The Roman public baths of Central Italy during the Imperial period:

an architectural study

Volume I: Text

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Abstract

This thesis considers the architecture and technology of the public, urban baths of Central Italy during the Imperial period (27 BC – AD 250), but excluding the well-preserved and better-known examples of Rome, *Ostia* and *Pompeii*, which have dominated the discourse on Italian baths for far too long. Using data from ca. 70 bath buildings, gathered together for the first time, the thesis tackles the design of baths and of bathing rooms, the selection and use of construction materials, the management of water within the baths, and the selection of technological devices for their heating. The question of the funding of baths is considered through the physical aspect of the epigraphy, and comparison with the bathing landscape of Rome, *Ostia* and *Pompeii*, the rest of Italy, and selected Roman provinces, is drawn. Finally, the thesis considers the role of the different actors in the building process—the builders, the baths specialists, the architects, the commissioners—and their respective influence in the architectural outcome.

The thesis reveals how economic considerations and local conditions underlaid almost every step of the construction, from the selection of construction materials for the structure and the heating systems, to the strategies of water management and use in the baths; at the same time, it shows how the standardisation of heating systems technology and the use of blueprints for individual rooms simplified the planning and construction processes. This streamlining of the construction of baths leads to arguing that a percentage of the municipal baths offered by benefactors were almost 'run-of-the-mill' benefactions. This picture does not preclude the existence of profit-driven technological creations, original architectural room shapes, and expression of some benefactor's personal interest in the architectural outcome of their bath benefaction.

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List of Abbreviations

Italian abbreviations

P.za — Piazza

S., S.to, S.ta, SS — San, Santo, Santa, Santi

SABAP — Soprintendenza Archeologia, Belle Arti e Paesaggio

SBA — Soprintendenza per i Beni Archeologici

V. — Via

Abbreviations commonly used in tables

B. — Baths

BA — Bathing Area

BB — Bathing Block

M/W — Men's section/Women's section

SA — Surface Area

Epigraphic corpora and databases

AE: L'année épigraphique

CIL: *Corpus Inscriptionum Latinarum*

EphEp: *Ephemeris epigraphica*

EAOR : Epigrafia anfiteatrale dell'Occidente romano

ET: Etruskische Texte (RIX & MEISER 1991)

IGR: *Inscriptiones Graecae ad res Romanas pertinentes* (CAGNAT *et al*. 1906–1927)

ILLRP: *Inscriptiones latinae liberae rei publicae* (DEGRASSI 1957–1965)

ILPaest: Iscrizioni latine di *Paestum* (MELLO & VOZA 1968–1969)

ILS: Inscriptiones latinae selectae (DESSAU 1892–1916)

InscrIt: *Inscriptiones Italiae*

SEG: *Supplementum epigraphicum graecum*

SupplIt: *Supplementa Italica*

SupplIt Imagines Latium 1: *Supplementa italica. Imagines. I: Latium vetus praeter Ostiam* (GRANINO CECERE & REGGIANI 2005)

Online databases

EDR — Epigraphic Database Roma, 1999– <www.edr-edr.it>

HD — Epigraphische Datenbank Heidelberg, 1986– <https://edh-www.adw.uni-heidelberg.de>

EDCS — Epigraphik-Datenbank Clauss/Slaby, <http://db.edcs.eu>

LSA — Last Statues of Antiquity, 2012 <http://laststatues.classics.ox.ac.uk/>

TESS — TESS - Sistema per la Catalogazione informatizzata dei Pavimenti antichi, <http://tess.beniculturali.unipd.it/>

UbiEratLupa — *Ubi Erat Lupa*, Bilddatenbank zu antiken Steindenkmälern, 2002– <http://lupa.at/>

I. Introduction

I.1 State of the research, aims of the thesis

I.1.1 State of the research

Bath buildings—again! The last three decades have completely overturned the way bath buildings are perceived and considered by archaeologists. This type of structure went from a frowned upon topic—after a century of neglect punctuated with a handful of studies[1] that made it look like everything was known on the topic—to a very prolific field of study, multiplying approaches and cases studies.[2] This increased interest is both welcome and justified, for the importance of bath complexes cannot be overstressed. Baths had a fundamental role in Roman societies, not only for their hygienic function but also as an integral part of daily life.[3] It was probably the most Roman of all Roman buildings, distinguishing the civilised from the barbarian,[4] and was provided for most (if not all) strata of the population, even in the most remote corners of the empire. At the same time, it was also the type of monument that offered architects and builders most opportunities for architectural experimentation, for it did not have a long architectural tradition to follow, as was the case for temples or basilicas, neither did it have a purely utilitarian function, like terracing or storage.[5] For that same reason, baths could also act as vectors of innovation: the Baths of Trajan in Rome were a milestone in the development of Roman bath architecture, being the first to be built on such a gigantic scale and with such an extensive use of brick-faced walls

[1] KRENCKER *et al.* 1929; BRÖDNER 1958.

[2] The state of the research on bath buildings is well summarised in two articles published 25 years apart (DELAINE 1988; MARÉCHAL 2012); only main publications will be referred to in the following notes, and further bibliography will be provided in the relevant chapters.

[3] FAGAN 1999a, 81–88; YEGÜL 2010, 213–230; KOLOSKI-OSTROW 2015.

[4] Tacitus, *Agricola* 21.

[5] YEGÜL 1992, 2; LANCASTER 2005, 172.

and concrete vaults;[6] in turn, they influenced other baths in the provinces. These provincial baths found inspiration in the models and the technologies of Rome but also in local traditions.

The last thirty years have seen a profusion of studies on the topic: the beginning of the 1990s set the tone with the publication of major monographs focusing on social, architectural and/or constructional aspects of baths.[7] Questions such as the identity of the bathers,[8] the nature of the activities in bath buildings beyond simply the hygienic and the functional, as well as the atmosphere therein,[9] without forgetting their potential religious, moral, medical, symbolic and political connotations,[10] were considered. The contribution of other types of evidence, such as epigraphy[11] or material culture, was drawn upon;[12] the decoration of baths was not forgotten either.[13] Research on the socio-economic aspects of bath buildings was also furthered, looking into the management and daily running of the baths—including questions *a priori* simpler to answer, such as the entrance fees and the openings hours—and the legal framework of these activities.[14] Individual bath buildings started to be the object of full architectural studies;[15] aspects of their water management[16] and heating systems[17]

[6] LANCASTER 2005, 169.
[7] YEGÜL 1992; NIELSEN 1993; DELAINE 1997; ZYTKA 2013; GUÉRIN-BEAUVOIS 2015.
[8] WARD 1992; FAGAN 1999a, 189–219; 1999b; GUÉRIN-BEAUVOIS 2000, 141–144; MARTINI 2014.
[9] FAGAN 1999a, 75–78; 2000; GUÉRIN-BEAUVOIS 2000, 129–131; FAGAN 2011; BLONSKI 2014b; 2014a; FAGAN 2016, 240–242.
[10] DUNBABIN 1989; FAGAN 1999a, 85–103; ZAJAC 1999; GUÉRIN-BEAUVOIS 2000, 124–126; 2007; ZYTKA 2013; GUÉRIN-BEAUVOIS 2015.
[11] FAGAN 1999.
[12] WHITMORE 2013; HOSS 2018.
[13] MANDERSCHEID 1981; GENSHEIMER 2018.
[14] WISSEMANN 1984; BRUUN 1993; 1999; FOULCHÉ 2011, 511–618; BLOUIN 2014; FAUCHER & REDON 2014; CARLSEN 2015.
[15] From ESCHEBACH 1979 to MEDRI & DI COLA 2013.
[16] GARBRECHT & MANDERSCHEID 1994; MANDERSCHEID 2000.
[17] KRETZSCHMER 1953; DEGBOMONT 1984; MILIARESIS 2019.

became worthy of investigation. The question of their origin was tackled, with a focus alternating between Campania, Latium, Sicily and the Greek world.[18] The terminology used to designate baths also became a focus of attention.[19] Approaches started diversifying, with more recently a focus on specific categories of bath buildings, such as private baths,[20] spa baths[21] or rural baths.[22] Several important large and small-scale regional studies and projects have also taken place, with areas such as *Hispania*, Gaul, North Africa, and the Near-East amongst the most thoroughly investigated;[23] other studies preferred an interregional approach focusing on a specific period.[24]

What is left, therefore, to study? Despite this regained interest in Roman baths, the baths of Italy still have not been the object of a synthetic and exhaustive architectural study. Most literature produced about Italian baths has focused on the examples of Rome, *Pompeii*, *Herculaneum* and *Ostia*, leaving the rest of the Italian baths in the shade of those better-preserved examples. For example, Nielsen's study considered, for the whole of Italy and during the entire Roman period, 61 urban public baths in a reasonable state of preservation; out of these 61, only 20 are located outside

[18] FAGAN 2001; TRÜMPER 2009; HENDERSON 2010; YEGÜL 2013; DI MICHELE 2019.

[19] REBUFFAT 1991; MARÉCHAL 2015; DI MICHELE 2019.

[20] GARCÍA ENTERO 2005; DE HAAN 2010.

[21] CHELLINI 2002; ANNIBALETTO, BASSANI & GHEDINI 2014; GUÉRIN-BEAUVOIS 2015.

[22] SAVANI 2017.

[23] **Italy**: CIAMPOLTRINI 1993 (Tuscany); BORRICELLI 1997 (Apulia); RIZZITELLI 1997 (Sardinia); POCCARDI 2006b (Ostia); FOULCHÉ 2011 (Rome); EQUESTRI 2014/2015 (Regio X). ***Hispania***: FERNÁNDEZ OCHOA *et al.* 2004 (Proyecto Termas Romanas); REIS 2004 (*Lusitania*); FERNÁNDEZ OCHOA, GARCÍA ENTERO & GIL SENDINO 2009 (Asturias). **Gaul**: BOUET 2003 (*Gallia Narbonnensis*); LE BOT 2003 (*Armorica*). **Northern provinces and Central Europe**: HEINZ 1979 (Baden-Württemberg); BAÇE 1980 (Albania); MANDERSCHEID 1983 (Switzerland); ROOK 1992 (Britain); DODT 2003 (*Germania Inferior*); HUMER & KONECNY 2011; KASTLER *et al.* 2012 (*Noricum*); TRAXLER 2012. **North Africa**: THÉBERT 2003; ROSSITER 2009 (Carthage); MARÉCHAL 2013 (Lybia); FOURNET, REDON & VANPEENE 2017 (Egypt). **Greece and Turkey**: YEGÜL 1992 (*Asia Minor*); FARRINGTON 1995 (Lycia); WASSENHOVEN 2012 (Peloponnese); KELLY 2013 (Crete); OULKEROGLOU 2018 (Macedonia). **Near-East**: HOSS 2005 (Palestine); FOURNET 2012 (Syria; Balnéorient Project); CHRISTODOULOU 2014 (Cyprus); FOURNET & BOUSSAC 2015 (Jordan). This list of regional studies, all with very different degrees of coverage, is by no means exhaustive.

[24] MARÉCHAL 2020 forthcoming.

of these four cities.[25] More recent databases and catalogues[26] reveal that, outside of these cities, in Central Italy alone there are approximately 63 baths identified through physical remains. If we were to consider all the hypothetical identification of public bath buildings found through bibliographical research for this thesis (and regrouped in the gazetteer), the figure would go up to ca. 175 examples (fig. 1–4)—without even considering private and spa baths.

It is therefore clear that there remains much to do on the baths of Central Italy, and in order to understand what happened in the region, we will need to depart from the towering presence of the baths of Rome, *Pompeii* and *Ostia*, and instead focus on the other baths in their own right, for their own sake and not as subordinate to what was done in those three cities. Material from the latter will be called upon only when necessary, and eventually tackled in a final, comparative chapter.

I.1.2 Aims of the research

Bath buildings were complex structures, combining usual construction practices with the necessity to introduce large quantities of water and equip them with heating systems. In order to better understand the architecture of these buildings, remaining at the level of general considerations is not enough and it is necessary to examine independently and in detail each element composing the building, especially those that characterise it (water, heating), and to assess their influence in the final outcome.

[25] NIELSEN 1993, vol. 2.
[26] MANDERSCHEID 1988; 2004 ; *Archäologische Bibliographie*, in PROJEKT DYABOLA (dyabola.de).

The thesis will therefore investigate the design and architecture of baths, and the technology used in their construction. The main questions are different for each chapter, and are detailed below; underlying themes will be the conflict between local identity and wider influences; standardization, innovation and the transmission of technology and ideas; underlying rationale in the decisions during the construction process, by the different players involved (builders specialised and not, architects and contractors, commissioners); funding dynamics, and the social aspect of bath construction

By freeing the discourse on (Italian) bath buildings from the diktat of the examples from *Pompeii,* Rome, and *Ostia*, the thesis hopes to determine the identity of the baths of central Italy, which distinguished them from baths elsewhere in Italy, and elsewhere in the Empire, in terms of their architecture, the technology they used, and their funding patterns. It will approach Central Italy as a society in its own right, *a priori* discarding the assumption that central Italian bath architecture was necessarily indebted to what happened in Rome.

What will be missing in the thesis is the question of the actual use of the structure by the bathers. This topic has been extensively discussed, and this thesis aims first and foremost at being an architectural study. I would further argue that an architectural study is a preamble to a research on the use of the baths: without understanding how water flowed in the pools, how different rooms were heated differently, how funding patterns affected the physical outcome of the structure, we are condemned to remain at a superficial level of understanding of the use of specific baths. Builders, architects, and commissioners, had to think about all these aspects when building, and we shall do the same. Another aspect the thesis will be concerned

with only in a limited way is the question of the influence of Rome on provincial bath buildings, for the simple reason that questions of chronology have not been considered, for reasons detailed below.

The thesis will unfold as follows, aiming at answering the following questions for each chapter:

- **Design of baths complexes**. How were the plans of the baths conceived? What were the underlying principles that governed the final aspect of the plan of these structures? And how did the design affect the bathing experience of customers?
- **Construction materials and techniques**. What were the materials used, and what criteria governed their selection? According to what rationale were they used within the structure?
- **Water management**. How were the baths supplied with water? What were the sources available to the builders, and how did their selection affect the provision and size of water facilities in bath buildings? How did water circulate in bathhouses, and how was it disposed of?
- **Heating systems**. How were the baths heated? What was the technology available to the Romans, and how was it used? What was the rationale behind the choice of one specific technological device over another, and its implications?
- **Funding patterns**. Who commissioned and paid for those baths, and what did they pay for exactly? What does the physical aspect of inscriptions, our main source material for this topic, tell us about the intentions and priorities of the commissioners?
- **The baths of Central Italy in their local, regional and empire-wide contexts**. The regional or local specificities of a series of bath buildings can

be understood either within the region considered itself, or by comparison with the areas around it. This exercise will be attempted at the very end of the research, when the characteristics of the bathhouses of Central Italy have been established; the situation in Central Italy will be compared with that of Rome, *Pompeii*, *Ostia*, as well as with northern and southern Italy, and with some specific examples from beyond the borders of Italy.

I.2 Methodology

Even though baths in Italy are under-represented in broader studies, there still is an impressive number of Italian baths examined, described or at least mentioned in archaeological excavation reports and publications. If this can be partly explained by baths being now more fashionable than they used to be, as mentioned above, it is mainly due to the ease with which they can be identified: the sole presence of a hypocaust is enough to encourage authors to identify the monument as a bath building. Apart from the fact that the presence of a hypocaust does not necessarily imply that the building is a bath complex,[27] the identification of a bath building on the sole presence of a hypocaust adds little to our understanding of the building as a whole and of baths as a building type; at the same time, these identifications remain interesting for the information they contain about heating technology. Several examples from the catalogue have been identified only on the basis of the discovery of *pilae* in a room or a building that archaeologists did not entirely excavate. Such limited evidence does not tell us much, if anything, about the status of the baths (private or public), their context, their extent, their architecture or their design, but is still worthy of consideration since it provides information about the heating technology used in the baths.

An assessment of the extent and the quality of the research on the imperial-period public bath buildings of Central Italy also reveals huge discrepancies in the knowledge of individual baths. This situation is in part due to the extent to which baths

[27] A hypocaust could also be used to heat non-bathing complexes (even though that is more common in colder areas than in Italy), or in warehouses to protect goods from humidity (e.g. *Portus*: BUKOWIECKI & PANZIERI 2013).

are preserved, but mainly to the period and the method in which the baths were studied and published. Some baths are only known through 19th century or earlier excavations, others through mentions in archaeological guides,[28] and a few from the interest scholars had in their mosaics. Studies on the urbanism of individual cities (usually considered under the umbrella term of 'topografia antica'), in which all traces of ancient structures are considered, are also useful for finding evidence related to bath buildings, even though the baths are then only considered in relation to the urban fabric.[29] Only a handful of bath buildings have been studied in a more comprehensive way, by taking into account not only the structures or their integration in the urban fabric but also several aspects of the 'functional requirements' they had to meet (enough space for the expected number of customers; heating of water and spaces; fuel; supply of water; enough space for the operation of the complex; placement of the service areas so that they may supply water and fuel without disturbing customers and neighbours) and 'possible limitations' they could face (available budget; space available in the urban fabric; availability of water and construction materials; regional factors such as the climate or local customs), as laid out by De Haan.[30] If there is no such thing as a perfect publication, this last approach is certainly the one doing justice to bath buildings, if only by not subordinating baths to another field of research. When it comes to considering baths buildings beyond individual examples, only two small-scale regional studies have been completed, in which baths are approached as an

[28] E.g. the Laterza guides: GAGGIOTTI *et al.* 1980; TORELLI 1980a; DE CARO & GRECO 1981; COARELLI 1982; COARELLI & LA REGINA 1984; COARELLI 1985; SISANI 2006.

[29] E.g. the series 'Città antiche' and 'Atlante Tematico di Topografia Antica'.

[30] DE HAAN 2007, 45–46.

architectural and/or social phenomenon.[31] Research is however going on as I write,[32] with several archaeological excavations being conducted on various sites across Central Italy, along with a handful of previously studied bath buildings now being re-examined.[33]

For all these reasons—lack of comprehensive published documentation, with little information about construction techniques, heating technology or water supply, on top of an absence of phase plans—the collection of more data has been a necessity. Bibliographical research has been at the core of this study, but was complemented by work in the field, conducted in three surveys over the course of three years during which some 50 bath buildings were visited and photographically recorded. Archival material was also considered in exceptional cases, but the nature of the research, which considered many aspects of a large number of bath buildings, did not allow for an in-depth investigation of the archives produced during the excavation of every bath building; several of the larger complexes would deserve a monographic study.

I.2.1 Criteria for the definition of a *corpus* of bath buildings

This study will consider the bath buildings of Central Italy. There is no definitive definition of what constitutes 'Central' Italy, and the criteria used here will be the ancient *regiones* as defined by Augustus in 7 BC. The following *regiones* will be considered: I (*Latium et Campania*), IV (*Samnium*), V (*Picenum*), VI (*Umbria et Ager Gallicus*), VII (*Etruria*) (fig. 5). This conventional division was chosen out of

[31] CIAMPOLTRINI 1993; GRABNER 2001.

[32] The 'Terme italiche' conference held in October 2018 in Rome bears witness to the dynamism of current research on Roman baths in Italy (MEDRI & PIZZO 2019).

[33] Excavations or study are ongoing on the following sites (list non-exhaustive): *Amiternum*, *Aquinum*, *Cales*, *Cosa*, *Forum Sempronii*, *Neapolis* Fuorigrotta, *Pisae*, *Telesia*, *Tifernum Mataurense*, *Tusculum*.

convenience, since there is no expectation that Augustan administrative divisions will affect the architecture of bath buildings; because of that, some examples of bath buildings from beyond this area have been included in this study, for instance the baths at *Velia* and *Paestum*,[34] technically belonging to *regio* III (*Lucania et Bruttium*). The exceptional state of preservation and publication of some of these bath buildings made them too important not to be considered in this study; they informed my understanding of other, less well-preserved bath buildings, especially in the early stages of the research. On the other hand, for reasons of simplicity, the baths will here be classified according to modern-day regions; this helped in requesting permits to visit sites from the Soprintendenze, and will make for an easier consultation of the catalogue.

'Central' Italy is sometimes understood in an opposition between a more 'Italic' centre, an 'Etruscan/Gallic'-influenced North and a 'Greek'-influenced South. According to this vision, both the northern part (*regio* VII) and the southern part (southern half of *regio* I) of the area selected for this research would belong to the second and third categories, respectively. If these differences are worth keeping in mind, they have their limitations. Thébert warned us on the risks, for understanding bathing culture, of placing too much emphasis on a single region. He also added that already in the late 2nd cent. BC, the place of economic power and technological and cultural development was the Tyrrhenian, Central Italian coast—*Etruria, Latium, Campania*.[35] By the Augustan period, the beginning of the period considered here, these

[34] The Latin names of central Italian cities will be used whenever possible, otherwise the Italian name will be used. Latin words will be italicised throughout the thesis.

[35] THÉBERT 2003, 83.

differences in the development of individual regions must have had only a very limited relevance, if at all, to bathing architecture and architecture in general.

In terms of chronological boundaries, the focus will be on the imperial period, understood as starting with Augustus in 27 BC. Even though the 'imperial' period technically ended in the 6th cent. AD, the research does not go beyond the mid-3rd cent. AD, when Late Antiquity traditionally starts. These chronological boundaries correspond to a period in which bathing traditions, even though still evolving, had become more established before transforming again in the 3rd cent. AD. By starting with Augustus, this study avoids the bathing architecture of the Republican period, in particular the still heated debate on the origins of bath buildings, long tainted by nationalistic connotations, for which recent discoveries[36] continue to change the perspective. Around the time of Augustus and during the 1st cent. AD, bathing culture was transformed, a change reflected in the writings of Seneca (*Ep.* 86.4-12) when he complained about the luxury of the new type of bath buildings; these changes were visible in many facets of their architecture, including in the more importance given to cold rooms, the opening of large windows, the improvements brought to the heating systems, the wealth of the decoration using figurative mosaics and imported marbles, and the abundance of water for communal immersion pools and other water-consuming decorative facilities. Another architectural change occurred in the mid- to late 3rd cent. AD, which reflected a change in the practice of bathing itself: large communal immersion pools rarefied in favour of multiple, smaller individual immersion pools; curvilinear architecture became visibly prominent.

[36] E.g. the baths at *Fregellae* in Lazio (TSIOLIS 2013).

Bath buildings were used by virtually everyone in the Roman world; they appeared in a wide variety of contexts (urban, peri-urban, sub-urban, rural, along roads, in military camps), and were commissioned, owned and exploited by a wide array of people and organisations—from the emperor, to the city, to private individuals—which would open them to a more or less large part of the population. In this study, the focus will be on the public, urban baths, i.e. built in a city or close-by and open to the public at large. This category of baths could have taken a variety of shapes and dimensions, and have been commissioned by any of the players mentioned above, but the rationale behind it is that every city was equipped with one or more of those baths and that they were conceived to cater for a more or less large part of the population, independently from questions of ownership or management, to which there is often no answer. This contrasts with 'private' baths, understood as domestic baths belonging to houses and villas with an access restricted to a limited, controlled audience.[37] If these latter bath buildings were not necessarily technologically different from public ones, the goal in building them was itself different, and their design and size can be expected to be different too. *Mansio* baths will not be part of the study either. By definition these were located on main roads, outside of urban centres, and were often included in a larger complex including residential areas and other services. The last category of baths to be discarded is the spa bath, characterised by its construction directly on a spring; consequently, these were often built outside of city centres. They differ significantly from urban bath complexes in their technology—they had a constant water supply and/or natural heating directly at their disposal—and in their design, which made best use of the hydraulic and thermal specificities of the

[37] On the distinction private/public, see FOULCHÉ 2011, 185–190.

place. Because of their associations with springs, these spa baths were often associated with sacred connotations and therapeutic virtues, aspects absent from urban baths.

Public urban baths, in; private, spa and *mansio* baths, out. In an ideal study on bath architecture, all these categories of baths would be considered together: the same architects and builders could be responsible for the planning, design and construction of baths of any category; baths outside of town could have an 'urban' design if that was the wish of the commissioner; the heating technology was not necessarily different according to those lines but more likely depended on building teams' expertise and material availability; choice of construction materials and water supply strategies depended probably more on local availability than on the status of the bath building. However, boundaries had to be set in order to restrict the material considered and produce a thesis with a reasonable scope; these are the selection criteria, but their limitations will be kept in mind, and comparisons will be brought in when necessary.

I.2.2 Composition of the catalogue and gazetteer

The public, urban baths of Central Italy constitute a significant corpus. They are regrouped by modern regions, subdivided between a catalogue (with detailed entries), a gazetteer (with short entries) and a list of uncertain identifications. The catalogue and gazetteer contain details for some 75 public and probably public baths in Central Italy, to which can be added some 100 buildings identified as baths, located in ancient urban centres and not clearly private, grouped under the 'uncertain identification' category.

A typical catalogue entry is presented in detail at the beginning of the catalogue volume. The layout, inspired by that of the Balnéorient project,[38] reflects the approach to baths taken by the thesis, which decomposes the buildings into their individual components. There are two types of entries, one for the main catalogue and a second, more condensed one for the gazetteer; the order in which the different elements are presented and their numbering stays the same, unless the information on a bath building is very limited, in which case the layout is dropped entirely. Besides, the gazetteer version has a 'reliability' field, where the reliability of the identification of the structure as baths, as well as the public or private nature of the building, is assessed. This assessment is inevitably subjective, so the following graded scale will be used: 'weak – 'possibly' – 'probably' – 'certainly', or 'unknown' when not enough information is available to express an opinion.

The degree of completeness of the entries is necessarily variable; a key factor has been the possibility to visit the sites, allowing for the gathering of a significantly larger quantity of information. Whenever there was a discrepancy between two sources of information (e.g. between what I could see on site and a published plan, or between a plan and a description), I have tried to distinguish the sources of information.

The plans have been redrawn at a 1:400 scale, with a set of symbols and conventions inspired from the *Balnéorient* project. The plans proposed are schematic, not stone by stone drawings or architect's plans, and a minimal degree of liberty was taken in redrawing them. Schematic plans provided without description of the remains have not been redrawn, but have been as far as possible sized to the same

[38] FOURNET *et al.* 2013; FOURNET, REDON & VANPEENE 2017.

1:400 scale. Whenever possible, a colour-coded phasing was proposed. Every effort has been made to clearly differentiate the hypothetical from the certain, but the varying completeness of publications, the state of preservation of the building and the extent of restorations did not allow me to create plans that offer an exact picture of the remains and the original structure; the plans shall therefore not be considered independently from the catalogue entry. Since Roman architecture used mostly orthogonal construction, a description of the rooms using cardinal points is the most convenient option; for ease of description, a conventional 'building north' was used, closest to the original north.

I.2.3 Distribution and number of bath buildings in Central Italy

Comparing the distribution of the catalogued bath buildings to that of cities (based on Hanson's catalogue),[39] we see that several settlements have no known bath buildings (fig. 6). Unlike theatres and amphitheatres, the absence of bath buildings in a city is certainly due to gaps in the current state of the knowledge and not to actual absence, as it is virtually impossible that a city, regardless of its size, was not equipped with at least one public bathing complex. The distribution of bath buildings must therefore roughly reflect that of settlements. *Ostia*, with 13 public bath buildings, was certainly the exception, but *Florentia* had at least two major complexes, *Neapolis* at least five baths, peripheral large cities like *Paestum* and *Velia* at least two each, and even smaller cities like *Forum Sempronii* or *Sentinum* had at least two. Where archaeological evidence stops, epigraphical material still informs us: at *Lanuvium*, no less than five inscriptions mentioned bath buildings [E35–E39], from possibly as many baths; by the

[39] HANSON 2016b; 2016a.

Augustan period, the city counted at least two or three complexes. Similarly, at *Pisae*, the stipulations for the mourning of Augustus required *balneisque publicis […] omnibus clausis*.[40] Geophysical prospections and aerial photography also contribute to our knowledge of the distribution of bath buildings, with two more possible examples identified at *Falerii Novi* [La.G.31] [La.G.32] and a large complex at *Amiternum* [Ab.G.08]. A city as large and important as *Capua* must have had a handful of baths too. For the sake of the exercise, using the surface area of cities as a proxy for the number of bath buildings they had,[41] we could expect a number of bath buildings close to 500 for the region and period considered here.[42] This is probably a conservative estimate.

I.2.4 On the dating and evolution of bath buildings

Taking the counterpart of a common trend that seeks to analyse the development of bath buildings (or any architectural form for that matter) over time, this thesis will *not* be concerned with the absolute chronology of individual buildings. Bath buildings are by nature difficult to date: they had long lives during which they went through many transformations, some major (enlargements, partial or complete redecorations, defunctionalisation of some rooms etc.), some minor (small changes in the heating system, alterations of the circulation patterns etc.). These transformations

[40] *CIL* XI.1421=EDR142467.

[41] Hanson's database lists 178 cities for Central Italy. The surface area provided by Hanson, which he later demonstrated was a viable proxy for assessing population sizes (HANSON & ORTMAN 2017), was used as a proxy for the number of bath buildings (since their number in a city depended in part on the size of the population of the city), as follows: 0–9 ha: 1 BB; 10–19 ha: 2 BB; 20–29 ha: 3 BB; 30–49 ha: 4 BB; 50–79 ha: 5 BB; 80+ ha: 6 BB. Larger cities can be expected to have had larger bath buildings, and therefore a potentially smaller number of bath buildings compared to the population.

[42] This is not at odds with the number of theatres listed by SEAR 2006: his catalogue contains 175 theatres for the whole of Italy, of which 115 for the area considered here—but there was rarely more than one theatre per city, and their construction stopped in the late 1st cent. AD (SEAR 2006, 97), much earlier than that of baths which continued well into the 3rd cent. AD and later.

are just as difficult to pinpoint chronologically. The statement made by Janet DeLaine in 1999 that there are few baths excavated and published in sufficient detail to allow precise dating of both original construction and subsequent phases remains valid.[43] The picture is of course less dramatic, as there are now more baths excavated and published than in 1999, but the number of baths for which a phasing has been proposed remains limited. We shall therefore aim to avoid the trap that consists in offering a picture based on at best vague, more often inaccurate, dating, usually established on the basis of unreliable arguments such as the construction techniques of the walls[44] or the style of what little decoration is preserved. Any of the following dating criteria (the construction techniques of the walls, the insertion of the baths in a datable construction program, the stylistic comparison of the baths' decoration with other dated examples, or the material found during the excavation) is of limited help in pinpointing precise construction phases and comes with its own issues. Dating on stratigraphical grounds was proposed only for recently excavated structures, yet stratigraphy is no panacea as it usually provides more information about the post-bathing phases of the complex than the phases relative to its lifetime as a bath building. Chronologies based on room typologies[45] are another interesting means of dating, but the validity of the types, as well as that of the chronologies beyond the area considered, need to be questioned, and new discoveries could easily extend the proposed chronological ranges. As a result, chronologies spanning two centuries are not uncommon and, simply put, this does not allow for a precise study of the chronology of the spread of baths construction or the evolution of bath buildings outside of Rome.

[43] DeLaine 1999, 67.
[44] See section III.2.1a.
[45] E.g. Bouet 2003.

In the absence of more dedicated in-depth studies of individual bath buildings, considerations using absolute chronologies and considering the architectural evolution of bath buildings shall remain wishful thinking.

II. The design of bath buildings

II.1 Typologies for bath buildings?

Bath buildings, as most other building types, did not escape typological classification by scholars, and since Krencker's seminal work of 1929,[46] typologies have been at the heart of the study of bath architecture. Despite a recent—and justified—move away from typologies, they have the merit of putting order into disordered evidence and allowing scholars to quickly understand each other. On the other hand, fitting complex structures such as bath buildings into neat typologies is necessarily reductive, as no single type and no paratactic combination of labels will ever explain how a building was planned, built and used. Furthermore, buildings, unlike typologies, are not static; baths, more than any other building type, underwent many transformations, and could therefore have changed type during their lifetime, blurring the lines as to whether they belonged to a type coincidentally or purposely. Typologies also usually ignore differences in scale, and focus on ground plans whereas any building was conceived and used in three dimensions. The real issue with using typologies, however, appears when one is tempted to use them as an interpretative tool, assuming that meaning lies therein, and being content to limit their analysis of bath complexes to their categorisation into different types.[47]

A wide variety of architectural criteria have been used to classify public bath buildings. The ground plan and the bather's path are the two best-known criteria and have been used since Krencker, but other scholars have come up with different arguments for establishing typologies: urban location, ancient terminology, absolute size, presence or absence of specific rooms, number of bathing rooms, shape of

[46] KRENCKER *et al.* 1929.
[47] DELAINE 1988; 1992; DE HAAN 2007; MEDRI & DI COLA 2013, 97–101; RENFREW & BAHN 2016, 128.

individual rooms etc.[48] It is those individual criteria that inform us about bath buildings, and the question of classification of baths should not only consider the effects of those criteria on baths, but also differentiate between criteria that stemmed from the planning process of the baths, and those that were aimed at altering the bathers' experience of the building.

The symmetrical, double paths plan and the large scale of the imperial-type baths of Rome conjured ideas of grandiosity, of *voluptas* (by offering bathers a variety of paths and rooms to use), and of huge numbers of people. How did the symmetry of the double path matter to the bathers, who could have experienced only one path at a time? Did a circular path change the experience of the bather in any way compared to a retrograde path, or was the choice dictated by a wish to better the flow of people and avoid bottlenecks in the building? Since this study focuses on the planning and constructional stage of the building, I will not delve into those questions, but rather discard typologies (since no single typology will help us understand the planning process of baths), and instead use the criteria that underlaid those typologies. Thus, I will talk of baths with an asymmetrical, semi-symmetrical, or symmetrical plan. Similarly, the criterion of the 'path of the bather', or whether a bather had to retrace their steps during the bathing process or could proceed in a continuous way without crossing twice the same heated room, will be considered, without grouping all the buildings with a 'retrograde' path into a category.

Arguably, the only modern type that corresponds to an ancient reality on the ground is Krencker's imperial type (both 'small' and 'large' types, fig. 7), characterised

[48] E.g. NIELSEN 1993; BOUET 2003; THÉBERT 2003; POCCARDI 2006b. See FOULCHÉ 2011, 180–184 for a review of those typologies.

by symmetry along a main central axis along which the main rooms (*caldarium*, *tepidarium*, *frigidarium*) were arranged, a second, perpendicular, axis, and the multiplication of hot rooms.[49] DeLaine reconstructed the planning process of these apparently complex structures, showing how the basic ground plan design and the relationships between rooms, and the proportions of the rooms, including their height and the features they contained, were governed by a small range of simple geometrical figures and arithmetical ratios, with the architect mostly responsible for coordinating the spaces and details, both in plan and elevation.[50]

The 'imperial' type of bath buildings was created in Rome, probably with the Baths of Trajan,[51] and became popular in North Africa (late 2nd–early 3rd cent. AD) and Asia Minor, as well as in the Near-East from the 3rd cent. AD onwards.[52] It was much less used in other regions, including in Central Italy where, beyond Rome, only two examples are known, at *Castra Albana* [La.02] and *Puteoli* [Ca.07], the first one at least, built by Caracalla, in close connection with imperial power. These two complexes, with their specific layout inspired from the examples from Rome and their very large dimensions (both ca. 7,400–7,500 m² for the bathing block), were exceptional in Central Italy. Both structures are poorly preserved and their ground plan is mostly hypothetical, but the scale of the structures, the complexity of the layout, as well as the imperial connection, suggest the use of imperial architects and a similar design process to the imperial baths of Rome as reconstructed by DeLaine. It is the compound criteria

[49] DeLaine 1988, 21.

[50] DeLaine 1997. See Wilson Jones 2000, 87–107, 126–127 on the planning of other types of buildings.

[51] The Baths of Trajan are the first to display with certainty all the characteristics of the type, as the Baths of Nero and Titus are known only through 16th cent. sketches by Palladio. Regarding the Baths of Nero, Palladio saw structures that had undergone significant refurbishment in AD 226 (Yegül 1992, 137); as for those of Titus, Calvigioni recently demonstrated that Palladio could not have seen any pre-Flavian structure (Calvigioni 2013–2014, summarised in Medri 2014, 795–796).

[52] Fournet 2012.

that set those baths apart and make the intervention of imperial architects indubitable, since imperial-type plans could be used for significantly smaller baths (e.g. the Roman baths at Karnak,[53] ca. 1,200 m²)—with the implication that the monumental character of such baths resided in the organisation of the plan rather than in the scale of the building—and imperial benefactions did not always translate into imperial-type plans (e.g. the Terme di Porta Marina at *Ostia*).[54]

The baths of *Castra Albana* and *Puteoli* are not representative of the baths of Central Italy. They would fall into the category of 'large' baths as defined by Thébert,[55] who categorised bath buildings, on the basis of their absolute dimensions, as small (<1000 m²), medium (1000–3000 m²) and large (>3000 m²), whereas the vast majority of the public baths of Central Italy for which a large enough part of the structures is known fell into the medium (50%) and small (45%) categories (table 1).

TABLE 1: SURFACE AREA, TYPE OF PATH, TYPE OF PLAN AND NUMBER OF HEATED ROOMS OF THE PUBLIC BATHS OF CENTRAL ITALY

SA*: the first figure is that of the bathing block, including service areas; the second figure includes the *palaestra* (or any large porticoed courtyard) and *natatio*, if applicable.

Legend: col. 1: M=Men, W=Women; col. 3: SA=Surface Area; col. 5: R=Retrograde, C=Continuous, M=Mixed; col. 6: A=Asymmetrical, SS=Semi-Symmetrical, S=Symmetrical

SITE, baths	**Cat. no**	**SA (m²)***	**No. of heated rooms**	**Path type**	**Plan type**
ALBA FUCENS	[Ab.01]	1,700?	6?	?	A
AQUINUM (M; W)	[La.01]	2,800/5,000	4; 4	M; M	A
CALES	[Ca.01]	1,400?	6?	?	A
CASTRA ALBANA	[La.02]	–/7,400	6–8?	C	SS?

[53] BORAIK *et al*. 2017.

[54] POCCARDI 2006a, 174–175; the baths were probably a Hadrianic benefaction, as the recent reattribution of *CIL* XIV.98=EDCS-05700098 to this set of baths (TURCI forthcoming) indicates.

[55] THÉBERT 2003, 126.

Cosa	[To.01]	600?	3?	R?	A
Cumae, Forum Baths III	[Ca.02]	1,200/3,000?	4	R	A
Faesulae II	[To.02]	1,000/3,500	2	R	A
Ferentum II (M; W)	[La.03]	1,370/2,100	2–3?; 2	R; R	SS
Florentia, Capitoline Baths	[To.03]	1,150?	5?	C?	S?
Florentia, Piazza Signoria	[To.04]	2,000/5,000?	7?	C?	S?
Forum Sempronii, Large B.	[Ma.04]	1,200?	?	?	A?
Forum Sempronii, Small B. I (M; W)	[Ma.05]	600	5; 3	R?; R	A
Forum Sempronii, II (M; W)	[Ma.05]	750	3; 3–4	R; R	
Frusino	[La.04]	> 400	3	R	A
Lavinium, Central Baths	[La.G.13]	> 1,000	5	R	A
Lucus Feroniae (M; W)	[La.06]	750	4; 1?	R?	A
Minturnae	[La.07]	> 600	2?	R?	A
Neapolis Fuorigrotta I	[Ca.04]	600/800	5	C	A
Neapolis Fuorigrotta II	[Ca.04]	650/900	5	R	
Paestum, Forum Baths I	[Ca.05]	800	3	R	A
Paestum, Forum Baths II	[Ca.05]	1,000	3	R	
Paestum, Large Baths I	[Ca.06]	400	4	M	A
Paestum, Large Baths II	[Ca.06]	600	5	M	
Paestum, Large Baths III	[Ca.06]	950	5	M	
Pisae	[To.05]	>1,800	3–5?	M	A
Privernum I	[La.08]	650	3	R	A
Puteoli	[Ca.07]	7,500	?	?	S?
Rusellae, Urban Baths	[To.06]	1,400	4–5	R	A
Sentinum, Extraurban B. I; II	[Ma.07]	2,300/4,600	8; 7	C; R?	SS
Sentinum, Urban Baths	[Ma.08]	> 1,500	> 3	?	A
Septempeda	[Ma.09]	570/1,100	3	R	A
Tadinum	[Um.G.05]	> 750	> 3	?	A
Teate Marrucinorum	[Ab.03]	1,600	3	C	A?
Telesia, Theseus Baths	[Ca.08]	> 950	3	M	A
Tifernum Mataurense I	[Ma.10]	800/1,300?	2	R?	A
Urvinum Hortense	[Um.02]	600	3?	R	A
Vada Volaterrana, Large B.	[To.07]	700/1,100	3	R	A
Velia, South Baths	[Ca.09]	1,000	3	C	A
Velia, Vignale Baths I	[Ca.10]	400	2	R	A
Velia, Vignale Baths II	[Ca.10]	550	3	R	
Velia, Vignale Baths III	[Ca.10]	700	7	R	
Velia, Vignale Baths IV	[Ca.10]	800	8	M	

These medium- and small-sized bath buildings with asymmetrical plan composed almost 90% of the Central Italian bathing stock considered here, and correspond to the *masse thermale* of Thébert. Just as he observed for the baths of North Africa, even in Central Italy the choice of an asymmetrical plan was not linked to the dimensions of the building, as these ranged from some 500 m² (*Neapolis* Fuorigrotta) up to 3,000 m² (*Aquinum*).[56]

The limitations of typologies for bath buildings become obvious when 90% of the examples fall within the same category, and a different approach is necessary to understand the design process of these asymmetrical bath buildings: the focus will now be on the individual rooms that composed the bathhouses.

[56] THÉBERT 2003, 341.

II.2 Types of rooms

Medri and Di Cola recently restated that since no two bath buildings were identical, the way to compare them is at the level of the individual elements that composed them, i.e. each single room.[57] This approach is not new: Krencker had already considered the rooms individually,[58] and was followed by scholars such as Lézine, then Bouet and Poccardi in recent regional studies.[59] Bouet in particular, using a large catalogue of baths, made it clear that models existed for certain rooms and that those models circulated in *Gallia Narbonnensis*; in this, he followed Lafon who had hypothesised the existence, in the late Republican period, of travelling teams of specialised workers, operating in a radius of more than 100 km around the city of Rome, and installing private and public *balnea* after the structural works had been completed by others;[60] Lafon used the close similarity between the mosaics from the *caldaria* of several sites[61] to support his hypothesis. It must however be noted that in both cases, the similarities found by Lafon and Bouet are mostly similarities in the decoration of the pools and the floors, and the question whether the travelling specialists were experts in the construction of hydraulic infrastructures or expert mosaicists, or both, needs be asked. On the other hand, the existence of such models did not preclude more original architectural solutions, even though truly original creations apparently remained rare in the region with which Bouet was concerned.[62]

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[57] MEDRI & DI COLA 2013, 97.
[58] KRENCKER *et al.* 1929, 181–187.
[59] LEZINE 1961; BOUET 2003, 13–159; POCCARDI 2006b, 59–107.
[60] LAFON 1991, 113.
[61] Rome, *Musarna*, maybe *Cortona*. Antibes was added by Bouet (2003, 59–60), and the baths on the acropolis of *Populonia* presented a similar decoration (GUALANDI & PATERA 2001, fig. 4).
[62] BOUET 2003, 157–158.

Bouet pushed his analysis of room plans to the extreme, creating a type for every variation. In the same way that typologies for bath buildings are of limited interest, the soundness of such detailed subdivision can be questioned. Does having one, two or three pools in a *caldarium* make as many types? Does a subdivision according to the shape of the pools (rectangular, apsidal), and their arrangement (next to each other, facing each other or orthogonal to each other), create new subtypes? In a sense it would, if a *caldarium* with two pools, one rectangular and one apsidal, each placed at the centre of two contiguous walls, was a type, a blueprint, conceived and then repeated identically in several bath buildings. In most cases, however, these shapes are too simple for us to demonstrate that this was the case. Just as a bath complex is subdivided into the rooms that compose it, a room can be considered as the juxtaposition of all the individual elements that compose it, and an alternative way to look at them, instead of as types, would be to consider them as a square or rectangular room to which extensions (either quadrangular or apsidal) are added for pools or basins; the location of these extensions could in turn depend on the available space, on the location of doors and on the orientation of windows. None of those two answers would preclude the correctness of the other, as it can certainly be expected that some rooms indeed followed predefined models, whereas other were arranged around those models and adapted to suit the local conditions.

If models existed, they were in all likelihood used for the most important rooms of the baths—i.e. the *frigidarium* and the *caldarium*. Before we look at them, two other types of rooms less central for bathing need considering—the entrances and the changing rooms.

II.2.1 Entrance rooms

The baths of Central Italy could be entered through different types of rooms—via a corridor, a vestibule, a double-door entrance, through a *palaestra* or a combination of two types—but never directly into a bathing room (table 2, fig. 8). A common type of entrance was a vestibule[63] which would also act as a distribution space, providing access to the *frigidarium,* a changing room and the heated section in the case of a continuous circuit (*Cumae* Forum Baths [Ca.02], *Neapolis* Fuorigrotta [Ca.04], *Velia* South Baths [Ca.09], *Teate Marrucinorum* [Ab.03], *Forum Sempronii* Small Baths [Ma.05]). That vestibule could be monumentalised by the use of a pair of columns, marking the passage towards the *frigidarium* (*Neapolis* Fuorigrotta, *Velia* South Baths, *Cumae* Forum Baths) or occasionally separating the vestibule from a transitional space, creating a monumentalised vista from entrance to vestibule, as at *Teate Marrucinorum*. The sizes of those vestibules ranged from 50 m² to 200 m², distinguishing them from the double-door entrances, which were small, simple rectangular rooms, found at *Cales* [Ca.01], *Lucus Feroniae* (Forum Baths [La.06]), *Paestum* (Large Baths [Ca.06]) and *Rusellae* (Urban Baths [To.06]); they had a surface area of 15–20 m², but could be as small as 4 m² (*Cales*). Without any claim at monumentality, their purpose could have been to grant some privacy to the bathers by preventing the passers-by from having an unobstructed view into the building, since these entrances are located along a road (*Cales*) or on the forum (*Lucus Feroniae*); they could also have helped control accesses. In the Large Baths of *Paestum*, a double-door entrance was created in phase II (R2),

[63] The Latin term appears only once in an inscription from *Germania*, as *cellam vestibulam* (*CIL* XIII.5661=EDCS-10801071), and is referred to by Cicero (*Cael*. 62: '*in vestibulo balnearum*') as a room towards the entrance of the baths where people were still dressed.

directing the bathers in the direction of the vestibule to the S, the latrines to the E and possibly a *palaestra* or a *natatio* to the N.

Sometimes it was corridors that granted access to the bath building: they served the same purpose as the double-door entrance, but owed their shape to the necessity to lead the bather further inside the building, so that they could access the first main room. At *Gabii* [La.05], the wish to orientate the heated rooms towards the SE made it necessary to position the latter along the road from where the baths were accessible, and to place the other rooms further to the N, making a corridor (R1) necessary to access the first main room (R8, changing room or *frigidarium*). Such corridors are found at *Gabii* and *Cales* (R13), but also at *Aquinum* [La.01] where they lead straight into the women's *frigidarium* (R35 to R41) or the men's vestibule (R3 to R8). At *Neapolis* Fuorigrotta [Ca.04], in phase II, the addition of a latrine and further rooms to the E led to the creation of a corridor to access the original vestibule. Lastly, the bathing section could sometimes be accessed via the *palaestra* or a porticoed area. At *Aquinum*, the *palaestra* (R80) was one amongst several possible accesses, and it led, through the ambulatory, to either the men's or women's section (R8 or R41). At *Sentinum* (Extraurban Baths [Ma.07]), the ambulatory (R26) of the *palaestra* (R27), accessible through an initial vestibule (R22), led into the *frigidarium* of the baths (R4), as well as into two lateral corridors (R1, R7) leading directly into possible changing rooms (R2, R6) and heated rooms (R9, R13). One of the entrances to the Forum Baths of *Cumae* [Ca.02] was possibly through the *palaestra* (SE corner of R1). These two or three examples are extreme in their dimensions (1700 m², 2200 m² and ca. 1250 m² respectively), but smaller *palaestrae* could act as monumental entrances, for instance at *Septempeda* [Ma.09] (350 m²). A closely related type is that of the porticoed courtyard,

similar in aspect but not necessarily acting as a *palaestra*; there is sometimes a pool at the centre of that space. These are found at *Ferentum* [La.03] (500 m² or 300 m² excluding the ambulatory, of which ca. 65 m² were occupied by a central pool) and *Urvinum Hortense* [Um.02] (R1, ca. 145 m², 50 m² of which was occupied by a central basin); a similar arrangement was found in the Urban Baths of *Sentinum* [Ma.08] (R6: 450 m², 200 m² of which was occupied by central basin), but it seems that the room did not open to the street. Finally, the Urban Baths of *Rusellae* [To.06] may have had a secondary entrance via a porticoed courtyard (250 m²), but its existence remains hypothetical. Occasionally, baths could have several entrances: the baths of *Aquinum* [La.01] were accessible from the S via the *palaestra* or from the north via two corridors opening either into the women's *frigidarium* or into a vestibule for the men's section; it is possible that there were further entrances to the W and E. Those of *Cales* [Ca.01] were accessible via a double-door along the W side or through a corridor on the N side, but these two entrances probably belong to different phases.

In a few cases, entrance into the bath building is made through a combination of several entrance room types. This configuration was not always the initial intention of the builders: at *Neapolis* Fuorigrotta [Ca.04], because of the construction of a block of commercial structures along the E side of the building in phase II, the vestibule became accessible only through a long corridor; the situation was similar in the Forum Baths of *Cumae* [Ca.02], where the addition in phases II–III of a couple of rooms before the vestibule, on either side of the passage, created a corridor. In other baths, we see that this combination was deliberate: in the Extraurban Baths of *Sentinum* [Ma.07], the entrance to the bath complex was possible via a large vestibule (R22, itself accessed via a couple of perpendicular elongated rooms R20–R21 and a series of steps), then a

2,200 m² *palaestra* (R26–R27). At *Aquinum* [La.01], the men's section was accessible from the street via a narrow corridor (R3), but the first proper room encountered by bathers was a large vestibule (R8), decorated with a mosaic and equipped with a *labrum*. Similarly, the *palaestra* entrance (R47) led into the men's vestibule (R8). In the women's section, both the corridor (R35) and the *palaestra* entrance (via R56) arrived directly in the *frigidarium* (R41), not in the vestibule (possibly R42). At *Teate Marrucinorum* [Ab.03], a staircase (R1) led down to the level of the baths, and the first room encountered by the bathers was a very long hall (R2) accessed from the centre of one of the long sides; directly in front of them, a large vestibule (R5) opened through a columnar screen.

The picture provided here shows a great variety of types of entrance, but very few are likely to have functioned as waiting rooms, as could be supported by the presence of benches.[64] The location of the bath building within the urban fabric definitely played a role in the type of entrance, but we see in some cases a deliberate choice of a type of entrance that would grant the baths a certain degree of monumentality. This is visible, for instance, when the entrance was made via the *palaestra*, showcasing the available space and the many columns it contained (*Septempeda* [Ma.09]), or a porticoed courtyard with pool and fountains (*Rusellae* [To.06], *Urvinum Hortense* [Um.02], *Ferentum* [La.03]), or through a vestibule made more grandiose by two columns framing the passage towards the *frigidarium* (*Cumae* Forum Baths [Ca.02], *Neapolis* Fuorigrotta [Ca.04], and a similar solution at *Teate* [Ab.03]). In those latter cases, the *frigidarium* was conceived as being a prolongation of

[64] Only at *Gabii* was there a bench in the entrance. There could however have been benches made of perishable material that disappeared (or not built up and therefore possibly robbed), and it is also possible that this function was fulfilled by other rooms.

the vestibule, and this conception could very well have been a room model, a blueprint.

TABLE 2: LIST OF (SECURELY OR HYPOTHETICALLY) IDENTIFIED ENTRANCES IN THE BATHS OF CENTRAL ITALY

Legend: P=*palaestra*, C=corridor, V=vestibule, DDE=double-door entrance

SITE, baths	**Room type**	**Surface area (m²)**
AQUINUM [La.01]		
- R47 (M+W)	P	1,700
- R3+R8 (M)	C + V	20 + 170
- R35 (W)	C	16
- R42 (W)	V	75
CALES, Central Baths [Ca.01]		
- R1	C	40
- R13	DDE	4
CUMAE, Forum Baths [Ca.02]		
- R1	P	1,250
- R11	V	100
FERENTUM [La.03]		
- R1	V	500
GABII [La.05]		
- R1	C	23
LUCUS FERONIAE, Forum Baths [La.06]		
- R1	DDE	15
NEAPOLIS Fuorigrotta [Ca.04]		
- R1 (II)	C	35
- R3	V	50
PAESTUM, Forum Baths I [Ca.05]		
- R3	V	105
- R9	V	60
PAESTUM, Large Baths [Ca.06]		
- R2 (II)	DDE	20
PISAE [To.05]		
- R17	V	> 35
- R5?	V	75
PRIVERNUM [La.08]		
- E of R1	Colonnaded hall	80

Site, baths	Room type	Surface area (m²)
Rusellae, Urban Baths [To.06]		
- R14	DDE	20
- R17?	Colonnaded hall	250
Sentinum, Extraurban Baths [Ma.07]		
- R26–R27	P	2,200
- R22	V	250
Septempeda [Ma.09]		
- R1	P	350
Teate Marrucinorum [Ab.03]		
- R1	C/Staircase	30
- R3	V	210
- R7	V	200
Urvinum Hortense [Um.02]		
- R1	V	163
Velia, South Baths [Ca.09]		
- R1 + R2	C+V	30 + 52
Velia, Vignale Baths [Ca.10]		
- R2?	V	60

II.2.2 Changing rooms: *apodyteria*

The *apodyterium* was one of the few rooms that had a clear function identified by its etymology, being a Latinised form of the Greek word ἀποδυτήριον, from 'ἀποδύω', to undress. It worked as a changing room and a place to leave one's belongings, sometimes for a fee,[65] before moving into the bathing section; for this reason, it was necessarily placed close to the entrance of the building. Pliny (*Ep.* V.6.25) said the *apodyterium* of his villa was large and located before the *frigidarium*; a location close to the *frigidarium* was also made clear in Hippias's baths, which contained two *apodyteria*.[66]

[65] Diocletian's Price Edict (VII.76): the *capsarius* could charge maximum 2 *denarii* per bather.
[66] Luc., Ἱππίας ἢ Βαλανεῖον, 5.

Despite having a clear function, *apodyteria* are not easy to identify archaeologically (table 3). They could be characterised by benches along the walls, and/or by niches above them, but these architectonic elements also appeared in other rooms: in the baths of *Cales* [Ca.01] (fig. 9), in a possible late Republican phase, niches were included in the walls of two of the largest rooms (R4, R10), away from the entrances and more likely to be bathing rooms than *apodyteria*. At *Ferentum* [La.03], two rooms were equipped with benches (R11, R20), the latter of which was probably the *tepidarium* of the baths, and in the 2nd phase of the South Baths of *Velia* [Ca.09], there were benches in the *caldarium.* Only the baths of *Attidium* [Ma.03] had an *apodyterium* that can securely be identified by its infrastructures, as it was equipped with benches with niches (fig. 10).

These architectonic characteristics, however, were not always built-up, and benches and storage spaces could have been movable furniture pieces made of wood, stone or metal, no longer visible because they decomposed or were robbed. When the function of the room did not translate in architectural terms, the only way to tentatively identify the *apodyterium* is by its location: close to entrance—but if possible not the first room entered by the bathers—and potentially on the way to the bathing rooms. This identification method is obviously not perfect, and for many baths it is not possible to securely identify an *apodyterium*: at *Cumae* (Forum Baths [Ca.02]), *Lucus Feroniae* (Forum Baths [La.06]), *Sentinum* (Extraurban Baths [Ma.07]), *Teate Marrucinorum* [Ab.03], *Velia* (South Baths [Ca.09]), several rooms could have acted as *apodyteria*. Furthermore, based on the criteria of location only, several baths did not have a dedicated changing room (*Urvinum Hortense* [Um.02], *Faesulae* [To.02], *Gabii* [La.05]) and we must imagine that the entrance room, or another room on the bathing

circuit (the *frigidarium*, or even a heated room)[67] served for that purpose too—at *Gabii*, benches are found in the entrance corridor (R1) as well as in the *tepidarium* (R2).

Since the criterion used for their identification *is* their location, it is difficult to make relevant observations about their location without running the risk of circular reasoning. For instance, several identified changing rooms are located off the main circuit, meaning that they could be avoided if one wanted to—whereas a stop in that room was more or less compulsory (that is the case at *Cumae* Forum Baths [Ca.02], *Ferentum* [La.03], *Forum Sempronii* Small Baths [Ma.05], *Lucus Feroniae* Forum Baths [La.06], *Neapolis* Fuorigrotta [Ca.04], *Sentinum* Extraurban Baths [Ma.07], *Tadinum* [Um.G.05], *Teate Marrucinorum* [Ab.03], *Telesia*? [Ca.08], and *Velia* South Baths [Ca.09] R3). On the other hand, these rooms have been identified as *apodyteria* because they were close to the entrance, were not one of the main bathing rooms, and were *off* the main bathing path—the rooms *on* the main bathing path are usually given other functions. Only in a limited number of examples were these changing rooms securely located on the main path: *Gabii* [La.05] (because benches were located in the entrance corridor R1 and in the *tepidarium* R2), and *Paestum*'s Large Baths [Ca.06] (R3, because there were no alternatives).

The rooms identified as possible *apodyteria* in the baths of Central Italy (fig. 11) displayed little variation in shape: they were, with few exceptions, all more or less rectangular. The trapezoidal shape of *Velia*'s [Ca.09] changing room R3 was due to the shape of the plot of land, and it is interesting to note that of all rooms, it was likely the

[67] Heated *apodyteria* were uncommon but existed, for instance in the Terme di Nettuno at *Ostia* (POCCARDI 2006a, fig. 3 R11).

changing-room, not a more important room like the *frigidarium* or a heated room, whose regularity was compromised.

With one exception, no *apodyterium* was equipped with water features. Only in R11 at *Velia* (South Baths [Ca.09]) was there a small footbath with a bench (R11a); the room could be interpreted as an *apodyterium* if there was indeed an entrance from R14, but that remains hypothetical.

Some inscriptions and literary passages mentioning *apodyteria* from Italy and North Africa allude to large, richly decorated rooms, adorned with marble statues or columns.[68] This view contrasts with the *apodyteria* of the public baths of Central Italy, where none seems to have been particularly richly equipped: no traces of columns or pedestals, no architectural elaboration, only *opus spicatum* or monochrome mosaic on the floors (black-and-white at *Ferentum*), and only occasionally marble veneer on the walls. This is perhaps surprising considering that stopping in the *apodyterium* was necessary for the bathers to remove their clothes, but since it was also a room where they would only stay very temporarily, it seems also logical to see the more luxurious decoration being concentrated in the rooms where bathers would sojourn longer, like the *frigidaria*. The inscription [E36] from *Lavinium* mentioned an *apodyterium* simply adorned with stucco work—in this regard, more typical of Central Italy.

