American Research Center in Egypt
Egyptian Antiquities Project

"Conservation and Display of Roman Mosaics

Kom el-Dikka, Alexandria"

5th Progress Report

Completion Report

for Mosaic Conservation Work

submitted by Dr Wojciech Kołątaj, the Project Director

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Ewa Parandowska

COMPLETION REPORT FOR MOSAIC CONSERVATION WORK

In 1972-73 the Polish Archaeological Mission working at Kom el-Dikka partially uncovered group of the Early Roman floor mosaics decorating House *alpha* - an urban villa dated to the 1st-3rd centuries AD. At the time, the excavations were made in narrow trenches limited by later constructions of the Late Roman age. Excavated fragments of mosaics were documented and provisionally protected, than reburied in 1974 (Rodziewicz 1976: 169-210; id. 1984: 42-53).
In 1998-99, during the work carried under the ARCE/EAP Conservation Project, it was possible to follow the full extent of the mosaics, to identify the layout of the house and after conservation to display the remains of Early Roman villa within the roofed shelter.
The excavated and partially reconstructed eastern part of the House *alpha* contains four mosaic pavements representing different decorations and various techniques of execution.

1. DESCRIPTION OF THE MOSAICS:

1.1. Mosaic α-2.

Located in the north-eastern corner of the villa. Black-and-white geometric design. Black rosette surrounded by a circle and octagon enclosed within a square, on white background. Five big black four-pointed stars adorn each side of a nearly square mosaic floor (dimensions ca. 2.40 x 2.60 m). The pattern was arranged with rather big tesserae (2 x 1.5 cm) of irregular shape, roughly cut.

Stratigraphy:

- tesserae, 1.5 -2 cm thick
- setting bed; layer of lime and marble powder some 0,5-1,0 cm thick.
- nucleus; layer of grind stones, ashes mixed with lime and sand, some 3 -3,5 cm thick.
- rudus; concrete, some 6,5 - 8 cm thick.

All these layers were prepared directly upon the well preserved earlier floor of white lime mortar.

1.2. Mosaic α-3.

The biggest mosaic floor decorates *triclinium* - main reception room of the villa (7.50 x 6,20 m). Pavement was made in two techniques: *opus sectile* and *opus tesselatum* arranged in U+T pattern. The central part of the pavement measuring 4 x 4.5 m was arranged in *opus sectile.* The geometrical pattern is composed of combination of circles, squares, triangles and stars made of pieces of multicolored marble, and other kinds of different stones. This is in turn surrounded on three sides by a wide U-shaped fine *opus tessellatum* border decorated with tiny black crosslets against white background. On the southern edges there is a border frame composed of black, diagonally set squares. The edges of the entire mosaic were underlined with black stripes.

Opus tessellatum was precisely made of very regular, small tesserae (0.4 - 0.8 cm). Unfortunately the major part of *opus sectile* is missing. In big lacunae of the *opus sectile* mosaic, well preserved bedding carefully prepared of terra-cotta tiles (made of amphoras cut into strips), pressed into the mortar left the pavement even and flat. The remains of decoration and geometric arrangement of the preserved tiles, makes the theoretical reconstruction of the missing part of *opus sectile* decoration possible.

Stratigraphy:

a) *Opus tessellatum*
- tesserae (0.4 - 0.8 cm) made of basalt and white flint.
- setting bed; layer of lime mortar ca. 0,5-1 cm thick.
- rudus; lime and coarse sand mortar, ca. 3,5 cm thick.
- earlier floor; lime mixed with crushed brick powder, surface painted red,
- ca. 1 cm thick.

b) *Opus sectile:*
- marble tiles of different shape, color and thickness.
- setting bed - very thin (0.5 cm) of white lime mortar.
- layer of cut pottery shards - 1-2 cm thick.
- rudus; lime and coarse sand mortar ca. 3.5 cm thick
- earlier floor, lime mixed with crushed brick powder, ca. 1 cm thick.

1.2. Mosaic α-5.

Decorates the room between α-2 and α-6. Overall dimensions of the mosaic pavement: 3.30 x 4.00 m. A composition executed in *opus tessellatum* technique is not symmetrical. Beside the western wall, probably at the entrance, there is a multicolored design consisting originally of 9 square, figural panels framed with multicolored guilloche pattern. This decorative scheme is surrounded with black-and-white geometric pattern: from the north and south with a row of transversal black squares and from the east with a large segment (3.30 x 1.30 m) decorated with linear squares and rectangles. Fine execution of decorative panels may suggest the application of ready made elements in the main part of the room in front of the entrance, and casual, simple decoration for filling the rest of the surface.

Each of the seven preserved figural panels represent different species of birds (duck, heron, parrot, peacock, quail, pigeons and a couple of pigeons drinking water). Some of the panels have additional decorative elements (cups, flowers, fruits and floral motifs). Multicolored figures are on white background framed with guilloche made of white, yellow, red, gray, blue and black tesserae. Tesserae are carefully cut to regular shape (0.6 - 1 cm) for geometric design and very tiny cubes (0.3-0.6 cm) of glass paste and soft stones for birds panels. The panels were arranged on a colored ground.

Stratigraphy:
- tesserae, multicolored made of marble, soft stones and glass paste.
- setting bed; layer of lime and marble powder, ca. 0,5-0,7 cm thick.
- nucleus; layer of lime mixed with sand, ashes and charcoal, ca. 5-6 cm thick.
- statumen; stone blocks, ca 20-40 cm thick.

1.4. Mosaic α-6.

Located in the south-east edge of the villa (now in the niche of the shelter). Preserved fragments measured 2 x 2 m and 1,80 x 0.30 m respectively.
The *opus tessellatum* mosaic is composed of central element surrounded by a wide border featuring a geometrical design made of overlapping black and white squares and circles. The central element (1,20 x 1,20 m) is decorated with an elaborate multicolored floral design framing a small panel. Basically black acanthus scrolls are completed with red, brown and turquoise leaves and flowers. Small emblema (0,51 x 0.51 m), surrounded with stepped triangles design, represents an animal (a panther under the tree). The original design of emblema has been altered due to reparation in antiquity. Out of original hunting scene only the panther remained with two little horns of goat beside the left leg. The emblema was made of very tiny colored tesserae (0,3 - 0.5 cm) of soft stones and glass paste in *opus vermiculatum* technique . The decoration of the whole pavement was arranged with colored marble tesserae: black, white, red and brown (ca 0,8 x 1,5 cm). Turquoise faience cubes (ca. 1 x 1 cm) very rarely used in mosaics, were employed for rendering floral motifs.

Stratigraphy:

- tesserae, ca. 1 - 1.5 cm
- setting bed, a white layer of lime and marble powder 0.5 - 1 cm thick.
- nucleus - layer of dark - gray lime mortar mixed with ashes, ca. 1.5 - 2.5 cm.
- rudus - coarse lime mortar mixed with grind stones and crushed pottery shards.
- statumen - concrete of grind stones and smashed pieces of old plasters mixed with soil, ca. 15 cm .
- earlier floor prepared with lime mortar painted red, ca. 3 cm thick.
- preparatory bedding of grind limestone 15 - 20 cm thick, mixed with soil.

2. CONDITION OF THE MOSAICS:

The state of preservation of the bedding and the tesserae of these mosaics varied greatly. When excavated, they appeared to be in a fairly good condition, although some fragments were completely loose (2 panels with birds in mosaic α-5, major part of *opus sectile* pavement in α-3, big parts of geometric design in α-5 and α-6). There are also further damages along the edges of all four mosaics where the stone walls of the villa were dismantled.
Fragments of mosaics geometric decorations in α-2, α-3 and α-6 are quite well preserved. The bedding of those mosaics is stable in major part and the tesserae are in good condition due to the hardness and low porosity of the stone of which they are made. In contrast, the mosaic α-5 and *opus sectile* pavement were in poor condition. In several zones a fire caused breaking of tesserae and blackening of the surface. In those zones the bedding mortar lost its coherence and the tesserae no longer adhere to the bedding. The stones and glass paste used for birds panels (α-5) and the floral design in α-6 are very soft and porous and have been seriously eroded by humidity and soluble salts as well as by mechanical damages.

