A TECHNIQUE FOR DEVELOPING FOSSILS FROM THE MATRIX IN WHICH THEY ARE EMBEDDED

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The technique described below is that which is used at the Coryndon Museum, Nairobi, with Miocene and Pleistocene mammalian fossils from Kenya and Tanganyika. There are many different ways of tackling this work, but we have found that after due consideration of expense, and the materials at our disposal, we can prepare fossils for study which are clean and tough by adopting this method.

By developing, we mean the preparation of fossils for study, which entails the removal of all possible matrix from around the fossil, consistent with its shape, strength, and the accessibility of the part to be cleaned. In many cases it is impossible or unwise to remove all matrix from around a fossil, as in the case of long bones which may have been fractured shortly after death, where the matrix may be acting as a strong cement between the two pieces. (See Fig. 1.) If the matrix is removed, and often this type of infilling is of a very hard substance, the two broken edges of the bone may be so worn that the original points of contact no longer exist, and to effect a durable repair of the break would be a difficult problem. Again, a specimen such as a small rodent skull is often better left with a certain amount of matrix still attached in places where its removal might render slender processes or thin arches of bone liable to damage. (See Fig. 2.) When one is dealing with such small specimens any breakage of, say, a small process may end in the broken piece being mislaid.

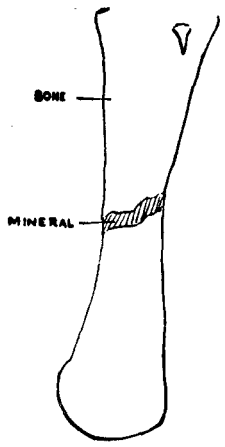

Fig. 1. Mammalian humerus showing fracture rejoined by mineral

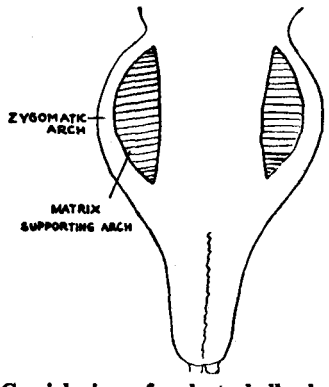

Fig. 2. Cranial view of rodent skull, showing matrix left undisturbed to support zygomatic arch

The preparation of fossils for study starts in the field at the site of discovery. In East Africa fossils are often found on the surface a little removed from the deposit of origin, due to the action of rain or flood water washing the fossil out of the deposit and lodging it further down the gulley or stream bed. In this case there may be only little

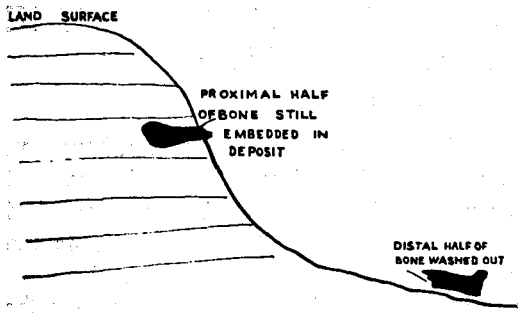

Fig. 3. Cross-section through deposit

matrix attached to the bone. However, very great care must then be taken, especially if the fossil has a fresh-looking break, to try to ascertain from which part of the deposit the fossil has been washed out, and if possible trace back the path of the fossil in case there may be other pieces of the same specimen which might otherwise have been overlooked. When a specimen is found lodged in a deposit it may be necessary to dig carefully to see if any pieces are embedded farther in, and also to look below the deposit for fragments that may have been washed out of the original deposit. (See Fig. 3.)

If the specimen is large, as are many of the Pleistocene fossils from Tanganyika, the safest way of moving them is to encase the entire fossil and the surrounding matrix in a cage of Plaster of Paris, after which they can be taken to the institution where they will be developed without fear of damage. (See Fig. 4.) The upper or outer surface of the fossil is exposed as far as possible without damaging the specimen, and the exposed parts are then coated with shellac, not too strong, for extra strength. When the shellac is dry, the surface is wetted with a paint-brush (1″ to 2″) all over, and sheets of fine paper (Bronco is ideal) are laid on the exposed side and dampened down with more water so that the paper is in close contact with the fossil. This forms a protective layer between the Plaster of Paris and the fossil, facilitating the removal of the plaster at a later stage without damage to the specimen. Strips of material such as hessian are then cut and moistened and laid across the fossil, one or two strong sticks being laid on top of the hessian parallel to the long axis of the specimen. The Plaster of Paris is then prepared, and further strips of hessian soaked in the plaster and laid across the whole, including the sticks. When the plaster is completely dry, the whole fossil is very carefully dug out together with the surrounding matrix, placed with the plaster side down, and the process repeated on the untreated side, making sure that the edges are completely covered. The specimen may then be transported safely without fear of damage.

The tools used in developing out fossils in this museum vary according to the size of the specimen and the personal preferences of the worker, but chisel, mallet, and odd dental excavators sharpened to a point are most commonly used, together with a couple of paint-brushes varying in size from a 2-inch painter's brush to a small camel hair such as is found in a child's paint box. A child's old soft toothbrush is also very useful, especially when cleaning fossil teeth. It is important to maintain all tools in good condition, i.e. those with a sharp point will need resharpening at least once a day, small dental burrs used for fine work more frequently, and the paint-brushes cleaned each day.

