

THE CLAY CYLINDERS FROM AKROTIRI, THERA.  
A NON LITERATE ALTERNATIVE WAY OF ACCOUNTING?

PART ONE: *The Finds*

In some of the houses of the Late Minoan settlement at Akrotiri, objects in the shape of a cylinder, made of unfired, crumbling clay were found in groups or in isolation. The main features shared by virtually all of these are, briefly, as follows: they are cylindrical objects pierced along the length, of very similar manufacture and they fall into categories based on similarity of size. The edges are rounded and the surfaces have been roughly smoothed off by hand. The curved surface is flattened at one point, forming a seating surface that extends from one end to the other. The total number of complete cylinders discovered so far is just over 60.<sup>1</sup> Many of them have small impressed circles, at first sight arranged in no particular order and occupying a large part of the surface. The cylinders date from the final occupation phase of the settlement.<sup>2</sup>

The present article consists of a catalogue of the artefacts classified according to the find spot, and an analysis of each category.<sup>3</sup> This is followed by a discussion of their features and an attempt to provide an interpretation in the context of the settlement.<sup>4</sup>

*West House*

Seven cylinders were found in the West House. Five of these may be regarded as a group since they were found in, or come from, the same place.

WH 1 Incomplete. Off-white clay with inclusions (inv. no. 4264).

Hand-smoothed surface, rounded edges

Diam. 0.089, preserved length 0.095

Found outside the north side of the West House, probably fallen from the upper part of the staircase or the roof.

WH 2 Complete. Off-white clay with inclusions (inv. no. 5781).

Hand-smoothed surface, rounded edges

Diam. 0.084, length 0.13, weight 625 gr.<sup>5</sup>

<sup>1</sup> Some ten cylinders were found recently during the excavation for the pillars of the new shelter. They will not be taken into consideration.

<sup>2</sup> For a summary of recent views on the date of the eruption of the volcano, see Manning 1999, pp. 200-216.

<sup>3</sup> Abbreviations used in the catalogue: WH = West House. HL = House of the Ladies. HA = House of the Anchor. X III = Xeste III. Δ2 = building complex delta, room 2. Δ18 = building complex delta room 18. Δ17 = building complex delta room 17.

<sup>4</sup> The material was published briefly in 1992 (Tzachili 1992, pp. 143-144).

<sup>5</sup> The weight is given only in the case of complete cylinders.

- Upper part of the staircase  
FIGS. 1, 3; PLATE IA
- WH 3 Complete. Off-white clay with inclusions (inv. no. 5782)  
Hand-smoothed surface, rounded edges  
Diam. 0.080, length 0.11, weight 627 gr.  
Upper part of the staircase  
FIGS. 1, 3; PLATE IB
- WH 4 Complete. Off-white clay with inclusions (inv. no. 5783)  
Hand-smoothed surface, rounded edges  
Traces around the hole  
Diam. 0.079, length 0.80, weight 625 gr.  
Upper part of the staircase  
FIGS. 1, 3; PLATE IC
- WH 5 Complete. Off-white clay with inclusions (inv. no. 5784)  
Hand-smoothed surface, rounded edges  
Diam. 0.080, length 0.80, weight 630 gr.  
Upper part of the staircase  
FIGS. 1, 3; PLATE ID
- WH 6 Complete. Off-white clay with inclusions (inv. no. 5882)  
Hand-smoothed surface, rounded edges  
Diam. 0.060, length 0.80, weight 310 gr.  
Found on the floor of the room 3Γ in the ground-floor  
FIG. 1
- WH 7 Complete. Off-white clay with inclusions  
Diam. 0.060, length 0.80, weight 310 gr.  
Not retrieved; still *in situ* in room 4 of the ground floor  
FIG. 3

The cylinders from the West House were found in three places. Four were discovered in the fill covering the second flight of the staircase leading from the ground floor to the first floor, three of them near the entrance of room 3. They probably fell from some higher point, possibly the roof (FIG. 3). One found outside the north wall of the building belongs to the same group, since the clay and dimensions are the same and probably fell from the same place. These five cylinders exhibit some notable similarities. All five are made of the same off-white clay, and four of them have roughly the same dimensions and the same weight. It may thus reasonably be asserted that they were all made, and probably used, at the same time. They will have been put to similar uses, and the actual number of them may perhaps not be fortuitous. All are also flattened at one point of the curved surface, indicating that they rested on the long side. It follows that they were placed in this position when in use, and perhaps set to dry in a similar position. The flattened section was probably formed by their weight while they were drying. One (WH 4) has traces around the hole that seem to have been made by a rope (see chapter on 'experimental reconstruction'). According to the excavation drawing (FIG. 3), three of them had been placed in a parallel position.

Two more were found on the floor of the ground-floor rooms. One, WH 6, was found in room 3Γ, amongst pithoi, small vases and pebbles. The other, which has not been retrieved, is *in situ* in room 4 (PLATE IIA). Both these are of

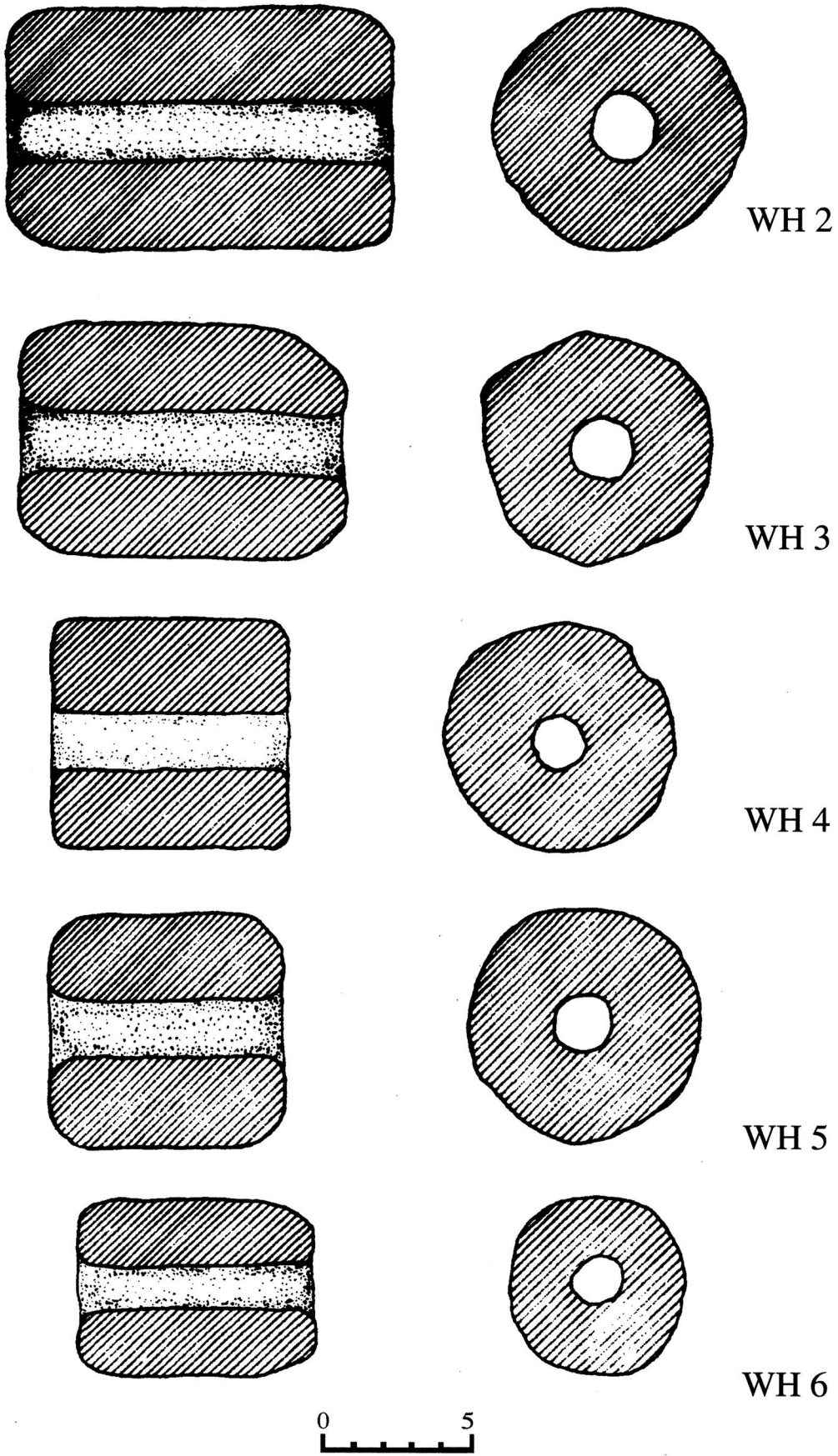
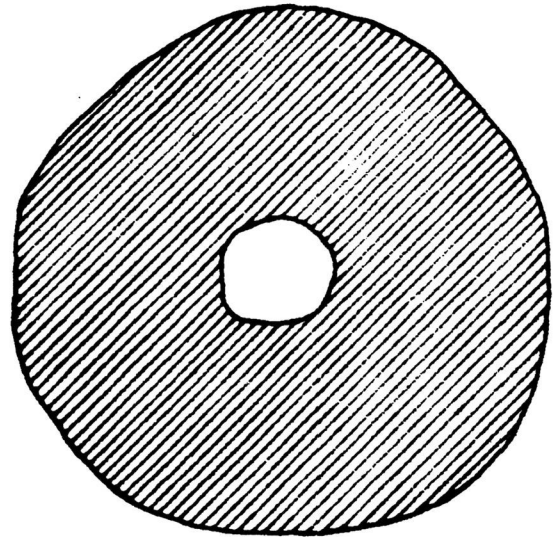
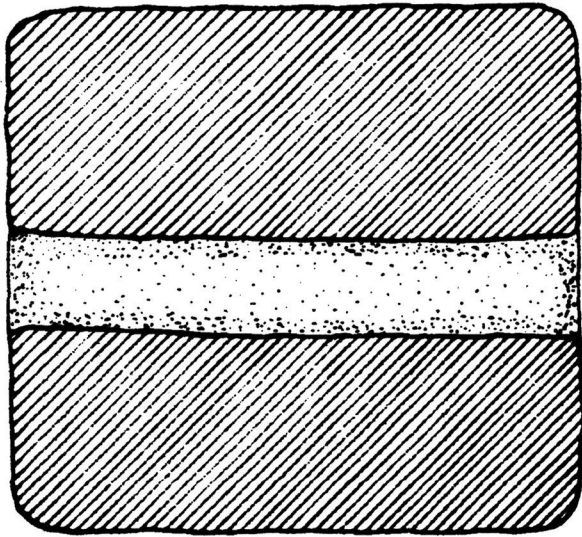
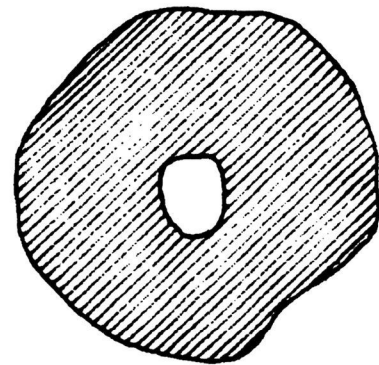
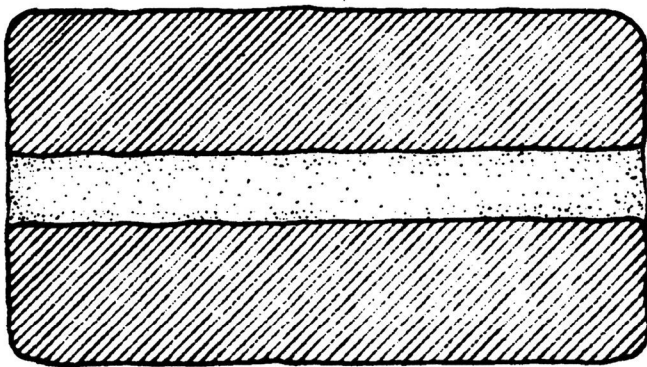


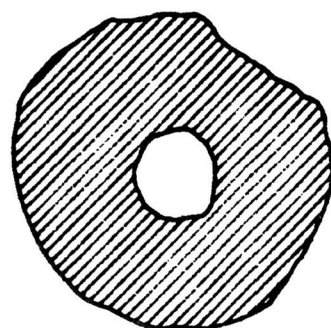
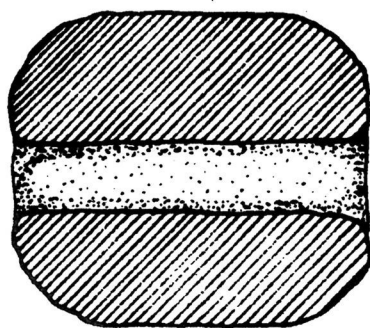
Figure 1: *Cylinders from the West House*



HL 1



HL 2



HL 3



Figure 2: *Cylinders from the House of the Ladies*

smaller size and weight and were made of different clay. They cannot, therefore, be considered to belong to the same group as the ones from the staircase and they are also unconnected with each other.

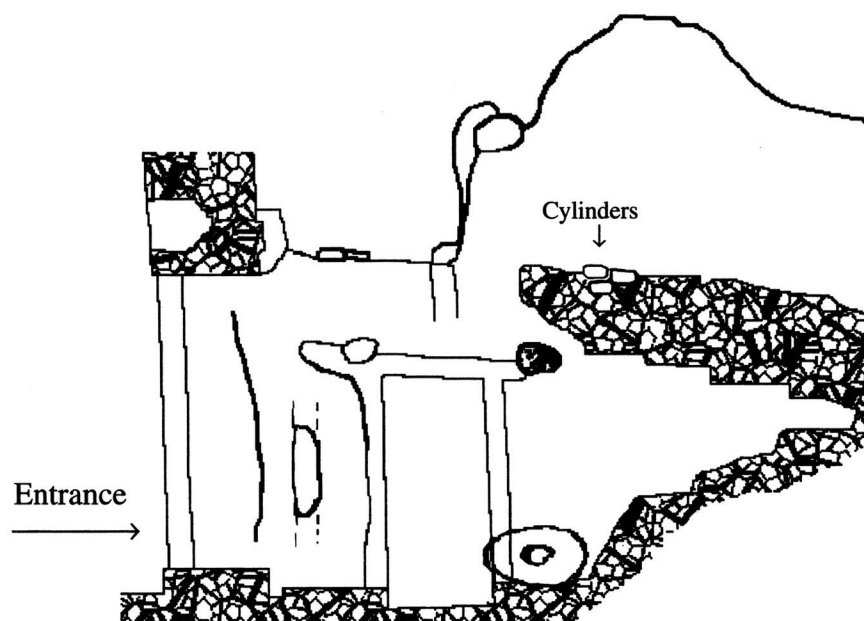


Figure 3: *West House Section in the Staircase*

Three preliminary conclusions may be drawn from the above. a) During their use, or, more accurately, during the process with which they were associated, either a single cylinder, or more than one, may have been involved. b) They fall into two categories in terms of size, one group consisting of the larger and the other of the smaller, fewer examples (two to five). This latter group consists of the two cylinders found on the ground floor. The large cylinders in this WH category all have about the same length and diameter. c) During their use, they sat with the long side of the cylinder resting on a firm base.

Some observations about the find spots: five cylinders were discovered on the staircase outside the entrance to room 3. Room 3 is the largest in the house, situated on the upper storey, and has a central column supporting the roof. It forms the main route to rooms 5 and 4, in which were found the famous wall-paintings of the flotilla and the fishermen. The room has been identified as a weaving workshop, since a large number of loomweights were found here.<sup>6</sup> Despite this, and despite the fact that the cylinders have been associated in the past with weaving activities (see chapter on 'function'), I do not believe that in this case they are connected with weaving. The position in which they were found indicates that they had probably fallen from the roof, since they were

<sup>6</sup> For the identification of this room as a weaving workshop, see Tzachili 1997, pp. 183-193. For a general analysis of the finds from the room, see Michailidou 2001a, p. 430.

discovered high in the deposit level (FIG. 3). In contrast, the two smaller cylinders found in isolation in the ground-floor rooms were lying on the floor. Room 3A has been thought to be a kitchen on account of the presence in it of ash and an *asaminthos*. The neighbouring rooms 3Γ and 4, in which the cylinders were found, are regarded as storage rooms because of the large number of pots discovered in them (Michailidou 2001a, p. 427).

### *House of the Ladies*

Another group of cylinders with shared features was found in Room 7 of the House of the Ladies.

- HL 1 Small part missing. Brown-red clay with inclusions (inv. no. 6470)  
 Hand-smoothed surface, sharp edges  
 Diam. 0.150, length 0.160, weight 2740 gr.  
 Found on a bench in room 7 on the ground floor  
 FIG. 2, PLATE IIB
- HL 2 Complete (inv. no. 6469). Brown-red clay with inclusions, like the previous one  
 Hand-smoothed surface, sharp edges  
 Diam. 0.100, length, 0.180, weight 2653 gr.  
 Distinctly flattened at one point of the curved surface. Marks left by a slab can be seen on the flattened area, indicating that the cylinder was placed on it while still wet and that the flattening was produced by its weight as it dried.  
 Found on a bench in room 7 on the ground floor, next to the previous one  
 FIG. 2, PLATE IIC
- HL 3 Small part missing. Brown-red clay with inclusions, similar to the two previous ones.  
 Hand-smoothed surface, rounded edges  
 Diam. 0.90, preserved length 0.10  
 Found on the floor of room 7 on the ground floor.  
 FIG. 2
- HL 4 About half missing. Brown clay with inclusions, different from the clay of the previous three.  
 Hand-smoothed surface, rounded edges  
 Diam. 0.088, length 0.11  
 Found on the floor of room 7 on the ground floor

The cylinders found in the House of the Ladies have the same form as those from the West House, though they have some clearly distinct features. The most important of these is their size. The cylinders from the West House, as well as the majority of the cylinders found elsewhere in the settlement, belong to two categories of size (see chapters on 'shape', 'dimensions' and 'weight'). To them is now added a third, notably larger size-category. The two cylinders from the House of the Ladies are so far the largest cylinders found in the settlement and the only ones of this size.

Some indications based on their findspots may perhaps furnish evidence as to their use. The largest cylinders were resting on a bench, while the other, smaller ones lay on the floor. This is certainly their original position –the position in which they were used. Some were placed at some height above the ground and

the others directly on it. The latter are smaller than the former. In the light of the present data, no interpretation of this phenomenon can be offered, though it appears significant.

Another feature of importance to the investigation of their function is that they were found in pairs, at the same level and with their long axes parallel (FIG. 4, PLATE III and IVA). The two large cylinders were found very close together on the bench and almost parallel to each other, while the two smaller ones were found, also parallel to each other, on the floor of the same room, amongst vases.

These are the only cylinders in the settlement made of obviously different clay, which is brown-red in colour and more argillaceous. Whereas all the others were probably made by taking earth from the immediate environment, irrespective of its quality, this clay appears to have been brought from a greater

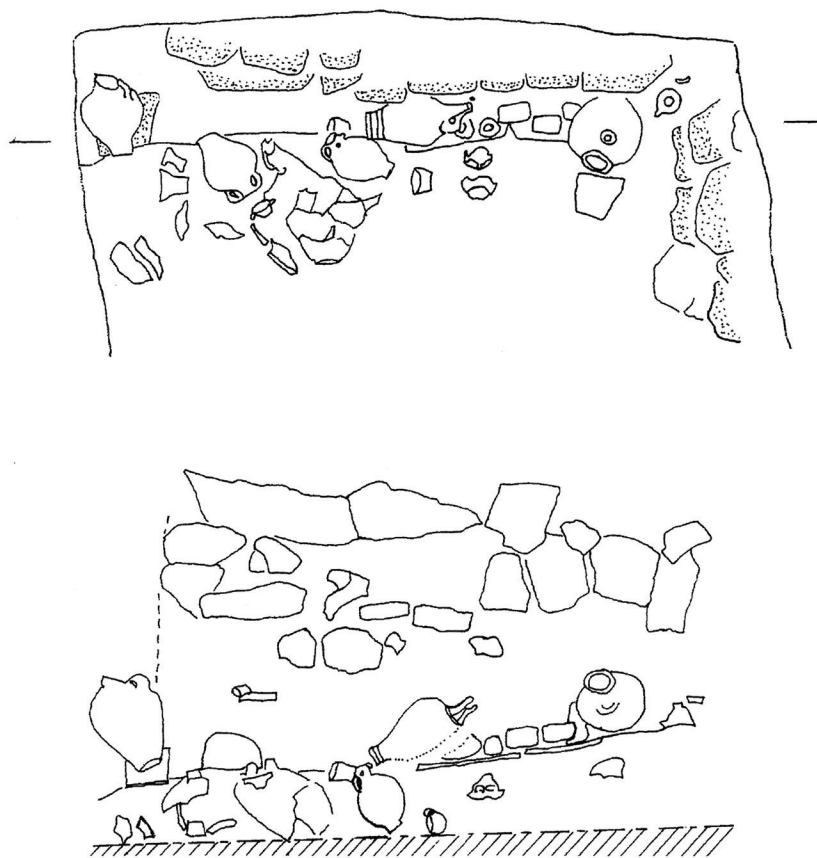


Figure 4: *House of the Ladies, Room 7: Plan and Section*

distance. I believe that this difference, and the greater effort to make them durable, is connected with their larger size and weight. The off-white clay from the surrounding area, consisting of volcanic earth, was more friable. In order to give the larger cylinders some durability, that is, to avoid cracking when they dried, a better-quality clay was required, with many inclusions which would ensure that it could withstand the contraction that occurred during drying.

A few more details relating to the find place. Room 7 was excavated in 1972 by S. Marinatos, who noted its use as a storeroom (Marinatos 1972, pl. 8, 3). The excavation of the room was completed in 1994 and the fact that the room was

used for storage purposes, became even more apparent (Doumas 1994, p. 231). The floor and the built bench along the north wall were covered by a quantity of large vases, amongst which the cylinders were found (FIG. 4, PLATES III and IVA).

### *House of the Anchor*

HA 1 One third missing. Off-white clay with inclusions (inv. no. 4469)

Traces around the hole.

Diam. 0.095, preserved length 0.115

HA 2 Complete. Off-white clay with inclusions (inv. no. 5029).

Surface corroded

Diam. 0.090, length 0.96

FIG. 5

Only a very small part of the House of the Anchor has been excavated. The day-book refers to “two cylindrical objects” and it is this reference that leads me to include HA 2 here, which is recorded in the inventory without any further clarification but is made of the same clay. According to the excavation day-book, the cylinders were discovered “in the south-east corner of the excavated area of the house, at a depth of 0.15 m. beneath the window-frame”: that is, in the earth deposits in this area, not on the floor. They had probably fallen from the upper storey. If it is not just a coincidence (for the excavation was not continued), we may note that, once again, two cylinders were found in a pair.

### *Xeste III*

X 1 Half missing. Off-white clay with inclusions (inv. no. 1045)

Diam. 0.08, preserved length 0.090

The find spot is not clear. According to the day-book it was found “to the north of corridor 5”, which possibly implies somewhere in room 4. This is the only one reported from Xeste III.

### *Complex Δ*

The large building complex Delta consists of four building units, in contact with each other.<sup>7</sup> The cylinders were found in the east and north units (ΔII and ΔI), in three places quite close together: in rooms Δ2 and Δ18, which both belong to the east unit, and in Δ17, which belongs to the north one. After the volcanic destruction, the winter torrent flowed through this part of the settlement, disturbing the archaeological deposits in its bed. This accounts for the fact that the outlines of the houses are rather unclear and the archaeological sequence confused.

Δ2.1 Small part missing at one end. Off-white clay with inclusions (inv. no. 3825)

Diam. 0.075, preserved length 0.10

On the floor

<sup>7</sup> For the definition of the four units of the complex, see Palyvou 1999, FIG. 7.



- Δ2.2 Incomplete and squashed. Off-white clay with inclusions (inv. no. 3827)  
Diam. 0.080, preserved length 0.090  
On the floor
- Δ2.3 Complete. Corroded surface (inv. no. 3828)  
Diam. 0.06, length 0.10, weight 475 gr.  
On the floor  
FIG. 5, PLATE IVB
- Δ2.4 Fragment of a cylinder (inv. no. 3829)  
preserved length 0.065  
Found in the courtyard of Δ2, that is in the present area Δ21, near the wall on the ground floor.<sup>8</sup>

These cylinders were found on the floor along with a large number of vases. Δ2 is the room decorated with the wall-painting of the lilies. In addition to the large quantity of pottery, it contained metal objects –including sickles–, traces of organic materials, and a bed. It has been considered a shrine, but the finds make it possible that it also functioned as a storage place, at least in the final phase of its use (Marinatos 1972, p. 26, Nanno Marinatou 1984, p. 174, Doumas 1992, p. 104).

Despite the fact that they are all made of different clays, these cylinders seem to have formed a group (it is noted in the day-book that they were found “together”), because they were probably all used at the same time. They were not, however, made at the same time, or at least as a single batch, since they are made of different clays.

#### *Area Near Room Δ17*

Here I include a number of cylinders of rather uncertain provenance, since they are from the early excavations and the indications are not perfectly clear. However, after comparison of the day-books and the early publications, I have come to the conclusion that they probably come from the area of Δ17 (where the large group of impressed cylinders was found) or Δ18. These are rooms belonging to different building units, but unfortunately we have no more precise evidence.

- Near Δ17 One quarter missing. Light brown clay with inclusions (inv. no. 4691)  
Distinctly flattened seating surface  
Diam. 0.095, preserved length 0.12
- Near Δ17 About half missing. Light brown clay with inclusions (inv. no. 4552A)  
Diam. 0.105, preserved length 0.13.
- Near Δ17 Complete, chipped. Light brown clay with inclusions (inv. no. 4552B)  
Traces around the hole  
Diam. 0.09, length 0.11, weight 1100 gr.

Cylinders Near Δ17. 2 and Near Δ17. 3 are of the same dimensions made of the same clay, and presumably formed a pair. They are recorded in the inventory

<sup>8</sup> The fragment was found during the 1968 excavations and has the label ‘Bronos 2’. This has been identified with complex Δ, between building units II and III.

without any indication of their find spot, but details in the day-book suggest that they probably come from Near  $\Delta 17$ . The 1993, 1994 and 1995 excavations revealed  $\Delta 18$  to be an important storage room. It was established that it is divided into two smaller rooms and that it contained furniture, baskets, the only Linear A tablets so far found on Thera, and a number of sealings (Doumas 1993, p. 183; Doumas 1994; Doumas 1995). The lack of clarity surrounding the provenance of the cylinders assigned to this group makes it impossible to correlate their function with the that of room  $\Delta 18$ .

### *Room $\Delta 17$*

The cylinders found in  $\Delta 17$  undoubtedly form a group, not only because they were all found together in a heap in the south-west corner of the room, but also because, apart from being uniform, all but two of them bear small impressed circles. Numerically, they are the majority of the cylinders found in the settlement. All were made of the same off-white clay, and most of them were found squashed, probably by their own weight, though possibly also because they were piled up while still slightly wet. Many of them had completely disintegrated, so that it is impossible to ascertain the exact number, which is given only as an approximation. In the catalogue that follows, in addition to the other features, details are given of the way in which the impressed circles were recorded. For more on this subject, see PART THREE.

