CONSERVATION WORK
in the funerary chapel of Meref-nebef

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FUNERARY CHAPEL

The chapel of Meref-nebef was hewn in a sedimentary rock called mudstone, which is heavily stratified and features high loam content. Many calcite veins and crystal concretions can be observed. The color of the walls clearly differs from greenish-gray in the lower parts to yellowish-rusty in the upper ones, the differentiation being due to the presence of iron compounds in the rock. The upper stratum is visibly subject to stronger erosion, observable in the form of rifts and delamination. The southern wall of the chapel is in particularly poor condition. Horizontal foliation of the bedrock leads to pieces of the stone falling away. Delamination in the vertical plane also occurs, with stone layers of 0.5-2.0 cm thickness coming away from the bedrock together with the painted surface and all. Numerous vertical and horizontal cracks, as well as shifts of the face (up to 3 mm) are to be observed as well. Rock detritus filling the damaged places presents an obstacle in reattaching the face to the matrix.

Other walls reveal vertical and diagonal cracks as well. The crevices widen toward to the top, and particular wall planes are displaced relative to each other.

Long rifts cut through the ceiling of the chapel, one longitudinally (slightly obliquely), another one latitudinally. There is evidence of slight sinking and mutual wedging of adjoining parts of the ceiling (which is 1.30 m thick). Inside the chapel these rifts are more conspicuous (2-10 mm) than outside. The mutual displacement of particular sections of the ceiling reaches 2-10 mm. This damage is due probably to the rock's poor structure and low resistance (especially in the upper parts), as well as the weight of superimposed structures comprising both stone and brick elements; finally, the cracking may be caused by internal movements of the rock matrix and the tension occurring between solid rock and empty spaces.

The ceiling over the northern part of the facade is considerably cracked, with a piece of the underside having fallen out completely. The cracks continue onto the lateral walls of the facade, reaching deep into the structure of the rock. Some of the cracks (e. g., the ones running N-S, closer to the entrance) are partly covered with paint, an indication that they were there prior to the construction of the chapel. The chink, which follows the southern wall, must have appeared considerably later, after the brick walls above the chapel had been erected, as these walls have cracked along with the rock.

Observation of the rock of the chapel ceiling and floor suggests considerable horizontal delamination. A closer examination of the rock surface above the chapel ceiling indicates that at least some of the cracks follow calcite veins present in the rock structure.

Salt efflorescence occurs on the chapel wall surfaces in varying degrees of concentration, from a hard crust on the lower parts (up to 1 m) to patches of salt crystals in the upper sections and ceiling, the latter being easily removed with a brush-pencil.

CLIMATIC CONDITIONS

The first step was to improve the climatic conditions inside the funerary chapel. The existing system of lighting was changed, the halogen lamps installed in the four corners of the chamber in the absence of the mission being replaced with energy-saving lamps mounted on mobile stands. Six lamps (OSRAM, 23 W each) were used: four inside the chapel and two in front of the facade, corresponding in power to the traditional 120 W bulb. The light was magnified with aluminum foil used as a mirror, providing sufficient light for the work to be continued. The level of emitted thermal energy was thus reduced more than twentyfold. The effect was immediate: lower temperature and lower humidity inside the chapel.

In order to ensure a minimum of ventilation, two rows of vents (each with a diameter of 15 cm) were pierced in the iron door of the chapel.

An oblong exhaust with a ventilating-fan installed at the end was also constructed outside the chamber. When necessary, this exhaust was reversed, blowing dry air from outside into the chapel interior. As soon as the consolidation of all, even the smallest parts of the polychromy threatening to detach, powder or fall away, was finished, the exhaust was removed and replaced with several ventilators installed beside each of the work-stands.

The number of persons allowed inside the chapel at any given moment was reduced to five.

All these steps have stabilized the climatic conditions at an acceptable level. A further, expected effect of this procedure is a considerable reduction of salt efflorescence in view of the diminished dampness of the rock.

ROCK

Samples of the rock were taken for laboratory analyses to determine the exact physical and chemical properties. A detailed conservation program will be prepared based on these results, particularly regarding choice of appropriate preservation chemicals and methods.

