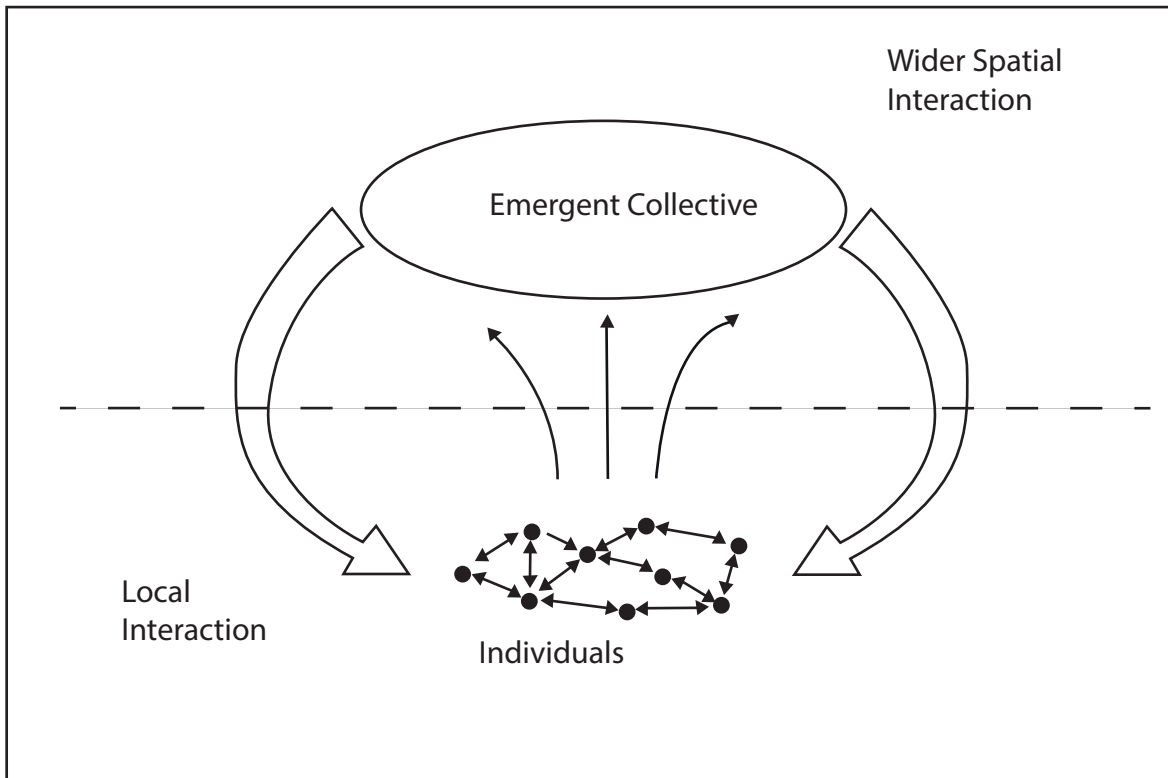


Fig. 2.5. Representation of «Langton's ants» and interaction principles between individuals and their emergent collective group (Drawing: author, after Malkin 2011, Fig. 1.9).

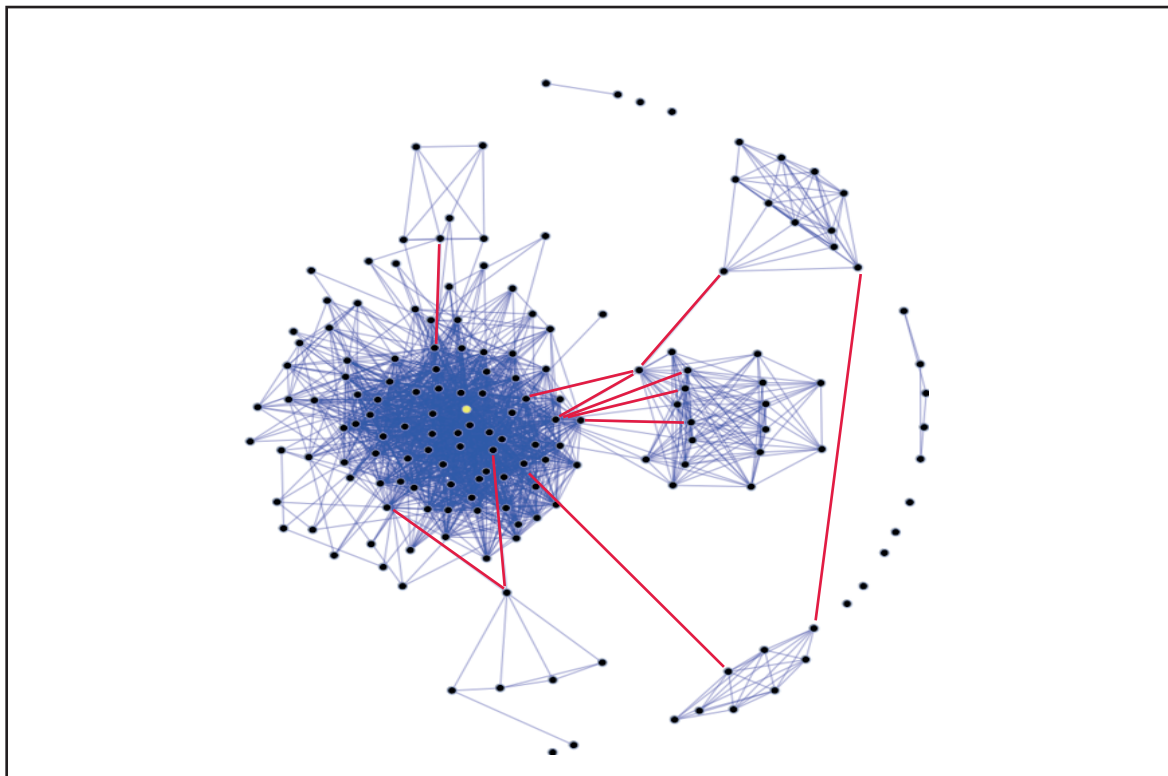


Fig. 2.6. Model of Granovetter's system of weak ties (red) and strong ties (blue) (Drawing: author, after a GUESS, Creative Commons diagram).

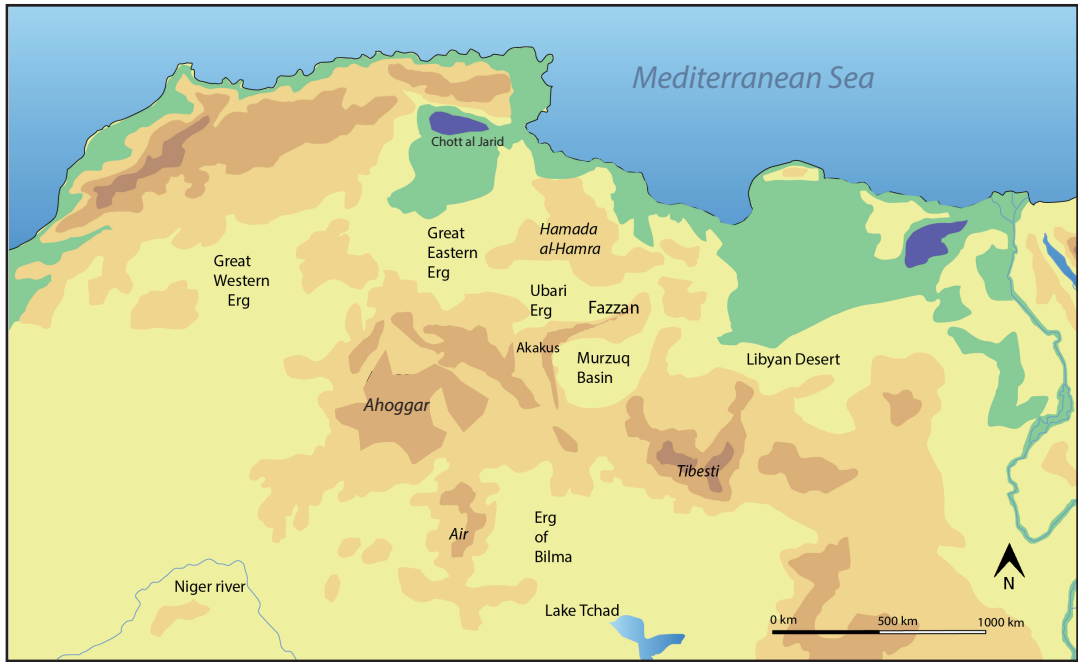


Fig. 3.1. Map of the central Sahara (Map: author, based on a map by T. L. Miles, Wikimedia Commons).

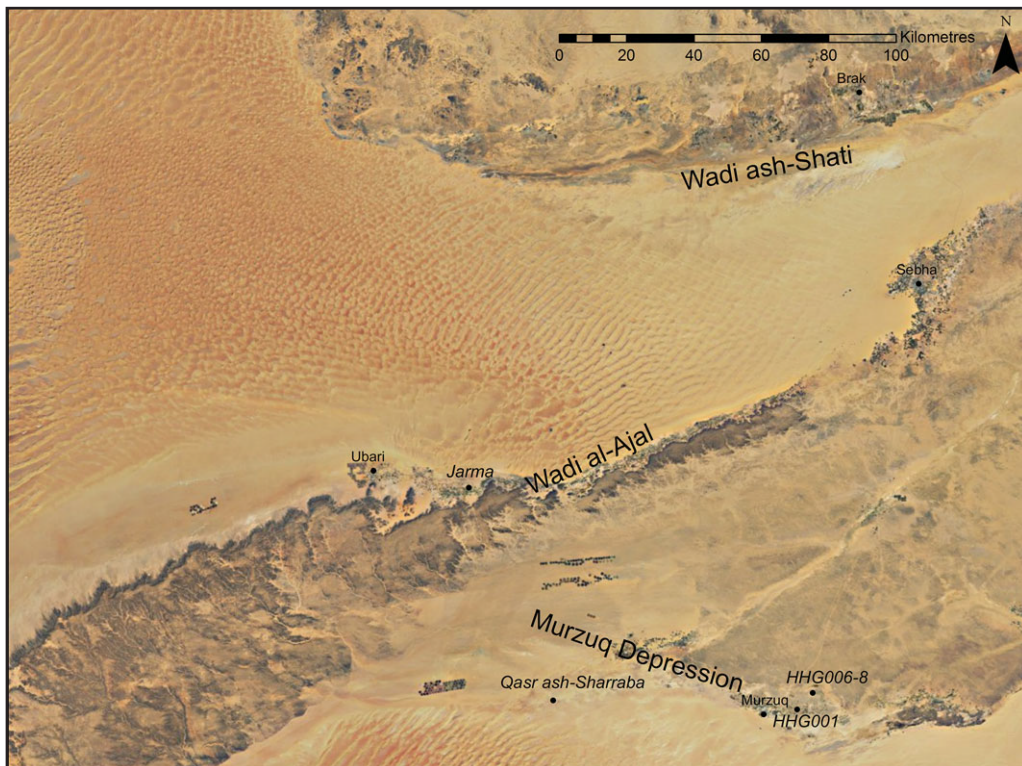


Fig. 3.2. Detail of the Fazzan area and its three oasis belts: the Wadi ash-Shati, Wadi al-Ajal and Murzuq depression (Mattingly and Sterry 2013, Fig. 1).

