

Wall and lower ceiling in broad-hall of tomb of the High Priest Bekenkhons (35).
 Decoration is revealed by removal of soot and dirt.

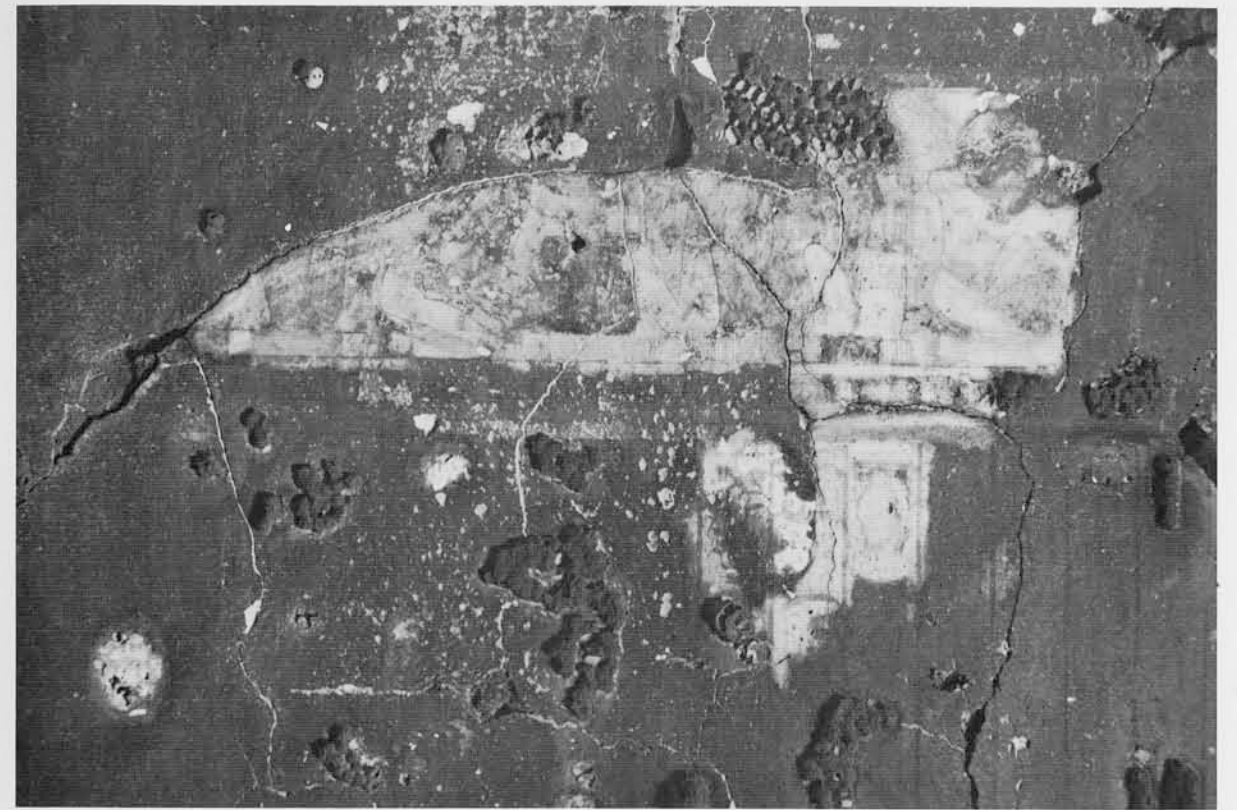
The Conservation of Wall Paintings in Tomb 35 at Dra Abu el-Naga

By GEOFFREY PEARCE

A preliminary examination of the walls and ceiling of Tomb 35 revealed that although its remaining plastered sections have suffered extensive damage from soot and smoke, and actual physical destruction by extremes of temperature—incurred primarily during the Coptic and subsequent occupations—and the accumulative attentions of the mud-dauber wasp, there

exists a larger scheme of painted texts and figurative motifs than had been supposed by previous investigators.

Before embarking on any conservation work on wall paintings, it is essential to discover the nature of the materials originally used for their execution and support, and to realize that such works differ from panel paintings in that they



Vaulted ceiling in broad-hall of tomb of the High Priest Bekenkhons. Decorative motifs begin to emerge from beneath heavy deposits of soot and dirt. Extensive cracks due to shrinkage of plaster and its separation from the underlying limestone. Dark clusters are nests of mud-dauber wasps.