[68] Pliny (*Ep.* V.6.25): the *apodyterium* was '*laxum et hilare*'. *CIL* VIII.1295=EDCS-17701167 (*Membressa*, 2nd–3rd cent. AD): an *apodyterium* decorated with marble columns. Possibly [E14] (*Capua*, 1st cent. AD), if the columns and marble decoration indeed applied to the *apodyterium.*

TABLE 3: LIST OF (SECURELY OR HYPOTHETICALLY) IDENTIFIED CHANGING ROOMS IN THE BATHS OF CENTRAL ITALY

Bath building, room no	**Surface area (in m²)**	**Additional features**
AQUINUM [La.01]		Possible benches and shelves between the piers of R2
- R40 (W)	60	
- R2 (M)	75	
ATTIDIUM [Ma.03]		
- R3	8	Benches with triangular niches
CALES, Central Baths I [Ca.01]		
- R4?	120	Niches
- R10?	160	Niches
CUMAE, Forum Baths [Ca.02]		
- R10? (II)	48	
- R12?	75	
- R14? (II)	80	
FERENTUM [La.03]		
- I: R11 + R14	95 each	Benches in R11
- II, M: R11	95	
- II, W: R8?	23	
FORUM SEMPRONII, Small Baths [Ma.05]		
- R2? R9? R18?	25, 42, 42	
GABII [La.05]		
- R1?	23	Benches
- R2?	45	Benches
LUCUS FERONIAE, Forum Baths [La.06]		
- R5?	42	Benches
- R6?	42	Benches
NEAPOLIS Fuorigrotta [Ca.04]		
- R4? (I)	25	
- R5? (II)	12	
PAESTUM, Forum Baths [CA.05]		
- R3 (I)	108	
- R9? (II)	58	
PAESTUM, Large Baths [CA.06]		
- R3	> 55	
PISAE [To.05]		
- R6?	–	
- R16?	160	

Bath building, room no	Surface area (in m²)	Additional features
Privernum [La.08]		
- R4	23	
Rusellae, Urban Baths [To.06]		
- 13?	34	
- 3? 4?	25, 15	
Sentinum, Extraurban Baths [Ma.07]		
- R1?	60	
- R2?	165	
Septempeda [Ma.09]		
- R2? R4?	13, 23	
Tadinum [Um.G.05]		
- R4?	20	Bench?
Teate Marrucinorum [Ab.03]		
- R5?	70	
- R6?	55	
Telesia, Theseus Baths [Ca.08]		
- R2?	20	
Velia, South Baths [Ca.09]		
- R3?	55	
- R11+R11a?	57 + 10	
Velia, Vignale Baths [Ca.10]		
- R1?	45	

II.2.3 Heated rooms IV: *caldaria*

The *caldarium*, also called *cella caldaria* or, especially during Late Antiquity, *cella soliaris*,[69] was the most important of all the heated rooms; it was usually located the furthest away from the entrance and was equipped with one or several immersion pools, called *alvei* or *solia*. It could also be equipped with a water basin, the *labrum*, sometimes located in a *schola labri*, often an apsidal recess within the *caldarium*.[70]

[69] On terminology, see Delaine 1987 (*cella soliaris*); Rebuffat 1991, 2; Nielsen 1993, 156–157.
[70] See Nielsen 1993, 157 for the literary and epigraphical evidence on *solium* and *alveus*, 158 for *labrum*.

Bouet showed the variety of shapes of *caldaria* of the imperial period, mostly a series of variations on a quadrangular room with one, two or three rectangular or apsidal pools attached to it (fig. 12). The range of shapes was narrower during the Republican period, and most *caldaria* were usually elongated rooms equipped with a *solium* and a *labrum*, which could be arranged in different places in the room (fig. 12). These *caldaria* are known from the late 2nd cent. BC (e.g. *Vulci*, House of the Cryptoporticus)[71] and continued being used in the early imperial period (*Pompeii*, Stabian Baths),[72] but they seem to have fallen out of favour soon afterwards as they do not appear in the baths of the catalogue.

The main characteristic of these late-Republican/early-imperial *caldaria* seemed however to have been, more than a specific shape, an emphasis on the *labrum* as much as on the immersion pool (both described in detail by Vitruvius V.10.4); the *labrum* was placed in a large, dedicated recess, which allowed bathers to spray themselves with the water it contained (cleaning with a strigil was done at that stage of the bathing process). Only one bath building from the catalogue was equipped with a room where a similar emphasis was given to the *labrum*, at *Castellum Amerinum* [La.G.9] (R2), but the room function was identified as a *tepidarium* with possible use as *apodyterium*. The shape of the room with the *labrum* does not correspond to any of the shapes of the types explained just before, but the insertion of the baths in a small *insula*, with their back against a small hill to the SE, may have constrained their shape. One of the two baths discovered in the excavations of the harbour of *Neapolis* (Northern Harbour

[71] CAVOLI 1985, 64–70.
[72] TRÜMPER 2017, 266.

Baths [Ca.G.14–15]) seem to have had a *caldarium* of a similar type, with the *labrum* placed in an apsidal *schola labri*.

The typical imperial-period *caldarium* focused more on the immersion pools than on the *labrum*, with the latter being relegated to a smaller niche of the *caldarium* or even to a different room (often called '*destrictarium*'); for Poccardi, this architectural change reflected a change in the practice of bathing and occurred in the 1st cent. AD.[73]

This focus on the immersion pools is clearly visible in *caldaria* of the baths of Central Italy (table 4). One *caldarium* model seems to have been particularly popular: a rectangular room with two lateral rectangular pools along the short sides and an axial apse, which we will call the 'triptych' model or blueprint from now on.[74] This model appeared in no less than 13 public baths (and twice at *Velia*), and was also used for private baths (fig. 13–14). The axial apse, if it was deep enough, could have contained a pool, whereas others could be fitted with a *labrum*. In some cases, the apse was very shallow and, if it contained a *labrum*, the latter encroached upon the surface area of the room. This apse could be reminiscent of the *schola labri* of the 'Republican'-type *caldarium*,[75] but it is also likely that the fondness for architectural diversity, already seen in *frigidaria* equipped with both curvilinear and rectangular pools, may explain the presence of this recess that animated the wall. The *caldaria* that followed this model varied in size from 22 m² to 75 m², but the percentage of the surface area of the room occupied by the pools remained admirably stable, oscillating between 30–35% (with two outliers at 58% and 23%);[76] it is worth noticing that this last figure is

[73] POCCARDI 2006b, 81–83. E.g. *Pompeii*, Central Baths.
[74] It corresponds to Bouet type 2a (2003, 51–52).
[75] POCCARDI 2006b, 82.
[76] The smaller figure is that of the baths of *Neapolis* Vico Carminiello, which is also the smallest *caldarium* of the group at 22 m²; the pools are hypothetical, and considering its small dimensions and the fact

that of the baths of Vignale at *Velia* [Ca.10] in their 2nd phase, which saw the construction of a second *caldarium* (R6) in addition to that of phase I (R5), with the almost same shape but larger. We also see that there was some flexibility in the way the 'triptych' model was used: the *caldarium* of the baths of *Neapolis* Fuorigrotta [Ca.04] (R13) followed that blueprint, but the apsidal recess instead served as an entranceway into the room. The shape of the room suggests there might have been a second pool against the S wall, and in that case the percentage of the surface area of the room occupied by pools would be around 36%, in line with all the other *caldaria* following that model. The *caldarium* could not have been placed the other way around, with the apse facing away from the entrance, as it would have encroached upon a road. On some rare occasions, we find that shape used for another room, such as the *tepidarium* at *Minturnae* (R3) [La.07], which probably did not contain pools. As at *Neapolis* Fuorigrotta, the apsidal recess was used as a passageway towards further rooms to the E.

We have seen, with the example of *Neapolis* Fuorigrotta [Ca.04] and possibly *Minturnae* [La.07], that the topographic conditions could force the 'triptych' blueprint to be rotated, with the entrance through the apse and a straight wall on the opposite side. Could we equally consider that adaptations of the model could go further, and the apse entirely removed if it could not be fitted in any of the two long sides? The *caldarium* of the baths at *Gabii* [La.05] (R4) was equipped with two lateral rectangular pools but without an apse, and it might be considered that it derived from the same blueprint, with the limited space available in the *insula* making it necessary to remove the apse as it would otherwise have encroached upon a secondary road or would have

that they are measured on a plan, small variations of measurements may impact significantly the resultant figures.

forced the previous heated room in the circuit (R3) to deal with the back wall of the apse, reducing its dimensions and creating an unpractical (and unattested) shape.[77] The ratio of pools:room at *Gabii* was 39%, very close to the other *caldaria* of the same model, and had it been equipped with an apse, the ratio would have been closer to 34–35%, perfectly in line with them.

Another potential reason leading to the disappearance of the apse, on top of topographic conditions, is that it was simply deemed no longer necessary for the activities that took place in the room. Supporting this argument are the apses of the *caldaria* of *Neapolis* Fuorigrotta [Ca.04] and *Minturnae* [La.07], which serve no functional purpose, and both builders and bathers could have certainly done without it. If the apse of the *caldarium* (R7) of the Theseus Baths of *Telesia* [Ca.08] indeed initially contained a *labrum* which was later removed to make space for an immersion pool, then this example could further support the theory of the end of the usefulness of the *labrum* in *caldaria*. Considering this, is it possible that rectangular rooms with two lateral pools along the short sides are nothing but a variation on the same model? Its virtual absence from the baths of Central Italy, with examples only at *Ostia*, *Gabii* [La.05] and possibly *Saturnia* [To.G.09],[78] would certainly demonstrate that if it was a blueprint, it did not achieve popularity, and if it was an adaptation of the model with apse, the apse was preferred.[79]

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[77] The *caldarium* at *Gabii* also had to be located where it is to benefit from a SE orientation. Further evidence of this limited availability of space is the fact that to create a service area with the *praefurnia* to heat the baths, a section of the portico of the main road was blocked off.

[78] The *caldarium* of the baths at *Saturnia* present an additional difference: a curved back wall for one of the pools.

[79] This is Bouet's type 9a1 (2003, 74–77), which did not achieve great success according to the author. He indicated two baths for *Ostia*, the Terme del Faro and the Terme del bagnino Buticosus. On the plan of the former, there is a tiny semi-circular niche in one of the long walls, so it could have easily fitted in his type 2a. For the latter *caldarium*, there was, like at *Gabii*, a road passing at its back, which may

The repetition of this 'triptych' model for *caldaria* in no less than 14 examples pushes me to argue that this is an example of a blueprint that circulated amongst bath builders and architects, and achieved a great degree of popularity in Central Italy.[80] Its applications on the ground varied in absolute size but remained proportional to the size of the bath building, and they were marked by a strong axiality.

No other plan seems to have had as much success as the 'triptych' blueprint. In all the other *caldaria* with two pools, the pools were perpendicular to each other—a 'Γ-*caldarium*' (fig. 14, group II);[81] most were rectangular with the occasional apsidal one, but never with two apsidal. The pools were usually centred on the side they occupied, but circumstances could push them to one side (*Velia* South Baths [Ca.09], R8b; *Lucus Feroniae* Forum Baths [La.06], R12). Was the 'Γ' *caldarium* a model as well, or was it instead the result of the wish to have two pools in the *caldarium* when the available space was limited? The 'triptych' model was characterised by symmetry along a main axis, whereas unless exceptionally, it was not the case for this model. To a certain extent, the 'Γ' *caldarium* was similar to the 'triptych' one, with one of the pools being rotated 90° and fitted along one of the other sides. It had the advantage of allowing communication with two adjacent rooms, when the 'triptych' one, because of its axis of symmetry, could usually be accessed from only one room—in terms of paths, the model 'Γ' *caldarium* allowed for a circular path (without entailing a systematic correlation), whereas the 'triptych' one virtually always required a retrograde path.

have made it impractical to add an apse. Poccardi (POCCARDI 2006b, 85–86) added a couple of Ostian examples to Bouet's type 9a1: the *tepidarium* of the Terme di Nettuno and the *caldaria* of the Terme dei Sette Sapienti (in phase II) and of the Terme in via di Iside.

[80] Additional examples are known from *Ostia*: Terme del Nuotatore (with back walls slightly curved) and Terme del Mitra.

[81] This caldarium type will be referred to as the 'gamma' (or Γ) *caldarium*, as the perpendicular arrangement of the pools approximates a gamma (or a L) on plan.

This perpendicular arrangement, if it was indeed an adaptation of the 'triptych' model, was by no means considered less appealing than the latter as it was found in elite baths such as the Small Baths of Hadrian's Villa, in which every room was carefully designed to have a shape different from the next. The main difference between the 'triptych' and the 'Γ' *caldaria* is the percentage of the surface area occupied by pools: if it was consistently between 30–35% for the former, the range is larger for the latter, with values oscillating between 26–40% (with *Teate Marrucinorum* [Ab.03], as outlier at 20%, possibly explained by questions of water supply).[82]

Few *caldaria* were equipped with three pools (Group III), and no prevalent model is discernible. At *Cumae* (Forum Baths [Ca.02]), the *caldarium* was square and equipped with three rectangular pools that occupied the whole length of the three sides, leaving the side of the entrance free.

There were several advantages in having more than one pool of hot water: one of the pools could remain in service if the other(s) had to be maintained; keeping two smaller pools at the right temperature may have required less energy, since they could both be equipped with a *testudo*; the surface for the bathers was greater, since they would use the perimeter of the pool to recline against; they could contain water at different temperatures (e.g. in the Forum Baths of *Cumae* [Ca.02], where two pools were equipped with *testudines* and the third one was not). These reasons may account for the fact that so few of the *caldaria* of the baths of the imperial-period in Central Italy had only one pool.

[82] The baths at *Teate* were possibly supplied exclusively by ground and spring water, see IV.1.4. The only pool preserved of the *frigidarium* is also of notably small dimensions compared to the size of the room.

This overview of the *caldaria* of the baths of Central Italy suggests that *caldaria* often follow a predetermined model, a blueprint, that architects or builders could choose from a book of blueprints, the same way mosaicists could choose from a book of mosaic patterns when creating a floor. Some blueprints seemed particularly popular in the imperial period in Central Italy, such as the 'triptych' *caldarium* described above. The *caldarium* also appears to be the type of room for which blueprints were most often used. A possible reason for this may have been that the technical difficulties created by the need to have heat and water (and ideally several pools), were more easily and effectively solved by resorting to a pre-existing model.

Caldaria were sometimes architecturally modified, but the changes brought to them differed: in the Forum Baths of *Paestum* [Ca.05], one of the pools was decommissioned; at *Forum Sempronii* (Small Baths [Ma.05]), both men and women's *caldaria* were enlarged, possibly for the addition of a pool; at *Velia* (South Baths [Ca.09]), both pools were reduced in surface area and turned into individual immersion tubs. This latter type of change reflected the well-known shift in later periods from communal immersion to individual immersion.

TABLE 4: LIST OF (SECURELY OR HYPOTHETICALLY) IDENTIFIED *CALDARIA* IN THE BATHS OF CENTRAL ITALY

Legend: col. 4: imm=immersion; bas=basin; col. 5: SA=Surface Area; col. 8: BA=Bathing Area

SITE, baths	**Cat. no**	**Room no**	**No. pools**	**Total SA (m²)**	**of which pools**	**Pools as % of *caldarium***
ALBA FUCENS	[Ab.01]	R2	2	100	≈ 25?	25%
ANCONA P.za Stracca	[Ma.02]	R1	1/2	34	12	35%
AQUINUM M	[La.01]	R22	2imm 2bas	195	35	18%
AQUINUM W	[La.01]	R24	2imm 1bas	100	35	35%
CUMAE Forum B.	[Ca.02]	R3	3	82	27	33%
FAESULAE	[To.02]	R8	2	100	25	25%
FERENTUM	[La.03]	R24	2?	100	30	30%
FORMIA, P.za Sta Teresa	[La.G.12]	–	2?	50	–	–
FORUM SEMPRONII, Small Baths, M	[Ma.05]	R8	1–2?	23	≈ 8	35%
FORUM SEMPRONII, Small Baths, W	[Ma.05]	R14	1–2?	9.5	≈ 3.6	38%
FORUM SEMPRONII, Large B.	[Ma.04]	R1?	2?	80?	–	–
FRUSINO	[La.04]	R2	2?	40	14	35%
GABII	[La.05]	R4	2	62	24	39%
IUVANUM	[Ab.G.07]	R1	2/3?	66	20?	30%
LAVINIUM	[La.G.13]	R1	2/3	50	16.5 / 23.5	33% 47%
LUCUS FERONIAE, Forum Baths	[La.06]	R12, R13?	1/2?	75/ 100	15/40	20/ 40%
MINTURNAE	[La.07]	R4	2–3?	105	–	–
MISENUM	[Ca.03]	R1	1–2?	115?	40?	35%
NEAPOLIS Fuorigrotta	[Ca.04]	R13	1 or 2	32	6 (1) 11.5 (2)	19% 36%
NEAPOLIS Vico Carminiello	[Ca.G.17]	R125 ?	2 or 3	21.5	8 or 12.5	37% or 58%
PAESTUM Forum Baths I	[Ca.05]	R4	1	75	26.5	35%
PAESTUM Forum Baths II	[Ca.05]	R1	2	60	10	17%
PAESTUM Large Baths II	[Ca.06]	R13	1–2? 1bas?	70	8 (1) 19 (2)	11% 27%

SITE, baths	Cat. no	Room no	No. pools	Total SA (m²)	of which pools	Pools as % of *caldarium*
PAESTUM Large Baths III	[Ca.06]	R7	2	65.5	19	29%
PRIVERNUM Ia	[La.08]	R12	2	24	7	26%
RUSELLAE, Urban Baths	[To.06]	R11	2	58	22	38%
SAEPINUM, *Decumanus* B.	[Mo.02]	R2	2?	20	7	35%
SATURNIA	[To.G.09]	R1	2	40	15	38%
SENTINUM, Extraurban Baths	[Ma.07]	R17	1–2?	≥ 140	≥ 19 (1) ≥ 40 (2)	14% 29%
SEPTEMPEDA	[Ma.09]	R8	2 1bas	40	12	30%
TADINUM	[Um.G.05]	R1	1–2? 3? 1bas?	≥ 58	11 (?2)	19%
TEATE MARRUCINORUM	[Ab.03]	R11	2	125	25	20%
TELESIA Theseus B.	[Ca.08]	R7	1–2?	180	43	24%
URVINUM HORTENSE	[Um.02]	R5	2 1bas?	72	22	31%
VADA VOLATERRANA, Large Baths	[To.07]	R7	1–2?	60	15	25%
VELIA, South Baths	[Ca.09]	R8	2	90	28	31%
VELIA, Vignale B. I	[Ca.10]	R5	2	43	14	33%
VELIA, Vignale B. II	[Ca.10]	R6	2	70	16	23%
VELIA, Vignale B. III	[Ca.10]	R11	2	20	7.5	38%

II.2.4 Cold rooms: *frigidaria*

The main cold room of the baths, traditionally named *frigidarium*,[83] usually contained one or several cold-water pools for immersion, called *baptisteria*, *piscinae* or *natationes*.

Although this room was central in imperial-period baths, it was not part of the standard set of rooms of Republican-period baths: there was none in the Stabian Baths

[83] On terminology, see NIELSEN 1993, 153–154; THÉBERT 2003, 390–394.

of *Pompeii* or the Forum Baths of *Herculaneum* until the round *laconicum* was transformed into a cold-water immersion pool. Even then, the room was closer to a small immersion pool than a large space fitted with pools, as we can see in larger imperial baths in Rome. According to the literary tradition, the practice of immersing oneself in cold water became popular after the physician Antonius Musa cured Augustus in 23 BC using this method.[84] But it is more likely that cold-water immersion was practiced before and that the story only popularised it further; this, in turn, might have contributed to the popularity of the *frigidarium* in imperial-period bath buildings.

In imperial-period baths, the *frigidarium* takes a central place, in several aspects. It became one of the largest and most decorated rooms, and acted as a distribution space. Its importance was also visible in its location, usually close to the entrance space, in connection with it and/or the changing room, this despite being one of the last rooms to be used in the bathing process: bathers would immerse themselves in cold water, in order to provoke a healthy thermal shock, only after having sojourned in the heated rooms, but they would have had to go through the *frigidarium* in order to reach the heated rooms.

This emphasis on the *frigidarium* is clearly visible in the baths of Central Italy (table 5), not only in the imperial-type baths of *Puteoli* and *Castra Albana* which stuck closely to imperial models where the *frigidarium* was an essential room, but also in the average municipal bath buildings. The *frigidarium* was usually the largest room in the building, second in size only to the *palaestra* or to an open-air courtyard should the complex be equipped with one (*Aquinum* [La.01], *Faesulae* [To.02], *Ferentum* [La.03], *Sentinum* Extraurban Baths [Ma.07], *Tadinum* [Um.G.05], *Urvinum Hortense* [Um.02];

[84] Plin. *HN* 29.10; Suet. *Aug.* 81; Cass. Dio 53.30; FAGAN 1999a, 86, note 8.

only the baths of *Teate Marrucinorum* [Ab.03] break apart from this rule, with a *frigidarium* (R12) smaller than both hall R2 and vestibule R5). It could act as a distribution space (*Ferentum* [La.03], *Lucus Feroniae* Forum Baths [La.06]), and was the room around which the semi-symmetrical bath buildings were conceived (*Ferentum*, *Florentia* Capitoline Baths [To.03], *Sentinum* Extraurban Baths [Ma.07]). It could sometimes be placed in a prominent position, attracting the gaze as one entered the bath building (*Cumae* Forum Baths [Ca.02], *Ferentum*, *Neapolis* Fuorigrotta [Ca.04]). Finally, in some bath buildings, it was planned alongside an entrance vestibule, in which case all the functions and aspects mentioned previously were taken over by the combination vestibule-*frigidarium* (*Cumae* Forum Baths, *Neapolis* Fuorigrotta).

In terms of shapes (fig. 15–16), most *frigidaria* took the form of a simple, square or rectangular room to which one or two pools were attached, either rectangular or semi-circular. In its simplest form, the *frigidarium* was rectangular and the pool occupied one of the short sides (fig. 15, group Ia), with little architectonic elaboration (niches in the walls of the pool at *Rusellae* [To.06]). Instead of being part of the room, the pool could also be attached to the room (fig. 15, group Ib), which translated in plan by the pool being an outer extension of the room (*Paestum* Forum Baths I R4 [Ca.05], *Lucus Feroniae* Forum Baths R3 [La.06], *Urvinum Hortense* R2 [Um.02], *Tadinum* I R7 [Um.G.05]).

The Urban Baths of *Sentinum* [Ma.08] and the baths at *Septempeda* [Ma.09] stand aside by the absence of an easily recognizable *frigidarium* (fig. 15, group Ic); instead, one of the first accessible rooms was a large open-air porticoed courtyard, with a pool occupying part of the open-air surface area (*Sentinum*, R6; *Septempeda*, R1). The example from *Septempeda* was actually closer to a *palaestra*, with significant space for

physical exercise (ca. 12 x 10 m), whereas at *Sentinum* the pool occupied most of the space, leaving only a 3.5 m wide ambulatory all around. We see here a couple of bath buildings without dedicated *frigidarium* but equipped with a *natatio*, which possibly took over the functions of *frigidarium*. Two examples are too few to talk about a regional specificity, but it is worth noticing that these two baths were located in the same area (35 km apart as the crow flies).

Most *frigidaria* with two pools (fig. 15, group II) were square or rectangular, and the pools could be rectangular, semi-circular, or have a segmental back wall. They could be placed opposite one another (fig. 15, group IIa), or perpendicular to each other (fig. 15, group IIb). Whether they occupied the whole length of the wall (*Cumae* Forum Baths [Ca.02], *Velia* South Baths R4b [Ca.09]) or only part of it, they were generally centred on that wall, with a few exceptions (e.g. *Velia* South Baths, where pool R4c was pushed westwards to make space for R10 and R3, or *Telesia* [Ca.08], where pool R1c was offset to the east, in both cases because a side of the baths adapted to the course of streets running alongside the building).

Amongst the *frigidaria* with two pools, one model seems to have been more popular than others (fig. 16, group IIc); it consisted in a square room with two protruding rectangular pools facing each other at the centre of the lateral walls. This description could correspond to many *frigidaria*, but to that must be added four small rooms, one on each side of the pools, resulting in what looked like an architectural blueprint repeated in several bath buildings. Without taking into account the openings, whose location could vary, this model had in theory two axes of symmetry, like the *frigidaria* of the imperial-type baths. The clearest examples of this model, which we shall call the 'block'-*frigidarium*, were found at *Sentinum* (Extraurban Baths

[Ma.07]), *Ferentum* [La.03] and *Neapolis* (Fuorigrotta I [Ca.04]). These three examples illustrate the different scales at which these models could be adapted to proportionately fit in the bath complex (the *frigidarium* at *Sentinum* was more than four times larger than the one of *Neapolis*), and how the placement of doors and passages could vary: at *Sentinum*, R3 and R5 were not accessible from the central room R4, and R10 and R12 were larger than R3 and R5 and broke one of the axes of symmetry. There was also flexibility in the proportions, with width:length ratios ranging from 1:1.15 to 1:1.6.

If this was indeed an architectural model that was adaptable by changing its ratio, its dimensions or the passageways that led to and from it, to what extent did other, similar *frigidaria* stem from it and were modified further? The *frigidarium* of the South Baths of *Velia* [Ca.09] could potentially have followed the same model, where only half of it had been used (rooms R4, R4a, R5, R9). Because of the topography of the site, the *frigidarium* could not be placed in a central position like in *Sentinum*, *Ferentum* and *Neapolis*; in turn, this off-centre position could have required pushing pool R4c further W (to leave room for passage R10 and room R11), and creating a pool in R4b instead of in R4a where it would have had restricted dimensions. The poorly preserved Capitoline Baths of *Florentia* [To.03] could belong to that series too, despite some significant differences such as the absence of the corner rooms, replaced by passages or taken over by other rooms. However, if pushing this logic further leads us to assume that a square *frigidarium* with two opposed rectangular pools stems from that initial model, where do we draw the line between 'adaptions of a blueprint' and 'variations around a simple shape, that of a quadrangular room with a pool opening off of it'? The *frigidarium* of the baths of *Telesia* [Ca.08] could be said to follow the same model too,

without corner rooms, and with pool R1c having an irregular shape and being off-centre because of the proximity of the road. The question of the origin of the plan of these rooms remains open, but it is interesting to note that two of the clear examples where the *frigidarium* does indeed seem to follow the 'block-*frigidarium*' model, at *Sentinum* [Ma.07] and *Ferentum* [La.03], were also two buildings where the cold section is entirely symmetrical (the so-called 'semi-symmetrical' type), which required more planning than asymmetrical baths.

Virtually no *frigidarium* was equipped with more than two pools. The only example of such an arrangement could be that of *Teate Marrucinorum* [Ab.03] (fig. 16, group III), which presented an original plan: a square room with horseshoe-shaped apses in some or all of the corners, at least one of which contained a pool. The state of preservation is however very limited, and it is possible that the *frigidarium* was equipped with only one corner pool; there was perhaps another pool further to the S, as was the case in the other examples of *frigidarium* with that specific shape, for instance in Rome (Stazione Termini Baths), Athens (Olympieion Baths) or *Bulla Regia* (Small Baths) (fig. 17).

In terms of the evolution of the room over time (fig. 16, group IV), the most common modification was the addition of a second immersion pool to some *frigidaria* that only had one. At *Aquinum* [La.01] and *Paestum* (Forum Baths [Ca.05]), rectangular pools were added to the *frigidarium*, whereas at *Tadinum* [Um.G.05] and *Paestum* (Large Baths [Ca.06]), the addition was a curvilinear pool. The addition of pools may reflect an increase in the availability of water, in the frequentation of the baths (where the number of facilities was increased to cater for more customers contemporaneously), but most interestingly, the diversity of shapes seems to be of utmost importance too:

based on these examples, the pool added later was often of a different shape than the pool already existing (this was the case in both baths of *Paestum* and at *Tadinum*). A confirmation of this search for diversity of shapes may be found in the baths of *Neapolis* Fuorigrotta [Ca.04], initially equipped with two rectangular pools, one of which (R6a) was turned in phase II into a semi-circular pool. Other explanations, such as changes in the water supply,[85] may exist for this transformation, but the search for a diversification of shape remains the most likely explanation.

This appreciation for diverse shapes was also visible in initial projects: the baths at *Cumae* [Ca.02], *Velia* (South Baths [Ca.09]) and possibly *Privernum* [La.08] were equipped with a curvilinear and a rectangular pool from their first phase. A majority of the pools were rectangular (3:1), and no bath of the catalogue was equipped with exclusively segmental pools. A preference for curvilinear features progressively became more prominent, as visible in the Vallebuona Baths at *Volaterrae* (AD 250–350), whose *frigidarium* was equipped with two segmental pools (and the *caldarium* with two segmental pools out of three).[86]

As mentioned earlier, many of these rooms had a very simple plan, square or rectangular, and pools seemed affixed to them without a rational underlying plan. If there was indeed no such overall plan, it would mean that even though the room and its components were all planned at the same time (along with the whole building), they were only the sum of their parts, not more—by this I mean that the bath building was composed of individual rooms and subsidiaries affixed together and not obeying

[85] The change of shape of the pool reduced its surface area by 35–50%, reducing the volume of water needed to fill the pool. However, another possible change of this phase is that the baths started being supplied by an aqueduct, presumably making *more* water available, not less.

[86] CORVO 2000, 67, fig. 3.16, see II.2.3.

a grand design. This is a different concept to the room and the pool(s) being planned altogether, as a unit—even though this planning method also existed, as demonstrated by the *frigidaria* of group IIa. The flexibility granted by this organic composition is visible in later modifications: additional pools could easily be added to those rooms, whereas rooms that followed a blueprint were less easily adaptable and modifiable, possibly because they made a more rational use of spaces, placing the more important rooms such as the *frigidarium* as the centre of the building.

TABLE 5: LIST OF (SECURELY OR HYPOTHETICALLY) IDENTIFIED *FRIGIDARIA* IN THE BATHS OF CENTRAL ITALY

SITE, baths	**Cat. no**	**Room no.**	**No. pools**	**Total SA… (m²)**	**…of which pools**
ANCONA, Amphitheatre B.	[Ma.01]	R7	1+	125?	20
AQUINUM (M)	[La.01]	R11	2	300	80
AQUINUM (W)	[La.01]	R13	2	175	60
ATELLA	[Ca.G.11]	R1	2	–	–
CUMAE, Forum Baths	[Ca.02]	R8	2	130	48
FAESULAE	[To.02]	R6	1	210	55
FERENTUM	[La.03]	R9	2	135	35
FLORENTIA, Capitoline B.	[To.03]	R3	3	130	30
FLORENTIA, P.za Signoria	[To.04]	R2	3	680	140
FORUM SEMPRONII, Small B.	[Ma.05]	R10	2	93	17
FRUSINO	[La.04]	R10	1?	35?	10?
LUCUS FERONIAE, Forum B.	[La.06]	R3	1	120	20
MINTURNAE	[La.07]	R6	1	–	20
NEAPOLIS Fuorigrotta	[Ca.04]	R6	2	75	23
PAESTUM, Forum B. I	[Ca.05]	R4	1	115	21
PAESTUM, Forum B. II	[Ca.05]	R4	2	140	45
PAESTUM, Large B. I	[Ca.06]	R6	1	77	30
PAESTUM, Large B. II–III	[Ca.06]	R6	2	90	43
PRIVERNUM	[La.08]	R7	2	57	17
RUSELLAE	[To.06]	R6	1	85	19

SITE, baths	Cat. no	Room no.	No. pools	Total SA… (m^2)	…of which pools
SAEPINUM, *Decumanus* B.	[Mo.02]	R5	1	22	8
SENTINUM, Extraurban B.	[Ma.07]	R4	2	250	75
SENTINUM, Urban B.	[Ma.08]	R7?	1	470	90
SEPTEMPEDA	[Ma.09]	R1	1	350	30
TADINUM I	[Um.G.05]	R7	1	53	6
TADINUM II	[Um.G.05]	R6–R7	2	120	22
TEATE MARRUCINORUM	[Ab.03]	R12?	1+	?185	> 12
TELESIA, Theseus B. I	[Ca.08]	R1	2	260	70
TELESIA, Theseus B. II	[Ca.08]	R1	1	240	45
URVINUM HORTENSE	[Um.02]	R2	1	84	12
VADA VOLATERRANA, Large B.	[To.07]	R2/3	2?	190	60
VELIA, South Baths	[Ca.09]	R4	2	120	33
VELIA, Vignale Baths II	[Ca.10]	R3	2	60	22

II.2.5 The contribution of epigraphy

Ten inscriptions from Central Italy mention eleven different rooms from bath buildings (table 6); in most cases, the room in question was the object of a restoration. This epigraphic dossier, if compared with similar dossiers from other regions of the Empire, could potentially shed light on regional specificities, such as the prevalence of certain types of rooms in Central Italy that were not found elsewhere, or the use of specific words or expressions to refer to rooms, words that were more or less used in other regions.

TABLE 6: LIST OF BATH BUILDING ROOMS MENTIONED IN THE INSCRIPTIONS OF CENTRAL ITALY

TERM	Site (and baths, if the inscriptions was connected to a set of baths)	Reference	Dating
APODYTERIUM	*Capua*	[E16]	AD 1-70
	Lanuvium	[E36]	
CELLA CALDARIA	*Capua*	[E15]	Undated
COLIMBUM	*Interamna Lirenas*	*CIL* X.5349=LSA-2030	AD 408
CRYPTA	*Aquinum* [La.01]	[E09]	Augustan
DESTRICTARIUM	*Pompeii*, Stabian Baths	*CIL* I².1635=EDR150879	Ca. 80 BC
LACONICUM	*Pompeii*, Stabian Baths	*CIL* I².1635=EDR150879	Ca. 80 BC
LACUS	*Aletrium*	*CIL* X.5807=EDR071508	Late 2nd–early 1st cent. BC
	Forum Novum	[E27]	1st cent. AD
	Pitinum Pisaurense	[E55]	AD 50–150
PALAESTRA	*Aquinum* [La.01]	[E09]	Augustan
	Pompeii, Stabian Baths	*CIL* I².1635=EDR150879	Ca. 80 BC
PISCINA	*Pitinum Pisaurense*	[E55]	AD 50–150
	Lanuvium	[E36]	Principate/2nd cent. AD
PORTICUS	*Amiternum*	*AE* 1937.119=LSA-1788	AD 325
	Interamna Lirenas	*CIL* X.5349=LSA-2030	AD 408
	Pompeii, Stabian Baths	*CIL* I².1635=EDR150879	Ca. 80 BC
	Saepinum	*CIL* IX.6583=EDR0133724	AD 352/57
TEPIDARIUM	*Pitinum Pisaurense*	[E55]	AD 50–150

With a sample of such limited size (11 inscriptions), any conclusion drawn from it must remain hypothetical, and since only the inscriptions from *Aquinum* [La.01] and *Pompeii* are connected to architectural remains, it is not always possible to try and associate terms with specific shapes. Some interesting aspects can however still be highlighted. First, there are occurrences of most of the commonest words used in archaeological literature to name bathing rooms. There is no *frigidarium*, but *apodyterium*, *tepidarium*, *laconicum*, *destrictarium* and *cella caldaria* are all attested with

an inscription.[87] Two other interesting aspects are a multiplicity of occurrences of words referring to pools on the one hand, and to open-air courtyards and related infrastructures on the other.

Three different words (6 occurrences on 5 different inscriptions) refer to pools: *lacus, piscina* and *colimbum*.[88] These words were probably not mere synonyms—that is made clear by the inscription from *Pitinum Pisaurense* that mentioned a patron who *[la]cus piscinamque fecit*—[89]and formal differences must have existed. For Nielsen, *colimbum* was synonym with *piscina* and *natatio*, but the etymology of the word indicates that it was intended for diving, and it is conceivable that it was deeper than the other pools.[90] Pools with a depth of 0.80–1.20 m were probably not suitable for diving and do not qualify as *colimbum,* whereas it might have been the case for pools deeper than 1.50 m; this could hypothetically give a function to the unusually deep pool R8a at *Rusellae* [To.06]. The *colimbum* at *Interamna Lirenas* might have been an open-air pool, as it was surrounded by porticoes built contemporaneously.

The second noteworthy aspect is the many occurrences of words referring to open-air courtyards and related infrastructures: *palaestra* (two occurrences), *porticus* (four) and *crypta* (one). These covered different realities: in the most common sense, *palaestra* was an open-air courtyard for physical exercise, and *porticus* was the colonnade that ran around the *palaestra*. *Crypta* was virtually never used in thermal contexts: it is known only through one other inscription from the Hadrianic Baths of

[87] The modern popularity of these terms to describe bathing rooms is usually attributed to the descriptions ancient authors make of bathing rooms, but could also arguably be attributed to specific inscriptions, in particular the one from the Stabian Baths of *Pompeii*, which contributed to the posterity of the words *destrictarium* and *laconicum*.

[88] See NIELSEN 1993, 154–155.

[89] A similar distinction appears in Ausonius (*Mos*. 337–344).

[90] FAGAN 1999a, cat. 118.

Lepcis Magna, where it has been connected to the covered gallery around the *frigidarium*.[91] In the inscriptions too, both *porticus* and *crypta* were connected to a *palaestra*, as they were sometimes offered alongside the latter: at *Aquinum*, *crypta(m) palaest(ram)*, at *Pompeii*, *porticus et palaestr(am)*. The inscription mentioning a *crypta* comes from the baths of *Aquinum*, where no underground room or gallery has been found, and the current suggestion is that the *crypta* was a covered corridor running around the *palaestra*;[92] in that latter case, one is entitled to wonder in how far this would have been different from *porticus*.

Does this epigraphic dossier, despite its limited size, reveal Central Italian specificities? It certainly seems so, even if it is difficult to draw conclusions from them. There are three occurrences of the word *lacus* in clear thermal contexts, whereas there are only two other inscriptions answering these criteria for the rest of the Empire.[93] The Central Italian dossier also contains one of the only two occurrences of c*olimbum*,[94] and one of the two occurrences of *crypta*, in a thermal context. Is this specificity due only to the survival rate of inscriptions, to a larger number of public baths than elsewhere, to the epigraphic tradition being stronger in Italy than elsewhere, or does it actually mean that the names of the rooms in Italian baths, and possibly their shapes, were different than elsewhere?

It is worth asking the question of who decided on the wording of the inscription. Was it the patron who paid for the inscription, the architect, or the builders? The bath-related vocabulary used by these different categories of people was probably not the

[91] *IRT* 396=FAGAN 1999a, cat. 90. DI VITA-ÉVRARD 1991. The inscription is restored: [*c*]*ry*/[*pta*].
[92] CERAUDO *et al.* 2017.
[93] EDCS–14300127. Search made on EAGLE database with *lacus* keyword.
[94] An inscription from *Rhodiapolis* mentions a κολύ]νβου (*IGRR* 3.739=*TAM* 2.905, XIX B–D=FAGAN 1999a, cat. 311).

same, the same way their education and familiarity with bath buildings were not the same. A typical patron could be expected to build one, maybe two sets of baths, but he would probably have visited several bathing suites, both public ones and private ones when invited in the villas of other members of the elite. The choice of a room name could stem from reading ancient authors (including authors such as Vitruvius, whose book is aimed at such an audience), visiting other bath complexes and discussing with their peers. It is also likely that not every patron had a direct interest in the baths they were funding (see VI.3), and left considerations such as the names of the rooms to the architect or the builders. Architects and builders who constructed bath buildings, on the other hand, were specialised in those structures and might therefore have been responsible for the design and construction of a larger series of bath buildings, and could have used names dictated by custom.

II.3 Decoration

The decoration of bath buildings, not considered in depth in this research, could further support the idea of the use of blueprints for rooms and of standardised yet adaptable room modules. Focusing on floor decoration, more often preserved than parietal decoration, the following picture emerges: for bathing areas, mosaic floors were most commonly used, while floors made of marble slabs occurred regularly in pools and basins. The mosaic floors could be as simple as monochrome white, sometimes framed by a black or coloured stripe; geometric patterns were used occasionally.[95] When it comes to figurative motives, however, we see a handful of themes used over and over again, above all marine themes, with figures of Neptune, tritons, Nereids, fish, and sea creatures and monsters (horses, bulls, panthers, lions, griffins, deer etc.) in a variety of shapes;[96] less common were motifs of athletes[97] or Nilotic scenes.[98] The existence of blueprints for mosaics is well-known, and concerned individual figures more than entire scenes.[99] In a way, the use of blueprints of individual figures for mosaic floors is comparable to blueprints of individual rooms in bath buildings: blueprints proposed standard shapes for a room or a figure, while at the same time offering the possibility for the individual components of the room or figure to be altered individually. This is very clear in the way some sea creatures are represented in mosaic: an example from the Neptune Baths of *Ostia* depicted a sea-goat and a sea-donkey with an identical body and tail, the only difference being in the

[95] Elaborate geometric patterns: *Velia* South Baths [Ca.11].
[96] Marine themes: *Aquinum* [La.01], *Pisaurum* [Ma.G.27] [Ma.G.28], *Sentinum* [Ma.G.32], *Velia* South Baths [Ca.11], *Falerio Picenus* [Ma.G.11], *Histonium* [Ab.02].
[97] Athletes: *Gabii* [La.05] (charioteers).
[98] Nilotic: *Aquinum* [La.01] (in latrine R10, along with a hippopotamus on the threshold between R16 and R22).
[99] BECATTI 1965, 22.

ears and horns, to represent different animals, and in the elongation of the body to adapt it to the available space—just like the rooms following a blueprint could have varying sizes and ratios, the openings could be located in different places, and individual elements could be altered, enlarged, removed (fig. 13, 16). The iconographic themes witnessed in bath buildings were predictable: marine scenes, the most common type of decoration, emphasised the connection with the water element in the building, and athletes strengthened the idea of physical exercise.[100] The fact that these decoration types could be composed by employing individuals units made them suitable for all room shapes and types: in rooms with a square or rectangular ratio, or in elongated corridors (fig. 18); in rooms whose centre was already occupied by a water feature or another element; in transitional rooms meant to be crossed in a single direction and in rooms meant to be used from all directions. The baths of *Neapolis* Fuorigrotta [Ca.04] perfectly illustrate this latter point: upon entering the atrium-vestibule (R3) of the baths, the bather was greeted with a central figure facing him; once they entered the *frigidarium*, they would always have a figure oriented towards them whichever activity they performed in it, be it entering from R3, bathing in R6a or R6b, or using R16 (fig. 19). This decoration choice, based on modular individual units adapting to room shapes, would also explain why the most original decoration is found in rooms with the most original plans, such as the octagonal room of the baths of *Ocriculum* ([Um.01], R1, fig. 20) or, in *Ostia*, the circular hall of the Terme dei Sette Sapienti. In the same way that there was a stock of sea-themed motifs to choose from when decorating the floors of bath buildings, there may have been a standard set of parameters that determined the type of wall decoration. Too little is left to delve further into the matter,

[100] BECATTI 1965, 22–26; GENSHEIMER 2018.

but other aspects of the question could be investigated in more depth: for instance, in several bath buildings (e.g. *Tifernum Mataurense* [Ma.10]), a preference was noted for warmer colours (red, oranges, yellows) in the heated rooms, for colder colours (blues, whites) in the cold rooms.

II.4 Design process: architects, blueprints, and modularity

II.4.1 Three design processes

The question of what was the underlying process in the creation of the different types of rooms was asked at the beginning of this section, and three different design processes have been identified: a room could be the product of an architect's mind (much in the modern understanding of a creative architect), or the application of a well-known architectural blueprint (the existence of which was demonstrated in sections II.2.3 and II.2.4, at least for the most important rooms (*caldaria* and *frigidaria*), some of which achieved notable success). The third possibility is that the room grew organically, by gluing together the various elements so that it could fill its function, but without a blueprint behind it. At this stage, the boundary between an established blueprint that was modified to adapt to local circumstances, and a layout that developed organically, can be very thin.

Bath buildings being highly functional structures, the shapes of the rooms that composed them resulted, at least in part, from answering a set of criteria linked to the expected function and use of that room. In the case of a cold room, the main criterion would have been that it was equipped with a certain number of pools to allow for immersion in cold water; additional criteria could be that it was large enough to accommodate a certain number of customers contemporaneously, and arranged in such a way that it could act as a distribution space. For the *caldarium*, the criteria would have been to have a hot atmosphere and to enable immersion in hot water. The only known representation of a bath building plan, on a mosaic found in Rome in 1872

(fig. 21), showed a series of communicating rooms with a clear bathing function; most interestingly for the argument at stake, some symbols and colours on the plan have been interpreted as referring to *praefurnia* and water supply,[101] suggesting that these more technical aspects could be worthy of being indicated on plans, and could perhaps have also been part of the blueprints. These technological criteria had to be kept in mind, whichever design process was used.

As we have seen, the boundary between modified blueprints and organic developments of room shapes was thin, but one way to reconcile them is to think of rooms as being composed of several 'modules', such as the pools, the apses, or the basins, grouped together. Blueprints could have been significantly altered by changing the modules that composed them. It seems to me that the most important rooms could be designed by following blueprints, but even those were highly flexible in their dimensions, in the location of passageways, and to a certain extent in their proportions and in the curvilinearity of the walls. For the latter point, the slight curvature of the back wall of the pool was easier to adapt or conceal in the thickness of the wall than a proper semi-circular apse. The one constant was the one that allowed the room to fulfil its function, for instance what allowed people to bathe in warm water in a warm environment for the *caldarium*. For that latter type of room, it is noticeable that the percentage of the surface area of the room occupied by pools stayed stable in the case of the 'triptych' model, with the dimensions of the room, the proportions and the passageways changing. Going back to modules and blueprints, one way of looking at them would be to see the 'triptych' *caldarium* as one of the most common blueprints in Central Italy, and the 'Γ' *caldarium* as a modification of that model with a 'pool-module'

[101] BOUET 1998, 584–585.

being shifted 90° and placed on a different side. The three-pool *caldarium* of the Forum Baths at *Cumae* [Ca.02] could be another variation, where the 'apse-module' was replaced by a 'pool-module'—a variation that became so popular that it eventually turned into a blueprint.

We have seen the existence of blueprints for the *frigidaria* and *caldaria*, and that each type of room followed different blueprints—which was to be expected because the functions fulfilled in the rooms were different. Would it therefore be possible for some blueprints typical of one room to be used in another? We have seen that the 'triptych' model, common in *caldaria*, was possibly used in the heated room R3 at *Minturnae* [La.07], but although apparently rare, this did not require much adaptation as both rooms were heated. An example from a private set of baths at Tor Paterno[102] is more interesting (fig. 22): its *caldarium* looked very much like a combination between the 'block' *frigidarium* and the 'triptych' *caldarium*.

When either a *caldarium* or a *frigidarium* followed a blueprint, did the other main room follow one too? There are a few cases where there seems to be a correlation. Both the baths of *Neapolis* Fuorigrotta [Ca.04] and *Ferentum* [La.03], whose *frigidarium* followed the 'block' model, also used a 'triptych'-blueprint for the *caldarium*. In most other cases, both rooms are not preserved well enough to ensure this, but when they are there does not seems to have been a correlation: at *Paestum* (Forum Baths [Ca.05]), the *caldarium* followed the 'triptych' blueprint whereas the *frigidarium* took an irregular shape with one apsidal pool, to which a rectangular pool was affixed in phase II—a

[102] LAURO 1998.

more modular arrangement. It is interesting to notice that it was the *caldarium* that was at the centre of the baths and that the other rooms were apparently arranged around it.

The choice of one blueprint over another could have been dictated by personal preferences and requirements of the commissioner, by the experience of the architect, by questions of price or by a current or regional fashion. Determining what was popular at a certain time would require better dating of buildings and will not be attempted here; on the other hand, a fashion would certainly be emulated by interactions between elites, at times in a spirit of competition with each other. Since those who commissioned those public urban baths were members of the elites who also had private bathing suites in their countryside villas, and who would visit each other and see each other's creations, it would be interesting to investigate the use of blueprints in private bathing suites.

If the use of blueprints was widespread, promoting the repetition of identical rooms in different complexes, how comes there are no two identical bath buildings over the whole empire? Many other factors could influence the final plan, and topographic conditions naturally came first. At the planning stage, the interaction between commissioner and 'designer' could influence the shape of the rooms, by playing with the different modules that composed them or by requiring a more original plan. Finally, modifications brought during the lifetime of the baths, for various reasons such as the adaptation of the building to the latest technological developments or to new bathing fashion, or the or to reduce the cost of the building's working by cutting its fuel or water consumption, could account for the differences between bath complexes.

II.4.2 (In)dispensable architects

Vitruvius (VI.8.9) wrote that the construction of large-scale public buildings was the result of the interaction between a commissioner, an architect and a contractor (with a team of builders behind him); he clearly distinguished their roles, with the lavishness (*magnificentia*) resulting from the financial input of the commissioner (*dominus*), the quality of the workmanship (*fabrilis subtilitas*) depending on the manager of the workforce (*officinator*), and the harmony of architectural design (*venustas proportionibus et symmetriis*) being the work of the architect (*architectus*). Consequently, since the main rooms could follow blueprints and the ancillary rooms were most often *adapted* to the available space, the *venustas proportionibus et symmetriis* was to be found more in those pre-designed rooms, less in the design of the entire complex. Furthermore, since the question of the design was already taken care of by the existence of those blueprints, it is conceivable that those bath buildings did not need an architect for their design. We should probably not put too much emphasis on the architect's genius in the creation process of individual rooms: public urban baths were, to a certain extent, a common commodity in the imperial period, with maybe three projects starting each year in Central Italy alone (see V.2.2), and not every single one of them can be expected to have been designed by a brilliant, creative architect. Even though this may very well be fortuitous, almost no names of architects of bath buildings are known, while we know of several architects responsible for the construction of theatres;[103] and the few baths-architects we know empire-wide (Apollodorus of Damascus, or a certain [---]δείξιος) were responsible for structures of the 'imperial'-type (respectively the Baths of Trajan in Rome and the baths of Kôm el-

[103] Architects responsible for the construction of theatres in Central Italy are known at *Pompeii*, *Herculaneum*, and possibly *Casinum* (SEAR 2006, 24).

Dikka near Alexandria), characterised by a huge scale and by symmetry and axiality in plan—clearly the one type of bath building that did require an architect.[104]

Instead, a contractor experienced in the construction of bath buildings and the use of bath blueprints, backed by specialised workers (in the construction of hypocausts, heating facilities, and water systems), could have sufficed to design a bath building. This specialised workforce must also have travelled from city to city to build baths, according to the necessities. This may shed a different light on the understanding of the anecdote recounted by Aulus Gellius (*NA*, 19.10.1-4): what the contractors (*fabri aedium*, not *architecti*) showed Fronto might have been a series of blueprints, or even plans based on the combination of several blueprints for individual rooms, and not necessarily entirely original creations by an architect's mind.

Furthermore, the (potential) architect's input cannot be considered independently from the will of the patron who commissioned the building. It is highly likely that the baths with the most original room shapes, such as the Small Baths of Hadrian's Villa[105] and the baths at *Thenae* (in North Africa),[106] were carefully planned by architects at the request of patrons who expressed a specific interest in having a large variety of shapes to impress guests and customers, respectively. On the other hand, commissioners did not necessarily always have a vested interest in the architectural outcome, and they might just have wanted 'a set of baths', caring little for their architectural elaboration: businessmen commissioning baths as part of a profit-driven venture were probably looking for a functional, attractive structure, whereas

[104] Cass. Dio 69.4 (Rome); *SEG* XL.1554 (Kôm el-Dikka); possibly *Olbia* (*IGR* I.854). DONDERER 1996, cat. A79, A81.
[105] MACDONALD & BOYLE 1980.
[106] KRENCKER *et al.* 1929, 224–225; YEGÜL 1992, 246–247.

benefactors (tackled in more depth in section VI.3) might have sought above all to reap the social benefits their benefaction brought them. The latter scenario (i.e. the commissioners not being interested in the architectural outcome) is to be thought of in rational economic terms, whereas the former introduces a component of individuality: depending on how much leeway a commissioner granted their architect, the outcome showed elements of the competence and inventiveness of the latter and the personal interests of the former.

III. Construction materials and techniques

Introduction

This chapter is concerned with the selection and use of building materials and techniques, and above all with the identification of the different types of material used, their origin (local or imported) and the way they were employed in the construction.[107]

Several factors played a role in determining the choice of material used in the construction of bath buildings in Central Italy: "the location of its source, the reliability and sufficiency of its supply, the feasibility of its procurement, the methods and routes of its transportation to the building site, its quality, and its cost."[108] DeLaine further stressed the critical role that the supply of building materials played in a project and pointed out that these considerations ultimately depended on a combination of local geology and topography.[109] Lancaster added to the picture: funding, tradition, nature of the workforce, level of technical knowledge, time available for the project, and exigencies of the application. The relative importance of each of these aspects varied from project to project, and each affected the others.[110]

Most construction material used in the building industry in Rome was local: during the Republican period until the early Empire, builders used the volcanic tuff coming from *Fidenae*, Grotta Oscura, Monteverde and Anio, the *Lapis Gabinus* and *Lapis Albanus* from the volcanic districts of the Monti Sabatini and Colli Albani, and the travertine from Tivoli for ashlar construction; with the development of concrete, builders used the same local stones as *caementa*, the lime came from outcroppings of the Apennine chain or from isolated peaks north and north-east of Rome, the

[107] See ch. V for materials and techniques used for the construction of heating systems.
[108] FITCHEN 1986, 49.
[109] DELAINE 1995, 555–556.
[110] LANCASTER & ULRICH 2014, 158.

pozzolane from the Colli Albani and the Monti Sabatini volcanic deposits, and the brick for the facing would be produced in *figlinae* in the Tiber valley and shipped to Rome.[111] Luxury marbles for decoration, on the other hand, were imported to Rome from all over the Empire. This is a simplified picture, but the use of local over imported material naturally made more sense from an economic point of view, considering how complex and expensive the transportation of material could be: DeLaine calculated that about a third of the cost of the construction of the Baths of Caracalla resulted from the transport of building materials.[112] This was exactly the point made by Vitruvius when he advised to make the best use of local material to avoid increasing costs (I.2.8), and when he said that were the quarries of so-called peperino near *Tarquinii* closer to Rome, the City would be built with it (II.7.4).

Therefore, determining which materials were used for the construction of the baths of Central Italy, their provenance and the way they were used, should not only inform us about the economic choices made ahead of the construction, but should also allow us to understand the rationale behind the choice of such materials. The geology and topography of Central Italy vary significantly from North to South and West to East, defined by the prominent features of the Apennine chain, which bisect the region, and the volcanic areas along the west coast, around Rome and Naples (fig. 23–24).[113] The locally available materials therefore differed from site to site and if, as was the case of Rome, a preference for local construction materials was confirmed, regional variation in the construction of bath buildings is to be expected.

[111] DeLaine 1997, 85–91; Lancaster 2005, 64; Jackson & Marra 2006.
[112] DeLaine 1997, 219–220.
[113] Lancaster & Ulrich 2014, 158–159.

On the other hand, the decision to import a specific material for a specific purpose would be interesting too. For instance, the use of volcanic lightweight scoria from *Vesuvius* in the upper parts of the vaults of the Pantheon, the Baths of Trajan and those of Caracalla,[114] denoted the know-how of the builders who used it to reduce the weight of the vaults and thus the lateral thrusts they were exerting on the walls. Similarly, the selection and use of specifically imported materials in a provincial bath complex might yield information about building traditions and techniques, trade and transportation routes, and economic choices in an area where trade was not as intense as in the capital, for economic and/or logistic reasons. The role of available trade routes and means of transportation was not negligible either, as it certainly played a major role in the selection of materials. During the Imperial period, Rome benefited from waterways such as the Tiber and the Anio rivers; such an advantageous situation was not common to all the cities of Central Italy, and many of them had to resort to land transportation or to a combination of several means of transportation.[115] A ratio of transportation costs by means of sea:river (downstream):river (upstream):road has been extrapolated, based on a fragment of Diocletian's Edict, at 1:3.9:7.7:42; although these figures would have varied according to local conditions and available technology, they do reveal the extent to which maritime transportation, when possible, was preferable over land transportation.[116] The question of the provenance of construction materials, allowing us to determine transportation routes, is therefore key to a more global understanding of the economic choices behind the construction of Roman baths.

[114] LANCASTER 2005, 62.
[115] ADAMS 2012, 231.
[116] RUSSELL 2013, 95–96.

The identification of the construction materials results from information provided in publication and direct observations on the field; no sample collection or scientific analysis was conducted. Due to the relative lack of documentation of most baths, reconstruction of the phasing of the structures proved to be a difficult task, and correlating specific materials to determined phases has not always been possible.

III.1 Construction materials

III.1.1 Ceramic building material (CBM)

Baked brick was used as a construction material in Italy from the mid-Republican period,[117] and baked terracotta tiles had been used for centuries before that; the shift to a large-scale use in Central Italy, however, did not occur before the mid-1st cent. BC.[118] The dimensions of baked bricks became standardised, based on multiples of the Roman foot (1 RF = ca. 29.6 cm), allowing for the simplification of their production, transportation and storage. Vitruvius mentioned, in the context of bath buildings, the use of square *bessales* (2/3 RF), *sesquipedales* (1.5 RF) and *bipedales* (2 RF). Despite this standardisation, imperial-period bricks in Central Italy could still have other, 'atypical' dimensions, as noted in the exedra of the Baths of Trajan.[119]

The main source of information for the provenance of specific CBM are the stamps occasionally found on them, which will be tackled below. Other type of evidence include the patterns of production and distribution of CBM, which are helpful to understand broad movement patterns but do not allow us to answer the question of the provenance of material for specific buildings. Statistical analysis of the dimensions of CBM in wall facings is of little help in the context of this research,[120] as is the question of composition of CBM in the absence of scientific analysis on specific samples.

[117] Vitruvius II.8.11; BONETTO 2015, 105–109, with bibliography.
[118] BONETTO 2015, 109.
[119] ROSSI 2015, 31.
[120] The shrinkage of bricks during firing (up to 20%, BUKOWIECKI 2010, 145), and the different ways in which same-sized bricks could be cut (ADAM 2008, 159; BUKOWIECKI 2010), make such analysis hardly comparable between buildings (e.g. BUKOWIECKI 2010 and PASQUINUCCI & MENCHELLI 1989, 67).

It has long been thought that CBM was not imported over long distances, and when it was, it was as part of a return cargo. Examples of long-distance trade of CBM, such as Italian production found in North Africa, often in bath buildings,[121] and southern Gaulish production (from Fréjus) in *Tarraconensis*,[122] have been known for some time; recently Rice, using shipwreck evidence, highlighted how these examples might be the tip of the iceberg, and that CBM was a commodity that could be traded in and of itself, with some of the cargos found on shipwrecks possibly being direct commissions.[123]

It remains that for an area rich in raw materials and with a strong CBM production industry during the imperial period (in the Tiber Valley but also in Campania), a production in Central Italy, i.e. local or regional, was probably more common[124]—all the more so when Central Italy had been the place where several CBM types were developed.[125] We should therefore look at an *a priori* local or regional provenance for CBM, with possible exceptions that could be explained by the absence of clay beds in an area where baths were built. In case CBM had to be imported, they could be purchased from established production places that manufactured the products on a continuous basis, but this scenario was valid only when there was a large enough demand that manufacturers were certain their products would be sold; away from very large centres like Rome, it is more likely that orders for CBM were put to those facilities on an on-demand basis.[126] These production facilities, whether

[121] THÉBERT 2000, 348–349; WILSON 2001a.
[122] RICO 1993.
[123] SHEPHERD 2015, 126–129; RICE 2016, 172–174, 192.
[124] LANCASTER & ULRICH 2014, 171; SCALENGHE *et al.* 2015, 204. E.g. production for *Pompeii* (DESSALES 2015) and *Florentia* (SHEPHERD *et al.* 2006).
[125] SHEPHERD 2015.
[126] DELAINE 2015. On patterns of production and supply of CBM, see V.4.

dedicated to the production of CBM or part of agricultural estates, could also produce other types of ceramic materials, such as amphora, *dolia* and *mortaria* and possibly cooking and storage wares.[127] The use of CBM in the wall facing of bath buildings, when most other buildings in town were faced differently (e.g. *Teate Marrucinorum* [Ab.03][128] or *Saepinum* [Mo.02]), certainly points in the direction of direct requests put to workshops by the builders or contractors, specifically for the construction of the baths.

