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## SKULL CHARACTERS OF *AMPHICOTYLUS LUCASII* COPE

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### INTRODUCTION

In the Cope Collection of Fossil Reptiles in The American Museum of Natural History is a fairly well-preserved crocodilian skull from the uppermost beds of the Morrison Formation near Canyon City, Colorado. This skull (Amer. Mus. Cope Coll. No. 5782) is from the same locality and level as the type of Cope's *Amphicotylus lucasii*. It is hereby referred to that species on the basis of this fact, with consideration also of the fact that no other crocodilian remains are known from that

locality and level, and that in size and general characters it fits the characters of the type. In view of the fact that the type is fragmentary this specimen may be considered provisionally as the neotype.

No direct comparison between corresponding parts of this specimen and the type has been possible up to the present time, although parts recorded to be associated with the skull now described may permit this comparison later.

### GENERAL FORM OF THE SKULL

The specimen is somewhat crushed from above, but this crushing is simple in character and does not prevent accurate determination of most characters and fairly accurate determination of others.

The skull is moderately long and narrow, with no dimension unduly exaggerated. The cranial table is much broader than it is long. Apparently it was not sharply separated from the snout in level, but crushing makes this point difficult to determine accurately. This cranial table is sufficiently large to enable the supratemporal fenestrae, which are moderately large themselves, to be separated from each other, from the orbits and from the external borders by fairly broad plates of bone.

The snout is moderately long but not excessively so. Its breadth is about three-fifths of its length. Its external borders are nearly parallel, converging only slightly forward to the level of the fifth maxillary teeth, there being no pronounced constriction immediately posterior to this level,

as in many crocodilians. The constriction near the level where the premaxillo-maxillary sutures intersect the lateral borders of the skull is very marked. The level of greatest indentation appears to be *in* the premaxillaries, and not directly *at* the premaxillo-maxillary suture. The notch is deep vertically as well as horizontally.

The anterior expanded portion of the snout is much broader than it is long. It turns sharply downward at its anterior end.

On either side of the snout, slightly anterior to the base of the snout, and located just above the lateral border, is a conspicuous pit. On the right side the skull has been crushed somewhat just anterior to this pit, and the excavation looks as though it might have been caused by a hard object, such as a quartz pebble, or a femur head might have been squeezed against the skull. On the left side of the skull, however, the skull is little, if at all, crushed, and the excavation on that side corresponds exactly in position and character with that

<sup>1</sup> Contributions to the Osteology, Affinities and Distribution of the Crocodilia, No. 36.

