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THE CUTTING AND PREPARATION OF TOMB-CHAPELS IN THE THEBAN NECROPOLIS

BY ERNEST MACKAY

JUDGING from the large number of unfinished tombs in the Theban Necropolis, it would appear that in many cases the ancient Egyptian did not start on the work of constructing his tomb in early life, but set about it only on the signs of approaching age or perhaps the occurrence of an illness¹. There are, moreover, a great number of tombs that at a cursory glance appear to be entirely finished, but in which a closer examination will discover a great deal left undone. It is within the bounds of probability that a tomb was constructed, plastered and painted or sculptured at different periods of the owner's life, that is, the work was stopped when funds ran low and was resumed later. This surmise, if correct, would agree with the custom prevailing in Egypt at the present day in the matter of house-building, and it is supported by the fact that several of the Theban tombs have clearly been enlarged. But, be this as it may, there is proof that a great many of the tombs were hurriedly prepared for their occupants. Sculptured tombs were often left uncompleted, while other tombs have only partially cut chambers, the finished walls being plastered and painted as far as could be done in the time.

At a later period than those of the Theban tombs, if we are to trust Herodotus, an Egyptian corpse was not buried until ninety days after death. If such a custom prevailed in earlier times, it would, in the writer's opinion, have given ample time to cut and plaster the chambers and paint the scenes required in a chapel of moderate size and finish, and we actually have two good examples in the necropolis of Thebes of tombs in the process of being cut, plastered and painted all at the same time. In Tomb 229 (see Fig. 1, p. 155), the outer chamber is only partially cut, and yet a portion of one wall has been smoothly plastered over, squared and outlined in red with two figures and an elaborate table of offerings. Tomb 75 (Amenhotpe-si-se) has the end of the northern half of the outer chamber unfinished, showing both rough plastering and the rock, whereas the southern half of the chamber has been finished and its walls covered with scenes. This intensive method of finishing a tomb-chapel quickly may not, of course, have been regularly adopted, but the examples given illustrate how a tomb could be finished quickly in case of emergency.

The following pages deal with the preparation of tomb-chapels in general and explain in detail the technical side of tomb construction, which for the study of a people is just as important as the artistic side, but which for some reason has hitherto been sadly neglected.

THE CUTTING OF TOMB-CHAPELS.

During the Eighteenth and later Dynasties the following seems to have been the usual method of cutting a rock tomb. A suitable face of rock having been selected, a rough-hewn

¹ We have definite proof, however, that the tomb of Amenemhät (No. 82) was completed long before his death. The construction of a Royal Tomb also seems to have been begun early in the Pharaoh's life.

passage was made which was continued until the pre-determined length of the tomb was reached; see Pl. XXIII, Fig. 2, where the illustration shows the beginning of such a passage, which is about two feet square. A series of secondary cuttings was then made in either side of the beginning of the passage, and at right angles to it, for what is generally known as the outer chamber. Further in, if the tomb was to be a complex one, additional chambers were then cut.

There were two methods of removing the stone when cutting the preliminary passage and these outer and inner chambers. The first was by hacking the rock away piece by piece, not at all a difficult task in the case of tombs cut in shaly rock. The tools used in cutting tombs in poor rock were simply hard stone mauls, whose cutting edges were either pointed or chisel-edged. Many such implements have been found in the *débris* outside tombs, and the tombs themselves bear no marks of having been cut with other tools. In the case of tombs cut in harder rock, however, chisels or adzes of bronze were used, different sized points being employed for various kinds of work. The second method, which was probably that adopted in the case of harder stone, was one which can be seen illustrated in the limestone quarries a little north of the entrance to the Valley of the Tombs of the Kings¹. Here large blocks of fairly hard stone were removed from the vertical face of the cliff by first cutting a narrow passage entirely round and above them and then splitting away the core left in the centre by means of wedges inserted in a line. This method could be perfectly well employed in cutting a tomb-chamber, as the rock could be removed in large pieces which might subsequently be used for building purposes². Also, by first cutting the long preliminary passage, the masons obtained the necessary vertical faces to work against and in the proper directions to cut out halves of the future chambers. Thus two men could hew a passage around the opposite sides of one half of an intended chamber and meet in the middle at its end. Unfortunately there are but few tombs left unfinished at this stage now to be seen in the Necropolis, for, owing to lack of room, a tomb partly cut in one period and then left would be finished and utilized in another. We have, however, in the courtyard of Tomb 86 a good example of how the rock was removed in large blocks, and an unfinished tomb (No. 229) shows the preliminary tunnel and the commencement of an outer chamber; see Fig. 1. The intended plan for the first portion of this latter tomb was a rectangular room with a roof supported by six square pillars. A long axial cutting was first made in the rock, running from east to west, and then one half of the outer chamber was commenced from the north side of the passage as a neat cutting, the exact width of the chamber from the north wall to the face of the pillars; this was done in

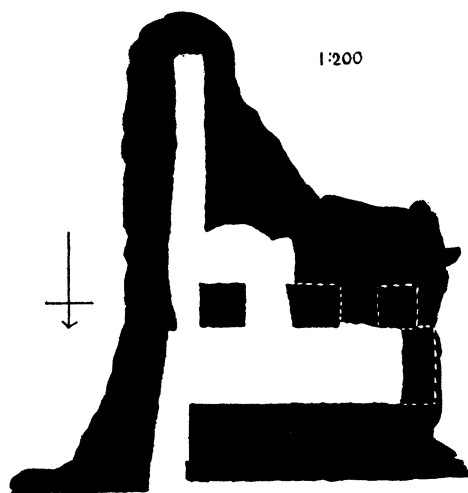


Fig. 1. Ground-plan of Tomb 229 at Thebes.

¹ These quarries all appear to be of late date, Saite and Roman.

² Stone suitable for building was doubtless as valuable in ancient times as it is at the present day in Egypt.

order to obtain a suitable face for the marking out of the two columns. The spaces between and behind the columns were then cut away, this work being done from the preliminary axial passage as well as in the cutting described above. For some reason the work was stopped at this stage, but enough was completed to show us the method of cutting out tomb-chambers with pillars. The other half of this chamber to the south of the passage was not begun, which goes to show that one half of a chamber was finished before the other half was attempted. We find corroboration of this in the inner chamber of Tomb 58, where the original tomb belonging to a man of the Eighteenth Dynasty was left partly unfinished and the tomb was taken over in both the Nineteenth and Twentieth Dynasties¹. The shrine was evidently intended to be a large room provided with four columns, but only one side with its two columns was finished, the remaining half on the other side of the preliminary passage being untouched, except for a slight cutting which was afterwards filled in, presumably by the people who took over the tomb at a later date.

