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ÖRJAN WIKANDER

Etruscan and Roman roof-tiles

Paralipomena

Abstract

The publications of the roof-tiles from Acquarossa, Poggio Civitate and San Giovenale have left a number of issues in need of further discussion. Besides three sections of special character (1, 4, 6) and two concentrated on tile dimensions (3, 5), the article centres around five questions of more general interest: contacts between the early Etruscan/Latial and Campanian terracotta industries (2), problems connected with the eaves (7), damage to and repairs of the roofs (8), manufacture and price of the tiles (9) and the socio-economic background of the diffusion and breakthrough of the tile-roof (10).*

Keywords: antefix, Campania, eaves, Etruria, Etruscan, manufacture, pan-tile, roof-tile, roofs

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After the publication of roof-tiles from Acquarossa, San Giovenale and Poggio Civitate,[1] the time has come for me to bring my studies of ancient roof-tiles to an end. There are, however, a number of loose threads and uncompleted arguments which call for further discussion. Such neglected and forgotten issues are the subject of this article—not additions to my lists of comparanda, nor a survey of the most recent literature, but rather a more careful ransacking of the old. The studies of ancient roof-terracottas are advancing at a quick pace, and we run the risk of important earlier observations falling into obscurity, if not being repeated. The issues which will be treated may look (and are) somewhat haphazard, but they will be concentrated around typological and technical matters:

1. Terminology
2. Area of investigations. The Campanian connection
3. Pan-tile sizes and weight
4. Raised borders (flanges) of pan-tiles
5. Cover-tiles and antefixes
6. Marks on back and underside of tiles
7. The eaves. Attachment and interlocking
8. Damage and repairs
9. Manufacture, workshops and price
10. The socio-economic background

AR stands for Acquarossa, PC for Poggio Civitate (Murlo). Expressions such as AR Teg F 7, AR Imb 19, and AR Kal B 25 refer to my catalogues in Ö. Wikander 1986; PC Teg 65, PC Imb 11, and PC Kal 29 to those in Ö. Wikander 2017. Others, such as T 21e, I 18 and K 51, refer to my lists of comparanda in Ö. Wikander 1993a and 2017. The Acquarossa roofs are presented in Ö. Wikander 1993a, 87–99, fig. 60, and the phases and subphases of the architectural terracottas *ibid*., 157f., fig. 60.

1. Terminology

For most parts of the ancient tile-roof, we know the Latin and Greek technical terms, and we should use them correctly. In his publication of the antefixes from Satricum, Riemer Knoop commendably analysed in detail the meaning of the word *antefixa*, and I have tried to do the same concerning

* My thanks are due to Nancy A. Winter and an anonymous peer-reviewer for a number of useful comments. Julia Habetzeder (editor) and Rebecca Montague (corrector of my English) have diligently scrutinized my text, and Rebecca Bugge has—as always—been of invaluable assistance to me. My son, Ola Wikander, helped me to get hold of important literature. All translations from Latin and Greek are my own, unless otherwise stated.

[1] Acquarossa: Ö. Wikander 1986; 1993a. San Giovenale: Ö. Wikander 1981; 2024. Poggio Civitate: Ö. Wikander 2017.

tegula and *imbrex*.[2] But there is more to be said about the matter.

Besides *tegula*, several other Latin words have been used for the plain pan-tile. *Testa* (a derivation of *torreo*, "burn", "roast") mostly refers to a broken piece of pottery, but it can be applied also to fragments of brick and tile. Cicero used it once to denote roof-tiles in general rather than a particular category, whereas a fragment of the historian Sisenna may suggest that it should be connected only with pan-tiles and not with cover-tiles.[3] *Pavimentum* ("floor") is, remarkably, once met with in such a context that it must necessarily mean the tiling of a roof.[4] Another "hapax" is *caementa*, normally meaning unhewn stone, sometimes concrete, but in one instance—the Puteolan Lex parieti faciendo—it must be referring to a pan-tile.[5] In Greek, the ὀπαῖον is simply an opening, whereas the skylight-tile is called ὀπαία κεραμίς.

Imbrices can, as well as *tegulae* (and the Greek κέραμος) be used to denote the tile-roof in its entirety.[6] I know no Latin synonym to the word, as I doubt that Cato the Elder's *vallus* can have had that meaning and have suggested, instead, that it may refer to a ridge-tile.[7] Anyhow, I see no reason to abandon the Greek term kalypter for the ridge-tile, but take this opportunity once more[8] to oppose the widespread use of "kalypter hegemon". Admittedly, the Greek καλυπτήρ was used for any covering tile, preferably the *imbrex*, but Greek inscriptions prove indisputably that ἡγεμόνες κεραμίδες were eaves-tiles and that ἡγεμόνες καλυπτῆρες ἀνθεμωτοί were the backers of palmette antefixes.[9] Any tile denoted ἡγεμῶν was associated with the eaves.

2. Area of investigation. The Campanian connection

The area selected by Arvid Andrén for his terracotta *corpus* of 1940 was to a great extent obvious, and it has been taken over by both Nancy Winter (2009) and me.[10] Etruria (including a few sites north of it) and Latium constitute the main areas for Central Italic architectural terracottas. The Aniene, the Tiber and the Chiana (and even more the Apennines) mark a clear border eastwards. Only the Sabine territory breaks the rule. But the south-eastern border remains a problem.

Knoop called Andrén's choice "unfortunate",[11] considering the increasing importance of the Campanian terracotta industry for the study of the Etruscan and Latial one. But in spite of all correspondences, Campania remains a world of its own,[12] and the only obscure question regards the position of Minturno. Winter did not include the site, but I followed Andrén in doing so—an unfortunate choice, indeed, as its terracottas are almost entirely Campanian, even though Minturno happened to be later counted among the towns of Latium. As a matter of fact, it is situated only 16 km from the (later) Campanian border, and the distance to Satricum is more than twice as long as the one to Capua. In short, at least as far as architectural terracottas are concerned, Minturno belongs to Campania, not to Latium.[13]

The contacts between Campania, Latium and Etruria were close, and it seems to be generally taken for granted that Campania spread new ideas towards the north-west. I believe so myself, but in most cases it is far from easy to prove which area was first. When Herbert Koch studied the Campanian material in 1912, most of it was unstratified and difficult to date.[14] The situation has improved but, seemingly, very few Campanian terracottas can be dated convincingly before 560 BC—and, when they can, their Latial or Etruscan parallels are often dated similarly. For instance, Winter brings out terracottas from Pithekoussai and Cumae, on the one hand, and from three roofs in Rome, on the other—all dated between 590 and

[2] Knoop 1987, 2 n. 7; Ö. Wikander 1993a, 25f., 45f.

[3] Cicero, *Dom*. 23.61; Sisenna, *apud* Non. 125.18: *dissipatis imbricium fragminibus ac testis tegularum*.

[4] [Caesar], *BAlex* 1. Cf. Lewis & Short, s.v.

[5] *CIL* I² 698, cols II–III, lines 38–41: *Nive maiorem caementa*[*m*] *struito quam quae caementa arda pendat p. XV*.

[6] Plinius, *HN* XXXV 46.159. Cf. Vergilius, *Georg*. IV 296, Prudentius, *C. Symm*. I 66f. Remarkably, Vitruvius does not mention the word at all.

[7] Cato, *Agr*. 14.3–4. See Ö. Wikander 2017, 69f. n. 116. Blake (1947, 300) thought that vallus was an obsolete word for *imbrex*, but *imbrex* was used even earlier by Plautus (*Mil*. 504, *Mostell*. 111).

[8] See Ö. Wikander 1993a, 58 with n. 129. The expression kalypter hegemon was used at least as early as 1938, by Mingazzini (1938, 742, 750).

[9] Orlandos 1966, 86. Cf. Robertson 1945, 389f., s.vv. "Sima" and "Tile"; Martin 1965, 73f., 77; Müller-Wiener 1988, 49.

[10] See Ö. Wikander 2017, fig. 1. Cf. the maps in Naso 2010, figs 1f.

[11] Knoop 1993, 62–64.

[12] An opinion for some reason not shared by Åkerström (1966, 267): "*Es ist die Beliebtheit dieses Typus* [antefixes with Blattstabnimbus], *die uns veranlasst, überhaupt von einer kampanischen ‚Provinz' der Bauterrakotten zu sprechen.*"

[13] Minturno was also, correctly, included in Rescigno 1998. Scatozza (1971, 58) located Minturno "*in* [...] *l'area campana*".

[14] "*Salvo qualche caso* [...] *non è possibile avanzare per gli esemplari cumani una datazione più precisa*" (Scatozza 1971, 52). Still in 1998, Rescigno had remarkably few dates to offer, mainly later than 560 BC.

580 BC and "so similar [...] that the moulds were probably made by the same artisans".[15]

Knoop, however, maintains that "No Archaic courtyard building in Central Italy is known with Campanian-style architectural decoration."[16] True, half the number of parallels that I will discuss below are to be found at Acquarossa Zone F and/or Poggio Civitate, but Knoop is right in as far as that the most typical Campanian decoration (eaves-tiles with painted soffit, painted ridge-tiles, tongue-framed antefixes and raking simas) is lacking. Nothing like the "Campanian roof" at Satricum[17] occurs around the courtyards, nor could this be a matter of chronology, as Campanian(?) decorations (as mentioned above) were found at three roofs in Rome in the 580s BC. Early influences (in one direction or the other) would be no surprise considering "the Etruscanization of Latium and Campania, which began in c. 620 and culminated around 575 with the cultural domination of Campania".[18]

At least one thing seems certain: the fundamental changes that characterize the transition from Alessandro Della Seta's Phase 1 to Phase 2 had to a great part their origin in Campania—most obvious concerning the great shell antefixes and torus simas. "These changes regarding type, style, subject, clay, colour, and position, occurred in Campania around the middle of the sixth century and were adopted in Etruria and Latium in the later part of the same century."[19] But, whereas an even earlier Campanian connection seems difficult to deny, the direction of the influence is hard to decide. I have earlier pointed out a great number of terracotta details which occur in both areas, and there is reason to examine them together in more detail.[20]

(1) As far as the types of ordinary pan-tiles are concerned, two are to be found only in Etruria/Latium (Wikander Type I) and Campania (Rescigno Type b), respectively. The third (Wikander Type II = Rescigno Type a) was common in both areas, in Etruria as early as *c.* 630 BC (T 57), but in Campania apparently much later.[21]

(2) In order to make the overlapping more efficient, the raised borders of the pan-tiles were often cut or chipped off for a few centimetres close to the upper end. Such tiles are known from Etruria in the late VII century BC and from Campania slightly later.[22]

(3) Some antefix backers have notches in the long sides (immediately behind the antefixes), intended to interlock with similar notches in the lateral sima or with projections from the raised borders of the eaves-tiles. The earliest Campanian examples are seemingly to be dated in the late VI century BC, whereas a group of such tiles derive from the OC2/Workshop at Poggio Civitate, dated to *c.* 630 BC.[23]

(4) In the second half of the VI century BC, the nail-holes of Campanian eaves-tiles were often reinforced by projections from the raised borders (cf. *Item No. 3*) or by detached bosses. The earliest Etruscan examples are more or less contemporary (*c.* 530 BC).[24]

(5) Eaves-tiles provided, in their lower parts, with a protruding panel along both long sides appear in Campania in the VI century BC, whereas no examples from Latium or Etruria can so far be dated earlier than *c.* 500 BC, with the possible exception of Minturno.[25]

(6) Painted soffits on eaves-tiles and lateral simas are, as already mentioned, known in both Campania and Latium/Etruria from *c.* 590/580 BC onwards.[26] Red, reddish-brown and black hourglass-shaped patterns decorate the upper side of pan-tiles in Campania in the early VI century BC and probably in Rome as well.[27]

(7) In Latium and Etruria, a great number of sites have yielded fragments of skylight-tiles, beginning with Satricum in 590/570 BC and Acquarossa in 575/540 BC, whereas Campania, as far as I know, has presented only one example, Pithekoussai, with some fragments dated to the V century BC.[28] Thereafter, there is nothing to be found until the many specimens from Pompeii and Herculaneum in the I century AD.

(8) Cover-tiles with nail-holes are so rare and varied that there is no reason to look for diffusion from one area to the other. At Acquarossa, they are in evidence on a roof dated 620/600 BC,

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[15] Winter 2009, 144–148, 221, cf. 536f., Roofs 3–1/5. But Winter (2009, 143, 556) seems convinced that it was Rome that exerted influence on Campania. The parallels suggest "that the Rome workshop may have undertaken commissions also in Campania during the period 590–580 B.C.". The proposal is elaborated in detail in Winter 2006. The idea was first suggested by Rescigno (1998, 380).

[16] Knoop 1987, 206.

[17] For the terracottas of the "Campanian roof" at Satricum and its prototypes, see Lulof 2006, 235–237.

[18] Knoop 1987, 212.

[19] Knoop 1987, 26. Cf. *ibid*. p. 29, where the Campanian innovations are dated "as early as the second quarter of the sixth century". But cf. Rescigno 2006, 269: "*La diffusione tirrenica dei tetti campani è fenomeno limitato agli anni successivi alla metà del VI secolo a.C., precedente all'introduzione dei tipi ad antefisse con testa femminile entro fiore di loto*."