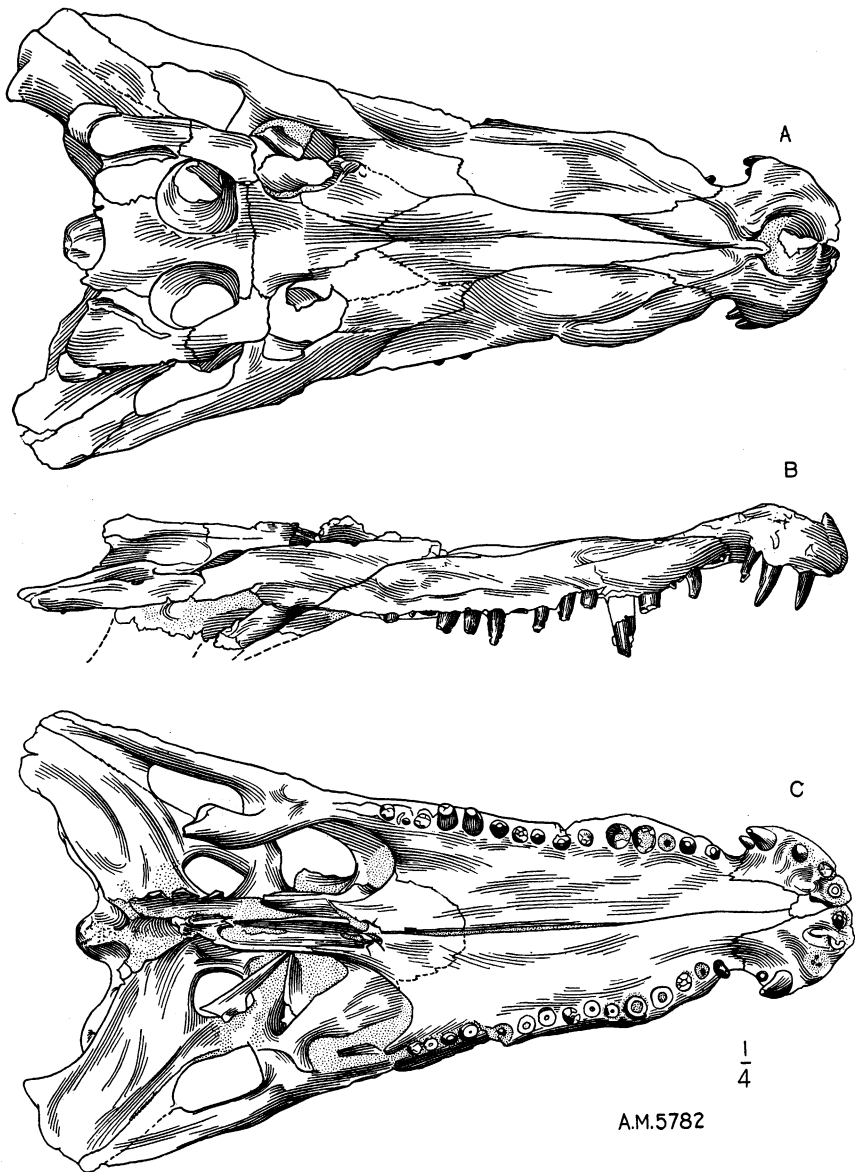


Fig. 1. *Amphicotylus lucasii* Cope. Neotype (Amer. Mus. Cope Coll. No. 5782). A, superior view; B, lateral view, right side; C, inferior view. All figures one-fourth natural size.

on the right side. These excavations are about twice as long as they are high, and they are moderately deep. They are smooth, lacking the pitting that is characteristic of surrounding areas. They suggest riding spots for jaw muscles.

An unusual feature of this skull is a distinct groove shaped like a letter U. It extends forward along the snout on each

side from a point slightly anterior to the excavation mentioned above to the level of the fifth maxillary tooth, then bends inward toward the notch, and near the latter bends more sharply toward the mid-line, immediately posterior to the external narial aperture, and from thence symmetrically to its opposite end. This is a unique feature among crocodilians.

#### THE OPENINGS OF THE SKULL

The *supratemporal fenestrae* are of moderate size. They are distinctly rounded, and the left one is more nearly circular than the right one. The latter may have been narrowed slightly by crushing. They are separated from each other and from the orbits by moderately and subequally broad plates of bone. They are separated from the posterior border by a plate of bone twice as broad as that separating them from each other. Their edges are slightly uprolled.

The *orbits* are approximately equal in size to the supratemporal fenestrae. They have a suggestion of triangular form in their outlines, but their anterior ends are too broadly rounded to permit their description as subtriangular. They are widely separated from each other but are rather close to the external borders.

The *lateral temporal fenestrae* are not distinctive in character.

The *external narial aperture* possesses several characters worthy of notice. Its breadth is greater than its length. It is separated from the anterior edges of the premaxillaries by plates of these bones whose vertical diameters are greater than

their fore and aft. The anterior rim is somewhat elevated except at the mid-line. There is a projection of bone extending into the aperture from the posterior border. The composition of this projection is not clear, but it appears to be premaxillaries at the surface, and perhaps nasals at a deeper level, or it may be a reappearance of the nasals at the surface anterior to their portions that are covered by the premaxillaries.

The *premaxillary foramen* has imperfectly preserved borders. It is evident, however, that it was small in size and was very narrow.

The *palatine fenestrae* have incomplete borders. They are broadly rounded anteriorly and were evidently fairly broad for their length. Their anterior ends overlap three maxillary teeth on each side.

The *internal narial aperture* has no borders preserved. Its exact position cannot be made out, but it was apparently about half-way between the level of the posterior ends of the palatine fenestrae and the posterior end of the pterygoids. Whether it was surrounded entirely by pterygoids, by palatines or by a combination of both cannot be determined.

#### THE BONES OF THE SKULL

The *premaxillaries* are distinctive. The whole premaxillary region is short. The premaxillary expansion, anterior to the notch, has a length about equal to three-fifths of its breadth. The anterior plates, in front of the narial aperture, are much higher vertically than they are long antero-posteriorly. The notch is deep, and the expansion anterior to it is pronounced, so

a considerable portion of the external border of each premaxillary faces directly backward. The two premaxillaries have contact with each other for the space of about one inch on the surface of the snout, immediately posterior to the narial aperture and anterior to the tips of the nasals as they are exposed on the snout.

The two posterior processes are broad

anteriorly; they narrow rapidly to terminal points at the level of the fourth maxillary teeth. The contact of each premaxillary with the corresponding nasal is short.

On the palate are deep pits for lodgment of the first and second mandibular teeth. The position of the premaxillo-maxillary suture appears to be directly transverse across the notch.

Each premaxillary contains five teeth; the first and second and the second and third are spaced moderately far from each other; the third is widely spaced from the fourth, and the fourth is close to the fifth. The alveolus of the fifth is far up the slope toward the notch. The second, third, fourth and fifth teeth of the right side are well preserved. The first is broken off in the alveolus. The fourth is the largest, the third is second in size, the first and second are smaller than the third and are approximately equal to each other in size, and the fifth is the smallest of the five. These teeth are long and slender and are subcircular in outline. They are finely striated, exhibit faint anterior and posterior keels and are only slightly curved.

The *maxillaries* have only moderately long contacts with the premaxillaries and with the nasals, the contacts with the lacrymals being somewhat longer than usual. They include the lateral pits of the snout, noted above, and much of the grooving of the skull.

On the palate the characters of the maxillaries are somewhat obscured by crushing. The form of the sutures with the premaxillaries has been noted above. The sutures with the palatines are not clear, but near the mid-line, at least, they form a straight transverse line.