- $\Delta 17.1$  Incomplete and squashed. Off-white clay with inclusions.  
Hand-smoothed surface (inv. no. 5035)  
Diam. 0.075, preserved length 0.105  
This is one of the two cylinders found in  $\Delta 17$  that does not have impressed circles.  
PLATE IVC
- $\Delta 17.2$  Complete. Off-white clay with inclusions (inv. no. 5030). Slightly squashed.  
Diam. 0.090, length 0.096, weight 625 gr.  
No impressed circles
- $\Delta 17.3$  Complete, squashed. Off-white clay with inclusions (inv. no. 5057)  
Diam. 0.075, length 0.090, weight 500 gr.  
Impressed circles on one end and on the curved surface, set in rows. The total number of circles is preserved. There are 9 on the end and 18 on the curved surface. They are arranged boustrophedon.  
Recording Style A  
FIG. 6, PLATE VA
- $\Delta 17.4$  Complete, slightly squashed. Off-white clay with inclusions (inv. no. 5054)  
Indistinct traces around the hole  
Diam. 0.078, length 0.098, weight 525 gr.  
Impressed circles on the curved surface and one end. The circles on the large curved surface are set in 5 regular rows, each of which starts from a circle on the end. They are arranged boustrophedon.  
The total number of circles is preserved: 10 on the end and 26 on the curved surface.  
Recording Style A  
FIG. 7, PLATE VB

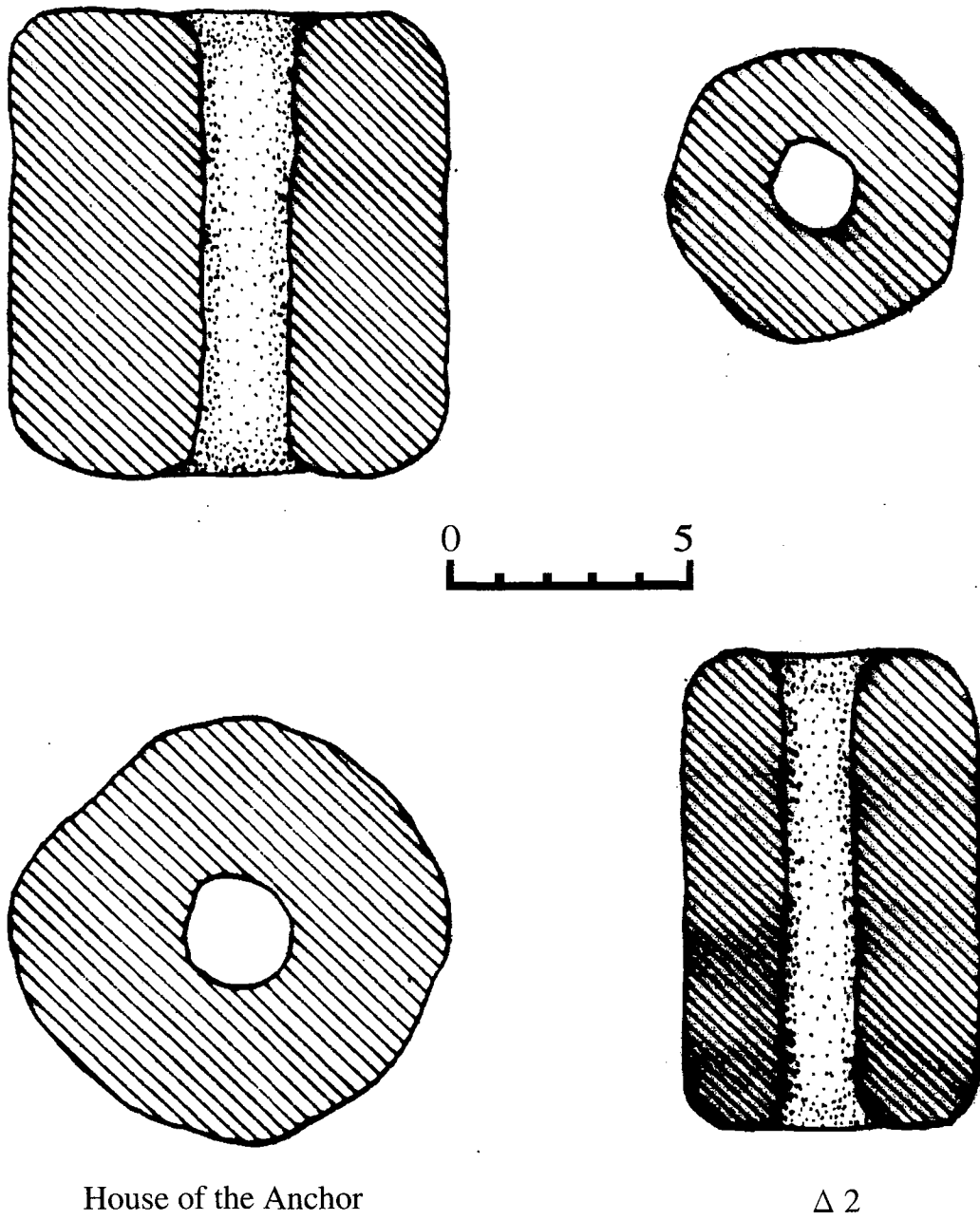


Figure 5: *Cylinders from the House of the Anchor and Delta Room 2*

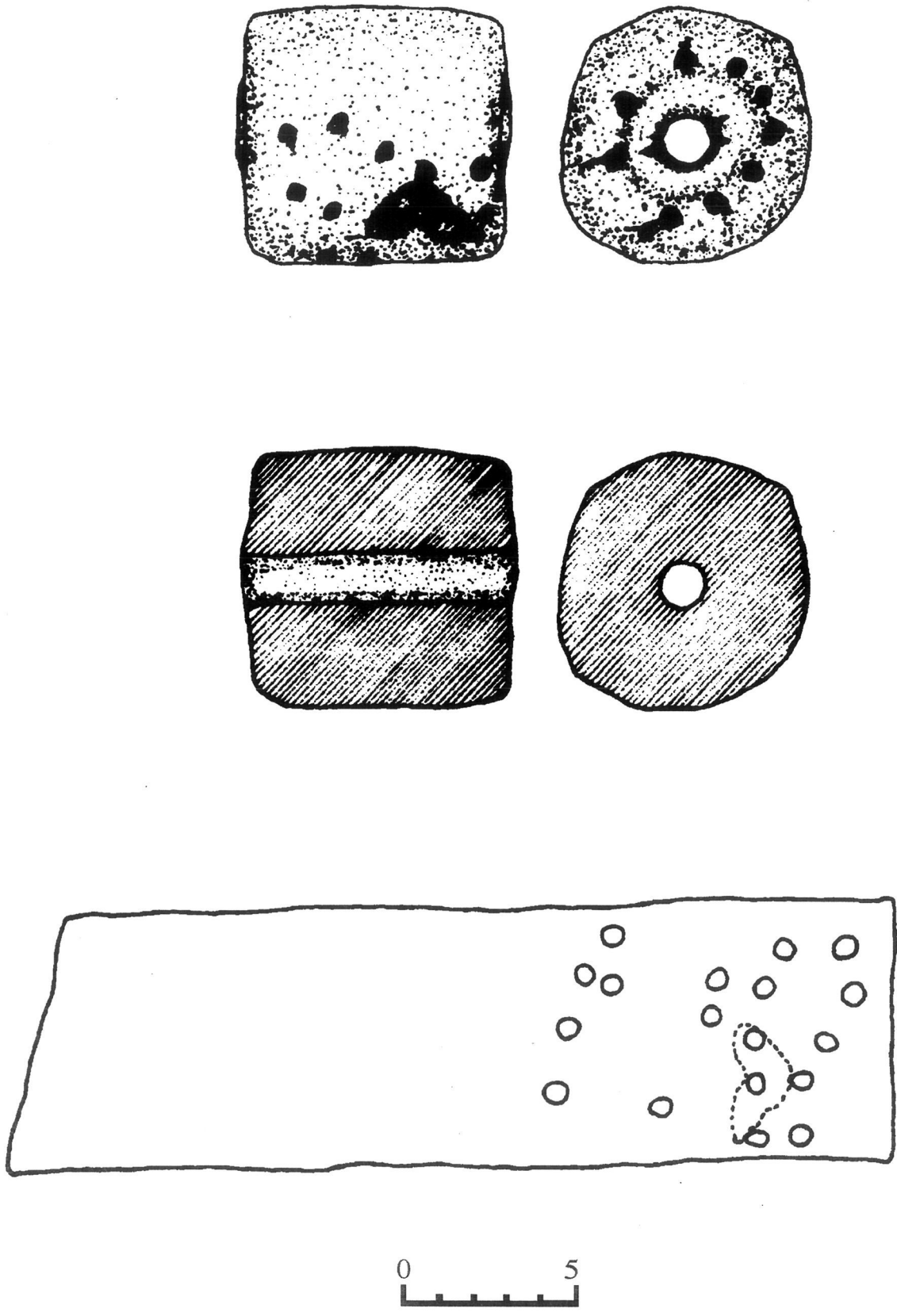


Figure 6: *Cylinder no. 17.3 from the Delta Room 17*

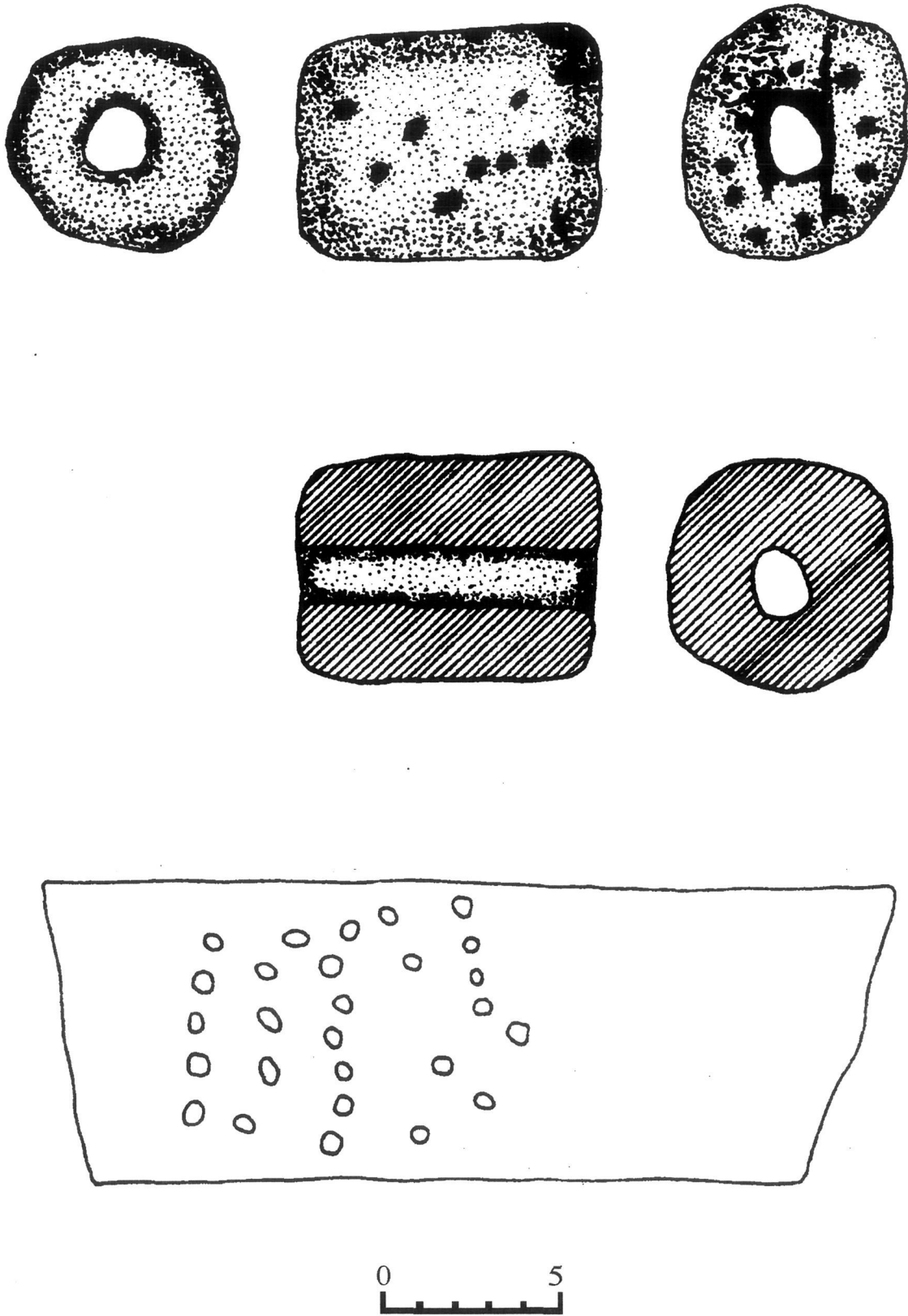


Figure 7: Cylinder no. 17.4 from the Delta Room 17

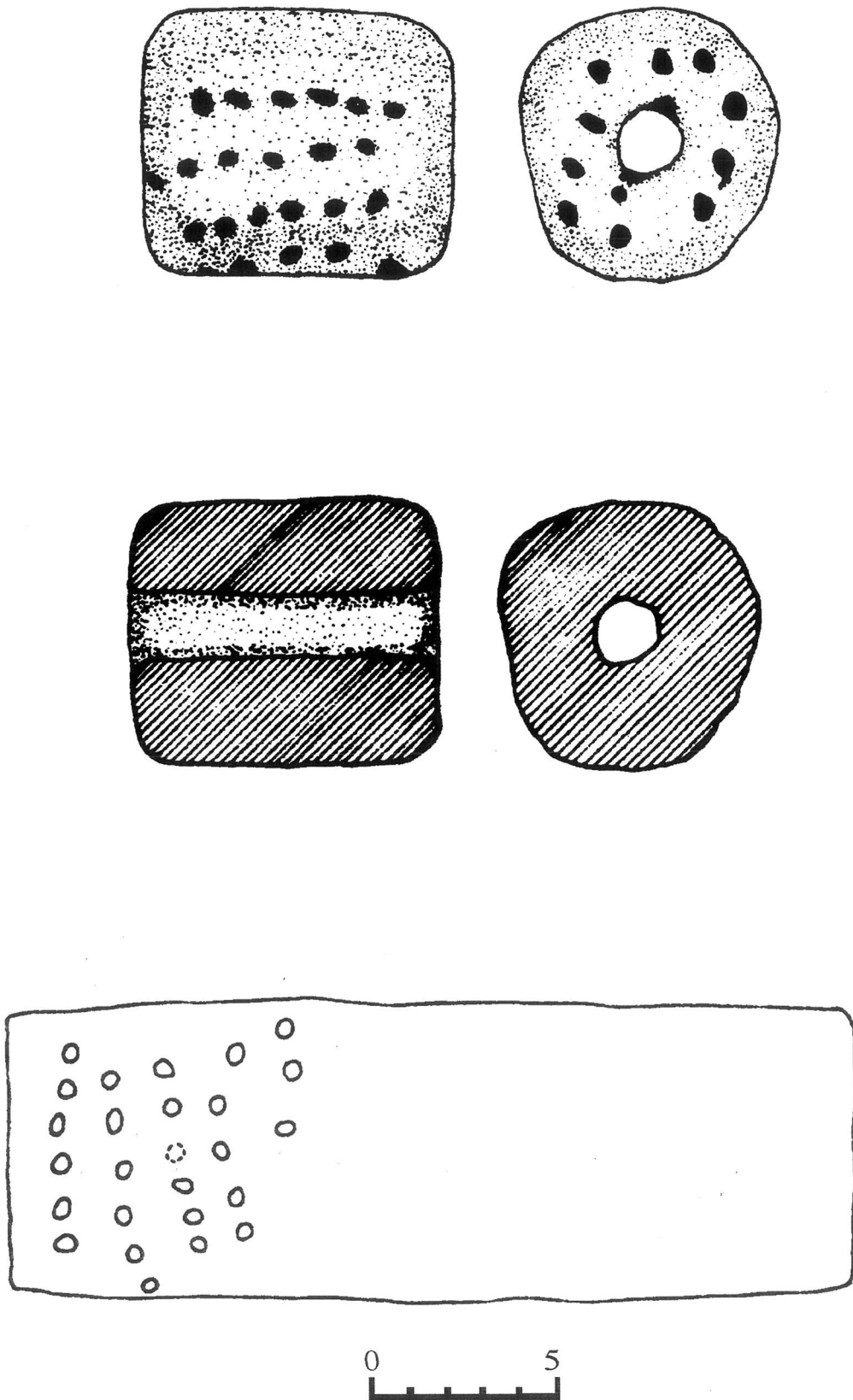


Figure 8: *Cylinder no. 17.5 from the Delta Room 17*

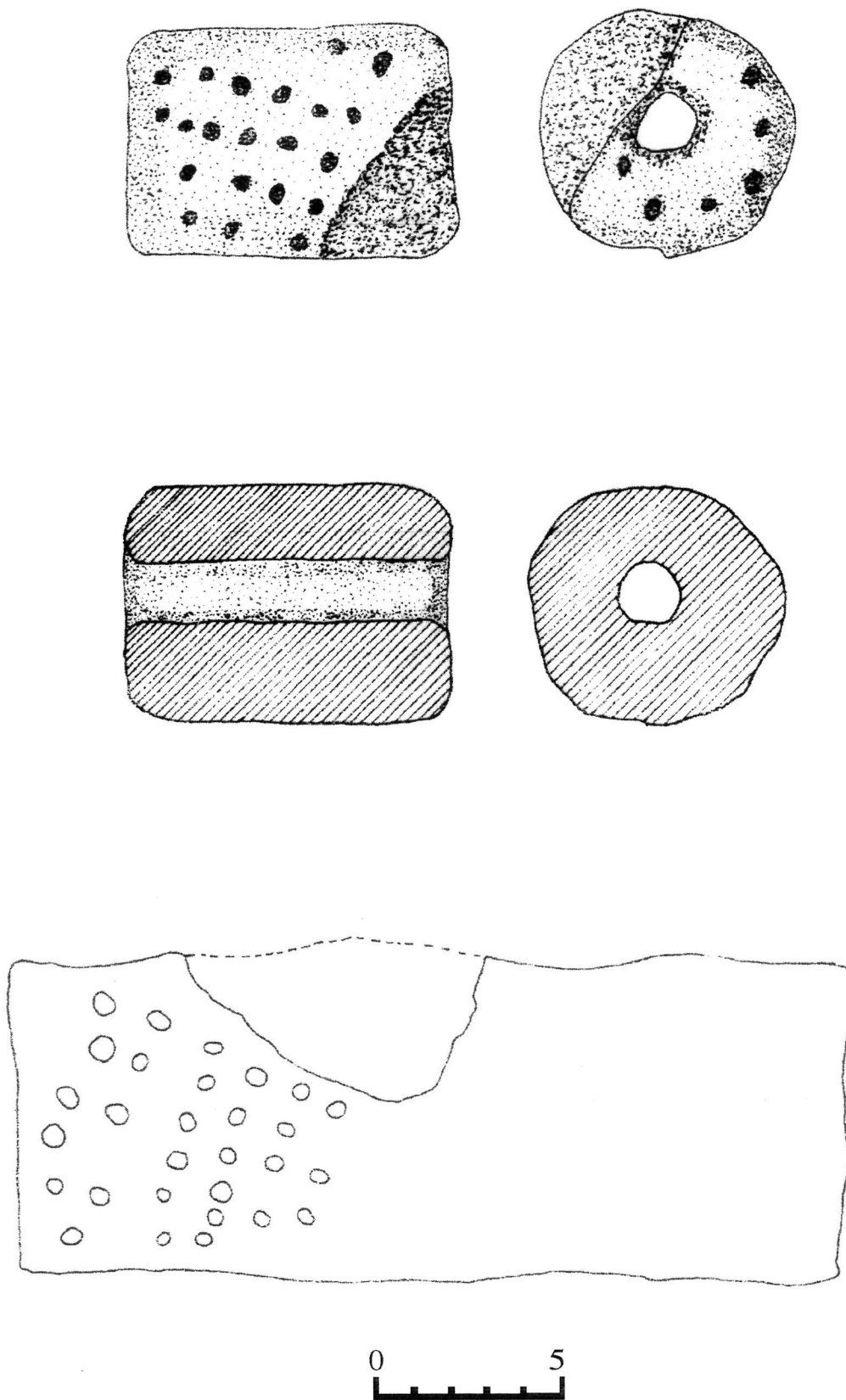


Figure 9: *Cylinder no. 17.7 from the Delta Room 17*

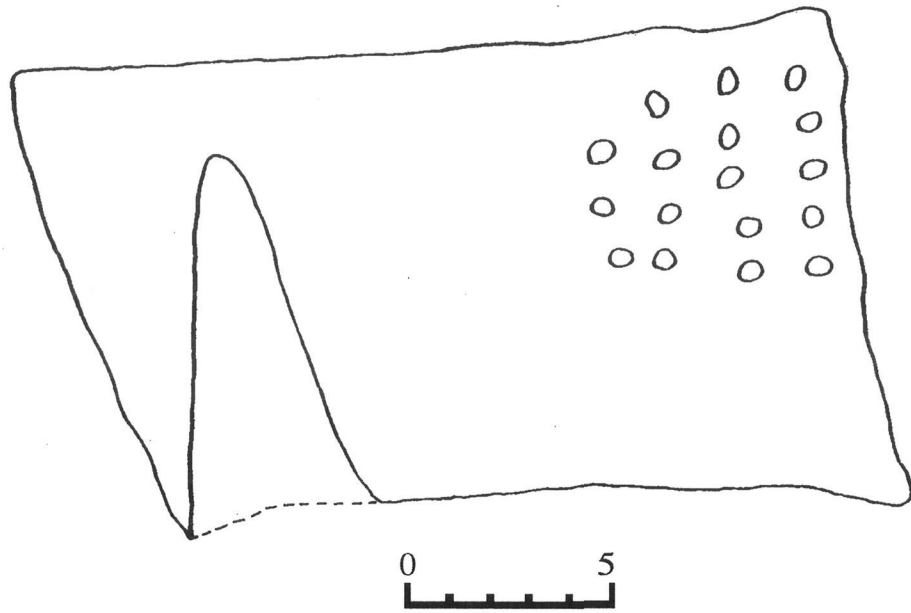


Figure 10: *Cylinder no. 17.8 from the Delta Room 17*

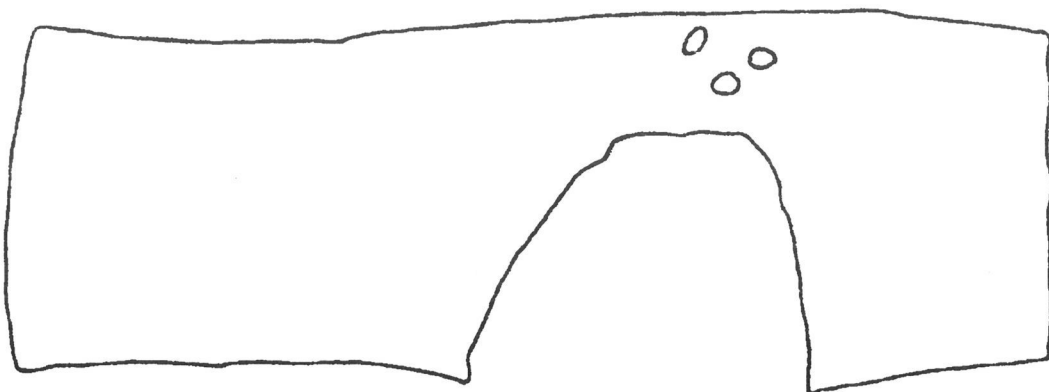
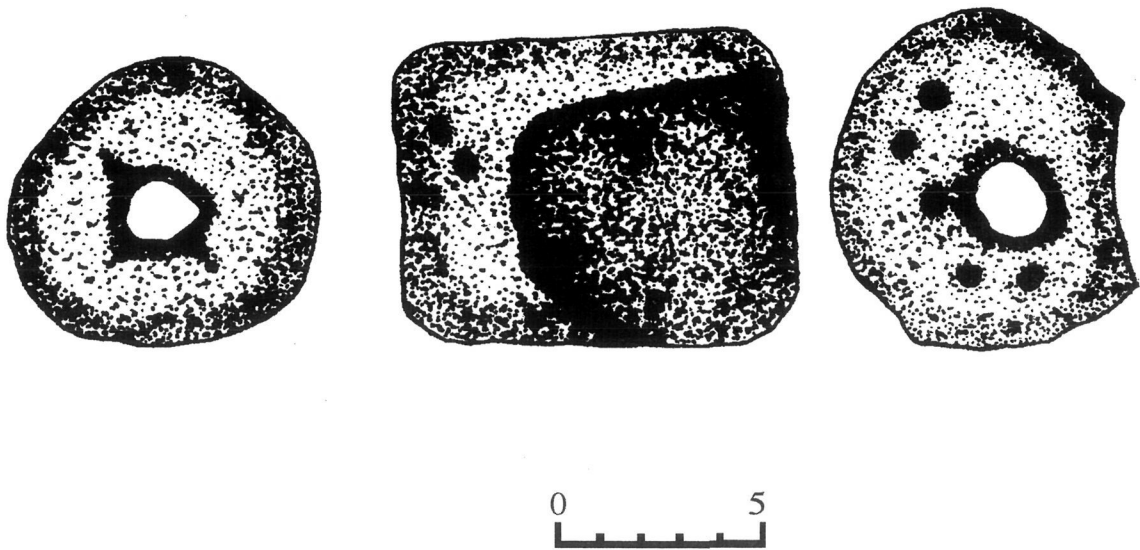


Figure 11: *Cylinder no. 17.9 from the Delta Room 17*



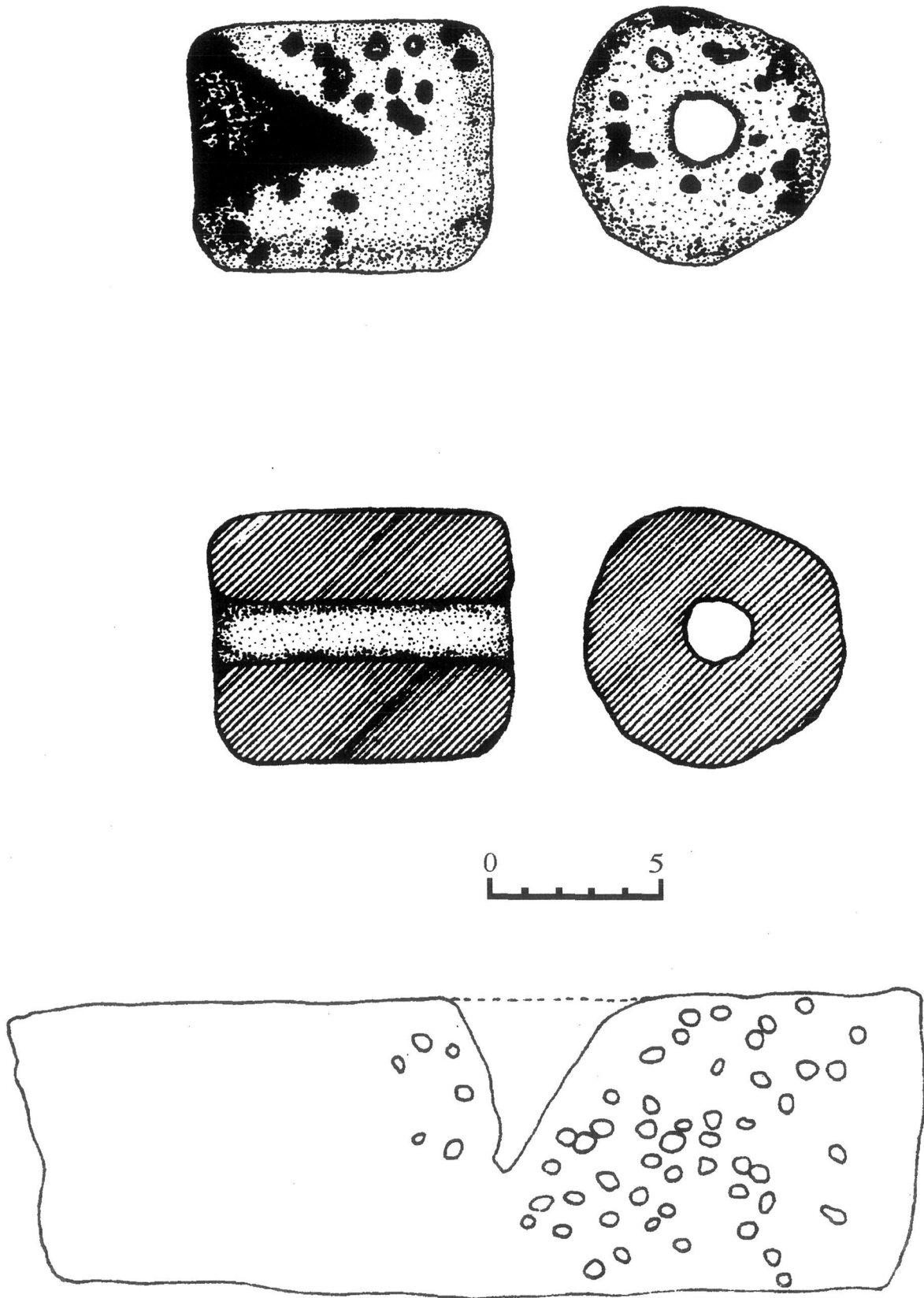


Figure 12: Cylinder no. 17.10 from the Delta Room 17

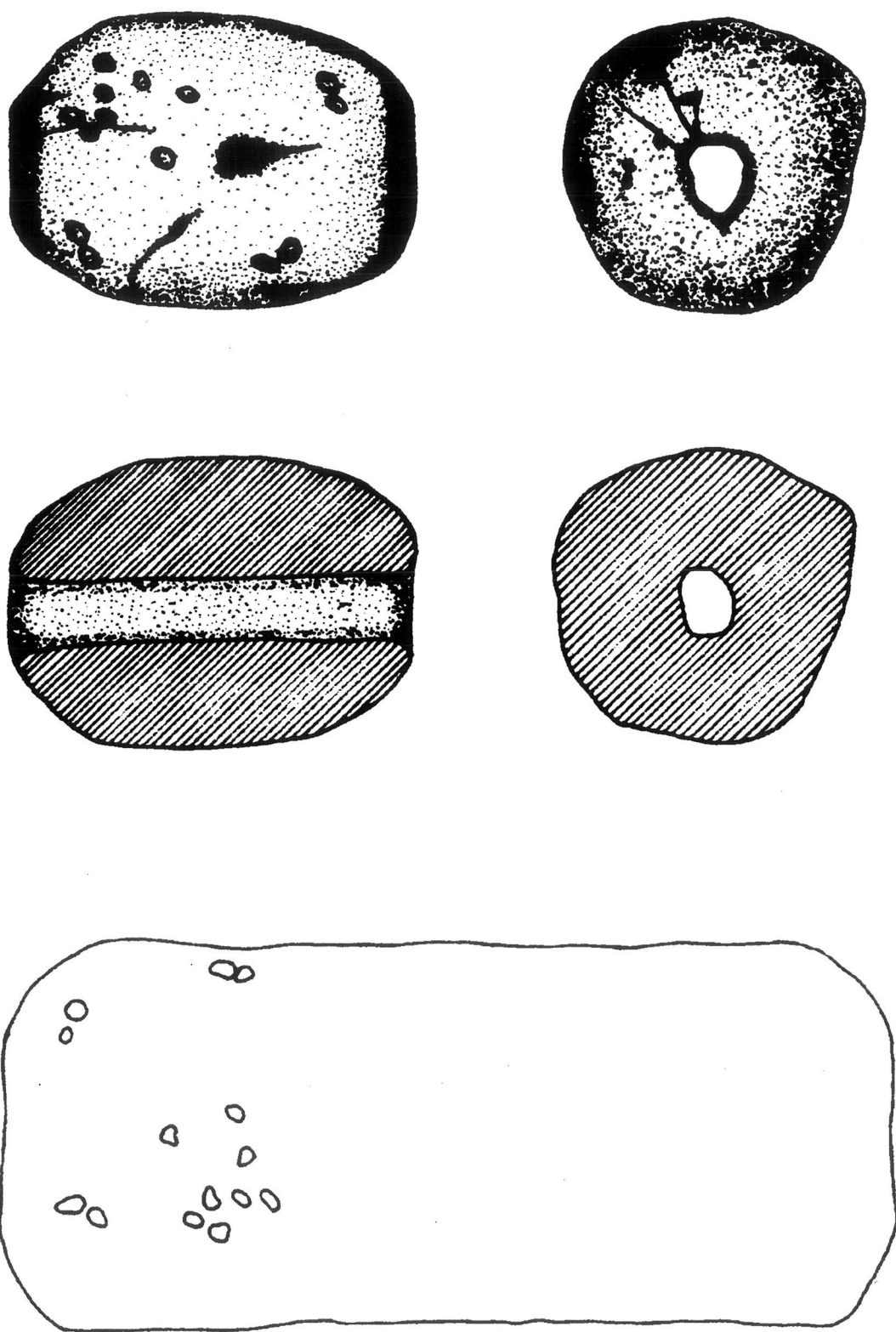


Figure 13: *Cylinder no. 17.11 from the Delta Room 17*

- Δ17.5 Complete. Off-white clay with inclusions (inv. no. 5052)  
Traces around the hole  
Diam. 0.075, length 0.09, weight 500 gr.  
Impressed circles on the curved surface and on one end. The circles on the curved surface are set in regular rows, boustrophedon. The circles on the end are deeper, and were probably made first, some time before the others. The total number of circles is preserved. There are 11 on the end and 26 on the curved surface.  
Recording Style A  
FIG. 8, PLATE VC
- Δ17.6 Squashed and badly corroded. Off-white clay with inclusions (inv. no. 5053)  
Preserved length 0.048  
Only four impressed, regularly arranged, circles can be made out on the curved surface.  
Recording Style A  
PLATE VD
- Δ17.7 Almost complete, broken at one end (inv. no. 5061). Off-white clay with inclusions.  
Traces around the hole  
Diam. 0.075, length 0.102  
Impressed circles in six regular rows on the curved surface and on one of the ends. The record is boustrophedon and begins at the right, starting from the end with the impressed circles. The circles are deeper on the end, as in the case of Δ17.5, presumably because this is the starting point for the record. Preserved numbers of circles: 6, 29 and 6.  
Recording Style A  
FIG. 9, PLATE VIA
- Δ17.8 One third missing; squashed (inv. no. 5047). Off-white clay with inclusions  
Preserved length 0.101  
Circles in regular rows on the preserved part of the curved surface.  
Number of preserved circles: 17  
Recording Style A  
FIG. 10, PLATE VIB
- Δ17.9 Incomplete, squashed. Off-white clay with inclusions (inv. no. 5068)  
Diam. 0.080, preserved length 0.102  
Impressed circles on one end and on parts of the curved surface.  
Number of preserved circles: 3 on the curved surface and 5 on one end.  
Recording Style A  
FIG. 11, PLATE VIC
- Δ17.10 Complete, squashed. Off-white clay with inclusions (inv. no. 5064)  
Diam 0.070, length 0.10, weight 525 gr.  
Impressed circles on the one end of which the surface is preserved (the other is squashed). They are shallow and frequently in contact with each other, as in the case of Δ17.17.  
The circles are set in irregular rows, those on the curved surface forming continuations of those on the ends. They were apparently all made at the same time, since they all have the same depth. The surviving number is probably incomplete, because part of the surface is missing. There are 40 circles on the curved surface and 20 on the preserved end.  
Recording Style B  
FIG. 12, PLATE VID