In other tombs (Nos. 76, 88, 90, 115, etc.), also, we see this preliminary axial passage. Tomb 76 (Thenuna) has an unfinished inner chamber with a floor that runs upwards in rough steps or inclines, showing how the rock was removed. The walls of the southern half of the outer chamber are in two stages of preparation, namely, mud-plaster and rough stone. The northern half has been finished and decorated with painted scenes. Tomb 90 (Nebamūn) is practically completed, but a rough niche at the west is really an unfinished prolongation of the first axial cutting.

In the course of tomb cutting, large flint boulders were sometimes met with. These were either removed from the wall and the holes filled up with mud and stones, or they were left *in situ* and plastered over and painted (Tombs 16, 150, etc.). In the latter case, these stones often interfered greatly with the straightness of a wall, but this could not be avoided, as flint is an impossible stone to cut even with a modern tool. Any attempt to remove such boulders was complicated by the difficulty that there was often no means of knowing how large the boulder would prove to be. Tomb 76 has a piece of a large boulder projecting from its eastern wall, which was left bare and unpainted. Flint boulders found in cutting the roof of a tomb were also left *in situ*, if of large size, and plastered over and painted, giving the roof an irregular appearance which sometimes is not unpleasing (Tombs 16, 60, 147, 169, etc.). Advantage was taken of just such an irregularity of the roof in Tomb 96B (Sennūfer); it was plastered and then decorated with a very free running design of a grape-vine with its leaves, tendrils and grapes, the whole giving a most charming impression.

Great care was taken in most of the tombs to ensure the exact alignment of the axial passage by drawing a line in red or black paint upon its roof, as may be seen in Tombs 166 (Raḥmōse) and 211 (Penēb). This line was probably set out by stretching a cord against the roof down the centre of the rough passage and then marking its direction. Offshoots were measured from this line to ensure an equal width to the passage throughout. The axial line in Tomb 166 (red in colour) is painted upon a well-cut surface, but that in Tomb 211, which is black, closely follows the uneven surface of the roof, which is so very irregular as to cause the line in places to become quite vertical².

¹ The man for whom the tomb was originally cut was probably buried in it, as some of his scenes and roof decoration are to be seen in the inner chamber.

² There is a series of red crosses on the roof of the main chamber of Tomb 86, which is difficult to understand unless they were marks made by an overseer to show progress made and the rate of work.

In the Royal Tomb of Haremhab the roof line is missing, but offshoots are still to be seen marked on the walls in black paint. In this tomb, in order to ensure the perfect straightness of the walls, the strange, but none the less effective, system was adopted of making a series of small holes in the rough rock of the proper depth and touching in their bases with black. The base of each hole, which is horizontal, is exactly half the width of the finished tomb from a line stretched along the axis of the tomb. When the architect had thus completed his survey, he could safely leave the walls to the masons, as the latter had only to cut away the surrounding rock between the holes and use a straight-edge between the black marks that were then exposed on the surface.

Lines were also employed to mark out the roof of a vaulted chamber: a good example of this is to be seen in Tomb 211¹. The position of the spring of the vault having been determined, a horizontal line was first drawn around the chamber at this height. This line on the two end-walls was then divided at regular intervals by short vertical marks, from which vertical offshoots were measured upwards to fix the curve of the vault. A very fair degree of accuracy could be obtained by this method, as after the curve of the two end walls had been fixed, it was only necessary to stretch a cord between the corresponding points on the end walls to ensure the vault in the middle of the chamber being the proper height. Unfortunately, the tomb in which this method was followed was cut in very bad rock and the workmen were unable to finish it with any degree of accuracy.

Tomb 166 provides an excellent example of how the roof of a tomb cut in hard rock was levelled for plastering after it had been roughly hewn into shape. When the walls of the chamber had been trued up, a horizontal line in red paint was run along each with a large brush or rag wrapped around a stick, with the object of ensuring the correct level of the roof, offshoots being measured vertically upwards from this line. From the appearance of the line in this tomb, it was ruled by means of a long straight-edge, whose level was taken from the floor² or, more likely, fixed by means of a plumb-bob level. Such a line for adjusting the levels of roofs may be seen in many tombs in the Theban Necropolis, the best examples occurring in Tombs 63, 64, 86, 89, 91, 166, 224 and 229.

The distances of these lines from the present ceilings of some of these tombs are as follows:

Tomb	Depth of line from ceiling	Cubit	Palm	Digit
86	55½ cm.	1	0	1·7
89	57½ cm.	1	0	2·7
91	39½ cm.	0	5	1·1
166	71½ cm.	1	2	2·2
229	74½ cm.	1	3	—

It would appear from the above table that the cubit standard used was the royal one³. The digit numbers and their fractions can be explained by errors in cutting the levels of

¹ See Pl. XXIII, Fig. 1 (left, nearly half-way up). The photograph unfortunately shows only two of the vertical markings; the remainder are, however, quite clear to the eye.

² In most tombs, however, the floor seems to have been finished last. Cf. Tombs 76, 86, etc.

³ The royal cubit, the ancient unit of length, was equal to 52·310 cm. This was divided into 7 palms of 7·47285 cm. or 28 digits of 1·86821 cm. The ordinary cubit was 44·837 cm., being 6 palms instead of 7. These measurements are taken from cubits in the Museums of Liverpool, Turin and Cairo, the average of the three giving us the above standard. See HOWARD CARTER, *Report on the Tomb of Zeser-Ka-Ra* in *Journal*, III, 147–154.

the roofs, which plastering would eventually hide. Another source of inaccuracy is the occasional great thickness of the levelling lines, in consequence of which the writer had to take his measurements from their middle, whereas from the top may have been the correct distance.

On the mud-plaster of the two side-walls of the second chamber of Tomb 77 there is a white horizontal line 63 cm., or 1 cubit 1 palm and 1·7 digits, below the spring of the vaulted roof. The object of this line, which it should be noted is painted on the mud-plaster, was to secure a correct level for the plaster used to fill the crevices of the roughly cut vaulted roof; see Pl. XXIII, Fig. 5 (near the bottom).

