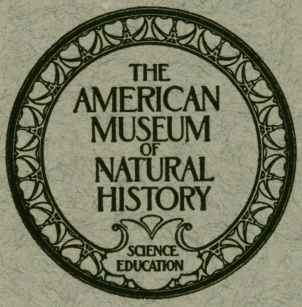
Fossil Lizards of Mongolia

By Charles W. Gilmore



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Article IV.—FOSSIL LIZARDS OF MONGOLIA[1]

By Charles W. Gilmore[2]

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INTRODUCTION

This paper presents the results of a study of the extinct lizard materials collected in Mongolia by the several Central Asiatic Expeditions of The American Museum of Natural History between the years 1923 and 1930.

Originally this collection was placed in the competent hands of the late Dr. G. K. Noble for study, but his untimely death left the task unfinished. Many of the illustrations were prepared under his direction, and these, together with a few rough notes, were turned over for my use through the kindness of the late Dr. Walter Granger.

I wish to express here my great appreciation for aid received from Dr. Granger during the earlier stages of the preparation of this manuscript. Drs. Barnum Brown and Edwin H. Colbert also gave some help during the course of my studies. The illustrations were made by Mr. John C. Germann and by Mrs. Louise Waller Germann under the supervision of Dr. Colbert.

The collection is not extensive, consisting in all of eighteen specimens, most of these being fragmentary. However, the comparative rarity of Sauria specimens, coupled with the remoteness of the region from which the specimens were obtained, makes the collection of more than ordinary interest.

Representatives of six families, Agamidae, Chamaeleontidae, Arretosauridae, Amphisbaenidae, Varanidae and Anguidae have been recognized. These comprise nine genera, of which seven genera and eight species are described as new. Two pertain to North American genera, and one species cannot be adequately distinguished

[1] Publications of the Asiatic Expeditions of The American Museum of Natural History, Contribution No. 147. [Contribution No. 146 in this subseries was inadvertently not numbered. It is "A Revision of the Mongolian Titanotheres" by Walter Granger and William K. Gregory, Bull. Amer. Mus. Nat. Hist., LXXX, pp. 349–389, February 4, 1943.—Editor.]

[2] Curator of Vertebrate Palaeontology, United States National Museum.

from *Glyptosaurus nodosus* Marsh from the Bridger, Eocene. The presence of a member of the Amphisbaenidae marks the first occurrence of this family in the fossil state outside of North America. The finding of members of the Agamidae and Anguidae in the Upper Cretaceous records the most ancient occurrence of these families. Fragmentary remains too meager for characterization quite certainly show the presence of other undescribed forms.

Insofar as checks can be made these Mongolian Sauria are quite in accord with their geological distribution in North America, a condition previously noted in the Dinosauria and Chelonia from this region. The geological distribution of the Sauria in Mongolia, as known at the present time, is graphically shown in the accompanying table.

OCCURRENCE OF FOSSIL LIZARDS IN THE CRETACEOUS AND CENOZOIC FORMATIONS IN MONGOLIA

Geologic Age	Formation	Approximate Thickness in Feet	Faunal List
Miocene	Tung Gur	500+	Sauria (not determinable)
	Loh	100+	
Oligocene	Hsanda Gol	300 ±	*Crythiosaurus mongoliensis*
	Jirilgo	200 ±	
	Houldjin	40	
	Baron Sog	30	
	Elegen	160+	
	Ardyn Obo	500	Sauria (not determinable)
	Ulan Gochu	200 ±	Serpentes *Arretosaurus ornatus*
Eocene	Shara Murun	200 ±	Serpentes *Glyptosaurus* near *nodosus* Marsh
	Tukhum	150+	
	Ulan Shireh	150+	*Tinosaurus asiaticus*
	Irdin Manha	100+	
	Kholobolchi	250+	
	Arshanto	100 ±	
Paleocene	Gashato	300	
Cretaceous	Djadochta	500	*Macrocephalosaurus ferrugenous* *Mimeosaurus crassus* *Conicodontosaurus djadochtaensis* *Telmasaurus grangeri* *Isodontosaurus gracilis*

DESCRIPTION OF GENERA AND SPECIES

AGAMIDAE

In this collection the family Agamidae is represented by at least two genera, both from the Djadochta, Upper Cretaceous, the most ancient occurrence of this family yet recorded.

The living Agamidae inhabit Africa, Asia, Australia and Polynesia, but none occur in the Americas. Fragmentary specimens from both North America and Mongolia, provisionally referred to the Chamaeleontidae, may eventually be found to belong to the present family.

MACROCEPHALOSAURUS, NEW GENUS

TYPE.—*Macrocephalosaurus ferrugenous*, new species.

DIAGNOSIS.—Dentition acrodont, heterodont, with much enlarged anterior maxillary teeth, having flattened crowns; postfrontal absent, pineal foramen entirely within the parietal; jugal with a strong posteriorly directed process. Orbits large, ovate.

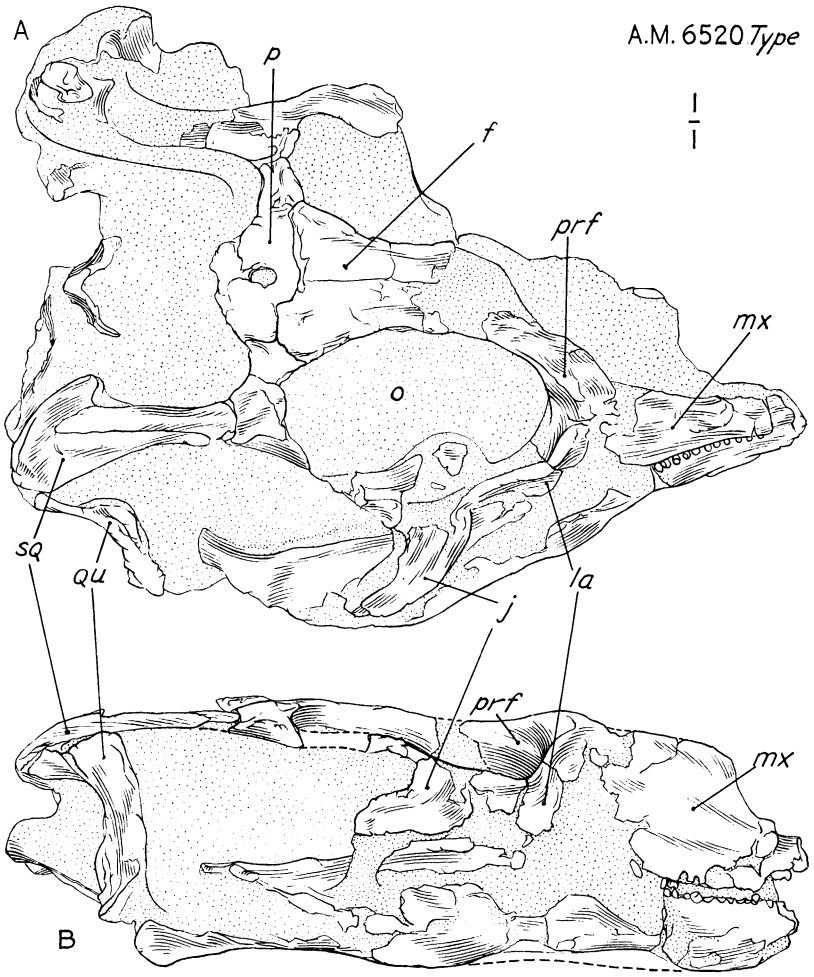

Fig. 1. Skull of *Macrocephalosaurus ferrugenous*. Type, A.M.N.H. No. 6520. A, top; B, lateral view; *f*, frontal; *j*, jugal; *la*, lacrimal; *mx*, maxillary; *o*, orbit; *p*, parietal; *prf*, prefrontal; *qu*, quadrate; *sq*, squamosal. Natural size.

Macrocephalosaurus ferrugenous, new species

TYPE.—A.M.N.H. No. 6520, consists of an incomplete skull and part of the right ramus. Collected in 1923.

LOCALITY.—Shabarakh Usu, Inner Mongolia.

HORIZON.—Djadochta, Upper Cretaceous.

DIAGNOSIS.—Sole known species of the genus. See generic diagnosis above.

The type skull lacks the premaxillary and most of the bones of the left side, and practically all of the occiput and palate. Much of the right ramus is present, but it is so distorted by crushing and otherwise mutilated that none of its detailed structure can now be determined. Likewise the closure of many of the skull sutures makes the detailed cranial structure difficult of interpretation.

Overall, the skull of *Macrocephalosaurus* has an estimated length of about 115 mm. and a width across the quadrates of about 64 mm. The orbits are of large size, subovate in outline, with the longest diameter anteroposterior, as clearly shown in Fig. 1.

The parietal, of which only the anterior portion is preserved, is perforated by the

pineal foramen, which is wholly enclosed within that bone. As in most lizards the parietals are fused. The frontals have smooth upper surfaces that are slightly concave transversely. They contribute extensively to the upper borders of the orbits. Their least diameter between the orbits is 11.5 mm. The nasals and premaxillae are entirely missing. There is a single element uniting the jugal with the parietal and frontal at their junction. Whether it is the postfrontal or postorbital or a fusion of the two, there is no way of determining, but as studies of recent Sauria have shown that the postfrontal is absent in most Agamidae, it will here be designated postorbital. Its inner end straddles the parietofrontal suture, but the forward process of this bone that lies along the side of the frontal is very short. It unites inferiorly with the jugal by a nearly horizontal suture. Its long, posteriorly directed process appears to lap along the inner side of the squamosal, thus forming the strong supratemporal arch. The jugal does not appear to be in contact with the squamosal. The squamosal is relatively narrow. The outstanding peculiarity of the jugal is the presence of a strongly developed process that curves downward and backward, terminating in a bluntly rounded end. In development this process is somewhat similar to that in *Polyglyphanodon*. The right quadrate, which is nearly complete, has a greatest length of 23 mm. Its external anterior border is produced outward so as to embrace a longitudinal concavity or conch on the anterior longitudinal face of the bone. The upper end of the bone is produced decidedly backward.

The right lacrimal and prefrontal bones are present, but their limits cannot be determined. Much of the right maxillary is present, but its preservation is so poor that it contributes little to our knowledge of the skull. Its forward end is excavated by the posterior border of the external nares, as shown in Fig. 1B.