- Δ17.11 Complete, squashed (inv. no. 5048). Off-white clay with inclusions, surface corroded in many places. The ends are rounded to the extent that there are virtually no flat surfaces. The curvature of the cylinder becomes gradually less pronounced towards the hole.  
Diam. 0.070, length 0.10, weight 500 gr.  
Shallow impressed circles, smaller in diameter than those of the previous cylinders and frequently in contact with each other. All the surface is treated as a single, indivisible unit.  
Preserved number of circles: 14. This is not the total, however, since there were probably others that cannot be made out because of the corroded surface.  
Recording Style B. Some slight differences, owing to the fact that the impressed circles, though made by the same person, were made with a different implement.  
Recording Style B  
FIG. 13, PLATE VIIA
- Δ17.12 One third missing, squashed, surface corroded. Rounded ends that form a continuous curve with the main surface (inv. no. 5049). Off-white clay with inclusions.  
Diam. 0.070, preserved length 0.090  
Impressed circles on both ends, difficult to detect because of the surface corrosion. On one of the ends they are deeper and were therefore probably made at a different time from the others, which are shallow. Many of the circles are in contact with each other. There are 12 circles preserved on the curved surface and 10 on one end. There is no clear distinction between the circles on the curved surface and those on the end.  
Recording Style B  
FIG. 14, PLATE VIIB
- Δ17.13 Completely squashed (inv. no. 5034). Surface corroded. Off-white clay with inclusions.  
Diam. 0.080, preserved length 0.095  
Clear traces of impressed circles preserved only on one end. Barely distinguishable circles on the other end and the curved surface. Number of circles preserved: 10 on the curved surface, 23 on the well-preserved end and 5 on the other.  
Recording Style B  
FIG. 15
- Δ17.14 Complete, squashed, large part of surface corroded (inv. no. 5066). Off-white clay with inclusions.  
Diam. 0.080, length 0.090, weight 500 gr.  
As in the case of Δ17 11 and Δ17 12, the ends are rounded to the extent that they form a continuous curve with the main body of the cylinder, as do the rows of circles. These are often in contact with each other and spread over both ends and the main curved surface. The number of preserved circles is 26 on the curved surface, 18 on the fully preserved end, and 6 on the partly preserved one.  
Recording Style B  
FIG. 16, PLATE VIIC
- Δ17.15 Complete, one of the best-preserved cylinders (inv. no. 5040). Off-white clay with inclusions. Rounded edges.  
Diam. 0.075, length 0.095, weight 500 gr.  
Impressed circles in irregular rows on the curved surface and both ends, frequently in contact with each other. Some of the circles are deep and others shallow. They were therefore not all made at the same time. There are 15 and 16 circles on the two ends and 60 on the curved surface. Because of the excellent state of

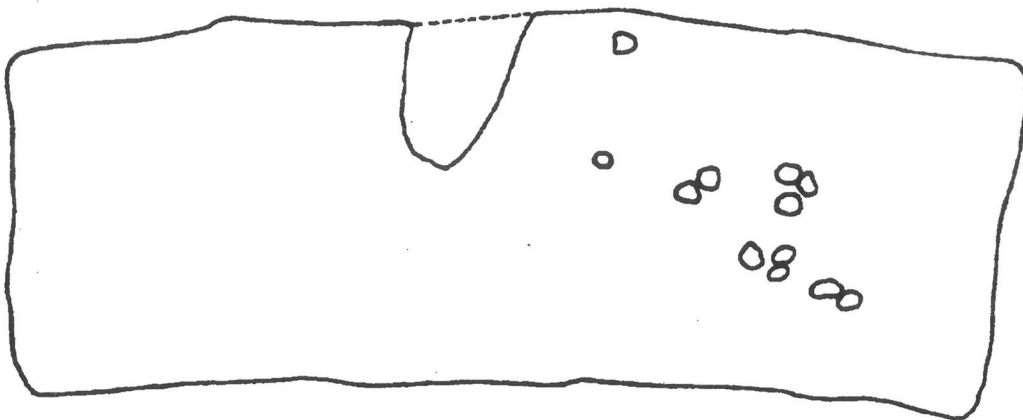
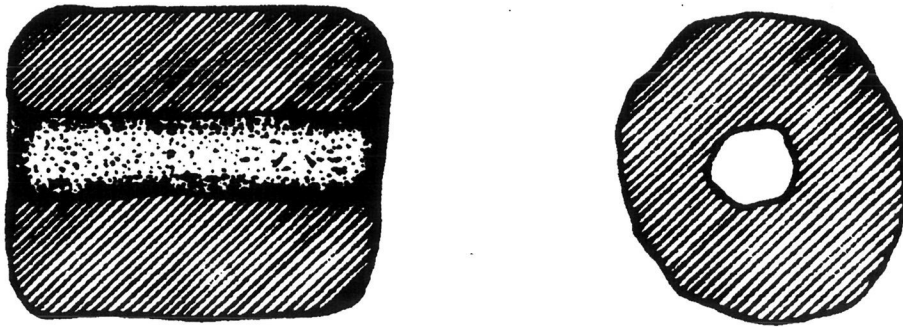
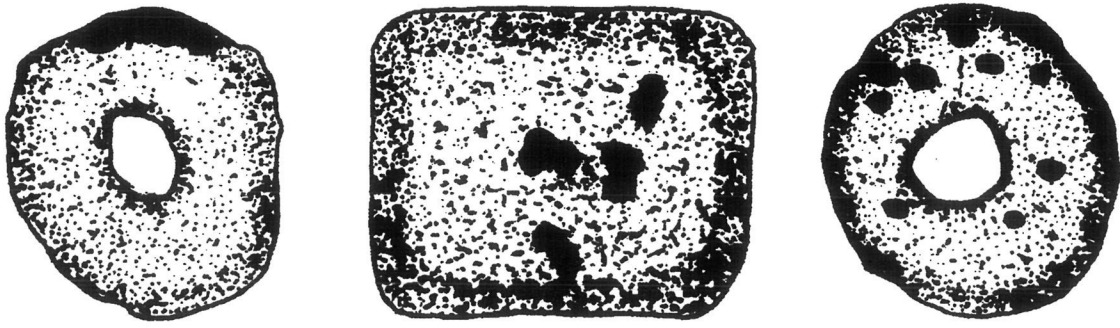