In four tombs¹ in the hill of Sheikh 'Abd el-Kurneh, in which columns serve to support the roofs of the outer chambers, red lines are still visible down the middle of some of the columns. These lines must have been marked on vertical rock faces to show the masons where the columns were to be cut; to fix the width of a column all that was required was to measure with a rod on each side of such a line. This system of marking out the position and dimensions of columns was doubtless employed in nearly all the tombs, but in most cases the guiding lines have been covered over with plaster and thus lost to view; see, however, Pl. XXIII, Fig. 4, from Tomb 229².

Red lines were also employed to delimit architectural features in Tombs 87, 228 and 229. In the first tomb a line is seen on the soffit of the door leading into the second chamber, together with a vertical line in the middle of the frame on either side of the door. In Tomb 228 a mason's mark is to be seen on the end-wall of the shrine, where lines were marked in red to show the stone-cutters the proper dimensions of the niche in the shrine. Another curious feature in this tomb is the outlining in red of an unfinished cavetto cornice above the niche. This could not have been intended for the guidance of the painter of the tomb, for, if the cornice was to be a painted one, all such marks would necessarily have been covered over with plaster before the painting was commenced. Either the cornice was marked to show the proper height of the niche, or it was intended to cut or mould a cornice of plaster, which would require such marks to indicate where to apply the plaster. In the third tomb the line of an architrave is marked in red upon the rock.

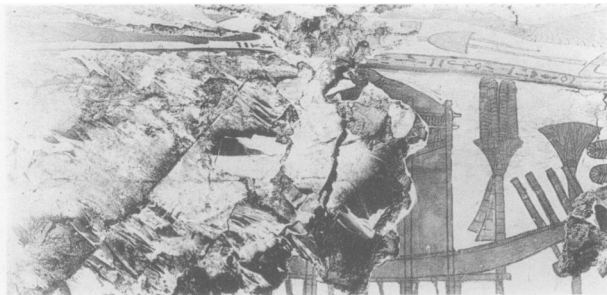
THE PLASTERING OF TOMB-CHAPELS.

After a tomb had been cut and squared, the walls were prepared for plaster, if the rock was of poor stone, or, if it was of good quality, for sculpture.

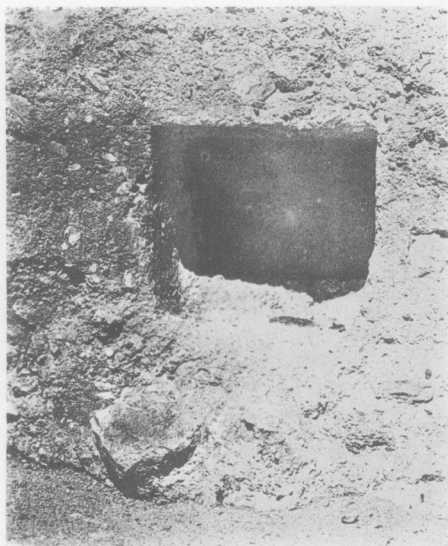
It can be regarded as certain that the majority of the more important tomb-chapels were painted because the rock in which they were cut did not permit of their being sculptured. The rock of the western desert at Thebes is a shaly limestone of varying quality which is fairly compact at and beneath the foot of the hills, but which, as one ascends, becomes more and more friable. Hence the sculptured tombs there, of which, alas, there are only too few, are situated at the base of the hills, and the painted tombs are above them. On the western bank there is a district now known as the 'Asâsif, where the rock is very suitable for sculpture, but it contains tombs only of the Saite period or prior to the

¹ Nos. 87, 89, 224 and 229. The last tomb has a mark resembling a *nfr* sign upon an unfinished column. There seems to have been a similar mark on a finished column.

² In this illustration we have a good example of such a guiding line in the middle of the column and also lines defining the edges.



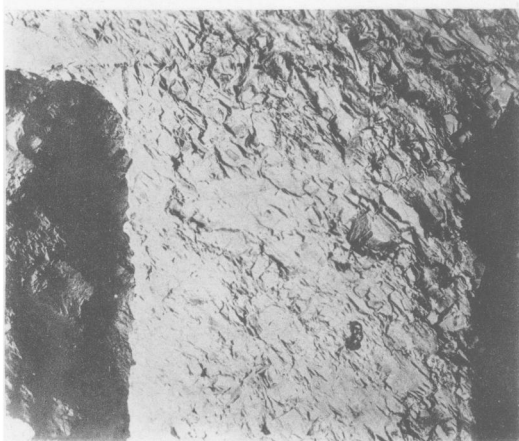
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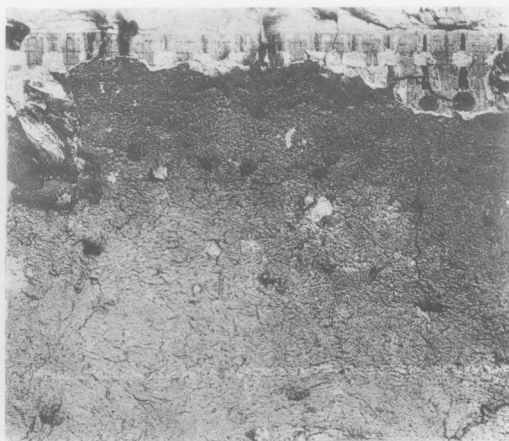
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5

TECHNICAL DETAILS FROM THE PRIVATE TOMBS AT THEBES (I)

Eighteenth Dynasty¹. The reason why this particular patch of ground was not utilized for tombs during the Eighteenth and Nineteenth—Twentieth Dynasties is probably explained by the presence of the temples of Mentuhotep III and of Hatshepsut, the approaches to which lead up from the river through the 'Asâsîf.

In those few cases in which a tomb excavated in rock of good quality was painted, the surface of the rock was dressed as smoothly as possible and then covered with a thin coat of plaster on which the colours were laid. In two instances (Tombs 22 and 56), the colours were laid direct on to the rock without the latter being suitably prepared with a pore-filler; with most unsatisfactory results, for it led to a dulling of the colours, and, what is more serious, to considerable scaling.

