ON THE SKELETON OF ANEUGOMPHIUS ICTIDOCEPS BROOM AND ROBINSON

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Abstract

The skeleton of *Aneugomphius ictidoceps* was not taken into consideration with the original description and became separated from the type skull. After the present author had submitted a more detailed description of the type skull for publication, the skeleton was discovered where it had been kept in store. Subsequently the skeleton was cleaned and is described and figured in this paper. A dorsal and a side view of the reconstructed skeleton are also given.

Introduction

In April, 1946, Mr. J. W. Kitching collected a small specimen low in the upper part of the *Cistecephalus* zone of the Karroo, on the farm Hoeksplaas in the Murraysburg district. In our field catalogue he made an entry at field number 182, reading: "small Therocephalian skull and portion of skeleton". The specimen was collected in two pieces, one containing only the skull and the other the skeleton, both bearing the same field number. Shortly afterwards he proceeded to clean the skull, but before he had made reasonable progress, Dr. Broom, on a visit to the Bernard Price Institute, recognised it as a remarkable new form and took it with him for investigation and description. The skull was eventually described as *Aneugomphius ictidoceps* by Broom and Robinson (1948), but the fact that the specimen includes the greater part of the skeleton was not mentioned. When the skull was returned it was placed with other cleaned, identified and described specimens and it received the official museum number 11. When it was recorded in the museum catalogue, the skeleton again passed unnoticed.

Subsequently the present author subjected the skull to the acetic acid preparation technique and submitted a more detailed description for publication (1956). The author obtained his field information from the museum catalogue and he did not notice that there is a skeleton on record. Shortly after this paper was submitted for publication, Mr. Kitching checked certain specimens in store against the field catalogue and discovered the skeleton bearing the same field number as the type skull of *Aneugomphius ictidoceps*. This portion of the type specimen was immediately subjected to preparation.

As the acetic acid technique proved so remarkably successful in the case of the skull this method was employed at first but, on account of an intricate system of cracks and the porous nature of some weathered areas in the matrix, it was considered too dangerous. It has also been mentioned in the description of the skull that the bone is a great deal more vulnerable to the acid than the matrix, and in the case of this skeleton greater difficulty was encountered to protect the more delicate bones. Especially the ribs were very prone to attack by the acid. The alternative method then resorted to was the dental automatic mallet.

The specimen is very flat and before preparation commenced, many bones were partially exposed equally on both upper and lower surfaces. It was decided to expose these bones on both sides as clearly as possible, in spite of the danger of complete disintegration. The method employed to avoid this danger is as follows. The specimen was given a substantial border around its edge of Calistone, leaving both dorsal and ventral aspects open. The ventral aspect was then secured in a thick bed of plasticine which adhered well to the table surface. Under the binocular microscope as many bones as possible were exposed with the aid of the automatic mallet. Thereafter the cleaned upper surface was properly treated with glyptal for strength and then in its turn secured in a thick bed of plasticine. With the lower plasticine bed removed, preparation was carried to a similar extent on the ventral surface. In places the thickness of the matrix between the bones was reduced to an extent where the mallet inclined to strike through the specimen, but the Calistone border kept it as a whole intact while the plasticine below cushioned much of the shock and prevented local damage. Eventually some additional details had to be exposed by gently employing the otherwise objectionable dental emery disc.

Nearly all the vertebrae included in the specimen were exposed on both surfaces, the centra below and the neural arches above, and the humeri also show equally in the two aspects.

The two surfaces were then photographed accurately to the same scale. The photographs were traced separately and the one trace was transferred to the reverse side of the paper containing the other in a manner allowing as true an apposition as in the specimen itself. On a tracing table the information contained on the one side was traced through on to the other, both ways. Information not actually exposed in the specimen could then readily and quite accurately be sketched in. Thus figures 7 and 8 were obtained.

In producing the dorsal and lateral views of the reconstructed skeleton (figure 9), the following factors were taken into consideration:

(1) The body was evidently not carried high on the legs and when not in motion it was probably lowered to the ground in typical reptilian fashion. This assumption is based on the reptilian nature of the limb articulations, the relatively

small feet, the weak shoulder girdle, the broad, flat trunk (see 2 below) and the nature of the vertebral column (see 3 below).

(2) The trunk is interpreted as broader than high, that is, reptile-like, judging from the long slender ribs as seen in relationship to the short and outwardly inclined legs. The mammalian trunk is normally higher than broad, usually corresponding to a somewhat similar ratio in the skull, while in reptiles in general these ratios are also somewhat similar, but breadth normally exceeds height. Although it is by no means a common characteristic, one could with some degree of confidence attribute to the trunk a height-breadth ratio approximating that of the skull, because it appears that when an animal passes through obstructions or goes into hiding in secluded spaces, if the head finds that there is room available, the body would follow without it being necessary for the animal to turn it to a different angle. Another characteristic supporting the view that the trunk was flat and reptile-like is the insignificant height of the dorsal processes of the vertebrae and their uniform inclination (see 3 below).

