

A TILE STANDARD IN THE AGORA OF ANCIENT ATHENS

(PLATE 82)

SEVERAL of the most important administrative offices (*'Αρχεῖα*) of the Athenian state were concentrated in the southwest corner of the Agora (Fig. 1). Here were the Bouleuterion or Council House, the Metroon which housed the state archives, and the Tholos which served both as a club-house for the Councillors and as a repository for a set of official weights and measures. In the open square opposite the Metroon stood the long enclosure around the statues of the Eponymous Heroes, known from numerous literary references as the official public notice board of Athens.

The recent excavations in the Agora have brought to light a small building toward the southwestern corner of the square, which may with great probability be regarded as another in the group of *'Αρχεῖα*; it is now designated on plans of the Agora as the Civic Offices (Fig. 1).¹ The building consists of three rooms set side by side at the foot of the terrace wall to the north of the Middle Stoa. The rooms diminish in size from east to west in such a way as to cause a minimum of obstruction to traffic moving in or out through the southwest corner of the square. Although the exploration of the area has not been completed, there is reason to believe that the building dates from the early Roman period, perhaps the latter part of the first century B. C.; it was certainly destroyed in the Herulian sack of A. D. 267, abandoned and speedily buried.²

Among the beddings for monuments that rose in front of the Civic Offices one is outstanding in size and interest, viz. a massive pedestal set in the angle formed by the porch of the easternmost room (Fig. 1, A and Pl. 82, 1).³ The pedestal is made of re-used poros blocks of unknown provenance. They are *in situ* in so far as the monument is concerned. The north face of the lower eastern block was originally covered with a very thin, hard, red stucco of which some traces remain. The red coloring

¹ For reports of the excavations compare *Hesperia*, IV, 1935, p. 324; XVI, 1947, p. 200; XVII, 1948, pp. 151-153.

² It is likely that the Civic Offices were necessitated by the temporary loss of the Tholos, due to damage inflicted during the Sullan sack of 86 B. C. But we may also imagine that the Civic Offices were the result of the natural growth of the City of Athens, for civic consciousness brings with it an increased number of magistrates and consequently a greater need for office space.

³ Professor Homer A. Thompson, who is in charge of the excavations of the ancient Agora of Athens, kindly supplied the writer with the data thus far presented in this article; and, as the writing and drawings for the article progressed, Professor Thompson continued to give very valuable assistance.

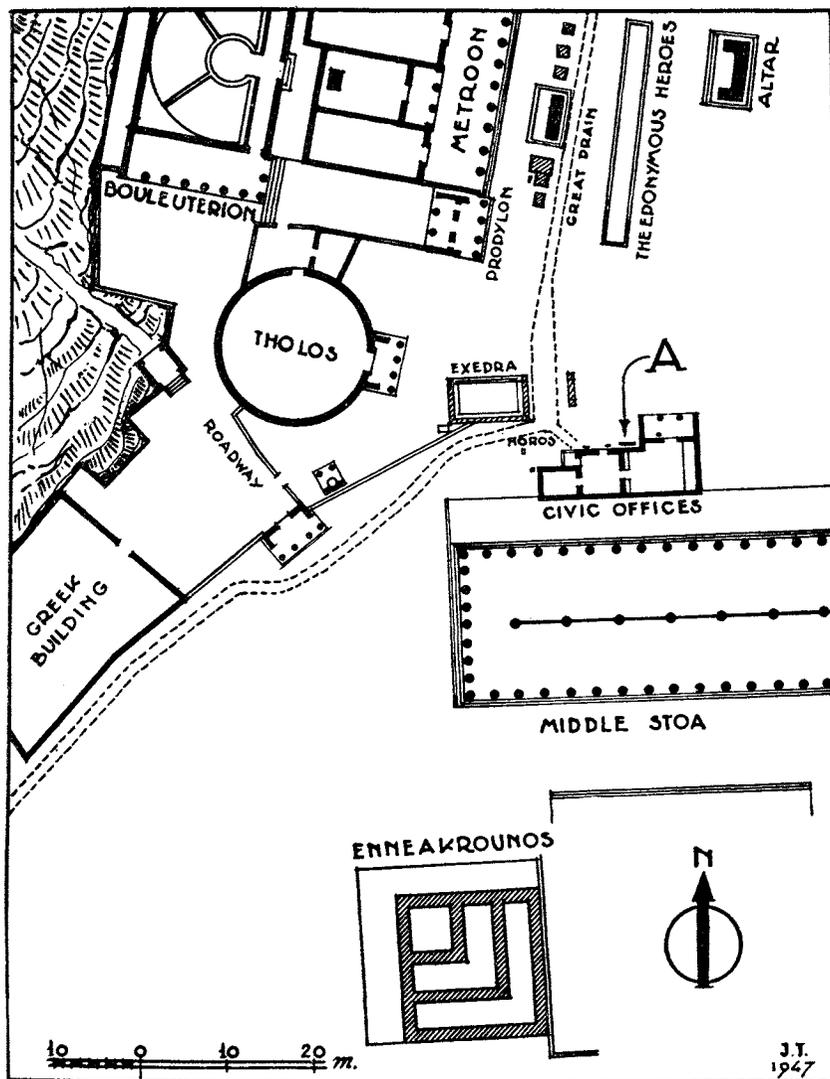


Fig. 1. Southwest Corner of the Agora of Ancient Athens: Plan.

matter was thoroughly mixed with the stucco before the latter was applied to the block. The stucco probably dates from the fifth century B. C.⁴

The two blocks of the upper course of the pedestal are cut with a broad deep groove suitable for the reception of large stelai (cf. Fig. 2). In addition to the slot there are two smaller cuttings in the top of the course, to the north of the slot (cf. Fig. 2, plan A-B). Both these cuttings are roughly made. The eastern cutting is

⁴ A sample of the stucco is on file in the museum of the excavations of the ancient Agora. For Greek stucco compare G. P. Stevens, pp. 160-163, above.

fairly complete, including a drain on its northern side; but there is little left of the western cutting.

