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Wall Heating Systems in the Roman Period Lycian Baths -The Examples from Patara and Tlos-

F. Fatih GÜLŞEN*

The scope of this study is to explore in detail the applied to the wall heating systems of the Lycian baths and to identify the inter-regional relations from the architectural features based on new evidence from surface remains and from the excavation results[1] obtained from the baths at Patara (Fig. 1) and at Tlos (Fig. 2). This study is primarily based upon the following six baths, which are the most authentic and important amongst the 71 hitherto known examples from Lycia[2]: the Nero-Vespasian Baths (Fig. 3)[3], the Hurmalık Baths (Fig. 4)[4], the Central Baths (Fig. 5)[5] and the Small Baths (Fig. 6)[6] at Patara and the Palaestra Baths (Fig. 7)[7] and the Large Baths (Fig. 8)[8] at Tlos. According to the information published to date, no Lycian bathhouse dates to before the Claudian period when

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1 Out of the six baths forming the basis for the present study, the Hurmalık Baths in Patara and the Large Baths in Tlos are currently being excavated. The Hurmalık Baths were excavated from 1991 to 1997 and the excavations resumed under the direction of F. Alanyalı in 2005. The excavations at the Large Baths in Tlos were undertaken by F. F. Gülşen from 2005. Another important bathhouse complex recently excavated is at Rhodiapolis. The excavations at the Rhodiapolis Baths started and were completed during 2006.

2 Çevik – Varkıvanç 2004, 232.

3 Benndorf – Niemann 1883, 148; Kalinka 1920, 142-143. 148 no. 396; Bean 1978, 62; Bayburtluoğlu 1983, 62; Yegül 1992 (Large Baths) 258. 299. 300 fig. 391; Farrington – Coulton 1990, 55 ff; Farrington 1995, 156 ff. Fig. 17 cat. no. 38; Korkut 2003, 53. 445 ff.

4 Kalinka 1920, 142 plan no. E; Bean 1978, 86; Bayburtluoğlu 1983, 63 plan no. 5; Farrington – Coulton 1990, 55 ff; Işık 1990, 30; Işık 1991, 236; Çevik 1992, 393 ff; Yegül 1992 (Small Baths), 258. 299. 300. Figs. 392-393; Bulba – Kızgut 1993, 286 ff; Çevik – Kızgut 1994, 255 ff; Farrington 1995 (North Baths) cat. no. 41. 18. 109. 111. 160; Kızgut – Özhanlı 1996, 165 ff; Kızgut – Özhanlı – Aktaş – Gülşen 1997, 199-200; Kızgut 1998, 159-160.

5 Kalinka 1920, 142 Plan no. F; Farrington – Coulton 1990, 55 ff; Farrington 1995, cat. no. 40. 22. 108. 134; Korkut 2003, 445 ff.

6 Kalinka 1920, 142 (not designated as a bathhouse in the plan); Farrington – Coulton 1990, 59 ff; Farrington 1995, cat. no. 39. 19. 128. 129; Korkut 2003, 445 ff.

7 Wurster 1976, 34 fig. 7; Bayburtluoğlu 1983, 78-79; Farrington – Coulton 1990, 55 ff.; Farrington 1995 ("Baths A"), cat. no. 58. 10. 35. 130-132. 156. 165.

8 Wurster 1976, 34-35 Fig. 4; Bean 1978, 66-67; Bayburtluoğlu 1983, 79; Farrington – Coulton 1990, 63 ff; Yegül 1992 (Large Baths) 301 fig. 396; Farrington 1995 (Baths B), cat. no. 59. 20. 35. 112. 144. 145; Gülşen 2006 (in press).

the Lycian region was organised into a single province[9]. However, the bathhouse known as the Vespasian Baths at Patara is known to have been built by Nero together with the waterways of the city[10]. As a matter of fact, the presence of baths predating the reign of Nero should be expected in Patara with its special geographic and political position as a consequence of its being a port-city. In the light of these finds, the thesis that "there exists no bathhouse in Lycia predating the Flavian period"[11] is no longer valid.

The most primitive hypocaust system consisting of heating by means of a stove is documented in the first phase of the Olympia Baths dating from the end of the 5th century B.C.[12]. The hypocaust system in its true sense appears at Gortys in Arcadia towards the mid-3rd century B.C.[13]. The most effective form of the hypocaust system was first built by the Romans in the fourth phase of the Olympia Baths about 100 B.C.[14]. As the hypocaust only heated the floor, it is very difficult to reach and preserve the desired temperature, especially in the bathing rooms of the large baths built in the Roman period. In addition to the hypocaust, the interior of the walls were also heated during the Roman period in order to achieve the desired temperatures in the bathing rooms[15]. When one takes into consideration that "the hypocaust needs to go over 100 degrees in order to get 25 degrees in the caldarium when the exterior temperature is -5 degrees"[16], then the importance of the heating of the walls for the heating systems in bath houses becomes clear. The smoke and gases produced as a result of burning were discharged through the chimneys. The wall heating technique is archaeologically attested to in the caldarium of the Forum Baths and in both the caldarium and the tepidarium of the Stabian Baths in Pompeii, both dating from the early 1st century B.C.[17]. The earliest mature example of this system is first attested in the Suburban Baths in Herculaneum dating to the Late Republic or the Early Imperial period[18].

As archaeological excavations continue, our information on the hypocaust and the heating systems employed in the Lycian bath houses is increasing (Figs. 26, 30-31). In the Hurmalık Baths of Patara, the hypocaust was found beneath the pool to the south of the large arch to the west of the caldarium, as well as in front of an arched doorway opening south[19]. The brick pillars supporting the floor are either square or rectangular (Figs. 26, 30-31) and have an arched superstructure by the wall. The fact that an arched doorway in the middle of the south wall was built together with the upper level of the hypocaust and was closed in three different textures suggests this was the furnace for the baths. Three large

9 İşkan 2001, 21 ff; Şahin 2002, 19.

10 Stendon – Coulton 1986, 56-59.

11 Farrington 1995, 52 ff.

12 Schleif 1943, 12 ff; Kunze – Schleif 1944, 32 ff.

13 Ginouvès 1958, 58-77. 164-167; Ginouvés 1962, 126. 185. 198. 199. 206. 207 figs. 126. 153. 156; Brödner 1983, 10. 12. 15. 23. fig. T5a Plan Z 4; Heinz 1983, 47-48. figs. 35-37; Yegül 1992, 26. 48. 380. 384. figs. 26. 30.

14 Kunze – Schleif 1944, 51-56; Brödner 1983, 8 ff, 23. 75. 82. Z 1, 2, 3; Heinz 1983, 7. 22. 37. 41-47, 189 figs. 333-34; Yegül 1992, 48. 357. 374. 376-379 figs. 474-476

15 Adam 1984, 287-294; Yegül 1992, 94; Farrington 1995, 101.

16 Abbasoğlu 1982, 28.

17 Eschebach 1979, 41 ff; Yegül 1992, 363.

18 Brödner 1983, 61. 62 fig. T36a; Heinz 1983, 52 ff. fig. 61. 62; Yegül 1992, 385 fig. 66 no. 102; Farrington 1995, 101; Pappalardo 1999, 229 ff.

19 Özhanlı 1997, 57.

flat metal pieces recovered from here prove the presence of a cauldron[20]. The door that opens to the South is at the same level as the hypocaust and was made during the second phase of construction.

The wall heating systems in bath houses aimed to optimise the use of the heat produced, through carrying it in the walls, thus increasing the temperature in the baths. Wall heating systems first used *tegulae hamatae/tegulae-mammatae* (Figs. 9-12 - top row)[21]. Vitruvius had recommended the use of *tegulae mammatae* for keeping the walls dry and also to prevent the spread of damp and humidity in the rooms[22]. They were later used in the wall heating systems. Large square terracotta plaques - those in the corners also had small feet - (*tegulae mammatae*) were fitted to the walls using metal *pins* (Figs. 9-12) and the hot air was circulated in the gap between the wall and these plaques (Figs. 11)[23]. The special plaques were mounted on the wall surface using T-shaped clamps, pins or rarely terracotta pins (Fig. 10). The *tegulae mammatae* plaques are located about 5 cm away from the surface of the wall (Figs. 9-12). Taking into consideration that heating is low in narrow surfaces, *tubuli* of 10-15 cm. in average width, which are costlier but more efficient than *tegulae mammatae*, were preferred in the large bath complexes and *tubuli* are more popular in the large Roman bath complexes covering large areas. However, there are also examples of *tubuli* only 6 cm. thick[24].

In addition to the dowel holes for metal pins for fitting the *tegulae mammatae*, there are other dowel holes for fitting the *marble plaques* onto the walls (Fig. 20)[25]. Usually on the interior side of the walls of Lycian baths there are numerous regularly carved dowel holes for metal pins (Figs. 19 ff). These holes usually measure 1.5x1.5 cm. or 2x2 cm. and are 2-3 cm. deep. They are generally found on the walls of the frigidarium, tepidarium and caldarium and sometimes on the exteriors of the baths in order to attach the marble or terracotta plaques to the walls. In many baths the remains of metal pins in the holes remain visible (Fig. 20). The dowel holes for securing the marble facing measure 2x2 and 3x3 cm. in the Large Baths at Tlos, Hurmalık and the Central Baths at Patara, as well as at the Vespasian and the Nisa Baths at Kadyanda; while those in the Small Baths at Patara and the Palaestra Baths at Tlos are relatively smaller[26]. The vertical and horizontal distances between the holes are fixed at the Hurmalık Baths in Patara and the Kadyanda Baths, while they are not fixed at the Large and the Nisa Baths in Tlos, and at other baths these distances are both fixed and variable.

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20 Kızgut 1998, 159-160.

21 Spitzelberger 1968, 65 ff; Eschebach 1979, 41 ff. Fig. 8-12. 19. 20. 49a. 49b; Heinz 1983, 189; Farrington – Coulton 1990, 66; Yegül 1992, 363.

22 Vitruv VII. 4, 2.

23 Crema 1959, 71-73; Abbasoğlu 1982, 23-24; Brödner 1983, 21; Heinz 1983, 189 ff; Adam 1984, 292-293 figs. 630-631; Biers 1985, 46. 49. 53. 55. 78. 99. 103 no. 113-115; Farrington – Coulton 1990, 55; Yegül 1992, 363 ff. Figs. 455-456; Farrington 1995, 101 ff; Martin – Guiral 1999, 251 ff; Korkut 2003, 458.

24 Farrington – Coulton 1990, 66 no. 49.

25 Farrington – Coulton 1990, 61; Farrington 1995, 111 ff List 18; Korkut 2003, 457.

26 There are no holes to support a marble or terracotta plaque facing in the caldarium and frigidarium of the Palaestra Baths in Tlos. Such holes of 2x2 cm. have been attested to only on the interior side of the east wall of the room (tepidarium ?) to the west of the bathhouse, which is entirely in ruins, and on the exterior west wall of the caldarium and in a small area over the large arch in the middle.

The most important and common material employed for wall heating systems was the *tubuli* (Figs. 12-14)[27]. Perforated bricks (water pipes) were generally called *tubuli* in ancient literature[28]. There are *tubuli*-shaped holes in the wall surfaces to carry the circulating heated air. This method facilitates the heating of the walls, by placing side by side along the wall the perforated bricks that are connected to the hypocaust.

It is possible to see the *tubuli chimneys* above the cornices (horizontal beams, lintels) and vault tympana in the transition area to the superstructure. These are also terracotta elements placed at an angle in order to prevent the rain water from entering into these chimneys[29]. In essence, *tubuli* are sort of a chimney for the wall heating systems, they function like fireplaces and were very effective in heating these rooms[30]. The perforated bricks, which support their own weight, were concealed under plaster (Fig. 14). *Tubuli* bricks were fitted to the wall surface using either or both mortar and metal clamps[31] and were covered with a mortar layer 3-6 cm. thick faced with stucco (plaster) or with marble plaques (Fig. 14)[32]. Consequently, the room temperature was increased rapidly from both the floor and the walls, heating the room[33], with a layer of these perforated bricks between the main body wall of the bathhouse and the marble facing[34]. The *tubuli* system was extensively used from the 2nd century B.C. through to the 1st century A.D. and the perforated bricks protruding out of the wall surface are in a variety of types (Figs. 12-14)[35], the quadrangular terracotta pipes were first used during the reign of Augustus[36].

In addition to the *tegulae mammatae* and *tubuli*, terracotta pins (nails) also constitute a wall heating system element (Figs. 15-17)[37]. The *metal pin-nail* holes for *tegulae mammatae* and marble facing are small and shallow while those for the *terracotta pins* are both large and deep (Figs. 19 ff). Holes for metal pins are found in all the interior spaces including the frigidarium and apodyterium, even on the exterior facades but the holes for *terracotta pins* are found only in tepidarium and caldarium which need to be heated[38]. Although not all the Lycian baths have the wall heating system, holes for *terracotta pins* have been found in 14 baths in 10 Lycian towns to date[39]. Holes for terracotta pins for heating purposes have been found in the following Lycian baths: the Nero-Vespasian Baths

27 Kunze – Schleif 1944, 68 ff. fig. 35; Abbasoğlu 1982, 23; Brödner 1983, 21 fig. T 12a, T 48a, Z 6, Z 52; Heinz 1983, 189, Res. 195. 197; Adam 1984, 287-294; Biers 1985, 53. 102. no. 116 fig. 31; Farrington – Coulton 1990, 63 ff; Yegül 1992, 363 ff. fig. 442. 443. 448. 454. 455; Farrington 1995, 101 ff; İnan 1998, 38 ff. fig. 114.