A. *Mud-plaster*. The method most commonly used, and that which has proved to be the most permanent, was to cover the rock walls with a thick layer of mud mixed with *tibn* (chopped straw) as a binding material. Upon this was laid a coat of lime-plaster or gypsum, of varying thickness, on which the scenes were painted. In those tombs which were cut in very friable rock, it was frequently impossible, owing to the nature of the stone, to obtain level surfaces for the walls; hence a great number of the painted tombs with walls of mud-plaster are very irregular, which is not the case with sculptured tombs. Another cause of irregularity in tomb walls is the contraction of the mud in drying, which pulled it away from the rock behind and produced an undulating surface.

When, in the course of cutting a tomb, the rock was found to be very bad, holes were often filled up with pieces of limestone and mud-mortar, which were eventually hidden by the general layer of mud-plaster. In the case of very large holes, bricks and sometimes brick walls were built in; so in Tombs 44, 157, etc.

Some mention should here be made of the tombs of Dêr el-Medîneh, which, with one exception that seems to be of an earlier date (Tomb 8, of Kha^c), belong exclusively to the period of the Nineteenth and Twentieth Dynasties. Owing to the friable nature of the rock in the lower parts of this valley, it was found necessary in many places to line the chambers that were excavated for tombs with walls of sun-dried brick and barrel-vaulted ceilings of the same material. Hence the lower tombs consist mainly of simple chambers or cells; in some cases they were made entirely of mud bricks and stood in the open at the foot of the valley. In many of the tombs built inside the rock, a hole was first excavated and lined with a single layer of brick; the outer chamber was then built on, and as a rule is found to have thicker walls than the inner one, as there was no rock face to support them.

The bricks used for the barrel-vaulted ceilings of these tombs were evidently made for this express purpose; they are thinner than those used for the walls and also have a series of deep grooves running the length of the brick on both sides, made by the fingers of the moulder when the brick was still soft. The object of these grooves was to ensure that the bricks should adhere closely to the mud-mortar laid between them, as they were placed with their grooved sides against one another, their edges forming the concave and convex sides of the vaulting. In some of the tombs one layer of brick was employed for the roofs, but in others, two layers for greater strength (see Pl. XXIII, Fig. 3). Such grooves in the bricks are not really necessary in the construction of vaulting, and are not used at the present day in Egypt. In all cases, plain mud-mortar alone was used to bind the bricks

¹ Lately a few Seventeenth Dynasty tombs, which are unpainted, have been found at the cultivation end of the 'Asâsîf.

together, and in those tombs which have been protected from the elements and other dangers, the vaulting seems as strong as when it was first put up.

In an unnumbered tomb in the district of Dêr el-Medîneh there is a curious roof, half of rock and half of brick. The rock above the brickwork is in a very rotten condition and had to be supported by brick to prevent fragments falling. If the tomb had been finished, mud-plaster would have finally hidden this curious structure; see Pl. XXIV, Fig. 1.

It is rather a difficult problem to decide whether or not wood centring was employed in building these vaulted tombs; if so, very narrow sections must have been used, as, in the case of those tombs which were built in the rock, there was not space enough left between the rock and the top of the vaulting to make it possible for the mason to build the roof from above. Owing to the irregularity of some of the vaulting, it seems probable that a simple centring of loose bricks was the means by which these roofs were built, especially as this method is to this day employed in building the roofs of native houses at Aswân and in its neighbourhood.

Occasionally, fine limestone gravel was mixed with the mud-plaster, producing a substance much lighter in colour, but, as we now know, not very durable. Rarely, limestone gravel was mixed with lime instead of mud, a plaster also not permanent in character.

When the preliminary coating of mud was finished, it was left to dry before application of the final coat or coats, and in the process of drying it frequently came away from the rock and has been kept from falling only by its natural stiffness and the fact that it adheres to the roof and floor of the tomb. The thicker the coating of mud-plaster¹ the greater the contraction, but, by very reason of that thickness, the more likely is the wall to remain intact. On the whole, a mud-plastered wall when well rammed is as durable as any other in an exceptionally dry climate like that of Egypt. There is one objection, however, to the use of mud-plaster, which the ancient Egyptian did not anticipate, namely that by removing pieces of it bodily it is easier to destroy than any other plaster.

As a general rule, mud-plaster was faced with a coating of lime or gypsum-plaster in order to provide a sufficiently smooth surface to take the colours. In ten tombs², however, the final coating was of mud, a method only used in the latter end of the Eighteenth Dynasty and in Ramesside times, and its rareness even in those periods may be explained by the great difficulty of providing by its means a surface smooth enough to paint upon, owing to the tendency of mud, however carefully applied, to crack and roughen in drying. Paint applied to mud direct has a peculiar brilliancy which is unmistakable and can be recognised at once on entering a tomb. The reason of this is doubtless the non-absorbent properties of mud as compared with plaster, which has to be sized before it can be painted upon. A plain mud surface, however, is not so durable as a plaster one, the walls being soft and the *tibn* contained in the mud being exposed to the attacks of white ants.

Before leaving the subject of this material, it is interesting to note that in Tomb 138 (Nezemger), of the period of Ramesses II, a series of eight light mud buttresses was built against the mud-plastered long walls of the outer chamber to prevent their falling. These buttresses were built at the same time as the walls were plastered and are not later additions, the painted scenes being put between them.

¹ In some tombs the thickness has been found to be as much as 20 cm.

² Tombs 5, 7, 8, 40, 51, 80, 111, 181, 217 and 259. In Tomb 40 the mud has been rubbed down to an exceptionally smooth hard surface.

B. *Lime or gypsum-plaster.* A coating frequently applied to tomb walls was of lime or gypsum-plaster. It was generally used in those tombs which were cut in the harder rock and did not therefore require a very thick coating. The average thickness of such a plaster was 5 cm. In some tombs, doubtless for the sake of economy, this kind of plaster was reinforced with pieces of limestone, and in Tomb 155 (Antef), the lime-plaster is mixed in places with linen rags to bind the coating more firmly together. A lime or gypsum-plaster was also often applied as a coating to mud-plaster, as it could be provided with a very smooth surface with little trouble by the aid of a float, the marks of which can be seen in many tombs.

