59.81.4:14.71,5

Article XVI.—SKULL CHARACTERS OF *ALLIGATOR SINENSE* FAUVEL[1, 2]

By Charles C. Mook

When the skull characters of the recent species of Crocodilia were described by the writer in 1921[3] no skull of *Alligator sinense* was available for study, in consequence of which this species was dismissed with a brief summary of characters taken from Boulenger's 'Catalogue of the Recent Reptilia in the British Museum.'

In 1922 the American Museum received a number of skins, skulls, and skeletons of the Chinese alligator, collected by the Third Asiatic Expedition. This material sheds light upon previously unknown characters of this species and forms the basis of the present communication. This description is based particularly upon one skull (A. M. N. H. No. 23898) and many of the characters have been verified upon three other skulls (A. M. N. H. Nos. 23899, 23900, 23901).

General Form

The skull is short and broad. It is relatively shorter than that of *A. mississippiensis* and resembles in this respect the Miocene *A. thomsoni*. The height is greater than in the Florida species.

The snout is moderately broad at its anterior end and expands rapidly to the level of the fourth maxillary teeth, then contracts slightly to the level of the sixth maxillary teeth, back of which it expands again. The length of the snout is one and one-sixth times as long as its breadth at the base.

The interorbital plate is situated at a distinctly higher level than the snout and descends abruptly at its anterior end. A pair of prominent ridges extend forward and outward along the anterior borders of the orbits to points slightly in front of the semi-detached supraorbitals and then extend directly forward over the base of the snout. In this character the skull resembles those of the various species of *Jacare* and that of *A. thomsoni* but differs from that of *A. mississippiensis*. The interorbital plate is relatively narrow and is uprolled at its edges. It is also slightly convex in antero-posterior profile.

The cranial table is short antero-posteriorly but rather broad laterally. Its lateral borders converge in the anterior direction at such

[1]Contributions to the Osteology, Affinities and Distribution of the Crocodilia, No. 12.
[2]Publications of the Asiatic Expeditions of The American Museum of Natural History. Publication No. 14.
[3]Bull. Amer. Mus. Nat. Hist., XLIV, Art. 13, pp. 123–268.

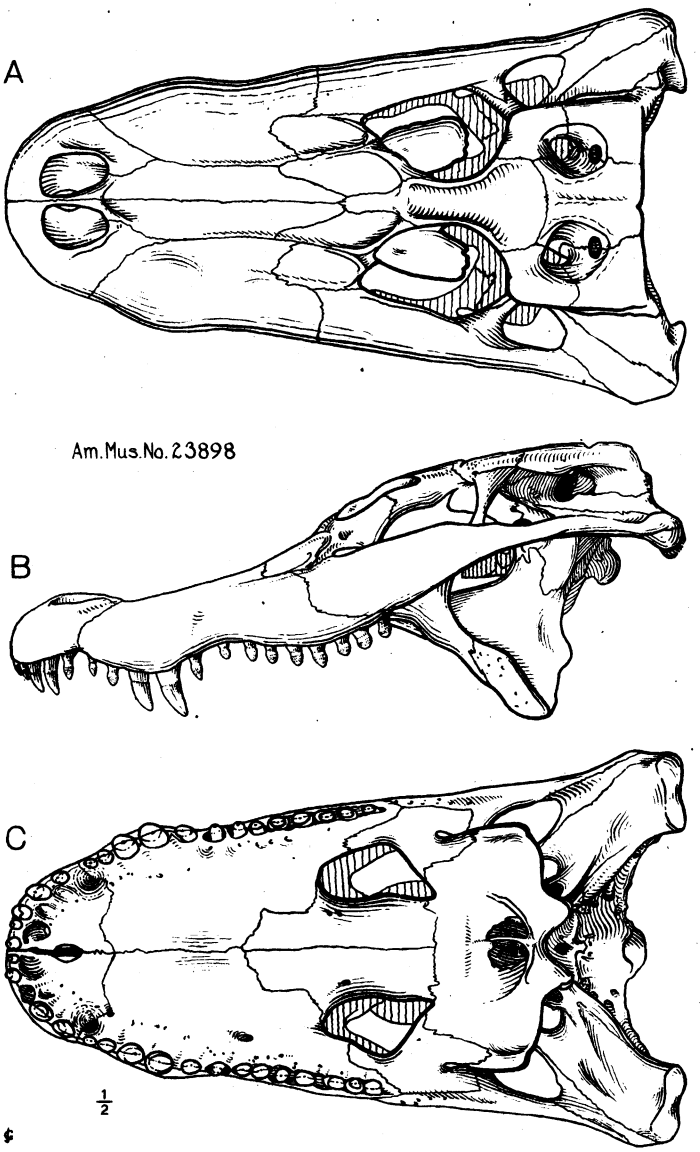

Fig. 1. *Alligator sinense* Fauvel.