[20] I here will refer mainly to my 1993a and 2017 monographs, where ample references to primary publications can be found.

[21] Ö. Wikander 1993a, 40; 2017, 47, fig. 13.

[22] Ö. Wikander 1993a, 38 with n. 44; 2017, 50 with n. 61, 150f.

[23] Ö. Wikander 1993a, 124f.; 2017, 51 n. 67, 149f.

[24] Ö. Wikander 1993a, 41f.; 2017, 51f. items 7–9.

[25] Ö. Wikander 1993a, 126; 2017, 51.

[26] Ö. Wikander 1993a, 153; 2017, 149 with n. 194.

[27] Ö. Wikander 1993a, 153; 2017, 176.

[28] Ö. Wikander 2017, 195f. nos 30 (Acquarossa), 51 (Pithekoussai), 52 (Satricum), fig. 59. Rescigno (1998, 49, 245 nos 43–45, figs 78–80) mentions only "*Pocchi frammenti*" from Pithekoussai.

apparently earlier than in Campania. But the few examples known are probably local inventions.[29]

(9) Cover-tiles Type III B were used as antefix backers in both Campania and Etruria. The earliest examples from Acquarossa have been dated to 640/620 and 620/600 BC, respectively.[30] Those from Campania are much later.

(10) Animal protomes on cover-tiles were used at Acquarossa as early as 640/620 BC and at Capua in the early VI century BC. But the Etruscan and Campanian examples are so different, even though structurally similar, that it seems more reasonable to see them as unconnected, local innovations. Not even the species represented are the same: griffins and lions in Etruria, horses and boars in Campania.[31]

(11) Painted bands on cover-tiles, transverse in Etruria and diagonal in Campania, can also be explained as local innovations.[32]

(12) Acquarossa ridge-tiles of Type III, with overlapping torus-shaped flange and lateral openings for cover-tiles, are externally almost identical with their Campanian counterparts. But minor structural differences make it uncertain if we dare reckon with a true connection. The earliest Etruscan examples have been dated to *c.* 560 BC, whereas no Campanian ones seem earlier.[33]

(13) Ridge-tiles with cover-tile openings at the joints, a quarter of a circle in each corner. I know of only one example from Latium/Etruria: two specimens from Ficana dated to the late VI or V century BC. From Campania, Carlo Rescigno mentions three examples, without stating their date.[34] But this solution is so obvious that we must not necessarily reckon with a connection.

(14) Ridge-tiles painted with zigzags or diagonal bands are well known from both Campania and Latium/Etruria from the late VI century BC onwards.[35]

(15) Antefixes decorated with a painted palmette, presumably the earliest variant of the palmette antefixes, are known from Sicily, Pithekoussai, Tarquinia and Acquarossa.[36] Knoop seems to trace their origin to Sicily, with Pithekoussai intermediate in their diffusion to Etruria. But the Acquarossa antefixes (Types IV and V) can hardly be dated later than 575 BC, and similar antefixes without preserved decoration from Ficana belong to the end of the VII century BC. Silva Ciaghi seems to attribute the invention of the palmette antefix to Tarquinia rather than to Campania.[37]

(16) A water-spout from San Giovenale in the shape of a ram's head has such close parallels from Pithekoussai and Cumae that it seems unavoidable to posit that there must be connection. The Pithekoussai spout preserves parts of its lateral sima and can be dated stylistically to *c.* 600 BC or slightly earlier. Campanian inspiration seems unmistakable, as the shape of the San Giovenale ram deviates completely from other Etruscan representations.[38]

(17) Acquarossa has yielded one probable example of a corner sima with a feline-head water-spout at its extreme left (Type II). Related, Late Archaic simas from Campania are mentioned by Andrén, but their identification as corner simas is apparently only conjecture.[39]

(18) Disc acroteria were to be found in both Campania and Etruria from the VI to the III centuries BC. Earliest are two specimens from Cumae and Rome, both dated by Winter to 590/580 BC.[40]

(19) Disc antefixes have been found at Acquarossa (Type VII) and Veii, dated variously between 600 and 550 BC. A circular antefix from Capua is constructed so differently that they could hardly be related—except for a possible common origin in the Laconian disc acroteria.[41]

The result of this survey is rather discouraging. Most items give no information at all on a possible diffusion from one area to another, and the dates of the Campanian terracottas remain uncertain or possibly too late. But of the items which seem more encouraging, five imply a precedence for Latium/Etruria (*Nos 1–3, 7, 9*) and only two for Campania (*Nos 5, 16*). In fact, Campania has yielded few (if any) architectural terracottas dated convincingly earlier than *c.* 600 BC.[42] Perhaps,

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[29] Ö. Wikander 1993a, 56; 2017, 69.

[30] Ö. Wikander 1993a, 51; 2017, 67 n. 98.

[31] Ö. Wikander 1993a, 57f.; 2017, 175 with n. 23; Bonghi Jovino 1993, 47–49, figs 4–7.

[32] Ö. Wikander 2017, 177 with n. 48. But diagonal bands are to be found on Etruscan ridge-tiles, for instance, K 48 from Civita Castellana and K 51 from Ficana (*ibid*., 83, 178). Cf. *Item No. 14*.

[33] Ö. Wikander 1993a, 69. Even Andrén (1940, CLXII) pointed out that the overlapping ridge-tiles from Minturno "betray influence from Magna Graecia and Sicily [...], probably transmitted by Campania, although no such tiles seem to have been so far discovered there". Now they have, in abundance, but Svanera (2006, 354 n. 9) shares my doubts concerning the connection: "*Il confronto tra Acquarossa e tetti campano-sicelioti è in realtà solo apparente, in quanto i sistemi sono tecnicamente differenti*."

[34] Ö. Wikander 1993a, 71f. with nn. 171f.; 2017, 83 no. K 51, 87, fig. 32; Rescigno 1998, 44, 242 nos 14–16, pls XIVf.

[35] Ö. Wikander 1993a, 154 with n. 76; 2017, 178.

[36] Knoop 1987, 139–142, fig. 96. Cf. C. Wikander 1988, 117f.

[37] Ö. Wikander 1993a, 76; 2017, 90; Ciaghi 1993, 205f.; 1999, 11f. C. Wikander (1988, 118) suggested Caere.

[38] Ö. Wikander 2017, 103 n. 240; 2024, 138 no. 13, fig. 19.

[39] Andrén 1940, CLXXXVI; Ö. Wikander 1993a, 86.

[40] Ö. Wikander 1993a, 77; 2017, 88.

[41] Ö. Wikander 1993a, 75, 77 with n. 202; 2017, 90 (Acquarossa, Veii); Koch 1912, 47f. no. IX:C, pl. X.1 (Capua).

[42] Winter (2022, 76-78, 80), in her survey of early architectural terracottas in Italy, does not reckon with any such in Campania before *c.* 590 BC.

their introduction there was a consequence of the strong cultural, Etruscan influence towards the end of the VII century BC, only later affected by the terracotta industry in Sicily and Magna Graecia. Rescigno dated "*la prima fase dei tetti campani*" to the end of the VII century BC and the beginning of the VI.[43] Two daedalic, female-head antefixes from Capua are sometimes dated before 600 BC, but they are probably later.[44] Etruscan influence in Campania was strong towards the end of the VII century BC, even including the establishment of important bucchero workshops there.[45] But, for the time being, any attempt to suggest the transfer of related terracotta workshops from Etruria to Campania is impeded by the almost total lack of early Etruscanizing terracottas there.[46] True, Knoop mentions a "newly found Late Orientalizing architectural terracotta" from Satricum which "closely recalls the style of the early Murlo protomes of the late 7th/early 6th centuries [...] and illustrates Etruscan architectural influence this far South as early as c. 620/610–550".[47] But I have found no further information on the piece.

Towards the end of the period, a central part was apparently played by Minturno and Satricum, elucidated particularly by Knoop's publication of antefixes and some other terracottas from the latter site.[48] Knoop admitted that the relative chronology between the Campanian and Satrican antefixes "remains elusive" but apparently reckoned with a continuous influence from Campania, at least from *c.* 560 BC onwards—probably as a result of the transfer of Campanian artisans, even bringing with them Campanian temper. From Satricum, the influence continued northwards: "The fact that an antefix of the mould B series was found at Rome [...] illustrates the mobility of the artisans". "It suggests that Satricum was not the end-point of the Campanian service routes, but may have acted as a northern distribution centre that employed the best artists in the workshop."[49]

The facts at our disposal—few admittedly—rather indicate that influences went *from* Etruria *to* Campania at least up to *c.* 560 BC.[50] During the following decades, the direction tended to change and, if not earlier, the light Campanian clays reached Satricum with the so-called Campanian roof of the Temple of Mater Matuta about 530 BC.[51] Light brown or beige terracottas were used in Etruria even earlier, but the true breakthrough occurred within the Veii-Rome-Velletri system in 530/520 BC—a fact that may emphasize the importance of Satricum as transmitter of Campanian innovations (and artisans).[52] And only ten or twenty years later, we witness the triumph of terracottas of Della Seta's second phase.

3. Pan-tile sizes and weight

The pan-tiles constituted the basic module for the entire roof. Their width determined the interval between the rafters (or perhaps the other way around) and, in combination with the length, their weight. Their dimensions, in turn, could not be decided without taking two factors into consideration. The tiles should not be so light that they could be moved by ordinary winds and stormy weather, nor so heavy that they were too difficult to handle, particularly, by workers on the roof.[53] But even though these prerequisites led to a concentration to lengths between 57.5 and 72 cm and widths between 43 and 52 cm, a great number of Central Italic pan-tiles fall outside this standard.

My first published diagram of pan-tile lengths shows clear lacunae for lengths between 54 and 57 cm and between 72.5 and 77.5 cm.[54] Three such tiles can now be added: T 95d (Veii, Portonaccio), T 139a (Petriolo), and AR Teg F 7. But they do not change the picture markedly. The lacunae remain odd, and they emphasize the peculiarity of the long and short tiles even more. I have earlier discussed the extra long pan-tiles in

[43] Rescigno 1998, 394.

[44] Koch 1912, 71, pl. XIX.1; Scatozza 1971, 52. Johannowsky (1983, 73, pl. 45c) expressed himself more cautiously "*Agli ultimi decenni del VII secolo a.C. possono essere datati* almeno i prototipi *di alcune teste femminili di tipo tardo-dedalico*" (my emphasis). Winter (1978, 34, pl. 9.3; 1986, 179) took one step further, suggesting that they are late, provincial imitations, to be dated as late as 580/570 BC, half a century after the earliest female-head antefixes known, from Poggio Civitate, *c.* 630 BC. Several later scholars date these antefixes in the first half of the VI century BC. See Knoop 1987, 112–115.

[45] Johannowsky 1983, 299–301, 318f.; Bonghi Jovino 1993, 52–54.

[46] Unless Winter (2009, 143-148) is right attributing two early Campanian roofs to a Roman workshop. "The link between Tarquinius Priscus and the early decorated roofs at Rome, and the appearance of this shared terracotta roofing system at Pithecusae and Cumae [...] has great significance for the dissemination of terracotta roofing into Campania, where it forms the prototype for what later becomes the typical Campanian style of roof" (Winter 2006, 354).

[47] Knoop 1987, 245, referring to Maaskant-Kleibrink 1987, 101, frontispiece—who, however only describes the piece as "one small terracotta head".

[48] Knoop 1987, *passim*. See particularly pp. 26, 29, 31, 109, 113, 117, 186–188, 199–204, 208, 214–216. The earliest roof of the Dea Marica temple at Minturno (with reddish-brown terracottas) has been dated to *c.* 560 BC (Rescigno 1998, 337 n. 98, 346).

[49] Knoop 1987, 109, 117.

[50] Winter (2022, 87f.), too, emphasizes Etruria's prominent position in the development of architectural terracottas in Central Italy during the Late Orientalizing period.

[51] Knoop 1992, 93.

[52] Ö. Wikander 2017, 140 item 1, 143f. "*Il tetto* [*campano*] *di Satricum è opera di una bottega campana*" (Rescigno 1998, 351).

[53] Ö. Wikander 2017, 48f.

[54] Ö. Wikander 1993a, fig. 9.

some detail,[55] but there is much more to be said about the exceptionally short ones. My lists of comparanda include eleven such pan-tile groups with lengths between 43.5 and 53.5 cm:

		Date (century BC)	Type	Size (length × width)
T 21e	Civita Castellana	V/III?	II	50 × 33 cm
T 25d	Civita Castellana	V/III?	II	51 × 44 cm
T 34g	Falerii Novi	III/II?	II	50 × 38 cm
T 57e	Poggio Civitate	Late VII	II	51–52 × 40–41 cm
T 57f	Poggio Civitate	VI	II	43.5–44 × 37.5 cm
T 73a	Rome, Sacra Via	VI	I	51–51.5 × 41–43 cm
T 73b	Rome, Sacra Via	VI	I	51 × 38 cm
T 88b	Satricum	VI	I	53 × ? cm
T 98	Veii	Late VII?	I A	53.5 × 33 cm
T 166	Satricum	VI/V	I + II	52 × 45–46 cm
T 183	Veii	VII/V	I	51–52 × 33–33.5 cm

The tiles in the list belong to both Type I and Type II, they extend in time from the VII to the III/II centuries BC, in space from Satricum in the south to Poggio Civitate in the north. But they have one quality in common: apart from the two groups from Poggio Civitate, they are all tomb-tiles. Apparently, short tiles were preferred in tombs, even though longer ones would have been easier to handle there than on a roof. Consistently, only two extra long tiles derive from tombs (T 33a, 34a). As a consequence of this, I have had reason to reconsider my earlier views concerning the dimensions of ordinary Roman pan-tiles.