C. *Ḥib-plaster.* *Ḥib* is a substance found in large rock pockets or basins in the desert. It consists of a kind of decayed limestone of a light yellow colour. At the present day it is largely employed as a coating for the inside walls of houses, as it can be rubbed down to a very smooth surface. It is difficult to paint upon direct. Occasionally an admixture of *ḥib*, sand and lime was applied as an extra coating to mud-plastered walls, but it was not satisfactory owing to its softness. The few tombs in which this material was used are situated fairly near together and belong, with one exception, to the latter end of the Eighteenth Dynasty¹. The close vicinity of a large pocket of *ḥib* perhaps explains its use in their preparation. Five of these tombs (Nos. 108, 172, 175, 200 and 201) have *ḥib*-plaster applied to all or a part of their walls, with, of course, the necessary thin coat of lime-plaster over it to take the colours. The walls of the remaining tombs are covered with alternate layers of mud and *ḥib*, noticeably in Tomb 181, some of whose walls bear three successive thin coats of plaster, namely, mud-plaster next to the rock, then a layer of *ḥib*, followed again by a layer of mud. It is difficult to see why *ḥib* was thus employed, considering its defects, except that perhaps it was cheap, as it could be obtained on the spot, whereas mud had to be brought from a distance.

In many tomb-chapels we find mud-coated walls associated with lime-plastered ceilings, a combination which was well suited to the case of tombs cut in very poor rock. After the walls were finished, the roofs were first coated with a thick layer of lime-plaster into which numbers of flat limestone chips were then hammered while the material was soft. This conglomerate was then finished off with a smooth coat of lime or gypsum-plaster. The same method was followed with mud-plaster, but ceilings in that material are not common, except in the harder rock, because of the tendency of a thick coating of mud to drop when drying, owing to contraction and the weight of the stone in it. As a general rule, mud-plastered roofs are for these reasons somewhat thinly coated, while roofs with other kinds of plaster are generally very thickly coated and on that account are comparatively even².

In rare instances (the writer knows of only two examples, namely Tombs 63 and 181), a shelf was cut along the sides of the tomb-chamber or chambers in order that the edges of the mud-plaster of the ceiling should rest upon it in case it failed to adhere properly to the rock roof above. In the case of a small chamber, a mud ceiling of any considerable thickness would be greatly helped by such a support at the edges.

¹ Tombs 38, 69, 103, 108, 138, 172, 175, 181, 200 and 201. The exception is Tomb 103, which is of the period of the Eleventh Dynasty.

² The mud ceiling of the outer chamber of Tomb 63 is in some places over 30 cm. thick and has fallen owing to its great weight. Such ceilings were made by applying successive coatings of mud-plaster as the preceding ones dried.

A strange method of avoiding the use of stone in mud-plastered ceilings is to be seen in a few tombs of the Nineteenth and Twentieth Dynasties, namely, Tombs 51, 111, 149 and 166¹; large pieces of dried donkey dung were inserted in the wet mud instead of stones. This material, though having no strength in itself, yet has the advantage of being extremely light, and so a greater thickness of mud could be applied through its aid in the case of a very uneven roof. It should be noted that in the well-known tomb of Menna (No. 69) pieces of wood resembling that of the date-palm were pressed into the mud-plaster of the roof of its outer chamber near the entrance. In Tomb 51, the nuts of the *dôm*-palm were utilized in making the ceiling of the inner chamber of the tomb.

The ceiling of a tomb, if of mud, seems to have been plastered before the walls were commenced, for in the case of an unfinished tomb the roof is always finished and sometimes painted, whereas the walls may be untouched. In those tombs, however, which have mud-plastered walls and lime-plastered ceilings, it is evident that the coating of mud on the walls was applied first and allowed to dry before the work on the roof was started, a procedure which left no cracks due to shrinkage at the junction of ceiling and wall.

In practically every case, it is evident that the first and preliminary coat of lime or mud-plaster was applied to the rock by the hands of the plasterer, as the finger marks show, in the form of deep grooves. For this kind of work the hand is the best tool, as the plaster can be well pushed into cracks and fissures of the rock which could not be reached with any other tool. The final coat of plaster was certainly applied with the aid of a float, and where the plaster is exceptionally thin a stiff brush was probably also employed. In Tomb 91 there are quite obvious brush-marks.

Occasionally, when the plastering was finished and the tomb-chapel was being painted, small defects appeared in the plaster which needed repairing. From the poor way in which these repairs were generally carried out, it would seem that they were done by a man inexperienced in such work, probably by the artist himself or his assistant. Sometimes, but fortunately only rarely, the mistake was made of applying a coat of lime-plaster over another coat already dry without first roughening the undercoat to afford a key-hold. A good example of this mistake is to be seen in the inner chamber of Tomb 148, where important sculptured work in plaster has suffered from the surface layer having fallen away.

In some cases walls were plastered in three layers, as is especially noticeable in Tombs 60, 69 and 139. In the former tomb, the walls were first covered with a mixture of lime and *tibn*, which was followed by a coating of mud and faced with a coating of lime-plaster. In Tomb 69 the first coat was of mud and *tibn* with a layer of *hib* and lime over it, followed by a thin lime-plaster to take the colours.

The final layer of lime-plaster varies considerably in thickness. In Tomb 52 an unusually thick coating of plaster was laid on the mud, in some places over 3 cm. thick. On the other hand, in Tomb 68 the final coating of plaster was exceptionally thin, and appears to have been applied with a brush.

The plastered faces of the unpainted or partially painted tombs in the Necropolis are of a light drab colour, which suggests that they were treated with a solution to fill up the pores, for the natural colour of lime or gypsum-plaster is a light grey or a pinkish-grey. There is no doubt that a pore-filler of some kind must have been employed, for the plaster could not otherwise have been painted.

¹ Tomb 149 has been burnt out, and the hollows left by the dung are clearly visible.

It would appear from the evidence to be found in several tombs, and especially in Nos. 78 (Haremhab) and 79 (Menkheper), that the plasterers often started work on the walls before the masons had finally finished cutting the chapel. In Tomb 78 the outer faces of two columns were plastered with a preliminary coating of mud, though their backs are still rough and in places not trimmed, nor even properly cut.

Mud-plaster and lime-plaster were also employed for the construction of simple architectural features in a tomb-chapel, such as stelae, false doors, cornices, mouldings, etc. The use of lime-plaster for such a purpose was a comparatively simple matter, but the manipulation of mud presents many difficulties. A good example of a mud cornice can be seen at the entrance to the innermost chamber of Tomb 65, and there is a representation of a stela in raised mud-plaster in Tomb 75. Lime-plaster stelae occur in Tombs 21, 67, 75 and 254, and there is an excellent representation of a false door in the same material in Tomb 100. Cornices of moulded lime-plaster can be seen in Tombs 29, 65, 100, 201 and 253.