Skull (Amer. Mus. No. 23898). One-half natural size. A, superior view; B, lateral view, left side; C, inferior view.

an angle that, if produced forward, they would meet slightly beyond the tip of the snout. The plate between the supratemporal fenestræ is of moderate breadth and is distinctly uprolled at its edges. The lateral borders of the skull are more distinctly wavy than in the southern alligator.

The Cavities of the Skull

Supratemporal Fenestræ.—The supratemporal fenestræ are large at the surface of the cranial table but diminish rapidly in size in depth. Viewed from above, less than half of the area of each fenestra penetrates to the base of the brain-case. The larger part, chiefly posterior, is very shallow and is floored by portions of the parietal and squamosal bones. The small internal cavities which extend from the supratemporal fenestræ to the aural passages are in most crocodilians nearly or quite invisible when the skull is viewed from above; in this species they are entirely visible from above. The edges of the fenestræ are distinctly uprolled, especially on the postero-internal borders. In this character they differ from those of *A. mississippiensis* and *A. thomsoni*. In shape the fenestræ are irregular and not smoothly rounded. Their outlines end posteriorly in rather blunt points and anteriorly, or rather antero-externally, in sharp points. There is a certain amount of variation among the various individuals in regard to this character. The space between the fenestræ is relatively broad.

Infratemporal Fenestræ.—These fenestræ are of moderate size. Their chief point of interest is that their triangular outline is more rounded than in most crocodilians.

Orbits.—The orbits are large. They are irregular in outline; their posterior and postero-internal borders are broadly rounded; their antero-internal borders are nearly straight, as are their external borders. They end anteriorly in rather sharp points, which are nearer their external than their internal boundaries. The length of the orbits is considerably greater than their breadth. The interorbital plate is of moderate breadth; its borders are sharply uprolled. In all of the specimens the anterior ends of the orbits lie over several maxillary teeth. This character indicates immaturity in all of them.

External Nares.—The external narial aperture is broader than it is long. The bony bar which divides it into right and left elements at the surface is moderately stout. It is composed chiefly of the anterior processes of the nasals, but partly of processes of the premaxillaries. In outline the cavity is a somewhat rounded quadrilateral, whose anterior

border is slightly curved and whose lateral borders converge slightly in the posterior direction. The posterior border is very irregular. The lateral borders are distinctly elevated above the general level of the anterior end of the snout. The median bar is also elevated and the posterior border slightly so.

PREMAXILLARY FORAMEN.—This foramen is very small; on the median line it occupies less than one-third of the distance between the tip of the snout and the premaxillo-maxillary suture. It is acutely pointed at both anterior and posterior ends and its lateral borders are simple curves.

PALATINE FENESTRÆ.—The palatine fenestræ are small and are very irregular in shape. In this the species differs from *A. mississippiensis*. The internal borders are nearly straight parallel lines throughout the posterior two-thirds of their lengths; the anterior thirds diverge rapidly. The external borders are composed of two components of about equal length, which make pronounced angles with each other slightly posterior to the level of the last maxillary teeth. About one-fifth of each external border consists of maxillary bone, the ectopterygoid portion comprising nearly four-fifths, with a minute portion at the posterior end consisting of pterygoid; the entire internal border is composed of palatine. The maximum breadth is considerable in proportion to the maximum length. The anterior end is broadly rounded but the posterior end is acute. The anterior end is situated at the level of the space between the tenth and eleventh maxillary teeth.

INTERNAL NARIAL APERTURE.—This aperture is completely divided by a median vertical plate. On its anterior border at the median line is situated a slight but distinct elevation. Posterior to the aperture is a prominent vertical ridge, approximately semicircular in outline, which completely separates the depression, of which the aperture is the center, from the postero-external elevated flanges of the pterygoid bone.