The almost industrial scale of production of CBM for the city of Rome, located in the Tiber valley and reaching the Urbs via waterways, was exceptional in the production landscape of Italy.[129] Rome was the main market for the produce of those *figlinae*, but evidently the various cities along the course of the river could have benefitted from their products, as the stamps found on bricks from the baths of *Castellum Amerinum* [La.G.9], *Ocriculum* [Um.01] and *Lucus Feroniae* [La.06] make clear.[130] Further urban brickstamps were found outside of the Tiber Valley, in the baths of *Castra Albana* commissioned by Caracalla [La.02];[131] the same stamps were found on CBM in the baths of Caracalla in Rome, suggesting both a relation between these two contemporary projects in the supply of ceramic building material,[132] and that the CBM probably reached *Castra Albana* via Rome, carried down the *Via Appia.* Two further urban brickstamps of early Hadrianic date possibly came from the baths of *Puteoli*

[127] PEACOCK & WILLIAMS 1986, 41–43, 68–71 (municipal production); LAZZERETTI & PALLECCHI 2005 (urban production). Also KOMPARE 2015.
[128] COARELLI & LA REGINA 1984, 151.
[129] QUILICI 1986; STEINBY 1993, 10. This is reflected in Strabo, *Geography* V.3.7.
[130] Some of the same stamps used in the baths of *Ocriculum* and *Castellum Amerinum* were also found in Rome (Baths of Trajan) and *Ostia* (Casa degli Aurighi).
[131] The stamps were from the *figlinae Domitianae* and *Oceanae*, by that time owned by the emperor (FILIPPI & STANCO 2005, 172, 190).
[132] DELAINE 2015, 227.

[Ca.07] which, considering their dimensions and design, similar to the imperial examples of Rome, were in all likelihood an imperial commission; the stamped CBM came in any case from *figlinae* owned by the emperor. In the same building, an earlier stamp was found on a *pila* of the hypocaust of an earlier phase; the stamp has been tentatively interpreted as being of local origin,[133] revealing how different material supply sources could be used for different phases and, for projects of such large scale, several workshops might possibly have been called upon to reduce the production times and the risk associated with relying on a single source of supply.

The picture of the production of CBM outside of Rome and its immediate surroundings is very fragmentary, and municipal brickstamps do not allow for as precise a pinpointing of the location of production facilities. The *LEPIDI* stamps found on several *bipedales* in the *caldarium* R22 of the baths of *Aquinum* [La.01] are probably the most informative: the tuff inclusions in the paste and the distribution of the stamps, not only locally (*Aquinum*, *Interamna Lirenas*) but all along the W coast of Italy (from northern Etruria to Sicily), suggest a production facility located in Campania (or possibly southern Lazio). The products thus required to be imported to *Aquinum*—which did not have any clay beds in its surroundings—and may have reached the city via the harbour of *Minturnae* (where an example was also found), shipped on the Liri and Garigliano rivers.[134] At *Rusellae*, the recovery of a majority of brickstamps *Probi/Russel(lani)* indicates that the supply of bricks was the responsibility of a municipal *figlina*. The few urban brickstamps, on the other hand,[135] suggest that the existence of a municipal production centre did not prevent products from other

[133] DEMMA 2006.
[134] CERAUDO, MOLLE & NONNIS 2017–2018, 13–14.
[135] CELUZZA & MEDRI 2019, 362.

(competing?) sources to reach the city, and raises questions as to the supply strategies: was the CBM directly ordered from different *figlinae*, or was it purchased mostly from a single, municipal one, with occasional CBM from an urban *figlina* making its way into the construction? How did the latter occur: was the urban CBM purchased later to supplement the initial, municipal order, or was it left over from a previous project and reused for marginal savings?

Unknown or little known (non-urban) brickstamps have been found in several baths located not only in Lazio and Campania (*Aquinum* [La.01], *Arretium* [To.G.08], *Ferentum* [La.03], *Frusino* [La.04], *Minturnae* [La.07], *Puteoli* [Ca.07]) but in Tuscany (*Rusellae* [To.06]) and Marche (*Attidium* [Ma.03], *Tifernum Mataurense* [Ma.10]), more than could have been expected in areas that did not require the same degree of organisation as the production area around Rome. On the other hand, no brickstamps were found in several baths making an extensive use of brick (e.g. *Pisae* [To.05], *Teate Marrucinorum* [Ab.03], *Histonium* [Ab.02], *Sentinum* (Extraurban Baths [Ma.07]) or *Septempeda* [Ma.09]). Since not all CBM were stamped, it may be that no stamped examples were recovered, but it is also possible that stamping the CBM was not deemed necessary in the production process. The limited information available on these stamps prevents further developments, but highlights that a lot of potentially fruitful work remains to be done on municipal brickstamps.

In several cases, it is the local geology and the presence of clay beds in the vicinity that allowed for the extensive use of CBM in the facing of the walls: *Septempeda* [Ma.09], as other sites located in coastal Marche (*Matilica* [Ma.06], *Urbs Salvia* [Ma.G.35], *Helvia Ricina* [Ma.G.25]) benefitted from an abundance of clay, still visible nowadays in the omnipresence of brick in Medieval and Renaissance buildings in

towns of the area. *Velia* had a long tradition of brick making since Hellenistic times, and the presence of several clay beds in the close vicinity of the town may partly account for that; local CBM-producing kilns, such as the ones identified just NE of the Vignale Baths,[136] could have been commissioned to produce the CBM for the baths.

III.1.2 Stone

Stone was widely used in the architecture of the baths of Central Italy, but its identification and, consequently, its provenance are not always easy to pinpoint. One of the many issues is linked to the way it has been characterised so far in the archaeological literature: the archaeological terminology, often drawn from ancient literary sources, is geologically imprecise, sometimes including several different varieties under a same name. For instance, *peperino* is a name given to several stones sharing a common appearance, with inclusions of dark grey lava fragments similar to black peppercorns, but can refer to several different tuffs, from *Gabii* (*Lapis Gabinus*) or the Monti Albani (*Lapis Albanus*), or even to two tuffs from Rome.[137] The terminology used in archaeological publications is in dire need of greater consistency. In this study, the identification of building stone relies therefore on direct observation, compared with regional geological maps; in the absence of scientific analysis conducted on the stone used for construction, there is an underlying assumption that if a stone looks characteristic enough of one of those large rock groups traditionally used for construction (only simple distinctions were made: tuff, limestone, sandstone or travertine), and if that stone is available nearby according to geological maps, then

[136] D'ANGIOLILLO & GASSNER 2017.
[137] JACKSON & MARRA 2006, 403, 420; FARR, MARRA & TERRENATO 2015.

builders would have selected that locally available stone; this scenario does not take into account the suitability of the stone for construction.

TABLE 7: TYPES OF STONE USED IN THE CONSTRUCTION OF THE WALL FACING OF THE BATHS (UNLESS OTHERWISE STATED)

*Col. 3: tuffs are subdivided between a Southern area (S), including the tuffs from the Campi Flegrei, *Vesuvius* and Roccamonfina, and a Northern area (N), with the volcanic districts around Rome.

SITE	Cat. no	Tuff*		Limestone	Sandstone	Travertine	Comments
		N	S				
AQUINUM	[La.01]					■	
ATTIDIUM	[Ma.03]			■			
CALES	[Ca.01]		■	■			
CASTELLUM AMERINUM	[La.G.9]					■	
CASTRA ALBANA	[La.02]	■					*Lapis Albanus* and Tufo Giallo della Via Tiberina as *caementa*
COSA	[To.01]			■			
CUMAE	[Ca.02]		■				Also *caementa*
FABRATERIA NOVA	[La.G.11]					■	As *caementa*
FAESULAE	[To.02]				■		
FERENTUM	[La.03]	■		■			
FORUM SEMPRONII	[Ma.04], [Ma.05]			■			
LUCUS FERONIAE	[La.06]	?		■			Forum Baths: tuff used in modern restorations, possibly used for construction too
MINTURNAE	[La.07]		■				Tuff from *Roccamonfina*
NEAPOLIS	[Ca.04]		■				
OCRICULUM	[Um.01]	■					As *caementa*
PAESTUM	[Ca.05] [Ca.06]					■	
PISAE	[To.05]				■		Mainly as *caementa*
PRIVERNUM	[La.08]			■			
PUTEOLI	[Ca.07]		■				Also as *caementa*
RUSELLAE	[To.06]			■			
SAEPINUM	[Mo.02]			■			
SENTINUM	[Ma.07], [Ma.08]			■			

Site	Cat. no	Tuff* N	Tuff* S	Limestone	Sandstone	Travertine	Comments
Vada Volaterrana	[To.07]				■		Base of walls
Velia	[Ca.09] [Ca.10]				■		

A comparison of table 7 with a map of the volcanic areas of Italy (fig. 24) makes it clear that volcanic stone was predominantly used when locally available (fig. 25): the baths of *Cumae* [Ca.02], *Neapolis* [Ca.04] [Ca.G.16] [Ca.G.17] and *Puteoli* [Ca.07], had tuff from Campi Flegrei and *Vesuvius* at their disposal, and those of *Cales* [Ca.01] and *Minturnae* [La.07] used the tuff from Roccamonfina (fig. 26); the baths of *Castra Albana* [La.02] used dense tuff from *Colli Albani*, and *Lucus Feroniae* [La.06] and *Ferentum* [La.03] were located in proximity to the Monti Sabatini and Monti Cimini—*Ferentum* was actually built on a tuff plateau. *Ocriculum* [Um.01] was located at the edge of a lava flow (fig. 27).[138]

Similarly, and unsurprisingly, baths where limestone, travertine and sandstone were extensively used in the construction were for the most part found in non-volcanic areas (fig. 25, 28). Limestone was used in the Apennines range and east of it (or was skipped entirely in favour of CBM). West of the Apennines, we find *Aquinum* [La.01], *Castellum Amerinum* [La.G.9], *Fabrateria Nova* [La.G.11] and *Paestum* [Ca.05] [Ca.06], which all sat on travertine bedrocks; *Velia* [Ca.09] [Ca.10], where sandstone was used since Hellenistic times,[139] and the sites of Tuscany, often using the stone of the hill on which they were built (*Rusellae* [To.06], *Faesulae* [To.02]).

[138] Hay, Keay & Millett 2013, 4.
[139] Already in the Hellenistic Baths (Greco & Di Nicuolo 2013).

Following the same rationale of using locally available stone, the few places where two or more stones were used alongside each other were located along geological interfaces. Indeed, *Cales* [Ca.01] sat on the volcanic area of Roccamonfina, right next to limestone outcrops (fig. 26); *Ferentum* [La.03], built on a tuff plateau,[140] also sat next to limestone, sandstone and travertine outcrops (fig. 27). At *Cales*, builders made the most of the availability of two different stones, using the lighter tuff in the upper part of the walls and the heavier limestone in the lower parts. (fig. 29)

These are merely broad strokes, and for each site, the local topography, the quality of the stone, the existing infrastructure (e.g. already operating quarries, roadways, established trade routes) would have had an effect on the choice of the material. Only a case by case study could provide a more precise picture. A few examples will illustrate this point. The city of *Lucus Feroniae* (fig. 30) rested on a travertine plateau, but the travertine, apparently of low quality, was not used for the baths, and instead limestone and possibly tuff, coming from slightly further away, were preferred. The limestone was quarried from two outcrops less than 10 km NW of the city; the topography presented a gentle downwards slope from the outcrop to the city, facilitating transportation.[141] Tuff (Tufo Giallo della Via Tiberina) was (and still is) widely exploited directly south of the city, in the quarries of Grotta Oscura, and quarrying traces are visible just 4 km south of the city.[142] A reasonable question would be why tuff was not exclusively used, when it was lighter and easier to work than limestone? It is possible that the durability of limestone was preferred, or that the product of the tuff quarries was primarily aimed at the city of Rome and mainly

[140] SPANU 2014, 121.
[141] JONES 1963, 139–140.
[142] Visible on Google Earth at 12.569924 E, 42.101621 N.

organised to be shipped downstream. *Privernum* [La.08] was located in a plain without immediately available suitable construction material, but surrounded by the Latial Anti-Apennines, composed of limestone, from where the stone used in town came; this, however, did not prevent the builders of the baths from reusing the limestone blocks of the Republican domus that were dismantled to build the bath complex, again for obvious economic reasons.[143]

III.1.3 Concrete

The use of concrete, or *opus caementicium*—a mixture of lime mortar with *caementa* (fist-sized pieces of stone or broken brick used as aggregate), to which volcanic ash, or pozzolana, could be added—[144]in Roman architecture developed in Rome and central Italy from the mid-2nd cent. BC;[145] by the time of the Principate, concrete was used extensively in walls and vaults for most buildings in central Italy, including bath buildings. In the framework of this research, which did not include any scientific analysis, only components whose type could be determined from autoptic analysis have been considered.[146]

Lime mortar required the burning of calcium-rich stone, such as limestone,[147] the main stone composing the Apennine mountain range; lime-based mortar being used in virtually every construction of the imperial period in Central Italy, its production must therefore have been semi-industrialised, at times possibly as part of the production of villa estates which may have also produced lime for agricultural

[143] DeLaine 2001, 240–245 on the economies of scale achieved by reusing material.
[144] Pozzolana is used conventionally in this text, see Lancaster 2015b, 21–25 for a geological definition.
[145] Mogetta 2015.
[146] Furlan & Bissegger 1975; Scalenghe *et al.* 2015, table 10.
[147] Palladius (*op. agr.* I.X.3) mentioned the use of travertine for making lime.

purposes,[148] geared towards the construction market and with facilities supplying one or several cities, such as the one found near *Lucus Feroniae* which served part of the needs of Rome.[149] *Tarracina*, located where the limestone of the Apennines joined the sea, was also an exporter of lime to *Portus* and possibly Rome, at least in later periods.[150]

The same way local material was preferred for the facing of the walls, for obvious economic reasons, locally available material was the most likely to be used as *caementa*; this could be verified in the few cases where a wall core was exposed and no traces of modern restorations were visible, amongst others at *Attidium* [Ma.03] (limestone), *Cales* [Ca.01] (black volcanic stone), *Neapolis* Vico Carminiello [Ca.G.17], *Ocriculum* [Um.01], *Pisae* [To.05] (fig. 31), and was certainly the case for most if not all buildings. In the baths of *Castra Albana* [La.02], entirely faced in brick, the stone used as *caementa* in the concrete of the walls was predominantly *Lapis Albanus*, set in carefully laid horizontal courses in the walls of the upper floor (fig. 31), with the presence of Tufo Giallo della Via Tiberina as well (fig. 32A–B). The use of *Lapis Albanus* was naturally the most sensible from an economical point of view[151] considering that the deposits of the volcanic systems of the Colli Albani, on which the city was located, were mostly composed of that stone. Tufo Giallo della Via Tiberina, though not strictly local, may have been desirable because of its significantly lighter weight,[152] and could have easily been transported from Rome (where it was widely used from the Flavian period)[153] down the *Via Appia*. The local Yellow Tuff from the Campi Flegrei seem also

[148] DeLaine 1995, 560–561.
[149] Fontana 1995.
[150] *Cod. Theod.* 14.6.3, see DeLaine 1995, 559–560.
[151] DeLaine 2001, 238–239.
[152] Tufo Giallo: 1,350 kg/m³; *Lapis Gabinus*: 2,250 kg/m³ (Lancaster 2005, 13).
[153] Lancaster 2005, 60–62.

to have been used in the other very-large-scale bath building the catalogue, at *Puteoli* [Ca.07]; this volcanic, lightweight stone[154] was deemed suitable for the large (14.50–16.50 m) spans the vaults had to cover.

Some specific materials, such as lightweight stone or volcanic ash and scoria, could travel long distances to be used in large-scale structures that would benefit from their properties.[155] The hydraulic properties granted by pozzolana to concrete, for instance, were well-known to Roman builders,[156] as were the relative weight of different stones, especially useful for building vaults with the lightest *caementa* in the highest parts and the heaviest in the haunches.[157] Pozzolana from the area around Rome seems to have been used in the walls of the baths of *Pisae* [To.05] (fig. 32C);[158] it might also have been used in the concrete of the vaults to make it stronger and more durable,[159] and it is worth highlighting that the vault hypothetically covering R4 would have had one of the largest spans (ca. 15 m) of the non-imperial type baths of the catalogue. *Pisae* being located far away from any volcanic district, that material had to be imported, in all likelihood via sea; this possibility is further supported by the discovery of volcanic ash from the area of *Volsinii* in amphorae from the ships found in Pisa.[160] Whether it arrived as ballast or as part of a proper trade is debated, with more recent assessment tending to support the latter view.[161] Long distance-transportation of this material for bath buildings was however probably the exception, and the only other places where it has been identified in central Italy are in the areas

[154] 1,350 kg/m³ (DESSALES 2011, 50).
[155] HOHLFELDER & OLESON 2014; LANCASTER 2015b, 29–38 with bibliography.
[156] Vitruvius II.6.1; LANCASTER 2005, 55.
[157] E.g. the Pantheon in Rome (LANCASTER 2005, 62).
[158] PASQUINUCCI & MENCHELLI 1989, 65.
[159] LANCASTER 2015b, 24–25.
[160] MARRA & D'AMBROSIO 2013.
[161] HOHLFELDER & OLESON 2014, 224.

from which it originally comes: it was noticed in the baths of *Castra Albana* [La.02], *Ferentum* [La.03] and *Ocriculum* [Um.01] (fig. 32D–F), all located in volcanic areas where the material would have been readily available. Local pozzolana (*pulvis puteolanus*) could have been expected in the baths around the Bay of Naples area, but was not spotted, not even in the imperial-type baths of *Puteoli* [Ca.07], mentioned above; *caementa* of the lightweight local Neapolitan Yellow Tuff[162] was deemed sufficient. Unsurprisingly, no pozzolana was recorded in the baths east of the Apennines, where the absence of volcanic features would have required the importation of such material (either by land by crossing a mountain range, or by sea by going all the way around Italy) at probably significant costs.

III.1.4 Perishable materials

Perishable materials such as timber or clay were used in Roman architecture and certainly in the construction of bath buildings; this is supported by a passage in Vitruvius (5.10.3) in which he mentioned the presence of timber in the vaults of heated rooms in the baths. Even though he was writing during the 2nd half of the 1st century BC, it is likely that this technique continued to be used afterwards, as an example in the baths of Piazza della Signoria in *Florentia* [To.04] suggests.[163] The main use of timber, however, was during the construction process of large scale buildings, for shuttering, scaffolding, vaults centring and formwork,[164] which applies for several baths of Central Italy, above all the very-large-scale examples of *Puteoli* [Ca.07] and

[162] See note 154.
[163] SHEPHERD 2014.
[164] DELAINE 1997, 91–93.

Castra Albana [La.02], but also some baths with large vaulted rooms, e.g. *Sentinum* [Ma.07], *Pisae* [To.05] or *Florentia* [To.04].

As expected due to the organic nature of these materials, very little evidence of the use of perishable materials has been recorded. The presence of wooden lintels above openings such as doors and windows was recorded in the baths at Vico Carminiello in *Neapolis* [Ca.G.17], where the vaults also bear the imprint of the centring, composed of wooden planks ca. one Roman foot wide.[165] Same-sized marks (probably a standard size) are visible in vaults in service corridors in the baths of *Florentia* Piazza Signoria [To.04] (R11) and *Neapolis* Fuorigrotta [Ca.04] (R19).

The baths at *Vada Volaterrana* ([To.07], as well as the nearby 'piccole terme')[166] are thought to have been built in rammed earth or unbaked bricks on a base of stone, with a levelling course of tiles to insulate them from humidity. This choice of material would explain the unusual thickness of the walls, greater on average (0.90 m and more) than concrete walls in most other bath buildings of the catalogue (usually 2 Roman feet, i.e. ca. 0.60 m); it would also explain the very small size of the rooms of the nearby 'piccole terme': smaller rooms (6.25–10 m²), i.e. short spans (max. 3.30 m in the heated rooms), would lead to lighter roofs and less pressure on the outer walls.

The suggested use of unbaked bricks is surprising when actual baked bricks were used for the heating system (*area, pilae*, facing of hypocausts walls, bridging the gaps between the *pilae*, some wall facing). On the other hand, the disparate nature of these CBM, especially in the facings where both bricks and tiles of different thickness and colour were used, might suggest that the supply of CBM was extremely limited

[165] DeLaine 1994, 39–40.
[166] Menchelli & Sangriso 2019.

and that the builders rationalised their use by selecting the places in which they were going to use them. The geology of *Vada Volaterrana* and its surroundings was mostly composed of clay and sands, making the raw materials for an elevation in rammed earth or unbaked bricks readily available; on the other hand, stone was available within a radius of 15 km from the site: limestones were present to the NE and SE, and the calcarenite (the so-called panchina) used for the base of the walls was extracted along the shore some 10–15 km from the site and could have been shipped down the coast. Since stone was available close by, one is allowed to wonder why it was not used for the elevation of the walls; the answer might have to do with the poor stability of the soil (composed of clay and sands), which made it necessary to use lighter material for the upper part of the walls, and to build thicker walls, as explained above.

III.2 Construction techniques

III.2.1 Wall facings

The most common facing techniques in the bath buildings of the catalogue were reticulate, horizontal courses of small stone blocks, and horizontal courses of brick; these techniques were often combined with each other in a variety of ways. The traditional archaeological nomenclature used to describe the facings comes from a combination of Latin sources and modern creations, and is rather vague, if not misleading at times; in the frame of this research, I opted for a more descriptive nomenclature, using 'reticulate', 'brick courses' and 'courses of small stone blocks' for the simple facing techniques, and describing the more complex ones as 'combination of…'.

There are further complications in our attempts at categorizing wall facings, because of the large variety of possible combinations. For instance, the ratio of courses of stone blocks to courses of brick when they alternated in the facing could vary, and is not reflected in the traditional nomenclature; the way quoins were made and the material used was not necessarily the same for all facing types. A single wall could be divided horizontally into different facing techniques, sometimes because part of it was below the level of the *suspensura* floor, in the hypocaust (e.g. fig. 33), a difference rarely explicitly mentioned in publications. A change in facing type could also occur higher up in the walls, as visible at *Pisae* [To.05]: in most rooms, the facing was entirely made of brick courses up to ca. 1 m, where it started alternating with courses of stone blocks; in the outer walls of the one room preserved up to the roof (R1), this shift occurred only at ca. 4 m, and only on the E and N outer walls (fig. 34). This example is quite

telling of the risks faced in reconstructing a wall facing when only the lower part of the wall is preserved.

This section will be mostly concerned with the selection and distribution of the different techniques in Central Italy, and the use of facing techniques in specific points within the buildings. Before tackling those questions, the issue of using facing techniques for dating purposes will be considered, as it underlies the choice of attaching little importance, in this study, to the chronology of bath buildings.

Quantitative and qualitative parameters of the facings, following the method proposed by Medri,[167] will not be considered here. Even though such an approach could be useful to reconstruct the construction processes and possibly identify different workshops at work on a single building, who may have been responsible for different sections of the baths (as proposed for the South Baths at *Velia* [Ca.09]),[168] it would require a much more in depth study of each building (which was beyond the scope of this research) and would not necessarily allow for a comparison of structures separated in time, space or function, as variations could be due to many other factors.

III.2.1a (Issues with) dating facing techniques

Following Lugli's and other classifications of facing types,[169] facing types have long been—and still are—used as a criterion for dating. This, however, is not without issues: most facing types were used for centuries, and two facings using the same technique and built at the same time could have very different aspects. The method developed by Lugli to date brick-faced concrete construction through the *modulo* of

[167] MEDRI 2001; 2015.
[168] VECCHIO 2007. Construction details such as putlog holes could also be informative (BOOMS 2007).
[169] Usually VAN DEMAN 1912; MAIURI 1942; BLAKE & VAN DEMAN 1947; LUGLI 1957; BLAKE 1959; BLAKE & BISHOP 1973.

five rows of bricks and five of mortar[170] has been proven to be unreliable: the *modulo* could even vary within the same building, in the same construction phase.[171] The same degree of variation has also been observed for other techniques.[172]

Similar issues plague reticulate construction: after Vitruvius (II.8.1) who mentioned two facing types (*structurarum genera*) in his chapter on building materials, *incertum* (irregular stone facing) and *reticulatum* (reticulate), stating that the latter was more recent, modern authors theorised a linear evolution of these facing types, from the irregular *incertum* to the regular *reticulatum* via a *quasi-reticulatum*, a purposely-coined term. These steps came, in this theoretical scheme, with fixed chronological boundaries.[173] However, the dating of key monuments supporting this chronology has been recently reviewed, invalidating the proposed chronology.[174] Furthermore, the picture thus proposed failed to take into account other factors that may account for the irregularity of the facing, and that do not have to be understood in evolutionary terms: the type of stone (harder stone is more difficult to cut in blocks with neat edges), its provenance (whether quarried on purpose or reused), as well as the structural function and context of the wall (load-bearing or not).[175] The Central Baths of *Cales* [Ca.01] are a good example of how the hardness of the stone affected its final shape: the soft volcanic tuff, easier to cut than the hard limestone, allowed for a much more regular shaping of reticulate blocks than the limestone, even though both were used contemporaneously on the same wall (fig. 29).

[170] LUGLI 1957, 583–584.
[171] STEINBY 1974, 404–405; DELAINE 1997, 142–143.
[172] MEDRI 2001, 24 on reticulate facing.
[173] COARELLI 1977, 9–15 (esp. fig. 1).
[174] MOGETTA 2015, 7–19.
[175] MOGETTA 2015, 7.

The sequence of introduction of facing types could be of some help in dating monuments, but most types had already been introduced in Roman architecture by the beginning of the Imperial period. Some of them, such as the brick facing, would only become the norm a bit later—one of the first monuments to use a full brick-facing in Rome is the tomb of *Caecilia Metella*, dated to the early 20s BC, but the technique goes as far back as the 4th cent. BC and was used for the whole duration of the Imperial period.[176] The reticulate technique mentioned by Vitruvius was developed in Rome in the last decades of the 2nd cent. BC or soon after,[177] popular in Lazio and Campania from the 1st cent. BC to the 2nd cent. AD, and occurred occasionally until the 4th cent. AD, for instance at *Ostia*.[178] The alternance of brick and stone block courses was popular in the 4th cent. AD under Maxentius, but was used much earlier under Augustus in parts of Italy and Gaul and during the Imperial period in Rome.[179] The risk here is to fall into a circular argument: dating bath buildings on the basis of the established chronology for facing techniques only reinforces the established chronology and prevents us from questioning it or from seeing possibly diverging patterns for bath buildings.

A most suitable dating method would be based on the material found during proper stratigraphic excavations, which, as mentioned earlier, was not done in 19th cent. and early 20th cent. excavations. It must however be noted that even so, we would only be informed on the later phases of use of the building and not necessarily on the dating of the different construction phases.

[176] GERDING 2006, 357–358.
[177] TORELLI 1980b, 141.
[178] VAN DALEN 1991.
[179] LUGLI 1957, 633–655; LANCASTER & ULRICH 2014, 168.

III.2.1b Selection of facing techniques

Comparing the distribution of the facing techniques used in the baths of Italy with that of the general distribution of the technique could inform us on a potential differential treatment of baths compared to other structures.

Of all facing techniques, reticulate was probably the most distinctively Roman. Developed in Central Italy in the late 2nd cent. BC or soon after, it was in part born out of the local availability of easily workable tuff. It allowed for faster construction than ashlar masonry by using much smaller pieces of standardised shape and dimensions, and therefore the possibility to mass-produce them with a reduced need for skilled workforce; its development has also been connected to the increased availability of slaves after the military conquests of the mid-2nd cent. BC, which would have provided the necessary workforce.[180] Reticulate was used predominantly in Central-Southern Italy, and occasionally outside this area.[181] The distribution of the technique (table 8, fig. 35), concentrated in Lazio and Campania between Rome and Naples, with occasional sites east of the Apennines and in southern Tuscany and Umbria and northern Lazio, actually corresponds to that already noted by Torelli in 1980 (fig. 36): the baths had no surprise in store. Whereas most of the reticulate blocks were made of tuff, the baths of *Rusellae*, *Ancona*, *Amiternum*, *Iuvanum*, *Aesernia*, *Larinum* and *Saepinum* used harder stones, more difficult to work;[182] reticulate was already a comparatively more expensive facing technique than a brick or an irregular facing,[183] and having to

[180] COARELLI 1977; TORELLI 1980b.

[181] TORELLI 1980b; MEDRI 2001, 30–36. SPANU 1996 for its use outside of Italy.

[182] The hardness of each stone would have been different, and should be assessed individually: that of *Amiternum*, for instance, was said by Vitruvius (II.7.1) to be only moderately hard (*temperata*, between *mollis* and *dura*).

[183] DELAINE 2001 for a comparison of the relative labour costs between different facing techniques in *Ostia* and Rome.

work a harder stone would have added to the production costs. Considering this, and assuming that the choice of reticulate was deliberate and not the default option—courses of stone blocks would have been a more traditional choice in *Rusellae*, for instance—the reason accounting for this choice may have been ideological, and connected to the commissioner of the building. That ideological factors could account for the use of specific construction materials and techniques was shown by both Torelli and Medri, highlighting how the use of reticulate outside of its core region could be connected with Roman upper classes financing public buildings, even possibly providing building teams specialised in working with that technique, with the ideological aim of associating themselves with the dominant Roman culture;[184] furthermore, simply the ability to commandeer resources, which would have been visible during both the construction process and once the construction was complete,[185] would have been a means for the commissioner to display their power and wealth.

How this translated practically can be seen through the example of *Rusellae* [To.06], where most public buildings were faced in reticulate.[186] The amphitheatre was the only one of coastal Tuscany (and one of the few in the whole region, with *Luca* and *Florentia*), indicative of the desire of the commissioner to have a distinctively Roman building in the city. Perhaps the choice of reticulate, also a distinctively Roman facing type, is to be explained by the same rationale. The *curia* of the city, entirely faced with brick and veneered in imported marble, hosting the statues of the family who paid for it, could belong to the same pattern. The baths seemed to have been the only building in town to use reticulate panels and brick courses, and this choice may have been the

[184] MEDRI 2001, 34.
[185] DELAINE 2001, 240.
[186] TORELLI 1980b, 149–151.

result of the commissioner's wish; alternatively, it could be that they employed a building team expert in the construction of bath buildings and accustomed to this facing technique. The walls of *Saepinum* fall in the same category: they were an imperial benefaction made in AD 4–7 and were faced with a reticulate of limestone. The *Decumanus* Baths of the same city [Mo.02], on the other hand, used reticulate alongside several other techniques; their small dimensions along with the heterogeneity of the facings instead suggest that reticulate was used because of the availability of blocks, possibly leftovers from the construction of the city walls. What was exceptional, in the case of those baths, was the use of brick facing, unseen elsewhere in town.

Reticulate was rarely used on its own to face a wall, and only in early baths such as *Aquinum* [La.01], *Cales* [Ca.01] or *Gabii* [La.05]. Reticulate was not suited for quoining, so quoins were often made of brick (usually a bonded quoining, but occasionally, in earlier periods, a sawtooth quoining as at *Cales*, possibly because it was deemed to better fit the shape of the reticulate blocks) (fig. 37), or occasionally of stone blocks. Reticulate also commonly appeared as panels framed by brick courses and quoins (fig. 37R). On the other hand, reticulate was virtually never used with stone courses.

When it comes to brick facing, we see that if a significant number of the baths made some use of bricks, only a handful display a full, or almost full, brick facing: *Teate Marrucinorum* [Ab.03], *Castra Albana* [La.02], *Ocriculum* [Um.01], *Septempeda* [Ma.09] (full), *Pisae* [To.05], *Sentinum* Extraurban [Ma.07] (almost full), possibly *Histonium* [Ab.02] and *Lavinium* [La.G.13].[187] Furthermore, the baths of *Castra Albana*

[187] The baths of *Frusino* [La.04] and *Urvinum Hortense* [Um.02] might be part of the list.

and those of *Teate Marrucinorum* are the only ones confirmed to have been entirely built in brick-faced concrete, when the rest of the town and the surroundings employed other facing techniques.[188] There appears to be no concentration in the distribution of those baths (fig. 35): one in Tuscany, which had a long tradition of stone construction and where other baths made a much larger use of stone (*Faesulae* [To.02], *Rusellae* [To.06]), three or four east of the Apennines (in Abruzzo and Molise). The other baths with full brick facing were located in Lazio and Umbria, either along the Tiber river or in close proximity to Rome or *Ostia*, and in Marche, both regions where access to clay and/or CBM was not an issue.

A comparison between the Cellomaio Baths of *Castra Albana* [La.02], built under Caracalla, and the contemporary Baths of Caracalla in Rome also highlights interesting aspects on materials choice and use. In her study of the latter baths, DeLaine noted that two different types of brick were used in different places of the central block,[189] with her Type B—thicker, paler than Type A—used mostly to face the interior walls of the heated rooms and the walls of the *caldarium*. These two types of brick were not mixed on the same wall and, when preserved, the connections between them were neat and precise. Remains of the facing of the central heated room (R1–04) of the upper floor of the baths at *Castra Albana* reveal that two different types of bricks were also used. The bricks of the upper courses (fig. 38L) were thinner (2.5–3.3 cm, cluster around 3–3.1 cm), pink to light red, whereas the bricks of the lower courses were thicker (2.8–4.1 cm, average 3.7 cm) and had different colours, from pale buff to yellow or pale salmon; these two types seem to correspond to those identified in the Baths of Caracalla in Rome. They were however not used in the same way: they both appeared

[188] COARELLI & LA REGINA 1984, 151 (*Teate Marrucinorum*); AGLIETTI 2015, 97 (*Castra Albana*).
[189] DELAINE 1997, 140–141.

on the same wall, in a heated room. The thinner bricks seem to be the most used in the whole structure, and the most carefully laid, while the thicker, yellower bricks appear in patches (fig. 38R), without any apparent reason to account for their location. In the wall pictured on fig. 38L, both brick types are bound with the same type of mortar, grey with inclusions of pozzolana nera. It was not possible to determine, for the baths in Rome, if the two types of brick came from different sources or if one of them was reused,[190] and that information cannot be deduced either for the baths of *Castra Albana*; it is however possible that the thicker, yellower bricks from the latter baths were leftovers from the construction of the Baths of Caracalla in Rome; this would explain their apparent limited number (but not their seemingly random distribution in the building).

Within the same bath building, different techniques could be used for different phases, as at *Aquinum* [La.01], shifting from a travertine reticulate to a brick facing. At *Cales* [Ca.01], *Cosa* [To.01] and in the Large Baths of *Paestum* [Ca.06], the rooms built in later phases were faced in brick whereas the initial facing technique was reticulate or stone block courses. In the Small Baths of *Forum Sempronii* [Ma.05], the heated rooms were initially faced with brick courses and the other rooms, with courses of stone blocks; during the modifications of phase II, the extension of the heated rooms R8, R13 and R14 was faced with stone blocks instead of bricks, as one would have expected; stone blocks would have been readily available whereas it may not have been the case for bricks. These shifts can be explained by several factors, either technical (the need to face the heated rooms with brick), ideological (the desire to have a Roman-looking building, or to display one's wealth and power by using specific materials and

[190] DeLaine 1997, 140.

techniques), but also economical (for instance changes in the supply of raw materials to the city) and contextual (local and personal preferences, contemporary fashion etc.).

Reusing materials enabled the funders to save on materials, transportation, and workmanship if the blocks or bricks already had the right shape. The baths of *Privernum* [La.08] reused the blocks of the two Republican *domus* that previously occupied the same location. In the Vignale Baths of *Velia* [Ca.10], examples of the typical Hellenistic Velian brick[191] were roughly cut and used as facing, either in horizontal courses or in an irregular reticulate (fig. 39); they were also used in the latrines of the South Baths of the same city [Ca.09], when the rest of the fabric used stone and brick courses. The stone blocks used for the reticulate in the *Decumanus* Baths of *Saepinum* [Mo.02] may have been leftovers from the construction of the Augustan city wall and theatre, the only two constructions in town where reticulate blocks were originally used (fig. 40). These limited examples illustrate a phenomenon that may not have been unusual, especially in baths in the lower end of the 'prestige' scale (smaller, less grand baths), but interpreting the practice in the light of a lesser investment is only part of the picture: the Vignale Baths of *Velia*, one of the rare ones equipped with a *piscina calida*, hardly fit into a 'lesser-investment' category. A question of a rational allocation of resources would make more sense in this case: there was the possibility to cut on the expense for construction, so it was seized, and in turn this may have allowed for the allocation of more resources to offer more interesting bathing facilities.

[191] CICALA & VECCHIO 2014.

TABLE 8: WALL FACING TYPES IN THE BATH BUILDINGS OF CENTRAL ITALY. ONLY THE FACINGS OF THE MAIN PHASES ARE CONSIDERED.

Legend

Confirmed use Possible use

Header row: C=Courses; Q=Quoins. Col 1: *=No visual confirmation. Col. 3–10: Inc.=irregular stone facing; Spic.=stone blocks laid in a herringbone pattern; Alt.=quoins made of alternating courses of brick and stone blocks; BQ=Brick Quoins. These indications inside *coloured* cells are *on top of* the facing of the relevant column.

Site, baths	Cat. no	Reticulate	Reticulate + brick		Reticulate + stone blocks		Stone blocks	Brick	Brick + stone blocks
			C	Q	C	Q			
AESERNIA, Via S Ippolito*	[Mo.G.03]								
ALBA FUCENS	[Ab.01]						Inc?		
*AMITERNUM**	[Ab.G.08]								
ANCONA, P.za Stracca*	[Ma.02]								
AQUINUM	[La.01]								
ARRETIUM, Theatre Baths	[To.G.08]								
*ATELLA**	[Ca.G.11]								
ATTIDIUM	[Ma.03]								
CALES, Central Baths	[Ca.01]								
CASTELLUM AMERINUM	[La.G.9]						Spic.		
CASTRA ALBANA	[La.02]								
*CASTRUM INUI**	[La.G.26]								
COSA	[To.01]						Inc.		
CUMAE	[Ca.02]								
*CUPRA MONTANA**	[Ma.G.22]								
CURES SABINI	[La.G.28]								
FAESULAE	[To.02]								
FERENTUM	[La.03]								
FORUM SEMPRONII, Small B.	[Ma.05]								
FORUM SEMPRONII, Large B.	[Ma.04]								
FRUSINO	[La.04]								
*GABII**	[La.05]								
HISTONIUM	[Ab.02]								
*IUVANUM**	[Ab.G.07]								
LARINUM, Amphitheatre B.*	[Mo.01]								
LAVINIUM	[La.G.13]								

Site, baths	Cat. no	Reticulate	Reticulate + brick C	Reticulate + brick Q	Reticulate + stone blocks C	Reticulate + stone blocks Q	Stone blocks	Brick	Brick + stone blocks
Lucus Feroniae, Forum B.	[La.06]						Inc.		
Matilica	[Ma.06]								
Minturnae	[La.07]								
Misenum	[Ca.03]								
Neapolis Carminiello	[Ca.G.17]								
Neapolis Santa Chiara	[Ca.G.16]								
Neapolis Fuorigrotta	[Ca.04]								
Ocriculum	[Um.01]								
Ostra	[Ma.G.12]								
Paestum, Large Baths	[Ca.06]						BQ		
Paestum, Forum Baths	[Ca.05]						BQ		
Pisae	[To.05]								
Pitinum Pisaurense	[Ma.G.29]								
Privernum	[La.08]								
Puteoli	[Ca.07]								
Rusellae	[To.06]								
Saepinum, *Decumanus* Baths	[Mo.02]						Inc.		
*Saturnia**	[To.G.09]								
Sentinum, Urban Baths	[Ma.08]								
Sentinum, Extraurban B.	[Ma.07]								
Septempeda	[Ma.09]								
*Tadinum**	[Um.G.05]								
Teate Marrucinorum	[Ab.03]								
Telesia, Theseus Baths*	[Ca.08]								
Tifernum Mataurense	[Ma.10]								
Trebula Balliensis	[Ca.G.19]								
Urvinum Hortense	[Um.02]								
Velia, South Baths	[Ca.09]								+BQ
Velia, Vignale Baths	[Ca.10]								
Volsinii, Seio Strabone*	[La.G.37]								

III.2.1c Specific uses of CBM

Bricks and tiles were used in a variety of shapes and placements within the buildings, and to a different extent from monument to monument; they could be left entire, divided into regular shapes or even broken down into fragments. As mentioned above, CBM was most commonly used in baths for wall facings, but also to make quoins, bonding courses, relieving arches, floors and vaults, as well as some architectonic elements such as columns; it was also commonly used in the heating systems, to create hypocausts floors, *pilae*, *praefurnia*, *tegulae mammatae* and *tubuli*.[192]

When CBM was not used to face the entire building, as tackled above, it was used selectively. A common practice was a full brick facing in the heated rooms only, presumably for reasons of thermal efficiency:[193] CBM resisted heat better than other common materials and also had a lower thermal conductivity, meaning that it retained heat better.[194] This solution was adopted in a large series of baths, notably at *Cumae* [Ca.02] (fig. 41), *Ferentum* [La.03], *Forum Sempronii* Small Baths phase I [Ma.05], *Neapolis* Fuorigrotta [Ca.04] (fig. 42), *Pisae* [To.05], *Saepinum Decumanus* Baths [Mo.02], *Velia* South Baths [Ca.09].

The hypocausts were often built so as to resist heat better, either with a different facing or with tiles to protect the walls.[195] At *Lucus Feroniae* [La.06], the facing in the hypocaust of room R12 was made of brick courses when the elevation was faced with stone (fig. 33T); the same is visible at *Privernum* [La.08], with further adjustments detailed below. This practice could have also been used in the outer walls of heated

[192] On the use of CBM for heating systems, see ch. V.
[193] This was already noted by DELAINE 1997, 141, note 20.
[194] LANCASTER 2015b, 193.
[195] See ch. V.

rooms: the lower part of the N wall of corridor R6 of the baths of *Cumae* [Ca.02], in correspondence to the hypocausts of the heated rooms, was faced in brick when the upper part of the walls was faced in reticulate, as was the entire S wall of the corridor (fig. 43).

This concern for the effect of heat on the walls of the bathing rooms is also visible in construction details. At *Privernum* [La.08], the facing of the hypocaust was in full brick, and the elevation in alternate courses of brick and stone. The builders' solution to protect the walls from the heat was to use a full brick facing also on the walls around the mouth of the *praefurnium* (fig. 44), as well as to continue the brick facing for about ten courses above the *suspensura* floor before starting the alternate brick/block facing. The passage from hypocaust facing to wall facing, i.e. the level of the *suspensura* floor, was marked by two courses of tiles instead of brick; this was probably the result of a builder's habit, marking the level at which the *suspensurae* was supposed to arrive. A similar solution was adopted in the Large Baths of *Paestum* [Ca.06], where the hypocaust was faced with ca. seven courses of brick, three of travertine blocks, then four of brick marking the level of the *suspensura*, and the rest of the wall was faced in stone blocks (fig. 45).

This attention paid to the construction of heated rooms was also visible when brick was not the only material used, as at *Paestum* (Forum Baths [Ca.05]), where the facing of the walls (alternating courses of travertine blocks and bricks) was completed with greater care in the heated rooms (R1, R2, R8) than in the non-heated bathing rooms (R3, R4), and the walls were significantly thicker (0.90 m wide, as opposed to 0.60 m wide for the other walls),[196] not only because of the vaulting solutions chosen

[196] VITTI 2019.

to cover the rooms, putting a greater stress on the stone blocks, but possibly also out of concern for the heat resistance of the material. That the local travertine at *Paestum* was not entirely structurally trustworthy is visible also in the fact that the facing of both bath buildings [Ca.05] [Ca.06], made of courses of small stone blocks, had quoins in brick (fig. 46): this is exceptional since facings of stone blocks usually used the same stone blocks for their quoins.

In addition to heated rooms, pools and other water containing spaces could also be treated differently: at *Privernum* [La.08] (R12a), as well as in the Large Baths of *Paestum* [Ca.06] (R7b), full brick facing was used in the walls of the pools. The pools of the *caldarium* R3 of the Forum Baths of *Cumae* [Ca.02] were delimited by an unusual module of brick, rectangular, possibly obtained by cutting *bessales* along the median (fig. 47). This allowed a gain of space since the bricks were not used as facing on a concrete wall, but rather to create a solid wall of a thickness of a brick.

This additional care granted to the walls of heated rooms and pools was not gratuitous: the facing was to support the decoration and therefore had to be long-lasting in these adverse conditions. The effect of heat on unsuitable stones is clearly visible in unprotected hypocausts (fig. 48), and if a facing had decayed in this way, any decoration it held would have been lost. Whether such precautionary measures in the facing of the bathing rooms were necessary is unknown—the walls of the rooms would not be subject to the same temperature as the walls of the hypocaust—but what is clear is that they were *deemed* necessary.

Beyond heat-protection uses, different facings could be used in wall areas of increased stress: quoins, jambs and wall extremities were the parts of the walls were

most stress was exerted (fig. 49, also fig. 42).[197] On the other hand, the brick facing of these areas had probably only a minimal structural role, as the strength of the wall was conferred by the concrete,[198] and the limited length of the face may better account for the choice of a brick facing, since reticulate was not fit for quoins. In the case of the brick-faced corner piers in R8 and R11 of the Forum Baths of *Cumae* [Ca.02] (fig. 50), if only the quoins had been made of brick, there would have been only a very small section of the facing left for a reticulate panel: the brick quoins of the piers in R11 were 0.60 m long, and since the piers sides were ca. 1.40 m long, that would leave a theoretical 0.20 m space for a reticulate panel. The shortest wall faced with a combination of reticulate and brick is found in the baths of *Neapolis* Carminiello [Ca.G.17] (fig. 51): the wall was a little bit longer than 2 m and the reticulate portion of the facing, ca. 0.90 m wide.

III.2.2 Vaulting

Despite limited evidence—vaults having a tendency to collapse first and their material, to be recovered for reuse—an interesting array of roofing solutions has been observed in the baths of Central Italy.

The public baths of Central Italy, with the limited size of their rooms—when compared to those of imperial-type baths in Rome and elsewhere in the Mediterranean—did not usually require the importation of specific materials to lighten the vaults. Vaults larger than 10 m were only rarely used: with a ca. 12 m span, the *frigidarium* R4 of the Extraurban Baths of *Sentinum* [Ma.07] was, possibly with that

[197] GIULIANI 2006, 143.

[198] Steinby (1974, 402) however noted, in a selection of Ostian buildings, the use bricks of better quality in placements where more stress was exerted, such as pilasters and ledges—but not consistently.

of *Pisae* [To.05] mentioned above, one of the largest roofed rooms in non-imperial-type baths, but its exceptional nature in the regional context has already been highlighted.[199] In most cases, the plan of the largest rooms was such that a central space could be vaulted in one way, and its extensions covered by other vaults; this could be the case, at least theoretically since no preserved example is known, for the common 'triptych-*caldarium*' blueprint, with the central space covered by a barrel-vault or a cross-vault, the lateral pools by barrel vaults, and the apse with a quarter-sphere vault. The type of vaulting was therefore, in all likelihood, part of the blueprint as well.

Concrete was a common material for vaults,[200] for both ends of the dimension scale. Concrete vaults are still preserved in some service corridors (preserved because located at a lower level than the rest of the structures), for instance at *Florentia* Piazza Signoria [To.04], in the E–W leg of R11 (with radially-set bricks in the intrados) and in R11 and its E counterpart, entirely in concrete and with the imprints of the wooden centring visible on the intrados (also visible in the service corridor R19 of the baths of *Neapolis* Fuorigrotta [Ca.04]), or at *Castra Albana*, where the intrados was lined with bricks (fig. 52). The transition between the vault and the walls was sometimes made with different materials or a different facing: at *Florentia* Piazza Signoria, in R11, a thick concrete layer separated the lower part of the wall faced in courses of stone blocks from the vault; at *Neapolis* Fuorigrotta, it was 5–6 brick courses that separated the concrete vault from the facing of the lower part of the wall, made in courses of stone blocks. This transition allowed builders to have a flat level from which to start building

[199] See ch. II on design.

[200] Chunks of concrete vaults are still visible, collapsed, in several buildings, e.g. *Velia* South Baths [Ca.11], *Paestum* Forum Baths [Ca.07], *Cales* [Ca.01].

the vault, and would have been particularly necessary when it separated the vault from a lower facing in reticulate, as in corridor R6 at *Cumae* [Ca.02] (fig. 53).

Since the pressure exerted by barrel-vaults on the lateral walls pushed the latter outwards, they had to be reinforced, often by placing barrel-vaulted rooms against each other in a central position in the building, so that the other rooms would work as buttresses. This technique partly accounts for the linear disposition of rooms in Republican-period baths such as the Stabian Baths of *Pompeii*, and even during the imperial period we see barrel-vaulted rooms coming in pairs or more (e.g., and probably: *Pisae* [To.05] R8–R9, *Teate Marrucinorum* [Ab.03] R6–R7, R8–R10–R11, *Telesia* Theseus [Ca.08] R5/R6–R7, possibly *Atella* [Ca.G.11]). Barrel-vaults were commonly adopted for rectangular rooms, whereas cross-vaults were more common in square rooms, and required only the corners to be strengthened, as is clearly visible at *Cumae* [Ca.02], in R8 and R11 where the corners are much thicker, and in the latter two corner piers were added, in all likelihood for that purpose (fig. 50). Cross-vaulted rooms thus had the advantage of allowing for larger openings to be created in the walls, not only doors but also steps leading to pools, as well as clerestory windows, making them the ideal solution for *frigidaria* since they required pools, good lighting, and ideally a central position (e.g. *Cumae* R8 [Ca.02], *Ferentum* R9 [La.03], *Neapolis* Fuorigrotta R6 [Ca.04], *Pisae* [To.05] R11, *Privernum* R7 [La.08], *Velia* South Baths R4 [Ca.09]) (fig. 54).

Not all vaults were made of concrete. The baths of *Florentia* Piazza Signoria [To.04] contained two alternative roofing options: in a heated room R7, a system of a suspended vault of CBM hanging from girders and, above a water tank R8, a vault made of terracotta tubes.

The first alternative was a suspended ceiling made of terracotta elements, placed on a metallic grid suspended via metal beams (equipped with hooks), themselves hanging from wooden trusses; the CBM could then be plastered and decorated, and would protect the wood of the trusses from the humidity (fig. 55).[201] This was the technique described by Vitruvius (V.10.3); it is known only through very few archaeological attestations (in part because the metal would have been a prime material to rob), most of them however found in connection with concrete vaults. Several of these vaults were (possibly) identified in large-scale imperial structures in Rome and around.[202] At *Florentia* [To.03], that roofing system covered the 11–11.50 m span of a heated room (R7), and if the metal bar found in the baths of *Faesulae* [To.02] also belonged to a similar system to roof a heated room, it would have covered a 9 m span (R7 or R8).

The second type of non-concrete vaults was made of vaulting tubes, a vaulting technique common in North Africa from the 2nd half of the 2nd cent. AD onwards,[203] but which appeared only rarely in Italy, mostly during the Republican period in Sicily and at *Pompeii*, and in late Antiquity and later.[204] The tubes from *Florentia* (fig. 55) followed the North African type and possibly came from there too—the presence of such tubes on several shipwrecks makes it clear that they could be exported over long distances,[205] but possibly more as cargo filler than primary export.[206] Vaults made of tubes could be

[201] SHEPHERD & SABELLI 1989.
[202] DELAINE 1987.
[203] LANCASTER 2012, 151–160, with previous bibliography.
[204] WILSON 1992; LANCASTER 2015b, 99–128.
[205] SHEPHERD 2014, 4.
[206] LANCASTER 2015b, 115.

put up with lighter centring than concrete vaults, thereby reducing the need for wood and skilled carpentry work during the construction.

It is also noticeable that the earliest attestation of a third vaulting technique common in bath buildings of the Western Empire, the armchair voussoir, comes from *Florentia* as well, both from the Vingone kilns (20 BC–AD 20) that supplied the city in CBM and from the city itself.[207]

The question as to why several vaulting techniques were used in the same bath building, some significantly more expensive than 'normal' concrete (vaulting tubes had to be imported, and iron beams had to be produced, both at a certainly greater cost than concrete), shall remain unanswered, but considering that the size of the baths and their possible symmetry along a main axis would classify them amongst the largest buildings of central Italy, requiring the highest financial input, the answer may rest with the commissioner, for whom the expense may not have been an issue[208] and instead, an offer of a large diversity of vaulting solutions, reflecting the most advanced techniques, may have been a more interesting avenue. This proposition would be valid for the suspended ceiling, not for the vaulting tubes which were used above a water tank; another answer must be sought for the latter case, possibly looking at connections between the commissioner and the production place of those elements.

This search of diversity in architectural spaces is a well-known phenomenon in some high-end baths of the imperial period, aiming at offering different sensory experiences to the bathers as they progressed from one room to the other. The best

[207] LANCASTER 2015b, 156. There existed earlier, 'experimental' armchair voussoirs (e.g. at *Fregellae*) but those at *Florentia* are the first to display the typical shape that kept on being used for several centuries.
[208] As emphasized by DELAINE 1987, 151 for imperial constructions in Rome.

illustration of this phenomenon is probably the Small Baths of Hadrian's Villa, where vaults (and also rooms) had different shapes (fig. 56), but this also seemed to have been a concern for the upper range of urban baths, such as those of *Pisae* [To.05] (fig. 54R), where the rooms were probably covered by a mix of barrel- and cross-vaults, and an elsewhere-unattested pavilion vault pierced by eight rectangular openings distributed around a central *oculus*, or the baths at *Ocriculum* [Um.01], where the main octagonal room R1, ca. 11.50 m wide, was covered by a rare segmented umbrella vault (fig. 57). At *Puteoli* [Ca.07] too, the vault of the *frigidarium* was animated by alternating cross- and barrel-vaults.

If vaults made of concrete appear to have been the most widespread technique, it is not only because they left more traces than other techniques, but because they were preferred for reasons of resistance to the heat and humidity of bathing rooms, and also of abundance of raw materials (wood for centring, limestone for lime production) and ability to create large-scale, varied shapes. Other techniques such as suspended ceilings, vaulting tubes, or armchair voussoirs, attested directly or indirectly, were possibly more common that what the archaeological material would lead us to believe (and were indeed much more common in other areas of the empire), but probably not to the point of substantially altering the picture provided here.

III.3 Selection of construction materials and techniques

It is worth going back to the criteria laid out at the beginning of the chapter, to emphasize how almost every one of them lay behind the selection of a material and technique for the construction of bath buildings. The influence of local geology is undeniable, and the proximity of and ease of access to the source of material, as well as the existence of established transportation and trade routes, played a fundamental role. Preferring locally available material (clearly visible in the baths of *Faesulae* [To.02] which used the stone of the hill on which they were built) decreased the transportation costs, an aspect already highlighted by Vitruvius (I.2.8). Proximity to the sea or to inland waterways would have allowed for cheaper transportation of goods, and it is no surprise that at *Forum Sempronii* [Ma.04–05], *Faesulae* [To.02] or in the Urban Baths of *Sentinum* [Ma.08], the walls of the heated rooms were faced in local stone, even though the stone was not necessarily suited to withstand heat exposure and was consequently strongly damaged. Those sites were located far inland, and purchasing CBM for their construction might not have been economically viable, but was still deemed necessary for the construction of the heating systems. The baths entirely or almost entirely faced with bricks were located near the sea or inland waterways (*Pisae* [To.05], *Histonium* [Ab.02]), along the Tiber River in the brick production area (*Ocriculum* [Um.01]), close to Rome or *Ostia* where brick was readily available (*Castra Albana* [La.02]), or were the result of exceptional commissions (*Sentinum* Extraurban Baths [Ma.07], possibly *Teate Marrucinorum* [Ab.03]). We have also shown how the quality of the stone determined its selection and use (e.g. the travertine at *Lucus Feroniae* [La.06] and *Paestum* [Ca.05] [Ca.06]), and whereas we have no precise figures

for the cost of material, the relative cost in workforce of different techniques and materials did play a role in their selection, and accounted for the occasional reuse of materials (*Privernum* [La.08], *Saepinum* [Mo.02], *Velia* Vignale Baths [Ca.10]). Construction tradition (e.g. small stone blocks facing in Etruria, tuff reticulate in volcanic areas) and expertise of the builders (e.g. in reticulate) limited the availability of construction techniques, but materials and people travelled, all the more so in the relative small scale of the well-integrated region considered here; the choice of a non-traditional technique, or one for which no experts were locally available, was still possible by investing enough time and funds. It would therefore have been the commissioner who could have had the last word on the selection of material and techniques (as Vitruvius mentioned),[209] should they have had an interest in selecting them. As benefactors from the higher classes of society commissioning bath buildings certainly had ties with Rome,[210] their interest may have stemmed from a desire to emulate what was done in Rome, and/or to offer the city a distinctively Roman-looking building standing out in the urban landscape, for the ideological connotation of materials and techniques cannot be underestimated. Should the commissioner have had no interest in the selection of materials and techniques, the task would have fallen on the builders or the contractor, who would have worked within the economic parameters determined by the available funds; the contract passed between the commissioner and the contractor could have made this clear.[211] These considerations could be valid for a wide variety of public buildings; for bath buildings, technical

[209] *De Arch.* VI.8.8.

[210] See chapter VI on euergetism.

[211] A typical *locatio-conductio* contract could have stated which materials were to be used (e.g. the *lex parieti faciendo*), leaving either the commissioner (Cat. *Agr*., 14–15) or the contractor (*Dig*. 19.2.30.3; *Dig*. 6.1.39) responsible for the supply of materials (DESSALES 2011, 49).

considerations should be added, in the form of all the precautions taken by builders to ensure that the structures would resist heat and water better than average. The hydraulic properties of pozzolana mortar, and the heat and humidity resistant quality of CBM, made them worth transporting over longer distances. This also accounts for the widespread use of CBM in the facing of heated rooms.

Thanks to their publication in a dedicated monograph, the baths of *Pisae* [To.05] offer an interesting example to demonstrate the choice, provenance and use of construction materials in their architecture. In terms of choice, both brick and stone were laid in courses to face the walls, the former extensively, and as *caementa* in the concrete; there is no indication of the use of perishable material. As regards the provenance, most materials came from the surroundings of Pisa: grey calcilutite from local quarries (but the exact quarry could not be identified) and limestone from the Monti Pisani (some 25 km NE of Pisa) were used as *caementa*; the mortar contained sand from the Arno and *Auser* rivers (both crossing *Pisae* in Roman times), and imported pozzolana; the stone for wall facing was a local calcarenite called panchina; the brick came from local *figlinae* (no further than northern Etruria), possibly owned by the *Venuleii* (see VI.2) who restored the baths [E52]. The only material coming from further away was the red pozzolana imported from Lazio and used in the mortar.[212] The choice of using as far as possible locally available materials is to be explained in terms of economics of construction, where the transportation cost of construction materials coming from far away would impact significantly on the total cost of any construction. Importing construction materials was necessary only when a specific material was required for a specific function and not locally available—as we see with

[212] PASQUINUCCI & MENCHELLI 1989, 65–71.

the pozzolana imported from Lazio: its properties in strengthening the construction were well known, and it was available only in the surroundings of Rome and Naples.

Most buildings from our catalogue used, for their construction, several of the types of material tackled here, but for each material the source of supply seems to be unique—at least as long as a single phase is concerned. Indeed, the builders commissioned for the restoration of a set of baths could very well stock up in a different place than the workers who erected the original building. The few cases where there are two or more sources of supply for the same material in a single phase are the exception and can usually be explained by the particular nature of the subsoil, when the site is located on a geological interface as in *Cales* [Ca.01] or *Minturnae* [La.07], or by the historical context, such as the baths of *Castra Albana* [La.02] built contemporaneously to those of Caracalla in Rome and possibly benefitting from the organisation already set in place for the latter.