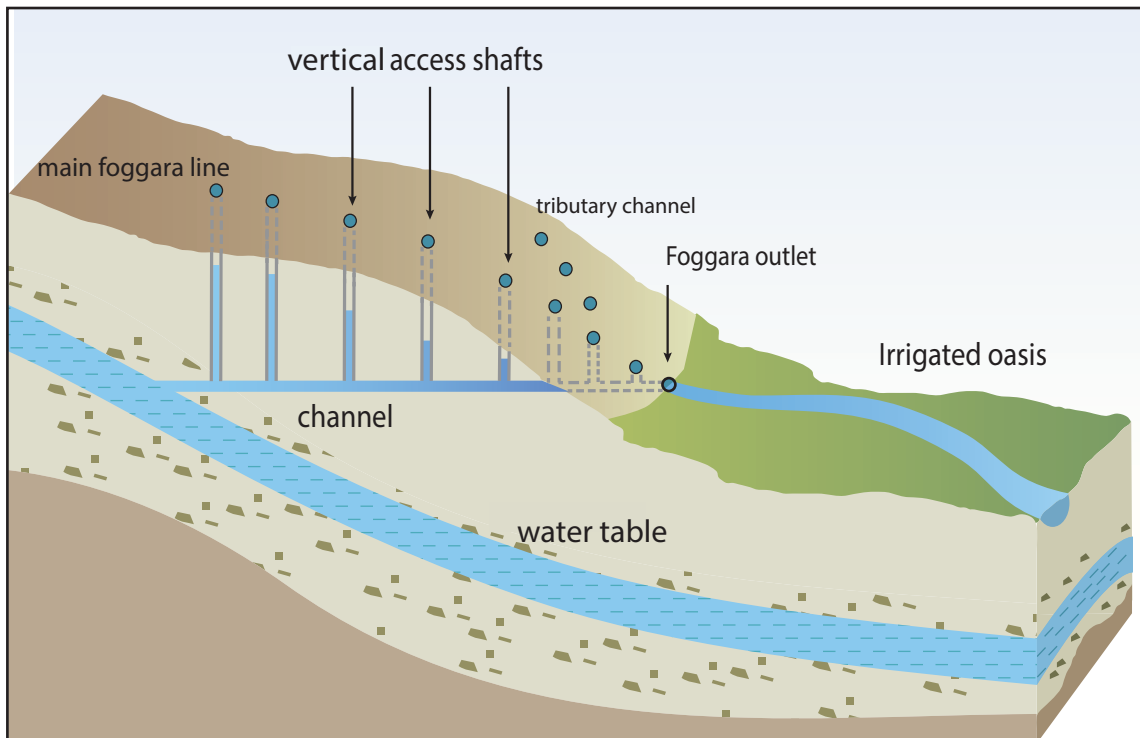


Fig. 3.3. Diagram showing the principles of a *foggara / qanat* (Drawing: author, after a © 2013 GRID-Arendal and ICQHS-UNESCO diagram, used with permission).

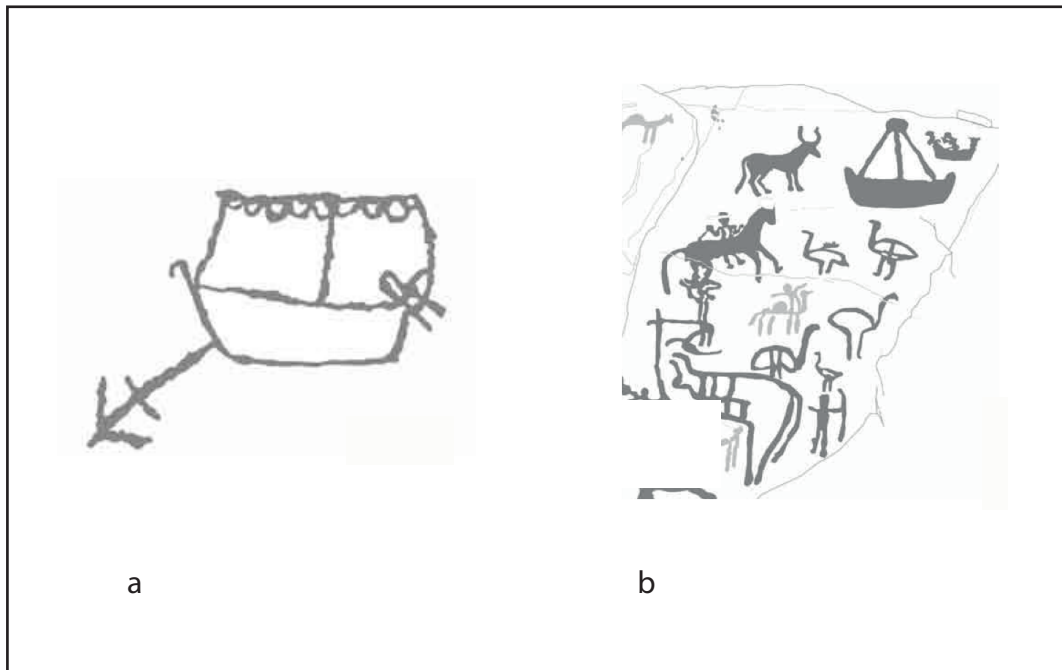


Fig. 3.4. Ship representations in the rock art of the Wadi In Alobu a) and Wadi Zizaw b). (Le Quellec 2006, Fig. 2 and Fig. 6).



Fig. 3.5. Elephant from Lepcis Magna (Photo: author).



Fig. 3.6. Elephant in rock art, Akakus region (source: L. Galuzzi, WikiCommons).



Fig. 3.7. Group of giraffes in the Massak Sattafat rock art (Source: R. Baumann, WikiCommons).

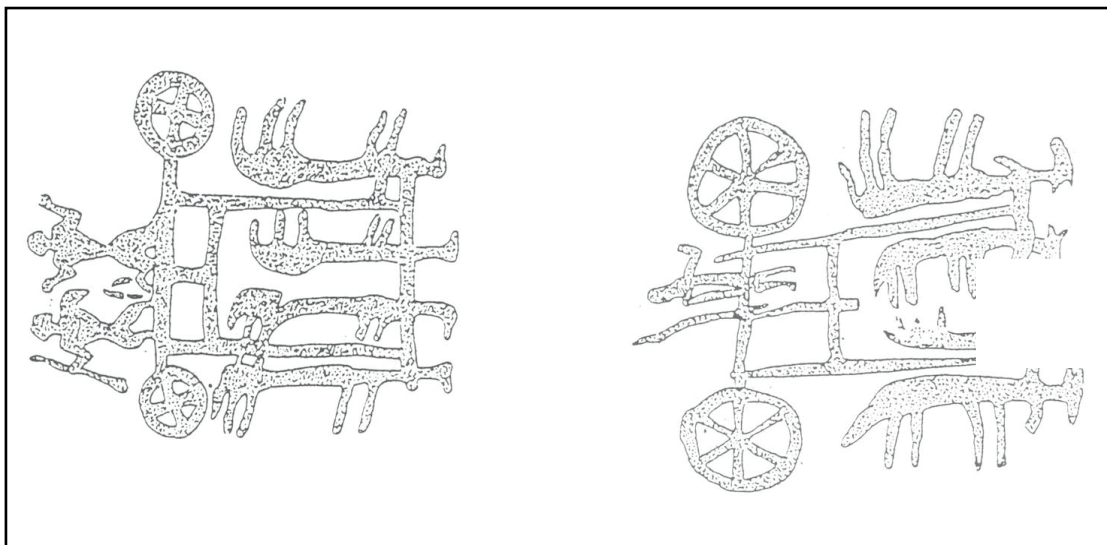
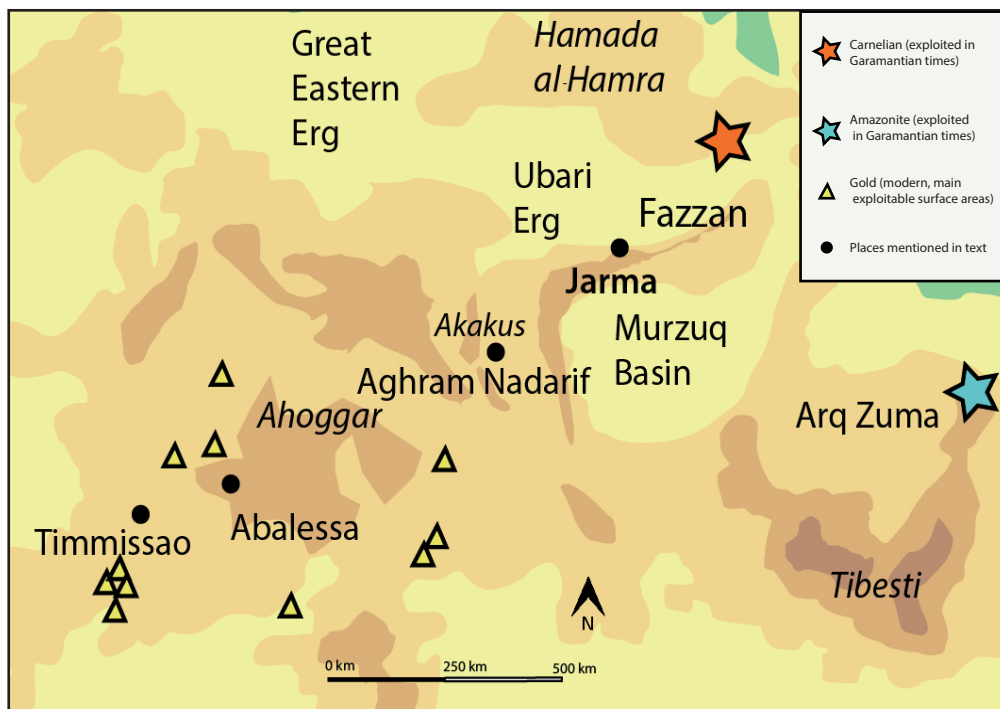
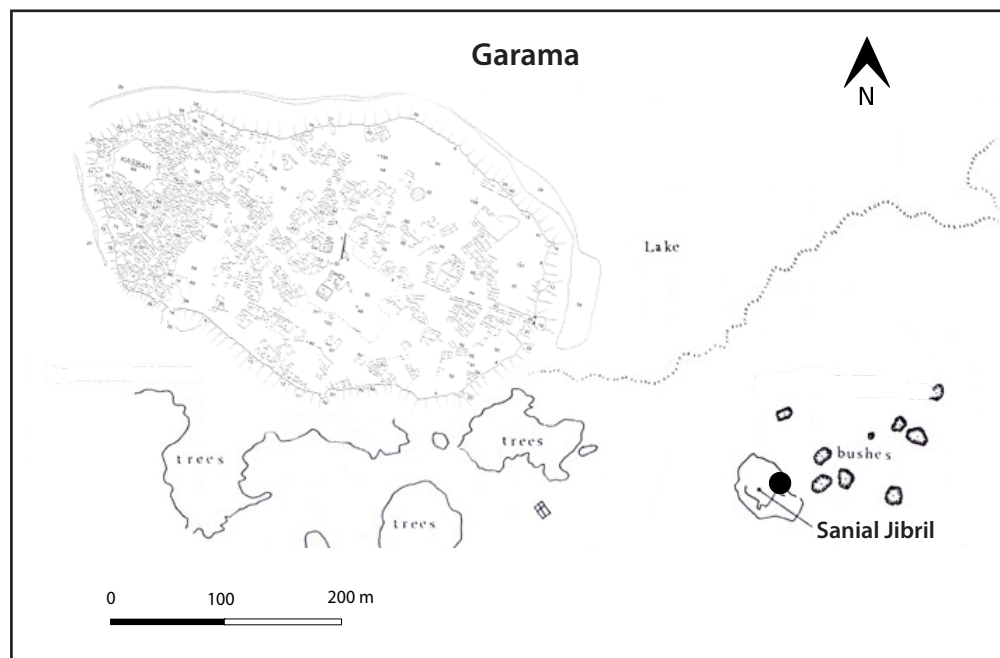


Fig. 3.8. Sketches of rock art in the Wadi Zizaw showing Garamantes riding chariots (Camps 1993, 1881).



3.9. Map of the central Sahara with the location of precious ores (Map: author; gold data from the Algerian Ministry of Energy and Mines).