THE BONES OF THE SKULL

PREMAXILLARIES.—The premaxillaries are considerably broader in proportion to their length on their superior surfaces than in the Florida alligator. Their posterior processes are of moderate length, extending backward from the level of the second to that of the fourth maxillary teeth. A small process of both premaxillaries extends backward from the anterior end of the narial aperture to meet the anterior process of the nasals, as in *A. mississippiensis*. The edges of the premaxillaries forming the lateral borders of the aperture are turned sharply upward however,

differing in this character from those of the Florida species. The posterior end of the narial aperture is situated farther back than in the latter species with respect to the level of the premaxillo-maxillary sutures at the lateral borders of the skull.

On the palate the proportion of length to breadth is the same as in the Florida alligator. There are two deep pits on each side, one posterior to the space between the first and second teeth, the other at the premaxillo-maxillary suture. The first of these lodged the first mandibular tooth, the second, the fourth mandibular tooth. On the median line the distance from the anterior end of the premaxillary foramen to the anterior border of the skull is equal to the distance from the posterior end of the foramen to the premaxillo-maxillary suture.

The suture between the premaxillaries and the maxillaries differs from that of *A. mississippiensis*. It extends inward and backward from the external border, across the pit for the fourth mandibular tooth, to a point half-way between the external border and the median line and at the level of the space between the first and second maxillary teeth; from this point it extends inward and slightly forward half-way to the median line, then turns inward and backward and meets the median line at the level of the spaces between the first and second maxillary teeth. From the median line it extends in a symmetrical direction to the opposite border of the skull. The entire suture is therefore wavy in outline.

Each premaxillary contains five teeth, of which the fourth are the largest, the third second in size, the fifth third in size and the first and second very small. The teeth are evenly spaced.

MAXILLARIES.—These bones are short and broad. They are especially short along the sutures with the nasals; these sutures are less than one-fifth as long as the skull, in contrast to over one-fourth in a Florida alligator of slightly larger size. The sutures with the prefrontals are exceedingly short, being about one-fourth the length of the maxillo-lacrymal sutures. In the Florida alligator they are over one-half the length of the maxillo-lacrymal sutures. The sutures with the jugals are long, especially in their transverse portions. On the palate the maxillaries are especially short and broad. Comparison with a small skull of *Alligator mississippiensis* may be expressed as follows.

	A. sinense A. M. N. H. No. 23898	*A. mississippiensis* A. M. N. H. No. 12572
Length maxillaries, median line / Length skull	.215	.295
Length maxillaries, median line / Maximum length, maxillaries	.444	.500
Length maxillaries, median line / Maximum breadth, maxillaries	.451	.720
Length maxillaries, median line / Length palatines, median line	.682	.968

Each maxillary contains thirteen teeth, of which the fourth is the largest and the third is second in size. The first and second maxillary teeth are moderately stout and moderately sharp; the crowns of the posterior teeth are all small. The first six teeth are spaced moderately and evenly; the last seven are close together. In the largest skull studied (A. M. N. H. No. 23898) the first six maxillary teeth have separate alveoli and the last seven are lodged in a common alveolar groove. In smaller skulls, however, not at present thoroughly cleaned, the posterior teeth, or at any rate, some of the posterior teeth, appear to have separate alveoli.

NASALS.—These bones are very short; on the median line they occupy considerably less than one-half the length of the skull. The anterior process, extending forward into the narial aperture, is moderately broad at its base and very narrow where it joins the process of the premaxillaries, extending back from the anterior border of the narial aperture. From the posterior border of the narial aperture the nasals broaden rapidly to the posterior extremities of the premaxillaries, which is the point of their greatest breadth. From this point back they narrow gradually to the anterior ends of the naso-prefrontal sutures, back of which they narrow rapidly to their blunt posterior extremities, which are situated slightly forward from the level of the anterior ends of the orbits. The sutures with the maxillaries are relatively short; those with the prefrontals are relatively long.

PREFRONTALS.—The prefrontals are moderately long. Their anterior ends extend forward as narrow processes, wedging apart the nasals and lacrymals and to a slight extent the nasals and maxillaries. Their contacts with the lacrymals are somewhat elevated into ridges and their orbital borders are greatly elevated, to a slight extent even overhanging. Their posterior processes are short and their contacts with the frontal are moderately so.