28 Spitzelberger 1968, 104 ff; Heinz 1983, 189.

29 Abbasoğlu 1982, 23 ff.

30 Heinz 1983, 189 figs. 195. 197.

31 Yegül 1992, 363 no. 21.

32 Yegül 1992, 363 figs. 442. 443. 454. 455b.

33 Baatz 1979, 40 ff.

34 Heinz 1983, 189.

35 Brödner 1983, 19.

36 Brödner 1983, 18 z6.

37 Hayes 1983, 132 ff. fig. 13; Coulton 1987, 209 figs. 3-4; Farrington – Coulton 1990, 56 ff; Sackett 1992, 245 ff. fig. 217; Yegül 1992, 363 ff. fig. 455 c; Farrington 1995, 101 ff. List 14; Radt 1999, 144 ff. fig. 88; Korkut 2003, 445 ff.

38 As an exception, holes for *terracotta pins* have also been attested in the frigidarium of the Nero-Vespasian Baths of Patara? These holes, very few in number, are not aligned in any determinable fashion.

39 Farrigton – Coulton 1990, 59 List 1; Farrington 1995, 105 List 14.

(Figs. 19-22)[40], Hurmalık Baths (Fig. 23-31)[41], Small Baths (Figs. 33-38)[42] and the Central Baths (Fig. 32)[43] at Patara, in the Palaestra Baths at Tlos (Figs. 39-49)[44], the Arif Baths at Balboura (Fig. 15)[45], the Vespasian Baths at Kadyanda[46], the Antoninus Pius Baths[47] and the North Baths[48] at Kyaneai, the Limyra Baths[49], the MI 1 Baths at Oinoanda[50], the ZB/ZC Baths at Phaselis[51], in the Rhodiapolis[52] and the Sidyma Bath houses[53].

The holes for terracotta pins in Lycian baths measure on average 12x14 cm. and are 5-7 cm. deep (Figs. 19 ff). The holes measure 7-20 cm. horizontally, 5-23 cm. vertically and 4-12 cm. in depth; they are placed 26-82 cm. apart horizontally and vertically are 33-96 cm. apart[54].

The holes for terracotta pins are frequently encountered within Lycian baths and can be situated in a regular or an irregular pattern. For example, at the Hurmalık (Fig. 23), Small (Figs. 33-35) and Central Baths at Patara, as well as in the Palaestra Baths at Tlos (Figs. 39-47), these holes are placed at regular intervals; while in the Nero-Vespasian Baths at Patara (Figs. 19-22) they are spaced regularly in some places but irregularly in others. In a single room, there are both heated walls and unheated walls; therefore, these pin holes can be found all over the wall including the arches or only in certain parts of it. For example, the arched doorway in the middle of the east wall of the caldarium in the Nero-Vespasian Baths at Patara is flanked by holes for terracotta pins on either side but there are none on its arch (Fig. 19). On the other hand, both the walls and arches of the

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40 Benndorf – Niemann 1883, 148; Kalinka 1920, 142. 143. 148 no. 396; Bean 1978, 62; Bayburtluoğlu 1983, 62; Farrington – Coulton 1990, 60 List 1; Yegül 1992, 258. 299. 300. Fig. 391; Farrington 1995, 156 cat. no. 38 Pl. 17. 154. 155.

41 Kalinka 1920, 142 (shown as E in the plan); Bean 1978, 86; Bayburtluoğlu 1983, 63 (plan no. 5); Farrington – Coulton 1990, 60 List 1; Yegül 1992, 258. 299. 300 figs. 392-393. 422; Farrington 1995, 158 cat. no. 41. Pl. 18. 109. 111. 160.

42 Kalinka 1920, 142; Farrington – Coulton 1990, 60 List 1; Farrington 1995, 157 cat. no. 39, Pl. 19. 128. 129.

43 Kalinka 1920, 142; Farrington – Coulton 1990, 60 List 1; Farrington 1995, 157 cat. no. 40.

44 Wurster 1976 (Baths A), 34 Fig. 7; Bayburtluoğlu 1983, 78-79; Farrington – Coulton 1990 (Baths A) 60 List 1; Farrington 1995 (Baths A) 161 cat. no. 58 Pl. 10. 35. 130-132. 156. 165.

45 Coulton 1987, 209 Figs. 3-4; Farrington – Coulton 1990, 55-59 List 1; Farrington 1995, 151 cat. no. 12 Pl. 25. 195.

46 Benndorf – Niemann 1883, 142. 148; Kalinka 1920, 240. 241 no. 651; Bean 1978, 44-45; Wurster 1980, 32 fig. 2; Bayburtluoğlu 1983, 83; Farrington – Coulton 1990, 59 List 1; Farrington 1995, 105 List 14 cat. no. 14 Pl. 3, 117, 123, 200.

47 Bean 1978, 109; Farrington – Coulton 1990, 60 List 1; Kupke 1993, 13-16; Farrington 1995, 105 List 14 cat. no. 19 Pl. 4. 114. 124.

48 Kupke 1993, 11 fig. 4 no. 15 (designated a library).

49 Wurster 1976, 23-49; Farrington – Coulton 1990, 60 List 1; Farrington 1995, 153 cat. no. 26 Pl. 16. 158.

50 Bean 1978, 172 Fig. 96; Farrington – Coulton 1990, 60 List 1; Farrington 1995, 155 cat. no. 34 Pl. 6. 33.

51 Bean 1978, 151; Bayburtluoğlu 1984, 310-312; Farrington – Coulton 1990, 60 List 1; Farrington 1995, 159 cat. no. 44 Pl. 13.

52 Farrington – Coulton 1990, 60 List 1; Farrington 1995, 160 cat. no. 48. Excavations at Rhodiapolis were initiated under the direction of N. Çevik in 2006 and the digs in the bathhouse were completed during the course of the first season's excavations. The results of these excavations are in the process of being prepared for publication.

53 Benndorf – Niemann 1883, 58 Fig. 40 Pl. XII; Kalinka 1920, 60; Bean 1978, 81; Wurster 1980, 32; Bayburtluoğlu 1983, 71; Farrington – Coulton 1990, 60 List 1; Farrington 1995, 160 cat. no. 50 Pl. 14. 34. 157.

54 At the Palaestra Baths at Tlos, the dimensions of the holes for the terracotta pins are 18-20 cm. horizontally and 11-12 cm. vertically with a depth of 9.5-10 cm.. The holes are placed 65 cm. apart horizontally and 40 cm. apart vertically from each other. On the other hand, Farrington and Coulton, who have contributed greatly to our knowledge of bathhouse architecture and heating systems published the following measurements for the terracotta pins holes of the same bathhouse: 23 cm. horizontally and 9 cm. vertically with a depth of 5 cm; the holes are 28-50 cm. apart horizontally and 49-50 cm. apart vertically. There is a consequently a considerable difference in the reported dimensions of these holes.

North Baths in Kyaneai have such holes. In the Hurmalık Baths at Patara, these holes are found quite extensively on the west wall of the tepidarium (Fig. 23) and the east wall of the caldarium (Fig. 29) while on the south, north (Figs. 28-29) and west walls (Figs. 25-26) they are fewer. As with the dimensions, the shapes of these holes also vary. On the same wall there may be small or large rectangular holes alongside square ones or rectangular ones with rounded corners. They may be found in the middle, top, bottom or sides of a stone block (Fig. 18). Beside the individual holes, there may be double holes side by side or one on top of the other, or even triple holes located diagonally (Fig. 18)[55].

In the caldarium and tepidarium of the Palaestra Baths at Tlos there are holes for *terracotta pins* in the arched or flat *niches* (Figs. 39-49). Each niche is connected to the hypocaust individually *forming a panel; this is a unique feature of the Palaestra Baths of Tlos in Lycia.* It is possible to see the traces of the terracotta plaques covering over these *terracotta pins* in all of the niches (Figs. 43-45) and the surviving terracotta pipes in the chimneys (Figs. 47-48). The only niche in the caldarium is in the north wall and it measures 4.75 m. wide and is 1.20 m. deep, having a visible height of 4 m. (Fig. 39). Over the niche there are chimney canals. Apart from the niche, there are numerous holes for *terracotta pins* in the walls of the caldarium. Even the jambs and lintel of the doorway in the east of the room has holes for *terracotta pins* providing evidence of the extensive heating in this chamber. In the tepidarium, the holes for terracotta pins are found in two arched niches in the north wall (Figs. 47-48), in a large niche in the east wall (Fig. 40) and in three niches – one arched and the other two having a flat top – in the south wall (Figs. 41-44,49)[56]. The arched northern niches of the tepidarium measure 2.10 m. wide, are 1.20 m. deep and have a visible height of 3 m. above the earth filling. In the south wall, the south-eastern-most niche measures 2.55 m. wide, is 0.50 m. deep and has a visible height of 5 m.. The niche to the west of the large arch in the south wall of the tepidarium measure 2.35 m. wide, is 0.40 m. deep and has a visible height of 4.85 m. (Figs. 41-42). The large arched niche in the east wall of the tepidarium measures 6.20 m. wide, is 1.90 m. deep and is approximately 5 m. high (Fig. 40). It is possible to see the traces of the plaques covering over the *terracotta pins* on the walls of all the niches (Figs. 43, 45, 47). As is understood from the measurements given above, there is a distance of 40-50 cm. between the *holes for the terracotta pins* and the 2 cm. deep grooves for fitting the plaques over the pins encircling the niches – both arched and flat-topped. As no other Lycian bathhouse has heating within the niche panels, the Tlos example is evaluated separately. The pin holes in the niches are 9.5 cm. deep. Therefore, the distance between the pin holes and the plaques should be about 15 cm. Based on the grooves for fitting the plaques, it can be estimated that these *terracotta pins* were 50-60 cm. long. Although this situation does not look possible technically, the dimensions of the *pin holes* in the niches are quite large[57]. As the Palaestra Baths of Tlos have not as yet been excavated, we do not have any example of a

55 At the Nero-Vespasian Baths in Patara, the holes are found individually or as a series of two in the caldarium, while they are found individually or a series of two or three placed side by side or diagonally on the south wall of the tepidarium.

56 The Palaestra Baths of Tlos has niches not only in the heated chambers such as the caldarium and tepidarium but also in the unheated chambers. There are two niches in the east wall of the frigidarium, one niche in the north-east of the south chamber which is in ruins, and two niches on the exterior of the north wall of the bathhouse facing the Palaestra (see Fig. 9).

57 See fn. 54.

terracotta pin to hand. It is possible to see the regular chimney canals in all of the niches (Figs. 41-44, 47-48). In the chimney canal of the northwest niche of the tepidarium traces of the terracotta pipe and fire are still visible (Figs. 47-48). The dimensions of the pins and the distances between them are close to each other, both on the walls and in the niches. Some of the pin holes in the niche to the west of the large arch in the south wall of the tepidarium were made smaller through infilling with mortar (Figs. 41-42). Thus, it can be inferred that these pins were not produced to any standard size. Indeed, the holes in the caldarium are narrower and rectangular (Fig. 39), while those in the tepidarium are close to a square and wider (Figs. 40-49).

The terracotta pins were placed horizontally in these holes and secured with mortar (Fig. 17). The terracotta plaques were placed between the two reel-shaped discs forming the head of these pins (Figs. 15-17)[58]. These pins are not themselves visible as they are between the wall and the plaques (Fig. 17)[59]. Thus, an air gap is formed between the body of the wall and these plaques (Fig. 17). This air gap is connected to the hypocaust below and this gap can be considered an extension of the hypocaust. As with the other elements of the wall heating system, the aim in employing these terracotta pins was to keep as much of the hot air in this space between the wall and the terracotta plaques and for as long as possible. These terracotta plaques were further faced with mortar and marble plaques (Fig. 17)[60].

The terracotta pins are also called brick pins, spit or distance-keepers and their lengths vary from 18.5 to 25 cm. (Figs. 15-16)[61]. The disc forming the head of the pin has a diameter of approximately 10 cm.. The pins usually have a round body with rectangular, square or round terminations (Figs. 15-17)[62]. The terracotta pin uncovered at Balboura has an orange-buff colour (Fig. 15), while those from the Hurmalık Baths at Patara have a vivid red, reddish yellow or even a brown colour; thus we know that at least four colours of terracotta were employed[63]. The pins have a variety of dimensions and colours suggesting they must have been produced at different workshops and were made especially for the holes that they would fit into.

There exist no fixed Roman dimension for the plaques covering the wall heating system elements such as *tegulae mammatae, tubuli, terracotta pins* and *chimneys*; however, in Lycia, they can be square in shape, measuring approximately 8 inches (20.32 cm.), 1.5 feet (50x50 cm.), 2 feet (66x66 cm.), or rectangular, sometimes with a ratio of 1:2, 2:3 or 4:5 between their widths and lengths and they can be located horizontally or vertically[64].

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58 Coulton 1987, 209 Figs. 3-4. The basics of the *terracotta pin* found in the course of the 1986 survey at Balboura and how it was used have been published in detail by Coulton in 1987 and by Farrington – Coulton in 1990.

59 The terracotta pins found in the caldarium in the course of excavations at the Hurmalık Baths of Patara carry a thick mortar residue around the groove in the knobs. Thus, it is understood that these pins were concealed entirely under the facing plaques and mortared plaster and were not visible from outside. See Radt 1999, 144 ff. fig. 88; Korkut 2003, 445 ff. no. 48 fig. 10.