In 1993, I presented a number of Roman imperial tomb-tiles, 50–66 cm long (average 58 cm) and 33–55 cm wide (average 44 cm) and concluded that Roman pan-tiles in Italy were markedly smaller than their Etruscan forerunners.[56] I found support for my statement in the fact that Roman tiles in Britain seldom pass a length of 50 cm (average 43 cm).[57] But if Etruscan tomb-tiles were smaller than others, the same might well be the case for the Roman ones, and there is plenty of evidence that this is actually the case. Josef Durm stated an average size of 66 × 49 cm for Italy, and Jean-Pierre Adam has gathered a number of relevant measurements:[58]

Ostia: 72 × 48, 60 × 45, 57 × 41, 53 × 40.5 cm.
Pompeii: 69 × 47.5, 66 × 52.5, 64 × 47.5, 59 × 50, 59 × 48 cm.
Rome: 66 × 49, 46 × 39 cm.

We may discern a tendency towards smaller sizes at Ostia but, on the whole, the differences compared to Archaic Etruscan tiles are small—except for tiles from the northern provinces.

Two more pan-tile sizes are worthy of comment. One group of tiles from Acquarossa (often described as "squarish") diverge markedly from the others: Group D with a maximum length of 60 cm, minimum width of 50 cm.[59] It comprises six certain and nine probable tiles, seven of which indubitably belong to two of the earliest houses at the site, dated to 640/620 BC. None can be associated with a later building. Squarish tiles are as rare in the rest of Central Italy. My lists of comparanda include only five examples—none of them, surprisingly, earlier than the V century BC: three Faliscan tomb-tiles (T 28, 34e, 101) and two from the temples at Pyrgi (T 64, 150c).

Whereas standard measurements are rare in Etruria and Latium, they were apparently present in Campania. A great number of Campanian pan-tiles measure 68–72 × 48–50 cm.[60] It so happens that no fewer than 13 South Etruscan and Latial examples match the Campanian ones (69–72 × 47–50 cm), but it is no ordinary group. Nine are mostly late Faliscan tomb-tiles (T 21a, 24a, 29a, 33b, 34b, 36a, 38a, 89, 103), three come from temples at Minturno and Satricum (T 49a, 83, 84) and one was found in a well in Rome (T 67). It may be more than coincidence that Minturno and Satricum are situated in southern Latium and strongly influenced from Campania, but the Faliscan tomb-tiles are difficult to explain.

Even though I believe in standard measurements for Campanian pan-tiles, it would be absurd to convert them into Oscan or any other foot unit, as the result would be something like 2.37 × 1.66 feet.[61] Nor would the result be more convinc-

[55] Ö. Wikander 2017, 49; cf. 1993a, 38.

[56] Ö. Wikander 1993a, 38, 171, fig. 9.

[57] Brodribb 1987, 12, 142; cf. Warry 2006, 130, fig. 8.6. According to Durm (1905, 326), the average dimensions of pan-tiles from the Agri Decumates were 46 × 36 cm. In south-east France, pan-tile sizes decreased continuously from *c.* 57.5 × 38 cm in the I century BC to 40–48 × 30–34 cm in the III–IV centuries AD (Clément 2009, 13–15, figs 26–29).

[58] Adam 1984, 230.

[59] Ö. Wikander 1993a, 36f., figs 8f.

[60] Ö. Wikander 2017, 48 n. 44. See Mingazzini 1938, 720; Rescigno 1998, 30f., 48f.

[61] Measurements such as these are often suggested for ancient buildings and their roofs. For instance, Richardson (1960, 35) described the size of the podium of Temple D at Cosa as 48 3/4 × 37 1/4 Roman feet, even though he himself found these figures "clumsy and intractable" and "incommensurable with each other". Admittedly, the original pan-tiles on the Temple of Jupiter at Cosa had dimensions corresponding to 3 × 2 feet, but when the tile-roof was replaced later, the new pan-tiles had a size of 2.125 × 1.5 feet (Richardson 1960, 171).

ing concerning other Central Italic pan-tiles, even though the conversion would inevitably—by pure chance—fit some of them. Thirty years ago, I devoted an entire (though short) article to the problem in the hope of once and for all exorcizing the Oscan foot from the study of Etruscan roof-terracottas,[62] but it is still cropping up now and then. Just a glance at my diagrams of tile dimensions[63] should prove unequivocally the uselessness of maintaining such a relationship. After careful study of the terracottas from the Mater Matuta temple at Satricum, Knoop admitted—rather than "stretching the evidence in procrustean manner"—that "there seems to be no standard unit of measurement for the antefixes, tiles and plaques".[64]

Another dimension worthy of study is the thickness of the pan-tiles. When Peter Warry stated (concerning tiles from Roman Britain) that "the thickness needs to increase as the tile gets larger to provide the same degree of structural strength", I confined myself to pointing out that the thickest Poggio Civitate tiles are also the smallest.[65] But the gigantic (135 × 88.5 cm) pan-tile from the Basilica in Pompeii[66] is allegedly 5 cm thick, and the question apparently needs further investigation.

The thickness mostly varies considerably within each pan-tile and often reaches a maximum of *c.* 3.0 cm. I have accordingly decided that a measurement of 3.5 cm or more is enough to consider it extraordinary. Poggio Civitate (and Pyrgi) has yielded no such tiles. Of 16 examples certainly and 13 probably belonging to the largest pan-tiles (Group a, 77.5–80.5 cm long), only one exceeds 3.0 cm (PC Teg 3, 3.3 cm) and that may well be the backer of a lateral sima. Of twelve pan-tiles with extremely high raised border, eight have known thickness. Three of these reach 3.3 cm, one 3.4 cm.[67]

At Acquarossa, no pan-tile is longer than 67 cm, but 17 reach a thickness of 3.5 cm or more. Five reach between 4.0 and 4.6 cm but, as usual, the thickness varies considerably within each of them: eleven of the "thick" tiles have parts as thin as 1.0–1.8 cm and are, thus, immediately disqualified. Only one is relatively thick all over (AR Teg H 12), but it is only a small corner fragment and might have been much thinner in its missing parts. No pan-tile with extremely high border and no backer of a lateral or raking sima is thicker than 3.4 cm, even though these tiles carried a greater weight and could have needed some extra structural strength.[68] Whatever the situation in Roman Britain, there seems to be no connection between thickness and size in Archaic Etruria.

Laying out a tile-roof was a laborious task, not free from risks. Even though most Etruscan and Roman houses were quite low, the high *insulae* from the I century BC onwards have certainly claimed many victims. Most pan-tiles, both in Archaic Etruria and Roman Italy, weighed no more than *c.* 6–13 kg and should have been reasonably easy to handle, but weights between 14 and 20 kg were not rare, and the great ridge-tiles, particularly those carrying large acroteria, must have been a great challenge to the workers.[69] Some pan-tiles were even more difficult to handle. The gigantic one from the Basilica at Pompeii weighs more than 95 kg.[70]

A stipulation in the Puteolan Lex parieti faciendo may be intended to avoid the use of too heavy pan-tiles when settling a maximum weight of *c.* 4.9 kg for each.[71] Another way to avoid too great weights was suggested by Winter: "Calcareous marls, common in Central Italy, produce pale terracottas with porous texture that makes them lighter in weight and therefore suitable for large tiles."[72] This may even be the explanation of the sentence which immediately precedes the just-quoted regulation in the Lex parieti faciendo: "Put one quarter of slaked lime into the clay."[73]

The most obvious method however—next to using tiles of small sizes[74]—would be to reduce the amount of clay, either

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[62] Ö. Wikander 1993b; cf. 2017, 123, 148.

[63] Ö. Wikander 1993a, figs 8f.

[64] Knoop 1987, 198f. with n. 526. Cf. Winter 2009, 534f.

[65] Warry 2006, 106; Ö. Wikander 2017, 33.

[66] Maiuri 1951, 232 no. 1, figs 4a, 5. Other extremely large pan-tiles have been found at Selinus, Temple C, 120 × 76 cm (Gabrici 1933, 193); Olympia, Heraion, 120 × 54.5–59 cm (Laconian, Koch 1915, 47); Pompeii, 117 × 49 cm (skylight-tile, Ö. Wikander 1983, 88 no. 23b); Chiusi, 115 × 85 cm (T 20a); Paestum, Sacellum, 110.5 × 75 cm (Adam 1984, 230); Marzabotto, 107/108.5 × 81 cm (T 46a). "*D'après la largeur des blocs de sima (1 m. 17), A. von Gerkan (*Von Ant. Archit.*, p. 4) est tenté d'admettre de grandes tuiles, ayant 1 m. 17 de large et 1 m. 60/1 m, 70 de long, proches de celles qui furent retrouvées à Éphèse et a Samos*" (Martin 1965, 72 n. 2 [Priene]). I know nothing about these alleged, gigantic tiles from Ephesos, Samos and Priene, nor are they mentioned by Åkerström (1966, 96–101).

[67] Ö. Wikander 2017, 33f., fig. 8.

[68] Ö. Wikander 1993a, 27, 78, fig. 3.

[69] Ö. Wikander 1993, 130; 2017, 48f., 163 with n. 268. "Two men could readily move and position a unit of [...] 45 kg, and a 50 pound lift (22.5 kg) is the conservative industrial standard in the USA today" (Turfa & Steinmayer 1996, 3). But this standard is hardly valid for a labourer balancing on the rafters.

[70] Maiuri 1951, 233 with n. 1. I fail to understand the comment of Ohr (1991, 34): "*Zweifellos hatten die ungewöhnlich grossen Formate der Dachplatten dazu gedient eine weniger kleinteilige hölzerne Dachkonstruktion zu ermöglichen.*"

[71] *CIL* I² 698, cols II–III, lines 39–41: *Nive maiorem caementa*[*m*] *struito quam quae caementa arda pendat p. XV*. This, of course, on condition that caementa actually refers to a tile (p. 208), but it is difficult to say what else it could be.

[72] Winter 2009, 524 n. 97.

[73] *CIL* I² 698, col. II, lines 38f.: *in te*[*r*]*ra calcis restinctai partem quartam indito*.

[74] At Poggio Civitate, the 77.5–80.5-cm-long Group a pan-tiles of the Oriental Complex were replaced by the considerably shorter

by making the tile plaques thinner or by cutting bevels under the raised borders. The first alternative may help to explain why the thickness of the tiles did not, as could be expected, increase when the dimensions did (see above). But against the second speaks the fact that such bevels along the long sides are actually very rare.[75] Anyhow, if these phenomena are in any way related to the inconvenience of the tile-layers, reduced thickness may have helped somewhat, but bevels almost not at all. The long bevels remain a mystery. Concerning several examples from Roman Britain, Gerald Brodribb concluded that "This bevelled edge has no obvious purpose", whereas Marion Elizabeth Blake wrote: "Sometimes the flanges were beveled to lessen the span."[76]

4. Raised borders (flanges) of pan-tiles

As early as 1900, Giacomo Boni described the manufacture of ancient pan-tiles essentially correctly.[77] Presumably, he had observed the activities at a contemporary tile factory. Nonetheless, various details have been the subject of further study, for instance, the methods used to work out the lateral, raised borders. Various suggestions have been presented, but today there is a growing consensus concerning the matter.[78] A completely different opinion was, however, expressed by Brodribb—remarkable, but worthy of closer examination: "Personal experiment has shown that these [raised borders] can be created by folding up the edges of the clay in the mould or former, and then slicing away the surplus clay. It is often possible in a broken section to see how the clay is curved-up to create the flange."[79]

Brodribb's idea cannot be refused at once, as this mode of production is actually in evidence in two Archaic, Central Italic skylight-tiles—not, however, for their lateral borders but for the one that surrounds the central opening.[80] On the other hand, part of the raised border around the horseshoe-shaped opening of a skylight-tile from Acquarossa has come loose leaving only a smooth scar, proving that the border was made separately.[81] But, as far as the lateral borders of ordinary pan-tiles are concerned, various publications report explicitly that they adhere firmly to the tile plaque and, if they have been chipped off, left a rough and rugged surface.[82] This is the case also with the raised border along the short side of many ridge-tiles, whereas their plastic cordons often have come loose leaving only a smooth scar.[83]

As the raised border of Corinthian pan-tiles presumably developed from the upturned border of the protocorinthian combination-tiles,[84] it would only be natural if the Etruscan pan-tiles sometimes retained their curved shape, but this is extremely unusual.[85] Instead, the clay is elaborately packed to form a right-angled edge together with the vertical border—particularly noteworthy as the workers sometimes took the trouble to cut bevels along the edge afterwards. But perhaps the most conclusive argument is the fact that the raised border is normally much wider than the thickness of the tile plaque. Brodribb's suggestion is attractive, but to me it seems absolutely out of the question that it should have relevance for Etruscan pan-tiles.