3.10. Saniat Jibril (after Daniels 1970, Fig. 8 and Mattingly and Edwards 2007, Fig.11.4).

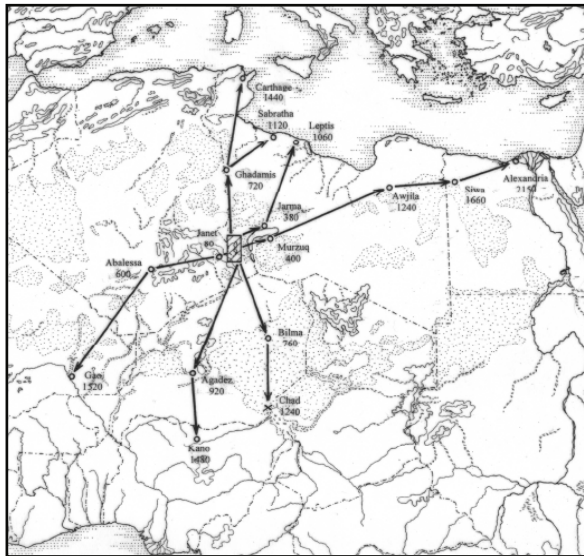


Fig. 3.12. General map of the Akakus region (Morri 2010 Fig. 1; after Liverani 2005, Fig. 37.2).

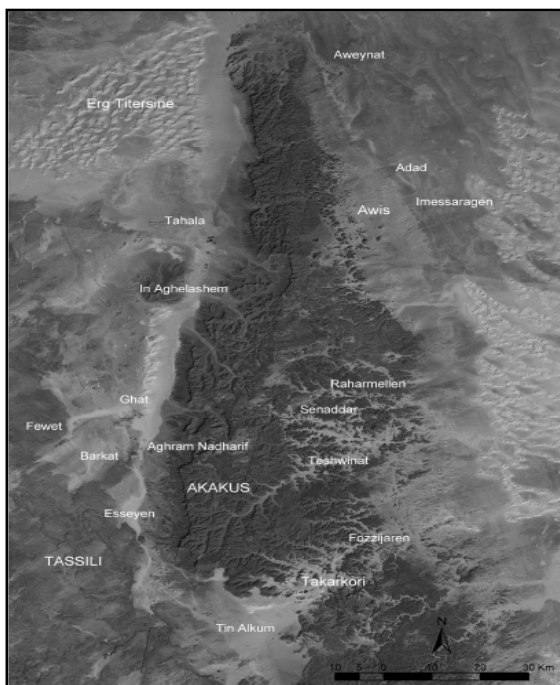


Fig. 3.13. Detail of the Akakus region showing the location of Aghram Nadarif (Gatto 2010, Fig. 1.).

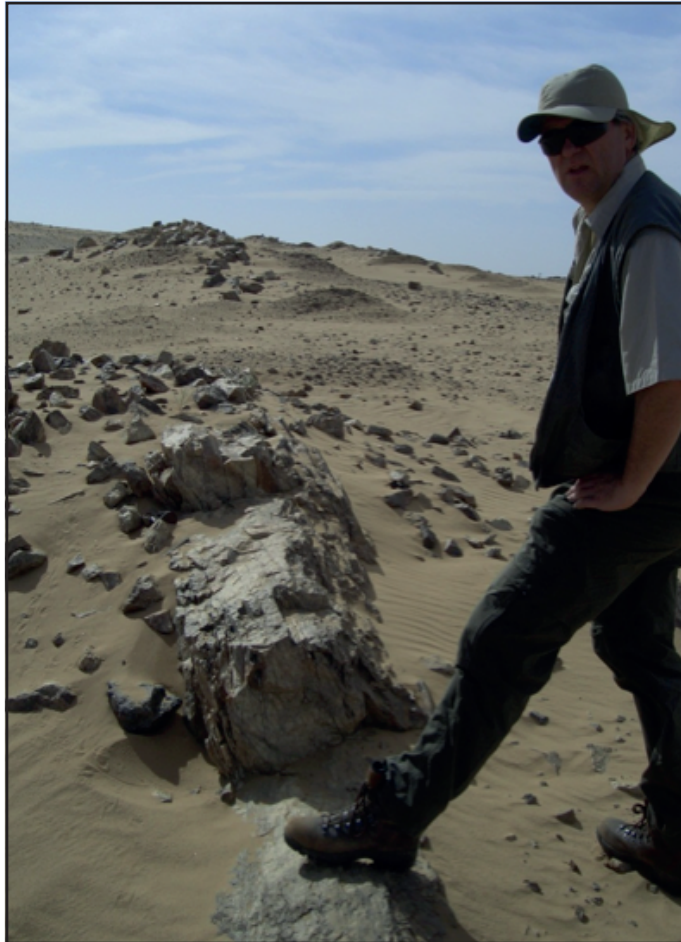


Fig. 4.11. Typical quartz vein outcrop in the Amessmessa area, Algeria. Quartz is more resistant to the winds, exposing gold veins. Gold can be handpicked, or collected from the sand by dry panning or minimal tool work. (Photo: courtesy of Ken Norris).

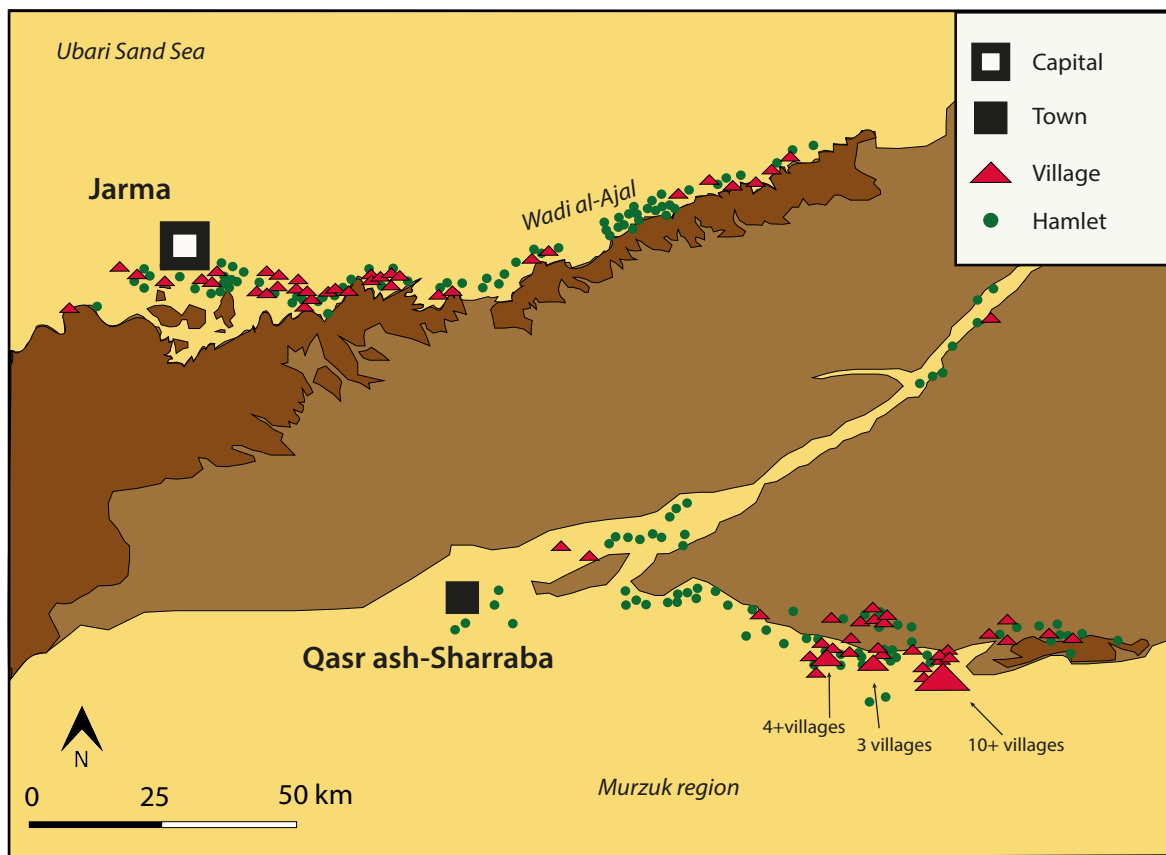


Fig. 3.14. Garamantian settlement hierarchies in the Wadi al-Ajal and Murzuq areas (Map: author, after Mattingly and Sterry 2013, Fig. 7).



Fig. 4.1. General topography of the Eastern Desert of Egypt (Map: author; basemap: AWMC à-la-carte).

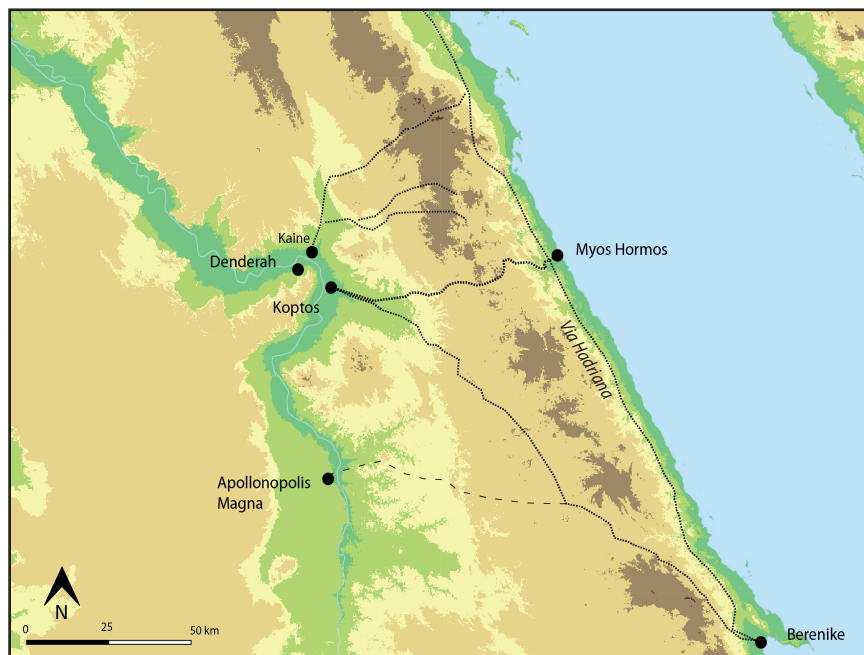


Fig. 4.2. Main reconstructed paths across the Eastern Desert of Egypt in the Roman period. The dotted line to Apollonis Magna shows the Ptolemaic path no longer in use in the Roman period (Map: author; basemap: AWMC à-la-carte).