Figure 14: *Cylinder no. 17.12 from the Delta Room 17*

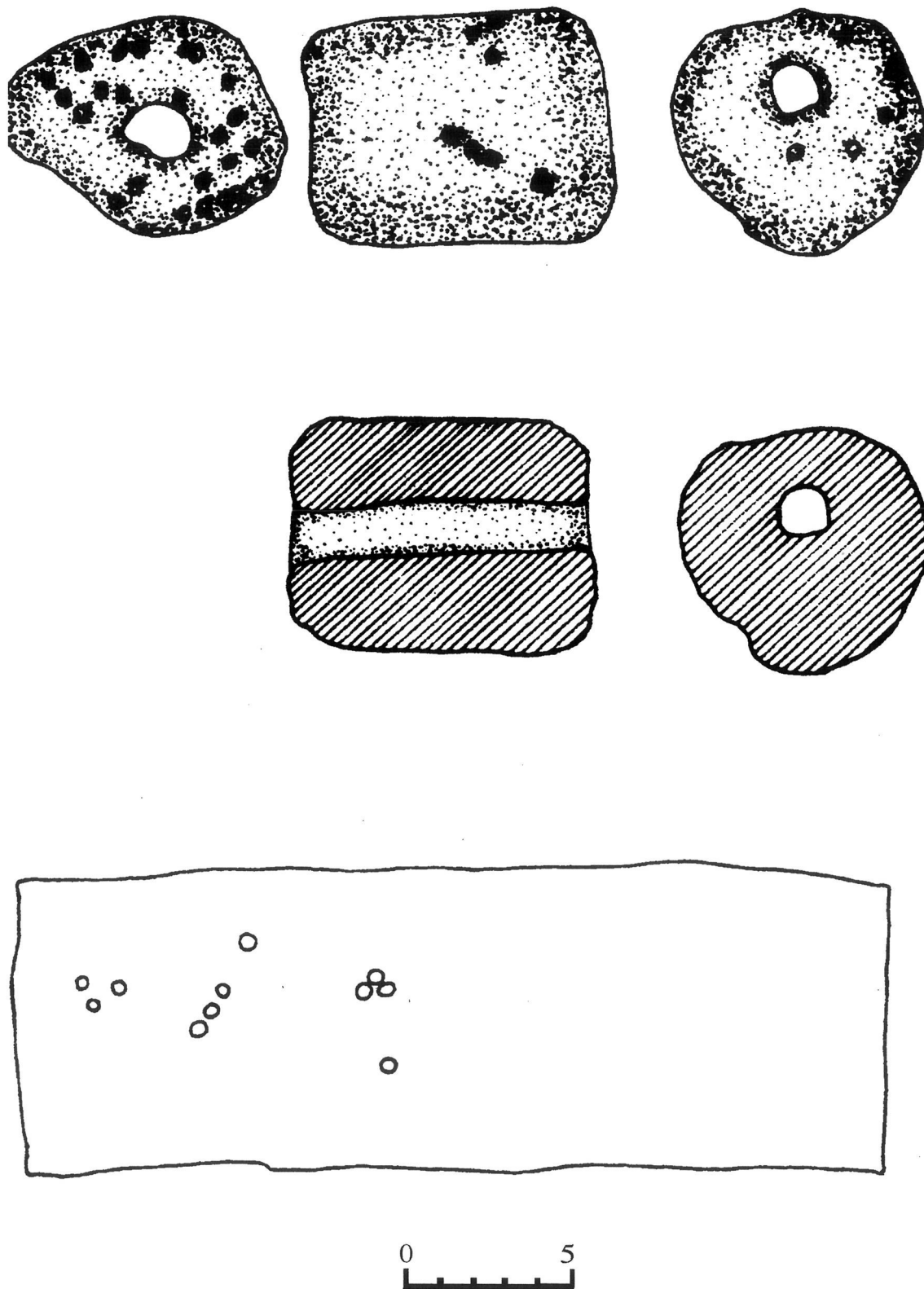


Figure 15: *Cylinder no. 17.13 from the Delta Room 17*

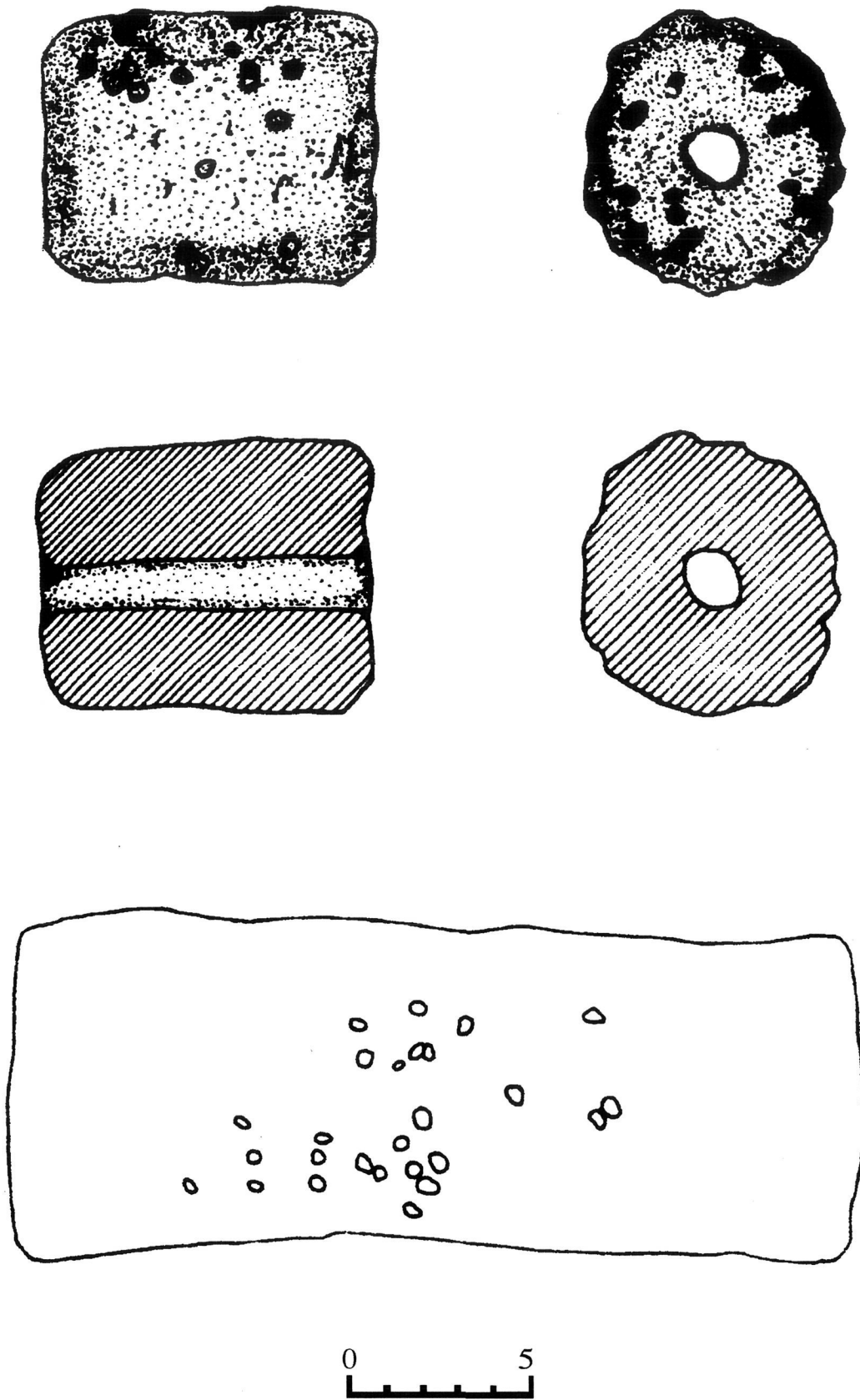


Figure 16: *Cylinder no. 17.14 from the Delta Room 17*

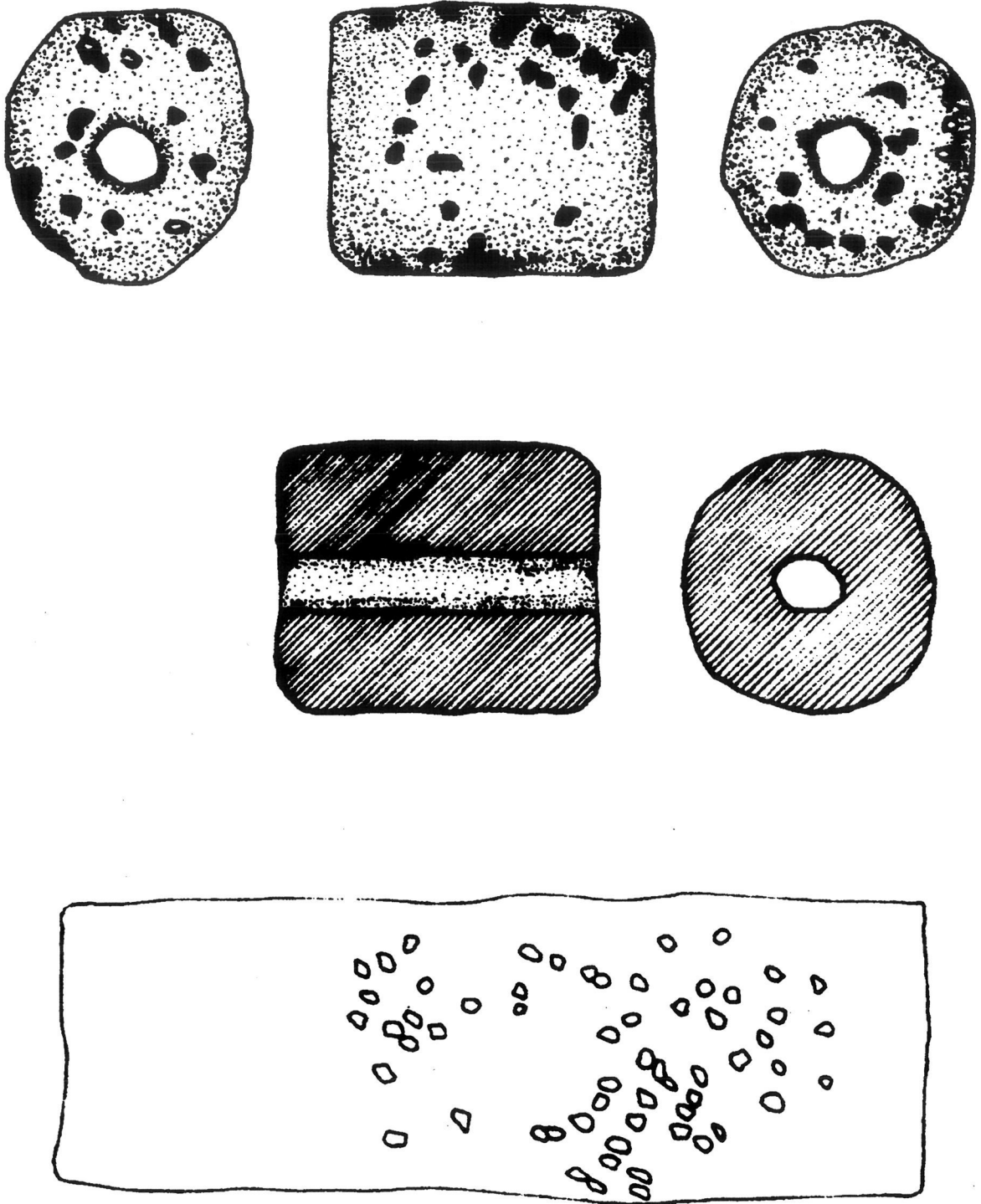


Figure 17: Cylinder no. 17.15 from the Delta Room 17



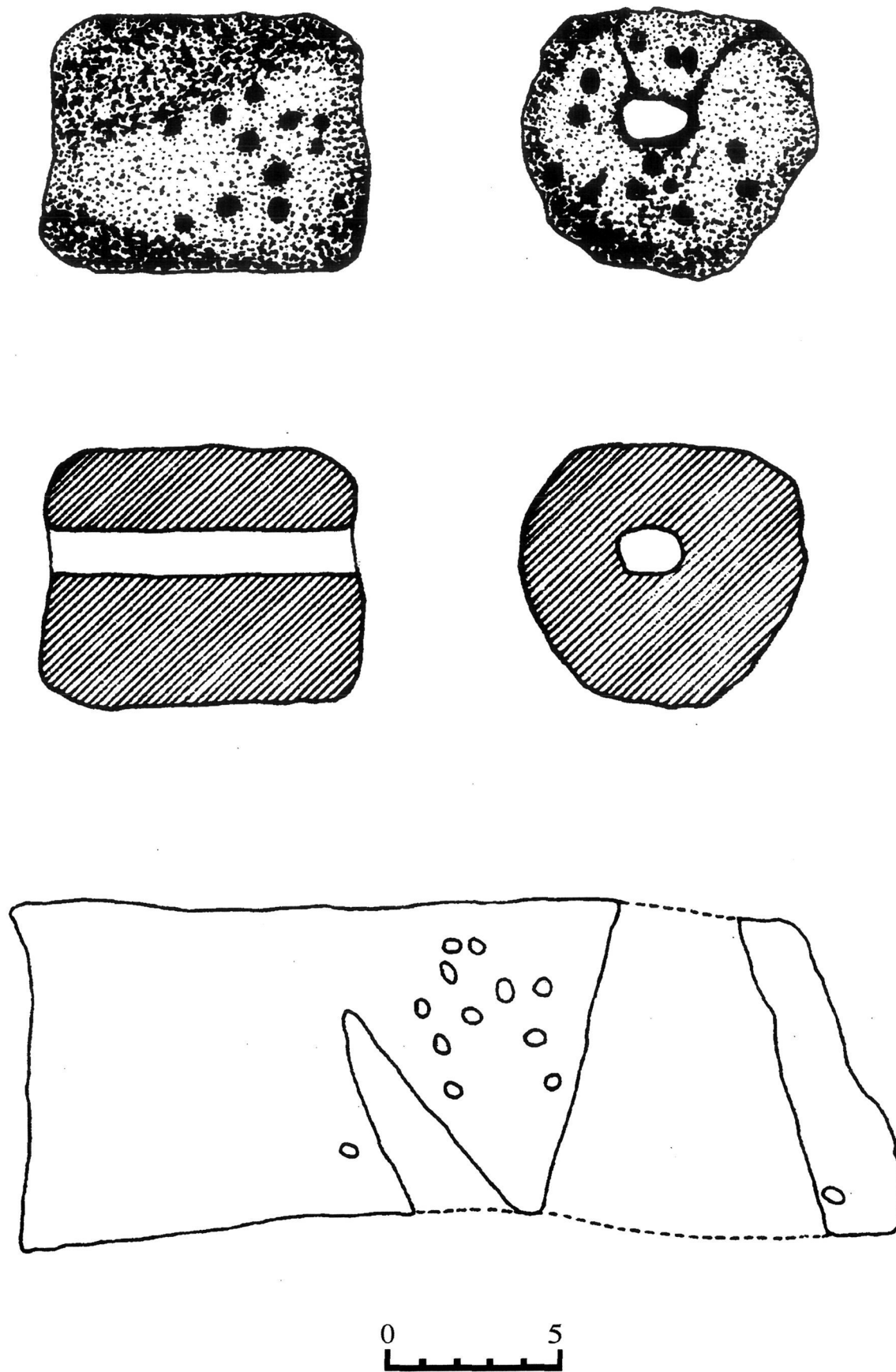


Figure 18: *Cylinder no. 17.16 from the Delta Room 17*

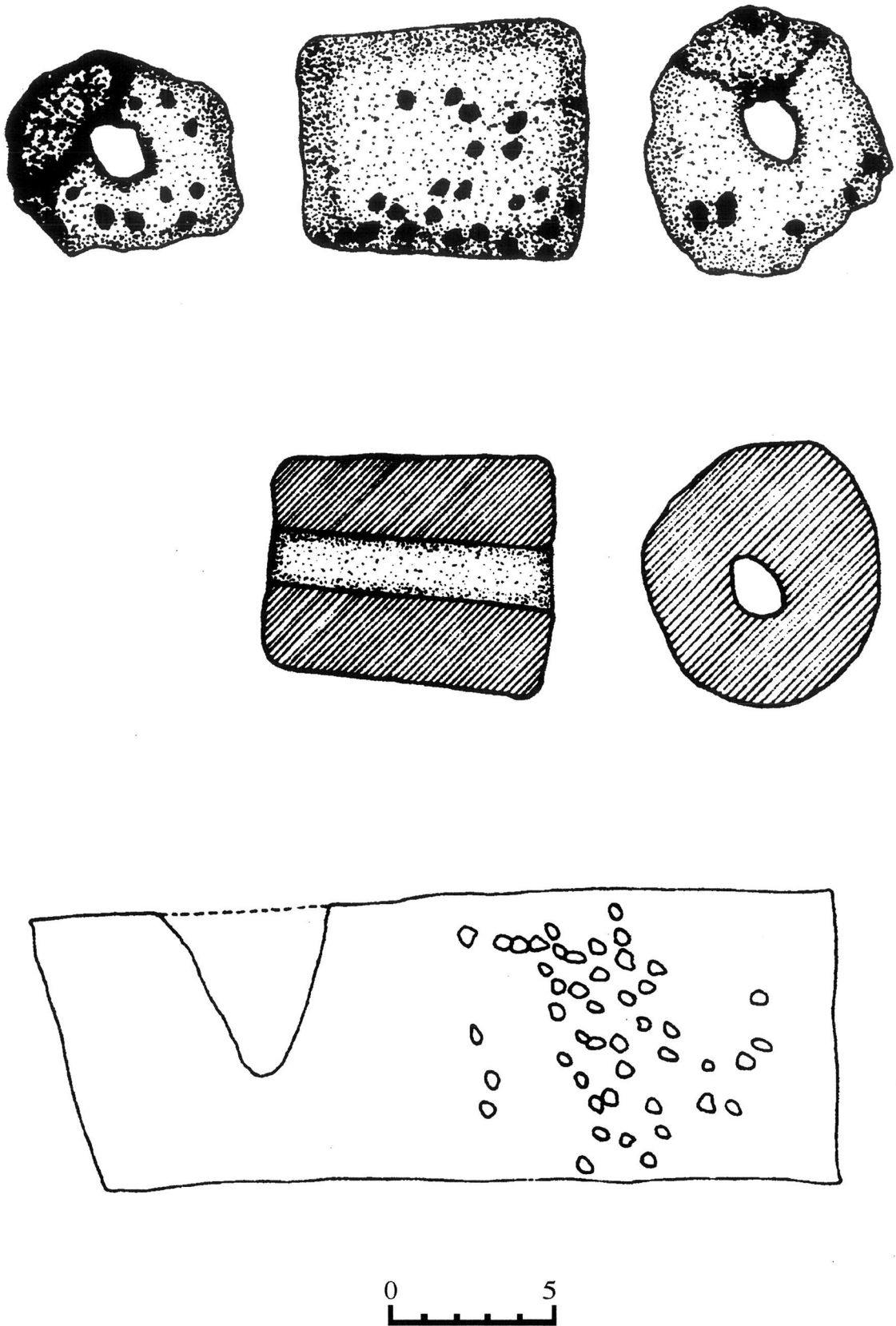


Figure 19: *Cylinder no. 17.17 from the Delta Room 17*

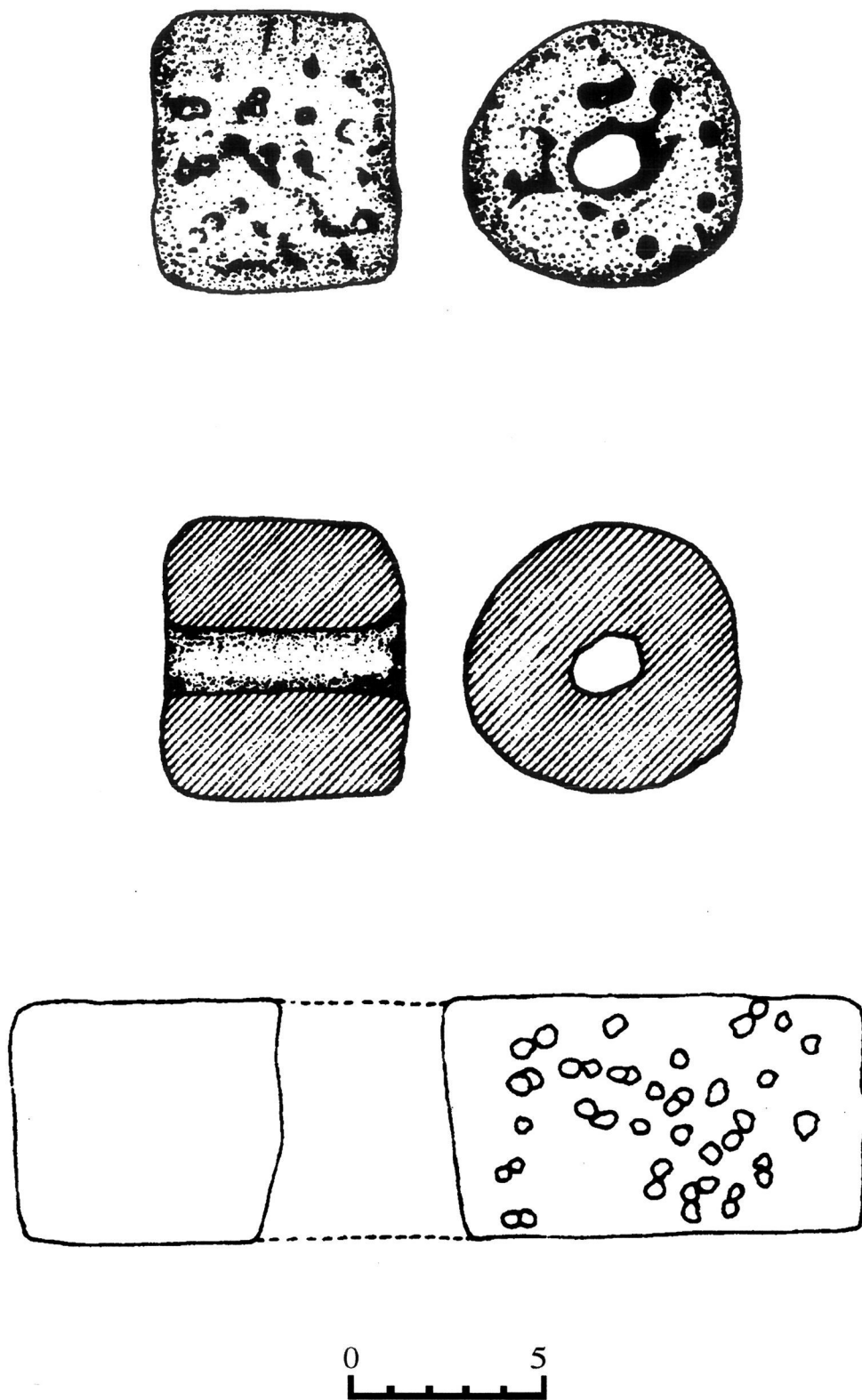


Figure 20: *Cylinder no. 17.18 from the Delta Room 17*

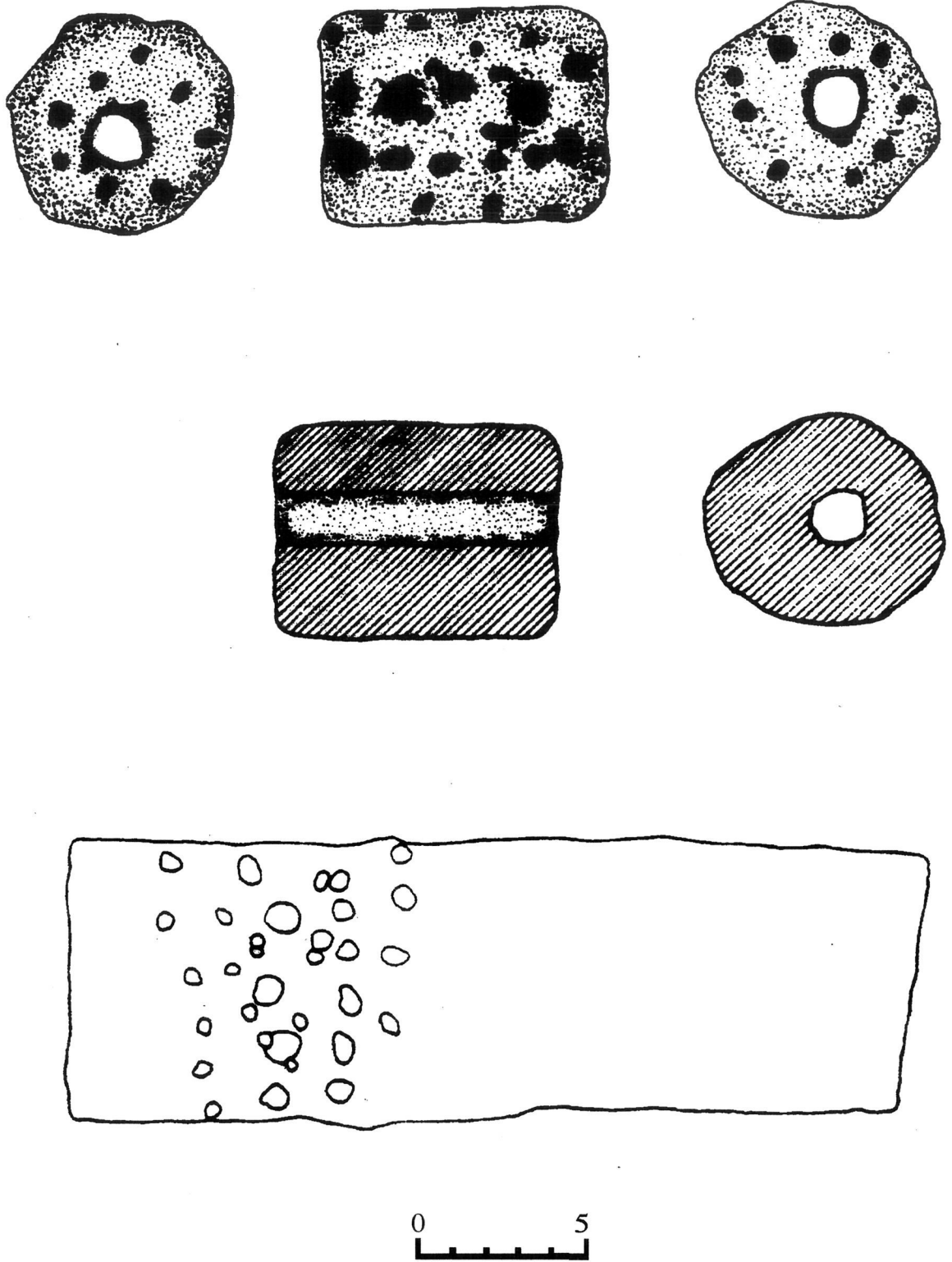


Figure 21: *Cylinder no. 17.19 from the Delta Room 17*

preservation of the cylinder, it is evident that none are missing, and that these are the original numbers.

Recording Style B

FIG. 17, PLATE VIID

- Δ17.16 Squashed, half missing (inv. no. 5100). Off-white clay with inclusions. Diam. 0.075, preserved length 0.105  
Impressed circles in irregular rows. The larger part of the curved surface is missing. Numbers of preserved circles: 13 on the curved surface and 14 on one end.  
Recording Style B  
FIG. 18, PLATE VIIIA
- Δ17.17 Complete, squashed, slightly chipped (inv. no. 5031). Ends perfectly rounded. Traces around the hole.  
Diam. 0.080, length 0.090, weight 500 gr.  
Impressed circles in irregular rows on both ends and the curved surface. Each of the circles on the ends marks the beginning of one of the rows on the main surface. The rows were obviously impressed boustrophedon. The impressed circles are not all the same depth. The shallower ones are in contact with deeper ones. There are 7 and 11 circles on the ends and 45 on the curved surface but the original numbers were undoubtedly larger, since parts of the surface are missing.  
Recording Style B  
FIG. 19, PLATE VIIIB
- Δ17.18 One third missing (inv. no. 5032). Off-white clay with inclusions. Wear-traces around the hole.  
Diam. 0.075, preserved length 0.070  
Impressed circles on the preserved end and the curved surface. The circles are arranged in irregular rows, boustrophedon. There are 10 preserved circles on the end and 42 on the curved surface.  
Recording Style B  
FIG. 20, PLATE VIIC
- Δ17.19 Large part missing, squashed (inv. no. 5065). Off-white clay with inclusions. Diam. 0.075, preserved length 0.11  
Part of the curved surface is preserved, together with impressed circles. The rows and position of the circles are regular, and some of them are in contact with each other. A total of 11 circles is preserved, 8 of them contact, forming pairs.  
Recording Style unclear – possibly a combination of A and B, since features of both styles are present.  
FIG. 21, PLATE VIID
- Δ17.20 Complete. Off-white clay with inclusions (inv. no. 5056). Traces around the hole. Diam. 0.062, length 0.080, weight 520 gr.  
Impressed circles on both ends and the curved surface in 4 regular oblique rows. The recorder possibly began at the ends. Rows arranged boustrophedon. Shallower circles are often in contact with others. The circles are of unequal size. The total number of circles is preserved: 8 + 9 + 31. The recording style has features of both A and B. Conceivably recorder A made the regular rows, which were later completed by B, using his own methods –that is, adding circles in contact with each other and aligning them with the circles on the ends of the cylinder.  
FIG. 22, PLATE IXA
- Δ17.21 Squashed (inv. no. 5100). Off-white clay with inclusions. Diam. 0.090, preserved length 0.070  
Impressed circles on the end and the curved surface. The latter are smaller than those on the end. The circles were probably made by two different hands. There

are 6 circles on the curved surface and 5 on the end.  
Recording Style A and B, as in the case of  $\Delta 17.20$ .

- $\Delta 17.22$  Complete. Off-white clay with inclusions (inv. no. 5038). Smoothed surface. The ends are clearly formed.  
Diam. 0.075, length 0.087, weight 500 gr.  
Shallow impressed circles, larger than on the other cylinders. The circles on the main surface form a spiral. No circles on the ends. The total number of circles, 17, is the original number.  
Recording Style C  
FIG. 23, PLATE IXB
- $\Delta 17.23$  Complete, squashed. Off-white clay with inclusions (inv. no. 5036). Surface corroded.  
Diam. 0.080, length 0.103, weight 550 gr.  
Impressed circles on the curved surface, barely distinguishable. Number of preserved circles 12. No circles on the ends.  
Recording Style C  
FIG. 24, PLATE IXC
- $\Delta 17.24$  Complete, chipped at one end. Off-white clay with inclusions (inv. no. 5060). Traces around the hole. Smoothed surface, corroded in places. Ends clearly formed and edges distinct.  
Diam. 0.075, length 0.090, weight 415 gr.  
Deep, impressed circles in groups of three, in three rows. None missing. No circles on the ends.  
Recording Style C  
FIG. 25, PLATE IXD
- $\Delta 17.25$  Half missing. Off-white clay with inclusions (inv. no. 5051). Surface corroded. Preserved length 0.009  
Very few, barely distinguishable circles. Preserved number: 5.  
Recording Style C  
FIG. 26, PLATE XA
- $\Delta 17.26$  Squashed, chipped at both ends. Off-white clay with inclusions (inv. no. 5067). Surface corroded.  
Diam. 0.075, preserved length 0.105, weight 475 gr.  
Fairly deep, rather irregular, large impressed circles only on the curved surface. Number of circles: 9.  
Recording Style C  
FIG. 28, PLATE XB
- $\Delta 17.27$  Complete, squashed. Off-white clay with inclusions (inv. no. 5062). Surface corroded in places. Flat ends.  
Diam. 0.075, length 0.098, weight 550 gr.  
Impressed circles only on the curved surface, boustrophedon in two rows. Number of circles 9 –probably the original number.  
Recording Style C  
FIG. 27, PLATE XC
- $\Delta 17.28$  Complete, squashed. Off-white clay with inclusions (inv. no. 5055). Cylindrical surface corroded in places. Flat ends.  
Diam. 0.075, length 0.090, weight 475 gr.  
Impressed circles, sparsely arranged on the curved surface. 10 circles on main surface and 2 on one end.  
Recording Style C –with some reservation, since there are two circles on one end, which is not usual in this recording style.  
FIG. 29, PLATE XD

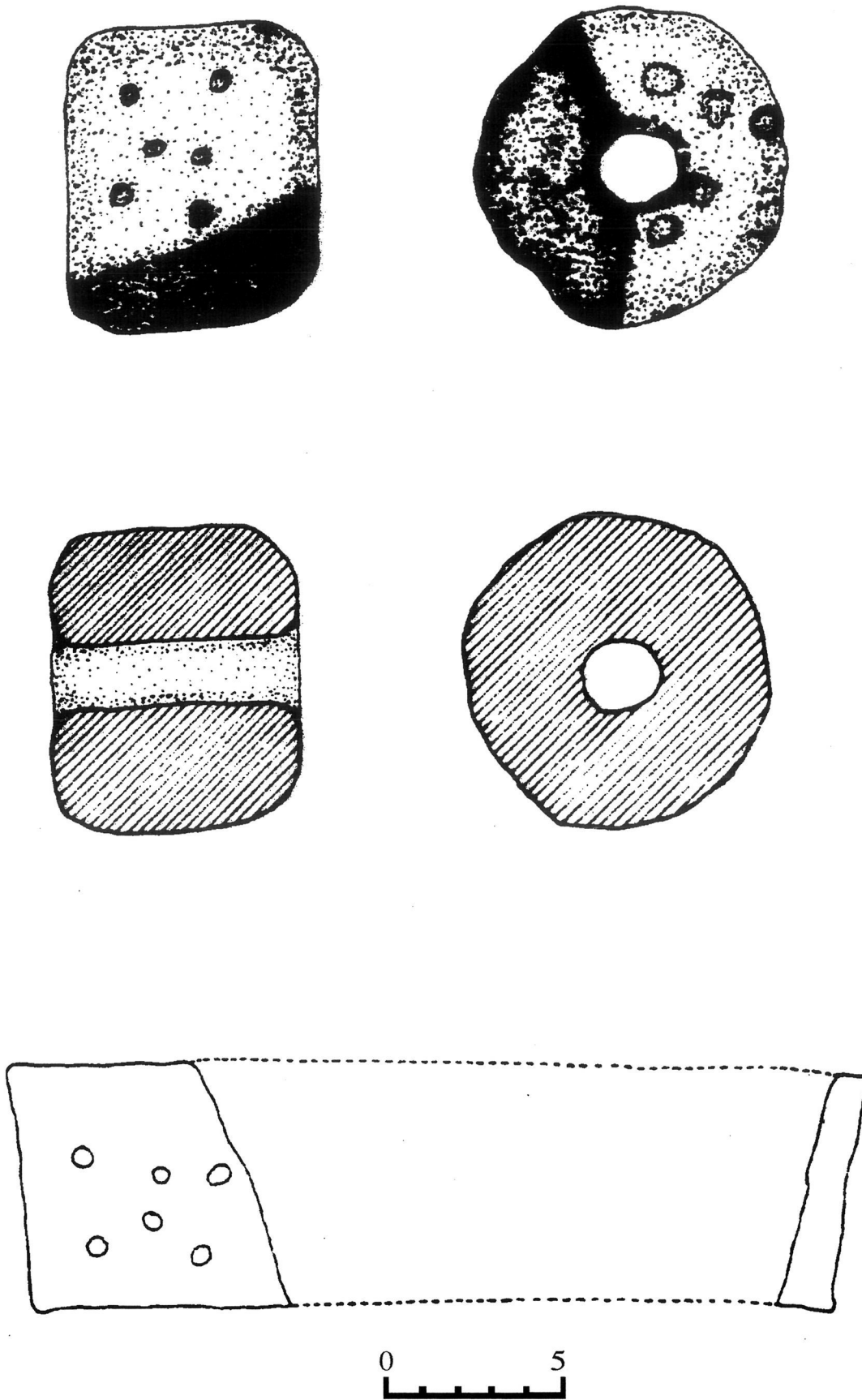


Figure 22: *Cylinder no. 17.20 from the Delta Room 17*

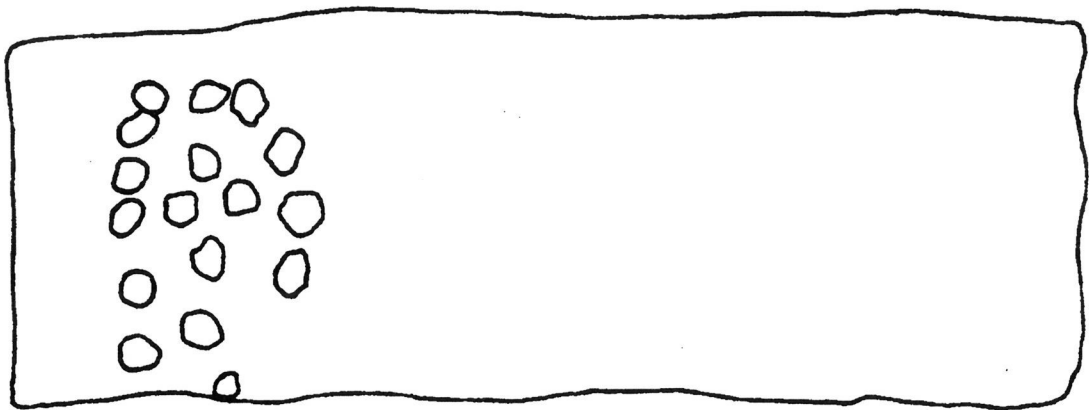
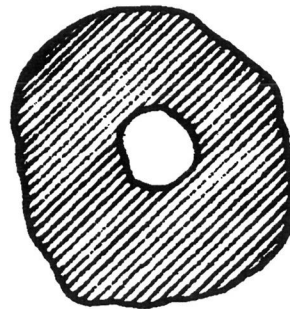
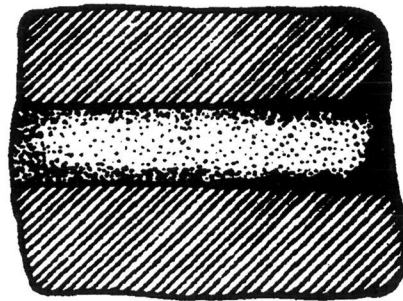
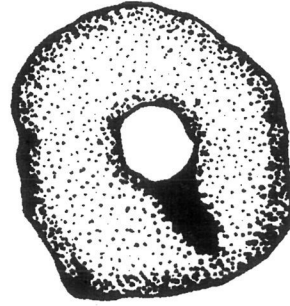
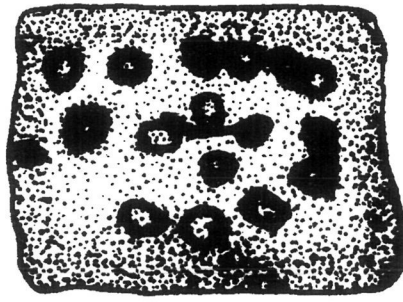