form an integral part of the *structure* of the building involved. Therefore, the careful maintenance of the fabric of a structure is as important as any attention to the actual painted surface. The aims of such conservation work are both preventative and curative. The structural technique employed in the Theban Necropolis is different from modern methods, but sufficiently similar to the European Mediaeval schemes of building to make continental transition no especial difficulty to one already acquainted with the basic problems involved. The basic danger everywhere to paintings on plaster supports comes primarily from the actual wall itself, and secondly from any previous detrimental treatment of the decorated surface. The contemporary system of building walls containing a cavity and a damp course was unknown or unconsidered by previous civilizations, because they could have had no conception of the action of variations of temperature, atmospheric pressure, or, most important, the corrosive and erosive properties of water-borne mineral salts. The ancient methods of rendering the walls of the tomb of Bekenkhons must be understood

fully before any explanation of subsequent conservation can be attempted. Tomb 35 is, in fact, a roughly hewn cave in the limestone cliffs of Dra Abu el-Naga. Limestone is notorious for its friability, its excess of mineral salts, and its low tolerance to the adhesive properties of plaster rendering. In this the particular local conditions of the quality of the rock of the chosen site and the materials utilized for the plaster work appear to be, unfortunately, inferior to those of other sites almost immediately adjacent.

By the simple technique of infilling all cavities with mud, presumably collected from the banks of the Nile, the uneven surface of the limestone was rendered acceptably level for the application of the final coat of mortar. This undercoating, applied very wet and (presumably) without consideration of the extreme temperatures encountered in Upper Egypt, must have dried out too quickly (apart from being an unsuitable building material at the outset), and in many areas of the tomb, especially the vaulting, has shrunk. The effect of this shrinkage has been a separation from the structural

supports and also a cracking of the lime and sand mortar which is the actual support of the paint surface.

Paradoxically, the final coat of lime mortar is of the highest quality, having been manufactured from the finest slaked rock-lime available and the very best fine, sharp sand, apparently in proportions of approximately three parts sand to two parts lime, beautifully trowelled, and 'floated' to a perfectly even painting surface about one-eighth inch in thickness.

The painting is executed in tempera, *i.e.*, mineral pigments dissolved in water and mixed with size or a gum medium and applied when the plaster had dried (as opposed to fresco technique). Some of the characteristics of tempera painting appear exaggerated in the extreme temperatures of Upper Egypt; for example, with great age and excessive temperature, the binding medium used with the pigments tends to decompose, leaving the painted surface very friable, so much so that in the later stages of conservation it is necessary to impregnate the pigment with a fresh binding agent. Another, and particularly significant characteristic as far as Tomb 35 is concerned, is that the nature of some pigments necessitates the use of much larger quantities of medium than is usual. In such cases the shrinkage is far more drastic than for colors applied with a nominal amount of medium. In extreme cases (as can be seen frequently in the 'heker' frieze in Bekenkhons) this shrinkage has been so acute that entire motifs executed in certain colors have been pulled completely away from the plaster ground by the powerful contraction, leaving the design as a negative pattern of bare plaster within the painted area.

Tomb 35, considered three thousand years after its completion, presents a varied, complicated, and extremely interesting set of conservation problems, all related, but which must be dealt with separately. Briefly, these are the removal of soot and smoke and the nests of mud-dauber wasps, and the repair and preservation of the mortar rendering which supports the painted surface.

The removal of soot and smoke at present obscuring the decorative scheme was quickly found to be impossible with a mechanical method, *e.g.*, dusting or brushing (nor was the extensive use of putty rubbers entirely satisfactory), and so had to be tackled chemically with a solvent or solvents suitable for the safe removal of this particular kind of deposit.

Being in the field, with no scope for laboratory analysis, we had to perform a series of trial and error tests based on previous knowledge of

the properties of various solvents in current use by European conservationists. It soon became apparent that the acetone and hydrocarbons (*e.g.*, dichloroethylene, trichloroethylene, toluene) used for the destruction of wax or varnishes were unsuitable for this situation, and that the film obscuring the paintings was, in fact, mainly carbon with a small resinous content that had been consolidated by the action of intense heat.

Finally it was discovered that a positive and rewarding result could be obtained by cleaning with a diluted solution of ammonia, applied lightly on cotton swabs, rolled gently to and fro across the decorated surface—rather than rubbing it—to minimize the shifting of pigments and damage to the underlying plaster supports. Repeated applications and frequent rinsing with fresh water produced a satisfactory result over an area of almost half of the antechamber of the tomb, being particularly rewarding in revealing polychromatic, hitherto unknown, figurative scenes on the vaulted ceiling.

In certain, and alas, quite substantial areas, although the carbon deposit was removed successfully, the painted plaster surface had been subjected to such intense heat that the decoration is permanently obscured by the physical and chemical changes due to actual burning.

At a future date, some areas of pigment which have been revealed by cleaning will require an impregnation with either a preservative or a new binding medium to ensure permanence.