During the excavations two fragments of the stelai which were originally inserted in the slot mentioned in the last paragraph were found not far from the pedestal itself. One fragment was large, the other small (cf. Fig. 2). Both were of Pentelic marble. The blocks were replaced in the slot, but not exactly in their original positions—the west side of the big fragment should be flush with the west face of the poros block beneath (Fig. 2, G), a relation which is indicated by the fact that the slot runs to the west end of the poros block—an important fact, for it helps in estimating the width of the original stelai, as we shall see a little later on. Representations of curved roof tiles are carved in full size on the two marble fragments. From the above observations we may conclude that the monument was a standard for roof tiles, and, further, that it was a municipal standard, as it was located in front of the Civic Offices.

The tiles carved on the standard are curved and thin (Fig. 2, plan E-F)—they are representations of Laconian tiles. All Laconian tiles, so far as the writer is aware, are made of terracotta and are thin (sometimes as thin as 0.012 m.). Curved tiles, especially if thin, could not easily be cut in marble, and they would, moreover, be liable to break in transporting and setting. A highly paid stonecutter would have to be employed to produce such marble tiles, and it would take him a long time to make even one tile. All examples of marble tiles known to the writer are of the Corinthian type (flat pan tiles and hipped cover tiles). On account of the expense involved, marble tiles were used only for very important buildings.

The contention that the standard represents terracotta Laconian tiles is supported by the fact that many such tiles have come to light in the excavations of the Athenian Agora, while not one curved marble tile, thick or thin, has thus far been dug up.

The Laconian and Corinthian types of tile are well illustrated by the tile standard at Assos, where curved pan and curved cover tiles as well as flat pan and hipped cover tiles are cut in full size on the same block.⁵ We may think of the curved tiles of the Assos standard as models for terracotta tiles, and of the flat pan and hipped cover tiles as models not only for marble tiles but also for terracotta tiles, for there are many examples of terracotta flat pan and terracotta hipped cover tiles in Greece.⁶

Our Athenian standard, then, is concerned solely with the control of terracotta tiles. Now, ancient terracotta tiles have certain characteristics all their own—characteristics which it will be profitable to discuss briefly. Fortunately there are excellent samples of both curved terracotta pan and curved terracotta cover tiles in the Agora Museum in Athens. In types they are like those of the standard. In addition, the dimensions of some of them closely agree with the dimensions of the standard.

⁵ F. H. Bacon, *Assos*, p. 71.

⁶ There are good examples of flat pan and hipped cover terracotta tiles in the museum of the Athenian Agora (Cat. Nos. A 1178 and A 1181).