The rifts on the ceiling have been drawn and photographed. Mud mortar mixed with sand (1:2) was used to cover the top surface of the rock above the chapel. A white cement and sand putty (1:4) filled the rifts in the ceiling. The new mortar and the ceiling was protected against atmospheric changes (such as daily temperature differences, excessive insolation), with a 10 cm thick layer of sand spread on top of the rock. Gypsum seals placed on cracks inside the chamber will help monitor any rock movement.

PAINTED AND RELIEF DECORATION

The work was pursued simultaneously on the chapel facade and interior. The decoration of the facade was secured the moment the original rubble filling covering it was removed. Each fragment of the wall was first cleaned, removing all kinds of sediments and dust down to the smallest fraction. Parts of the decoration found in the fill were then reattached to the matrix. Paraloid B72 in toluene was generally used. Its concentration varied according to the case. Reattachment of loose polychromy preserved on mortar followed a two-step procedure. A 5% solution of Paraloid was used on the mortar to reinforce it sufficiently, after which the piece was fastened to the rock in its proper place. For this purpose, an 8-10% solution of Paraloid was used, possibly with the addition of chalk and sifted sand in order to condense the fixative and to fill the cracks. The procedure was similar in the case of painting on mortar still attached to the walls. Treatment was limited to reinforcing the mineral ground of the painting layer. The same procedure was applied to mortar leveling the rock surface, which, following various circumstances connected with the rock, lacked any polychromy. Minor pieces of painting which had peeled from the ground were reattached using a water solution of Primal E330 (5%), after having been treated first with a water solution of 96% ethyl alcohol (1:1) in order to reduce surface tension and to increase glue penetration.

Structural reinforcement was required in the case of many loose fragments. A special cement prepared for this purpose consisted of chalk, ground limestone, fine sand, white cement (respectively 2:2:2:1,5) in a Primal E330 solvent. Trial lutes (chalk, ground limestone, white cement (4:4:2) modified with Primal E330 and 2% MORTELDICHT III (Remers)) were also applied to salt-covered surfaces Structural lutes helped to fill in the air-pockets. This work will be continued in 1999.

In the case of wall decoration inside the chapel and on the door jambs, conservation consisted of the following procedure: Thin fragments of polychromy were reattached to the wall with Primal E330 (as above). Also used was a Paraloid B72 solution in toluene (5%) whenever the ground needed to be reinforced.

Fig. 1. Detail of hunting scene on the eastern wall of the chapel, after conservation (Photo Z. Kość)

Small, very friable fragments of the polychromy (in the zone just below the ceiling and in the central parts of the "false doors") were reinforced with Paraloid B72 in toluene (3%) prior to reattachment. The same solution was used to reinforce the falling and crumbling surface of the southern wall in the part which is void of polychromy. Any existing painted fragments surviving directly on the stone surface were safeguarded using Japanese tissue paper. Their fastening to the walls required a special mastic which was made of Primal E330 (10%) with filler containing chalk and sifted sand (1:1), the substance having the consistency of a watery paste. Upon fixed in place, the Japanese tissue paper was removed from these fragments using acetone enriched with toluene to dissolve the Paraloid solution.

Extensive salt efflorescence was the reason why so many pieces of the polychromy had to be reattached. If the process fails to be stopped or at least radically reduced, this procedure may have to be repeated every year.

In some places (e. g. blocks inserted in the southeastern corner of the chapel, inside the hieroglyphs on the "false door"), the surface of the rock tends to powder. In order to reinforce it and protect against detaching, a 6% solution of Paraloid B72 in xylene was applied. This treatment was repeated twice.

As in the case of the facade, structural lutes were applied, the "bridges" stabilizing large disconnected surfaces which have been detached as much as 1 cm from their rock bedding. This concerns the southern wall where this type of destruction is considerable. The lute used here for the salt-covered surfaces was composed of: white cement, chalk, fine sand (1:2:2) modified with PRIMAL 330 and 2% MORTELDICHT III (Remers) in 1:2 proportion.

It seems that the exploration of shaft 1 a mere 70 cm from the eastern wall of the chapel may have a favorable influence on the condition of the polychromy and of the rock itself in the northeastern part of the funerary complex. The ventilation in the shaft being better than in the chapel, it would probably cause the salts found in the rock left between them, and not only there, to migrate toward the shaft, thus diminishing the danger of new damages to the painting layer and the bedrock in the chapel's northeastern corner.