LACRYMALS.—The lacrymal bones are relatively short and broad. Each suture with the prefrontal extends in a line which is almost parallel with the median line but which is inclined very slightly toward the median line in the anterior direction. The sutures with the maxillaries extend forward and outward irregularly from the anterior ends of the prefronto-lacrymal sutures to points near the external boundaries of the bones, then slightly outward and backward to join the straight lacrymo-jugal sutures. A small but conspicuous oblique ridge extends outward and forward from the postero-internal corner of each lacrymal to the center of the lacrymo-jugal suture, separating a small, low, smooth orbital surface from the more elevated pitted surface. The anterior extremities of the lacrymals are situated farther forward than those of the prefrontals. In this character the species differs from *A. mississippiensis*.

FRONTAL.—The anterior process of the frontal is smooth and is relatively short. It does not wedge apart the nasals at their posterior extremities but ends abruptly. The interorbital portion is narrow and is decidedly uprolled at the edges. The pitting is arranged in such a manner in this portion of the bone as to leave a distinct but slight median ridge. The posterior portion is relatively broad. The sutures with the postorbitals are very short; the suture with the parietal is a simple curve, the convexity being directed backward. The frontal is entirely removed from the supratemporal fenestræ, thus differing somewhat from that of the Florida alligator.

POSTORBITALS.—The postorbitals are slightly longer than broad; in *A. mississippiensis* they are considerably longer than broad. They also differ from those of the latter species in occupying a larger proportion of the external border of the cranial table.

SQUAMOSALS.—The proportion of the breadth to the length of the squamosals is greater than in the Florida alligator, and the sutures of these bones with the parietal are less symmetrically curved than in the latter species.

PARIETAL.—This bone occupies a considerable portion of the surface of the cranial table anterior to the supratemporal fenestræ as well as posterior to them. It occupies nearly a third of the posterior border of the cranial table. Its interfenestral plate is relatively broad, compared with *A. mississippiensis*. It is somewhat uprolled at its external, or fenestral, borders. A low median ridge serves to distinguish it readily from that of the American species.

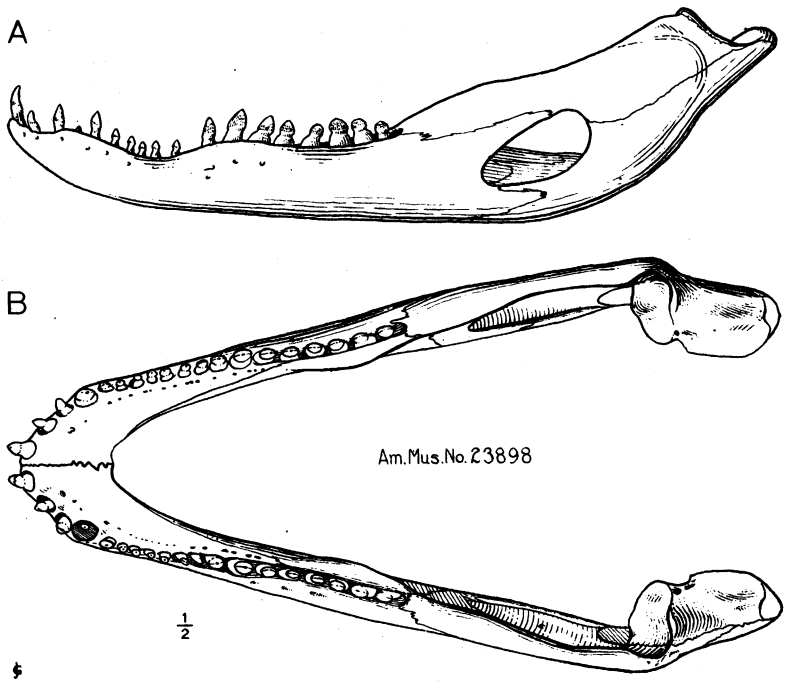

Fig. 2. *Alligator sinense* Fauvel.

Mandible (Amer. Mus. No. 23898). One-half natural size. A, lateral view, left side; B, superior view.

SUPRAOCCIPITAL.—As in *A. mississippiensis* this bone occupies no portion of the border of the cranial table. On the posterior surface of the skull it is narrow laterally and deep vertically. It extends downward to a point about four-fifths of the total distance from the foramen magnum to the cranial table, below the latter.