Figure 23: *Cylinder no. 17.22 from the Delta Room 17*



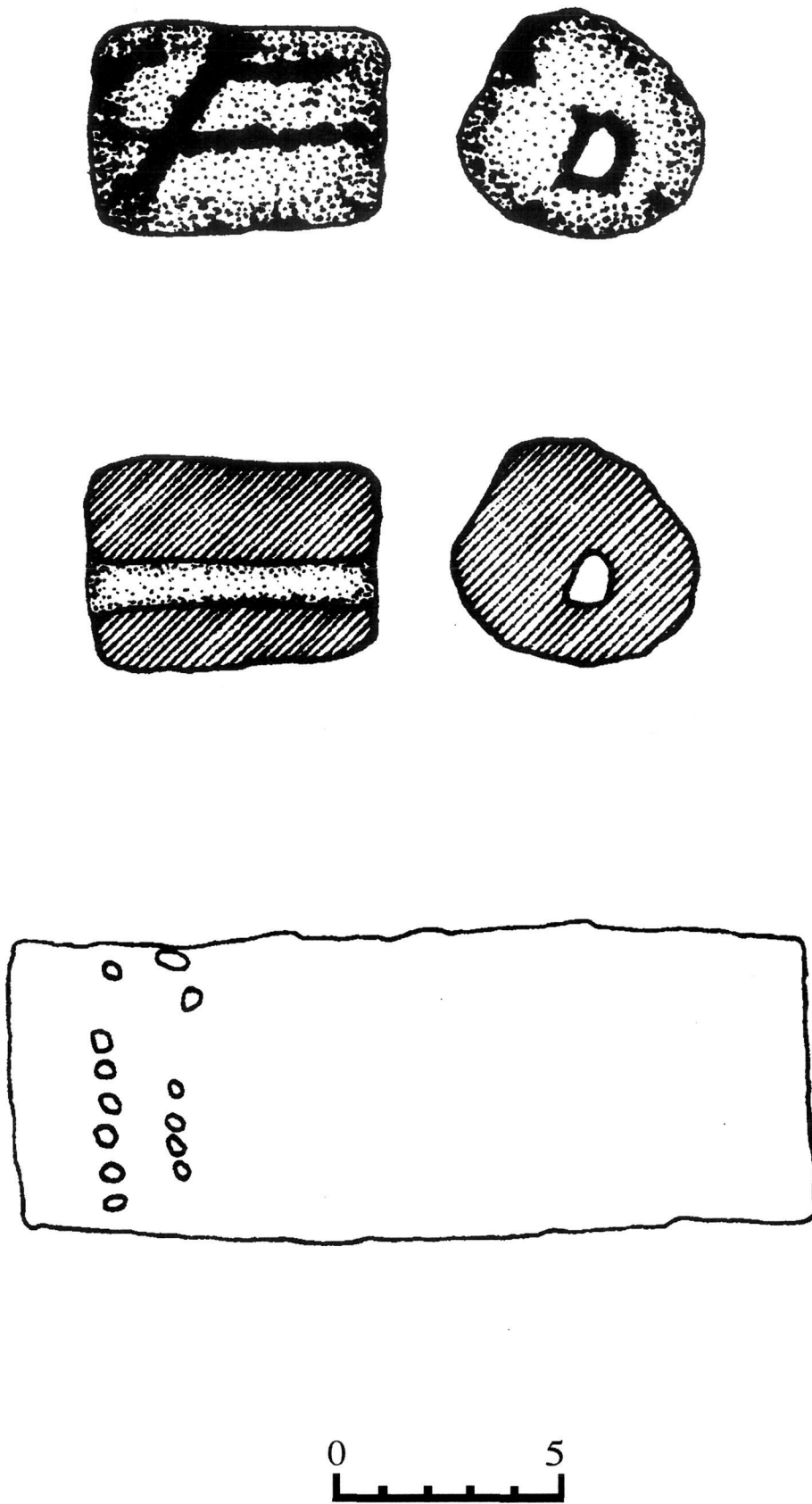


Figure 24: Cylinder no. 17.23 from the Delta Room 17

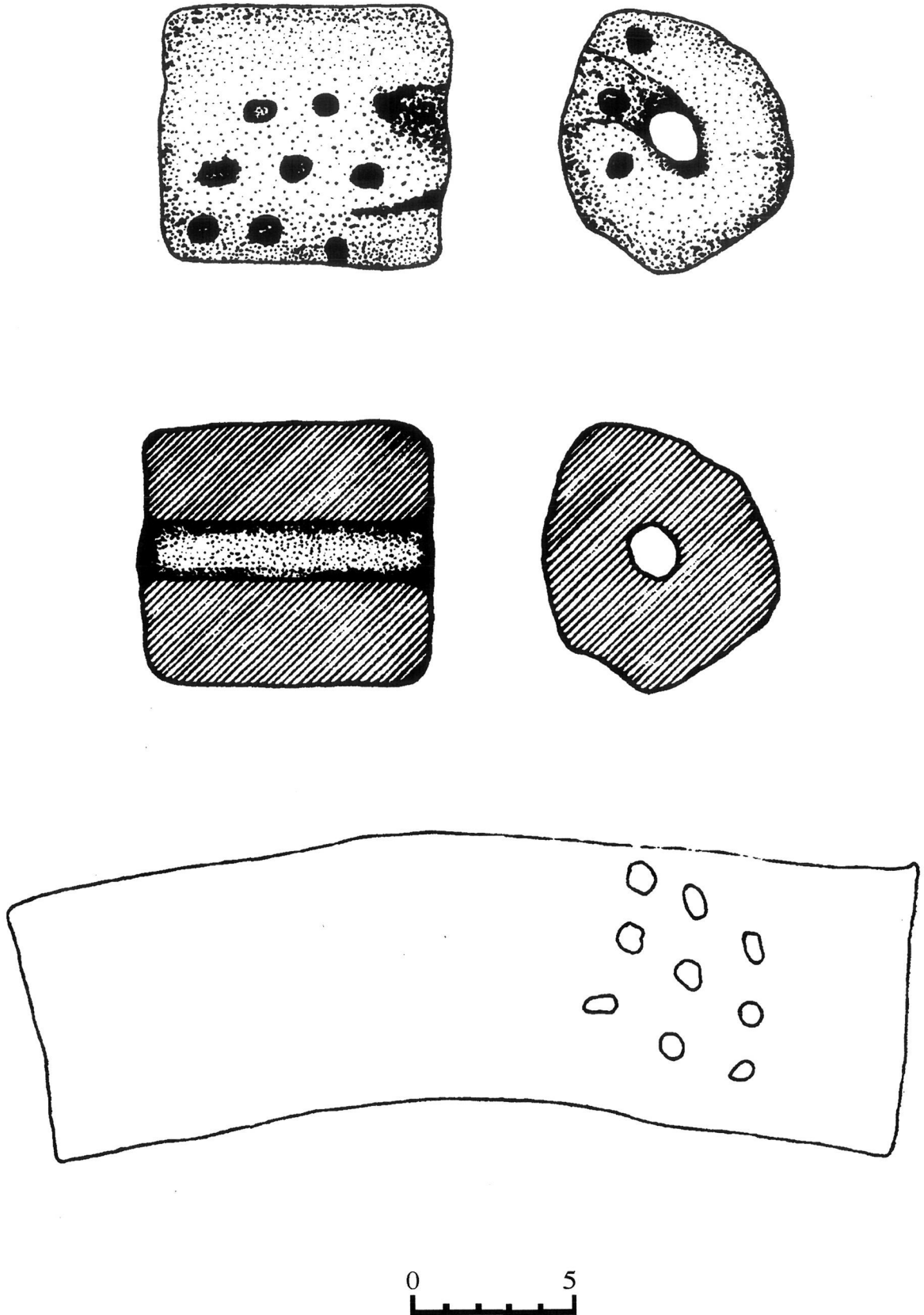


Figure 25: *Cylinder no. 17.24 from the Delta Room 17*

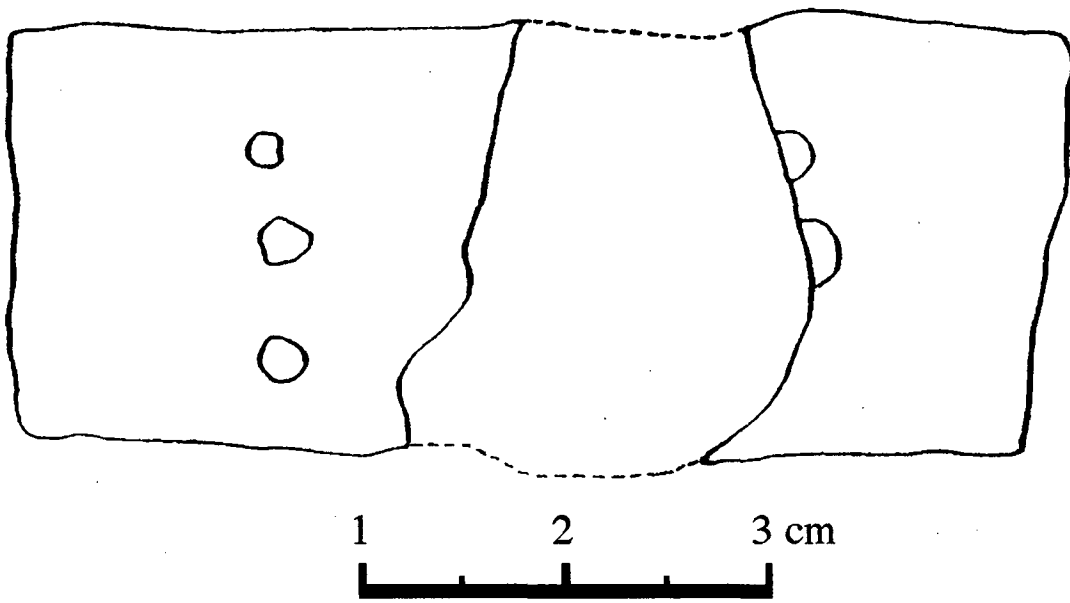


Figure 26: *Cylinder no. 25 from the Delta Room 17*

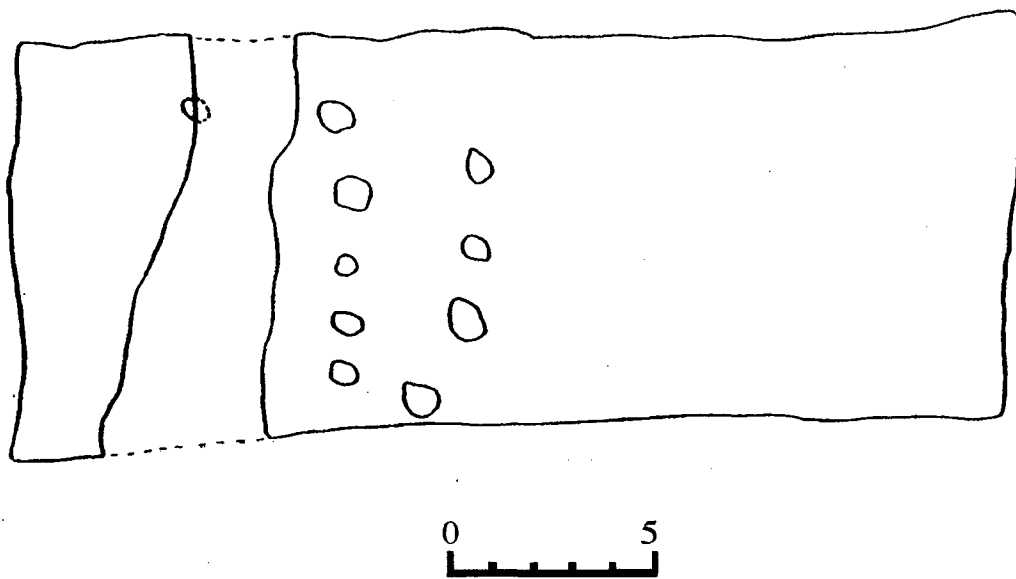


Figure 27: *Cylinder no. 17.27 from the Delta Room 17*

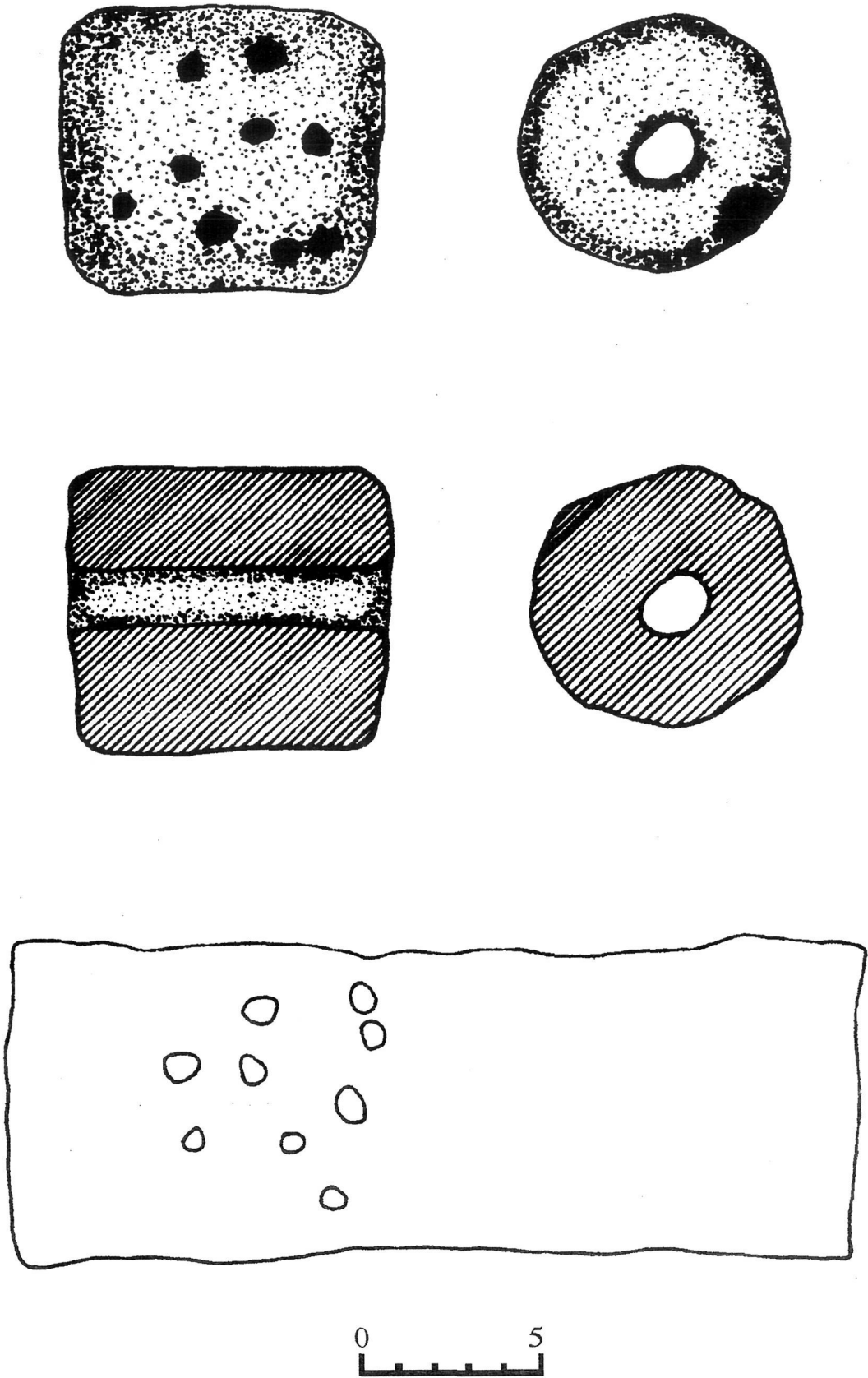


Figure 28: *Cylinder no. 17.26 from the Delta Room 17*

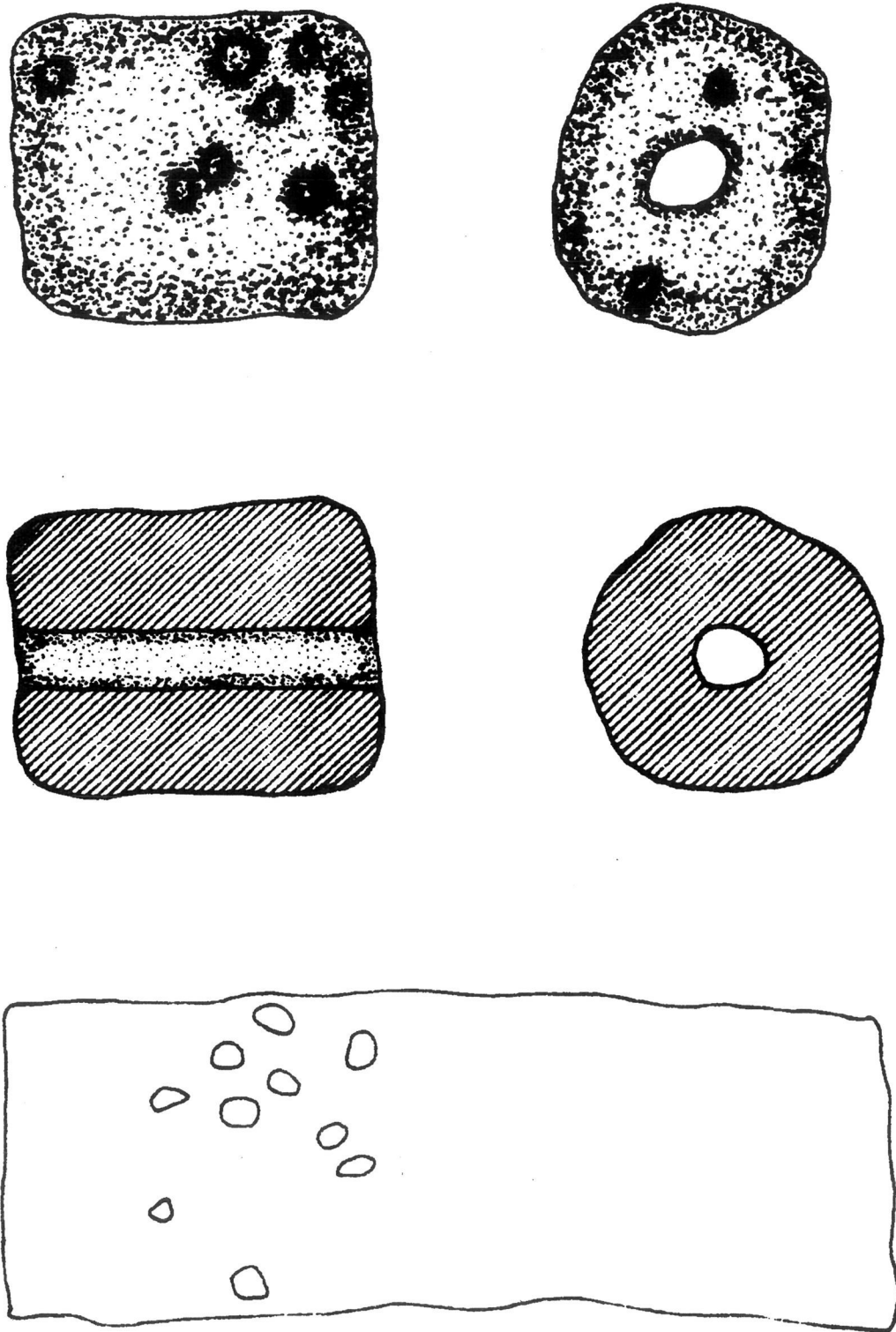


Figure 29: Cylinder no. 17.28 from the Delta Room 17

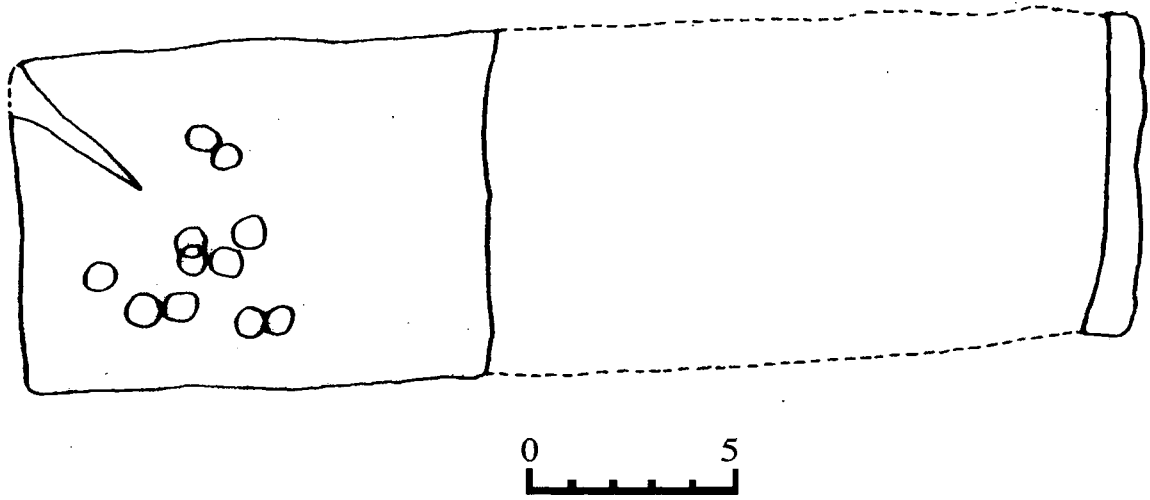


Figure 30: *Cylinder no. 17.29 from the Delta Room 17*

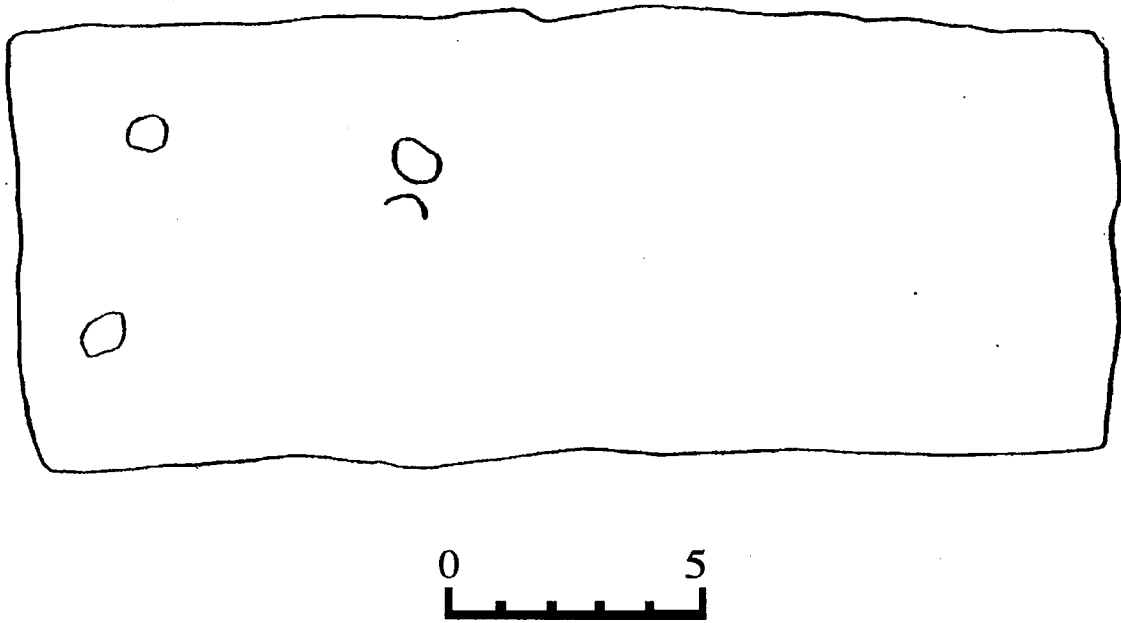


Figure 31: *Cylinder no. 30 from the Delta Room 17*

- Δ17.29 Large part missing, squashed. Off-white clay with inclusions (inv. no. 5050).  
Surface corroded.  
Diam. 0.080, preserved length 0.08  
No circles on the one preserved end. A few, large, shallow circles, like those on Δ17.22, on the curved surface. Some of them are in contact with others. Number of preserved circles: 11.  
Recording Style difficult to establish: possibly C, though with the difference that the circles are irregular and in contact with each other, as in Δ17.26.  
FIG. 30, PLATE XIA
- Δ17.30 Completely squashed, incomplete (inv. no. 5039). Off-white clay with inclusions.  
Traces around the hole.  
Diam. 0.075, preserved length 0.09  
The part of the curved surface bearing the circles is completely squashed. Four shallow circles can be made out with difficulty. There seem to have been no circles on the ends.  
Recording Style C  
FIG. 31, PLATE XIB
- Δ17.31 Small part missing, squashed, surface corroded (inv. no. 5059).  
Diam. 0.075, length 0.092, weight 450 gr.  
A few badly formed, shallow, large circles on the corroded surface. No circles on the ends.  
Recording Style difficult to establish: possibly C  
PLATE XIC
- Δ17.32 Complete, slightly squashed (inv. no. 5037)  
Diam. 0.075, length 0.10, weight 525 gr.  
Impressed circles in two rows on the curved surface and on one end. Each row consists of five circles. The rows begin from one end, occupy the full length of the curved surface, turn boustrophedon at the other end and finish at the next circle on the first end.  
Numbers of circles 6 plus 10. None missing.  
The Recording Style, D, resembles A in its practices but uses a larger implement. There is some visual resemblance with Δ17.33.  
Recording Style D  
FIG. 32, PLATE XID
- Δ17.33 Complete, squashed, significantly smaller (?), surface, damaged in places (inv. no. 5063). Rounded edges which form a continuous curve ending at the hole.  
Diam. 0.045, length 0.060, weight 375 gr.  
Two rows of impressed circles, boustrophedon, one of 7 and the other of 6 circles. No circles on the ends. This is the only small cylinder in the settlement bearing circles.  
Recording Style D  
FIG. 33, PLATE XIA
- Δ17.34 Incomplete, squashed, corroded surface. Off-white clay with inclusions (inv. no. 5033)  
Diam. 0.070, length 0.11  
Shallow impressed circles only on the curved surface. Number of preserved circles: 16.  
Recording Style difficult to establish: none of the above.  
FIG. 34, PLATE XIIB

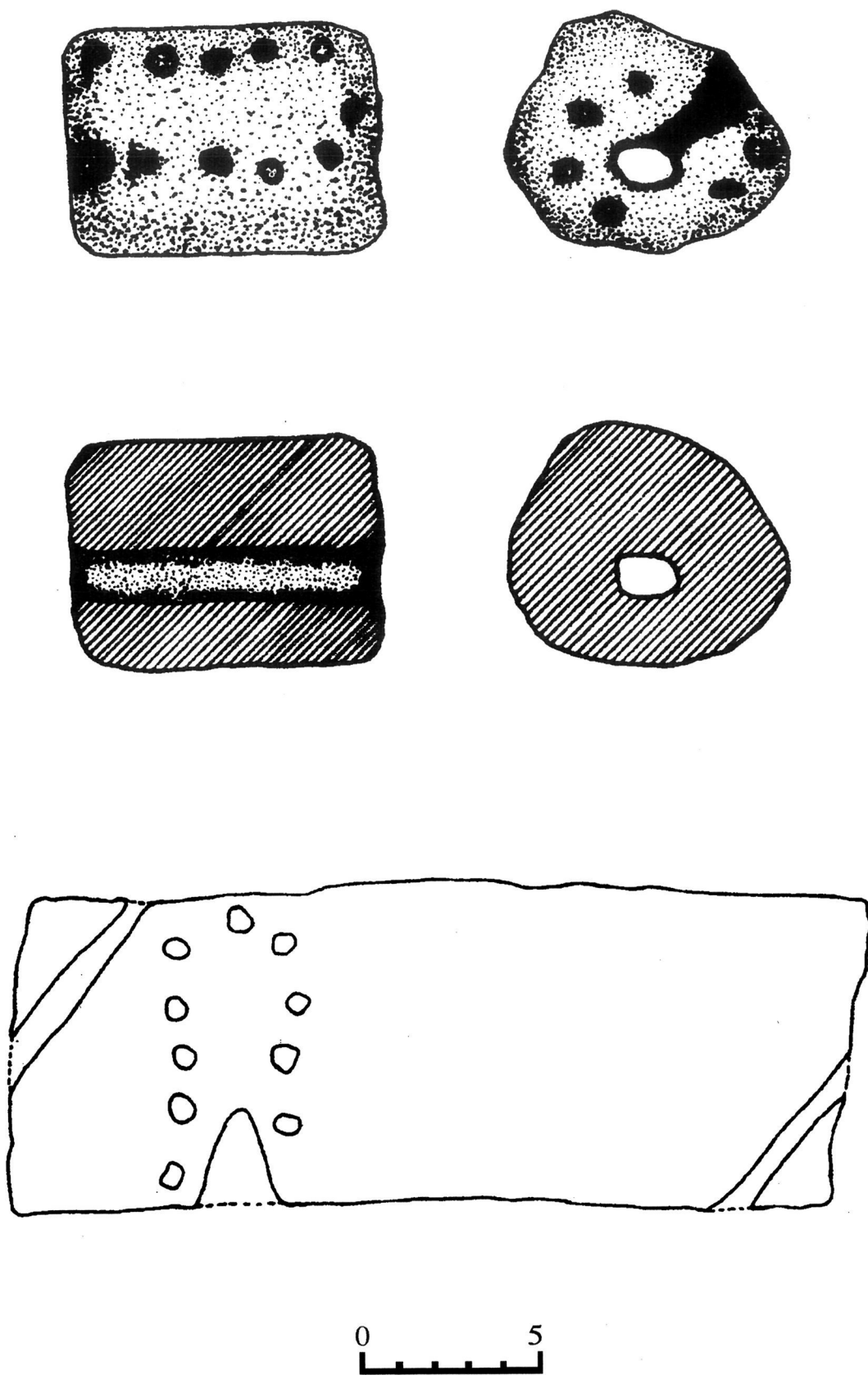


Figure 32: *Cylinder no. 17.32 from the Delta Room 17*



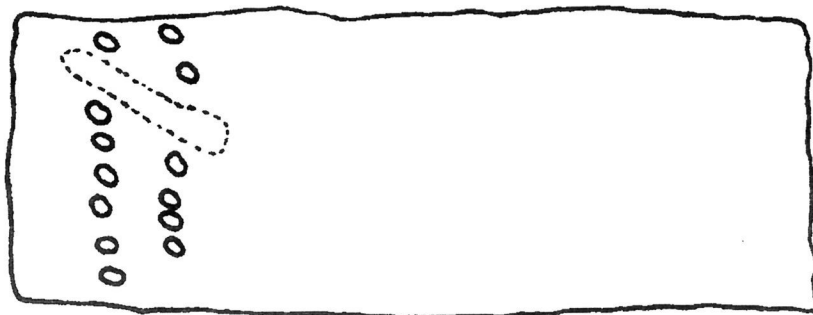
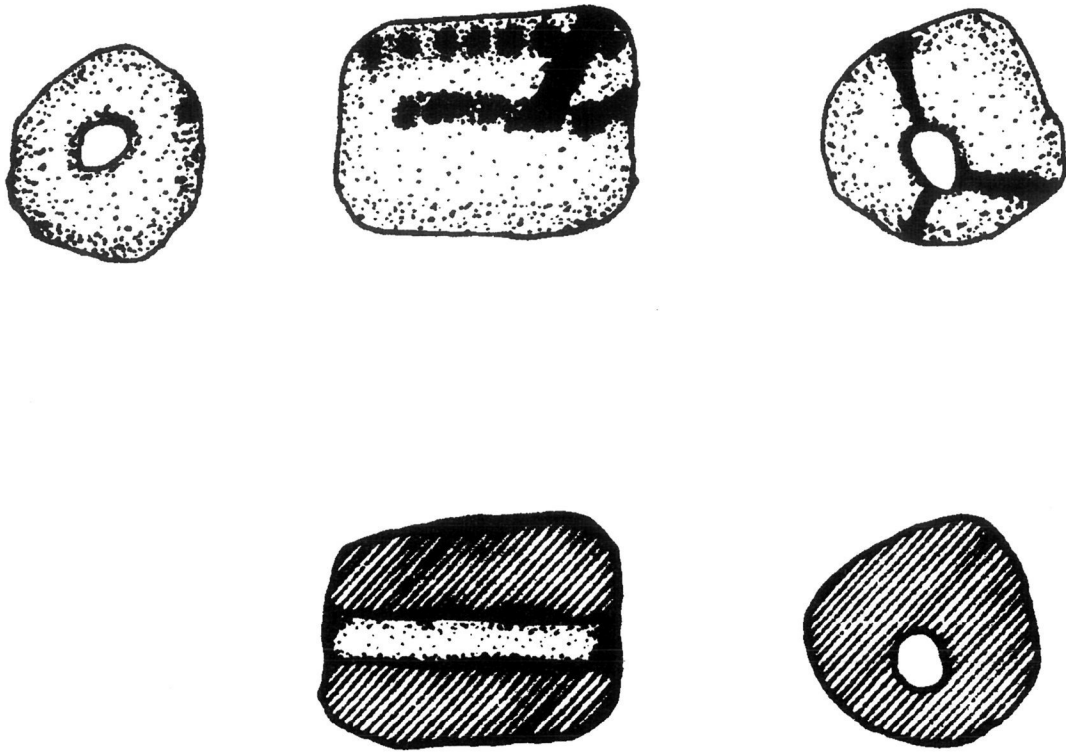


Figure 33: Cylinder no. 17.33 from the Delta Room 17

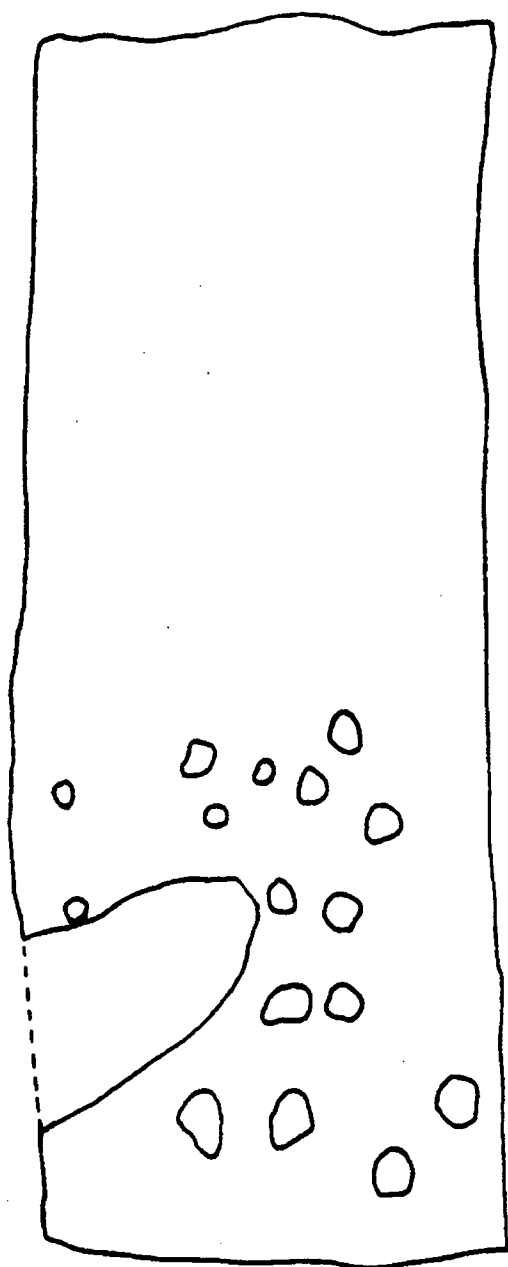


Figure 34: *Cylinder no. 17.34 from the Delta Room 17*

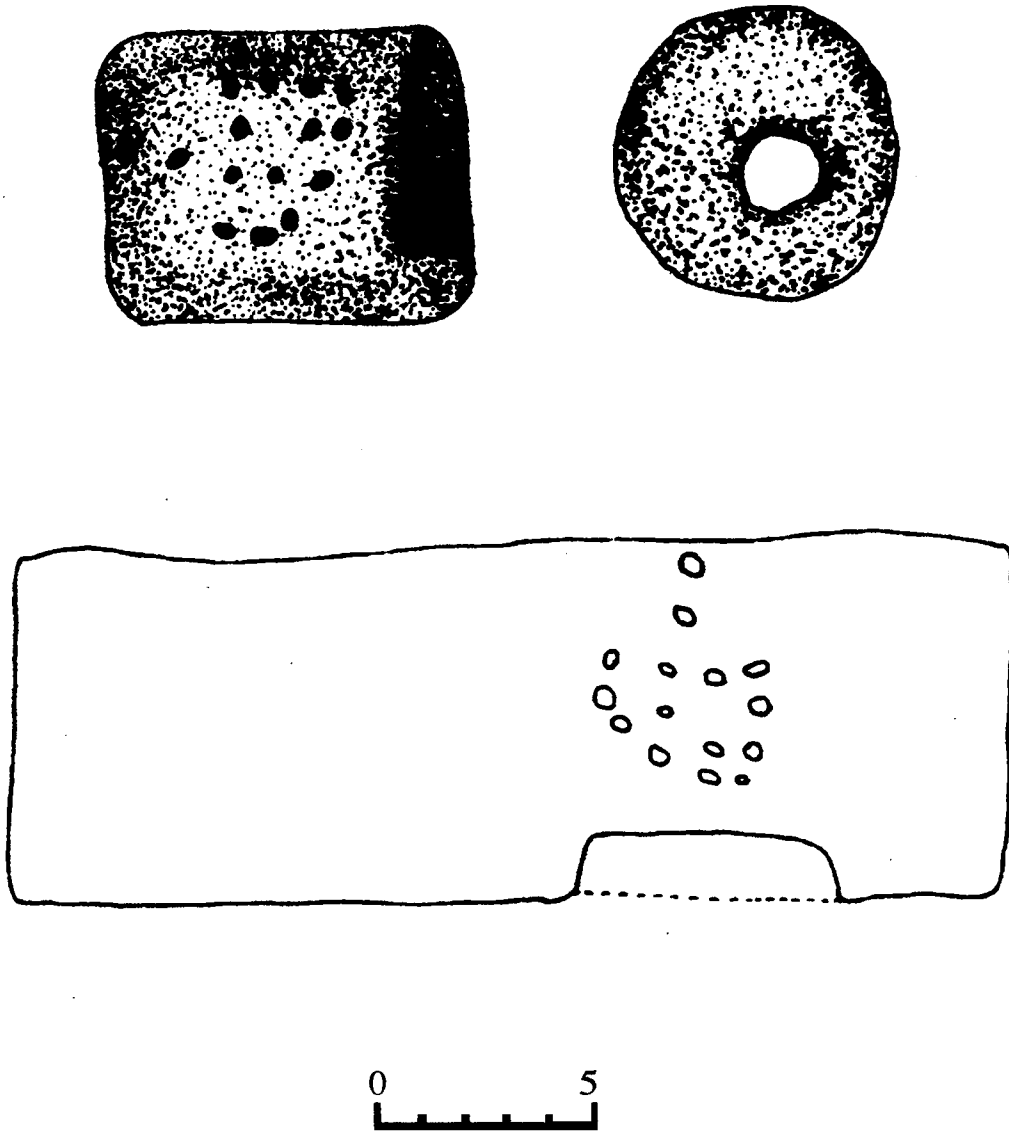


Figure 35: Cylinder no. 17.35 from the Delta Room 17

- Δ17.35 Part of one end missing, squashed. Off-white clay with inclusions (inv. no. 5058)  
 Diam. 0.075, preserved length 0.09  
 Impressed circles on the curved surface in four rows, boustrophedon, distinctly smaller than the ones on other cylinders. No circles on the ends. Number of circles: 15.  
 Recording Style difficult to establish: none of the above.  
 FIG. 35, PLATE XIIC

To these should be added about 8 pieces of squashed cylinders. It is not clear to how many cylinders these belong. There are also about 10 other small fragments, for which it is again unclear to how many cylinders they belong.

From the first excavation season in 1967, S. Marinatos published three cylinders, discovered in the trench 'Arvanitis 2'. According to his descriptions, these are similar to those from Δ17 (Marinatos 1968, pp. 146-147 pl. 132c). They were found on the floor of the upper storey and have impressed circles like those from Δ17. Unfortunately the numbers of circles are not recorded, but the description suggests that they form a group, like the cylinders from Δ17<sup>9</sup> (PLATE XIII). I believe that they probably came from Δ17.

#### *Data analysis of the cylinders from Δ17*

It should be borne in mind that part of the room Δ17 lies in the bed of the winter torrent that crossed the ruins of the settlement, and the evidence is therefore disturbed.

The cylinders in this group have the same basic morphological features as the previous ones, that is, a similar shape and similar dimensions. They have some important new characteristics, however, that make them a completely distinct category.

The first of these characteristics is their large number. When the fragments are taken into account, there were probably about 50 of them. The second largest group is the seven cylinders from the West House, though only five of these can be regarded as a group, on the basis of their find spots. The group from Δ17 is thus substantially larger. There can be no doubt that they form a group, however, since they were all made of the same clay and probably at the same time. They are thus by far the largest group.

The second difference is in the way in which they were found. They were discovered all together in a heap in the south-west corner of Δ17, on the floor of the upper storey, along with an upturned kyathos (PLATE XIV). All the other cylinders from the settlement were discovered in twos or threes; the largest number was five, and even these were scattered at different parts of the upper part of the staircase in the West House, not in a heap. The majority of these other cylinders were probably discovered in the position in which they were used. The only ones found in a heap were the cylinders from Δ17.

<sup>9</sup> I was unable to find these cylinders in the storerooms.

The third feature is the presence of the impressed circles on the curved surface and the ends. These are the only cylinders from Akrotiri with impressed circles, apart from those reported from the 1967 excavation (see above), which were also found in the same way, in a heap, in the same area, and probably in the same room.

If these three elements are combined, two conclusions emerge. First, that the difference between these cylinders and the others is that these were assembled and stored. They are the only ones in the settlement that were stored in this way. Second, only the stored cylinders have impressed signs. They were probably, therefore, stored because of these signs, which were the source of their interest and made them worth keeping.

It is perhaps worth noting that they were found squashed, but not broken into fragments, which suggests that they were not completely dry when they were piled up. This would also account for the fact that some cylinders bear the impression of the one that was piled on top of them.

#### *Cylinders on Thera outside the settlement of Akrotiri*

Cylinders have been found on Thera outside the settlement of Akrotiri, in two sites: the old German excavation at Potamos and at Phtellos.

