ResearchGate

See discussions, stats, and author profiles for this publication at: https://www.researchgate.net/publication/288762344

On a new ichthyosaur of the genus otschevia from the volgian stage of the volga region near ulyanovsk

Article *in* Paleontological Journal · January 2001

CITATIONS
21

READS
234

1 author:

Maxim Savvich Arkhangelsky
Saratov State University
77 PUBLICATIONS **678** CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:

Biodiversity dynamics of Cretaceous marine predators View project

Late Jurassic ichthyosaurs of the Boreal Realm: their taxonomy, phylogeny and palaeobiogeographic implication View project

All content following this page was uploaded by Maxim Savvich Arkhangelsky on 29 April 2016.

The user has requested enhancement of the downloaded file.

Paleontological Journal, Vol. 35, No. 6, 2001, pp. 629–634. Translated from Paleontologicheskii Zhurnal, No. 6, 2001, pp. 66–71.
Original Russian Text Copyright © 2001 by Arkhangelsky.
English Translation Copyright © 2001 by MAIK "Nauka/Interperiodica" (Russia).

On a New Ichthyosaur of the Genus *Otschevia* from the Volgian Stage of the Volga Region near Ulyanovsk

M. S. Arkhangelsky

Saratov State University, ul. Astrakhanskaya 83, Saratov, 410750 Russia

Received January 10, 2000

Abstract—Based on a large part of a skeleton, a new species of the genus *Otschevia* (*O. alekseevi*) from the Volgian Stage (*Dorsoplanites panderi* zone) of the Volga Region near Ulyanovsk is described. The diagnoses of the family Undorosauridae, the subfamilies included in the family, and the genus *Otschevia* are emended.

INTRODUCTION

In the autumn of 1995, G.N. Uspenskii and I.A. Shumilkin (research fellows of Ulyanovsk State University) found cranial bones of a large ichthyosaur on a foreshore of the bank of the Volga River at the child health center 18 km north of Ulyanovsk. The traces of enclosing rock indicate that the bones were washed out of the base of a pyroschist member of the *Dorsoplanites panderi* Zone. This was corroborated by an excavation performed in 1996, since the bone bed occurred on a level with a contact between light marl clay and the first member of dark bituminous clay, which is the boundary between beds 8 and 9 (after Gerasimov and Mikhailov, 1966). The excavation performed by Ulyanovsk State University and specimens collected on the foreshore yielded a number of cranial bones, humeral girdle, forelimbs, and a large part of a vertebral column articulated with ribs. The accompanying fauna included the ammonite *Dorsoplanites panderi* (d'Orb.), rostra of the belemnite *Cylindroteuthys (Lagonibelus) magnifica* (d'Orb.), and several shark teeth.

The examination of the above ichthyosaurian bones shows that they belong to the genus *Otschevia* Efimov, 1998 from the subfamily Undorosaurinae (Arkhangelsky, 1999), since the forelimb contains five principal digits and the intermedium adjoins a facet on the distal epiphysis of the humerus. The type species of the genus *O. pseudoscythica* was described by Efimov from the *Ilowaiskya pseudoscythica* and *Dorsoplanites panderi* zones of the Volga region near Ulyanovsk. Arkhangelsky (1998, 2000; Pervushov *et al.*, 1999) distinguished the other species of the genus *O. zhuravlevi* from the *Dorsoplanites panderi* Zone of the Saratov and Samara regions. The examination of the forelimbs and humeral girdle of the new find shows a number of substantial differences from the members of *Otschevia* described earlier; this provides the basis for the establishment of a new species. Certain features of this species indicate that the diagnoses of the family Undorosauridae, the subfamilies included in the latter, and the genus *Otschevia* should be revised.

SYSTEMATIC PALEONTOLOGY

Family Undorosauridae Efimov, 1999

Subfamily Undorosaurinae Efimov, 1999

Genus *Otschevia* Efimov, 1998

***Otschevia alekseevi* Arkhangelsky, sp. nov.**

Etymology. The species is named in honor of late geologist A.V. Alekseev from Ulyanovsk.

Holotype. Ulyanovsk Regional Museum (URM), no. 56702, fragmentary skull, humeral girdle, forelimbs, vertebral column, and ribs; Ulyanovsk Region, Ulyanovsk District, child health center, 18 km north of Ulyanovsk, right bank of the Volga River; Upper Jurassic, Volgian Stage, *Dorsoplanites panderi* Zone.

