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# *CHAMPSOSAURUS TENUIS* (Reptilia: Eosuchia) A NEW SPECIES FROM THE LATE PALEOCENE OF NORTH AMERICA

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Abstract — A partial skeleton and skull of an unusually long-snouted champsosaurid is described from the Tiffanian of western North Dakota. Rostral bones are lengthened, shoulder girdle is narrow, clavicles concave anteriorly with tuberosities for probable deltoid muscle tendons.

## INTRODUCTION

During 1979 a survey of potentially important paleontological sites was undertaken by the writer and Robert Spading of the museum staff on behalf of the U.S. Department of Agriculture, Forest Service. These sites, under lease for development by various petroleum interests, are situated in the "upper breaks" of the Little Missouri River in Billings County, North Dakota within exposures of the Bullion Creek (Tongue River; Clayton, et al. 1977) Formation.

Among the fossil vertebrate remains recovered during this survey is an interesting partial skeleton of a small eosuchian reptile which has been determined to represent an heretofore unknown species. The new fossil clearly belongs to the genus *Champsosaurus;* however, the peculiar nature of its shoulder girdle, as well as its exceptionally long skull rostrum, sets it apart from all other species. It is herein presented as the evidence for recognizing a new species which has reached a peak of specialization for the group. Comparison with *Tchoiria nemsarai* (Efimov, 1975) from the Cretaceous of Mongolia, the oldest known champsosaur, and two intermediate North American species reveals significant proportional changes in the skull.

## SYSTEMATIC DESCRIPTION

Suborder CHORISTODERA
Family Champsosauridae
Genus Champsosaurus
*Champsosaurus tenuis* new species

*Diagnosis.* — A species possessing an extremely long, slender snout; postcranial skeleton with narrow shoulder girdle; clavicles short and deeply concave anteriorly; limbs reduced in length.

*Holotype.* — SMM P79.14.1, partial skeleton with a nearly complete skull.

*Etymology.* — The specific name *tenuis* is Latin for thin.

*Horizon and Type Locality.* — Bullion Creek Formation (Tiffanian) NE¼ SW¼ Sec. 4, T.143N, R.101W, Billings County, North Dakota.

*Skull.* — The skull of the holotype (Figs. 1, 2; Table I) and only known specimen is dorsoventrally flattened but essentially complete. The rostrum is unusually long, having a length to breadth ratio of 4:1 as preserved (measured along midline from the tip of the snout to the level of the posterior edge of the orbits). The skulls of four different champsosaurids are compared in Figure 3 to illustrate the progressive lengthening of the rostrum.

The orbits are oval in outline and the rims are slightly elevated above the surrounding skull surface. The location of the external nares is indicated by a remnant of the margin of the opening on the left premaxilla and the tip of the nasal which penetrates it. The extremity of the snout including the anterior-most margin of the nasal opening is missing. Ventrally the position of the choanal openings is just halfway between the tip of the rostrum and the posterior point of the occipital condyle. In other species the openings are closer to the front due to relative shortness of the rostra.

Most of the suturing of the skull bones can be traced and is in agreement with that of other forms (Fig. 3). Minor differences are found between the maxilla and jugal wherein their common border is longer, and in the application of the parasphenoid to the basioccipital.

There are spaces for 48 to 50 teeth in the skull, whereas the species having the closest number, *C. gigas,* has only 44 to 46. Among preserved teeth the wrinkled or folded pattern of the base and the narrow, sharply-pointed blade may be observed (Erickson, 1972).

