Logistics of Building Processes: The Stabian Baths in Pompeii

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When Pompeii was buried by Vesuvius in 79 AD, the city boasted three large baths and a series of smaller establishments. The construction of these baths required significant efforts, in terms of logistics, building material and technological skills, especially with regard to the necessary water management, heating system and vaulting. While building processes and construction techniques have received significant attention in scholarship on Pompeii[1], these have not yet been discussed specifically for Pompeian baths. This paper attempts to fill this gap, focusing on the Stabian Baths that were longest used of all Pompeian establishments. They are also the target of a new research project that is being carried out within the frame of the Excellence Cluster Topoi in Berlin and investigates the development, function, and socio-cultural context of the Stabian and Republican Baths.[2] Following a brief overview of the state of research, this paper will discuss preliminary results of the new project. In his monograph from 1979, Hans Eschebach proposed a development of the Stabian Baths in six phases from the 5th century BC to the Imperial period (fig. 1).[3] Eschebach's phase VI includes all of the many building measures carried out in the Imperial period. He did not discuss building logistics and reconstructed phases, which would have entailed numerous major constructional changes. For example, the porticoes of the palaestra (fig. 2: B/C), including the styblobates, drainage channels, columns, and roofs would have been modified and moved repeatedly: the eastern portico four times and the southern and northern porticoes at least twice. Similarly, the many changes of the bathing rooms between his phases IV and VI would have required the extension of two barrel-vaults: by about 4 m in the women's caldarium (fig. 2: IX), and about 1.50–2 m in the men's tepidarium (fig. 2: III). Since the patching of barrel vaults seems difficult, the entire vaults must have been rebuilt when enlarging the rooms.

The ongoing Topoi project has shown that Eschebach's building history requires significant revisions. The baths were only built after 130/125 BC (fig. 2). It is possibly to distinguish three large remodeling phases, dated to the years after 80 BC, when Pompeii became a Roman colony; to the early Imperial period; and to the years after a major earthquake in 62 AD. Inscriptions suggest that the Stabian Baths were built at public initiative and remained public property and responsibility until AD 79.[4]

The building history of the Stabian Baths has been investigated using different methods, including stratigraphic excavation and a comprehensive survey and analysis of all standing remains. The survey of architectural elements and decoration assessed features such as the relationship of walls to one another, differences in materials, mortars, and techniques, and the types of pavements, wall paintings, and stucco decorations. The chronology of building materials and techniques and their significance for providing rough chronologies of Pompeian structures remains subject to discussion.[5] But the combination of different

Published in: Michael Heinzelmann – Cathalin Recko (Eds.), Quantifying Ancient Building Economy, Panel 3.24, Archaeology and Economy in the Ancient World 23 (Heidelberg, Propylaeum 2020) 5–18. DOI: *https://doi.org/10.11588/propylaeum.634*

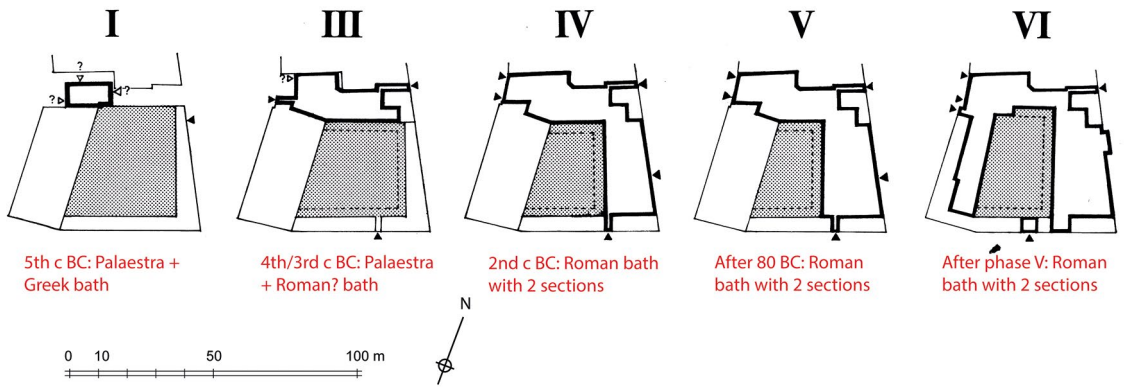

Fig. 1: Pompeii, Stabian Baths, development in 6 phases according to H. Eschebach (phase II is missing here).