Each maxillary apparently lodged seventeen teeth. Most of these are partially preserved on the right side, and the bases are preserved on the left. The alveoli of the first maxillary teeth are small, those of the second teeth slightly larger, those of the third are still larger, while those of the fourth and fifth, approximately equal to each other, as in *Diplocynodon*, are the largest in the series. Even these are actually not very large. Behind the fifth the

alveoli are of moderate size, as in the third, to and including the thirteenth; these alveoli are spaced approximately equally from each other. Behind the thirteenth the teeth apparently rested in a common alveolar groove rather than in separate alveoli.

The teeth themselves are moderately long and slender, with slight anterior and posterior keels and with moderately developed striations, back to the thirteenth; behind this the crowns were apparently short.

The *nasal bones* appear to be short. Their anterior ends are well preserved, but their posterior ends are crushed and obscure. At their tips they appear to enter the narial aperture, slightly below its posterior rim. Behind this aperture they do not appear on the surface for a space of five or six millimeters. From their anterior tip on the surface they broaden rapidly to the posterior ends of their contacts with the premaxillaries, at the level of the fourth maxillary teeth. Behind this they broaden rapidly to the level of the tenth or eleventh maxillary teeth. Posterior to this maximum expansion the nasals narrow suddenly, and a pair of narrow processes make contact with the frontal. The nasals are crushed at this point, but the preserved anterior tip of the frontal indicates that the nasals could not have extended very far back.

The *lacrymals* are long and are rather broad at the base, occupying a considerable portion of the anterior border of each orbit. The contacts with the nasals are long, but those with the prefrontals are short. The left lacrymal is well preserved while the right one is badly crushed. The anterior end of the left lacrymal is at the level of the tenth maxillary teeth.

The *prefrontals* are considerably smaller than the lacrymals. Each prefrontal occupies only a small part of the orbit border. They appear to have long contacts with the lacrymals, short ones with the nasals, and moderately long ones with the frontal.

The *frontal bone* is characteristic. It is broad, separating the orbits widely from each other. This interorbital plate is flat, with little or no uprolling, and this appears

to be original, and not a character induced by crushing. The bone does not occupy much of the orbital border. The anterior wedge of the frontal is broad at its base, and it extends forward with straight, rapidly converging sides. The central portion of this anterior wedge, near its base, is elevated into a small, but distinct, ridge. The contact with each postorbital is short. That with the parietal is almost directly transverse; it is distinctly anterior to the supratemporal fenestrae, the frontal taking no part in forming the boundaries of this opening.

The *parietal* is distinctive in form. Its anterior transverse plate separates the frontal from participation in the borders of the supratemporal fenestrae. The sutures with the postorbitals are short and are continuous with those separating the frontal and postorbitals. The interfenestral plate is moderately broad, with slightly uprolled edges. The posterior part of the bone is unusually large, the fenestrae being far from the posterior border.

The boundaries of the *supraoccipital* are too obscure to admit description.

The region of the *basioccipital*, *basisphenoid*, *exoccipitals*, *palatines*, *pterygoids* and *ectopterygoids* is too poorly preserved to warrant description, except to note that the boundaries of the foramen magnum include the usual crocodilian proportions of basioccipital and exoccipitals, and that the palatines extend forward to about the level of the tenth maxillary teeth.

The *quadrates* are not unusual except that the glenoid surfaces are proportionally smaller than usual.

The *quadratojugals* are rather short and broad, overlapping the quadrates to a slightly greater extent than usual. This may be emphasized by crushing.

The *jugals* conform to the usual crocodilian pattern.

MEASUREMENTS

Length of skull, tip of snout to supra-occipital border.....	387 mm.
Length of skull, tip of snout to occipital condyle.....	400
Length of snout.....	258
Length of external narial aperture....	30
Length of premaxillary expansion....	61
Length of right facial pit.....	60
Length of left facial pit.....	62 est.
Length of right orbit.....	42
Length of left orbit.....	43
Length of right supratemporal fenestra.	45
Length of left supratemporal fenestra..	44
Length from left supratemporal fenestra to posterior border of cranial table..	30
Breadth across premaxillaries.....	89
Breadth across external narial aperture.	35
Breadth across premaxillary-maxillary notch.....	58
Breadth across 5th maxillary teeth....	112
Breadth across 7th to 8th maxillary teeth.....	110
Breadth of snout at base.....	152
Breadth of interorbital plate.....	45
Breadth of right orbit.....	45
Breadth of left orbit.....	47
Breadth of right supratemporal fenestra.....	35
Breadth of left supratemporal fenestra..	39
Breadth of interfenestral plate.....	16
Breadth across postorbitals.....	110
Breadth across squamosals.....	145
Breadth across quadrates.....	220
Breadth across quadratojugals.....	237

AMPHICOTYLUS COPE

The presence of the lateral facial pits, noted above, with the very great constriction at the premaxillary-maxillary notch, may be considered as establishing the genus *Amphicotylus*.

*Amphicotylus lucasii* Cope

The characters of the genus, with the moderate size of the supratemporal fenestrae and the extent of their separation from each other, from the external and from the posterior borders of the cranial table, define the species.