(3) In side view the vertebral column is interpreted as fairly straight or evenly curved. Only in mammals and certain larger extinct reptiles (considering only these two classes of vertebrates) does the vertebral column develop particular curves, where the trunk is carried well above the ground and suspended across the front and hind limbs. Then the vertebrae develop dorsal processes of varying lengths and inclined at various angles. These angles are such that the dorsal processes incline away from the girdles, that is, forward in the cervical region, backward in the thorax, forward in the lumbar region and backward in the caudal vertebrae, while they attain their greatest lengths in the girdle regions. This arrangement, very well displayed in the dog, is obviously an adaptation advantageous to the general muscular strength of the vertebral column. In mammals these lengths and inclinations of the dorsal processes are more exaggerated anteriorly, because the weight of the head as balanced across the shoulder girdle is more significant than that of the tail as balanced across the pelvic girdle. Where the arrangement is as in the present specimen or any average reptile, that is, no differentiation in the size and inclination of the dorsal processes, the conclusion is arrived at that the vertebral column did not carry much strain and that the trunk was lifted off the ground only when the animal was in motion.

The Vertebral Column

The pro-atlas, atlas and axis are included in the specimen, but they are very indistinct. They suffered some weathering and with every attempt at exposing them properly more damage was done to them than the probable successful preparation warranted.

The atlas is large with wide transverse processes but the detailed shape can not clearly be ascertained. Only the dorsal process of the axis could be exposed. It is covered to some extent by the transverse processes of the atlas. The axis appears