Lancaster showed how baths played a pioneering role in development of vaulting techniques, but most of those innovations occurred earlier, during the Republican period, or outside of Italy during the Imperial period.[213] Italy was well-endowed with raw materials for construction (including limestone for lime mortar and timber for centring or trusses), and by the beginning of our period there is no question that it had a well-established tradition of concrete architecture, and an abundant and specialised workforce, which meant there was no need for innovation—at least in the public urban baths, which drew on a 'technology shelf'[214] that combined the architectural and technological developments that took place in Central Italy and

[213] LANCASTER 2015b, 193–195.
[214] GREENE 1992.

Rome during the previous three centuries. A more likely place to look for innovation in bath buildings in Central Italy would be in private and spa baths. Private baths, because the commissioners might have had a more active role in determining the physical outcome of the structure (its design, decoration, water and heating features) so that it would suit the aims of their bathing facility, most notably impress their guests through the architecture (the varied vaulting solutions of the Small Baths at Hadrian's Villa being a prime example). Spa baths, because the naturally abundant heat and water supply, the non-urban setting of the building (i.e. possibly more space and a lesser reliance on established raw material supply routes) and, as for private baths, the source of funding, could have offered commissioners and architects an experimentation ground for less traditional room designs. In either cases, the consequence was that builders could have had to adapt to new room shapes and found new ways to suit the construction options to the heat and water stresses they were undergoing, possibly requiring them to free themselves from the traditional way of building bath complexes they might have been accustomed to.

IV. Water management: supply, circulation and disposal

Introduction

Water, on top of being "very necessary for life, for delight, for daily use" (Vitr. VIII.1.1), was a condition *sine qua non* for the existence of bath buildings. Palladius highlighted the importance of having an adequate water supply in order to build baths: "it is not inappropriate that a *pater familias* takes the construction of a private bath into consideration, if the availability of water permits it".[215] With rare exceptions, water was a prerequisite for settling down, and would therefore have been locally available; its abundance, on the other hand, affected the choice of the type, size and number of water-consuming facilities. This was made clear by Seneca who compared the bathing fashion of his forefathers to that of his contemporaries, blaming the latter for their excess of luxury: in the old days, "water flow didn't keep welling up from under; water didn't keep running forever fresh, as though from a hot spring", whereas new bath establishments offered "a load of waterfalls, sluicing down the steps in a din".[216] The epigraphic record supports these ancient authors and has given us good evidence of the importance of having a reliable water supply for the baths.[217]

Water was served both cold and warm, the latter requiring heating systems which will be tackled in chapter V. Heat and water are considered separately, whereas in a Roman bath building there would have been no neat separation: they were the essence of the bathing experience—one without the other would have made no sense to a Roman visiting a bath building.

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[215] Palladius, *Op. Agr.* I.39.1 (translation DE HAAN 2001, 42). De Haan placed Palladius in the 3rd cent. AD, but datings ranging from the 3rd to the 6th cent. AD have been proposed (BARTOLDUS 2012, 11–12).

[216] Sen., *Ep.*, 86.9 (translation HENDERSON 2004, 112, 115).

[217] FAGAN 1999a, 308–312.

In order to understand the importance of water in bath buildings, it is not enough to examine the circulation of water just within the complex; the complete circuit followed by the water, from its provenance, its supply to and circulation within the baths, all the way down to its disposal, has to be taken into account.[218] The poor conditions of preservation of most bath buildings considered in the research and their limited state of publication constrain the representativeness of the conclusions reached here; the focus will therefore be placed on a limited number of examples.

[218] MARÉCHAL 2012, 154–156 summarized the main research leads on the topic. Italian well-preserved examples: NIELSEN & SCHIØLER 1980; LOMBARDI & CORAZZA 1995; KÖHLER 1996; PAPPALARDO & MANDERSCHEID 1998; PARSLOW 2000; DE HAAN & WALLAT 2006; MANDERSCHEID & GARBRECHT 2009. Also BOUET 2003, 235–277 (*Gallia Narbonnensis*) and POCCARDI 2006b, 128–148 (*Ostia*). Manderscheid has worked extensively on the question: GARBRECHT & MANDERSCHEID 1994; MANDERSCHEID 2000, along with MANDERSCHEID 1988, 36; 2004, 21–22 for a bibliography up to 2001. The *Frontinus Gesellschaft* (http://www.frontinus.de/) and the *Deutsche Wasserhistorische Gesellschaft* (https://www.dwhg-ev.com/) are also very active in the study of water.

IV.1 Supply and storage of water

IV.1.1 Introduction

Freshwater was most commonly used in Roman baths, with the notable exception of spa baths where water from natural, often hot springs would be used for their therapeutic virtues.[219] The use of seawater was however not unheard of both in conventional and spa baths, as indicated by occasional literary passages[220] and an inscription from *Pompeii*,[221] but the fact that this was deemed worthy of notice might be a good indicator that the practice was not common.

The water necessary to supply baths (or any other building) could be obtained from three different sources: from rainfall, from the aquifer and from springs. Each water source had its advantages and disadvantages, and the choice of one over another depended on their availability, on economic considerations as well as on ancient perceptions of their relative qualities. Vitruvius (VIII.6.12–15) ranked them, advising to start by looking for springs, then to dig wells if no spring could be found; as a last resort, if the soil was too hard or the water table too deep, he advised rainwater be collected in cisterns.

Current Mediterranean climate is characterised by a marked seasonality with dry summers and abundant rainfall only in winter, a pattern that seems to have started around 550–50 BC, thus including the period researched here, with variations during the Roman period as well.[222] This relative aridity of the area in question made it

[219] Vitr., VIII.3.4.
[220] FAGAN 1999a, 62–63, note 75.
[221] *CIL* X.1063=EDR150470.
[222] BÜNTGEN *et al.* 2011; PEYRON *et al.* 2011, 142; KEENAN-JONES 2013, 234–235.

necessary for bath commissioners to ensure that sufficient quantities of water would be available year-round for the facilities to remain in function throughout that period, either with a reliable supply or suitable storage facilities.

The question of water storage[223] can therefore not be considered separately from that of its supply, since before being made available to the bathers, water first transited in tanks and reservoirs serving for short- and long-term storage, decantation, and/or redistribution (see appendix I). The selection of one source of water over another also had implications on the strategies of use and conservation. The issue of the consumption of water within the building is also part of the picture, since water consumption would have in part been determined by the strategies of supply and storage. Since it is only rarely clear which source of water was used to supply a bath building, the following discussion will focus on a narrow range of examples.

IV.1.2 Water needs of bath buildings

The availability of water and the reliability of its supply would have been the upper limiting factor when it came to choosing the number and size of the pools (table 9), and their modes of operation, i.e. if they were continuously or sporadically refilled with water. Other factors, such as the financial investment in the building from the commissioners, their desire for lavishness, the adaptation to the expected number of bathers, would naturally have had an influence as well in the selection of facilities, but they will not be considered here: the focus will be on tentative calculations of the

[223] 'Cistern', 'reservoir' and '*castellum*' are used inconsistently in archaeological literature (BUKOWIECKI, DESSALES & DUBOULOZ 2008, 10–18). Here, 'reservoir' will be used for the largest (several hundredths or thousands cubic meters) water storage structures (the largest of which were sometimes called *castra*: WILSON 2007) usually fed by aqueduct, 'cisterns' for rainwater-fed structures, usually underground, and 'tanks' for the smaller structures (1–100 m^3). '*Castella*' will designate the redistribution structures.

water volumes needed by different facilities in bath buildings and its consequences on the running of the complex.

Too many variables need to be taken into account when calculating the water needs of bath buildings to allow for a precise quantifying of their consumption. When pools are preserved, it is possible to calculate the volumes of *static* water in the baths, i.e. the volumes of water needed to fill them once; on the other hand, we are ignorant of the rate of water renewal in the pools, the amount of water consumed in other facilities (*labra* and drinking fountains,[224] probably supplied with running water), that used for flushing latrines, cleaning floors, or lost through splashing and people exiting pools.

Seneca's passage mentioned above (*Ep.* 86.7) strongly suggests that running water was a luxury that could be used in lavish bath buildings. There are no doubts that the supply of water to pools and basins could be regulated and shut off when desired, as attested by the recovery of many taps,[225] including on boilers.[226] Opting for a continuous renewal of water in the pools was therefore a deliberate decision, with clear advantages: a cleaner water for patrons to bathe, no disruption in the use of the pool, and potentially a decorative use of the water via its display.

Some pools (and *labra* as well) could have received a continuous water inflow,[227] which can only be confirmed when overflow pipes are attested in the upper parts of the pools, as in the cold-water pool R4b of the South Baths of *Velia* [Ca.09] (fig. 58). The absence of an overflow pipe does not necessarily preclude a continuously running

[224] MANDERSCHEID 2000, 492 on fountains.
[225] JANSEN 2000; KESSENER 2017 with bibliography.
[226] BROISE *et al.* 1987, 97–100.
[227] As recommended on the *Vipasca* tablets (*CIL* II.5181=EDCS-60700134).

supply method: the drain could have been left open continuously[228] or, but less likely for practical reasons, water could have overflowed outside the pool in the room, where the slope of the floor would have led it towards a grating connected to sewers. Overflow pipes are occasionally found in hot-water pools (e.g. pool R8a still at *Velia*) but it is unlikely that they attest to the continuous water supply of the pool, since that would require that the water in the boiler was heated fast enough and in suitably large quantities to be fed into the pool without cooling down the water already in the pool.[229] Instead, it is more plausible that hot water was fed into the pool occasionally, several times throughout the day, the excess water being evacuated via the overflow pipe, all this without requiring the preliminary draining of the pool and disturbing the operation of the pool or the activity of the bathers. The other option would have been to completely empty the pool before refilling it, which seems unlikely considering the disruption it would have caused to the patrons who would have had to leave the pool for the time of the operation.

Overflow pipes were observed in a limited number of examples, at *Aquinum* [La.01], a site—as the name indicates—well-endowed with water, as well as at *Minturnae* [La.07] and *Velia* [Ca.09]. Apart from pointing in the vague direction of an 'abundance of water', an overflow pipe does not say much of the actual quantities of water used; all it can tell is the *maximum* amount of water used by that facility per unit of time. The *natatio* of *Minturnae* (R5) contained ca. 90–110 m^3 of water; the size of its overflow channel could in theory empty up to 1.7 m^3 of water per minute, which means that the largest quantity of water that could be poured in the pool without it overflowing in all directions was 100 m^3 per hour—a huge figure, especially when

[228] MANDERSCHEID 2000, 503.
[229] The presence of a *testudo* (see ch. V) would have helped maintain the warmth of the water.

compared to the average capacity of tanks and reservoirs, and the actual consumption was evidently lower.

If the water in the pool had to be renewed during the opening hours of the baths, the bathers would have had to leave the pool—something that could be avoided by continuously supplying the pools with water, or by staggering the process when a room was equipped with several pools. The time necessary to drain pools makes it clear that it would have significantly disrupted the operation of the baths: *natationes* and large pools would have taken a long time to empty (ca. 25 minutes for R5 at *Minturnae* [La.07], ca. 60 minutes for R1 at *Septempeda* [Ma.09]), and the same is true for the smaller pools in *frigidaria* (e.g. 50 minutes for R8b at *Cumae* [Ca.02]); the refilling would have further increased the time required before the pool could be ready again (that may have taken less time than the drainage thanks to the multiplication of supply pipes[230] and their potentially larger size).

It was much more likely that the water in the pools was renewed outside of the working hours of the baths, in order to be ready for the morning opening; a mid-day refill is also conjecturable if the baths closed between the morning and afternoon sessions.

[230] See section IV.2.2.

TABLE 9: INDOOR POOLS AND THEIR CAPACITY IN SELECTED BATH BUILDINGS

Legend: col. 5–6: *: dimensions from plan or reconstructed depth; col. 7: the figures have been rounded to the nearest unit to insist on the fact that they represent approximate values.

Bath building	Cat. no	Pool no (phase)	Hot/ Cold	Dimensions (m)	Depth (m)	Approx. capacity (m^3)
AQUINUM	[La.01]	R11a	C	8 x 6.40	1.00	50
		R11b (+)	C	4.60 x 3.70	1.10	18
		R22a	H	8 x 2.90	0.65	15
		R22b	H	6.20 x 2.50	0.65	10
		R22c	H	4.20? x 2.90?	0.75*	10
		R22d	H	4.20? x 2.90?	0.75*	10
		R24a	H	4.80 x 2.40	0.50	5
		R24b	H	4.80 x 2.90	0.50	6
		R41a	C	4.70 x 4.65	0.90	19
		R41b	C	5.65 x 5.25	0.90	26
		Labra in R11, R41; fountains in R47 (3), R49?; basins R11c, R24c				
CASTRA ALBANA	[La.02]	All reconstructed pools			1.00*	550
CUMAE	[Ca.02]	R8a	C	6.80 x 3.60	1.00*	19
		R8b	C	6.00 x 4.50	1.00*	27
		R3a	H	4.50 x 2.10	0.80*	8
		R3b	H	4.30 x 2.00	0.80*	7
		R3c	H	4.30 x 2.10	0.80*	7
FAESULAE	[To.02]	R6a	C	10.9 x 5.60	1.10	54
		R8a	H	2.75 x 2.10	0.60*	3
		R8b	H	6.25 x 2.30	0.60*	8
FERENTUM	[La.03]	R1a	C	9.30 x 6.60	1.00	60
		R9a	C	5.75 x 3.20	1.00	60
		R9b	C	5.00 x 3.20	1.00	
		R15a (II)	C	3.10 x 2.40	0.80*	
		R21a (II)	H	4.60 x 1.70*	0.60*	
		Fountains in R1, R21				
LUCUS FERONIAE, Forum B.	[La.06]	R3a	C	4.50 x 3.70	1.10	18
		R8a	C	5.20 x 2.70	1.10*	15
		R12a	H	3.50 x 3.00	0.80*	10
		R13	H	5.90 x 3.10	0.80*	1
PAESTUM, Large Baths	[Ca.06]	R6a (I–III)	C	6.10 x 4.90	0.90	24
		R6b (II–III)	C	4.20 x 3.20	0.60	7
		R13a (II)	H	3.50 x 2.30*	0.70*	5
		R13b (II)	H	5.60 x 2.00*	0.70*	7

		R7a (III)	H	5.70 x 1.80*	0.70*	7
		R7b (III)	H	3.70 x 2.70	0.80	8
		R12 (III)	H	8.70 x 5.30	1.20	50
Privernum	[La.08]	R7b	C	3.70 x 3.10	1.00*	11
		R12a	H	2.00 x 1.35	0.80*	2
		R12b	H	2.50 x 1.35	0.80*	2
		Fountains in R2a, R6, R7a				
Sentinum, Extraurban B.	[Ma.07]	R4a	C	7.20 x 4.40	0.80*	25
		R4b	C	7.20 x 4.40	0.80*	25
		Warm-water pools in R17, possible *labra* in R2, R4, R6				
Teate Marrucinorum	[Ab.03]	R12a	C			
		R11a	H	6.20 x 2.40	0.80*	12
		R11b	H	4.40 x 3.10	0.80*	9
Vada Volaterrana, Large Baths	[To.07]	R2a	C	8 x 3.70	0.80*	22
		R3a (II–III)	C	7 x 3.60*	0.80*	20
Velia, South Baths	[Ca.09]	R4b	C	5.90 x 2.90	1.00	18
		R4c	C	4.35 x 2.25	?	?
		R8a	H	4.80 x 3.80	0.65*	12
		R8b	H	5.20 x 2.60	0.65*	7
		Labra in R4a, R7, footbath in R11a				
Velia, Vignale Baths	[Ca.10]	R3a (I–IV)	C	4.70 x 3.20	1.00*	15
		R3b (II–IV)	C	2.60 x 2.60	1.00*	6
		R5a (I–IV)	H	3.60 x 1.70*	0.70*	4
		R5b (I-III)	H	3.50 x 2.30	0.70*	6
		R6a (II–IV)	H	3.80 x 2.40*	0.70*	6
		R6b (II–IV)	H	3 x 2.30	0.70*	5
		R11a (III–IV)	H	2.60 x 1.30	0.60*	2
		R11b (III–IV)	H	2.70 x 1.40	0.60*	2
		R14 (IV)	H	4.50 x 7.00	1.00	27

IV.1.3 Baths supplied from wells

Water for bathing could also be fetched from the aquifer, or phreatic table, if it was of good enough quality and not too deep. The phreatic table was reached by digging wells, whose walls could be reinforced to withstand lateral pressures; water-lifting devices[231] were necessary to bring the water at a level at which it could be used.

[231] See section IV.1.6.

Of all the baths of Central Italy considered here,[232] only those of *Cales* [Ca.01] (in a service area next to R12, fig. 59) were equipped with a well located inside the building, clearly for its exclusive use;[233] it is unclear if it remained the only source of supply for the entire life duration of the baths, but no aqueduct is known to have supplied *Cales*. Water had to be lifted from the phreatic table to a level at which it could be used, in this case a tank located right above R11 (fig. 60), supported by a brick vault, floored with *cocciopesto*, and with waterproofed walls.

If wells located outside bath buildings could in theory also have been used for the supply of baths, this solution seems less likely as they would have had to share the water with neighbouring structures, complicating the management of the resource. It has been suggested that the well outside the Large Baths of *Vada Volaterrana* [To.07] was used only by the bath attendants and did not serve the needs of the bathers.

IV.1.4 Baths supplied from rainwater

In Central Italy, only the baths at *Cosa* [To.01] were certainly supplied exclusively with rainwater, the site being notoriously deprived of any other water resource. To supply the city at large, small cisterns dotted the entire site, as well as four large public cisterns benefitting from vast catchment areas. One of those public cisterns (700–750 m³, fig. 61) was modified in the 2nd cent. AD, when the baths were built just west of it, to improve the supply to the baths: it was roofed to decrease loss by evaporation, a channel connected it to a secondary cistern (R15) directly under the baths, from which water was lifted up to a small elevated tank (R7) from which the pools and boilers could be fed (fig. 62). Because of its limited availability, water had to

[232] See section VII.2 for the contrasting situation at *Pompeii* and *Ostia*.
[233] Depth unknown, min. 6 m.

be carefully managed, not only by building suitable storage facilities to make provisions for the drier months of the year but probably also by a greater degree of control from the authorities than if water availability had been less of an issue—they would have had to ensure the baths would not consume too much so as not to risk running out of water for the inhabitants.[234] The only pool known in the baths of *Cosa* (R3a, 2 m^3) was one of the smallest recorded in Central Italian baths, in line with a limited and unreliable water supply, but the requirements of the baths cannot be estimated further.

Using 20th century precipitation data as a proxy, Bouet calculated the water requirements of a small bathhouse in Saint-Vincent-de-Gaujac (southern France) which could count only on rain for its supply.[235] If only the rain falling on the roofs of the baths was collected, the 67 m^3 cistern could have been filled three times per year (25% monthly average, down to 15% in July–August). With static water requirements of ca. 9.30 m^3, the bathing pools could be refilled only twice a month, which seems implausible. The catchment area must therefore have been larger and included neighbouring buildings, but it remains that the water had to be carefully managed, possibly with different uses between seasons: some facilities could be stopped in summer, or were not used as much in winter to store water for the summer.[236]

A rainwater supply was postulated for the baths of *Teate Marrucinorum* [Ab.03], where 1940s calculations indicated how a heavy rain collected on a 100,000 m^2 catchment basin would have filled the 2,450 m^3 reservoir next to the baths in less than

[234] DE GIORGI 2018. BIUNDO 2008 (esp. 170) on the management of public water.
[235] BOUET 1997.
[236] BOUET 1997, 140–144.

an hour.[237] A spring was also channelled so as to flow into the reservoir, but Colosimo discarded the water supply role of the spring on the basis of its limited contemporary outflow (ca. 60 m³/day in the 1940s). However, the effort made by builders to connect it to the reservoir rather suggests that its role was more important in Roman times: the spring is more likely to have been the prime water source for the reservoir, as well as the main reason for the construction of the latter—and thus that of the baths—in that specific location. The baths may have required 50–75 m³ of water to fill the pools (26 m³ for the heated pools, at least as much for the cold-water pools); these figures make it clear that the reservoir supplied not only the baths but also part of the town.

The unreliability of a rainwater supply, especially in the semi-arid climate of Italy, and the extremely limited evidence of baths relying on rainwater alone (in Italy and beyond),[238] make it clear that if it was in theory possible to use it as unique supply source, it was probably avoided at all costs, all the more so for public bath buildings aimed at serving the population of a city year-round. The situation may have been different for baths in rainier locations, for instance in the northern provinces.

IV.1.5 Baths supplied from aqueducts…

The unreliability of rainwater and limited use of wells in baths in Central Italy makes it clear that aqueducts were the most common means of fetching water to supply a city and its public bath buildings, at least during the imperial period. Before that period, this was not necessarily the first choice for Romans, as the construction of an aqueduct did not come without a cost, and other means of supply, using wells and cisterns, were much more common (especially for private supply), cheaper, and faster

[237] COLOSIMO 1940, 259–261.
[238] E.g. *Tiddis,* Algeria (WILSON 1997, 128).

to build—but were frequently insufficient for the quantities of water needed in baths. Some cities continued to use them even after they were connected to an aqueduct, when others (e.g. London and Empúries) were never even equipped with an aqueduct.

Modern scholarship has emphasised the connection between baths and aqueducts.[239] Baths were certainly amongst the main consumers of clean water in a city; however, apart from imperial *thermae*, there are few cases where a bath complex can be shown to be the very reason an aqueduct (or a branch thereof) was built.[240] Aqueducts, more than 'wasting' water or being structures aimed only at prestige,[241] brought water to the inhabitants of towns who did not necessarily have access to domestic cisterns and wells, and would have enabled larger populations to be sustained through droughts when other local sources might fail;[242] they could also have supplied industrial complexes in towns and filled irrigation needs along their course. Baths were far from being the main or only driving force behind the construction of aqueducts. In the case of imperial baths, it was the scale and therefore the water requirements of such gigantic structures that accounted for their direct relationship with an aqueduct.

The only baths of the catalogue for which a similarly close relation could be conceivable are those in *Puteoli* [Ca.07] and in *Castra Albana* [La.02], whose scale was closer to the imperial baths in Rome than to the other Central Italian baths (ca. 7,500 m²

[239] HODGE 1992, 5–6. See BRUUN 1997, 124–125 with previous bibliography.

[240] E.g. the *Aqua Antoniniana* for the Baths of Caracalla (GARBRECHT & MANDERSCHEID 1992; 1994, 93–109). There are also clear connections between the *Aqua Virgo* and the Baths of Agrippa (Plin., *HN*, 36.xxiv.103–104), and between the *Aqua Traiana* and the Baths of Trajan (BRUUN 1991, 135; TAYLOR 2000, 211–212).

[241] This view was expressed by LEVEAU & PAILLET 1976, 166–167, later toned down LEVEAU 1991, but had a long-lasting influence on the perception of aqueducts.

[242] WILSON 1998, 89–93; 2001b.

for both bath buildings, against ca. 3,000 m² for the largest provincial one in *Sentinum* [Ma.07]), and the baths of *Castra Albana* were also an imperial initiative by Caracalla. A rough estimate of the requirements of static water for the *Castra Albana* baths reaches 550 m³,[243] making it clear that any supply other than by aqueduct would have been unconceivable; it is perhaps telling that in both cases, the cities in which they were located were supplied by two aqueducts each.[244] The aqueduct supplying *Castra Albana* was modified in the Severan period, at the same time as the construction of the baths, perhaps to suit it to the water needs of the baths. It is true that baths and their water supply could occasionally be part of a unitary construction or restoration program—the epigraphy is clear on that[245]—and ensuring that newly built baths had a sufficient water supply would have been a prime concern of the benefactor, but this does not imply that they built an entire aqueduct.

Aqueducts are usually associated with the idea of tapping into distant rivers and springs, but tapping into local springs also technically required an 'aqueduct', only much shorter and not necessarily requiring the engineering features—bridges, siphons—that usually come to mind when we talk of aqueducts. Water from rivers in town could potentially be used (Frontinus (*Aq.* I.4) said that the Romans drank water from the Tiber before the construction of the first aqueduct in 312 BC), but was nevertheless less preferable because of the degraded quality of the water, since sewers could discharge in them.[246]

[243] Compare with the water requirements of the Baths of Caracalla in Rome (2,000 m³) and those of *Ferentum* [La.03] (100 m³).
[244] TORTORICI 1975, 66; JOHANNOWSKY 1993, 107.
[245] FUSCO 2013. See chapter VI.
[246] HODGE 2000, 27–28.

A supply from a local spring is attested for the South Baths of *Velia* [Ca.09], where a spring slightly uphill of the bath complex supplied a large reservoir (ca. 650 m^3) storing water for the baths and probably other structures too; this was the same spring that supplied the Hellenistic Baths.[247] The capacity of the reservoir could have easily supported the baths' needs, estimated at ca. 50 m^3 of static water. Cold-water pool R4b probably benefitted from a constant renewal of water, as indicated by the overflow pipe built in its steps.[248] A spring also supplied water to the baths of *Teate Marrucinorum* [Ab.03], mentioned above,[249] and possibly to those at *Misenum* [Ca.03].

Methodologically, if it is fair to assume that the baths received their water from the aqueduct when we know that the city was equipped with one,[250] it remains difficult to demonstrate it since the piping connecting the baths to the urban network is rarely preserved. Pipes leaving a bath building could indicate it was connected to the urban network, as the lead *fistula* found *in situ* under the pavement along the N façade of the baths of *Aquinum* [La.01] (fig. 63) reveal, but they could also have connected with a nearby reservoir or cistern that could have been filled by other means than by an aqueduct. Furthermore, the contemporaneity of baths and aqueduct should be carefully assessed: because a connection is usually assumed between both structures, there has been a tendency to date a bath complex based on the construction of an aqueduct—and vice-versa.

[247] GRECO & DI NICUOLO 2013.
[248] See section IV.1.2.
[249] See section IV.1.4.
[250] DE ROSA 2008.

IV.1.5a …via *castra*

As baths were amongst the most important water consumers in towns, storing water must have been a priority, and considered in the planning phase. Looking at North African cities, Wilson proposed a water management model in which large reservoirs (*castra*) filled overnight, when the baths and other heavy users were not working; then either the reserve created overnight would be completely depleted during the following day, or it would only be partly depleted, allowing for a gradual filling of the reservoir over a longer period so as to have a seasonal reserve to be used during a dry period.[251]

Such reservoirs, holding several thousand cubic metres, were not uncommon in the mountainous regions of Central Italy, marked by wet winters and dry summers, as in the baths of *Teate Marrucinorum* [Ab.03] (2,450 m³), discussed above. Several large-scale *castra* were dotted around many towns in Central Italy, not only in hilly or mountain areas but wherever there was a need for medium- or long-term water storage, for a variety of purposes.[252] The best known is the 12,600 m³-large reservoir of *Misenum* (*Piscina Mirabilis*), the final destination of the Serino aqueduct system, which owed its existence to the presence of the imperial fleet at *Misenum*.[253] Such reservoirs are known, for instance, from *Firmum Picenum* [Ma.G.24] (fig. 64), and *Arretium* [To.G.08] (2,000 m³), where it has been suggested they stored water for the baths. If it is rarely possible to ascertain a direct connection between baths and *castra*, their large capacity makes it fair to assume it was the case—as long as the latter was located in a higher position than the baths. The so-called Grotta Dragonara at *Misenum*, a different

[251] WILSON 1998, 89–93; 2001b, 86–87.
[252] BODON, RIERA & ZANOVELLO 1994.
[253] HODGE 1992, 279.

type of reservoir made of channels dug into the rock (fig. 65), could have stored water from an aqueduct or a local spring, possibly for use in the nearby baths [Ca.03].

IV.1.5b …via smaller reservoirs

Dedicated tanks were occasionally located inside or nearby the bath building, preferably at a higher level than the water-consuming facilities inside the baths so as to redistribute water by gravity. It is not always possible to ascertain a connection between a reservoir and a bath building since pipes are rarely preserved *in situ*.

The clearest example is the reservoir directly to the NW of the Forum Baths of *Cumae* [Ca.02]. It is poorly preserved but assuming a water level of 3–4 m, it could have contained ca. 400–550 m³ of water which, when compared to the ca. 70 m³ of static water (both cold and warm) needed to fill the pools of the baths, would have allowed the water they contained to be renewed at most 6–8 times over the course of a day. Could this quantity have allowed a continuous water supply to the cold-water pools? No overflow pipe was found in the cold-water pools R8a–R8b, arguing against this suggestion, but the drains could in theory have been left open continuously. Assuming this and a 1 m water level in the pools, we can calculate that the 27 m³ of water in pool R8b would have been drained in ca. 50 minutes,[254] requiring that 32 m³ of water be supplied to the pool every hour to maintain the same water level. If pool R8a had a drainage pipe of identical dimensions, its 19 m³ of water would have emptied in 32 minutes, requiring a supply of another 35 m³ per hour. The cold-water pools would therefore have consumed ca. 77 m³ of water per hour, draining the reservoir in 5 to 7 hours, without even taking into account the consumption of the hot-water pools,

[254] Based on Torricelli's theorem, with application of a coefficient of discharge of 0.6272; see appendix II for calculation method. I thank Jean-Pierre Beaufay and Thomas Heide for their help with the calculations.

labra, fountains etc., or the possibility that the reservoir also supplied neighbouring buildings. A continuous water supply would therefore be conceivable only if the reservoir was also continuously refilled during the day.

On the other hand, the scenographic introduction of water in pools R8a–R8b, detailed below,[255] would have worked best with a continuous flow of water, and it is conceivable that a continuous flow was activated intermittently, or at specific times during the day. Some bathhouses could be open for specific clienteles at specific times—women in the morning, men in the afternoon and evening—[256]and it is not inconceivable that the latter benefitted from a larger expenditure of water. Supposing all the pools were filled at the beginning of the day (70 m³), then once more at the beginning of the afternoon session (another 70 m³), there would still be another 250–400 m³ of water in the reservoir to be used throughout the day, not only for supplying *labra* and other small basins, but possibly also to renew the water in all the pools a third time (by staggering the process), occasionally to top up the pools, and above all, to provide a continuous supply of water to the cold-water pools for a few hours a day, which could be increased if the drain was not fully open.

Similar reservoirs are found in the Santa Chiara Baths at *Neapolis* [Ca.G.16] where a 12 x 8 m reservoir (R5) was added in an undetermined phase. The baths were also equipped with a 110 m³ *natatio*, suggesting that the min. 235 m³ tank was in all likelihood dedicated to the use of the baths. Another reservoir is found next to the baths at *Privernum* [La.08], built on two levels at the same time as the baths, on a

[255] See section IV.2.4.
[256] NIELSEN 1993, 135–138.

slightly higher position.[257] Containing 40–80 m³ of water, it would have sufficed for the limited water requirements of the baths (ca. 15 m³), allowing for a full renewal once or twice per day. At *Castellum Amerinum* [La.G.9], two tanks were located against the W wall of the bath building and possibly supplied via a small aqueduct; the smallest tank may have acted as a settling tank (fig. 66). The reservoirs were located at the highest position in the neighbourhood, so could very well have acted as *castella* for the neighbourhood, but they could just as well have been dedicated to the baths, whose water needs are not known but ranged amongst the lowest of the catalogue based on the overall visible size of the building.

Not all tanks served for water storage: the ca. 25-40 m³ tank (assuming a 2–3 m water level) against the N wall of the South Baths of *Velia* [Ca.09] would clearly not have sufficed for the daily needs of the bathhouse, whose pools had a capacity close to 50 m³—all the more so that pool R4b could be continuously refilled, as indicated by its overflow pipe. The reservoir proper was the ca. 640 m³ reservoir slightly N of the building, and the smaller tank only acted as a balancing tank for the piping within the baths, allowing for a finer tuning of the water delivery to the different facilities. The tank located ca. 25 m NE of the Vignale Baths of the same city [Ca.10], possibly containing 35–50 m³ of water (reconstructing a 2–3 m water level), was in all likelihood also a balancing tank, as it would not have answered the daily water needs of the baths, especially in their phase IV (min. 60 m³).

Reservoirs that could have stored water for baths have been tentatively identified at *Castra Albana*, where water for the city and the camp was supplied by two

[257] AMICI & CANCELLIERI 2004, 35. Reservoirs of this type (on two levels and acting as *castella*) have parallels in *Ostia*, e.g. the reservoir of the Terme del Nuotatore (287 m³; RICCIARDI & SCRINARI 1996, 181–182).

aqueducts and stored in the large *Cisternoni* (ca. 10,000 m³); from there it flowed into several smaller reservoirs, one (ca. 290 m³) possibly feeding the *nymphaeum* of Santa Maria della Rotonda, another one (capacity unknown) supplying the Cellomaio Baths [La.02].

IV.1.6 Lifting

Depending on the type of water supply and its provenance, water either arrived into the baths at the right level or had to be raised to an elevated tank by means of a lifting device. Several devices were known to the Romans,[258] but not all of them could be used for that purpose: the selected device had to fit in the shaft of a well in a dense urban context and to fetch water from sometimes great depths (e.g. 25 m at *Pompeii*). *Cosa*, *Ostia* and *Pompeii* are among the few sites of Central Italy to have provided actual remains of water-lifting devices that were associated with baths.[259] In the baths of *Cosa* [To.01], a tread-wheel driven bucket-chain lifted water to a 4 m high elevated tank. A small bronze force pump is known from *Castrum Novum* and has been, debatably because of its small capacity, connected to a set of baths.[260]

Since most of the components of these water-lifting devices were made of wood or metal, they rarely survive in the archaeological record and their existence must be inferred from the presence and the shape of wells and reservoirs. The shape of well R12 in the Central baths of *Cales* [Ca.01] (fig. 59), a rectangle with curved ends, and its depth (min. 6 m) make the use of a bucket-chain quite likely, since this is the only type of device that offered the desired flexibility to reach great depths in a narrow well;

[258] SCHIOLER 1973; OLESON 1984; 2000; MALOUTA 2013.
[259] *Ostia*: RICCIARDI & SCRINARI 1996; POCCARDI 2006b, vol. 1, 133–135; *Pompeii*: OLESON 1984, 70–71; OLSSON 2015, 59–60, 65.
[260] OLESON 1996, 75; BOUET 1997, 136–137.

water was raised to the reservoir located above (fig. 60). The long and narrow shaft with walls covered with *cocciopesto* located next to the baths of *Neapolis* Fuorigrotta [Ca.04] probably housed a compartmented wheel: the recess on one of the long sides and the corresponding pier against the opposite wall (fig. 67) would have supported the horizontal axle of a wheel lifting water to a now lost redistribution tank.

The evidence of water-lifting devices for the public baths of Central Italy unfortunately stops at these three sites. Discoveries in the last twenty years, however, hint at a not so uncommon presence of water-lifting devices in the vicinity of baths, with evidence from Britain, France, Spain and also Italy.[261] They are occasionally found lifting water for larger public baths that were not supplied by aqueducts (e.g. Barzan, London). Even in cities supplied by aqueducts, water occasionally had to be brought up before it could be used in baths, as could be the case at *Cumae* [Ca.02], where traces of a water-lifting device may have been identified in a two-level redistribution tank to the NE of the baths, which redirected water to the tank to the NW of the baths. One further implication of this is that the sound of a water wheel or bucket-chain in motion would have been part of the 'soundscape' of a visit to the baths.

IV.1.7 Conclusion

It must be kept in mind that the picture provided above, and the calculations made to obtain it, are based on many variables and are therefore highly speculative, but they have the merit of showing the possible variety of the modes of operations,

[261] London (UK, BLAIR, SPAIN & TAYLOR 2005), Barzan (FR, COADIC & BOUET 2005), Tavel and Mont-Berny (FR, BOUET 1997, 134–140), Empuriés (ES, AQUILUÉ *et al.* 2002, 254), Pollena Trocchia (IT, SOUČEK 2017). All were bucket-chain devices apart from that at Tavel, a water pump.

and give an idea of the order of magnitude of water consumption in those Central Italian baths.

While being careful not to generalize too much, there seems to be a rough correlation between the size of the baths (without considering the *palaestra* when there was one) and their water consumption, even though not a systematic one. The imperial-type bath complex at *Castra Albana* [La.02] (7,400 m²) had pools totalling ca. 550 m³; the largest non-imperial baths, at *Aquinum* [La.01] and *Sentinum* [Ma.07] (both 3,000 m²), were also the largest non-imperial water consumers (170 m³ at *Aquinum*, 50 m³ of cold-water only at *Sentinum*); several baths with a surface area of ca. 1,000 m² (*Cumae* [Ca.02], *Velia* South Baths [Ca.09], *Ferentum* [La.03]) had facilities of a total capacity of ca. 40–60 m³, and smaller complexes (e.g. *Privernum* [La.08]) required significantly less water; in several cases, the ratio cold:hot water was ca. 2:1 (*Aquinum*: 113:56; *Cumae*: 46:22). There are significant exceptions to this, however: the baths of *Faesulae* [To.02] show a marked difference between cold- (54 m³) and hot-water (11 m³) pools, further increased by the 120 m³ cold-water *natatio;* hot-water *piscinae calidae* and other large pools do also alter the picture, as at *Paestum* (Large Baths [Ca.06]) or *Velia* (Vignale [Ca.10]), where the ratio cold:warm was closer to 1:2.

It is not possible to add to the model proposed by Wilson[262] that saw a correlation between size of baths, methods of supply and modes of operation: the public baths of Central Italy do not show the same diversity as those of North Africa in size (there were almost no imperial-type *thermae* in Central Italy, where most are middle-sized, ca. 500–1,500 m²) or in methods of supply, since a vast majority of Italian

[262] WILSON 1997, 131.

baths received their water from an aqueduct, and the few exceptions are in too poor a state of conservation to be useful comparisons.

The water consumption of most baths supplied by aqueducts, even if not negligible, was only a small portion of what an aqueduct could have brought to town (e.g. *Lucus Feroniae*, where the pools of the baths had a capacity of 60 m^3, and the aqueduct's outflow was estimated at 2,800 m^3/day),[263] and the baths of Central Italy did not require the construction of aqueducts, but instead benefitted from their existence: they simply adapted their consumption to the local availability of water, and probably to its price. Provisions for water would have been made, in all likelihood by the funders of the bath buildings as highlighted by several inscriptions testifying to the benefactions of baths and their water supply, to ensure the smooth working of the complex.

[263] JONES 1962, 201.

IV.2 Circulation of water within the baths

From a balancing tank, water was led to pools, *natationes*, *labra* and water-drinking fountains. Water did not reach the boilers directly but instead transited via a small tank close to the boilers (fig. 68), so that bath attendants could regulate with some degree of precision by a series of taps and pipes the pressure and amounts of hot and cold water to send to the pools. These water tanks, either built up or made of metal (usually lead), were located in an elevated position in order for the water they contained to be sent under pressure to the pools and basins via lead pipes.[264]

The evidence, once more, is tenuous: the metal of the tanks and pipes was usually robbed, leaving only occasional negative traces in walls, floors, or masonry stands. The supply of water to the water-consuming facilities occurred at a reasonably high level, rarely preserved. Reconstructing the water network of a bath building is therefore rarely possible, and a few well-preserved examples (*Velia* South Baths [Ca.09], *Cumae* [Ca.02], *Neapolis* Fuorigrotta [Ca.04]) provide most of the evidence for the following discussion. Four main characteristics determined from these examples will be discussed: the separation between cold- and hot-water supply lines, the wall openings for pipes, the independence of the water facilities, and the scenographic introduction of water into the pools.

IV.2.1 Independent cold- and hot-water supply networks

One clear feature of the water circulation in the baths of *Velia* and *Cumae* was a separation between a cold- and a hot-water network. At *Velia*, the two networks were

[264] BOUET 2003, 212, 217.

distinct as soon as they left the main redistribution tank (W1), with one pipe leading to the smaller tank(s) presumably on top of the masonry block next to *praefurnium* A (fig. 69), which supplied the boilers for the hot-water facilities (R8a, R8b and possibly the *labrum* in R7), and another pipe going around the building and supplying the cold-water pools (R4b, R4c, R11a and *labrum* in R4a).

A similar separation was also observed in the Forum Baths of *Cumae* [Ca.02]. The main reservoir of the baths was located NW of the complex and was equidistant from both cold- and hot-water facilities. From there, water reached the *praefurnia* area (R2) through an opening in the N wall of R2 (fig. 70) and supplied smaller water tanks (presumably on top of the large masonry piers next to the *praefurnia*); from there, water was brought to the three hot-water pools of the *caldarium* (R3a, R3b, R3c). A different, independent network supplied the cold-water facilities (pools R8a and R8b), probably without any intermediary.

At *Neapolis* Fuorigrotta [Ca.04], from the shaft in R25, water was lifted to one or more upper redistribution tank(s), probably located in the service area (R17). The structures W of *praefurnium* A could have supported a tank for water waiting to be heated (fig. 71R), and the masonry block in the SE corner possibly supported the redistribution tank for cold-water facilities, feeding them water via the opening on the wall (fig. 71L); in this scenario, the supply for cold- and hot-water was clearly distinct too.

Finally, the reconstructed water system of the baths of *Privernum* [La.08] (fig. 72) also had a bipartite water system, with a division happening already at the exit of the cistern. One pipe ran towards the boilers supplying R12a–R12b, another pipe supplied the cold-water pool R7b and the fountains R2a and in R6.

A separate supply for cold- and hot-water facilities would in theory have the advantage of enabling bath attendants to have a better control over what could be offered to patrons. It is clear from the multiplicity of pipes and taps used in the management of the water temperature for hot baths, as seen in the example of the boiler of the Pisanella villa at Boscoreale,[265] that there was a precise control of the quantities of hot and cold water sent to the pools; it is therefore not surprising that this precise control was found also higher up the supply line, at the place where the water left the reservoir of the bath building.

IV.2.2 Wall openings for pipes

In order to reach the water-consuming facilities, the pipes had to go through a series of openings, which could be either created through the walls or, potentially, accommodated in functional openings such as windows and doors.

At *Velia*, water (either cold or warm) entered pool R8a through two square openings in the back wall (fig. 73), supplied the *labrum* in the recess of R7 via a square opening in the wall (fig. 74), and reached pool R8b via another opening in the wall, at the corner above *praefurnium* B (fig. 75). In the cold section, the water network, after running along the W outer wall of the building, supplied pool R4b through openings in the wall junctions and under the central window (fig. 76). The piping then entered the building at the junction between the walls of R11a/R4b, first feeding shallow pool R11a, then continuing along the walls to supply R4b via another opening (fig. 77), then R4c through its W wall before continuing along the outer wall of R4c to supply it through its E wall (fig. 78).

[265] BROISE *et al.* 1987, 97–100.

This preference for purpose-built openings located at the junction between walls is also found in the Forum Baths of *Cumae* [Ca.02]. The pipes carrying water in the direction of the service area (R2) took the straighter path through the N wall of R2 in order to avoid a deviation (and therefore a path with more angles) through the door some 3 m further to the W (fig. 70). All the openings in the walls to fit the pipes supplying cold-water pools R8a–R8b were located at the junction between two walls (fig. 79), whereas the openings leading to the hot-water pools were all made in a flat section of the wall (fig. 80), not necessarily close to a junction between walls.

Based only on the examples of *Velia* and *Cumae*, it appears that those openings were most often purposely-built, and that doors and windows were apparently not used to let pipes in, apart from exceptions in the apsidal pools R4b at *Velia* and R8a at *Cumae*—but even there, the sill of the window was dug in order to accommodate the pipes, probably in later phases. There does not seem to be any structural advantage in doing so, so the reason is probably to be looked for in decorative motives: doors and windows were probably framed with a veneer of marble, making the fitting of a pipe through them more difficult, whereas outer walls and walls in less prestigious areas would only have been plastered, making maintenance of those pipes easier.

For the South Baths of *Velia* [Ca.09], Vecchio noted that most of the openings were square, apart for those that were in a curve, which were rectangular. The situation at *Cumae* [Ca.02], where all the openings appear square (fig. 70, 79–80), even those located in a curve, could on the other hand suggest that the pipes going through rectangular openings supplied several facilities, and could therefore have been either larger or, more likely, there could have been several of those pipes, hence the need for a larger, rectangular opening.

What were the reasons for this difference in the setting of pipes and openings between cold and hot pools? Structural reasons have been discarded, and a shorter travel distance for pipes could be discarded too since the pipe supplying the *labrum* in R4a at *Velia* could have gone through the W wall of R9 instead of crossing R4b first. Perhaps the reason was to avoid having too pronounced bends in the pipes, as they are a weak point in any pressurised water system. Entering the building at a junction between two walls would have limited the bend to 45°, instead of an entry point in a flat wall where the bend would have been of 90°. Perhaps the difference between cold- and hot-water supply was the wish to create a scenographic introduction of water into the former,[266] which required to have some pressure in the pipe in order to create a projecting water stream (supposing the water supply was continuous). A similar projecting stream of hot water activated only occasionally was probably not desirable as it might have startled and scalded patrons. It also seems clear that builders tried as much as possible to locate the pipes outside of the areas used by the patrons; both at *Velia* and *Cumae*, most of the distance covered by the pipes was along the outer walls of the building.

IV.2.3 Independence of water features

Another characteristic of the circulation of water within the baths was an independence of the water features. None of those features ever seem to have been connected; they were conceived as independent units, and once water had reached a pool, it stayed in it until it was disposed of. This is perhaps unsurprising considering the desired degree of control over water circulation bath managers seemed to have

[266] See section IV.2.4.

sought. For that reason, the exception of *Minturnae* is all the more so noticeable. There, a passage was opened between a large, unroofed pool (*natatio*?) (R5) and the roofed pool of the probable *frigidarium* (R6, not fully excavated) (fig. 81). Despite modifications that blocked this communication in a later phase, it appears that it was the same water body that filled both pools; it is however less clear to what extent patrons could use this passage freely to shift from one room to the other. This feature is exceptional in bath architecture, with comparisons only in spa baths (e.g. *Centumcellae*, fig. 82, and Rennes-les-Bains),[267] but its impact in the bathing practice is not fully appreciated yet.

IV.2.4 Scenographic water introduction into pools

Lastly, there appears to be a certain scenography in the supply of water to the pools, by the use of axiality and/or symmetry, especially for the cold-water pools. In the baths of *Velia,* a bather standing inside the building would have perceived the water supply as follows. In the heated pool R8a, water arrived via two openings in the back wall (fig. 83). R8b, on the other hand, apparently received its water only via a pipe coming out of the wall inside R8, which only then reached R8b (fig. 84). For the *labrum* in R7, the opening was in the centre of the N wall (fig. 85); it is not clear if the water was freely poured from above into the basin or if the pipe went down before going back up from within the *labrum* in order to provide water under pressure. As for the cold pools, in R4b, water was supplied from three sides: one axial spout from the base of the back window and two lateral spouts in the jambs framing the opening towards R4 (fig. 86). Shallow pool R4c was similarly supplied, with spouts in the lateral

[267] KÖHLER 1996, 188.

jambs (fig. 87). Damage to the back wall of R4c does not allows us to determine if there was a third, axial spout.

A similar staging of the introduction of water was also noticed in the complexes of *Cumae* [Ca.02] and *Neapolis* Fuorigrotta [Ca.04]. The apsidal cold-water pool at *Cumae* (R8a) may have benefitted from a two- or three-points water supply, two in the jambs framing the opening towards R8, and a possible third in the axial window, possibly added in a later phase (fig. 88); if it had a three-ways supply, it would be similar to pool R4b at *Velia*. As for rectangular pool R8b at *Cumae*, its supply is comparable to that of pool R4c at *Velia*, with a supply via the jambs (fig. 89). The hot-water pools at *Cumae* (R3b, R3c), mentioned earlier, had a supply from the back wall and a possible additional one from the side wall (for R3c) (fig. 80); no supply came from the jambs. Last well-preserved example, the smaller cold-water pools of the baths of *Neapolis* Fuorigrotta (R6a–R6b) were also supplied via the jambs framing the opening towards R6; instead of a pipe going through the wall via an opening, another solution was used: a recess was dug in the lateral wall to accommodate the *fistula* (fig. 90).

An axial supply was also found in the baths of *Aquinum* [La.01]. In both cold-water pools R11a and R41a, water arrived through the back wall, via an architectural element monumentalizing its ingress. In pool R11a, a pedestal-like structure against the N wall played a part in the water display, as indicated by the thick incrustation layers that covers it (fig. 91); it could be that water flowed down on it, or perhaps more likely that it supported some sculptural element from which water poured. In R41a, the supply pipe is still preserved at the bottom of a small niche high up on the wall. At *Minturnae* [La.07], a tower-like structure in the *natatio* R5, installed in a secondary

phase, allowed for water to enter the pool in a decorative way, possibly by a vertical water stream or a now lost ornate spout (fig. 92).

This staging of the water elements was achieved through symmetry and axiality, which in turn monumentalised said supply. A supply from a single source tucked away in a corner would fill a functional purpose; multiplying that supply, making it the focus of the attention by placing it in a visually striking position and by enhancing it with spouts (whose use was not uncommon, cf. Sen., *Ep.*, 86.6: *aquam argentea epitonia fuderunt*) or niches, added an intentional display element. This type of monumentalised supply—via both the jambs and the back wall—is well illustrated by one of the pools of the Small Baths of Hadrian's Villa (fig. 93). Axiality and symmetry in the supply of water are obviously not a feature restricted to Central Italy, as Bouet showed for the baths of *Gallia Narbonnensis*; interestingly, he identified that the smaller, private baths rarely displayed an axial and/or symmetrical supply, whereas that was the case for all the larger, public baths.[268]

The experience of a patron visiting a bath complex would no doubt have been enhanced by such decorative arrangements, further complemented by the architecture of the space and the decoration (marble veneer, mosaics floors, wallpainting, potential sculptures): from a vestibule preceding the *frigidarium,* the columns separating the two rooms would have framed an axial pool in the *frigidarium,* possibly equipped with an axial spout from which water flowed. Once inside the *frigidarium,* water flowed from several spouts in streams into the pools; these streams would have framed the view of the bather standing or sitting in the pool. The sound environment played a great part as well—Seneca (*Ep.* 86.7) talked about water crashing down *cum fragore*—and a patron

[268] BOUET 2003, 225.

must have known which room they were about to enter even before having actually entered it. Once inside a pool, the constant splashing of the water stream on the water surface drowned out the other sounds in the room. This lavish use of water, as reflected through the archaeological remains of the baths of *Velia*, *Cumae*, *Aquinum* or *Neapolis*, at times combined with a continuous supply of water, might be exactly what Seneca was complaining about when he was talking about 'masses of water that fall crashing down from level to level' (*Ep.* 86.7). If a more elaborate introduction of water was noted for cold-water pools (accounted for by the availability of larger quantities of water and the greater flexibility in the positioning of the water ingresses), water in heated rooms also offered a sensorial experience to the bather, the heat and steam blurring the vision, dulling the senses, allowing one to relax. Appreciating the displays and aesthetics of water, and finding pleasure in its use, was part of a wider Roman attitude towards water, visible in many building types beyond baths.[269]

[269] ROGERS 2018, esp. 64, 69, 82–83 for baths.

IV.3 Reuse and disposal of water

Once used in the baths, the wastewater had to be disposed of outside of the building. This water could, however, serve a secondary purpose before ending in the city sewers. We will first look at how water was disposed of, then examine the possibilities of reusing such water, above all in latrines.

IV.3.1 Evacuation of water from water-consuming facilities

The facilities consuming most water were the pools for communal immersion. The large shallow outdoor swimming pools, or *natationes*, of the imperial baths of Rome that contained several hundred cubic meters of water (1,400 m³ for the *natatio* of the Baths of Caracalla in Rome)[270] were the exception rather than the rule, and most of the Central Italian examples were not equipped with such a facility (tables 10–11).

TABLE 10: *NATATIONES* AND LARGE POOLS IN THE BATHS OF CENTRAL ITALY

Site	Cat. no	Room no	Dimensions (m) and capacity of *natatio*
FAESULAE	[To.02]	R1	18.70 x 5.65, depth 1.15 m Capacity: ca. 120 m³
MINTURNAE	[La.07]	R5	15.70 x 7.20, overflow at 0.80–1.00 m Capacity: ca. 90–110 m³
NEAPOLIS Santa Chiara	[Ca.G.16]	R2	15.90 x 5.80, depth 1.20 m(?) Capacity: ca. 110 m³
SEPTEMPEDA	[Ma.09]	R1a	8.20 x 3.80, depth 0.90 m Capacity: ca. 28 m³

[270] MANDERSCHEID 2000, 522.

TABLE 11: LIST OF BATH BUILDINGS CONTAINING A POOL ERRONEOUSLY IDENTIFIED AS *NATATIO*

Site	Cat. no	Room number	Dimensions (m) and capacity of pool
FAESULAE	[To.02]	R3–R4	33.65 x 14.80, depth max. 2.20 m Capacity: ca. 750 m³
FERENTUM	[La.03]	R1b	9.30 x 6.60, depth 1.20 m Capacity: ca. 70 m³ (40 m³ for GARBRECHT & MANDERSCHEID 1994, 21–22)
RUSELLAE	[To.06]	R8a	11 x 8, depth 2.60 m Capacity: ca. 230 m³

The large quantity of water in the *natationes* (up to 110–125 m³) required an evacuation system that had to be planned at the time of their construction. Only the *natatio* of *Minturnae* [La.07] provides us with evidence as to its drainage: in its NE corner, an evacuation channel (0.50 m wide, 0.10 m high) allowed the emptying of the pool, discharging into a larger channel running E–W between the heated rooms R3–R4 and the *natatio* R5 and continuing westwards, where it collected water from the roofs and the *palaestra* (in R7) before disappearing under structures further to the west. This type of channel, running in a wall between a heated room and a pool and connecting to both, is unattested elsewhere. The estimated time (25 minutes) for the emptying of the *natatio* of *Minturnae* [La.07],[271] the absence of any large disposal pipe in that of *Faesulae* [To.02] and *Septempeda* [Ma.09] (for which the drainage time was calculated as ca. 62 minutes), or in the large decorative pool R1b of *Ferentum* [La.03] clearly indicates that the operation of the baths did not require a quick drainage of the pools.

If *natationes* are found only in a handful of Central Italian public baths, virtually all the baths, on the other hand, were equipped with indoor immersion pools in the

[271] See section IV.1.2.

frigidarium and the *caldarium* (table 9). Water could be evacuated from pools in a variety of ways, with significant differences if the pool was on a hypocaust or not. The bottom of cold pools was usually at a lower level than the circulation level of the baths, and since the holes for evacuation had to be located on the floor of the pool or at the bottom of the side walls, a system of pipes was required to lead the water to a drainage network running under the baths and connected to the urban sewer network. Such pipes were closed with a metal hinge or plugged with a terracotta stopper.[272] At *Aquinum* [La.01], pool R11a was emptied via a drain in its NW corner, leading water into the channel of the nearby latrines;[273] the pool floor was sloping slightly in that direction. Similarly, at *Neapolis* Fuorigrotta [Ca.04], in a secondary phase, the pools of the *frigidarium* emptied via pipes that went underneath the floor of the room (fig. 94), ran along the E wall of R6 and R3 to feed the contemporary latrine. Water from *labra* and basins could be emptied the same way, with a second pipe in the basin leading water directly into a sewer network, as used for the centrally positioned *labra* in the *frigidaria* of the baths of *Aquinum* [La.01] in R11 and R41 (fig. 95–96).

Another way of evacuating water was to empty the content of pools and basins on the floor of the room from which they were accessible. Continuously supplied *labra* could work on this principle, with overflowing water: at *Velia* (South Baths [Ca.09]), water from a *labrum* placed in a recess (R4a) spilled on the floor and reached the sewer network running underneath the complex via one of the two gratings located near the foot of the *labrum*. Pools could empty on the room floor only if their floor was at the

[272] GARBRECHT & MANDERSCHEID 1994, 60–64.
[273] See section IV.3.3.

same level or higher than the circulation level of the room, and was therefore more common for warm-water pools (e.g. pool R24b at *Aquinum* [La.01], fig. 97).

From the floor of the room, water would be disposed of through gratings opening into the baths' sewer network (see section IV.3.2 and table 12) or via a drainage channel leading outside of the room. Draining water from the floor of heated rooms was more complex since it would not have been possible to place a grating into a *suspensura* floor: the water could have been redirected to a cold room (allowing for the cleaning of the room at the same time) or sent through a drain directly outside the room, as at *Aquinum* [La.01] R24 where a *tubulus* set horizontally in the masonry seems to have channelled water outside the room, passing above a *praefurnium*.

When no evacuation pipes are found in the pool, two options remain: either an evacuation by hand (certainly possible, but probably unlikely for any pool apart from the smallest ones) or an evacuation through the *praefurnium*.[274] Maréchal, using evidence from *Ostia*, recently suggested that the drainage occurred through the *testudines* that were equipped with taps, enabling the pools to be emptied when desired, probably at the end of the day when the fire in the furnace was put out or its intensity diminished so that the operators could handle the hot metal. Through these taps, the content of the pools would have been disposed of via a drainage channel, remains of which are sometimes found in the vicinity of several *praefurnia* (for instance in R13 in the South Baths at *Velia* [Ca.09]). We know of only one *testudo* with a tap, from *Samos*, considered by Garbrecht and Manderscheid as a local invention but Maréchal deems it might have been more widespread (we know after all of very few

[274] MANDERSCHEID 2000, 504–505.

preserved *testudines*).[275] The reconstruction of a drainage system via the *testudines* would account for the absence of draining pipes in many hot-water pools.[276] Further, service areas with *praefurnia* equipped with boilers required a water drainage system to empty water from the boilers for maintenance. Service area R25 at *Aquinum* [La.01] still contains *in situ* remains of a lead *fistula* interpreted as drainage for the boiler on *praefurnium* F, which could also have served to empty water from pool R24b (fig. 98). Worth mentioning is the situation in the second phase of the *caldarium* pool R8b of the South Baths of *Velia* [Ca.09], where water was drained via a *fistula* still *in situ* through the decommissioned first-phase *praefurnium*.

IV.3.2 Sewers networks within and outside bath buildings

Bodon, Riera and Zanovello (1994) offered a useful hierarchical classification of drainage systems, divided in four categories.[277] Water, once evacuated from the facilities in which it was used via 1st order drains, could be disposed of in several ways: by discharging into a drainage network running under the building, by emptying into a dedicated channel leading it out of the building and into the urban sewer network (both 2nd order drains), or by connecting directly with the latter when it ran underneath the bath building (3rd or 4th order drain).

A second order drain network was commonly found in bath buildings and served to convey water drained from the pools outside of the building. These networks had to be thought out at the same time as the first construction phase of the building,

[275] GARBRECHT & MANDERSCHEID 1994, 74; MARÉCHAL 2017, note 13.

[276] MARÉCHAL 2017.

[277] In brief, first order drains conveyed water away from a point of use, 2nd order drains led it out of a building, 3rd order drains were the main canalisations under the streets of the city and 4th order drains were the main collector discharging outside of the city. Not all orders needed be present in a city, and bath buildings were rarely concerned with 4th order drains.

and the complex of *Forum Sempronii* [Ma.05] provides a good picture of such network. A main collector ran through the length of the building (R10, R9, R20), collecting water from the cold-water pools (R10a, R10b) and possible *labra* (R5?, R12?) before leaving the building and being joined by another drain coming from the NW. The collector then turned eastwards to flush a latrine (R22), then bifurcated southwards and continued outside of the building, where another channel coming from the *praefurnia* in R15 discharged into the main channel. This example contrasts with the one from *Privernum* detailed below: at *Forum Sempronii*, a main channel went around the whole building to collect water from all facilities in order to flush the latrines, then to take water outside the building, whereas at *Privernum*, most of the water-consuming facilities had dedicated channels bringing water to the pre-existing 4th order drain in the shortest way possible.

Sewer networks seem to have had two focal points. One was the *frigidarium*: in several examples, the collector either passed under or started from the centre of the *frigidarium*, and water reached the collector via a decorated grating (table 12). The second focal point was the latrine, when the building was equipped with such a facility (see section IV.3.3); the sewer network was organised in order to pass through them, even if that meant significantly increasing the path the water had to follow before arriving outside the building, as seen at *Forum Sempronii* [Ma.05]; similarly, the water disposal system at *Neapolis* Fuorigrotta [Ca.04] was reorganised in a posterior phase in order to flush the newly-built latrine.