60 Farrington – Coulton 1990, 59; Yegül 1992, 363; Radt 1999, 144 ff. fig. 88; Korkut 2003, 445 ff.

61 Balboura: Coulton 1987, 209 figs. 3-4; Farrington – Coulton 1990, 56 fig. 2 Pl. Va-b; Farrington 1995, 104 fig. 195. Pergamon: Radt 1999, 144 ff; Patara: Korkut 2003, 455 fig. 10.

62 Farrington – Coulton 1990, 55 fig. 2.

63 Balboura: Coulton 1987, 45 ff fig. 2; Farrington – Coulton 1990, 57. Patara: Korkut 2003, 456.

64 The horizontal and vertical distances between the pin holes observed in the Lycian baths vary. The minimum and maximum values are as follows: the horizontal distance between the holes is approximately 25 cm. at the Nero-

The plaques for the terracotta pins must have been specially produced having a particular dimension, based on the dimensions of the bathhouse walls, as well as the horizontal and vertical distances between the holes for these pins. The *tegulae mammatae* plaques have holes in their corners in order to fix them with iron *pins* to the wall, while the plaques for *terracotta pins* have their corners cut to facilitate the insertion of the *pins*[65].

When using *terracotta pins*, the corners of the plaques must match the locations of the pins, as also the length of the pins and depth of the holes for them must match accordingly (Fig. 17). The handicap in employing this system is that, on one side, the pins must be secured to the wall with mortar, while, on the other side, they must hold the plaques firmly. It is a difficult task to use hundreds of such pins for only a medium-sized bathhouse. On the other hand, the *tubuli* system has a sturdier form and the perforated bricks carry their own weight, which is an advantage; but, it is difficult to make elbows with them and then rejoin them safely over wide distances, around wall corners, arches and niches. In addition, the problem of obstruction due to smoke and the accumulation of soot is observed more frequently with the perforated bricks and pipes than with the *terracotta pins*.

The chimneys of the wall heating systems are seen above the projecting cornices of numerous Lycian baths as in the Nero-Vespasian (Fig. 22), Hurmalık and Small Baths at Patara (Figs. 34-38), at the Palaestra (Figs. 43-44, 49) and Large Baths (Figs. 50-53, 57-58) at Tlos, at the Antoninus Pius Baths at Kyaneai and at the Limyra Baths. The bottom sides of the projecting cornices of the Nero-Vespasian, Hurmalık and Small Baths at Patara are carved in a concave form, forming a semicircular route to facilitate the movement of the hot air to the chimneys. The cornices of the Large Baths at Tlos project, but their bottom sides are flat, while those of the Palaestra Baths are flat at the bottom and are angled at the top. At the Hurmalık (Figs. 26-27) and Small Baths (Figs. 34-38) at Patara and in the Large Baths (Figs. 50-58) at Tlos, it is possible to see the canal sockets between the cornices, opening into the chimneys[66]. The cornices of the Small Baths carry the chimney canals coming from the *terracotta pins*; those of the Large Baths carry those coming from the *hypocaust* if there was no wall heating or from the *tubuli*? if there was wall heating; those of the Hurmalık Baths carry the chimney canals coming from both the *terracotta pins* and from the *hypocaust*. The cornices originally carrying the weight of the vaulted superstructure became an outlet suitable for the chimney sockets of the wall heating systems.

The vertical canals above the cornices along the long side walls of the caldarium and tepidarium (Figs. 54, 57-58) and those in the vault tympanum of the short northeast wall (Figs. 50-53) of the Large Baths at Tlos (Fig. 8) must be considered chimney canals coming directly from the hypocaust or as *tubuli chimneys* if there was a wall heating system

Vespasian Baths of Patara and 80 cm. between the holes on the east wall of the caldarium of the Hurmalık Baths of Patara; the vertical distance is approximately 35 cm. on the east wall of the caldarium of the Nero-Vespasian Baths of Patara and approximately 95 cm. in the caldarium of the Small Baths of Patara. In addition to the differences between the baths, the different pinhole dimensions found on the same wall of a bathhouse suggest that the facing plaques did not have any standard size. For the dimensions of the plaques see Farrington – Coulton 1990, 61.

65 Farrington – Coulton 1990, 65.

66 At the Large Baths in Tlos, protruding cornices (horizontal beam, lintel) are found only on the northeast walls of the caldarium and tepidarium. Although the cornice does not protrude out on the northwest and southeast walls, it carries chimney canals.

employed[67]. Although there are no holes for *terracotta pins* or grooves for *tegulae mammatae* in the Large Baths at Tlos, small holes for pins to secure the marble facing are found on the walls (Figs. 57-58) and *chimney canals* placed at a distance from each other are found on the vault tympana and inside the cornices. There are no chimney canals on the south facade, which faces the sun and has large windows. On the north vault tympana of both the caldarium and the tepidarium, chimney canals – one in the middle and one on the ends – can be followed, up to the top of the vaulted superstructure (Figs. 50-51, 53)[68]. Terracotta pipes must have been placed in these chimney canals and then plastered over. Chimney canals extending through both the cornices and the arches have been detected in the Lyrbe-Seleukia Baths (Fig. 59). In the Large Baths, only chimneys are found, no other wall heating system elements and the chimney in the northwest of the caldarium provides evidence for extensive heating here (Figs. 55-56)[69]. However, this chimney is found in an arched niche which opens to the outside via a window (Figs. 55-56). In the Palaestra Baths there are also chimneys in arched niches (Figs. 39-49); however, these niches are blind niches in the walls, without any window openings, that also have *holes for terracotta pins* for heating purposes. In the Large Baths, as the windows would not be blocked, it does not seem possible that *tubuli* elements of perforated bricks were placed in these arched niches. It is also not possible to be certain of a wall heating system here, as these chimneys could also be joined with pipes in order to discharge the smoke and gases from the hypocaust. The other chimney canals in the vault tympana and cornices may also have been directly connected to the hypocaust. The Large Baths in Tlos were probably not furnished with a wall heating system. In case there was an element of wall heating systems at the Large Baths in Tlos, this must have been the *tubuli* -despite the lack of any remains belonging to the perforated brick - because there are no traces indicating the use of *terracotta pins* or of *tegulae mammatae.* Although there is no Lycian bathhouse that is known to have been furnished with *tubuli*, the Large Baths in Tlos is certainly a candidate.

The chimney canals of the Hurmalık, Central and Small Baths at Patara are found in the same rooms as the terracotta pins but upon different walls (Figs. 23-29, 31). These two different elements are used simultaneously in the same room of a bathhouse to warm up different walls. Hence, it is possible that both systems were planned together during the course of construction. There exists also an example where both *tegulae mammatae* and *tubuli* were employed in the same bathhouse[70]. However, for the time being, there is no known bathhouse where terracotta pins are employed together with *tubuli* or *tegulae mammatae.* When the parallels between the *terracotta pins* and the *tegulae mammatae* is taken into consideration, it will not be surprising in the future to find baths where these were employed together. It will be then be understood how, where and when the transition from the earliest wall heating element – the *tegulae mammatae*, widely used in

67 Farrington considers the vertical canals in the caldarium and tepidarium of the Large Baths in connection with *tubuli.* See Farrington 1995, 104.

68 Vitruv. V, 10, 3. "The superstructure systems which constitute an important element for heating systems are resistant to the humid hot air, thus they are built as concameratio (a stone vault in the form of a high arch)."

69 At the Large Baths, in the chimney canal above the arched niche on the northwest wall of the caldarium, traces of burning and soot can still be seen on the terracotta pipe.

70 Eschebach 1979, 19. 20. 49a. 49b; Yegül 1992, 363 ff fig. 456. At the Stabian Baths in Pompeii, *tegulae mammatae* are found in the caldarium for ladies, while *tubuli* are found in the tepidarium for the men. Thus, these two systems are found in the same bathhouse but in different sections.

Central Roma and Provincial Imperial Baths – to the *terracotta pins* – the wall heating element peculiar to Lycia – took place and the stages in this transition.

Vertical recesses in the walls functioning as chimney canals have been found at the Large Baths at Tlos (Figs. 50-58), in the Nero-Vespasian (Figs. 21-22), Hurmalık (Figs. 24-31) and Central Baths (Fig. 32) at Patara, as well as at MI 1 at Oinoanda, and at the Sidyma and Nisa Baths. On the other hand, chimney holes are found in the Small Baths in Patara (Figs. 35-38). In the Pataran baths, vertical grooves in the form of *terracotta pins* and *chimney canals* are found all over the walls. In the Pataran baths, the relation between the chimney canals in the form of vertical canals, which are followed from the hypocaust up to the superstructure, and the holes for terracotta pins will be only clarified following excavations that reveal the connection between them and with the hypocaust. In the Nero-Vespasian Baths the holes for terracotta pins are found side by side with the chimney canals, some holes are even carved in the chimney canals (Figs. 21-22). As terracotta pins would be fixed in these canals, this means that pipes could not be installed in them. Therefore, it is inferred that the chimney canals were constructed in an earlier phase, while the holes for terracotta pins were carved in the pipe canals subsequently. Thus, it is not possible to consider a preplanning of these two systems together at the Nero-Vespasian Baths. The documentation of the chimney canal grooves, together with the *terracotta pins* is important evidence for bathhouse architecture and wall heating systems[71].

Although the chimney canals found in the arched window niche at the Large Baths in Tlos, cornice and vault tympana were used for the transition to the superstructure, the chimney canals and holes for terracotta pins are found side by side on the same walls in the Nero-Vespasian, Hurmalık, Central and Small Baths at Patara (Figs. 21-22, 24-25, 27, 29). These canals are in the form of vertical bands. As different from those in the Large Baths, the chimney canals in the Nero-Vespasian, Hurmalık, Central and Small Baths of Patara open not only at the beginning of the superstructure, but also directly to the hypocaust and reach the bottom level of the cornice and 2 – 2.5 m. above the suspensura (Figs. 21-22, 24, 29). The *pipe canals* seen in these baths must be related to direct heating rather than being *tubuli chimneys* ? or *hypocaust chimneys* ?, as in the Large Baths. The wide pipe canals set side by side and close to each other prove this (Figs. 28-29) and some of them can be followed up to the superstructure (Figs. 22, 26-27).

In the Large Baths of Tlos, the caldarium walls must have been faced with marble plaques up to the level of the arch above the windows and niches as can be inferred from the holes and metal pin holes within them, and starting from the polygonal masonry, it must have been plastered only in order to absorb the excess damp condensing there. The fact that there are also windows in the northwest wall in addition to the southwest wall must have been due to making optimal use of the sun rays (Fig. 8).

The baths were built facing a south-southwest direction, in the midst of sites of daily life near to the social centres. There are no high rising structures near them that could block sunlight reaching them. The Pataran baths and the Tloan baths, except for the Palaestra Baths, are orientated towards the south, southwest so that they could make best use of the

[71] All four of the Pataran baths employ the terracotta pin technique. Their connection with the chimney canals and chimney grooves/troughs is still being explored.

sunlight and heat (Figs. 3-8)[72]. The Nero-Vespasian and Central Baths at Patara, as well as the West and East Baths of Antiphellos face south; while the Small and Hurmalık Baths at Patara, the Large Baths of Tlos, the North-South Baths of Arykanda, the Balboura Baths, the Sidyma Baths, the South and North Baths of Xanthos, the Nisa Baths, the Apollonia Baths, the North and Antoninus Pius Baths of Kyaneai, the Vespasian Baths of Kadyanda and the Mk1 baths of Oinoanda all face southwest[73]. The main room of the Palaestra Baths at Tlos is in the south and is expected to have been the caldarium; however, it is in ruins to its foundations and is filled with debris, so its plan cannot be understood clearly today (Fig. 7). However, traces on the walls show that the two rooms in the northwest were extensively heated; if it was the case that these were the main bathing rooms, then we would have to admit that these baths face northwest[74].

Lycian baths are usually smaller than 1,000 sq.m. and they are, on average, about 400-500 sq.m.. Thus, they are much smaller than the Roman Imperial Baths, and the *terracotta pin* system is much more economic and efficient for this size. When compared with Rome, Lycia had limited means and it was inevitable that this method found widespread use as the local masters could employ it. On the other hand, because the Roman Imperial baths were such huge buildings, the *tubuli* system was much more efficient for them[75].

Despite the differing advantages of wall heating system elements, in Lycia, the terracotta pin system must have been preferred due to factors such as: tradition and practice, climate, durability, cost, technical availability, maintenance, the employment of local masters, with the heating productivity in a bathhouse not exceeding a surface area of 1,000 sq.m..

Among the Roman Imperial baths in Anatolia, although there are known examples from outside Lycia, *tubuli* were of more widespread employment than were the *terracotta pins*[76]. For example, although the Pamphylian baths were influenced by the Lycian ones in respect to their overall design and planning[77], curiously enough, *tubuli* were preferred in Pamphylia instead of the *terracotta pins* system.

In Central Rome, there is not one bathhouse that is known to have employed the *terracotta pin* system, this system is commonly found, outside Italy, in Pergamum, Kourion (Cyprus), Knossos, Maktaris (Tunisia), Gortyn, Cherchel, Tehouda, Timgad, as well as in northwest Europe and the Levant (Palestine and Syria) during the Roman Imperial period[78]. Most of these structures are dated to the 2nd - 3rd centuries A.D.