methods, particularly including stratigraphic excavation, provides a solid foundation for reconstructing the major steps in the development of the Stabian Baths. Reconstructions also rely on the basic assumption that construction and particularly remodeling measures were planned economically and major changes avoided whenever possible. For various reasons, the building processes cannot be quantified any further, such as providing numbers regarding the required work force and man-hours, or required materials and their costs.[6] Important steps of the building process such as large-scale terracing and digging of foundations were identified in some trenches, but cannot be reliably estimated for the entire building in any of its phases. Standardized, calculable materials were only used in some phases and selected parts of the Stabian Baths. Materials were reused, from earlier phases of the baths and possibly also from other buildings, which makes it difficult, if not impossible, to calculate labor and costs. Finally, the methods and sources used for quantifying the economy of Roman construction remain debated and require a more comprehensive assessment than can be provided here.[7]

This discussion is therefore limited to an evaluation of the following general logistical questions for each of the large four phases of the Stabian Baths: How was the construction site accessed? Which materials (local, regional, imported) and techniques (with or without standardized materials) were employed? Which technologies and skills were required? Decoration is not systematically included because it cannot be fully assessed for the first three phases. It is clear, however, that most rebuilding measures required redecoration.

Construction

The baths were built after 130/125 BC at the southern end of insula VII 1. While they provided separate sections for men and women on a surface area of 2,400 m^2, the southwest corner of the lot was occupied by a house of 900 m^2 (fig. 3). Before construction of the