5. Cover-tiles and antefixes

It is often taken for granted that pan-tiles and cover-tiles from the same roof were of the same length. I myself have vacillated and never made a serious attempt to investigate the issue. In 1993, I stated that "As a rule, the length of pan and cover-tiles is identical; the flange of the cover is more or less equal [...] to the overlap of the pan." But in 2017, I was more sceptical.

(62.5–64 cm) Group b in the Archaic one (Ö. Wikander 2017, 33, 49). On the Temple of Jupiter at Cosa, erected 240/220 BC, the original giant pan-tiles (89 × 59 cm) were later replaced by much smaller ones (63 × 44.5 cm): Richardson 1960, 153f., 171, 208.

[75] Ö. Wikander 1981, 76, fig. 5:13 (San Giovenale); 1993a, 126 (Acquarossa); 2017, 150 (Poggio Civitate). Cf. Knoop 1992, 89 n. 6, 91. Bevels under the lower corners are quite another matter, intended to make overlapping more efficient.

[76] Brodribb 1987, 13; Blake 1947, 304.

[77] Boni 1900, 328f., followed by Vaglieri 1903, 132f.

[78] Ö. Wikander 1993a, 106f.; 2017, 132. Pan-tiles are almost always provided with raised borders. When Vitruvius (V 10.3) speaks about *tegulae sine marginibus*, it is the matter of plaques attached underside vaulted ceilings. *Margo* is apparently the technical term—Vitruvius must have known, even though he devoted remarkably little interest (almost none) to the tile-roof. For rare unflanged tiles in Roman Britain, see Brodribb 1987, 18.

[79] Brodribb 1987, 12f. This may possibly be what Andrén (1940, CLII) was referring to when stating that the long sides of Central Italic pan-tiles "are provided with raised or bent-up flanges". But he gives no examples to substantiate his claim.

[80] Skylight-tiles nos 29a (San Giovenale) and 52 (Satricum). See Ö. Wikander 1981, 83 nos 59f., figs 13f.; 1983, 90 no. 29, fig. 8; 2024, 118f., fig. 4 left.

[81] Ö. Wikander 1983, 90f. no. 30b, fig. 8; 1986, 99 no. AR Teg F 51, figs 54, 57.

[82] Ö. Wikander 1993a, 38 n. 44; 2017, 132, 150, with further references.

[83] Seven examples at Acquarossa: Ö. Wikander 1993a, 110. But there are some examples of raised borders on Type III ridge-tiles, which were apparently turned up in the manner suggested by Brodribb (Ö. Wikander 1993a, 110 n. 65).

[84] Winter, in Ö. Wikander 2017, 186 n. 67.

[85] For a possible example, see AR Teg F 16 (Ö. Wikander 1986, fig. 53).

As for the Acquarossa tiles, the "agreement is no more than 'general'—that is, most lengths are to be found within a range of 61–67.5 cm. But the thick cluster of pan-tile lengths between 61.5 and 64 cm has no counterpart among the cover-tiles, and the 14 pan-tiles (13.5%) with lengths between 55.5 and 60 cm have not a single cover-tile to match them."[86] But this is not entirely true.

As minor differences are easily concealed by varying length of the overlap, we must consider lengths differing up to at least 3 cm basically equal. But the comparison is made difficult by the fact that Acquarossa yielded 107 pan-tiles with complete lengths vs only 16 cover-tiles.[87]As for the extra short pan-tiles (Group D), six derive from Zone F, House D (Roof F:2), five from Zone G, House B (Roof G:1), whereas one is sporadic. No complete cover-tile derives from Zone G, so there is no way to show whether they may have equalled the pans. But one cover-tile with "correct" length (that is, only slightly longer) has actually been assigned to Roof F:2 (AR Imb F 28). The remaining cover-tiles come from four different zones and can be assigned to six roofs with pan-tiles of similar length: Roofs B:4, B:6, H:1, L:2, L:3 and M:2. In other words, there is nothing to contradict that new buildings were originally covered with tiles of the same length but, on the other hand, there is nothing to say that they remained such, when a number of broken tiles had been replaced. In fact, a closer study of the terracotta ensembles presented in 1993[88] clearly indicates that tiles of different dimensions were often used together.

At Poggio Civitate, there is evidence of two buildings carrying tiles of the same length, and of one (OC2/Workshop) using different.[89] From San Giovenale, no complete tile lengths are known. Moreover, a quick comparison between my diagrams of pan-tile and cover-tile lengths from other sites[90] reveals that a number of the latter lack counterparts among the former, for instance, I 6, 18, 19, 67, 68.

The length of Central Italic cover-tiles varies from *c.* 35 (I 18) to 90 cm (I 15a, 33), those from Poggio Civitate from 57.5 to 80.5 cm, whereas Acquarossa presents the smallest range, from 60.5 to 67.5 cm (excluding five antefix backers, 66.5–70 cm).[91] Antefix backers are generally longer than plain cover-tiles and often both wider and higher. From Poggio Civitate, we have 15 cover-tiles longer than 62 cm. Seven are ordinary tiles of Type I, whereas six are antefix backers of Type II or III (two cannot be classified with certainty). Among the comparanda, this tendency is even more manifest: of twelve cover-tiles longer than 62 cm, all belong to Type III and at least six were antefix backers.[92]

The majority of the cover-tiles cluster about a length of *c.* 60 cm. At Acquarossa, none is shorter. At Poggio Civitate, there are seven examples between 57.5 and 60.5 cm (Type I, Group d), all but one deriving from the Orientalizing OC2/Workshop. The comparanda comprise eight short examples, completely without chronological or geographical connection. They derive from Norba in the south to Marzabotto in the north, they are dated between the VI and III centuries BC, and they belong to both Type I and Type III C. There is no indication of a gradual decrease in length.

But cover-tiles can be larger than ordinary also regarding width and height, without necessarily being longer. The width and height of Archaic (and probably also ordinary later) cover-tiles were normally quite small.[93] The greater measurements of tiles from Poggio Civitate, Pyrgi and Satricum apply mostly to Type III and/or antefix backers. Those from Satricum have probably been exaggerated by being taken at their attachment to the antefix (as the cover-tile was in most cases missing): "The measured circumference of cover-tile attachment at the backs of the antefix plaques may therefore be systematically larger than the average measured cover-tile dimensions".[94]

At Acquarossa, most cover-tiles are not wider than 15 cm and not higher than 8 cm.[95] Three groups are larger than normal:
(a) Plain cover-tiles of Type II. Fragments of such have been found from Roofs B:4, F:8, F:9, H:2 (AR Imb H 19) and M:3 (AR Imb M 1, 7, 8), all of them from Phase 3.[96]
(b) Antefix backers, all from Zone F: AR Imb F 7 (Type I, antefix Type I), 15, 17, 18 (Type III A, antefix Type V), 34, 40 (Type III C, antefix Type I).
(c) AR Imb G 13, with griffin protome.

At Poggio Civitate, only one cover-tile is markedly wider or higher than the others: PC Imb 42, not an antefix backer but of Type III and exceptionally long. Moreover, a great number of cover-tiles surpass the Acquarossa standard, with widths up to 18 cm and heights up to 9.5 cm.[97] My lists of comparanda include 19 cover-tile groups wider and higher than the Acquarossa standard. More than half the number are Archaic, but one is dated as late as the III or II century BC. Their length varies from 66 to 90 cm. Only one is markedly short: I 24

[86] Ö. Wikander 1993a, 126; 2017, 152 n. 235.
[87] Ö. Wikander 1993a, 27, figs 2, 8 (pan-tiles), 53, fig. 12a (cover-tiles). I exclude five antefix backers, as it is uncertain how much of their length actually rested on the pans.
[88] Ö. Wikander 1993a, 87–99.
[89] For details, see Ö. Wikander 2017, 152.
[90] Ö. Wikander 1993a, fig. 9; 2017, fig. 24.
[91] Ö. Wikander 1993a, fig. 12a (Acquarossa); 2017, 62 (Poggio Civitate), fig. 24 (comparanda).
[92] This, however, is at least partly due to the fact that excavators have tended to appreciate antefix backers more than plain cover-tiles.
[93] Ö. Wikander 1993a, fig. 18.
[94] Knoop & Lulof forthcoming, ch. 4.3.2.
[95] Ö. Wikander 1993a, fig. 14.
[96] Ö. Wikander 1986, 202, 232.
[97] Ö. Wikander 2017, fig. 21.

from Pyrgi (57.5 cm). Seventeen groups belong to Type III (five of which certainly III C), two to Type I (I 24, 62), none to Type II. At least five are antefic backers. Seven groups are more than 20 cm wide, five more than 14 cm high.

Antefix backers tend to be long, wide and provided with a flange. But we can perceive a chronological development. The early examples from Acquarossa and Poggio Civitate (630–540 BC) are distributed as follows:

	Antefix type	**Cover-tile type**
AR	I (female head)	I
	I (female head)	III C
	II (triangular hole)	III B
	III (two triangular holes)	II (with cross-bar)
	IV (painted palmette)	?
	V (painted palmette)	III A
	VI (semicircular plaque)	?
	VII (disc)	?
PC	I A (female head)	II
	I B (canopic)	?
	II (gorgoneion)	II–III

Apparently, all types (and subtypes) of cover-tiles could carry antefixes. Only three of the seven groups of antefix backers belong to Type III, with its fully developed flange. Remarkably, the female-head antefixes from Acquarossa, Zone F, Building A (Roof F:8) were attached to cover-tiles of Type I, whereas those from its twin Building C (Roof F:9) were of Type III C.[98] But later conditions change. Of the seven antefix backers in my lists of comparanda dated from *c.* 530 BC to the III century BC (I 1, 27, 33, 43, 51, 69, 72), all were of Type III, and all three that can be classified exactly belong to III C. Apparently, from the Late Archaic period onwards, antefixes demanded a distinctly flanged backer—presumably to provide a better support for the huge shell antefixes.

But while antefix backers normally had a more or less distinct flange, a flange does not prove the existence of an antefix. At Acquarossa, one group of III B cover-tiles were demonstrably not equipped with antefixes and, at Poggio Civitate, the same is true of at least one long and wide Type III (A?) cover-tile.[99] My lists of comparanda include seven Type III cover-tiles with and ten without antefix. As, for a long time, undecorated terracottas were seldom retained at excavations, this clearly indicates that only a minority of the Type III cover-tiles were antefix backers.[100]

6. Marks on back and underside of tiles

In 2017, I expressed surprise that a plastic female terracotta head from Cumae had two paw impressions on its back side—foolishly, as the publisher gave a both simple and convincing explanation for the phenomenon.[101] The clay had been left to dry in the mould, with the face downwards and the back of the piece lying exposed to be trodden upon. But the fact is that not all marks on back- and undersides are so easily explained.

Pan-tiles often show marks on the underside produced during the drying process. Imprints of leaves under tiles from Poggio Civitate, Balena and Florence, and "fern leaf and a clump of grasses, [...] some tesserae of a mosaic floor" in Roman Britain[102] are just traces left by the ground where the tiles were put to dry. More interesting, however, are the deliberate smoothing and impressions of fingers on underside, even the imprint of a child's hand under a tile from Pontecagnano,[103] as they confirm the suspicion that pan-tiles were standing on their short sides at least during parts of the drying process.

Ridge-tiles not seldom have deep impressions of fingers on the underside. If they were not made during the transport to the drying area, they may reveal difficulties in making the tiles stand stable there.[104] More remarkable, however, are the clear signs of smoothing and even coating on the underside of some ridge-tiles[105] and, most of all, the probable imprint of a hoof under AR Kal L 9 and the unmistakable mark (looking like letters XY) incised under AR Kal Sp 23.[106]

Apparently, the undersides of the ridge-tiles were accessible sometimes during the drying, either resting upside-down or standing on one of their short sides. If the suspected hoof print is actually such, only the former alternative is possible—

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[98] But this is not the only difference between the two roofs: Building A had ridge-tiles of Type II, Building C of Type III. Cf. the different pan-tile types on Temple A and Temple B at Pyrgi (Melis, in *Pyrgi* 1970, 689 n. 1).

[99] Ö. Wikander 1993a, 51, particularly AR Imb F 28 (Acquarossa); 2017, 60 PC Imb 42 (Poggio Civitate).

[100] Concerning the finds at Tarquinia, Civita, Ciaghi (in Bonghi Jovino 1986, 169) reports that cover-tiles of Type III B were "*piuttosto frequenti*", but "*mancano qui le prove che questo tipo sia caratteristico dei coppi completati da antefisse*".

[101] Rescigno 2006, 271, fig. 27.3. Cf. Ö. Wikander 2017, 137 n. 68.

[102] Ö. Wikander 2017, 135 n. 55, 137 n. 67; Brodribb 1987, 125f.