TABLE 12: BATH BUILDINGS WITH A WATER DISPOSAL SYSTEM CENTRED UNDER THE *FRIGIDARIUM*

Site	Cat. no	Room no.
CUMAE	[Ca.02]	R8
NEAPOLIS Fuorigrotta	[Ca.04]	R6
PRIVERNUM	[La.08]	R7
RUSELLAE	[To.06]	R5
VELIA South Baths	[Ca.09]	R4

Similarly to what happened with the supply of water, where a division between supply to cold- and hot-water facilities occurred straight from the exit of the redistribution tank, there seems to have been a distinction between the disposal of water from cold- and hot-water facilities. The water from cold-water facilities was most often disposed of in a dedicated collector channel, of the required length to collect water from all the pools before discharging outside of the building, after having flushed a set of latrines if there was one. Water from the warm-water facilities, instead, was emptied into the *praefurnium* chamber and crossing the service area, usually joined the 3rd- or 4th-order drain outside of the building, without connection to the disposal network of the cold-water facilities.

The rarest case was that of the urban sewer network (a 3rd or 4th order drain) running under the bath building. These main urban networks, planned already from the design phase of new city foundations, were difficult to retrofit to older cities that were not originally equipped with them;[278] in their absence, the streets were open drains. For easiness of construction, in both situations, urban drainage networks usually followed the street network (e.g. *Tifernum Mataurense* [Ma.10]) and therefore, did not pass under already built buildings. This is the reason why such major drainage

[278] WILSON 2000b, 307.

networks are usually not found under bath buildings, with the exception of those of *Privernum* [La.08] and *Aquinum* [La.01], two bath complexes built over previously existing structures and over neighbouring areas, thus impinging upon the more ancient sewers network. It is possible that some establishments did not benefit from sewers and instead discharged into neighbouring fields and gardens,[279] but this was more likely for smaller, rural baths than larger urban complexes. Urban sewer networks discharged most often in rivers that flowed near or through cities (as at *Minturnae* [La.07], emptying into the river *Liris*, modern-day Garigliano), or in the sea for coastal sites. Less often, waste could be collected in a tank or spread in fields.[280]

IV.3.3 Secondary use of water: latrines

The most common secondary use of bathing water was to flush latrines[281]—another long neglected topic, which started drawing proper interest from the 1990s onwards.[282] Latrines are very commonly found associated with baths, more often than with any other kind of public building,[283] and are readily identifiable by their remains (the deep channel in which faeces fell and were flushed, and the narrow clean water channel than ran next to the feet of the customers).[284]

Latrines in bath buildings in Central Italy have recently been studied by Van Vaerenbergh,[285] who collected evidence for ca. 40–50 examples, most located in bath

[279] Palladius, *Op. Agr.* I.39.4.
[280] WILSON 2000a, 176–178.
[281] Other possibilities existed: powering industrial facilities (e.g. the water mill under the Baths of Caracalla in Rome (SCHIØLER & WIKANDER 1983), a practice perhaps not exceptional according to Palladius (*Op. Agr.* I.41)), and, in rural contexts, irrigating and fertilizing fields (WILSON 2000a, 177–178).
[282] NEUDECKER 1994, esp. 83–91; BOUET 2009; JANSEN, KOLOSKI-OSTROW & MOORMANN 2011.
[283] JANSEN & VAN VAERENBERGH 2011, 113.
[284] WIPLINGER 2012.
[285] VAN VAERENBERGH 2006; JANSEN & VAN VAERENBERGH 2011, 78–84.

complexes falling outside the scope of this research;[286] he identified two examples from public baths in Central Italy, at *Neapolis* Fuorigrotta [Ca.04] and *Faesulae* [To.02], to which we can add another 20 examples in 17 baths (table 13).

TABLE 13: LIST OF LATRINES IN THE PUBLIC BATHS OF CENTRAL ITALY

Legend: Col. 3: *: identified based on plan only. Col. 4: Ins: inside the bath building; Ent: close to the entrance of the bath building; Ag: against the bathing block but not accessible from within; Sep: separated from the bath building.

Bath building	Cat. no	Room no	Location	Length of channel (m)	No. of corners	No. of seats[287]
Alba Fucens	[Ab.01]	R10E	Ent/Ins	9	2	13
		R10W	Ent/Ins	18	2	27
Ancona, Amphitheatre B.	[Ma.01]	R9	Ag	4.5	1	6
Aquinum	[La.01]	R10	Ins	10	1	15
		R36	Ent	ca. 7	1	10
Faesulae	[To.02]	R13	Ag	ca. 11	2	15
Florentia, P.za Signoria B.	[To.04]	R15	Sep	–	–	–
Forum Sempronii, Small B.	[Ma.05]	R22	Ag–Ent?	6	1	8–9
Forum Sempronii, Large B.	[Ma.04]	R5	Ag–Ent?	ca. 8	2	10–11
Lucus Feroniae, Forum B.	[La.06]	R2?	Ent	max. 4	1	max. 6
Neapolis Fuorigrotta	[Ca.04]	R2	Ent	5	0	8
Privernum	[La.08]	R5	Ins	1.5	0	max. 3
		R8	Ins	2.5	0	4
Rusellae	[To.06]	R2	Ins	ca. 5	1	7
Saepinum, *Decumanus* B.	[Mo.02]	R14	Ag	2.8	1	3–4
Sentinum, Extraurban B.	[Ma.07]	R29	Ag	28	3	42
Sentinum, Urban Baths	[Ma.08]	R20?	Ins?	?	1–2	> 4
Tadinum?	[Um.G.05]	–	–	–	–	–
Velia, South Baths	[Ca.09]	R12	Ins	10	1	–

[286] JANSEN & VAN VAERENBERGH 2011, note 19.

[287] Calculated using the seat width in latrine R10 at *Aquinum* (ca. 0.63 m/seat), where the seats are preserved, then deducing a seat per corner. Compare with the seat width of latrines at Hadrian's villa, ranging from 0.50 to 0.87 m (JANSEN 2003, note 12).

Latrines were often located inside the bath complex and/or close to its entrance. If they were naturally a facility provided to the customers of the baths, their position close to entrances suggests that they were also used more widely, by passers-by and local inhabitants.[288] At *Lucus Feroniae*, *Neapolis* Fuorigrotta, and *Velia* (South Baths), the latrines were located next to the main entrance and were accessible either by a vestibule, a small corridor, or the *palaestra*; their access did not necessitate entering the rooms equipped with water facilities. At *Aquinum*, the latrine of the women's section (R36) had two entrances, one from an access corridor (R35) leading to the *frigidarium*, the other directly from the street.

The very large number of seats in the toilets linked to the baths of *Alba Fucens* (ca. 40 seats) and *Sentinum* (42 seats) was due to the exceptional circumstances surrounding those baths: at *Sentinum*, the bathing block was part of a very large complex with an accommodation block and a large *palaestra*, filling functions beyond a traditional bath building;[289] at *Alba Fucens*, the latrines were certainly used by the people frequenting the neighbouring sanctuary of Hercules and by the inhabitants of the centre. Similary, at *Faesulae,* the 15-seater latrines located against the outer wall of the baths may have accommodated the users of the nearby theatre. Otherwise, most latrines were much smaller in scale and accommodated 5–10 people, with the notable exception of the baths of *Aquinum* [La.01], equipped with no less than two sets of latrines for some 25 people, the sheer scale of those baths easily explaining this larger figure.

[288] The identity of the users of the baths' latrines is difficult to determine; graffiti left on the wall plaster may sometimes be of help (see MARCHIONNI 2015 on a set of latrines at *Minturnae*), but none was found in the latrines of the baths of our catalogue.

[289] DE MARINIS, SILVESTRINI & PALERMO 2008, 206 suggested that the building also served as *xenodochion.*

IV.3.3a Water in latrines

The working of a bath latrine: the case of Aquinum

The well-preserved latrine at *Aquinum* [La.01] (fig. 99) provides a good example of the way water circulated in latrines. Clean water arrived from the west and filled a small basin on the floor, against the W wall. The massive lime incrustation now visible makes it clear that running water was used (fig. 100). The overflow of this basin flowed in the gutter channel starting in the NW corner of the basin, followed the course of the gutter channel towards the N, then arriving in the SE corner of the latrine room, fell into the latrine channel more than 1 m below. The slope then guided the (now waste-)water towards the NW corner of the room, at which point it bifurcated N to discharge into a main city sewer, running E–W under a street. In this scenario, the flow of water in the latrine channel would be weak but constant. There was however an additional water supply coming from pool R11a, directly to the E of the latrines: at floor level, in the NW corner of the pool, a drain connected the pool to the latrine channel. Its location at ground level, and the absence of any other water evacuation hole in the pool, indicate that the water of the pool would be disposed of by this means; when this happened, the flow could be much more intense—though brief—than the gentle constant flow from the basin (depending on the size of the drain pipe). Finally, this evacuation hole was located at the bottom of a vertical groove that continued for the whole height of the preserved wall, and may have contained a pipe (possibly a lead *fistula* robbed at a later time, or a terracotta pipe) serving as overflow for the pool and directing the water in the latrine, thus flushing the latrine channel with another gentle water flow.[290]

[290] FERRARI 2019.

This example illustrates three aspects of the use of water in latrines, which will be considered in the following sections. First, it tells us about the necessity of having two types of water in a latrine, clean- and wastewater. Second, it reveals that two different flushing methods could be used to clean the latrine channel: either a gentle, continuous flow or a sudden, violent burst. The last point connects to the first one: if two types of water were necessary, then two different supply channels had to be used, and the most convenient supply for wastewater was water from a pool of the baths, either via overflow or via emptying, thus highlighting that the location of the latrine next to the pool was a rational decision.

Clean- and wastewater use in latrines

Many latrines were equipped with a clean-water basin, some even with a small fountain, the latter implying the use of running water and requiring a connection to the water supply network.[291] As detailed above, the men's latrines in the baths of *Aquinum* were equipped with basins; the same is true of the women's latrines of the same baths, as well as at *Faesulae* [To.02], *Sentinum* Extraurban [Ma.07], *Velia* South Baths [Ca.09], *Neapolis* Fuorigrotta [Ca.04], and this feature was probably more common than the archaeological remains suggest. These basins have been interpreted either as places to store and clean (self)-washing material, or as hand-washing basins.[292] On the other hand, few indications of fountains have been found. The basin at *Aquinum* was possibly fed by water under pressure, with a spout above it. The basin in a corner of the latrines of *Neapolis* Fuorigrotta is likely to have had a fountain, with the groove in the back wall containing a lead *fistula* that brought water to a spout. Even

[291] JANSEN & VAN VAERENBERGH 2011, 74.

[292] JANSEN & VAN VAERENBERGH 2011, 74 found only one literary reference to handwashing after going to the toilet (Petron., *Sat.*, 2.271) and warned about the possibility that practice might be more a modern than a Roman one.

though none were found, taps may have been used to turn the flow on and off. The water contained in the basin could have also been used to clean the latrine floor and seats.

Upon leaving the basin, water flowed in a shallow gutter channel, examples of which are still visible *in situ* at *Aquinum* [La.01] and *Neapolis* Fuorigrotta [Ca.04]; bathers could have used that water stream to clean themselves once they were done.[293]

Once clean water had gone through fountain, basin and gutter channel, it fell down the latrine channel, at a significantly lower level, becoming wastewater as it flushed the latrines. This source of water provided a continuous but gentle flow, which might not have been enough to keep clean the channel of a set of latrines used by the customers of an entire bath building and more. The drop in height from the gutter channel to the bottom of the latrine channel would have increased the efficiency of its cleansing, since water falling down from a certain height would see its speed increased.

The significant depth at which the latrine channel was usually set, sometimes several meters below circulation level, was also due to technical factors. First, when water from a nearby pool was used to flush the latrine channel, this water had to come out of the pool by its evacuation hole, normally set at the floor level of the pool. Since the pools are already set at a lower level than the main circulation level of the rest of the baths, this evacuation was therefore located at a deep level. Second, supposing that this flush might be somewhat violent to get rid of all residues, water might have occasionally flooded the channel and its level increased before being drained out

[293] SCOBIE 1986, 411; CHARLIER *et al.* 2012; WIPLINGER 2012.

(when it was not the entire urban sewer network that backed up during floods).[294] A deep channel was therefore useful to avoid having all the wastewater charged with residues overflowing in the latrine room.

Two flushing methods

The example of *Aquinum* postulated the existence of an overflow in pool R11a, flushing the latrine channel (R10), making it one of the rare examples, possibly with *Rusellae* [To.06] (where the overflow of R8a may have flushed the latrines in R2) of the use of an overflow to flush latrines. In order to have a constant gentle flushing of the channel, it was however more reliable to have a dedicated supply of clean water, first feeding the basin and the gutter channel before entering the latrine channel.

An intense, occasional flush would have been desirable for a thorough cleaning of the latrine channel and would have been possible only if the latrine was connected to a pool. Both a continuous gentle flow and an occasional, intense flush would have required large enough quantities of water to correctly flush the latrine channel. Therefore, the creation of latrines in a secondary phase of construction could reflect changes in the water supply, which may have been the case at *Neapolis* Fuorigrotta [Ca.04] and at *Faesulae* [To.02].

IV.3.3b Location of latrines in relation to pools

The necessity of water for cleaning the latrine required that they be integrated into the water circuit; for a larger occasional intense flow, a location at the end of the water circuit, after water was used by customers and just before it was disposed of in the sewers, was the most rational choice. This requirement explains why many latrines were located next to facilities using the largest quantities of water. At *Aquinum* [La.01],

[294] WILSON 2000a, 176.

both latrines were located next to the large *frigidarium* pools; the situation was the same at *Faesulae* [To.02], in the Large Baths at *Paestum* [Ca.06], and possibly at *Rusellae* [To.06].

Conversely, the latrines at *Velia* [Ca.09] were located close to the entrance but away from the pools, and were not connected to the water supply system of the bath building, the water instead coming directly from a large urban reservoir. The independence from the water network of the bath building, and therefore from the level at which water was evacuated from the pools, is probably the reason why the latrine channel was set at the same level as the circulation of the room instead of being set at a deeper level, as in all other examples.

When the latrine was connected to a water-consuming facility, it was always with a facility using cold water. The less frequent renewal of water in the hot pools, dictated by the necessity to heat water—which could only be done in batches—necessarily limited the quantity of water available from such pools and made a constant water flow impossible. The stronger smell and increased mineral build-up generated by hot water might also have been reasons to prefer the use of cold water,[295] even if questions of smell were much less of an issue for the Romans than they are for us.[296]

[295] Even in the spa baths of *Centumcellae*, where hot water availability was no concern, aqueduct-supplied cold water was preferred to flush the latrines (VAN VAERENBERGH 2011, 80).
[296] BLONSKI 2014b on Roman attitudes to filth and cleanliness.

IV.3.3c Conclusion on latrines

The existence of multi-seats public latrines was linked with the presence of abundant water for flushing, and discharging possibilities.[297] The best location in a town to have an abundant supply of water without using clean water, which could be put to better use, was clearly at the end of the water network of bath buildings. The association of latrines with public baths is clearer than with any other large-scale public building hosting crowds for several hours, such as theatres or amphitheatres,[298] because of the much more constrained circulation patterns in the latter,[299] the lesser abundance of water, and the greater difficulty in accessing latrines inside the structure from outside. Van Vaerenbergh suggested that the creation of large toilets was not the objective of bath builders;[300] perhaps we may go further and consider the possibility that it may not always have been the decision of bath builders to offer latrines to customers but instead, that there was a push—perhaps a legal requirement—from municipal authorities to incorporate latrines into bathing establishments.

[297] The first known multi-seats public latrines appeared in public baths at *Pompeii*, after their connection with the aqueduct (VAN VAERENBERGH 2011, 78).
[298] GROS 2002, 448, who suggested the existence of temporary installations.
[299] ROSE 2005.
[300] VAN VAERENBERGH 2011, 78.

IV.4 Conclusion

This examination of the water supply and water usage of bath buildings confirmed that, if most baths were indeed supplied by water from an aqueduct, the commonly supposed correlation between the construction of bath buildings and that of aqueducts was valid only in the exceptional cases of imperially-funded baths in the capital and other very large cities: in no case could it be demonstrated that an aqueduct was built so that a city could be equipped with a bath complex. This is supported by the epigraphic evidence: none of the commemorative or honorific inscriptions of the period indicate that a benefactor built both a water supply and a bath building (at *Mevaniola* [E43], the benefactor *restored* the baths and water supply); quite the opposite, since the supply of water to a city could be a benefaction in itself, as suggested by an inscription from *Forum Novum* [E27]. That no benefactor offered both an aqueduct and a bath building could be accounted for by the obvious economic explanation, but it is also very likely that by the first century AD most cities were already equipped with aqueducts,[301] and the water-consuming facilities of the baths were sized according to the availability of water in town. The few inscriptions from Central Italy where both bath and water benefaction are recorded together date to the Late Republican period (or the very beginning of the Imperial period), at *Praeneste* (1st half of the 1st cent. BC)[302] and at *Mevaniola*, mentioned above (2nd half of the 1st cent. BC), where in both cases the

[301] DE ROSA 2008, 20-21 collected evidence for the construction of 67 aqueducts in Central Italy, 33 (49%) of which are dated to the Augustan period and 1st cent. AD, 16 (24%) before that, 2 (3%) after, and the remaining 16 (24%) are undated.

[302] *CIL* I².1473=EDR110711 (*Praeneste*).

local council restored *balnea* and brought water to them, thus ensuring they would be sufficiently supplied in water.[303]

On the topic of the circulation of water within individual buildings and its distribution to the water-consuming facilities, the few well-preserved examples (*Velia, Cumae, Ferentum, Neapolis* Fuorigrotta) revealed how water could be delivered with a scenographic goal in mind, spurting out from the jambs framing the access to the pools, and/or from their back wall, all this geared towards an enhanced sensorial experience of bathing. Similarly, some repetitive features of the water disposal system, such as the presence of a drain at the centre of the *frigidarium,* were noted in several bath buildings. Considered together, these features strongly suggest that some elements of the water distribution and disposal were integral parts of the blueprints of the individual rooms; a further implication is that the water distribution network was planned alongside the rest of the building and its installation, including the creation of the recesses and holes in the walls into which to fit the pipes, was carried out during the construction process, not after the fabric of the building was finished. The famous mosaic from Via Marsala in Rome (fig. 21), even though it represented the plan of a finished building rather than that of a project, did include indications of water elements—not only pools, but also possibly the water supply system.[304]

[303] FAGAN 1999a, 308–312.
[304] BOUET 1998, 855.

V. Heating

Introduction

The heating system is arguably the most characteristic element of any bath building of the imperial period and often allows for a straightforward identification of the function of the structure, even when such structure is poorly preserved.[305]

The most elaborate description of the heating system of Roman bath buildings is, once more, provided by Vitruvius (V.10.1–2), who first tackled the question of the furnaces (their location, number, disposition, and what they should heat) before listing paratactically the different elements that composed the hypocaust.

> "[…] Care should also be taken that the men's and women's caldaria are connected and placed in the same area. In this way it will be possible for them both to share a common furnace for the tubs. Three bronze tanks should be assembled above the furnace, one a caldarium, one a tepidarium, one a frigidarium, and they should be so placed that however much hot water flows from the tepidarium into the caldarium, as much cold water is coming in from the frigidarium to the tepidarium in the same fashion. In addition, the ceilings of the tub rooms can be heated by this common furnace."

> "This is how to make the suspended floors of the caldaria. First, the floor is laid with one and one-half foot tiles that incline towards the furnace, so that if a ball is thrown in it it cannot stay in place, but returns to the furnace of its own accord. In this way flame will circulate more easily under the suspended floor. On top of this, piers of eight-inch tiles should be placed so that two-foot tiles can be placed over them. The piers should be two feet high and they should be mortared with clay mixed in with hair, and over them place the two-foot tiles, which will hold up the pavement." (Trans. ROWLAND & HOWE 1999).

Most of the heating systems of the imperial-period baths of Central Italy followed the structure outlined by Vitruvius—a hypocaust made of a brick floor (*area*) with short pillars (*pilae*) made of small bricks supporting a floor (*suspensura*), and boilers warming water for the hot pools—but variations were not exceptional at all

[305] MARÉCHAL 2012, 153–154 for a summary of research on the topic, with bibliography.

(some of which mentioned by later technical authors)[306] and will be investigated in this chapter.

[306] Further descriptions of bath heating systems were provided by Faventinus, 16 (3rd cent. AD) and Palladius, I.39.2 (3rd cent. AD or later) (PLOMMER 1973, 1–3). They are very similar to Vitruvius' description, with slight variations in the dimensions of individual elements. Unlike Vitruvius, however, the two later authors were above all concerned with private baths, mostly in villas (PLOMMER 1973, 11), and will therefore not be focused on in this chapter.

V.1 Components of the heating systems

V.1.1 *Praefurnia*

The *praefurnia* were the furnaces through which the air in the hypocaust and in the walls was heated; at the same time, they served to warm the water feeding the pools of the heated rooms. They were operated from the service areas of the baths that were usually hidden from the sight of the bathers.

The simplest *praefurnia* took the form of an opening in the wall of the hypocaust, usually covered by a flat lintel, or by a relieving arch to redirect the loads away from the opening. The width of such openings varied, but most ranged between 40 and 60 cm. *Praefurnia* could be closed by a metal door, which allowed the operators to better control the fuel consumption and the draft; an example is known from the Suburban Baths of *Pompeii*, but their use was in all likelihood more common.[307] However, not every opening in the wall of a hypocaust was a *praefurnium*: some differed from proper *praefurnia* by their smaller size, their position often on the shorter side of the room, and the absence of a lining made of refractory stones. These could be accesses to the hypocausts to enable bath operators to clean and maintain them,[308] but the very small dimensions of some could instead suggest they helped in regulating the draft. They appear only rarely in the baths of the catalogue (*Septempeda* [Ma.09] R10, possibly *Velia* (Vignale Baths [Ca.10] *praefurnium*(?) L, fig. 101)), but were apparently common in the baths of *Ostia*.[309]

[307] D'AMBROSIO, CHIDICHIMO & SORRENTINO 2006, 6.
[308] POCCARDI 2006b, 150.
[309] POCCARDI 2006b, 150; see also BROISE *et al.* 1987, 106.

Some *praefurnia* were more elaborate, with the addition of longitudinal extensions forming a 'heating channel', going either inside the hypocaust, outside of it, or in both directions; these extensions were often more than a meter long, and sometimes up to 3 m (*Paestum* Large Baths [Ca.06], *praefurnium* I, fig. 102; *Aquinum* [La.01], *praefurnium* E). The typology established by Degbomont illustrates in a simple way the different types of *praefurnia* (fig. 103).[310] Enclosing the fire with such channels had the advantage of enabling a better control of the air draft,[311] and the more elaborate types were deliberately chosen for particular purposes. Degbomont's types 1 and 2 had the advantage of having the hearth almost inside the hypocaust, as opposed to types 3 and 4 where the hearth was outside the hypocaust, potentially leading to a greater heat loss. The advantage of types 3 and 4 therefore resided in the fact that the outer channel could double as a support for a boiler, warming water for a pool located on the other side of the wall; the same channel could also have easily supported a *testudo* (fig. 104).[312]

The question remains of the inner channel, used in Degbomont's types 2 and 4. Depending on the mode of construction of the channel, it could have helped support the weight of the *suspensura* floor, useful especially if a pool was located directly above. It has been suggested that channelling the hot air produced in the hearth would increase the speed at which air circulated in the channel and therefore in the hypocaust, thus providing better heating;[313] this was probably only valid when a channel was present under most of the area of the floor, not just after the hearth. The most plausible reason for this arrangement was that an inner channel prevented large

[310] DEGBOMONT 1984, 61–96.
[311] MILIARESIS 2013, 55 note 3.
[312] See section V.1.5b.
[313] GUARDASCIONE 2008, 141–142.

discrepancies in the heating of the room: without it, there might have been a risk that the part of the room around the *praefurnium* was significantly warmer than the part opposed to it. With this channel, heat was directed towards the centre of the room, from where it would have spread.

The *praefurnia* of the publics baths of Central Italy (table 14) mostly belonged to type 3 (36%), then types 2 (28%), 1 (21%), and type 4 being much less common (9%).[314] Type 1 *praefurnia* were often used in rooms other than *caldaria*—i.e. not the last room on the heated path, and not equipped with pools. Type 3, the most commonly used, was associated with most pools; the few pools that did not have a *praefurnium* type 3, like pool R3c in the Forum Baths of *Cumae* [Ca.02] (heated by *praefurnium* C, type 1 or 2) necessarily received their water from a boiler located on a *praefurnium* type 3 or 4 and connected to a nearby pool (probably *praefurnium* B in this case). Degbomont, examining private baths,[315] came up with a different repartition (1: 57%, 2: 28%, 3: 5%, 4: 8%; n=61), a difference easily explained by the fact that in domestic contexts, the heated rooms were generally smaller, and the number of pools fewer: a small room would not have required a *praefurnium* with an inner channel, and a room without a pool did not require an outer channel.

[314] Sample: 56 *praefurnia*. The *praefurnium* type could not be determined in a third of the cases, usually because the *suspensura* floor is preserved and hides the presence (or the absence) of an inner channel. In those cases, the *praefurnium* has been considered as belonging for half to each type. The proportions remain similar if the *praefurnia* of uncertain type are removed: 1: 10%, 2: 21%, 3: 30%, 4: 5%, undetermined: 33%.

[315] DEGBOMONT 1984, 62.

TABLE 14: CONSTRUCTIONAL ASPECTS AND TYPOLOGY OF SELECTED *PRAEFURNIA*

Legend: col. 4: C=*caldarium*, H=heated, *Pisc=piscina calida*. Cols. 5–7: V=confirmed presence, – =confirmed absence, ?=possible. Col. 8: type according to Degbomont's typology.

SITE, Baths	**Cat. no**	**Room/ *praef.* no**	**Room type**	**Pool**	**Channel in**	**Channel out**	***Praef.* type**	**Boiler, *testudo***	**(Refractory) stone slabs**
AQUINUM	[La.01]	A	H	–	V	–	2	–	V
		E	C	V	–	V	3	B, T?	
		F	C	V	?	V	3/4	B	V
		G	C	V	V	–	2	T?	V
		H	C	V	?	V	3/4	?	–
		I	C	–	V	–	2	–	V
		J	H	–	V	–	2	–	V
		K	H	–	?	–	1/2	–	V
		L	H	–	–	–	1	–	–
		N	C	?	V	–	2	–	V
CUMAE	[Ca.02]	A	C	V	–	V	3	B+T?	–
		B	C	V	–	V	3	B+T?	–
		C	C	V	?	–	1/2	–	–
		D	H	–	?	–	1/2	–	–
		E	H	–	?	–	1/2	–	–
		F	H	–	?	–	1/2	–	V
FAESULAE	[To.02]	A	C	V	–	V	3	2B, T	–
		B	H	–	–	V	3	B?	–
		C	C	–	V	V	4	–	–
		D?	C	–	–	–	1?	–	–
FERENTUM	[La.03]	A	H	–	V		2		V
		B	H	V	–	?	3	B, T?	V
		C	H	–	V	–	2		V
FORUM SEMPRONII, Small Baths	[Ma.05]	C	H	–	–	?	1/3	–	V
		D	H	–	–	?	1/3	–	V
		E	C	?		V	3	B?	V
LAVINIUM	[La.G.13]	R1W	C	?	–	V	3	B?	–
		R1S	C	?	V	–	2	–	–
LUCUS FERONIAE, Forum Baths	[La.06]	F	C?	–	–	V	3	?	–
		G	C?	–	V	–	2	–	V?
MINTURNAE	[La.07]	R2S	H	–	V	–	2	–	V
MISENUM	[Ca.03]	R2W	C	V	V	V	4	B, T?	?
NEAPOLIS Fuorigrotta	[Ca.04]	A	C	V	–	V	3	B, T	–
		B	H	–	–	–	1	–	–
		C	H	–	–	–	1	–	–
		D	H	–	–	–	1	–	–
		E	H	–	–	–	1	–	–

SITE, Baths	**Cat. no**	**Room/ *praef.* no**	**Room type**	**Pool**	**Channel in**	**Channel out**	***Praef.* type**	**Boiler, *testudo***	**(Refractory) stone slabs**
		A	H	–	–	V	3	–	V
		C	H	–	–	V	3	–	V
		D	C	V	?	?	?	B?	
PAESTUM, Large Baths	[Ca.06]	F	*Pisc*	V	?	V	3/4	B?T?	?
		G	C	V	–	V	3	?	V
		H	C	–	–	V	3	–	V
		I	C	V	–	V	3	B? T?	
TEATE MARRUCINORUM	[Ab.03]	A	H	?	V	–	2	–	V
		A	*C*	V	?	V	3	V	V?
		B	*C*	V	?	V	3/4	V	V?
VELIA, South Baths	[Ca.09]	C	H	V	–	V	3	–	
		D	H	–	–	–	1	–	V
		E	H	–	?	?	?	–	
		D	C	V	?	V	3/4	B, T?	–
		G	C	V	?	V	3/4	B?, T?	–
		K	*Pisc*	V	?	–	1/2	T?	–
VELIA, Vignale Baths	[Ca.10]	L	*Pisc*	V	?	–	1/2	–	–
		M	H	–	?	–	1/2	–	–
		N	H	V	V	–	2	–	–

Praefurnia were for the most part built using either baked brick or large slabs of refractory stone, or a combination of both (table 14). From visual examination, the stone used for these slabs was often of volcanic origin, which was very well suited to be used in direct contact with fire; its widespread use makes it clear that it was deliberately chosen for its heat-resistant quality. At *Ferentum* [La.03], where volcanic material was locally available, the stone slabs of the *praefurnia* seem to have been made of *selce*, or leucitic lava (fig. 105). Furthermore, *Ferentum* is only ca. 40 km south of Orvieto, one of the main production centres of leucite millstones during the imperial period which were exported around the Roman world.[316] A comparison of the

[316] ANTONELLI, NAPPI & LAZZARINI 2001, 167–169, 183.

distribution of millstones from Orvieto with the distribution of refractory stone slabs used in the *praefurnia* of bath buildings could potentially yield interesting results, but would require determining the provenance of the stone using scientific analysis. While millstones in volcanic stone from Orvieto were widely exported and were found on sites such as *Paestum*,[317] the refractory stone used in the *praefurnia* A, C, G and H of the Large Baths of *Paestum* [Ca.06] differs visually from that used at *Ferentum*, indicating we should look for different provenance and trade routes. The obvious possibility is the Bay of Naples, where millstones made of stone from the Somma-Vesuvius complex were exported locally in Campania, but volcanic stone from Mount Vulture (Basilicata) and from the Etna (Sicily) was also used to make millstones, some of which were then exported to other parts of central-southern Italy.[318] It is also possible that since the slabs used in the *praefurnia* did not require the same grinding properties as the stone used for millstones, a different quality of volcanic stone could be used, quarried elsewhere.

An alternative was to use local stone to make the *praefurnia*, even if it was less heat-resistant, at the risk of having to repair the *praefurnia* more often. This was the case in the Small Baths of *Forum Sempronii* [Ma.05], located in a non-volcanic region: the *praefurnia* were made with the same local limestone with poor heat-resistant qualities that was employed for the walls, to the point that almost nothing is left of them (fig. 106). The construction techniques of *praefurnia*, with a relieving arch above the opening, would have allowed for an easy replacement of the stone slabs once they were too consumed. Clearly, economic considerations played a role in the selection of

[317] ANTONELLI, NAPPI & LAZZARINI 2001, 167.
[318] ANTONELLI & LAZZARINI 2010.

the stone to use, of which the transportation costs were probably the determining factor.

V.1.2 Hypocausts

Hypocausts were composed of three elements: the floor, called *area*, a series of intermediary supports resting on that lower floor, the *pilae*, usually taking the form of pillars spaced at regular intervals, and an upper floor resting on those pillars and on which patrons circulated, the *suspensura* floor (table 15).

TABLE 15: CONSTRUCTIONAL ELEMENTS OF THE HYPOCAUSTS IN THE BATHS OF CENTRAL ITALY

Legend: B: *Bessales*; Bp: *Bipedales* (x1/x2: 1/2 layers); C: Circular; Co: *Cocciopesto;* HT: Hollow tubes; O: Other; Oct: Octagonal; S: *Sesquipedales*; T: tiles (with knocked-off flanges); Tb: *Tubuli*; TM: *Tegulae Mammatae*

SITE, bath building	**Cat. No**	***Area***	***Pilae***	**Wall lining**	***Suspensurae***	**Wall heating**
ALBA FUCENS	[Ab.01]	T	B			Tb
ANCONA, Amphitheatre Baths	[Ma.01]	O	B			
ANCONA, Piazza Stracca	[Ma.02]	T	B			
AQUINUM	[La.01]	T	B	T	Bpx2	
ATELLA	[Ca.G.11]	T, ?	B, C		Bp	
CAPREAE	[Ca.G.24]	TM				
CASTELLUM AMERINUM	[La.G.9]		B		Bpx1	Tb
CASTRUM INUI	[La.G.26]		B, HT			
CUMAE, Forum Baths	[Ca.02]		B		Bpx1, x2	Tb
CURES SABINI	[La.G.28]					Tb
FABRATERIA NOVA	[La.G.11]	T		T		
FAESULAE	[To.02]		Oct		Bpx2	
FERENTUM	[La.03]	Bp	B, SM		Bpx2	Tb
FLORENTIA, P.za della Signoria	[To.04]		B			
FLORENTIA, Capitoline Baths	[To.03]		B, C			
FORUM POPILII	[Ca.G.26]					Tb

Forum Sempronii, Large Baths	[Ma.04]		B, C			
Forum Sempronii, Small Baths	[Ma.05]		B (II), C (I)			
Frusino	[La.04]	Bp	B	T	Bp	Tb
Histonium	[Ab.02]	T+Bp	B			
Interamnia Praetuttiorum, Corso de' Michetti	[Ab.G.05]		B			
Interamnia Praetuttiorum, Isolato Castelli	[Ab.G.06]		B			Tb
Lavinium	[La.G.13]		B			
Lucus Feroniae, Forum Baths	[La.06]		B, SB	T		Tb
Marruvium	[Ab.G.19]	T	B			
Matilica	[Ma.06]	T	B			
Minturnae	[La.07]		B	T		Tb
Misenum	[Ca.03]		B		Bp	Tb, TM
Neapolis, Santa Chiara	[Ca.G.16]	T	C, HT			Tb
Neapolis, Fuorigrotta	[Ca.04]		B, HT	Co		
Neapolis, Vico Carminiello	[Ca.G.17]					Tb
Paestum, Forum Baths	[Ca.05]	S	B			
Paestum, Large Baths	[Ca.06]	T	B			
Pisae	[To.05]	Bp	B		Bpx1, x2	Tb
Privernum	[La.08]	O	B			
Saepinum, *Decumanus* Baths	[Mo.02]		C	T	?x1	
Sentinum, Extraurban Baths	[Ma.07]	Co	C	C	Bpx2	
Sentinum, Urban Baths	[Ma.08]		B, C			
Teate Marrucinorum	[Ab.03]		B	C		Tb
Telesia, Theseus Baths	[Ca.08]		C			
Tifernum Mataurense	[Ma.10]	Co	B, C			
Trebula Balliensis	[Ca.G.19]		B			
Vada Volaterrana, Large B.	[To.07]		B			
Velia, South Baths	[Ca.09]		B			
Velia, Vignale Baths	[Ca.10]		B			TM, Tb

Vitruvius recommended that the hypocaust be floored with *sesquipedales*, that the *pilae* be two-feet high, made of *bessales*, and supporting *bipedales*. This configuration, however, was actually very rarely followed to the letter, and Faventinus and Palladius, two later technical authors who drew heavily on Vitruvius, suggested different dimensions for each element (table 16).

TABLE 16: ELEMENTS OF BATHS HEATING SYSTEMS ACCORDING TO VITRUVIUS, FAVENTINUS AND PALLADIUS

	Vitruvius (V.10.2)	Faventinus (16)	Palladius (I.39.2)
Area	*Sesquipedales*	*Sesquipedales*	*Bipedales*
Pilae	2 RF high Made of *bessales*	2.5 (private baths) or 3 (public baths) RF high Made of circular bricks of the dimensions of *bessales*	2.5 RF high, 1.5 RF distant
***Suspensura* floor**	*Bipedales*	One layer of *bipedales*	Two layers of *bipedales*

V.1.2a *Area*

Despite Vitruvius (and Faventinus) recommending that the floor be covered in *sesquipedales*, in practice this solution was only rarely encountered—only at *Paestum* (Forum Baths [Ca.05]), *Telesia* [Ca.08] and *Velia* (South Baths [Ca.09]). *Bipedales* appear only at *Ferentum* [La.03] and *Histonium* [Ab.02]. More common was the use of tiles with knocked-off flanges, and several types of terracotta elements could occasionally be used to floor the different hypocausts of a same bath complex. Only occasionally were *areae* made of *cocciopesto* (e.g. *Tifernum Mataurense* [Ma.10], *Sentinum* Extraurban [Ma.07]). The preference for a large module of brick naturally made it possible to floor the whole surface of a hypocaust quickly, and the use of square *bipedales* would have allowed builders to position the *pilae* without the need to take measurements. Traces of a grid of ca. 0.60 m squares were visible in the *cocciopesto area* at *Tifernum Mataurense*, made by the builders to set up the *pilae* in a regular fashion; this was probably common practice for *cocciopesto areae*, as also visible in the East Baths of *Leptiminus*, North Africa (fig. 107).[319] All in all, only a narrow range of materials and shapes was used for the

[319] STIRLING, MATTINGLY & BEN LAZREG 2001, 41.

areae, in stark contrast with other regions like *Hispania*.[320] On the other hand, the choice between tiles, *bipedales* or *sesquipedales* does not seem to have owed anything to structural criteria, but rather depended on questions of material supply.

V.1.2b *Pilae*

The *pilae* were the small pillars raising the circulation floor in order to create a space in which hot air, heated from the *praefurnium*, could flow. *Pilae* were most often created using small CBM, usually square bricks, but other shapes occurred occasionally (table 15, fig. 108). The technique for making *pilae* appears fairly standardised, consisting in stacking square bricks whose main dimension ranged between 19 and 22 cm—close to the theoretical standard of ⅔ of a Roman foot (19.7 cm) recommended by Vitruvius and Faventinus. This practice goes back at least to phase II of the 2nd cent. BC baths of *Fregellae*, where *pilae* were made of broken tiles arranged so as to measure ⅔ RF.[321]

The *bessales* were the most commonly used type of brick for *pilae* in Central Italy, as already noted by De Angelis d'Ossat.[322] They had the advantage that they could easily be reused for other purposes in case of surplus, such as for wall facing or to build the *praefurnia*. Variations are however not uncommon, for instance circular and octagonal bricks, hollow tubes, monolithic stone blocks, small stone blocks, and any combination thereof; the use of several types of *pilae*, usually *bessales* with another type, in the same baths and even in the same hypocaust was not exceptional either.

[320] GRACIANI 2009, 722.
[321] TSIOLIS 2013, 95.
[322] DE ANGELIS D'OSSAT 1943, 41–43.

Pilae made of circular bricks (fig. 109) were not as common as those made of *bessales*, without being exceptional either. The 10 baths in which they are found are divided in two groups, one in the north of the area (seven baths), the other in the south (three baths). All the sites in the north and *Atella* [Ca.G.11] in the south also had *pilae* made of *bessales* alongside the circular bricks. This northern group is not surprising, as circular *pilae* were a very common feature in North Italy.[323]

Octagonal bricks were used extensively at *Faesulae* [To.02] (fig. 110), alongside *bessales*, to support the *suspensura* floor of the *caldarium* R8. This suggests that octagonal bricks were produced with this specific purpose and were not recut from square bricks (which would have left traces on the sides of the bricks).

What was the advantage of using circular or octagonal bricks? It is worth noting that the longest non-diagonal dimension (i.e. median or diameter) of each brick was the same as that of the square *bessales*, so that each shape was interchangeable and could be combined with any other, as was often the case in the baths of our catalogue. It seems to me that the answer lies in economic terms: by turning a square shape into an octagon or a circle, the weight of a single brick would be reduced by 17% and 21.5%, respectively, with a direct impact on transportation costs.[324] Peveler argued that for CBM, weight, more than volume, would have been the constraining factor determining the quantity that could be carried overland in one shipment.[325] Using his same parameters (a four-wheeled cart with a capacity of 5 m^3 drawn by a single or a pair of mules transporting between 500–1,000 kg), a calculation can be attempted for

[323] DE ANGELIS D'OSSAT 1943, 41–43.
[324] Square *bessales*: 19.7 cm side. Circular brick: 19.7 cm diameter. Octagonal brick, 19.7 cm medium diagonal, 8.2 cm sides.
[325] PEVELER 2018, 289.

the *caldarium* R8 of the baths of *Faesulae* [To.02] (tables 17–18).[326] 9–17 carts would have been necessary to carry the material for the *pilae* to the construction site, as opposed to 10–20 if *bessales* had been used instead of octagonal bricks—a 10–15% difference. This difference may not seem significant, but depending on the production place, if the CBM had to be carried uphill to the construction site, these 10–15% could have translated into a significant absolute sum.[327] Marginal gains would also have been made on the price per unit, as less raw material was used for octagonal bricks. Finally, it has been suggested that circular and octagonal *pilae* opposed less resistance to the circulation of heat in the hypocaust,[328] probably thanks to their reduced volume and lack of sharp corners, but this would need to be verified by experimentation. Using circular or octagonal *pilae* would have slightly increased the volume of hot air in the hypocaust, but whether this had an impact on the heating of the rooms remains to be seen. What is certain is that this was a concern of at least some bath builders, as indicated by baths at *Aquincum* (*Pannonia*)[329] or Pergamon,[330] where *pilae* made of monolithic stone blocks had their sides dug out, in a way that makes them look very much like the hollow tubes considered below (fig. 111).

[326] The *pilae* were made of 12 bricks (10 octagonal, two *bessales* as base and capping), apart from a row of *pilae* made of rectangular bricks against the S wall. The masonry blocks under pools R8a–R8b have not been considered. Based on SABELLI & BALLERINI 2014, pl. 10, 250 regular *pilae* and 22 rectangular ones were reconstructed. The weight of CBM is 1,750 kg/m³ (DESSALES 2011, 50).

[327] PEVELER 2018, 292–293 on the effects of topographic factors on overland transportation.

[328] DE ANGELIS D'OSSAT 1943, 41–43.

[329] DE ANGELIS D'OSSAT 1943, 41–43.

[330] YEGÜL 1992, 360, fig. 447.

TABLE 17: QUANTITY, VOLUME AND WEIGHT OF CBM FOR THE *PILAE* OF THE *CALDARIUM* R8 OF THE BATHS AT *FAESULAE* [TO.02]

Brick type	Dimensions (cm)	Volume/unit	Unit no.	Total volume	Total weight
Bessales	19.7 x 19.7 x 4	1,552 cm^3	500	0.78 m^3	1.36 tonnes
Octagonal	medium diagonal: 19.7; thickness: 4	1,286 cm^3	2500	3.22 m^3	5.63 tonnes
Rectangular	39.4 x 19.7 x 4	3,104 cm^3	265	0.82 m^3	1.44 tonnes
Total			**3265**	**4.82 m^3**	**8.43 tonnes**

TABLE 18: QUANTITY, VOLUME AND WEIGHT OF CBM FOR THE *PILAE* OF THE *CALDARIUM* R8 OF THE BATHS AT *FAESULAE* [TO.02], IF *BESSALES* WERE USED INSTEAD OF OCTAGONAL BRICKS

Brick type	Dimensions (cm)	Volume/unit	Unit no.	Total volume	Total weight
Bessales	19.7 x 19.7 x 4	1,552 cm^3	3000	4.66 m^3	8.15 tonnes
Rectangular	39.4 x 19.7 x 4	3,528 cm^3	265	0.82 m^3	1.49 tonnes
Total			**3265**	**5.48 m^3**	**9.64 tonnes**

A different technology used to make terracotta *pilae* was the hollow tube. These tubes, made of a hollow cylinder with both ends widening into a square of the dimensions of a *bessalis*, appear to be a Campanian specificity, as they were found in baths in *Neapolis* and around the Bay of Naples, not only in public (Santa Chiara [Ca.G.16], possibly Fuorigrotta [Ca.04] where all the tubes are modern restorations) but also in private and spa baths (fig. 112).[331] The presence of these hollow tubes, specifically designed to be used as *pilae* instead of *bessales*, within a narrow geographic area would encourage us to hypothesize the existence of a local workshop specializing in the production of that particular terracotta element. This technique was not necessarily more ancient than regular *pilae*, as the public baths using them have been dated to the 2nd cent. AD; instead, it appears more a specialised, regional product that

[331] *Baiae*, Pollena Trocchia (personal observation), Boscoreale, *Herculaneum*, *Oplontis*, Ottaviano, *Pompeii*, *Stabiae* (DE HAAN 2010), *Salernum* (NAVA 2011, 759–760) and *Surrentum* (RUSSO 2009, 102).

had a fairly limited success and never spread beyond its area of production, despite clear advantages over standard *pilae* both in terms of weight and of quantities of raw material used. This limited spread could be due to structural issues (several of the tubes seem to have been filled with mortar at some point, in all likelihood to strengthen them), to their lack of flexibility (depending on the height of the hypocaust, they had to be complemented with *bessales*, e.g. in the baths of *Neapolis* Fuorigrotta) and/or to difficulty of transportation, since the breakage rate must have been higher than for regular solid bricks. A different type of hollow tube is known from the baths of *Castrum Inui* [La.G.26] (fig. 113), in a phase dated to the Flavian period, so it is possible that the idea of using hollow tubes came from the Vesuvian area and was experimented with elsewhere, without much more success.[332] The use of hollow tubes possibly stemmed from the same idea that encouraged bath builders to use circular or octagonal *pilae*, i.e. to increase the volume of hot air in the hypocaust and/or to facilitate its circulation within the hypocaust.

What we do not see, on the other hand, are *pilae* made of annular or semi-circular bricks,[333] of pillars supporting arches,[334] or of elements initially designed for other purposes, like *tubuli*.[335] Semi-circular bricks were however produced in the Vingone kilns near *Florentia*,[336] and may therefore have been used for the *pilae* of baths not discovered yet.

[332] Further hollow tubes are known from the baths of Vignale at *Velia* [Ca.12], but the larger dimensions (ca. 26 cm wide) suggest a different type. Other examples come from two villas at Rome (one tube alongside *bessales*) and *Castrimoenium* (DE HAAN 2010, cat. A82, K10).

[333] Annular bricks: *Catina*, Sicily (MANGANELLI 2019, 104, fig. 10). Semi-circular bricks: Morocco (CAMPOREALE 2015, fig. 2).

[334] Common in Spain (ROLDÁN GOMEZ 2008).

[335] DEGBOMONT 1984, 106.

[336] SHEPHERD 2006, 192–196, fig. 167.

Contrary to what has been claimed,[337] the use of a specific type of *pilae* over another does not bear any chronological implication, at least for the imperial period: both *bessales*-type brick and circular brick were produced in the same kiln at Vingone, active in the Augustan–Tiberian period; hollow tubes were found in pre-Vesuvian eruption baths and were still used in 2nd cent. AD baths.

According to ancient authors, the *pilae* were to be two (Vitruvius), two and a half (Palladius) or three feet tall (Faventinus). The higher the *pilae*, the larger the volume of air in the hypocaust but also the greater the risks of instability of the floor. This lack of consistency in the authors is also visible in practice, where the height of the *pilae* went from 0.40 m (*Vada Volaterrana* [To.07]) up to 0.90 m (*Minturnae* [La.07]), with several examples around 0.60 m (*Faesulae* [To.02], *Ferentum* [La.03], *Lucus Feroniae* [La.06]). In any case the *pilae* had to be high enough to allow a bath operator to enter the hypocaust for maintenance and cleaning operations.

Concern for stability

None of those *pilae* shapes seems to have affected the stability of the *suspensura*. When there was an apparent concern for the latter, other solutions were instead adopted: at *Faesulae* [To.02], part of the *pilae* under the *caldarium* pools R8a–R8b were replaced by segments of walls (fig. 114). At *Ferentum* [La.03], the *pilae* under R21a, made of monolithic stone blocks (probably belonging to a secondary phase), were set close to each other, less than 0.60 m away interaxially (fig. 115).

[337] GRACIANI 2009, 723.

V.1.2c *Suspensura* floor

The final element of the hypocaust was the upper layer of brick that spanned the gap between the *pilae*; this was virtually always made of *bipedales* (table 15), simply because that module of brick allowed the *pilae* to be set the furthest apart (0.60 m interaxially) while still having a stable *suspensura* floor, and therefore have a larger ratio hot air:support volume in the hypocaust. This element is actually rarely mentioned in the publications of bath buildings, presumably because it is assumed only *bipedales* could have fulfilled that role—and with the lack of indication of the distance between the *pilae* (or when it is mentioned, the lack of precision if it is interaxial or not), possible exceptional variations cannot be detected. On top of the *bipedales* layer, one or several layers of waterproof *cocciopesto* were laid, on top of which the decorative floor (marble, mosaic etc.) was set.

Vitruvius and Faventinus recommended that the *pilae* be capped with *bipedales*, and Palladius insisted that two layers of *bipedales* were necessary. Both practices are encountered, sometimes even within the same structure. The reasons for the preference of one over the other are unclear, as are their respective advantages. Considerations about heating efficiency and structural stability may have played a role: it has been argued that the thickness of the *suspensura* floor affected the heat that radiated into the room, with a thinner *cocciopesto* floor insulating less and therefore allowing for a warmer room.[338] It is possible that builders determined the number of layers of *bipedales* according to the thickness of the *cocciopesto* layers (and therefore to the desired heat in the room), with a double *bipedales* layer used with thinner *cocciopesto* layers, thus improving the stability of the *suspensura*. This hypothesis cannot be

[338] GRASSMANN 2011, 39 and review by HEINZ 2013.

confirmed yet, but more granular measurements of hypocaust elements should allow for its validation or falsification. Plain structural considerations, on the other hand, did not seem to have been of relevance as there is no clear correlation between the surface area of the room, or the presence of a pool, and the number of layers of *bipedales*.

V.1.2d Communication between hypocausts

The hypocaust of a given room often communicated with that of an adjacent room, enabling the heat of one *praefurnium* to spread under several rooms.[339] These communications passages usually took the same form as that of a simple *praefurnium* of type 1,[340] being often ca. 40 cm wide and covered by a lintel or arch, sometimes a flat arch. Unlike *praefurnia* type 2, 3 and 4, they were virtually never extended by channels, with rare exceptions: at *Aquinum* [La.01], the hypocaust passage between R34 and R32 was extended with a channel, which also has the peculiarity of being slanted away from the opening towards the following room R30. The reasons for such arrangement are unclear but might have more to do with phasing than with the distribution of heat.

While most hypocausts communicated with each other via a single opening, their number was occasionally increased: at *Minturnae* [La.07], no less than three openings connected R3 and R4, in a 14 m-long wall. Increasing the number of openings no doubt helped the temperature to remain constant in the whole hypocaust of the room further away from the *praefurnia*. The shape and dimensions of these openings could also be adapted to reach and maintain a desired temperature: for instance, in the first phase of the Fuorigrotta Baths in *Neapolis* [Ca.04], the connection between the hypocausts apparently occurred only through small circular-section pipes. This

[339] BOUET 2003, 267.
[340] On *praefurnia* types, see section V.1.1.

configuration is highly unusual and makes one wonder how warm the room furthest away from the *praefurnia* (A–B) (R10) was.

V.1.2e Protection of hypocausts' walls

In a few buildings (table 15: *Aquinum* [La.01], *Minturnae* [La.07], *Saepinum Decumanus* [Mo.02], *Fabrateria Nova* [La.G.11], *Lucus Feroniae* Forum [La.06]), CBM (usually tiles with knocked-off flanges) were set vertically against the facing of the walls in the hypocausts (fig. 116), in a clear attempt to protect these walls against the constant heat they were subjected to. Occasionally, a layer of *cocciopesto* was used instead of CBM, as at *Sentinum* (Extraurban [Ma.07]), *Neapolis* (Fuorigrotta [Ca.04], fig. 117) or *Teate Marrucinorum* [Ab.03]. It is unclear how widespread the practice was, but it is clear that it was not systematically used: the local limestone of the facing of the hypocaust in the Small Baths of *Forum Sempronii* [Ma.05] was significantly damaged by the heat to which it was exposed (fig. 118), damage that could have been avoided had the walls been protected this way. Interestingly, in the baths of *Grumentum*, further south than the area considered here, the hypocaust wall protected by tiles was already faced in brick—a seemingly excessive solution, as if the builders were following an established practice but did not give a second thought as to its usefulness.

V.1.3 Wall heating

An improvement of the hypocaust system was the introduction of wall heating.[341] This was achieved by leaving a gap between the masonry and the revetment of the wall, which communicated with the hypocaust. This gap was fitted with a series of purposely-made terracotta elements that allowed the air coming from the hypocaust

[341] YEGÜL 1992, 363–368; DE HAAN 2010, 66–68.

to flow more or less freely within them, heating the room by radiation. Yegül has stressed the importance of this technological development that allowed for a better control of the temperature of the rooms, and argued that it was the one element that allowed for the increase in size of the heated rooms, eventually leading to the creation of the very large heated rooms of the imperial *thermae*.[342] Wall heating indeed increased the heated surface of the room, decreased the heat loss towards the outside—therefore reducing fuel consumption—and made it possible to open large windows in the walls of the heated rooms. Yegül and Couch's experiments in the NOVA Baths at *Sardis* revealed the importance of wall heating in the working of the baths, putting an end to previous claims that wall heating contributed little to the overall heating of the baths: without it, in order to maintain a comfortable temperature in the *caldarium*, the floor would have had to be heated at 62°C to compensate for heat loss via the walls—when 42°C is the maximum temperature that a floor can reach and remain bearable to walk on.[343]

Several techniques were developed to heat walls, such as *tegulae mammatae*, *tubuli*, and spacer pins or tubes;[344] only the first two have been recorded in the baths of Central Italy. *Tegulae mammatae* were tiles with small, raised bosses close to the corners, attached to the wall by iron nails, with the bosses turned towards it so as to create a space of a few centimetres into which hot air could circulate. *Tubuli* were hollow parallelepipedal terracotta bricks, usually of rectangular section, stacked on top of each other against the wall, to which they were fixed by metal clamps. Their open extremities communicated with each other, and their lateral sides were sometimes

[342] YEGÜL 1992, 363–365.
[343] YEGÜL & COUCH 2003, 169. Contra, LÉZINE 1961, 15–16 who postulated the use of sandals in baths.
[344] YEGÜL 1992, 363–365.

pierced by corresponding openings, allowing hot air to circulate laterally as well. Whichever technique was used, this layer was then covered by mortar, then by a decorative layer, making it invisible to the bathers.

The chronology of these two wall heating elements is debated. *Tegulae mammatae* are traditionally considered to be the most ancient technique, used earlier than *tubuli*.[345] The written sources do not shed much light on the question: Vitruvius (VII.4.2), in the context of wall-paintings, described a wall insulation system that used *tegulae hamatae* and was very similar to that found in some bath buildings. Pliny (*HN* XXXV.46.159), writing at a time when *tubuli* were already used, listed the ceramic products of a *figlina* and mentioned one that was '*ad balineas mammatis*' (but this passage is not without interpretative issues).[346] While DeLaine suggested that *tegulae mammatae* could have been developed in Campania in the late 2nd cent. BC,[347] the most ancient archaeological evidence for their use comes from the Stabian and Forum Baths of *Pompeii*, in their early 1st cent. BC phase,[348] and they continued to be used much later, as we shall see below. The date for the invention of *tubuli* is not clear either. Literary and archaeological evidence tell us that they predated the mid-1st cent. AD: Seneca (*Ep.* 90.25) spoke of *tubus* against the walls of baths, a system he said was invented 'in his time', and *tubuli* produced in the area around Rome were found in a shipwreck dated to the 1st half of the 1st cent. AD.[349] Authors have suggested dates ranging from

[345] DEGBOMONT 1984, 136. Also YEGÜL 1992, 363, more cautiously: "[*tegulae mammatae* were] contemporary with or even earlier than [*tubuli*]."
[346] CLERBAUT 2016, 122; GAZENBEEK 2016, 112.
[347] DELAINE 1989, 126.
[348] YEGÜL 1992, 363. The Stabian Baths are being re-examined by Monika Trümper (recently TRÜMPER *et al.* 2019), the dating of the phase(s) using *tegulae mammatae* could therefore be revised.
[349] Capo Carbonara shipwreck, see section V.4.

the 2nd half of the 1st cent. BC to the first half of the 1st cent. AD,[350] but the relatively recent discovery of what has been interpreted as ceramic tubes to heat the walls and act as flues in the baths of *Fregellae*[351] (phase II, dated to the 1st half of the 2nd cent. BC) suggests that the concept of *tubuli* existed at least from that period. There may have been a gap, however, between this 2nd cent. BC invention and the widespread use of the parallelepipedal *tubulus* in Italy, which took place at the latest in the 2nd half of the 1st cent. AD, as attested at *Pompeii*,[352] and probably earlier.[353]

There is very limited evidence of the use of *tegulae mammatae* in the baths of Central Italy: they have been recorded only in the baths of *Neapolis* Fuorigrotta [Ca.04] and in both baths at *Velia* [Ca.09] [Ca.10]. At *Neapolis*, they were used in R15, where some are still *in situ* nowadays (fig. 119). *Tegulae mammatae* might also have been used in R10, where traces and fragments of iron nails are visible on the N and E walls; all the other heated walls used *tubuli*. The position of R15 between *frigidarium* R6 and *caldarium* R13 suggests that it acted as a heat trap, offering bathers a gradual transition from hot to cold. At the level of the hypocaust, the heat reached R15 from *caldarium* R13 only through a circular-sectioned (diam. 8 cm) terracotta pipe (instead of the more common, ca. 40 cm wide connection),[354] allowing only a very limited amount of heat to reach R15. The use of *tegulae mammatae* with short bosses (ca. 5 cm) in R15 may therefore have been a deliberate choice by the builders who sought to ensure that the room only had a low draught, preventing a too significant heat loss towards the

[350] 2nd half of 1st cent. BC (NIELSEN 1993, 14–15, doubted by BOUET 1999, 66–67); 1st cent. AD (DEGBOMONT 1984, 140); 1st half of 1st cent. AD (ADAM 2008, 293).

[351] TSIOLIS 2013, 95.

[352] *Tubuli* were used alongside *tegulae mammatae* in several baths of *Pompeii* and *Herculaneum*, see note 359.

[353] *Tubuli* were common in *Gallia Narbonnensis* from the Augustan period (BOUET 1999, 66–67).

[354] See section V.1.2d.

frigidarium and avoiding a noticeable increase in fuel consumption. The heating efficiency of *tegulae mammatae* with bosses shorter than 5 cm has been questioned,[355] and accordingly their primary role in this room may have been one of insulation rather than of active heating. In the South Baths of *Velia* [Ca.09], only *tubuli* are nowadays visible but the use of *tegulae mammatae* has been deduced from marks on the walls of the heated rooms and from *tegulae mammatae* bosses reused in the modifications of the window of pool R4b (fig. 120). According to Vecchio, the initial wall heating system using *tegulae mammatae* was replaced by *tubuli* in a secondary phase, a replacement process she also hypothesized for the baths at *Neapolis* Fuorigrotta.[356] In the Vignale Baths of *Velia* [Ca.10], the *piscina calida* R14, the most recent addition to the building in the mid-2nd cent. AD (phase IV), had at least part of the intrados of its vault lined with *tegulae mammatae*, while the walls were lined with *tubuli*.

