HESPERIA 70 (2001)
Pages 127–162

THE AGORA MINT AND ATHENIAN BRONZE COINAGE

ABSTRACT

The large square building in the southeast corner of the Athenian Agora, excavated in the 1950s and in 1978, served as the Athenian mint for the striking of bronze coins from the 4th through the late 1st century B.C. The best-preserved part of the building, the southwest room, produced ample evidence of industrial activity, including unstruck bronze coin blanks and rod segments from which the blanks had been chopped. The building was constructed near the end of the 5th or at the start of the 4th century B.C., but whether it was originally intended for the coining of bronze is uncertain.

In 1952 and 1953 a large square building of Classical date was found at the southeast corner of the Agora square (Figs. 1 and 2); further excavations were carried out in 1959 and 1978. Though poorly preserved, the building has been identified as a mint on the basis of large amounts of industrial debris found in the area, together with numerous unstruck bronze coin blanks, or flans.[1] We present here an account of the surviving remains and related small finds, the results of metallurgical analyses of a selection of the blanks and of Athenian bronze coins, and consideration of the role of the building in the history of Athenian coinage.

THE BUILDING AND THE EXCAVATIONS OF 1978

The Site

The building lies immediately west of the Panathenaic Way and east of the Archaic Southeast Fountain House. For most of its extent, it rests directly on bedrock that slopes down relatively steeply toward both the west and north. Floor levels were not preserved throughout most of the building, but the lowest course of foundations lies some 3.35 meters lower at the northwest corner than at the southeast corner. Bedrock within the building rises as high as 67.82 masl in the southwest quadrant, 68.60 in

1. The site was first excavated by M. Crosby in 1952, with preliminary notices published in H. A. Thompson 1953, p. 29, and H. A. Thompson 1954, pp. 45–48. Further work was done by D. B. Thompson in 1959, with the results published in H. A. Thompson 1960, pp. 343–344. Additional work done in 1978 was published in Camp 1978 and Camp 1979. More synthetic accounts appear in Camp 1986, pp. 120–135, and Camp 1990, pp. 162–163. See also J. Kroll in *Agora* XXVI, pp. 292–295. In the present study both authors collaborated, J. Camp being largely responsible for the report of the building and the excavations of 1978 and J. Kroll for the report of the unfinished coin blanks and associated bronze debris. We are indebted to the Agora photographer, Craig Mauzy, for new photographs, to Anne Hooton for inking the drawings, to the Solow Art and Architecture Foundation for assisting the final stages of Kroll's contribution with a summer research fellowship, and to the anonymous readers of the manuscript for some very helpful recommendations.

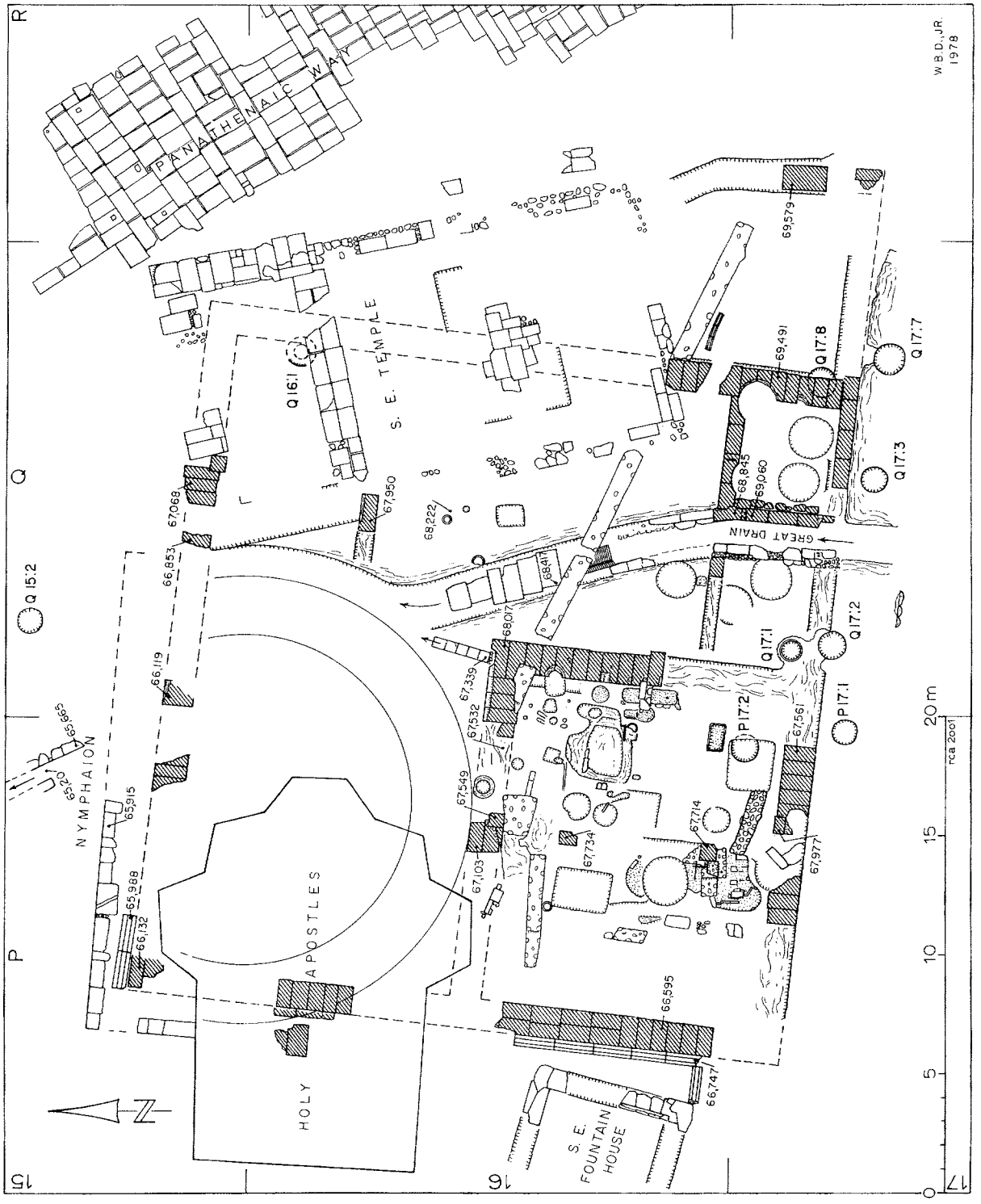

Figure 1. Agora Mint, actual state plan. After a drawing by W. B. Dinsmoor Jr., 1978

Figure 2. Agora Mint. Church of the Holy Apostles at upper left, foundations of Southeast Temple at upper right. Aerial view, 1979.

the central room along the south, and 69.00 masl in the southeast room, where it appears to have been dressed down. The limited depth of fill has contributed to the poor state of preservation of the building; later kilns and casting pits, a lime-slaking pit, and cuttings for pithoi go deep into bedrock at various places.

There are no traces of an immediate predecessor on the site. A few very short stretches of rubble walls and several wells in the vicinity suggest that there were modest private houses in the area until the middle years of the 6th century B.C. The first obviously public building is the Southeast Fountain House, which should be dated to the years around 530–520 B.C., lying just west of our building, with its floor level some 1.80 m lower than the level of bedrock in the southwest quadrant of the Mint.

A narrow space was left between the two buildings; as the fountain house is set on a more northeasterly orientation than the Mint, the space is wedge-shaped, with the narrow end opening toward the north. This area was paved with poros slabs, and a well-cut open gutter made of poros blocks was laid running along its south side from the southeast corner of the fountain house to the southwest corner of the Mint, at which point it turned north and ran along the entire length of the Mint's west wall. At the northwest corner of the Mint, it turned east and continued at least partway along the north wall (Fig. 3). It is not clear whether this gutter was designed simply to carry off drainage water, but its origin at the corner of the fountain house suggests that it may have been possible to tap into a water channel—which probably ran within the south and east walls of the fountain house—to ensure a continuous flow of water in the gutter when desired.

Figure 3. Agora Mint, northwest corner with poros water channel; mortared rubble masonry of the Nymphaion, above. View from northwest.

Figure 4. Agora Mint, west wall under the western apse of the Church of the Holy Apostles. View from south.

The level of the poros paving is intermediate between the floor levels of the two buildings, lying some 0.64 m above that of the fountain house and ca. 1.17 m below the level of bedrock in the southwest quadrant of the Mint. At some point the paving was covered with a thick layer of waterproof cement made of small rounded pebbles set in a hard white mortar. This layer, together with its packing, is ca. 0.16 m thick, bringing the floor level flush with the rim of the poros gutter. The poros slabs and cement floor could represent two distinct building phases, though they might equally well be regarded as part of a single operation.

Description of the Remains

The building itself is in a poor state of preservation, with the wall blocks extensively robbed out, and only the partially preserved lowest course of foundations gives some idea of the plan. The northern half, in particular, has suffered; here, the northeast corner was overlaid by the Southeast Temple in the early 2nd century A.C., while the northwest corner was first covered by the hemicycle of a huge nymphaion, also of the 2nd century A.C., and then by the Church of the Holy Apostles in ca. A.D. 1000 (Fig. 4).[2] The foundations are of well-cut squared blocks of easily worked, light poros (L. 1.20–1.30, W. 0.60–0.65, H. 0.48 m; i.e., 4 by 2 by 1.5 ancient feet). For the most part they are laid as headers, though for at least part of the length of the west wall they were set as a double row of stretchers. The overall dimensions of the building correspond nearly to a square, measuring 27.20 m north–south and 28.90 m east–west. In addition, the irregular area between the east wall and the Panathenaic Way was at least partially enclosed by walls at the south and east.

Of the interior arrangements, only those of the south half of the building may be restored with any degree of confidence. In the southwest quadrant there was a large room measuring ca. 14.00 m east–west by 11.00 m north–south (Fig. 5). Near the midpoint of the room, on its east–west line, two poros blocks remain in situ in an appropriate position to have carried interior supports. The southern block was moved when it was incorporated into a Roman wall, though it should lie close to its original position.

To the east, in the southeast quadrant of the building, there are two smaller rooms set side by side along the south wall. The western room measures ca. 5.00 m east–west by 3.90 m north–south; the eastern room measures ca. 4.20 m east–west by 3.90 m north–south. In the western room, the eastern parts of the west foundations are made up of irregular blocks of Acropolis limestone, the only use of a material other than poros in the surviving foundations.

To the north of these three southern rooms only a few blocks survive of the west and north walls of the building. Two poros blocks lying just outside the western wall (Figs. 4 and 6) perhaps indicate the position of an entrance on that side. Within the northeast quadrant a single poros block remains in situ, oriented east–west and lying about 6 m from the line of both the east and north walls. It may well be that a large part of the northern half of the building was an open-air courtyard, perhaps with a light colonnade, but not enough survives to allow more than this tentative suggestion.

2. For the date of the Southeast Temple: Dinsmoor 1982, pp. 431–433; for the Nymphaion: *Agora* XIV, pp. 202–203; and for the Holy Apostles: *Agora* XX.

Figure 5. Balloon view of Agora Mint, southwest room

In addition to the poros gutter along the outside of the west and north walls, several other hydraulic installations in the immediate area should be noted. The east branch of the so-called Great Drain passed under the building: on the south, it ran under the east side of the central room, where the drain and room shared a common eastern wall, and just north of the north wall of the room, it turned to a northwesterly orientation and passed through and outside of the north half of the building. Not enough survives in this area to show what channels of the Mint, if any, may have emptied into the large drain. A well (Q 15:2) some 6 m north of the building, west of the Panathenaic Way and within the open square of the Agora, might be associated with the Mint in some way. The Mint is the building closest to the well, which should presumably be thought of as a public well, and a huge mass of material was thrown into the shaft when the well went out of use apparently at the end of the 5th century B.C., just as or soon after the Mint was built. Finally, within the northeast quadrant of the Mint was excavated a bottle-shaped Hellenistic cistern (Q 16:1), in use in the 3rd century B.C.[3]

3. Only a handful of pottery (lot ΠA 168) and three catalogued objects (basin: P 26660, casserole: P26661, and a storage jar: P26662) were recovered from the cistern; they provide no useful information about the use of the building. For well Q 15:2, see *Agora* XII, 2, p. 397.

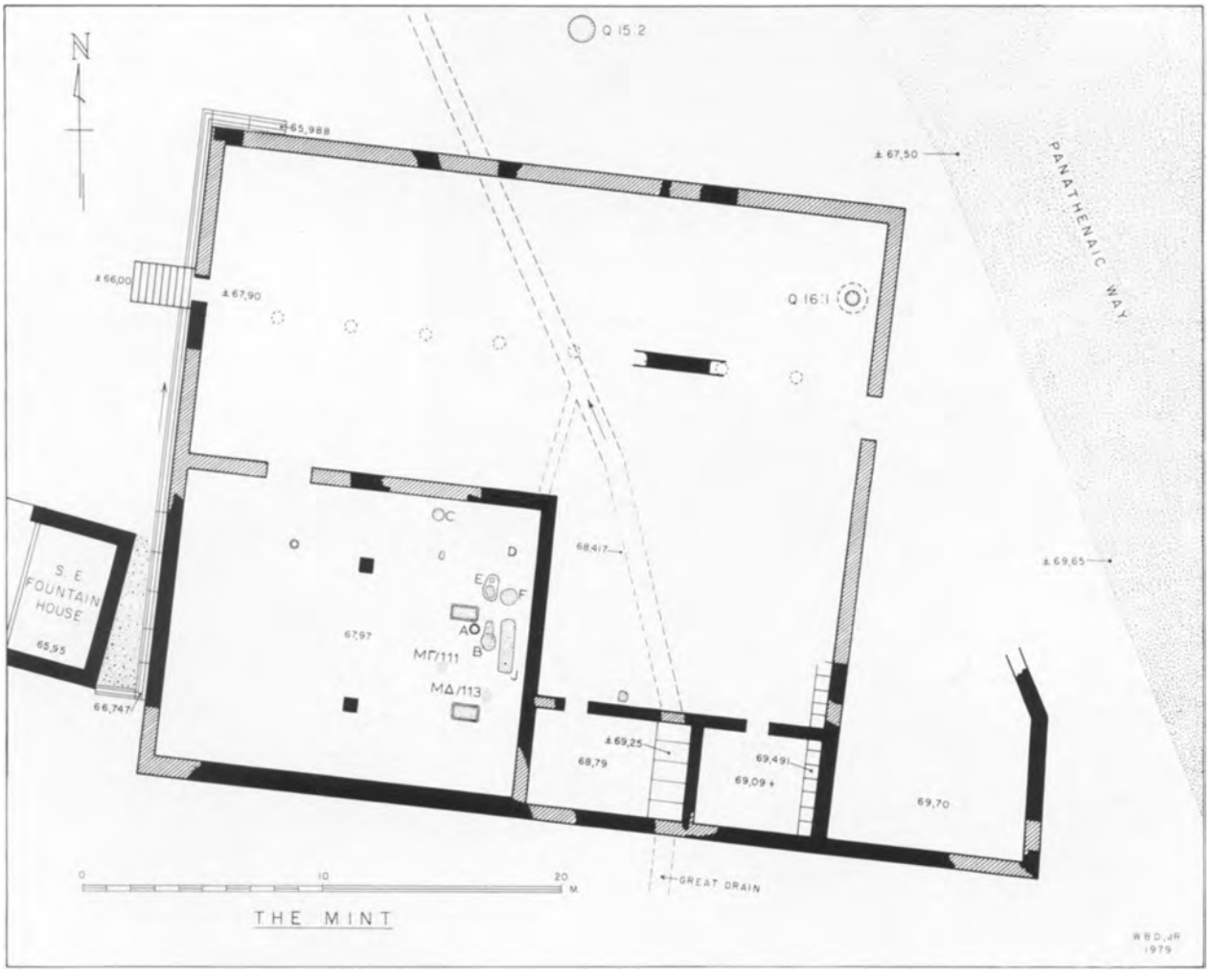

Figure 6. Agora Mint, restored plan.
After a drawing by W. B. Dinsmoor Jr., 1979

Southwest Room: Industrial Installations (Figs. 5 and 7)

The large southwest room is the best-preserved part of the building and here were found installations and small finds which lead to the identification of the building as a mint. In all, ten pits and two water basins were uncovered in the eastern part of the room, where the latest floor levels were preserved, along with lumps of bronze and slag together with some ash and flecks of carbon. Here, too, were found dozens of coin blanks, scattered throughout the fill and in the pits.