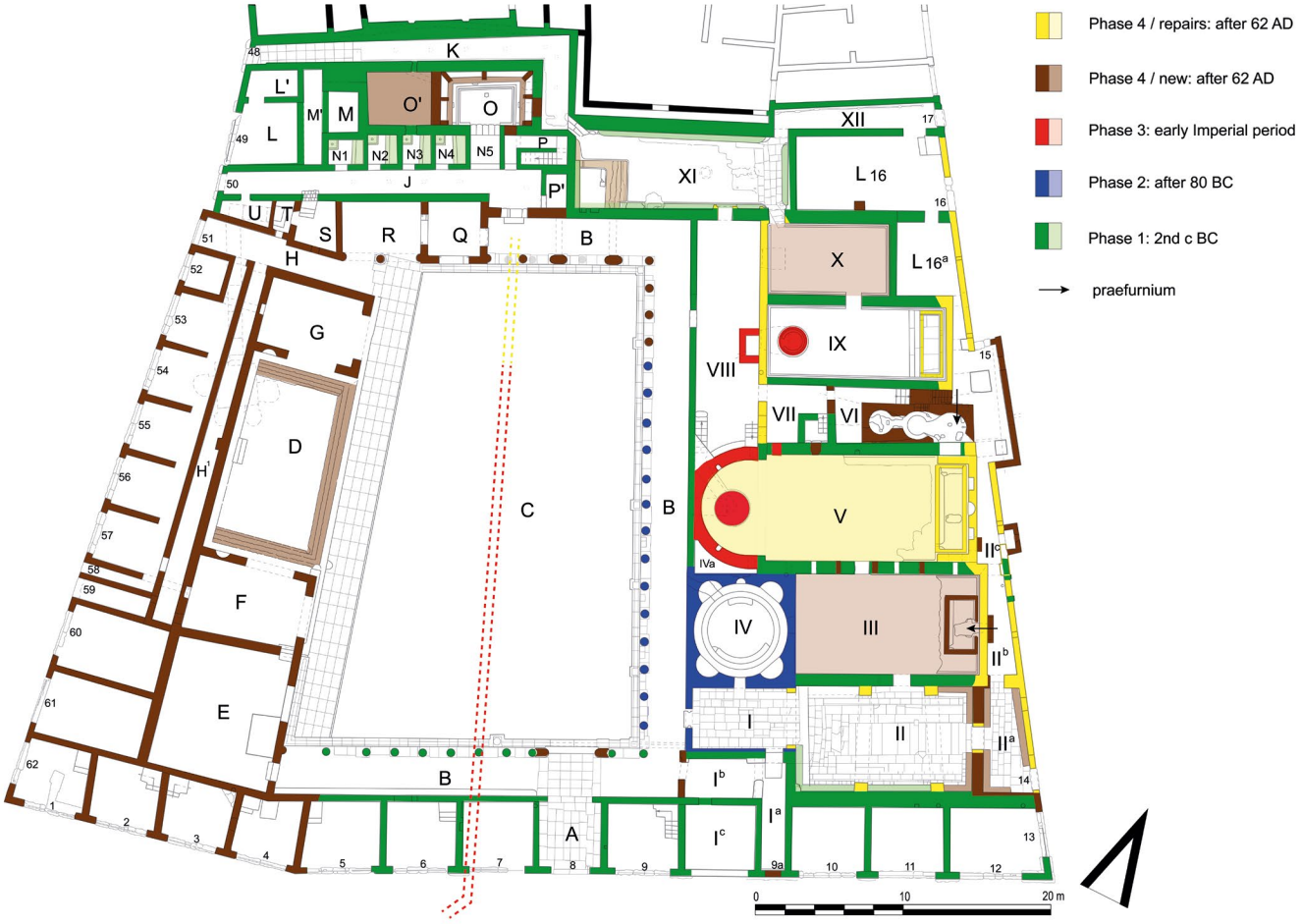

Fig. 2: Stabian Baths, phase plan.

baths, the terrain was barely developed, except for isolated water features. The lot was served by the two major arteries of the city, Via dell'Abbondanza and Via Stabiana. It was freely accessible from the west, south and east, while the lot to the north was already occupied by a house. As the terrain sloped from north to south and west to east, it was first systematically leveled and terraced. Then earth mortar foundations of up to 0.65 m depth were put in place for the major walls of the baths.[8] These earth mortar foundations were wider than the walls built on top of them, protruding for about 20–80 cm on both sides and dug into the levelled ground (fig. 4). The rising walls were predominantly made of opus incertum with locally available material, black lava and cruma di lava. Opus caementicium was also used for the large barrel vaults of the six bathing rooms (fig. 2: II, III, V, IX–XI), which were all maintained until AD 79. Architectural elements with a specific decorative function were made of high quality grey tuff that was quarried regionally, in the Sarno River plain.[9] This is true of the frames of the five entrance doors to the men's and women's sections (fig. 2: Ia, IIb, XII, K, J), large niches in the six bathing