It is probable that the mud used for plastering tomb walls was as carefully selected and prepared for use as were the other substances employed. At the present day, the mud for good work is carefully sifted when dry and put into soak for three or four days before use. When straw is mixed with it, as is usual, this is also put with the mud to soak¹. An interesting sidelight is thrown on this matter by the biographical stela of Anena (Tomb 81), in which, among other things, Anena says, "I made fields of clay in order to plaster their tombs of the necropolis²." It is possible that in ancient times in Egypt a man who possessed a plot of suitable clay permitted people to use it in the preparation of their tombs in order to obtain merit in the next world. It is considered an act of piety in Egypt at the present day to allow poor people the free use of mud for the purpose of building a house, etc.

SCULPTURED TOMBS.

Only in the case of a sculptured tomb was the ancient Egyptian anxious to obtain a really flat surface, as a rough wall was more adapted to a coat of plaster. An exceptionally good example of the dressing of a hard rock face to be sculptured may be seen in Tomb 166 (Ra^cmöse). The walls of the tomb were first roughly hewn into shape by means of chisels, two sizes being employed, whose cutting edges are shown by the marks left on the walls to have been 9 and 14 mm. in breadth respectively. The strokes left by these chisels are either vertical or oblique with the point running to the left as one faces the wall. The narrower chisel seems to have been used to remove the projecting pieces of rock, while the broader one was employed to face it. When the passages and chambers of the tomb were roughly squared off, the surface of the rock was dressed down to a smoother surface by means of an adze. That it was an adze that was used for this purpose is proved by the tool-marks showing none of the signs of shake, which are always present in the marks of tools used in conjunction with a mallet. An additional proof is that the adze strokes are always oblique, running from left to right or *vice versa*, whereas if a chisel is used with a mallet, the strokes always run in one direction only; for it is difficult to use a chisel properly with either hand, whereas an adze can be employed in this way. By the use of an

¹ Mr Robert Mond is of the opinion that the presence of straw in mud-plaster or mud-brick turns it into a highly plastic clay by reason of the formation of colloidal bodies during the fermentation of the straw (Lecture at the Royal Institution: "The Mortuary Chapels of the Theban Nobles," May 22, 1914).

² BREASTED, *Ancient Records*, II, § 106. This actually refers to some of the Royal Tombs, but the same conditions must have held for the private tombs.

adze, which had an edge of 10 mm. in breadth¹, an almost flat surface was produced, but not one sufficiently smooth to be sculptured. A last dressing was then given to the rock by means of a broad-bladed adze, which only took off a thin shaving of rock, leaving slight traces here and there of the previous deeper chiselling. Before this last bit of tooling was done, however, cracks and flaws in the rock were filled in with lime-plaster, the surface of which was levelled together with the rock surface; see Pl. XXIV, Fig. 4 (Tomb 55), where the small white marks represent plaster. Finally, a thin coat of wash was laid on the wall to conceal the porous face of the plaster and to hide any tool marks that were left. In other sculptured tombs the final coat of wash was applied after the wall was carved, and not before. It was probably found easier to apply a wash all over than merely to fill up the pores of the rock with a solution. Limestone requires a very large amount of pore-filler to make it fit to take a water-paint. This was fully realized in the earlier periods, but the tendency in later times, and especially in the Saite and Ptolemaic periods, was to apply an excessively thick coating of plaster to the sculptures, with the result that much detail was lost.

In the tomb-chapel of Ra^cmōse (No. 55), we can clearly see the stages in the completion of a wall by an artist-sculptor. In this tomb, and also in others, after the broad-bladed adze already alluded to had produced a uniform surface, an abrasive stone or other such material was rubbed over the wall to make it still smoother. This is to be seen in other tombs, *e.g.* Nos. 31, 48, 53, 56, 57, 106, 125, etc. As was doubtless intended, this procedure effaced the very slight marks left by the adze, but did not entirely do away with the marks left by the original chiselling, which it was evidently not thought necessary to remove completely.

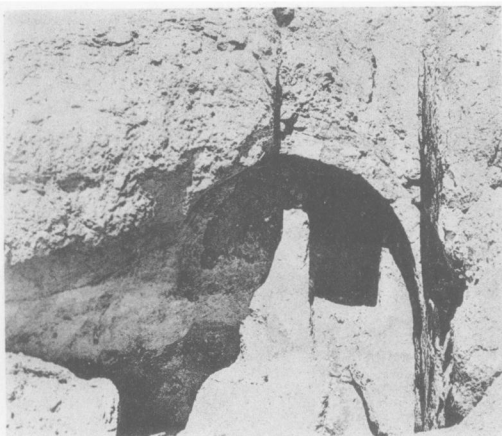
The finished and rubbed-down wall was next set out with red lines into squares, on which the designs and figures to be carved were outlined in black paint; see Pl. XXIV, Fig. 3 (Tomb 55). The background between the figures was then cut down to a depth of about three millimetres by means of a fine-edged chisel, and was then rubbed down again with an abrasive to remove the chisel marks, thus leaving a series of figures outlined in relief with square edges. After this preparatory process had been completed the edges of the reliefs were rounded off, for which purpose a knife or hand chisel was employed, as is shown by the smoothness and regularity of the cuts, there being a total absence of the jump-marks which are bound to occur with the use of a mallet or hammer. When all the square edges had thus been neatly rounded off, attention was paid to the modelling of the minor details, such as the fingers of the hands and the more prominent muscles, etc. It seems that no particular plan was followed as to the parts of the walls or figures to be finished first, for in some cases the feet of several figures were completed before even the background was cut down on other parts of the same wall.

In Tomb 257 (eastern wall of outer chamber), the outlines of the figures were first roughly cut with the point of a flat-edged chisel², with which a hammer was evidently employed, as each cut is separate and short, making the outline appear slightly serrated. When all the outlines had been cut in this way, a thin chisel or graver with a very sharp edge was used, without a hammer so as to make as broad and as smooth a cut as possible³.

¹ The average width of the adzes used has been found from measurements made in a number of tombs to be 11 mm.

² The marks left by this chisel vary from 2 to 3 mm. in breadth, but from various indications it would appear that a wider chisel than this was employed, and that it was used obliquely and with only one of the points marking the rock.