The incomplete dentition illustrated in Fig. 2 depicts the relationship of the upper and lower teeth just as they are preserved in the jaws. Most of them appear to be old teeth that have been much worn. This statement is based on the fact that a long replacement tooth in the maxillary near the center of the series has an unworn crown that is bluntly chisel-shaped, with a steep internal bevel. Most of the other teeth, both above and below, have flattened or gently rounded triturating surfaces showing evidence of much wear. Viewed laterally the large tooth (see Fig. 2) gives the impression that it has lost its crown, but a study of the crown surface, in conjunction with the slightly smaller tooth which precedes it, leads me to the conclusion that it never was a long pointed tooth. It seems more probable that its crown was more or less flattened, except for low cusps, which in this specimen have been reduced in size by wear. All the teeth are fused with the jaws, and this feature, coupled with the heterodont nature of the series, as shown by the development of a large canine-like tooth in the anterior part of the maxillary, clearly indicates the affinities of this specimen to lie within the Ascalabota division of the Sauria.

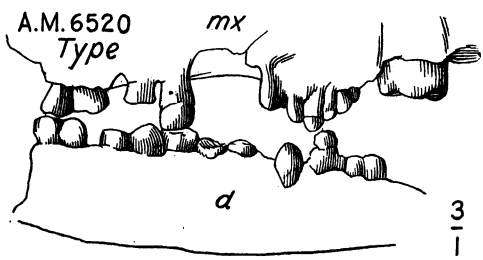

Fig. 2. Upper and lower dentition of *Macrocephalosaurus ferrugenous*. Type, A.M.N.H. No. 6520. Lateral view, left side; *d*, dentary; *mx*, maxillary. Three times natural size.

CONICODONTOSAURUS, NEW GENUS

TYPE.—*Conicodontosaurus djadochtaensis*, new species.

DIAGNOSIS.—Dentition acrodont; teeth subconical, stout, closely spaced with bluntly pointed apices, inner sides swollen, bases securely

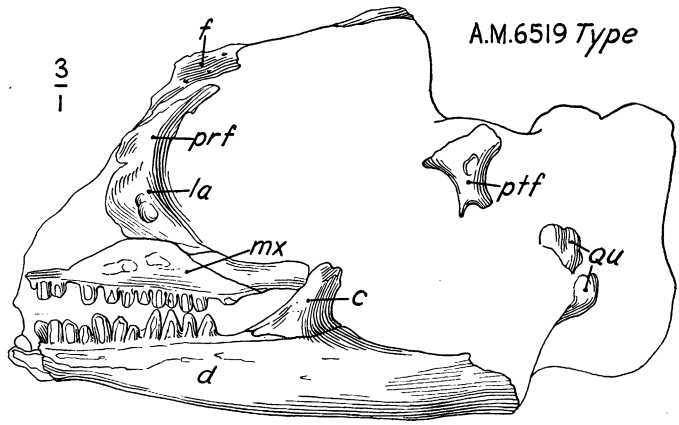

Fig. 3. Skull and lower jaws of *Conicodontosaurus djadochtaensis*. Type, A.M.N.H. No. 6519. Viewed from the left side; *c*, coronoid; *d*, dentary; *f*, frontal; *la*, lacrimal; *mx*, maxillary; *qu*, quadrate; *prf*, prefrontal; *ptf*, postfrontal. Three times natural size.

ankylosed to jaw bones; postfrontal and postorbital distinct, latter contributing to border of the orbit; coronoid high and without anterior process on outside of ramus.

Conicodontosaurus djadochtaensis, new species

TYPE.—A.M.N.H. No. 6519, consists of a fragmentary skull, parts of both lower jaws and teeth. Collected in 1923.

LOCALITY.—Shabarakh Usu, Inner Mongolia.

HORIZON.—Djadochta, Upper Cretaceous.

DIAGNOSIS.—Sole known species of the genus. See generic diagnosis above.

The type specimen consists of fragmental parts of the skull, considerable portions of both lower jaws and teeth. The skull parts and jaws have been retained in the matrix in approximately their natural relationships as shown in Figs. 3 and 4.

On account of the very fragmentary condition of the skull it is the dentition upon which greatest reliance has been placed for characters to distinguish this genus and species. The teeth are acrodont, being firmly ankylosed with the jaw bones.

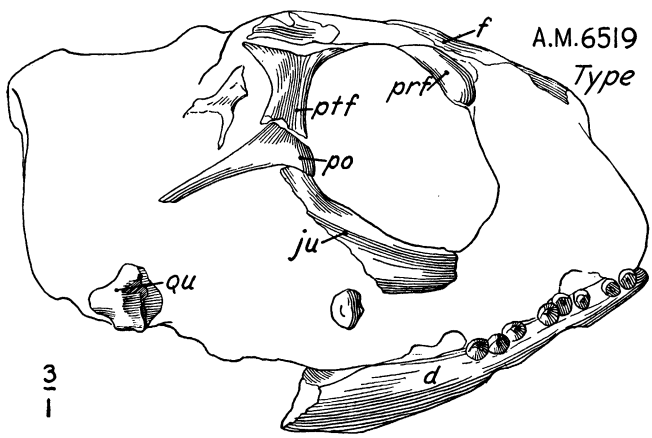

Fig. 4. Skull and lower jaws of *Conicodontosaurus djadochtaensis*. Type, A.M.N.H. No. 6519. Viewed from the right side; *d*, dentary; *f*, fragment of the frontal; *ju*, jugal; *po*, postorbital; *prf*, prefrontal; *ptf*, postfrontal; *qu*, fragment of the quadrate. Three times natural size.

Because the teeth in the front of the skull are all missing, it cannot be determined whether incisors and canines were present, as in *Macrocephalosaurus* and some of the living Agamids. In all there are twenty-eight teeth present: eleven in the left maxillary, nine in the left dentary and eight in the right dentary. In the manner of attachment they are in close agreement with those of *Tinosaurus asiaticus* but less compressed transversely, and none show evidence of accessory cusps or denticles. The teeth are stout, closely spaced and with obtusely pointed apices. As shown in Fig. 3, the teeth are hollow. Seven teeth occupy a space of 5 mm.

The fragmentary skull strongly suggests it to have been a compressed rather than a depressed cranium. On the right side (see Fig. 4) the few skull elements preserved show clearly that the postorbital and postfrontal were present as distinct elements. In most Agamidae the postfrontal is absent. Other skull parts are present, on one side or the other as shown in the illustrations, but since none are complete as to form, extent or true relationships they add but little to our knowledge of the skull structure.

The left ramus is best preserved, but it lacks portions from both ends, and as all the sutures are coalesced except the coronoid, its detailed structure cannot be determined. The coronoid rises prominently above the top of the jaw with a decided backward slant, its upper extremity terminating in a bluntly pointed end. It appears to contribute further evidence of the agamid affinities by the fact that there is no anterior process running forward on the outside of the ramus.

This genus and species are provisionally referred to the Agamidae, chiefly on the basis of the acrodont dentition.

CHAMAELEONTIDAE

The new genus and species *Mimeosaurus crassus* are provisionally referred to the present family.

Previous practice is being followed in continuing the genus *Tinosaurus* in the family Chamaeleontidae. As pointed out in an earlier paper (Gilmore, 1928, p. 30), this assignment is provisional, as present evidence would apply equally well to placing it in the Agamidae. The fragmentary specimen about to be described contributes nothing new concerning the systematic position of *Tinosaurus*.

TINOSAURUS MARSH

TYPE.—*Tinosaurus stenodon* Marsh.

DIAGNOSIS.—"Teeth typically of small size, acrodont; short, laterally compressed, pointed apices, tricuspid posteriorly, denticles reducing anteriorly; anterior teeth with or without lateral cusps; vertical grooves between teeth on external side of ramus caused by wear of opposing upper teeth. Teeth reducing in size from back to front" (Gilmore, 1928, p. 30).

Tinosaurus asiaticus, new species

TYPE.—A.M.N.H. No. 6717, consists of the median portion of a right ramus, bearing four posterior teeth. Collected in 1928.

LOCALITY.—Chimney Butte Quarry, North Mesa, Shara Murun region, Inner Mongolia.

HORIZON.—Ulan Shireh formation, Eocene.

DIAGNOSIS.—Distinguished by the close spacing of the teeth, blunt crowns and comparatively well-defined longitudinal grooves that set off the denticles from the large median cusp.

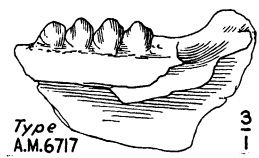

Fig. 5. Median portion of right dentary of *Tinosaurus asiaticus*. Type, A.M.N.H. No. 6717. Internal view. Three times natural size.

The type jaw is fragmentary and displays little of its structural features, but the teeth show characters that at once place it in the genus *Tinosaurus* as now known. These teeth are acrodont, short, compressed transversely, tricuspid, with the large median cusp bluntly pointed. The teeth are closely spaced, and four occupy a longitudinal space of 5 mm. The groove for Meckel's cartilage is unusually large.

Tinosaurus asiaticus may be distinguished from *T. stenodon* Marsh and *T. pristinus* (Leidy) by the closer spacing of the teeth, blunter crowns and better defined longitudinal grooves that set off the denticles from the large median cusp. The meagerness of distinctive characters is fully realized, but when the distant geographical occurrence of the present specimen is taken into account it would appear to justify the establishment of this new species.

The occurrence of *Tinosaurus* in the Ulan Shireh, Eocene, of Inner Mongolia is in accord with its geological position in the Bridger formation of North America. It is of interest to note the presence of the turtle *Anosteira* in both of these formations.

MIMEOSAURUS, NEW GENUS

TYPE.—*Mimeosaurus crassus*, new species.

DIAGNOSIS.—Dentition acrodont; twelve teeth in maxillary, first two enlarged; upper border ornamented by a row of rounded node-like projections; maxillary subquadrangular in outline.

Mimeosaurus crassus, new species

TYPE.—A.M.N.H. No. 6655, consists of a left maxillary with dentition. Collected in 1925.

LOCALITY.—Shabarakh Usu, Inner Mongolia.

HORIZON.—Djadochta, Upper Cretaceous.

DIAGNOSIS.—Sole known species of the genus. See generic diagnosis above.

