Conservation work in Marina el-Alamein in 2018 (Polish–Egyptian Conservation Mission)

Abstract: The article presents the program and results of continuous monitoring and preservation of historic architectural structures after the winter period at the site of Marina el-Alamein in Egypt, carried out by the Polish-Egyptian Conservation Mission. The program embraced studies of ancient plaster, polychromy and execution techniques employed for producing elements of sculptural and architectural decoration, as well as conservation of archaeological artifacts.

Keywords: Marina el-Alamein, architectural decoration, wall paintings, stone conservation, in situ restoration, research, microscopic analyses, thermovision, mobile laboratory, Roman baths, metal artifacts

The archaeological site of Marina el-Alamein on the Mediterranean coast of Egypt affords significant opportunities for developing and testing conservation procedures to be implemented in the specific conditions of a coastal site suffering from constant exposure to the elements, especially the particularly degrading conditions of a rainy and windy winter season. This is due to the varied building structure, location of individual monuments and the variety of local and imported build-

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ing materials. Experience gained from the work complements the historical knowledge derived from the archaeological excavations at the site even as it enhances the protection of cultural heritage for future generations. [PZ]

GENERAL ARCHITECTURAL CONSERVATION ASSUMPTIONS AND IMPLEMENTATION

The conservation team, wall painting conservator Anna Selerowicz and stone sculpture and architectural conservator Piotr Zambrzycki, continued already initiated conservation research programs (see Zambrzycki and Selerowicz 2018) and carried out current conservation procedures as required. Experiments were conducted on applying mortars modified with synthetic resins and various fillers. Recipes developed based on the results of these trials helped to protect newly discovered fragments of wall painting decoration and plaster. Conservation work was of a rescue nature and constituted an introduction to the research project, assessing the possibilities of preservation *in situ* of painting decoration exposed to atmospheric conditions prevailing in the coastal area of Marina el-Alamein.

Research on ancient architectural decoration techniques was continued, both in the conservation workshop and at the site. Microscopic analyses complemented standard registration procedures. The work focused on the necropolis in the southern part of the ancient town. Recorded traces demonstrated the use of pickaxes, flat and spike chisels, confirming an initial hypothesis that tools used over different periods actually shared certain features.

[PZ, AS]

DAMPNESS DISTRIBUTION STUDY

A new program was initiated to study dampness distribution within the city and the necropolis (Więcek, Perkowski, and Wysocki 2010). Planning for the analysis, several research areas were identified in the necropolis and city respectively, corresponding to areas with the most visible deterioration of the walls wherever these had been cleared during archaeological excavations and now rise above ground level.

Diverse types of tombs have been preserved in the city necropolis. They include pillar tombs, tombs in the form of a free-standing kiosk, as well as imposing mausolea with hypogea. The aboveground wall parts were constructed of blocks of local limestone, bonded in lime-sand or clay-sand mortar. Urban buildings were built using two construction methods: either massive blocks (like the ones used in the necropolis) or the broken-stone method of *opus emplectum*. During the research planning stage, emphasis was placed on structurally similar walls in different areas of the archaeological site, mainly in the massive-stone block structures.

One of the chief conservation issues concerning the ancient ruins revolves around their location. The city lies on the rising slope of the coastal plateau with a northern exposure. Private houses and

public buildings were built at levels of 1 to 7 m above sea level, while the main and southernmost part of the necropolis was at 15 m above sea level. Tomb T21, part of the southern bath house by the central square and the ruins of house H21 located by the sea were selected as benchmarks for the analysis.

Observations made over a 20-year period have shown that despite wide-ranging conservation work, full prevention of the deterioration process of some parts of wall was unsuccessful. The main agents of deterioration include climate zone-related moisture levels and salt migration from the soil. Seaside areas are notorious for their changing weather conditions, which include strong winds and rapidly fluctuating humidity. By sunrise and sunset air humidity nears 90%, often crossing the dew point. The situation is made worse by seasonal weather changes: torrential rain in winter, strong desert winds in spring and summer. Such severe exposure strongly impacts the state of conservation of the ancient walls.

Method of analysis

Thermal recordings and moisture distribution measurements were taken in mid-May, between 8 and 9 AM. High air humidity fluctuation and a dynamic increase of temperature can be observed in this part of the day. An electrical resistance Geo Fennel FHM 10 moisture meter and a Seek Thermal thermographic camera (range of 7000–14,000 nm) were used to conduct the tests.