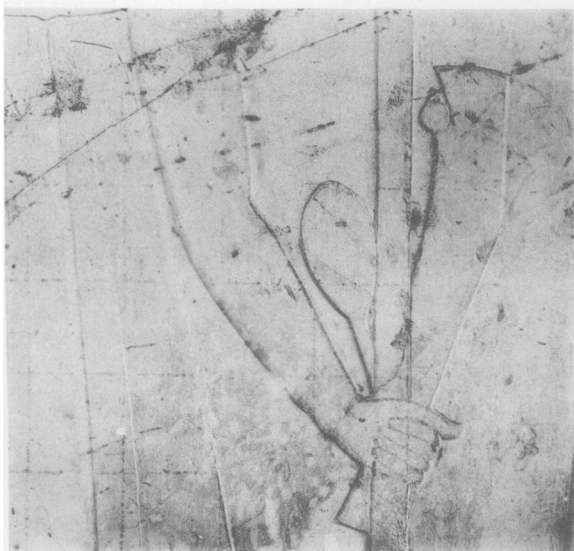
³ A hand chisel seems to have been generally employed for this special work.



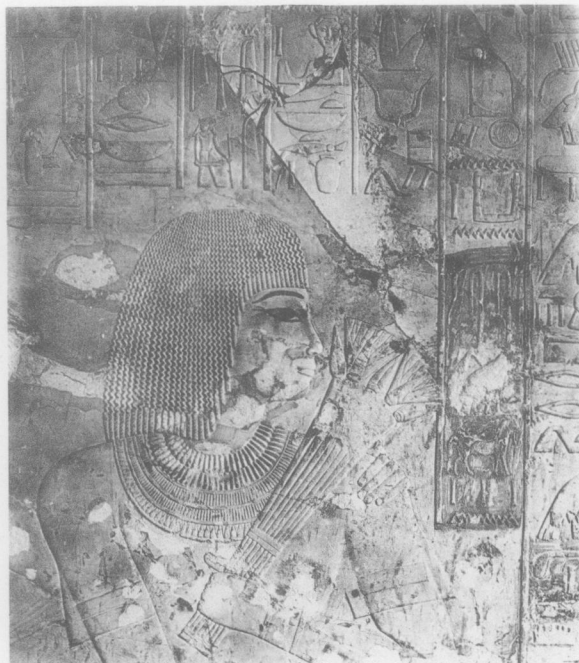
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TECHNICAL DETAILS FROM THE PRIVATE TOMBS AT THEBES (II)

The Ramesside work in this tomb is of the *relief en creux* type, that is, the limbs and the body are incised in the stone with the modelling just level with or below the general surface of the wall. The preliminary modelling of the limbs was accomplished by placing the edge of the chisel in the middle of the space between the two incised outlines and cutting towards these. This method left a sharp ridge down the centre of the limb, which was afterwards smoothed off and rounded over. There is no trace in this tomb of the figures being first outlined in red or black. The sculptor seems to have outlined his figures without anything to guide him, which argues considerable courage on his part. It is, however, conceivable that outlines were first marked in with a loose colour which could easily be brushed off.

In many sculptured tombs it was not considered at all necessary to remove the chisel marks from the skirting of the walls, though the rock prepared for carving on the upper parts of the walls might be worked exceptionally smooth. An otherwise well-dressed wall is, therefore, frequently found to be very rough and badly dressed along the lower edge, as in Tomb 36, which was probably left so with a view to its being painted in broad bands of colours, as was frequently done.

As stated above, flaws in the rock were filled in with lime-plaster, which was trimmed and sculptured to match the surrounding rock. In many instances, however, flaws and faults in the rock were much too large to be satisfactorily dealt with in this way, and recourse was had to the expedient of cutting out the defective part and neatly inserting a limestone block in its place, secured with a lime-cement. These blocks were inserted before the rock surface was dressed down. Good examples of the insertion of stones in this manner are to be seen in Tombs 11, 36, 39, 55 and 65. Inset stones are nearly always irregular in shape, though their edges are straight and slightly bevelled. It appears from this that the mason cut away only the bare limits of a rock flaw and inserted a stone of the required shape. This must have caused an unnecessary amount of trouble, one would think, as an exactly square or rectangular hole could be more easily filled with a corresponding stone than an irregular one. It must be admitted, however, that the inset stones fit the apertures fairly well; see Pl. XXIV, Fig. 4 (Tomb 55) and Fig. 2 (Tomb 36).

In a few instances the mason, in cutting out a tomb, found that whereas at one end of a chamber the rock was of excellent quality it was extremely poor at the other end. In such a case, a thick layer of the poor rock was removed and a limestone wall was built up in its place. In Tomb 39 nearly the whole of one of its inner shrines had to be built up in this way, as the masons found a poor stratum of rock at the end of the tomb. The same method was adopted on a smaller scale in Tomb 20.

In Tomb 57 (Kha^cemhēt) there are two interesting examples of large inset stones. In the course of cutting the outer chamber, a large natural fissure or flaw was found in one of the walls, extending about half way across the ceiling. A large stone measuring 90 by 60 cm. was cut and fitted into the wall, and two stones, which together measure roughly 98 by 91 cm., were inserted in the ceiling. To prevent the two blocks in the roof from falling, their edges were cut slightly wedge-shaped so as to engage the surrounding rock which was similarly cut to fit them. One end of each of these two stones was also made to rest on the top of the large block inserted in the wall. The latter has now fallen, but the two ceiling stones still remain *in situ*, which is good testimony to the skill of the mason who put them up. To fit in two blocks of stone in this way satisfactorily must have been a somewhat difficult proceeding. As their edges are wedge-shaped, the man who put them up must have cut a hole in the roof deeper than the thickness of the blocks in order that they might

drop properly into place. A certain amount of surplus stone was evidently left on what were to be the exposed faces of these two blocks, and this was trimmed off afterwards when the roof was levelled. This is proved by one of the stones having a slight projection at right angles along part of its end, which projection forms part of the wall of the tomb.

Occasionally the walls of a sculptured tomb were covered with a thin stucco coating, on which the various colours were applied. It should be mentioned before proceeding further that all carved walls were intended to be painted, and that in only one tomb, as far as is known, was it possibly intended to omit painting the sculptured scenes. This is the tomb of Raḥmōse, which is unfinished, and even in this case it is not at all certain that its sculptured walls would not have been coloured eventually, if time had permitted. A few walls in carved relief show indications that the coat of stucco was a fairly thick one, and in some cases it has destroyed a certain amount of detail, so that one wonders why it was ever put on at all and the paint not applied on the rock surface itself. It seems, however, that some difficulty was found in applying colours direct to stone, perhaps owing to the great absorbent powers of limestone, which would take up all the moisture of the paint, including its fixative, and leave the colour in a powdery form on the surface¹. Most sculptured tombs now show very little trace of their original colouring, which remains only in some of the hollows of the reliefs and in other well-protected parts.