Mechanical damages (caused by crumbling walls) as well as subsidence of the soil had resulted in serious deformation of the mosaics.
The eastern edges of pavements in α-3 and α-2 had settled about 20 cm below their original level. In α-3, along the western foundation wall large cracks had formed and tesserae at the edges of the cracks were detached. In the mosaic α-6, beside the western edge, the settled area (ca 50 sq. cm) has been severed from the rest of the mosaic. Due to the weakening of the bedding the tesserae in this part of the mosaic had become loose and detached. Also the whole part of this mosaic which has been covered with a superimposed mosaic was in a much worse condition than the rest of the floor. Tesserae are very dirty, their surface covered with traces of pink mortar. The bedding is weakened, the mortar lost its cohesion and tesserae were becoming detached. The mosaics were restored and protected in the past.
Two kinds of old repairs are visible on the surface: ancient, and modern ones (from 1970's). In the antiquity the lacunae of the *opus sectile* mosaic α-*3* were filled with colored marble slabs chosen at random, fixed rather carelessly with a dark mortar. Small fragments of the guilloche in α-5 mosaic has been repaired in the same way. The emblema with panther in α-6, arranged originally with very fine colored tesserae was also reconstructed. The reparation was performed in similar stones but with slightly bigger tesserae, altering original pattern (the goat-like animal has not been reconstructed).

In the 1970s uncovered fragments of all four mosaics were temporarily protected - small lacunae were filled and edges were reinforced with cement mortar. All the ancient repairs were preserved, while the cement mortar used for protection in 1970s has been removed.

3. THE TREATMENT

A policy has been adopted in this Project, to preserve the mosaics *in situ* and to display the whole assemblage within its original architectural context.

Prior to conservation procedures two basic goals of the preservation had been named:
- Consolidation of mosaics *in situ*, preserving the irregularity of the surface and all ancient repairs.
- Restoration should involve also reconstruction of small missing parts of pavements. This was possible thanks to retrieval of original materials and legible patterns. The reconstruction of small parts of the mosaics was suggested for technical and aesthetic reasons (easier perception).

The treatment consisted of:
- Temporary protection during excavations and unearthing of the mosaics.
- Long term preservation and restoration, which had to be individually adapted according to the condition of the different elements of the mosaics.

The conservation of the mosaics started on June 1, 1998, (Cf. Progress Report no 2) and was continued in three stages :

1st - carried out from July 15 to August 8,
2nd - carried out from October 8 to December 12, 1998
3rd - carried from February 1, to April 15 1999.

Breaks in the conservation process were necessary in order to allow to continue excavations along the eastern and southern wall of the shelter, to erect the roof over the mosaics and to built the niche for mosaic α-6. (Cf. Progress Report no.4)

The working plan for the first stage consisted of uncovering, documentation and restoration of mosaics α-2 and α-3. The second stage was devoted to the conservation of the multicolored mosaic with decorative panels (α-5). The third stage consisted of conservation and partial reconstruction of *opus sectile* pavement (α-3) and full conservation treatment of α-6 mosaic. The course of work was supervised by the author, who was helped by local worker trained in mosaic conservation.

Conservation measures included:

- unearthing and cleaning of the mosaics floors. All the mosaics were cleaned mechanically using brushes, scalpels and blowers. Following reinforcement of the weakened parts of the mosaic surfaces were washed up carefully.
- detailed documentation of the condition of mosaic (photography, drawings, recording of damages).
- temporary protection of mosaics' edges and borders of the lacunae. Edges of lacunae and borders of mosaics were temporarily reinforced with Japanese tissue paper and carboxymethylocellulose chosen as a glue. Paper facing has been removed gradually during consolidation.
- reinforcement of original bedding in weakened parts, reinforcement of disintegrated tesserae. For consolidation and reinforcement of the original bedding, Primal E-330 and Plextol B-500 (acrylic resin emulsions) 1:1 and 1:2 diluted in water were injected. In order to reduce surface tension, a solution of ethyl alcohol and water (1:1) was applied. Disintegrated tesserae were reinforced by impregnation with Paraloid B-72 in acetone and Paraloid B-60 in ethanol, both in 20% solution.
- removal of modern cement fillings and repairs. The cement mortar used in 1970's for filling lacunae and protecting crumbling edges had to be removed mechanically with chisels and dentist's tools.
- reconstruction (refilling of small lacunae) using original tesserae. The lacunae were recomposed with original tesserae found in the debris and with stone material similar to the original in shape and in color. Lime mortar with marble powder and Primal emulsion was used as bedding (slaked lime, marble powder and Primal in the proportion 1:2:0.5).
- protection of mosaics edges with lime mortar. The mortar composed of sand, lime Plextol B-500, acrylic resin emulsion was applied for protection of mosaic edges.

- Lifting and resetting in its original position the most damaged and distorted fragments on new fixed bedding.
- After reconstruction of the wall foundations, missing parts of the mosaic bedding and big lacunae were filled with new mortar and gravel.

3.1. Mosaic α-2

State of preservation.

- Loss of tesserae along borders of the mosaic, ca. 15% of the original surface is missing. (Phot. 1)
- Small lacunae in geometric design were filled with cement in 1970's.
- Surface is distorted and sagged
- Bedding mortar is weakened and disintegrated.

Conservation measures:

- the surface was mechanically and chemically cleaned (rinsed and dried)
- cement fillings of lacunae were removed mechanically
- lacunae were reintegrated and some parts of the mosaics edges were reconstructed with original tesserae found in the debris (Phot. 2, 4).
- Some crumbled areas, edges and cracks were stabilized with a soft mixture of mortar (lime, marble powder, Plextol).

3.2. Mosaic α-3

State of preservation of the *opus tessellatum* mosaic:

- big damages and loss of tesserae along borders of the mosaic where the stone walls were plundered.
- Loss of many black tesserae from black strips which emphasized the mosaic edges (Phot. 6).
- In several sections a fire caused breaking of tesserae and darkening of the white background. There, the underlying mortar has lost its coherence and tesserae are loose (Phot. 6).
- Ancient repairs of the big lacunae filled with marble slabs at random (Phot. 7)
- Modern repairs from 1970's using big tesserae and cement mortar (Phot. 8).
- Severe cracking of bedding - the mosaic was distorted in its western part due to ground subsiding. Consequently a wide crack was formed and the tesserae on the edge of the pavement were dislodged (Phot. 9, 10).

The physical condition of the two different parts of this pavement (*opus tessellatum* and *opus sectile)* differs considerably. Tesserae are in relatively good and stable condition because of the low porosity of the stone used which prevented chemical damage. In

In contrast, the *opus sectile* decoration is in poor state. The loss of colored stones which are often rare and precious and of high craftsmanship, is due to the weakening and disintegration of lime mortar used for arranging the decoration. The remaining fragments composed with thin marble tiles are also deteriorated due to surface corrosion of soft material and other damages (mechanical and physical). The underlying mortar has lost its coherence and the tiles no longer adhere to the bedding; many of them have been dislodged.

Conservation measures:

Opus tessellatum mosaic:

- consolidation of original bedding in the weakened parts with injections of Plextol emulsion diluted in water 1:2.
- Re-establishment of loose tesserae; two methods were chosen for this purpose. The direct method applied to the small lacunae where lost tesserae were pressed into the soft lime mortar to fill the voids. In the other, indirect method, the tesserae were first reconstructed face down on canvas with drawn contour of the missing sections. The reconstructed section of *tessellatum* mosaic was turned face up and put back in place in the bonding layer (lime, marble powder, acrylic resin). After checking and adjusting for adhesion, the cloth from the tessellatum surface was removed. Crack repair and lacunae were filled using original tesserae or local materials similar to the original.

One of the aims of the conservation of this mosaic was to preserve all historical evidence, hence the decision was made to leave ancient repairs executed with big marble slabs chosen at random as well as all deformation and distortion of the surface. Modern repairs with the use of cement mortar had to be removed.

Opus sectile mosaic

- Four fragments of decoration in opus sectile were traced (1:1) and detached from the bedding mortar. Remaining parts of decoration were lifted, then carefully cleaned and partially reconstructed. A bedding of two layers of different mortars was applied to the reverse side of these fragments. 1st- thin layer of lime, marble powder and Plextol. 2nd - lime, sand, white cement mixture(1:4:0,3) reinforced with stainless wire netting. Fragments were fixed onto their original position. (Phot. 15, 16).
- Other fragments of opus sectile decoration have been provisionally protected with Japanese tissue paper facing, in order to prevent the fragile parts from further damage, then gradually reinforced with rich fluid mortar of lime and Plextol and left *in situ*..

3.3. Mosaic α-5

State of preservation

- about 30% of the surface of this mosaic has been lost completely (Phot. 18).
- Two of the panels with birds, big fragment of the geometric design and decoration along the edges of the mosaic are missing.

- The underlying soil has sagged and shifted.
- The surface is distorted due to mechanical damages (collapsed roof and walls)
- The glass tesserae are very soft and have been disintegrated and seriously eroded by soluble salts activity due to the high alkaline content of the glass paste. In many parts, where the glass paste was used for decoration, only remnants of colors and shape of tesserae can be seen (phot. 23, 25, 27, 29).
- In ancient times, a fire caused darkening of the mosaic surface and disintegration of the bedding mortar in several places (Phot. 19, 20). In antiquity small lacunae had been filled with white marble pieces (Phot. 31-33).