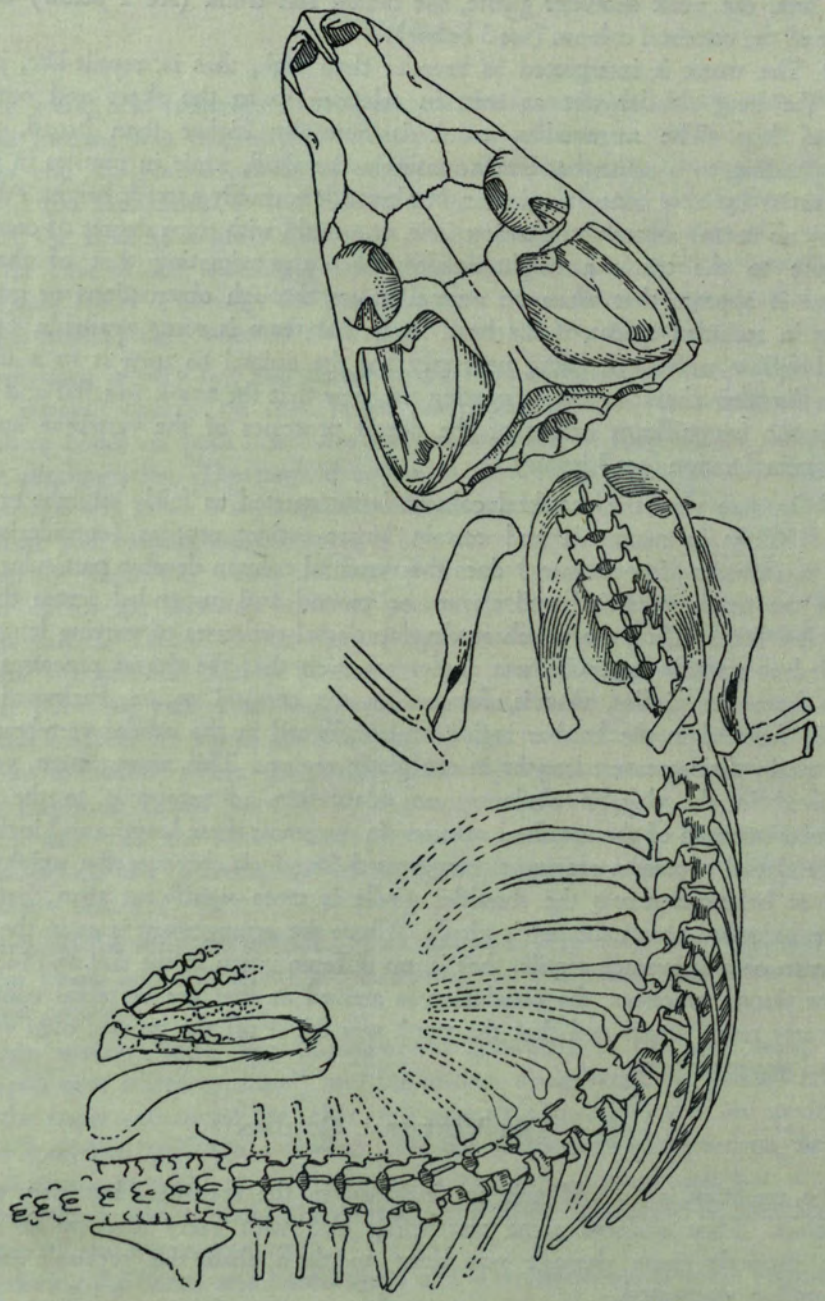

Figure 7—Dorsal view of the skeleton of *Aneugomphius ictidoceps*, as preserved, with information shown in ventral view traced in. Natural size.

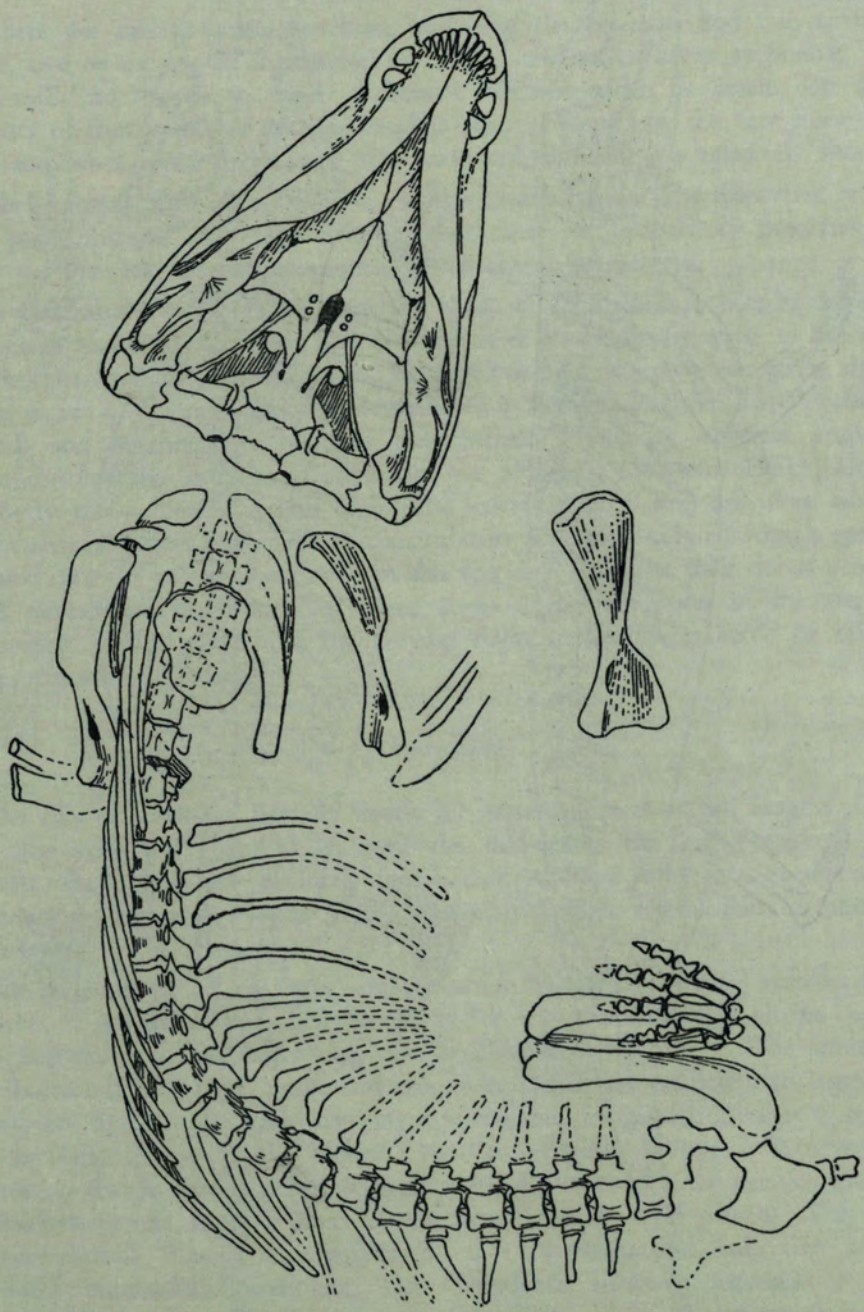

Figure 8— Ventral view of the skeleton of *Aneugomphius ictidoceps*, as preserved, with information shown in dorsal view traced in. Natural size.