Probably once again due to its occupation or to acts of vandalism, the fabric of Tomb 35 has suffered extensive physical damage, resulting in the destruction of large areas of plaster, especially from the lower sections of the walls. The remaining plaster is loose, due to this breakage and the previously mentioned poor quality initial rendering of mud and straw mortar. So extensive is this damage that to ensure the continuing adherence of the presently existing paintings, it is necessary to support the ancient mortar and, especially, to consolidate the broken and loose edges of the painted sections, by replastering the bare limestone. Similarly, it is essential to repair the not inconsiderable number of smaller holes in both walls and vaulting where old plaster has detached, fallen, and been destroyed.

Where extensive separation of the mortar from the limestone has occurred, to create a new bond it will be necessary to inject, by the use of syringes, a new mixture of mortar (or a synthetic resin) into the cavity thereby formed. In some cases consolidation must be undertaken first, to make the plaster capable of withstanding even the slight pressures associated with cleaning. In ex-



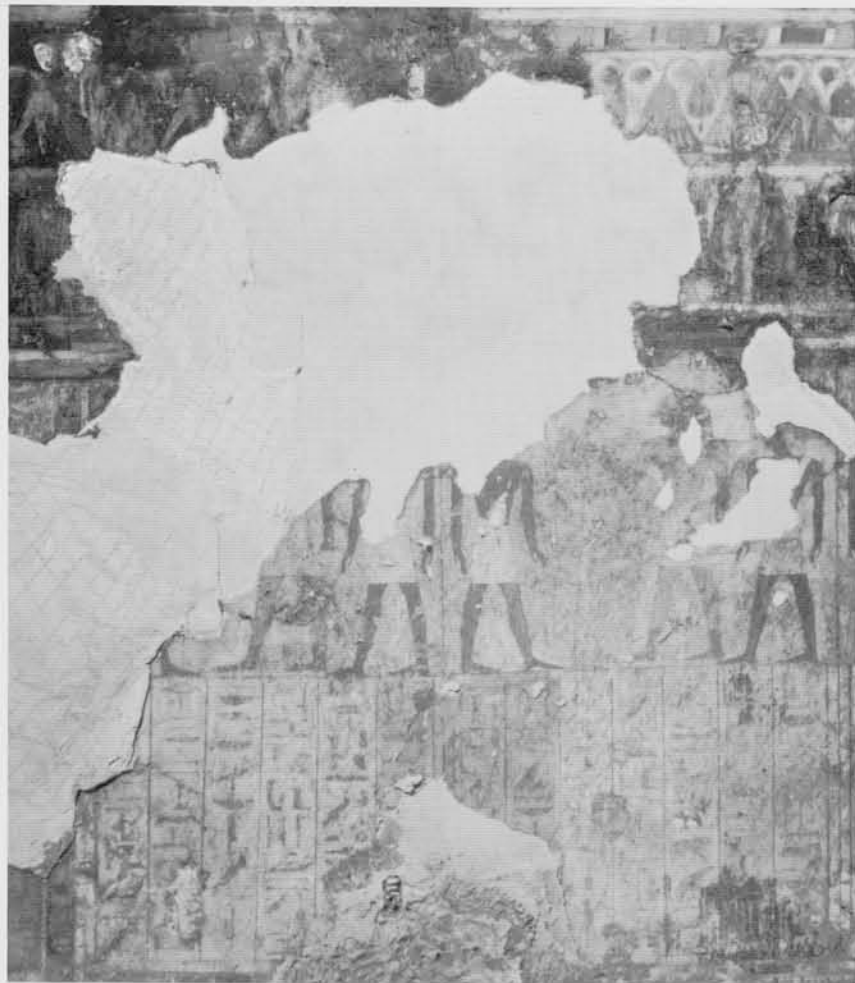
Two painted panels surmounted by a 'heker' frieze. From a series of newly discovered vignettes on the ceiling in the broad-hall of the tomb of the High Priest Bekenkhons.



Removal of soot by manual cleaning of upper walls in broad-hall of tomb of Bekenkhons.



Damaged 'Opening of the Mouth' scene in broad-hall of tomb of the High Priest Bekenkhons, after partial cleaning. Discoloration due to physical and chemical decomposition of paint; head of figure on right obscured by nests of mud-dauber wasps. Below, surface plaster has fallen away, showing underlying fine, white lime plaster on left and thick, coarse mud plaster on right.



Wall in broad-hall of tomb of the High Priest Bekenkhons, after partial cleaning. Scenes and accompanying texts are surmounted by decorative bands, the black areas of which are due to irreparable damage by heat and fire. White patches represent various stages of modern replastering. In lower center are visible, consecutively, the underlying lime plaster, mud plaster, and rough-cut limestone supports of the painted surface. Cleaning of the three broken columns of inscription immediately above was delayed until consolidation by replastering could be completed.