Conservation measures:

- detailed photographs and 1:1 tracings of all lacunae and sensitive zones were made.
- The surface was mechanically (brushes) and chemically (water and sponges) cleaned.
- Edges were provisionally protected with Japanese tissue paper (Phot. 35).
- Modern repairs with cement were removed mechanically using chisels and dentist tools (phot. 34). Protective band of cement applied on mosaic edges was replaced with lime mortar.
- The weak tesserae, small in size, eroded, mainly those made in glass or very soft stones, were treated individually with Paraloid B-60 diluted in ethanol.
  Some fragments of decoration were reconstructed. The reconstruction was done in the small lacunae, on the mosaic edges and in parts of the panels where there is no doubt as to the shape and color of the design. The reconstruction was possible thanks to the preserved colored ground and retrieval of original material (glass paste and tesserae found during excavations in the debris). Resetting of tesserae and reconstruction f disintegrated fragments was executed using magnifying glass (x 2,5). (phot. 28, 30, 35)
- After reconstruction of the wall foundations, missing parts of the mosaic bedding and big lacunae were filled with new mortar and gravel.

3.4. Mosaic α-6.

State of preservation

- about 20% of the original surface is missing.
- The mosaic is preserved in two separated fragments. A long diagonal gap, about 50 cm wide separates northern part of geometric decoration from the rest of the pavement.
- Loss of tesserae along the edges of the mosaic.
- The central part of pavement has been covered with a fragment of superimposed geometric mosaic α-7. Remnants of this mosaic were lifted and transferred to the store.
- The remains of pink bedding mortar of the lifted fragment cover the surface of the central part of the mosaic. In this part the bedding is disintegrated and tesserae are crumbling.
- Blue faience tesserae eroded, their surface is very dark and deteriorated.

- The western half of emblema with representation of a panther was reconstructed with slightly bigger tesserae (3-5 mm) altering original design.
- Several small and big distortions of the floor surface. A fragment (about 50 cm^2) of mosaic with vegetal decoration beside the western edge has sagged and shifted (ca. 10 cm lower). The sunken mosaic in this part was disintegrated with crumbling and dislodged tesserae.

Conservation measures:

- Temporary protection of edges of the mosaic and all weakened parts with Japanese tissue paper and methylocellulose.
- Reinforcement of disintegrated and crumbling tesserae. Injections and impregnation with Paraloid B-60.
- Resetting of disintegrated fragments. Injections with Plextol B-500 and Primal E-330 and soft mixture of lime, marble powder and Primal 1:2:0.5.
- Partial reconstruction of all small lacunae and weakened edges.
- Lifting of the disintegrated fragment. Due to the sunken bedding, deformation of the surface and disintegration of the cubes, the fragment measuring ca. 50 cm^2 had to be lifted and replaced in situ on a new fixed bedding. The fragment was carefully cleaned, the soil from the edges has cleared away. Loose tesserae were collected, bagged and their location marked on a 1:1 tracing. The cut lines were traced on a 1:1 drawing. The edges of cut lines on the mosaic were protected with Japanese tissue facing. The fragment was faced with gauze tissue and a second layer of canvas using carboxymethylocelullose as a glue. The faced fragment had to be dried with hot air (with the help of hair-dryer). The fragment was removed and reverse cleaned mechanically. The new bedding was prepared to reset lifted fragment made of lime and sand mortar with 0.5 % of white cement, while lime, marble powder and Plexol was used to make a bonding layer.
- Cleaning - removal of all calcareous accretion and remnants of superimposed bedding mortar from the surface of the mosaic (mechanically with scalpels and fiberglass brushes).
- Reinforcement of edges of the mosaic. Preserved fragments of this mosaic were uncovered down to the earlier floor level (ca. 25 cm deeper), then overlaid with lime, sand mortar with small addition of white cement.

4. DRAINING SYSTEM

The mosaics were preserved *in situ*, on their original beddings. Neither large lacunae were filled nor deformed mosaics surfaces were rearranged, it seemed therefore advisable for conservation reasons to introduce aeration pipes sunken below the surface of layer of gravel all around preserved fragments.
Perforated PVC pipes Φ 4 - 6 cm (1.5" - 2"), installed some 20 cm below the level of the mosaics, were buried in loosely strew gravel, to secure aeration of bedding and proper evaporation of humidity. This measure, will certainly protect mosaics against micro-organism developing in bedding, and also will accelerate drying of humidity remained in soil, at the same time localizing possible salt crystallization to immediate vicinity of the pipes.

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3. Fragment of the mosaic lacuna prepared for reconstruction.

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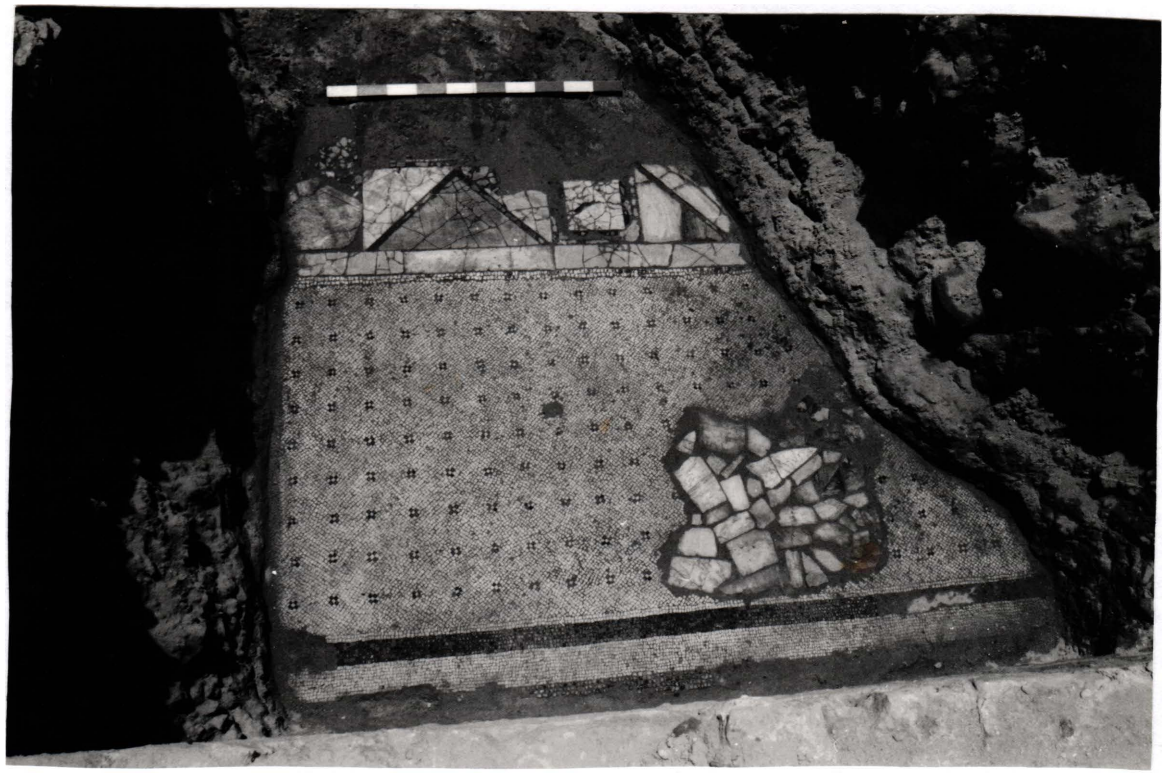
5. Mosaic α-3. Western part of the U-shaped mosaic with *opus sectile* decoration during the cleaning of the surface.