Potamos is a winter torrent to the east of the settlement now being excavated. In 1899 a small-scale excavation was conducted here by R. Zahn, alongside baron Hiller von Gaertringen's excavation at the Classical town of Thera. A preliminary report on this excavation was published in the three-volume work on Thera (Hiller von Gaertringen 1904, pp. 38-47). At present it is not clear whether the area involved was part of the town of Akrotiri or a group of houses a short distance outside it. The excavation was of limited extent. Amongst the finds, mention is made, in addition to the pottery, of weights, a gold bead, and pierced cylinders of unfired clay. The way in which the reference is formulated suggests that there were several of these.<sup>10</sup> No more precise details of their findspots exist.

Phtellos is about 1 kilometer to the south of Phira, and therefore some considerable distance from the settlement at Akrotiri (Doumas 1973, p. 163, pl. 78b). It is a small structure with two rooms surrounded by open areas. Doumas considers it to be a shepherd's installation. The finds were rather scanty and do not exhibit the wealth of Akrotiri. They were mainly pithoi and stone tools. One clay cylinder was found on the floor of the ground floor of the building.

#### *PART TWO: Analysis of the archaeological data*

So far the cylinders have been listed by group and findspot, with a brief description of their individual features. In this part an interpretation of them is attempted.

<sup>10</sup> These cylinders cannot now be located.

When, as in the case of these cylinders, the function of an artefact is completely unknown, exploration of features that may possibly suggest some hypothesis is based on the assumption that its shape, dimensions and material are determined by the function for which it was intended, or to which it is ancillary, or of which it forms part. An artefact assumes its form by a gradual process, and may change or remain unaltered, depending on the environment and its development. A variety of non-technical and non-functional factors, usually described by the single word cultural, also exercise an influence on this process. Nevertheless, the fundamental characteristics of shape, size and material must inevitably be consistent with its function. This is our starting point, and these elements must therefore form the basis of the investigation of the function of the cylinders.

### *Material*

The question of the kind of clay of which the cylinders were made is of interest in that it illuminates the manner in which, and possibly also the purpose for which, they were manufactured.

Apart from the cylinders in the House of the Ladies, all the others were made of local earth, a compound of volcanic ash. The manufacturers and users presumably simply took earth from outside their houses, where it was easiest to find. This accounts for their being so crumbled. The presence of many small pebbles in the clay is due to the fact that these gave them stability and cohesion. In the absence of these inclusions, the pure clay would crack and break as it dried and contracted. The inclusions, therefore, as in the case of pottery, are deliberate and calculated to control the contraction.

Another interesting feature is that in most cases, all the cylinders of a particular group were made of the same clay and may therefore be assumed to have been made at the same time; they were not artefacts that were intended to be preserved and kept. If this had been so, different cylinders from different batches, and therefore of different fabrics, would have been found together. This is so in only one case, that of the cylinders in  $\Delta 2$ , but here, unfortunately, neither the position or the context is clearly recorded in the day-books. As a rule, the cylinders were made in a single batch and used on the spot for a single occasion.

Certain differences can nevertheless be detected. The two largest cylinders from the House of the Ladies are made of a different, more argillaceous clay. I believe that the use of a different clay in these two large cylinders represents an attempt to make them more durable, in view of their size. If the usual, friable clay had been used, they might have disintegrated at once. This different kind of clay was brought from further away; the users (and manufacturers) could not find it ready to hand and perhaps fetched it from the pottery workshops where it would have been available. In this case, then, some planning and a greater effort was required.

Finally, account should be taken of the fact that they were not fired. They were probably left to dry slowly in the shade. This was so apparently for two reasons. One is that they were used very soon after they were made, possibly while they were still drying. This is attested by the marks left by the slab of the bench on one of them, HL 2, and by the fact that all of them seem to have been affected by the pressure of their weight while drying, creating the flattened area at one point of their surface. The other reason is connected with their purpose. The cylinders were not meant to be kept, and no interest was shown in their conservation. Since they were unfired, they easily crumbled, and were thrown away. Or they could be remodelled with the addition of water. It may be no coincidence that no cylinder fragments have been found in the debris. All of them were found *in situ*.

### *Shape*

The shape of the artefacts under examination is that of a cylinder, pierced lengthways and with rounded edges and sometimes ends. The shape is standard, though the fact that they are handmade has led to minor variations. No cylinder is absolutely identical with another. There are variations in the form of the two ends and their relation to the curved surface. These variations fall into three categories, based on the way in which the ends are formed (FIG. 36).

a. The edges are simply rounded by hand. The transition between the curved surface and the ends is thus smooth, though the point separating the two surfaces is clearly identifiable and they are quite distinct. The vertical end tends to be flat (FIG. 36 bottom).

b. The edges do not really exist, since they are rounded to the degree that there is not real distinguishing line. The transition from the curved surface to the end is secured by a continuous curve (FIG. 36 top right).

c. The edges are distinctly formed, since the ends are completely flat and at right angles to the curved surface (FIG. 36 top left).

In the case of the cylinders with impressed circles, their profile is related to the recording style (see below, Recording Style B). This probably indicates that the maker of the cylinder and the recorder were the same person.

The cylinders of medium size (see section on dimensions and weight) that have no impressed circles, such as those from the West House, are all of type a – that is, although they have rounded edges, the ends are distinguished clearly from the curved surface.

Other differences in the profile are due mainly to the dimensions of the cylinders. The two large cylinders from the House of the Ladies have vertical, completely flat ends and sharp edges. I believe that, apart from the question of how the signs were arranged, the profile did not play an important role in the function of the cylinders. The important functional feature is the hole pierced lengthways, through which something was passed, perhaps a twig or a piece of wood. Certainly something inflexible, and not a piece of rope. Something else

was attached to it, or the branch itself may have pierced something (fruit, threads, strips of leather, etc.).

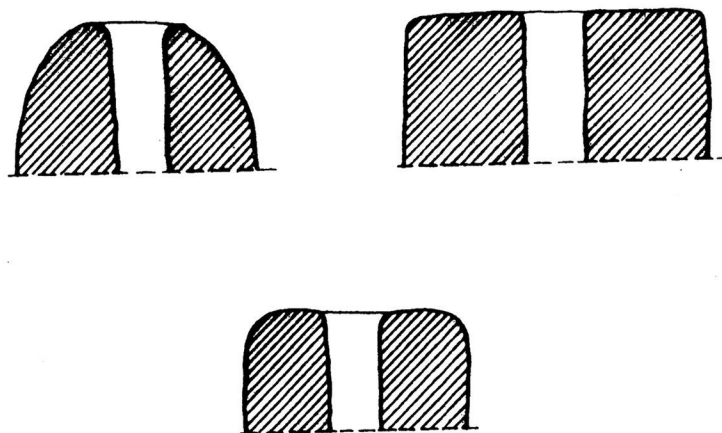


Figure 36: *Schematized profile of cylinder ends*

#### *Dimensions and weight*

When the cylinders from the settlement are examined as an assemblage, it is at once apparent that they can fall into three categories based on their size. This is confirmed by the measurements (FIG. 37).

i) The great majority, involving about 55 cylinders in a relatively good state of preservation, are about the same size.<sup>11</sup> They are about 0.09 to 0.11 long and have a diameter of about 0.075 to 0.090. These are the dimensions of most of the cylinders, and of all those from  $\Delta 17$  except one.

ii) The second clearly distinguishable group consists of cylinders of distinctly smaller dimensions, with a length of 0.07 to 0.08 and a diameter of 0.06. There are only a few specimens in this group, to which only two from the West House and one from  $\Delta 17$  clearly belong.

iii) The third group comprises the significantly larger cylinders. In this case there are only two specimens, with dimensions of 0.18 (length) and 0.10 (diameter). These are the only large cylinders found so far in the settlement.

It is thus apparent that the ratio of cylinders to their size differs greatly. The composition of the groups also reveals some similarities. I believe that a tendency to use them in pairs can be detected which is very clear in the House of the Ladies and the House of the Anchor, and also in the case of two cylinders from  $\Delta 17$  or  $\Delta 18$ . In each pair the cylinders are of the same size.

It is not easy to group the cylinders on the basis of weight. The same standardisation is not observed here, since the weight varies not only with size, but also with the composition of the clay. There is a tendency to cluster around

<sup>11</sup> The fact that numbers of cylinders are frequently given as approximations is due to the fact that many are preserved only in fragments.



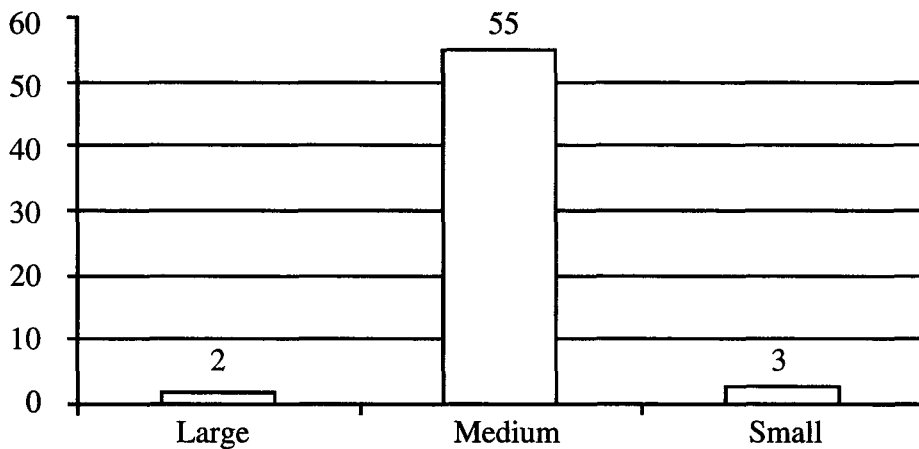


Figure 37: *Number of Cylinders by Size Category*

certain weights: the medium-sized group contains 16 cylinders with an average weight of 520 gr. and 5 that deviate at about 620 gr. The two largest from the House of the Ladies weigh about 2750 gr. and the two smallest are about 350 gr. Classification by weight is hazardous, however, since cylinders of the same size have different weights.

Two final observations on size. First, variations within each category are small. The cylinders exhibit a remarkable uniformity of size, to the extent that it is legitimate to speak of standardised sizes. Second, their size is such that they can easily be held in the hand, lifted and moved –that is, they can be handled with ease. The ‘pairs’ of cylinders could, therefore, easily be handled by a single person using both hands. It is only the large cylinders that require the use of both hands to grasp and handle each of them comfortably.

#### *Experimental reconstruction (PLATE XV)*

An attempt to reconstruct the cylinders was made as part of the investigation into their function. Usually in such experiments the use of the artefact is known, and technical operation (*chaîne opératoire*) is designed to confirm, or to identify technical problems and possible solutions to them. Such experiments could not be made in the case of the cylinders, since their use was unknown. The experimental tests focused solely on how they were made. Despite this, some useful evidence emerged.

It should be stressed that the technical and social environment of the activity of which the cylinders formed part is completely unknown. By this I mean the immediate context for the specific activity. To secure at least the same material conditions, earth was taken from the fill of the excavation, below the destruction level, at a fairly deep point, from where the earth used in the actual cylinders was probably taken. Efforts were made to ensure that it was of similar texture and appearance. The earth was sieved to reduce the number of inclusions, though not to remove them entirely, since the clay used in the cylinders had several inclusions. As became clear, these were deliberate, since otherwise the cylinders cracked as they dried.

During the actual reconstruction I endeavoured to follow the stages and methods of manufacture suggested by their form. A lump of clay was formed into a cylinder with a diameter the same size as that of the ancient cylinders, that is, between 0.075 and 0.085. This was then cut into lengths roughly equal to the ancient ones, that is, 0.90 to 0.10. The curved surfaces were then smoothed using the fingers and palms and the ends rounded. I then inserted a reed lengthways to form a transverse hole with a diameter of about 0.02. This method produced cylinders fairly similar in appearance to the ancient ones.

Let us now see what had been learned so far. First of all, that the size can easily be achieved by visual assessment, and this was probably the ancient practice. Homogeneity with regard to size could be attained without any special effort, perhaps simply with the use of a makeshift measure for the length or diameter (the palm, a finger, a branch). Second, the traces around the hole (as, e.g. in the case of WH 4) are created when the reed is passed through the cylinder to form the hole. These traces seemed at first sight to have been made during use, but the experimental reconstruction suggests that they were made when the reed was passed through them to form the hole. There is still a degree of uncertainty here, however, which will be discussed below.

I next tried to establish how the impressed circles were made. I took a reed and a branch, the former hollow and the latter solid. After two or three attempts it became clear that the circles were made by a branch, not a reed. The circular signs were easy to impress. The smaller circles could be made by pressing lightly on a branch of any kind. In fact, they are a kind of punctuation. The circles were shallower when they were impressed after a few hours, when the clay had begun to dry and yielded less to the same pressure. The latter, shallower circles, found touching the deeper ones (e.g. in Recording Style B), were thus made some time later, when the clay had already dried somewhat, making them shallower. The time lapse will have been of the order of three hours.

This second stage thus furnished two further pieces of information. One is that no special tool was required to make the impressed circles, since any ordinary branch would produce precisely the same markings. The other is that the shallower circles were not the product of less pressure, but resulted from their having been made later in time, after the clay had already dried a little.

I also observed the length of time it took for the cylinders to dry, since this is a question that appears to be critical to their function. I again attempted to reproduce the ancient conditions. The cylinders were left outside in the shade in the afternoon and overnight. By the afternoon of the following day they were completely dry –that is, they took a full twenty-four hours to dry in the shade, in summer. I noted that the ones that had several small stones included in the clay dried better, since this prevented cracking. As they dried, they all yielded under the pressure of their weight, creating a flattened area at one point of the cylinder; this appears at first sight to have been made deliberately, but is in fact simply created by the weight of the clay as it dries. An interesting detail arises at this point. The cross-section of the holes running lengthways through the cylinder

does not appear to have been modified during drying by the weight of the clay. They continued to have a round, not oval cross-section. Either, therefore, the branch was left in the hole for at least the drying period, which would account for the circular cross-section and the fact that not all the cylinders have traces around the hole; or it was taken out while the clay was still wet and traces were left around the hole, but it was reinserted by the user while the cylinder was still quite wet and before there was time for the shape of the cross-section to change. That is, in every case, the branch was in the hole when the cylinder was used.

#### *Distribution in the settlement*

The distribution of the cylinders within the settlement exhibits a number of features that are presented briefly here.

1. The distribution is not uniform. To date, cylinders have been found in the West House, the House of the Ladies, the House of the Anchor, and in complex  $\Delta$ , in  $\Delta 2$  and  $\Delta 17$  (see FIG. 4). It should be noted that they are by no means a common find throughout the entire settlement. Indeed, they are not found at all in some of the houses – none is reported, for example, from complexes A, B and  $\Gamma$ . Even when account is taken of the fact that the excavation is far from complete, this fact is significant.

2. The numbers of cylinders found in the houses are various and totally uneven. They begin with almost 50 from  $\Delta 17$ , and the smallest number is 1 (Xeste III) or 2 (House of the Anchor). The commonest number seems to be 4 or 5 (West House, House of the Ladies,  $\Delta 2$ ).

3. No cylinder has been found outside the houses. None, whether complete or a fragment, was found in the streets, open spaces, or earth deposits. Most were found on floors inside the houses. Those that were found in the fill of the rooms had fallen from the upper storey, and were invariably inside a house. There are two possible explanations for this phenomenon. It is either due to conservation problems, since the unfired clay crumbled and dissolved very easily, especially as a result of the humidity of the soil, or to the fact that the cylinders were thrown away after use or deliberately broken up. In the latter case, we are dealing with human choice, with an intention. In view of the fact that they were almost all found *in situ*, I am inclined to believe the latter. I imagine that after they had been used, they were thrown away or deliberately broken up, with the same clay possibly being used to make new ones.

4. All the areas in which they have been found are either rooms used for storage or situated close to such rooms. The cylinders from sector  $\Delta$  were found in ( $\Delta 2$ ) or next to storage rooms ( $\Delta 17$ ). The same is true of the West House and the House of the Ladies. Those found on the staircase in the West House will have fallen from the roof, where some products may have been piled up. The converse is not true. Not all storerooms contain cylinders. Given the exceptionally good state of preservation of the site of Akrotiri, this, though admittedly an *argumentum ex silentio*, is nevertheless a valuable argument.

5. It is worth noting that cylinders are reported from two sites outside the main settlement of Akrotiri: once at Potamos, a site directly connected with the settlement, and once further away, at Phtellos (see above).

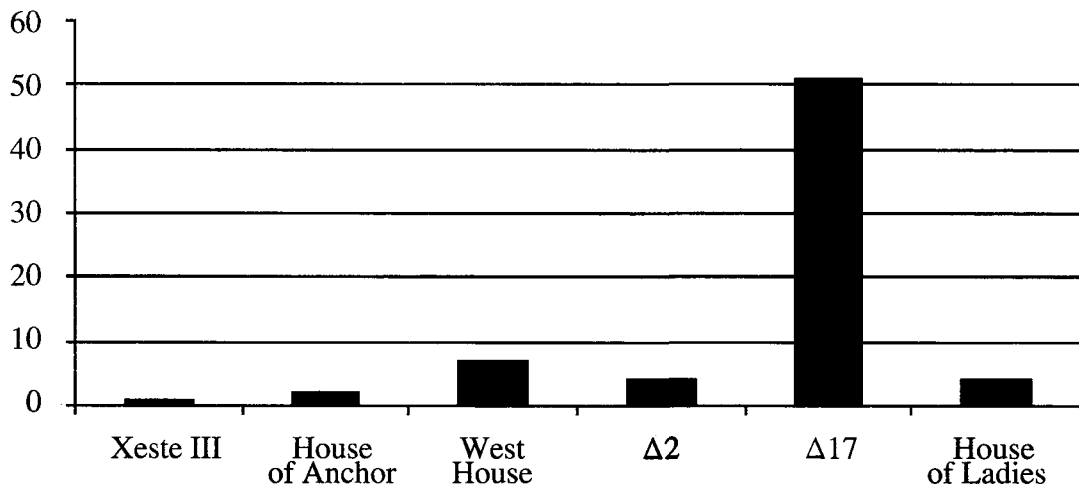


Figure 38: *Number of Cylinders by Findspot*

### *Function*

Cylinders of this kind have sometimes been regarded as weights used in weaving, rather like the loomweights used to stretch the warp on upright looms. This observation was made long ago by Schliemann, who found similar weights at Troy (Schliemann 1880, nos. 1200 and 1201), and was repeated in the case of the Early Bronze Age cylinders found on Lemnos (Bernabo Brea 1964 pl. LXXXIIa).<sup>12</sup> In my opinion, this view cannot be supported. The cylinders from Akrotiri are enormous compared with the other known loomweights and would have been very unwieldy. They would have taken up a large amount of space in the width of the loom and could not easily have followed the movements of the weaver. This would vitiate the main advantage of the warp-weighted loom, which is the ease with which the warp could be moved (Tzachili 1997, pp. 200-202). Second, and more importantly, since they were unfired and crumbling, they would not withstand the tension of the thread that they were stretching with their weight: that is, they would break very quickly and probably cover the threads with dust. Furthermore, cylinders have nowhere been found in association with looms, at least not at Akrotiri. Even in the West House, where the weaving workshop was on the upper storey, the cylinders were found outside the room, higher up on the staircase.

What other purpose could the cylinders have served? I shall now list some of the factors that I believe to be associated with their function, some of which have already been mentioned, and shall then proceed to form a hypothesis.

1. The cylinders have an entirely makeshift construction, indicating that they were probably destined from the outset to be short-lived.
2. There are a number of different, but fixed orders of size, three in all, indicating that the objects involved in the process are of correspondingly different size, and, above all, correspondingly graded. It is also evident that one of these orders is more important than the others, since it contains the overwhelming majority of the cylinders. The others are subordinate to it.
3. The impression of the signs was part of the function of the cylinders, by not exclusively. Another activity which did not need

impressing was carried out. Nevertheless, the two activities are connected, not independent of each other, since they were carried out simultaneously.

4. One circumstance of great significance is that some of the cylinders had signs and others did not. Those with signs were found all together in a heap, stored. Two explanations may be advanced for this: either they were thrown away or destroyed after they had been used and only those with records were kept. Or we are dealing with the same basic process in two phases: the first phase involved the unknown activity (possibly an act of measurement or counting), while in the second the impressed signs were made, after which the cylinders were stored.

5. They were placed in a position resting on the long side. They were not suspended, therefore. The manner in which they were found also points to this conclusion. If they had fallen from a great height they would have broken and smashed.

6. Since they were placed on some surface, it is impossible for any bulky objects to have been hung from the branch that may have been passed through the hole. There would have been no room for this: only a few centimetres would have been available.

7. The cylinders that were piled up and bore records were still wet when they were heaped together, from which it may be concluded that the time during which they were used lasted only a few hours.

8. While the cylinder was drying the branch was still in the hole, for while the cylinders themselves were squashed slightly while drying, as a result of their weight, this is not true of the hole, which remained clearly circular in section, indicating that the branch was in position to prevent this distortion occurring.

9. The entire activity took only a few hours, and certainly less than a full day.

Taking all this into account, I shall try to arrive at a hypothesis based primarily on the proposition that the impressed circles are the record of some act of counting (see below). I believe that the branch passed through the hole was of prime functional importance. To it were fixed or tied, or from it were suspended, the objects to be counted. The branches could not have been passed through the objects themselves, since the available space was too small and the cylinders could not withstand weight or pressure. It is in my view likely that small objects rather like tokens, which were the means of accounting, were attached to or threaded on the branches. The overall effect was of something like an abacus. The objects in question could have been something made of perishable material – pieces of leather, wood, bark, or knotted string. Another possibility is that the counting was done by cutting notches in the wood (FIG. 39). When the wood was removed, the circles were impressed on the cylinders in confirmation, as an archive record or a copy for those taking part in the exchange. The means by which the counting was done was somehow attached and stayed on the branches,

<sup>12</sup> This view is adopted and documented by J. Carrington-Smith (1975) in her unpublished doctoral dissertation.

which remained in position, passed through the cylinder, as long as the counting was taking place. When it was over, they were removed. When the result had to be retained, it was additionally recorded by means of small impressed circles and the cylinders were kept as an archive. The cylinders were made for the specific purpose just before the counting and the branches were passed through them to make the hole and left in position while the counting itself was taking place (FIG. 39).

The difference in size between the cylinders might conceivably be connected with the methods by which the counting was done. The smaller cylinders were perhaps associated with smaller values and the larger ones with larger values. It is worth noting that no large cylinder bearing circles has been discovered so far.

### PART THREE: *The impressed signs*

The most fruitful approach to interpreting the function of the cylinders was that based on examination of those found together in a heap in  $\Delta 17$ .

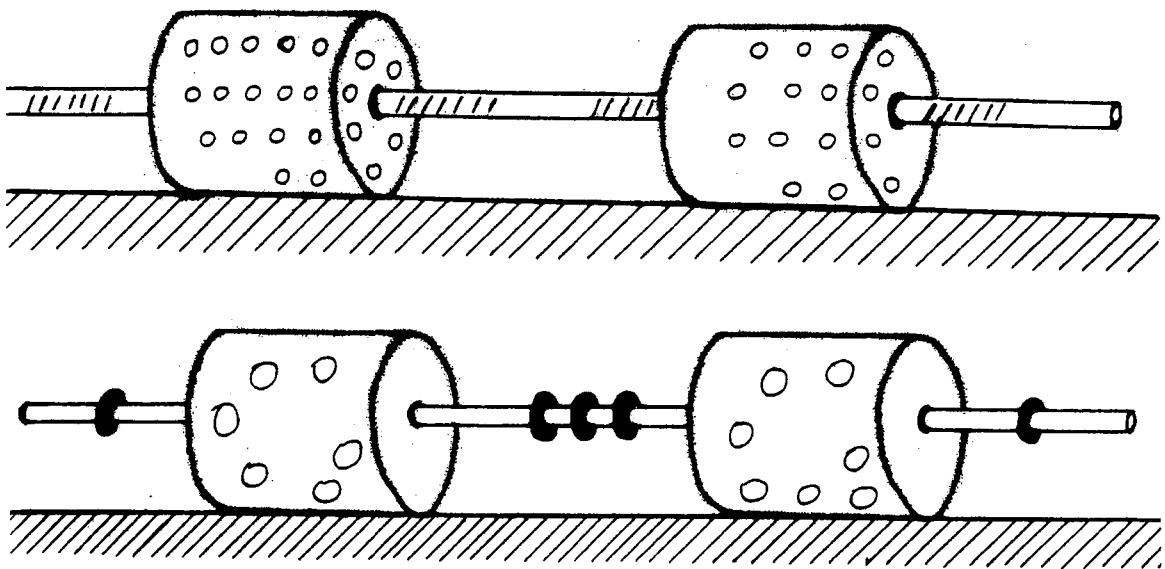


Figure 39: *Suggested function of the cylinders*

The shared features of the cylinders in this group are as follows:

1. The signs all have the same form: they are all impressed circles. On the same cylinder the circles are usually of the same diameter, though occasionally smaller ones are also found. However, the diameter frequently varies from cylinder to cylinder. There is no other kind of sign.
2. The impressed circles are often distributed over a large part of the surface, both the curved surface and the ends, but are never found on the part that served as a base, which takes up about one third of the entire curved surface. This is normally the part that is flattened. That is, during the act of counting, of which the impressing of the circles formed part, the cylinders were firmly placed somewhere, resting on part of the curved surface.
3. The surface of the cylinder that could be seen was covered either completely or partly with circles.

4. There are often impressed circles around the hole on one or both ends, irrespective of whether the available space on the curved surface is filled or not. We cannot say, therefore, which was the main side, and indeed there cannot have been a main side.

5. There are never circles only on the ends, though there may be circles only on the curved surface.

6. The circles are often in rows, which are frequently oblique, deviating from the axis of the transverse hole.

7. The impression of the circles in rows is most commonly made boustrophedon.

8. The circles on the end frequently serve as starting points for the rows extending along the main curved surface. In these cases, the edges of the cylinders have been rounded off with the fingers.

9. This implies that the final form taken by the cylinders depended to a large extent on the manner in which the record of the counting was made.

10. In some cases some of the impressed circles are in contact with each other. This is the case on only some cylinders.

11. Those that are contiguous are frequently shallower and smaller. This is probably due to the passage of time –that is, they were impressed later, and the clay had dried somewhat in the meantime, making the circles shallower.

12. There are great fluctuations in the numbers of circles on the different cylinders. No numeral system emerges from analysis of the numbers. It was apparently a one-to-one system, with each unit measured corresponding to one sign (see below).

13. Finally, the numbers of circles reveal some interesting correspondences between cylinders and recorders (see chapter 'A few numbers').

#### *Recording Styles, personalities of recorders*

Despite the common features mentioned, the recording style used in these signs is not uniform. Fundamental differences can be detected, different methods of recording or, more accurately, different practices. The impressed signs are the same, of course, the only variation being a slight difference in their diameter; but the manner in which they are distributed over the surface of the cylinders differs distinctly. The differences reside in the density of the circles, their position, whether or not they form rows, their number, and even the area of the curved surface covered by them, as well as the implement used.

These recording styles are not fortuitous or casual. They are repeated with a fair degree of consistency. That is, some of the features are repeated consistently on some cylinders, while others are found on other cylinders. It follows that groups may be formed on the basis of these similar features, since the same ones occur on a fairly large number of them. It may reasonably be asserted, therefore, that behind the consistently repeated features lie particular people whose individuality emerges through their habitual practices, people who, while recording the quantities, revealed their personality. We are dealing, that is, with a kind of 'personal script'.

The term 'personal script' is inappropriate, of course, since there is in fact no script, no personal way of moving the pen or stylus to create the letters. Nevertheless, some differences can be identified in the mental 'construction' of the record, mainly in the visual organisation of the space, in the order followed by the signs, in the presence or absence of rows, in their sequence, or in whether or not they are recorded boustrophedon. Since these differences occur consistently, they probably reflect the practices of different people, whether men or women.

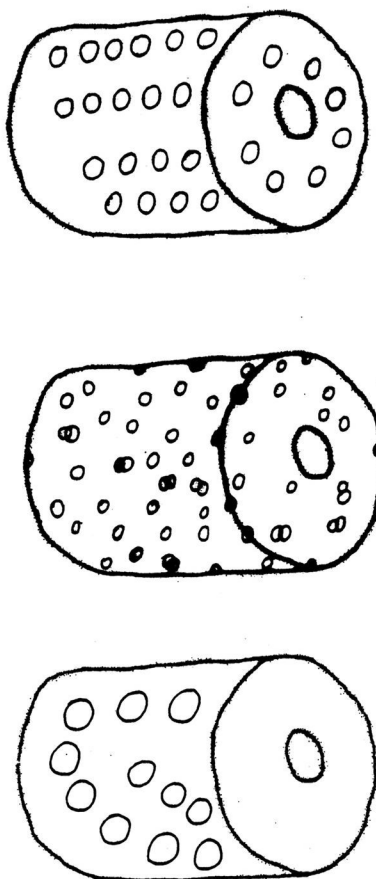


Figure 40: *Schematized Recording Styles*

#### *Recording Style A*

The person behind this style is the tidiest and had a clear picture of the space available and of the number of circles that it had to contain. He or she was therefore able to adapt the signs harmoniously to the space (FIG. 40 top).

The main features of the style are as follows:

- i. The circles are impressed in regular, straight or oblique rows.
- ii. Both the circles and the rows are set equidistantly.
- iii. The record is made boustrophedon, probably beginning at the right.
- iv. The circles occupy part of the curved surface and only one of the ends.
- v. Each row on the curved surface apparently starts from a circle on the end.



- vi. The ends are rounded off by hand, but despite this, they are clearly distinguished.
- vii. The number of circles seems to be constant. There are 26 circles on the large surface on two occasions, and 29 once.

### *Recording Style B*

The practices of the person who made these records are completely different from those of the previous recorder, and the style is therefore clearly distinguishable. The recorder is far less tidy, joined the circles together, and used both ends for the record. The number of circles in this group is much larger (see FIG. 40 middle).

The main features of this style are as follows:

- i. The record is made without forming rows. The recorder seems to have treated the entire surface as a whole and distributed the signs all over it without arranging them in sections or rows.
- ii. Many of the circles are in contact with each other. In these cases, the second circle –the one that seems to have been added later– is shallower.
- iii. The circles on the ends form a continuation of those on the curved surface.
- iv. There are circles on both ends of the cylinder.
- v. The curved surface of the cylinder tapers gently towards both ends. There is hardly any edge, and no attempt is made to distinguish the ends from the curved surface.