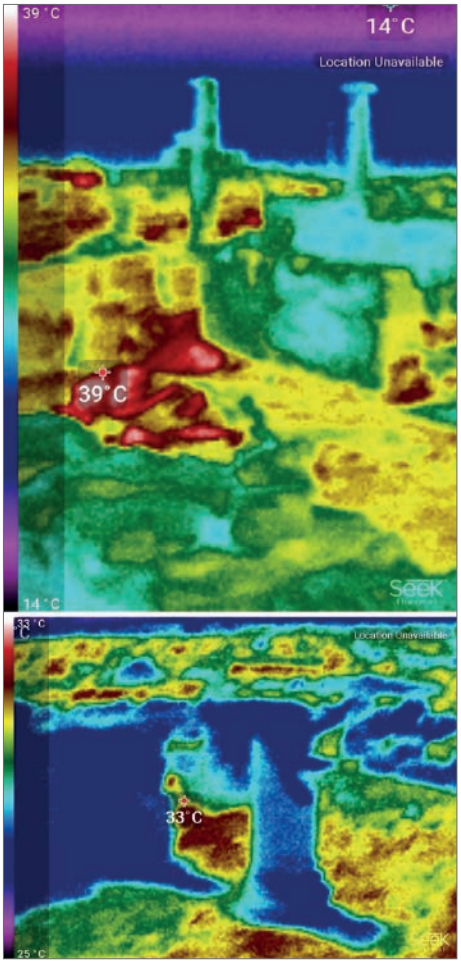

Fig. 1. Dampness study: left, thermovision measurements in the main square of the ancient town; right, wall humidity measurements being taken in Tomb T21 (Polish-Egyptian Conservation Mission | thermovision-image processing P. Zambrzycki, photo A. Selerowicz)

Wall moisture distribution was measured using an electrical resistance device in vertical axes. The axes were marked from the eastern, northern (sea direction) and western sides. Measuring point spacing was set between 20 and 30 cm, depending on wall structure. The research goal was to establish dampness distribution, analysing the walls near the soil and up to a height of approximately 1 meter. The top parts of the walls were measured in addition.

Thermal recording has shown temperature distribution, which in the earlier part of the day matched the dampness distribution of the walls and surrounding terrain. This has also provided valuable information regarding the temperature span of the walls warming up throughout the day.

Conclusions

Instrumental analyses confirmed the higher dampness levels of house walls when compared with structures in the necropolis located on higher ground. In the lower part of the bath walls, dampness exceeded 2%. Significantly, plasters with preserved polychrome paintings reached values of 1.0–0.8% in comparable areas. This confirms that the major cause of dampness is capillary soaking from the soil, where periodic fluctuation of air humidity is a less important factor. Measurements taken at House H21 near the bay show a much higher