The pits seem to break down into three distinct types; in general, they seem also to represent a distinct chronological sequence. The features of each group may be characterized as follows:

Group 1 (pits A–E) (Figs. 7–9)

These pits are irregular or round in shape, measuring 0.50–0.72 m across and ca. 0.30–0.45 m deep. Characteristic of these pits are the large, thick-walled terracotta basins apparently set down into them, their inner

Figure 7. Southwest room. Pits A, B, E, F, and J in foreground; east wall beyond. View from west.

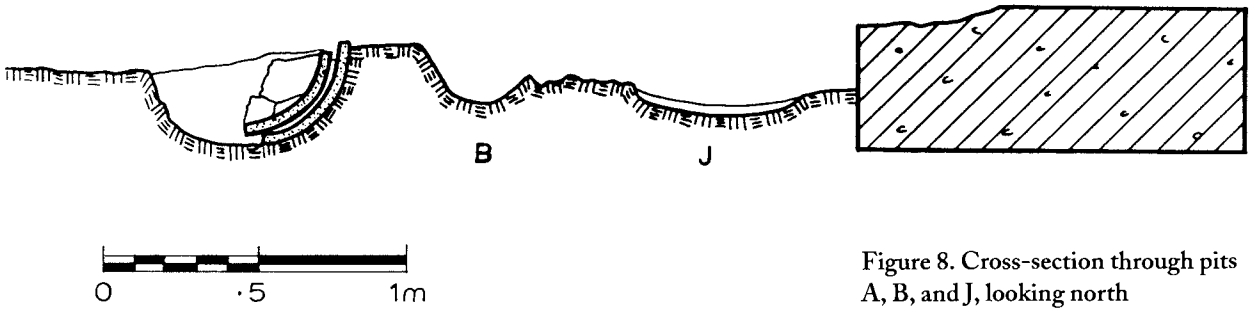

Figure 8. Cross-section through pits A, B, and J, looking north

Figure 9. Pit A, detail of basins P 31129 and P 31130, as found in situ. View from southwest.

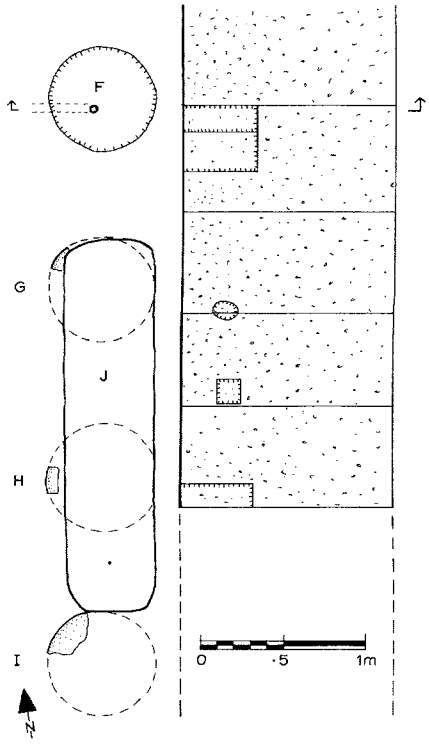

Figure 10. Southwest room. Plan showing the east wall *(at right)*; pits F and J, traces of pits G, H, and I *(at left)*.

surfaces displaying ample signs of burning. Pit A had two basins preserved in situ, one nestled within the other (P 31129, P 31130). Pits B and C had large fragments of similar basins in their fill, though not in situ. Another distinguishing feature is the date of the material in the fill of these pits, which suggests a terminus ante quem in the early 3rd century B.C. Pit D, which had no fragments of basins, went out of use at this time.[4]

Group 2 (pits F–I) (Figs. 10–13)

Only one pit of this type was fully preserved. It was shallow, 0.65 m in diameter, and was lined at the bottom with red clay or mudbrick. Above were three very thin packed floor levels (ca. 0.008–0.01 m thick) made up of fine, flakey, grayish-brown silt. Cut through the bedrock at the bottom, and covered by the top two floor surfaces, was a hole ca. 0.05 m in diameter that led to a horizontal channel cut through bedrock, measuring 0.10 m high and 0.08 m across, its top the original red clay floor of the pit. It ran westward from under pit F toward the south end of pit E. Pottery associated with pit F was generally nondescript and not readily datable.[5]

Figure 11. Pit F, detail of hole *(at center)* and channel *(at right)*. View from northwest.

Three more pits (G, H, and I; Figs. 10 and 14) attributed to this same series were largely overlaid by pit J of the next group and were put out of use by it. Their western edges could be made out projecting beyond the limits of J. As restored, they align with pit F in a north–south line, ca. 0.50 m apart, some 0.15 m from the foundations of the east wall of the southwest room. From their position and apparent similarity it seems likely that they are contemporary with pit F.

Group 3 (pit J) (Figs. 14 and 15)

The third type is represented by a single example, which differs radically from the other pits in shape, composition, and date. It takes the form of an

4. Pottery lots: A = ΠΑ 284, B = ΠΑ 285 and 286, C = ΠΑ 287, D = ΠΑ 283, and E = ΠΑ 281. The pits were given numbers as excavated; the correspondence of the notebook designations with the letters used here is as follows: pit A = 5, pit B = 6, pit C = 7, pit D = 4, pit E = 2, pit F = 1, and pit J = 3. S. I. Rotroff and J. Hayes kindly provided expertise in dating the Hellenistic and Roman pottery.

5. Pottery lot ΠΑ 280. Generally nondescript pottery with fragments of a casserole.

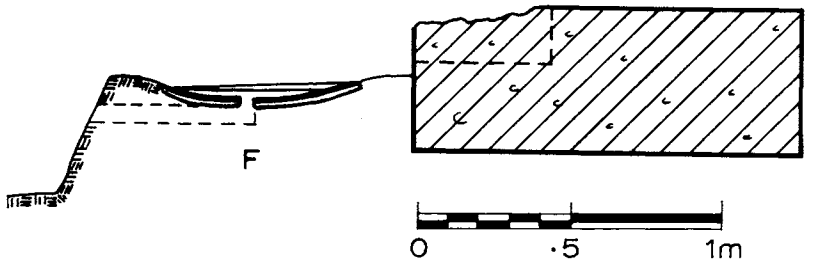

Figure 12. Cross-section through pit F, looking north

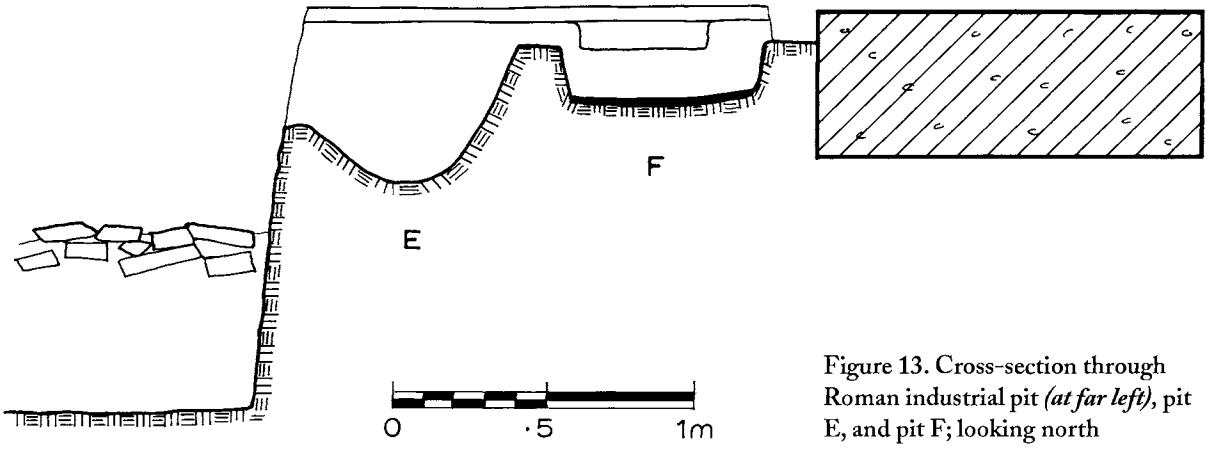

Figure 13. Cross-section through Roman industrial pit *(at far left)*, pit E, and pit F; looking north

elongated rectangle with rounded corners, measuring ca. 0.55 m wide by 2.30 m long, set in a north–south orientation along the east wall of the room. The flooring was reported to consist of numerous very thin, compacted layers of clay and ash with an admixture of corroded bronze, measuring altogether some 0.025–0.04 m in thickness. Pottery from levels associated with pit J suggests that it went out of use in the late 3rd/early 2nd century B.C.[6] As noted, it overlies pits G, H, and I and therefore postdates them, as well as—perhaps though not certainly—pit F.

It is assumed that these pits, with their evidence of burning and their green discoloration, were somehow used in the processing of metal, primarily bronze if we may judge both from the actual material found as well as analysis of numerous samples taken from in and around the pits. At first glance, some of the pits might seem to represent the bases of furnaces or ovens used in some way in the preparation of the bronze. The analysis of the minute layers making up the successive floors of pit J, however, revealed no evidence of pyrotechnology, and if there were furnaces in the building, they must be sought elsewhere. The floors of pit J, on analysis, prove to have been built up of successive layers of plaster rather than clay.[7]

A series of shallow cuttings set into the foundations of the east wall may well have supported additional equipment or some superstructure over the pits (Figs. 7, 10, and 14). Opposite the southern half of pit F there is a rectangular cutting in the east wall measuring 0.45 m east–west by 0.40 m north–south. The southern 0.24 m is 0.05 m deep, while the northern 0.16 m is 0.18 m deep. Part of a similar rectangular cutting lies 1.97 m to

6. Pottery lot ΠΑ 282. Coarsewares with fragments of a large basin.

7. Eleven separate layers of pit J were recognized, ranging in thickness from 0.9 to 3.7 mm. The analysis was carried out in 1997 by Roger Doonan, formerly of the Fitch Laboratory of the British School of Archaeology in Athens. No analysis was performed on the "furnaces" reported from the excavations in the 1950s (Thompson 1954, p. 46); it may well be that the original excavators found pits similar to these and assumed, as did Camp initially, that they were evidence of pyrotechnology. The thin layers of pit J are all of a greenish color, which looked as though it were created by bronze corrosion, though Doonan's analysis showed that the layers themselves did not contain significant amounts of bronze, certainly not enough to indicate the melting or working of bronze.

Figure 14. Southwest room. East wall, pits F and J at right. View from north.

Figure 15. Pit J. View from southwest.

the south, opposite the southern half of pit H. It measures 0.44 m east–west and the preserved north–south dimension is 0.14 m; the adjoining block to the south, which would have carried the south half of the cutting, is missing. The depth of the cutting is 0.17 m. Two smaller cuttings survive between these two, opposite the north half of pit J. The southern of the two is rectangular, measuring 0.14 m east–west by 0.15 m north–south, its western edge set in some 0.22 m from the edge of the foundations. It is 0.14 m deep. The fourth cutting lies ca. 0.45 m to the north, in an area where the foundations are somewhat battered. As preserved, it is rounded or oval, measuring 0.16 m by 0.12 m, and is 0.18 m deep. It is set ca. 0.19 m from the edge of the foundations.

Figure 16. Southwest room, remains of northern plaster-lined basin. View from northwest.

Figure 17. Southwest room, southern plaster-lined basin. View from southeast.

As well as these three series of pits and the cuttings apparently used for industrial activity there were also two water basins built within the southwest room which take the form of rectangular pits cut into bedrock, their bottoms and sides coated with a layer of waterproof cement. The northern one was largely destroyed by a later casting pit and only the southeast corner is preserved, its eastern edge lying some 1.90 m from the eastern foundations of the room (Fig. 16). The southern basin, measuring 1.10 m long by 0.60 m wide and at least 0.80 m deep, is set on an east–west orientation, its eastern side lying some 1.33 m from the line of the east wall of the room (Fig. 17).