6. South-west corner of the mosaic after cleaning.



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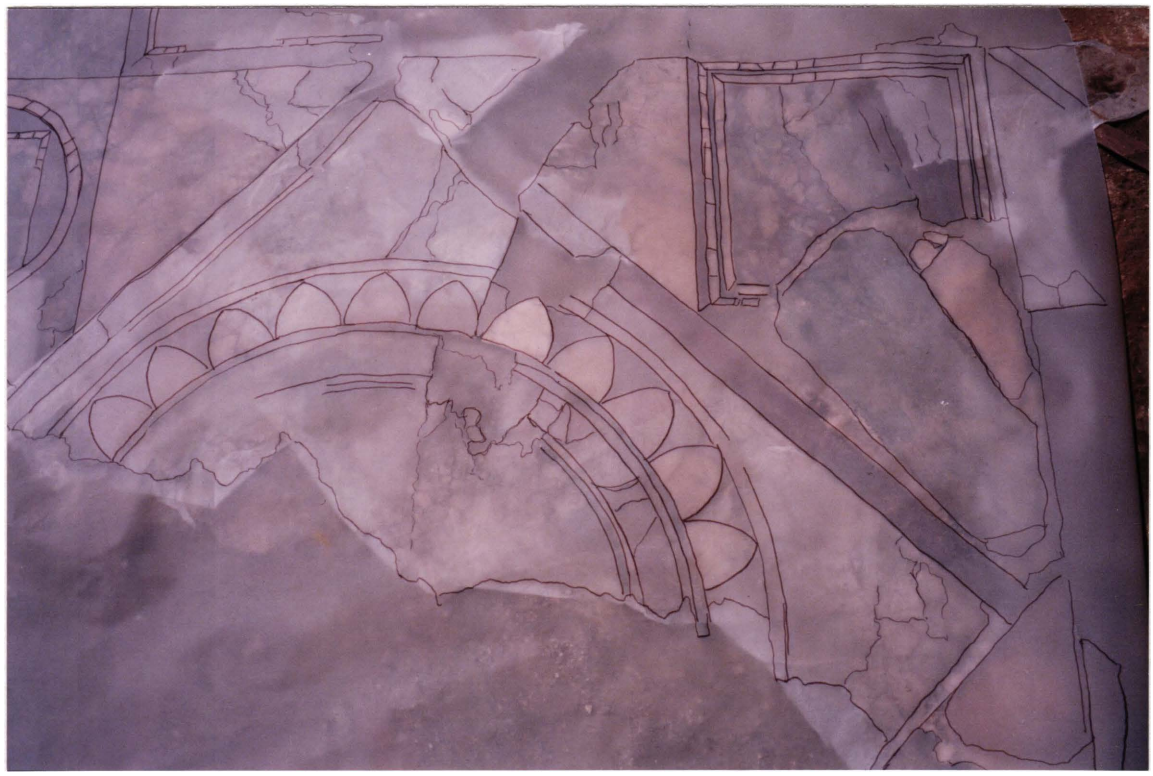

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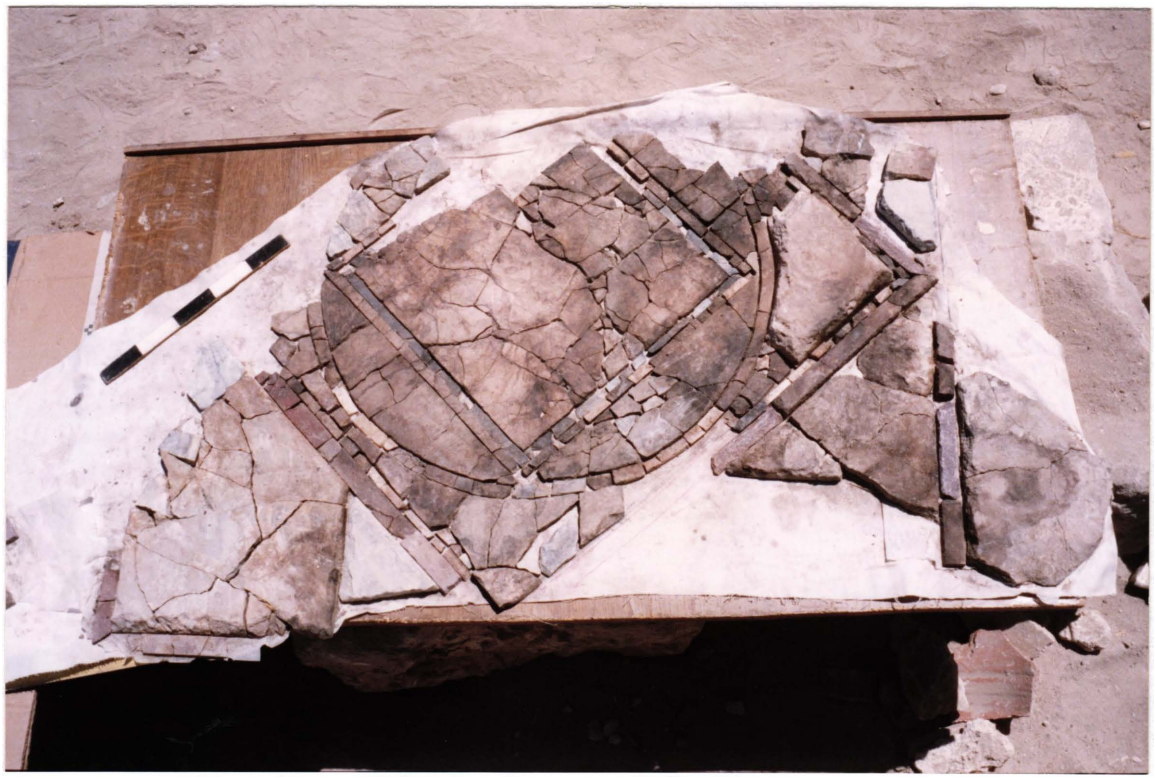

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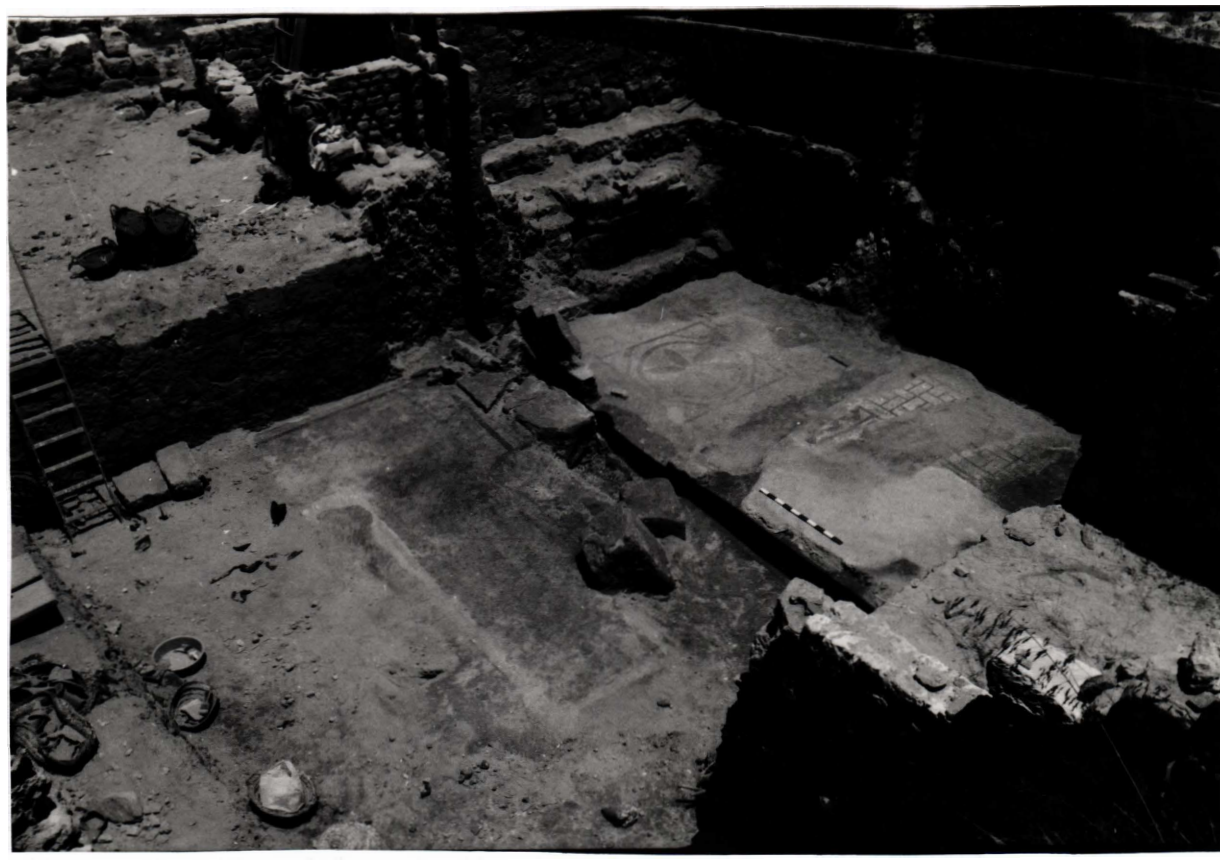
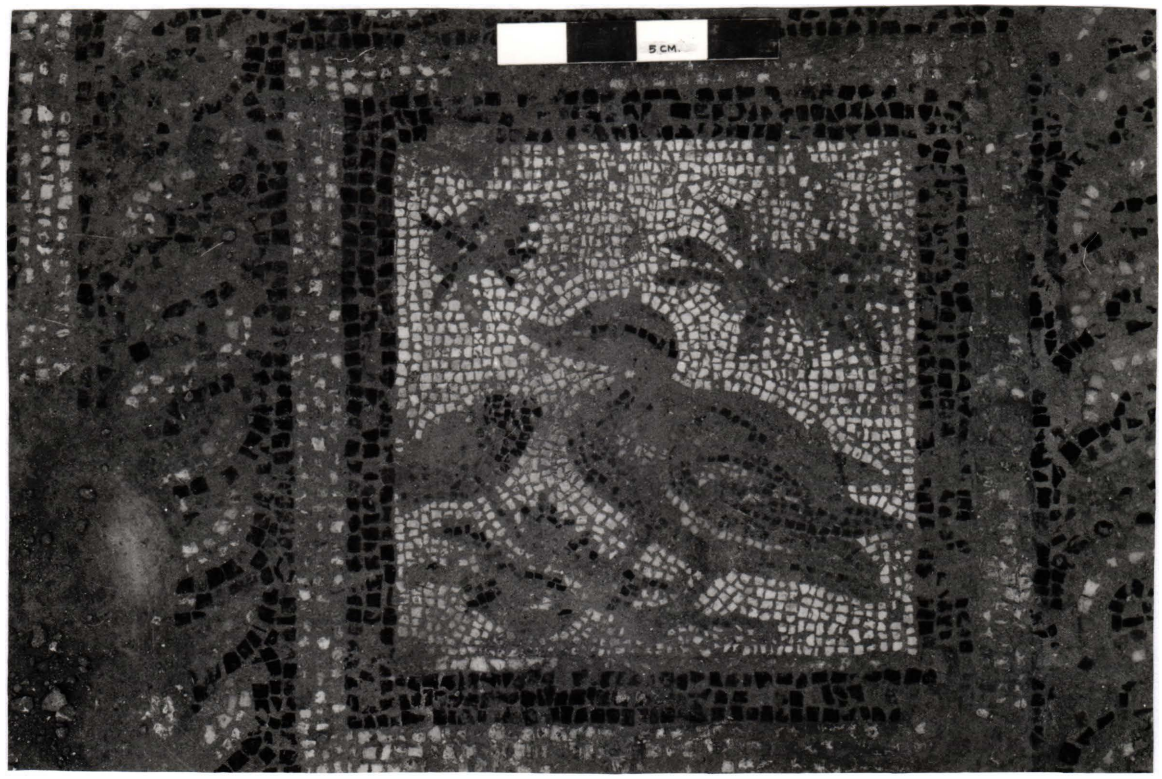