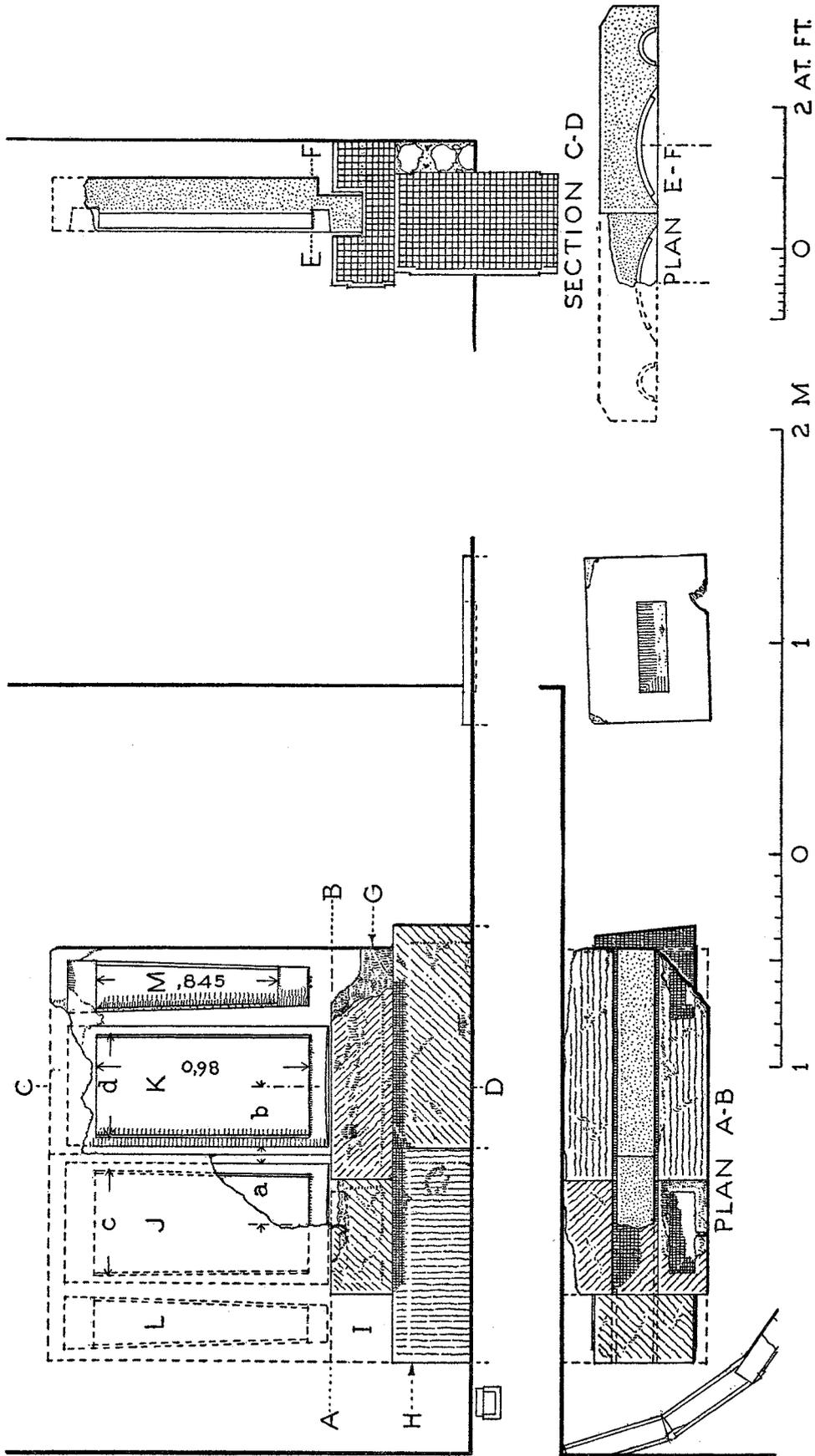


Fig. 2. Drawings of the Tile Standard at "A" in Fig. 1.

The type of these ancient terracotta tiles is the same as that of the modern Athenian terracotta tile. But the ancient cover tile is about twice as long as the modern tile, while the cross sections of the two are almost alike; the ancient pan tile is about twice as long and twice as wide as the modern tile.

The ancient terracotta tiles presented certain advantages and also certain disadvantages when compared with the ancient marble tiles. Where good clay was abundant, as for example in Athens, terracotta tiles could be mass-produced relatively quickly. In other words, they were considerably less expensive than marble tiles. Then again, the weight of terracotta is only 74% of that of marble, and, in addition, terracotta tiles were, and are today, made much thinner than marble tiles. Consequently light terracotta tiles required a lighter roof construction than did heavy marble tiles, and a lighter wood construction meant a saving in money. Still another advantage of the terracotta tile was that before being dried in the sun it could be easily touched up by hand and even somewhat modified so that the overlapping of the tiles might become more weather proof. And after the tiles were fired, they could be more easily chiseled and sawed than marble tiles.

Two disadvantages of curved terracotta tiles may be mentioned:

(1) Terracotta pan tiles had to be bedded in clay. Those preserved in the Agora Museum are only 0.017 m. to 0.02 m. thick, *ca.* one meter in length, and *ca.* 0.45 m. in width. If such tiles were laid directly on boarding, they would easily break along the center of the tiles. To prevent the breakage, the tiles were, therefore, imbedded in clay.⁷

(2) When damp clay is dried in the sun and then baked in a kiln, the clay shrinks about 10%. The percentage varies somewhat with the ingredients in the clay (for example, less shrinkage takes place when sand is added to the clay). The writer tested the shrinkage at a large tile factory in the outskirts of Athens, with the following results: the mould for the tile measured 0.508 m. in length and the finished product 0.456 m.; shrinkage, 8.8%. The director of the establishment predicted before the test was made that the shrinkage would be *ca.* 10%, evidently a round number in his mind. The Atlantic Terra Cotta Company of America claim that their products shrink in the proportion of 13 inches to 12 inches, a 7.7% shrinkage.

⁷ For clay bedding of the terracotta tiles used in the Peiraic Arsenal and in the gallery of the walls of Athens, compare Paton and Stevens, *Erechtheum*, Text, p. 368. It is obvious that a bed of clay required continuous boarding beneath it, and as a matter of fact such boarding is actually specified for the gallery of the walls of Athens. Ancient marble pan tiles, being flat, did not require continuous boarding beneath them; such tiles were supported by the jack rafters and by strips of wood between the jack rafters (cf. Paton and Stevens, *op. cit.*, Plates XVI, XVIII, XXIV). The Erechtheum Building Inscription specified the dimensions of the strips of wood used to support the marble tiles over the main portion of the temple (cf. Paton and Stevens, *op. cit.*, Text, p. 369).

The shrinkage of terracotta raises an uncertainty in regard to the tile standard in Athens. Does the standard prescribe the size of the mould, or the size of the finished tile? It seems to the writer that the officials of ancient Athens would wish to have the finished terracotta tiles as near the size prescribed by the standard as possible, for, in determining the total number of tiles for a "job," the officials could then base their calculations upon exact measurements given by the standard, not upon measurements derived from tiles after they had shrunk indeterminate amounts. In their calculations the officials of course used ancient measures; and, further, it is probable that they used convenient measures. As the following tables show, the sizes of the tiles of the standard can be expressed in convenient measures of the ancient Attic foot of 0.328 m.:—

Pan tile

Length	= 3 Attic feet (to within 0.002 m.)
Width	= 1½ " " (exactly)

Cover tile

Length	= 2½ Attic feet + 1 dactyl (to within 0.004 m.)
Width at top	= ¾ " " (to within 0.001 m.)
" " bottom	= 9 dactyls (to within 0.005 m.)

From the tables it would appear that the dimensions of the tiles of the standard were in Attic feet. If that is so, then the belief that the finished terracotta tiles were to be the same size as the tiles of the standard is strengthened. Furthermore, the manufacturer of the tiles undoubtedly knew more about the shrinkage of clay than the officials, and could determine better than the officials how much bigger the mould should be than the standard. Finally, that the terracotta tiles, after baking, were to be the sizes prescribed by the standard seems to be borne out by one of the curved terracotta pan tiles in the Agora Museum (A 938)—it has almost exactly the dimensions of the well preserved pan tile of the standard (Figs. 2 and 3; Pl. 82, 2).