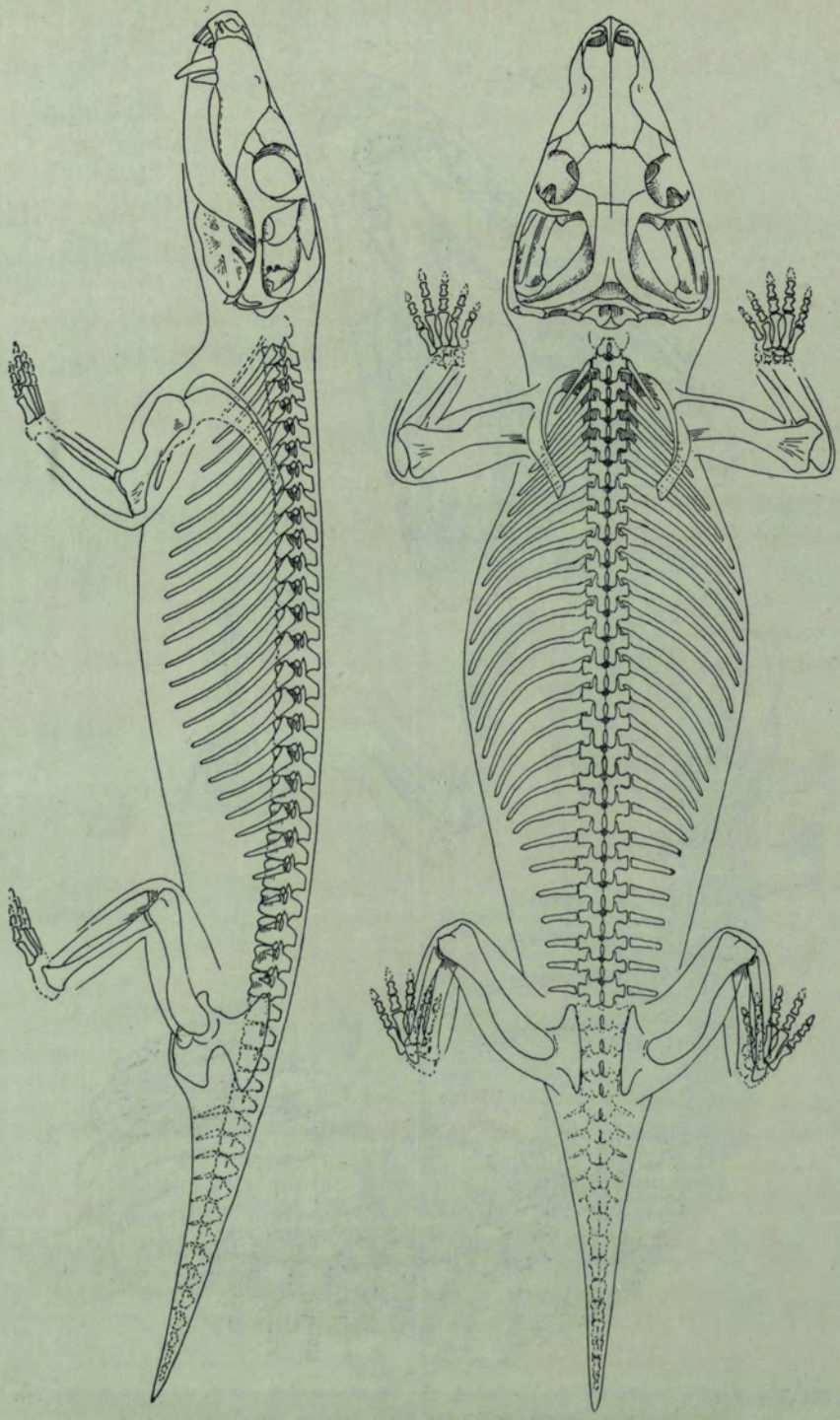

Figure 9—Dorsal and side views of the reconstructed skeleton of *Aneugomphius ictidoceps*. Approx. x$\frac{2}{3}$

to be rather small and not very different in shape from the following cervical vertebra.

There are twenty seven vertebrae, excluding the pro-atlas and the sacrals. Of these, five or six can be interpreted as cervical and six or seven as lumbar. There is actually no feature on which a definite subdivision can be based. The sacrum consists of four vertebrae and the caudals are represented by the first three. There is a somewhat rapid decrease in size backward, indicating a relatively short tail.