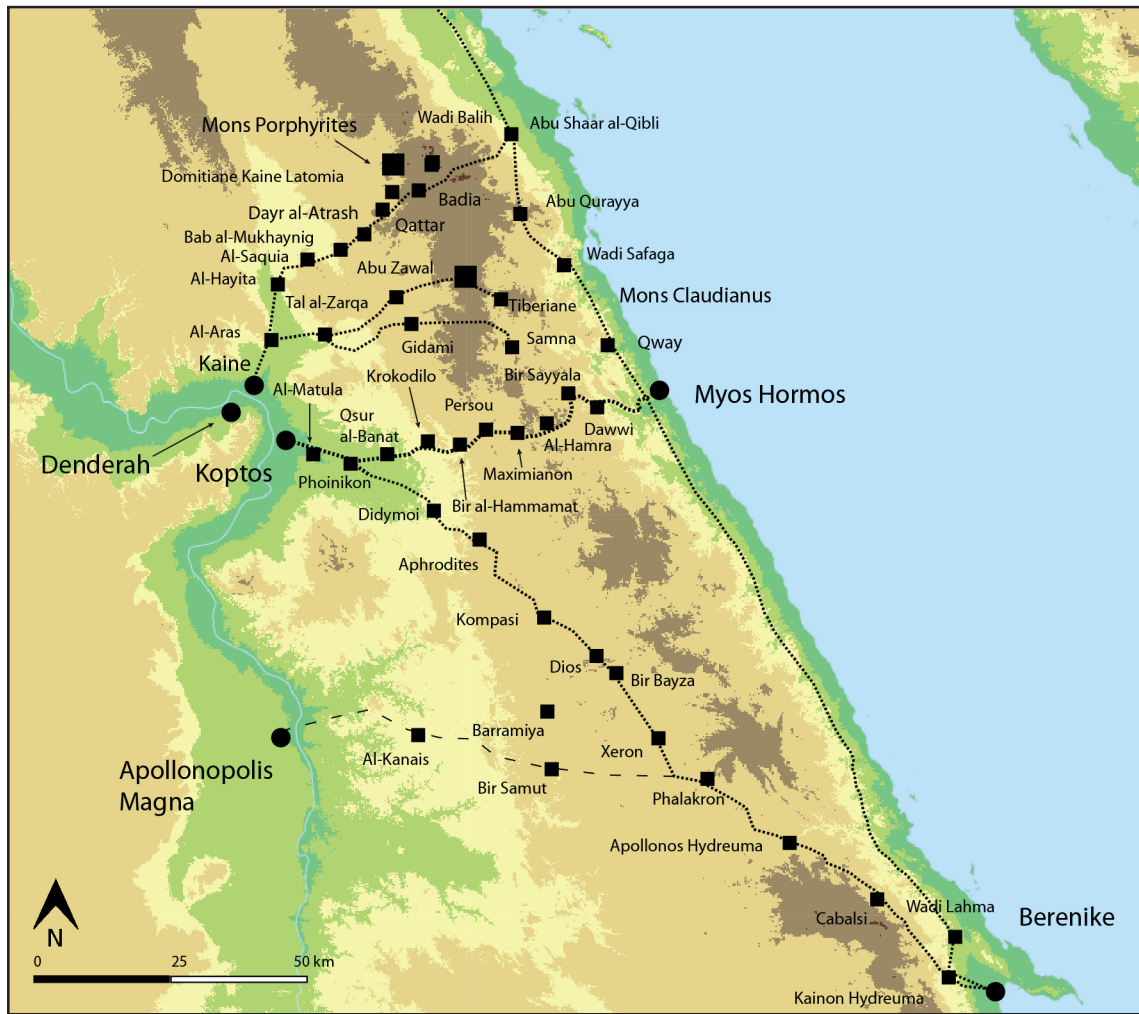


Fig. 4.3. Forts in the Eastern Desert of Egypt (Map: author; basemap: AWMC à-la-carte).

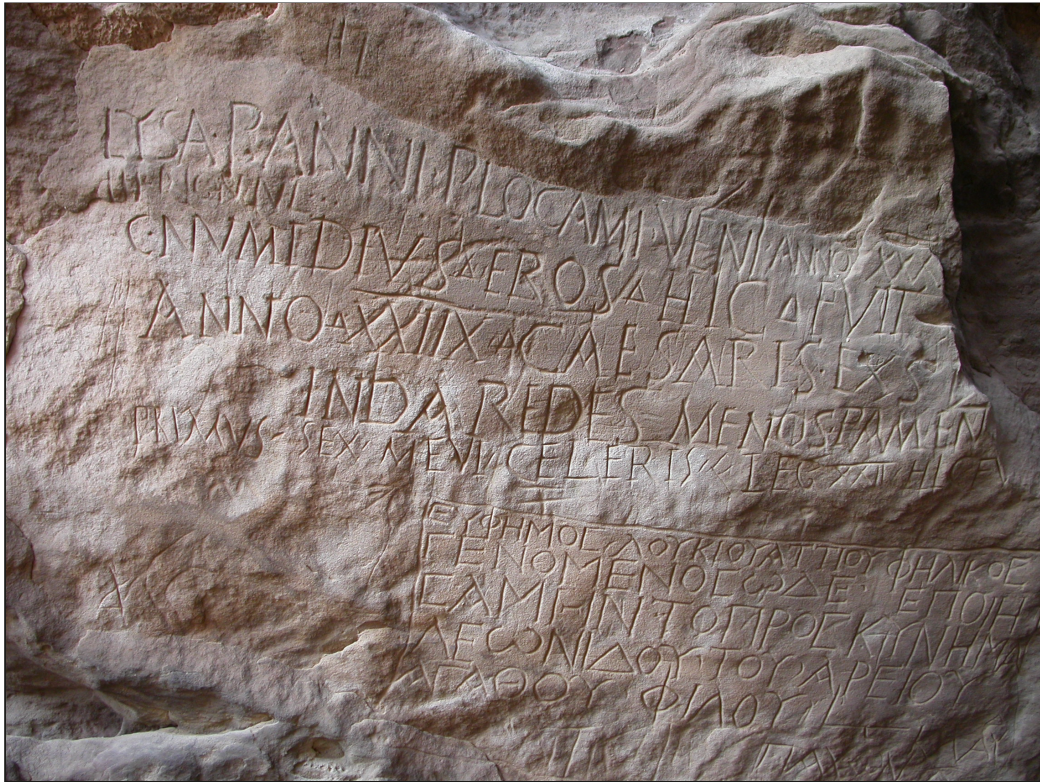


Fig. 4.4. Wadi Minayh graffiti, including the one by Lysas, slave of Annius Plocamus in the upper part of the photograph (Photo: E. Botte).



a

b

Fig. 4.5. Wadi Minayh rock shelter: a) exterior (Cuvigny 2011a, Fig. 5); b) interior, life-size replica of the *paneion*. Note the floor as a scale; it is barely possible for a small person to stand inside the *paneion*. (Photograph: author, Museo archeologico dei campi flegrei, Baia).

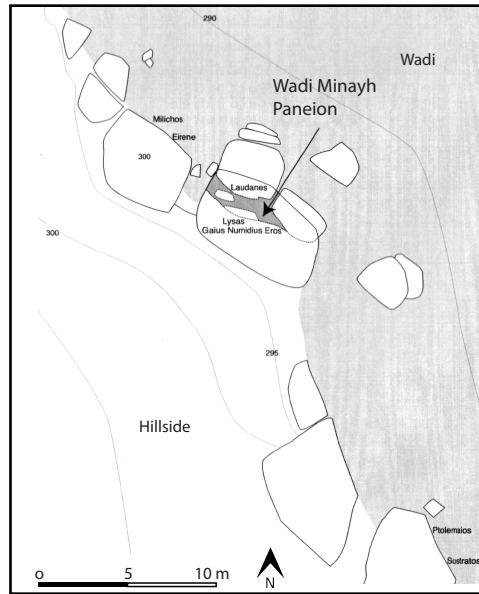


Fig 4.6. Plan of the wadi Minayh (After Cuvigny 2011a, Fig. 7).

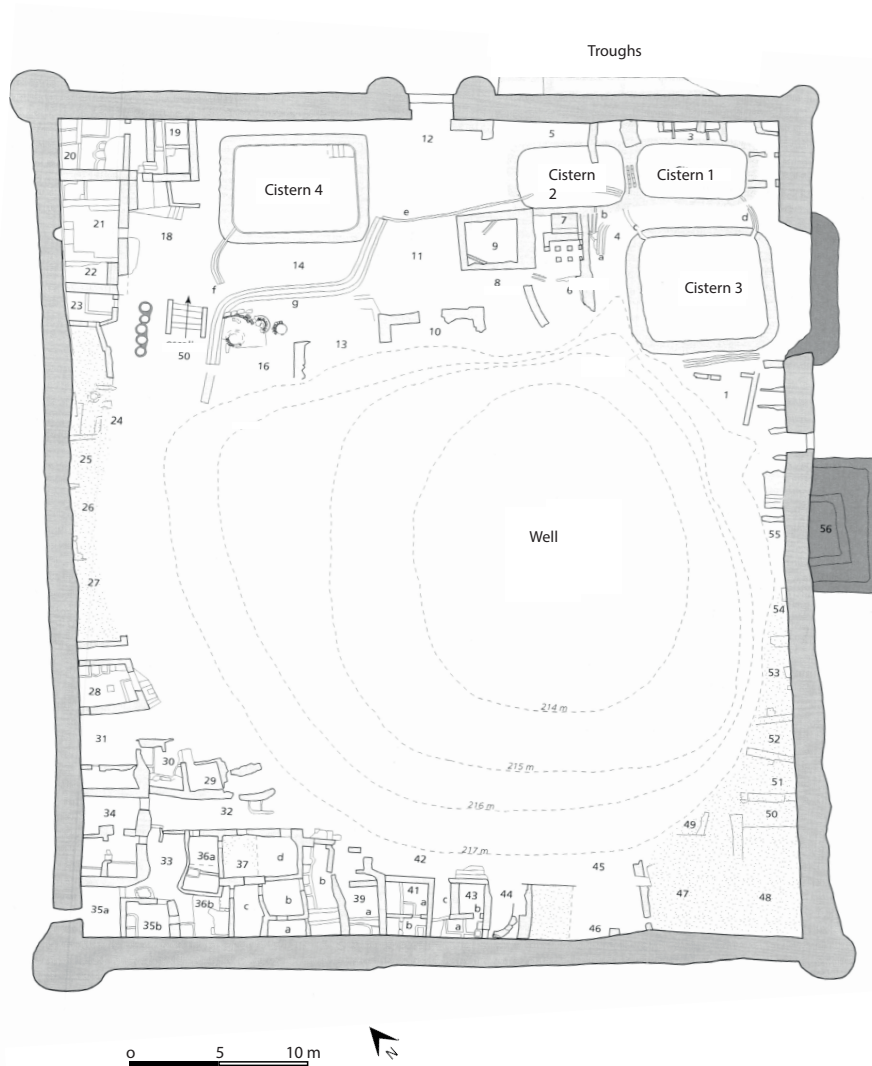


Fig. 4.7. Plan of the fort of Didymoi showing original water cisterns (1 and 2) and the additional cisterns (3 and 4) (After Cuvigny 2011, Fig.18).



Fig. 4.8. Diachronic map of all ancient quarry sites of Egypt (Harrell and Storemyr 2009, 51).



Fig. 4.5. Portrait of a Julio-Claudian prince made of *bekhen* stone from the Wadi Hammamat quarries (De Nuccio and Ungaro 2002, n. 20).

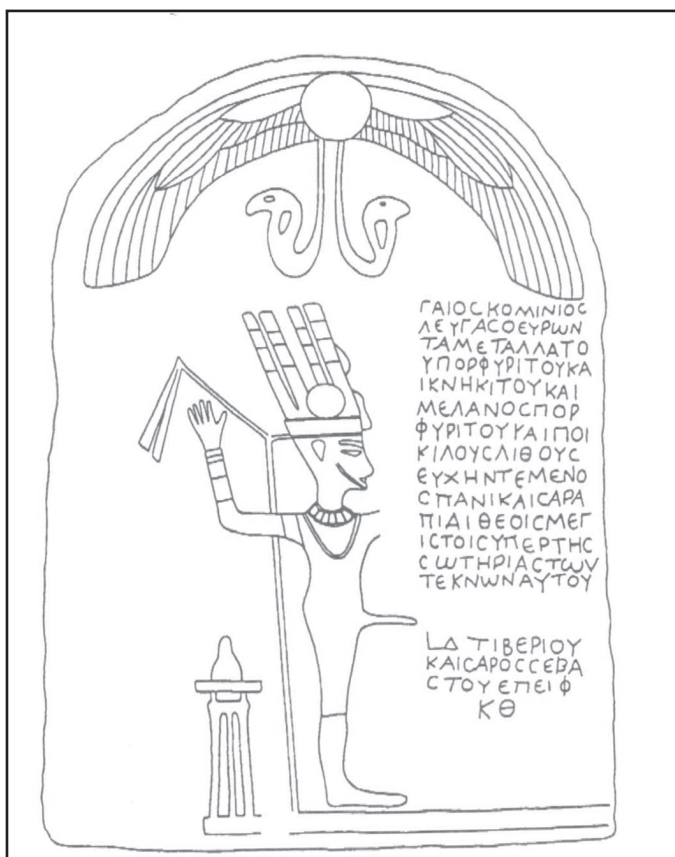


Fig. 4.6. Drawing of the dedication by C. Cominius Leugas detailing the successful discovery of new decorative stone types (Maxfield 2001, Fig. 7.4).