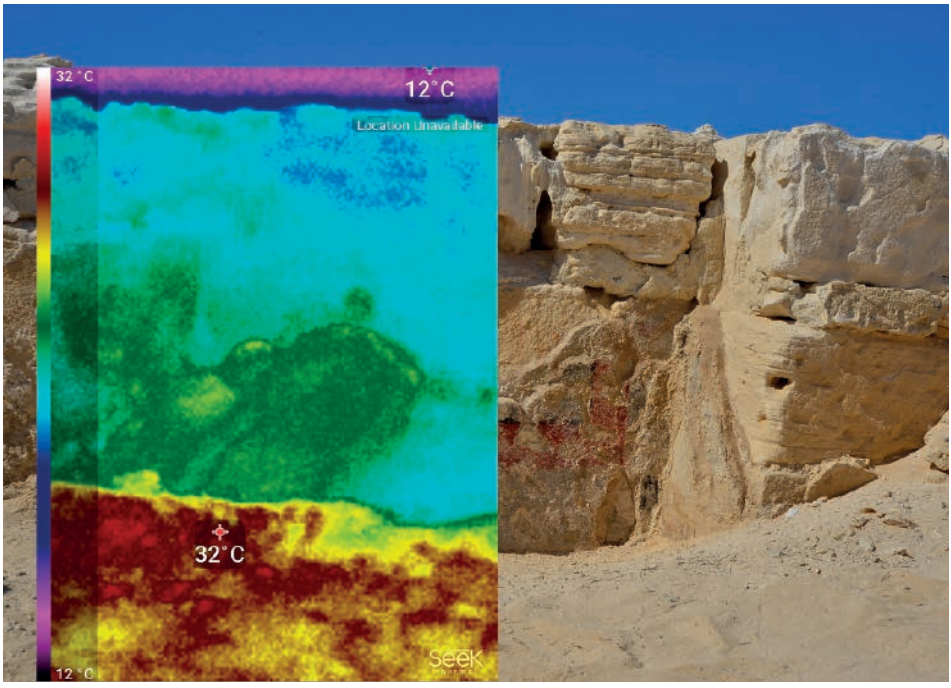

Fig. 2. Dampness study: thermovision measurement in the northeastern corner of Room 11 in the Roman baths with preserved relics of plaster (Polish-Egyptian Conservation Mission | photos P. Zambrzycki).

level of ground dampness. The readings fit within the 2% scale only above the height of 130 cm, which might be connected with high ground water levels and close proximity of the sea. Readings taken on the sunlit (eastern) and shadowed (western) sides of the walls differ only slightly. This further reinforces the belief that dampness is caused by capillary soaking from the soil. The situation is greatly improved in the area of the necropolis. The soaking effect is very limited there due to terrain, as the tombs are located on bedrock and far from the sea. In comparable areas the readings reached from 1.2% to 0.6%. [PZ]

CONSERVATION OF POLYCHROME MURALS

A major conservation issue at the site is the protection of painted decoration *in situ*. Research was continued in selected rooms of the baths (for the archaeological and architectural description, see Bąkowska-Czerner and Czerner 2019, in this volume). Observation of last year's implementations have shown positive results of pasting the back of detached fragments of plaster with a 5% water solution of Primal AC33 and reinforcing the painting surface with a 2% solution of the preparation.

Experiments with the use of modified mortars for conservation have essentially confirmed the effectiveness of the solutions used.

In seasons to come research will concentrate on remains of wall decoration with eastern, western and northern exposure, analyzing the influence of wind directions and thermal and humidity conditions on the effectiveness of preventive conservation methods in relation to specific exposure conditions within the ancient town [AS]

ROMAN BATHS: CORRIDOR 11

Several layers of decorated plaster of different degrees of cohesion are present on the lower walls of Corridor 11 of the Roman baths located south of the main town square in the central part of the site [*Fig. 3*]. The main threat to the integration of the layers are the unfavourable microclimatic conditions. Hence preventive action was undertaken aimed at reinforcing plaster adhesion to the substrate and protecting the surface of the polychromy.

Photographic documentation was made, samples were taken for testing and the stratigraphic structure of the layers was established. The uncovered layers (in some places up to 10 layers were observed) were partly cleaned of depositions. Edges of losses were protected with bands of lime–cement mortar with sand and crushed brick filler, and a sprinkling of a 5% water solution of Primal AC33 as plasticizer. The polychromed plaster surface was reinforced with a 2% water solution of Primal AC33 (Jakubowski 2008: 130–131). The decorative layer is preserved in relatively good condition [*Fig. 3* bottom]. Traces of cuts in this layer testify to ancient preparations for adding another plaster coating.

Fig. 3. Northeastern corner of Room 11 in the Roman baths with preserved relics of plaster: top, before conservation; bottom, after conservation; note bands reinforcing the plaster edges (Polish-Egyptian Conservation Mission | photos P. Zambrzycki).

ROMAN BATHS: ROOM 13

Polychrome plaster was discovered also on the lower walls of Unit 13, a corridor leading to the latrine (Bąkowska-Czerner and Czerner 2017: 181; 2019, in this volume). The first step was to assess the preservation condition of the mural, identify the nature and number of technological layers and determine the scope of research and conservation treatment in the coming seasons. The objective was naturally to reinforce the layers of polychrome plaster and to prepare the more valuable fragments for future transfer onto a movable substrate. Following the work, the painted plaster decoration was covered temporarily with geotextile and sand until the next season.