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72 Vitruv. V, 10, 1. For the selection of location: *"First, as warm a spot as possible is to be selected, that is to say, one sheltered from the north and north-east. The hot and tepid baths are to receive their light from the winter west; but, if the nature of the place prevent that, at all events from the south, because the hours of bathing are principally from noon to evening".*

73 Farrington 1995, 13 List 3.

74 With the start of systematic excavations at the site, the baths were also taken into the excavation programme. The digs began with the Large Baths and to date the scientific excavation of the frigidarium has been completed. In two rooms to the northwest of the Palaestra Baths, numerous *holes for terracotta pins* have been identified. However, in the remains of the chamber to the south, which was thought to have been the main bathing space, no trace of any wall heating system has been found.

75 See fn. 27.

76 Mansel 1978, 216 ff Fig. 243; Abbasoğlu 1982, 23. 28. 68. 78 Pl. XIX-3; İnan 1998, 38 ff Fig. 114.

77 Abbasoğlu 1983, 147.

78 Pergamum: Radt 1980, 412 fig. 8. Knossos: Hayes 1983, 97-169; Yegül 1992, 363 no. 26. Curium, Maktaris, Gortyn, Cherchel and Timgat: Farrington 1995, 102 no. 7. North Europe and Levant: Farrington – Coulton 1990, 63. 64 no. 39. 40.

While the *terracotta pin method*[79] is common in Lycian baths, it is not encountered in the Roman baths in Italy and the *tegulae mammatae* and above all, the *tubuli* system were preferred in Roman Imperial baths[80]. According to some scholars, *terracotta pins* were a primitive type of *tegulae mammatae*[81]. However, despite the similarities between these two systems, the structure of the plaques and the mounting techniques employed are different (Figs. 9-11, 15-18). It is not known exactly when and where the *terracotta pin* technique first emerged. The protruding feet in the corners of the *tegulae mammatae* plaques and the holes for placing the metal *pins* through are not found in the *terracotta pin* technique. As the *terracotta pin* method was preferred all over Lycia, while the *tubuli* and *tegulae mammatae* were widely used all over the Imperial baths, this heating system peculiar to Lycia should not be considered as a variety of the *tegulae mammatae* system[82].

As it was never employed in Rome, it does not seem plausible that Rome exported the *terracotta pin* method to Lycia and to the other provinces. The sites[83] where this *terracotta pin* system was employed used different types, profiles and fitting holes for the *terracotta pins* from those that were employed in Lycia[84]. In Lycia, the *pins* are fitted in the special holes carved in the stone blocks while at the other sites where this system is found, the *pins* are fitted into the mortar between the rubble or the stone blocks comprising the walls[85]. In addition, in the Roman Imperial period, the baths with a terracotta pin system are mostly dated to the 2nd century A.D., some are even from the late 2nd - early 3rd centuries[86].

On the other hand, the earliest bathhouse in Lycia is the Nero-Vespasian Baths in Patara which dates from earlier than all the abovementioned examples employing this system. The inscription of the Nero-Vespasian Baths in Patara carries the names of the Emperor Vespasian as the patron and the military governor Sextus Marcius Priscus[87]. Priscus, who is also known from the inscriptions of the Pataran Pharos, was still in office as the ambassador; thus, the baths must have been built in the last years of the reign of Nero and the first years of the reign of Vespasian, i.e. 65-69 AD[88]. The Hurmalık Baths of Patara is

79 Our research has shown that the *terracotta pin* technique was widely used in the bath houses of Lycia. For Lycia see also Farrington – Coulton 1990, 55 ff List 1; Farrington 1995, 101 ff List 14. For Lycia and the Mediterranean see also Yegül 1992, 363 no. 26.

80 Brödner 1983, 21 figs. T 12a. T 48a. Z 6. Z 52; Heinz 1983, 189 figs. 195. 197; Adam 1984, 287-294; Farrington – Coulton 1990, 63 ff; Yegül 1992, 359. 363 ff figs. 442-443. 448. 454-455; Farrington 1995, 101 ff.

81 Yegül 1992, 363.

82 Biers 1985, 46. 49. 53. 55. 78. 99. 102-103, nos.113-115; Farrington – Coulton 1995, 65.

83 See fn. 78.

84 Balboura: Coulton 1987, 205-211 figs. 3-4; Farrington – Coulton 1990, fig. 2 Pl. Va. Patara: Korkut 2003, fig. 10.

85 In Lycia, the holes for *terracotta pins* are generally placed 66 cm. apart vertically and 52 cm. apart horizontally. However, in the North African baths employing this same system the holes are placed closer to each other and the heads of the pins join the necks with a sharp "<" shape. It is highly likely that problems will be encountered when joining the plaques and risk of breaking is also higher. For the details and dimensions of these pins which are less efficient than those in Lycia see Farrington – Coulton 1990, 58.

86 Curium and Maktaris: Trajan's reign. Pergamum: late 2nd century A.D.. Knossos: late Antonines period? The Ephesus Harbour Baths: between reign of Domitian - late 2nd century A.D., although not certain. Perge: South Gymnasium, Hadrian's reign. See Farrington – Coulton 1990, 63-64 nos. 39, 40; Yegül 1992, 363 no. 26; Farrington 1995, 102 no. 7; see fn. 78

87 For the inscription at Delikkemer, Patara, see Kalinka 1920, 396; Balland 1981, 2-4 no. 23; Stendon – Coulton 1986, 56-59; Farrington – Coulton 1990, 61.

88 It is understood from the inscription on the Pataran Pharos (lighthouse), the excavation was completed in 2005 exposing the entire monument, that this Pharos was built by the Emperor Nero and Sextus Marcius Priscus, the governor general of the Province of Lycia, in the years 64-65 A.D.. It is understood that S. Marcius Priscus served in office for eight years non-stop in the period between Nero and Vespasian. In the inscription of the Nero-

another of the earliest Lycian baths[89]. Apart from these Pataran baths, the Vespasian Baths in Kadyanda and the Kandyba Baths are also amongst the earliest baths of Lycia; the baths employing this system in other regions are all of a much later date than the Lycian examples[90]. Thus, it would not be a mistake to claim that this wall heating element peculiar to Lycia, the terracotta pin technique, established a model, with its early date, for the other examples observed in Anatolia and in other provinces of the Empire[91].

With the Trebenna and Typallia baths are included, the number of known Roman baths in Lycia is 71; "at the Typallia Baths, in addition to the structural elements indicating the presence of the hypocaust, the round holes in the upper corners of the walls document the compulsory presence of heating systems in rural Lycia, though primitive they may be"[92].

The monumental Large Baths at Tlos is the leading Lycian bathhouse displaying a large influence from Roman bath design and technology[93]. In addition to its overall plan, the Large Baths set the clearest example of Roman design and technological influence in Lycia with its constructional skeletal system, vaulted niches, arched windows with a panorama, large apsidal arrangement, and heating and chimney systems. This structure can be considered a product of Romanisation overall together with other elements. These also carry importance as they indicate the importance that was paid to Tlos by Rome. The Large Baths of Tlos reflect a typical and classical Lycian bathhouse in respect to the planning and overall design, if not in regard to its wall heating system.

Lycian bathhouse architecture originates from the bathhouse types found in central and southern Italy. They generally comprise a series of three rooms and the best examples are the bathhouse series in Pompeii and the bathhouse in the forum of Pompeii[94]. This bathhouse type is planned as a series of rooms side by side, paced on parallel axes, with another room sometimes placed perpendicularly; it probably originated during the first half of the 1st century A.D.[95]

In the frigidarium of the Large Baths at Tlos, in the caldarium of the Palaestra Baths at Tlos and in both the caldarium and frigidarium of the Hurmalık Baths at Patara there are apses, large arches spanning wide distances, a high vaulted superstructure and rooms with niches (Figs. 4, 7-8). These rooms could be covered only with the advances made in vaulting and in arch systems and the binding elements such as mortar.

As overall in Lycia, at the baths at Tlos and Patara, traditional polygonal masonry is employed together with cut stone masonry[96]. The well-fitted traditional polygonal masonry

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Vespasian Baths, the name of Priscus is cited together with both Emperors; consequently, the structure must have been built between 65 and 69 A.D..

89 Işık 2000, 89-90.

90 Işık 1999, 489 ff.

91 Based on our knowledge today, the terracotta pin was used in Lycia and the baths where this system was used in the states of Anatolia and others apart from Lycia, has been researched. See also, Korkut 2003, 458.

92 Çevik – Varkıvanç 2004, 231-232.

93 Our surveys and excavations at the city have shown that in addition to the baths, the theatre, stadium and large complexes with arches and galleries carry extensive traces from the Roman period. See also, Farrington 1995, 84-85. 93.

94 Farrington 1995, 88 ff.

95 Yegül 1992, 57 ff; Farrington 1995, 88 ff.

96 Yegül 1992, 258.

walls of Lycia not only improve the strength of the structure but also enhance their aesthetics (Figs. 33-35). In particular, it has been attested that the fine quality well-fitted polygonal masonry observed in the Small Baths at Patara and in the Palaestra Baths at Tlos transformed into a looser technique employing mortar and into an entirely rubble masonry with mortar in the superstructure of the Large Baths in Tlos of a later date (Figs. 50-51, 53, 57-58) and this transformation in materials is to be observed all over Lycia.

In the light of the evidence available at the present time, the earliest bathhouse in all Lycia -not only in Patara and Tlos- is the Nero-Vespasian Baths at Patara[97]. On the other hand, from its plan, skeletal construction system, rubble masonry with mortar, loose masonry technique and heating system, the Large Baths at Tlos is the latest of all the six baths explored in the present study[98].

With the emergence of wall heating technique, architecture and the heating systems of the baths improved greatly and it became easier to cover wide spans with windows and to warm up the large caldaria and tepidaria. Consequently, the layout of the baths were also influenced and new bathhouse plans with apses and wide panoramic windows appeared, creating decorative and articulated bathhouse facades. Heat and damp could be easily regulated with the advances made in the *tegulae mammatae, tubuli* and *terracotta pin* techniques, and thus the hot and dry air provided the bathers with comfort in Roman Imperial period baths.

97 See fn. 10. 87. 90.

98 Although the excavations at the Large Baths are quite young, small finds such as ceramics and coins point to mainly 2nd-3rd centuries A.D. date. In addition, the loose rubble masonry with mortar and masonry techniques also show that this bathhouse was built at a later date than the other five baths at Patara and Tlos, that form the scope of this study. The dating will be finalised more precisely at the end of these excavations.

Abbreviations

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Özet

Roma Dönemi Likya Hamamlarında Duvardan Isıtma Sistemleri -Patara ve Tlos Hamamları Örneğinde-

Bu çalışma, Patara ve Tlos'daki Roma Dönemi'ne ait hamamlarda, yüzey kalıntıları ve kazılar sonucu elde edilen yeni bulgulardan hareketle, Likya hamamlarındaki duvardan ısıtma sistemlerinin ayrıntılıca irdelenmesini ve bunların mimari özellikleri aracılığıyla bölgeler arası ilişkilerin saptanmasını içerir.

Hamamların duvardan ısıtılmasındaki amaç, hypokausttaki ısıyı duvarlara taşıyarak sıcak havadan en üst düzeyde yararlanmak ve böylece hamam içindeki ısı oranını artırabilmektir. Duvar ısıtma sisteminde en erken *tegulae hamatae/tegulae mammatae* kullanılmıştır. Bu teknikte geniş ve kare biçimli terrakotta levhaların köşelerinde metal çivilerin geçebileceği, içleri delik küçük ayaklar bulunur. Levhalar duvarlara metal çivilerle, "T" şeklinde kelepçelerle ya da nadiren terrakotta çivilerle sabitlenmiş ve duvarla ayaklı plakalar arasında kalan boşlukta, hypokausttan gelen sıcak havanın dolaşması sağlanmıştır.

Duvar ısıtma sisteminde kullanılan en önemli ve yaygın bir diğer malzeme de *tubuli*dir. Bu yöntemde duvar yüzlerine, hypokaustla bağlantılı delikli tuğlalar (künkler) duvar boyunca dizilirler. Delikli tuğlaların çok farklı tipte yapılmış örnekleri bulunmaktadır. Roma İmparatorluk hamamlarında, yaygın olan teknik *tubuli*dir. Likya'da ise duvardan ısıtma sisteminde kullanılan en yaygın eleman *terrakotta çivilerdir*. Likya'da, pek çoğunun kazısı henüz yapılmamış olmasına rağmen, bugün için 10 antik kentteki toplam 14 hamam binasında *terrakotta çivi* kullanımı tespit edilmiştir; ancak duvardan ısıtma sistemi olmayan örnekler de mevcuttur.

Duvar ısıtma sistemi elemanlarının üzerini örten kaplama levhalarının belirli bir Roma ölçüsü bulunmamakla birlikte, Likya'dakiler kare ya da dikdörtgen formlu ve eni boyunun 1:2, 2:3 ya da 4:5 oranına sahiptirler. Bu levhalar yatay ya da dikey örülebilmektedir.

Tlos Palaestra Hamamı'nın kaldarium ve tepidariumunda, duvarların içine açılmış büyük, kemerli ve düz nişlerin içinde *terrakotta çivi* kullanımı tespit edilmiştir. Bu nişler, paneller şeklinde olup Likya'da, Tlos Palaestra Hamamı'na özgüdür. Nişlerin tamamında çivilerin üzerini kapatan terrakotta levhaların duvarlar üzerindeki oturma izlerini ve bacalar içinde sağlam kalmış terrakotta künkleri görmek mümkündür.