The type maxillary has a full dentition consisting of twelve transversely compressed, acrodont teeth. The teeth are closely spaced and completely fused with the maxillary bone, as in the Chamaeleontidae and in *Sphenodon*. The two anterior teeth are the largest of the series.

An outstanding peculiarity of this bone is its quadrangular outline, as contrasted with the triangular shape of most lizard maxillae. The superior process of this bone that rises to meet the prefrontal and nasals is developed near the anterior end as in *Sphenodon*, whereas in most lacertians it arises from near the center of the maxillary. The finished upper border apparently forms the lower boundary of the orbit, and it gives no indication of articulation with the jugal, which always contributes to the formation of this boundary. It is barely possible that this portion of the jugal is present here, but so fully coalesced with the underlying maxillary that their union can no longer be detected. That such might be the case is further suggested by the ornamentation along its upper border, which resembles the ornamentation on the jugal bones of *Chamaeleo roperi*.

Fig. 6. Left maxillary of *Mimeosaurus crassus*. Type, A.M.N.H. No. 6655. Lateral view. Three times natural size.

The type maxillary has a greatest length of 10.7 mm.

On account of the close resemblances of the acrodont dentition to that of *Chamaeleo* and the presence of a similar ornamentation, this inadequately known lizard is provisionally referred to the Chamaeleontidae.

ARRETOSAURIDAE, NEW FAMILY

The new family Arretosauridae is proposed for the reception of the new genus and species *Arretosaurus ornatus*. Although agamid-like in many of its characters, *Arretosaurus* displays a unique dentition that excludes it from that family. Reference is made to the typical pleurodont teeth of the upper series and the pleuroacrodont teeth of the lower jaw. On the basis of the tooth insertion the Arretosauridae would appear to occupy an intermediate position between the acrodont Agamidae on the one hand, and the pleurodont Iguanidae on the other.

ARRETOSAURUS, NEW GENUS

TYPE.—*Arretosaurus ornatus*, new species.

DIAGNOSIS.—Skull broad and ornately sculptured; orbits and supratemporal fenestra relatively small; no evidence of pineal foramen; jugal deep, without posterior process. Inferior frontal plate not surrounding olfactory lobes of the brain; an epipterygoid present. Dentition pleurodont above, pleuroacrodont below, teeth simple. Rami slender with outwardly and inwardly projecting processes on either side of the

cotylus; splenial ending in a point short of the angular; angular long and narrow, faintly visible from a lateral view; vertebrae procoelus; all cervicals have intercentra; clavicles simple, imperforate; scapula without prescapular process; coracoid with two emarginations. Manus probably has five digits. Skin, ventrally with irregularly placed, node-like projections.

Arretosaurus ornatus, new species

TYPE.—A.M.N.H. No. 6706, consists of an incomplete skull and lower jaws articulated with the anterior portion of the skeleton, including some of the pectoral girdle and one fore limb and foot, and a small patch of skin impression. Collected in 1928.

LOCALITY.—Twin Oboes, Shara Murun region, Inner Mongolia.

HORIZON.—Ulan Gochu, Upper Eocene.

DIAGNOSIS.—Sole known species of the genus. See generic diagnosis above.

The type specimen to a great extent remains in an articulated condition as shown in Figs. 7 and 9. There has been some displacement of skeletal elements, due to postmortem causes, but for the most part all the important relationships have been preserved. Where the specimen protruded from the matrix the anterior third of the skull and jaws is missing. Study of this specimen in its articulated state is rendered difficult because of the hiding of many details either by overlying bones or by the presence of matrix due to incomplete preparation.

SKULL.—In relation to the size of the vertebrae the skull is large. It is low and broad, but from the outward flare of the quadrate and jugal bones, the breadth is probably exaggerated by vertical crushing. One of the outstanding features of the skull is the ornate ornamentation of the external surfaces of its top and sides. This ornamentation consists of a series of bluntly pointed tubercles of irregular shape and size that in some places, as on the squamosal, frontal and parietal, form longitudinal rows. This sculpturing effectually hides the sutural contacts, thus making it impossible to determine the shape or extent of the individual skull elements.

The supratemporal fossa are small, ovate in outline, with the longer diameter longitudinal. The orbits are relatively small and circular in outline. There is no evidence of a pineal foramen.

The upper surface of the parietal is entirely covered with osseous tubercles except the very tips of the divergent posterior processes. The parietal at the center of the supratemporal fossae has a width of 19 mm. The divergent posterior processes of the parietal meet at the center, forming a broad V. The frontal has a least width between the orbits of 9.4 mm. Each orbital border is decorated by a longitudinal row of tubercles, the intervening space being filled with smaller node-like protuberances.

A second specimen (A.M.N.H. No. 6708) from the same locality as the type, consisting of some disarticulated skull elements, has a frontal that is entirely free from matrix, and it shows the olfactory lobes not to have been underarched, as indicated by the low, rounded, inferior ridges. This same specimen shows the frontal to be strongly lapped by the posteriorly directed process of the prefrontal, and that the ends of the postfrontal and prefrontal were separated by a space of 8 mm. above the orbit.

The squamosal in the type is heavy, with a thickened, truncate, posterior end. This transversely expanded end turns strongly inward, thus forming much of the posterior border of the supratemporal fossa. On the inner posterior end it articulates with the posterior parietal process and the tabulare and below with the quadrate. The supratemporal arcade formed by the squamosal and postorbital has its outer surface ornamented by a single longitudinal series of ridge-like projections that traverse the middle of this bar for its full length. The sutural union of the squamosal with the postorbital cannot be traced.

The tabulare is a thin, splint-like bone which is wedged in between the posterior parietal process and the squamosal, as indicated in Fig. 7.

The subtriangular jugal is deep, extending downward nearly to the alveolar border of the maxillary, but without a posterior projecting spur. Its entire external surface is sculptured by projecting nodes of various shapes and sizes but without definite pattern. The outlines of this bone cannot be certainly delimited in this

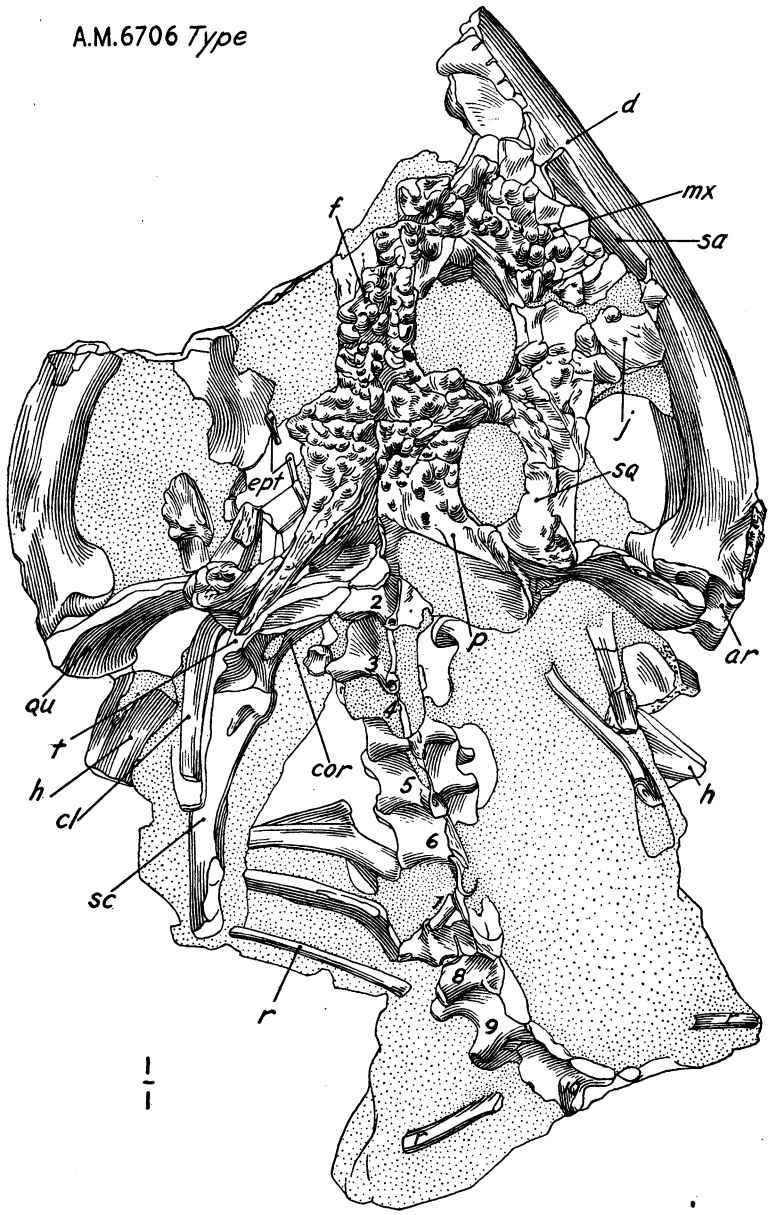

Fig. 7. Skull and anterior part of skeleton of *Arretosaurus ornatus*. Type, A.M.N.H. No. 6706. Top view as preserved articulated; *ar*, articular; *cl*, clavicle; *cor*, coracoid; *d*, dentary; *ept*, epipterygoid; *f*, frontal; *h*, humeri; *j*, jugal; *mx*, maxillary; *p*, parietal; *qu*, quadrate; *r*, ribs; *sa*, surangular; *sc*, scapula; *sq*, squamosal; *t*, tabulare; 2, 3, 4, 5, 6, 7, 8, 9 and 10 vertebrae from atlas posteriorly. Natural size.

specimen. The greater part of the right maxillary appears to be present but, like the jugal, its precise extent cannot be determined. The disarticulated specimen, A.M.N.H. No. 6708, has the posterior halves of both maxillae preserved, and these show the upper border to be longitudinally grooved for the reception of the jugal (see Fig. 8). The outer posterior surface is free from sculpturing, and the wide posterior end is angularly faceted for union with the jugal. The quadrate has a greatest length overall of about 28.5 mm. It is relatively long, wide transversely and thin anteroposteriorly.