[103] Maaskant-Kleibrink 1987, 117 (smoothing); Strøm 1993, 122, fig. 17 (child's hand).

[104] See, particularly, AR Kal F 67 (Ö. Wikander 1986, fig. 65) and G 19-21; PC Kal 11 and inv. no. 84-59 (Ö. Wikander 2017, 206 n. 43).

[105] Smoothing: Ö. Wikander 2017, 137, PC Kal 29, 37 (Poggio Civitate); 2024, 132 (San Giovenale). Coating on tiles from Poggio Civitate: Ö. Wikander 2017, 137, 138 n. 85, PC Kal 40.

[106] Ö. Wikander 1993a, 114 n. 95 (hoof); 1986, 262, fig. 145 (marks).

and then difficult to explain. It could have been effected by heaping up sand or earth along the curved sides of the inverted ridge-tile, but it is hard to believe that this could have been done without grains of sand or earth getting stuck on the surface of the still wet clay—and no such grains have ever been observed. Raising the tiles on one short side seems a more likely solution. I have earlier brought up and rejected the idea,[107] but ridge-tiles were perhaps (like pan-tiles) dried alternatively lying and standing.

That ridge-tiles were at least partly dried lying down like cover-tiles is shown, particularly, by the fact that a number of such tiles from Acquarossa have small depressions on the underside, almost certainly deriving from wooden sticks used to hold them upright during the drying process and avoid warping.[108] Eighteen units preserve up to six stick-holes each, but their limited distribution is noteworthy; this practice was obviously not widespread. Only one ridge-tile belongs to Acquarossa Type II (AR Kal B 25), all the others to Type III. Three of these come from Zone F (AR Kal F 158, 163, 177), apparently deriving from the same building, Portico C (Roof F:9). The rest, 14 Type III ridge-tiles, come from two adjacent buildings in Zone B: Houses A and C (Roofs B:4 and B:6). On tiles from other sites, I have seen no traces of such props.

Nevertheless, ridge-tiles show fewer signs of warping than do cover-tiles, but their much greater weight may have caused both long sides to slide slightly outwards, making their profile lower than a semi-circle. While the height of cover-tiles is about or more than half of their width, the majority of the ridge-tiles are much lower.[109] Acquarossa Type III is an exception, perhaps because of their wooden-stick support.

"It is always worth while looking at the underside of a tile."[110]

7. The eaves. Attachment and interlocking

The weakest point of the complete tile-roof was its lower ends, along the long sides of the building: "*Le tegole di gronda che essendo le più esposte alla furia dei venti dovevano essere frequentemente sostituite.*"[111] The overhang was apparently quite deep. Vitruvius' (IV 7.5) recommendation for Tuscan temples is unfortunately ambiguous: "the eaves of the complete roof should correspond to one third" (*stillicidium tecti absoluti tertiario respondeat*). Other translations have been suggested and a number of interpretations. In the end, Andrén had to confine himself to state that Etruscan temples "were characterized by widely projecting eaves".[112] I have earlier reckoned with an overhang of between 0.5 and 1 m and see no reason to change my mind.[113]

The importance of the eaves is emphasized by the fact that there are at least six Latin words for it:
protectum. *Digesta* IX 2.29, XLIII 25.15, XLVII 7.6
protectura. Vitruvius IV 2.1
stillicidium. Vitruvius IV 2.5, 7.5; Obsequens 27a; Festus, p. 8 L.[114]
suggrunda. *CIL* I² 687 (Capua); Varro, *Rust.* III 3.5; *Digesta* IX 3.5.6, L 16.242.1.
suggrundatio. Vitruvius IV 2.1.
suggrundium. Vitruvius II 9.16; Plinius, *HN* XXV 13.160.
The Lex parieti faciendo from Puteoli (105 BC) supplies the technical term for the eaves-tiles: *tegulae primores*.[115]

Severe winds and storms would often tear tiles loose from the eaves (p. 219), and even though they were easy to replace (as pointed out by Vitruvius VI 8.8), various methods were devised to keep them in place—particularly, those equipped with antefixes or lateral simas.
(a) Vertical nail-holes in pan-tile plaques. VII–II centuries BC. From Minturno to Marzabotto (Ö. Wikander 1993a, 40–42, 124; 2017, 51f.). Often reinforced by bosses or projections from the raised borders (Ö. Wikander 2017, 52 items 7–9).
(b) Horizontal "nail-holes" through raised borders of pan-tiles. VI century BC. Only Acquarossa (Ö. Wikander 1986, 259, 261 nos AR Sp Teg 11, 14f., fig. 143; 1993a, 40, 124 n. 159).[116]
(c) Nail-holes in cover-tiles. VII–III centuries BC. From Alatri to Castiglion Fiorentino. Very rare (Ö. Wikander 1993a, 56, 124; 2017, 69).
(d) Crossbars under the cover-tile flanges. VI century BC. Only Acquarossa (Ö. Wikander 1993a, 42, 56f., 124).

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[107] Ö. Wikander 1993a, 110, 113.
[108] Ö. Wikander 1993a, 113, fig. 43.
[109] Ö. Wikander 1993a, fig. 14; 2017, fig. 21 (cover-tiles); 1993a, fig. 20a; 2017, 79f., fig. 30, PC Kal 23, 33 (ridge-tiles).
[110] Brodribb 1987, 126.
[111] Stefani 1953, 47.
[112] Andrén 1940, LXVI. Cf. Boëthius 1970, 46. I once maintained, incorrectly, that Vitruvius recommended that the eaves should take up 1/12 of the Etruscan temple's width (Ö. Wikander 1993a, 123). For the Capitolium at Cosa, Richardson suggested 1/9 of its width.
[113] Ö. Wikander 1993a, 123; 2017, 114, 149, 161, fig. 54 (= Winter 2009, Ill, Roof 3-8:2). Cf. also the narrow tile-layer about 1 m from a wall at Satricum: Maaskant-Kleibrink 1987, 58, map xxv.
[114] Andrén (1940, LXII–LXVI) analysed the meaning of *stillicidium* in detail and showed convincingly that it developed from "rain-water falling from the eaves" to denote sometimes the eaves themselves—with an appropriate reference to the German "*Traufe*".
[115] *CIL* I² 698, col. II, lines 26f. In Greek ἡγεμόνες κεραμίδες (Orlandos 1966, 86). Cf. p. 208.
[116] Three fragments of Type I pan-tiles from an obliterated building on the highest part of the plateau, with fragments of Type II pan-tiles (otherwise unknown outside Zone F), Type I raking simas, and relief plaques of types known from Zone F—presumably from some kind of monumental building. The function of the "nail-holes" is unknown. If two adjacent tiles were united by a rope, stick or wire, it seems doubtful how efficient such a construction may have been. Cf. Ö. Wikander 1993a, 35 no. T 96, 124 n. 159 (Veii, Portonaccio).

(e) Notches in long sides of cover-tiles, intended to fit over a cross-piece projecting from one of the eaves-tile's raised borders. VI–III centuries BC. From Minturno to Marzabotto. Rare (Ö. Wikander 1993a, 124f.; 2017, 149f.).
(f) Notches in cover-tiles, intended to fit over vertical part of lateral sima. VII century BC. Only Poggio Civitate (Ö. Wikander 1993a, 125; 2017, 63, 100, 149).
(g) Tile-stops. VI and III centuries BC? From Caere to Poggio Civitate? Very rare (Ö. Wikander 2017, 151; 2024, 117, 144 with n. 169, fig. 2 left).
(h) Pan-tile (Type V) with a low raised border along its upper short side, intended to fit into a corresponding, transverse groove under the next (upper) tile, close to its lower short side. Early V century BC. Only Pyrgi (Ö. Wikander 1993a, 40 no. T 63; 2017, 47).
(j) Stones resting on the eaves-tiles. Probable method, difficult to prove (Ö. Wikander 1993a, 130; 2017, 149).
(k) Clay or mortar attaching the cover-tiles to the pans. Few and isolated examples before I century BC (Ö. Wikander 1988, 208 with n. 56; 1993a, 130; 2017, 132, 149; Brodribb 1987, 24; Warry 2006, 101, pl. 6.5f).
(l) "Chinese roofs" (horizontal at the eaves)? Suggested for the Archaic Building at Poggio Civitate, but probably never used in Central Italy (Ö. Wikander 2017, 150).

In spite of the obvious need of reinforcements at the eaves, such devices were, thus, far from common. On the contrary, frequent replacement of eaves-tiles was apparently a matter of course, even though the cost was considerable (p. 221). Most reinforcements are in evidence at few (or even one single) site, and many were apparently solutions reached at local tileworks. The only device in my list above that was not rare or unique is the nailing of pan-tiles to the woodwork (*Item a*), and not even that was a common occurrence. True, at Acquarossa nail-holes are in evidence at one third of the buildings, but Poggio Civitate has yielded no more than eight holes and San Giovenale only one. Of the 80 sites in my lists of comparanda, 58 have not produced any.[117] In the light of this, I am convinced that the often-cited regulation in the Puteolan Lex parieti faciendo should not be interpreted (as it has mostly been) so that *only* the eaves-tiles should be nailed, but rather as a demand that they, at least, should.[118]

As a matter of fact, there is no indication that ordinary pan-tiles higher up on the roof-slope were ever equipped with nail-holes. For instance, at Pyrgi, nail-holes were to be found in a number of eaves-tiles, certainly identified by their painted soffit (T 59-60, 64, 149), but not in the plain tiles. At Minturno, one such pan-tile was allegedly provided with nail-holes, but all eaves-tiles were not necessarily decorated (none, for instance, at Acquarossa). For the roof of OC2/Workshop at Poggio Civitate, Winter suggests that "some of the pan tiles in the row above the lateral sima may have been nailed, another special provision perhaps required by the position of the unwalled structure [...] where it would be subject to updrafts".[119] It is the matter of three small corner fragments (PC Teg 65–67), probably (but not certainly) belonging to the late VII-century BC workshop, extraordinarily furnished with vertical nail-holes through the raised border.

If the nail-hole fragments actually derive from the workshop, Winter is right in as far as they were probably not connected with the lateral simas, but there is another possible explanation. Warry suggests that holes at the long sides of Romano-British pan-tiles "were presumably to secure the gable end tiles".[120] If the same is true concerning the Poggio Civitate nail-holes, they would, as suggested by Winter, have had their place higher up the roof, but they would still not have been ordinary pan-tiles with nail-holes but, instead, tiles exposed to extra strain at another overhang, that is, along the gables.

Why, then, were nail-holes so rare? Their concentration at the eaves (and perhaps gable rakes) is no surprise, as the ordinary pan-tiles were efficiently held in place by the entire system of overlapping and interlocking. But why did so many buildings not have any nail-holes at all? Even though iron was presumably quite costly, this fact must be balanced against the cost of replacing broken tiles, which were perhaps even more expensive. Anyhow, no more nail-holed tiles were produced than necessary; in fact, the tile-layers had sometimes too few such tiles at their disposal and had to chip holes into fired pan-tiles, with the unavoidable risk of breaking them.[121]

The very few cover-tiles with nail-holes (*Item c*) that still preserve their lower end were antefix backers, and Francesca Melis was probably right when stating that a number of such tiles without lower ends had once carried antefixes.[122]

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[117] Ö. Wikander 2017, 51f., fig. 1.

[118] *CIL* I² 698, col. II, lines 26f.: *Tegulas primores omnes in antepagmento ferro figito*. I once made the same mistake myself: Ö. Wikander 1993a, 124. But as early as 1881, Gräber pointed out that "*Alle Ziegel mit Nagellöchern gehören* [...] *ausnahmlos der Traufe an*" (Dörpfeld *et al.* 1881, 18).

[119] Mingazzini 1938, 726; Rescigno 1998, 338 (Minturno); Winter 2009, 127, 141 n. 262, 532; Ö. Wikander 2017, 155f. no. O 4, fig. 50 (Poggio Civitate).

[120] Warry 2006, 102, pl. 2.14. Cf. Ö. Wikander 2017, 151 n. 229.

[121] Four holes out of 64 at Acquarossa: Ö. Wikander 1993a, 40. In Roman Britain, 12% of the nail-holes are chipped (Warry 2006, 133). Some examples are known from Campania, if I understand correctly Rescigno 1998, 47.

[122] Melis, in *Pyrgi* 1970, 694 no. 7b.

8. Damage and repairs

In 1993, I divided the types of damage an ancient tile-roof could be exposed to into five main groups: by people walking on it, by theft, by deliberate hooliganism, by using the tiles as weapons, and by storm and bad weather.[123] I gave a number of examples from ancient literature, but now have more to add.