Patara'da Nero-Vespasian, Hurmalık ve Küçük hamamlar, Tlos'da Palaestra ve Büyük Hamam, Kyaneai'da Antoninus Pius ve Limyra Hamamı'nda olduğu gibi Likya'daki birçok hamamda dışa taşkın kornişler üzerinde duvar ısıtma sistemlerinin bacaları görülmektedir. Nero-Vespasian, Hurmalık ve Küçük Hamam'da kornişlerin alt kısımları içe kavislidir ve böylelikle sıcak havanın, baca çıkışlarına daha kolay ulaşması için yarım yuvarlak bir

tüp-yol yapılmıştır. Tlos Büyük Hamam'da kornişler dışa çıkıntılı ve alt kısımları düz, Palaestra Hamamı'nda ise alt kısımları düz üstleri açılıdır. Tonoz örtünün ağırlığını taşıyan kornişler, duvardan ısıtma sistemlerinin baca yuvaları için uygun birer çıkış kanalına dönüşmüşlerdir.

Pompei Stabian Hamamı'nın kaldariumunda *tegulae mammatae*, tepidariumda ise *tubuli* kullanılmıştır. Ancak *tubuli* ve *terrakotta çivi* yöntemlerinin aynı hamamda birlikte kullanıldığı bir örnek şimdilik bilinmemektedir. Tlos Büyük Hamam, Patara Nero-Vespasian, Hurmalık ve Merkez hamamları ile Oenoanda Ml 1, Sidyma ve Nisa hamamlarının duvarlarında düşey girintiler şeklinde baca kanalları, Patara Küçük Hamam'da ise yuvarlak baca yuvaları tespit edilmiştir. Nisa dışındakilerde, *terrakotta çivi* ve *baca kanalları*, aynı mekanlarda, bir arada kullanılmıştır. Bunların, birlikte mi yoksa farklı dönemlerde mi kullanıldıkları, hamamlarda yapılacak kazı çalışmalarıyla anlaşılabilecektir. Tlos Palaestra Hamamı'nda yalnızca *terrakotta çivi* kullanılırken, Büyük Hamam'da büyük bir olasılıkla duvardan ısıtma tekniği kullanılmamıştır ya da zayıf bir olasılıkla kullanılmışsa da bu *tubuli* olmalıdır. Eğer Tlos Büyük Hamam'da *tubuli* kullanımı kesinleşirse, bu Likya'da bilinen tekil örnek olacaktır.

*Tegulae mammatae*nin, *terrakotta çivi* ile aynı hamamda, birlikte kullanıldığı bir örnekte şimdilik bilinmemekle birlikte, Terrakotta çivi ve tegulae ma*mmatae* arasındaki benzerlik göz önüne alınacak olursa, Likya hamamlarında ileriki yıllarda, terrakotta çivi ve tegulae mammatae elemanlarının birlikte kullanıldığı hamam örneklerinin bulunması şaşırtıcı olmayacaktır. Böylece Merkezi Roma ve Eyaletlerdeki İmparatorluk hamamlarında, yaygın bir şekilde kullanım bulan ve en erken tarihli duvardan ısıtma elemanı *tegulae mammatae*den, Likya'nın özgün duvardan ısıtma elemanı terrakotta çiviye nerede, nasıl ve ne zaman geçildiği ve bu geçişin aşamalarının niteliği daha rahat anlaşılabilecektir.

Isıtma yöntemlerinin birbirlerine göre farklı açılardan üstünlükleri olmasına karşın, Likya'nın bu özgün duvardan ısıtma sistemi elemanı, *terrakotta çivi*; gelenekler, iklim, dayanıklılık, maliyet, teknik imkanlar, pratiklik, servis-bakım, yerel ustaların rahatça iş yapabilmesi ve 1000 m^2'yi geçmeyen hamam yapılarında ısıdan elde edilecek randımanla ilişkili olarak, Merkez Roma dışında Likya ve tüm Akdeniz havzasına yayılmıştır.

Merkez Roma'da *terrakotta çivi* tekniğinin kullanıldığı bir hamam örneğine rastlanmamıştır. Buna karşın, Roma İmparatorluk Çağı'nda bu yöntemin; Pergamon, Kourion (Kıbrıs), Knossos, Maktaris (Tunus), Gortyn, Cherchel, Tehouda ve Timgad, Kuzey-Batı Avrupa'da ve Levant'da (Filistin-Suriye) yaygın olarak kullanıldığı bilinmektedir. Likya Bölgesi dışında Anadolu'daki diğer İmparatorluk Dönemi Eyaletlerinde de sistem bilinmesine karşın, *terrakotta çivi* yönteminden ziyade *tubuli* kullanımının daha yaygın olduğu görülür. Örneğin Pamfilya Bölgesi hamamlarının genel tasar ve planlamada Likya'dan etkilenmiş olmasına karşın, duvardan ısıtma sisteminde, Likya'da yaygın kullanılan *terrakotta çivi* yöntemi yerine *tubuli*yi tercih etmesi ilginçtir.

Terrakotta çivi kullanımının tam olarak nerede ve ne zaman ortaya çıktığı bilinememekle birlikte, *tegulae mammatae*nin daha ilkel bir türü olduğu düşünülmektedir. Oysa *tegulae mammatae* ve *terrakotta çivi* teknikleri birbirlerine benzemekle birlikte, kullanılan levhaların yapısallığı ve montaj tekniğinde farklılıklar vardır. Roma'nın kendi merkezinde bile kullanmadığı *terrakotta çiviyi*, Likya'ya ya da eyaletlere ihraç etmesi mümkün görünmemektedir. Roma dışında sistemin görüldüğü merkezlerde ise *terrakotta çivilerin* tip,

profil ve duvara sabitlendikleri yuvalar Likya'dakilerden farklıdır. Kaldı ki, Likya dışında bilinen örneklerin çoğu 2. yy.'dan hatta bazıları 2. yy. sonu 3. yy. başlarındandır. Buna karşın Likya'da bilinen en erken hamam, yakın zamana kadar Vespasian Hamamı olarak adlandırılan, fakat kente gelen su yollarıyla birlikte İmparator Nero Dönemi'nde yaptırıldığı tespit edilen Patara Nero-Vespasian Hamamı'dır ve yukarıda sistemin kullanıldığını belirttiğimiz söz konusu örneklerden çok daha erken bir tarihe sahiptir. Şu andaki bilgilerimizle Likya'da, Nero Dönemi'nden öncesine tarihlenen bir hamam yapısı bulunmamakla birlikte, özel coğrafi ve politik konumu ile Patara'da, bir liman kenti olmanın beraberinde getirdiği zorunlulukla da, bu tarihten önceye giden hamam yapılarının beklenmesi şaşırtıcı olmayacaktır. Bu bulgular ışığında "Likya'da Flaviuslar Dönemi'nden önce inşa edilmiş olan hiçbir hamam binasının bulunmadığı" tezi artık geçerliliğini yitirmiştir. Kadyanda Vespasian ve Kandyba hamamları da, Likya'daki en erken tarihli hamamlar arasındadır ve sistemi kullandığı bilinen diğer bölgelerdeki hamamlar, Likya'dan çok daha geçe tarihlenmektedir. Böylelikle, Likya'ya özgü bu duvardan ısıtma elemanı, "terrakotta çivi tekniği"nin, Anadolu'da ya da İmparatorluğun diğer eyaletlerinde kullanıldığını gördüğümüz söz konusu örneklere bir model oluşturduğunu söylemek yanlış olmayacaktır.

Duvardan ısıtma tekniğinin ortaya çıkmasıyla, hamam binalarının mimari ve ısıtma sistemlerinde çok önemli bir gelişme kaydedilmiş, hamamlarda büyük açıklıkları pencerelerle kapatmak ve geniş alanlara yayılan kaldarium ve tepidariumları ısıtabilmek kolaylaşmıştır. Bu durum hamamların planlarını da etkilemiş, düz ya da apsisli ve büyük pencereli manzaralıklarıyla, yeni hamam planlarının doğmasını ve dekoratif görünümlü, hareketli hamam cephelerinin kazanılmasını sağlamıştır. Tegulae mammatae, tubuli ve terrakotta çivi kullanımlarındaki gelişmelerle, hamam binalarında istenilen ısı ve rutubet kontrolü çok daha rahat bir şekilde sağlanmış, sıcak ve kuru hava, Roma Dönemi hamamlarının iç mekanlarında, yıkanmak isteyenlere rahat ve konforlu bir banyo olanağı sunmuştur.

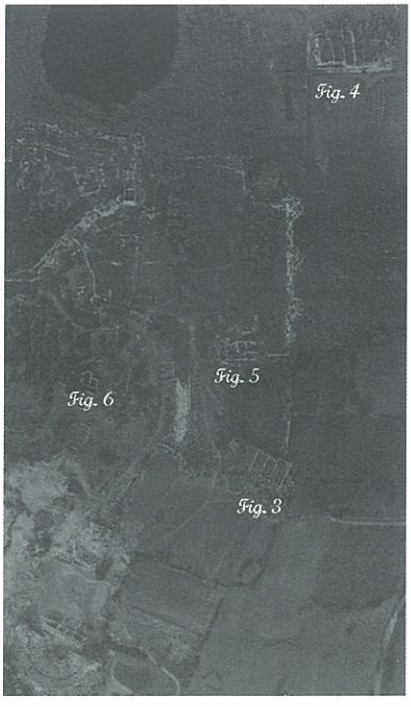

Fig. 1 Aerial photo of Patara (courtesy of General Commandership of Cartography).

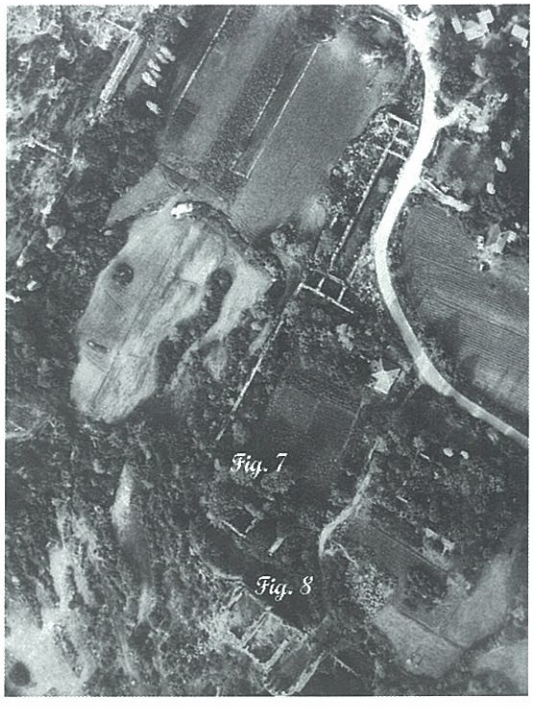

Fig. 2 Aerial photo of Tlos (courtesy of General Commandership of Cartography).

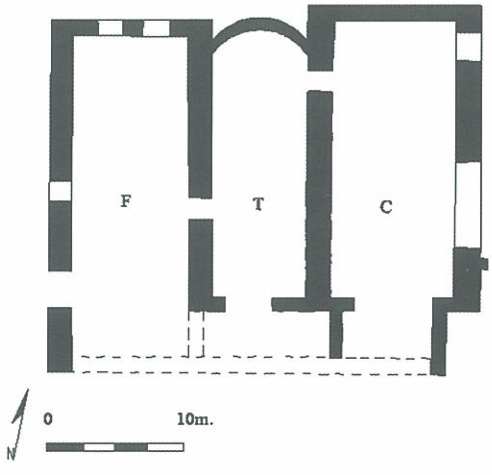

Fig. 3 Patara, Nero-Vespasian Baths, plan.

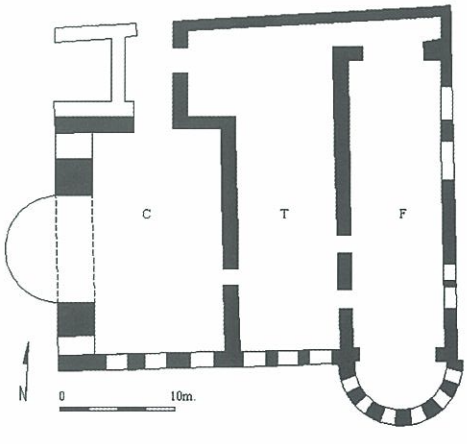

Fig. 4 Patara, Hurmalık Baths, plan.

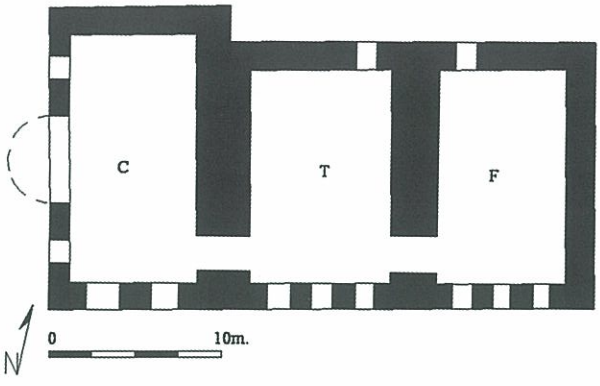

Fig. 5 Patara, Central Baths, plan.

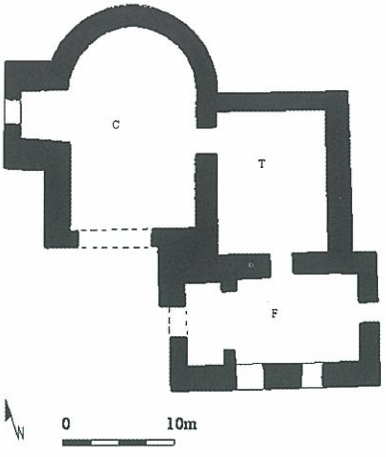

Fig. 6 Patara, Small Baths, plan.