If the dating of all three baths is correct, it would mean that *tegulae mammatae* were still used in the late 1st–2nd century AD—and even more so, had been the first choice of builders ahead of *tubuli*. A similar situation is known for the Great Baths on the Lechaion Road at Corinth, built around AD 200, where *tegulae mammatae* were used alongside spacer tubes and *tubuli*.[357] *Tegulae mammatae* should therefore not be seen simply as a step in the evolution of wall heating technology towards *tubuli* but rather as a different technological solution to the problem of how to heat walls. The specialists in charge of building the heating system made that choice deliberately, for reasons as

[355] ADAM 2008, 292; BOUET 1999, 31–32.
[356] VECCHIO 2007, 121 and note 167.
[357] BIERS 1985, 46, 53, 61–62; BIERS 2003, 310–311.

varied as heating efficiency, building tradition, wall and vault shape, and geographical dispersal of the technologies and their local availability.[358]

Furthermore, the fact that the *tegulae mammatae* were replaced by *tubuli* in the South Baths of *Velia*, and perhaps in the baths of *Neapolis*, suggests that they could have been initially more common, but were eventually removed and replaced in secondary phases of the baths. There appears to be a move towards replacing the *tegulae mammatae* by *tubuli* in the baths of *Pompeii* and *Herculaneum* too, around the time towards the end of the lifetime of these two sites.[359] The causes for that could be that the *tubuli*, with their thinner walls and greater volume of hot air than the *tegulae mammatae*, transferred heat more effectively,[360] or that *tubuli* had become a more common production (possibly for the same performance reason) and were therefore easier to come by.

In Central Italy, *tubuli* were therefore the most commonly adopted solution to heat walls, and were found in virtually all the baths of the catalogue. They are rarely thoroughly described in reports, but their shape appears to have been already strongly standardised by the early imperial period.

[358] As suggested by KELLY 2004–2005, 617 for the use of spacer pins in Crete.

[359] BOUET 1999, 66–67. The Central Baths of *Pompeii*, built after AD 62, used only *tubuli*, whereas the older Stabian Baths and Suburban Baths, refurbished after AD 62, used both *tegulae mammatae* and *tubuli* (JACOBELLI 1987, 154; BOUET 1999, 66–67). A stack of unused *tubuli* was found in a *taberna* at the entrance to the Suburban Baths of *Herculaneum* (in which both *tegulae mammatae* and *tubuli* were used), perhaps to repair the damage caused by the earthquake (PAPPALARDO & VARRIALE 2006, 424).

[360] DELAINE 2020, 79.

V.1.4 Chimneys

Rarely preserved, chimneys were indispensable for the good working of the heating system: they led the hot gases out of the structure and helped maintain a movement of hot air within the system.[361] In their simplest form, they were made of a pipe leading from the hypocaust to the outside through the roof or the wall. This pipe could be embedded in the thickness of the wall, placed in a recess in the wall, or stuck against it; it could be formed of a series of bricks with circular or square cross-section stacked on top of each other, or in the case of a chimney located in a recess, the recess could simply be covered by flat bricks.[362] Chimneys should not be confused with pipes leading water from the roofs to the sewers: these could take exactly the same shape as chimneys, as visible at *Pisae* [To.05], in a room that was clearly not heated (fig. 121).

Problematic was the connection between chimneys and heated walls. One possibility was that chimneys did not communicate at all with heated walls, and the gases trapped there could only exit the building by going back into the hypocaust and up the chimneys. Another option was that all the *tubuli* had their upper ends opening right below the eaves. Both cases are attested archaeologically, and the second one would have created a much stronger draft, more radiant heat, and led to a much higher consumption of wood. An intermediary option was used in the NOVA Baths, which saw only some of the *tubuli* columns communicating at the top with a horizontal header that then acted as a chimney and led the gases towards the outside.[363] This

[361] YEGÜL 1992, 357–358, 381.
[362] KRETZSCHMER 1953, 17–20; DEGBOMONT 1984, 146–156; YEGÜL 1992, 358–358, 381; NIELSEN 1993, 15.
[363] YEGÜL & COUCH 2003, 163.

solution is not attested archaeologically, but Kretzschmer argued that the principle was not unknown to Roman builders.[364]

As stated above, chimneys were indispensable for the good working of heating systems, and Kretzschmer stated that quadrangular rooms needed to be equipped with at least four chimneys to work effectively.[365] Furthermore, chimneys of the first two types (embedded in the wall and placed in a recess in the wall) would have left visible marks in the walls of the hypocausts. It is therefore surprising to have so few traces of chimneys in the baths of the catalogue. The clearest example of chimneys is visible in R3 at *Minturnae* [La.07], where each corner was fitted with a chimney made of stacked circular-section terracotta tubes set within the thickness of the wall (fig. 122). At *Aquinum* [La.01], R14 was equipped with four chimneys dug in a secondary phase. This room was not equipped with wall heating and did not communicate with any other room at the level of the hypocaust, so chimneys were the only way smoke and air could leave the hypocaust (fig. 123).

There are actually two possible reasons for this relative lack of recorded chimneys in our sample. It is possible that when several rooms, heated from one or more *praefurnia*, communicated at the level of the hypocaust, only the last one in the heat path, furthest away from the *praefurnia*, was equipped with chimneys, so as to ensure a flow of hot air towards it. This would still not explain why so many rooms lack visible chimneys, and therefore strongly argues for the wall heating acting as a chimney, with (some of) the *tubuli* connected at their top either with direct evacuation

[364] KRETZSCHMER 1953, 20.
[365] KRETZSCHMER 1953, 17.

to the outside or, perhaps more likely, with a horizontal conduit that acted as a chimney, as in Yegül & Couch's reconstruction.

V.1.5 Water heating

V.1.5a Boilers

From the small water tanks described in chapter IV, water entered the boilers (table 14),[366] made of metal,[367] where it was heated before being distributed to the pools (fig. 124). Little is known of those devices as they have been almost systematically robbed to recover the metal; the only complete surviving example comes from the villa della Pisanella at Boscoreale, a 1.92 m high cylinder with a diameter of 0.58 m made of two lead sheets hammered together on a bronze disc in contact with the fire (fig. 125). A series of pipes equipped with taps allowed for a regulated supply of water towards the pool and *labrum* of the nearby *caldarium*. The boiler had a theoretical capacity of 0.53 m³, but practically less since the location of the pipes allowed only for sending half the water of the boiler to the pool.[368] The example of Boscoreale is potentially representative of the type of boilers used in public baths, but certainly at a much smaller scale since the water requirements of public baths were significantly higher.

Boilers were placed either on the *praefurnia* or on a nearby stand with a furnace underneath, and (at least partly) encased in a masonry block usually taking the form of a circular arrangement of bricks or refractory stones that insulated it, allowing for a

[366] Called '*aenea*' by Vitruvius (V.10.1), '*miliaria*' by Seneca (*QN* III.24.2). BOUET 2003, note 83 for literary evidence.

[367] Boilers were probably made (at least in part) in bronze, based on Vitruvius (see note 366) and on the fact that lead, the other commonly used metal and whose melting point is ca. 328°C, may not have withstood the temperatures reached in furnaces (up to 600°C at the initial firing according to YEGÜL 1992, 381).

[368] BROISE *et al.* 1987, 97–100.

safer operation and a reduced heat loss (and therefore a reduced fuel consumption).[369] This casing left clear traces more often than the boiler itself, as in the baths of *Faesulae* [To.02], where two boilers were set on either side of *praefurnium* A (fig. 126), at *Aquinum* [La.01], where one course of the circular arrangement of the boiler stand is preserved (fig. 127), or at *Ferentum,* where the presence of refractory stone slabs set in a curvilinear arrangement next to *praefurnium* B can only be explained by reconstructing a boiler there. Virtually every *praefurnium* with outer extensions (types 3 and 4) could have supported a boiler (fig. 128).

Since most boilers have disappeared and it is rarely possible to reconstruct their dimensions based on the traces they left, assessment of hot-water output compared to the hot-water requirements of pools cannot be attempted.

V.1.5b *Testudines*

The temperature of the water in the pools could be maintained by an optional device, the *testudo alvei*, known through archaeological evidence and described by Vitruvius (V.10.1). Most commonly, it comprised a semi-cylindrical (or occasionally cylindrical)[370] metallic container, usually made of bronze,[371] either cast in one piece or made of several metallic plates riveted together,[372] placed with the flat surface on top of the furnace and supported by buttresses or iron girders. The *testudo* was closed on the furnace side and open towards the hot water pool; its semi-cylindrical shape,

[369] YEGÜL & COUCH 2003, 175: in the NOVA Baths, the insulation of the boiler and large windows (allowing for sunlight to heat the rooms) allowed for a reduction of fuel consumption by 60%.
[370] E.g. Villa della Pisanella at Boscoreale (PASQUI 1897, 450, fig. 44)
[371] *Testudines* made of copper apparently existed (BRÖDNER 1958, 111).
[372] GARBRECHT & MANDERSCHEID 1994, 39; the authors rightly refuted Brödner's suggestion (1960, 383) that the cast examples were later than the riveted examples, on the grounds of lack of securely dated examples. ESCHEBACH 1979, 43, pl. 49c–d, 11a, 19.

sometimes tapered towards the closed end, required that the opening in the wall towards the pool be arched, and a flap attached to the rim of the device along with a flat extension at its bottom allowed the *testudo* to be sealed to the masonry of the pool (fig. 124). The seal could also be made via a lead plate added to the *testudo*.[373] The bottom of the *testudo* was set at a slightly lower level than the floor of the pool so that there was always some water in it to avoid damage during firing, and its top was below the water surface so that the device was completely filled with water. The direct heating of the metal and the water it contained created a convection movement, bringing in cooler water from the bottom of the pool and replacing it with warmer water from the top of the *testudo*.[374] This device allowed a higher temperature to be maintained in the pool than if the latter was heated only by a furnace, at the same time allowing for reduced fuel consumption. The closed end of the *testudo* could be fitted with a tap to empty the water of the pool.[375] The most ancient known examples of this device are the ones from the men's *caldarium* and *tepidarium* of the Stabian Baths of *Pompeii*,[376] but Vitruvius's account makes clear that that technological device was already in use by the end of the 1st cent. BC.

Testudines are rarely preserved as they were usually melted down to recover the large quantities of metal. Unsurprisingly, no preserved example is known from the baths of the catalogue. A fragment of bronze with a rivet in it recently discovered in the baths of *Aquinum* [La.01] (fig. 129L) could have come from a *testudo* or a boiler; its shape (with five edges) suggests that that piece was cut off a larger element that

[373] On this lead plate or sheet, see OHLIG 2001, 202–203.
[374] MANDERSCHEID 2000, 498–499.
[375] See section IV.3.1; MARÉCHAL 2017.
[376] YEGÜL 1992, 374. Yegül (1992, 466, note 49) also discarded the hypothesis that there might have been a *testudo* in the 4th phase of the baths of *Olympia*.

probably ended up being melted. Another fragment from *Faesulae* [To.02] (fig. 129R) could also have belonged to a *testudo* or a boiler. Indirect evidence, on the other hand, can be more helpful: some arched openings between furnaces and pools (where the intrados of the arch goes above the floor of the pool) could only be explained by a *testudo*, and are therefore a good proxy to assess their more or less widespread use (fig. 130). Additionally, because *testudines* were fixed to the floor of the pool by a protruding metallic sheet in order to avoid leakages, their removal resulted in damage to the floor, usually in the shape of a missing semi-circular portion of the floor of the pool around the furnace opening; this is visible in the Vignale Baths at *Velia* [Ca.10] where metallic fragments of the *testudo* remained enclosed in the basin floor.[377]

Indirect traces of *testudines* reveal that their use was not uncommon, with examples from Lazio, Campania and Toscana (tables 14, 19). In total, 15 *testudines* from 7 bath buildings were safely identified, a total that could go up to 19 possible examples from 9 different baths.

TABLE 19: *PRAEFURNIA* EQUIPPED WITH *TESTUDINES*

Site	**Cat. no**	**Total no**	***Praefurnium* no. and type of evidence**
AQUINUM	[La.01]	2?	*Praefurnia* F, G (shape of *praefurnia*)
CUMAE	[Ca.02]	3	*Praefurnia* A (arch), B (arch), probably C in earlier phase (arch)
FAESULAE	[To.02]	1	*Praefurnium* A (arch, damage to pool)
MINTURNAE	[La.07]	1?	*Praefurnium* SW of R4 heating R4a (cut, but floor very damaged)
MISENUM	[Ca.03]	1	*Praefurnium* in R2 (arch, cut in pool's floor)
NEAPOLIS Fuorigrotta	[Ca.04]	1	*Praefurnium* A (arch)
PAESTUM, Large Baths	[Ca.06]	3/4?	*Praefurnia* E (arch), F (arch), G (cut in floor), I? (shape of *praefurnium*)

[377] KRINZINGER 1986, 41.

VELIA, South Baths	[Ca.09]	2	*Praefurnia* A (arch), B (arch)
VELIA, Vignale Baths	[Ca.10]	4	*Praefurnia* D (cut on floor, remains of metal), G (cut in floor), H (arch), K (cut in floor)

Is this large number of *testudines* recorded for the urban public baths of Central Italy exceptional? *Testudines* are known from baths all around the empire, with safely identified examples and reliable indirect evidence from North Africa (twelve baths), Greece (seven in four baths), Italy (outside catalogue: seven in four baths, all from Central Italy) and the northern provinces (four baths).[378] The concentration of *testudines* in Campania, with fourteen examples in six bath buildings, is interesting; even though it is in part due to the state of preservation of the sites under the eruption of AD 79, and possibly to the intensity of the research in the area and the prominence given to the region in bath studies, it is in stark contrast with the rest of Italy where seven or eight examples are known, and only one example is certified from outside Campania, at *Faesulae* (plus a handful of hypothetical examples). Was it that Campania actually promoted a technologically more advanced fashion of bathing?

The comparison with the distribution of the 'samovar' device could be interesting, as the latter is often deemed a very elaborate technological device for further heating large pools (*piscinae calidae*), which would have had a higher cost than that of *testudines*, which would in turn have limited its spread;[379] when used, it also left clear evidence in the hypocaust and *suspensura* floor. Examples are known mostly from Italy, with a strong concentration around the Bay of Naples (4 examples out of 11).[380]

[378] See YEGÜL 1992, 374; NIELSEN 1993, 16, note 34; GARBRECHT & MANDERSCHEID 1994, 37–44; WILSON 1997, 121–122, all with bibliography.

[379] MANDERSCHEID 2000, 514–519.

[380] Out of 13 examples, 11 are from Italy: Rome (Vigna Barberini, Villa of Livia at Prima Porta (2)), *Ostia* (Terme Marittime), *Pompeii* (Suburban Baths), *Herculaneum* (Suburban Baths, Insula nord-occidentale), *Stabiae* (Villa San Marco), and three villas in Northern and Southern Italy. The remaining two are from Spain (*Italica*, Los Palacios) and France (Izernore) (MANDERSCHEID 1996; GUIDOBALDI,

Should the Bay of Naples once more be considered an innovative ground in terms of the development of bathing technology? The most ancient known example of a samovar could instead be the one from Rome, dated to the middle of the 1st cent. BC;[381] based on that date and on the fact that the example from Rome is an exceptional 'twin samovar', Manderscheid and Garbrecht suggested that the invention took place in the capital and then spread elsewhere, particularly to the Vesuvian area.[382] This would be an interesting case of technological transfer, giving Rome a pioneer role, and the Vesuvian area an innovative role in picking up the technology and making full use of it; the issue with this picture, however, is naturally the limited evidence from Rome. The question as to why the samovar technology did not spread any further is also interesting; cost and the additional consumption of fuel should be part of the answer, along with the question of the need for such luxurious device, which could be installed only in *piscinae calidae*, a type of room that was in any case not common in the first place.[383]

As already highlighted by Manderscheid and Garbrecht, this search for technological innovation in order to increase the attractiveness of the bathing establishments by offering new experiences to the patrons is in a way reflected in Seneca's comment on the new fashion of bathing, where "establishments that won admiring crowds when they were dedicated are rejected as outdated when luxury has devised something new to outdo herself."[384] That these technological developments

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FORMISANO & ESPOSITO 2009, 123, fig. 49 on *Herculaneum*'s Insula nord-occidentale; MESSINEO & CALVELLI 2001 on the Prima Porta villa).

[381] VILLEDIEU 1996, 436.

[382] MANDERSCHEID 2000, 518.

[383] Only two baths in the catalogue were equipped with a *piscina calida*: *Velia* (Vignale Baths [Ca.12]) and *Paestum* (Large Baths [Ca.08]). GRABNER 2001 identified 29 bath complexes with a *piscina calida*, 18 of which in Italy, out of which only 6 were in public baths (including the two from the catalogue).

[384] Sen., *Ep*. 86.8; trans. FANTHAM 2016.

took place in the realm of heating was further commented on, still by Seneca: "For even the most noble aediles performed this chore of entering the places which received the common people and demanding cleanliness and a beneficial and healthy temperature, not the one recently adopted as hot as a fire, so much so that a slave convicted of some crime should be sentenced to be bathed alive. It seems to me that there is no difference whether the bath is burning or just hot."[385]

[385] Sen., *Ep*. 86.10; trans. FANTHAM 2016.

V.2 Baths specialists

V.2.1 Construction process of the heating systems of bathing rooms

The degree of technicality the heating systems presented required to employ contractors who were specialised (or at least experienced) in the planning of baths, were familiar with the blueprints, and had a clear idea of their water and heating requirements. A specialised workforce must have been required to build the hypocausts, but their presence on site was probably necessary only when those technical facilities were built, since the rest of the fabric could be completed by labour versed in more traditional construction.

The role of these specialised teams can be tentatively sketched out. Since *caldarium* and *frigidarium* could be the first rooms to be built after the foundations of the entire building had been laid,[386] bath specialists were needed on site early on. The contemporaneity of the construction of *frigidarium* and *caldarium* also suggests that the same teams specialised in heating systems were also versed in the construction of pools.

The following succession of operations, using a *caldarium* as example, can therefore be proposed:

1) Laying of the foundations of the entire building, with the design of the *caldarium* following a blueprint
2) Start of the erection of the walls, then vault, of the *caldarium*, leaving gaps and openings for a) the *praefurnia* and hypocaust connections, b) the piping from the boilers to the heated pools (and possibly the chimneys). The baths specialists

[386] As was the case at *Bulla Regia* (Memmian Baths) and *Lepcis Magna* ('Unfinished' Baths) (THÉBERT 2003, 466).

must have arrived on site before the start of the erection of the walls, to ensure openings for the *praefurnia* were made. Alternatively, the *praefurnia* openings could have been part of the blueprints and respected by the builders of the fabric under the supervision of a contractor experienced in bath construction. A last option, where a blind wall was built only to be pierced afterwards when the heat specialists arrived on site to install the hypocausts, is rather unlikely.

3) Setting up of the *praefurnia*, including the longitudinal extensions and the *testudines* where necessary.
4) Construction of the hypocausts: *area*, *pilae*, *bipedales* layer of the *suspensura* floor, and hypocaust wall lining if necessary. The position of the putlog holes for the scaffolding in the *caldarium* of the baths of *Teate Marrucinorum* [Ab.03] (fig. 131), just above the *suspensura* floor, makes it clear that the scaffolding used during the erection of the walls was first removed, only then the hypocaust built.
5) Setting up of wall (and vault) heating. The wall heating was covered by a layer of mortar, which could be applied directly after it was set up, or after 6).
6) Finishing of the *suspensura* floor by adding the cocciopesto layer(s); fixing of the *testudines* to the cocciopesto while still fresh.
7) Construction of the heated pools, using the *suspensura* floor as bottom: CBM set around the perimeter of the pool, against the mortar covering the wall heating, and then covered with waterproof mortar (fig. 47). Water disposal via *testudo* or via pipe in the access steps.
8) At any point after 3), the boilers and water tanks are set up. After 7), piping connections.
9) Completion of the other rooms of the bathing block.
10) Only once all the heated rooms are set, heating test of the entire heating system, and repairs if necessary. Similarly, test of the water circulation. Once both systems are approved, the bath specialists leave.
11) [Completion of the non-bathing rooms, and decoration, by other teams]

How many of such specialised teams existed, how many people composed them, what their exact specialisation(s) were, how the latter influenced their choices of technological elements used in the hypocausts, the speed at which they could set up hypocausts, wall heating, and pools, and whether they left traces that could allow us to distinguish one team from another, are all questions that are not answerable at this stage. Only a very rough attempt at quantifying the amount of work that was available to them can be made.

V.2.2 Quantification of the amount of work

Central Italy, especially *regio* I, was densely settled, and every city was equipped with at least one, more likely two but sometimes as many as five bath buildings. Each of those, depending on their scale and complexity, could have taken several years to build,[387] and similarly, most of them went through one or several refurbishment, enlargement or upgrade phases[388] that required bath specialists. Using the following, hypothetical values:

- an average construction duration for a medium-sized (around 1,500 m²) bathing establishment of three years;
- that specialists were required to be on site only for a third of the duration;
- a hypothetical figure of ca. 500 public urban baths built during the Principate (see I.2.4);

[387] The restoration and enlargement of a 2nd cent. AD bath building at *Novaria* in Northern Italy took two years (*CIL* V.6513=EDR108483); inscriptions from North Africa mentioned durations from 14 to 17 months for the construction of baths (THÉBERT 2003, 467–468). These durations were mentioned probably because they were deemed to be an exceptional feat, and are therefore on the lower end of the scale.

[388] E.g. the Vignale Baths at *Velia* [Ca.12], with four phases, each adding bathing rooms to the previous one.

- that all these baths underwent at least a restoration or enlargement phase, of half the duration;

between 0 and AD 250 there would have been work on public urban baths for a total of 750 years, or ca. 15 bath buildings under construction in any given 5-year period (i.e. 3 constructions starting per year). The same teams would have also worked on the myriad of smaller bathing suites in Rome and in the countless villas and private residences in town and countryside, plus the occasional very large scale building that no doubt mobilised several of these teams for several years. It is also possible that a team was employed on several nearby bath construction sites. Despite the hypothetical nature of these figures, it is clear that there would have been no shortage of work for a small number of such teams; most of their work would have been concentrated on the western coast of Central Italy, where a vast majority of the settlements, and therefore baths, were located.

V.3 Fuel

Alongside water, fuel was the other indispensable resource for the working of any bath building, to heat the air in the hypocausts and the water in the boilers. Baths, because of their omnipresence and the many furnaces they contained, are often considered to be important consumers of fuel in the Roman world, but the extent to which this assumption is true will be reviewed below.

The main source of fuel for the ancient world was wood, either as raw wood or as wood charcoal, accounting for at least 50% of the total fuel consumed.[389] It is very likely that the supply of fuel to the urban public baths was part of a larger supply network of fuel to the city at large.[390] Bath buildings were after all only one of the many consumers of fuel in a city, alongside industries, cooking, and domestic heating. Several ancient sources confirm that dried wood was the most commonly used fuel to heat baths;[391] the large storage spaces identified in some bath buildings confirm this.[392] Charcoal may have been used too, perhaps preferably in braziers in heated rooms instead of in the *praefurnia*, the advantage being that charcoal does not produce smoke when burnt—a concern of several ancient authors.[393] While ancient authors made clear that specific types of wood should be used for specific purposes,[394] the first choice of wood was not always available and the use of complementary sources or the reuse of

[389] VEAL 2013, 57.

[390] BLYTH 1999, 87.

[391] See NIELSEN 1993, 19–20.

[392] The Baths of Caracalla in Rome had storage spaces for 2,000 m³ of wood, which could have fuelled the baths for seven months (PISANI SARTORIO 1999, 22). In the Terme del Foro of *Ostia*, a month's worth of wood reserve could be stored, most of it being stored in one single room and with smaller amounts scattered closer to the furnaces (MILIARESIS 2013, 281–282). DELAINE 2020 however pointed out that Miliaresis's results were probably an underestimation (see note 416).

[393] Plut., *Quaes. Conv*. 3.10.

[394] Plut., *Quaes. Conv*. 3.10. The *Vipasca* tablets clearly stated not to use cut branches, as they made a poor combustible (*CIL* II.5181=EDCS-60700134, lines 28–29).

wood (e.g. construction elements) may not have been uncommon; the stack of wood found next to the *praefurnium* of the Suburban Baths of Herculaneum, which included a wooden door and was mostly composed of silver fir (*abies alba*), a wood used in Herculaneum for most kind of structural elements, can be interpreted that way.[395]

Determining which type of fuel was used can inform us on the economic aspects of running a bath building, since fuel, alongside with water, would have been one of the daily expenses faced by the managers, who would have had to ensure its continuous supply; this is exemplified in the *Vipasca* tablets, where the leaseholder was required to ensure there was a stock of wood for a certain number of days.[396] Blyth calculated that the total amount of fuel needed to run a bath building would have reached up to two-thirds of the income of the bath tenants from bathers' fees,[397] and Miliaresis demonstrated that wood consumption and the operation of the baths was more efficient if the baths were not allowed to go cold.[398] Identifying the type of wood used as fuel also allows us to suggest possible sources of supply (specific wood species requiring certain types of climates and altitudes), which in turns informs us on trade networks at a more or less local scale. Almost any type of wood could be used as fuel and many types are found in the archaeological record; hardwoods such as oak, beech, maple and hornbeam were generally preferred, as they had a higher calorific potential, but this did not preclude the use of other types of woods.[399]

[395] PAPPALARDO & MANDERSCHEID 1998; PAPPALARDO 1999, 234; MOSER, NELLE & DI PASQUALE 2018, 913.
[396] *CIL* II.5181, line 31; the precise number of days is lost.
[397] BLYTH 1995; 1999.
[398] MILIARESIS 2013, 301.
[399] VEAL 2017, 392.

The wood for fuel could be collected in the direct vicinity of the city when available: *Ostia* benefitted from ash trees in its surroundings,[400] and in the Apennines, oak—one of the best suited tree types—and beech were present in large quantities (fig. 28). Pliny also mentioned that the forests surrounding his Laurentian villa (close to *Ostia*) were sufficient to supply his house with firewood.[401] It is actually quite likely that non-urban villas with baths found their supply of fuel in their immediate vicinity as long as they could, for instance in the Late Roman villa of Faragola (Puglia).[402] Fuel could also come from further away, as was the case for *Pompeii*: Veal's work on the Campanian city revealed that the favoured type of wood used for fuel was beech, which, considering the quantities required to supply the city and the fact that the species grows only above 600 m above sea level (and ideally between 1,200–1,500 m asl), could only have come from the Lattari mountains and the Apennines slopes, some 15–25 km away from the city.[403] A distance of 25 km from the Apennines was not problematic as the area of provenance was well connected to *Pompeii* by the Sarno river, but highlights how several cities (in this case *Pompeii*, *Nuceria* and *Nola*) might have competed with each other to access natural resources.[404] Rome, also, would have significantly impinged on other cities' natural resources.[405] Finally, while it seems unlikely that wood was imported from far away when local resources were available (with the usual exception of Rome),[406] recent analysis of charcoal remains from *praefurnia* of the baths of *Aquinum* [La.01] could slightly alter this picture. The results

[400] MILIARESIS 2013, 302.
[401] Plin., *Ep.* 2.17.26.
[402] CARACUTA & FIORENTINO 2012.
[403] VEAL 2012.
[404] VEAL 2017, 395.
[405] HARRIS 2011, 124: Symmachus (*Relatio*, XXXX, 3), prefect of Rome in AD 384/5, demanded that *Tarracina* supplied Rome in wood for the baths. The contribution might have been modest.
[406] HARRIS 2011, 120, 124: in the mid-4th cent. AD, wood from North Africa was imported to Rome.

revealed that *Pinus Pinaster* (‘*pino marittimo*’) was used. The provenance of the tree was said to be the Monte Circeo area,[407] some 80–100 km away from *Aquinum* by modern road. This choice seems surprising, considering the position of *Aquinum* between two mountain ranges (Monti Aurunci to the south, Monti Ausoni to the north), both reaching high altitudes (>1000 m) and being well wooded nowadays. The question of the phase to which these charcoal remains belong must be kept in mind: if they belong to the later phases of the lifetime of the baths, which is likely considering that baths and their *praefurnia* were certainly cleaned on a regular basis during their period of operation, perhaps an explanation could come from the fact that there might have been a well-established fuel supply network operating in the Circeo area. As mentioned above, *Tarracina*, located close to Circeo, had to supply fuel to Rome in the late 4th century AD; it is not inconceivable that the officials responsible for the supply of fuel for *Aquinum* turned towards that established network to supply their city.[408]

Despite the predominance of wood as fuel, other types of fuel were also used, either because of a lack of local or regional availability of wood, or because of the existence of alternatives that were cheaper or easier to come-by. The opportunistic use of straw, chaff, reeds, and animal dung, was demonstrated for baths in Egypt,[409] and pomace may have been seasonally used as fuel in North African baths and elsewhere, especially in scarcely wooded olive-production areas.[410] This, however, was probably of little concern for the urban public baths of Central Italy. The seasonal aspect of the

[407] Communication G. Ceraudo during the Convegno terme italiche, Rome, 5–6 October 2018.

[408] If that suggestion has any validity, it would be interesting to determine if other cities along this supply line (which probably followed the *Via Appia* via *Minturnae* and *Casinum*, or used coastal navigation until *Minturnae* before continuing by road), for instance *Minturnae*, used the same type of fuel. The itineraries between *Tarracina* and *Aquinum* are those suggested by the Orbis project.

[409] REDON 2009, 415–418; 2012; BOUCHAUD & REDON 2017, 338.

[410] BRUN *et al.* 1989, 126; ROWAN 2015.

production of pomace was emphasised,[411] which makes clear that pomace could not have overshadowed wood as an energy source overall,[412] and that even if there was an intentional selection of fuel to use in heating of the baths, the type of fuel could have changed over time, either seasonally or over longer periods of time according to changes in the local or regional ecosystem.

Recent studies have given a mixed picture of the fuel needs of bath buildings.[413] Miliaresis showed that the Terme del Foro at *Ostia* would only have needed 147 average-size ash trees (*Fraxinus*) for a year of operation (ca. 300–375 m^3/year); these trees could theoretically have occupied less than half the area of the *palaestra* of the baths.[414] For *all* the baths of *Ostia* (public and private), Miliaresis suggested the very rough figure of ca. 1,700 trees, or 3,380 m^3, per year—[415]an overall figure that "does not suggest that the baths have caused dramatic levels of deforestation".[416] In contrast, an assessment of the fuel needs of a large set of baths at *Sagalassos*, using a different method, arrived at a result of 1,670–3,100 tons of wood per year;[417] the assessment of the fuel needs of the city as a whole ranged between 3,650 and 12,775 tons/year,

[411] The availability of pomace would have been maximal right after the olive pressing, in late autumn and winter, which is also when charcoal would have become more expensive (ROWAN 2015, 477).

[412] VEAL 2017, 392.

[413] Fuel needs calculations include a wide array of variables, requiring caution when making comparisons between experiments; for a review of several such calculations, see DELAINE 2020, 85–90.

[414] MILIARESIS 2013, 283, fig. 5-4. The calculations assumed 12.50 m tall trees with a diameter of 0.45 m producing 1.99 m^3 of wood.

[415] MILIARESIS 2013, 296. This equates to a weight of 1,768 tonnes, based on 13 kg of hardwood taking up a space of 0.025 m^3, i.e. one cubic meter weighed 520 kg and one tree, 1,040 kg (MILIARESIS 2013, 278).

[416] MILIARESIS 2013, 303. Miliaresis assumed an efficiency of 100% for her calculations (i.e. no heat loss in the system); changes to that parameter would significantly affect the result (compare with the NOVA Baths experiment (YEGÜL & COUCH 2003, 174–175), where an efficiency of 8% was assumed, a figure in turn questioned by ROOK 2019).

[417] Note that the baths of *Sagalassos*, with three sequences of heated rooms and up to 14 heated pools, were significantly larger than those at *Ostia* and were located in a colder climate, closer to that of northern Europe than the Mediterranean (JANSSEN *et al.* 2017, 598).

suggesting that the baths were one of the main consumers of wood in the city and that the city used its local resources at the limit of sustainability.[418]

The question of deforestation in ancient times is a much-discussed topic, with the latest more accepted view that proper evidence for deforestation is not visible before the Medieval period.[419] The heating of bath buildings, although it accounted for no small percentage of the cities' fuel consumption, was most likely not amongst their largest consumers of wood (other than fuel): other consumers, more or just as important, included building and military requirements, but also ceramic and other goods and construction materials production, industries, cooking, domestic and public (non-bath) heating.[420] Furthermore, there is evidence pointing in the direction of a practice of sustainable management of woodlands, at least for certain periods—[421]even though occasional shortages certainly occurred.[422] In the case of the baths of Central Italy, the availability of wood resources for fuel for the baths was probably never an issue, as Italy's wood capacity was much greater than the population's requirement, even in the highest periods of consumption.[423] The figure given for the needs of the baths of *Ostia* is also on the upper range of the spectrum of what the baths of a single city might have required, as *Ostia* had about 20 public and private bath buildings and apart from Rome and perhaps *Neapolis, Capua* or *Florentia*, no other city had anywhere near that many baths.

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[418] JANSSEN *et al.* 2017, 597. The figure refers to an intermediate scenario between the most energy-saving and the most energy-consuming.

[419] VEAL 2013, 42. See HARRIS 2011, 110–111 on the definition of 'deforestation'.

[420] VEAL 2013, 44. HARRIS 2011, 120: the needs in fuel of baths were quite low compared to those of metallurgy.

[421] VEAL 2013, 44.

[422] HARRIS 2011, 129–130.

[423] GROVE & RACKHAM 2001, 174.

Proper data on the types of fuel used in baths is still woefully lacking, as the identification of wood species is only possible when carbon and other organic remains are collected during the excavations, which until recently has rarely been the case for bath buildings, leaving us in a relative ignorance on the topic; further research and analysis of carbon residues from *praefurnia* and hypocausts should greatly contribute to the question. Additional factors such as the presence of windows, their glazing,[424] and the orientation of the heated rooms, also affected the temperature within the baths and therefore the rate consumption of fuel.

[424] Most recently MILIARESIS 2019 with bibliography.

V.4 CBM for heating systems: production, supply, innovation

This detailed examination of every single element composing the hypocaust has implications that go beyond mere thermal technology. Most of these elements (such as the brick for *pilae,* the *bipedales,* the *tubuli*) were specialised products, which required little specialised craftmanship (apart probably for the hollow tubes) and were created with a thermal use in mind.[425] Because CBM were virtually indispensable for the construction of hypocausts, the choice of one shape over another must reflect economic choices based on patterns of production and supply, and was made by the people in charge of selecting the materials for the baths.

In the imperial period, the production of construction materials for bath buildings was part of an already established production of *opus doliare*—they were produced alongside other, more common types of material, such as tiles or amphoras, and so far there is no conclusive evidence in Central Italy of a *figlina* producing exclusively, or predominantly, material for hypocausts.[426] The CBM for heating systems could therefore come from a variety of sources:

1) The same *figlinae* that supplied the city of Rome and were located in the Middle Tiber Valley, some of which had ties to the imperial family; this could be the case for baths located along the course of the river (e.g. *Castellum Amerinum*

[425] SHEPHERD 2006, 184–185, 188–189.

[426] This might have been different in other parts of the Empire, as the example of the Sussex tilemakers in Britain would suggest (BETTS 2016).

[La.G.9]),[427] or that had access to material shipped down to Rome (e.g. *Castra Albana* [La.02]), or for which a contractor ordered a specific batch of material.[428]

2) Tileries whose production was aimed at a whole city, some of which could be under municipal ownership. The Vingone kilns, for instance, near Firenze (Augustan-Tiberian), produced many *opus doliare* elements interpreted as construction material for the city of *Florentia*. The main production was tiles, but many of the components of hypocausts have been discovered, including circular bricks,[429] some of which were used to create the *pilae* of a set of baths in *Florentia*.

3) Private kilns, linked to villas or agricultural production units, producing export amphoras, and which could have added other types of CBM to their usual production. Lancaster emphasised the role of the adoption of villa culture from the 1st cent. AD for the spread of technologies, considering that "brick and tile manufacture was often closely linked with amphora production for export of agricultural goods from the villas".[430] Production of circular bricks for *pilae* has been identified in the vicinity of Giano Vetusto, in Campania,[431] alongside tiles, bricks and mainly amphoras. Similar production landscapes are known from Spain[432] and Istria,[433] and are quite likely in Central Italy.

Several people could have been responsible for supplying the materials to the bath buildings, such as the builders or the contractor, as suggested from passages in

[427] The *bipedales* of the hypocaust at *Castellum Amerinum* [La.G.09] came from the *figlinae* of the *Domitii*.
[428] See note 436.
[429] SHEPHERD 2006, 184-185.
[430] LANCASTER 2015a, 244.
[431] CHIOSI *et al.* 1994, 302.
[432] ROLDÁN GOMEZ & BUSTAMANTE ÁLVAREZ 2015, 135.
[433] KOMPARE 2015.

Cato[434] and Ulpian,[435] or the commissioner/benefactor if they had any reason to do so; they could have fetched them from any of the places mentioned previously. The most common scenario was probably that of an 'on-demand' production, where the contractor or the builders, in all likelihood, directly requested a tilery, ideally close to the construction site or to a transportation route, to produce the material they required. In Rome and close-by, they could have benefitted from what was produced in the *figlinae* in the Tiber Valley, which were producing on a continuous or semi-continuous basis because of the high demand from Rome; the material was possibly purchased directly from warehouses, not necessarily from the *figlinae* themselves. Shipwreck evidence demonstrated the existence of shipments of urban material specifically for the construction of bath buildings.[436] Exceptionally, it was the commissioners themselves who could have supplied the material, if they owned *figlinae*, as could have been the case for the baths of *Pisa*e, restored by a *Lucius Venuleius Apronianus Octavius* [E52], consul in AD 168 and a member of a family well known for owning *figlinae*, probably in the area of Pisa.

These patterns of production and supply account for the variations seen in the hypocausts of Central Italy. The Vitruvian hypocaust, using *bessales*, *sesquipedales* and *bipedales*, reflects the organisation of the production in the Tiber Valley for the city of Rome. The aim of the standardisation of the production of brick for Rome to those

[434] *Agr*. 14.

[435] D.6.1.39; MARTIN 1989, 40.

[436] Shipments of material from the Tiber Valley area specifically destined for the construction of bath buildings are known by the shipwreck of Capo Carbonara (1st half of 1st cent. AD), whose cargo contained *bessales*, *bipedales* bearing the stamp of the *Domitii* (*CIL* XV.999g, 1105 var.), *tubuli*, and tiles bearing the stamp of *M. Procilius Meleager* (*CIL* XV.1387). Similarly, in the Villa delle Grotte on the isle of Elba, analysis of clay and brickstamps demonstrated that Urban material was imported specifically for the construction of the bath building (SHEPHERD 2006, note 54. Capo Carbonara: ZUCCA 1987, 666; SALVI 1996. Villa delle Grotte: CASABURO 1997, 29–30).

three main modules may have been to simplify the organisation of the production process, with in mind the main market that was Rome.[437] It may therefore not be surprising if Vitruvius (V.10.2), who worked in Rome when writing his books, recommended using those three modules of brick to build the heating systems of the baths: he would have witnessed them being used in the construction of countless bath buildings in Rome. Away from Rome, the fact that the most common elements in heating systems were tiles and *bessales*, which were also amongst the most common products for other types of buildings, simply reflects the usual production of *opus doliare* tileries. This explains why some of the elements of the Vitruvian hypocausts were replaced by more common material, for instance why tiles often replaced *sesquipedales* for the flooring of the *area*. More unusual types of bricks for *pilae* could possibly be the result of economically driven decisions, and the high demand for bath buildings in the imperial period, in large part due to the construction of numerous private baths, would have been a factor in the development of new types of tiles: some *opus doliare* workshops could have answered that demand by adding to their usual production the products to build baths. The octagonal bricks are too rare to be a standard product of a tilery; instead, it seems safer to see them as a one-off demand from the bath builders or commissioners to cut down on transportation costs. The circular bricks are common in certain areas only and once they started being used, they could have been offered by several tileries of the area as a more standard product, thus leading to their more common use in the northern part of Central Italy and further north. Finally, there is potential for some innovative, 'entrepreneurial' behaviour. The Campanian hollow tubes were all very similar and it is therefore possible that they

[437] BUKOWIECKI 2010, 145.

were the product of a single, or a limited number of tileries; in this case, it could be hypothesised that they were a technological invention by a workshop owner more than a request by a contractor: they could be seen as an attempt to offer an alternative to the traditional *pilae* with a specialised piece of technology deemed more effective, potentially cheaper and certainly faster to set up. The fact that they are almost exclusively found in the Vesuvian area could be explained by the density of bath buildings in the area, including the many private and spa baths, which meant that there was a potential market for this product; their limited distribution could also be accounted for by the increasing transportation costs (and higher risk of breakage) from this putative tilery to further distances, when more readily available *bessales* would have been an economically more rational solution. Another possible example where a single mind, or a single workshop, might be behind a specific piece is found in the baths of *Augusta Praetoria*, in northern Italy, where the lower element of the *pilae* (and probably the upper one too) was made of a square base united to a circular part—a piece produced for that purpose only, and which could not have been used or recycled otherwise.[438] We can surmise that such 'entrepreneurs' existed by stories like that of *Sergius Orata*, the Campanian inventor of *pensiles balineae*;[439] whether his invention was related to hypocaust systems or not,[440] he was driven by profit above all else, a motivation probably shared by the inventor of the hollow tubes.

[438] ARMIROTTI *et al.* 2019, 85.
[439] Plin. *HN* IX.168; further literary evidence in FAGAN 1996b, 64–65.
[440] FAGAN 1996b convincingly argued against this connection.

VI. Funding patterns

Introduction

This chapter will be concerned with funding patterns, or who paid for bath buildings, for what reasons, and what they stood to gain from that. Benefactors wanted their acts of munificence to be remembered, and thus recorded and advertised them on inscriptions on durable supports, in line with the 'epigraphic habit' that developed from the 2nd cent. BC and reached its apex in the 1st–2nd cent. AD before declining in the 3rd cent. AD.[441] Central Italy had a particular place in this epigraphic practice, as it appears to be—outside of Rome—the area from which the largest number of inscriptions come;[442] this is also true for inscriptions recording acts of benefaction linked to baths.[443] Thanks to those numerous inscriptions and to previous studies on the topic, it is possible to offer a view of the practice of bath benefaction in the imperial period in Central Italy.

If building inscriptions constitute the main source of information for this chapter, they are not the only type of evidence to provide information on bath constructions. Statue bases were sometimes erected to honour a benefactor who offered a bath building to the city; funerary inscriptions could record a bath benefaction made during the lifetime of the deceased; contracts of patronage, *tabulae patronatus*, could also record or include similar acts of euergetism; finally, the

[441] LLORIS 2015 with bibliography.

[442] LLORIS 2015, 138–139: based on inscriptions listed on *EDCS* and excluding the *instrumentum domesticum*, Italy accounts for ca. 50% of the Latin inscriptions of the Roman Empire for any period, and the *regiones* considered here, for 15%. See also WOOLF 1996, 36. A very large number of these inscriptions are funerary.

[443] FAGAN 1999a's catalogue contains 339 entries in ca. 295 inscriptions, and 45 fragmentary inscriptions from p. 227, note 10. Out of this total 339 inscriptions mentioning baths, 90, i.e. 26%, come from Central Italy (110 including Rome and *Ostia*, 153 (i.e. 45%) for the whole of Italy), 75 from North Africa, 39 from Asia, 25 from Gaul and the remaining 48 scattered through the rest of the Empire.

occasional passage in ancient authors or advertisements engraved or painted on the walls of the baths themselves provide glimpses of a less formal nature.

Potentially very interesting are the inscriptions that were displayed inside the bath buildings but not directly related to constructional benefactions. Baths were also a place for display, and wealthy individuals could pay for statues or other works of art to adorn the different rooms; if the inscriptions accompanying them did not mention their placement in a bath building, it is virtually impossible to determine their original location, or if they were even located in the bath building. Once more, the paucity of the older archaeological documentation and the terseness of many excavation reports limit our investigations. The same is true for other, ephemeral inscriptions like graffiti or paintings, which would give us glimpses about the identity of the bathers and the everyday activities happening within those structures.[444]

Keeping in line with the chronological boundaries set at the beginning of this study, only the inscriptions from the Augustan period until the mid-3rd cent. AD will be considered (see catalogue of inscriptions). Inscriptions where at least part of the proposed date range falls into the chronological frame of the study will still be considered. This chapter is much indebted to the material gathered by Fagan in his 1999 volume. In the twenty years since its publication, only a handful of new inscriptions have come to light in this geographical area, and Fagan's conclusions on the identity of the benefactors and the nature of the benefactions are therefore still valid.[445] This chapter however focuses on issues not tackled by Fagan, above all on what the physical appearance of the inscriptions can tell us about the nature of the

[444] Cf. FAGAN 1999b, 27.

[445] FAGAN 1999a. Inscriptions not considered by Fagan include: [E03], [E04], [E08], [E09], [E10], [E16], [E20], [E22], [E41], [E43], [E60], [E78], [E82?], [E83?], [E85?].

funding, and on the relationship between inscriptions and archaeological remains. The identity of the funders will nonetheless be tackled first.

Since the focus is on the physical appearance of the inscriptions, each physical inscription is an entry, even when two inscriptions are a copy of each other. Some inscriptions recorded several benefactions and several benefactors; in order to accurately redirect the reader to the right benefaction or benefactor, the different benefactions will be referred to using a lowercase letter after the inscription number, and the benefactors by a capital B followed by a number.[446] 80 inscriptions have been collected; they are numbered [E01]–[E80] and sorted alphabetically by the Latin name of the site of origin.[447] They are followed by six very fragmentary inscriptions possibly mentioning baths, numbered [E81?]–[E86?].

[446] For instance, the inscription from *Paestum* [E69] recorded two benefactions ([E69.a] and [E69.b]), each funded by a different benefactor ([E69.B1] and [E69.B2]).

[447] [E62], [E67], [E68], [E70], [E73] do not mention baths but are included here because of their findspot.

VI.1 Who paid for public baths?

The practice of euergetism is widely attested in the Roman world and has been the object of much research since the fundamental volume of Veyne,[448] with publications focusing on regions,[449] periods,[450] non-epigraphic material,[451] types of benefactions,[452] categories of benefactors,[453] and the intentions of the latter.[454]

The benefactors who appear in the inscriptions collected in the epigraphic sample covered many categories of the upper classes of Roman society, from the emperor[455] to his imperial freedmen[456] by way of members of the senatorial[457] and equestrian[458] orders. They also occupied a wide array of political, religious and/or military functions in society, both within and without the political body of a city. From the top down, we know of emperors who offered baths,[459] as well as people close to Rome and the imperial power, such as consuls[460] or imperial representatives in the provinces.[461] Within the political body of the cities, politicians of every rank could offer

[448] VEYNE 1976. Only publications relevant for Italy are listed hereafter.
[449] JOUFFROY 1977; CÉBEILLAC GERVASONI 1990; CANCRINI, DELPLACE & MARENGO 2001; GOFFIN 2002; LOMAS 2003; LOMAS & CORNELL 2003; HORSTER 2015.
[450] ALFÖLDY 1997; PANCIERA 1997; POBJOY 2000.
[451] BRUUN 1995.
[452] CORBIER 1984; CENERINI 1987–1988; CORBIER 1989; DELAINE 1999; KOKKINIA 2012.
[453] DUNCAN-JONES 1974b; DLOOTJES 2004; GRANINO CECERE 2008; ENGFER 2017. Emperors in particular have attracted more attention: BOATWRIGHT 1989; COARELLI 2000; HORSTER 2001; ALFÖLDY 2002; PATTERSON 2003; CASTAGNO 2008; CAMODECA 2017.
[454] NG 2015.
[455] [E29], [E51], [E65], [E81?].
[456] [E07], [E13.B1], [E58], possibly [E20].
[457] [E18.B1]=[E19], [E52], [E66], [E69.B1–B2].
[458] [E05], [E23.B3], [E28.B2], [E44].
[459] See note 455.
[460] See note 457.
[461] [E80] (*praefectus Aegypti*). [E66] was also a *curator rei publicae* of several communities in Tuscany.

benefactions.[462] Amongst the higher magistracies, we know of *duoviri*,[463] *quattuorviri*[464] (some of which *iure dicundo*),[465] *octoviri*,[466] *aediles*,[467] and some individuals had occupied several of these.[468] Holders of lower magistracies (*tresviri*,[469] *seviri*,[470] *decemviri*[471] are attested) at times offered bath-related benefactions, and local councils are occasionally attested too.[472] Away from the political body of the cities, military[473] or religious officials,[474] members of *collegia*,[475] and women,[476] sometimes offered benefactions, as did benefactors without specific titles or offices.[477] Finally, *patroni* of cities are well attested;[478] these could have been the same people holding magistracies, but not necessarily.

A distinction is often made between benefactions made by the emperors and his representatives, those offered by the local authorities, and those resulting from the actions of private benefactors.[479] This distinction is useful and sensible, since these

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[462] The political organization of cities was generally similar for settlements with official civic status in Italy during the Imperial period, with elected magistrates (the higher offices being *duoviri*, *quattuorviri* and *aediles*) and a local council (*ordo*) (CÉBEILLAC-GERVASONI 1998, 80–86; HORSTER 2015, 521). Local differences however existed, such as *octoviri* in eastern Central Italy, or *decemviri* (CURCHIN 2016), or *aediles* sometimes being called *duoviri* at *Pompeii* (MOURITSEN 1988, 28).

[463] [E08.B1–B2], [E26]=[E27], [E79]. Several *duoviri* were also *quinquennales*: [E09] (*iterum*), [E49.B1], [E54], [E63].

[464] [E01.B1–B2], [E43], all three *quinquennales*. Also [E17] (several positions).

[465] [E03] (*quinquennalis*), [E62]. [E28] (B1–B2) were both *quinquennales* but their exact position was lost or not mentioned.

[466] [E31.B1–B2]=[E32] (both *iterum*).

[467] [E39.B1].

[468] [E30] (*decurialibus omnibus honeribus functus*), [E38] (*aedilis, dictator*), [E44] (*duovir iterum, omnibus muneribus functus*).

[469] [E19] (*aere argento auro flando feriundo*).

[470] [E21.B2], [E36], [E72] (*augustales*).

[471] [E07].

[472] [E18.B2], [E21.B1], [E35], [E50].

[473] *Primus pilus*: [E23.B1], [E76].

[474] [E39.B2] (*flamen*). [E22.B1] held several military and religious positions.

[475] [E37] (*quinquennalis*), [E58] (*magister conlegii libertorum*).

[476] [E06], [E11], [E13.B2], [E42], [E77].

[477] [E13.B1], [E49.B2], [E56].

[478] [E07], [E17], [E22.B2], [E31]=[E32], [E40], [E44], [E47], [E49.B1], [E55.B3], [E63], [E66].

[479] E.g. FAGAN 1999a.

different categories of people had different resources at their disposal and may have had different motivations. On the other hand, the line separating the two latter categories should not be drawn too firmly, as it was often the same people eventually paying for the baths—local elites who, in many cases, would pursue a (political) career at a local level. To which category did someone like *Q. Petronius Melior* [E66] belong, a member of the senatorial order who held several offices, both as imperial representative and in the municipal government of *Tarquinii*, in addition to being patron of the town? The inscription from *Corfinium* [E18] is also interesting in this regard: *Sergius Cornelius Dolabella*, consul, acting privately, offered a bath building to the city; he died before the completion of the works, and the *possessores* of his estate added 100,000 sesterces to see to the completion. This was not enough and the city itself added a further 152,000 sesterces to the works. This is all recorded on the same inscription, with the layout and the use of outdents making clearly visible the three steps of the funding, or the three different funders—but keeping the focus on the initial benefactor, written in larger letters. Furthermore, even when political offices were mentioned on an inscription, it is not always possible to correlate them with the benefaction—it is not even guaranteed that the bath benefaction was connected to one of the offices mentioned. *Aufidius Verus*, for instance, successively *pontifex*, *quaestor* and *duovir quinquennalis* at *Pisaurum* [E54], made it clear that the benefaction of free oil for bathing he gave the citizens was at his declaration of citizenship, not in connection with the magistracies he held. It is also probable that the distinction between private and public benefactors mattered little to the vast majority of the people who saw the inscription and used the baths; what mattered was the identity of the benefactor more than any office they might have occupied. Central Italian communities were rather

small in Roman times, a few thousand inhabitants for most of them,[480] and the contemporaries of a benefactor would have had an idea of his or her identity by reading their name more than by looking at their titles.

From the variety of the offices held by the magistrates who paid for the construction of restoration of bath buildings, it is clear that no single office entailed additional responsibility towards the construction and maintenance of bath buildings. If it is true that there is a significant dominance of higher magistrates (17) being responsible for acts of euergetism compared to lower magistrates (5) and local councils (4), this reflects wealth more than any form of political responsibility, as might be expected given that one of the criteria for election in office was property of a certain value, increasing as one moved further up the ranks. A possible confirmation of this comes when we consider the nature of the benefaction (table 20): initial constructions are more common for higher magistrates than for lower ones, for whom restorations or non-constructional benefactions occur more often. At the same time, the conclusions reached by this type of comparison can only lead us so far, since 1) the surviving inscriptions, especially when in small numbers like those regarding the lower magistrates and the local councils, might not give a representative picture of the contemporary practice, and 2) we have no clear idea of the scale intended by the terms 'construction' or 'restoration' (the Latin terms are not more helpful):[481] even if a construction can be expected to be more expensive than a restoration, the total refurbishment of a large bath complex, especially one that included the decoration (which can be presumed for all restorations), might cost more than the construction of

[480] Based on the formula proposed by HANSON & ORTMAN 2017.

[481] WITSCHEL & THOMAS 1992 argued that these inscriptions have to be read as more ideological than reflecting an ancient reality, a view opposed by FAGAN 1996a whose opinion was naturally followed here.

a small bathing facility. Either that, or there is simply no direct connection between wealth and nature of the benefaction; this is best illustrated by the imperial benefactions, most of which are restorations when the resources available to the emperors meant that they could have completed any type of benefaction.[482] This question will remain unanswered unless inscriptions can be correlated to remains on the ground, which is only rarely possible.

TABLE 20: INSCRIPTIONS RECORDING BENEFACTIONS MADE BY LOCAL AUTHORITIES, BY TYPE OF MAGISTRACIES

Legend: *=inscription appearing in two categories.

	Construction	**Restoration**	**Other**
Higher magistrates	[E08], [E09], [E17] (+ non-constructional), [E49a], [E79]?, [E28.B1], [E62]	[E01.B1–B2], [E30] (+ embellishment), [E39.B1], [E43], [E31.B1–B2]=[E32], [E38]	[E26]=[E27], [E44], [E63], [E54]
Lower magistrates	[E19]	[E07], [E36] (+ embellishment), [E21]*	[E72]
Local councils	[E18.B2], [E35]	[E50], [E21]*	

That wealth was the prime factor in determining the ability to fund bath buildings has already been made clear by Janet DeLaine who highlighted the shift from public to private funding between the Republican and Imperial periods.[483] This pattern is consistent with the information from the inscriptions of the period and area concerned here: out of 61 benefactions for which the origin of the funds can be determined, the vast majority (52) points to the funds coming from the pockets of the benefactors, and in only nine cases was the funding public. Most of these nine are

[482] Out of four imperial benefactions, three were restorations [E65] [E51], [E29]), the nature of the fourth one [E81?] is unknown.

[483] DELAINE 1999.

dated to the early Imperial period;[484] by the middle-imperial period, public funding was virtually non-existent. During the imperial period, towns simply did not have the necessary means to pay for bath buildings of a certain standing, no longer simply hygienic and functional structures but larger, more luxurious and grandiose establishments, which, following the latest developments seen in Rome since the opening of the Baths of Agrippa—the first of the imperial *thermae*—to the public,[485] had come to be an expected part of the urban monumental apparatus of any respectable city.[486] Cities drew their income from tax on trade and money-changing, from revenues from their estates, and from the payment of *summae honorariae* by magistrates and other officials taking office.[487] These latter sums, however, could have been used for a wide range of purposes and would hardly have been enough on their own to fund any decent-sized bath complex:[488] the few times *summae honorariae* are mentioned on a bath-related inscription, whether explicitly or not,[489] they were complemented with funds from other sources[490] and/or used for smaller benefactions. Furthermore, if paid from the municipal treasury, the expense for such a construction could have put a strain on

[484] Late Republican/Early Imperial period/1st cent. AD: [E08], [E43], [E72], [E50], [E23.b], possibly [E01]. Later: [E18.b], [E35] (*summa honoraria)*, [E21].

[485] Nothing is known of the original layout of the Baths of Agrippa, but literary accounts insisted on the wealth of their decoration, unusual for the time (Plin., *HN* 34.62, 35.26, 36.121, 36.189).

[486] DeLAINE 1999, 70. This is reflected by Pausanias (X.4.1) when he wonders "if one can give the name of city to those who possess no government offices, no *gymnasium*, no theatre, no market-place, no water descending to a fountain" (transl. JONES 1918–1935).

[487] DUNCAN-JONES 1985, 29; ECK 1997, 307–315. On *summae honorariae*, see DUNCAN-JONES 1974a, 86–87, 147–155; 1985, 28–33; 1990, 174–184; also BRUUN 2014.

[488] The known sums given as *summae honorariae* in Italy ranged from 1,600 to 20,000 sesterces (4,500 average) (DUNCAN-JONES 1974a, 154); compare with the amounts mentioned on bath-related benefaction inscriptions: 5,250 sesterces for a *labrum* at *Pompeii* (*CIL* X.817=EDR143048), 15,000 sesterces for the restoration of a *balneum* at *Lanuvium* [E39], and the lowest figure for construction starts at 150,000 sesterces at *Tifernum Tiberinum* [E74].

[489] Explicit: *Lavinium* [E35]; implicit: *Cures Sabini* [E21], *Teanum Sidicinum* [E72], *Lavinium* ([E36], [E39]), perhaps *Alba Fucens* [E03].

[490] DUNCAN-JONES 1974a, 82–88. E.g. the expression *ob honorem*, which implied sums that could be much larger sums that the amount expected for the *summa honoraria*.

a city's budget for a considerable time.[491] If, for Eck, cities had access to a larger budget than is traditionally assumed,[492] it remains that even the largest cities of the area either relied on, or at any rate welcomed, fully-fledged, well-decorated bath building(s) that were privately funded: for instance, the main baths of *Aquinum*, one of the largest towns of Central Italy,[493] were still funded by a local magistrate with his own money [E09].

If most of the benefactors who funded bath buildings are relatively unknown and their biographies are limited to what the inscriptions tell us, some of them stand out as belonging to the upper levels of Roman society. In addition to the emperors Trajan [E29], Caracalla [E51], Antoninus Pius [E65] and perhaps Commodus [E81?], well-known benefactors include senators like *Dolabella Metilianus*, consul suffect in AD 113, at *Corfinium* ([E18]=[E19.B1]); *L. Venuleius Apronianus Octavius Priscus*, consul in AD 168, at *Pisae* [E52];[494] and at *Tarquinii*, *P. Tullius [Varro]*, consul suffect in AD 152, and his son [E69.B1–B2], as well as *Q. Petronius Melior*, *curator rei publicae* of several communities in *Etruria* [E66]. These characters were prominent members of the elite of their time, with activities that went beyond euergetism and politics, and sometimes strong connections both to Rome and to the territory from which they originated. The family of the *Venuleii*, for instance, was one of the most prominent at *Pisae* in the 1st and 2nd cent. AD, and its members held several consulates and important priesthoods.[495] They were very well established in the area, possessing *praedia* with *figlinae* around *Pisae* and beyond, whose production was found in the aqueduct of *Pisae*

[491] DUNCAN-JONES 1990, 27–278 gave a figure of ca. 30 years of a North African town's budget for the construction of an 'if at all extensive' bath building.
[492] ECK 1997, 307–315.
[493] CERAUDO 2019, 111.
[494] SCHEID 1983.
[495] VALLEBONA 1989.