EXOCCIPITALS.—These bones are relatively deep in the vertical direction. They comprise small portions of the occipital condyle.

BASIOCCIPITAL.—This bone comprises most of the occipital condyle but not all of it.

BASISPHENOID.—This bone is not especially characteristic.

QUADRATES.—The quadrates are stout in proportion to their length and their articular surfaces are unusually broad.

QUADRATO-JUGALS.—These bones do not differ from those of *A. mississippiensis* in any characteristic way.

JUGALS.—The jugals are relatively larger than in the Florida species and differ from those of the latter in form. Their length is over half the

total length of the skull and they occupy a large portion of the lateral surface of the skull. Their posterior processes are slender, as in the American form, but the anterior processes are much greater than in the latter. The maximum height of each jugal in *A. mississippiensis* is considerably behind the posterior end of the maxillary, near the posterior end of the orbit; in *A. sinense* it is over the posterior process of the maxillary, near the level of the anterior end of the orbit. The suture with the maxillary differs considerably from that in the Florida alligator.

PALATINES.—The palatines of this species differ considerably from those of *A. mississippiensis* and in fact of all other crocodilians. Their sutures with the maxillaries extend inward and slightly forward from the anterior ends of the palatine fenestræ about half-way to the median line, then turn directly forward or with a gentle curve whose concavity faces outward to the level of the eighth maxillary teeth, then either directly inward (A. M. N. H. No. 23899) or inward and forward (A. M. N. H. No. 23898) to meet at the median line. The interfenestral portions are very broad and their fenestral borders are nearly parallel. Their pterygoid borders form a nearly straight line.

PTERYGOIDS.—The pterygoids are not especially distinctive. They are considerably arched and the ridge back of the internal narial aperture is unusually high. The aperture is divided, as in the Florida species.

ECTOPTERYGOIDS.—These bones are very short antero-posteriorly and are very stout.

THE MANDIBLE.—The mandible is relatively broader in proportion to its length than in the Florida alligator, the rami diverge at a relatively sharper angle, and the individual elements are all stouter. The symphysis extends back to the level of the fifth mandibular teeth, contrasting with the short symphysis reaching only slightly back of the level of the third in the American species. The splenials do not enter the symphysis but extend forward within a relatively minute distance of it; this is in contrast with the wide spaces between the anterior ends of the splenials and the symphysis in *A. mississippiensis*.

The dental borders occupy about half the length of the mandible, an unusual condition among the living crocodilians, probably approached only by *Jacare latirostris*. There are nineteen teeth in each ramus. The fourth is the largest of these and the thirteenth is second in size. The first teeth are moderately large and are widely separated from the smaller second, which are widely separated from the equal-sized third, which are moderately far from the fourth. Back of the fourth are seven small teeth close together. Back of the thirteenth the short blunt teeth are

all close together. The variation in the size and the arrangement of the teeth is quite different from that in *A. mississippiensis.*

The external mandibular foramen is relatively high in proportion to its length. Its surangular border is longer than in the American form. The internal mandibular foramen is relatively small.

Discussion

This species resembles the living Florida alligator very closely in some respects but differs from it quite markedly in others.

It has certain resemblances to the various species of *Jacare* which are absent in *A. mississippiensis.* These resemblances are offset by other more fundamental characters, however, and there is no evidence of close relationship.

The nearest approach to the structure of this species is to be seen in the Miocene *Alligator thomsoni,* recently described by the writer.[1] The species may therefore be considered more primitive than *A. mississippiensis,* though it has some specializations absent in the latter. *A. thomsoni* approaches *Allognathosuchus polyodon* from the Bridger, which in turn approaches *Allognathosuchus heterodon* of the Wasatch in a number of characters, so that we may consider the following as a logical morphological sequence: *Allognathosuchus heterodon* (Eocene); *Allognathosuchus polyodon* (Eocene); *Alligator thomsoni* (Miocene); *Alligator sinense* (Recent); *A. mississippiensis* (Recent). This does not necessarily indicate a line of descent, but it does indicate that *Alligator sinense* serves partially to bridge the wide structural gap between *A. mississippiensis* and the earlier Tertiary crocodilians. *A. mississippiensis* has been found in Pleistocene deposits. We await the discovery of *A. sinense,* or a very closely related form, in Pleistocene, or even Pliocene, deposits.

[1] Amer. Mus. Novitates, No. 73.