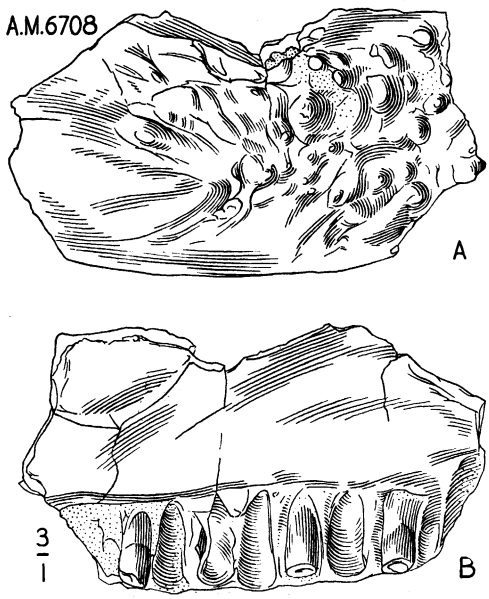

Fig. 8. Left maxillary of *Arretosaurus ornatus*. A.M.N.H. No. 6708. A, outer view; B, inner view. Three times natural size.

PALATE.—The posterior portion of the palate is well preserved and presents a clear conception of its detailed structure. The occipital condyle is hidden by the articulated atlas and cannot be studied at this time. The strongly developed basioccipital processes are joined by an obtuse transverse ridge which stands out prominently from the main mass of the bone. U-shaped notches separate these processes from those of the basipterygoid processes which are directed forward and outward in about the same plane. These processes have dilated ends that abut the pterygoid bones at midlength.

The pterygoid bones are wide apart and do not meet on the midline. Their posterior portions expand into a wide, nearly vertical plate, which may have been in contact with the quadrate. At midlength a wide process turns outward to articulate with the ectopterygoid, which it laps along the posterior side. Anterior to this process the pterygoids are much narrowed and continue forward to meet the palatines, of which only a small part of the right element remains. Viewed from the front, the ectopterygoid is triangular in outline and articulates with the outer anterior face of the ptyergoid process, with which its ventral end is subequal in length. Its anterior half tapers to a point and is applied to the inner side of the maxillary. Its union with the jugal is hidden by the articulated lower jaw. Whether or not the maxillary is excluded from participation in the boundary of the palatine vacuity cannot be determined because of the damaged condition of the palatine bones. There is no indication of teeth on either the pterygoid or palatine bones.

A very slender epipterygoid is present on the left side (see Fig. 7). Its inferior end rests on the pterygoid immediately posterior to the ectopterygoid process, as in

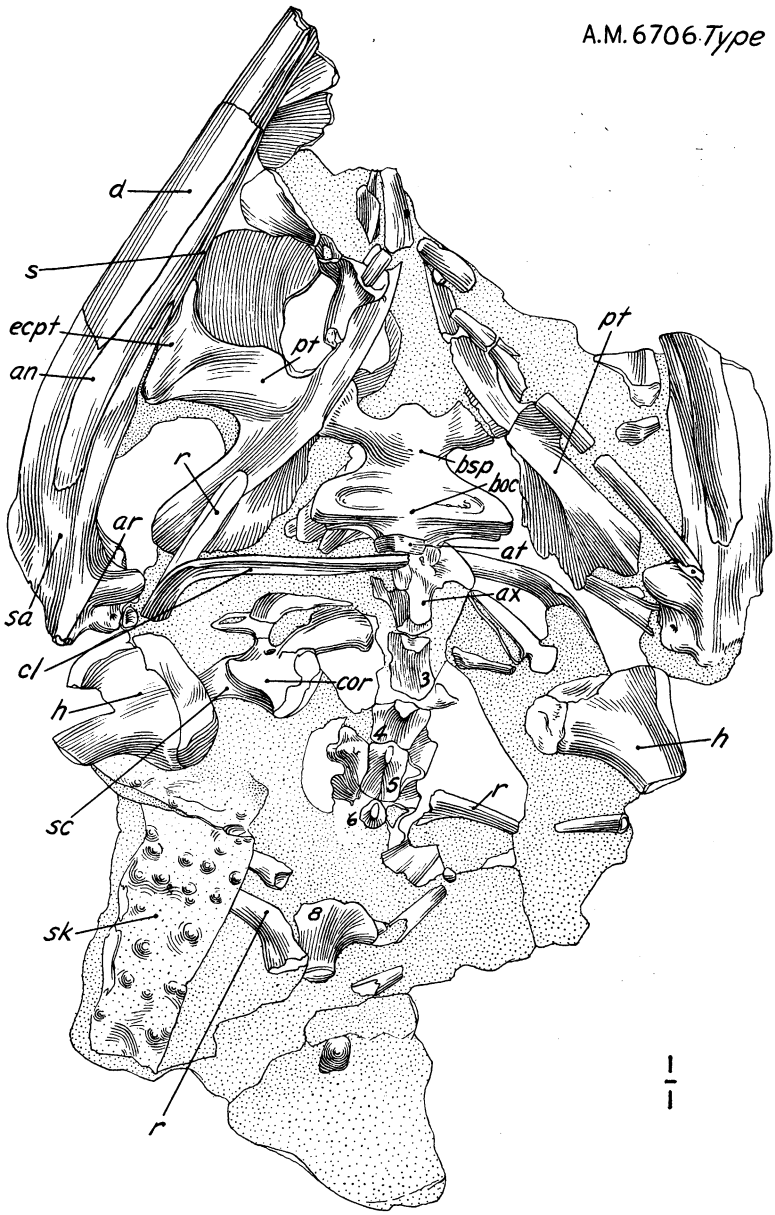

Fig. 9. Skull, jaws and anterior part of skeleton of *Arretosaurus ornatus*. Type, A.M.N.H. No. 6706. Palatal view; *an*, angular; *ar*, articular; *at*, atlas intercentrum; *ax*, axis; *boc*, basioccipital; *bsp*, basisphenoid; *cl*, clavicle; *cor*, coracoid; *d*, dentary; *ecpt*, ectopterygoid; *h*, humeri; *r*, ribs; *s*, splenial; *sa*, surangular; *sc*, scapula; *sk*, skin impression; 3, 4, 5, 6 and 8 cervical and dorsal centra. Natural size.

most lizards. Its superior end is missing, and thus its exact upper connection cannot be determined.

LOWER JAW.—The lower jaw in this specimen is represented by portions of both rami, which remain in articulation with the skull, as shown in Fig. 9. The right ramus is complete except for the loss of a short section of the symphysial end.

The ramus is composed of seven separate elements: dentary, angular, articular, splenial, coronoid, surangular and prearticular. The coalescence of some of the sutures makes it impossible fully to delimit all these bones.

The outstanding features of the lower mandible are its relative slenderness and the development on the posterior extremity of two prominent processes, in the vicinity of the cotylus, which project away from either side. Laterally on the posterior half of the ramus the lateral and ventral surfaces of the jaw meet to form a sharp-edged longitudinal ridge. Posteriorly this ridge turns sharply upward and merges into the anterior border of the wide surangular process that projects outward and upward from this part of the ramus. The posterior border of this process is thickened and rounded and terminates in contact with the articular near the posterior terminus of the ramus.

The angular is large but is scarcely visible from a lateral view, as the inward inflection of this part of the ramus causes it to lie practically on the ventral and internal sides. Posteriorly the widened, rounded end underlaps the surangular, anteriorly its regularly tapered end passes to the inside of the dentary where it terminates in a point in advance of the anterior end of the splenial. It has an extreme length of 53.5 mm.

The surangular forms most of the ventral and lateral sides of the ramus posterior to the angular, with the exception of a very small portion of the posterior extremity formed by the articular which it underlaps, as shown in Fig. 9. On the inner side the surangular develops a flattened obtuse process that extends inward, slightly upward and forward. This process is smaller than the outer one on the opposite side. From tip to tip of these two processes the surangular has a diagonal width of 22 mm. The union of this bone with the dentary cannot be clearly determined. A nearly horizontal suture, starting at the cotylus and continuing forward to the coronoid region, marks the union of the surangular with the prearticular.

The articular is wedged between the surangular and prearticular; the cotylus for the quadrate is bifossate. Its posterior end forms the posterior extremity of the jaw

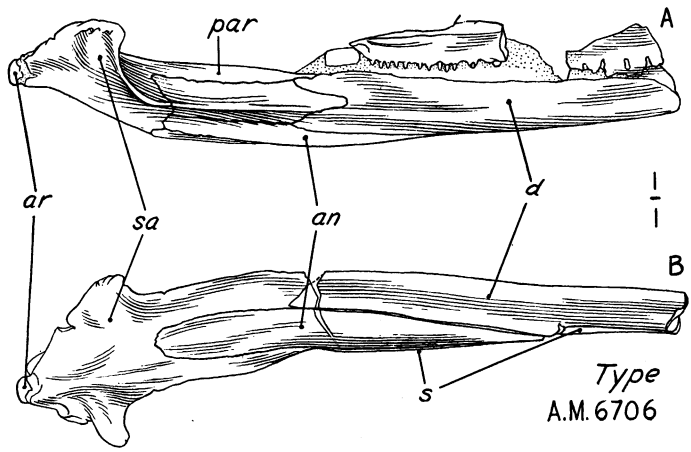

Fig. 10. Right ramus of *Arretosaurus ornatus*. Type, A.M.N.H. No. 6706. A, lateral view; B, ventral view; *an*, angular; *ar*, articular; *d*, dentary; *par*, prearticular; *s*, splenial; *sa*, surangular. Natural size.

and is slightly visible from a ventral view (see Fig. 9).

The coronoid is almost completely hidden by the matrix that holds the jaw in position with the skull. On the left side a posteriorly directed process from this bone meets the prearticular. The prearticular rests upon the top of the surangular, turning upward at the posterior end to buttress the front wall of the articular. Its anterior termination is obscure.

The dentary is relatively slender and tapering anteriorly. The anterior symphysial end is missing, and the dental border is overlapped by the maxillary of the overlying skull.

The splenial is the usual thin bone that is applied to the inner side and covers Meckel's groove. It tapers to a point, which ends not only short of the angular, but far short of the symphysis. A fragmentary specimen (A.M.N.H. No. 6716) from the same formation also shows the splenial to terminate short of the angular.

TEETH.—In the type specimen, teeth in the right maxillary are the only ones available for study, and these are hidden by the articulated ramus except in lateral view, as shown in Fig. 11.