Figure of the High Priest Bekenkhons in broad-hall of his tomb. In spite of extensive damage of varying sorts, even partial cleaning reveals high quality of the ancient painting.



Burnt crushed lime is slaked in barrel in court of tomb of Bekenkhons. Slaked lime is to be combined with clean, sifted, sharp-grained sand to prepare new plaster.

trema cases, entire sections could be removed, the rubble rerendered, and the decoration securely reattached.

The composition of the mortar to be used for this replastering is most important for several reasons. Firstly, it should consist as far as possible of materials identical both in quality and quantity to those of the original Pharaonic layer, and should be prepared and applied in as similar a method to the original as possible, while utilizing contemporary knowledge to prevent an imbalance caused by the fusion of suitable and unsuitable ancient and modern materials. This applies particularly to the prevention of efflorescence and discoloration of both plaster and painting by the passage of water-borne salts from the sand or mud aggregate. Although there are few instances of this in Tomb 35, the nearby tomb of Nefertari, in the Valley of the Queens, affords a tragic example of the destructive power of these water-borne mineral salts, which modern conservationists regard as their most formidable adversary.

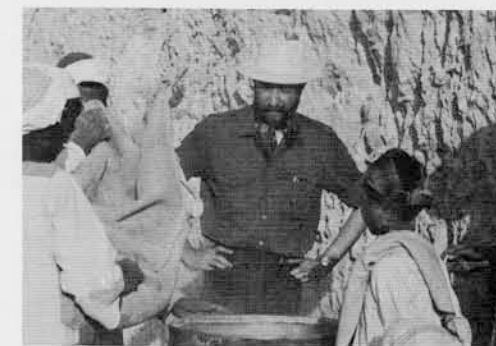
Consequently, to prevent any such actions, the preparation of the replacement mortar was strictly controlled, using only locally obtained materials, with every precaution being exercised as to their purity. A quantity of high grade rock-lime was slaked (*i.e.*, on the site converted from limestone, by the chemical combination with water, into calcium hydroxide) and left to mature. This was subsequently combined in varying proportions with sand procured, presumably, as locally as was the original. Although very suitable for use as the aggregate, being sharp-grained, this sand proved to contain large quantities of loam, which in turn harbors the dangerous mineral salts.

To the great alarm of the local workers, whose concern was for the conservation of water, the sand was thoroughly washed many times, until all of the foreign matter was separated from the clean sand. Since the lime-putty and sand mixture must be applied with as little water as possible, to prevent rapid drying and therefore shrinkage, the washed sand was dried in the sun. Then it was sifted, the larger particles being separated out for the initial layer of rendering, which in proportions of approximately two parts sand to one part lime, provided a surface of sufficiently rough texture to afford a satisfactory bond for the final coat of mortar, which was prepared from the finely sifted residue, in the proportions of approximately three parts sand to two parts lime. Allowed to dry, this mortar proved to be highly stable and very strong but, because of the extreme whiteness of the lime, too light in color to blend satisfactorily with the orig-

inal. In future it will be necessary to add to the mixture a quantity of mineral colors (chemically inert) to rectify this deficiency.

The removal of the nests built over several centuries by mud-dauber wasps (some indeed so ancient that they are as blackened by soot as their supporting plaster) proved to be a task as uncomfortable as it is complex. Preliminary tests showed that their removal by mechanical means was unsatisfactory; the nests with their cellular structure of concrete-hard mud are so firmly attached (in some cases by their deceased inhabitants), with anchorage bore-holes reaching approximately half an inch into the mortar, that violent treatment removes not only the offending mud, but also the plaster beneath. The most effective means of removal was found to be through gradual dissolution by both spraying and poulticing with large quantities of water before gently scraping away the residue with a knife blade; but more research is necessary before a perfect method can be obtained (compare Zaky Iskander, "Bees in the Temple of Edfu and their Control," in *Annales du Service des Antiquités de l'Égypte*, vol. 58 [1964], pp. 187-96).

With the experience gained from the 1968 season in Tomb 35, a system of conservation techniques has been evolved which, with the aid of gradually trained local assistants, should prove effective not only in the completion of the present project, but also in the future program of research.



GEOFFREY PEARCE, a British subject living in London, was awarded his National Diploma in Design in 1961 after having attended the Kingston-upon-Thames School of Art. His interest in Mediaeval art led him to join Eve Baker Associates, a small, dedicated team of conservationists engaged in the preservation of wall paintings in British cathedrals and churches, in which pursuit he is still occupied.

SUGGESTED READING: ALFRED LUCAS, *Ancient Egyptian Materials and Industries*, 4th edition, revised and enlarged by J. R. Harris, London, 1962.