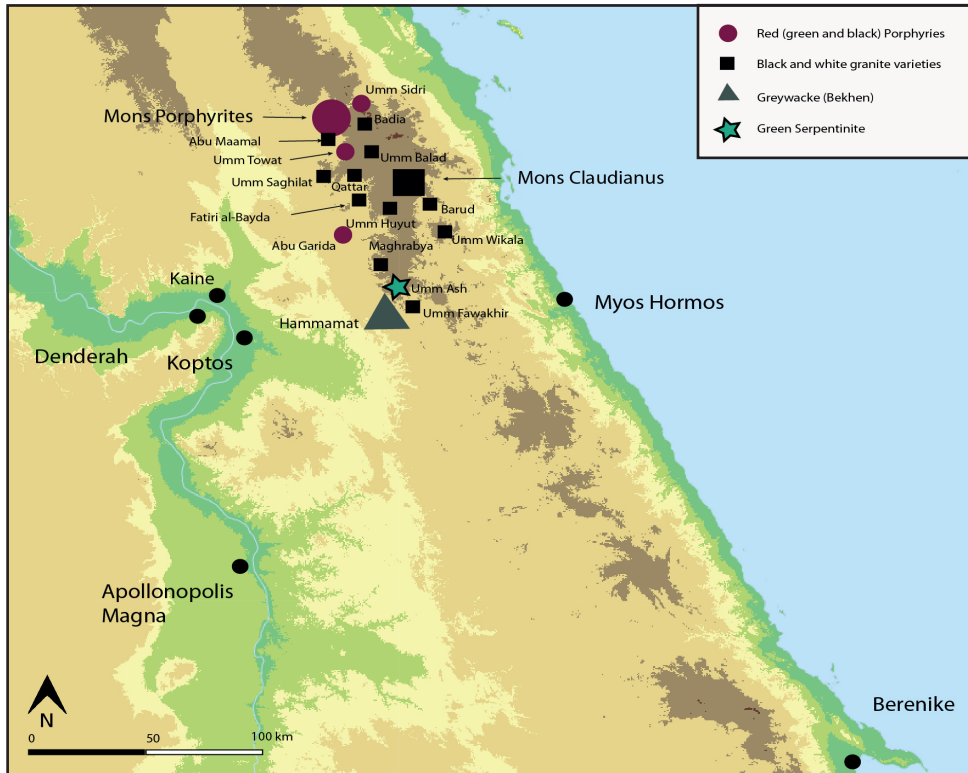


Fig. 4.11. Main types of Eastern Desert decorative stones (small icon: small sites; large icon: main quarrying areas; Map: author; basemap: AWMC à-la-carte).



Fig. 4.12. Sitting dog made from the Wadi Atalla / Umm Ash quarries (De Nuccio and Ungaro 2002, n. 63).

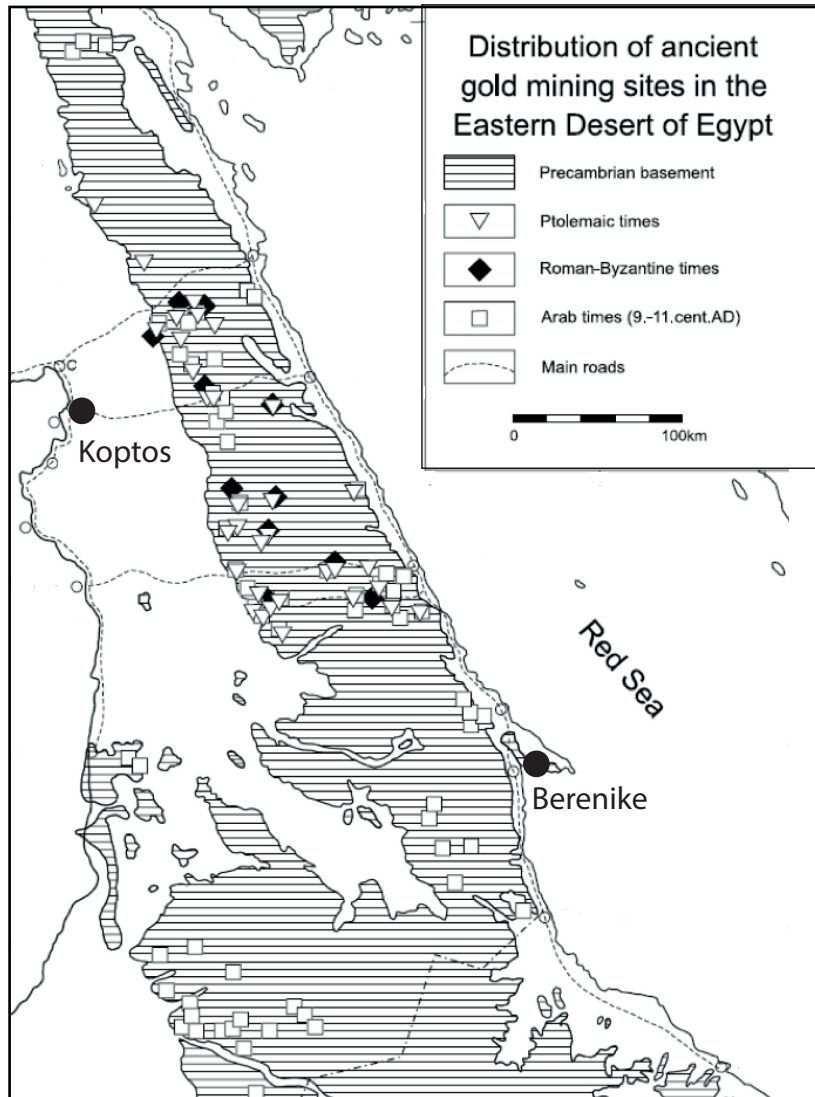


Fig. 4.13. Diachronic distribution map of gold mining sites in the Eastern Desert of Egypt (After Klemm *et al.* 2001, Fig. 16).



Fig. 4.14. Satellite view of the Wadi Gimal A Roman emerald mining settlement (GoogleEarth).

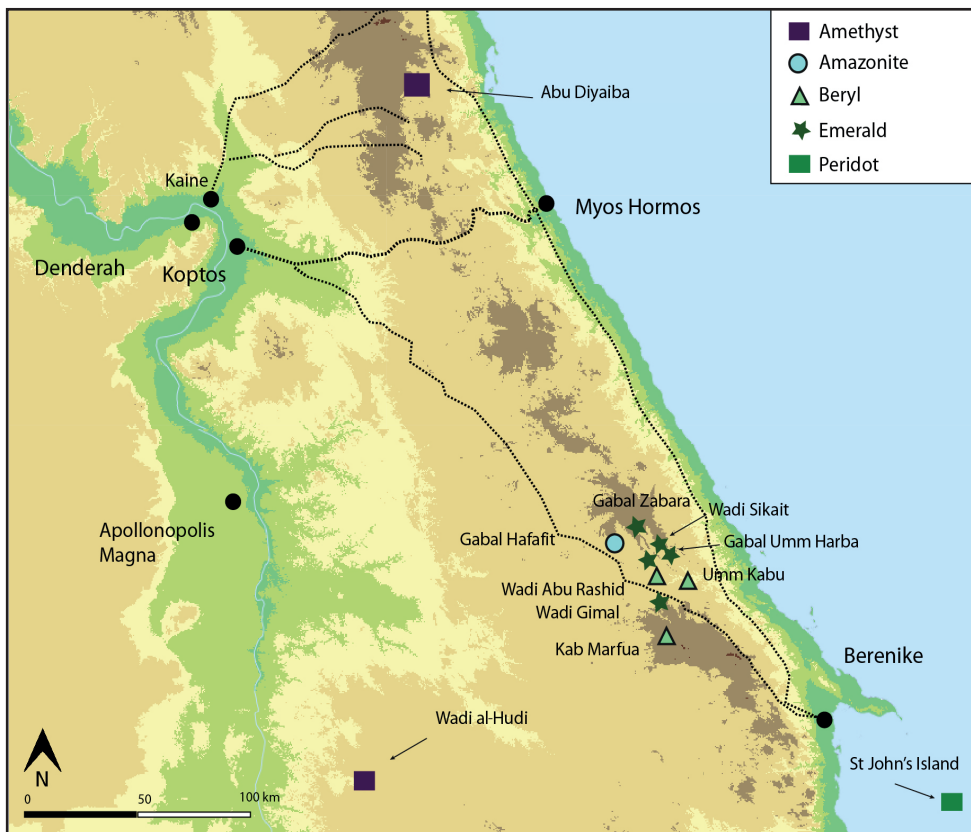


Fig. 4.15. Main types of Eastern Desert gemstones (Map: author; basemap: AWMC à-la-carte).

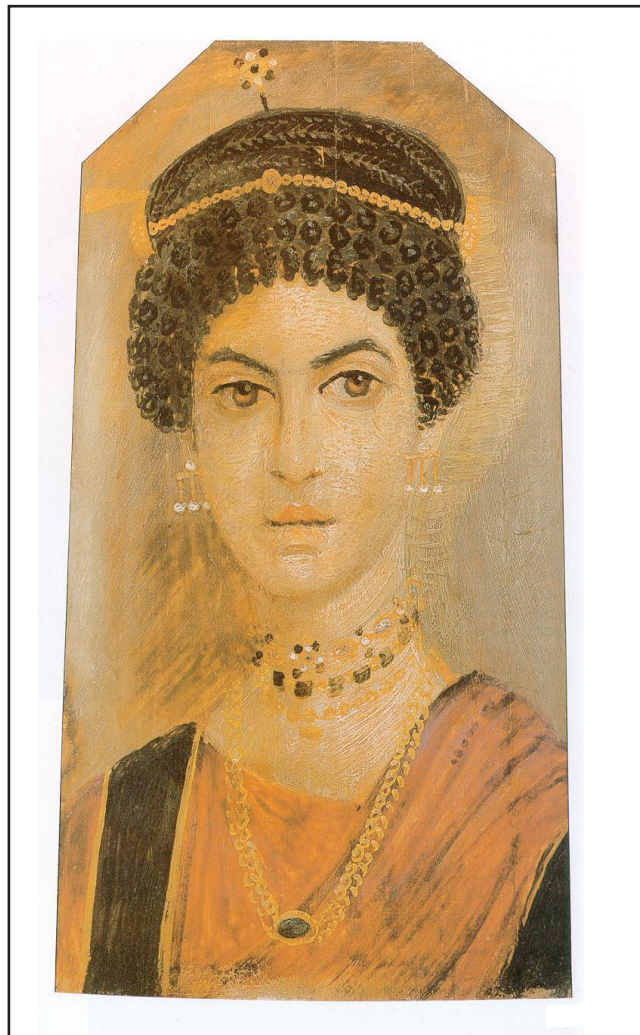


Fig. 4.16. Fayum portrait of a woman wearing pearl earrings and necklaces with gemstones (Source: WikiCommons, Royal Museum of Scotland).