Sculptured plaster. A peculiar method of working in relief on plaster was extensively used in this necropolis in Ramesside times. It appeared first in the Eighteenth Dynasty, but does not seem to have become popular during that period, probably owing to its being considered a very poor and cheap imitation of rock sculpture. The rock face was covered with a thick coating of lime-plaster, and before this coating had dried, and sometimes after, the scenes and inscriptions were modelled or carved in it. There is no doubt that very effective results could be obtained in this manner, and one of the best examples of this kind of work in the Necropolis is to be seen in the Ramesside tomb, No. 148 (Amenemopet), which, though badly destroyed, yet has some excellent relief work left in its outer chamber. Another good example, though the work is poor compared with that in Tomb 148, is the remarkably well-preserved Ramesside tomb, No. 23 (Thoy). With the exception of these two tombs, the majority of examples of relief in plaster show evidence of poor execution, as is to be expected of Ramesside work.

The processes gone through in this form of sculpture were as follows:—The figures and scenes were modelled as far as possible before the setting or hardening of the plaster prevented further work in this direction. Cutting was then resorted to, leaving a very porous and pitted surface which had to be coated over with a fine slip to make it smooth when the work was completed. Tomb 26 (Khmemhab) is an excellent example of an unfinished tomb showing these various stages of work. It is quite evident that in this tomb, and probably in most of the others carved in plaster, a slow-setting material was employed, which most likely contained a large proportion of lime mixed with a little gypsum.

Tomb 26, though a very large one and made for an important personage—Khmemhab was Overseer of the Treasury of the Ramesseum—yet affords striking evidence how Egyptian craftsmanship had deteriorated even in the Nineteenth Dynasty. This tomb is

¹ Another probable objection was that in order to paint direct on stone it was first necessary to have an exceptionally good surface, which meant much time and trouble, whereas by applying a thick wash to the walls this extra toil was avoided.

cut in rock quite equal in quality to that of the tomb of Raḥmōse, and yet the sculptor preferred to smear the surface of the limestone with a coating of thick plaster and execute his work in that material. The only exceptions that he made were the jambs of the entrance doorway and those parts of the wall facing the door which were well lighted; on these parts he carved in the rock itself. The cost of sculpture as compared with painting must have been considerable. It is true that some attempt was occasionally made to utilize the rock as a material to work in, but only the simple outlines of the figures were carved in the stone, and to these figures a coat of plaster was applied, in which the limbs and faces were modelled or cut. Thus we have here a series of figures which were cut in two materials, the upper layer being plaster and the lower one stone. That this curious form of technique is not, as it were, an accident is shown by the fact that it can be seen in another tomb, No. 105 (Khaḥemopet). Here there are similar figures cut in relief in good rock, but with a thick coating of plaster spread over them. The surface of the rock-cut figures was purposely left rough so as to afford a good keyhold for the plaster. Unfortunately, whereas Tomb 26 definitely belongs to the time of Ramesses II, this tomb can be only tentatively assigned to the Nineteenth Dynasty, which makes it impossible to decide whether the work in the two tombs belongs to the same reign, and, perhaps, to the same craftsman.

Another tomb (No. 23, that of Thoy already mentioned) affords an example of this system of carving in plaster instead of direct upon the stone, which in this tomb also was of fairly good quality. Simple work, such as hieroglyphic characters, was in most cases cut direct in the stone, but more complex work was first outlined in the stone and then heavily plastered, the latter serving as a relief. From the roundness of the edges, absence of scratches and other indications, it would appear that the plaster was modelled when soft and not cut after it was dry.

There are, as before mentioned, but few tombs of the Eighteenth Dynasty where plaster was employed as a material in which to work in relief. When it was so used, it was generally only on the jambs and lintels of the doorways leading into the inner chambers of painted tombs¹. The best examples at present known are Tombs 82, 85, 97, 99 and 188. In the first of these tombs (Amenemḥet), the statues of the owner and his wife are moulded in plaster on a rough core of rock, and the doorway in the west wall of the outer chamber and the lintel above the niche in the shrine are also decorated with reliefs moulded or cut in plaster. Tomb 85 (Amenemḥab) has two figures in relief upon the plaster jambs of the doorway leading into the inner chamber. Parts of Tomb 65, which was usurped and replastered in late Ramesside times (Imisibe), were also originally carved in plaster². There can be little doubt that the idea of cutting reliefs and incised figures in plaster is derived from the compulsory use of that material in filling up flaws in the rock walls of tombs that were intended to be sculptured in the usual manner, in which case the sculptor had to cut or mould small surfaces of plaster in the course of his work in order to make the scenes and figures continuous and unbroken.

In the inner chamber of Tomb 189 (Nekhtdhōut), which is of Ramesside date, the walls are in places plastered with a mixture of mud, chopped straw and a little lime, in which

¹ Wigs, of which many excellent examples may be seen in Tombs 18, 54, 79, 100 and 155, are excepted.

² It was begun as a sculptured tomb. The north wall was sculptured by Nebamūn, the original owner, but, owing to the bad state of the rock, it was found necessary to employ plaster and carve in that material. Despite the difficulties the work is very good.

curious material inscriptions and figures were cut. This tomb is the only example of carving in mud that the writer has found.

It is quite possible, though a search for indications of this has proved unsuccessful, that the plaster was applied to the rock surface bit by bit for convenience in modelling. If the whole surface of a wall were plastered at one time, the greater part of the plaster, even if slow-setting, would certainly be useless for modelling purposes and could only be cut, and even then with difficulty. The method of applying plaster to a limited surface at a time has been found by the writer, in the course of restoration work, to be a very convenient one, for even after it has set, plaster can be carved with a certain amount of ease with the use of a hammer and chisel as long as it is still damp. When it is quite dry, however, it is prone to break away in small pieces.

Carved plaster work is very common in the Tombs of the Queens, where the finest example is to be seen in the inner chamber of Tomb 36. In these tombs even purely ornamental work, such as *keker* friezes, etc., was cut in plaster.