

A METHOD FOR THE EXCAVATION OF PAREIASAURS

BY

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With one text-figure.

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In order to conclude our series of descriptive and comparative morphological investigations of the pareiasaurs, it is necessary to give a short report on the excavation method we used. The necessity for this report is clear in that before the use of this method not a single complete skeleton was known—not because of the absence of complete skeletons but rather because of faulty excavation methods.

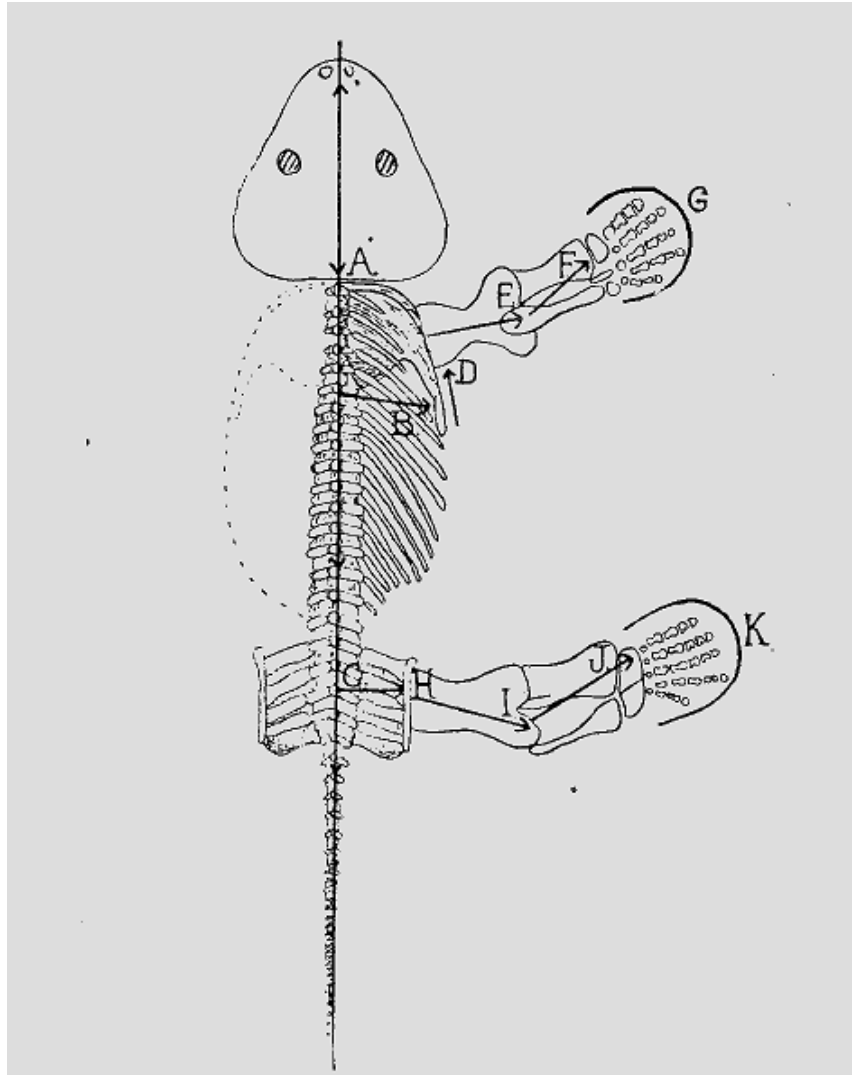
About 60-70 percent of these skeletons discovered are completely articulated as reported by Watson, Houghton, and the current author. The other 30-40 percent are either incompletely fossilized or parts have been removed by erosion. Although we are actually going to describe the excavation of a complete skeleton, it is self-evident that slight adaptations of the method can be used in cases where a partial skeleton is excavated. Furthermore, all of the above mentioned authors found that in at least 70 percent of the cases the animal was included in the rock lying down on its belly with its legs spread out at its side with the head slightly elevated.