The teeth gradually increase in size from back to front and are ankylosed to the maxillary bone. They are relatively small and project but little below the alveolar border. Specimen A.M.N.H. No. 6708, which certainly pertains to the present genus and species, shows the maxillary teeth to be typically pleurodont in the manner of insertion (see Fig. 8). They are closely spaced, but each is separated from the other by an alveolar ridge of bone that envelops nearly the whole sides of the teeth.

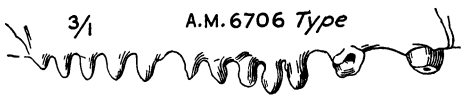

Fig. 11. Right maxillary teeth of *Arretosaurus ornatus*. Type, A.M.N.H. No. 6706. Lateral view. Three times natural size.

A measurement taken at the posterior end of the maxillary of the type shows there are eight teeth in a space of 10 mm.

More anteriorly there would be fewer teeth in this same space, as the teeth increase in size in an anterior direction.

The crowns are subround, with blunt apices, and bent strongly inward from the alveolar border. The shafts are semisolid, with anterior and posterior sides slightly flattened. There are more than fifteen

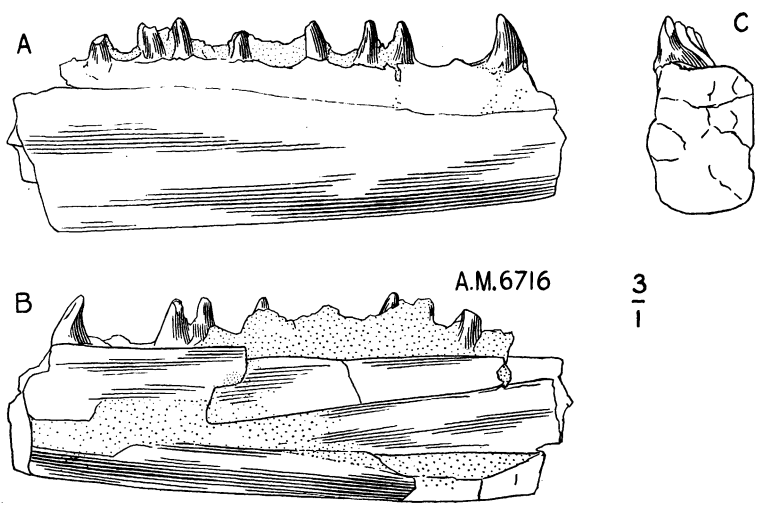

Fig. 12. Portion of right dentary of *Arretosaurus ornatus*. A.M.N.H. No. 6716. A, lateral view; B, inner view; C, anterior side of most anterior tooth. Three times natural size.

teeth in the complete maxillary series, as shown by the type (see Fig. 11).

None of the teeth of the lower jaw are visible in the type specimen. These, however, will be described from the fragmentary specimen (A.M.N.H. No. 6716) from the same formation and locality as the type. This specimen consists of three short sections of the dentaries, one of which is illustrated in Fig. 12. Six of the eight teeth present are wholly preserved. The method of attachment differs from those of the upper in that the teeth are set in shallow depressions on the top of the dentary. Similar to the upper, the teeth are small, with subconical crowns and expanded bases. This expansion of the base is confined almost entirely to the internal side of the base. The external side of the teeth is flush with the outside dentary border to which most of the teeth are fused. The dental formula of *Arretosaurus* must await the discovery of better preserved specimens.

The difference in the insertion of the teeth between upper and lower dentitions constitutes one of the important characteristics of the genus *Arretosaurus*. The lower series seems partly to bridge the gap between pleurodont and acrodont and might be termed pleuroacrodont type of insertion.

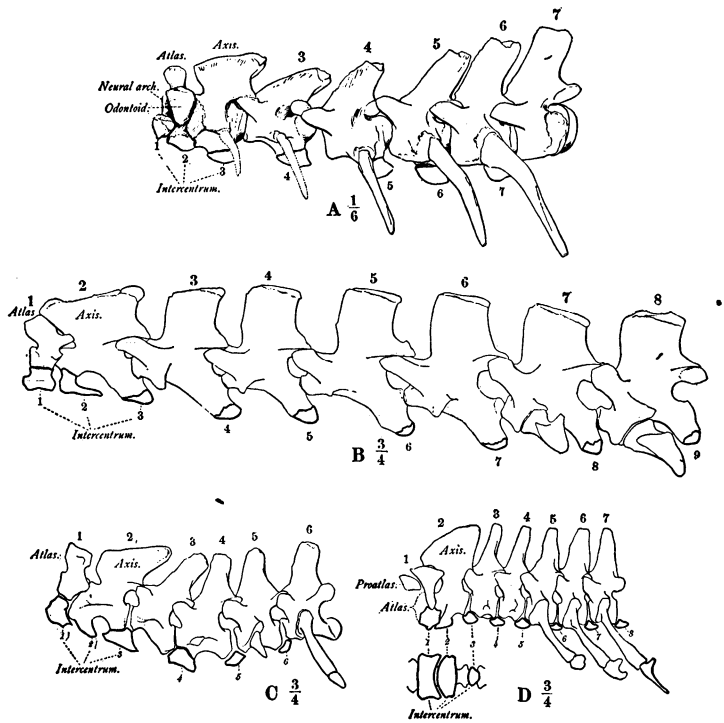

Fig. 13. Cervical vertebrae and intercentra of lizards, *Mososaurus* and *Sphenodon*. A, *Platecarpus*, with left side of neural arch removed from atlas exposing odontoid. B, *Varanus* with intercentra at tips of hypapophyses. C, *Cyclurus* with intercentra in primitive relation except upon axis. D, *Sphenodon* with intercentra in primitive relation except upon axis. After Osborn.

VERTEBRAE.—The vertebral column is represented by ten anterior vertebrae, all in articulation (see Fig. 9). The first six of these certainly pertain to the cervical series; the others are probably anterior dorsals. All the vertebrae are procoelus. No indication of a secondary hyposphenal articulation has been found.

The atlas is present, but only the keeled intercentrum is visible at this time. It re-

mains in articulated position with the ventral side of the occipital condyle. The right neuropophysis is in articulation with the axis. It sends a thickened, rounded process posteriorly. The centrum of the axis, as well as cervicals 3, 4 and 5 have their ventral sides sharply keeled. At the ends of this keel, each vertebra presents beveled facets for the articulation of the intercentrum, the anterior facet always being the larger of the two. The intercentrum for the axis is the largest of the series and is further distinguished by having its thickened anterior ventral border divided by a low, rounded, median ridge. This element has a slight hook backward. Intercentra 3 and 4 are missing, but 5 and 6 are fully coalesced with their respective centra. These extend anteriorly sufficiently to articulate with the facet on the preceding vertebra. Thus the intercentra in *Arretosaurus ornatus* occupy a primitive position in relation to the vertebrae, as in *Sphenodon* and *Cyclura* (see Fig. 13), and while functioning as hypapophyses they are probably intercentral in origin. This condition is strikingly different from that found in the genus *Saniwa* where these elements articulate exclusively with the exogenous process of the anterior vertebra of each pair and have no contact with the posterior one, a condition also found in the living *Varanus* and the Upper Cretaceous *Platecarpus*, as shown in Fig. 13.

The centrum of the seventh vertebra is missing, but the eighth, when viewed from below, is squarish in outline, without trace of keel and broadly rounded from side to side. In the broadening of the condyle it resembles the vertebrae of *Ophisaurus*. The ball or condyle is set off by a very slight constriction, and the ball itself is transversely ovate. The diapophyses stand out prominently on either side of the anterior end of the centrum. The left one remains in articulation with its rib of that side.

Viewed from above (see Fig. 7), all the neural arches are present, but all the diapophyses are missing except the right one on the fifth cervical. It stands out prominently from the side of the centrum on the anterior end about midway between the anterior zygapophysis and the intercentrum. Its articular end is elongate dorsoventrally. The imperfect spinous process of the axis is broad anteroposteriorly; those of the succeeding cervicals are relatively narrow fore and aft, with thickened, truncated tops. Beginning with the seventh vertebra the spinuous processes become perceptibly shorter; wider anteroposteriorly with a heavier truncated upper termination.

PECTORAL GIRDLE.—The pectoral girdle is represented by the nearly complete left scapula and coracoid and left clavicle. Fragmentary parts of all three of these bones of the right side are also preserved. No trace was found of the important interclavicle. The scapula, which has a relatively heavy blade, is without a prescapular process.

The coracoid is articulated with the scapula and has two coracoid emarginations, as in most Iguanidae.

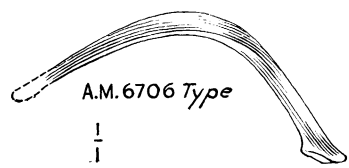

Fig. 14. Clavicle of *Arretosaurus ornatus*. Type, A.M.N.H. No. 6706. Natural size.

The clavicle is a simple, curved bar, broadened slightly at midlength by a V-shaped spur that projects forward and downward. The clavicle is flattened throughout its length. The clavicle in *Araeoscelis* is expanded toward the midline and imperforate.

FORELIMB AND FOOT.—The articulated right fore limb and foot are preserved, as shown in Fig. 15. The opposite limb is represented by the proximal half of the humerus.

The humerus is typically lacertian with the expanded extremities in divergent planes, with the greatest diameters of these ends subequal. In cross section the shaft at midlength is angularly rounded. The right humerus has a greatest length of about 53 mm.