There is another curved terracotta pan tile in the Agora Museum (A 945), whose dimensions are close to the dimensions obtained by deducting 8.8% from the dimensions of the pan tile of the standard. Also there are two terracotta cover tiles in the Agora Museum (A 1322 and A 1323), which are close to the dimensions of "M" (cf. Fig. 2) after "M" has undergone a supposed shrinkage of 8.8% (Fig. 4). Do these three tiles indicate that the moulds were to be the same size as the tiles of the standard? The arguments which might be based on these tiles in favor of such an idea are feeble when compared to the arguments given in the previous paragraph where the idea was set forth that the tiles of the standard represented the finished terracotta tiles.

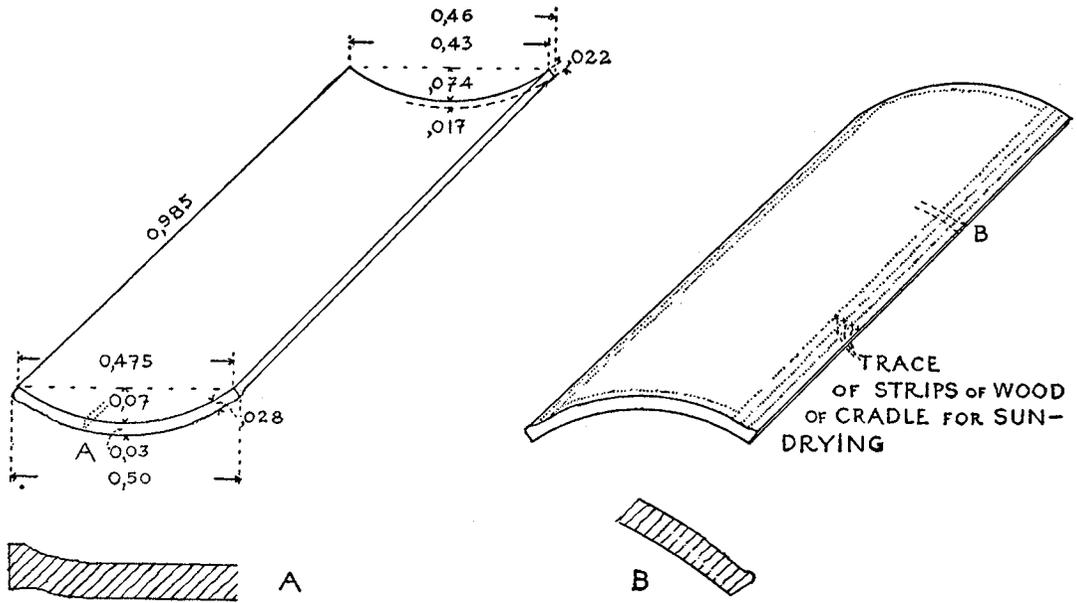


Fig. 3. Terracotta Pan Tile A 938 in the Agora Museum: Isometric Drawing.

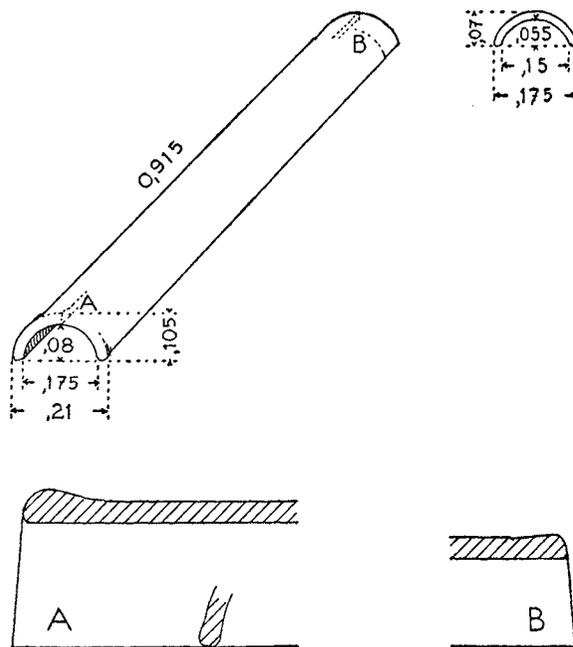


Fig. 4. Terracotta Cover Tile A 1322 in the Agora Museum.

The shrinkage of all kinds of terracotta work must have been well understood by the ancient Greeks. Perhaps some day an ancient inscription will be found which will explain how the shrinkage was taken into account.

Is there enough left of the standard of the Athenian Agora to restore it on paper? To answer this question, it will be necessary to describe the way curved terracotta tiles were used by the ancient Greeks—more specifically, how the ancient Greeks secured durable inexpensive roof coverings which would not leak in violent rain storms. Let us consider the simple case of a hipped roof between two pediments. The architect may well have laid the tiles in the following manner:—

- 1st A vertical row of pan tiles was tentatively laid, to make sure that there were proper arrangements at the eaves and ridge pole. As the tiles overlapped each other from 0.05 m. to 0.07 m., there could be some play in the distance between the eaves and the ridge pole. When the play did not prove to be sufficient, the tile next to the ridge tile was sawed to fit. Also it is possible that, when in the calculations the length of " K " (cf. Fig. 2) did not give good results, the shorter length of the pan tile which went with " M " would meet the requirement.
- 2nd A horizontal row of pan tiles was tentatively laid, to be sure of proper arrangements against the pediments. As there was a space of two or three centimeters between the tiles, there was a considerable play in the distance between the pediments. We are dealing, moreover, with standard tiles, whose joints did not have to line with a motive of the façade of the building (such as a triglyph).
- 3rd The architect began the final operation by laying a vertical row of pan tiles *in clay*, beginning at either pediment (or, if preferred, at both pediments simultaneously).
- 4th When a second row of pan tiles had been adjusted, cover tiles were placed over the joint between the two rows of pan tiles. The overlap of the cover tiles was the same as that of the pan tiles, as cover and pan tiles had the same length.