Basically, roof-tiles are quite durable; they seldom break if people walk on them—at least not if they avoid jumping and putting their feet in the very centre of large tiles. In AD 462, a priest of high station allegedly saved the church of St Anastasia in Constantinople from fire by climbing up to its roof whilst tearfully praying.[124] Tile-roofs were present almost everywhere and constituted a perfect platform for public appearance and speeches. It is a reasonable conjecture that they were often used as such, even though we mostly hear about these actions when the tiles actually broke—for instance, when a person is chasing a monkey on the roof in one of Plautus' comedies.[125]

There is no doubt that storms and bad weather constituted the greatest threat to an ancient tile-roof. This is certainly what Livius alludes to when relating that "the summit of the temple of Jupiter was hit by a thunderbolt and stripped of almost its entire roof".[126] When storms are reported to destroy (*diruere*, *deicere*, *evertere*, *deturbare*) *tecta*, it is certainly first of all the matter of roof-tiles.[127]

Also *detegere* ("uncover") was used in this connection.[128] But more puzzling is the use of the verb in municipal and colonial codes, with identical wording: *Neiquis in oppido* [...] *aedificium detegito*.[129] What can this prohibition of denuding buildings of their tiles imply? Simple theft and vandalism should not justify a particular law, nor should the use of tiles in war or riots. What remains to be forbidden could be the acts of municipal authorities and military commanders. Both kinds of offences are mentioned in our sources, one of them committed by a Roman censor.[130] Crawford's proposal is more commonplace: "The purpose was perhaps to prevent speculative building of shoddy tenements, the delapidation of the city centre or the diminution of the housing stock".[131]

In 1993, I published a list of 20 ancient testimonia concerning the method of fighting an attacking enemy by throwing tiles (and stones) from the roofs. Three years later, William Barry presented 14 more.[132] I can now add two late writers to his list: the IV-century AD bishop Optatus and the IX-century AD annalist Theophanes, who describes how, in AD 379, the holy bishop Eusebios of Samozata was killed by an Arian woman throwing a pan-tile upon his head, "something that God in his unfathomable judgement permitted".[133] Moreover, when Dio Cassius relates that people, during the urban riots of 41 BC, were hurling undefined objects from the roofs,[134] we are certainly dealing with roof-tiles.

The strength of a tile-roof was naturally to a great extent dependant on whether it rested upon a wooden boarding or directly on rafters and/or purlins. In his description of the Tuscan temple, Vitruvius expressed himself both briefly and vaguely: "Above the gable, the ridge-pole, rafters and purlins should be placed, so that the eaves of the complete roof should correspond to one third."[135] The meaning of this puzzling passage has been the subject of much discussion,[136] but here it may suffice to point out that Vitruvius does not even intimate the existence of a wooden boarding. In his corresponding ac-

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[123] Ö. Wikander 1993a, 131f. A more odd reason is reported, when Ti. Gracchus' foot was injured by a tile fragment broken loose from the eaves by two ravens: *corvi fragmentum tegulae ante pedes eius proiecerint ex stillicidio* (Obsequens 27a. Cf. Plutarchos, *Vit. Ti. Gracch.* 17). The eaves-tile may, however, have been cracked before the ravens dislodged a fragment.

[124] Theophanes, *Chronographia* (p. 112, ed. C. de Boor, Leipzig 1883).

[125] Plautus, *Mil.* 156, 160–162, 178f., 284, 308, 504. Cf. Terentius, *Eun.* 588. For tile-roofs used for sleeping, keeping guard, conducting festivals, watching processions, etc., see references in Barry 1996, 61. Likewise, the flat roofs in south-west Asia were used for a great number of activities: Vukosavović *et al.* 2022, 55 (with ample references to the Hebrew Bible).

[126] Livius XXVII 4.11: *Iovis aedis culmen fulmine ictum ac prope omni tecto nudatum* (210 BC).

[127] See, for instance, Obsequens 14: *procellosa tempestate tecta diruta* (163 BC); 62: *turbinis vi tecta deiecta* (60 BC); 68: *turbine* [...] *pleraque tecta eversa* (44 BC); Plautus, *Rud.* 78: *deturbavit ventus tectum et tegulas*.

[128] Plautus, *Rud.* 85: *ventus detexit villam*. Cf. *Mostell.* 162–165, where the speaker compares himself with a building.

[129] *CIL* I² 590, tabula IX, lines 32–38 (Tarentum 90/89 BC?), 594, 75 (Urso 44 BC).

[130] Ö. Wikander 1993a, 131 nn. 207f.

[131] Crawford 1996, 310. I have not had the opportunity to study Lewis 1989, apparently devoted to this very problem.

[132] Ö. Wikander 1993a, 130f. with nn. 204, 213; Barry 1996, *passim*.

[133] Optatus II 18 (*CSEL* 26, p. 52); Theophanes, *Chronographia* (p. 67, ed. C. de Boor, Leipzig 1883). Barry (1996, 70) mentions the assassination of Eusebios, but with reference to Theodoretos of Kyrrhos V 4.5–9.

[134] Dio Cassius XLVIII 9.4: ἀπὸ τῶν τέγων αὐτοὺς βάλλειν. On tile-throwing in urban riots, see Barry 1996, 62–64.

[135] Or "[...] the eaves correspond to one third of the complete roof": *Supraque eum fastigium, columen, cantherii, templa ita sunt collocanda, ut stillicidium tecti absoluti, tertiario respondeat* (Vitruvius IV 7.5). A completely different translation was suggested by Richardson (1960, 39 n. 26).

[136] A lucid summary of the arguments is presented in Andrén 1940, LX–LXII, but my translation of the passage still includes some uncertainties.

count of Greek temples, he adds that there should be "above [the purlins], under the tiles, *asseres* which project so that the walls are covered by their eaves".[137]

Whether *asseres* should be translated as battens or boards is of no consequence in this context. In any case, the Tuscan temple apparently lacked the closer wooden bedding of the Greek ones, and I am convinced that the same is true of most ordinary Etruscan and Roman buildings. I have discussed this issue earlier and gathered a number of ancient texts which clearly indicate (but perhaps not prove) my suggestion.[138] An almost conclusive argument is, however, provided by a passage in Appianos' *Bellum civile*, describing how the crowd pursued the adherents of Apuleius Saturninus, who had taken refuge in the Curia: "They tore off the tiles of the Senate house and threw them on those around Apuleius until they killed them."[139]

Whatever the reason, it remains a fact that ancient tile-roofs often lost some of their tiles. Many house-owners kept a stock of tiles in reserve and continuously inspected their roofs in order to exchange damaged tiles with new ones.[140] On the other hand, the replacement of an entire roof was probably a rare occurrence. I once stated that "a tiled roof may well have lasted a generation or two (or even longer)",[141] but that was obviously too conservative an estimation.

While minor repairs are difficult to prove,[142] the total life of a roof is easier. Of 13 Acquarossa roofs dated to the late VII century BC, at least five were obviously preserved up to the final destruction of the town in *c.* 540 BC[143]—that is, a life of between 60 and 100 years. And, moreover, they were not abandoned because of advanced age but in a general destruction, probably caused by an earthquake. During their long lives, these roofs must have been the subject of several repairs, but such are (as always) difficult to ascertain. None received obviously late replacements, such as pan-tiles of Type II, skylight-tiles or ridge-tiles of Type III. Concerning Roof G:1, some of the particular Type I A pan-tiles may have been replaced by more "ordinary" ones[144] and, if the so-called AR Sima G 23 is really a sima, it must be a later addition. Regarding clay, slip and paint, however, it agrees perfectly with the early Phase 1 A roof. A panther antefix may be a better conjecture.[145]

If the large ridge-tiles from the Esquiline (K 22-23.) were actually transferred from the Temple of Jupiter Capitolinus in the IV or III century BC,[146] they must have crowned its roof for about two centuries. At the Basilica at Pompeii, some extremely long pan- and cover-tiles (length 135 and 132 cm, respectively), dated by an Oscan tile-stamp to *c.* 100 BC, were apparently still resting on the roof when it collapsed in the earthquake of AD 62/3 or the volcanic eruption of AD 79. But the finds of much smaller pan-tiles indicate extensive repairs.[147] With continuous inspections and repairs, an ancient tile-roof could apparently last for hundreds of years.

9. Manufacture, workshops and price

The extreme production volumes that I mentioned in 1993[148] have nothing to say about the true capacity of Etruscan tile workshops. More appropriate figures can probably be found in graffiti on Roman imperial tiles from Italy, Germany and Britain, apparently impressed by tile-makers to celebrate the

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[137] Vitruvius IV 2.1; *deinde insuper sub tegulas asseres ita prominentes, uti parietes protecturis eorum tegantur*.

[138] Ö. Wikander 1993a, 122; 2017, 147f.

[139] Appianos, *B Civ* I 4.32: τὸν κέραμον ἐξέλυον τοῦ βουλευτηρίου καὶ τοὺς ἀμφὶ τὸν Ἀπουλήιον ἔβαλλον, ἕως ἀπέκτειναν; [Aur. Vict], *De vir. ill*. 73: *Apuleius* [...] *lapidibus et tegulis desuper interfectus est*. Cf. Barry 1996, 65f., concerning the lack of wooden boarding in Greek houses, with references to Thukydides IV 48 and Xenophon, *Hell*. VI 5.9. But another passage in Appianos' *Bellum civile* (IV 6.44) may indicate the existence of a wooden boarding (ἐκρύπτετο ἐπὶ διπλῆς ὀροφῆς μεταξύ), whereas a third (IV 3.13) is more puzzling: "Others [i.e. proscribed] crouched [...] under the thickly-packed tiles of their roofs" (H. White, in Loeb Classical Library) gives little meaning, but it seems a basically correct translation of τῶν τεγῶν ταῖς κεραμίσι βυομέναις ὑπεκάθηντο. In what way were the tiles "thickly-packed"? Tight-fitting?

[140] Ö. Wikander 1993a, 132 with nn. 219f.; 2017, 164 with nn. 278, 286. Some tiles from Sparta are stamped with the word παράθεσις (depot, storage), presumably a reserve stock organized by the city (Martin 1965, 86 with n. 3). Richardson (1960, 208) probably underestimated the need, when stating that "a temple decoration wanted repairing every twenty or twentyfive years".

[141] Ö. Wikander 2017, 144, cf. 163f.

[142] For possible examples, see Ö. Wikander 1993a, 132; 2017, 164; Winter 2009, ref. in the index p. 647, s.v. "repair". If Richardson's subtle arguments are to be trusted, the roof of Capitolium at Cosa, dated *c.* 150 BC, was the subject of two repairs (*c.* 120 and *c.* 80 BC) and two complete redecorations (*c.* 100 and *c.* 50 BC) in one hundred years. See Richardson 1960, 206–284, particularly, 206f., 231f., 239, 251, 269f.

[143] Roofs F:1, G:1 and M:1 from Phase 1A; Roofs B:2 and F:4 from Phase 1B. See Ö. Wikander 1993a, 89, 92, 95, 98, 157, fig. 60.

[144] Ö. Wikander 1986, 169f.

[145] Panther antefixes are rare, but we know of at least two early VI-century BC examples, from Tarquinia (Winter 2009, 172 no. 3.C.1.b) and San Giovenale (Ö. Wikander 2024, 135 no. 7, fig. 13). For AR Sima G 23, see Ö. Wikander 1986, 187f., fig. 102; 1993a, 84; Winter 2009, 77f. no. 2.B.1.a.

[146] As convincingly suggested by Mura Sommella 2010, 94–99.

[147] If they were not rather used in the lateral aisles: Maiuri 1951, 232–234, fig. 4.

[148] Ö. Wikander 1993a, 139.

end of the working-day. These figures indicate a production capacity of slightly more than 200 pan-tiles a day. An inscription from Pannonia mentions four workers making 220 tiles each.[149]

Warry tried to figure out the real value of a tile by estimating the number of workmen required, not only for the mere forming of it, but including the much more time-consuming (but necessary) associated tasks. He suggested a manpower cost for 220 pan-tiles a day as follows:[150]

Quarrying and moving clay	1
Preparing clay and moving tegulae	3.5
Forming tegulae	1
Obtaining fuel	8.5
Total	**14**

These estimations are, of course, conjectural but still important as they emphasize the surrounding tasks, which are mostly forgotten.

Even more uncertain, but of no less interest, is Warry's continued argument, which leads him to a price of *c.* 5.5 denarii a tile—a suggestion that gets at least some support from the Price Edict of Diocletianus (AD 301). There, unfortunately, the price of pan-tiles is not preserved, but that of *pedales* is settled at 4 denarii each.[151] As that (floor) tile is only half the size of a pan-tile and lacks its raised borders, the difference seems reasonable. If the calculation is correct, it can be compared with the Price Edict's daily pay to a labourer, 36 denarii—in other words, an income that would allow him to buy 6.5 pan-tiles a day.

But Warry does not mention another entry in the Price Edict (VII 15), which states that tile-workers should be paid as much as 2 denarii for four two-foot tiles (*bipedales*). These were considerably larger than an average pan-tile, a fact that may countervail their lack of raised borders. If we accept Warry's initial calculation above, it would follow that the cost of production for a pan-tile may have been something in the region of 2/4 × 14 = 7 denarii—not far from Warry's suggestion. If slave labour was employed—certainly a common occurrence—the cost would be reduced, but if this resulted in lower price for the customer or higher profit for the factory owner is impossible to say.

So far, I have followed Warry's calculations. They are basically convincing, but in need of further discussion. Nancy Winter rightly inquires: "if the chart gives 14 workmen required to produce 220 pan-tiles/day and a labourer's daily wage is 36 denarii, how can one pan-tile cost 5.5-7 denarii? [...] 14 x 36 divided by 220 = 2.3 denarii to produce one pan-tile in Roman Britain". The profit seems incredibly high.