The nature of the decoration and its relatively good state of preservation called for a separate preservation program [*Figs 4–5*]. Examination of the plaster on the south, west and east walls, the latter divided in the middle by the entrance to the latrine, revealed six layers. The oldest two layers of plaster preserved a dado decoration

The painted decoration was on a lime mortar ground. The thickness of both dado paintings reaches around 2 cm. The one on the bottom, chronologically the earliest, is characterized by considerably higher artistry and is also much better preserved than the top one. Therefore it allows more accurate and detailed recognition of the composition and artistic skills of the painter. Probably due to severe damage, the paintings were covered later with simple coats of mortar with coarse-grained filler, the thickness of which does not exceed 5 mm.

Fragments of the original painting composition discovered on the south and east walls allowed for a theoretical reconstruction of the wall decoration in this interior. The lower part was a dado, a color frieze consisting usually of three colors. Above the dado was a series of geometric panels. One can see a black dado and shades of red in the panels above it. The decoration was painted on white mortar applied onto the stone substrate. The paint layer is characterised by good adhesion to plaster of high cohesion and hardness. The edges of the surviving plaster were weakened by harsh, unfavourable climatic conditions, and had become partly detached from the wall.

Photographic documentation was made and samples taken for testing. There were no signs of salt efflorescence on the polychrome surface. The painting was cleaned of loose pieces of plaster and sand. Due to the high hardness of the plaster, it was decided not to deepen the cracks, as the vibrations induced during this procedure threatened to weaken the adhesion of the mortar to the substrate. The lime–sand mortar for the bands and filling in of cavities and bigger cracks was prepared with carefully chosen strength parameters. It was composed of lime, a fine-grained sand fraction, cement and a small amount of crushed brick (3:1:0.5:0.08 respectively). A 2% solution of Primal AC33 in water was added to increase mortar flexibility. Adding crushed brick served to enhance the hydrophobic properties (waterproof mortar) (Acharya, Archroy, and Gokhale 2017). Surfaces to be preserved were first moistened with water. As part of the research project, a 2% solution of Primal AC33 in water was applied for reinforcement, brushing it onto the surface with a soft brush.