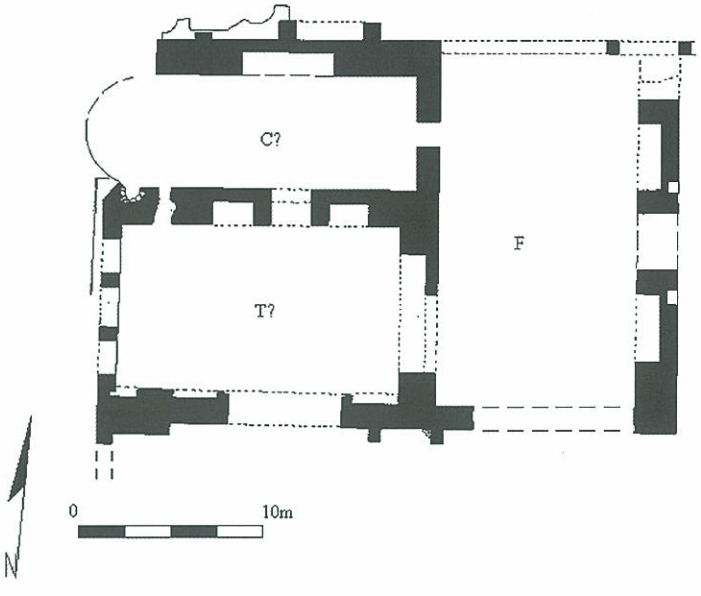

Fig. 7 Tlos, Palaestra Baths, plan.

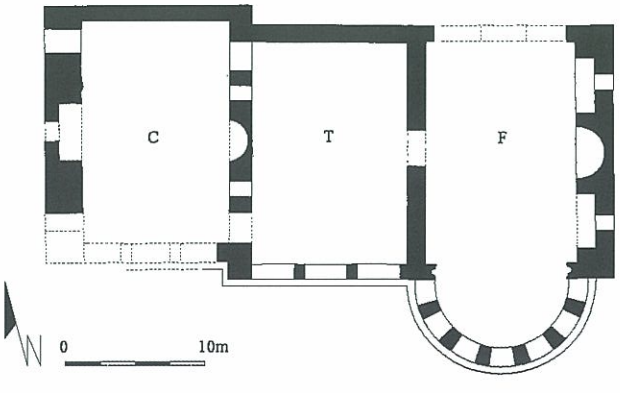

Fig. 8 Tlos, Large Baths, plan.

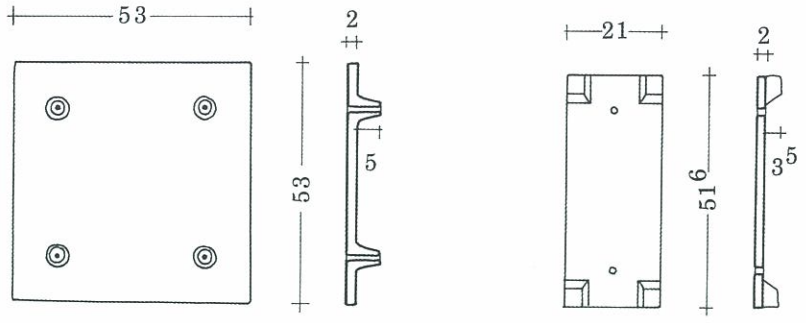

Fig. 9 *Tegulae mammatae* (Adam 1984, 292, Fig. 631).

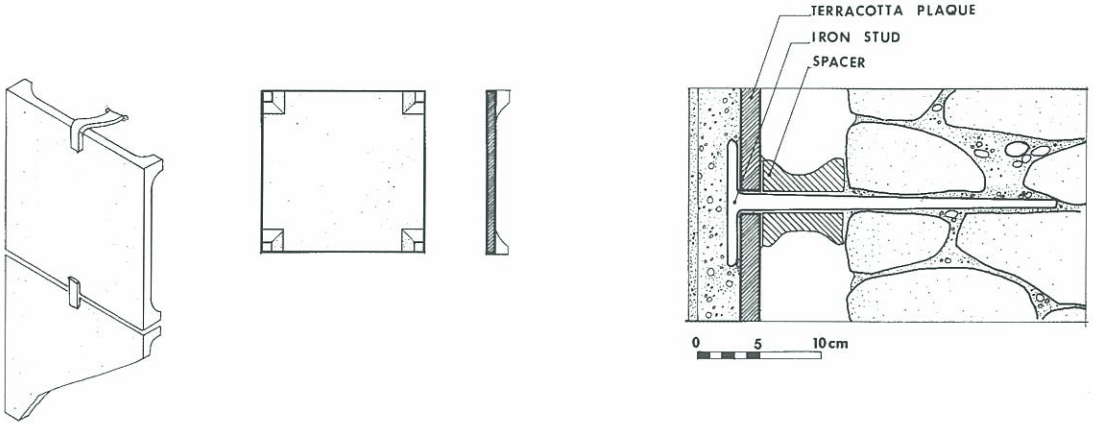

Fig. 10 System with *tegulae mammatae* and iron stud with terracotta spacer and iron pins (Yegül 1992, 364, Fig. 455a.d).

Fig. 11 Connection of *tegulae mammatae* to the hypocaust (Adam 1984, 291, Fig. 629).

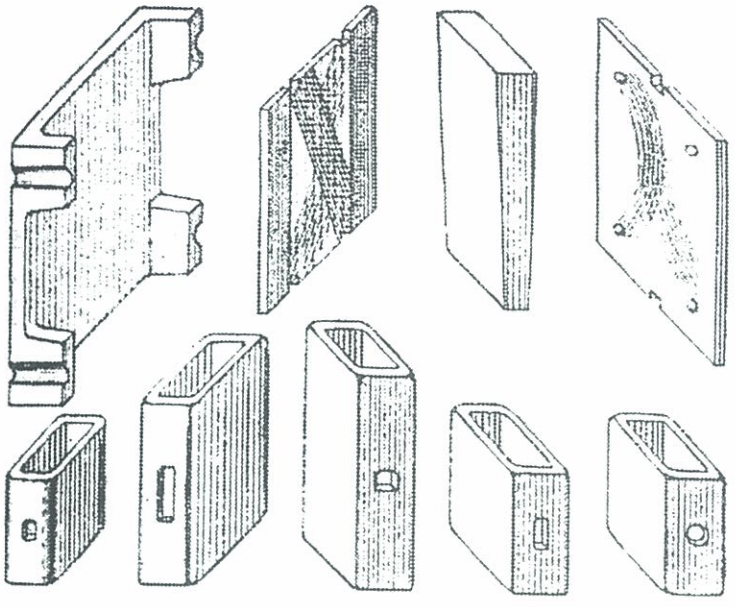

Fig. 12 Top: *Tegulae mammatae*. Bottom: Examples of *tubuli* (Crema 1959, 71, Fig. 77; for the original see L. Jacobi 1897, Saalburg).

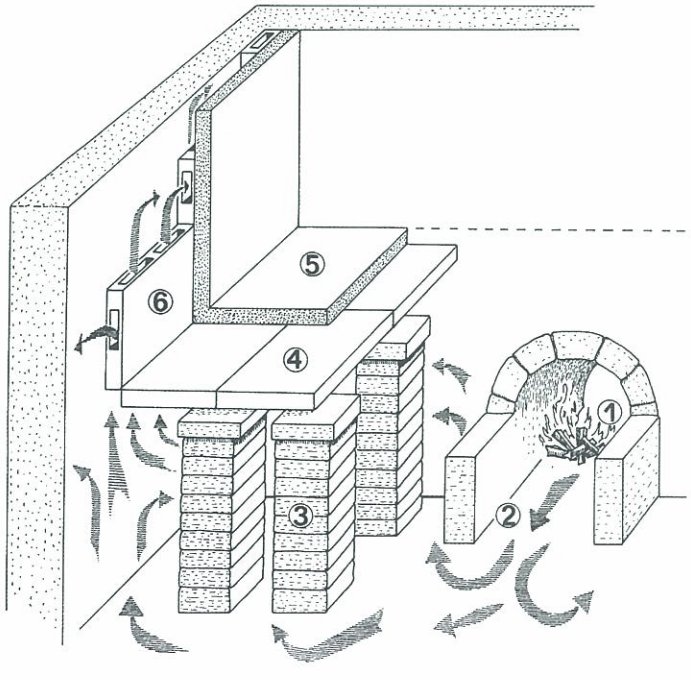

Fig. 13 Functioning of the hypocaust and *tubuli* (W. Heinz 1983, 187, Fig. 194; for the original see Ph. Filtzinger – D. Planck – B. Cämmerer (eds.), Die Römer in Baden-Württemberg, 1976).

Fig. 14 Ostia, Forum Baths, detail of wall heating with *tubuli* (Yegül 1992, 363, Fig. 454).

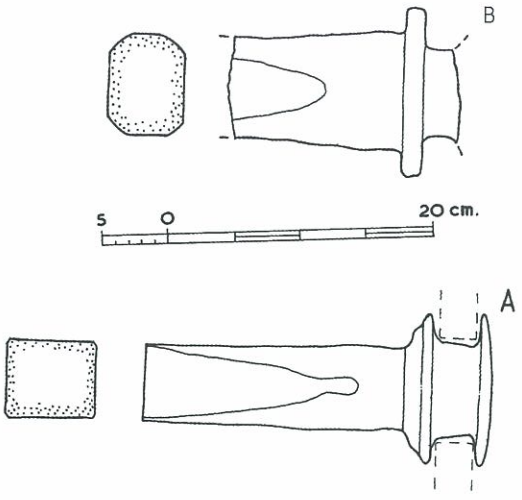

Fig. 15
Terracotta pin from Balboura
(Farrington – Coulton 1990, 56, Fig. 2).

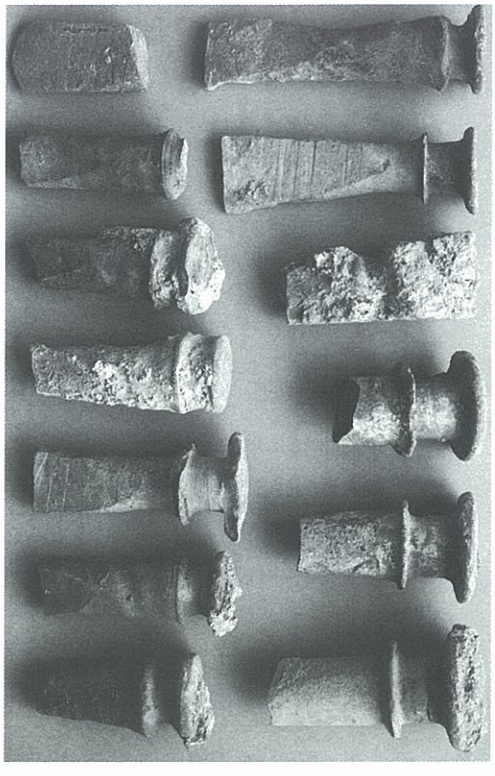

Fig. 16
Examples of *terracotta pins*
from the East Street Baths in Pergamum
(Radt 1999, Fig. 88).

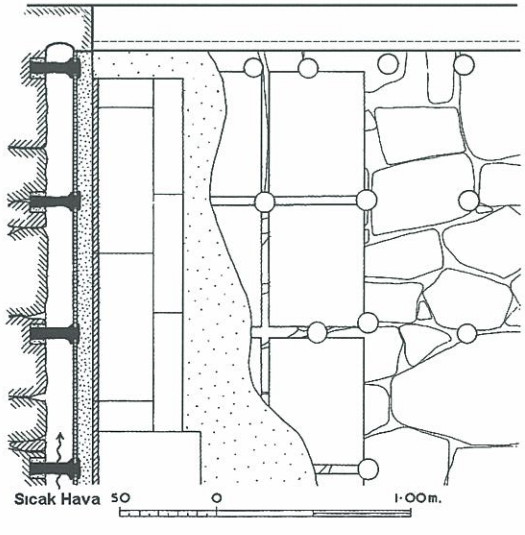

Fig. 17
Use of *terracotta pins*,
cornices with curves and chimneys altogether.

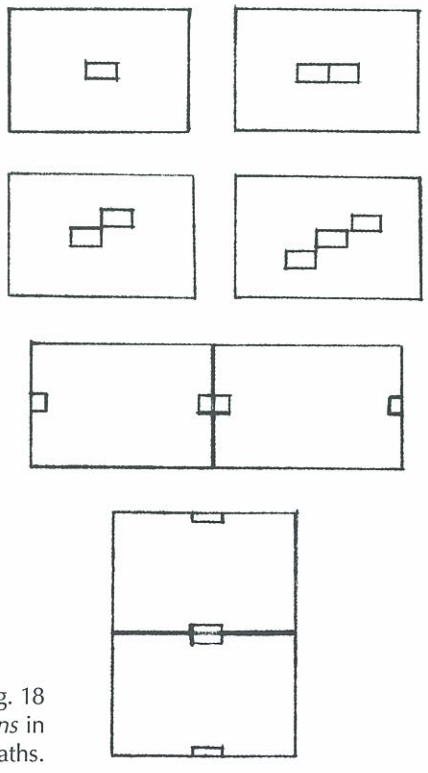

Fig. 18
Positions of holes for *terracotta pins* in
the Pataran and Tloan baths.

Fig. 19
Patara, Nero-Vespasian Baths,
east wall of the caldarium,
holes for *terracotta pins*.

Fig. 20
Patara, Nero-Vespasian Baths,
east wall of the caldarium,
hole for *terracotta pin* and the iron pin
for marble plaque facing.