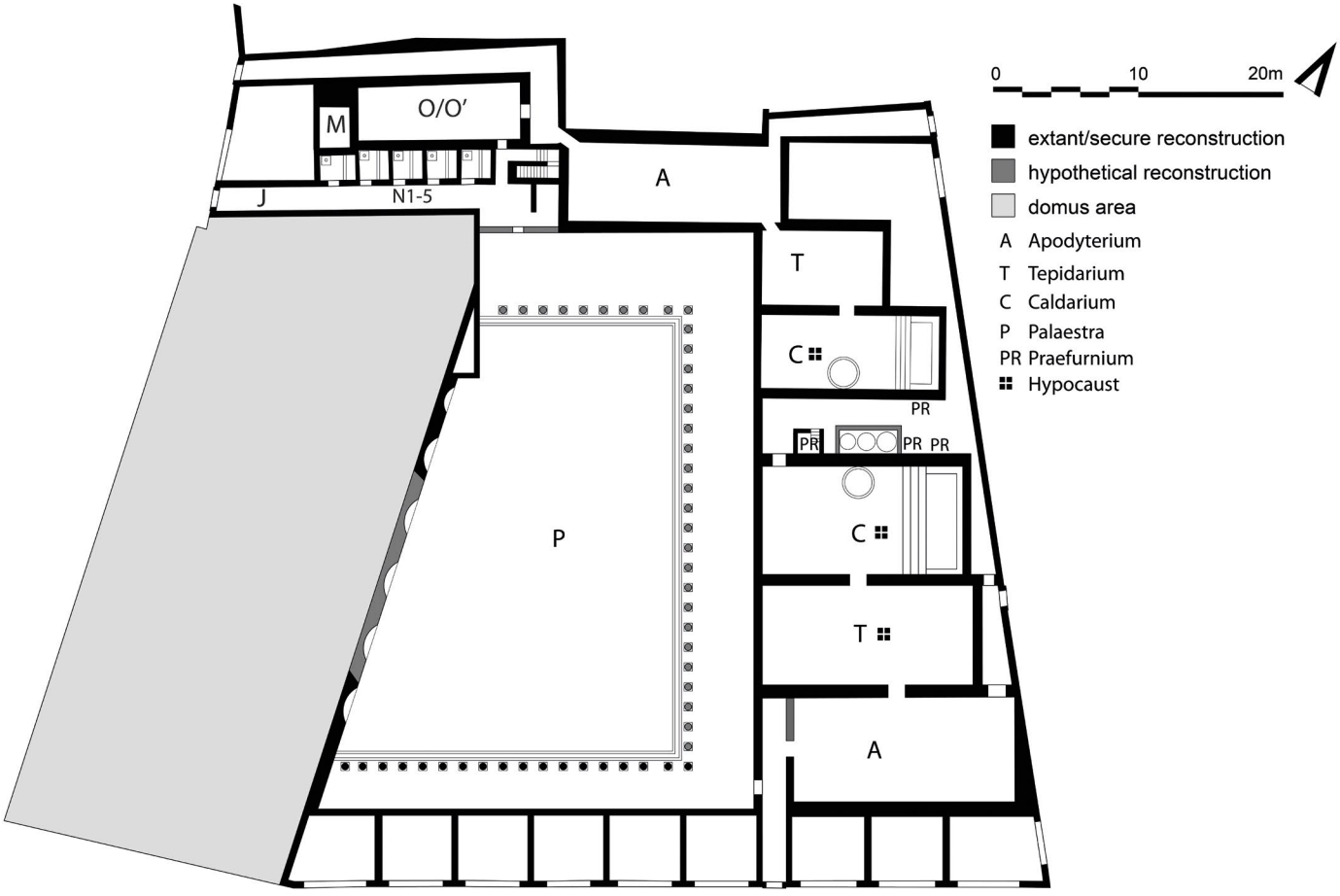

Fig. 3: Stabian Baths, reconstruction of the first phase.

rooms, the columns of the porticoes (fig. 2: B), and the pillars between the tabernae on Via dell'Abbonandza (fig. 2: 5–12).

Excavation and the analysis of standing remains imply a carefully planned, unified building program that also included the deep well and adjacent large water reservoir (figs. 2, 3: M; reservoir on top of O/O'), which constituted a major building effort and expense to ensure the required water supply of the baths.[10] The lot of the house in the southwest corner was obviously defined together with the lot of the baths, but the house was built together with the baths at the earliest or probably slightly later, and would not have blocked access to the site from the west during construction (fig. 3).

First Modernization

An inscription provides important information about the first modernizing remodeling process. It commemorates that "C. Ulius, son of Gaius, and P. Aninius, son of Gaius,

Fig. 4: Stabian Baths, trench in room L16a, earth foundation under the E wall of the women's tepidarium, from E.

duoviri for administering the law, by decree of the decurions, let contracts for the construction of a *laconicum* and a *destrictarium*, and for the restoration of the porticoes and the palaestra, from that money that, according to the law, they ought to have spent on games or in building. They saw to the work and also approved it."[11]

Some decades after construction of the baths, repairs were obviously necessary in two distinct parts, the porticoes and the palaestra. The original building had included porticoes to the east, south and possibly north of the men's courtyard. The term palaestra may refer here to the open courtyard, or the courtyard and porticoes together.[12] Excavation revealed several razed east-west oriented walls in the northern part of the courtyard, which clearly show that this area was remodeled several times (fig. 5). While the chronology of the walls has not yet been fully reconstructed, the northernmost (fig. 5: 1) has cautiously been assigned to the first phase (cf. fig. 3), serving as stylobate, and the central ones (fig. 5: 2, 3) to the remodeling after 80 BC, serving as stylobate and drain. Simultaneously, the eastern portico may have been relocated in this phase for about 3.00 m further west. The original stylobate slabs, columns and entablature of the north and west porticoes could have been reused in this remodeling, but the restoration of the porticoes and palaestra would still have required substantial works, rightly worthy of mention in a dedicatory inscription.

Fig. 5: Stabian Baths, trench in palaestra C, earlier east-west walls and drain, from W.