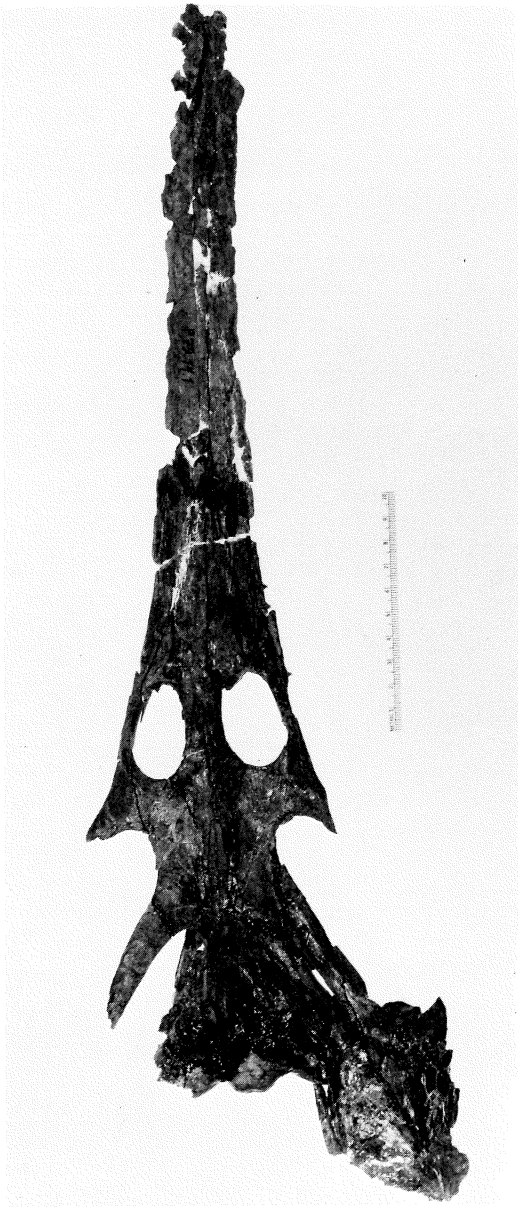

Figure 1. Dorsal view of holotype skull of *Champsosaurus tenuis* P79.14.1.

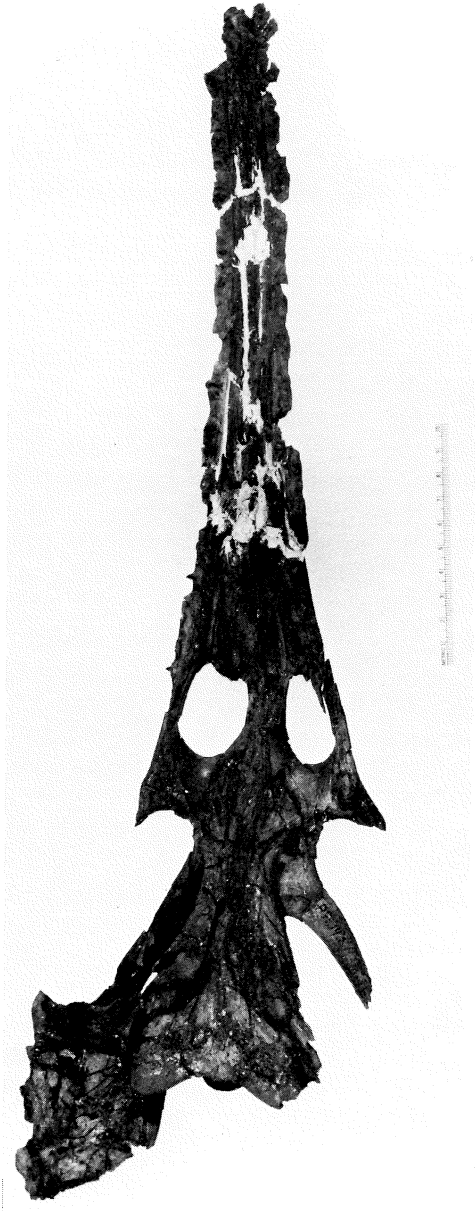

Figure 2. Ventral view of holotype skull of *Champsosaurus tenuis* P79.14.1.