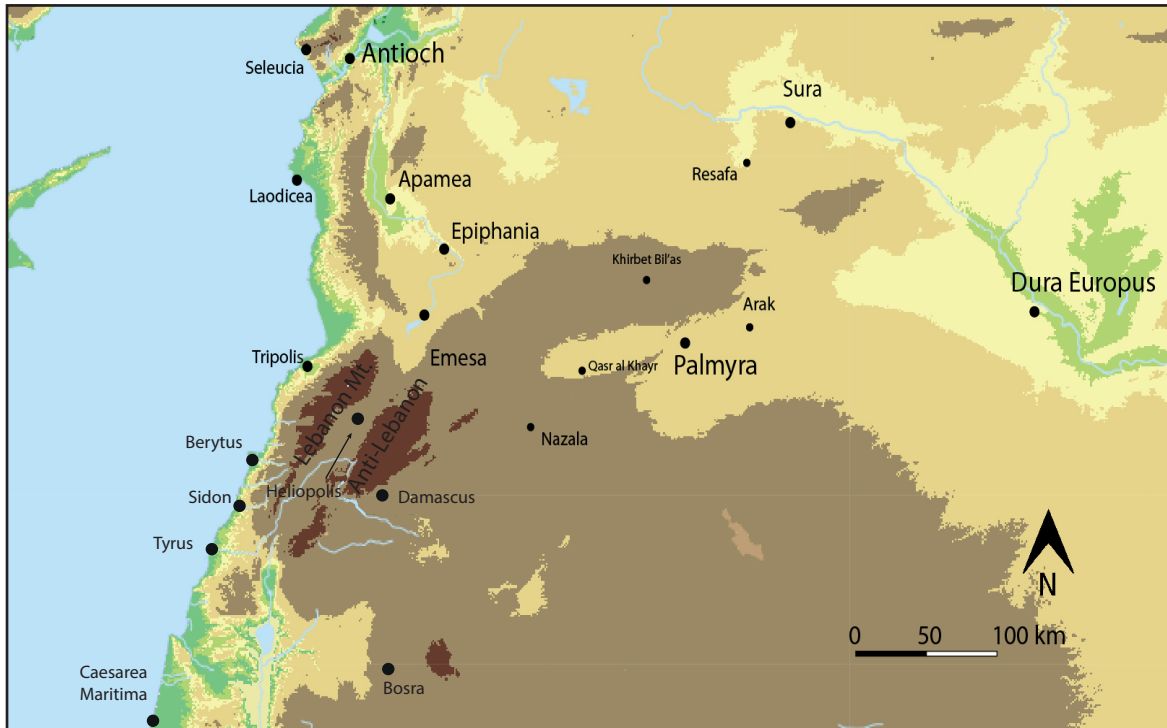


Fig. 5.1. General map showing the location of Palmyra within the Roman Near East (Map: author; basemap: AWMC à-la-carte).

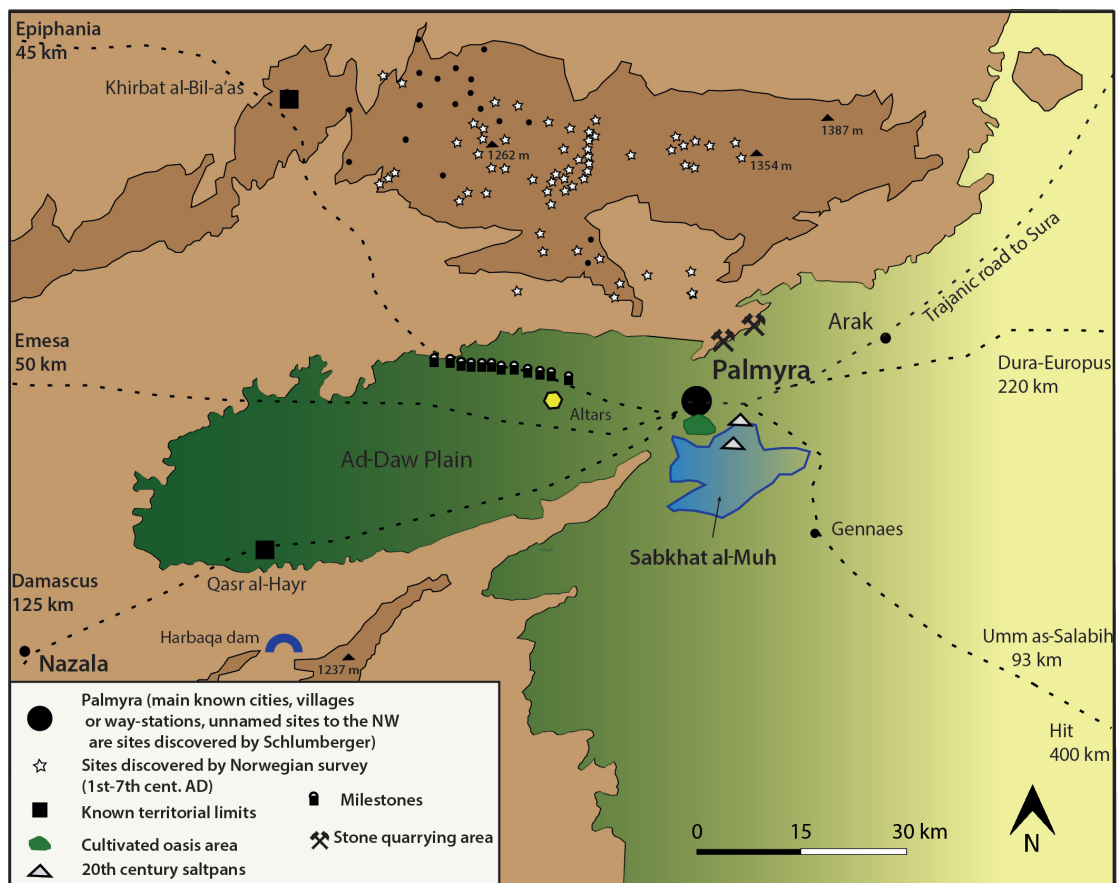


Fig. 5.2. Detail of Palmyra's direct hinterland and territories (Map: author, drawn from data in Matthews 1984, 163 and Meyer 2013, Figs. 1 and 3).

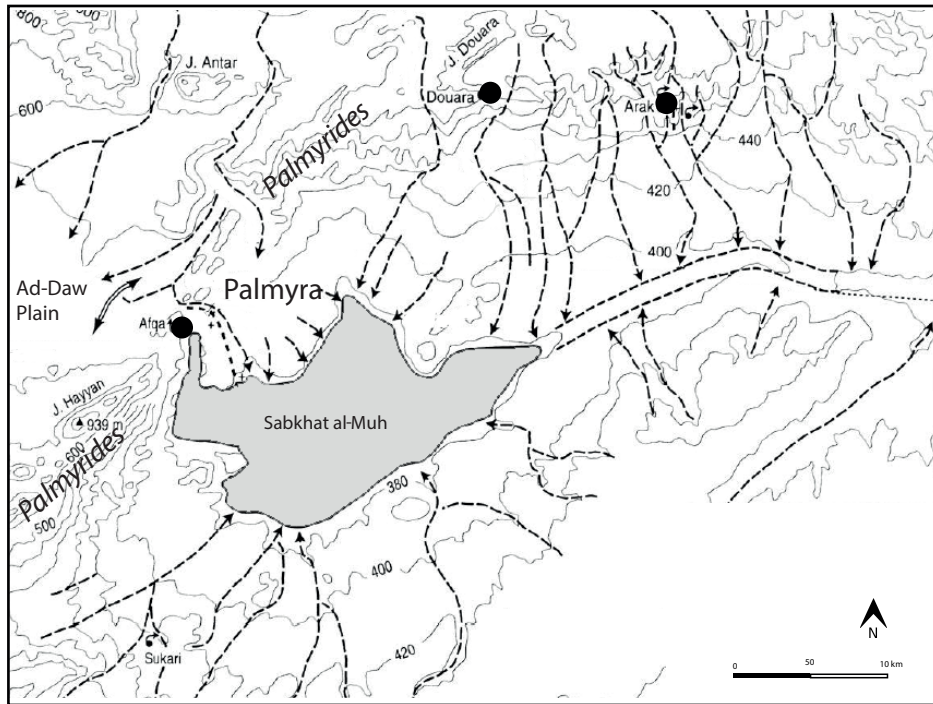


Fig. 5.3. Topographic map of the immediate hinterland of Palmyra showing wadis and drainage directions (dotted lines) along with the location of main geothermal water sources (circles) (After Vaudour *et al.* 1997, Fig. 1).

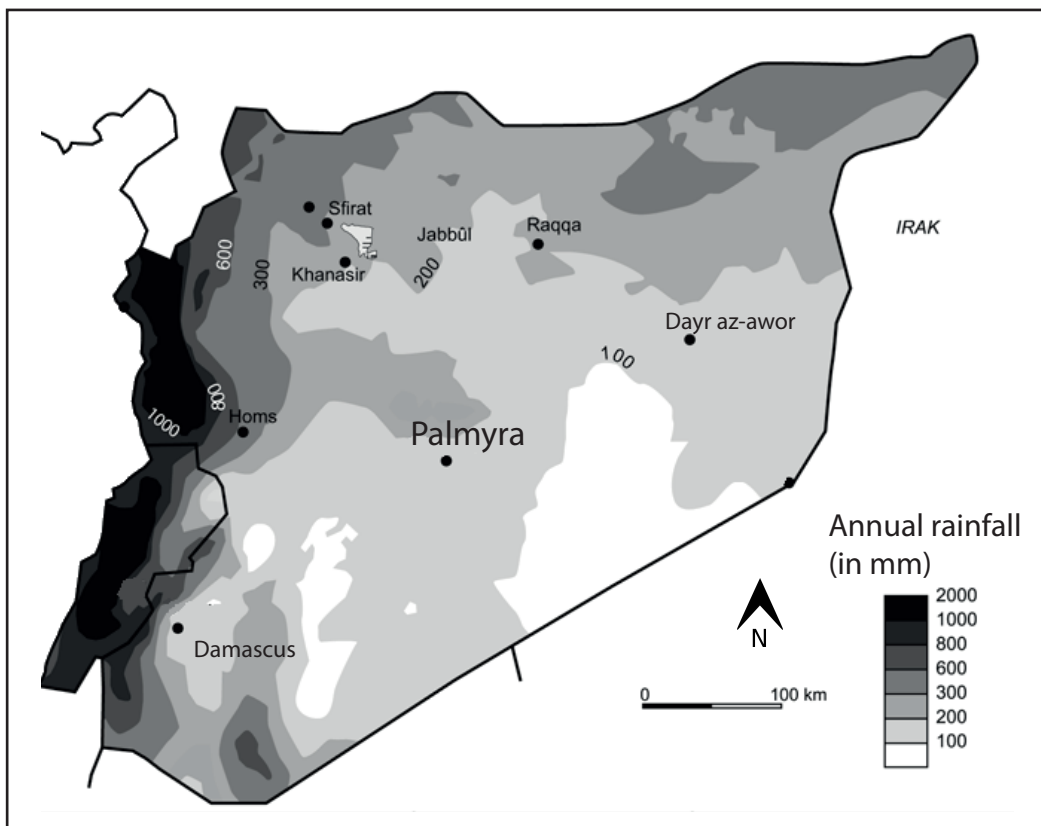


Fig. 5.4. Modern rainfall data for Syria (After Rigot 2006, Fig. 2).

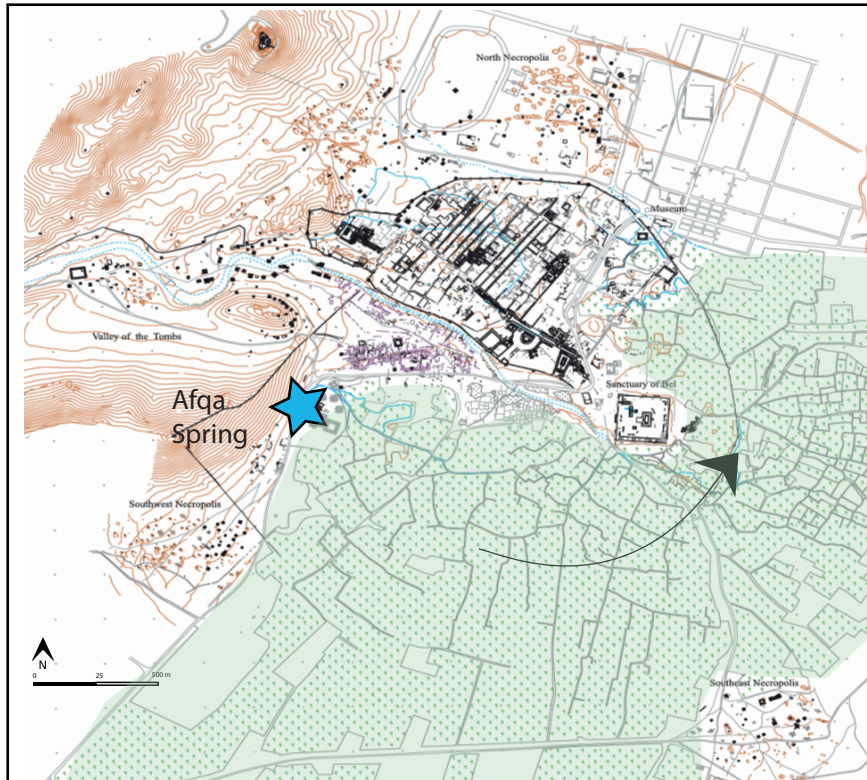


Fig. 5.5. The urban development of Palmyra occurred clockwise to northeast of the Afqa spring, with irrigated oasis fields developing anticlockwise to the south and east. (After Schnädelbach 2010, 31 and Hammad 2010, Fig. 79).