On the proximal end of the ulna a small

block-like portion of bone probably represents the displaced olecranon process. A small but distinctly separate ossification crushed into the proximal end of the radius may be a sesamoid bone, probably the patella ulnaris. The radius and ulna are well illustrated in Fig. 15, and there is no need of detailed description. The ulna

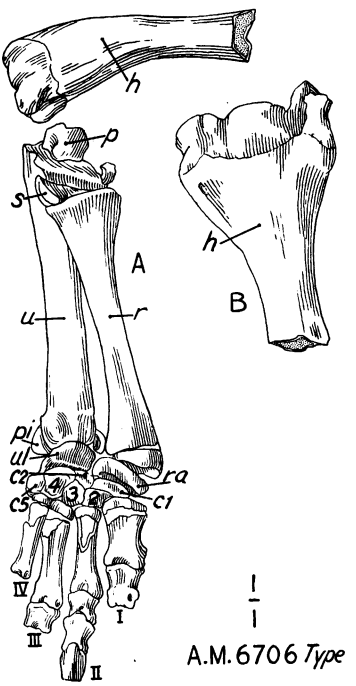

Fig. 15. Right articulated fore limb and foot of *Arretosaurus ornatus*. Type, A.M.N.H. No. 6706. A, limb viewed from the front; B, humerus viewed from the back; C, 1, 2, 3, 4, and 5, carpalia 1 to 5, respectively; *h*, humerus; *p*, patella ulnaris; *pi*, pisiform; *r*, radius; *ra*, radiale; *s*, sesamoid; *u*, ulna; *ul*, ulnare; I, II, III, IV, digits 1 to 4. Natural size.

with olecranon has a greatest length of 42.5 mm.; the radius, 34 mm.

The proximal row of the carpus consists of the ulnare, radiale and pisiform. The pisiform is of considerable size, as in *Iguana*, and articulates with the postaxial border of ulna and ulnare.

There appears to be a small centrale, but the complete coalescence of carpale 1 and 2 and what appears to be 4 and 5 leaves one in doubt as to the true condition of the carpus below the proximal row. Its tentative arrangement appears to be as shown in Fig. 15. This provisional determination must be used with caution.

There are four metacarpals, but that a fifth was originally present seems to be indicated by the unengaged articular surface of carpale 5. Metacarpal 1 is short and stout, having a greatest length of about 9 mm. The third is the longest of the series, and the fourth is shorter and more slender than the second. Digit 1 is complete except for the missing ungual; digit 2 lacks only the anterior half of the ungual; digit 3 has only the proximal phalangeal preserved; and digit 4 has all the phalangeals missing.

Ribs.—The presence in the matrix of a complete but short rib opposite the third cervical appears to indicate that all posterior to the axis bore ribs. On the left side ribs for the seventh, eighth and ninth vertebrae are preserved in practically articulated position. Attached to the underside of the rib for the seventh is a slightly smaller rib, probably for the sixth vertebrae. The distal ends of these ribs are hidden in the matrix beneath the blade of the left scapula. All four are relatively of good length.

Skin Impression.—On the ventral side parallel to the vertebral series is a series of rounded bony ossicles. There is a semblance of arrangement in both longitudinal and transverse rows. It is presumed these ossicles were held in the skin of the underside of the animal.

Discussion of Affinities.—*Arretosaurus*, aside from its dentition, shows many agamid characteristics, but as an acrodont dentition is the chief character by which lizards of this family can be at once distinguished from their allies, the presence of a pleurodont upper and pleuroacrodont lower dentition in *Arretosaurus* seemed to preclude its assignment to the Agamidae.

Although the teeth of both upper and lower series in the type specimen are prone to ankylose with the jaw bones, by no stretch of the imagination could they be considered acrodont in their manner of insertion. The distinct heterodontism so fre-

quent in the Agamidae cannot be demonstrated in the present specimen, for while there is an increase in the size of the teeth from back to front this change is gradual. Unfortunately the anterior teeth are missing in all available specimens, and thus the presence or absence of canine-like teeth cannot be determined at this time.

Agamid-like features found in the skull and skeleton of *Arretosaurus* may be enumerated as follows: reduced columelli cranii present; no pterygoid teeth; pterygoid wide apart and meeting on the median line; postorbital and postfrontal arches well developed; angular showing little if at all on the outer side of the ramus; splenial reduced; clavicle simple, nonperforate; no prescapular process and manus pentadactyle. On the other hand dermal ossifications on the skull might suggest affinities with the Anguidae, for such secondary ossifications are constantly absent in the Agamids. Also the pleurodont dentition would suggest relationships with the Iguanidae, but in that family the teeth are constantly cylindrical and hollowed out at the base and in *Arretosaurus* there is no indication of the teeth being so excavated.

AMPHISBAENIDAE

The Amphisbaenidae includes both recent and extinct representatives. The living members of this family inhabit the warmer parts of North and South America, West Indies, Africa and the Mediterranean countries. Up to this time extinct Amphisbaenidae have not been known outside of North America. The discovery in Inner Mongolia of an amphisbaenid lizard, therefore, greatly extends the known geographical distribution of this family and also provides a possible ancestral stock for some of the Old World representatives.

Geologically, the Amphisbaenidae of North America range from the Eocene (Wasatch) to the uppermost Oligocene (Leptauchenia zone).

CRYTHIOSAURUS, NEW GENUS

TYPE.—*Crythiosaurus mongoliensis*, new species.

DIAGNOSIS.—Teeth numerous on maxillary which extends far posteriorly beneath the orbit; prefrontal large; sagittal ridge absent; quadrate vertical; cotylus near posterior end of lower jaw.

Crythiosaurus mongoliensis, new species

TYPE.—A.M.N.H. No. 6629, consists of an imperfect skull, posterior portions of both rami and two cervical vertebrae. Collected in 1925.

LOCALITY.—Grand Canyon, north of Tsagan Nor, Inner Mongolia.

HORIZON.—Hsanda Gol, Lower Oligocene.

DIAGNOSIS.—Sole known species of the genus. See generic diagnosis above.

The type skull is imperfectly preserved and, aside from the loss of important parts, its study has been made difficult from the fact that it is not always possible to distinguish cracks in the bone from true sutural separations.

In profile the upper border slopes upward gradually from the muzzle, reaching its maximum height at about two-thirds its total length. From this point it slopes downward at a steeper angle to the occiput. In profile this skull has its closest resemblance in *Rhineura minutus* from the Oligocene of Wyoming.

The top view of the skull is depicted in Fig. 16 precisely as it is preserved, with the probable course of the sutures indicated by broken lines. At first it seemed that the longitudinal and transverse fractures had followed the natural sutures, but further study has convinced me that this is not always the case. These sutures will be discussed in more detail as the separate elements of the skull are described.

In length from the tip of the premaxillary to the end of the occipital condyle the skull measures 18.3 mm.; a greatest transverse diameter across the squamosal region of 8.3 mm. In size, therefore, *Crythiosaurus mongoliensis* exceeds the largest known *Rhineura hatcheri* skull but is less than half the dimensions of the Wasatch amphisbaenid *Ototriton solidus*.

The single parietal probably includes all the top of the skull covering the large brain from the supraoccipital forward to the frontals. The main frontoparietal separation may have followed the wide transverse

fracture shown in Fig. 16, but under the glass there appear to be traces of a suture, indicating that a wide median process of the parietal extended forward of the fracture between the frontals, as indicated by the broken lines in Fig. 16. This observation, however, needs verification, although a similar condition prevails in the genus *Hyporhina*. The lateral extent of the parietal cannot be determined, as all sutures have been obliterated. The dorsal surface of the parietal is smooth, and there is no median crest or ridge. In front of the parieto-supraoccipital contact on either side of the middle there are shallow depressions.

The paired frontals, as here interpreted, are longer than broad, and anteriorly they appear to join the nasal by an obscure suture, which seems to run straight across the nose, as depicted in Fig. 16. That the transverse fracture which meets the right prefrontal does not represent the position of the frontonasal suture is suggested by the fact that such an interpretation would place the nasal in articulation with the prefrontal bone, a relationship unknown in any of the fossil or modern Amphisbaenidae that were examined. Laterally the frontals roof over the orbits and more anteriorly articulate with the large prefrontal. The superior surface of the frontal is smooth.

The full extent of the nasal bones cannot be determined, as they are fully coalesced with the premaxillary. It is quite evident, however, that they were short anteroposteriorly. The muzzle formed by the premaxillary is thickened dorsoventrally and bluntly truncate.

The prefrontal best preserved on the right side is large, as in *Amphisbaena*, and medially articulates exclusively with the frontal. It forms the greater part of the anterior wall of the orbit (see Fig. 16). Its ventral border is notched, suggesting that it may have functioned in forming part of the border of the lacrimal foramen, which in many reptiles lies wholly within the lacrimal bone.

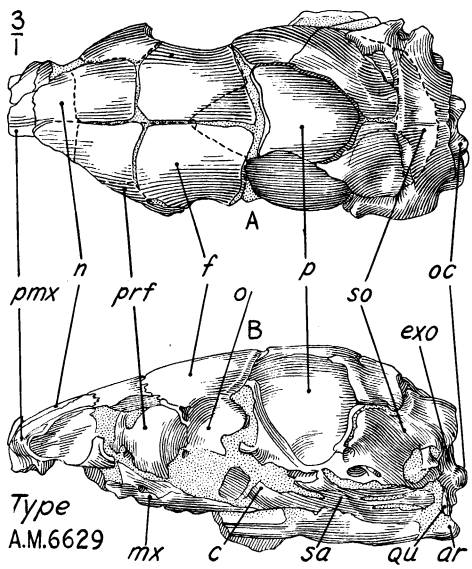

Fig. 16. Skull of *Crythiosaurus mongoliensis*. Type, A.M.N.H. No. 6629. A, top view; B, side view; *ar*, articular; *c*, coronoid; *exo*, exoccipital; *f*, frontal; *mx*, maxillary; *n*, nasal; *o*, orbit; *oc*, occipital condyle; *p*, parietal; *pmx*, premaxillary; *prf*, prefrontal; *qu*, quadrate; *sa*, surangular; *so*, supraoccipital. Three times natural size.

With the exception of the supraoccipital, the occipital segment of the skull is firmly and completely coössified, so that it is quite impossible to determine the limits of its component parts. The supraoccipital is subtriangular in outline and fills the space between the exoccipitals and the parietal. It appears to be excluded from participation in the formation of the foramen magnum by narrow processes from the exoccipitals, which meet on the median line at the top of this foramen, as shown in

Fig. 16. Its anterior border articulated with the parietal by a nearly straight transverse suture.

The exoccipitals appear entirely to surround the foramen magnum and participate about equally with the basioccipital in the formation of the tripartite occipital condyle. The transverse processes project slightly forward and at about their midlength are perforated by a foramen. The outer ends of both elements are incomplete.

In the lateral view, the posterior half of the left maxillary appears to be preserved in its normal relationships. The long, tapering, posterior end extends far underneath the orbit, as shown in Fig. 16. Although all the teeth are missing, scars on the alveolar border indicate they were ankylosed to the bone in a row and were numerous in number. There appear to have been no less than seven or eight teeth.