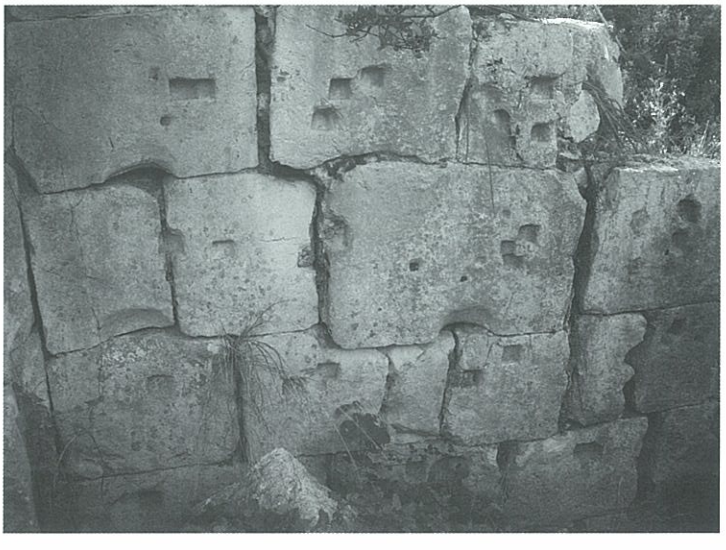

Fig. 21
Patara, Nero-Vespasian Baths,
south wall of the tepidarium,
holes for *terracotta pins*
and chimney canals.

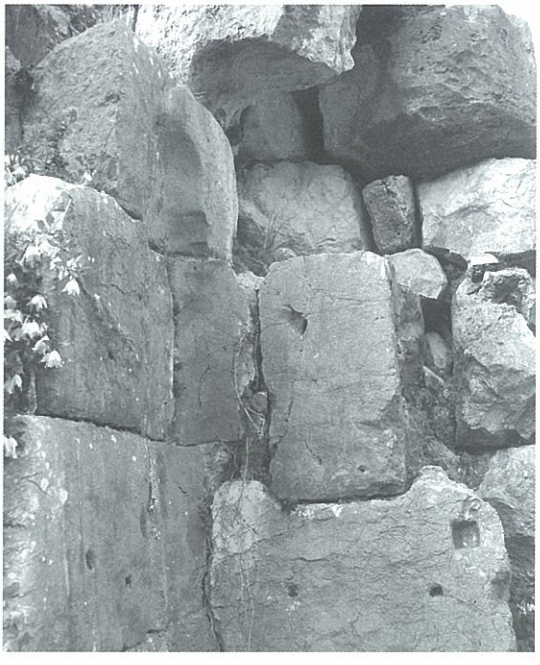

Fig. 22 Patara, Nero-Vespasian Baths, southwest interior corner of the caldarium, curved above the holes for *terracotta pins* and vertical chimney canals.

Fig. 23 Patara, Hurmalık Baths, west wall of tepidarium, holes for *terracotta pins*.

Fig. 24 Patara, Hurmalık Baths, southeast corner of tepidarium, vertical chimney canals.

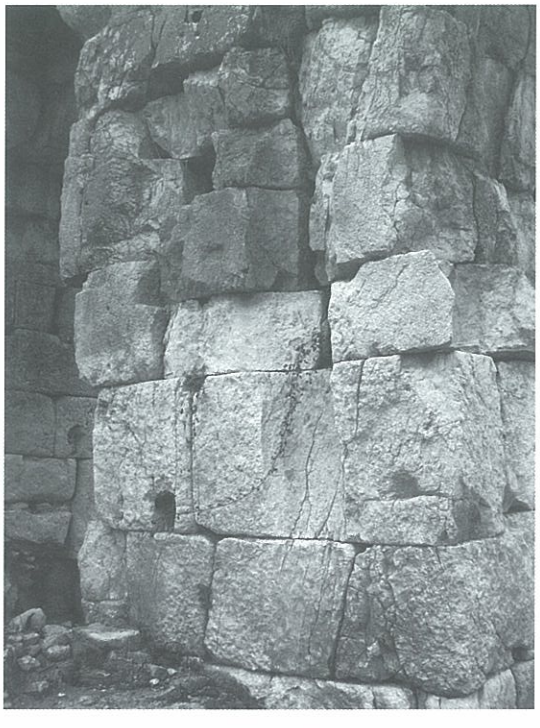

Fig. 25 Patara, Hurmalık Baths, west wall of caldarium, vertical chimney canal.

Fig. 26 Patara, Hurmalık Baths, west wall of caldarium, hypocaust and vertical chimney canal.

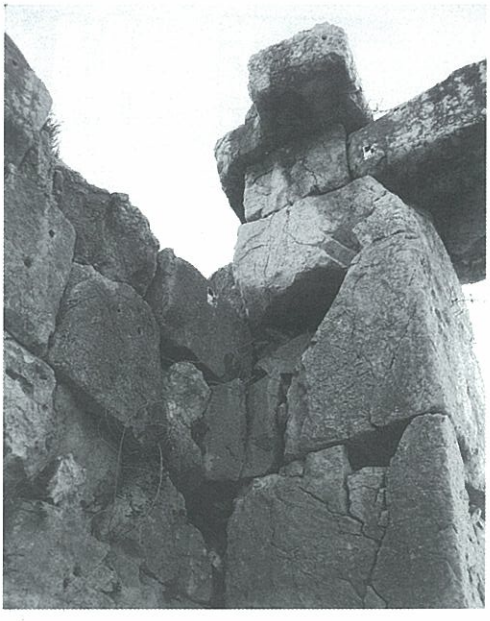

Fig. 27 Patara, Hurmalık Baths, southeast corner of caldarium, vertical chimney canal.

Fig. 28
Patara, Hurmalık Baths, north wall of caldarium, chimney canals side by side.

Fig. 29
Patara, Hurmalık Baths, northeast corner of caldarium, with chimney canals side by side on the north wall and holes for *terracotta pins* on the east wall.

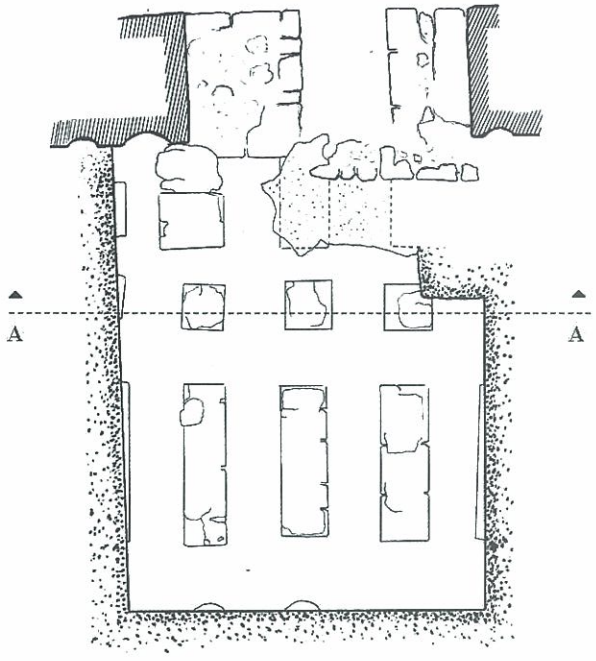

Fig. 30 Patara, Hurmalık Baths, plan of the chimney canals on the south wall of caldarium and hypocaust.

Fig. 31 Patara, Hurmalık Baths, cross-section of the south wall of caldarium, hypocaust and chimney canals.

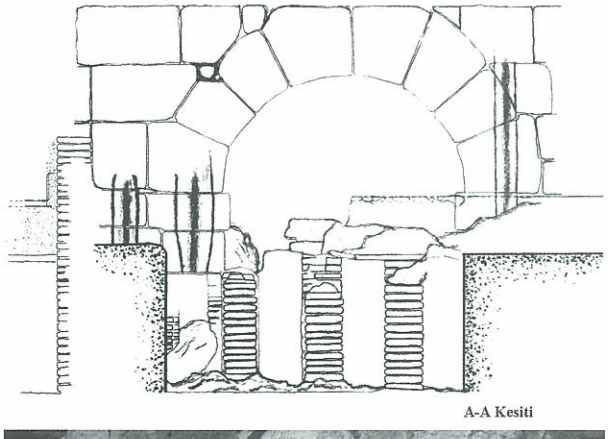

Fig. 32
Patara, Central Baths,
south wall of tepidarium, chimney canals.

Fig. 33
Patara, Small Baths, east wall of caldarium,
holes for *terracotta pins*.

Fig. 34 Patara, Small Baths, south wall of tepidarium, curvet above the holes for *terracotta pins*.

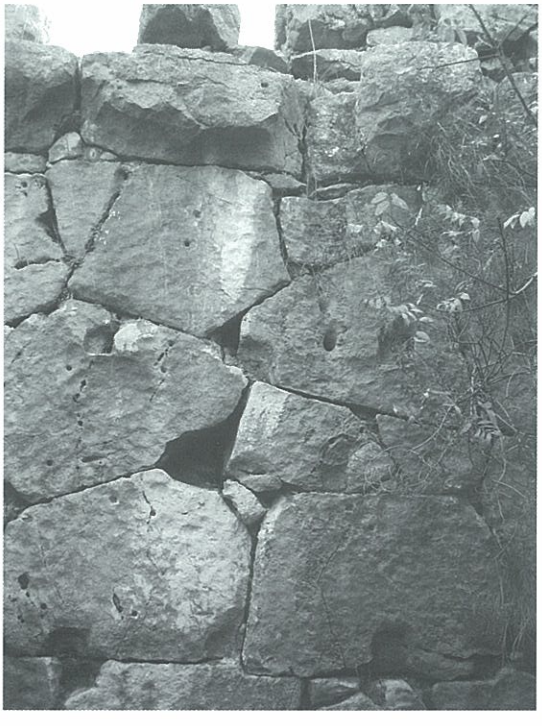

Fig. 35 Patara, Small Baths, east wall of tepidarium, vertical chimney groove above curvet.

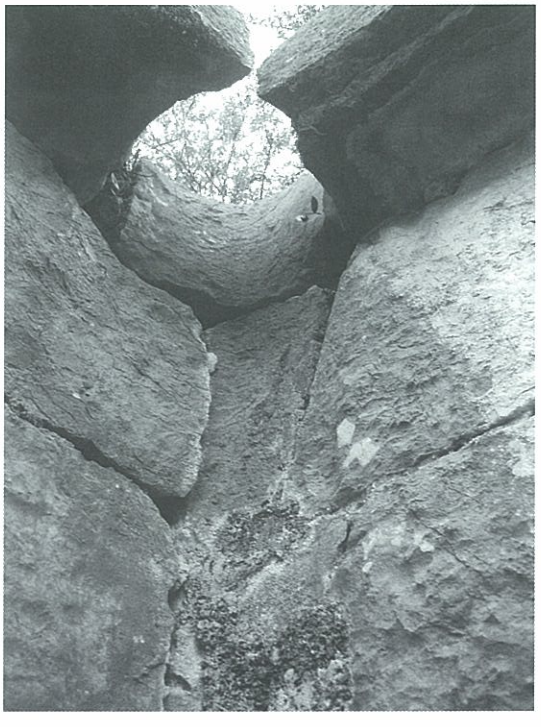

Fig. 36 Patara, Small Baths, tepidarium, *terracotta pin* chimney.

Fig. 37
Patara, Small Baths, tepidarium, *terracotta pin* chimney.

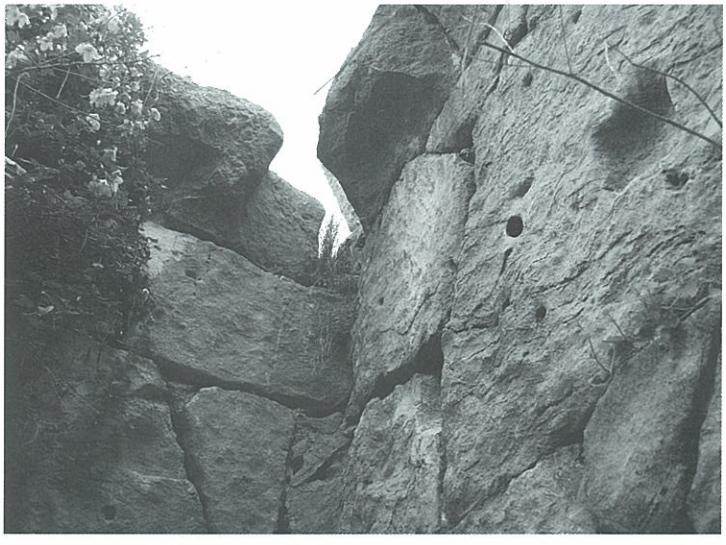

Fig. 38
Patara, Small Baths, tepidarium, *terracotta pin* chimney.

Fig. 39
Tlos, Palaestra Baths, northeast wall of caldarium, holes for *terracotta pins*.