17. General view of the mosaics of the Early Roman house alpha during excavations.

18. Mosaic α-2 with rosette and mosaic α-5 with bird panel.

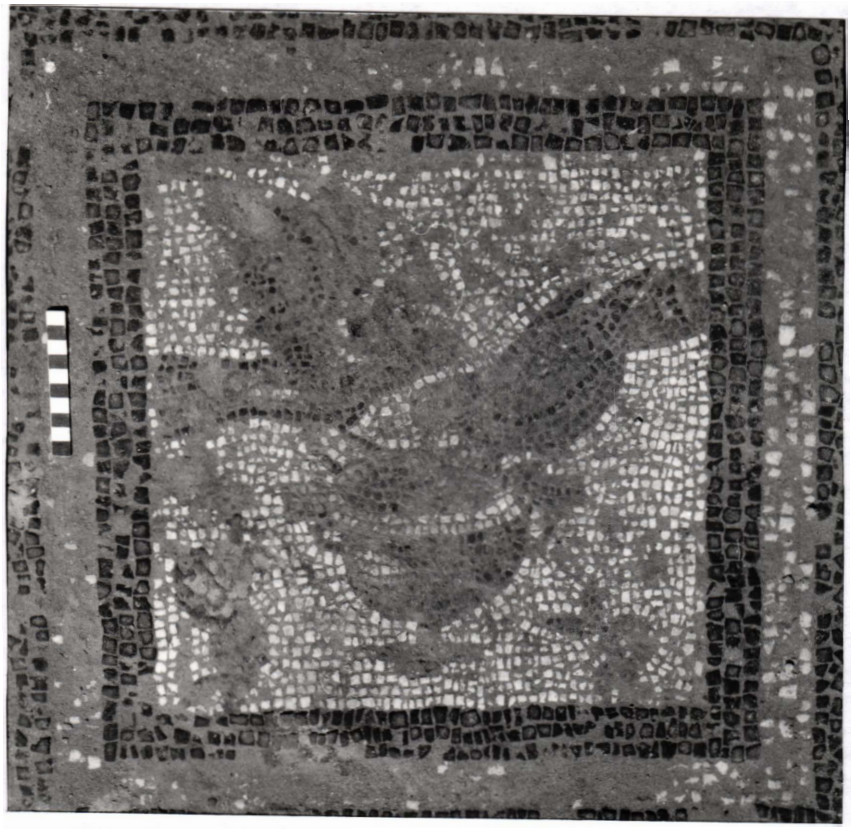
19. Panels with birds, before conservation.

20. Burned fragment of the mosaic. Surface protected with cement mortar in the 1970's.



21. Panel with duck, before conservation.

22. The same panel during restoration.



23. Panel with pigeons, before conservation.

24. The same panel after restoration.

25. Panel with heron, after cleaning.

26. The same panel after restoration.

27. Panel with parrot, before restoration.

28. The same panel after restoration.

29. Panel with peacock, before restoration.

30. The same panel after reconstruction.

31. Fragments of the panel with peacock showing deterioration of glass tesserae.

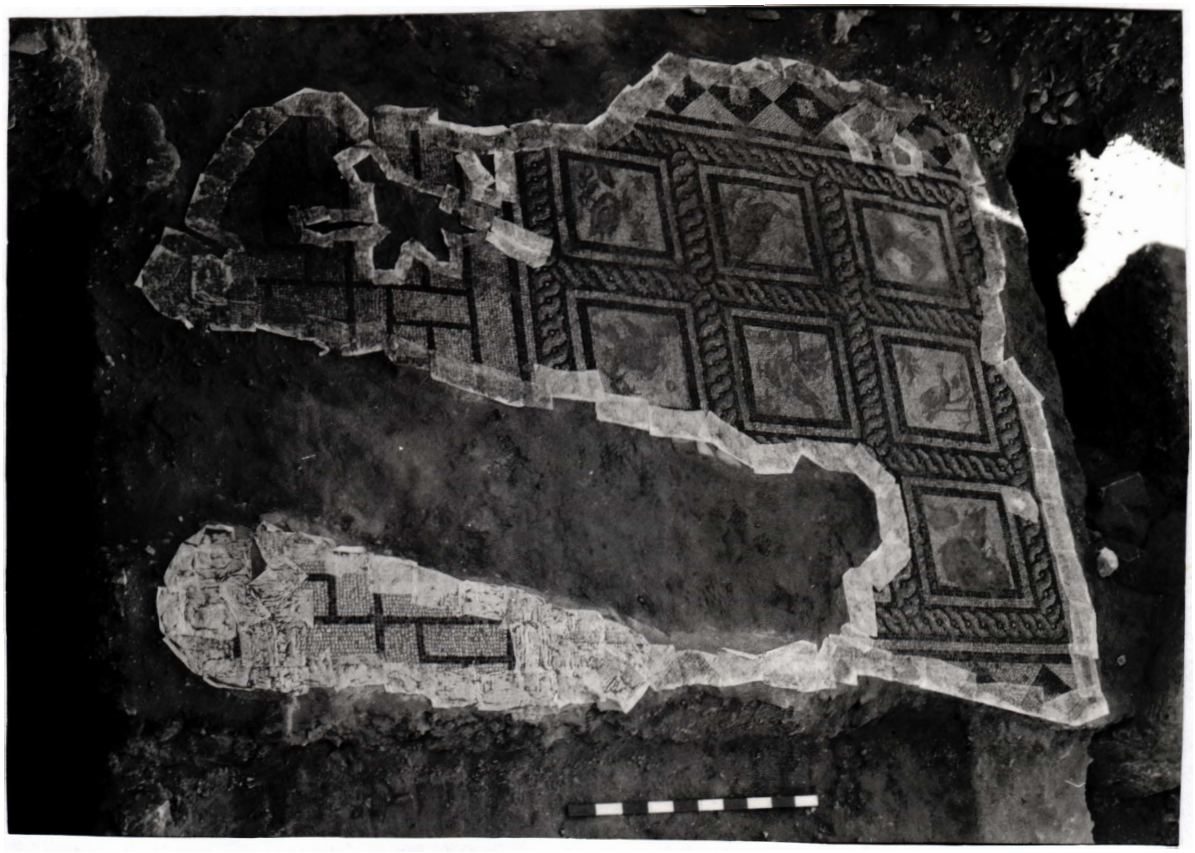
32. Head of heron, before conservation.