The above gave the architect sufficient data to complete the roofing. The Athenian standard specified both non-wedge shaped and wedge shaped pan tiles (cf. Fig. 2 and Plate 82, 1). Fig. 5 illustrates a roofing of non-wedge shaped pan tiles; Fig. 6, a roofing of wedge shaped pan tiles. It is clear in Figs. 5 and 6 that the cover tiles must have been wedge shaped in the case of both non-wedge shaped and wedge shaped pan tiles, if weather proof joints were to be obtained where *two cover tiles* overlapped each other. Note that the cover tile of the standard is wedge shaped, just as we would expect it to be—non-wedge shaped terracotta cover tiles just do not exist. Theoretically Fig. 6 presents a slightly better solution of the roofing problem than the solution shown in Fig. 5, because, in Fig. 6, both pan and cover tiles are portions of cones and on

that account an element of one can snugly fit against an element of the other. In Fig. 5, on the other hand, the pan tile is a portion of a cylinder and the cover tile is a portion of a cone, and on that account the element of one cannot come snugly in contact with the element of the other. The element of the cone is a straight line, while the projection of that straight line upon the pan tile cuts an ellipse out of the pan tile. But the position of the wedge shaped pan tiles in relation to the roof as a whole is of much greater importance than whether the pan tiles are wedge shaped or not. There is an

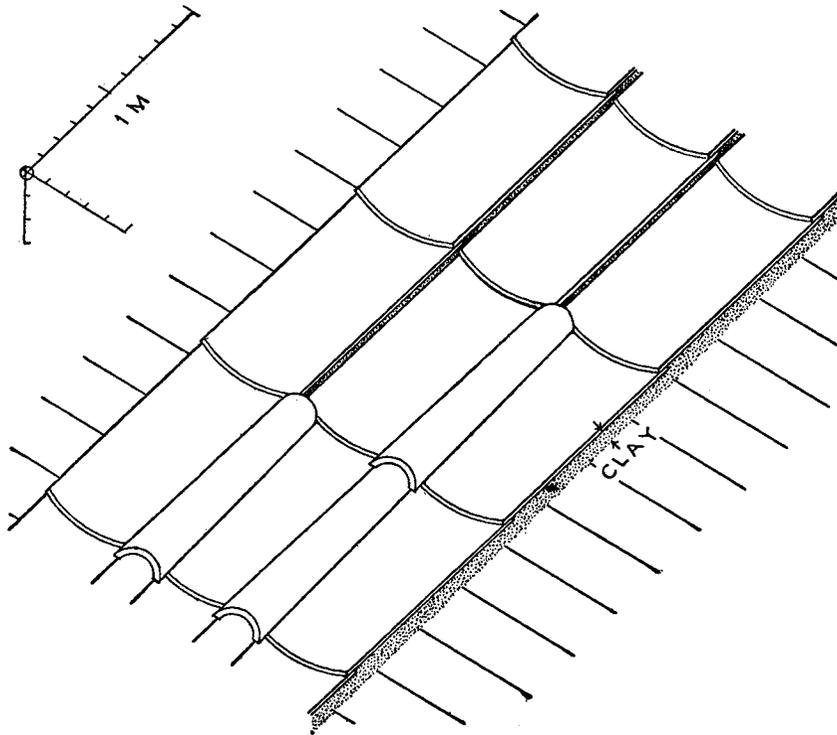


Fig. 5. Roof of Curved Terracotta Tiles; Pan Tiles not Wedge Shaped.

advantageous and a disadvantageous method of overlapping wedge shaped pan tiles, as shown in Fig. 7, "A" and "B." "A" gives the correct overlapping, with the elements of pan and cover tiles in good contact. "B" shows what would happen if the pan tiles were laid with their broad ends toward the eaves of the building; an element of the cover tile would not come in contact with an element of the pan tile but would be directly over a curved line of the pan tile, with the result that in stormy weather rain would be driven under the cover tile and would leak into the clay bedding at "a," Fig. 7, B.⁸

⁸ Compare *Olympia: Ergebnisse*, II, Pl. LXXXVII, Fig. 1, where the curved terracotta pan tiles of the Heraion are incorrectly indicated.

Now we are in a position to attempt a restoration of the tiles of the standard.

Did the marble portion of the monument consist originally of two blocks of the same width? This seems likely for two reasons:

(1) The east face of the marble block which is largely missing would then line with the east face of the foundations of the pedestal, at "H" in Fig. 2. To complete the pedestal of the monument we have but to imagine a poros block at "I" with a slot in its top, similar to the slot in the blocks to the east of it.

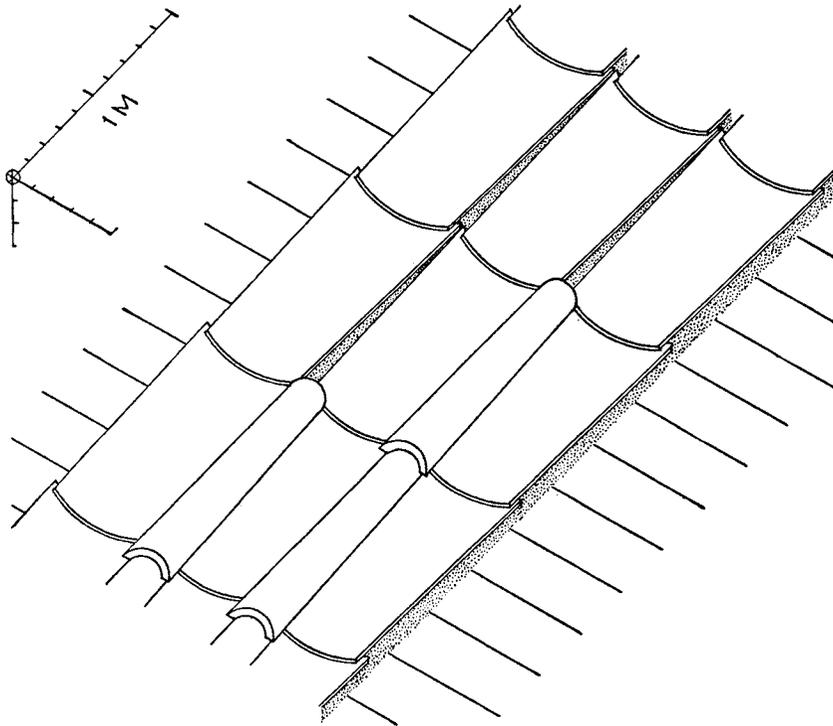


Fig. 6. Roof of Curved Terracotta Tiles; Pan Tiles Wedge Shaped.