The Blanks, Rods, and Weights(?) from the Southwest Quadrant

In addition to these various indications of industrial activity in the 3rd to 1st centuries B.C., the identification of the building as a mint, as noted, rests primarily on dozens of small bronze objects consisting mainly of unstruck coin blanks, but also pieces of the bronze rods from which the flans were struck, as well as small bronze rectangles which may have been weights. These objects were found around and in most of the pits of all three periods. Pits G and I were not excavated because of their poor state of preservation and relation to pit J. Of the eight remaining pits, all but pits C and D had small bronze objects found in them and/or embedded in their floors. A detailed analysis and catalogue is presented in the second part of this article (see also Table 1); the distribution of these finds is summarized below:

Pit A: **21–35** (Fig. 18): **12** blanks, 1 rod, 2 weights(?)
Pit B: **36–55** (Fig. 19): 20 blanks
Pit E: **56–60** (not illustrated): 3 blanks, 2 rods(?)
Pit F: **61–83** (Fig. 20): 18 blanks, 2 rods, 3 weights(?)
Pit H: **84–102** (Fig. 21): 15 blanks, 2 rods, 2 rod fragments(?)
Pit J: **103–127** (Fig. 22): 14 blanks, 5 rods, 4 rod fragments, 2 weights(?)

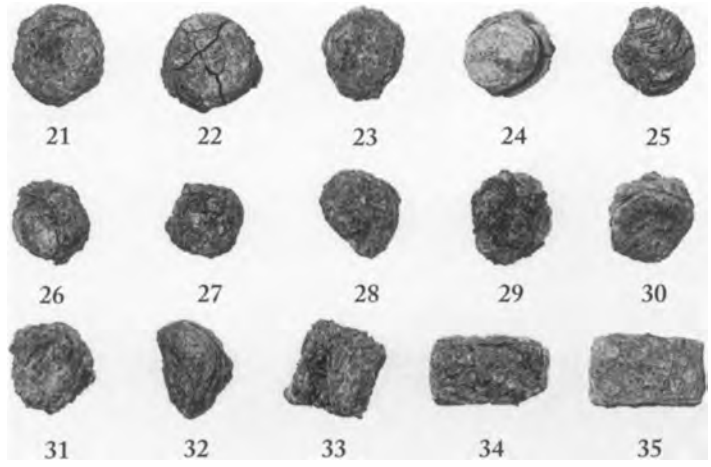

Figure 18. Blanks and other bronze debris (pit A). Scale 1:1

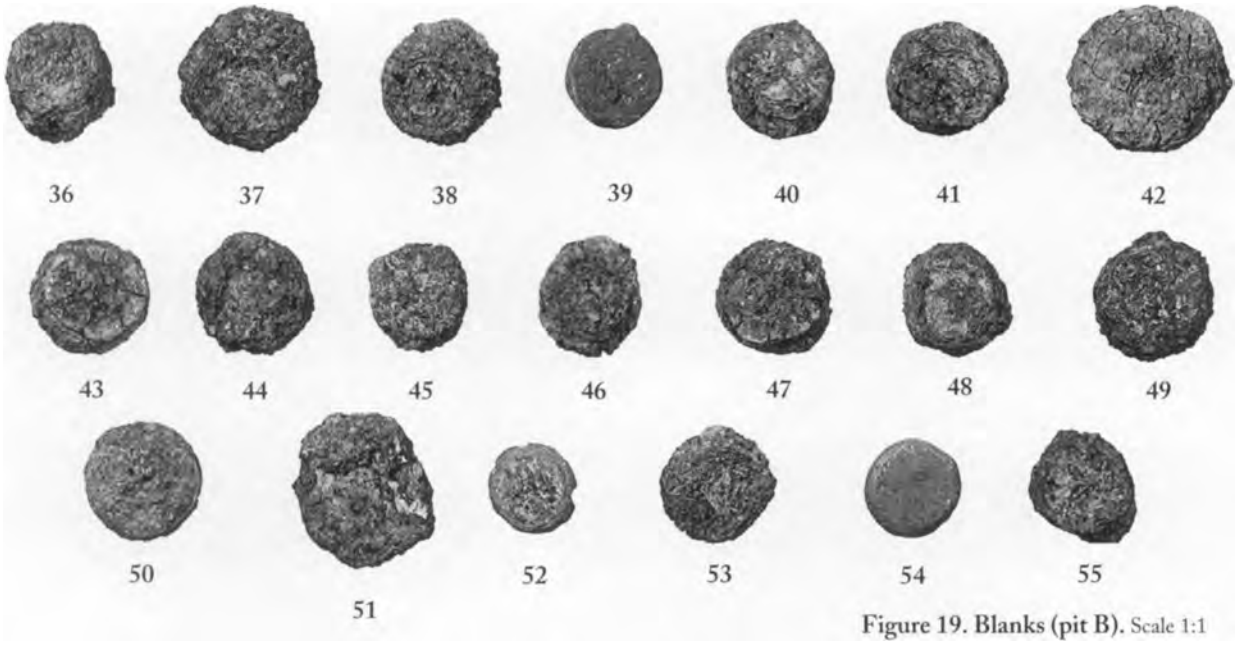

Figure 19. Blanks (pit B). Scale 1:1

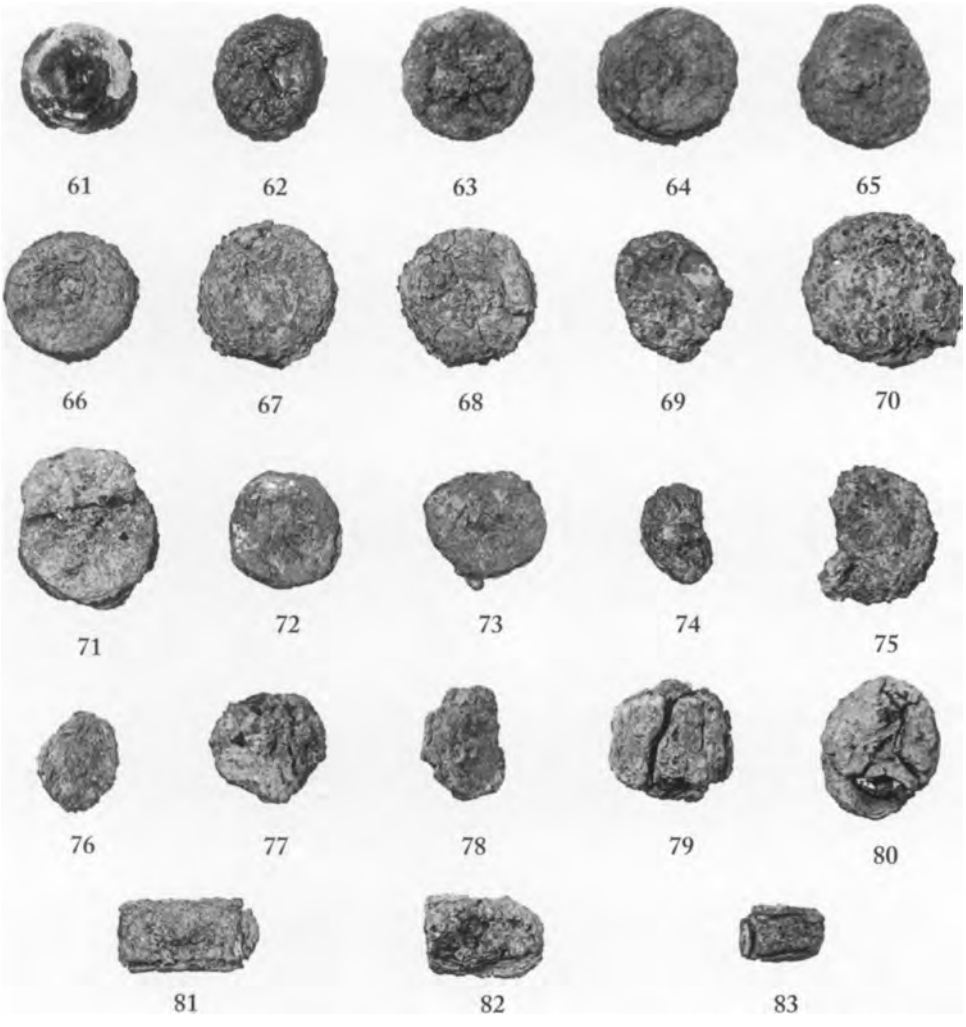

Figure 20. Blanks and other bronze debris (pit F). Scale 1:1

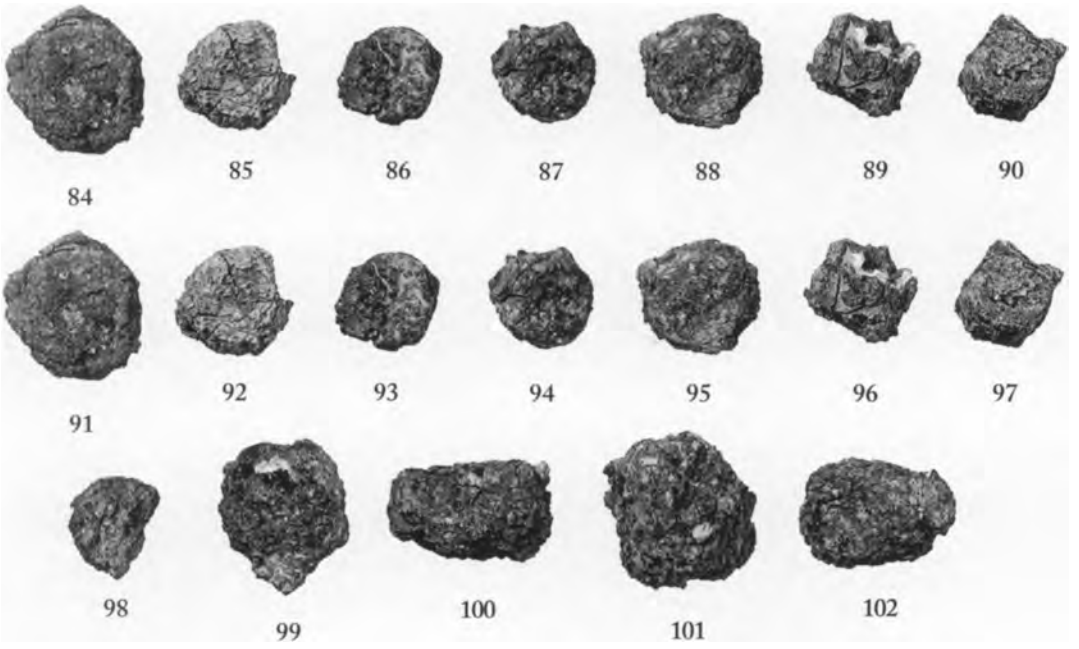

Figure 21. Blanks and other bronze debris (pit H). Scale 1:1

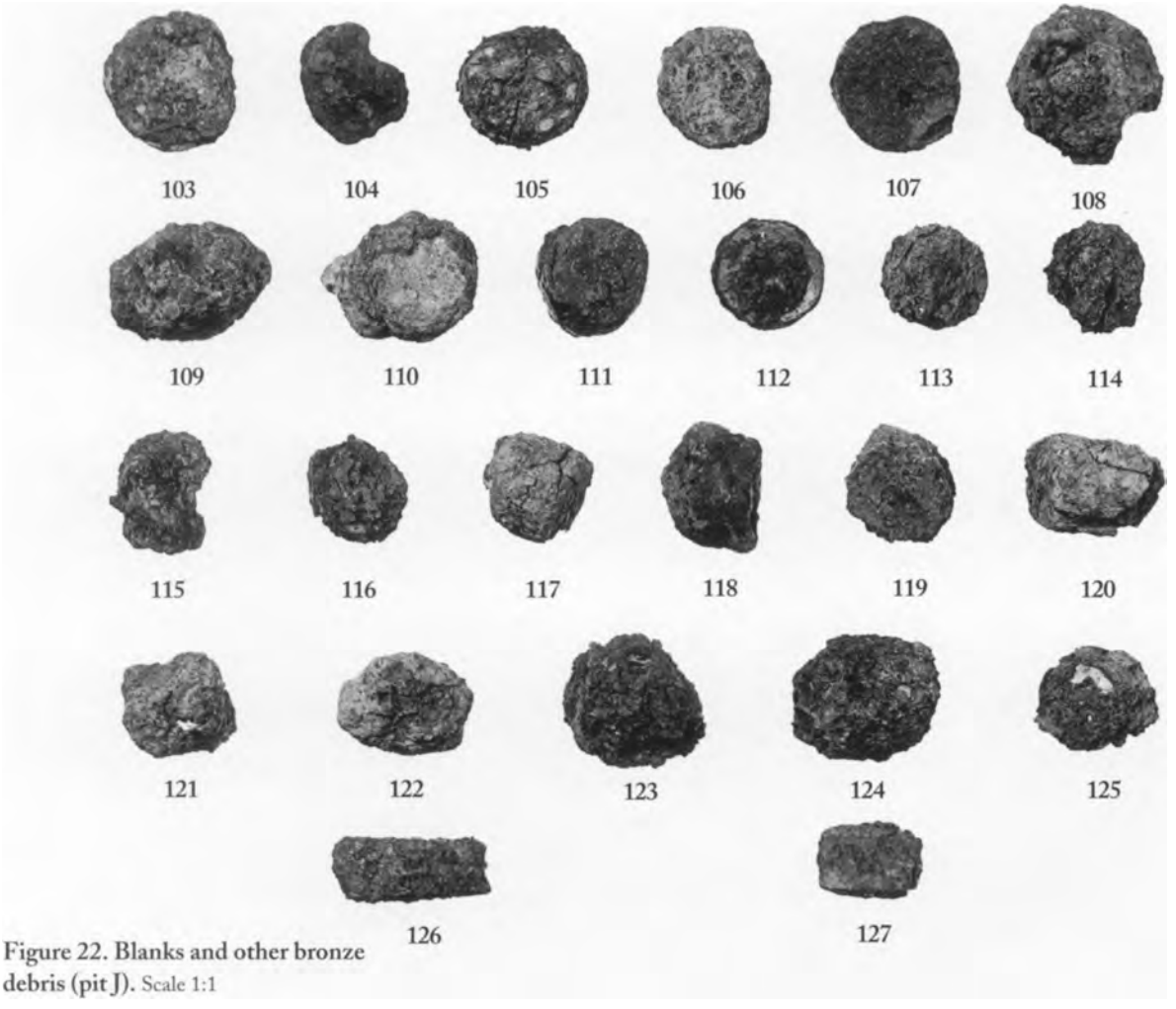

Figure 22. Blanks and other bronze debris (pit J). Scale 1:1

In addition to these fairly well defined pits, two other distinct groups of flans were found in shallow depressions in bedrock in the same general area:

From grid-square MΔ/113: **128–148** (Fig. 23): 20 blanks, 1 rod
From grid-square MΓ/111: **149–161** (Fig. 24): 13 blanks
Miscellaneous findspots: **162–169** (Fig. 25): 6 blanks, 2 rods

Thus from 1978 we have a total of 149 blanks, rod fragments, and weights(?),[8] all but eight of them from pits or distinct groups. Pottery found with these different deposits suggests that they were being prepared or used in the building throughout most of the Hellenistic period, from the late 4th or early 3rd century into the 2nd century B.C.