Having assembled and prepared the tools a start can be made on the removal

of the matrix. Starting at the side of the fossil already exposed, a weak solution of shellac is applied, taking care not to put more than necessary on the matrix, as the distinction between bone and matrix may become blurred. The matrix is then very carefully scraped off bit by bit, starting at the edge of the bone. If the matrix is very thick, pieces can be removed by the gentle tap of a mallet on a fine chisel or dental tool, but this must be done with very great care and the angle of percussion must be at right-angles to the plane of the bone lest a chip of bone be removed as well. (See Fig. 5.) An electrical grinding stone can be used to advantage when removing a thick, hard layer of matrix, but again great care must be taken to ensure that too much matrix is not removed and it is advisable to leave a thin layer over the bone for removal by hand.

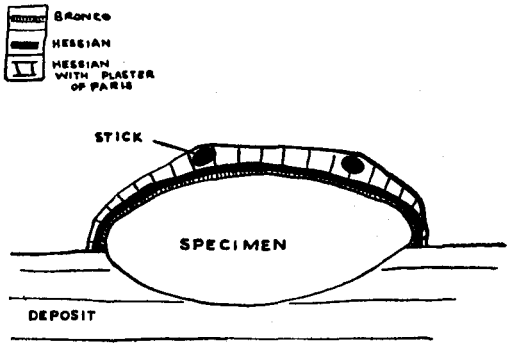

Fig. 4. Transverse section showing plastering method for removing large specimens

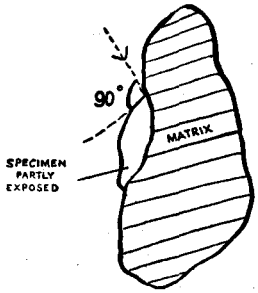

Fig. 5. Diagram to show angle at which percussion must be applied when removing matrix from a specimen

As each piece of bone becomes exposed it is coated with a very weak solution of shellac; this is particularly important where the bone is friable, as the repeated coating with weak shellac is absorbed by the bone and strengthens the whole specimen. If the shellac is too strong it merely forms a superficial layer which tends to obscure detail and does not strengthen the fossil.

When considering small specimens such as the skulls of rodents, frequent applications of plain water with a small paint-brush help one to distinguish between bone and matrix where each is similar in colour. A solution of 10% acetic acid may help to dissolve certain types of matrices, and can be applied very carefully with a small paint-brush on one area at a time, water then being used to remove any excess acid. It is advisable when using the acid for the first time to test an area of barren matrix so that the action of the acid on that particular type is wholly familiar. A word of warning—I remember trying this technique on some poor specimens of fossil grasshoppers (fortunately they were no good for study) and after half-an-hour's treatment with the acid all that remained was a nasty brown sludge.

Even the most careful of workers find that small pieces of bone or tooth may chip off during development, and in this case it is essential, especially with very small slithers of bone, to replace them immediately, using some adhesive such as 'Durofix'.

If the broken piece is put aside and left until the end of the operation it may be very difficult to orientate it into the correct position.

When dealing with small skulls, etc., a low-power microscope is necessary for the cleaning of teeth and delicate structures, and the best tools are a series of finely sharpened dental burrs, small enough to use with comfort under the lens. In such cases frequent cleaning of the loosened matrix with a fine brush is essential, as otherwise the tiny pieces of matrix may lodge in the depressions of the teeth just cleaned. When using a microscope the fossil must be absolutely dry otherwise the refraction of light through the liquid will tend to distort the image.

When the fossil has been cleaned of as much matrix as possible and all broken pieces put together, the whole specimen is given several coats of weak shellac, allowing each coat to sink in really well before applying the next. When the final coat is dry the specimen is ready for study.

Some fossils, especially the larger ones, may be incomplete although the general outline may be apparent. For the purpose of making the specimen more rigid, or for the clearness of display, the missing portions can be added using Plaster of Paris, coloured sufficiently like the fossil so that the original shape is clear, but not too like or the plaster might be mistaken for bone and so give the wrong impression.

Fossils when ready for study have to be housed very carefully in a box or drawer where they can be left without fear of damage. It is sometimes wise to make a base of Plaster of Paris for the specimen, for the purpose of exhibition, study, or so that it can rest in a drawer without damage to fragile points of contact. When required the specimen can be taken off the base easily. To make the plaster base, a cardboard or light tin box, about ½″ to 3″ deep according to the size and weight of the fossil, is used, and its length and breadth should be a little more than that of the specimen. The fossil is then coated on the underside (that side which will come into contact with the plaster) with first-grade olive oil. The box is then lined with fine paper and the Plaster of Paris is prepared as a solution and poured into the box. When the plaster is nearly set, about the consistency of whipped cream, the oiled side of the fossil is placed very carefully on to the plaster and pressed down very gently to ensure sufficient support for the fossil. Care must be taken that it does not go in too far or the plaster might undercut the fossil and make it difficult to remove. When the plaster is quite set, remove the fossil and clean off the oil. The plaster block can now be lifted out of the box, the paper peeled off, the edges scraped tidily and the registered number, or some other form of identification, written on the underside of the plaque.

The fossil is now ready for study, display or storage.