This is mentioned as introduction. Now the description of how we go about our work follows. The pareiasaurs are mostly found in the Koup (Gouph), that is, the basin south of Beaufort West between the Swartberg Mountains and the Nuweveldsberg Mountains. Here the fossiliferous layers which yield the pareiasaurs consist of hard blue mudstone and shales which are exposed on hillsides, next to stream beds and on top of weathered ridges and hills. These exposed rock layers are scoured for traces of fossil bones. When a fragment of fossilized bone is found at the bottom of an elevation one would scale the rock face to trace the origin where the bone was washed out. In most cases the rest of the skeleton will be found in situ. In other cases a piece of bone exposed in solid rock may be found on a hill or a neck or the back of a ridge where it is more or less level. In both cases a part of the skeleton was exposed by natural forces. This piece will be studied carefully and if necessary exposed slightly more by means of a cold chisel and hammer so that the form and structure of the bone is evident in order to determine the identity of the bone and also the type of animal to which it belonged can be determined. If it becomes evident that it is probably a pareiasaur bone, then there is a 60-70 percent chance of the rest of the skeleton being present. In the case of pareiasaurs it is mostly the skull or the vertebral column with the upper parts of the scapulae or the ilia which are exposed on the surface. This is obviously only the case if the skeleton is found on a flat surface, in the case of skeletons discovered on slopes either the

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head, or tail, or one of the legs will be exposed. The method which is described below is more applicable to the majority of skeletons which are found on level ground but with a few modifications could be used even in the excavation of those that are found in steep elevations.

If part of the skull is exposed (usually the tabulars), then a sufficient part of the skull is opened up by means of a cold chisel and hammer to determine the front and back of the skull. Then the covering rock is removed along the midline (A.C) until the upper end of the scapula is found at B. A cavity of about a foot in diameter is chiseled out next along the outer rim of the scapula (in the direction of D). The humerus will be found approximately at the level of the glenoid cavity of the scapula. The surface of the humerus is gradually exposed in a lateral direction (E), a protuberance (the olecranon of the ulna) indicates the distal end of the humerus. The rock is now more carefully removed in the direction F to expose the ulna and radius. A smaller chisel and hammer is used from a bit under a foot from the olecranon because of the proximity of the hand which necessitates a more careful excavation technique. If the ulna and radius is followed carefully one finds the radiale of the wrist joint. The rock is now carefully chiseled away to expose the palm bones. The rock covering the rest of the palm bones is chiseled away until all five palm bones are exposed. From here the rock covering each finger is removed up to the tip of each finger. The whole upper surface of the hand is now exposed. A groove is chiseled out (along the line G) approximately an inch or two around the periphery of the distal ends of the fingers. Two or three chisels are hammered into this groove. The exposed surface of the hand is now cleaned with a brush. The chisels are now carefully jogged to and fro until all the finger bones and wrist bones remain in their respective places but come loose from the underlying rock. When it is clear that all the bones are free but still in position, a sufficient amount of Plaster-of-Paris is prepared and the whole hand up to the groove is covered in a thick layer until the distal ends of both the ulna and radius are covered. The whole head and foot is now covered with a sack/bag to protect them from unnecessary handling. The same procedure is now followed for the other front leg.



Up until now the whole procedure is designed in such a way to insure that the excavator will find the two hands and feet. This is necessary because the methods used by most other excavators were unsuccessful in that none of them managed to excavate a complete hand or foot thus far. Loose finger and toe bones as well as ankle and wrist bones have indeed been collected, but in such a way that it is impossible to determine the exact structure of the hand or foot. The method described here insures that the many small loose bones of the hand and foot are secured in their correct orientation to each other in blocks of plaster before the removal of the skeleton is attempted.

The procedure to remove the skeleton can begin now after all four legs are secured. A groove is chiseled out around the skull approximately an inch from the skull. When the groove is approximately a foot deep under the upper level of the skull five large chisels are hammered into the groove—one in front of the snout and two on either side. Shortly after the chisels are hammered in one after the other, the skull will start to lift and can then easily be removed and placed immediately packed in a chest with wood shavings and paper.

The skull is removed by breaking off the block containing the skull between two neck vertebrae. Next an attempt must be made to remove the rest of the neck vertebrae in one

block. The humerus on either side can now be excavated followed by the removal of the radius and ulna. The distal ends of these bones must be loosened carefully from the blocks of plaster containing the hands, in such a way that the depressions where they were are preserved which will be handy to determine their original position during the reconstruction of the skeleton. The hand is removed next. A chisel is hammered in on either side of the plaster block, which enables one to lift the whole block containing all the small hand bones. The whole hand usually lifts up together with the block of plaster because of a shear plane that develops between the hand and the rock underneath. However, sometimes all the wrist and fingerbones do not lift up with the rest of the block of plaster. Those that remain in the underlying rock are now one by one chiseled out and placed in their corresponding hollows in the block of plaster. This insures that all the bones are in place which also supports and strengthens the block of plaster when transported. I have found that this is the only method to transport the multitude of small bones in their correct position in which they were found. In order to determine the structure of the hand it is obvious that the exact position of all the bones must be established. This is especially the case of the distalia and centralia of the wrist joint.