TABLE I — Skull measurements of the holotype of *Champsosaurus tenuis* SMM P79.14.1 in millimeters.

| | |
|---|---|
| Length, condyle to tip of snout along midline | 440 |
| Length, rostrum posterior edge of orbit to tip | 306 |
| Length, quadrate (ant. point) to tip of rostrum | 409 |
| Length of orbits | 40 |
| Breadth of skull, posterior edge of orbits | 82 |
| Breadth at maxillary - premaxillary lateral contact | 32 |
| Breadth of orbits | 26 |
| Narrowest breadth of interorbital plate | 15 |
| Breadth at inner edge of quadrates (est.) | 84 |

Mandible measurements of the holotype of *Champsosaurus tenuis* SMM P79.14.1

| | |
|---|---|
| Greatest length (est.) | 430 |
| Length of symphysis (est.) | 185 |

TABLE II — Limb bone measurements of the holotype of *Champsosaurus tenuis* SMM P79.14.1 and the holotype of *C. gigas* SMM P71.2.1 in millimeters.

| Bone | Length | | Width, proximal end | | Width, distal end | |
|---|---|---|---|---|---|---|
| | *C. tenuis* | *C. gigas* | *C. tenuis* | *C. gigas* | *C. tenuis* | *C. gigas* |
| Humerus | 122 (est.) | 142 | 40 | 49 | 49 | 51.2 |
| Radius | 68.9 | 79 | 16 | 19 | 12.5 | 13.2 |
| Ulna | 70 | 82.1 | 23 | 26.8 | 18.5 | 21.5 |
| Femur | 162 | 178.3 | 31.8 | 35 | 35 | 41 |
| Tibia | 113 | 123 | 29.2 | 34.5 | 18.1 | 21 |
| Fibula | 110 | 115.7 | 11.5 | 12 | 19.6 | 23.6 |

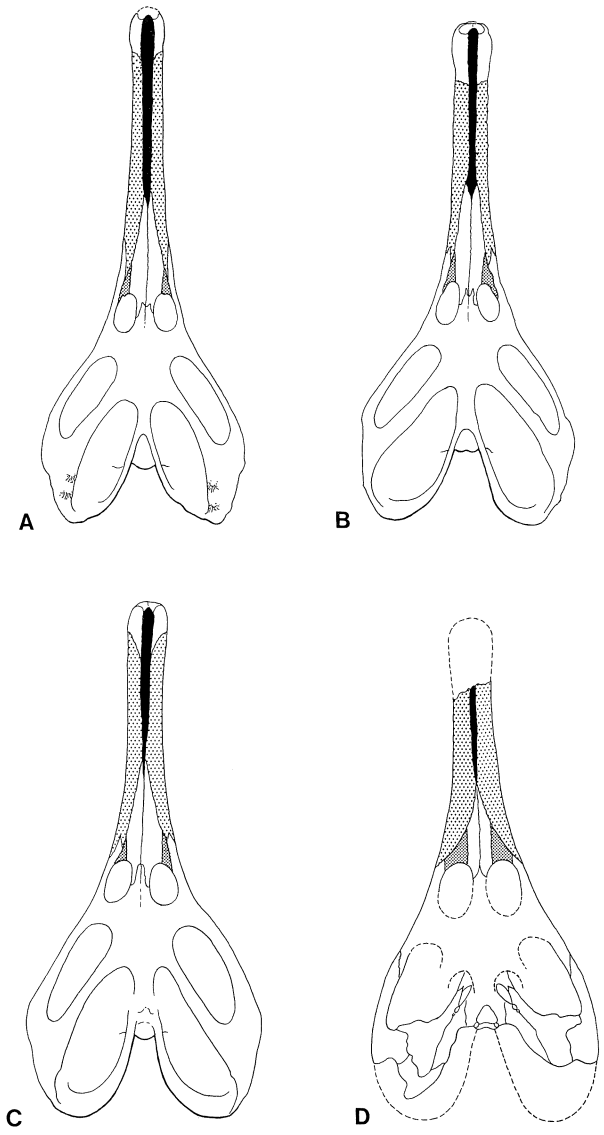


Figure 3. Dorsal views of skull of A, *C. tenuis,* B, *C. gigas* (after Erickson), C, *C. laramiensis* (after Brown), and D, *Tchoiria namsarai* (after Efimov); reduced to same size to show proportional differences and progressive lengthening of the rostrum. Solid area, nasal; light shading, maxilla; dark shading, lachrymal.