33. Fragment of parrot repaired with cement mortar, before conservation.

34. Fragment of pecock, before conservation.

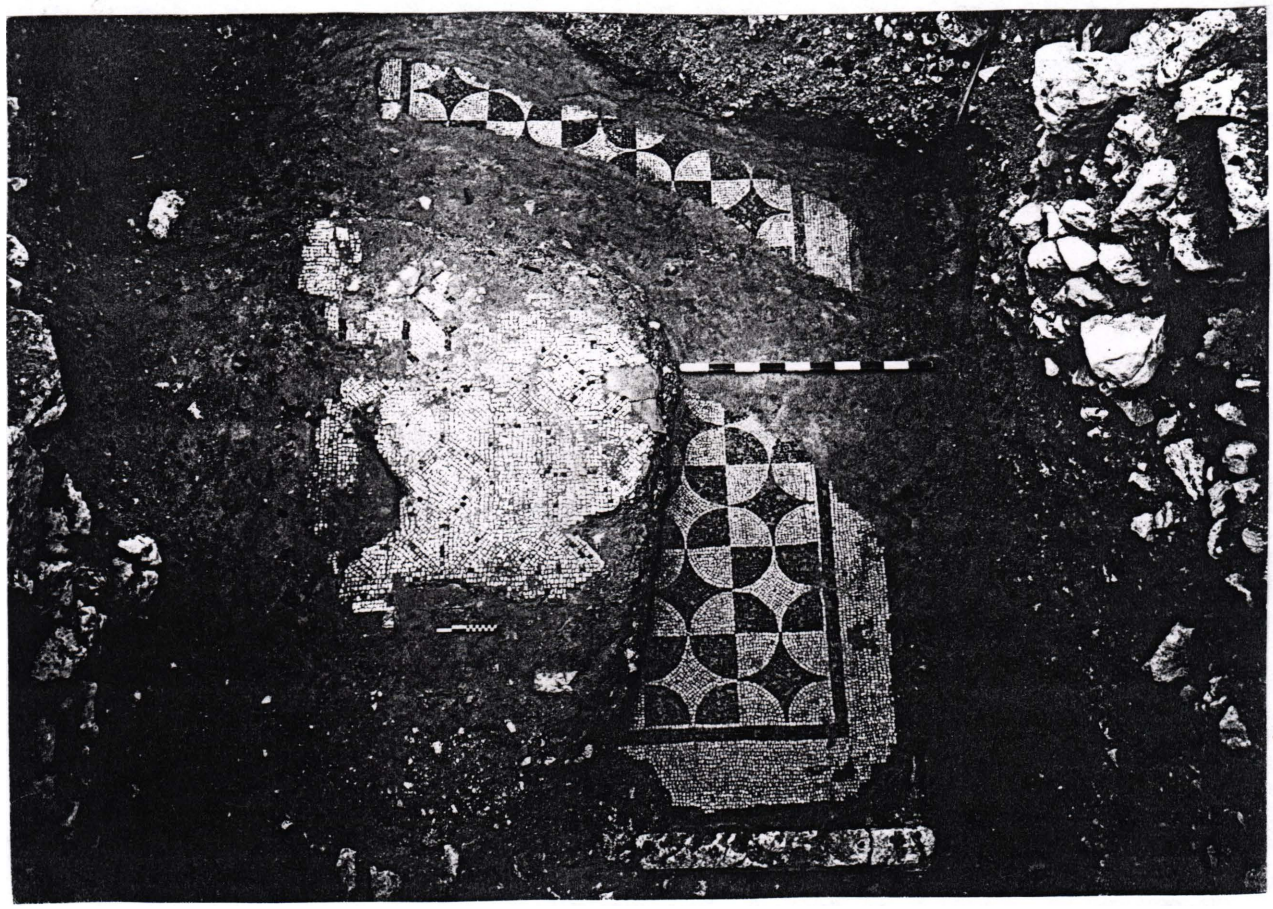
35. East corner of mosaic α-5 - geometric pattern, before conservation.

36. The same fragment after removal of cement and filling of lacunae



37. The borders of mosaic α-5 protected with Japanese paper facing.

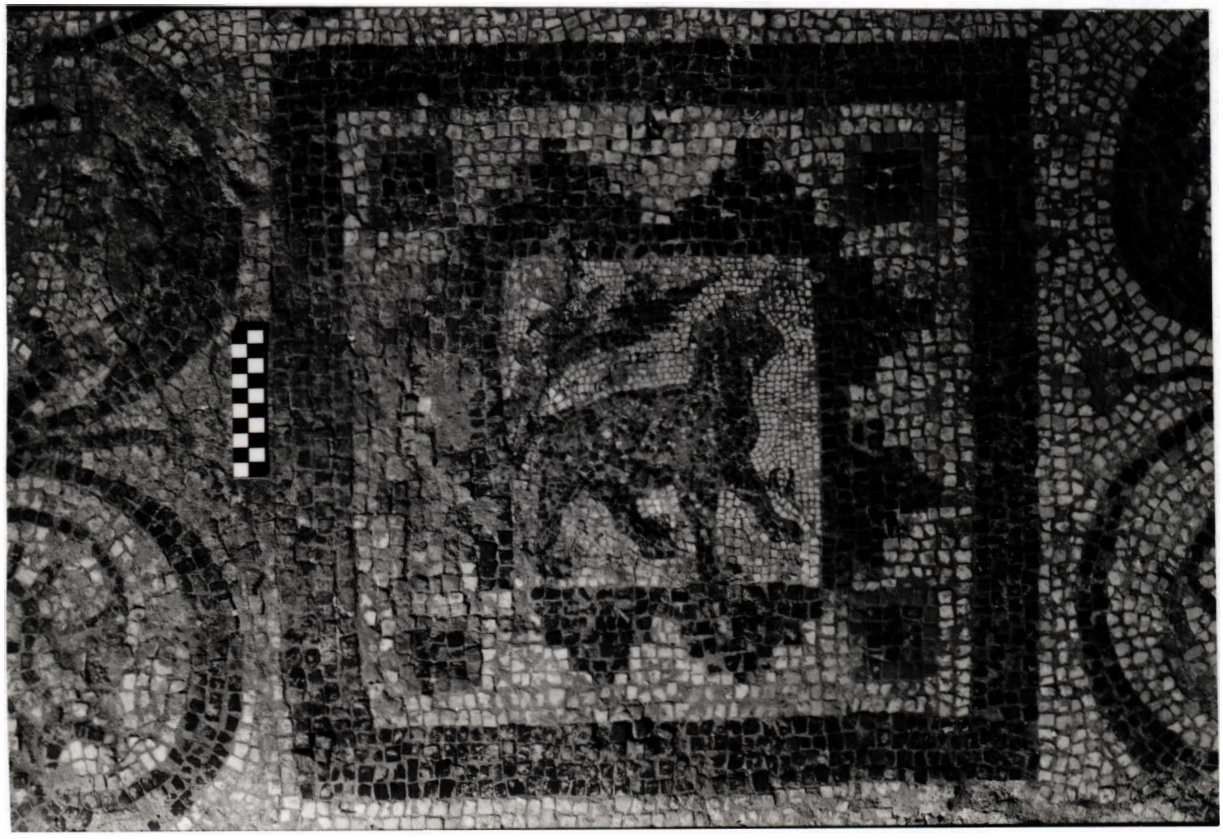
38. The mosaic after reconstruction of lacunae, edges reinforced with lime mortar.



39. Fragment of mosaic α-7, superimposed on mosaic α-6.

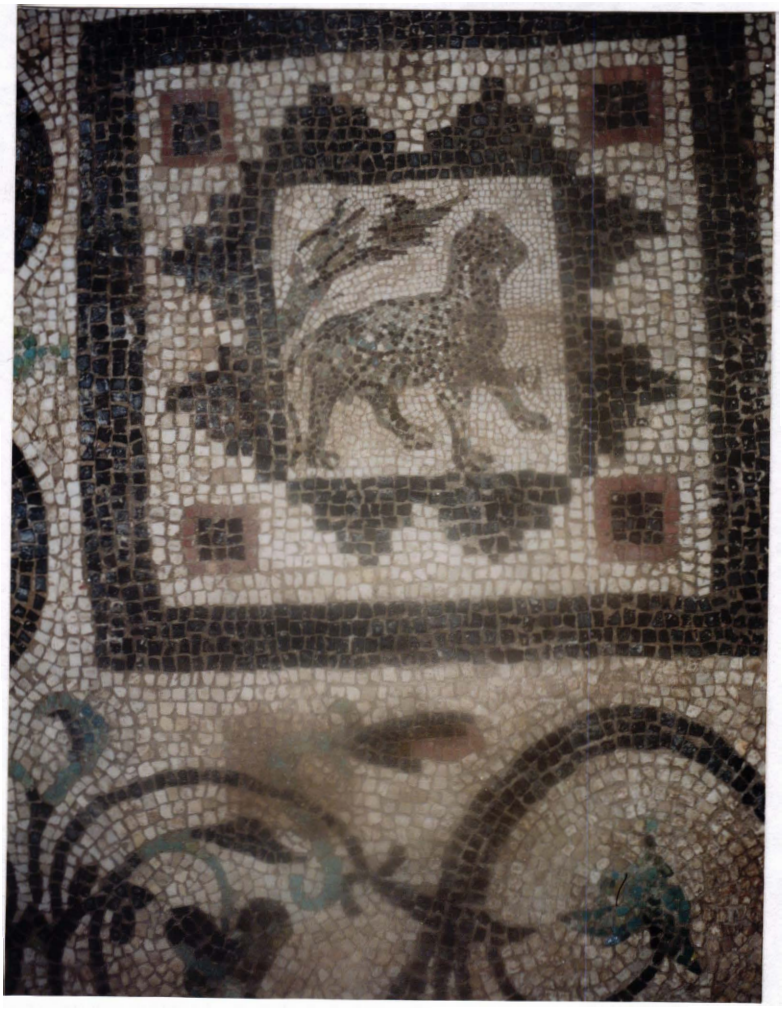
40. Facing of this fragment with canvas and PVA emulsion.