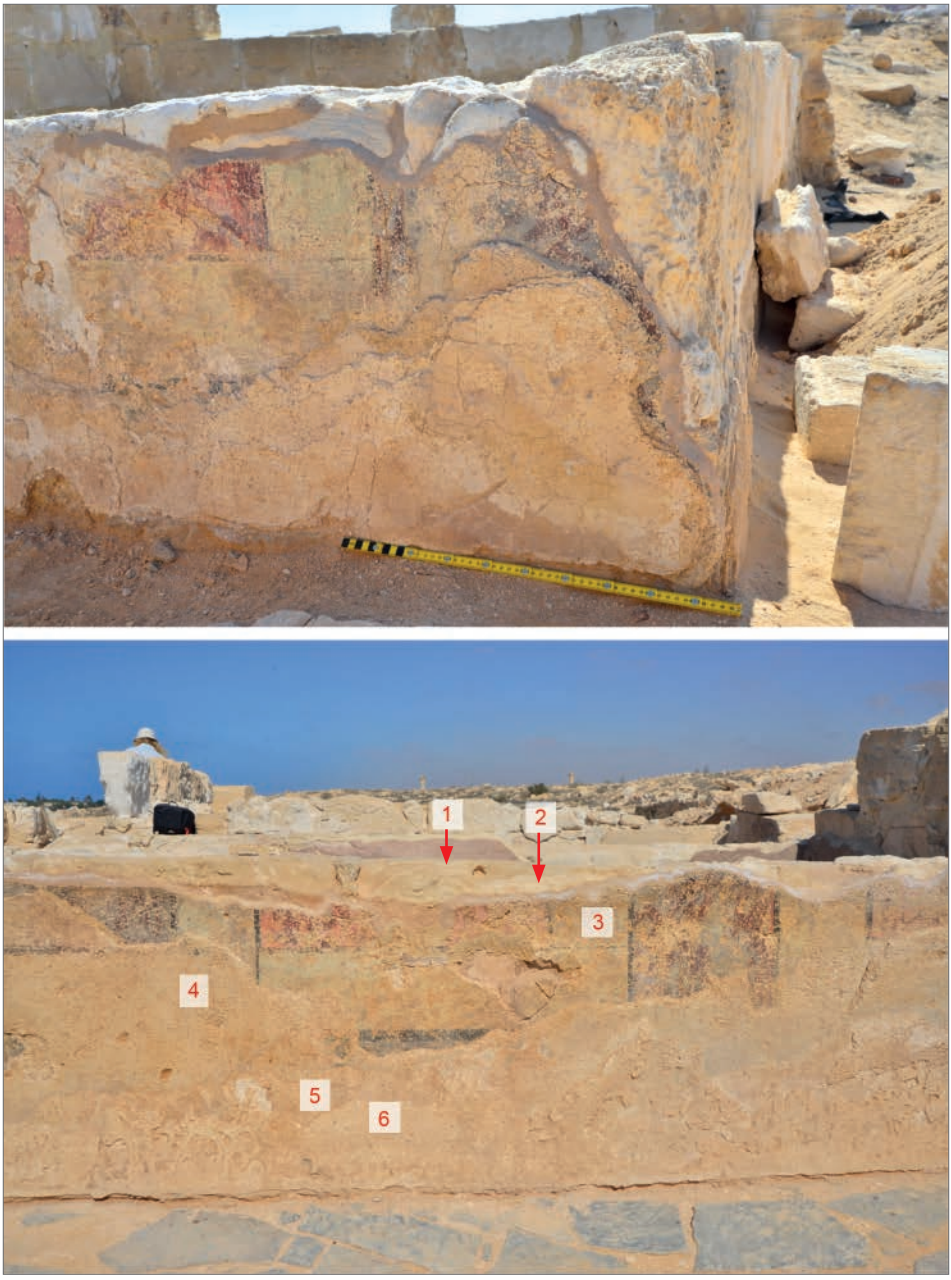

Fig. 3. Polychrome plaster on the walls of Room 13 of the Roman baths: top, east face of west wall during the installation of bands protecting the plaster edges; bottom, south wall revealing the underlying decoration in the tests; 1 – wall; 2 – lime mortar; 3 – plaster with "dado" decoration, 1.5 cm thick; 4 – plaster with "dado" decoration, 2 cm thick; 5 – thin mortar with coarse-grained filler, 0.3 cm thick; 6 – thin mortar with coarse-grained filler, 0.5 cm thick) (Polish–Egyptian Conservation Mission | photos P. Zambrzycki)