Eschebach convincingly identified room IV with the laconicum mentioned in the inscription, which was built at the expense of the men's tepidarium (fig. 2: III–IV).[13] The west wall of the tepidarium was demolished and re-erected about 1.00 m further east. The barrel vault was cut in the west, but did not have to be completely rebuilt. Accessibility to the new construction site via one of the two narrow entrances of the men's section (fig. 2: Ia, IIb) must have been difficult. The possibly substantial works carried out in the porticoes and palaestra, however, suggest that more convenient access was provided, for example by removing the back wall of one of the southern tabernae (fig. 2: 7, 8, 9). The required building material could have been stored in the open courtyard of the palaestra. While the well-preserved plaster on most of the inner and outer faces of the laconicum walls prevents full assessment, two features can be observed. First, the laconicum walls were at least partially made of opus reticulatum with cruma di lava, thus reflecting a change in available building techniques and a step towards standardization. The conical dome of the laconicum, a daring technical endeavor at the time, was made of opus caementicium. Second, the partition wall between the laconicum and the tepidarium was made of opus incertum with black lava and clearly reused material of the earlier tepidarium west wall including the blocks of grey tuff that framed the large upper niches of a frieze with double niches. In addition, the facing elements of the original incertum wall, as well as the rubble aggregate of its core, could have been recycled for the aggregate of the new wall.[14]

As the remodeling program of this phase was clearly confined to parts of the men's section, the women's section could easily have continued in use.

Fig. 6: Stabian Baths, E façade rebuilt after AD 62 with frames of fired bricks, from SE.

Connection to the Aqueduct

The connection of the baths to the public aqueduct enabled the development of bathing forms that required running water: a cold-water pool was created in room IV, transforming the laconicum into a frigidarium; two large labra with central fountains were set up on the western sides of the two caldaria (fig. 2: V, IX). While the women's original labrum was simply moved from the south wall to the west wall, the men's caldarium was extended with an apse for a new labrum by razing the original west wall. The daringly large apse was made of opus incertum with lava and sarno limestone and connected to the existing barrel vault. The connection between the original north and west walls and the apse was strengthened with fired bricks (opus latericium). The heating system in both caldaria was completely renewed, with partial use of standardized material: bessales for the pilae, bipedales for the floor above the pillars, and tegulae mammatae for the wall heating, while the floor of the hypocaust system consisted of roof tiles.[15] The socle of the men's labrum confirms the, admittedly sparse, use of fired bricks in this phase.

The building material required for these transformations could again have been stored in the courtyard, which was clearly affected by the remodeling process. A large drain, covered with an opus caementicium vault, was built in the center of the courtyard (fig. 5: 5). It ran under the back wall of taberna 7, which could have served as main access

to the construction site. The southernmost of the east-west walls in the northern part of the courtyard may have been built at this time, running over the newly built large drain. This suggests yet another remodeling of the northern portico (fig. 5: 4).[16] This was correlated with major changes of the courtyard's west wall and of the adjacent house, which was significantly remodeled, if not built in this period.

The third phase saw more important remodeling than the second and certainly required a complete shutting-down of the entire baths.

Earthquake Damage and Luxurious Renovation

After the baths and adjacent house had been significantly damaged during the earthquake of AD 62, the baths were repaired (fig. 2: yellow) and received new features (fig. 2: brown). The eastern façade and the eastern walls of most bathing rooms were largely rebuilt, from foundation level upwards, in opus incertum with mixed local materials and with the use of fired bricks to strengthen door and window frames as well as corners (fig. 6). The western walls of some bathing rooms (fig. 3: X–XI) were only rebuilt in the upper part in order to install large windows, again framed by bricks. The endangered vaults of the men's apodyterium and caldarium (fig. 2: II, V) had to be supported with brick arches, but otherwise remained intact. The vault of the apodyterium was also shortened in the east for the installation of a new vestibule (fig. 2: IIa).

Newly built features significantly contributed to enlarging and improving the baths (fig. 7). New heating systems were installed in both tepidaria, including floor and wall heating now completely made of standardized material (fig. 2: III, X). A new cold-water pool was installed in the women's apodyterium (fig. 2: IX), and a new warm-water pool in the men's tepidarium (fig. 2: III). The increased bathing standard also required a new praefurnium and furnace with three cauldrons (fig. 2: VI). All of the mentioned features were made entirely of fired bricks.[17]

The most significant modification was the complete demolition of the house, whose walls were razed to make room for a luxurious new addition to the baths: a large natatio flanked by two grotto-nymphaea and tabernae in the south and west. While the natatio was dug down deep below the floors of the house, the other features were built right on top of the razed walls and pavements of the house.