Palatal teeth occupy the same relative surfaces of the palatines, vomers, pterygoids, and ectopterygoids as in other taxa. They appear to be somewhat more abundant however. Their anterior extent is uncertain due to missing portions of the vomers. Posteriorly their limit is at about the level of the greatest constriction of the pterygoids.

Relief features, consisting of small ridges and tubercles, typically characterize the roofing bones of the skull. Ornamentation of the squamosal surface is also pronounced especially along the posterior margin. The general lack of cranial material does not permit detailed comparison with other taxa.

*Mandible.* — The posterior part of the right ramus from the symphysis back, a section of the left ramus near midlength, and the anteriormost tips of both dentaries are present (Fig. 4). The mandible's length can be satisfactorily determined despite its fragmentary condition. It is long and slender with an estimated symphysial area that makes up more than 3/7 of the length of the entire jaw.

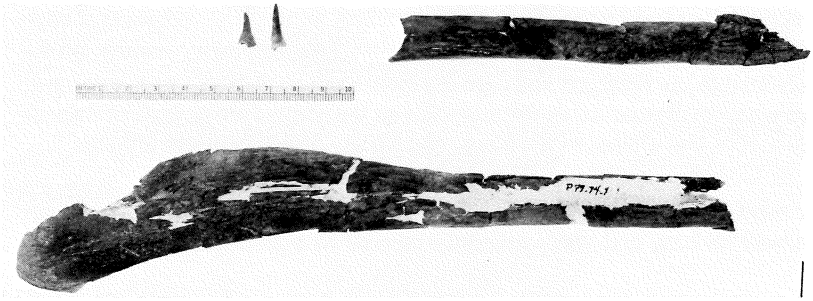

Figure 4. Mandible of holotype of *Champsosaurus tenuis* P79.14.1.

Brown (1905) reports 40 teeth in the dentary of *C. laramiensis* from the Cretaceous. *C. gigas* (Erickson, 1972), from the late Paleocene, has 45 and the new fossil an estimated 50, which is consistent with the number indicated for the skull. The anterior tip of each dentary contains three alveoli. The second is the largest and, in this respect, agrees with other species.

*Postcranial skeleton.* — Of the 25 or so vertebrae represented, three are cervicals, including portions of the atlas - axis complex, 12 are dorsals, and 10 are sacrals. No specific distinction is evident.

The most remarkable part of the postcranial skeleton is the pectoral girdle. It is narrow due to the short horizontal ramus of the clavicle which connects the interclavicle with the scapula. A specific character of the clavicle's horizontal

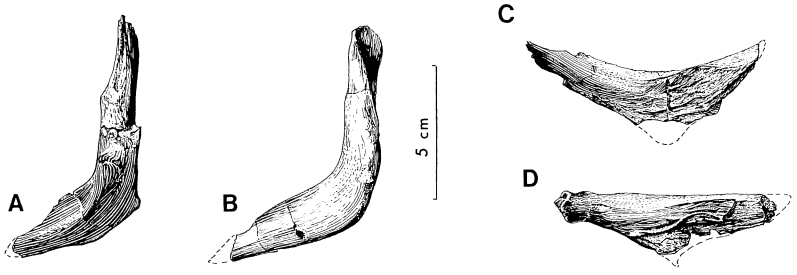


Figure 5. A, oblique anterolateral view of left clavicle of holotype of *Champsosaurus tenuis* P79.14.1. B, same view of holotype of *C. gigas* P71.2.1. C, dorsal view of A. D, dorsal view of B.

ramus is its deeply concave anterior side (Fig. 5A, C). Contact area for the interclavicle is also very broad and heavily grooved. The clavicles nearly join one another at midline when articulated with the interclavicle. The ascending branch of the clavicle is also short and incised along its posterolateral edge where it meets the scapular blade. At the base of the ascending branch, on the anterior edge, an enlarged and rugose process arises. Above this is a second, somewhat smaller process near midpoint on the shaft. One or both of these is presumably associated with strong, clavicular, deltoid muscle tendons.