(where they restored the bath building [To.05]), in their villa of Massaciuccoli (where they worked on the baths)[496] and close to *Populonia*. The father of our benefactor was consul in AD 123, the year in which the practice of indicating the consular date on brickstamps was at its peak; considering the close proximity of the family to the imperial power, and that they occupied the consulate in that year and had personal interests in the management of *figlinae*, it is not inconceivable that the family had a role to play in this change and in the hypothetical imperial decree that led to this practice.[497]

Senators, furthermore, had the obligation to reside in the vicinity of Rome at least part of the year, and therefore probably owned land in Central Italy—when they were not originally from Italy itself.[498] There was therefore a stock of wealthy individuals who had the means of paying for expensive constructions, not only bath buildings, in the cities of Central Italy,[499] potentially making imperial euergetic interventions in the area unnecessary.

Contracts of patronage can also be read in that way, where cities tried to attract wealthy people—whether senators or not, but people with connections in Rome[500]—first and foremost to be represented in the capital, but the possibility of benefitting from generous acts of euergetism was probably not a negligible factor.[501] Eleven *patroni* are known to have offered bath-related benefactions to the city they had signed a

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[496] *CIL* XI.1433a=EDR079076; CIAMPOLTRINI 1994. See also section III.3.

[497] The question is summarised in MANACORDA 1993, 47–51; BRUUN 2005, 12–16.

[498] HAMMOND 1957: even in the late 2nd cent. AD, half of the senators whose origin can be determined came from Italy.

[499] DELAINE 1999, 74.

[500] E.g. *M. Aurelius Sabinianus*, imperial freedman [E07], probable husband of *Marcia Aurelia Ceionia* [E06], the latter being therefore not the concubine of Commodus (FLEXSENHAR III 2016)); *Q. Petronius Melior*, senator and consul [E66]; the brothers *Q.* and *C. Poppaeus*, possibly the consuls in AD 9 ([E31]=[E32]).

[501] DUTHOY 1984; 1984–86. Also HEMELRIJK 2004.

contract with (table 21),[502] more than any other category of benefactor. The benefactions were varied (construction and restoration, embellishments, fuel and money for upkeep), and they were probably all paid *de sua pecunia*. Patrons composed a category *per se*, since one became patron on an entirely voluntary basis[503] and the relationship between patron and client-city was asymmetrical, the city gaining more out of the contract[504] and profusely honouring its patrons with dedicatory inscriptions and statues (cf. table 21). Several of these inscriptions emphasised the fact that the honorand was a *patronus* of the town by separating that term from the municipal offices the latter might have held: at *Tarquinii, Q. Petronius Melior*'s honorific inscription [E66] detailed his extensive list of offices, but ended with an emphasis on the patronage relationship; the same is true and even clearer in the case of the inscription of *Suasa* [E63]. Considering this imbalance between on the one hand a patron representing a city's interests in Rome as well as distributing largesse to it, and on the other a morally indebted city trying to settle its debt by honouring its patron with statues and inscriptions, it is perhaps not surprising that patrons compose the largest category of benefactors as cities would have eagerly been looking for wealthy and well-connected patrons.

[502] Construction: [E17] (and non-constructional), [E49.a], [E47]; restoration: [E07], [E40], [E55.c] (and embellishment), [E66]; embellishment: [E22.a]; non-constructional: [E44], [E31]=[E32], [E63].

[503] A person could refuse to become the patron of a city who requested it from him, as Fronto did with his city of origin, *Cirta* (*Ep.* II.11.1.3–4).

[504] DUTHOY 1984, 154–155.

TABLE 21: PATRONS WHO OFFERED BATH-RELATED BENEFACTIONS TO TOWNS OF CENTRAL ITALY

Legend: col. 7: H=Honorific; B=Building; SB=Statue Base; T=*Tabula*

ORIGIN [ref. no]	Benefactor	Status/role	Source of funds	Benefaction	Inscr. type (support)
ANAGNIA [E07]	*M. Aurelius Sabinianus Euhodus*	*Augg(ustorum) lib(ertus),* ***patronus*** *civitatis, decurialis decuriae lictoriae popularis denuntiatorum, decemviralis*	*sua pecunia*	Restoration of *thermae*	H (SB)
CORFINIUM [E17]	*Q. Avelius Priscus Severius Severus Annavus Rufus*	*flamen divi Augusti,* ***patronus*** *municipi, quaestor rei publicae, IIIIvir aedile, IIIIvir iure dicundo, IIIIvir quinq(uennalis), pontifex*	Probably *sua pecunia*	Construction of a *balineum muliebre*; 30,000 HS for upkeep	H (T)
LIGURES BAEBIANI [E40]	*Incertus*	***Patronus***	*ac sua pecunia*	Restoration *balineum*	H (SB)
MISENUM [E44]	*T. Flavius Avitus Forensis*	*IIvir iter., q(uin)q(uennalis), omnib(us) munerib(us) functus, v(ir) e(gregius),* ***patron(us)*** *col(oniae)*	Probably *sua pecunia*	Fuel (400 cartloads of wood in perpetuity)	H (SB)
PAESTUM [E49.a]	*M. Tullius Cicero Venneianus*	*IIvir q(uin)q(uennalis),* ***p(atronus)*** *c(oloniae)*	*sua pecunia*	Construction *balnea*	B (T)
PITINUM PISAURENSE [E55.c]	*Incertus*	***patronus*** *municipi*	*sua pecunia*	restoration and embellishment	B (T)
TARQUINII [E66]	*Q. Petronius Melior*	*v(ir) co(n)s(ularis), cur(ator) r(ei) p(ublicae),* ***patronus***	/	Restoration *thermae*	H (SB)
INTERAMNIA PRAETUT-TIORUM [E31]=[E32]	*Quintus and Caius Poppaeus*	***patroni*** *municipi et coloniai*	*de sua pecunia*	*lavatio*	B (T)
OCRICULUM [E47]	*L. Julius Julianus*	***patronus*** *municipi*	*sua pecunia*	Construction *thermae*	H (SB)
SUASA [E63]	*L. Octavius Rufus*	*trib(unus) mil(itum), duomvir quinq(uennalis), publ(icus)* ***patronus***	Probably *sua pecunia*	*lavatio*	H (SB)
FALERII NOVI [E22.a]	*C. Nummius* [–]	***patronus*** *rei p(ublicae)*	Probably *sua pecunia*	Embellishment: *mu[sivum et orn(amenta)]*	B (T)

Euergetism being a prime means of self-advertisement, most benefactors were to some degree motivated by the prospect of gaining visibility, social prestige and support within the city.[505] Pure altruism as a motivation cannot be discounted, as well as vested interest in a city with which one had a stronger connection, possibly because they originated from there (for instance at *Amiternum* [E05], where *Iulius Pompilius Betulenus Apronianus* offered *balneas Amiterninis patriae suae*)—what Frere called 'civic pride'.[506] Competition between benefactors cannot be excluded either: since many of them belonged to the same circles, they knew each other and would have been aware of the acts of largesse of their colleagues, especially if the benefaction had taken place in a neighbouring town. It remains that it is virtually impossible to fathom a specific benefactor's motives for offering a bath building. Nevertheless, more general patterns may be detected by considering the physical appearance of the main means they had of recording their benefaction(s): the inscriptions.

[505] HORSTER 2001, 222–247 on emperors' motivations.
[506] FRERE 1985.

VI.2 Materiality of inscriptions

Inscriptions were displayed in public places[507] and were meant to be seen by the largest possible audience; they are therefore best understood when considered alongside their urban and architectural contexts. Similarly, the physical appearance of the inscription—the dimensions and material of the support, the layout, shape and size of the letters, the use of decoration—could have been just as important as the text itself in a society where literacy concerned only a limited portion of the population.[508] Whether these inscriptions were being read, to what extent they were understood, and by whom, is also a matter of debate.[509]

VI.2.1 Material of inscription

All the inscriptions considered (apart from the mosaic ones) were carved on stone, usually white marble, a preferred choice for questions of prestige, availability, durability, cost, and legibility. Marble had become more widely available in Italy from the beginning of the Imperial period when Augustus started exploiting the quarries at *Luni*, and it eventually replaced tuff and travertine for inscriptions,[510] which possibly no longer conveyed the necessary *dignitas* that marble conveyed.[511] Coloured marble, as prestigious as white marble (if not more), was more expensive as it had to be imported, and the polychromy could have hindered the legibility of the inscription. Marble also had the advantage of being relatively soft, easy to polish so as to offer a

[507] CORBIER 1987; ALFÖLDY 1997; CORBIER 2006.
[508] HARRIS 1989, 259, 330: literacy was on average below 20% in Imperial-period Italy. Discussed in HUMPHREY 1991.
[509] BODEL 2015.
[510] EDMONDSON 2015, 123.
[511] THOMAS 2007, 243–244.

flat and even surface for carving, and finding a marble worker to inscribe an inscription must have been relatively easy considering that many craftsmen were trained to work in this material—not only for inscriptions but also for sculptures or reliefs.[512] The absence of non-durable supports could be attributed to the natural decay of materials such as wood or painting on plaster, but since a core idea of a commemorative or honorific inscription was for the awardee or the benefactor to be remembered forever, stone certainly was the material of choice.

VI.2.2 Urban context and architectural setting

With the exception of the mosaic inscriptions still located *in situ* on the floor of bathing rooms, virtually none of the inscriptions were found in their original setting. The initial location of the inscription was partly determined by the type of support: a building inscription was very likely to be set on the building whose construction or restoration it recorded; a honorific inscription would be set in a public place or on the streets of the town (e.g. *Praeneste,* where space was given on the forum for a statue of *L. Urvineius Philomusus* [E58]),[513] or in the baths themselves, as in the Memmian Baths at *Bulla Regia*[514] or at *Tarquinii* [E66]; advertisements, finally, would in all likelihood be placed in the vicinity of the bath building they promoted, possibly close to its entrance.

Building inscriptions must have been located in a prominent position, visible by a large number of people, in all likelihood in a place where natural light would shine on them at least part of the day, making them easier to read by casting a shadow in the recess of the letters, some of which could have been painted red to aid

[512] EDMONDSON 2015, 144.
[513] Plin. *NH* 34.17.
[514] BROISE & THÉBERT 1993, 347–351.

legibility.[515] None of the inscriptions had letters inlaid with bronze, however—most of the letters are on the small side (usually 3 to 8 cm tall, exceptionally up to 11 cm) and none show traces of clamps. The use of bronze was probably not deemed necessary and reserved for more monumental inscriptions.[516] Stone *tabulae* commemorating the construction of a building were in all likelihood set directly on the façade of the building they commemorated; a position above or close to an entrance, where everyone entering the structure would have seen them, must have been a prime location.

If a position on the façade of the bath building was the most likely, it is also conceivable that the inscription was set inside the building, on the façade of an open-air courtyard or *palaestra*. Evidence of the presence of an inscription above a door leading from the *palaestra* into the *destrictarium* of the Stabian Baths of *Pompeii* certainly argues this way.[517] The only inscribed architrave from the epigraphic sample (*Capua* [E14]) could certainly have been located in a *palaestra*; the inscription mentioned the offering of columns (*epistylia*), possibly the very columns that supported the architrave. The inscription also mentioned further benefactions but since half of it is missing, the connection between the different benefactions (restoration of the *apodyterium*, new decoration and columns) is unclear. Apart from colonnaded courtyards, columns were rare in Central Italian baths: they never appeared in what we identify as *apodyteria*, and were occasionally set in pairs between vestibule and *frigidarium* (*Cumae* [Ca.02] R8/R11, *Neapolis* Fuorigrotta [Ca.04] R3/R6) or marking the passage from a *frigidarium* to its pool (*Faesulae* [To.02] R6–R6a, *Aquinum* [La.01] R41–

[515] The *litterae rubricatae* mentioned by Pliny (*NH* 33.122).
[516] EDMONDSON 2015, 128. Bronze-inlaid letters were usually much larger (BOATWRIGHT 2013, 20 and note 82: from 15 to 42 cm, up to 70 cm for Agrippa's inscription on the Pantheon).
[517] Possibly *CIL* X.829=EDR150879.

R41b, *Velia Vignale* [Ca.10] R3–R3a). These pairs of columns could also have been spanned by an arch instead of an architrave (*Faesulae*, *Cumae*), making for a higher passage but for a less practical location for inscription. Only a *Teate Marrucinorum* [Ab.03] did a pair of columns separate a long corridor R2, possibly an *apodyterium*, from a large square hall R5. A fragmentary inscription [E86?] found nearby was said to have been placed on top of the columnar diaphragm; assuming it faced north, it would have been in a prime position for customers entering the baths and going down the stairs in R1—a superb example of the design of the building reminding everyone of the identity of the benefactor.

As mentioned above, honorific monuments such as statue bases could be set up in baths. Statue could however be moved (along with their bases) from one location to another, losing their original context; this was actually a type of benefaction, as recorded in Late Antique inscriptions from *Liternum* and *Beneventum*.[518] Alternatively, honorific inscriptions on *tabula* could be set in the floor of the room itself, as at *Tarquinii*, where four honorific inscriptions ([E66], [E67], [E68], [E70]) were set in the floor of a single room, two of which honoured *Q. Petronius Melior*, who restored the baths, and his wife. Their wear clearly indicates that these had been stepped on for a long period of time. Inscription [E70] was set so that bathers had to move to the opposite side of the room from the entrance to read it, but with such a crammed text (305 letters, 4 cm high, on a 0.6 m² surface), its legibility and effect on bathers were quite different from the commemorative mosaic inscriptions tackled below.

[518] *CIL* X.3714=LSA-1921 (*Liternum*); *CIL* IX.1588=LSA-1740 (*Beneventum*).

VI.2.2a Mosaic inscriptions

Thanks to their state of preservation, mosaic inscriptions are the most informative category when it comes to their insertion into the architectural setting. Eight Central Italian mosaic inscriptions are known, from *Alba Fucens* [E02] [E04], *Aquinum* [E09] [E10], *Ancona* [E08], *Urbs Salvia* [E75], *Mevaniola* [E43] and *Tifernum Tiberinum* [E73] (fig. 132).[519] Mosaic inscriptions were already in use in late 2nd cent. BC bath buildings, at *Musarna*[520] and possibly *Falerii Novi*[521] (respectively in Etruscan and Faliscan), and this practice appears to stop at the beginning of the 2nd cent. AD.[522]

The fact that some of them are still *in situ* today means that they remained visible during the entire lifetime of the bath building, sometimes for several centuries. By then, they might not have meant much to contemporary bathers who probably had no clue as to who the initial benefactors were—this could explain why the inscriptions of *Aquinum* and *Ancona*, partly damaged because of (undated) modifications brought to the water system, remained unrepaired.

The text of the mosaic inscriptions was treated the same way as that on stone slabs, with mention of the benefactor, their position, the benefaction and the verb of action, the origin of funds and any authorisation received from local authorities. Of these six elements, only the benefactor and the verb of action appeared systematically, while the other elements could be omitted, either because they were non-existent (e.g.

[519] This type of inscription is also found in Northern and Southern Italy (CERAUDO, MOLLE & NONNIS 2013, 107–108, with bibliography), and in non-thermal contexts (PICCARDI 2013).
[520] *ET* AT 5.1 + 5.2; BROISE & JOLIVET 2004, 81–89; BENELLI 2007, 237–239.
[521] *CIL* XI.3156a.
[522] PICCARDI 2013, 344–345: in non-bathing contexts, the practice stopped earlier (Augustan period) and resumed in Late Antiquity.

Vibia Galla, who restored (part of) the baths of *Alba Fucens* [E02], might not have had any official position) or because they were self-explanatory.[523]

Some of the mosaic inscriptions are amongst the shortest inscriptions of the catalogue. For instance, *Alba Fucens* [E02] or *Ancona* [E08] conveyed their message with only 41 and 43 letters, respectively,[524] while building inscriptions on stone slabs tended to be significatively longer, with an average of 161 letters.[525] The position of the inscription of *Alba Fucens*, in an entrance corridor, certainly explains the choice of a short text that could be read quickly since bathers would walk over it without stopping.

Despite this economy of characters, the mosaic inscriptions were significantly larger than those on stone: the height of the letters on mosaic inscriptions ranged from 11.1 to 26 cm (average min 16.4 cm, max 19.6 cm), compared to a range from 1.8 to 11 cm for the letters on building inscriptions on stone *tabulae* (average min 4.2 cm, max 6.6 cm), and 2.1 to 6 cm for letters on statue bases (average min 2.8 cm, max 4.6 cm). This marked difference is probably due to their setting on the floor which made them less easy to read because of the angle at which they were seen. Since they were located indoors, they could also have been more difficult to read than outdoors inscriptions in case of low luminosity, if the rooms in which they were in were not brightly lit[526] or if

[523] See section VI.2.5.

[524] Mosaic floor inscriptions: average 15 words, 60 letters, with extremes at 10/41 (*Alba Fucens* [E02]) and 19/96 (*Aquinum* [E09]) (sample: 3 complete or almost complete inscriptions: [E02], [E08], [E09]).

[525] Building inscriptions on stone slabs: average 32 words, 161 letters, with extremes at 8/52 [E50] and 58/329 [E35] and 63/305 [E66] (sample: 17 complete or almost complete inscriptions: [E01], [E05], [E18], [E23], [E27], [E29], [E31], [E34], [E35], [E42], [E49], [E50], [E56], [E66], [E72], [E76]. This is still shorter than honorific inscriptions mentioning a bath benefaction: average 53 words, 286 letters, with extremes at 36/195 [E77] and 46/179 [E54], and 108/588 [E17] (sample: 8 complete inscriptions: [E06], [E07], [E17], [E30], [E38], [E44], [E54], [E77]).

[526] As the discovery of numerous oil lamps in the Forum Baths of *Pompeii* would suggest (KOLOSKI-OSTROW 2007, 151).

bathing occurred late,[527] and larger letters would simply make the inscriptions easier to read. The very technique with which they were completed, in *tesserae*, also necessitated that the letters be larger in order to be intelligible, or to resort to using tiny *tesserae* of the type found in *opus vermiculatum*, but this technique was more expensive and therefore probably kept for more intricate designs.

Not only were inscriptions on mosaic floors on average shorter than those on stone slabs, they were also generally less complex. The inscriptions from *Alba Fucens* [E02] and *Aquinum* [E09] speak for themselves: the message was conveyed in two lines, stating the benefactor, the benefaction, the origin of the funds and the action verb. No need for (over-)emphasised declarations on the decayed state of the bath building (more common on *tabulae*),[528] or a lengthy *cursus*, or the other gifts the benefactor may have done to the city, the latter two being more common on honorific statue bases: the building in which the bathers stood or were entering spoke for itself, through the inscription.

If the dimensions of the inscription were in part dictated by the dimensions of the room—the 10 m long inscription of *Aquinum* [E09] was set in a 16 x 16 m room whereas the 3.19 m long inscription from *Alba Fucens* [E02] was set in a 4.55 m wide corridor R7 (fig. 133)—it remains that the choice of the location of the inscription, and therefore its dimensions, probably belonged to the benefactor. The inscription from *Ancona* [E08], occupying only 3.55 m in a 9.20 m wide room, could easily have been much longer if they had wanted it. The length of the inscription and its location were therefore deliberate, and it seems clear that the intentions of the benefactors of

[527] PASQUINUCCI & ALESSI 1987, 25–27.

[528] E.g. [E06], [E07], [E30], [E35], [E36], [E51], [E55] (old age and time), [E23], [E49] (fire damage), [E40] (earthquake), and very common in Late Antique inscriptions (WITSCHEL & THOMAS 1992).

Mevaniola [E43] were not the same as those of *Aquinum* [E09] when they set up the inscriptions. With its length of 10 m, the latter definitely aimed at impressing the bather and reminding him of the identity of the benefactor whose name was written in 26 cm tall letters (larger than the other elements, 19–23.6 cm), and the nature of the benefaction (proportionately the longest piece of information, spreading on both lines and using 45 letters out of the 96 the inscription contains). In contrast, that of *Mevaniola* seems to have been set there almost out of legal necessity but without any aim at conspicuousness: despite having the same height as that of *Aquinum*, it probably did not extend horizontally for more than 1–1.5 meters; on a space six to ten times smaller, it crammed as many letters on no less than five lines, each only ca. 11.5 cm tall, and did not emphasize any particular element. It almost seems like the inscription from *Mevaniola* was treated like an inscription on a stone slab: proportions closer to the square, size of the letters closer to those on stone, limited emphasis on specific elements of the content. Perhaps the main difference in terms of the nature of the benefaction, which could help explain the different physical treatment of the inscription, was the provenance of the funds: personal for *Marcus Veccius* [E09], and probably public for the *IIIIviri* of *Mevaniola*.[529]

Before even emphasizing specific aspects of their contents, mosaic floor inscriptions had to attract the attention of the bathers, whose gaze would not necessarily be naturally directed at the floor but more likely attracted by the decoration of the walls and ceiling, the facilities available to them in the room they entered, and the direction they needed to follow next. The limited number of inscriptions in the

[529] Deduced from the fact that the work was sanctioned by the *ordo* (*[ex] d(ecreto) c(onscriptorum)*), an approval usually not mentioned when the magistrates funded themselves the work they commissioned (CÉBEILLAC-GERVASONI 1991, 201).

sample show a certain variety of means of achieving this: by contrasting with their surrounding context, by their sheer size, and by selecting a location from which specific users would have no choice but to see it (or any combination thereof).

Contrast with the surroundings is most clearly seen at *Mevaniola* [E43], where the mosaic inscription took the form of a *pseudo-emblema* inserted in an *opus spicatum* pavement, with the black and white of the inscription contrasting sharply with the brownish-red of the *spicatum* bricks. A similar solution is visible in the *frigidarium* of the male section of the baths of *Aquinum* [E09], where the inscription, in black letters on white background, contrasted sharply with the black mosaic floor in which it was inserted (fig. 133). At *Ancona* [E08] too, the inscription broke the continuity of the chequered pattern of the mosaic floor into which it was inserted. Finally, the inscription from *Alba Fucens* [E02] was written with white tesserae on a black background, a high contrast potentially making it easier to read if the environment was dark, which might have been the case considering the location of the inscription, considered below.

Another means of attracting the attention of the bathers to the inscriptions was simply their size (fig. 133). With its length of 10 m, the inscription from *Aquinum* [E09] could not go unnoticed. Fig. 133 shows the percentage of the surface of the room's floor that was occupied by the inscription; interestingly, this figure is close to 3% in all cases, despite significant differences in the absolute dimensions of the rooms (ranging from 55 m² to 256 m²). This ratio may have been deemed best for an optimal perception of the inscription, based a reference point of view determined by the design. Had the inscription of *Aquinum* [E09] been smaller, it would have been lost in its extensive floor; had that of *Ancona* been larger, perhaps it would have been difficult for bathers

to view it at a glance considering the limited distance that separated those who entered the room from the inscription (ca. 3 m).

Considering the proportion of the floor occupied by the inscription is only part of the equation; its position within the room also must be considered. Indeed, at *Alba Fucens* [E02], the length of the room does not actually matter since the inscription, 3.20 m wide, was located at the entrance of a 4.55 m wide corridor, and oriented towards the entrance from the street; this location actually makes irrelevant the proportion of the surface area occupied by the inscription, since the corridor could have been much shorter without affecting the way the inscription was perceived. What was more important was that its location made it virtually impossible for bathers not to see it; it formed a sort of threshold they had to cross to access the complex. As it was oriented towards the exterior, it clearly addressed customers entering the building, and possibly passers-by if it was close enough to the entrance. The other inscription of *Alba Fucens* [E04], located at the other end of the same room and oriented towards the inside of the baths, played a similar role for the bathers exiting the baths, reminding them of who had made it possible for them to enjoy the facilities (fig. 133). The inscription of *Ancona* [E08] was set in the middle of the mosaic floor, directed at the bathers who entered the room. If the threshold to the room was indeed located where the mosaic stopped, bathers were ca. 3 m away from the inscription, making it possible to encompass the entire message from a single position. As for the 10 m long inscription of *Aquinum* [E09], it could only be seen in its entirety if the bather was standing further away from it—this explains its location at the back of the room, away from the entrance. In this position, some 15 m away from the entrance, it could not be read by a customer entering from the vestibule (R8), all the more so that there was a

labrum at the centre of the room, partly blocking the view to the inscription. It is actually very likely that standing behind the *labrum* was the ideal position from which to see the inscription: a customer using the *labrum*, assuming it was indeed a low basin with a short diameter (1 m or less),[530] would stand at a distance of ca. 5 m from the inscription, allowing them to have a clear view of the entire text (fig. 133–134). The same is true, at a reduced scale, for the women's *frigidarium* of *Aquinum* [E10]: the inscription was not entirely visible from either entrance, either because the *labrum* stood in the way or because it was first seen sideways, and the best position would have been behind the *labrum*, at a distance of ca. 4.5 m (fig. 133, 135). This ideal view allowed bathers to read the inscription in the women's *frigidarium*; whether they could have read the inscription in the men's *frigidarium* is less certain, and they may have had to move closer, and along it, in order to know its content.

The choice of the room to set the inscription also mattered: in an entrance corridor at *Alba Fucens* ([E02], [E04]), in *frigidaria* at *Aquinum* ([E09], [E10]) and *Ancona* [E08]. A position in an entrance corridor ensured that everyone using the building—either when entering [E02] or leaving [E04]—would see the inscription, as well as passers-by; as for the *frigidarium*, bathers went through that room several times, first when they crossed it to enter the hot rooms, then on their way back to use the cold-water pools; finally, it was also usually the largest room of the building and one in which customers would linger more than in others. That no inscription is known from warm rooms should not be too surprising since they presented several issues that may have discouraged placing the inscription on their floor: practicalities related to flooring and redoing hypocausts, higher likelihood to have marble floors, limited time spent

[530] As suggested in 3D reconstructions of the room, and more likely than a large diameter *labrum* like that in the Stabian baths of *Pompeii* (2.37 m) (AMBROGI 2005, L160).

by bathers in them, limited visibility (e.g. because of steam), and high heat might have played a role in this choice. Finally, a *palaestra* would have been too large a room for such an inscription, and the lukewarm rooms were above all transition rooms.

Both baths at *Aquinum* ([E09], [E10]) and *Alba Fucens* ([E02], [E04]) contained two mosaic floor inscriptions, set up by different donors in each case. Interestingly, there appears to be an interplay between the inscriptions, the later benefactor answering the earlier one in their choice of location and aspect of the inscription. At *Alba Fucens*, the (possibly) later inscription [E04] was set at the other end of the corridor at the entrance of which the earlier inscription [E02] was located; if the first one addressed passers-by and customers entering the baths, the second one addressed customers leaving the establishment. The interaction was of a different nature at *Aquinum* (fig. 133). There, the mosaic floor of the later inscription [E10], which was part of the benefaction, mirrored the mosaic floor of the men's *frigidarium* where the earlier inscription [E09] was set: in the men's section, the mosaic was black with white crosses, whereas the mosaic of the women's section was its negative, white with black crosses. The arrangement of the room was the same too, with the inscription pushed against the back wall and a central *labrum* from which the inscription was best seen.

VI.2.3 Duplicate inscriptions

Three inscriptions came down to us in two examples (*Praeneste* [E56]=[E57], *Interamnia Praetuttiorum* [E31]=[E32], *Forum Novum* [E26]=[E27]). Duplicate inscriptions have long been treated in epigraphic *corpora* as mere copies of an original, but Graham's recent article highlighted how this approach hides a more complex

reality: potential differences in the physical aspect of the two inscriptions, as well as in their architectural setting, could have made them work in different ways.[531]

From what can be deduced from the available editions and pictures, neither the text nor the layout of the inscriptions varied between the different examples. If, as can be expected, the inscriptions were located in two different places, they were however fulfilling the same purpose and interacting with the readers in the same way.

Only their urban environment and architectural setting could tell us if the way they were perceived was different, but unfortunately none of these inscriptions was found *in situ* either. If building inscriptions were in all likelihood set on the building whose construction (or restoration etc.) they commemorated, and duplicate inscriptions could have been located above or next to different entrances,[532] it is worth highlighting that apart from a duplicate inscription from *Pompeii*,[533] none of those collected here commemorated constructional works; instead, out of the three inscriptions, two recorded an offering of *lavatio* to the inhabitants of the town ([E31]=[E32], [E56]=[E57]); the third one recorded the hydraulic works made on several places in *Forum Novum* and concerned the baths as well as other buildings ([E26]=[E27]). There was therefore no necessity for these pairs of inscriptions to be set on a single building. An offering of *lavatio* could have been valid for several bath buildings in town, and both *Praeneste* and *Interamnia Praetuttiorum* [Ab.G.05–06] had several bath complexes: these commemorative inscriptions could have been located on any (or all) of those, just as well as in public places. As for the inscriptions listing the hydraulic works paid by *Faianius Plebeius* at *Forum Novum*, they could have been on

[531] GRAHAM 2019.
[532] E.g. *IAph2007* 5.207, 5.208 in the Hadrianic Baths of *Aphrodisias* (GRAHAM 2019).
[533] *CIL* X.819=EDR147480 and EDR147481.

the same building (the baths? the aqueduct? the *piscina*?) or on two different buildings; as Coarelli hypothesised, each of the buildings listed in the inscription could have had its own inscription, with the implication that there could have been more than two identical inscriptions.[534] That more than two examples of a single text could exist is exemplified by a 4th cent. AD triplicate inscription from *Ostia*, which recorded the unspecified works managed by a *Ragonius Vincentius Celsus*, possibly on the Terme del Foro.[535] The text was identical, but interestingly the support was different (two statue bases and an architrave), clearly indicating that the monumental context of the inscriptions was different.

It is probable that duplicate, or even triplicate inscriptions were more common than what the limited evidence would suggest. If some of these duplicates could address the readers in different ways by changing the layout or the support of the text, or by interacting with their architectural settings, it is also clear that the mere blunt repetition of the same message was an effective means of disseminating one's message and perpetuating the memory of a benefaction—in the same way that modern-day advertising works.

VI.2.4 Focus of the inscription

Looking at the physical appearance of the inscriptions—the layout of the text, the varying size of the letters, any punctuation or decorative elements, what comes first and last—can also further our understanding of them by allowing us to get closer to what was deemed more important to the people who set them up. It has recently been demonstrated how the appearance of the text had a role in the delivery of the

[534] COARELLI 2005, 86.
[535] *CIL* XIV.139=LSA-1651=EDR122143; *CIL* XIV.4717=LSA-2582=EDR073107; *CIL* XIV.4718=EDR106931.

monumental message;[536] simply put, a word written in larger letters would attract the attention more than one in smaller letters; the order in which information appears conveyed a sense of hierarchy, since they were the first ones to be read and a reader might not have gone through the trouble of reading the whole inscription; indentation and *vacats* could be used to draw attention to certain words or passages. Different types of inscriptions and supports did not necessarily work in the same way since they were displayed in different contexts and obeyed different conventions; they will therefore be treated consecutively in what follows.

VI.2.4a Mosaic inscriptions

Mosaic inscriptions, as mentioned above, are amongst the most straightforward type of inscriptions. The name of the benefactor(s) was always emphasised, always in first position, sometimes occupying the entire first line(s) (*Aquinum* [E10], *Ancona* [E08], *Mevaniola* [E43]) and sometimes written in larger letters ([E08]: 19–23.5 cm, vs. 15–16.7 cm for the rest). At *Aquinum* [E09], it was not only the position but also the space between the letters of *Veccius'* name that emphasised it, compared to the tightly packed letters detailing the benefaction. For the inscription of *Alba Fucens* [E02], there was neither difference in letter size between the two lines, nor any layout element to draw the attention to any specific part of the inscription. Since both first and second lines were treated similarly, the attention was drawn to the beginning of each line, *Vibia Galla* on line 1 and *de sua pecunia* on line 2—whereas the nature of the benefaction, *balneum*, was relegated to the end of the first line. There was actually little emphasis on the nature of the benefaction in mosaic floor inscriptions, but since the reader was walking on or inside the benefaction at the moment he read it, it was perhaps not

[536] GRAHAM 2013.

necessary to write it down: the physical aspect of the benefaction would have spoken for itself. The inscription of *Aquinum* was different in this regard, detailing every single element of the benefaction—certainly a way for the benefactor to insist that he paid for more than just the *frigidarium*, since some of the elements mentioned in the inscription (the *portico*, the fact that it was a double bath) were not visible from the *frigidarium*. The counterpart to emphasizing specific aspects of an inscription is exemplified by the inscription from *Mevaniola* [E43]: overall, it was a fairly small inscription with all elements written in the same letter size and fusing into each other, merely listing the information they had to.

VI.2.4b Building inscriptions

The vast majority of the ca. 60 commemorative building inscriptions gathered for the baths of Central Italy were carved on stone *tabulae*, one of which took the form of a *tabula ansata* [E49]; the rare exceptions were an inscription on a small column from the sanctuary of *Nemus Dianae* [E46] and an architrave from *Capua* [E14]. Just as for mosaic inscriptions, a prominent position was almost always given to the benefactor whose name usually occupied the first line(s) of the inscription (table 22). Their identity could be further emphasised by writing it in larger letters (e.g. [E14], [E18], [E23]), or more occasionally by repeating it a second time on the inscription, as on an inscription from *Forum Novum* ([E27], fig. 136) where the name appeared on the first and last lines of the text, outdented to make them more prominent. The main benefactor(s) would at times associate themselves with a relative, so that the latter could also benefit from the prestige of the benefaction.[537]

[537] See section VI.2.5.

TABLE 22: EMPHASISED ELEMENTS ON COMMEMORATIVE INSCRIPTIONS. ONLY INSCRIPTIONS ON *TABULAE* THAT WERE COMPLETE OR READABLE ENOUGH HAVE BEEN CONSIDERED

Legend: col. 1: *=layout information taken from *CIL* (no available picture); col. 3: NC=Non-Constructional.

ORIGIN (Inscr. no.)	**Support**	**Type**
Emphasised element(s) (1: most emphasis, then in decreasing order)	**Description of layout** **Means used to emphasize element(s)**	
CAPUA [E14]	Architrave	Constructional
1 (l1): benefactor's identity 2 (l2–3): nature of benefaction	Decreasing size of letters 1: larger letters, indent	
CORFINIUM [E18]*	*Tabula*	Constructional
1 (l1): benefactor's identity 2 (l2): nature of benefaction	Layout defines three blocks of text: benefactor and benefaction (l1–2) – sum of money given to the project by users of the estate (l3–4) – completion of project by *res publica*, and supervision of work (l5–6) 1: larger letters	
FURFO [E28]*	*Tabula*	Constructional
1–2: benefactors 1–2 (l1–5) Last: benefaction (l6)	Layout (outdents) defines three blocks of text: benefactor 1 (l1–2) – benefactor 2 (l3–4) – benefactor 2 + benefaction (l5–6)	
FANUM FORTUNAE [E23]	*Tabula*	Constructional
1 (l1): benefactor's identity 2 (l4): son of benefactor, associated to him 3 (l2–3): names and magistracies of benefactor 4 (l5): history of building 5 (l6–7): history of building and nature of benefaction	Complex layout, with varying letter size and outdents. Four blocks of text: benefactor 1 (l1–3) – benefactor 2 and benefaction (l4–5) – history of the building (l6–7) – nature of benefaction and source of funds (l7) 1: 8 cm letters, outdent 2: 7 cm letters, outdent 3: 5 cm letters 4: ca. 4.5 cm letters 5: 3 cm letters, *vacat* to separate both ideas	
FORUM NOVUM [E26]=[E27]	*Tabula*	NC: water adduction
1 (l1): benefactor's identity 2 (l12): benefactor's identity, again 3: two different benefactions	Layout defines three blocks of text: benefactor and 1st benefaction (l1–6) – 2nd benefaction (l7–11) – Benefactor again (l12) 1: 1st line, larger letters, outdent 2: last line, larger letters, outdent 3: clear separation between 1st and 2nd benefaction (carriage return, outdent)	

ORIGIN (Inscr. no.)	**Support**	**Type**
Emphasised element(s) (1: most emphasis, then in decreasing order)	**Description of layout** **Means used to emphasize element(s)**	
HELVIA RICINA [E29]	*Tabula*	Constructional
1 (l1–2): benefactor	Layout defines two blocks of text: benefactor (l1–2) – the rest (l3–7) 1: larger letters (6 cm, vs 3.5 for the rest)	
INTERAMNIA PRAETUTTIORUM [E34]	?	Constructional
1 (l1–2): benefactors	1: appear first, larger letters	
INTERAMNIA PRAETUTTIORUM [E31]=[E32]	*Tabulae*	NC
1 (l1–2): benefactor and position 2 (l5): nature of benefaction	Layout defines two/three blocks of text: benefactor and position (l1–2) – recipient of benefaction (l3–4) – nature of benefaction and source of funds (l5–6) 1: larger letters, outdent (l1), indent (l2) 2: outdent	
LANUVIUM [E35]*	*Tabula*?	Constructional
1 (l1): honoured emperor 2: unclear in absence of letter size	Layout defines three blocks of text: honoured emperor + benefactor (l1–2) – nature of benefaction + thanks to emperor for funds (l3–4) – source of funds and details on benefaction (l5–6) 1: 1st line	
LANUVIUM [E36]	*Tabula*	Constructional
1 (l1): authority which ordered construction 2 (l2–4): position of authority and identity of benefactors	Fragmentary, left alignments lost 1: 1st line, larger letters 2: large letters	
PAESTUM [E49]	*Tabula ansata*	Constructional
1 (l1–2): benefactor, his titles 2 (l2–4): 1st benefaction 3 (l4): 2nd benefactor	1st line outdented, then slightly decreasing size of letters 1: 1st line, larger letters 2: large letters 3: *vacat* before name	
PELTUINUM [E50]*	?	Constructional
1 (l1): benefaction 2 (l2): authority ordering works, source of funds 3 (l3): benefactor	1: 1st line, larger letters 2: same size letters as 1 3: smaller letters	
PISAE [E52]	*Tabula*	Constructional
Fragmentary 1 (l?): 1st benefactor? (not preserved) 2? (l5): 2nd benefactor	2: larger letters (ca. 6.5 cm, vs 4.5–5.5 cm for the other preserved letters)	

ORIGIN (Inscr. no.)	**Support**	**Type**
Emphasised element(s) (1: most emphasis, then in decreasing order)	**Description of layout** **Means used to emphasize element(s)**	
PITINUM PISAURENSE [E55]	*Tabula*	Constructional
Fragmentary 1 (l1): benefaction 2 (l6): decayed state of baths	Left part missing, so possible that the emphasised lines also contained the name of the benefactor(s) 1: large letters (ca. 10 cm) 2: large letters (ca. 6 cm)	
PRAENESTE [E56] [E57]	*Tabulae*	NC: *lavatio*
1 (l1–2): benefactor 2 (l6–7): benefaction + source of funds 3 (l3–5): recipients of benefaction	The layout defines 3 blocks of text: benefactor (l1–2) – recipients of benefaction (l3–5) – benefaction and source of funds (l6–7) 1 : outdent, large letters (8.7 cm) 2: outdent 3 : slight outdent	
SORRINA [E61]	*Tabula*	Constructional?
1 (l1): benefactor? 2 (l4): authority?	The layout defines 2 blocks of text: benefactor + benefaction (l1–3) – authority?, position and legal authorisation (l4–6) 1: larger letters, outdent 2: larger letters, outdent	
SPOLETIUM [E62]	*Tabula*	Constructional
1 (l1): benefactor + titles 2 (l2–3): 2nd benefactor + source of funds and land	Decreasing size of letters, from 8 cm to 3.5 cm. A *vacat* separates point 2 from the rest of the text 1: largest letters 2: large letters	
TARQUINII [E18]*	*Tabula*	Constructional
1 (l1): benefactor + titles	The layout defines 3 blocks of text: benefactor + benefaction (l1–2) – *bonores possessorum* achieved initial benefaction (l3–4) – *respublica* added further money to benefaction + curation of works (l5–6)	
TEANUM SIDICINUM [E72]	*Tabula*	Constructional
1 (l1): *senatus consultum* 2 (l4–9): benefactors 3 (l1): benefaction	The layout separates the benefactions and its details (l1–3) from the benefactors (l4–9) 1: larger letters 2: large letters 3: 1st line	
VALLIS DIGENTIAE [E76]*	*Tabula*	Constructional
1 (l1): benefactor + titles 2 (l2): benefaction	1: 1st line 2: isolated on 3rd line	

Potentially interesting would be the few inscriptions in which the benefactor's name was not the most emphasised item of the text. An inscription from *Lanuvium* [E35] put the emperor first, as the honorand to whom the bath building was dedicated; in that case, Septimius Severus had authorised the city to use the *summae honorariae* usually reserved for priesthoods for a bath benefaction, as well as interests from the *kalendarium*. A second inscription from *Lanuvium* [E36] placed the authority which delivered the authorisation for building the baths before the benefactor; it is possible that this choice was made because the funds came from the *summae honorariae* (the benefactors offered the baths *ob [honore]m sexvir[a]tus*)[538] and was therefore something expected from the benefactors more than an additional act of generosity towards the community.

The benefaction was only very rarely the focus of the inscription. The clearest exception is that of *Pitinum Pisaurense* [E55], where the mention of the construction of a *balineum* occupied the first line in 10 cm letters, compared to ca. 3.5–6 cm letters in the rest of the text; the emphasis on the benefaction was further strengthened by a description of the state of the baths before restoration (*vetustate corrupt[tum]*) on line 6, in 6 cm large letters. The only other clear case where the benefaction had any noticeable place on the inscription is at *Tarquinii* [E65], where it occupied the second most prominent place (2nd largest letters, outdent) of the text. Possible further inscriptions with an emphasis on the benefaction are *Vallis Digentiae* [E76] and, interestingly, the few benefactions of *lavatio* ([E76], [E31]/[E32], [E56]/[E57]), including a honorific inscription from *Suasa* [E63], where the benefaction always came as a clear second after the benefactor.

[538] GAROFALO 2010, 190.

Globally speaking, there was no clear common second element consistently emphasised on inscriptions by their layout. Instead, the layout often determined groups of ideas, usually with the use of indents and outdents, and occasionally with *vacats*. For instance, in the aforementioned inscription of *Fanum Fortunae* ([E23], fig. 137), four groups were defined by the layout, the first two (l1, l4) starting with an outdented line in larger letters (8–7 cm), the last two (l6–7) written in much smaller letters (3 cm) and separated from each other by a *vacat*. At *Forum Novum* ([E26]/[E27]), three blocks were defined, each starting with an outdented line, the first and last ones in larger letters (3.8 cm, compared to 2.5 cm for the rest of the text); the first and second blocks were separated by a blank line. The first line of one of those paragraphs could at times be further insisted upon (*Sorrina* [E61] where lines 1 and 3 were written in 9 cm letters when the rest of the text measured 4.5 cm; *Tarquinii* [E65]), but it also happened that it was outdented only to introduce a different idea or part of the text (e.g. *Forum Novum* [E27] where the first line of the second paragraph was written in the smaller letter size). This division of the text using outdents could at times be used for its own sake, without it following any logic, as at *Furfo* [E28]: the outdents created three blocks of text, the first and second ones naming the benefactors, but the titles of the second benefactor spread onto the first line of the third block, relegating the benefaction in a totally unremarkable place in the second line of the third paragraph.

While the benefactor was usually placed at the beginning of the inscription, other elements tended to appear towards the end: the provenance of funds, the verb of the action of the benefaction, the *probatio* if there was one (table 22). These general tendencies do raise the question of the existence of templates for benefaction inscriptions. The inscriptions of *Interamnia Praetuttiorum* ([E31]/[E32], fig. 138) and

Praeneste ([E56]/[E57], fig. 139) for instance, both concerning offerings of *lavationes*, had a very similar layout and organisation of the content: a first block of text, starting with an outdented first line, named the benefactor(s) and their position(s) when there was one; a second block of text, interestingly not or only marginally outdented, named the recipients of the benefaction (not the same on both inscriptions); finally, the third block of text contained the benefaction, the source of funds and the verb of action. Despite some differences between the two texts, the layout is strikingly similar, arguing in favour of possible standardisation of the format of some commemorative inscriptions.

One specific aspect of focus, which occurred only occasionally but with a certain degree of insistence, was inserting the benefaction in a timeline of benefactions, either by purposely perpetuating the memory of a previous benefactor, or by associating one's descendants to the benefaction. Both situations are exemplified in an inscription from *Fanum Fortunae* ([E23], fig. 137): the benefactor, *T. Varius Rufinus,* named on the first (outdented) line in 8 cm letters, was the focus of the inscription, followed by his son as a close second, named on the fourth (outdented) line in 7 cm letters; both stand out in a text written in smaller letters (4.5–5 cm). *Varius Rufinus* restored, in his name and that of his son (*nomine suo et* […] *filii sui*), a bath building that had been significantly damaged by a fire; that same bath had previously been restored by the *res publica*, and the initial builder was a *L. Rufellius Severus*. All these details were included in *Varius Rufinus*' inscription, including the offices held by the initial benefactor, indicated as having been *p(rimus) p(ilus), tr(ibuno)*. Certainly these previous benefactions had been recorded with dedicated building inscriptions, but these could have been lost over time, perhaps in the fire that led to the restoration by *Varius Rufinus*. Was the latter required, legally or morally, to add the whole story of the

building to his inscription? Or was he aiming at placing his restoration in the pedigree of the building, highlighting its history and passing it down the line with his son? Other inscriptions also showed benefactors associating their descendants to their benefaction so that they could benefit from the prestige associated with the benefaction: at *Spoletium* [E62], *C. Torasius Severus* associated his son *P. Meclonius Proculus* to the benefaction by stating it clearly in the second and third line of the inscription (*suo et […] fili sui nomine […] fecit*), in letters larger than the rest of the text and only just smaller than the name and titles of *Torasius*; at *Paestum* ([E49], fig. 140), *M. Tullius Cicero Venneianus* built the baths that were restored a generation later by his son. Not all joint benefactions implied a hierarchical relationship: in the inscription of *Furfo* [E28], the benefactors were simply ordered by age. The offering of *thermae* to the city of *Anagnia* by *Marcus Aurelius Sabinianus* and *Marcia Aurelia Ceionia*, father and daughter or wife and husband, known through two honorific inscriptions on statue bases ([E06], [E07]), would probably have been recorded on a joint inscription bearing both names.[539] There seem to have been some flexibility in playing with these timelines and hierarchy of benefactors: on the inscription of *Paestum* [E49], *M. Tullius Cicero Venneianus* father occupied the prime position, with his name and titles on the first two lines in larger and more spaced out letters; his titles and benefaction, the construction of the baths, occupied the first four lines. His homonymous son restored the baths, a benefaction recorded from the middle of the fourth line onwards, only separated from his father's benefaction by a *vacat* (table 22). Naturally, this inscription could only have been set up after the son's restoration of the baths, but one may therefore wonder why it is not the son's name which appeared in prominent position. Perhaps the initial

[539] THOMAS 2007, 175.

inscription recording the construction of the baths by the father had disappeared (possibly in the fire mentioned in the inscription), requiring the name of the father to be added to the new inscription, but this would not explain why the son's name seems almost secondary. Another explanation could be that the father paid for the restoration as well, but put it in his son's name so that the latter could benefit from the advantages provided by a visible benefaction in his town. Such liberality with the indication of the provenance of the funds and the real individual behind the benefaction (for political motives) is not unheard of—suffice it to mention the restoration of the Temple of Isis in *Pompeii* by *Numerius Popidius Celsinus*, only six years old at the time.[540]

VI.2.4c Honorific inscriptions

Honorific monuments (mainly statue bases) ought to be treated separately since their erection was not the choice of the benefactor but of a third party—local council, citizens, family members etc.—and as such, they reflected the third party's order of priorities. Table 23 shows that the emphasis was, unsurprisingly since these were honorific inscriptions, always on the honoured individual, who appeared in larger letters at the top of the inscription; his or her qualificative(s) and/or official position(s) were at times also emphasised ([E07], [E06], [E38], [E44], [E54]), but not always [E63].

TABLE 23: EMPHASISED ELEMENTS ON HONORIFIC INSCRIPTIONS

ORIGIN (Inscr. No.)	**Support**	**Dedicant**
Emphasised element(s) (1: most emphasis, then in decreasing order)		**Description of layout** **Means used to emphasize element(s)**
ANAGNIA [E07]	SB	*S(enatus) p(opulus)q(ue) Anagnin(us)*
1 (l1): *cognomen* of honorand 2 (l2–6): Honorand + his status, connection to town (patron), official positions		Layout defines three blocks of text: *cognomen* of honorand (l1) – identity of the latter (l2–6) – the rest (l7–14) 1: isolated on top of base

[540] *CIL* X.846=EDR150689.

		2: larger letters
ANAGNIA [E06]	SB	*S(enatus) p(opulus)q(ue) Anagnin(us)*
1 (l1–3): Honorand + her status (*stolatae*)		Layout defines two blocks of text: honorand (l1–3) – the rest (l4–12) 1: larger letters
CORFINIUM [E17]	*Tabula*	*Corfinienses publice*
1 (l1–3): Honorand, one official position (*flamen*), connection to town (*patronus*) 2 (l11–13): dedicant and their motivation for erecting monument + remittance given by honorand to set up monument		Layout defines four blocks of text: honorand (l1–3)–*cursus* (l4–5)–benefaction (l6–9)–dedicant (l10–12) 1: 1st line with largest letters, then lines 2–3 with decreasing-size letters 2: intermediate letter size
INTERAMNA LIRENAS [E30]	SB	*Ordo et universus populus*
Unclear from *CIL* 1: honorand		1 : 1st line
LANUVIUM [E38]*	SB	*Municipes compitenses veicorum quinque*
1: honorand + his official position		Layout defines two blocks of text: honorand (l1–3) – dedicant and benefaction (l4–11) 1: Lines 1–3, larger or more spaced out letters?
LIGURES BAEBIANI [E40]	SB	*Ordo et populus [Ligu]rum Baebian[or]um*
Too fragmentary		/
MISENUM [E44]	SB	*Ordo et popul(us) Misenat(ium)*
1: Honorand + his official position		Layout defines two/three sections of text: honorand (l1–2) – official positions, benefaction (l3–12) – dedicant (l12–14 – notice overlap of text sections on line 12) 1: lines 1–2, larger letters
PISAURUM [E54]	*Tabula*	*Plebs urbana*
1 (l1–2): honorand + his official positions 2 (l3–4): dedicant, motivation, provenance of funds 3 (l4–5): benefactor's motivation for benefaction 4 (l5–7): benefaction (money gift, food, oil in baths), official authorisation		Layout defines two sections of text: honorand (l1–2) – rest (l3–7); decreasing size of letters 1: 1st line, largest letters 2+: slight indent, isolates lines 1–2 from following text; decreasing size of letters
SUASA [E63]	*Tabula*	Not preserved (*d(ecreto) d(ecurionum) publ(ice) patrono*)?
Fragmentary 1: honorand 2: benefaction		Fragmentary. Layout creates (at least) two sections of text: honorand (l1–6) – benefaction (l7–12?) 1: 1st line, largest letters, outdented 2: outdented
VEII [E77]*	SB	*Sorores piissimae*
1: identity of honorand (name, husband, '*sola omnium feminarum*')		Layout creates three sections of text: honorand (l1–4) – benefaction (l5–13) – dedicant (l14) 1: name on 1st line

The layout participated in emphasizing the honorand: very often, it determined several blocks of text, created by a difference in letter size ([E06], [E07]), or by a line with fewer characters, centred or indented, and which marked the transition from one block of text to another ([E38]?, [E77]?), or by both techniques ([E17], [E44], [E54]); the first block of text was usually the honorand, thus emphasised by being visually separated from what followed. Just as for commemorative building inscriptions, indentations were also used to mark sections of text and emphasize specific parts of the information. On an inscription of *Suasa* [E63], the first line of a piece of information was outdented; first the name of the honorand was emphasised (followed by his *cursus*), then the benefaction received the same treatment; it is possible, since the bottom half of the inscription is missing, that there was a third block of text with the dedicant.

The benefaction itself was rarely the reason for the erection of the statue (table 24); most often, the monument was set up for a vague reason such as the benefactor's 'affection for one's hometown and its citizens' ([E07], [E17]) or on account of 'his/her services and efforts' [E17] or 'his/her generosity' [E40]. Only once was the bath benefaction expressly stated (*ob dedicationem thermarum*) as the reason for the erection of the statue of *Anagnia* [E06]. Its sister inscription, that honouring *Ceionia's* father *Euhodus* [E07], mentioned that the honorand displayed his affection for his hometown by restoring the bath building (*quod thermas […] sua pecunia restituerit*). In neither case was the passage on the bath building emphasised on the stone, it was just part of the flow of the text.

TABLE 24: REASONS GIVEN ON THE INSCRIPTION TO SET UP THE STATUE OF THE HONORAND

ORIGIN (Inscr. no.)	**Support**	**Dedicant**
Reasons given to set up statue (Latin)		**id. (translation)**
ANAGNIA [E07]	SB	*S(enatus) p(opulus)q(ue) Anagnin(us)*
erga amorem patriae et civium, quod thermas […] sua pecunia restituerit		"On account of his affection for his hometown and its citizens", "because he restored at his own expense the baths"
ANAGNIA [E06]	SB	*S(enatus) p(opulus)q(ue) Anagnin(us)*
ob dedicationem thermarum		"because of the dedication of the baths"
CORFINIUM [E17]	Tabula	*Corfinienses publice*
ob insignem eius erga rem publicam adfectum		"on account of his outstanding affection toward the town"
INTERAMNA LIRENAS [E30]	SB	*ordo et universus populus*
ob merita et labores eius		"on account of his services and efforts"
LANUVIUM [E38]	SB	*municipes compitenses veicorum quinque*
No reason given		/
LIGURES BAEBIANI [E40]	SB	*ordo et populus [Ligu]rum Baebian[or]um*
ob munificentiam eius		"on account of his generosity" "[…] who supervised and built with his own funds the restored baths […]"
MISENUM [E44]	SB	*ordo et popul(us) Misenat(ium)*
No reasons given		/
PISAURUM [E54]	*Tabula*	*Plebs urbana*
ob merit(a) eius		"on account of his services"
SUASA [E63]	*Tabula*	Not preserved (*d(ecreto) d(ecurionum) publ(ice) patrono*)?
Fragmentary inscription		/
VEII [E77]	SB	*Sorores piissimae*
No reasons given		/

What appears more important than the bath benefaction, and came just after the identity of the honorand, was the connection of the benefactor with the dedicant: in two cases where the statue was set up by the city ([E07], [E17]), the link of patronage between the honorand and the town appeared in the first section of text, before the *cursus* of the former. This is in line with the way the dedicant (and their motivation when indicated) were showcased, not quite as prominently as the honorand, but still

in a distinguishable way: in large letters at *Corfinium* ([E17], l11–13), directly after the honorand at *Pisaurum* ([E54], l3), *Lanuvium* ([E38], l4–5) and *Interamna Lirenas* ([E30], l3–5), and in a separate block of text at *Veii* ([E77], l14) and *Misenum* ([E44], l12–14). Interestingly, the only two inscriptions where the mention of the dedicant (the *s(enatus) p(opulus)q(ue) Anagnin(us)*) was not in a strategic place but instead lost in the flow of the main body from the text both came from *Anagnia* and probably recorded the same benefaction made by imperial freedmen, *Marcia Aurelia Ceionia Demetrias* and *M. Aurelius Sabinianus Euhodus*, probably father and daughter. If it was sensible for the city of *Anagnia* to want to honour people so close to the imperial power, it is somewhat surprising it did not place the dedicant in a more visible place on the stone—but probably the statue and the context made this connection obvious.

VI.2.5 Omission of the benefaction, and fading memory

It happens that the nature of the benefaction was omitted altogether of the text of the inscription. In those cases, the reader was expected to understand what the benefaction had been, most likely because it was self-explanatory as the reader was standing in, or in front of, the object of the benefaction. The mosaic inscription of *Ancona* [E08] illustrates this point quite clearly: the benefaction, not mentioned, was *something* visible from the place where the reader stood, certainly the mosaic floor, probably the room or parts thereof (such as the *labrum* or the cold-water pool R7a), possibly the whole building. This uncertainty was no issue for contemporary customers: the bathers who had visited the bathing complex before the benefaction would know by comparison. This knowledge would however fade away over time, and eventually only the memory of the generosity of the benefactor would remain, not their exact benefaction. This silence about the nature of the benefaction also applied to

stone slabs commemorating a benefaction, which were set directly on a bath building: at *Spoletium* [E62], *Caius Torasius* offered a bath building *loco et pecunia sua* but without naming it, in all likelihood because the inscription was placed somewhere on the structure.

If the memory of the benefaction could fade away over time,[541] the same was true for the identity of the benefactor, if no descendants took care to keep his/her memory alive. At *Tarquinii* [La.G.15], *P. Tullius [Varro]* and his son restored the *thermae* [E69] in the 2nd half of the 2nd century; less than a century later, the inscription commemorating that benefaction was taken down, cut in two and its back reused to honour *Q. Petronius Melior*, patron of the town, because he had restored the same baths [E66]; the other half honoured his wife, patroness as well [E70]. The city decided to sever the association between *P. Tullius Varro* and the baths, perhaps because nothing was left of the fabric of the Tullian Baths, or because it wanted an exclusive association of the most recent benefactor to the building, perhaps as part of a strategy to attract more potential future benefactors.

[541] *CIL* X.829=EDR150879, recording the addition of a *laconicum* and a *destrictarium* in ca. 80 BC to the Stabian Baths of *Pompeii*, was, in AD 79, stored away in the baths (personal communication M. Trümper). If it was taken down later than the Augustan period (when the *destrictarium* was decommissioned and the *laconicum* turned into a *frigidarium*), it would be an example of an inscription commemorating a benefaction of which all traces had disappeared.

VI.3 Conclusion: (dis-)interested benefactors?

How does this examination of the layout and physical appearance of the inscriptions inform us on the attitude of the people requesting these inscriptions be set up? The most striking point, beyond the importance given to the benefactor, is probably that the benefaction rarely occupied a prominent position in the inscription. By means of a first position, of larger letters, and/or of outdents, the benefactor, often followed by his titles, was clearly the most important element of virtually all inscriptions, whether it was a commemorative building inscription, a mosaic inscription or a honorific statue base. Honorific inscriptions often emphasised the connection of the benefactor to the dedicant, usually the city; there was no clear second element emphasised on the other types of inscriptions. The benefaction, on the other hand, was most often relegated in the body of the text, inconspicuous amongst other details such as the source of funding, the approbation of the building, and other legal aspects. This lack of focus on the benefaction is in clear contrast with inscriptions plainly advertising bath buildings: an advertising inscription from *Pompeii*, boasting how the structure of a certain *M. Crassus Frugi* offered both salt- and freshwater, placed the word *thermae* in a prominent position (fig. 141).[542] But even so, not all advertisement inscriptions placed such an emphasis on the offer of bathing itself, some preferring to draw the attention to the ownership of the baths.