Chronology and Function of the Building

The date of the building is based on ceramic evidence from earth brought in to raise the floor level in the southwest corner. Here, fill as deep as 1.00 m was encountered over bedrock, about half representing preexisting fill and half representing construction fill. The two fills are close in date, coming down into the last quarter of the 5th century B.C., and we would probably not be far off in dating the construction of the building to the last decade of the century.[9]

As we have seen from the evidence of the pits in the southwest quadrant, the building was in use through the Hellenistic period. The uppermost floors are generally not well preserved and the evidence for the date of the abandonment of the building is indirect. The latest preserved undisturbed floor levels in use would seem to date no earlier than the late 2nd century B.C.[10] Three kilns or firing pits seem to represent the earliest activity in the area after the building went out of use and therefore represent a terminus ante quem; they date to the late 1st century–early 2nd century A.C.[11] The building was therefore abandoned presumably in the 1st century B.C. or the 1st century A.C. As noted, the northeast part of the building was covered by the so-called Southeast Temple early in the 2nd century A.C. and the northwest corner was overlaid by a large nymphaion of Antonine date.

The identification of the building as a mint seems clear, given the dozens of unstruck flans and other signs of industrial activity. This makes

8. To these may be added those found in 1953 (**1–11**), 1959 (**12–20**), nine found in miscellaneous late contexts in the vicinity (**170–178**), and three more from the Agora excavations, though not near the building (**179–181**). These bring the total in the catalogue to 181 pieces, all but three found in or around the building.

9. Pottery lots ΠA 293–298. The ceramic material was plentiful; several thousand sherds were saved, representing characteristic coarse- and fineware shapes: lekanai, Chian amphoras, "Pheidias" mugs, late red-figured pieces, lamps, askoi, bowls, cooking wares, skyphoi, and lekythoi. Characteristic pieces represented by multiple examples include all-black Corinthian-style skyphoi (*Agora* XII, p. 83, no. 321: 425–400 B.C.), "Pheidias" mugs (*Agora* XII, pp. 72–74), saltcellars (*Agora* XII, no. 915: 425–400 B.C.), olpai (*Agora* XII, no. 273: ca. 400 B.C.), and Type 23 A lamps (*Agora* IV, no. 216, last quarter of the 5th century B.C.).

10. Pottery lot ΠA 277, with a long-petaled Megarian bowl (*Agora* XXII, pp. 34–37).

11. Pottery lots ΠA 289 and 290, and T 26, with alpha-globule lamps: *Agora* VII, pp. 15–17 and 106–107.

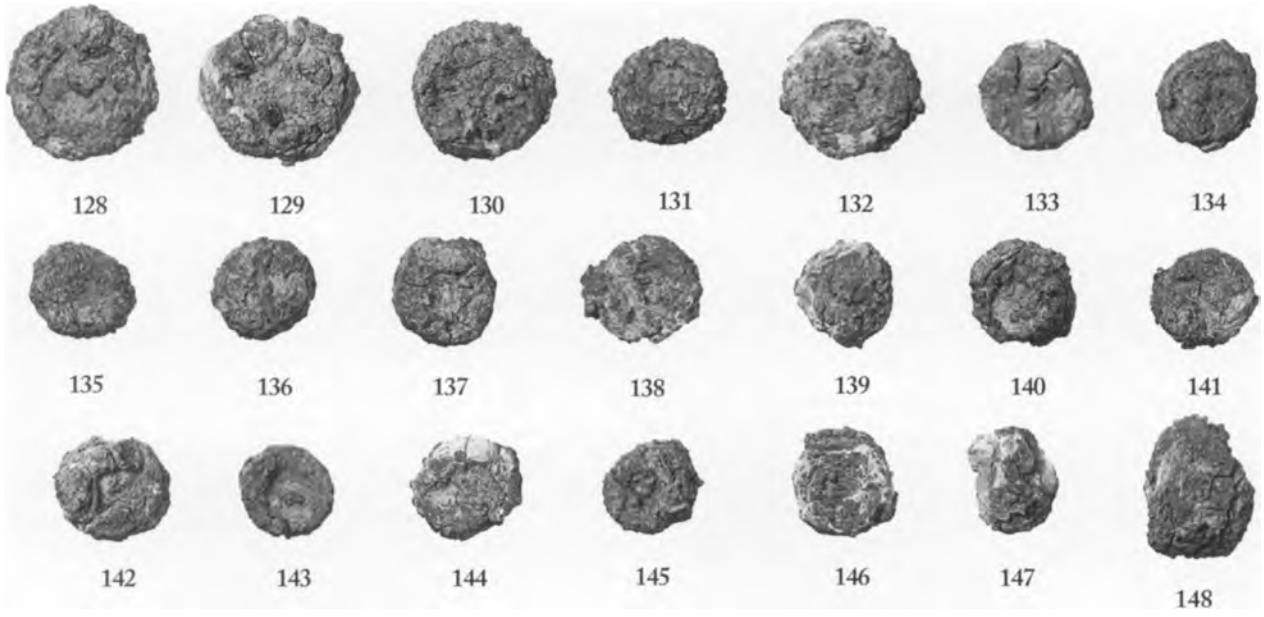

Figure 23. Blanks and rod segments (grid-square MΔ/113). Scale 1:1

Figure 24. Blanks (grid-square MΓ/111). Scale 1:1

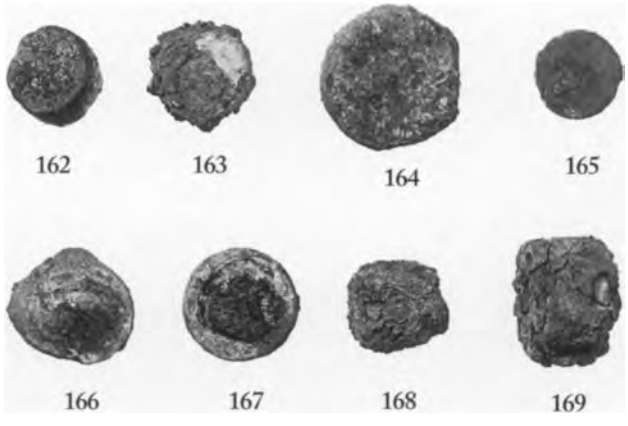

Figure 25. Blanks and rod segments (miscellaneous findspots). Scale 1:1

it one of the few recognized mints from antiquity, joining only a handful of examples from other sites.[12]

Analyses of assorted materials and samples recovered in the building have revealed only the slightest traces of silver.[13] It seems certain that the famous silver coinage of Athens which was a mainstay of the economy from the 6th to 1st centuries B.C. was not struck here. The so-called *argyrokopeion,* attested in literature and inscriptions, must be sought elsewhere.[14] What the analyses do show is that most of the material is largely copper, with lesser amounts of iron and tin, and lesser amounts still of lead. It seems likely, therefore, that bronze was the primary commodity being worked in the building, perhaps with some iron. Less certain, however, is how to correlate this information and the history of the building with the recognized development of Athenian bronze coinage. As noted, the initial construction can be dated to the years around 400 B.C., whereas the earliest Athenian bronze coinage is now usually dated no earlier than the middle years of the 4th century B.C.[15] Owing to the Athenians' reluctance to attach their name and coin types to a coinage of base metal, the earliest regular bronze coinage with the AΘE ethnic and Athena/owl types did not appear before the third quarter of the 4th century.[16] It was preceded by fourteen separately marked "Eleusinian" bronze issues, which, while inscribed ΕΛΕΥΣΙ and having the types of Triptolemos and a piglet, were nevertheless struck by the city of Athens, in all probability at the same mint later used for the AΘE bronze. But on current evidence the Eleusinian bronze is unlikely to have begun before the 350s.[17]

The bronze coinage inscribed ΣΑΛΑ for Salamis and designed with the sword and shield of Ajax begins earlier, however, and in the most recent discussion of it, Martha Taylor has plausibly argued that it too was struck by and presumably in the city of Athens, rather than on the island of Salamis as the ethnic would have one believe.[18] If so, it might have been minted in the Agora Mint. Several specimens come from contexts of the

12. Other recognized mints include Olbia (Koscjusko-Valjuzinic 1915), Halieis (Dengate 1975; Boyd and Rudolph 1978, pp. 339 and 347), Pella (Oikonomidou 1993), Nea Paphos (Nikolaou 1972a and 1972b; Nikolaou and Mørkholm 1976, pp. 9–10), and, from the Late Roman period, Thessaloniki (Velenis 1996).

13. Material from the building has been analyzed on various occasions under assorted procedures. For analyses of the bronze blanks and rod ends, see pp. 146–157 below. Thirteen samples, taken from not just blanks and bars, but also slag, the basins in the pits, and the floor of pit J, were analyzed by the late K. Konophagos of the Polytechnic University and H. Badeka, using X-ray fluorescence, in December of 1978 and January of 1979. Additional analysis by R. Doonan of the Fitch Laboratory was carried out on the floors of pit J in 1997 (above, note 7).

14. For the literary and epigraphical sources on the *argyrokopeion,* see *Agora* III, pp. 160–161, to which add Agora inscriptions nos. I 6236 (*Hesperia* 32, 1962, p. 31, no. 29) and I 7495 (unpublished), both of the 4th century B.C. As indicated by their generally different artistic styles, iconography, administrative markings, and circulation, Athens' silver and bronze coinages routinely were administered and struck independently of one another (see *Agora* XXVI, p. 14, note 46; p. 15; and p. 31, note 38); it is not surprising that they were minted in separate places. The possibility that early Athenian silver coinage was struck in south Attica, near the sources of silver, has been raised by the recent publication of what might be a Late Archaic bronze die from Sounion (Kalligas 1997). The dies for Athenian gold coinage of 406 B.C. were dedicated on the Acropolis (Harris 1995, p. 119, no. 34).

15. This despite an emergency issue of bronze-plated coinage in 406/5 B.C.: Ar., *Ran.* 725–726, with scholia, and *Ekkl.* 815–822; also references to *kollyboi* (Tod 1945), which some scholars have identified with small bronze tokens. For recent discussions of the *kollyboi* and the 4th-century date for the earliest official Athenian bronze issues, see *Agora* XXVI, pp. 24–27.

16. *Agora* XXVI, pp. 30–31.

17. *Agora* XXVI, pp. 27–30, and, for the striking in the same mint as the Athena/owl bronze, p. 32.

18. Taylor 1997, pp. 188–195.

early 4th century and perhaps the late 5th century, implying that the coinage began around 400 B.C.,[19] in which case it becomes tempting to associate the construction of the Mint with the inauguration of this earliest conventional Attic bronze coinage. This presents an alternative to the earlier suggestion that the building was constructed for the manufacture of public weights, tokens, and measures and only subsequently employed for the minting of bronze coins.[20]

Since the ceramic evidence allows that the Mint could have been constructed as early as the 410s, and since one cannot rule out the possibility—despite the absence of silver-working evidence from the remaining, essentially Hellenistic, floors, furnishings, and debris of the building—that the structure might have been intended or was used originally for the coining of silver, two further hypotheses deserve mention, both of which would give a date of ca. 414 B.C. for the building of a new mint. This was when the Spartans occupied Dekeleia, endangering Athens' control of the countryside; if the city had been refining or minting silver at Sounion (see note 14 above) or elsewhere in the mining distinct, it would presumably have had to move all such operations into the city at this time. Or, should the problematic "Standards Decree" prove to date as late as ca. 414 or shortly before,[21] the construction of a new mint would have been appropriate for the massive recoining of silver that the decree envisaged. On either scenario, however, it is doubtful that much silver would have been coined after 414, since the silver mines themselves had to be abandoned at that time, and the decree, if so late in date, could hardly have been put into effect after Athens' catastrophic losses at Syracuse in 413. Athens herself stopped minting silver at or before the end of the Peloponnesian War. Shut down by 404, the Mint would have been reopened in the next century for the coining of bronze.

So far as the date of construction and original purpose of the structure are concerned, therefore, we can offer theories but no answers. There are simply too many unknowns, even, in our view, for favoring any one of these solutions over the others. Fortunately for the rest of the building's long history, the evidence to which we now turn is more than sufficient to show that it served as the mint for Athens' bronze coinages of the 4th through 1st centuries B.C.

19. To the three specimens cited in *Agora* XXVI, p. 215, with contexts of the late 5th or early 4th centuries, a fourth specimen should be added. Coming from a context in the Kerameikos dating to 400 B.C., it will be published in U. Knigge's final report from the Bau Z excavations. Since these finds allow that the coinage could have begun slightly before 400, they raise the question of whether the bronze coins referred to in Ar., *Ran.* 725–726 and *Ekkl.* 815–822 might in fact be Salaminian bronze coins and not subaerate replications of conventional Athenian silver coins, as is usually assumed (Kroll 1976 and 1996b; *Agora* XXVI, pp. 7–8, 25 [where the Salaminian interpretation is raised but rejected, perhaps too summarily]).

20. Camp 1986, pp. 129–130. Many of these weights, tokens, and measures carried stamps and/or inscriptions indicating their public nature. We have no information as to how and where these items were produced, whether by the state or private individuals, but some measure of official control over their production and validation must have been necessary. Two cylindrical dry measures of bronze, one inscribed as "public" (*demosion*), were found in well Q 15:2, just north of the Mint (B 1082 and B 1082*bis* = *Agora* X, DM 42 and 43, p. 52, pl. 14). The Athenians did not employ stamped bronze allotment plates until after 388 B.C., probably in the early 370s (Kroll 1972, pp. 4–7, 87–90).

21. Figueira (1998, pp. 431–465) presents a lengthy review of the chronological evidence and favors a date in the early 440s. But an increasing number of scholars have been returning to the more traditional dating in the twenties or teens; see, e.g., Fornara and Samons 1991, pp. 98–102; Vickers 1996; and, in support of ca. 414 (as earlier Weil 1906 and 1910, Gardner 1913, and Johnston 1932), Kallet 2001, chapter 5.