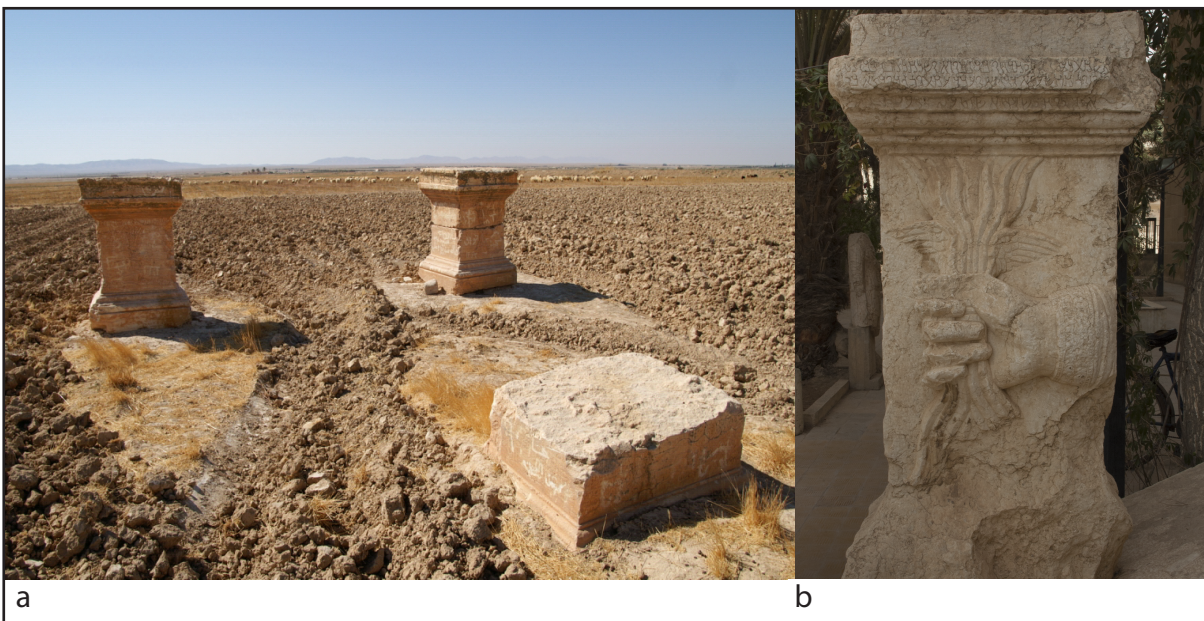


Fig. 5.6. Palmyrene altars in the Ad-Daw plain show the reliance on vast agricultural lands to the west of the city. a) Three altars are still *in situ* in laboured fields (right; photo: Palmyrena project); b) one is now in the museum of Palmyra (left; photo: Andrew Wilson).

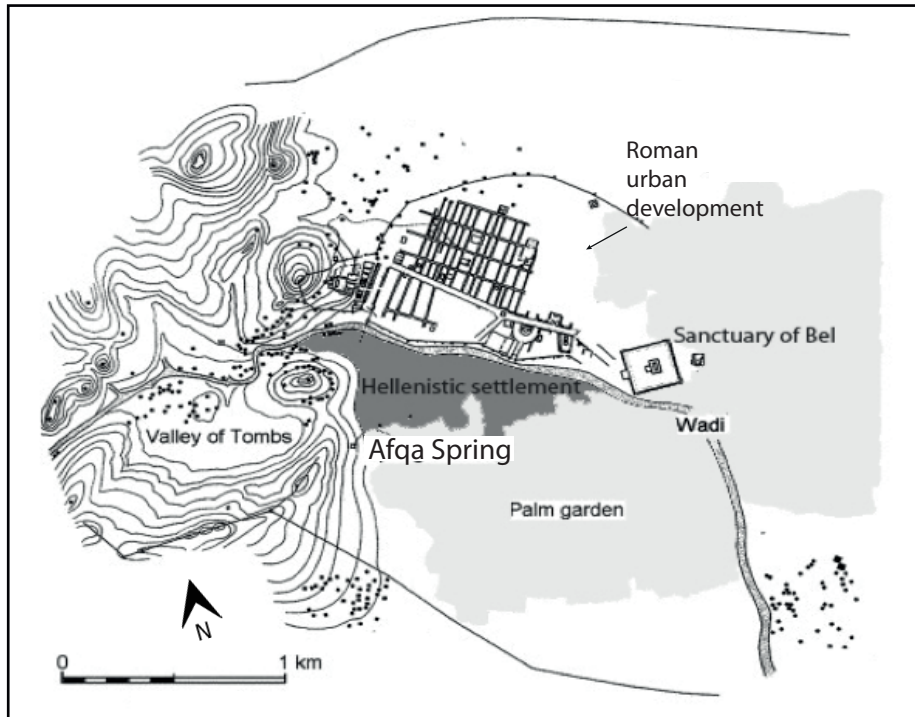


Fig. 5.7. Map of Palmyra highlighting the Hellenistic part of town (dark grey) aligned with the sanctuary of Bel (after Saito 2005, Fig.1).

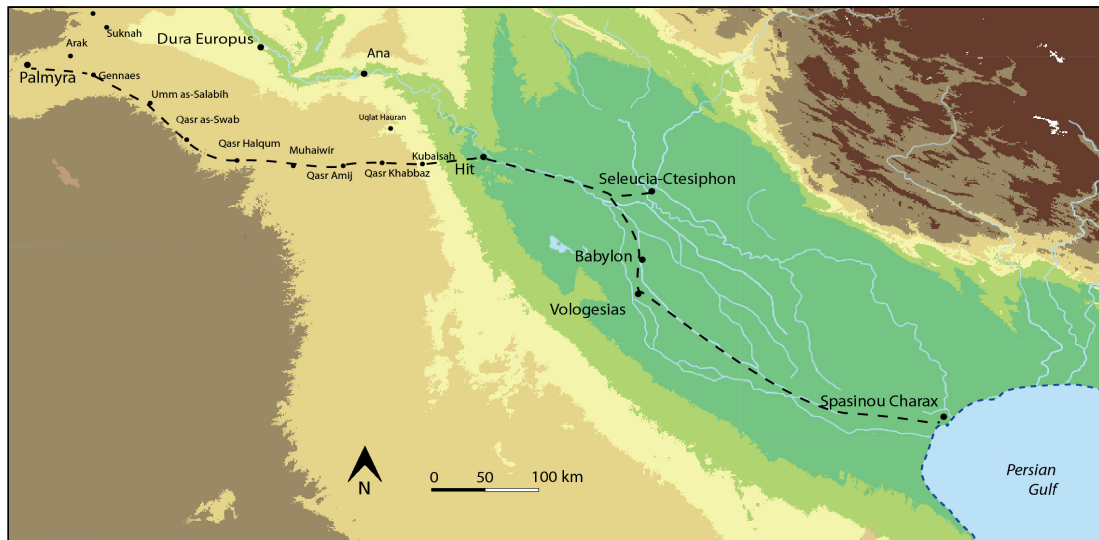


Fig. 5.8. Suggested route with way-stations between Palmyra and Hit and main cities mentioned in the Palmyrene inscriptions. (Map: author; basemap: AWMC à-la-carte. As the topography of the Euphrates has changed since Antiquity, the location of cities on the Euphrates, and ancient shoreline of the Persian Gulf is approximate).



Fig. 5.9. The 30-ton Lamassu (winged bull) from Nineveh now in the British Museum being transported on a *kalak* down the Tigris River. Painting by Frederick C. Cooper, c. 1850 (reproduced with permission, Victoria & Albert Museum).



Fig. 5.10. Funerary relief of a Palmyrene depicted with a camel in the hinterground, AD 150-160 (Ny Carlsberg Glyptothek, Copenhagen; <http://www.glyptoteket.com/explore/the-collections/the-collection-of-antiquities/greece-and-the-roman-empire/palmyra>).



Fig. 5.11. Palmyrenes riding camels in a procession (Starcky and Gawlikowski 1985, pl. 9.2).

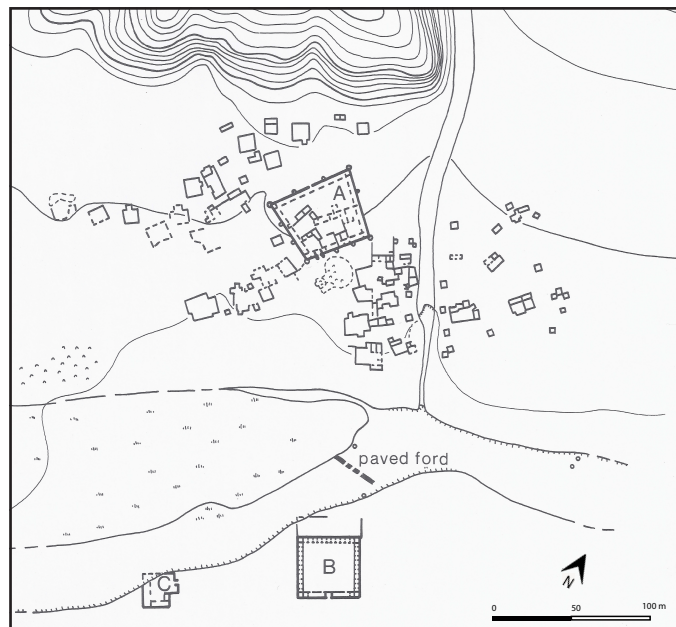


Fig. 5.12. Plan of Qasr as-Swab (Kennedy and Riley 1990, Fig. 37).



Fig. 5.13. Photograph of the stepped dam at Qasr Khabbaz (Gregory and Kennedy 1985, 195).

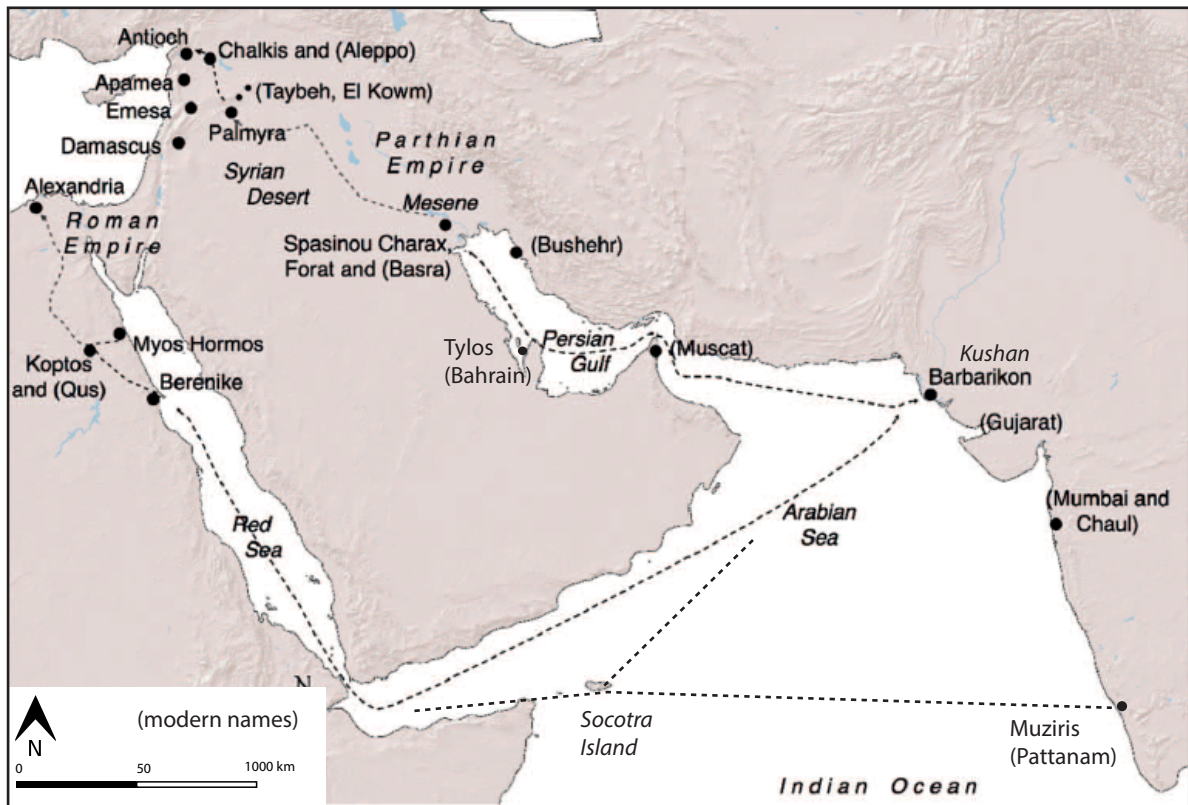


Fig. 5.14. General map of the Red Sea, Persian Gulf and Indian Ocean showing main maritime routes and trading posts in the Roman period. (After Seland 2010, Fig. 1).