The stout T-shaped interclavicle is not outstanding. The blade has a constriction near its base and was apparently tapered to a point posteriorly.

The endochondral portion of the shoulder girdle consists of a left scapula and a fragment of the left coracoid. The blade of the former is short, slightly expanded distally, and possesses a smoothly arched cartilaginous margin (Fig. 6). At the anterior basal angle the sharp keel that is developed matches a prominent sulcus on the posterolateral edge of the clavicle. Along the anteromedial edge of the blade a slight faceting defines the position of contact for the clavicle.

The pelvic girdle (Fig. 7) is complete on the left side. Only trivial differences show up in comparison with the type specimen of *C. gigas* (Erickson, 1972). The ilium of the new taxon is slightly lower in profile and all elements are somewhat less robust.

Partial ribs remain from various regions. The largest dorsals display diagnostic incising along the visceral surface distally (Erickson, 1972). Only scraps of gastralia and chevrons were found.

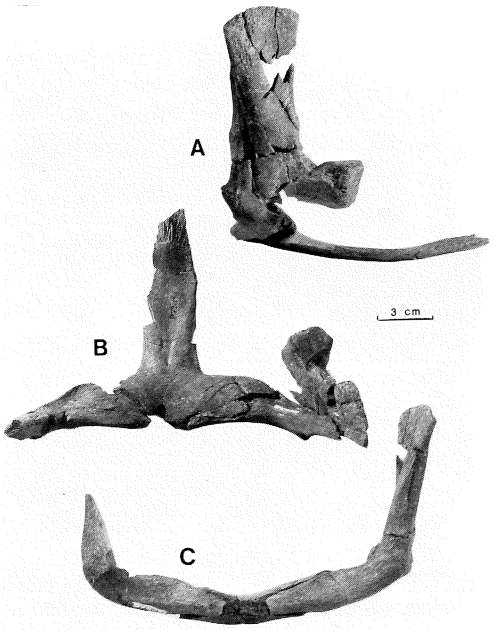


Figure 6. Articulated pectoral girdle of holotype of *Champsosaurus tenuis* P79.14.1. A, lateral view. B. dorsal view. C, anterior view. Coracoid fragment not included.

Insofar as the type specimen of *C. tenuis* can be compared with the type specimen of *C. gigas,* their skulls and vertebral elements are essentially the same size. Their appendicular skeletons, however, show differences in size, especially the bones of the appendages which are appreciably shorter in *C. tenuis*.

Of the limb bones (Fig. 8), all but the humerus are intact making a humerofemoral ratio impractical, but nevertheless providing informative proportional data on the limb structure. This data (Table II), is compared with that of the type specimen of *C. gigas*. Despite marked size differences, proportional differences remain very similar.

Foot bones are represented by less than a dozen fragmentary metapodials, phalanges, and one carpal or tarsal element.

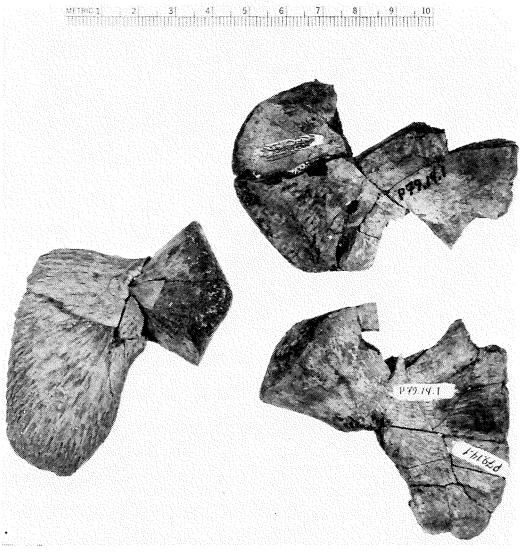

Figure 7. Left half of pelvic girdle of *Champsosaurus tenuis* P79.14.1. Pubis and ischium viewed in dorsal aspect; ilium in medial aspect.