THE UNFINISHED COIN BLANKS AND ASSOCIATED BRONZE DEBRIS

The notable group of ten unstruck coin blanks and the short length of a bronze rod from which they had been chopped (**1–11**; see Fig. 26, below, and Table 1) came to light during the second season of excavation of the building, in 1953. Since then the total of coin blanks, rod ends, and related bronze scrap from within the Mint has risen to 169 pieces, 149 of them recovered during the final exploration of the floors in 1978. Find contexts and comparison of the blanks with Athenian bronze coins by weight and alloy indicate that the blanks range in date from the late 4th or early 3rd century to the end of Athens' Hellenistic bronze coinage in the late 1st century B.C.

The composition of the blanks' alloys has proved to be an especially useful chronological index. As shown in Table 2, which lists all Athenian bronze coins that have been metallurgically analyzed, the percentages of tin and lead in the coin alloys display a pronounced shift over time. In the alloys of the 4th- and 3rd-century bronze coinage (*Agora* XXVI: Periods I and II) the levels of tin are relatively high, roughly in the range of 8 to 12 percent, while the percentages of lead, between 0 and 3 or 4 percent, are extremely modest. In the late bronze coinage of the second half of the 1st century (Periods IVB–E), however, the pattern is reversed: the alloy was cheapened, and softened for ease of striking, with a heavy admixture of lead, normally falling in the range of 10 to 20 percent, at the same time that the tin percentages decline well below their former levels. The analyses collated in Table 2 caution that one cannot expect exact metallurgical consistency within a given period or coin variety: a given coinage would have been minted from numerous batches of alloy, which are likely to differ among themselves to some measurable degree (see Table 2, variety 153, with its five analyzed specimens). In the case of some 1st-century B.C. coinages partially overstruck on earlier, obsolete coins that had been withdrawn from circulation, the inclusion of such blanks of older alloy would have produced even greater discrepancies, apparently explaining, for example, the extremely low lead content of two of the three analyzed specimens of the concluding Augustan coin varieties 157 and 158. Making allowances for such anomalies, however, the overall deduction nevertheless holds that Athenian coins and coin blanks with a high lead content characteristically belong to the last decades of the 1st century B.C. and later.[22]

One of the Agora blanks was chemically analyzed, soon after its recovery in 1953, at the Ohio State University.[23] The nineteen other blanks whose metallic compositions are recorded in Tables 1 and 3 were analyzed at the Fitch Laboratory at the British School of Archaeology in Athens in 1996, along with twenty-two Athenian bronze coins[24] that supplement the sampling of Athenian coins analyzed by E. R. Caley in the 1930s and by a student of Caley's in the 1950s.[25] Altogether, the analyses confirm that the heavily leaded pieces and the rod segment from the 1953 excavations belong to one of the final phases of Athens' Hellenistic coinage of the last half or third of the 1st century B.C. (Periods IVB–E); that the

22. Exceptions are found in Period III, which culminated in the Mithradatic star-in-crescent issue of 87/6 B.C. (variety 97), an emergency issue minted during the Sullan siege of Athens; its softened, heavily leaded alloy is thought to have facilitated striking while increasing the coins' weight and acceptability (*Agora* XXVI, p. 70). It is unlikely, however, that any such special historical circumstance will account for the anomalously high lead content of two specimens of the fractional varieties 99 and 100, which suggest that the Athenians employed heavily leaded bronze in the manufacture of minor denominational coinages before extending its use to the main, larger bronze denominations. More analyses of the Period III coinage are needed, but in the meantime, see the parallel inconsistency between some large- and small-denomination blanks (note 28 below).

23. Caley and Deebel 1955.

24. R. Doonan performed the analyses using Inductively Coupled Plasma-Atomic Emission Spectrometry, a technique that required drilling a slight turning of 0.2–0.4 g from the edge of each coin (see Hughes, Cowell, and Craddock 1976, pp. 22–26). Full results are reported below in Table 3 and in Doonan's Laboratory Report on file at the Fitch Laboratory. Besides Doonan, we have to thank, for their efforts in facilitating the project, I. K. Whitbread, Director of the Fitch Laboratory; A. Paterakis, Conservator of the Agora Excavations; and authorities of the Ephoreia of Classical Antiquities; and, for funding, the University Research Institute of the University of Texas at Austin.

25. Caley 1939; Thompson 1941, pp. 229–230; Thompson 1961, pp. 638–640.

TABLE 1. UNSTRUCK COIN BLANKS AND RELATED BRONZE DEBRIS FROM THE MINT[a]

Excavated in 1953

Rod end and 10 chopped blanks found outside the northwest corner of the southwest room, "immediately beneath the latest ancient ground level" (Thompson 1954, 46–47, pl. 14:b, photograph reproduced in Lang 1960, fig. 13; *Agora* XIV, pl. 33:c; Kleiner 1975, fig. 3; Thompson 1976, fig. 78). *Agora* XXVI, pp. 292–293, pl. 32:d, Group 1. All stripped to bare bronze. Fig. 26

1–11 B 1046	12–14 × 7–10	7.58 g	
		7.14	
		6.78	
		6.78	
		6.48	(Pb 24.03, Sn 6.50, Cu 67.60)
		6.03	
		5.93	
		5.10	
		3.12	fgt. cut on bias
		—	fgt. cut on bias; destructively analyzed in 1954 (Pb 25.63, Sn 7.08, Cu 66.53)
	13 × 24	16.95	rod end

Excavated in 1959

9 pieces, including 7 blanks and 1 rod segment "imbedded in the ancient floor" in the southwest quadrant (Thompson 1960, p. 343). *Agora* XXVI, p. 293, pl. 32:e, Group 2.[b] All stripped to bare bronze. Fig. 27

12 B 1237	15 × 9	7.70 g	(Pb 1.17, Sn 10.99, Cu 86.06) found with **13** and **14**
13 B 1238	9 × 7	1.85	fgt.
14 B 1239	11 × 11	6.94	rod segment
15 B 1240	15 × 10	—	now missing; found with **16** and **17**
16 B 1241	12 × 10	—	now missing
17 B 1242	12 × 8	5.33	smooth on both sides
18 B 1243	12 × 9	5.32	(Pb 1.73, Sn 8.97, Cu 89.89) smooth on one side
19 B 1245	13 × 10	7.60	(Pb 18.41, Sn 8.18, Cu 72.13)
20 B 1244	15 × 6	8.96	picked up on surface

Excavated in 1978

PIT A (pottery through early 3rd century B.C.) Fig. 18

12 blanks

21 B 1708	13 × 4	3.50 g	(Pb 0.47, Sn 9.26, Cu 90.93)
22 B 1709	12 × 7	3.44	
23 B 1710	10 × 6	3.42	
24 B 1711	10 × 8	2.94	
25 B 1712	10 × 8	2.43	
26 B 1713	11 × 8	1.90	
27 B 1714	9 × 5	1.60	
28 B 1715	12 × 6	1.40	
29 B 1717	11 × 8 to 1	1.58	miscut on bias
30 B 1718	11 × 5 to 1	1.52	miscut on bias
31 B 1719	11 × 6 to 1	1.50	miscut on bias
32 B 1720	12 × 7 to 1	1.35	miscut on bias

1 rod segment

33 B 1716	10 × 11	3.56	

2 rectangular weights(?)

34 B 1721	15 × 9 × 5	1.97	one edge broken away
35 B 1722	15 × 10 × 4	1.98	

PIT B (POTTERY THROUGH EARLY 3RD CENTURY B.C.) Fig. 19

20 blanks

36 B 1744	13 × 9	7.54 g	
37 B 1745	18 × 5	7.37	
38 B 1746	14 × 9	7.02	
39 B 1747	11 × 8	6.88	(Pb 0.50, Sn 9.33, Cu 87.97) flattened?; stripped to bare metal
40 B 1748	13 × 8	6.80	
41 B 1749	15 × 8	6.75	
42 B 1750	20 × 7	6.65	flattened?
43 B 1751	14 × 7	6.49	
44 B 1752	15 × 7	6.36	
45 B 1753	12 × 8	6.34	
46 B 1754	12 × 7	6.26	
47 B 1755	13 × 8	6.14	
48 B 1756	13 × 7	6.03	
49 B 1757	15 × 7	5.77	
50 B 1758	14 × 6	5.62	
51 B 1759	20 × 4	5.55	
52 B 1760	15 × 6	5.48	before stripped to bare metal
53 B 1761	14 × 7	5.35	
54 B 1762	12 × 6	5.11	flattened; before stripped to bare metal
55 B 1763	13 × 5	4.45	broken

PIT E (2ND CENTURY B.C.) Not illustrated

3 blanks

56 B 1646	15 × 6	5.30 g	(Pb 0.74, Sn 9.14, Cu 88.96)
57 B 1647	13 × 7	4.80	
58 B 1648	17 × 6	4.45	

2 rod or blank fragments

59 B 1649	11 × 7	2.13	
60 B 1650	11 × 5	2.02	

PIT F (2ND CENTURY B.C.) Fig. 20

18 blanks

61 B 1651	16 × 6	6.06 g	(Pb 0.65, Sn 11.01, Cu 88.57)
62 B 1652	16 × 5	5.89	
63 B 1653	17 × 6	5.21	
64 B 1658	16 × 6	5.15	
65 B 1659	16 × 7	5.11	
66 B 1660	17 × 6	5.09	
67 B 1661a	17 × 7	5.80	
68 B 1661b	18 × 7	6.25	
69 B 1777	14 × 4	3.21	
70 B 1778	24 × 7	7.29	

71 B 1779	21 × 5	6.53	
72 B 1780	16 × 6	4.98	
73 B 1781	16 × 5	4.72	(Pb 1.05, Sn 9.02, Cu 88.83) stripped to bare metal
74 B 1662	12 × 8	1.23	fgt.
75 B 1782	18 × 5	3.66	fgt.
76 B 1784	14 × 8 to 1	2.21	miscut on bias
77 B 1783	13 × 7 to 1	3.84	miscut on bias
78 B 1785	12 × 7 to 1	2.49	miscut on bias
2 rod segments			
79 B 1654	15 × 14	8.30	
80 B 1655	15 × 10	6.63	
3 rectangular weights(?)			
81 B 1656	16 × 10 × 7	1.93	
82 B 1657	15 × 10 × 7	2.28	one edge partially broken away
83 B 1786	10 × 8 × 6	1.83	

PIT H (2ND CENTURY B.C.) Fig. 21

15 blanks			
84 B 1683	18 × 5	6.45 g	(Pb 1.46, Sn 11.62, Cu 87.02)
85 B 1684	12 × 9	5.45	
86 B 1685	10 × 13	5.41	
87 B 1686	11 × 9	5.02	
88 B 1687	12 × 8	4.59	
89 B 1688	11 × 8	4.47	
90 B 1689	10 × 10	4.26	
91 B 1690	14 × 7	3.78	
92 B 1691	11 × 7	3.26	
93 B 1692	10 × 8	2.76	
94 B 1697	14 × 10 to 1	5.09	miscut on bias
95 B 1698	13 × 9 to 1	4.26	miscut on bias
96 B 1699	13 × 6 to 1	3.98	miscut on bias
97 B 1700	13 × 8 to 1	2.90	miscut on bias
98 B 1701	13 × 7 to 1	1.42	miscut on bias
2 rod segments			
99 B 1693	17 × 12	9.11	
100 B 1694	12 × 20	10.09	
2 rod fragments(?)			
101 B 1695	19 × 14	13.06	
102 B 1696	14 × 10	6.00	

PIT J (POTTERY TO LATE 3RD OR EARLY 2ND CENTURY B.C.) Fig. 22

14 blanks			
103 B 1663	18 × 4	6.54 g	(Pb 2.44, Sn 10.44, Cu 86.59)
104 B 1664	16 × 6	6.48	partially disintegrated after recording
105 B 1665	16 × 8	6.28	
106 B 1666	14 × 6	5.75	
107 B 1667	18 × 3	5.39	flattened; smooth on both sides
108 B 1671	19 × 7	8.75	
109 B 1672	15 × 5	9.71	
110 B 1705	17 × 6	7.50	(Pb 1.55, Sn 7.72, Cu 90.85)

111 B 1706	15 × 5	6.05	(Pb 2.39, Sn 10.26, Cu 84.72) stripped to bare bronze
112 B 1707	14 × 4	4.79	(Pb 0.63, Sn 9.07, Cu 84.6)
113 B 1676	13 × 9 to 1	4.09	miscut on bias
114 B 1677	13 × 8 to 1	3.21	miscut on bias
115 B 1678	16 × 8 to 1	3.00	miscut on bias
116 B 1681	14 × 6 to 1	2.42	miscut on bias
5 rod segments			
117 B 1668	14 × 13	6.43	
118 B 1675	14 × 10	9.00	(Pb 2.00, Sn 9.74, Cu 86.69)
119 B 1680	15 × 10	4.47	
120 B 1702	11 × 16	6.44	
121 B 1703	12 × 13	7.43	
4 rod fragments(?)			
122 B 1669	17 × 10	6.09	
123 B 1673	20 × 16	9.16	
124 B 1674	18 × 9	8.93	
125 B 1679	14 × 8	2.73	
2 rectangular weights(?)			
126 B 1670	20 × 9 × 6	4.14	
127 B 1682	13 × 9 × 6	2.02	

FROM GRID-SQUARE MΔ/113 Fig. 23

20 blanks			
128 B 1723	18 × 4	7.36 g	(Pb 2.81, Sn 9.98, Cu 86.81)
129 B 1724	20 × 6	7.12	
130 B 1725	17 × 6	6.98	
131 B 1726	13 × 6	6.06	
132 B 1727	17 × 4	4.84	
133 B 1729	13 × 6	4.03	
134 B 1730	13 × 4	3.58	
135 B 1731	12 × 4	3.32	
136 B 1732	13 × 4	3.29	
137 B 1733	13 × 6	3.22	
138 B 1734	13 × 4	3.15	
139 B 1735	12 × 5	3.03	
140 B 1736	12 × 5	2.97	
141 B 1737	13 × 4	2.93	
142 B 1738	15 × 4	2.75	
143 B 1739	12 × 3	2.63	
144 B 1740	14 × 4	2.58	
145 B 1741	11 × 3	2.26	
146 B 1742	11 × 3	2.22	
147 B 1743	13 × 4	1.53	broken
1 rod segment			
148 B 1728	16 × 11	9.93	

FROM GRID-SQUARE MΓ/111 Fig. 24

13 blanks			
149 B 1764	13 × 5	3.88 g	
150 B 1765	12 × 7	3.70	

151 B 1766	12 × 5	3.08	(Pb 0.16, Sn 6.81, Cu 91.89)
152 B 1767	10 × 5	2.82	
153 B 1768	12 × 4	2.68	
154 B 1769	11 × 4	2.62	
155 B 1770	12 × 5	2.51	
156 B 1771	12 × 3	2.46	
157 B 1772	11 × 4	2.42	
158 B 1773	10 × 3	1.37	
159 B 1774	9 × 4	2.59	
160 B 1775	8 × 7	2.53	
161 B 1776	8 × 5	2.15	

Miscellaneous findspots

Fig. 25

6 blanks

162 B 1645	11 × 7	5.69 g	
163 B 1787	13 × 7	4.87	
164 B 1790	19 × 6	9.54	flattened
165 B 1792	11 × 4	2.09	stripped to bare metal
166 B 1793	18 × 4	3.07	
167 B 1794	15 × 4	3.61	

2 rod segments

168 B 1789	9 × 11	3.98	
169 B 1791	15 × 12	11.60	

Excavated in various years

Blanks and 1 rod segment individually found near the Mint in disturbed or Late Roman contexts. All stripped to bare bronze.