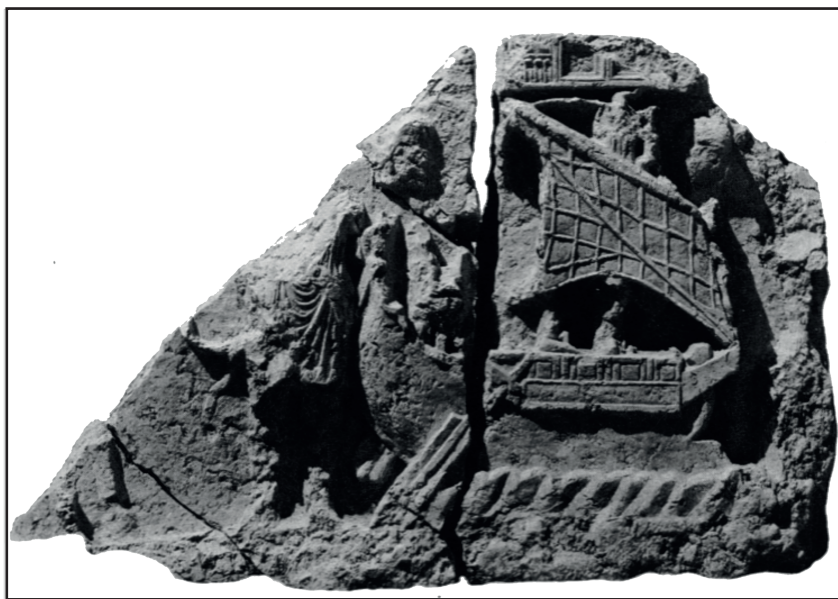


Fig. 5.15. Funerary relief of Julius Marona depicting the deceased with a sea-going vessel and indicating economic interests far beyond the Palmyrene territories (photo courtesy: Andrew Wilson).

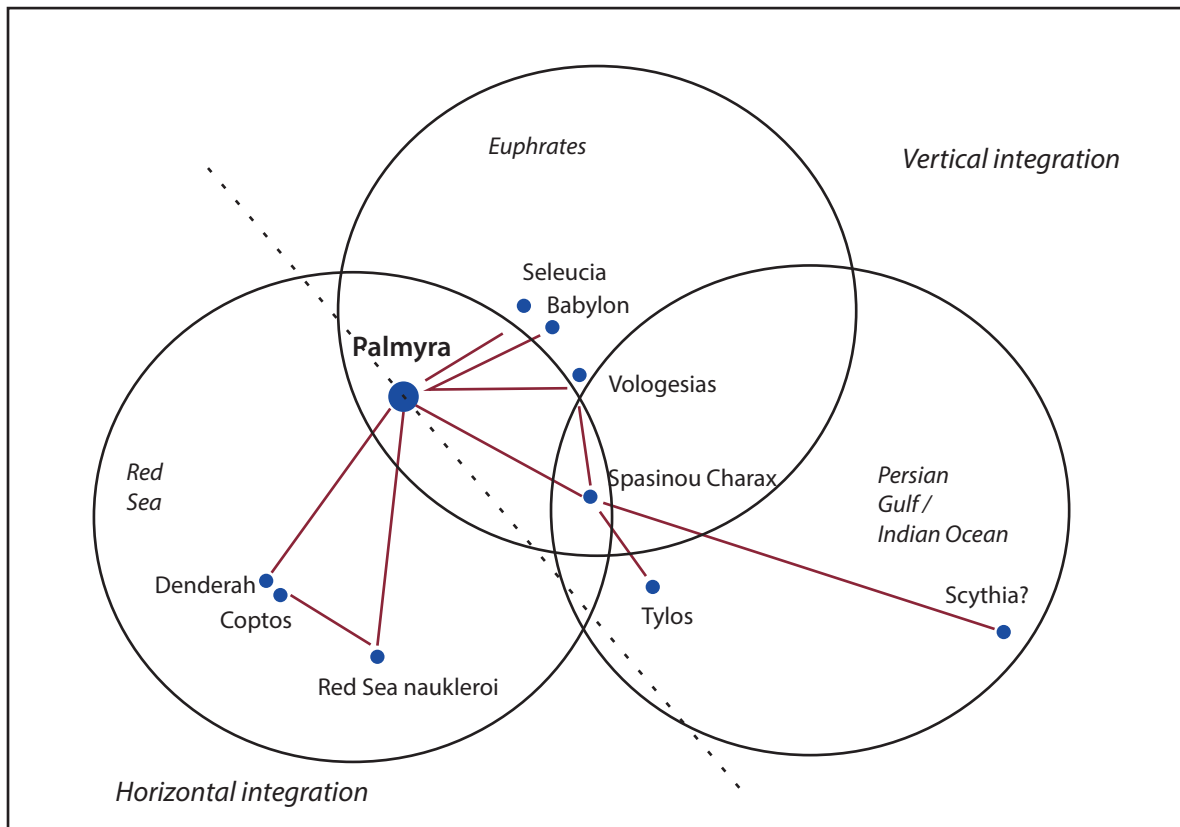


Fig. 5.16. Spheres of Palmyrene economic interest, economic integration processes and social network connections attested epigraphically (red lines indicate weak ties, blue circles local strong ties; dotted line economic integration strategies) (drawing: author).

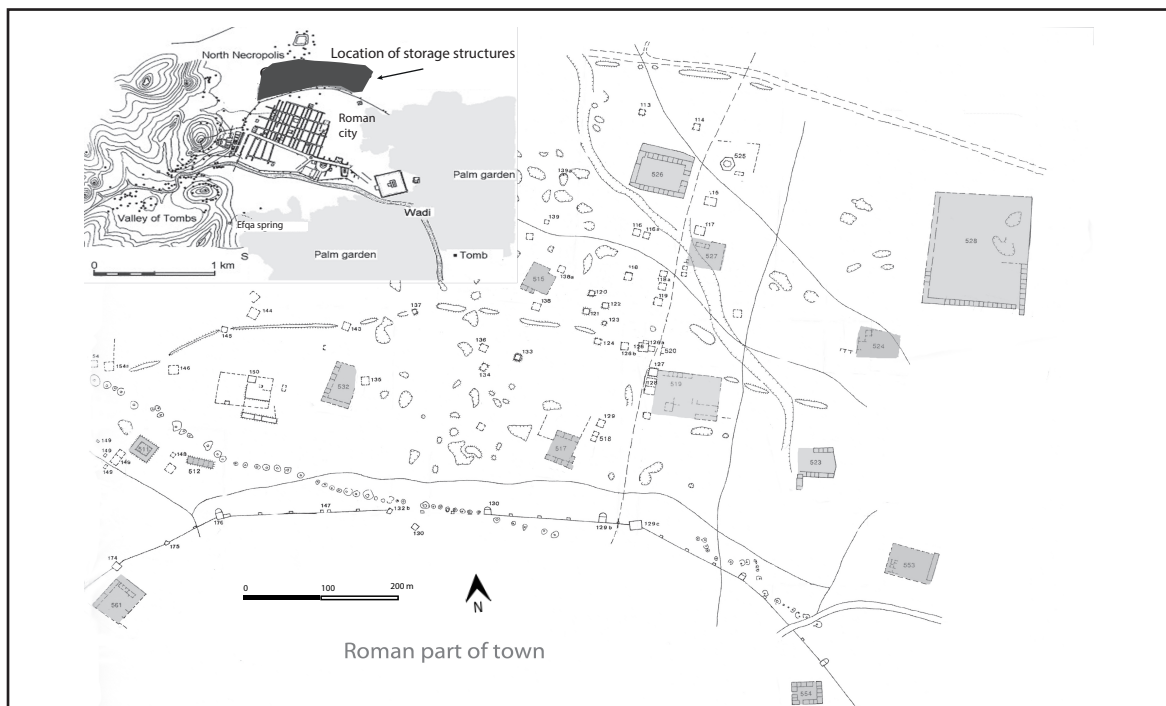


Fig. 5.17. Map of the northern part of Palmyra showing the location of the main group of structures suggested as entrepôts by Dentzer 1994 (after Schnädelbach 2010 and Saito 2005).



Fig. 5.18. Aerial view of structure n. 528. At least thirty individual rooms can be identified in the southern part of the building. (Dentzer 1994, Fig. 3).



Fig. 5.19. Funerary bust of a Palmyrene woman (Will 1992, 113).



Fig. 5.20. Severan Tondo representing the emperor Septimius Severus and his wife, Julia Domna, wearing a pearl necklace and earrings (WikiCommons).



Fig. 5.21. Large-scale salt production in Palmyra occurred until recently (Sakaguchi 1987, Plate 1.26:2).

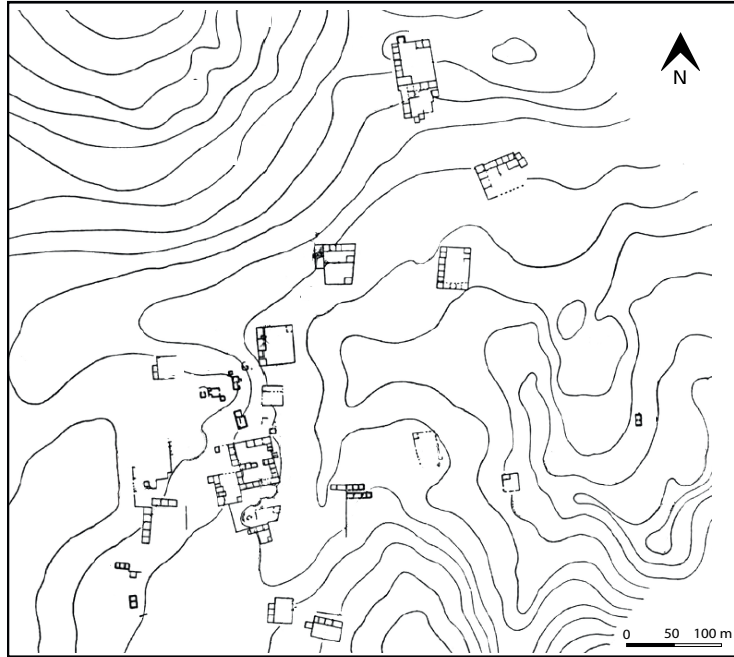


Fig. 5.22. Settlement of Marzouga in the northwestern part of Palmyra (Jabal Char) (After Meyer 2013, Fig. 2).