Description (Figs. 1–3). The following cranial bones are available: an isolated basisphenoid, occipital condyle, supraoccipital, both stapedes, both quadrates,

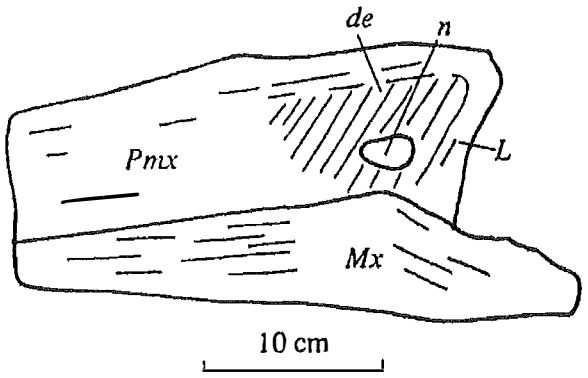

Fig. 1. *Otschevia alekseevi* sp. nov., holotype URM, no. 56702, cranial fragment from the region of the left naris. Designations: (*de*) depression, (*L*) lachrymal, (*Mx*) maxilla, (*n*) naris, and (*Pmx*) premaxilla.

Ex Libris

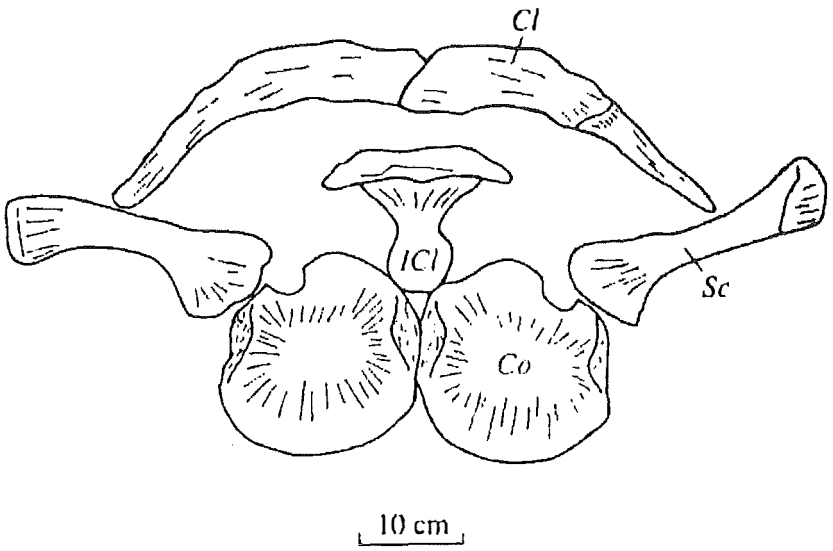

Fig. 2. *Otschevia alekseevi* sp. nov., holotype URM, no. 56702, humeral girdle, ventral view. Designations: (*Cl*) clavicle, (*Co*) coracoid, (*ICl*) interclavicle, and (*Sc*) scapula.

fragmentary jugal, fragmentary postorbital, region of the nares, several strongly deformed roof fragments, and upper and lower jaws.

Only the posterior part of the basisphenoid is preserved. It contains the oval foramen (1.2 cm wide and 0.5 cm high) and facets for the basipterygoid processes; the latter are elongated to a greater extent than those of *Ichthyosaurus* (McGowan, 1973, p. 11, text-fig. 1). McGowan (1973, p. 11, text-fig. 1) interpreted a similar foramen as the carotid foramen. However, the fact that this is a united foramen casts doubt on the correctness of such an interpretation. The occipital condyle is stout, 9.3 cm wide, and 7.7 cm deep. The supraoccipital is fragmentary and strongly deformed. The structure of the stapedes is typical of ichthyosaurs, each is 8.3 cm long. The right quadrate is better preserved than the left counterpart; it is 14.5 cm long. The articular facet for the mandible is subtriangular and 10.7 cm long. The right quadrate fused with the squamosal, a small fragment of which is preserved.