### *Recording Style C*

The main characteristic of recorder C, that enables him or her to be distinguished from the previous two, is that he does not make use of either end in recording the circles. As a result, the number of circles is plainly smaller (FIG. 40 bottom).

The main features are as follows:

- i. The impressed circles are clearly shallower. This implies that either the cylinders were drier when the recorder began work, or that he exerted less pressure on his implement –the branch– and had a lighter hand.
- ii. The circles have a larger diameter and were therefore made with a larger implement.
- iii. They are arranged in a spiral on the surface, not boustrophedon.
- iv. The two ends are not used for the record.
- iv. The circles are fewer in number.

### *Recording Style D*

Group D is less clear. There are only two cylinders that may be considered to be in this category. This is hardly a group, but their clear visual affinity suggests

that they were probably from the hand of the same recorder. Meticulous recording.

Main features:

- i. Deep, well-formed circles.
- ii. The circles form only two rows, executed boustrophedon.
- iii. On one cylinder there are circles on one of the ends, on the other none.

Matters are not equally clear in the case of all the cylinders. Not all have clear distinguishing features that assign them to the same recording style. Those that certainly belong to the hand of particular recorders form about two thirds of the total. There are some that cannot be categorised at all. In several cases where cylinders are assigned to the same recorder, a different implement –that is a larger or smaller twig– has been used for the circles.

Finally, special mention should be made of two cases. In the case of two cylinders,  $\Delta 17.20$  and  $\Delta 17.21$ , the two main recorders, A and B, seem to have worked together, with A making the initial record and B adding further details.

#### *A few numbers*

The differences between the groups of cylinders that have been attributed to specific recorders are not due solely to differences in the recording style, which implies individual habits and characters. There are also objective differences that

RECORDING STYLE A			
End	9	Curved surface	18
	10		26
	11		26
	6		29
RECORDING STYLE B			
End	15	End	16
	8		9
		Curved surface	60
			31
RECORDING STYLE C			
		Curved surface	17
			9
			9
			9
RECORDING STYLE D			
End	6	Curved surface	10

Table 1: *Number of Signs on complete cylinders*

go beyond the individual and are associated with the quantity of the objects counted. For, just as the recording styles are consistently repeated, so too are the quantities recorded by particular recorders.

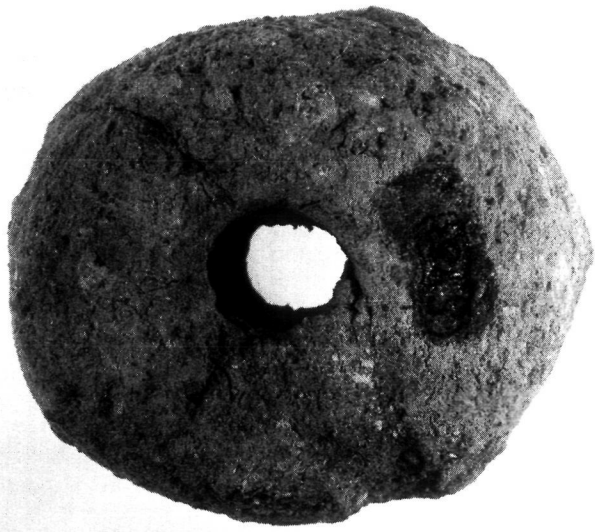
TABLE 1 lists the numbers of circles on complete cylinders, or in cases where the total number of signs is preserved. The conclusions that emerge are quite interesting. A tendency can clearly be discerned to fill the curved surface with about twice as many signs as those on the ends. This is true of recorder A. We may recall here the distinct tendency for the rows of circles on the curved surface



A. WH 2



B. WH 3



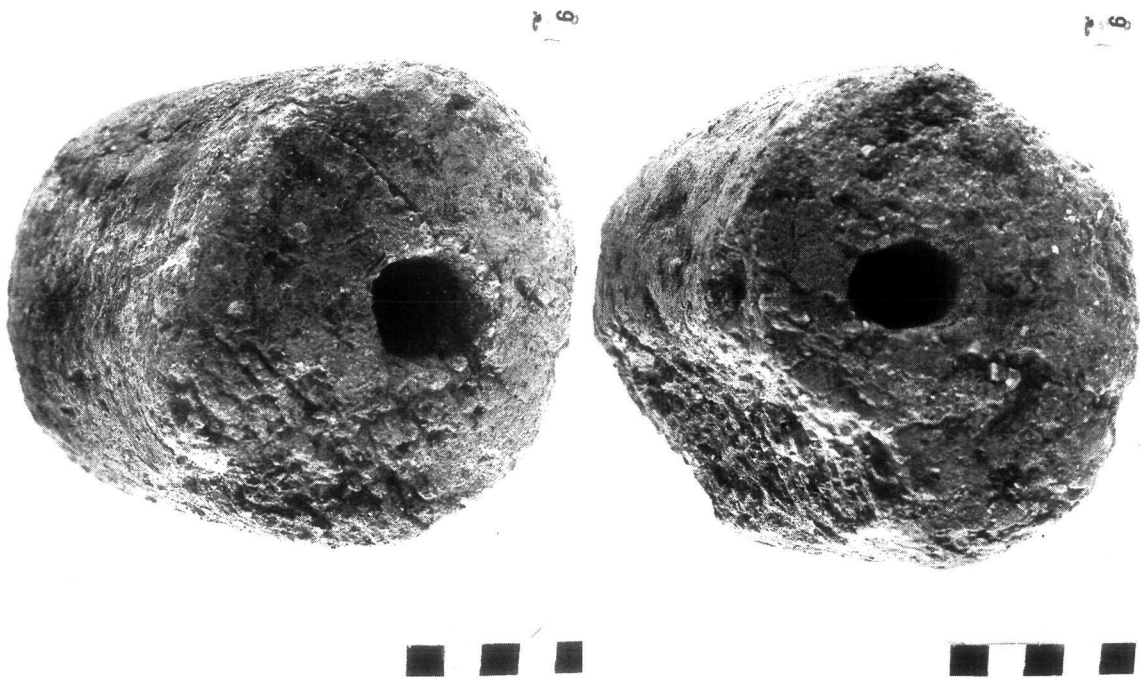
C. WH 4



D. WH 5



A.



B. HL 1

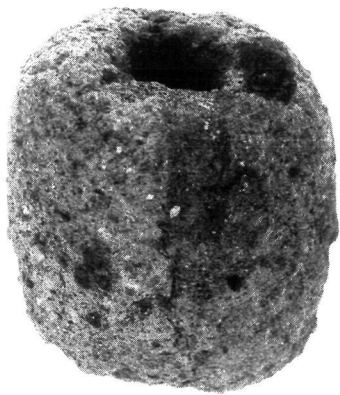
C. HL 2



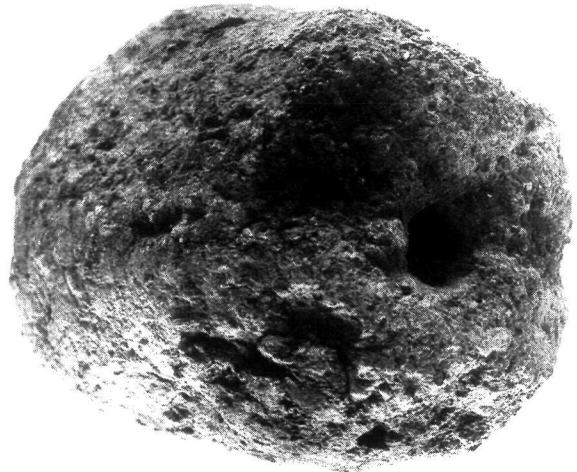
*House of the Ladies*



*A. House of the Ladies*



B. Δ2.3

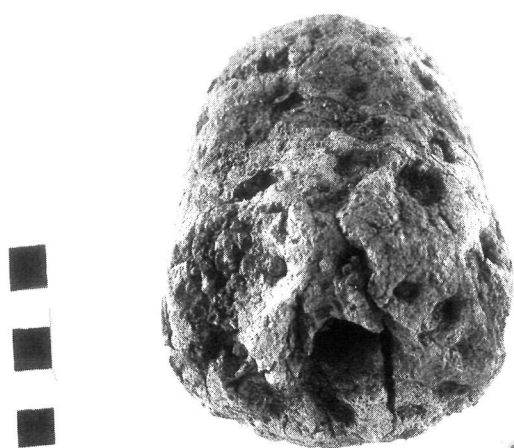


C. Δ17.1

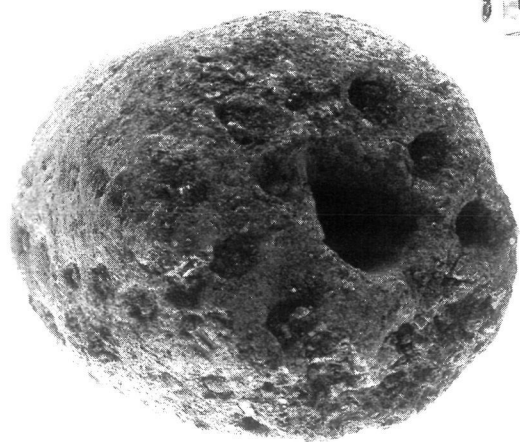




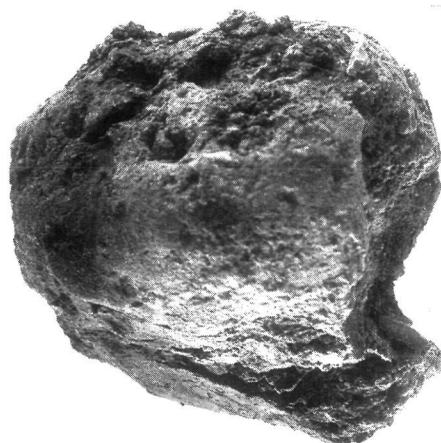
A. Δ17.3



B. Δ17.4



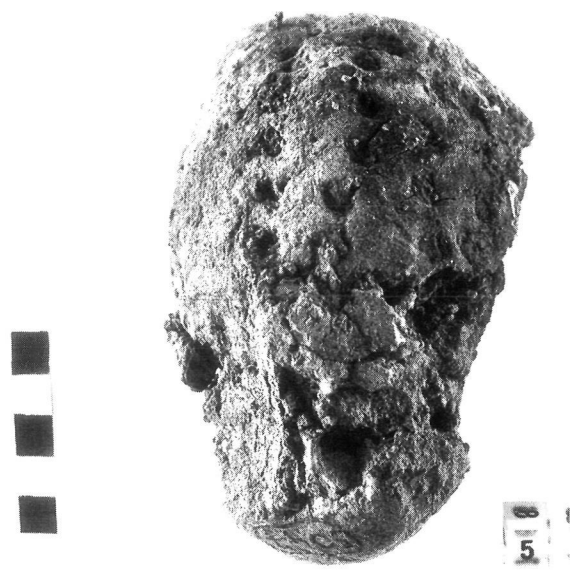
C. Δ17.5



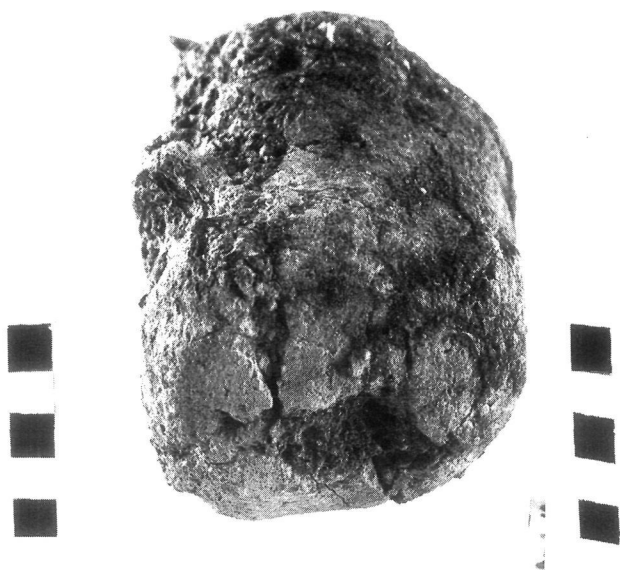
D. Δ17.6



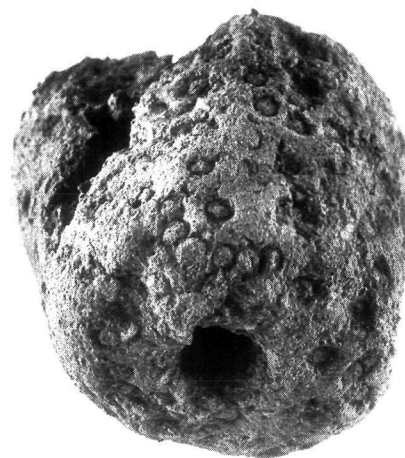
A. Δ17.7



B. Δ17.8



C. Δ17.9

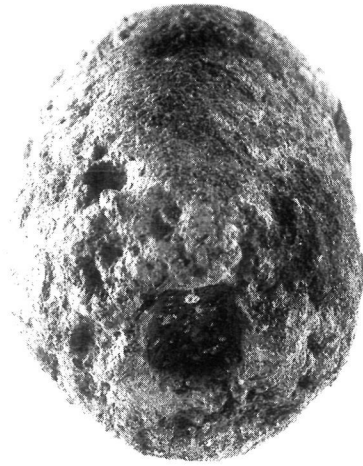


D. Δ17.10

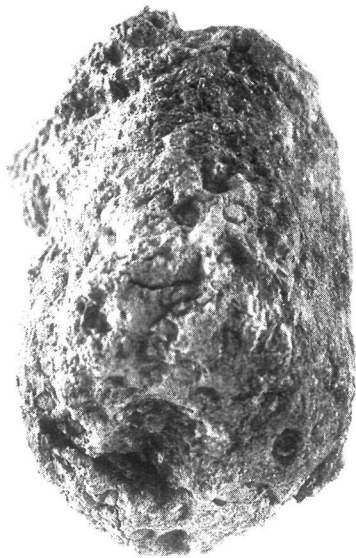




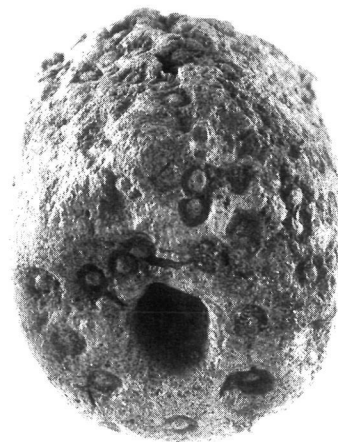
A. Δ17.11



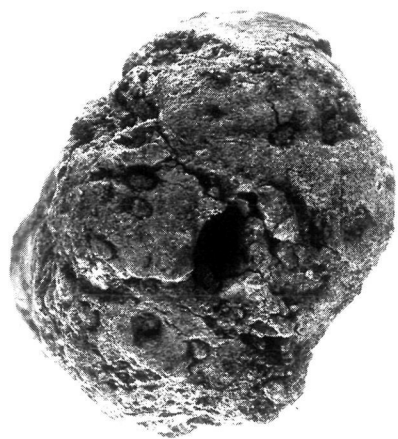
B. Δ17.12



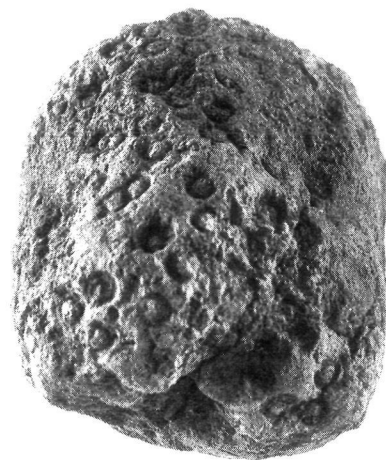
C. Δ17.14



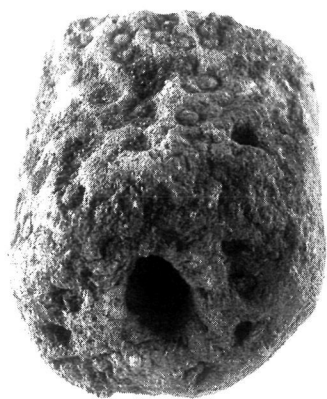
D. Δ17.15



A. Δ17.16



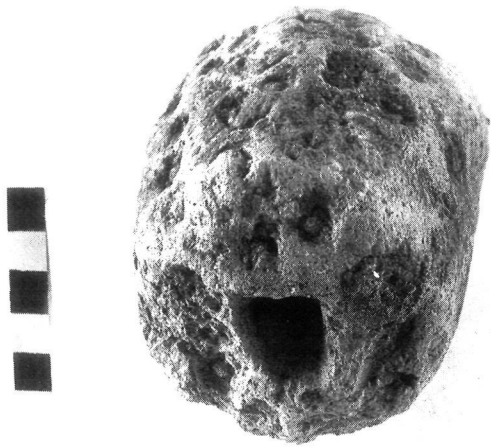
B. Δ17.17



C. Δ17.18



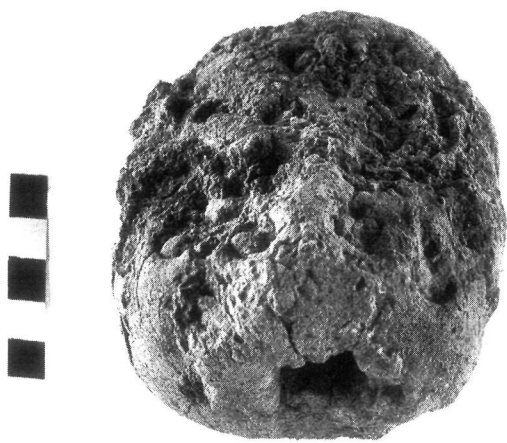
D. Δ17.19



A. Δ17.20



B. Δ17.22



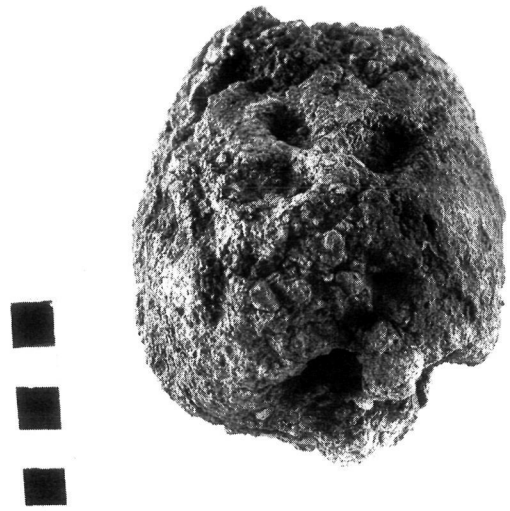
C. Δ17.23



D. Δ17.24



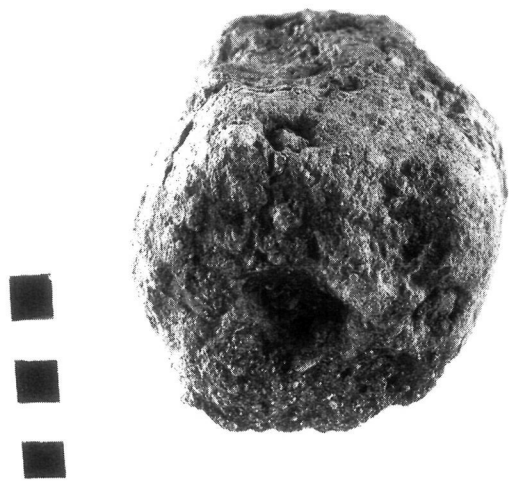
A. Δ17.25



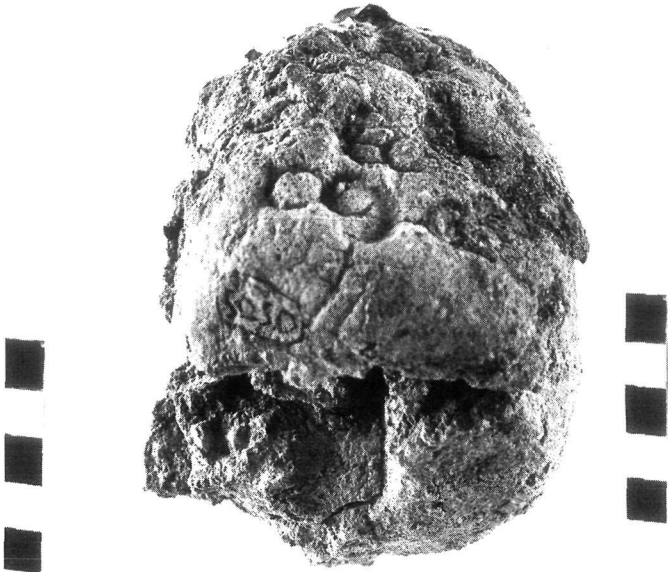
B. Δ17.26



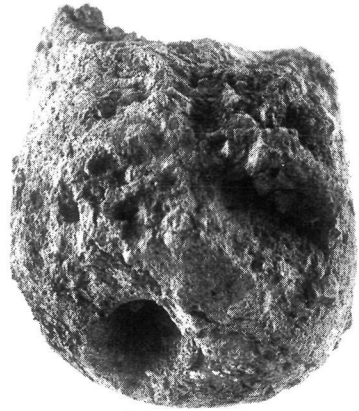
C. Δ17.27



D. Δ17.28



A. Δ17.29



B. Δ17.30



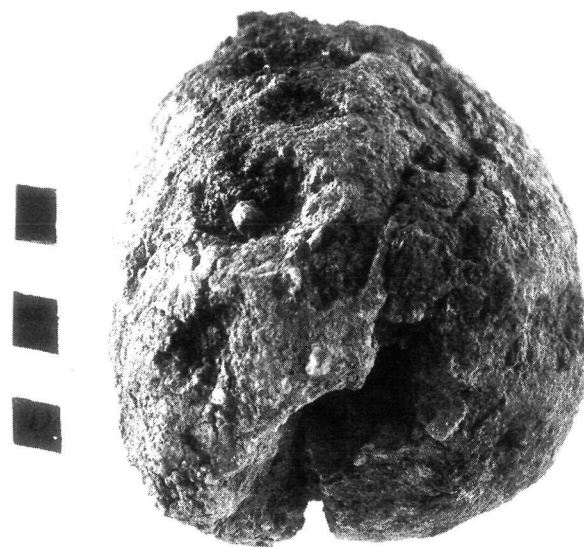
C. Δ17.31



D. Δ17.32



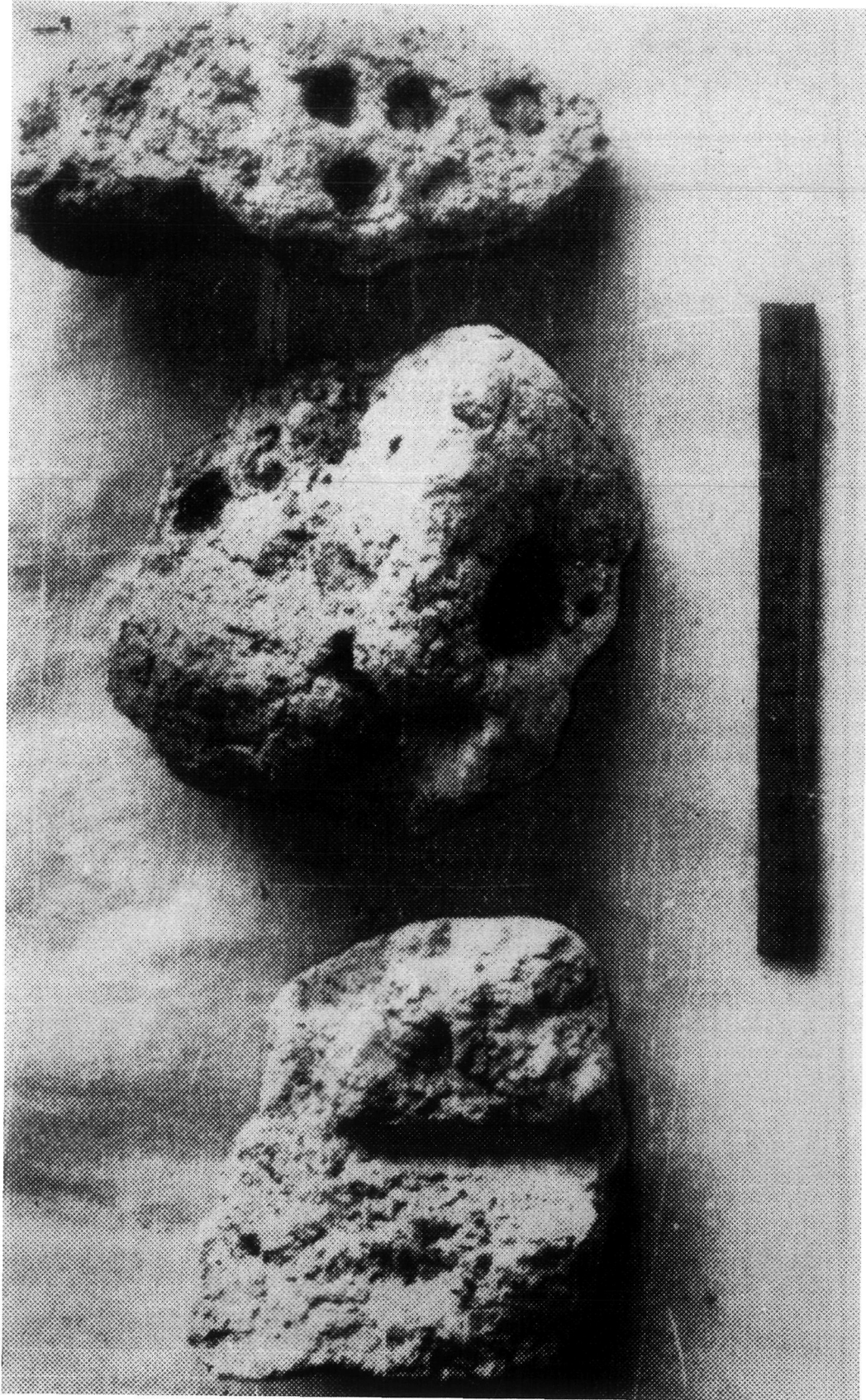
A. Δ17.33



B. Δ17.34



C. Δ17.35

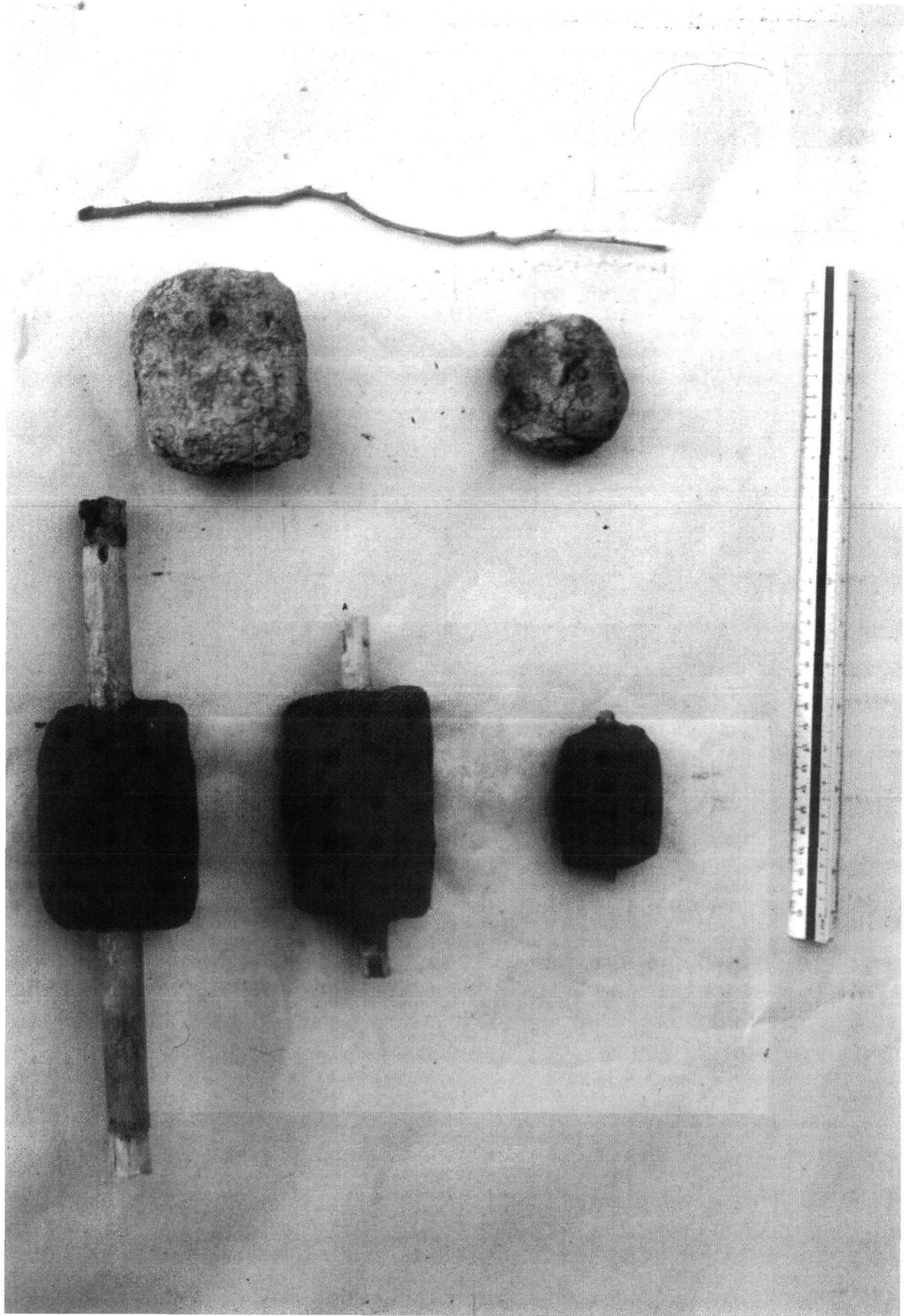


*Cylinders discovered in Trench 'Arvanitis 2' (after Marinatos)*



*Cylinders in Trench Δ17 in situ*





*Experimental Reconstruction of Cylinders*



*PK Zb 25*

to start from one of the signs on the end. It is possible, therefore, that not only did the record begin here, but that the basic information was recorded there and the number of signs on the end dictated the number on the large surface. In cases where both ends are impressed with signs (recorder B), the main surface is covered with about twice as many signs as both ends put together. Finally, style C involves consistently small numbers: 9 occurs three times, and 17, almost twice the figure, once.