41. Mosaic α-6, before conservation.



42. Detail of mosaic α-6. Emblema with panther, before conservation.

43. Mosaic α-6, after conservation.

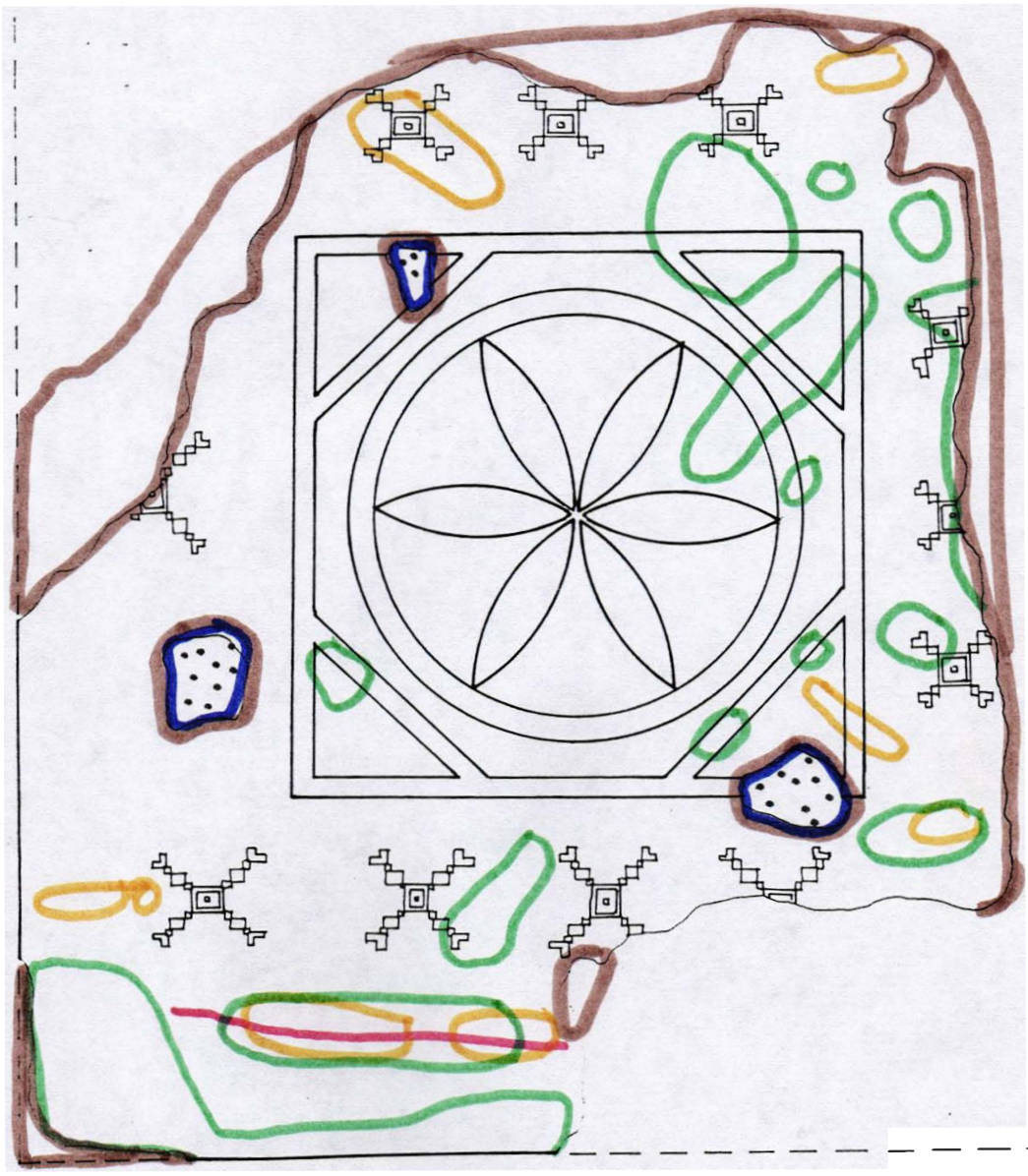


44. Detail of emblema, after conservation.

Drawing no. 1

MOSAIC α-2

Drawn by G.Majchere



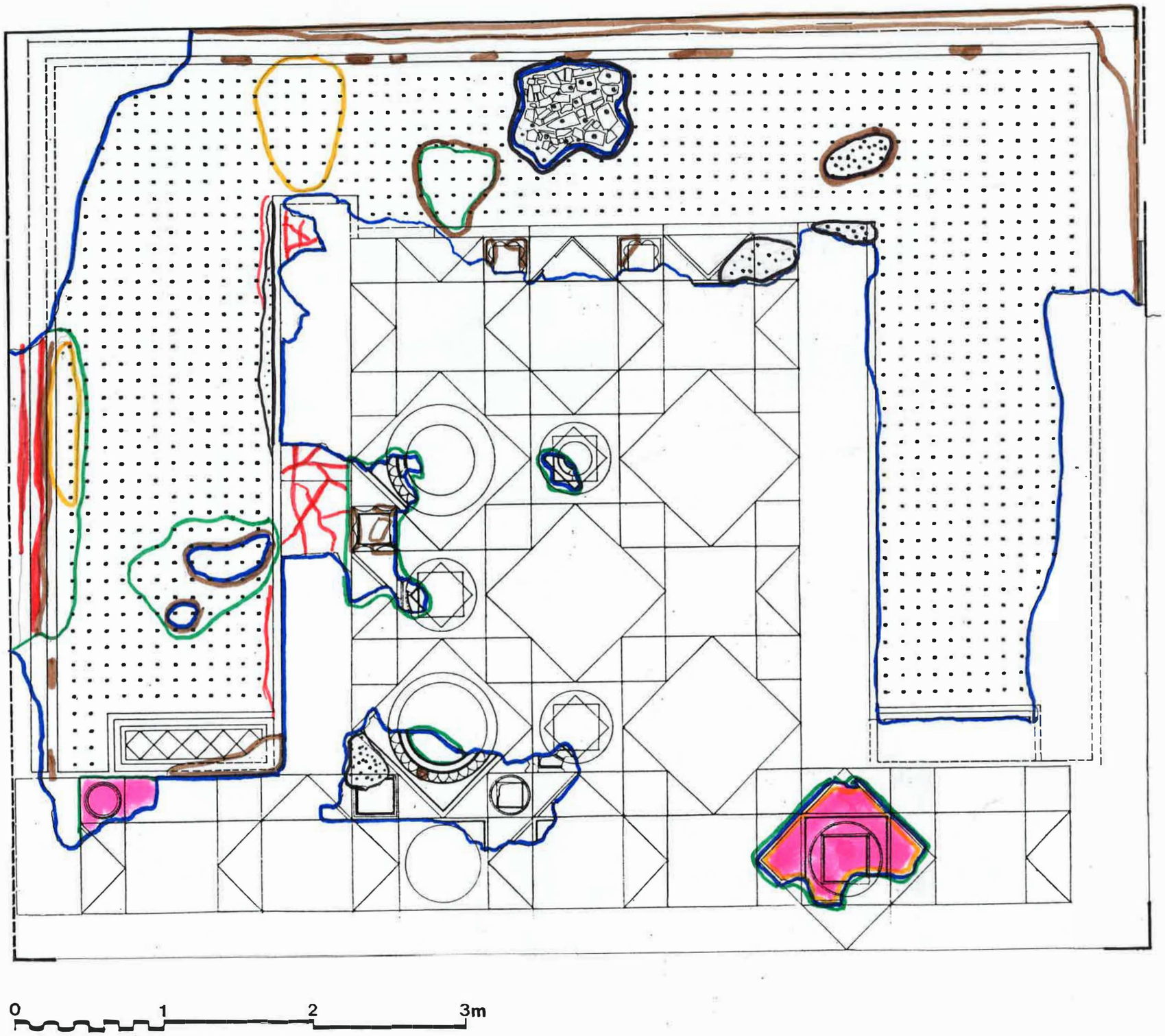
- cracks and fissures
- sunken surfaces
- lacunae
- fragments with disintegrated bedding
- old repairs
- reconstructed parts