170–171 B 1068	13 × 7	6.51 g	*Agora* XXVI, pl. 32:e (two flans)
	13 × 7	7.03	
172 B 1069	12 × 7	6.57	
173 B 1220	10 × 11	6.94	(Pb 1.50, Sn 10.71, Cu 87.97) rod segment
174 B 1221	16 × 6	8.88	(Pb 17.93, Sn 6.06, Cu 74.28) flattened
175 B 1223	11 × 7	4.04	(Pb 0.91, Sn 9.86, Cu 87.85)
176 B 1253	12 × 5	4.92	smooth faces
177 B 1281	13 × 9	9.53	
178 B 1642	10 × 6	3.55	Thompson 1954, note 20, no. 2

Flans of similar type from other areas in the Agora. Disturbed or late contexts.

179 B 1639	11 × 9	5.80	Thompson 1954, note 20, no. 1
180 B 1640	18 × 6	9.50	Thompson 1954, note 20, no. 3
181 B 1643	9 × 5	2.54	

[a] Each item is listed with its B(ronze) inventory number, size in millimeters (diameter or width × thickness), and weight in grams. Percentages of lead, tin, and copper are listed for pieces whose composition has been analyzed. In several cases, uncleaned blanks illustrated in the 1:1 photographs appear to be larger than the recorded dimensions indicate (see especially no. 102). This is the result of the two-dimensional photographic image, which sometimes shows not only the object's round upper face, from which the diameter was taken, but also some of the object's lateral surface behind (cf. the photographs of nos. 12–20 and 165, where the upper and lateral sides can be distinguished).

[b] Two errors in Agora XXVI need to be corrected: on p. 293, under "Group 2," read "Six of them" (for "Six others"), and on same page and on pl. 32:e, read B 1244 for B 1245, and B 1245 for B 1244.

TABLE 2. METALLURGICALLY ANALYZED ATHENIAN BRONZE COINS[a]

Variety no.		*Diam.*	*Avg. wt.*	*%Pb*	*%Sn*	*%Cu*	*Reference*
PERIOD I							
MID-4TH–MID-3RD CENTURY B.C.							
38	Piglet on mystic staff, ΕΛΕΥΣΙ above	15–18	3.20 g	0.05	10.78	88.94	(xi.1)
41	Double-bodied owl, on mystic staff	13–15	2.14	1.28	8.25	90.30	(viii.4)
				0.00	9.93	90.04	(viii.2)
42	Same, but no symbol	11–15	1.75	3.21	5.42	91.23	(viii.5)
43	Same, but owl on Eleusis ring	10–14	1.85	1.51	11.32	87.06	(viii.1)
44	2 owls over Eleusis ring	13–15	2.70	1.68	10.49	87.51	(v.8)
				1.29	10.67	87.49	(v.9)
46	2 owls, no symbol	13–15	2.34	1.73	10.57	87.28	(v.7)
50	Owl l.	14–16	3.53	4.18	12.76	82.23	(v.1)
				5.36	12.49	81.73	(v.2)
51	Piglet in wheat wreath, ΕΛΕΥΣΙ below	15–17	3.73	1.55	10.57	87.38	(ix.2)
52	Owl r. in olive wreath, ΑΘΗ	13–15	2.40	9.22	8.41	82.33	(v.3)
53	Owl r. in wheat wreath	12–15	2.37	5.70	10.24	83.57	(v.5)
54	Owl r. in olive wreath, Α-Θ	12–14	2.34	1.36	9.80	88.81	(v.4)
57	Owl r., wreath symbol	13–15	2.13	3.18	10.08	86.01	(v.11)
58	Owl r., grain-ear symbol	13–15	2.27	0.84	15.43	83.42	(v.10)
				5.78	9.10	84.72	(v.12)
PERIOD II							
229–CA. 183 B.C.							
66	Zeus/Athena Polias	19–22	9.43 g	4.27	10.74	84.77	(Thompson 1941, p. 230)
79	Standing Zeus, prow	16–20	5.00	0.22	11.10	88.74	(vi.3)
84	FZ, cornucopia, eagle	16–20	6.65*	2.73	10.56	86.38	(iv.4)
PERIOD III							
166–86 B.C.							
86	Demeter/piglet	17–19	6.15* g	6.54	6.52	82.47	(xi.3)
89	Zeus/Athena, wheat-ear, snake	17–20	5.97*	0.01	10.40	89.64	(v.13)
				0.54	9.40	89.54	(v.14)
94	FZ, 2 pilei	16–19	6.04* g	0.20	10.60	89.03	(iv.5)
				1.85	8.12	88.69	(Thompson 1961, p. 639)
97	FZ, star and crescents	17–21	7.65*	13.26	7.56	78.21	(vi.6)
				13.71	9.04	76.80	(Thompson 1961, p. 639)
				10.04	7.28	80.26	(Thompson 1961, p. 639)
99	2 owls over thunderbolt	12–18	2.84	9.54	9.64	80.54	(vii.6)
				18.42	7.22	74.57	(vii.7)
105	Apollo/amphora	10–12	1.72	20.84	7.85	70.92	(ix.5)
106	Kore/piglet	9–12	1.45	1.10	11.86	86.97	(ix.4)
PERIOD IVA							
86–42 B.C.							
115	NS Athena/owl on amphora, no symbol	19–22	10.82* g	5.15	9.89	84.96	(vi.4)
				7.49	9.77	82.26	(A-1304)

Variety no.		*Diam.*	*Avg. wt.*	*%Pb*	*%Sn*	*%Cu*	*Reference*
128	Demeter/Triptolemos, poppy symbol	15–17	4.35	2.23	10.77	86.38	(Θ-885)
129	Dolphin/plemochoe	14–17	4.09	12.60	7.95	79.73	(ΠΘ-446)
131	Apollo/cicada	14–16	3.89	4.64	11.13	81.72	(ΕΛ-116)
135	Apollo/2 wheat-ears	10–11	1.70	4.89	8.02	86.21	(Η′-3796)
PERIOD IVB							
42/1–32 B.C.							
137	NS Athena/FZ	18–21	9.42* g	10.61	9.31	80.73	(Π-400)
138	NS Athena/tripod	17–21	8.67*	9.93	8.54	81.25	(vi.5)
				18.69	12.95	67.17	(Π-567)
139	Gorgoneion/Athena charging	18–21	8.54*	13.83	7.30	78.25	(ix.8)
				16.79	9.20	72.01	(Thompson 1961, p. 639)
				17.61	8.66	72.80	(ΠΑ-163)
140	Young Dionysos/Athena charging	17–20	6.31*	18.82	7.54	73.16	(xi.9)
				17.29	6.13	74.56	(Ε-546)
141	Young Dionysos/kantharos	13–15	2.60	6.06	8.83	84.03	(Η′-3475)
142	Dionysos/Athena	11–14	1.39	16.13	5.11	77.52	(Κ-1195)
143	NS Athena/Apollo Delios	17–20	5.48*	8.43	9.20	83.12	(ΟΟ-1135)
144	Zeus/bearded Dionysos	15–19	6.33*	22.73	6.29	70.25	(Thompson 1941, p. 230)
				11.09	7.41	80.02	(ΛΛ-56)
145	Zeus/eagle	13–15	3.24	20.21	7.12	71.69	(ix.11)
				11.45	9.24	77.76	(ΟΟ-501)
PERIOD IVC							
31–EARLY 20S B.C.							
146	Athena in Cor. helmet/Demeter	19–20	8.09* g	10.45	8.75	80.48	(ix.10)
147	Athena in Attic helmet/Nike	18–20	8.51*	8.28	8.30	82.80	(Ε-1265)
PERIOD IVD							
MID-20S–19 B.C.							
149	NS Athena/Athena advancing, owl	18–20	7.80* g	18.68	6.89	73.60	(Thompson 1941, p. 229)
				23.71	5.54	68.42	(Γ-392)
150	Demeter/poppy and wheat-ears	13–15	3.26	15.49	6.29	77.31	(Η-1474)
151	NS Athena/Athena advancing, snake	19–20	7.53*	7.50	9.10	82.62	(Χ-32)
152	NS Athena/owl on prow	17–20	7.48*	20.46	5.71	71.66	(ΓΓ-29)
153	NS Athena/sphinx	17–20	7.57* g	20.38	6.84	71.24	(vi.7)
				15.02	6.12	77.86	(Thompson 1961, p. 639)
				15.38	6.09	78.12	(Thompson 1961, p. 639)
				19.18	7.32	72.75	(Thompson 1961, p. 639)
				23.10	6.31	68.22	(Β′-1039)
154	Triptolemos/mystic staff and wheat-ear	14–15	3.47	14.96	6.98	76.23	(ΠΑ-298)
156	NS Athena/2 owls on thunderbolt	15–19	2.97	17.41	7.79	73.77	(Γ-153)

Variety no.		*Diam.*	*Avg. wt.*	*%Pb*	*%Sn*	*%Cu*	*Reference*
PERIOD IVE							
CA. 15–10 B.C.							
157	NS Athena/owl on amphora, snake	16–19	6.42* g	4.60	8.59	85.14	(OO-252)
158	Same, but cicada symbol	16–19	6.20*	17.72	6.02	75.75	(Thompson 1961, p. 639)
				5.06	11.29	81.39	(P-456)
PERIOD V							
2ND CENTURY A.C.							
185	Athena/bucranium	23–26	7.40 g	10.35	7.72	81.44	(vii.1)
230	Athena/owl	10–12	1.49	26.51	6.84	66.25	(viii.10)
240	Theseus/bucranium	9–13	1.37	13.78	8.06	77.66	(viii.8)
				18.60	7.70	73.01	(viii.9)
271	Athena/Triptolemos	21–23	6.71	23.03	5.93	70.55	(iv.7)
PERIOD VI							
CA. A.D. 264–267							
305	Athena/Athena standing	20–22	5.29 g	23.03	5.93	70.55	(iv.8)
325	Athena/"Promachos"	20–22	5.02	32.51	3.89	63.23	(iv. 9)
332	Athena/"Promachos"	20–23	5.95	29.32	4.10	66.05	(iv.10)
386	Athena/agonistic table	20–22	4.46	29.18	3.75	66.19	(iv.11)

[a] Chronological periods, variety numbers, diameters (in millimeters), and average weights are taken from *Agora* XXVI. Weights are the average of the best-preserved Agora excavation specimens or, in the case of weights marked by asterisks, hoard coins that were recovered from outside the Agora. Alloy percentages are recorded individually for each specimen that has been analyzed. Agora coins analyzed in 1996 are referenced by their Agora inventory numbers, which begin with a Greek letter or letters. References that begin with Roman numerals are to analyses listed in the tables in Caley 1939. Additional analyses are reported in Thompson 1941 and 1961.

numerous blanks and rod fragments excavated from below the floor of the Mint in 1978, all with a very low lead content, belong to earlier phases of the coinage; and that the seven blanks recovered in 1959 "imbedded in the ancient floor" of the southwest room (Fig. 27) are a mixed lot that include some pieces with earlier, low readings of lead (**12, 18**) and at least one with a later, high reading of 18.4 percent (**19**). Analyzed blanks from the vicinity of the Mint prove similarly to have different alloy types and therefore to be from different phases of the Hellenistic coinage (**173–175**).

The 1953 Rod Segment and Blanks (1-11) (Fig. 26)

The eight blanks, two imperfectly chopped halves, and rod segment found together "immediately beneath the latest ancient ground level" outside the northwest corner of the southwest room constitute the only assemblage of metal debris from the Mint that has been studied and published in any detail. The pieces were cleaned to bare metal, and one of the two miscut fragments was sent to the Ohio State University for destructive analysis, which provided a lead reading of 25.63 percent and a lead/tin ratio of 3.62:1, figures that matched previously analyzed coins of the same weight of the later 1st century B.C.[26] Kroll provisionally proposed to associate the blanks with variety 144 of ca. 32 B.C. (Zeus head/bearded Dionysos head),[27]

26. Caley and Deebel 1955.
27. *Agora* XXVI, p. 293.

Figure 26. Blanks and rod end, excavated in 1953. Scale 1:1

although this would mean that the blanks and rod belonged not to the last issue or issues struck at the Mint, as one would expect from the blanks' early appearance in the clearing of the building, but to a variety that was minted some two decades before the last issue.

Now that a larger sampling of the alloys of the later-1st-century B.C. coinage is available for comparison and reveals how widely lead percentages varied within the period and even within single issues, it becomes apparent that the heavily leaded 1953 blanks might very well belong to any one of four late-1st-century varieties of similar weight. As the weight of the eight complete blanks averages 6.48 g, the four matching coin varieties are

140 (Young Dionysos/Athena charging), avg. wt. 6.31 g (of 11 slightly worn hoard specimens)
144 (Zeus/bearded Dionysos), avg. wt. 6.33 g (18 slightly worn hoard specimens)
157 (Athena/owl on amphora, snake), avg. wt. 6.42 g (49 slightly worn hoard specimens)
158 (Athena/owl on amphora, cicada), avg. wt. 6.20 g (58 slightly worn hoard specimens)

The last two varieties, which date roughly to the penultimate decade of the 1st century B.C., are the concluding varieties of the Hellenistic coinage. While one cannot be certain that the 1953 blanks were prepared for the last of these issues, the possibility has far more to recommend it than Kroll's former attribution to one of the earlier issues with the head of Dionysos.