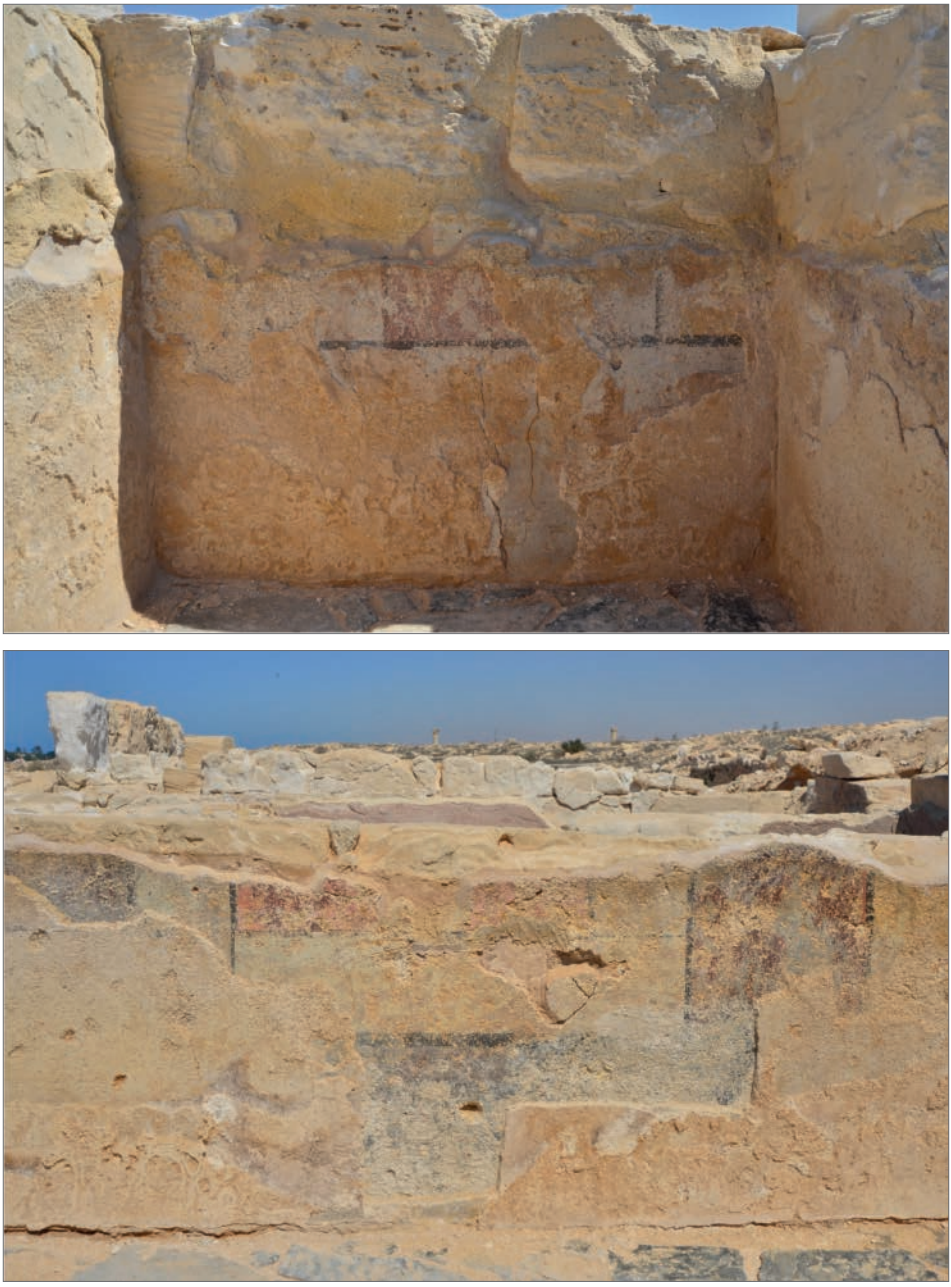

Fig. 5. Polychrome plaster on the east wall of Room 13 of the Roman baths: top, the first layer of plaster decorated with largely preserved polychrome decoration and successive technological layers preserved in poor condition, during conservation; bottom, original decoration visible in the tests (Polish–Egyptian Conservation Mission | photos P. Zambrzycki)

ASSESSMENT OF THE PRESERVATION OF STORED ITEMS

The collection of wall paintings on an artificial substrate (transfer) and natural stone (limestone blocks) in the storerooms at the site was assessed in terms of the state of preservation of the polychrome surfaces (for a review of these pieces, see Zambrzycki and Selerowicz 2018 with earlier references). The condition of the seven items, which have been repeatedly preserved and conserved, was stable. For most of the items there was no loss of adhesion to the ground or structural cohesion between technological layers. A significantly reduced humidity of the environment has eliminated salt migration from the plaster. Preventive work in 2017, consisting of strengthening the paint layer with a 2% solution of Primal AC33 in water and a 5% solution in batches of exposed stone and making protective bands and restorations, produced a satisfactory effect. [AS]

Fig.5. Bronze coins found in 2018: top, obverse and reverse, before conservation; bottom, same, after conservation (Polish-Egyptian Conservation Mission | photos P. Zambrzycki).

CONSERVATION OF ARCHAEOLOGICAL OBJECTS

The main purpose of the conservation activities is to stop deterioration processes attacking the material substance of individual artifacts and, if possible, to restore their original appearance, thus enabling identification and classification (Medeksza et al. 2010: 97). Most of the small finds restoration this season concerned small bronzes: coins, nails and pieces of metal. Several coins, including selected pieces from the collection in the storeroom coming from earlier archaeological work, were cleaned enough to allow a satisfactory identification by the numismatist (see Lichocka 2019, in this volume) [*Fig. 5*].

The procedure consisted as usual of photographic documentation recording the condition of artifacts before conservation. The products of metal corrosion were removed in a bath of a 1% water solution of disodium EDTA using an ultrasonic washer for the purpose. Items were then desalinated in distilled water using the washer. Where necessary, products of corrosion were removed with a glass fibre pen. Artifacts were then protected with a 3% solution of Paraloid B-72 in toluene (Phenix 1992) and final documentation made. [PZ]

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