0 1 m

Drawing no. 2

MOSAIC α-3

Drawn by W.Kołątaj

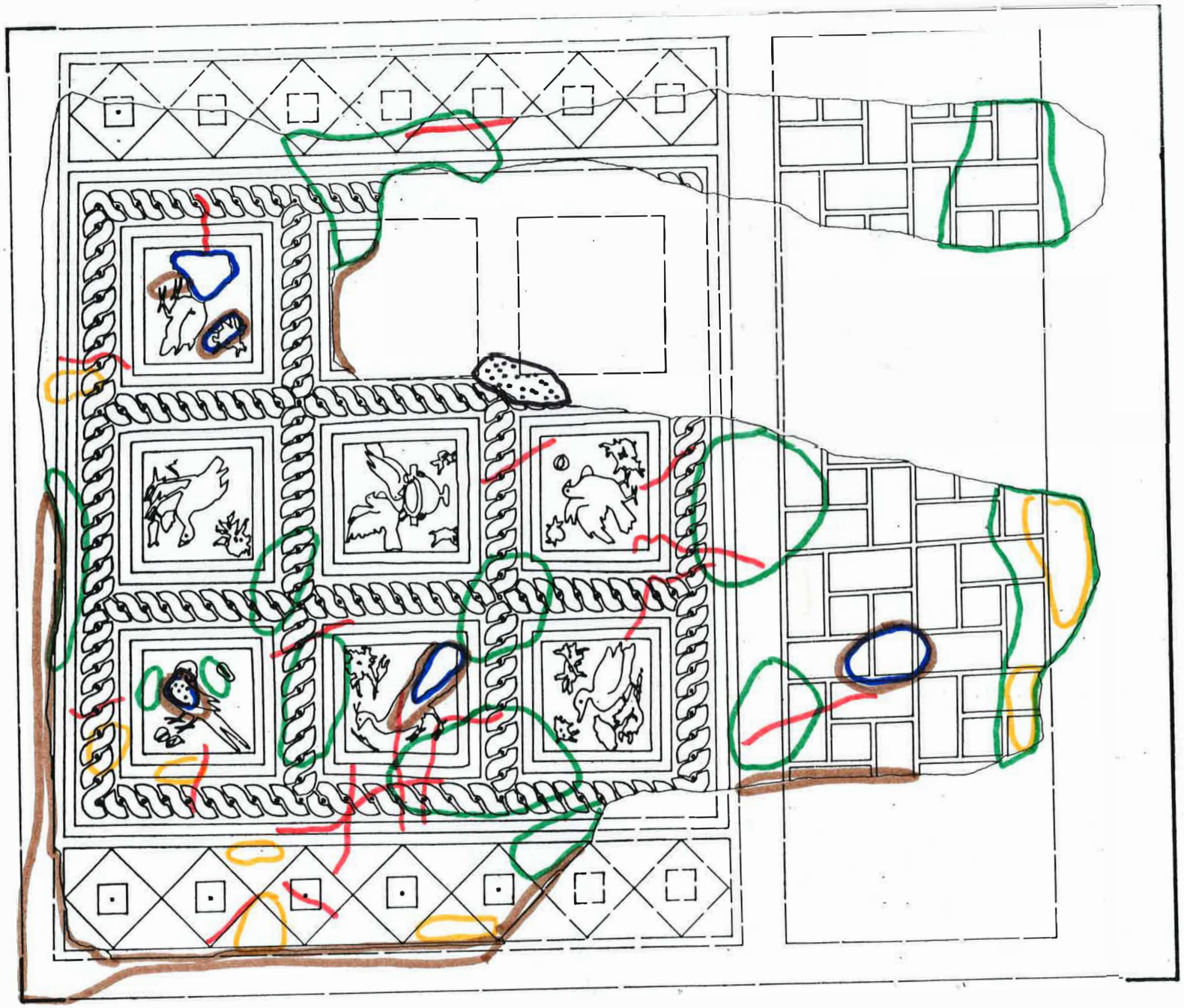


- cracks and fissures
- sunken surfaces
- lacunae
- fragments with disintegrated bedding
- old repairs
- reconstructed parts
- lifted and reset fragments

Drawing no. 3

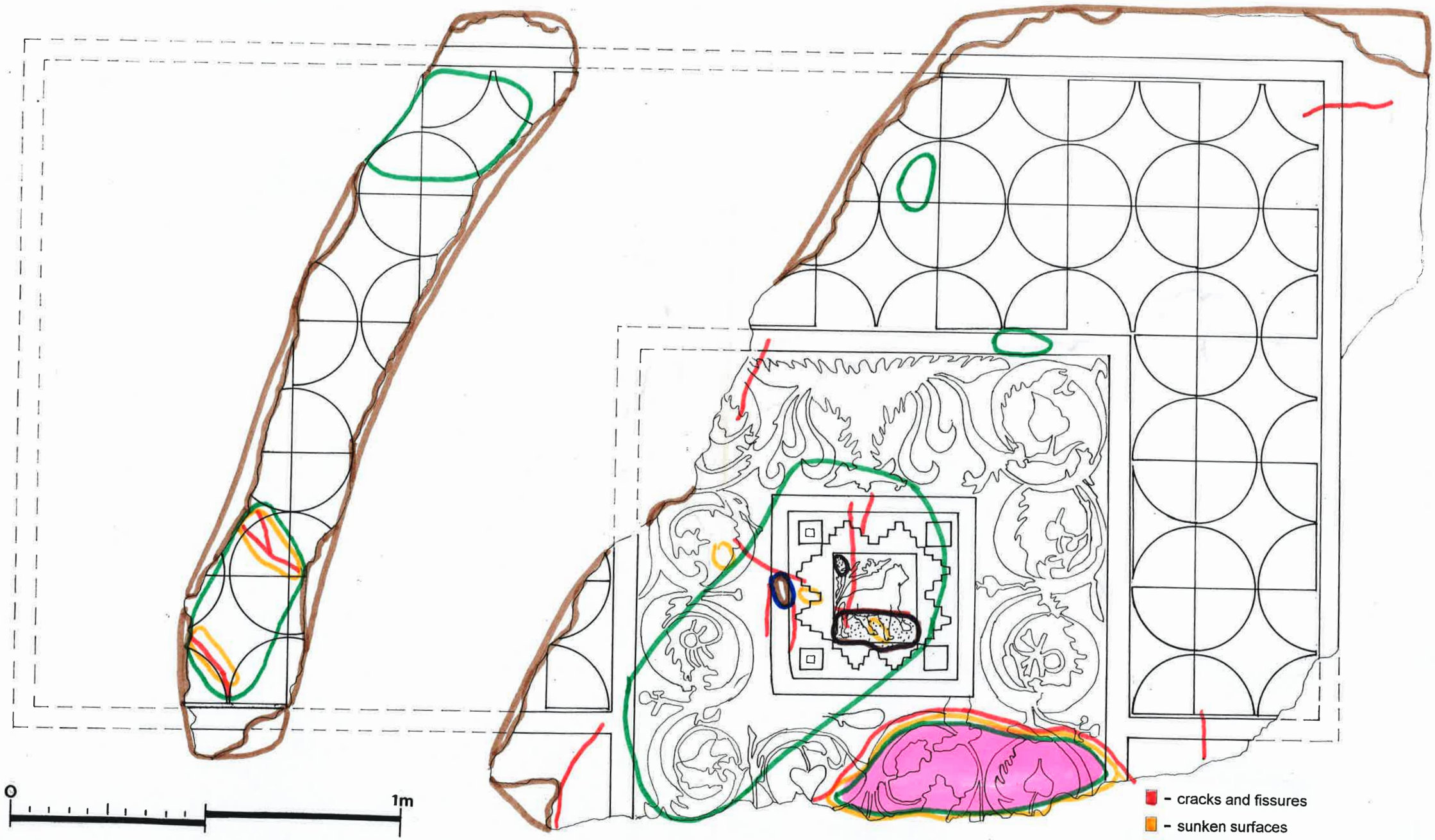
MOSAIC α-5

Drawn by W.Kołątaj



- cracks and fissures
- sunken surfaces
- lacunae
- fragments with disintegrated bedding
- old repairs
- reconstructed parts

0 1m



Drawing no. 4

MOSAIC α-6

Drawn by G.Majcherek