When the two front feet are removed an attempt must be made to retrieve the first 5-6 trunk vertebrae with their ribs and the whole shoulder girdle (scapulae, coracoids, procoracoids, clavicles, interclavicles, and cleithra) in one big block by means of large chisels and a big crowbar. After that the hind legs are removed in the same manner as the front legs.

A block that contains the next 4-5 trunk vertebrae are broken out with their ribs just in front of the hips.

The tail is then removed in 4-5 pieces in average sized blocks with just enough rock around it to preserve it during transport.

The only parts that remain are the hip girdle (ilia, ischia, and pubes) together with the sacral vertebrae. They can usually be removed in one big block by means of large chisels and a crow bar.

All the different blocks and the pieces that broke off in the removal process must be numbered carefully which should be copied in a sketch in a note book.

The method described above is obviously for an ideal situation, but which I have once applied personally. The position of the animal is however not always so symmetrical and it is often necessary to follow an alternate sequence of excavation procedure. In some cases it is necessary to secure the skull in plaster before removal. These modifications can be introduced by excavators as necessary when they have familiarised themselves with the general method described above.

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'n METHODE IN GEBRUIK VIR DIE OPGRAWING VAN
DIE PAREIASAURIËRS.

DEUR

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Met een Tekstfiguur.

Gelees 7 Julie, 1933.

Om ons reeks van beskrywende en vergelykende morfologiese ondersoekinge oor die Pareiasauriërs af te rond, is dit wenslik om ook 'n kort verslag te gee van die metode wat ons in hul opgrawing gebruik het. Dat so 'n verslag wel deeglik nodig is blyk uit die feit dat voor hierdie metode toegepas was daar geen enkele volledige geraamte opgegrawe was nie—en dit nie omdat die geraamtes nie as geheel teenwoordig was nie maar weens foutiewe opgrawingsmethodes.

Soos alreeds deur Watson, Houghton en die skrywer vermeld, word omtrent 60-70 persent van die skelette volledig geartikuleerd aangetref. Die ander 30-40 persent is óf onvolledig in die rots opgesluit óf gedeeltes is later deur verweringsprosesse verwyder. Alhoewel ons eintlik net die opgrawing van 'n volstandige skelet gaan beskrywe, spreek dit natuurlik vanself dat 'n effens gewysigde metode van toepassing is op die ander gevalle waar die skelet net gedeeltelik teenwoordig is. Dit is verder al deur die genoemde skrywers vasgestel dat die diere in minstens 70 persent van die gevalle in 'n bepaalde posisie in die rots opgesluit is, nl. dat die dier op sy pens gelê het met die pote aan weerskante uitgespreid en die kop effens omhoog gerig.

Dit ter inleiding. Nou 'n beskrywing van hoe ons te werk gaan. Die Pareiasauriërs word meesal in die Koup (Gouph), dit is die kom ten suide van Beaufort-Wes tussen die Swartberge en Nuweveldsberge, gevind. Hier bestaan die fossielhoudende rotslae, wat die Pareiasauriërs bevat, uit harde blou modderstene en skalies wat teen die hange van die randjies, langs waterlope en bo-op platgespoelde rande en koppies blootgestel lê. Langs hierdie blootgestelde rotslae word dan vir enige aanduidings van versteende bene gesoek. Onder aan 'n hang word daar miskien 'n stukkie versteende been gevind—dan klim 'n mens teen die hang uit om te bepaal waar die stukkie vandaan gespoel het. In meeste gevalle word dan op een of ander hoogte die res van die geraamte *in situ* gevind. Of bo-op 'n koppie, nek of rug, waar dit min of meer gelyk is, word 'n stukkie been, wat uit die vaste rots uitsteek, bespeur. In beide gevalle is 'n gedeelte