Light facets on the sides of the blanks and of the piece of rod show that the rod was shaped by forging. Facets around the circumferences of the blanks' faces reveal further that the rod was deeply scored by blows of a flat chisel, usually five blows, before a final blow chopped off each piece. Breakage from the chopping has left the central surface of the faces rough and irregular, and this together with the thickness of the blanks makes it clear that they needed to be flattened and widened by hammering before they would have been ready to be struck between dies. These eight complete blanks are therefore unfinished. The two unusable half-pieces have a wedge-shaped profile from being chopped on a bias, the result, presumably, of careless positioning of the chisel.

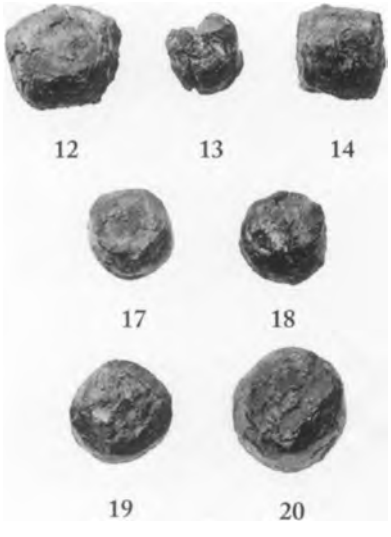

Figure 27. Blanks and rod segment, excavated in 1959. Scale 1:1

The 1959 Blanks and "Finished Blanks"

As stated, the blanks and rod segment recovered from the floor of the Mint in 1959 (**12–19**; Fig. 27) are a mixed lot, two pieces having a low lead content, one a high percentage of lead. The most interesting is blank **17**, which has been hammered flat, and hence is finished. A few other finished

TABLE 3. RESULTS OF ICP ANALYSIS OF BRONZE BLANKS AND COINS FROM THE ATHENIAN AGORA

Variety no.		*Sn*	*Zn*	*Pb*	*Cu*	*Ni*	*Fe*	*Ag*	*Total*
UNFINISHED BLANKS (SEE TABLE 1)									
5	B 1046e	6.496	0.123	24.035	67.604	0.055	0.259	0.054	98.628
12	B 1237	10.990	0.178	1.176	86.060	0.034	0.662	0.031	99.131
18	B 1243	8.976	0.216	1.729	89.891	0.028	0.287	0.054	101.182
19	B 1245	8.188	0.255	18.412	72.125	0.087	0.542	0.041	99.649
21	B 1708	9.262	0.190	0.473	90.938	0.021	0.150	0.033	101.067
39	B 1747	9.333	0.163	0.496	87.969	0.017	0.128	0.034	98.141
56	B 1646	9.138	0.781	0.738	88.960	0.082	0.139	0.078	99.917
61	B 1651	11.008	0.699	0.647	88.569	0.057	0.837	0.038	101.856
73	B 1781	9.025	0.158	1.050	88.830	0.024	0.194	0.037	99.318
84	B 1683	11.620	0.181	1.461	87.020	0.021	0.357	0.070	100.730
103	B 1663	10.438	0.173	2.441	86.592	0.026	0.237	0.028	99.936
110	B 1705	7.723	0.152	1.554	90.852	0.033	0.152	0.043	100.510
111	B 1706	10.261	0.173	2.398	84.716	0.029	0.222	0.056	97.855
112	B 1707	9.072	0.264	0.630	84.611	0.012	5.138	0.043	99.770
118	B 1675	9.743	0.176	2.000	86.691	0.021	0.106	0.033	98.770
128	B 1723	9.984	0.146	2.814	86.808	0.034	0.119	0.029	99.934
151	B 1766	6.809	0.190	0.161	91.889	0.012	0.088	0.156	99.307
173	B 1220	10.709	0.189	1.505	87.966	0.036	0.186	0.030	100.621
174	B 1221	6.057	0.139	17.930	74.280	0.067	0.210	0.049	98.734
175	B 1223	9.856	0.156	0.913	87.850	0.028	0.071	0.043	98.917
FINISHED BLANKS (SEE NOTE 28)									
	Z-2079	7.083	0.135	14.822	75.960	0.059	0.239	0.047	98.345
	Z-2091	8.794	0.153	4.022	86.420	0.053	0.290	0.026	99.758
	Z-2101	8.704	0.146	4.354	85.262	0.048	0.318	0.025	98.860

blanks were excavated in or around the Mint in 1978 (**39?, 42?, 54, 107, 164**; see also **174, 176**). To these may be added twenty-five finished coin blanks that were recovered in a mixed 3rd-century A.C. fill at the southwest side of the Agora square between the Middle Stoa and the Tholos, presumably brought there in redug, transported earth.[28] Technique, size, and metallic composition imply that they were intended for one of Athens' Hellenistic coinages and ought to have originated in the Mint.

THE 1978 BLANKS, ROD SEGMENTS, AND BALANCE WEIGHTS(?)

The numerous blanks excavated in 1978 from pits in the floor of the Mint were chopped from forged bronze rods in the same manner as the unfinished 1953 blanks. Short ends of the rods were found with them, as were

28. *Agora* XXVI, p. 294, pl. 32:f. Three of the blanks were analyzed in 1996: Z-2091 and Z-2101, two of the twenty-two AE 2 module pieces (avg. wt. 6.95 g) = Pb 4.02, Sn 8.79, Cu 86.42, and Pb 4.35, Sn 8.70, Cu 85.26. Z-2079, one of the three AE 3 pieces (wt. 2.7–2.9 g) = Pb 14.82, Sn 7.08, Cu 75.96.

The contrast between the modest amount of lead in the larger denomination and the heavy leading in a contemporary smaller denomination is paralleled in the few analyzed coins from Period III (see note 22 above), the period to which on the basis of size and weight these finished flans most likely belong.

Variety no.		*Sn*	*Zn*	*Pb*	*Cu*	*Ni*	*Fe*	*Ag*	*Total*
COINS (SEE TABLE 2)									
115	A-1304	9.772	0.141	7.492	82.255	0.035	0.068	0.037	99.801
128	Θ-885	10.766	0.161	2.229	86.380	0.064	0.317	0.019	99.945
129	ΠΘ-446	7.945	0.197	12.595	79.731	0.053	0.235	0.080	100.837
131	ΕΛ-116	11.126	0.177	4.640	81.723	0.415	0.103	0.031	98.214
135	Η'-3796	8.020	0.157	4.888	86.207	0.048	0.072	0.029	99.420
137	Π-400	9.313	0.181	10.615	80.732	0.065	0.051	0.028	100.986
138	Π-567	12.948	0.177	18.687	67.174	0.041	0.099	0.128	99.255
139	ΠΑ-163	8.663	0.133	17.608	72.795	0.098	0.026	0.016	99.340
140	Ε-546	6.130	0.131	17.285	74.555	0.068	0.354	0.070	98.596
141	Η'-3475	8.834	0.151	6.063	84.030	0.051	0.056	0.028	99.213
142	Κ-1195	5.113	0.133	16.127	77.517	0.062	0.089	0.036	99.080
143	ΟΟ-1135	9.204	0.153	8.425	83.120	0.063	0.113	0.058	101.136
144	ΛΛ-56	7.412	0.139	11.090	80.016	0.042	0.645	0.025	99.370
145	ΟΟ-501	9.237	0.163	11.445	77.760	0.056	0.076	0.069	98.806
147	Ε-1265	8.298	0.138	8.282	82.796	0.055	0.090	0.052	99.713
149	Γ-392	5.543	0.119	23.708	68.417	0.077	0.240	0.057	98.160
150	Η-1474	6.293	0.173	15.483	77.307	0.105	0.122	0.047	99.531
151	Χ-32	9.098	0.163	7.504	82.616	0.049	0.074	0.020	99.526
152	ΓΓ-29	5.712	0.117	20.468	71.663	0.076	0.070	0.056	98.164
153	Β'-1039	6.308	0.151	23.100	68.219	0.074	0.149	0.039	98.042
154	ΠΑ-298	6.983	0.141	14.960	76.230	0.061	0.187	0.045	98.611
156	Γ-153	7.784	0.149	17.407	73.771	0.099	0.217	0.034	99.461
157	ΟΟ-252	8.594	0.176	4.599	85.139	0.058	0.201	0.031	98.799
158	Ρ-456	11.290	0.187	5.063	81.390	0.053	0.586	0.030	98.604

This table presents in full the results of the metallurgical analyses performed on these specimens at the Fitch Laboratory in 1996.

occasional unusable pieces that had been miscut on a bias. With the exception of three to five pieces that appear to have been flattened or smoothed by hammering (**39?, 42?, 54, 107, 164**), the blanks are relatively thick, seem to have rough surfaces, and are apparently unfinished. However, because they are made of a much finer, nearly lead-free, alloy than the blanks excavated in 1953, and were found in a far more corroded state, the extent to which they could prudently be cleaned for examination has been limited. Whether their more advanced corrosion is due to their higher copper content or to their deeper deposition in the building floor, many of the blanks are blistered and mineralized to their core, and the original surfaces of some of the more intact pieces are roughened and distorted by particles of redeposited copper. Unlike the well-preserved blanks that were chemically stripped to solid, bare, brown-black metal in the 1950s, nearly all of the blanks and related pieces from the 1978 excavations retain their envelope of green corrosion products after having been chemically stabilized to halt any further spreading of bronze disease.

Two-thirds of the 1978 material was recovered with context pottery from closed pits. In all these deposits, save one, the ceramic dating agrees with the dating suggested by the alloy of the blanks: none of the pits were closed later than the late 2nd or early 1st century B.C., and none of the

analyzed blanks has an elevated level of lead. Moreover, the weights of the blanks from pit A are all appropriate for the smaller bronze denominations (the AE 3 [2–4 g] dichalkon and the AE 4 [1–2 g] chalkous) minted by Athens in the later 4th and early 3rd centuries, the time of the latest ceramic finds in the pit. Pits E, F, H, and J date on the basis of ceramics to the 2nd century B.C., when the bronze coinage of the city was struck predominantly in three denominations: the newer and larger AE 2 hemiobol [5–7 g], the AE 4 chalkous, and its AE 3 double; all the blanks from these pits are of AE 2 and 3 weight. The one discrepancy between the numismatic and the ceramic evidence occurs with pit B and its twenty-three AE 2 blanks. Since Athens did not strike AE 2 hemiobols until after 229 B.C.,[29] the pit must have been open much later than is suggested by the latest sherds, which are of the earlier 3rd century.

The chopping of blanks from rods and the wide weight tolerances of surviving bronze coins generally attest that speed in production was a greater desideratum than exactitude in weights. But if we are correct in identifying as balance weights the seven small bronze rectangles found with the blanks, it follows that, as one might expect, the weights of the blanks were routinely checked on a sampling basis. We are unable to suggest what else the rectangular strips could be, especially since five of them (**34**, **35**, **81**, **83**, and **127**) are of virtually the same weight, between 1.8 and 2.0 g, and the sixth (**126**) is a very close double at 4.1 g. With allowance made for minor weight loss from corrosion and from chipping at the edges, the double- and single-weight rectangles would represent the mass of a drachm (4.3 g) and of a hemidrachm (2.15 g), respectively, in Athens' precious-metal weight system, the system generally employed for weighing small units. At 2.28 g, however, the slightly incomplete seventh bronze rectangle (**82**), stands apart.

Although several techniques were employed for the manufacture of bronze coin blanks in antiquity,[30] the procedure documented by the debris from the Athenian mint—chopping from a rod and then flattening with a hammer—is well attested at other Greek sites. Dozens of bronze rod segments, chopped blanks, and blanks that had been finished by hammering have been excavated at Argos from a small pocket of earth beneath the floor of a temple;[31] at Halieis in the Argolid from a mint;[32] at Pella, both from the overbuilt remains of a mint[33] and more recently from the Pella

29. *Agora* XXVI, pp. 38, 48–53.

30. Hill 1922, pp. 1–13; Hackens 1975, pp. 4–7.

31. Consolaki and Hackens 1980. Despite the title of their paper, the authors do not discuss the possibility that the temple might have once served as a mint. Rather, they suppose that the minting debris had been dedicated in the temple upon the hypothetical termination of a coinage, similarly to the coin dies that were dedicated on the Athenian Acropolis in 404 B.C. or to those dedicated in a Delian temple in 166 B.C., when the dies were retired and had to be removed from the secular world. But far from being analogous to dies that had been used for precious metal coinages, the blanks, rod ends, and other small pieces of bronze scrap in the Argive deposit appear to comprise sweepings from the floor of a mint. If the minting did not take place within the building itself, perhaps the debris was brought in with some earth filling that originated in or near a mint.

32. Dengate 1975; Boyd and Rudolph 1978, p. 339. A full account of the mint and blanks is scheduled to appear in the second volume of the final publications of the Halieis excavation.

33. Oikonomidou 1993; Oikonomidou, Touratsoglou, et al. 1996, p. 80, fig. 1.

agora; and at Olynthos.[34] The brief publication of the mint at Chersonesos in the Crimea illustrates two of the forty-three blanks excavated in the building; both had been flattened, but the author had reason to believe that all of these blanks, too, had been cut from a rod.[35] Whether the twenty-three flat bronze coin blanks found in excavations at Laos in South Italy had been cast, as was proposed in their publication,[36] or had been cut and hammered is unclear from the photographs. But the slightly split circumferences of some of the twenty-five finished blanks from a curious hoard, possibly that of a thief, at Pergamon[37] strongly implies that these Pergamene blanks had been hammered. A final group of chopped coin blanks, silver blanks from Euboia, provides information that the same technique was sometimes employed in the manufacture of coins in precious metal, if only for smaller denominations.[38] The earliest of the chopped and hammered bronze blanks date from the 4th century B.C. (Halieis, Olynthos); the 1st-century blanks from the Agora Mint are apparently the latest.