(2) A little more than half the bottom of tile "J" is preserved. We are thus sure of the axis of tile "J." We find by measurement that "a" equals "b" (cf. Fig. 2). "J" can be restored as a wedge shaped tile of the same length as the non-wedge shaped tile "K." The eastern marble block of the monument may then be thought of as representing a wedge shaped pan tile with "c" equal to "d" (cf. Fig. 2), and as also representing a cover tile, "L," the same width as cover tile "M." We now have a good looking monument, with the tiles symmetrically arranged (cf. Fig. 2).

Can such a disposition of pan and cover tiles on the standard be rationally explained? We believe that it can. We have seen from Figs. 5 and 6 that wedge

shaped and non-wedge shaped curved terracotta pan tiles of equal length must have the same curved wedge shaped cover tile, and, further, that that cover tile must be as long as the pan tiles. In other words, if wedge shaped tile "J," Fig. 2, is restored with the same length as that of non-wedge shaped tile "K," then cover tile "L" must be wedge-shaped, and must have the same length as "K" and "J." This is satisfactory so far. But what about tile "M," which is considerably shorter than tile "K"—too short, in fact, to represent the length of the cover tile which might go with tile "K" even when "K" represents the mould? The short cover tile "M" can, we believe, be explained. To carve, at considerable expense, representations of wedge shaped and non-wedge shaped pan tiles to go with "M," would be unnecessary when such tiles would differ from "K" and "J" only in length—a length given by "M."

There is a tile in the Agora Museum, A 951 (Fig. 8), which resembles tile "M," for A 951 has almost the same length (0.856 m.) as that of "M" (0.845 m.), but it is *ca.* 0.09 m. narrower than "K." The records in the Agora Museum reveal the fact that A 951 must antedate the standard by about four hundred years, as A 951 was found in a well (on the northwest slope of the Acropolis) which had been filled up in the fifth century B. C. As A 951 and the tile standard (dated as we have seen, in the first century B. C.) are so similar, then we possibly have an indication that this particular type of tile was in use for a number of centuries.⁹

Now for a few remarks about the two cuttings north of the big slot in the top of the poros pedestal (cf. Fig. 2). The cuttings, as has been said, are roughly made. The east cutting measures 0.40 m. x 0.13 m. x 0.09 m. deep (at its deepest place); the west cutting is similar to the east cutting, except that it seems to have been about half as long as the east cutting. There is a drain leading out from the bottom of the east cutting (cf. Fig. 2). There may have been a similar drain for the west cutting, but the poros block is too badly damaged just where the drain should be to assert positively that there ever was a drain (cf. Fig. 2). The drain for the east cutting is wedge shaped, with an angle of about 60° pointing downward. What remains of the drain is well made, and, as it comes on the axis of the rough cutting, the drain may be surely considered as belonging to the same period as that of the rough cutting itself. Whatever went in the rough cuttings could not have been very high, as in that case the objects would have partially hidden the representations of the tiles. One thing seems clear, therefore, and that is that whatever went in the two cuttings was not as important in the composition of the monument as the marble representations of tiles.

⁹ The other tiles mentioned in this article were found under the following circumstances:

- A 938 curved pan tile from a well 50 m. north of the northeast corner of the Hephaisteion. The well was filled up in the 2nd century B. C.
- A 945 curved pan tile, from a well on the northwest slope of the Acropolis filled up *ca.* 500 B. C.
- A 1322 and A 1323 curved cover tiles, from an industrial establishment at the west foot of the Areopagus where they had been re-used as a drain. Context of *ca.* 400 B. C.

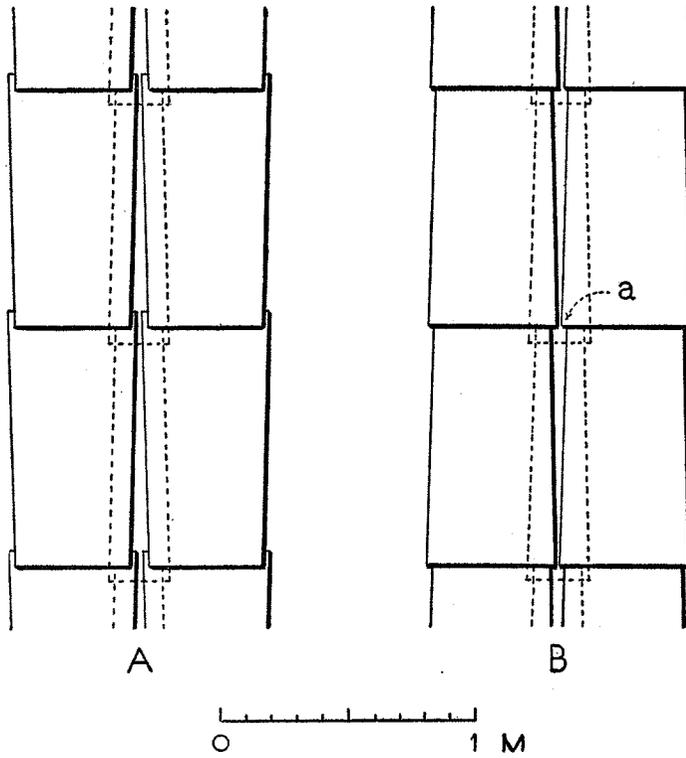


Fig. 7. Correct (A) and Incorrect (B) Overlapping of Curved Terracotta Pan Tiles.