The post-zygapophyses are broadest in the lumbar region. The transverse processes are fairly uniform. It is not clear whether there are articulatory processes other than the pre- and post-zygapophyses. There are no intercentra.

In general the vertebrae are very like those of *Ictidosuchops* but, in the several specimens at hand, it is not clear whether there is a differentiation in the nature of the dorsal processes in this genus. In the Cynodonts the vertebrae in the shoulder girdle region have longer dorsal processes, even in *Leavachia* of the *Cistecephalus* zone (Brink and Kitching, 1951), and they incline at slightly different angles. In *Scaloposuchus* this differentiation is not yet apparant (Watson, 1931), although the body was evidently carried high. The vertebrae of *Bauria* are more advanced in the shape of their transverse and articulatory processes, judging from a specimen at hand, but the vertebrae included in this specimen have lost their dorsal processes. It is nevertheless apparent that there is some differentiation in the angles of inclination in this genus and the varying sizes at their bases could be taken as indicating varying lengths.

The Ribs

The ribs of the right side are nearly all preserved in their full lengths. On the left side only the proximal ends of the mid-dorsal ribs are preserved. These indicate clear, but not distinctly subdivided, separate tubercular and capitular articulations, better developed in the posterior thoracic region than anteriorly or posteriorly.

The foremost rib on the right side appears to belong to the third vertebra behind the axis. It has quite appreciable length and it is not unlikely that all the cervicals, including the axis, had fairly long ribs, as illustrated in figure 9. The lumbar ribs are shortened, with blunt ends, and this reduction is just sufficient to suggest the probability that a developing diaphragm is revealing its presence, but it is certainly not as suggestive as in the higher Cynodonts (Brink, 1956). It is nevertheless interesting that in this specimen, with its reduced lumbar ribs, the peculiar glandular depressions in the upper regions of the maxillaries are also present. The author has interpreted these characteristics in the Cynodonts as indicative of very advanced mammalian conditions. The Cynodonts, however, represent a branch which did not give rise to mammals. The more likely "Bauriamorph" branch apparently did arise in the Therocephalia not far from the Whaitsiid origin, with

the Cynodont origin in the "Bauriamorph" branch also not far removed. It is therefore not strange that this primitive Whaitsiid should reflect some advances which were actually achieved in a more substantial way in later descendants in either of these branches.

The Girdles

The girdles are not very satisfactorily displayed in this specimen. Only the dorsal portions of the scapulae are exposed. These portions are very slender and they are interpreted as inclining sharply backward in their natural positions, because, as preserved, they are strongly curved backward. The glenoid regions and the coracoids and precoracoids are not exposed, except for a small piece of bone on the right side, which could be part of the precoracoid. The clavicles are well exposed. These bones are long and slender and articulated substantially with the scapulae. Ventrally they form flat portions which evidently completely overlapped the interclavicle. The latter bone is also well exposed and shows clearly two areas where the clavicles articulated. These areas are bordered on the anterior margin by distinct, delicate ridges.

The pectoral girdle shows very close affinities with the "Bauriamorph" branch. (The Bauriamorpha is interpreted here as including all the families listed by Watson and Romer 1956). From *Ictidosuchops* it differs only in the scapulae being more delicate and more curved (compared with actual specimens), while this difference is more pronounced when compared with *Scaloposuchus*. In the Cynodonts the scapula is broader, straighter, with its outer surface distinctly concave, while the clavicles are shorter.

The pelvic girdle is less satisfactorily exposed. The ilia have intimate articulations with broad transverse processes of the sacral vertebrae. They appear to be delicate, not high, but the alae are long antero-posteriorly. The ischia are more substantial. Only the left ischium is exposed, its ventral surface being completely displayed. It has a broad, flat wing, a narrow neck and a significant portion contributing to the acetabulum. The obturator foramen is large. The margin articulating with the right ischium is slightly shorter than the free edge forming the ventral margin, posteriorly, of the pelvic canal. The extent and shape of the pubis cannot be ascertained. It appears to be the weakest of the three bones.

The Limbs

Both humeri are fairly well exposed. The proximal ends of the radii and ulnae of both sides are preserved and partially exposed. The radius is a slender, round bone, while the ulna is flat. There is no distinct olecranon projection. The proximal and distal articulations of the humeri are primitive, reptile-like, unlike the more advanced condition in *Ictidosuchops* and *Scaloposaurus* where the limb bones are longer.

The left femur, tibia and fibula are preserved, but not well exposed. The left pes is well preserved and displayed in its ventral aspect. Only the terminal phalanx of the first toe is present, but it is quite clear that there are no reduced phalanges and that the digital formula is 23333 according to the Whaitsiid pattern.

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