It seems, therefore, that different people recorded different quantities.

*Signs as an indication of the perception of quantity. Quantity and numbers*

The style in which the signs are recorded reflects a way of perceiving quantity that derives from, and echoes the actual way in which goods were accumulated. This varied according to the product, depending on its nature, preservation requirements, and packaging. Sheaves of corn had different requirements from wine, which were in turn different from those for aromatic substances or textiles. The ways in which the goods were stored were the basis for the counting and recording of the products. The manner of storing probably also dictated the following step, the allocation, and therefore the division and distribution. The indication of quantity depended on these ways of perceiving size, and the manner in which quantities were recorded—in the form of signs—stems from this perception. In order to understand how the counting of a quantity was recorded, therefore, we have to investigate how the quantity was perceived. It is equally important, however, to have some idea of the physical properties of the commodities, their actual form and distinctive features, since all these determine the way in which it was counted or measured. In short, we need to know what is being counted or measured.

In the case of the cylinders we do not possess this information: we simply have the record of the counting. I turn, however, to a number of preconditions that apply in the case of any act of accounting, in the hope that these will assist us to evaluate the fragmentary information at our disposal.

First, any quantity in need of measurement or counting presupposes an accumulation of similar objects, so that the group has a uniform character. Otherwise it cannot be considered a group. Conversely, when different goods are counted and recorded together, we are obliged to establish the unifying characteristic that makes them a group.

On the other hand, anything that is stored may consist of an aggregation of individual objects or products or parts of them, but it is implicit that each exists in its own right. Potentially, they can exist separately. They are now an aggregate of items together forming a group, but they previously existed, or are capable of existing, separately. If three baskets of grapes are accumulated, for example, they clearly form a quantity, a group, or a total, but it is also obvious that each basket has a separate existence. Every quantity that is counted and recorded can be divided, using the same scale by which it is counted.

The accumulation of similar products is often carried out for a purpose that escapes us, but which undoubtedly determined the way in which they were counted. All that can be said is that we are not dealing with ordinary home-consumption, since in this case there would be no need to count or measure things –the crop, for example, or the total amount of clothing needed to cover the needs of a small group. The very fact of accounting implies relationships and exchanges, whether on equal terms or not.

Every measurement or count is ephemeral: it represents a point in time of the process of accumulation, and the record of it can easily be emended to take account of new data, though the memory of the previous count may be retained.

In order to measure or count something, methods are devised according to the requirements; frequently according to particular needs. These methods may be simple, such as those based on and confined to three-count system, or more complex, in which case we may speak of a number system (Schmandt-Besserat 1996, p. 113). During their formation, that is, during the process of abstraction, number systems are thought to pass through the stage known as ‘concrete counting’ (Schmandt-Besserat 1992, p. 199; 1996, p. 112). This implies that numbers were not the same for all objects counted. There was no unified number system like that of the present day. The system varied and was adapted to the needs of the particular occasion. That is, numbers were connected with the item to be counted: days were counted in a different way from corn or sheep. This is implicit in the term ‘concrete counting’. Traces of this kind of counting can be identified in many pre-literate societies at later periods, and also in the Indo-European languages (Goody 1977, pp. 12-13). That traces of this kind of counting can be seen in Mycenaean Greece in the Linear B archives, in the ideograms that are at the same time metrical signs. The ideogram LANA, for example, means at once a kind of product and an accounting unit. Here the method of counting is linked with the specific product (Ruipérez-Melena 1990, p. 88, Michailidou 2001b, pp. 66-71).

In the present instance, all the signs are the same –only their number varies. This implies that the count recorded on the cylinders did not make use of a complex number system involving units, tens and hundreds. The arrangement of the signs suggests a very simple system. Since they are all the same, this similarity implies that all the signs are of equal value. This system, in which the record consists of identical signs added as the count proceeds, is called one-to-one correspondence. In practical terms, this means that when something is counted, whether goods, products or quantities, a sign is made somewhere, followed by a second, similar sign for two, and so on. We are thus dealing with an archaic accounting system: a system that is considered to be the most primitive of all, in which there is essentially no number system, since there is no grouping into tens and units, as found in the various other number systems known from this period (Schmandt-Besserat 1996, p. 112). The fact that it was used, however, indicates that it was adequate for the needs it served.

Number systems are said to have no end, only a beginning. Here, however, we see rows of signs that have neither beginning nor end. The recorder obviously started somewhere, but neither we nor the users, for whom the count was recorded, can say where. It was therefore only the total that was of interest, as in all one-to-one correspondence systems. Anyone who wished to know how many signs there were had to count them all over again: where he started was immaterial. Since all the signs are the same, this makes verification a difficult task. As I attempted to count them, I frequently lost count and had to repeat it several times to be sure. Practice may have given the users the ability to recognise the total number of signs more easily, or perhaps they found it as difficult as I did. Whatever the case, there came a point at which the recorders could not add more, either because there was no room for more signs, or because the clay of which the cylinder was made had dried.

Other evidence for this kind of accounting has been found at Akrotiri. I believe that the inhabitants of the settlement used small objects of similar size and form to assist them in a particular count –that is, that they had tokens of some kind. This may have been the function of the pellets, which were small round objects of unknown use that were very suitable for such a purpose.<sup>13</sup> The pebbles which are reported in the day-books to have been found next to the cylinders (see above) may also have been used for the purpose, as, too, may rounded sherds.<sup>14</sup> Rounded sherds as memory tools are reported from two Early Bronze Age settlements in the Anatolia (Kielit Costello 2000). If these theories are correct, we have at Akrotiri, too, tokens used for accounting, like those of Mesopotamia, the significance of which to the evolution of writing has been analysed by Schmandt-Besserat (1989, 1992, 1996).<sup>15</sup> In a recent article on measurement in Minoan scripts, Emmett Bennett refers to the probability that there were tokens in the Aegean, as in the Middle East (Bennett 1999).

To pursue this line of reasoning, the recording of signs on the cylinders is possibly supplementary to other counts made with pellets or other objects that could be used as tokens. Irrespective of whether or not tokens existed, it may fairly safely be said that behind the records on the cylinders lies the same logic, the logic of one-to-one counting and recording.

#### *Similar signs in the Aegean scripts*

The circle is used as a numerical sign in both Linear A and Linear B, and it is found in the Cretan hieroglyphic script as a punctuation mark (Ventris and Chadwick 1973, p. 63, Bennett 1999). However, it cannot have been used in the

<sup>13</sup> Marinatos (1969, p. 45) believes that they were used as toys.

<sup>14</sup> The idea that rounded sherds may have had a function of this nature is due to Anna Michailidou, and I would like to thank her for allowing me to refer to it here.

<sup>15</sup> Schmandt-Besserat's views have been criticised by Zimansky, 1993; see also Daniels 1996, pp. 22-23. These criticisms, however, do not affect the arguments I adduce here. See also Poursat 1994.

same way on the cylinders. Underlying the numerical records of the scripts are a number system and abstract concepts, which, in the light of the above analysis, are not present in the records on the cylinders. The similarity is too general and could easily mislead if taken into account.

Circles, which again do not appear to be part of a number system, are to be found on weights, like those from Thera (Michailidou, 1990, fig. 20). A row of circles is painted in red on applied white paint on a lead weight from Oropos (Servais 1971, fig. 42, 43; Petruso 1992, pp. 56-61). At first sight these do not appear to perform the same kind of function as the signs on the cylinders. On the weights, the significance of the circles is probably associated with the recording of their value, rather than with an ephemeral accounting. In the case of potter's marks the punctuation mark occurs frequently, but it cannot have been meant for counting, since the number of signs on a pot is insignificant – usually one or more rarely two (Halepa-Bikaki 1984).

*What is and is not known about the count recorded in the cylinders*

There were many factors determining the reason for and therefore the existence of this recorded count, which was part of an activity set within a chain of human actions. In fact, we are in possession of only a small part, which had only meaning in the context of relations that are now unknown. Accordingly, it may perhaps be useful, alongside the known evidence, to identify some of these unknown factors, since this will assist us to make a global evaluation of the scant evidence at our disposal.

The first unknown factor is the nature of the items being counted. Were they agricultural or craft-industrial products, services, people, ships, animals? Were they days, a measurement of time, some kind of information about the natural world, elements in cult ceremonial? Nothing of this is known. In my opinion, however, they will have been goods or services, since they were all found close to storerooms and near the area ( $\Delta 18$ ) in which Linear A tablets recording products were found. They probably served the same purpose, therefore. Accordingly, even though we do not know what was counted, the count recorded on the cylinders probably served the needs of storage and distribution.

The second important unknown element is the purpose of the accounting. Why was it measured or counted, whatever it was? The most probable reason was to serve the needs of exchange. The ultimate purpose behind every act of accounting is the desire to establish correspondence, to confirm a proper equivalence, to ascertain the proper terms for an exchange. Moreover, the fact that a record was made implies that the memory of it was needed by someone, and this again suggests an exchange. All this is very general, however. What was the object of the exchange? Taxes, voluntary or compulsory contributions, salaries, gifts, a record of a delivery or of craft-industrial activities, redistribution, accumulation of goods for dispatch abroad, or preparation for journeys and commercial exchanges? Was it merchandise? Was it a debt, a delivery, the return of a loan?

There is some evidence for the manner of the exchange that is perhaps associated with its cause. The fact that all the signs are the same, identical, possibly suggests that all the products or quantities recorded were equal and therefore of equal value. Whatever these exchanges were, they involved a number of individuals and products in an equal distribution. The explanation that seems most likely to me is that it was a redistribution on equal terms, the allocation of an unknown product equally to members of a group enjoying the same rights; or, conversely, the collection of equal quantities or values from a group with the same obligations. That the record on the cylinders is unlikely to refer to unequal exchange relations, and is more probably connected with accumulation or distribution by some kind of guild or tribe. The members may be more or fewer, but the quantity of goods is the same, and this explains the variation in the number of circles. Thus, whatever the reason for the accounting, whatever the nature of the exchange, the recording style suggests an exchange on equal terms.

The third unknown factor is who, and how many, were the people making the exchange. Were there two, or more? How many were involved in the process? What was their relationship? Were they acquaintances, relatives, fellow craftsmen sharing some raw material, fellow countrymen exchanging goods between themselves? What social relations gave rise to the need to count or measure? These are enormous unknown areas that surround our cylinders and leave them dumb. Here again, however, we do have some evidence on the subject; a few crumbs of information do emerge. We know that at least 4 recorders were involved in recording the counts. It also appears that in at least two cases two different individuals impressed signs on the same cylinder. Given that no special knowledge was required and that anyone could make a record of this kind, the recorders were probably the same people who were making the exchange. This points to exchanges of a very simple kind. It is difficult to conceive of these cylinders as evidence for some kind of bureaucratic procedure; the relations here are more direct and immediate. Even on the assumption that the second person who worked on the same cylinder was confirming and correcting the previous count, this will still have been part of an exchange with a few, directly involved individuals. The scale of the exchanges will not have been very great. I would assume that the people involved knew each other, and that the unknown context for the exchange will have been intra-community.

When something is recorded in order to be remembered, the implication is that the exchange takes place over a period of time. Someone gives or takes something, but the delivery or receipt by one side or the other is deferred. Or, if it takes place at the same time, it will be followed by another delivery or receipt connected with the first. Therefore, however simple the exchange, it has to be recorded. This attempt to preserve the memory of a count is not intended to last long, however; whatever the exchange was, it was expected to come to a conclusion fairly quickly. This accounts for the makeshift nature of the cylinders.

Finally, it may be useful here to recall all the factors of which we have no knowledge but which are decisive in any exchange: the ethos of the transaction created by the social context, the intention, the aim, the climate, whether friendly or otherwise. We are also unaware of many other considerations attendant on human relations which go unrecorded: gestures, words, what is said and what is left unsaid, wishes, invocations, fears, whether the contracting parties spoke the same language, and the symbols that accompanied the transaction (Ong 1982). We have only the material remains, a few poor fragments in a vacuum, deprived of the attendant words and actions that gave substance and meaning to the accounting.<sup>16</sup>

#### *Accounting at Akrotiri*

Everything at Akrotiri was counted and weighed. This is the impression one gains from wandering amongst the dozens of vases arranged in standard categories of shape and size. The many weights found in different houses point to the same conclusion. Details of accounting at Akrotiri have so far been published with reference to the weights, which were used to establish correspondences on the basis of an abstract scale (Michailidou 1990, Petruso 1992, pp. 60-64). Details have also been published for certain categories of volume, for certain kinds of vases. It seems that in the settlement, efforts were made to achieve the systematic standardisation of volume, weight, and dimensions, and this implies that, an exchange mechanism operated within the context of the settlement through the standardisation of size (Katsa-Tomara 1990). We are dealing here with a pre-monetary society in which there was no abstract exchange unit that could be used to determine values and facilitate exchanges. The standardisation of sizes was thus a desirable and necessary requirement, for in a town, goods and services are exchanged on a wide scale and provision has to be made for the easy assessment of these transactions. The counts recorded on the cylinders should be seen in this context.

#### *Writing at Akrotiri*

The signs on the cylinders, which are a non-literate record of a count or measurement, bring forth the vast subject of whether the society of Akrotiri was literate, whether it had a script. Such a script is generally thought to have existed on account of the fragments of Linear A tablets and inscriptions on vases and one on a sherd, incised on the spot (Palaima 1989, Michailidou 1992-1993, Owens 1997, *GORILA IV*, pp. 101-105, Boulotis 1998). However, this need not exclude the possibility that daily needs were met in more simple ways.

In fact, the cylinders provide us with a count or measurement recorded in a non-literate way, in a settlement at which writing was known and used by some of the inhabitants, at least. They reflect one of the traditional, archaic practices of

<sup>16</sup> See, e.g., the complex symbols accompanying transactions in Mesopotamia (Cassin 1987, pp. 280-335).



the great, non-literate majority, who measured and counted for their own needs and were not inclined to keep the record for any length of time, because they did not need to do so. Relations were more immediate and interpersonal, and the exchanges took place between people who knew each other, and did not involve unknown middlemen. When it was necessary to preserve the memory of the count or measurement for some time, the parties to the exchange used the traditional methods of accounting and the traditional, simple and archaic recording system. What should perhaps be stressed is that so far, it seems that this system was much more widespread in the settlement than the script.

It has often been noted (e.g. Doumas 1983, chap. 5) that Akrotiri was a town that engaged in great seafaring and commercial activity. To serve these needs, the necessity of recording and checking products perhaps required a greater ability to negotiate through third parties and to deal with more complex administrative systems. The traditional accounting methods were perhaps insufficient. The presence in the settlement of people from other parts of the sea, with foreign customs and products that had travelled far, may have given rise to conditions under which more complex methods were adopted, including the Minoan script.

It is my impression, then, that there were overlapping methods of counting and recording at Akrotiri. One that served daily, ephemeral needs, which made use of traditional methods like the counts recorded on the cylinders, and another for more complex exchanges, for items of greater invested value, in which more people were involved and for which use was made of the 'international' Linear A script. Whether the recorders were in both cases Therans and knew both methods, or whether they were Therans in the former case and Minoans in the latter, is unknown and there is no basis on which to form a hypothesis. It is perhaps worth noting that in the room where the tablets were found, Δ18, a variety of imports was also discovered, including a vase from the East (Doumas 1993, pl. 63a).

*Similar cylinders from elsewhere in the Aegean. Middle Minoan Monastiraki*

Similar finds, that is, cylinders of corresponding shape, manufacture and dimensions, date mainly from the Early Bronze Age. They are common at Poliochni (Bernabo Brea 1964, p. 658) and Lerna (Caskey 1956, p. 168), in small numbers of two or three.<sup>17</sup> Various hypotheses have been advanced as to their function, though no convincing conclusion has been reached; they are most often considered to be weights used to stretch the warp of upright looms, rather like loomweights (see above, chapter 'function'). However, some are also reported at the end of the Middle and the beginning of the Late Bronze Age, which are fairly close in date to those from Akrotiri. I mention by way of example the unfired

<sup>17</sup> The pierced cylinders dating from the Early Bronze Age have been assembled by Carrington-Smith in her unpublished dissertation (1975, pp. 218-220).

cylinder from Kastsamba found in a level dating from the transitional MM IIIB-LM IA phase (Alexiou 1955, p. 315), and the cylinders from Chania (Tzedakis and Hallager 1978).

The find closest to the cylinders from Akrotiri, however, is the one found at Monastiraki Amariou, an important MM II settlement. Though slightly earlier in date, this find exhibits the main basic feature of the Akrotiri cylinders –the impressed circles.<sup>18</sup> The cylinders at Monastiraki were found in the same area as the lumps of clay bearing sealings (Godart-Tzedakis 1992, pl. LXXXIII). Here again, therefore, we have cylinders with impressed circles close to an archive. The main difference is that at Monastiraki the practice of sealing was very common, while it seems to have had only limited use on Santorini.

#### *Relations and exchanges within the settlement*

Finally, we may attempt to set the evidence of the cylinders in the general historical and social context of the settlement. The urban character of Akrotiri is attested by a variety of features, including the circulation of goods, exchanges of products and services, and a steady flow of transactions involving producers, middlemen and recipients.<sup>19</sup>

Traces of these exchanges can be detected in the archaeological record, but the kind of social relations that define the modes of exchange are harder to identify. At Akrotiri, we may speak in very general terms of a constant, clearly discernible mutual dependence between the countryside and the town, of the movement of agricultural goods (Sarpaki 1990), of the presence of craft specialisation within the boundaries of the settlement (Tzachili 1990), of seafaring activities, and of long-distance trade. A general outline of the production economy can thus be sketched. Social relations remain unknown to us, however. The archaeological record does not reveal any strong material differences within the town. The urban houses do not exhibit any obvious inequality, there are no great differences in size, and where they do exist (the West House is one of the smaller buildings), they are counterbalanced by a high level of material goods.

Methods of counting are determined not only by the kind of commodity to be counted, but also by these relations. In towns, accumulation and redistribution increased in scale with the size of the town itself. This does not necessarily mean, however, that accumulation was carried out by some administrative centre, or that there was some centralised council or administrative hierarchy that undertook this accumulation and redistribution for someone else's or its own benefit. There is no archaeological evidence for anything of this kind. Commercial exchanges were probably regulated by networks of various

<sup>18</sup> My attention was drawn to the cylinders from Monastiraki by Dr Athanasia Kanta, whom I would like to thank.

<sup>19</sup> The role played by exchanges in the development of cities has often been noted. See the classic work by Childe (1935) and more recently Huot *et al.* 1990, pp. 27-42).

relations, between clans, guilds, or age-groups. They certainly took place on a daily basis, were numerous, and were conducted by various agents or individuals. Their frequency, number and variety were great, though at many levels and amongst many exponents. Ways of satisfying daily needs functioned over a short range and, because of the short distances and small magnitudes involved, did not require a large administrative organisation. A good indication of this is the carefully standardised sizes of household vessels and the frequent discovery of balance weights in houses, where they facilitated domestic, and often small-scale exchanges.

It is perhaps worth noting that the practice of sealing objects, which was designed to control the movement of goods, is practised on only a limited scale at Akrotiri. Relatively few seals have been found, and the only sealings are those found assembled together in Δ18 (Doumas 1995, pl. 63). According to Ch. Doumas, they were impressed on non-Theran clay (Doumas 2000), and were therefore intended to record and accompany the movement of imports or exports. Either the administrative requirements were not great, or social relations did not call for the practice.

I think that this system of very simple, numerous exchanges, conducted over short distances and of short duration, reflects social relations that are not characterised by great inequality. It is associated rather with a method of assembling and distributing goods within a narrow communal context of limited range in both time and space. The methods used by the inhabitants, weighing and standardisation of volumes, 'concrete counting', possibly involving the use of pebbles or pellets, was sufficient. The cylinders record one manifestation of these methods. These were enough to meet the inhabitants' requirements, and there was no need for recourse to written records at the intra-community level. Such records appear in the context of their overseas exchanges. The social structure, in which there was no great differentiation, permitted the use of a one-to-one system of counting for everyday exchanges in which there were no serious inequalities. The system of production relations and the limitations of natural resources did not give rise to the need for large collective storerooms or the concomitant opportunity for the control of these by ruling groups. Large collective storerooms are not attested. Goods were stored individually in the houses. Not even in the face of the impending destruction, when the inhabitants were attempting to gather together their goods in the face of disaster, do we see any attempt at large-scale collective storage. The opportunities for social mobility that are a feature of cities were provided by openings to the outside world and by naval enterprises, not by the deepening of social inequalities within the community.

On the other hand, as an urban, island society, Akrotiri, with its harbour, fleet, crews, merchants, craftsmen, craft-industrial products, imports and exports, also required different methods of accounting that corresponded to these different needs. Hence, perhaps, the Linear A tablets. And the people of Akrotiri would

most probably have found ways to combine the different counting and recording methods and made use of them alongside each other.

*A historical event?*

As we have already seen, the cylinders were found in small groups, normally of three or four, throughout the settlement, in many of the houses of Akrotiri. It is only in Δ17 that the number of cylinders and recorded counts rises dramatically. A large number of items were clearly counted here. For what purpose? Was the count routine, part of everyday reality, reflecting a point in the work cycle? Or was it a response to an exceptional situation? If we recall the hasty storing of goods that can be detected in most of the buildings, especially the neighbouring Δ18, it appears that we are dealing once again with an unusual situation. Are the records on the cylinders evidence of an emergency? Was this the specific historical event that we know so well –that is, the coordinated evacuation of the settlement in the face of the horrors of the eruptions and earthquakes? People gathered together their possessions, shared out what was left, and fled. When this happened, however, the way in which people dealt with the emergency still reflected their normal way of life, the practices of social organisation. The exceptional (?) records on the cylinders possibly reflect an exceptional situation.

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REFERENCES

- Alexiou, S. 1955, «'Ανασκαφή Κατσαμβά Κνωσού», *Πρακτικά 'Αρχαιολογικής 'Εταιρείας*, pp. 311-320.  
 Bennett, E. L. 1999, «Minos and Minyas. Writing Aegean Measures», in S. Deger-Dalkotzy, S. Hiller and O. Panagl eds., *Floreat Studia Micenaea. Akten des X. Internationalen Mykenologischen Colloquiums in Salzburg von 1.-5. Mai 1995*. Wien, pp. 159-176.  
 Bernabò Brea, L. 1964, *Poliochni, città preistorica nell' isola di Lemno*.  
 Boulotis, C. 1998, «Les documents en linéaire A d' Akrotiri (Thera): Remarques préliminaires», *BCH* 122, pp. 407-411.  
 Carington-Smith, J. 1975 *Spinning, Weaving and Textile Manufacture in Prehistoric Greece*, Ph. D. Dissertation, University of Tasmania.

- Cassin, E. 1987, *Le semblable et le différent*, Éditions la Découverte.
- Childe, G.V. 1936, *Man Makes Himself*, London.
- Daniels, P. 1996, «The First Civilizations», in P. Daniels and W. Bright eds., *The World's Writing Systems*, Oxford University Press, pp. 21-32.
- Doumas, C. 1973, «Phtellos», *Ἀρχαιολογική Εφημερίς*, pp. 161-166.
- Doumas, C. 1983, *Thera, Pompei of the Ancient Aegean*, London.
- Doumas, C. 1992, *The Wall-Paintings of Thera*, Athens.
- Doumas, C. 1993, «Ἀνασκαφή Θήρας», *Πρακτικά Ἀρχαιολογικής Ἐταιρείας*, pp. 164-187.
- Doumas, C. 1994, «Ἀνασκαφή Θήρας», *Πρακτικά Ἀρχαιολογικής Ἐταιρείας*, pp. 156-166.
- Doumas, C. 1995, «Ἀνασκαφή Θήρας», *Πρακτικά Ἀρχαιολογικής Ἐταιρείας*, pp. 127-136.
- Friedrich, W. 1994, *Feuer im Meer: Vulkanismus und Naturgeschichte der Insel Santorin*, Spektrum Akademischer Verlag.
- Hiller von Gaertringen, F. 1904, *Die Insel Thera im Altertum und Gegenwart I*, Berlin.
- Goody, Jack 1977, *The Domestication of the Savage Mind*, Cambridge University Press.
- Godart, L. & Tzedakis Y. 1992, *Témoignages archéologiques et épigraphiques en Crète occidentale du néolithique au minoen récent IIIb*, Roma.
- GORILA 1976-1985 = L. Godart & J.-P. Olivier, *Recueil des Inscriptions en Linéaire A, Études Crétoises XXI* vol. 1-5, Paris.
- Halepa-Bikaki, A. 1984, *Ayia Irini, The Potter's Marks*, Mainz on Rhin.
- Huot J.-L., J.-P. Thalmann & D. Valbelle 1990, *Naissance des cités*, Éditions Nathan.
- Katsa-Tomara, L. 1990, «The Pottery-Producing System at Akrotiri: A, Index of Exchange and Social Activity», in D. Hardy, ed., *Thera and the Aegean World III. Proceedings of the Third International Congress, Santorini Greece, 3-9 September 1989*, vol. 1, London, pp. 31-40.
- Kielt-Costello, Sarah 2000, «Memory Tools in Early Mesopotamia», *Antiquity* 74, pp. 475-476.
- Manning, S. 1995, *The absolute chronology of the Aegean Early Bronze Age : archaeology, radiocarbon and history*, Sheffield.
- Marinatos, N. 1984, «Minoan Threskeiocracy at Thera», in R. Hägg and N. Marinatos, eds. *The Minoan Thalassocracy: Myth and Reality. Proceedings of the Third International Symposium at the Swedish Institute in Athens*, Stockholm 1984, pp. 167-178.
- Marinatos, S. 1968, *Thera I*, Athens.
- Marinatos, S. 1969, *Thera II*, Athens.
- Marinatos, S. 1971, *Thera IV*, Athens.
- Marinatos, S. 1972, *Thera V*, Athens.
- Michailidou, A. 1990, «The Lead-Weights from Akrotiri: The Archaeological Record», in D. Hardy, ed. *Thera and the Aegean World III. Proceedings of the Third International Congress, Santorini Greece, 3-9 September 1989*, vol. I, London, pp. 407-419.
- Michailidou, A. 1992-1993, «'Ostrakon' with Linear A Script from Akrotiri (Thera): A non-Bureaucratic Activity?», *Minos* 17-18, pp. 7-24.
- Michailidou, A. 2001a, *Ακρωτήριο Θήρας. Η Μελέτη των ορόφων στα σπίτια του οικισμού*, Athens.
- Michailidou, A. 2001b, «Script and Metrology: Practical Processes and Cognitive Inventions», in A. Michailidou, ed., *Manufacture and Measurement*.

- Counting and Recording Craft Items in Early Aegean Societies*, Athens, pp. 53-82.
- Ong, W. 1982, *Orality and Literacy: The Technologising of the World*, London - New York.
- Owens, G. 1997, «Further Comments on the Linear A inscriptions from Thera», *Kadmos* 36, pp. 169-171.
- Palaima, T.G. 1983, «Linear A in the Cyclades: The Trade and Travel of a Script», *Temple University Aegean Symposium* 7, pp. 15-22.
- Palyvou, K. 1999, *Ακρωτήρι Θήρας. Η οικοδομική τέχνη*, Athens.
- Petruso, N. 1992, *Ayia Irini. The Balance Weights. An analysis of weight measurements in prehistoric Crete and the Cycladic islands*, KEOS 8: Mainz.
- Poursat, J.-C. 1994, «Les systèmes primitifs de comptabilité en Crète Minoenne», in P. Ferioli, E. Fiandra, G. G. Fissore and M. Frangipane eds., *Archives before Writing. Proceedings of the International Colloquium Oriolo Romano October 23.25, 1991*, pp. 247-254.
- Ruipérez, M. - Melena J.L. 1990, *Los Griegos Micénicos*, Madrid.
- Schliemann, H. 1880, *Ilios* 1880.
- Sarpaki, A., «Small Fields or Big Fields, That is the question», in D. Hardy, ed., *Thera and the Aegean World III. Proceedings of the Third International Congress, Santorini Greece, 3-9 September 1989* vol. 2, London, pp. 422-432.
- Schmandt-Besserat, Denise 1992, «Two Precursors of Writing: Plain and Complex Tokens», in Wayne M. Senner ed., *The Origins of Writing*, University of Nebraska Press, Lincoln and London, pp. 27-41.
- Schmandt-Besserat, Denise 1992, *Before Writing* (vols I - II ), University of Texas Press: Austin.
- Schmandt-Besserat, Denise 1996, *How Writing Came About*, University of Texas Press: Austin.
- Servais, J. 1971, *Thoricos V (1968) Objets trouvés dans la Tholos*.
- Tzachili, I. 1990, «All important yet elusive: Looking for Cloth-making evidence at Akrotiri», in D. Hardy, ed, *Thera and the Aegean World III. Proceedings of the Third International Congress, Santorini Greece, 3-9 September 1989*, vol. 1, London, pp. 380-389.
- Tzachili, I. 1992, «Μικροαντικείμενα της ανασκαφής του Ακρωτηρίου», in C. Doumas ed., *Ακροτήρι Θήρας. Είκοσι χρόνια έρευνας (1967-1987)* Athens, pp. 139-145.
- Tzachili, I. 1997, *Υφαντική και Ύφαντρες στο προϊστορικό Αιγαίο*, Herakleion.
- Tzedakis, I. & E. Hallager, 1978, «The Greek-Swedish Excavations at Kastelli Chania 1976 and 1977», *Αρχαιολογικά Ανάλεκτα Αθηνών* 11, p. 39.
- Ventris, M. & J. Chadwick 1973 (1956), *Documents in Mycenaean Greek*, Cambridge University Press.
- Zimansky, P. 1993 Review of Schmandt-Besserat 1992, *Journal of Field Archaeology* 20, pp. 513-517.