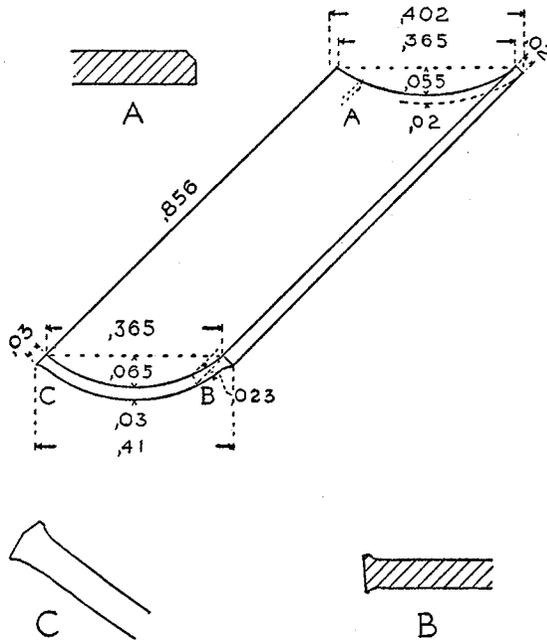


Fig. 8. Terracotta Pan Tile A 951 in the Agora Museum.

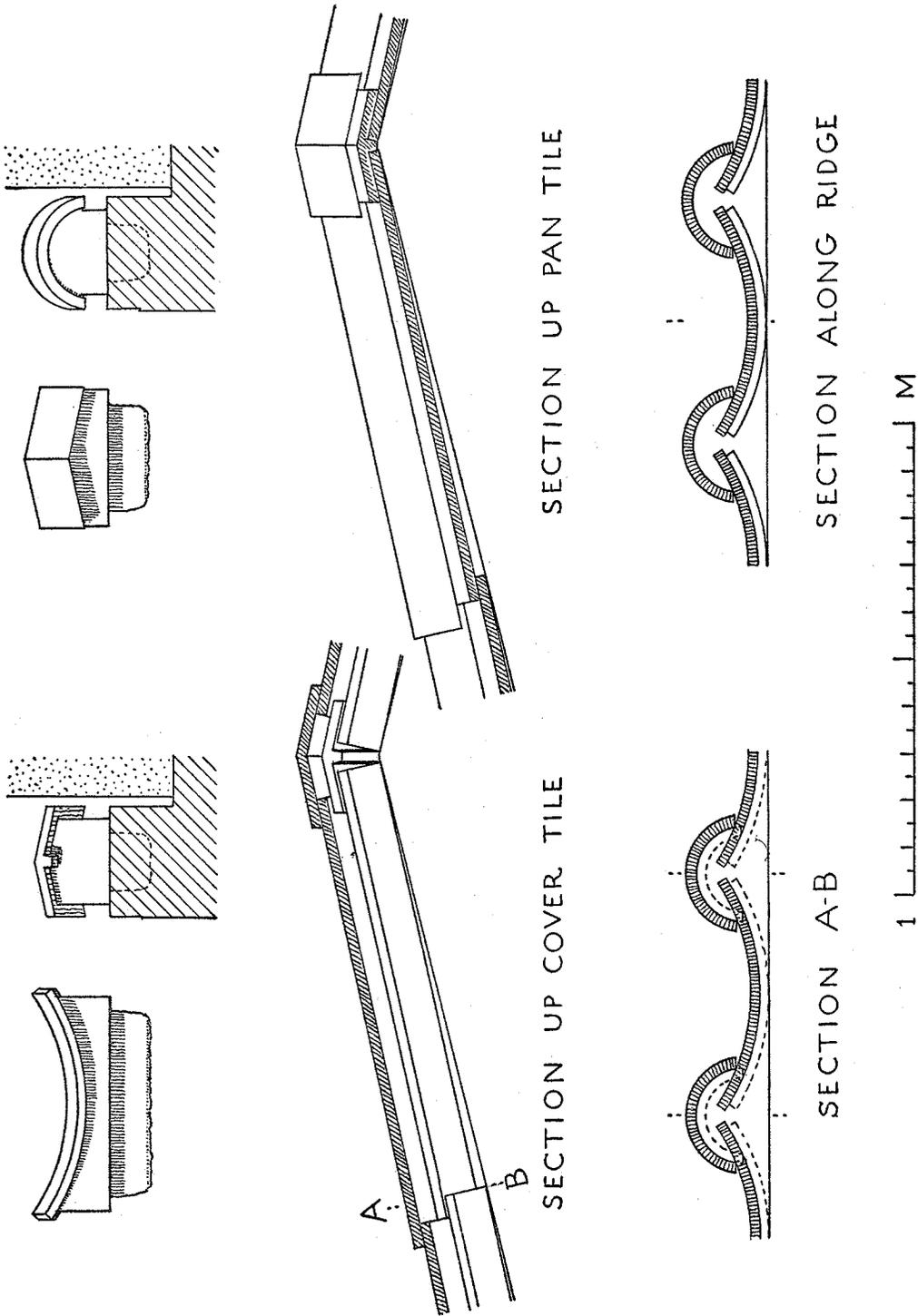


Fig. 9. Restoration of Standard Tiles for Ridge Pan and Ridge Cover Tiles, Derived from a Roof of Pan and Cover Tiles like those of the Standard.