On the left side, a vertical bone fragment extending upward from the ramus is thought to be a portion of the quadrate. The position of the cotylus at the end of the jaw indicates that the quadrate would be nearly vertical in position, whereas in many Amphisbaenidae the quadrate is strongly oblique, if not horizontal, in position.

The squamosal cannot be differentiated, and the preservation of the otic region is unsatisfactory for study, only the fenestra ovalis being recognized.

The palate details cannot be determined, as the rami remain attached to the posterior half, and the anterior half is either missing or badly crushed. Visible portions of the basioccipital and basisphenoid show the same compact form of other members of the family.

The posterior half of the left ramus is preserved nearly in its natural relationship with the skull, and it shows the postcoronoid part of the mandible to be long, extending to the posterior end of the skull. It displays one important peculiarity in having the cotylus for the quadrate near its posterior termination. This feature distinguishes *Crythiosaurus mongoliensis* from all extinct Amphisbaenids, as well as from many of the extant members of the family. The coronoid is large and rises well above the general level of the jaw.

VERTEBRAE.—Two articulated vertebrae were associated with the skull of *Crythiosaurus mongoliensis*. These have transversely compressed but blunt hypophyses on their ventral surfaces, thus indicating that they pertain to the cervical region. The ball of the centrum is subround; neural arch low and roof shaped, crest of arch terminates posteriorly in a low, truncate, but stout spine.

VARANIDAE

Saniwinae

The Saniwinae includes the extinct North American genera, *Saniwa*, *Palaeosaniwa*, *Parasaniwa* and tentatively the Australian *Megalania*. The members of this subfamily are distinguished chiefly by the presence of vestigial zygosphenes on the vertebrae.

TELMASAURUS, NEW GENUS

TYPE.—*Telmasaurus grangeri*, new species.

DIAGNOSIS.—Dentition subpleurodont, teeth sharply pointed, saber-like; pineal foramen close to median posterior border of parietal; hameal surfaces of dorsal vertebrae broad, slightly rounded; vertebrae tapering; vestigial zygosphene; postorbital present as a distinct element.

Telmasaurus grangeri, new species

TYPE.—A.M.N.H. No. 6645, consists of a fragmentary skull (parietal, fragment of frontal, both postfrontals, portion of postorbital, parts of both squamosals, proximal half of right quadrate, part of right jugal and jaw fragment with three teeth), three dorsal vertebrae, parts of others, rib and other bone fragments. Collected by Walter Granger in 1925.

LOCALITY.—Shabarakh Usu, Inner Mongolia.

HORIZON.—Djadochta, Upper Cretaceous.

DIAGNOSIS.—Sole known species of the genus. See generic diagnosis above.

Named in honor of the late Dr. Walter Granger who collected the type specimen.

The type is a fragmentary specimen which has been prepared in relief on two small slabs of a sandstone concretion. The

posterior portion of the skull is preserved partially articulated, but the other skeletal parts are scattered indiscriminately over the slab surfaces.

The parietal is nearly complete and resembles *Varanus* in having its least transverse diameter far posterior, where it measures 7.9 mm. This specimen is unique in having the pineal foramen near the median posterior border of the parietal, immediately in front of the V-shaped notch formed by the divergent posterior processes (see Fig. 17). On the outer posterior sides these processes are longitudinally grooved for the tabulare, both of which are missing. From the pineal foramen forward the parietal steadily widens to the anterior end, which meets the frontal by a straight transverse suture. A small portion of the frontal is preserved on the left side. On its outer posterior angle it is slotted and with the parietal appears to enclose a narrow slot-like opening that penetrates the top of the orbit. Except for its more posterior position this opening suggests the supraorbital fossa, found in *Lyrocephalus* and some Iguanids, but in these lizards the outer arch is formed by processes of the pre- and postfrontals.

Both the postfrontal bones are present and nearly in articulated position, but unfortunately both have their anterior processes wanting. The postfrontal is a triradiate bone, which articulates by a cupped articular surface with the parietal and frontal at their junction. A slender pointed process extends backward to articulate along the side of the parietal, and, although missing in this specimen, a somewhat similar process extends forward to lap the frontal, as shown by a longitudinal scar along the posterior border of that bone. The postorbitals are both missing except for the slender posterior process of the right element which remains articulated with the squamosal, thus indicating the presence of the distinct postorbitals as in *Saniwa ensidens*. In *Varanus* the postorbital and postfrontal are always coalesced, and it is seldom that the presence of two elements can be detected.

The squamosal is a long, flattened, slender bone that curves strongly downward at the posterior end. It unites with the post-

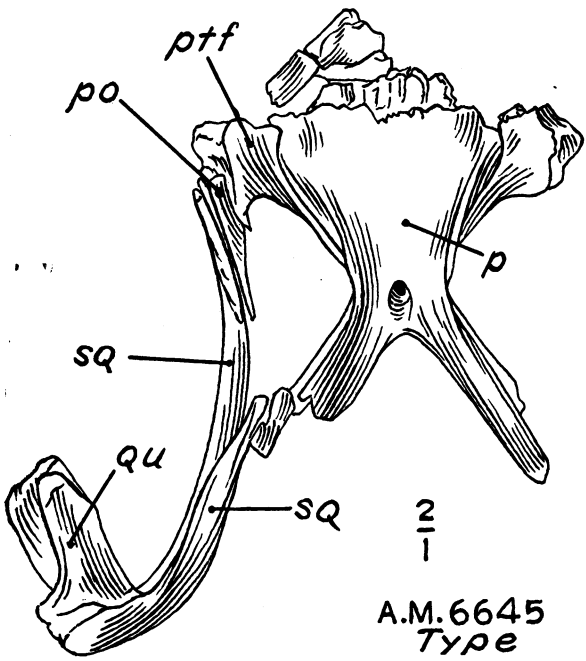

Fig. 17. Skull portion of *Telmasaurus grangeri*. Type, A.M.N.H. No. 6645. Viewed from the top; *p*, parietal; *po*, postorbital; *ptf*, postfrontal; *qu*, quadrate; *sq*, squamosal. Two times natural size.

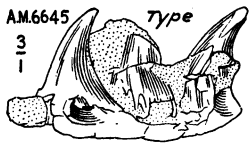

Fig. 18. Teeth of *Telmasaurus grangeri*. Type, A.M.N.H. No. 6645. Lateral view. Three times natural size.

orbital to form the supratemporal arcade. This bar is heavier than in a *Varanus* of equal size.

The middle part of the right jugal has the proportions of this bone in *Saniwa*, both being more robust than in the living *Varanus*.

On account of the missing posterior end of the jugal it cannot be determined whether it articulated direct with the postorbital, or whether, like modern Varanids, they were joined by cartilage.

The proximal half of the right quadrate is preserved in articulation with the squamosal, but both were found displaced on the left side of the parietal. The outer conch of the quadrate is more pronounced than in *Varanus*, and the longitudinal depression on the posterior outer side is deeper than in that genus.

A jaw fragment carrying three teeth shows the dentition to be pleurodont. These teeth (see Fig. 18) are sharply pointed, compressed transversely, saber-shaped and curved backward, as in *Varanus niloticus*. Bases of the teeth dilated with basal striations so characteristic of *Varanus* and *Saniwa*. The three teeth occupy a space of 8.5 mm.

VERTEBRAE.—There are three vertebrae that have their ventral surfaces exposed, and one of these shows enough of the anterior part of the arch to indicate the presence of a vestigial zygosphene, as in the Eocene genus *Saniwa*.

The centra (see Fig. 19) are tapering, broad, slightly rounded from side to side, and one centrum has an incipient median keel. Cup subovate, with longest diameter transverse. These vertebrae resemble those of *Saniwa* rather closely.

In the two concretionary blocks, there are a considerable number of fragmentary ribs and parts of other bones, but as none of these contribute to a better understanding of the skeletal structure, they will not be further described.

A second specimen (A.M.N.H. No. 6643, see Pl. LII), consisting of the articulated hind limbs, incomplete feet and pelvis, sacrum, a few dorsal and caudal vertebrae and portions of one fore limb and foot, from the same locality as the type is provisionally identified as pertaining to this same genus and species.

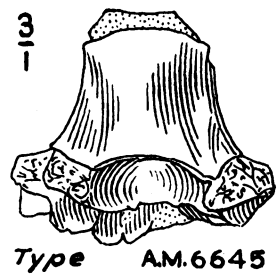

Fig. 19. Dorsal vertebral centrum of *Telmasaurus grangeri*. Type, A.M.N.H. No. 6645. Ventral view. Three times natural size.

The slenderness of the limbs and feet and the presence of a vestigial zygosphene on the anterior caudal vertebrae are the slender evidence on which this tentative assignment is made. In view of the uncertain status of this specimen further description would seem to be unwarranted.

ANGUIDAE

The Anguidae is represented in the present collection by two genera, *Glyptosaurus* and *Isodontosaurus*. The latter from the Djadochta, if correctly referred, considerably extends the known geological range of this family, as previously it had not been recognized earlier than Eocene (Wasatch) in North America.

GLYPTOSAURUS MARSH

TYPE.—*Glyptosaurus sylvestris* Marsh.

DIAGNOSIS.—"Head and body covered with osteoderms having tubercular ornamentation; head scutes four, five, and six sided, and more or less of equal size; body scutes rectangular, ornamentation usually forming regular pattern, frontals usually separate. Teeth on pterygoids and palatines; postorbital excluded from orbital boundary; parietal in contact with squamosal, roofing over part of supratemporal fossa" (Gilmore, 1928, p. 91).

Glyptosaurus near **nodosus** Marsh

A left frontal (A.M.N.H. No. 6669) found near Baron Sog, Inner Mongolia, in the Shara Murun formation (Upper Ecoene) is clearly referable to the genus *Glyptosaurus*.

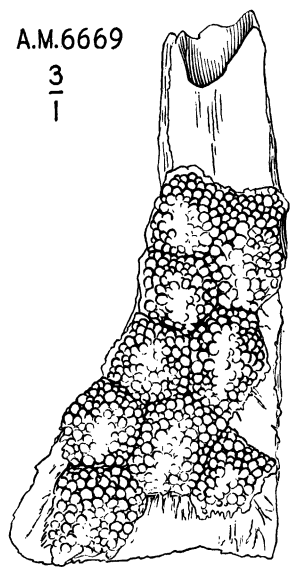

Fig. 20. Left frontal of *Glyptosaurus* near *nodosus* Marsh. A.M.N.H. No. 6669. Viewed from above. Three times natural size.