In this phase, the courtyard must have served as a major construction site. Large quarry pits were dug everywhere in order to access volcanic ash, which was particularly useful for making concrete.[18] These pits were then filled with building debris, probably from the structures destroyed by the 62 AD earthquake. Other material was reused in the partially remodeled courtyard, such as a Doric column of grey tuff that was transformed into a drainage channel (fig. 8). The main entrance to the men's section was transferred to a large taberna (fig. 2: 8/A) and monumentalized in correlation with the northern portico of the palaestra, which was only now moved to its current position. The large

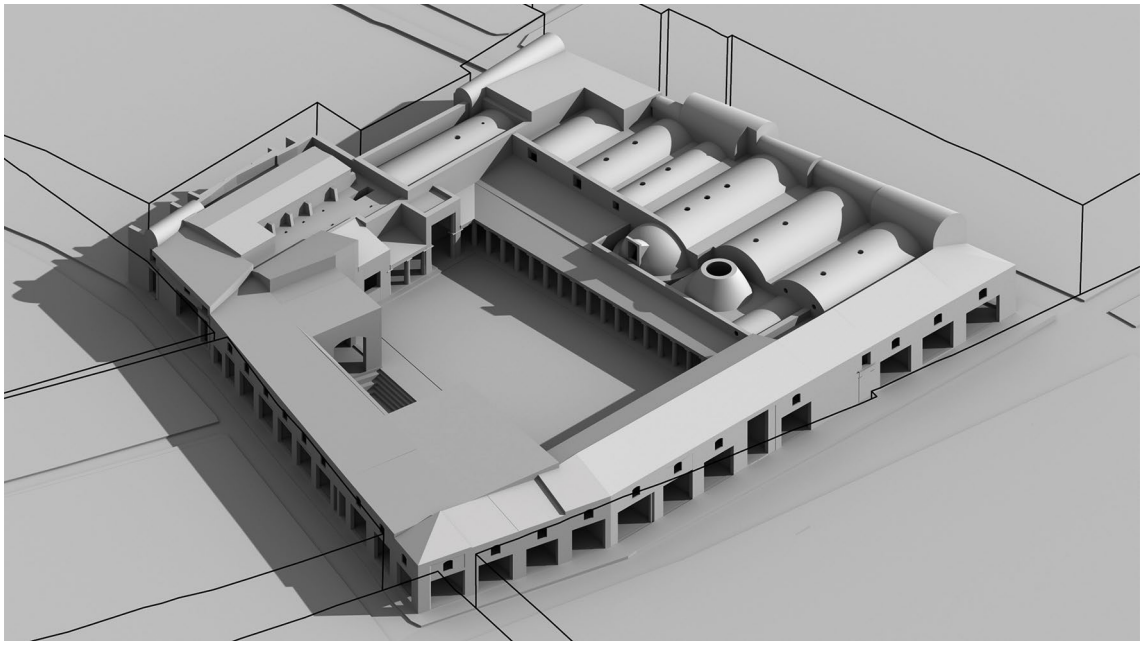

Fig. 7: Stabian Baths, 3D model of the baths after AD 62.

main drain in the courtyard had to be repaired in its northern part (fig. 5: 6), and it now needed to receive wastewater from a large newly built latrine (fig. 2: O).

The new natatio-nymphaea-tabernae complex included opus latericium and opus vittatum mixtum with fired bricks and small tuff blocks, but was still mainly made of opus incertum with local material, such as lava, sarno limestone and cruma di lava. The distribution of latericium and vittatum mixtum suggests that opus latericium was the more durable higher quality technique, used for the corners of the whole complex and features that had to resist water and heat. This phase also entailed a unified redecoration program with stucco decorations, wall paintings, opus tessellatum mosaics, and marble that was not locally available, but used quite abundantly for covering floors, pools, and walls.

Accessibility in this phase must have been easy because large parts of the eastern walls and the entire southwestern section were demolished. The baths must have remained closed during the major construction works, which may also have significantly hindered traffic in the adjacent streets.

Conclusion

If building efforts are evaluated in broad categories, the four building phases of the Stabian Baths can be classified as follows. Construction required the largest efforts, including the preparation of the terrain and the installation of all six bathing rooms with vaults

Fig. 8: Stabian Baths, E portico of the palaestra, Doric drum of grey tuff reused as drainage channel, from W.