It is difficult to say with certainty what was inserted in the rough cuttings. We would like to find something related to the tiles. We suggest for the larger cutting either a marble or a wooden standard of the ridge pan tile and for the smaller cutting a standard of the ridge cover tile (Fig. 9). As both these tiles were fairly small, their standards may have been kept in the Civic Offices and only brought out during office hours.¹⁰ The drain then becomes useful in carrying off rain water which would otherwise collect in the cutting while the standard was in the office. The bottom of the

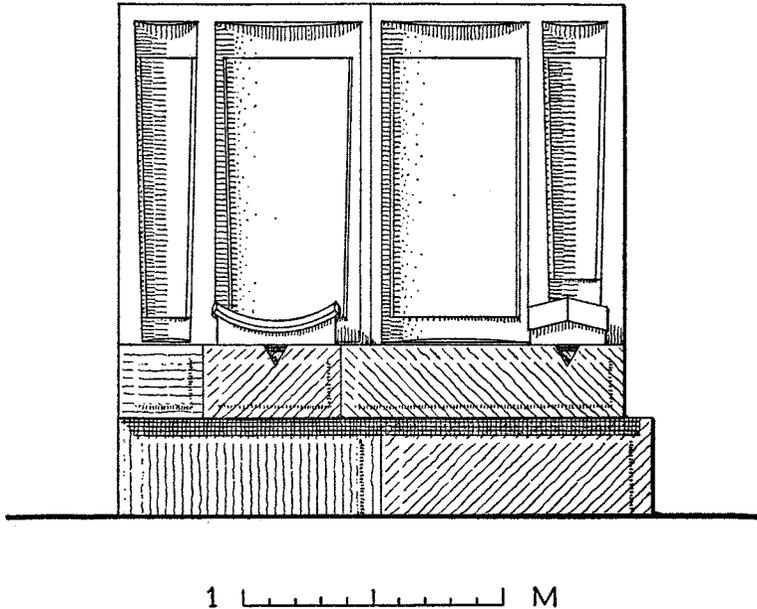


Fig. 10. Restoration of the Tile Standard in the Agora of Ancient Athens.

cutting for “M” in Fig. 2 is somewhat damaged along its edge—a damage which may well have been caused by the operation of putting the standard ridge cover tile into its place on the monument. We may add that the tile standard at Assos had a rough cutting measuring 0.39 m. x 0.18 m. x 0.063 m. deep. The cutting is much like the larger rough cutting of the Athenian standard, except that it has no drain (which can perhaps be explained on the ground that the object inserted in the cutting was not movable).¹¹ Everything considered, we believe that the small pan and cover tiles of the ridge give us a plausible explanation for the two rough cuttings in the Athenian standard.

¹⁰ Paton and Stevens, *op. cit.*, Pl. XXIV, Figs. 7 and 8 for marble ridge tiles.

¹¹ F. H. Bacon, *Assos*, p. 71, Fig. 1, and p. 73 for the text accompanying Fig. 1.

We are now prepared to attempt a complete restoration of the tile standard (cf. Fig. 10).

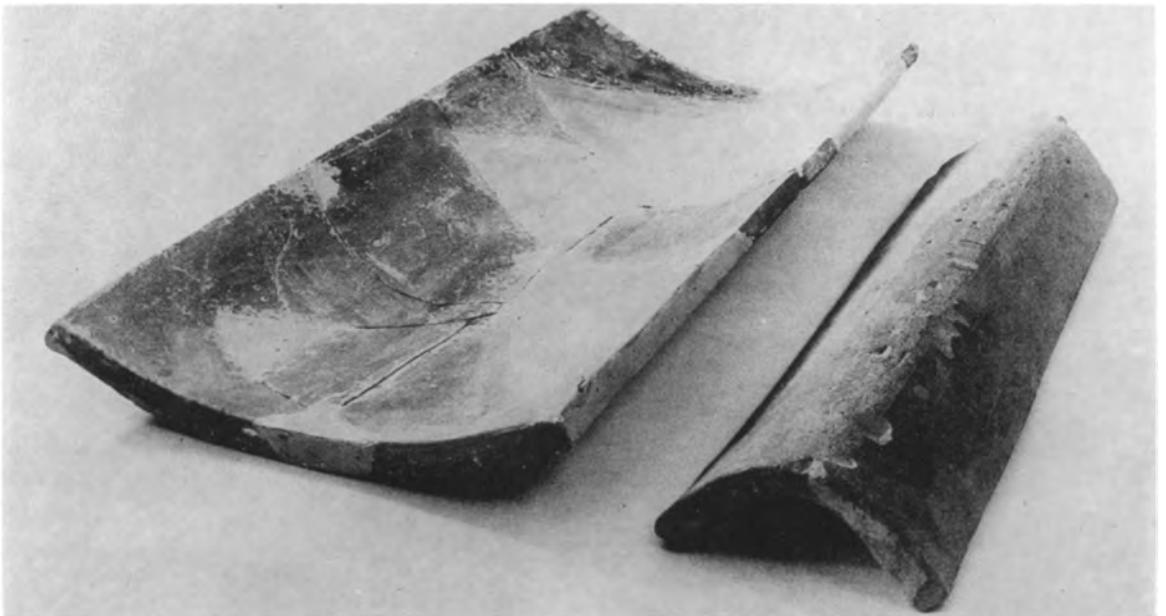
In conclusion, perhaps we may be permitted to remark that, when the writer began to "work up" the tile standard of the Athenian Agora, he believed that only one drawing and not more than two pages of text would be needed. In preparing the article, however, unexpected difficulties presented themselves. Difficulties are severe instructors, but they sharpen our wits and compel us to consider our problems from many points of view.

GORHAM PHILLIPS STEVENS

ATHENS, JUNE, 1949.



1. Tile Standard in the Agora at Athens



2. Terracotta Pan Tile A938 and Terracotta Cover Tile A1322, both in the Agora Museum