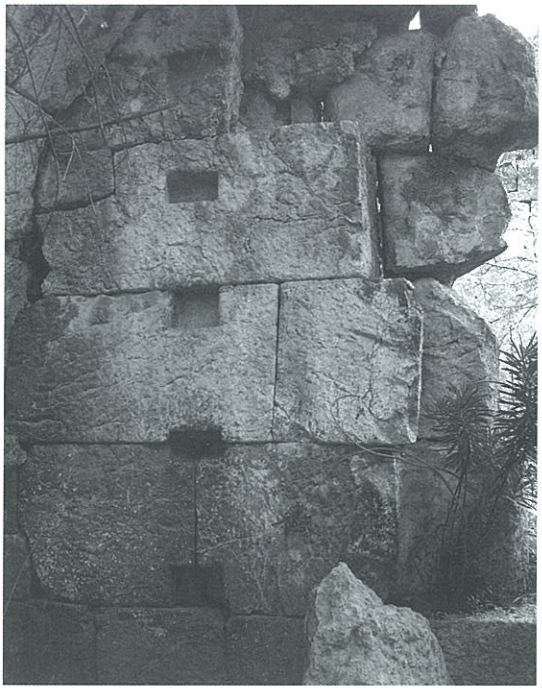

Fig. 40 Tlos, Palaestra Baths, southeast wall of tepidarium, holes for *terracotta pins* inside the arched niche.

Fig. 41 Tlos, Palaestra Baths, southwest wall of tepidarium, holes for *terracotta pins* inside the arched niche.

Fig. 42 Tlos, Palaestra Baths, southwest wall of tepidarium, the chimney groove of the arched niche, detail.

Fig. 43 Tlos, Palaestra Baths, south corner of tepidarium, holes for *terracotta pins* inside the niche.

Fig. 44 Tlos, Palaestra Baths, south corner of tepidarium, detail of the opening for the chimney in the niche.

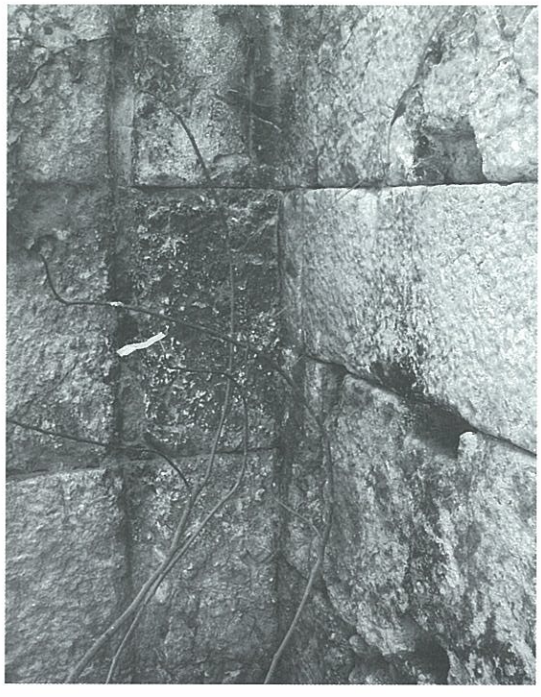

Fig. 45 Tlos, Palaestra Baths, south corner of tepidarium, holes for *terracotta pins*, the groove for the terracotta plaques to sit and traces of smoke passing through the walls.

Fig. 46 Tlos, Palaestra Baths, west corner of tepidarium, holes for *terracotta pins* and traces of smoke passing through the walls.

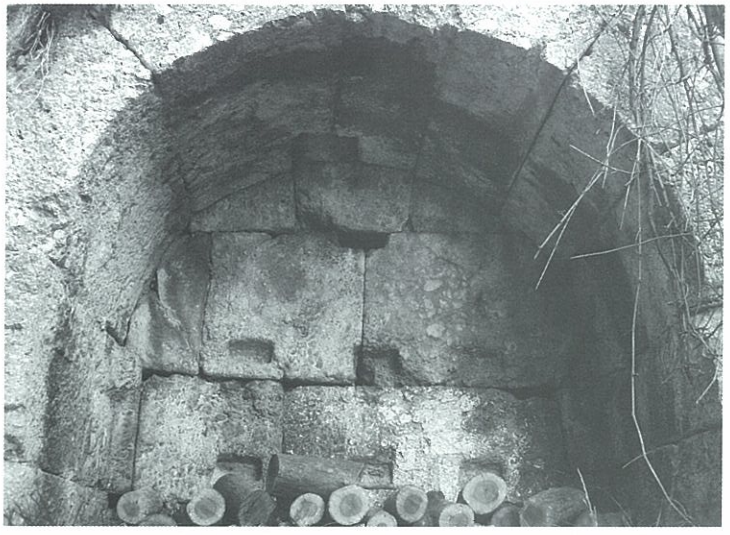

Fig. 47
Tlos, Palaestra Baths, east wall of tepidarium, holes for *terracotta pins* and chimney in the niche.

Fig. 48
Tlos, Palaestra Baths, east wall of tepidarium, chimney, detail.

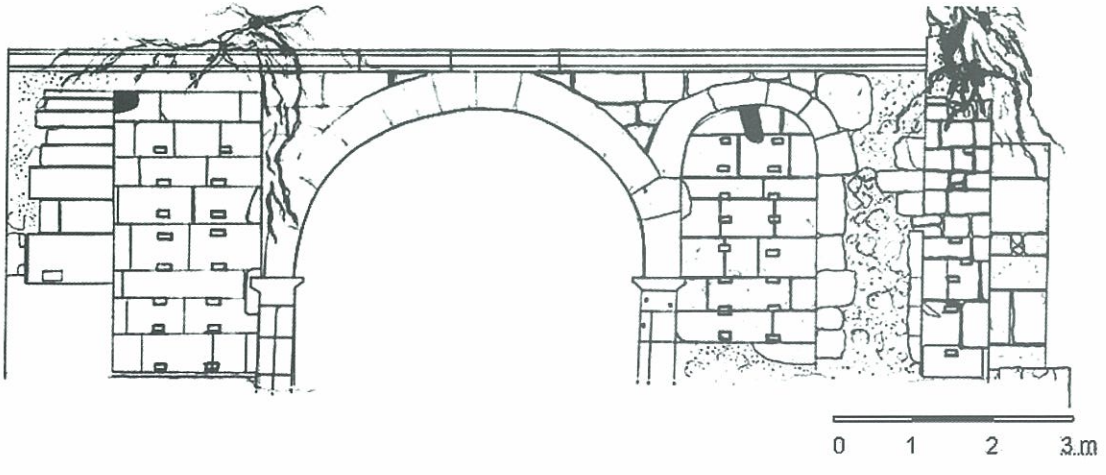

Fig. 49 Tlos, Palaestra Baths, southwest wall of tepidarium, frontal view. Holes for *terracotta pins* inside the niche panels.

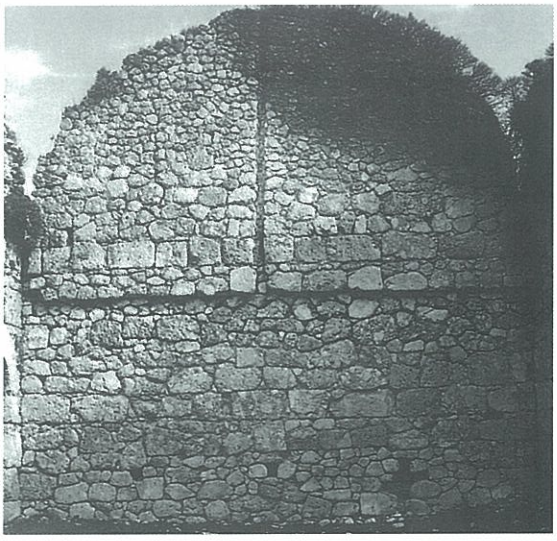

Fig. 50
Tlos, Large Baths, caldarium, chimney canal, *tubuli* ? in the vault tympanum.

Fig. 51
Tlos, Large Baths, caldarium, chimney canal, *tubuli* ? in the vault tympanum (looking from below).

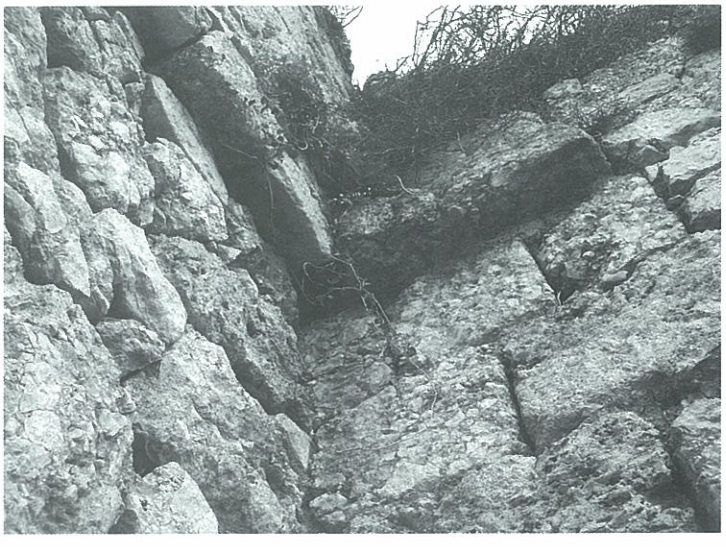

Fig. 52
Tlos, Large Baths, northeast corner of caldarium, chimney canal on the vault tympanum.

Fig. 53 Tlos, Large Baths, chimney canal on the vault tympanum of tepidarium.

Fig. 54 Tlos, Large Baths, southeast wall of tepidarium, chimney canal on the cornice (lintel).

Fig. 55 Tlos, Large Baths, northwest wall of caldarium, arched niche with window.

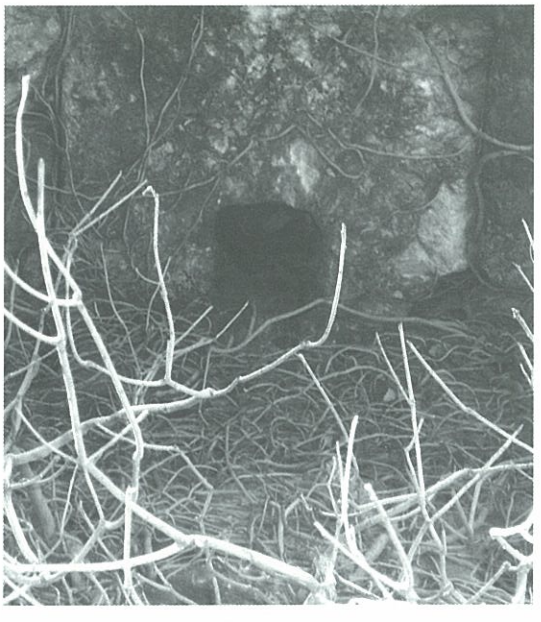

Fig. 56 Tlos, Large Baths, northwest wall of caldarium, chimney in the arched niche with window. The pipe is visible in the chimney.

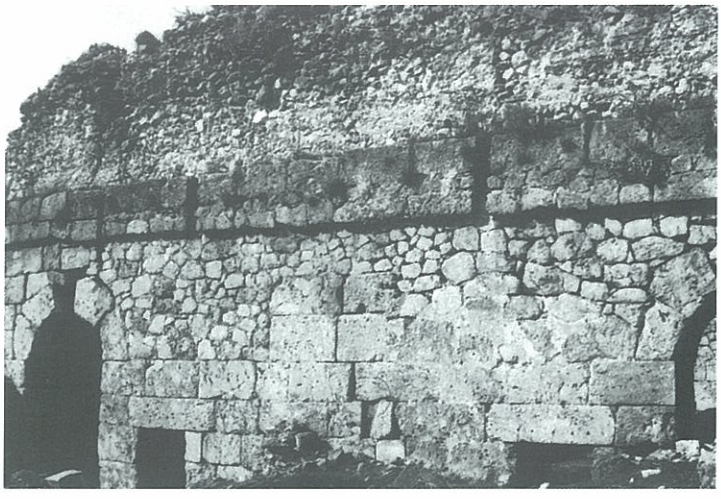

Fig. 57
Tlos, Large Baths,
northwest wall of tepidarium,
chimney canals.

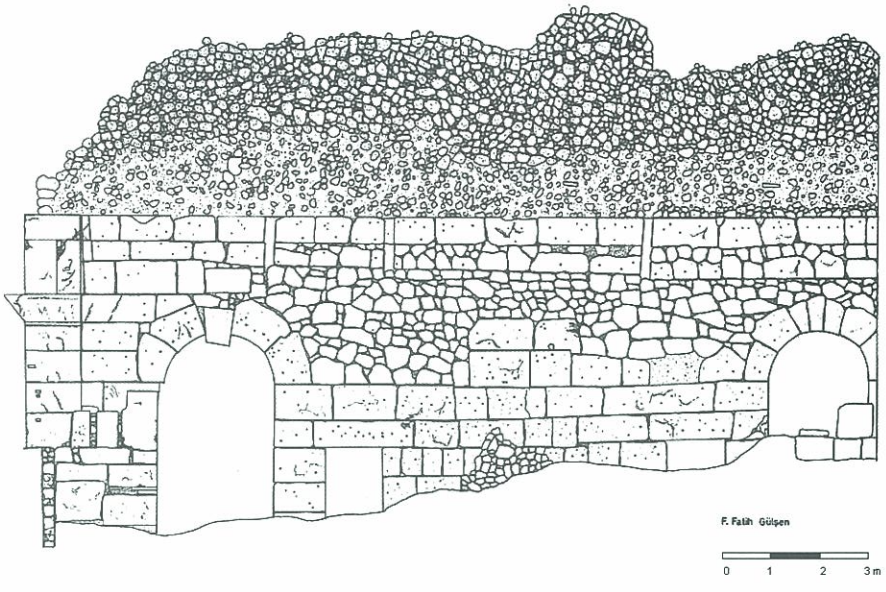

Fig. 58
Tlos, Large Baths,
northwest wall of tepidarium,
chimney canals.

Fig. 59
Lyrbe-Seleukia Baths,
the chimney canals extending
through the cornices and the arches.
(From B. Varkıvanç).