If it is true that the building on which the inscription was set could have spoken for itself—the Pantheon, with an inscription not mentioning it,[543] being a prime example of this—the façades of Central Italian bath buildings rarely stood out as

[542] *CIL* X.1063=EDR150470.
[543] *CIL* VI.896=EDR103378.

majestically as that of the Pantheon. Inscriptions that omitted the nature of the benefaction were in all likelihood set inside the bath building, in direct visual connection with what had been offered. It is perhaps significant that apart from straight advertising inscriptions [E24, E64], one of the few times a bath building was the focus of the inscription was for a benefaction made by the city itself [E50], where the anonymous benefactor(s) would have stood to benefit less directly from the benefaction than explicitly named private individuals.[544]

Perhaps it is a stretch to see in this absence of emphasis on the nature of the benefaction a limited interest by the benefactors in what they were paying for. There is little doubt that benefactors could occasionally have a vested interest in the architectural outcome of their benefaction. The semi-symmetrical plan of the Extraurban Baths of *Sentinum* [Ma.07], exception in the bathing landscape of Central Italy and recalling imperial designs, was without doubt due to a deliberate choice by the commissioner of the building. Their reasons for choosing such a plan and scale are not known, and they could be linked to a desire for emulation of another set of baths seen in the area, or perhaps more likely in Rome; the most plausible identity for the commissioner would be that of the famous jurist *Celsus filius*,[545] several times consul, who was indeed very well connected in Rome.[546] The descriptions Pliny the Younger made of the baths of his villas,[547] while illustrating the interest of a wealthy commissioner in the architecture of his baths, also makes it clear that this interest was directed first and foremost at the private bathing suites in their residences. If bath buildings could be showcases of complex design and could promote technological

[544] Also [E55], but the name(s) of the benefactor(s) is lost.
[545] MEDRI 2014, 793.
[546] *Cos. II* AD 129 (CAMODECA 2011).
[547] Plin. *Ep.*, II.17.10–12, V.6.24–25.

innovations, as Lancaster demonstrated in their use of vaulting,[548] the responsibility fell very much in the private sphere, where patrons could give free rein to their imagination (or to their architect's) with the direct goal of impressing their friends and guests. The wide array of room shapes and volumes visible in the Small Baths at Hadrian's Villa (fig. 142) also make this point blatant, and the contrast with the nearby Large Baths (fig. 143), which used simpler volumes and stock rooms following well-known blueprints (such as the such as the *caldarium* with three rectangular pools, already seen at *Cumae* [Ca.02] and *Ostia* (Nettuno, Sette Sapienti)) illustrates how different decisions made by their commissioner led to visibly different architectural outcomes.

On the other hand, benefactors might not have been as interested in the architecture of the public urban baths they commissioned—they might even never have set foot in them. The decision to make a benefaction was certainly carefully thought out, but more likely in terms of fulfilling one's political duty and asserting one's wealth and status, with the aim of reaping benefits in terms of prestige and self-promotion in the local community. The exact nature of the benefaction may have mattered only secondarily, provided it served as a constant reminder of the euergetic act; for that, it had to be long-lasting and used by many, and a building was best suited for this purpose.

By the late 1st cent. AD probably, when most cities of Italy were already equipped with a theatre[549] and those which were large or important enough to be equipped with an amphitheatre already had one, bath buildings might have become

[548] LANCASTER 2015b.
[549] SEAR 2006, 97.

the only type of public building that could still justifiably be built. Most if not all cities undoubtedly had already one set of baths, but they could do with a new one, larger, more richly decorated, offering different facilities and a different experience, or even catering for a different part of the population. Even if there was no need for a new set of baths, pre-existing bath buildings could be improved by the addition of new rooms and pools (including during the 1st cent. AD when many towns in Italy started being supplied by aqueducts and already existing baths could have adapted to this new availability of water);[550] they regularly had to be restored (much more often than other types of structures) because of their constant use and the damage created by the combination of water and heat. Finally, there were also benefactions aimed at the bathers, such as offerings of oil or of free entrance; even though these were by definition of a more ephemeral nature, they could be offered *in perpetuum*, setting them aside from other ephemeral benefactions such as games and *sportulae*. These options highlight the many possibilities of bath-related benefactions, according to one's means and desired outcome; they may also indicate that more than being a deliberate, first choice, a bath-related benefaction may have become almost the default option for a benefactor trying to determine how to benefit his community in a way that would make him remembered by the most inhabitants and for the longest period of time.

[550] See note 301.

VII. The baths of Central Italy in their local, regional and empire-wide contexts

Introduction

One of the main interests of conducting a regional study is to consider the specificities of the region in question, in comparison to what lies not only outside but also within the boundaries of the region itself.

The assessment of the specificities of the baths of Central Italy, the examination of sub-regional patterns, and the issues associated with this pursuit, are tackled in section VII.1 below.

The second aim of this chapter is to offer a comparison between the baths of Central Italy, those in *Pompeii*, Rome, and *Ostia*, and those in the rest of the Empire—first northern and southern Italy, then North Africa and a handful of other places. This comparison would ideally focus on what has been at the core of this research, i.e. the design, construction materials, and technology of these baths, as well as the related funding patterns, and see to what extent any of these determined visible trends. This task, however, is complicated by the fact that the studies concerned with other areas usually took different approaches, not tackling heat technology and water management in as much depth but most often preferring a typological approach (see section II.1), whereas typologies of entire buildings were discarded in this research. Consequently, not all aspects will be covered for all the regions considered here, and there will be a noticeable emphasis on questions of designs and on the use of blueprints. These comparisons will be tackled in sections VII.2, VII.3 and VII.4 below.

VII.1 Regional and sub-regional trends in the Imperial-period public baths of Central Italy

Defining a clear picture of the architectural identity of the public baths of Central Italy is an arduous task, not satisfyingly achievable in the frame of this thesis, for four reasons. First, the different aspects of baths tackled in this thesis—design (chapter II), construction materials and techniques (chapter III), technology (chapter IV–V), euergetism (chapter VI)—do not easily come together to explain the identity of baths, and some of these aspects were subordinated to others. Heating technology, for instance, while being the most characteristic element of bath buildings, does not seem to have influenced their design much. The same is true of construction materials: rooms built from the same blueprint could be made with local material, whether sandstone or limestone blocks, or baked bricks.

Further, since baths have been tackled through their individual components, they have not been considered as complexes. Instead, the focus has been on individual aspects that would have been the product of several actors, each concerned with a different aspect of the baths, or with a different approach of the same aspect. The commissioner, contractor, builders, specialised builders, and possible architect did not consider a building in the same way, and none had an all-encompassing vision of the different facets of any single building. For instance, on the design of a set of baths, a commissioner might have talked about the land he had secured, how large he wanted the building to be, for how many customers, or with how many pools; an architect/contractor/bath designer might have talked in terms of blueprints and orientation, and keeping the service areas invisible to the bathers. For heating, the commissioner possibly talked about the relative temperatures of rooms, while

contractor and heating systems specialists thought in terms of selection and supply of CBM for hypocausts, number and types of *praefurnia*, supply of hot water to pools. All this without even bringing bathers into the mix, who would have had little clue about all the architectural aspects researched here, but would instead probably have focused on scale, luxury, and available facilities.

A second reason why the architecture of the baths of Central Italy cannot be summed up easily is because several elements of importance where not taken into account. As mentioned, the question of their use by bathers was not tackled, yet it would have been a prime concern in the design of the building as a whole. Amongst the possible limitations that could have constrained the design of a building, that of the space available for its construction, arguably the most important, was not considered.

Third, for a question of definition. To what extent did similar but individual decisions made by two different baths commissioners in neighbouring cities constitute a 'regional' or 'sub-regional' pattern? Why would two (hypothetical) identical baths in northern Tuscany make for a 'sub-regional pattern', when two other identical baths at each end of the area considered here would not? The only way to define the patterns we see as 'regional' or 'sub-regional' is to find a factor at the regional or sub-regional level that accounts for this pattern, explaining why it did not (as far as we know) happen elsewhere.

Fourth, we are inevitably constrained by the nature of the evidence, and the limited number of examples always poses the question whether the patterns we see are coincidental or were actual phenomena.

Consequently, this attempt at determining sub-regional patterns within Central Italy will stay at a general level.

One main regional trend has already been highlighted in the use of specific blueprints: the 'triptych'-*caldarium* blueprint, for instance, spread across the entire area, from Tuscany (*Rusellae*) to Campania (*Velia*) and from the west (*Minturnae*) to the east of the Apennines (*Septempeda*/*Ancona*?), not displaying any sub-regional concentration that was not in line with the distribution of settlements.

In terms of sub-regional trends, the variations in the use of heating technology were already tackled in chapter V. The focus below will instead be on trends noticed through the use of specific room types, specific baths designs, and their location, keeping in mind the intentions of the commissioner.

In Marche, several small towns (*Ostra* [Ma.G.12], *Septempeda* [Ma.09], two baths in *Sentinum* [Ma.07–08]) were equipped with baths that, comparatively to the size of the town, appear quite large; two of those have a circular heated room off-axis, which may or may not be a regional characteristic. By their scale, they seem out of place in these small towns, but it could be that the limited degree of urbanisation of the *regio*, especially when compared to *regio* I, made those complexes a 'bathing hub' aimed not only at the inhabitants of the city but also at those of settlements in the surrounding countryside. The position of the Extraurban Baths of *Sentinum* [Ma.07] could certainly argue in this direction, but could also be interpreted as the only available option since they would not have fitted in the established urban grid.

Another sub-regional trend may have existed in southern Campania where two middle-sized baths (*Paestum* Large Baths [Ca.06], *Velia* Vignale Baths [Ca.10]) were equipped with *piscinae calidae*, a feature unseen in the other baths of the catalogue but

for which a geographically circumscribed preference can be confirmed with examples from both private (*Stabiae*: Villa San Marco, Villa del Pastore; Posillipo: Upper Baths) and public baths (Suburban Baths at *Herculaneum* and *Pompeii*).[551] Grabner suggested that the origin of *piscinae calidae* could be found in the large hot-water pools of spa baths, which were supplied with naturally hot water; while the reason(s) for the apparent success of this room type in that area have not been explored, it may have had to do with a desire to recreate the environment more typical of spa baths in conventional baths, giving bathers the possibility to not only immerse themselves but also swim in hot water.

[551] GRABNER 2001. *Piscinae calidae* are also concentrated in Lazio (ca. nine) and occasionally found elsewhere in the Empire (up to ten, see BOUET *et al.* 2008, table 1).

VII.2 Rome, *Ostia* and *Pompeii*

The main idea behind the decision to set aside the baths of *Pompeii*, *Herculaneum*, Rome and *Ostia* was to escape their towering presence in the study the baths of Central Italy; it is now time to turn the question on its head and try to determine how the imperial-period public bath buildings of Central Italy compared to those of the four cities. Are they representative of the public baths in Central Italy according to the picture drawn so far, or are they instead exceptional examples belonging to different architectural traditions and conceptions, using different technologies? A *caveat* however: comparing the bathing landscape of a large region to that of individual cities will inevitably lead to some degree of generalisation, and to cherry-picking specific cases.

During the imperial period, the baths of Rome obviously had a privileged position compared to the rest of Central Italy, with at their disposal water from several aqueducts, local construction materials (including pozzolana) from several nearby quarries, CBM produced in the Tiber Valley (for both facing and heating systems), plus decorative materials and presumably savoir-faire, expertise and ideas coming from all corners of the Empire,[552] on top of being home to some of the wealthiest citizens of the empire. These aspects cannot be researched in more details, but they highlight how there were virtually no technical or economic limitations to the construction of bath buildings in the City. That the bathing landscape of Rome is exceptional compared to the rest of the Italian cities is therefore no surprise, but this picture is very much due

[552] DeLaine 1995.

to the existence of the imperial bath buildings; the question remains of the picture given by the other publicly accessible bath buildings in the city.

The non-imperial baths of Rome were recently studied by Foulché, who however focused on topographical, legal and social considerations.[553] If the prominence of the imperially-funded, 'imperial-type' did have an effect on the other, non-imperial, publicly accessible baths, it was mostly visible on their distribution within the city: they were more concentrated in areas where no imperial-type bath was already drawing all the clientele.[554] The specificity of Rome, according to Foulché, was instead in the funding and ownership of the public baths. While in Central Italian cities, the municipality and private individuals were the main benefactors of bath buildings, with the city eventually becoming the owner of the building, in Rome Senate and private benefactors played little to no role, and the emperor was the main actor, commissioning, funding and owning the public bath buildings of the City.[555] While privately owned, commercially exploited, publicly accessible baths existed in Rome, there was apparently no equivalent to the 'municipal' bath building commonly offered by benefactors to the towns of Central Italy.

The plans of only five non-imperial, publicly accessible baths in Rome are known: the *Thermae Helenae*,[556] the baths under Palazzo Tittoni,[557] under San Giovanni in Laterano,[558] under Stazione Termini[559] and under the Lateran[560] (fig. 144–146).[561]

[553] FOULCHE 2011.
[554] FOULCHE 2011, 504.
[555] FOULCHE 2011, 626.
[556] Severan.
[557] 2nd–3rd cent. AD.
[558] >1500 m², Trajanic, Severan modifications.
[559] 1,500–2,000 m², 2nd cent. AD/Hadrianic.
[560] 1,200–1,500 m², Severan.
[561] FOULCHÉ 2011, cat. 37–38, 40, 45, 60.

These reveal interesting design similarities with the most elaborate baths of Central Italy. They did display a certain degree of monumentality, through large dimensions, a semi-symmetrical plan[562] (e.g. Lateran, S. Giovanni in Laterano, *Thermae Helenae*, comparable to the baths of *Ferentum* [La.03] and *Sentinum* Extraurban [Ma.07]) or the use of tripartite openings between *frigidarium* and vestibule, monumentalized by columns[563] (S. Giovanni in Laterano, *Thermae Helenae*, comparable to *Teate* [Ab.03], *Cumae* [Ca.02], *Neapolis* Fuorigrotta [Ca.04], possibly *Ferentum*). As for blueprints, the Lateran Baths seem to have used the 'block'-*frigidarium* known from several Central Italian baths (fig. 16).[564] There are noticeable differences, such as the more rectangular proportions of the block, the corner rooms replaced by openings, and a large pool along the NE side, but the core elements of the blueprint are visible. The *frigidarium* of the Stazione Termini Baths, a square room with semi-circular apses occupied by pools or openings in the corners, resembles the *frigidarium* R12 at *Teate* [Ab.03], which may also have been equipped with a pool along its (now lost) S side. The *caldaria* of the *Thermae Helenae* and of the San Giovanni in Laterano Baths could be of the type with three rectangular pools known seen in *Cumae* [Ca.02],[565] with the difference that one of the pools had a curved back wall.

One marked difference between these five Urban baths and the baths of Central Italy was a more common use of curvilinear shapes in Rome, with several rooms having both short ends segmental: that shape was found nowhere in Central Italy, where rooms had at most one curved side.[566] Curvilinear shapes became more common

[562] Section II.1.
[563] Section II.2.1.
[564] Section II.2.4.
[565] Section II.2.3.
[566] Lateran Baths: room E; Palazzo Tittoni Baths: two rooms; *Thermae Helenae*: one room; Stazione Termini Baths: '*basilica thermarum*'.

in Central Italy in later periods (e.g. the Vallebuona Baths of *Volaterrae*, late 3rd cent. AD),[567] possibly under the influence of such Urban baths, dated to the 2nd/early 3rd cent. AD.

The public, non-imperial baths of Rome, by their dimensions, their use of blueprints and room shapes already seen in Central Italy, and their standard heating technology, were part of the bathing landscape of Central Italy at large. Foulché had already noticed that they did not distinguish themselves in terms of originality of their design.[568] The leading and innovative role of the baths of Rome was limited to the imperial baths, which undeniably had a strong influence over a specific type of bath buildings found mostly in North Africa and a few other places around the Empire, but only to a very limited extent in Italy (e.g. *Castra Albana* and *Puteoli*, and *Mediolanum* in Northern Italy).

With no less than 33 bath buildings across all periods, Ostia was home to the largest concentration of bath complexes in a single city in Italy outside of Rome. Its situation had many points in common with that of Rome: it had access to the same supply chains of construction materials (for the fabric and the heating systems)[569] and decorative materials as Rome, and probably to the same specialised construction teams; developments in Rome can also be expected to percolate to *Ostia*. Water availability was naturally different, but the city had the advantage of having a phreatic table very close to the surface level, allowing several baths to initially use groundwater fetched via waterwheels (until the construction of an aqueduct in the

[567] CORVO 1993.
[568] FOULCHÉ 2011, 707.
[569] Tiber Valley CBM production was found in some Ostian baths (DELAINE 2002, 59).

Augustan/Tiberian period).[570] Just like in Rome, no technical or economic factor put a brake on the possibilities of construction of bath buildings in *Ostia*, and the most constraining factor must have been their insertion in a dense urban fabric, which determined the plan of even the prestigious Terme del Foro.

The funding process of the largest public baths of *Ostia* also made the city's bathing landscape stand apart from that of other Italian cities, with a significantly greater involvement of the emperor and his representatives: the Terme di Porta Marina were built by Hadrian and completed by Antoninus Pius,[571] the Terme del Foro, by *Gavius Maximus*, praetorian prefect of Antoninus Pius. After the beginning of the imperial period, it seems that virtually no private individuals were involved in the funding of large bath buildings in *Ostia*.[572] It is possible that the scale and lavishness of the public baths of *Ostia* made it impossible for most private wealthy citizens to offer similar bathing facilities; at the same time, the construction of any of those large bathing facilities may have made the construction of another large facility redundant for some years. This pattern of punctual imperial funding may have answered the needs of a growing population, as well as reflected the latest bathing developments.

This latter point is visible in the chronology of the construction of those large bathing complexes: the oldest one preserved, the Terme di Nettuno (fig. 147), with a first phase in the Domitianic period, also had a more archaic plan, with a linear arrangement of rooms, a retrograde circulation path, and simple volumetric shapes for the individual rooms.[573] The Hadrianic Terme di Porta Marina (fig. 148) and above all

[570] POCCARDI 2006b, 136.
[571] see note 54; POCCARDI 2006b, 9–10.
[572] A *balneum* benefaction by a private individual, *C. Cartilius Poplicola*, member of the most prominent family of the city at the time, is dated to the Late-Republican/Early Imperial period.
[573] POCCARDI 2006b, vol. 2, 71–91.

the Terme del Foro (fig. 149, AD 155–160) displayed a search for more diversity in the shapes of rooms, increasingly symmetrical plans for the cold areas, and proposed circular bathing paths. It is also striking that all three used the same blueprint for the *caldarium*, with three rectangular pools along the sides; these pools tended towards more curvilinearity in the two most recent examples, either with a curved back wall (Terme del Foro, E pool) or an extension of the rectangular pool with a semi-circular apse (Terme del Foro S pool, Terme di Porta Marina W pool). That the *caldarium* of the Terme di Nettuno did not undergo a similar upgrade but instead was decommissioned, possibly in the early 4th cent. AD, whereas the Terme di Porta Marina and the Terme del Foro continued being restored much later by imperial interventions,[574] suggests that the former was on the decline; by then, it may have become too old-fashioned (possibly in its design, paths, heating, and/or decoration,) for the tastes of the times. The Terme del Foro also used the '*frigidarium*-block' blueprint seen in Rome, *Neapolis, Sentinum* and *Ferentum*; at *Ostia* as in the latter two baths, the *frigidarium* was the central room of a symmetrical cold section.

The dimensions of these large Ostian baths (2,100–4,500 m² without *palaestra*) made them exceptional in the bathing landscape of Central Italy, comparable in size only to the baths of *Sentinum* [Ma.07] and *Aquinum* [La.01] (both 3,000 m²). Some of the smaller Ostian baths, however, would not be out of place elsewhere in Central Italy. Their status was variable—they could be baths of corporations or commercially-exploited baths—but they were closer in scale and scope to the majority of the other baths from the catalogue, and used some of the blueprints very popular in Central Italy, such as the 'triptych'-*caldarium*, for instance in the Terme del Nuotatore and the

[574] Foro: *CIL* XIV.4718=EDR106931 (AD 385); Porta Marina: *CIL* XIV.137=EDR163865 (AD 375–378).

Terme del Mitra (fig. 150). This blueprint may also have been used, with adaptations, in the Terme del Bagnino Buticosus and dell'Invidioso (fig. 151): in the first one, the apse was not included, probably for lack of space (a 1 m wide passage was left between the *caldarium* and the earlier Tempio Tetrastilo to the W). In the Terme dell'Invidioso, the blueprint was applied to a *frigidarium*, with one pool only fitted on one short side while the opposite side was a passage (the apse may have contained a *labrum* in its initial phase).[575] These alterations somewhat confirm that flexibility in the use of blueprints was not an uncommon phenomenon.[576] The *caldarium* with three rectangular pools, seen in Central Italy (*Cumae*), Rome (in the *Thermae Helenae* and at S. Giovanni in Laterano, in both cases with one pool's back wall curvilinear instead of straight) and in the large baths of *Ostia*, was also chosen for the Terme della Trinacria and the Terme dei Sette Sapienti.

Specialised building teams and/or contractors must have found in *Ostia* a workplace of choice, with additional work in the neighbouring areas as well, such as the *Vicus Laurentium* or *Portus*, or even Rome in case of a low period of activity in *Ostia*. The activity of these specialists may account for the popularity of specific blueprints in a confined region: for instance, the *caldarium* with three pools, known in Central Italy only in *Cumae*, but visibly more popular in the area around Rome, with examples from Rome (mentioned above), *Ostia*,[577] Hadrian's Villa,[578] and possibly *Castra Albana* [La.02].

[575] POCCARDI 2006b, cat. 28.
[576] E.g. *Minturnae* and Tor Paterno, see II.2.3, II.4.1.
[577] Terme di Nettuno, dei Sette Sapienti, della Trinacria, di Porta Marina.
[578] Large Baths.

Pompeii offers an overview of a bathing landscape dating to the earlier part of the imperial period. The baths of *Pompeii*, despite having dominated the archaeological discourse on bath buildings for decades, are still in need of proper studying, as the recent research by Trümper has made clear.[579] With the Stabian and Forum Baths on the one side and the Central Baths on the other (fig. 152), they illustrate the well-known (and well-complained about by Seneca, *Ep*. 86, 4–12) transition between two bathing forms, all evidence of which is usually lost in other Central Italian baths with a longer lifetime.

In the context of this research, the most relevant bath building of *Pompeii* would be the Central Baths, unfinished at the time of the eruption, as the most representative of the bathing fashion and facilities of the imperial period. If the city had lived a typical life, it is to be expected that the Stabian and Forum Baths would have been restored several times, possibly undergoing a complete overhaul to adapt them to the latest bathing fashions and leaving little trace of the more typical late Republican-period baths characterised by the linear succession of barrel-vaulted rectangular rooms, dimly lit and with limited water features. The Central Baths (still in need of a proper study)[580] contained several elements that marked a transition towards a type of bathing more typical of the imperial period: large windows, a multiplication of water facilities (a *natatio,* a pool in the *frigidarium* and two in the *caldarium*), changes in the shape of the *caldarium* with the abandonment of the *labrum*, more path options, and a growing emphasis given to the *frigidarium*, now in a dedicated room, at the expense of the *tepidarium*. The bathing block reveals interesting parallels with the early imperial phase of the baths at *Aquinum*, with the presence of a quadrilobed heated room, and

[579] TRÜMPER 2017.
[580] MAU 1877; 1878; MAIURI 1942; BARGELLINI 1991; DE HAAN & WALLAT 2006; 2008.

with a *caldarium* equipped with immersion pools on the short ends and numerous small niches along the long walls. On the other hand, this set of baths is still not representative of what was done in terms of bathing architecture at the heart of the Principate: the rooms still had very simple shapes, used quadrilobed heated rooms which disappeared soon after (as was the case at *Aquinum*), there was no visible attempt at monumentalizing the structure with a symmetrical cold section or the use of columnar screens, nor was there a multiplication of heated rooms.

The question of the funding patterns of the baths of *Pompeii* also casts a different light on its bathing landscape. The Republican-period baths of *Pompeii* were funded in ways that are similar to other Central Italian baths, with a mixture of members of the municipal elite and private individuals: the former built the Forum Baths,[581] restored the Stabian Baths,[582] and dedicated a *labrum*;[583] the latter played a less prominent role and offered braziers.[584] What could be more exceptional, however, is the origin of funds for the construction of the Central Baths: the commissioner and funder is unknown, but the building may have been a gift from the imperial representative sent to *Pompeii* in AD 70 by Vespasian to support the city following the earthquake of AD 62.[585] During the Principate, emperors and their agents intervened only rarely in bath-related matters in Central Italy, with notable exceptions in *Ostia*, as mentioned above. The possibility that an imperial agent was at the origin of the construction of the Central Baths does raise the question of the workshops and possible architects employed for the task: were they coming from Rome, and therefore did the end result

[581] *CIL* I².1628=EDR147480.
[582] *CIL* I².1635=EDR150879.
[583] *CIL* X.817=EDR143048.
[584] *CIL* X.818=EDR155380.
[585] BARGELLINI 1991, 128.

reflect developments that had already taken place in Rome? And if bath specialists or architects were not from Rome, where did the architectural forms come from, and who was responsible for their application: the contractor/architect, aware of recent developments in bathing practices, or the imperial commissioner? What seems clear is that there are no visible signs of the influence of the imperial baths of Rome on the design of the Central Baths of *Pompeii*, which, assuming the commissioner was indeed an imperial agent, may be a further, if indirect, argument in favour of the first imperial-type bath building in Rome being those of Trajan.[586]

Comparisons with the baths of Rome, *Ostia* and *Pompeii* offer only marginal help to better understand the bathing landscape of Central Italy. The imperial baths of Rome were a category of their own, and influenced the design of a limited number of bats in Central Italy in a very limited way. The non-imperial, publicly-accessible Urban baths could potentially be a better benchmark, but they are few and poorly known. The large public baths of *Ostia* would fit in well in the Central Italian bathing landscape, if it were not for the heavy influence of the imperial house and affiliates in their funding; they are on a scale with few comparanda in Central Italy. The smaller public baths, as well as some of the larger private baths, could be a better point of reference. By the size of the town and the greater remoteness from imperial influence, the bathing landscape of *Pompeii* could in theory be more representative of what happened in Central Italy, but its stopping in AD 79, before the full expression of the bathing solutions typical of the imperial period, makes the baths of this city a less than ideal point of reference.

[586] See note 51.

The use of blueprints, on the other hand, transcends questions of scale, dimensions, or funding types; the same blueprints were used by imperially-funded large-scale baths in *Ostia* and municipally or privately funded small baths in Abruzzo, or Tuscany, or southern Campania.

VII.3 Northern and Southern Italy

Just like Central Italy, the baths of Northern and Southern Italy would deserve a proper large-scale study too. So far, baths in the north and south of Italy have been considered in individual publications, or less often in brief articles concerned with one (ancient or modern) region, but without going in the detail necessary for a comparison with what has been done in this thesis. Therefore, only one-off comparisons based on readily available material will be made.[587]

It must first be noted that the number of bath buildings in those areas can be expected to be significantly lower than in Central Italy, mostly because of the lower density of settlements.[588] At the same time, the number of baths considered in this study grew from 40 at the beginning to ca. 80 after careful bibliographical research, and possibly up to 175 if all tentative identifications are included; a similar increase, even though not as dramatic, could certainly be expected for these other regions.

The *regiones* of Northern Italy, at least the Xth and XIth *regiones*, were dotted with larger but less numerous cities than Central Italy, and these larger cities concentrated most of the building activity recorded on inscriptions.[589] The patterns of euergetism reveal a similar reliance on public magistrates and on private benefactors for the funding of public bath buildings, but an interesting peculiarity stands out: much higher sums were invested in baths benefactions than in Central Italy. The few costs we know for the construction of baths in Central Italy (setting aside the exceptional

[587] See note 23.

[588] Based on data from HANSON 2016b, the *regiones* of Central Italy counted 178 cities (I: 60, IV: 26, V: 15, VI: 34, VII: 43), compared to 57 in Southern Italy (islands included) (II: 18, III: 15, *Sicilia*: 22, *Corsica* and *Sardinia*: 2), and 55 in Northern Italy (VIII: 17, IX: 12, X: 17, XI: 9).

[589] FRÉZOULS 1990, 199.

sum of two million sesterces paid by Hadrian at *Ostia*)[590] range from 150,000 HS at *Tifernum Tiberinum* [E74] to more than 252,000 HS at *Corfinium* [E18] and more than 330,000 HS at *Tarquinii*[591] [E69] (the latter two with an additional amount for the construction and completion of the baths, respectively); the only amount for upkeep we know of is 30,000 HS at *Corfinium* [E17]. The figures we know for baths in Northern Italy are noticeably higher: from a bequest of 200,000 HS left by *Albucia Candida* to the city of *Novaria* where her husband had restored and enlarged the baths with an undisclosed, presumably larger, sum,[592] to a gift of 800,000 HS for the restoration of the *balinea Sergium et Piti[nium]* at *Altinum* by a member of the *gens Fabia*, who added endowments of 400,000 HS for their heating and 200,000 HS for their maintenance,[593] all the way to the estimate of one million sesterces left by Pliny in his will for the construction (unknown amount), decoration (300,000 HS), and maintenance (100,000 HS) of a bath building at *Comum*, his birthplace.[594] The 400,000 HS left by *T. Aviasius Servandus* in his will so that, from the interests of the endowment, men and minors could use a bath complex in *Bononia*, could be added to the list.[595] These amounts are amongst the largest expenses for bath buildings we know of in the Western Roman Empire.[596] The dating of these inscriptions falls roughly within the same period (2nd cent. AD) and therefore does not affect the discrepancy between the amounts of money spent in the North vs in the Centre. These substantial sums are accounted for by the positions these individuals occupied but even so, they remain

[590] See note 54.
[591] There are doubts about the exact amount but the reading of 330,000 is preferred.
[592] *CIL* V.6513=EDR108483.
[593] NSc 1928.283=EDCS-60300076.
[594] *CIL* V.5262=EDR079478.
[595] *CIL* XI.720=EDR094018.
[596] With 75,000 *denarii* (=300,000 HS) '*ad marmorandum balineum'* at *Epomanduodurum* in *Germania Superior*, 2nd cent. AD? (*CIL* XIII.5416–5417=lupa.at/13858).

exceptionally high: even an oil benefaction at *Comum* was very generously funded with 40,000 HS.[597]

It is a pity no inscription was found associated with a structure, but the large set of baths partially excavated in *Comum*, dated to the 2nd half of the 1st cent. AD on stylistic grounds,[598] is a good candidate to be the object of Pliny's benefaction (fig. 153). From what is visible, the complex was characterised by significant dimensions (estimated between 4,000 and 8,000 m², making it the largest non-imperial type bath building in Italy),[599] a marked axiality and symmetry, and original rooms plans, in particular three octagonal rooms presumably with umbrella-type vaults (some of the walls are 3.20 m thick to support such vaults). These characteristics, taken together, are unseen in Central Italy. This was possibly the type of building that half a million sesterces could buy, and if the remains indeed belong to the building commissioned by Pliny, they would illustrate very well how original the design of a bath building could be when the commissioner took a particular interest in his benefaction.[600] That Pliny was interested in the design of baths is quite explicit by the description he made of the bathing suites of his villas.[601]

The reasons behind the larger sums invested in bath buildings in Northern Italy can only be conjectured. That cities in Northern Italy were larger and wealthier than in the rest of the country was well-known already in ancient times,[602] and the benefactors may also have been wealthier on average. The lesser density of large

[597] *CIL* V.5279=EDR164666
[598] JORIO 2011, 17.
[599] MARINI 2014, 32.
[600] See section VI.3.
[601] Plin. *Ep.*, II.17.10–12, V.6.24–25.
[602] Strabo V.1.12. Northern Italian towns also had on average a larger area at their disposal (1,450 km²) than Central Italian ones (320 km²) (DUNCAN-JONES 1974a, table 9).

settlements in the area also meant that each city, in addition to having an average larger population than many Central Italian cities, also managed a larger rural territory, potentially drawing in more people on specific occasions (games, festivals etc.); larger bathing facilities could therefore have been required. Frézouls also noted a large number of inscriptions commemorating the bequest of sums to cities for the maintenance of buildings, the two second largest of which were for bath buildings;[603] the high amounts gifted for maintenance were certainly correlated to the initial cost of the building.

As far as heating technology is concerned, circular bricks appeared to have been commonly used for *pilae*, in contrast to what was done in Central Italy where *bessales* were more common.[604] CBM production had a long history in Northern Italy, initially characterised by dimensions often linked to Greek measurements units, and which maintained, even at the beginning of the imperial period, characteristics distinct from the more standardised Urban and Central Italian productions, among other a notable thickness, up to 9–10 cm.[605] It is perhaps in the context of this tradition that the bricks used for the *pilae* of the Forum Baths of *Augusta Praetoria* are best understood. These *pilae* were made of bricks not only thicker than the usual *bessales* (ca. 9–10 cm, vs 4–5 cm), but also had a purposely-made base and top that combined in a single element a square brick with a circular one.[606] The creation of this product, in all likelihood specifically designed for *pilae*, certainly occurred in the same *figlina* that produced the circular bricks for the rest of the *pilae*, and could be due either to a request from a

[603] FRÉZOULS 1990, 203: 200,000 HS at *Altinum* and *Comum* each, only exceeded by the 400,000 HS given for the aqueduct of *Pola* (*CIL* V.47=EDR135369).
[604] DE ANGELIS D'OSSAT 1943, 42; section V.1.2b.
[605] BONETTO 2015, 106, 110–111.
[606] ARMIROTTI *et al.* 2019.

contractor or, and more likely to my mind, the result of an *officinator*'s idea. It would be tempting to use it as further evidence of possible 'entrepreneurial' behaviour,[607] but what we face in this case may be closer to an innovation for the simplification of the production rather than a profit-driven creation. It is likely that workshops did not produce *bessales*-type bricks, which were probably still sought after by bath builders to cap the *pilae* because they provided a larger surface area to support the *suspensura*; instead of producing a limited number of *bessales*-type bricks, *figlinae* could have opted for a product specifically designed and crafted for the purpose of supporting *suspensurae*.

The only regional study concerned with a part of Northern Italy concluded that in *regio* X, the design of public baths remained very simple, 'conservative' even, showing none of the characteristic elements of the imperial baths of Rome.[608] No regional preferences in plans and design of rooms were noticed in the baths of Northern Italy for which a plan was obtained.[609] None of the more common blueprints used in Central Italian baths seem to have been used in the limited Northern Italian sample.

Unlike Northern Italy, Southern Italy was marked early on by a wide array of influences from urban cultures. Sicily, Apulia and Calabria were long under Greek influence or domination, while Sardinia was under Carthaginian control.

Greek influences had a clear impact on bathing culture in *Magna Graecia*, where typical Greek-type baths, characterised by a circular *tholos* containing individual hip-

[607] See section V.4.

[608] EQUESTRI 2014/2015, 291.

[609] Checked examples include: *Albingaunum* (CONVENTI, MASSABÒ & TRIGONA 2019), *Albintimilium* (DE VINGO *et al.* 2019), *Altinum* (CIPRIANO 2010), *Augusta Praetoria* (ARMIROTTI *et al.* 2019), *Caesena* (LIPPOLIS 2000), *Comum* (JORIO 2011), *Mutina* (LIPPOLIS 2000).

bathtubs, are found from the late 4th cent. BC at least,[610] as well as more original forms of bathing found in the 3rd cent. BC 'Western Greek-style' baths which combined the hip-bathtubs with a heated communal immersion pool.[611] These bathing complexes may have been a predecessor of the 'transitional' Roman-style baths of the 2nd and 1st cent. BC elsewhere in Italy (e.g. *Fregellae*),[612] but the limited evidence for Late Republican public baths in Southern Italy[613] does not allow for easily following the evolution of baths throughout this period. In Carthaginian Sardinia, bathing culture was much less developed; this translated, during the imperial period, into a much stronger influence from Italian models.

The influence of Roman architectural models in Sicily was probably felt from the Late Republican period, earlier than the Augustan date posited in the only regional study of the baths of Sicily.[614] Despite this, few Roman public bath buildings are known for the imperial period in Sicily: examples include *Agrigentum*, *Catina, Centuripae, Lipara, Soluntum*, *Tauromenium*, *Thermae Himerae*, *Tyndaris*. From what can be gathered of the plans of the well-preserved examples, they were of modest proportions and took very simple shapes, with a series of aligned rectangular, barrel-vaulted rooms, close to the Late Republican examples of *Pompeii*. Only those at *Tauromenium* boasted larger dimensions, with the largest heated room measuring 7 x min. 14 m, comparable in size to the *caldarium* at *Ferentum* [La.03], *Aquinum* [La.01] or *Teate* [Ab.03].[615] On the other

[610] E.g. *Gela* (TRÜMPER 2019, table 2).

[611] TRÜMPER 2009, 151–152. E.g. *Velia* (Campania), *Caulonia, Locri* (Calabria), *Megara Hyblaea, Syracuse, Gela* and *Morgantina* (Sicily); FOURNET *et al.* 2013, cat. 1–3, 5–9.

[612] TRÜMPER 2009, 161–162, note 59.

[613] Two Late Republican/Hellenistic public baths are known at *Soluntum* (Sicily) (TRÜMPER 2019, 359–374).

[614] WILSON 1980–1981; BELVEDERE 1988, 347. The imperial-period public baths of Sicily are currently being researched by Paola Santospagnuolo (Freie Universität Berlin).

[615] See section II.2.3, Table 4.

hand, none of the monumentality seen in the more elaborate examples from Central Italy (e.g. *Ferentum, Sentinum* [Ma.07] or *Florentia* [To.03–04])[616] appeared in Sicilian baths: no visible search for symmetry or axiality, no use of any of the blueprints seen for Central Italian baths. Blueprints may still have been used, but with room shapes simpler that what we have seen in Central Italy, they may simply be less recognisable to us.

More characteristic of Sicily, in contrast to Central Italy, were the construction techniques and materials: there was a much greater reliance on traditional stone construction, with the consequence that brick[617] was used only to a very limited extent (on an extensive scale only at *Tauromenium*, where they were locally produced). Basalt was a raw material of choice in the eastern part of the island around Etna; this resulted in walls faced in what would be called *opus incertum*, but without any chronological implication—rather, it was the result of the difficulty of shaping the local stone to any regular shape. In the West (e.g. *Thermae Himerae*), local limestone was favoured instead.[618] An original vaulting solution rarely seen in Central Italy (only at *Florentia* [To.04]),[619] vaulting tubes, made its appearance in the 2nd half of the 3rd cent. AD under the influence of North Africa (or as a directly imported product), where this technique was used extensively at the time; at the same time, they harked back to the use of vaulting tubes in Hellenistic times, in the North Baths of *Morgantina* in the 3rd cent. BC.[620] There is, however, no evidence of the use of vaulting tubes in the period between the 2nd cent. BC and their reintroduction in the 3rd cent. AD, a gap interpreted as the

[616] Table 1.
[617] See section III.2.1c.
[618] WILSON 1980–1981, 229.
[619] See section III.2.2.
[620] LUCORE 2009.

result of the importation of more 'Italian' models to the island, with concrete vaults replacing vaulting tubes.[621] That 'Italian' (i.e. Campanian and Latial) models were imported could be seen in the design of the few Roman baths that have reached us, as mentioned above, but since those 'Italian' models could actually have been influenced by the design of the Sicilian Hellenistic baths, depending on where one decides to place the origin of the Republican-type bath buildings, it is possible that what we see in Sicily in the Late Republican and early imperial period is the continuation of what had been initiated in the Hellenistic period, adapted to the bathing fashion of the Romans (abandonment of individual bathing practices, for instance). External influence, therefore, is more clearly seen in the roofing techniques: concrete (from Italy), then vaulting tubes (from Africa).

On the mainland, some of the baths in areas close to the southern boundary of the area considered in this thesis (in *regio* III, nowadays Basilicata and the north of Apulia and Calabria) do show strong similarities with other baths from Central Italy. The so-called Imperial Baths of *Grumentum* (fig. 154L) have a plan with striking similarities to the baths of *Rusellae* [To.06], not only in the use of the same blueprint for the *caldarium* but also in the distribution of the heated rooms and *frigidarium* along a single axis, with a large service courtyard alongside all those rooms. The baths of *Copia Thurii* (fig. 154R) also show interesting similarities with the Forum Baths of *Paestum* [Ca.05]: they both had a central block made of three heated rooms, the *caldarium* used a similar template (with only the axial niche differentiating them), and the design of the complex seems very much to have been organised around this heated block, with the cold rooms organised around it.

[621] BELVEDERE 1988, 398.

Sardinia, during the imperial period, appears to have been very much in the sphere of influence of Rome and Central Italy. In two bath buildings, at *Turris Lybisonis* and in the Terme a mare at *Nora* (fig. 155), we find the blueprint for the *frigidarium* block, found in some of the largest examples of Central Italy, Rome and *Ostia*; these baths are also marked by large dimensions and a symmetrical cold sector.[622] Other public baths from Sardinia such as those at *Tharros*, *Nora* (Small Baths), and Marrubiu (fig. 156), even though not using any of the other blueprints commonly used in Central Italy, would not be out of place there: they find comparisons in size and layout with, for instance, the Small Baths of *Forum Sempronii* [Ma.05]. The influence of Rome and Central Italy on the architecture of Sardinia was felt in other types of buildings too, such as theatres, amphitheatres and aqueducts.[623] This influence was clear in the field of construction materials and techniques too: concrete became common, and brick could be used for facing, either produced locally but also commonly imported from Italy.[624] In vaults too, concrete was preferred and there are also no traces of the vaulting tubes used in Sicily and North Africa.

The patterns of bath euergetism in Southern Italy are difficult to determine, mostly due to a very limited number of building commemorative inscriptions.[625] The sample, limited to ten inscriptions recording eleven benefactions, shows a proportionately high involvement of local councils and magistrates (7/11) compared to private individuals (3–4/11), possibly in part correlated with the early dates of the

[622] *Nora*: 1920 m²; *Turris Lybisonis*: 2000 m², 3030 m² with *palaestra* (NIELSEN 1993, cat. 132, 135 respectively).

[623] WILSON 1980–1981, 222–225; only temples escaped this influence.

[624] WILSON 1980–1981, 228.

[625] Fagan (1999a) records only seven inscriptions for this area in the period considered here: one from *Sicilia* (cat. 55), three from *regio* II (cat. 48, 65, 116/181), three from *regio* III (cat. 67, 75, 144) and none from *Sardinia*. The following inscriptions can be added: *Sardinia*: *AE* 1928.117=EDR073095 (*Maracalagonis*); *regio* III: *AE* 2007.436=EDR106053 (*Bantia*), CHELOTTI 2015=EDR163266 (*Aceruntia*).

inscriptions (Late Republican–early imperial for 4/7 inscriptions involving local councils). Compared to Northern Italy where thirteen inscriptions are known, the scope of the benefactions appears much narrower, without any mention of amount of money.

One final observation could be made about heating technology: in Sicily, a limited series of baths used annular CBM to make the *pilae*.[626] By their distribution in a narrow geographical area and their effectiveness in reducing production and especially transportation costs, it would be possible to hypothesize a similar pattern of 'entrepreneurial' behaviour as suggested for the hollow tubes *pilae* in the Vesuvian area.[627]

[626] For instance: Bagno di Mezzagnone, baths at *Catina*, Comiso, Misterbianco, *Syracusae* (Dafne Baths, where they are combined with square and rectangular CBM) (PATITUCCI UGGERI 2016, 127–128; MANGANELLI 2019, 104–105).

[627] Sections V.1.2b, V.4.

VII.4 Beyond Italy—and on the use of blueprints

How do the bath buildings of Central Italy fare in the wider bathing landscape of other regions of the Empire? Without going into the peculiarities of bathing practices and architectural traditions of every region, a comparison can be made with the plans of the bath buildings of other areas of the empire, when available. Since it has been determined, throughout the course of this thesis, that the use of blueprints was a well-established method of planning bath buildings, I will look for familiar blueprints in the bath buildings of other regions.[628]

The 'triptych'-*caldarium* blueprint, very popular in Central Italy, was actually very little used in North Africa where it appears only in the Large West Baths of *Banasa* (fig. 157) and, even then, the room seems to have been fitted with only one pool. One possibility could be that this blueprint was more common in medium-scale bath buildings, and therefore to be looked for elsewhere than in the large 'small-imperial' baths of North Africa, but in places like southern Gaul, where those smaller baths have been properly studied, this blueprint does not seem to have been used either.[629]

Another blueprint for the *caldarium*, little used in Central Italy (*Cumae* [Ca.02], possibly *Minturnae* [La.07]) apart from at *Ostia*, in which the *caldarium* is roughly square and equipped with three rectangular pools along each wall, appears to be much more popular in North Africa, but with the variation noticed in *Ostia*: the back wall of one or several of the pools was often curvilinear. The blueprint was used at *Bulla Regia* (fig. 158, baths of *Julia Memmia*; one curved back wall); *Cuicul*/Djemila (fig. 158, Large

[628] The plans of the baths of Central Italy will be compared with those of several hundredth other baths, taken from the publications mentioned on note 23.
[629] BOUET 2003, 74, type 9a1.

Baths; curved back walls); *Gigthis*/Bougrara (fig. 159, West Baths), *Hippo Regius* (Large North Baths; curved back wall in axial pool), *Lambaesis* (Large Baths; id.), *Lambaesis* (Legionary Fortress), *Lepcis Magna* (Early Baths), *Mactaris* (Large East Baths), *Madaurus* (fig. 160, Large Baths; Small Baths, where one recess is used as a passageway instead of a pool), *Thaenae* (id.), *Thamugadi* (Large North Baths, with curved back walls; possibly the Large South Baths if the elongated room is another modification of the same blueprint). The tendency in the *caldaria* of North Africa was towards a much larger use of apses and curvilinear shapes, in part due to the later initial construction date of many of the baths; this evolution was reflected in the Terme del Foro of *Ostia* too, where the back wall of one of the pools of the *caldarium* was curvilinear, and an apse was added to a second pool. This blueprint appears also on a limited number of occasions beyond North Africa: in the Levant at Antioch (fig. 161, Baths E), *Bostra* (South Baths) and possibly Lejjun; in Greece at *Argos* (thermes A) and *Eleusis* (fig. 162, Propylea Baths); in the northern provinces at *Municipium Aelium Cananefatium*, in Gaul at *Gisacum*; in all those cases, the pools are strictly quadrangular.

Finally, the block-*frigidarium* blueprint, with two lateral pools and four passageways, characteristic of the largest and most elaborate examples of Central Italy (Rome and *Ostia* included), was very popular in North Africa where it was the hallmark of a series of large-scale bath buildings (sometimes called of the 'small imperial type'): it is found in *Bulla Regia* (fig. 158, baths of *Julia Memmia*), *Iol Caesarea* (Large West Baths), *Thysdrus* (West Baths), *Lambaesis* (Large Baths), *Mactaris* (Large East Baths) and *Madaurus* (fig. 160R, Small Baths), most characterised by very large dimensions, and all by a symmetrical plan, either for the cold section (*Bulla Regia*, *Madaurus*) or more often for the entire building (*Iol Caesarea*, *Thysdrus*, *Lambaesis*,

Mactar). Similarly to the first blueprint tackled above, this one seems non-existent elsewhere in the Empire.

Some of the blueprints associated with large-scale baths (block-*frigidarium*, *caldarium* with three pools) appear to have been very popular in North Africa. This is a very different picture from Asia Minor, another area known for large and elaborate bath buildings, but where they followed a totally different path: none of the blueprints described before appear to have been used there.

The use of several different blueprints also witnessed in bath buildings of Central Italy, Rome and *Ostia* suggests, on the one hand, that, as expected of blueprints, they could and did circulate beyond their point of origin (unfortunately impossible to pinpoint), at times for long distances. On the other hand, the use of a blueprint in closely clustered bath buildings could suggest either regional preferences, or that the inspiration for a bath building could be looked for in the already existing neighbouring structures. The popularity of the *caldarium* with three rectangular pools (including those when one of the pools has a curved back wall) in Rome and *Ostia* is striking: two baths in Rome (out of the five preserved) and five in *Ostia*, including in the three largest baths, when it appears only once in all the baths of Central Italy. This choice may be due to a question of frequentation in densely urbanised environments (three pools could contain a larger number of people contemporaneously), but other design solutions could have been employed to reach a similar result. That this blueprint was so popular in North Africa is interesting too considering the strong trade connection between North African harbours and *Ostia*. Patterns of euergetism might shed more light on the matter.

These blueprints did also evolve. The clearest example is that of the *caldarium* with three pools on the sides: initially rectangular, their back wall became more and more often curvilinear, reflecting a well-known tendency towards curvilinearity in bath architecture. Whether the blueprint remained that of three rectangular pools, one of which was then modified, or the blueprint itself was modified to turn into a new blueprint is a moot point; what counts is that it was the same idea that regulated and determined the plan of the *caldarium*.

A final note on blueprints: in the baths of *Neapolis* Fuorigrotta [Ca.04], we witness the combination of two blueprints, one for the *caldarium* with two lateral pools and central apse (but used upside down in this case), and another for the *frigidarium* (a 'block-*frigidarium*'). The latter blueprint, as we have seen, is characteristic of the largest examples of Central Italian baths, and of very large 'small-imperial type' baths in North Africa. In that same bath building of *Neapolis*, a tripartite division was used to separate and connect the vestibule and *frigidarium*, and the heated sector was composed of no less than five heated rooms, all of different shapes. All this reveals that such a small bath building could have high architectonic pretensions usually found in complexes of much larger scale; it also certainly reflects the ambitions of the commissioner, who managed to express his wealth and wishes in such a narrow space—using, in this case, blueprints to his advantage, so that customers could bathe in a fashion similar to those of the larger baths of *Ostia*, Rome, and North Africa.

VIII. Conclusion

Introduction

This thesis has brought together, for the first time, a large amount of material concerning some seventy little-known, often poorly preserved public bath buildings in Central Italy, and ca. 100 more structures tentatively or hypothetically identified as such. Our knowledge of bath architecture in Italy has long been dominated by the exceptional examples of Rome, *Pompeii* and *Ostia*, pushing the other baths into the shadows; one of the aims of this work has been to put the baths of Central Italy back on the map, so that the bathing landscape of Italy may no longer be wrongly considered a desert with occasional oases but instead more correctly understood as a dense forest.

More than just filling a gap in the knowledge of bath architecture empire-wide, this thesis has examined in detail the intricacies of the construction of bath buildings. By going down to the fine details, to a granular level where the building is decomposed into the individual elements that allowed for its funding, erection and operation—construction materials and supply, water management, heating systems, and patterns of funding—I have on the one hand questioned the influence of each of these factors on the architectural outcome, and on the other, shown the degree of involvement and responsibility of each of the players involved in its design and construction, the contractors, the builders (specialised or not), the architects, and the commissioners.

VIII.1 Influence of blueprints, construction materials, heating, and water, on the construction and design of baths

The high degree of standardisation and systematisation, not visible in general ground plans but discernible through the repeated use of blueprints for individual rooms, allowed for a streamlined design process (chapter II), where the number of variables was reduced and the creative process, simplified. Some of these blueprints (e.g. the 'tryptich'-caldarium) circulated widely over the entire area, possibly shared between practitioners or accompanying bath construction specialists. Blueprints still offered enough flexibility, by altering their absolute dimensions, their proportions, or by playing with the modules that composed them, that they did not constrain the design of baths.

While the selection of construction materials (chapter III) was in large part determined by the local geology, the same room types and shapes could be built with almost any of them (be it sandstone or limestone blocks, or baked bricks). Only the baths at *Vada Volaterrana* [To.07] clearly suffered from an unstable soil and a lack of suitable material for their construction, but the constraint was circumvented by adapting the structure by thickening the walls: only the builders had to adapt, while the design might not have been affected. Alternatively, materials of better quality or for specific purposes, such as pozzolana, could be transported some distance from their point of origin. The constraint here was economic, where a balance had to be struck between the financial input and the desired outcome.

In terms of heating (chapter V), we have seen how the technology was heavily standardised, and how deviations from this standard were explained by a selection of locally available CBM. Lack of local suitable material could potentially have constrained choices, but this constraint was lifted by putting specific production requests with local workshops, or by importing material from further afar. Blueprints probably mattered little in the choice of different heating technologies.

Local availability of water (chapter IV) could have certainly constrained the quantities of water used in the baths and therefore the type of pools and water-consuming facilities offered to the bathers, but this limitation was often circumvented by long-distance transportation via aqueducts, and by long-term water storage in reservoirs. Only in the most extreme cases did water resources become a constraining factor, as at *Cosa* [To.01]; while still not preventing the construction of bath buildings, it instead required that their water facilities be adapted to the availability of water, by playing with their number, size, and modes of operation. The modularity of blueprints would have facilitated this, making it possible, for instance, to remove a 'pool-module' from a blueprint, without necessarily having to resort to a different blueprint entirely.

None of these aspects, therefore, was a constraining factor *per se*. Central Italy had an abundance of natural resources useful for the construction (and operation) of bath buildings, either locally or within a reasonable distance so what was not locally available could be transported from further away, for a cost. The main constraint was, I think, an economic one, and unfortunately that is the one variable for which we have very little evidence that can be directly correlated to architectural remains, and the type of evidence that is not, or at least not visibly, dependent on geographical considerations at the scale selected in this thesis. Bringing differences and similarities

between buildings mainly down to economic considerations is of course only part of the picture, and adaptations to local factors, such as existing trade routes, topography (as the L-shape of the baths of *Rusellae* [To.06] clearly attests), climate, or legislation, could have had a strong impact on the physical outcome, an effect that cannot always be clearly perceived but that probably accounts for a large proportion of the variation witnessed in bath buildings across central Italy and beyond.

VIII.2 Design, and the commissioners, contractors, architects, builders, and specialised builders

The picture outlined so far has been that of the public bath mostly as a run-of-the-mill building type which, when not commissioned by businessmen to be exploited for profit, was offered to cities by benefactors, not necessarily because of their personal interest in this specific building type, but because of a desire for long-lasting social recognition as part of a well-established euergetic system at a time where the only benefaction type still available to them was the bath building. A streamlined design process using blueprints thus simplified the life and work of all players: the designers (architects or contractors), who, combining room blueprints, could easily come up with a design answering the criteria laid out by the commissioner; the builders, who used the traditional Roman building techniques they had been trained in (mainly concrete walls with various facings, and concrete barrel- or cross-vaults), and for which blueprints would not require expertise beyond their usual craft; the workshops specialised in the installation of heating systems and water features, who, thanks to the use of blueprints, could have known what to expect upon arrival on site at the start of the construction of the bathing block; and the commissioner, who could easily understand a project, assess its conformity with the requirements, as well as the budget, and validate it—as exemplified by the scene in which the orator Fronto was presented by a series of projects for the construction of a bath building.[630]

[630] Gell., *NA*, 19.10.1–4.

This standardisation did not preclude variety or even innovation, as made clear by the fact that no two identical bath buildings are known across Italy—or across the empire, for that matter. Commissioners could have had a direct interest in their creation, and were either directly involved in their design, or could require an innovative, unseen elsewhere design: this is how the baths of *Thenae* in North Africa, or the Small baths of Hadrian's Villa, are best explained. Beyond commissioners, individual entrepreneurs, driven in all likelihood by the prospect of financial profit, could have offered alternative or refined technological solutions to well-established, mainstream practices (e.g. hollow tubes instead of *bessales* for the *pilae*). Their impact is virtually impossible to determine, but it is possible that technological innovations introduced by such people led to new types of rooms (e.g. the *piscinae calidae*), and therefore blueprints.

VIII.3 Future directions, final words

This thesis is but a first step in the understanding of bath buildings in Central Italy. Important questions were not tackled, such as: the actual use of the baths by bathers; the location of baths within the urban fabric and the connection with specific buildings or infrastructures, such as theatres, fora, or city gates; the economics of construction of public urban bath buildings, including the strain put on local economies, the percentage of the financial input swallowed by the different components of the building, the maintenance and long-term running costs. Further research avenues could and should look into specific aspects of baths, some of which would require bringing scientific analysis of materials into the mix: purposely-made materials for baths (vaulting material has already been covered in large part by Lancaster,[631] but there remains work to be done on other material); the connection between production sites (kilns) and baths, and their respective roles in the elaboration of specific CBM for baths; the provenance of specific stones for heating systems, in particular the refractory stone slabs used for the *praefurnia*, and the supply and maintenance strategies; more experimental studies of the circulation of heat in heating systems, their efficiency, and the effect of different technological devices on it.

Finally, going back to the actual content of the thesis, the data gathered here should be regarded as the most up to date collection of evidence on the baths of Central Italy, and hopefully be used by experts working on baths in Italy as a repository of comparative material for a better understanding of their structures, allowing them to

[631] LANCASTER 2015.

steer clear of the dominance of *Pompeii, Ostia* and Rome in the discourse on Roman urban public baths in Italy and beyond.

Appendix I: List of water storage facilities connected to baths, and their supply source

Legend: US: Usable Surface; H: Height.

SITE – Storage facility	Cat. no	Source of water supply Dimensions (m)	Capacity (m³)	Notes
ARRETIUM	[To.G.08]	Aqueduct		
– Urban reservoir		ca. 23 x 23 (530 m²)	2,000?	
CALES, Central Baths	[Ca.01]	Groundwater		
– Deep well (R12)		Unknown, min. 6 m deep	–	
CASTELLUM AMERINUM	[La.G.9]	Aqueduct?		
– Tank		?4 x 3, H 3	35	Very approximate dimensions, taken by eyesight
– Small tank		?2.5 x 1.5, H 2	7. 5	
– Settling? tank		?1.5 x 1, H 2	3	
CASTRA ALBANA	[La.02]	Aqueduct		
– *Cisternoni*		45.50–47.90 x 29.62–31.90 (1436.5 m²)	10,130	Two aqueducts supplied the *Cisternoni*, which redistributed water to other tanks, storing water for the *nymphaeum* of SM della Rotonda (via Saffi) and Cellomaio (palazzo communale)
– Reservoir Via Saffi		30 x 4.20; H vault springing: 2.29	290	
– Reservoir under Palazzo comunale		Not preserved	—	
COSA	[To.01]	Rainwater		
– Cistern E of baths (R16)		17.20 x 13.30 (228 m²)	700–750	Rainwater collected in R16, passed in R15 via channel, lifted from R9 into R7 via bucket-and-chain device
– Cistern under E part of baths (R15)		15.18 x 3.80 (58 m²)	230	
– Four elevated tanks (R17)		Each 1.90 x 1.40	?	
CUMAE	[Ca.02]	Aqueduct		
– Reservoir directly NW of baths				

SITE – Storage facility	Cat. no	Source of water supply Dimensions (m)	Capacity (m³)	Notes
FIRMUM PICENUM	[Ma.G.24]			
– Urban reservoir		65 x 29		
– 2nd reservoir		28 x 12 x 5		
MISENUM	[Ca.03]	Aqueduct? Local spring?		
– Grotta della Dragonara		50 x 59 (3,000 m²)	check	
NEAPOLIS Fuorigrotta	[Ca.04]	Aqueduct?		
– Shaft with noria		1.85 x 6.10, H. 4.65	<20	Actual capacity lower than room volume since water level had to arrive to lower third of noria
NEAPOLIS Santa Chiara	[Ca.G.16]	Aqueduct?		
– Reservoir		12 x 8 (80 m² US)	235	Water level estimated at 3 m
PRIVERNUM	[La.08]	Aqueduct?		
– Dedicated tank on 2 levels		6.80 x 3.20. H lower level: 2.15–2.25		Calculated with water level at 2 m
TEATE MARRUCINORUM	[Ab.03]	Local spring + rainwater		
– Urban reservoir		60.13 x 14.45 (817 m² US)	2450	Waterproofing at 2.85 m. Alternatively, capacity of 3,350 m³, based on level of concretions on walls
VELIA South Baths	[Ca.09]	Local spring		
– Urban reservoir N of baths		ca. 20.50 x 8, H 4 m	642	
– Water tank (W1)		3.80 x 3.40, H preserved 0.85	26–39	Calculated with water level at 2–3 m
VELIA Vignale	[Ca.10]	?		
– Water tank NE of baths		4.50 x 3.50, H not preserved		

Appendix II: Formula for calculating the speed of water drainage in the pools of bath buildings

Application of Torricelli's theorem, corrected with a coefficient of discharge:

$$t = \frac{1}{Cd} \times \frac{S}{s} \times \sqrt{\frac{2h_o}{g}}$$

where:

t:	time (seconds)
Cd:	Coefficient of discharge (0.6272)
S:	horizontal section of reservoir (m^2)
s:	section of drainage pipe (m^2)
g:	gravity (9.81 m/s^2)
h_0:	water level at beginning of drainage (m)

Several simplifications were made:

- The possible slope of pools, usually very slight, was not considered
- The section of the drainage pipe was considered to be the smallest narrowest element in the whole drainage network

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