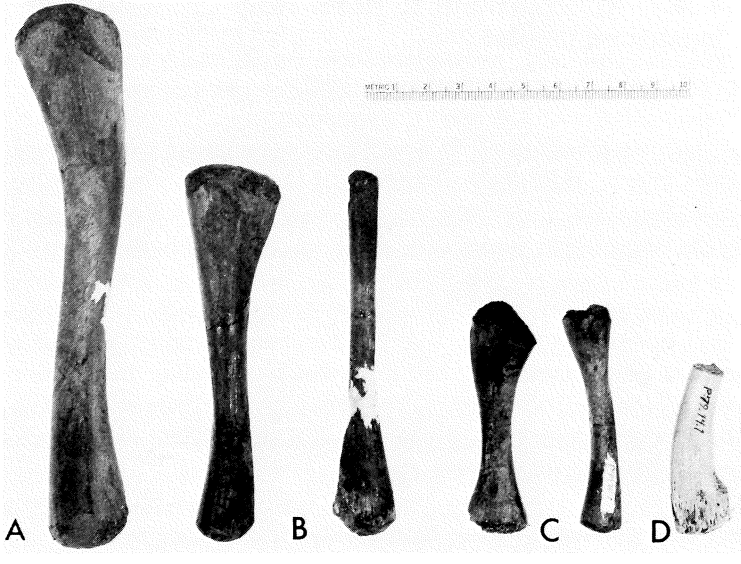


Figure 8. Limb and rib bones of holotype of *Champsosaurus tenuis* P79.14.1. A, Femur. B, Tibia - fibula. C, Radius - ulna. D, distal end of dorsal rib showing incised visceral surface.

## ECOLOGICAL NOTE

The sediment from which this reptile was collected is a light gray silty shale of fluvial - lacustrine origin. This evidence indicates environmental conditions that were different from those indicated by the dark lignitic (paludal) deposits that are most often associated with other Paleocene species *viz., C. gigas* (Erickson, 1972). Jacob (1972) describes these deposits as characteristic of those laid down in local floodbasins on a floodplain. The occurrence of *C. tenuis* in the former type of sediment suggests that its elongated rostrum, narrow body and reduced limbs were specializations for greater maneuvering capability either in open water or possibly under conditions of strong water currents that were associated with the depositional environment.

Unfortunately not enough remains of either the tail or the feet to infer how these structures may have been modified. The unusual form of the clavicle, as described above, probably had some function related to this form's general "streamlining" as well.

## DISCUSSION

Features distinguishing *Champsosaurus tenuis* are somewhat subtle; however, they are sufficiently developed to demonstrate an evolutionary trend wherein the snout becomes elongated, the body becomes slimmer, and the limbs reduced.

A long snout and morphological conservativeness of the postcranial skeleton are shared by all members of the group, a characterization reflecting its mode of life as a successful and well adapted, aquatic predator. Progressive lengthening of the snout, as well as the apparent concomitant slimming of the body and reduction of limb size found in the present form, illustrates advanced specialization along these lines.

*Tchoiria nemsarai,* the oldest known champsosaur, possesses a rather unspecialized skull, but an already moderately long rostrum (Fig. 3D). Its postcranial elements are also reminiscent of those of *Champsosaurus;* therefore, a possible ancestral position to this genus is suggested by Efimov.

On the basis of present evidence this suggestion seems reasonable. Whether *Tchoiria* is in direct line or merely an early side branch is yet to be determined. However the range in morphological variability between the Mongolian form and *C. tenuis* is appreciable and strongly suggests that there is a much broader niche distribution for the group than previous evidence indicates.

## ACKNOWLEDGMENTS

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