The size and arrangement of the osseous scutes in longitudinal rows, the pentagonal and hexagonal outlines of the scutes at their bases and their high subconical shape, with papillate ornamentation of their respective surfaces, are all features so closely resembling the type frontal of *Glyptosaurus nodosus* Marsh as to make the two specimens nearly indistinguishable. The present specimen is, therefore, tentatively referred to the American species, but in full realization that more fully preserved specimens will, in all probability, show their specific distinctness. Geographical considerations alone would point to such a conclusion.

The frontal of A.M.N.H. No. 6669 has a greatest length overall of 23.2 mm., whereas the type of *G. nodosus* measures 25.5 mm. in length. The frontal of the first mentioned contributes a length of 5 mm. to the median upper border of the orbit, the type 7 mm. to this border. The only other difference found is that the frontal bone of the Mongolian specimen is slightly thinner than that of the type. The principal features of this specimen are clearly shown in Fig. 20.

This is the first recognized occurrence of the genus *Glyptosaurus* outside of North America, unless *Placosaurus* of Gervais proves to be synonymous, as has been suggested (Gilmore, 1928, p. 92).

The occurrence of *Glyptosaurus* in the Shara Murun formation (Upper Eocene) is in accord with its geological occurrence in North America where it ranges from the Wasatch to the Oligocene. *Glyptosaurus nodosus* up to this time has not been recognized as occurring outside the Bridger formation.

ISODONTOSAURUS, NEW GENUS

TYPE.—*Isodontosaurus gracilis*, new species.

DIAGNOSIS.—Dentition pleurodont; homodont; teeth with crowns dilated anteroposteriorly, with posterior border lapping the outside of the next posterior crown; last tooth much reduced; coronoid stout, with thickened truncated upper extremity.

Isodontosaurus gracilis, new species

TYPE.—A.M.N.H. No. 6647, consists of posterior portions of both rami with teeth. Collected in 1925.

LOCALITY.—Shabarakh Usu, Inner Mongolia.

HORIZON.—Djadochta formation, Upper Cretaceous.

DIAGNOSIS.—Sole known species of the genus. See generic diagnosis above.

The left ramus of the type specimen carries seven teeth, the right ramus five teeth. Transversely the crowns are wedge-shaped, with the two beveled surfaces about equal. On the inside bevel there are faint indications of striae running downward at

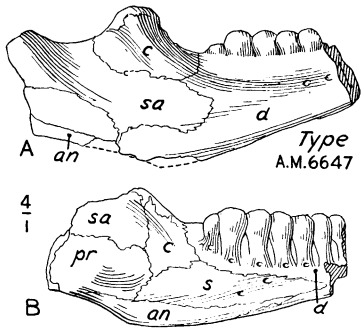

Fig. 21. Rami of *Isodontosaurus gracilis*. Type, A.M.N.H. No. 6647. A, right ramus, lateral view; B, left ramus, internal view; *an*, angular; *c*, coronoid; *d*, dentary; *pr*, prearticular; *s*, splenial; *sa*, surangular. Both figures four times natural size.

right angles to the cutting edge. The shafts of the teeth are rounded, with a small rounded foramen at the base of each. Five teeth in the left ramus occupy a horizontal space of 3.6 mm. in length.

The sutures defining the coronoid and splenial bones are fairly clear, but the others are so indistinct that one cannot be certain whether they represent true sutures or whether they are fractures. These are indicated in the illustrations (see Fig. 21), but with the above-mentioned exceptions all need additional verification. The splenial is relatively small and anteriorly ends far short of the symphysis. The coronoid is relatively low and stout, with a thickened, truncated, upper extremity. Its anterior termination on both sides of the jaw is posterior to the last tooth. It has a wide contact with the splenial.

Resemblances in the teeth to those of *Peltosaurus* suggest relationship with the Anguidae, to which it is provisionally referred.

Sauria Undetermined

Under this heading is included mention of a few fragmentary specimens too incomplete for identification or characterization, but of interest either in extending the geological range of the Sauria in Mongolia or indicating the presence of undescribed forms.

The distal end of a right humerus (field No. 817) found forty miles southeast of Iren Dabasu, Inner Mongolia, in the Tung Gur beds, Pliocene, is the first record of the Sauria in the late Tertiary of this region.

A fragmentary specimen (A.M.N.H. No. 6648) consisting of small portions of both lower jaws, attached by matrix to parts of the maxillaries, with a few teeth shows the presence of an undescribed lizard in the Djadochta, Upper Cretaceous. It was collected at Shabarakh Usu, Inner Mongolia, in 1925. The lack of characteristics by which other specimens might later be identified with it renders its description futile.

A second specimen (see Fig. 22, A.M.N.H. No. 6656) from this same locality and horizon, consisting of the articulated right ramus and maxillary, has a pleurodont dentition that cannot be identified with any of the lizards described in the present article. The poor preservation of the surfaces of both teeth and bone makes it a very unsatisfactory type and for that reason naming it has been deferred.

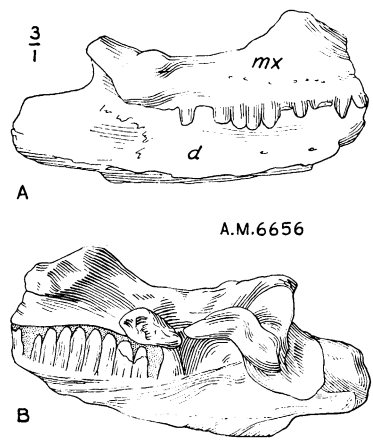

Fig. 22. Right upper and lower jaws of unidentified lizard. A.M.N.H. No. 6656. A, outer view; B, inner view; *d*, dentary; *mx*, maxillary. Three times natural size.

Small portions of the integument of the tail associated with two caudal vertebrae (A.M.N.H. No. 6521) were found at Shabarakh Usu, Inner Mongolia, in the Djadochta, Upper Cretaceous, in 1923. The dermal scutes are arranged in successive rows, the scutes of one row slightly overlapping the forward ends of the row behind. It is presumed these rows fully encircled the tail, though none of the rings are now completely preserved. The presence of osseous dermal scutes strongly suggests this specimen to pertain to the Anguidae and perhaps to *Isodontosaurus gracilis* which is assigned to that family.

A single thoracic vertebrae (without number) collected from the Ardyn Obo beds, Lower Oligocene, Inner Mongolia, in 1923 is the first record of Sauria occurring in that formation.

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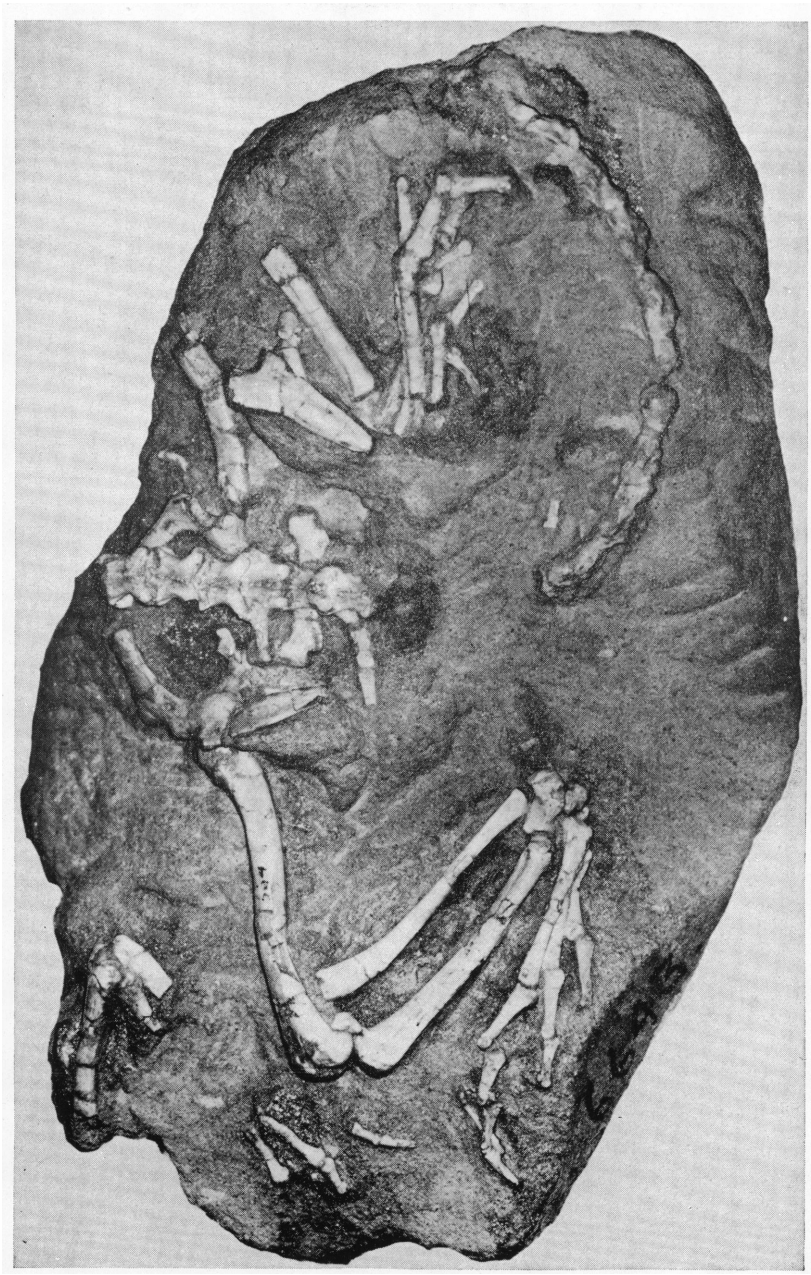

Articulated pelvis, sacrum, hind limbs and feet, articulated portion of caudal series and part of one fore limb. Provisionally identified as pertaining to *Telmasaurus grangeri*. A.M.N.H. No. 6643. Shown as worked out in relief on a sandstone nodule. About natural size.