The technique, however, was not practicable for larger bronze coins like those of Hellenistic Egypt and Syria, which were struck from cast blanks. Blanks that have been cast are usually identifiable from their beveled sides and from the presence of a small cavity in the center of one or, in some cases, both faces of the resulting coin.[39] Cast blanks with central

34. *Olynthus* III, p. 5 and p. 120, fig. 2; pl. XXVI, nos. 975–979. Sixteen rod ends and chopped blanks (D. M. Robinson's "cylindrical flans") were found in 1928 in a small dish in house B iii 2, together with fourteen flans that "are fairly flat, but convex on one side" (e.g., *Olynthus* III, nos. 968–974). One assumes that all of this material must derive from the same minting operation, in which case the wider, flat pieces, hammered over a slightly concave depression to produce convexity on one side, would represent the finished, hammered stage. A second group of bronze blanks, excavated in 1938 from the floor of the nearby house A iv 7, consisted of fourteen similar "flans that are flat on one side and convex on the other" (*Olynthus* XII, p. 73; *Olynthus* XIV, pp. 403–406, pl. 173:23–25). The slight convexity, and the slight outward tapering of the sides of these blanks from the convex (obverse) to the flat (reverse), led Robinson to suggest that the blanks were cast in individual, open molds. But the very slight tapering, like the convex surface, could also have resulted from hammering. None of these finished blanks is perfectly circular; all have irregular, some nearly ovoid circumferences, attesting that they were either cast from irregularly shaped molds or owe their irregularity to chopping and hammering, which, in light of the 1928 find, seems more likely. Since both houses are adjacent to the "open area," probably an agora, house A iv 7 may have served as the bronze mint. The contents of the dish in B iii 2 appear to be debris saved from a mint.

As one sees from the *cast* bronze blanks excavated at Aï Khanoum (Bernard 1985, pp. 83–84, pl. 11, nos. 225–234), Nea Paphos (Nikolaou 1972a and b; Voegtli 1973; Nikolaou and Mørkholm 1976, pp. 9–10, figs. 10, 11; Oikonomidou, Touratsoglou, et al. 1996, p. 80, fig. 2), and from the Late Roman matrices for casting blanks at Thessaloniki (Velenis 1996), blanks that were cast in series (*en chapelet*) have circumferences that are frequently as irregular as blanks that were chopped and hammered.

35. Koscjusko-Valjuzinic 1915.

36. Cantilena 1989.

37. Voegtli 1990, pp. 48–51.

38. Four of the six Euboian blanks at the American Numismatic Society are illustrated in Consolaki and Hackens 1980, fig. 14; one of the two at the British Museum is in Hill 1922, pl. I:6; and one at the former Seltman collection is in Seltman 1933 [1955], pl. I:4. All are essentially identical in size and weight, as well as in manufacture, having lateral facets from the forged rod and chisel-cut facets around the circumference of their circular faces. The blanks are from a hoard (*IGCH*, no. 194; Chalkis environs, 1913) that was said to contain 120 blanks. The ticket for the two British Museum pieces states that they are "from Euboia, Eretria(?), from a hoard"; whence presumably the Eretrian attribution in Hill 1922, p. 11, and in Thompson 1954, p. 46.

39. Such cavities were clearly in place before the blanks were struck, having been formed either during casting, by a protuberance in the center of each mold, or after casting, by a punching tool. The purpose of the cavities is still under discussion. See now Bouyon, Depeyrot, and Desnier 2000, pp. 14–28, 77, 87–89, with summaries of the earlier literature. For cast Greek blanks that may have been put into production without a central cavity, see the blanks from Aï Khanoum and Nea Paphos cited above, note 34.

cavities appear in Greece during the second half of the 1st century B.C., in bronze coinages of Lakedaimon, Corinth, Patras, and several other mints.[40] They were later adopted at Athens when the city revived the striking of a bronze coinage in the first half of the 2nd century A.C.[41] It is unknown where in Athens this Hadrianic and Antonine coinage was manufactured. Although one cast and punched blank that can be associated with the coinage has turned up in the Agora excavations,[42] the old bronze mint in the southeast corner of the Agora square had by this time been demolished and was overlain by the Southeast Temple and the later Antonine nymphaion.

A third method of blank preparation, that of *sawing* the blank disks from a rod, was employed for Athens' last bronze coinage, of the middle of the 3rd century A.C., and is very well documented by an Agora find of thirty-eight miscut or otherwise unusable sawn blanks and four misstruck or broken specimens of the coinage.[43] Since this material was found together in a pit in the floor of the Rectangular Peribolos or "Heliaia" at the southwest corner of the Agora square, there can be no doubt that the structure,[44] which had been converted to industrial use during the Roman period, served as the mint for this brief but massive, final coinage of the Classical city.

40. Kroll 1996a, p. 51.
41. *Agora* XXVI, pp. 113–114.
42. *Agora* XXVI, pp. 294–295, pl. 33:a (B 1641).
43. *Agora* XXVI, p. 295, pl. 33:b (B 1254, with coins K-1641–1644).
44. Now recognized as the Aiakeion (Stroud 1998, pp. 85–104).

REFERENCES

Agora III = R. E. Wycherley, *Literary and Epigraphical Testimonia,* 1957, repr. Princeton 1973.

Agora IV = R. H. Howland, *Greek Lamps and Their Survivals,* 1958, repr. Princeton 1966.

Agora VII = J. Perlzweig, *Lamps of the Roman Period: First to Seventh Century after Christ,* 1961, repr. Princeton 1971.

Agora X = M. Lang and M. Crosby, *Weights, Measures, and Tokens,* Princeton 1964.

Agora XII = B. A. Sparkes and L. Talcott, *Black and Plain Pottery of the 6th, 5th, and 4th Centuries B.C.,* 2 vols., Princeton 1970.

Agora XIV = H. A. Thompson and R. E. Wycherley, *The Agora of Athens: The History, Shape, and Uses of an Ancient City Center,* Princeton 1972.

Agora XX = A. Frantz, *The Church of the Holy Apostles,* Princeton 1971.

Agora XXII = S. I. Rotroff, *Hellenistic Pottery: Athenian and Imported Moldmade Bowls,* Princeton 1982.

Agora XXVI = J. H. Kroll, with contributions by A. S. Walker, *The Greek Coins,* Princeton 1993.

Bernard, P. 1985. *Fouilles d'Aï Khanoum* IV: *Les monnaies hors des trésors,* Paris.

Bouyon, B., G. Depeyrot, and J.-L. Desnier. 2000. *Systèmes et technologie des monnaies de bronze, 4e s. avant J.-C.–3e s. après J.-C.,* Wetteren.

Boyd, T. D., and W. W. Rudolph. 1978. "Excavations at Porto Cheli and Vicinity, Preliminary Report IV: The Lower Town of Halieis, 1970–1977," *Hesperia* 47, pp. 333–355.

Caley, E. R. 1939. *The Composition of Ancient Greek Bronze Coins,* Philadelphia.

Caley, E. R., and W. H. Deebel. 1955. "Chemical Dating of Bronze Coin Blanks from the Athenian Agora," *The Ohio Journal of Science* 55.1, pp. 44–46.

Camp, J. McK. 1978. "The Mint of Ancient Athens," *The Athenian* (August), pp. 22–25.

———. 1979. "Die Ausgrabung der antiken Münzstatte Athens," *SchwMbl* (August), pp. 52–55.

———. 1986. *The Athenian Agora: Excavations in the Heart of Classical Athens,* London.

Camp, J. McK. 1990. *The Athenian Agora: A Guide to the Excavation and Museum,* 4th ed., rev., Athens.

Cantilena, R. 1989. "Rinvenimento di un'officina monetale a Laos," in *Laos* I: *Scavi a Marcellina 1973–1985,* E. Greco, S. Liooino, and A. Schnapp, eds., Taranto, pp. 25–37, 87–88.

Consolaki, H., and T. Hackens. 1980. "Un atelier monetaire dans un temple argien?" *Études argiennes* (*BCH* Supplement 4), Paris, pp. 279–284.

Dengate, J. 1975. "The Mint of Ancient Halieis" (lecture, Washington, D.C. 1975), abstract in *Summaries of the Papers Presented at the 77th General Meeting of the Archaeological Institute of America, December 28–30, 1975,* New York, p. 4.

Dinsmoor, W. B. 1982. "Anchoring Two Floating Temples," *Hesperia* 51, pp. 410–452.

Figueira, T. 1998. *The Power of Money: Coinage and Politics in the Athenian Empire,* Philadelphia.

Fornara, C. W., and L. J. Samons. 1991. *Athens from Cleisthenes to Pericles,* Berkeley.

Gardner, P. 1913. "Coinage of the Athenian Empire," *JHS* 33, pp. 147–188.

Golenko, K. 1975. "Nordliches Schwarzmeergebiet," *Chiron* 5, pp. 497–633.

Hackens, T. 1975. "Terminologie et techniques de fabrication," in *Numismatique antique: Problèmes et méthodes, Études d'archéologie classique* IV, Nancy-Louvain, pp. 3–21.

Harris, D. 1995. *The Treasures of the Parthenon and Erechtheum,* Oxford.

Hill, G. F. 1922. "Ancient Methods of Coining," *NC,* ser. 5, no. 2, pp. 1–42.

Hughes, M. J., M. R. Cowell, and P. T. Craddock. 1976. "Atomic Absorption Techniques in Archaeology," *Archaeometry* 18, pp. 19–38.

IGCH = An Inventory of Greek Coin Hoards, M. Thompson, O. Mørkholm, and C. M. Kraay, eds., New York 1973.

Johnston, J. 1932. "An International Managed Currency in the Fifth Century," *Hermathena* 47, pp. 132–157.

Kallet, L. 2001. *Money and the Corrosion of Power in Thucydides: The Sicilian Expedition and Its Aftermath,* Berkeley.

Kalligas, P. G. 1997. "A Bronze Die from Sounion," in *Numismatic Archaeology, Archaeological Numismatics: Proceedings of an International Conference Held to Honour Dr. Mando Oeconomides in Athens, 1995* (Oxbow Monograph 75), K. A. Sheedy and C. Papageorgiadou-Banis, eds., Oxford, pp. 141–147.

Kleiner, F. 1975. *Greek and Roman Coins in the Athenian Agora* (Excavations of the Athenian Agora, Picture Book no. 15), Princeton.

Koscjusko-Valjuzinic, D. N. 1915. "Observations on the Technique of Minting in Chersonesos Taurika: 1. The Remains of a Presumed Mint in Chersonesos" (in Russian), *Numizmatichesky Svornik, Moskau* 3, pp. 162–165; abstract in Golenko 1975, p. 575, no. 286.

Kroll, J. H. 1972. *Athenian Bronze Allotment Plates,* Cambridge.

———. 1976. "Aristophanes' πονηρὰ χαλκία: A Reply," *GRBS* 17, pp. 329–341.

———. 1996a. "Hemiobols to Assaria: The Bronze Coinage of Roman Aigion," *NC* 156, pp. 49–78.

———. 1996b. "The Piraeus Hoard of Plated Drachms and Tetradrachms (*IGCH* 46)," in *Χαρακτήρ: Αφιέρωμα στη Μάντω Οικονομίδου,* Athens, pp. 139–146.

Lang, M. 1960. *The Athenian Citizen* (Excavations of the Athenian Agora, Picture Book no. 4), Princeton.

Nikolaou, I., and O. Mørkholm. 1976. *Paphos* I: *A Ptolemaic Coin Hoard,* Nicosia.

Nikolaou, K. 1972a. "Discovery of a Ptolemaic Mint at Nea Paphos," in *Πρακτικά 1ου διεθνούς Κυπρολογικού συνεδρίου, Λευκωσία, 14–19 Απριλίου 1969* I: *Αρχαίον τμήμα,* V. Karageorghis and A. Christodoulos, eds., Nicosia.

———. 1972b. "Decouvert d'un Hôtel des Monnaies de l'époque

ptolemaique à Paphos (Chypre)," *Bulletin de la Société française de numismatique* 27, pp. 310–315.
Oikonomidou, M. 1993. "Ενα νομισματοκοπείο στην αρχαία Πέλλα," *Αρχαία Μακεδονία: Πέμπτο Διέθνες Συμπόσιο,* Thessaloniki, pp. 1143–1154.
Oikonomidou, M., I. T. Touratsoglou, et al. 1996. *Coins and Numismatics,* Athens.
Olynthus III = D. M. Robinson, *The Coins Found at Olynthus in 1928,* Baltimore 1931.
Olynthus XII = D. M. Robinson, *Domestic and Public Architecture,* Baltimore 1946.
Olynthus XIV = D. M. Robinson, *Terracottas, Lamps, and Coins Found in 1934 and 1938,* Baltimore 1952.
Seltman C. 1933 [1955]. *Greek Coins,* repr. London.
Stroud, R. 1998. *The Athenian Grain-Tax Law of 374/3 B.C.* (*Hesperia* Supplement 29), Princeton.
Taylor, M. C. 1997. *Salamis and the Salaminioi: The History of an Unofficial Athenian Demos,* Amsterdam.
Thompson, H. A. 1953. "Excavations in the Athenian Agora: 1952," *Hesperia* 22, pp. 25–56.
———. 1954. "Excavations in the Athenian Agora: 1953," *Hesperia* 23, pp. 31–67.
———. 1960. "Activities in the Athenian Agora: 1959," *Hesperia* 29, pp. 327–368.
———. 1976. *The Athenian Agora: A Guide to the Excavation and Museum,* 3rd ed., Athens.
Thompson, M. 1941. "Some Athenian 'Cleruchy' Money," *Hesperia* 10, pp. 199–236.
———. 1961. *The New Style Coinage of Athens,* New York.
Tod, M. N. 1945. "Epigraphical Notes on Greek Coinage I: ΚΟΛΛΥΒΟΣ," *NC,* ser. 6, no. 5, pp. 108–116.
Velenis, G. 1996. "Νομισματοκοπείο στην αρχαία αγορά της Θεσσαλονίκης," in *Χαρακτήρ: Αφιέρωμα στη Μάντω Οικονομίδου,* Athens, pp. 49–60.
Vickers, M. 1996. "Fifth-Century Chronology and the Coinage Decree," *JHS* 114, pp. 171–174.
Voegtli, H. 1973. "Eine Ptolemaïsche Schrötlingsgussform aus Nea Paphos auf Zypern," *SchwMbl* 23, no. 89, pp. 9–10.
———. 1990. "Zwei Münzfunde aus Pergamon," *SNR* 69, pp. 41–51.
Weil, R. 1906. "Das Münzmonopol Athens im ersten attischen Seebund," *ZfN* 25, pp. 52–62.
———. 1910. Das Münzrecht der ΣΥΜΜΑΧΟΙ im ersten attischen Seebund," *ZfN* 28, pp. 351–364.

John McK. Camp II

American School of Classical Studies at Athens
54 Souidias Street
106-76 Athens
Greece

agora@agathe.gr

John H. Kroll

University of Texas at Austin
Department of Classics
Austin, Texas 78712-1181

jkroll@utxvms.cc.utexas.edu