In Hellenistic times, tiles were even more expensive (or wages lower), but this was at least to some extent dependent on the fact that Hellenistic tiles were much larger.[152] Our main sources concerning ancient tile prices are a number of Hellenistic building inscriptions dated between 346 and 169 BC.[153] In the end of the period, the prices were barely half those in the beginning. Between 208 and 169 BC, one pan-tile cost between 2.5 and 3 obols,[154] while a pair (pan-tile plus cover-tile) amounted to between 5 obols and 1 drachma 1 obol.

Of particular interest is an inscription which documents the erection of a mud-brick wall at Eleusis in 330/329 BC. The master-builder (τέκτων) was paid 2.5 drachmas a day, his assistants 1.5 drachmas.[155] Corinthian pan-tiles cost 5 obols or 1 drachma a piece, so the labourers could buy 1.5 or 2 tiles a day. The price may seem unreasonably high, but it agrees well with our next price quotation.

Shortly before the middle of the II century BC, Cato the Elder settled the price for a (second-hand) tile to one sestertius and the daily wages for unskilled labour to less than two.[156] If he referred to a single pan-tile, the labourers had to work half a day to buy it, if to a pair, the price was slightly less. Roof-tiles were expensive, a fact that explains why tiles mended with lead clamps have been found in Athens and perhaps at Satricum, and why Cato was prepared to sell broken tiles at a reduced price.[157]

Different pan-tile types and qualities and varying living costs and currencies make comparisons difficult. In the mid-IV century BC, half a drachma a day provided reasonable subsistence for poor citizens. In 330/329 BC, the assistants of a master-builder earned three times that amount, and the price of a pan-tile was one drachma or slightly less. Cato's (second-hand) pan-tiles were valued at one sestertius, that is, a fourth of a denarius—a Roman coin whose value at the time was more or less the same as that of a drachma. The price of a pan-tile would, thus, have been about 1 drachma in 330/329 BC, 1/4 to 1/2 drachma in the III and early II centu-

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[149] Brodribb 1987, 130f.; Warry 2006, 119, 120 n. 20, 128; *CIL* III 11381.

[150] Warry 2006, 121f., fig. 8.3.

[151] Price Edict of Diocletianus XV, col. 3, line 90.

[152] Could the decreasing pan-tile size be the result of their being sold by piece and not according to the area they covered (Warry 2006, 130)?

[153] Orlandos 1966, 89–92. Cf. Martin 1965, 81–84.

[154] An even lower price is mentioned by Herodas III 40–46: "three half obols for each pan" (τρι'ήμαιθα [...] ἑκάστου τοῦ πλατύσματος).

[155] *IG* II 2^2, 1672, lines 26, 28. "*Ces assistants préparaient l'argile et le portaient au maçon*" (Orlandos 1966, 66).

[156] Cato, *Agr*. 14.3–5, 22.3.

[157] Durm 1910, 202: "*Zersprungene Ziegel wurden des Flickens wert erachtet, wie mit Bleiklämmerchen zusammengehaltene Stücke in Athen zeigen.*"; Knoop & Lulof forthcoming, ch. 4.2, Group 1, Class 15.2 (Satricum); Cato, *Agr.* 14.4.

ries BC, and 1/4 drachma in the mid-II century BC—a clear tendency towards lower prices. The heavy inflation during the Roman Empire makes it almost unfeasible to compare them with those suggested in the Price Edict of Diocletianus.

Tile production was apparently a lucrative business, as witnessed by senatorial factories at least from the I century BC onwards and, particularly, the great imperial *figlinae*. But it was a dirty activity, spreading clouds of smoke and probably not welcome in densely populated places.[158] In 44 BC, the colonial law of Urso in Spain stipulated that "no one is permitted to possess tile-potteries with more than 300 pan-tiles and a tile factory in the town".[159] The limitation to 300 tiles must reasonably refer to one day's output—a rather small amount, when the "output of a single tile-maker could have been over one thousand tegulae a week".[160] What the law had in view was apparently a minor family business. Larger factories had doubtless quite a number of labourers. I have earlier—based on signatures on the tiles—suggested that they were organized in teams of four,[161] an idea that gets at least some support from George Payne, who in his publication of an excavation at Darenth in England "found four different designs [signatures] on 50 examples of box flue-tiles and believed that they belonged to different 'gangs' or 'stools' of tile-makers at a factory, each gang having its own scoring design to identify the makers of what was always a skilled piece of work".[162]

Roof-tiles were expensive and, in course of time, they were also going to indicate the wealth of their owners. The constitution (*lex data*) of the municipium of Tarentum, perhaps instituted as early as 90/89 BC, demanded that a *decurio* or a man with the right to vote in the local senate should own a house in the town, covered with at least 1,500 pan-tiles.[163] It also prescribed a fine of 5,000 sestertii a year for those who tried to fraudulently evade the law. 1,500 pan-tiles would have covered a building of between 350 and 450 m^2, depending on the size of the tiles. Crawford suggests at least 440 m^2, calculated "on the basis of the commonest size in central Italy, 0.65 m x 0.45 m."[164] These measurments were derived from *RE* V A, 1934, 123, and there is reason to question that this was actually the commonest size (p. 212). In addition, Crawford was obvioulsy unaware that pan-tiles always overlapped. With a 7 cm overlap, 1,500 of his tiles would rather have covered 400 m^2. At Urso in Spain, the requirements were less: 600 tiles for a *decurio* and 300 for an ordinary citizen.[165] It may seem an odd way to estimate a person's wealth, but it must have been much easier to effect and more difficult to deceive than a thorough assessment.

A similar use of roof-tiles occurred among the heavy taxes imposed by the young Caesar for the war against Marcus Antonius in 43 BC. Apart from contributions levied on land and slaves and a 4% tax on their entire property, "the senators [paid] four obols for each roof-tile on the houses in the City, both on those that they owned themselves and on those they lived in as tenants".[166] The phenomenon is odd, but it is a simple way to estimate the value of real estate. From the 17th century onwards, several European countries introduced a tax based on the number of windows in a building.[167]

10. The socio-economic background

Like many other scholars, I have been much too ready to treat architectural terracottas as living organisms, developing more

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[158] Ö. Wikander 1993a, 138 with n. 285; 2017, 172. For the smoke generation at 20th-century tile factories in South Italy, see Hampe & Winter 1965, 200. But when the inhabitants of Sybaris prohibited crafts such as bronze-working in their town, the reason was a wish to avoid disturbing noise during their sleep (Athenaios XII 518c-d).

[159] *CIL* I² 594, 76 (Lex coloniae Genetivae Iuliae sive Ursonensis): *figlinas teglarias maioris tegularum CCC tegulariumque in oppido colonia Iulia ne quis habeto*. The difference between *figlinas teglarias* and *tegularium* is not obvious. Johnson *et al.* (1961, 99) translate "pottery works" and "tile factory", respectively. Perhaps the former produced both pottery and tiles, the latter only tiles. Such combination of ceramic and terracotta articles was obviously common: Ö. Wikander 1993a, 137; 2017, 170 with n. 350. But Crawford (1996, 439) may be right when interpreting *tegularium* as "gen. pl. of *tegularia*, 'tile-like objects'"—if so, probably referring to various kinds of floor and wall tiles.

[160] Warry 2006, 35.

[161] Ö. Wikander 2017, 204.

[162] Brodribb 1979, 217, citing Payne 1897, 70 (*non vidi*).

[163] *CIL* I² 590, IX 26–31: *Quei decurio municipi Tarentinei est erit queive in municipio Tarenti*[*no in*] *senatu sententiam deixerit, is in o*[*pp*]*ido Tarentei aut intra eius muni*[*cipi*] *fineis aedificium, quod non minu*[*s*] *MD tegularum tectum sit, habeto*.

[164] Crawford 1996, 310.

[165] *CIL* I² 594, 14 (a recently discovered fragment).

[166] Dio Cassius XLVII 16.3, XLVI 31.3: οἱ δὲ δὴ βουλευταὶ καὶ τέσσαρας ὀβολοὺς καθ' ἑκάστην κεραμίδα τῶν ἐν τῇ πόλει οἰκιῶν, ὅσας ἢ αὐτοὶ ἐκέκτηντο ἢ ἄλλων οὔσας ὤκουν. The tax mentioned by Dio Cassius (XLVII 14.2) on houses may perhaps be the same, only deriving from another source and represented slightly differently. Cf. the fragment of a letter from Cicero to the young Caesar: *in singulas tegulas impositis sescentis sescenties confici posse* (*apud* Non., p. 269.2). I fail to understand the proposal of Blake (1947, 287 n. 67): "However, a levy of four obols (ten asses) for each roof tile in property in Rome [...] to defray the expences of the Civil War [...] may by a reminiscence of a tax imposed at this early period [390 BC] when the state furnished the tiles for the rebuilding. A tax on second-hand tiles would be an absurdity."

[167] For instance, England 1696, Sweden 1743 and France 1798.

or less by themselves within their given framework. Only in recent years, have I seriously contemplated the human element and the prerequisites provided by the environment. Particularly, the rapid diffusion of the new technique is inconceivable without taking these phenomena into account.

Demaratos arrived in Etruria in the 650s BC; his *fictores* constructed a "prototype roof", presumably a simplified version of the protocorinthian roofs in Central Greece.[168] They soon spread their craft inland. They invented a rich repertoire of decorative terracottas, and towards the end of the VII century BC most larger communities in Etruria and Latium lived in houses with tiled roofs. Like the phoenix, the urban centres rose from the ashes of the burnt Iron Age villages. So far, the picture is clear and intelligible. But how was it all effected?

Some time between 630 and 620 BC, a group of tile-workers from Caere arrived at San Giovenale and perhaps somewhat earlier at Acquarossa. They brought with them the capacity for manufacturing the basic categories of roof-terracottas, but a potential supply is of no value without a sufficient demand. Did the Late Iron Age villagers really *demand* rectangular houses covered with roof-tiles and, if so, why? Demand for a new artefact can be created by trade, whereas a new building technique remained abstract and probably incomprehensible for those who had never had the opportunity to experience it.[169]

Throughout history, people have mostly been hesitant or even reluctant to alter their everyday life, and we have no reason to believe that the Etruscan villagers found an oral description of a tiled building worth striving for. *We* may look at this innovation as a token of progress, but why should they?[170] Some inhabitants may, of course, have visited Caere and seen the new wonders, but hardly many. Moreover, it was the matter of a heavy investment. Tiles were expensive, and houses could not be built without the support of new occupational groups, stonemasons and carpenters.[171] But along with their aversion to novelties, people have often shown an inclination towards boasting. "A husband and wife who had grown up in huts [...] would have felt unspeakable pride and pleasure in becoming house-dwellers."[172]

The transition from thatched huts to tiled houses could not have been effected without a quite extensive population, economically prosperous and in possession of considerable capital.[173] An average Acquarossa house occupied an area of *c.* 60 m^2. With a 15–20° roof inclination and considerable overhang at eaves and gables, this would require a tile-roof of *c.* 75 m^2—that is, *c.* 250 pan-tiles, *c.* 240 cover-tiles and *c.* 12 ridge-tiles.[174] In the IV to the II centuries BC, the price of a pan-tile was equivalent to little less than half a day's work (p. 221),[175] and we have no reason to believe that it was cheaper some centuries earlier. Together, the three tile categories must have cost the villager almost half a year's income. Add the cost of cutting the tufa blocks, preparing the foundations, erecting the walls and constructing the woodwork, and he may have had to work almost a whole year to get his new home. A new hut could be built by his family in a month or two.[176]

And yet, he chose the house—hardly by a whim of fashion, by appreciation of the new building material, or because of "the greater efficacy of the [rectilinear...] in physically demarcating differences between the domestic and non-domestic".[177] But necessity is the mother of invention, and I have for almost 40 years maintained that necessity, in this case, was the need to protect oneself from devastating conflagrations.[178]

Simultaneously with the geographical diffusion of the tile-roof, we encounter an increase in the number of terracotta categories. The third quarter of the VII century BC witnessed the invention of a great number of decorative terracottas—totally lacking, when Demaratos' *fictores* landed in Etruria.[179] Interestingly, the population of Acquarossa was not satisfied with the simple tile-roof, but had their houses exuberantly adorned with decorative details painted in white on a dark or bright red background.

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[168] See, for instance, Ö. Wikander 1993a, 160; 2017, 184–186; Winter 2002–2003; 2009, 578–581.

[169] Cf. Ö. Wikander 2024, 141–144.

[170] Cf. Izzet 2001, 45: "We are still left with the question of why the Etruscans would have taken on terracotta tiles from the Greeks, or anyone else".

[171] "*Diese Konstruktion ist Ausdruck einer entwickelten Zimmermannskunst, welche über die Bauweise der Ovalhütten, aber auch leichterer Rechteckbauten* [...] *weit hinausweist*" (Prayon 1975, 169). Cf. Cifani 2008, 251.

[172] Drews 1981, 149.