(fig. 3). Key features of this original design, such as the position of the southern portico as well as the maximum extension of bathing rooms and vaults, were never changed in the following phases. Remodeling was motivated by decline and damage as well as newly available technologies and fashions. Improvements in the second phase were substantial and included the relocation of probably two porticoes (north, east) as well as the construction of two new vaulted rooms (laconicum, destricatrium). The remodeling of the third phase entailed even more changes, namely in vaulting, heating system, and water management. The fourth phase included a monumental building program that almost equaled the efforts of the original construction phase (fig. 7).

In all three remodeling phases, building measures were mostly, if not entirely concentrated on the men's section. The predominant building technique was opus incertum, used in all four phases with locally available materials. Prefabricated standardized materials were also employed in all four phases, but confined to architectural elements in the first phase and some opus reticulatum walls in the second phase. Fired bricks and standardized elements for the heating system became available in the third phase, and were much more abundantly used in the fourth phase. There is clear evidence that salvaged materials, including the marble slabs utilized for decoration, were reused in the second and fourth phases, similar reuse in the third phase seems probable. Accessibility was excellent for the major building processes in the first and fourth phase, but may have been unfavorably restricted in the second and third phase.

Public ownership of the baths will have facilitated control and regulation of access ways. All building processes were economically planned and carried out, with minimum efforts of rebuilding and reuse of material, which was well hidden by the decoration. Construction sites and related traffic as well as the closing of the

Stabian Baths during periods of renovation must have been noticeable in the urban landscape and life.

Notes

I am much indebted to all persons and institutions that supported research and fieldwork in Pompeii: the Parco Archeologico di Pompei with the Soprintendente Massimo Osanna and his colleagues; the Excellence Cluster Topoi; the research team of this project, including C. Brünenberg, J.-A. Dickmann, D. Esposito, A. Ferrandes, J. Hagen, T. Heide, A. Hoer, D. Lengyel, G. Pardini, C. Passchier, A. Pegurri, J. and M. Robinson, C. Rummel, M. Strauß, G. Sürmelihindi, C. Toulouse, and Kai Wellbrock; and all student volunteers whom I cannot list by name here. This article is based on an ongoing fieldwork project and thus includes preliminary reflections which may require revision after completion of the fieldwork.

[1] E.g. Dessales 2015; Mogetta 2016; Giannella 2017.

[2] Three of six campaigns, carried out between 2015 and 2018, investigated the Stabian Baths: <http://www.fastionline.org/excavation/micro_view.php?fst_cd=AIAC_4229&curcol=sea_cd-AIAC_10212> (22.06.2020).

[3] Eschebach 1979.

[4] Sundial with an Oscan dedicatory inscription, dated to 150–100 BC, Vetter 1953, no. 12; CIL 829, dated to after 80 BC; Trümper 2017a, 2017b. For the construction date of the baths, Trümper et al. 2019.

[5] E.g. Mogetta 2016; Anderson 2018, 530 f.

[6] For successful attempts, see DeLaine 1997; Volpe 2010; Bukowiecki et al. 2015; Maschek 2016; Bukowiecki –Wulf-Rheidt 2017.

[7] Barker 2010; Barker – Russell 2012; Russell 2013, 30–35. 228–232.

[8] The depth of these earth foundations could only be determined in one trench in room L16a, with 0.65 m. For the earth mortar, see in more detail Trümper et al. 2019, 143–145.

[9] For the provenance of stones used in Pompeii, Kastenmeier et al. 2010, 2014.

[10] This deep well is commonly identified as an older structure that was incorporated into the baths: Eschebach 1979, 6. 22. 27–31. 52 f. 56 f. 64; Schmölder-Veit 2009, 116 n. 22; 118 f.; discussion of the date in Trümper 2017b, 262.

[11] CIL X 829; translation Fagan 1999, 250 no. 61.

[12] For the use of the terms porticus and palaestra in connection with Roman baths, Taylor 2009.

[13] Eschebach 1973. Remains of the destrictarium, roofed with a barrel vault, were identified in fig. 2: IVa.

[14] Cf. Barker 2010, esp. 131.

[15] This floor is currently only visible in the men's caldarium. The phase plan fig. 2 cannot adequately show all changes carried out in phase 3.

[16] The possible reasons for the frequent relocation of the northern portico and reconstruction of the northern section in the various phases cannot be discussed in detail here.

[17] Further research will show whether these structures were made of locally or non-locally made bricks, and of new or reused bricks; cf. Dessales 2015.

[18] Robinson 2005.

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