[173] "*Il processo di produzione delle tegole richiede comunque una notevole serie di passaggi preliminari, estesi dall'approvvigionamento e dalla lavorazione dell'argilla alla realizzazione del combustibile necessario alla cottura, che le rendevano un prodotto finale senz'altro costoso e non ne hanno di certo favorito la diffusione*" (Naso 2010, 256). Cf. above, p. 221.

[174] For details, see Ö. Wikander 2017, 114 with nn. 41f.

[175] But not as much as 1.5 days' wages, as suggested by Barry (1996, 60) or between 0.5 and 2, as I once imprudently proposed myself (1988, 206).

[176] Ö. Wikander forthcoming.

[177] Cf. Miller 2017, 206f., 214f. The quotation from Izzet 2001, 48.

[178] Ö. Wikander 1988, 207; 1993a, 161f. Accepted, for instance, by Winter (2009, 1) and Miller (2017, 206f., 215). Cf. Ö. Wikander forthcoming. Moreover, Nancy Winter (2002–2003, 230f.) emphasized the marketing skills of the Bacchiads.

[179] A fact first pointed out by Williams in 1978 and now manifest. See, for instance, Ö. Wikander 2017, 186f.

Symbols of wealth and power? Perhaps at the Orientalizing Complex at Poggio Civitate—even though it is remarkable that the most abundant decoration there was not to be found on the Residence itself (OC1) but on an adjacent workshop (OC2). But at Acquarossa? The early monumental complex in Zone F was only moderately decorated, whereas the private houses glittered in bright colours.[180] All of them? It may look so, but the fact that all 13 roofs assigned to Acquarossa Phase 1 A–B (*c.* 640–600 BC) were equipped with painted revetment plaques of Type II[181] is of no consequence, as these plaques constitute the main diagnostic feature of that phase. What must be established is whether some of the undecorated roofs up to now assigned to Phase 3 (*c.* 560–540/530 BC) may possibly be earlier.

Of 22 such roofs, nine can be eliminated immediately, as they include Type III ridge-tiles, Type III antefixes, extra wide cover-tiles and/or cover-tiles with cross-bar under the flange—all of them diagnostic for Phase 3. One method remains to decide if some of the rest may, in fact, be earlier: the bright or dark red paint characteristic of tiles from Phases 1 and 2 but very rare in Phase 3. From the remaining roofs, 92 tile units were published in 1986. Occasional red fragments prove nothing, as they may originally derive from adjacent buildings; nor do occasional more or less complete tiles, as they may have been reused in repair. But concerning five roofs, the red paint occurs so frequently that we should at least consider the possibility that they belong, instead, to Phase 1 or 2: Roofs J:2, L:1, L:3, M:2 and R:1. The Zone L tiles are difficult to decide upon, as the houses are located on a shelf on a steep slope and fragments must often have tumbled down from above. On the other hand, the rich finds of early VI-century BC pottery there[182] make it plausible that at least one of the houses on the shelf was earlier than Phase 3.

In other words, it is quite possible that some roofs in Phase 1 were actually not decorated. Nevertheless, most facts still imply that the majority were—or at least so many that we cannot reasonably maintain that all these buildings were occupied by the town's aristocracy.[183] But whereas painted revetment plaques were a common occurrence, other decorative terracottas were not. Of the roofs assigned to Phase 1, four have left no other decoration; at least six had acroteria, four antefixes, two cover-tiles with animal protomes, and one pan-tiles painted on the underside. There were probably more to be found originally: large numbers of painted terracottas could not be attributed to specific roofs.[184] We must rather be dealing with a well-to-do middle-class than with an aristocracy. The true masterpiece from the first phase remains Roof G:1, which included all decorative terracotta categories known from that phase. Mario Torelli interpreted this building as the residence of an aristocratic rival of the owner of the monumental building in Zone F,[185] but its small size (probably *c.* 6 × 3 m)[186] makes the suggestion ridiculous.

However this may be, it remains a fact that roofs of many domestic buildings that were indisputably erected during Phase 3 were completely undecorated (save Type III antefixes, if these can in any way be considered decorative). With the exception of relief-moulded revetment plaques, raking simas and female-head antefixes, Acquarossa has yielded no decorative architectural terracottas that can be dated (stylistically or otherwise) later than the Greek-inspired types of Phase 2. The abandonment of decoration on private buildings towards the mid-VI century BC is a fact, but how can it be explained: "motivated be economic circumstances or a conscious decision made by local administrators" (Winter)?[187]

The question becomes even more difficult to answer, as we do not even know if this decoration was a general South Etruscan (or even Etrusco-Latial) phenomenon or if it was a local one, restricted to Acquarossa. To my knowledge, no other Archaic site has yielded decorative roof-terracottas which can be associated with certainty with domestic buildings.[188] From San Giovenale comes a fragment of a painted revetment plaque of a type identical with Acquarossa Type II B, but it is a stray find, and we know nothing of its origin.[189] Perhaps more promising are two semicircular antefix plaques from Ficana, dated to 620/600 BC and possibly to be attributed to a house in Zone 5a.[190] In case private dwellings were not decorated outside Acquarossa, we had better restrict this inquiry to Acquarossa itself.

Of Winter's two suggestions, it is, of course, possible that economic considerations have come into play—we cannot say anything definite about Acquarossa's economic position in the mid-VI century BC. But even in a period of decline, one should expect some individuals still able to afford acquiring a terracotta decoration, the cost of which was perhaps lower than that of the plain tiles. As for "a conscious decision made by local administrators", the idea may seem odd, but antilux-

[180] C. Wikander & Ö. Wikander in press, ch. II.5.5.

[181] With the possible exception of Roof B:3. See Ö. Wikander 1993a, 89, 157, figs 33, 60.

[182] See, for instance, Scheffer 1986, 116–122 nos 216, 219, 221, 223f., 229f., 257, 259.

[183] Cf. Rystedt 1984.

[184] See Ö. Wikander 1993a, 91f., 95, 98, fig. 33, under "Miscellaneous fragments".

[185] Torelli 1981, 174.

[186] Ö. Wikander 1986, 191–193, fig. 104.

[187] Winter 2009, 47.

[188] Cf. Damgaard Andersen 1993, 79; Winter 2009, 567.

[189] C. Wikander 1988, 27, fig. 6; Ö. Wikander 2024, 136 no. 8, fig. 14.

[190] Ö. Wikander 1993a, 76; Winter 2009, 20 no. 1.C.1.a.

ury laws were undeniably instituted in Antiquity. The legislation of Demetrios of Phaleron against exorbitant tomb monuments is a well-known example, and also the Roman Lex XII tabularum contained prohibitions of excessive burial customs. The explanation is not impossible, but still not attractive.

A third explanation may proceed from the painting technique. It may be more than coincidence that the abandonment of painted terracottas occurred simultaneously with the extinction of White-on-red pottery.[191] There is little doubt that terracottas and pottery were produced in the same workshops,[192] and when—for some reason—the White-on-red ware was replaced by other fine wares, the painted terracottas also had eventually to disappear. The new fine wares had nothing to offer that could decorate a building.

This suggestion may perhaps get some support from three other late buildings at Acquarossa: Houses A (Roof B:4) and probably C (Roof B:6) in Zone B, and House A (Roof G:4) in Zone G. Ridge-tiles of Type III (and in Zone B also antefixes of Type III and cover-tiles with cross-bar under the flange) date them unmistakably to the very last subphase, 3 B, dated about or slightly later than the mid-VI century BC. The ridge-tiles from Zone B are distinguished by white paint which covers the overlapping flanges (AR Kal B 34, 37, 42–45, 91). The Zone G roof had both cover-tiles and ridge-tiles painted white in their entirety (AR Imb G 2–8, 22–25, 31, Kal G 42–43). We may, thus, envisage a roof where rows of white cover-tiles, contrasting with the reddish-brown pans, ran up to the horizontal row of white ridge-tiles.[193] In other words, decoration of private houses was hardly forbidden by the authorities. The effect cannot have equalled that of the white-on-red terracottas but, if nobody was capable or willing any longer to produce them, the roofs in Zones B and G were at least a fair substitute.

One more Type III ridge-tile shows clear traces of white paint over its entire upper surface: AR Kal H 18, one of the few roof-terracottas published from House B in Zone H (Roof H:2; cf. Kal H 26). It differs from the painted ridge-tiles from Zones B and G by presumably being older. Even concerning shape and measurements, it diverges markedly and has its only true parallel in a ridge-tile from Zone F which can be stratigraphically assigned to the end of Phase 2—when white-on-red-painted roof-terracottas were probably gradually disappearing.[194] Perhaps it represents an early, cheaper roof decoration that was to inspire the white-painted cover- and ridge-tiles in Phase 3. Also totally isolated is a Type III ridge-tile from the Zone F gully (AR Kal F 176) with white-painted flange. Together, these tiles show that the white paint was used on at least five roofs and not a rare occurrence.

These rows of white-painted cover- and ridge-tiles were a novelty at Acquarossa about 575 BC, but they are not entirely without parallels.[195] Even the early Temple of Apollon at Corinth had pan-tiles painted in yellow, red and black, and similar decorations are known in the VI century BC from Sicily, Campania and Etruria/Latium. Of particular interest for the Acquarossa roof decorations are roofs where the colour of the cover-tiles contrasted with that of the pans: Satricum (black), Rome, Temple of the Dioscuri (I 72, white and black), Pyrgi (red and black) and Caere (black and reddish-brown/white).[196] Such cover-tiles have been found also in Greece and Campania (black and white).[197] Whereas the Greek examples are early, those from Central Italy are dated between 550 and 520 BC—that is, almost contemporary with the white-painted Acquarossa roofs. But, in contrast to Acquarossa, painted ridge-tiles from other sites are mostly decorated with geometric designs. Andrén, however, states that a ridge-tile from the Temple of Dea Marica at Minturno "seems to have been coloured uniformly white, except for a band of black along the lower edge".[198]

During the VI century BC, we can perceive a gradual tendency towards uniformity in the Central Italic terracotta industry. The almost wild, local experimentation which characterized its first generation was replaced by a more formalized output, similar if not identical from site to site. Also manufactural novelties spread fast. The red paint that covered the early terracottas, plain as well as decorative, was abandoned on plain tiles, too. The light clays of Campania prevailed (p. 211), and the North Etruscan Type II pan-tiles conquered the South. But uniformity was not complete. Type I pan-tiles are still reported from Rome, Veii and perhaps Satricum in the V century BC, and reddish clays were used at Pisa in the V/IV and Artena in the IV/III centuries BC.[199]

Most puzzling is the situation at San Giovenale. There, admittedly, the find circumstances were far from clear and unambiguous but, as far as we can tell, dark clays, Type I pan-tiles and cordoned ridge-tiles predominated completely throughout the V century BC. If this impression is correct, we seem to be dealing with a local terracotta industry which lost contact

[191] C. Wikander & Ö. Wikander in press, ch. II.3.4, 4.
[192] C. Wikander 1988, 131f.
[193] Ö. Wikander 1986, 175, 193f.; 1993a, 154.
[194] C. Wikander & Ö. Wikander in press, ch. I.3 (Kal F 167).
[195] See Ö. Wikander 1993a, 153f.; 2017, 176–178, with references to the statements in this paragraph.
[196] Ö. Wikander 1993a, 154 n. 72 (Satricum); *Pyrgi* 1970, 695 item 7d (Pyrgi); Winter 2009, 491 no. 6.G.1.b (Caere).
[197] Koch 1912, 4, 6.
[198] Andrén 1940, 490 no. I:14. But Mingazzini (1938, 743, 751) expressed himself slightly differently.
[199] Ö. Wikander 2017, 46f. with n. 27 (Type I pan-tiles), 143 with n. 143 (dark clays).

with the general South Etruscan development—not impossible, considering San Giovenale's isolated location, perhaps as a frontier fortification between the territories of Caere and Tarquinia.[200] But it would still be remarkable. There is general consensus that terracotta workers, from the very beginning, had a tendency often to change their place of sojourn—a phenomenon important for explaining the rapid spread of new ideas (cf. p. 211, on the diffusion of Campanian terracottas).

It is annoying that our ability to establish what drove people's decisions is very limited. Without written documents, the preserved artefacts can intimate, but never prove, the true reasons for human actions. Only from the II century BC onwards, conditions improve—slightly. In the Roman period, inscriptions and graffiti occasionally provide an indication of the tile-makers' working conditions, the organization of their workshops, their daily output and perhaps sometimes their attitudes to their work. We even know some of them by name, for instance, the slave girl Amica at Pietrabbondante, who laid out pan-tiles to dry in the beginning of the I century BC, the slaves Arverus, Candidus, Clementinus and Primus in Roman Britian, and the freedman Publius Anicius Eros, *tegularius*, who is mentioned on his tombstone from Campania (Volturnum).[201] But in Archaic Etruria, the workers remain silent.

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[200] Ö. Wikander 2024, 146. Cf. Knoop's (1987, 214) suggestion that the Campanian artists at Satricum were, for a period, cut off from the "quickly changing modes and fashions of their homeland".
[201] *CIL* I^{2} 3556a; Brodribb 1987, 117, 127; *CIL* X 3729.

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