The region of the left naris is relatively completely preserved (Fig. 1). The fragment is 32.1 cm long. At the nares, the skull is approximately 18 cm deep. The nares taper anteriorly, are subtriangular, and are located in depressions. They are 3.2 cm long and 2.3 cm high. The sutures between the bones are barely visible. The dorsal margin of the nares is formed by the nasal, forming a well-pronounced crest above the depression; the anterior and posterior margins are formed by the premaxilla and the lachrymal, respectively. The maxilla does not contribute to the formation of the nares. The dental groove contains eight fragmentary teeth. They are probably from 4 to 4.5 to 6.5 cm high. Among other fossils, there is a 20.1-cm-long fragment of the anterior rostral section of the upper jaw.

The mandible is presented by only three fragments of the left ramus. Two fragments belong to the anterior section of the dentary. Approximately at the midheight of the lateral surface, there is a groove containing a series of barely visible foramina for the mandibular ramus of the trigeminal nerve. The third fragment belongs to the middle part of the lower jaw. Judging from its measurements, the mandible under the nares is approximately 11.8 cm deep. The dental groove is damaged in the mandibular fragments considered.

Sixty vertebrae are preserved; most of them are articulated with each other. The atlas and axis are fused; the sutures between them are indiscernible. The two vertebrae together are 5.8 cm long and 7.7 cm high; the atlas is 8.6 cm wide, and the axis is 9.2 cm wide. Ventrally, the vertebrae weakly taper. The diapophyses fused only with the surface for the attachment of the neural arches and lack contacts with the anterior edge of the centra, the parapophyses merged with the latter. Ten anterior thoracic vertebrae are available; five retained the neural arches. The diapophyses and the parapophyses are round or rounded oval in outlines. The diapophyses merged with the area for the neural arch and the anterior edge of the vertebral centrum; the parapophyses merged with only the anterior edge of the centrum. The vertebral centra are subcircular in cross section, 7.5–8.0 cm high, 7.4–8.6 cm wide, and 3.0–3.1 cm long. The thoracic region is represented by 33 vertebrae, 28 of which retained the neural arches. In one-third of these vertebrae (located just caudal to the anterior thoracic vertebrae), the diapophyses are fused with the areas for the neural arches. The vertebral centra become pear-shaped in cross section, 8.0–9.4 cm high, 3.2–3.6 cm long, and up to 7.4–8.6 cm wide. The only available posterior thoracic vertebra is clearly pear-shaped in cross section, 9.3 cm high, 3.6 cm long, and 9.8 cm wide. The diapophyses and parapophyses closely approach the anterior edge of the centrum and almost merge into the latter. Out of the 16 available vertebrae belonging to the anterior caudal region, five possess neural arches. They are 9.4–8.6 cm high, 9.7–

8.8 cm wide, and 3.5–2.9 cm long. The posterior caudal vertebrae are absent. The diapophyses become isolated from the facets for the neural arches beginning with vertebrae 23–24. The diapophyses are positioned below the middle of the centrum beginning from vertebra 31; the parapophyses, from vertebrae 15–16. The diapophyses and parapophyses approach each other and merge beginning from vertebra 47. The material includes 56 ribs, varying in the extent of preservation.

The humeral girdle is completely preserved (Fig. 2). The coracoids are stout and subcircular and have the anterior incisure. The right coracoid is 19.5 cm long and 18 cm wide; the left bone is 19.1 cm long and 17.8 cm wide. The medial articular surfaces are subtriangular (the apex is directed ventrally) because of the presence of a well-pronounced and stout ridge extending from the medial edge to the lateral edge of the ventral side. In the medial part, the bones are 6.3 cm thick. The dorsal surface of the coracoids is flat. The attachment area for the scapula and articular surface for the humerus are weakly oblique anteriorly. In situ, the bones were in natural articulation.

The scapulae are relatively narrow and only weakly expanded ventrally. The right scapula is 23.6 cm long, and the dorsal and ventral surfaces are 6.4 and 9.3 cm wide, respectively; the left scapula is 24.1 cm long, and the dorsal and ventral surfaces are 6.9 and 10.3 cm wide. The acromion is small. The incisure between the acromion and the articular facet for the coracoid on the right scapula is weak; on the left counterpart, it is absent.

The clavicles are stout. The right and left bones are 28 and 32 cm long, respectively. In the region of the medial articulation, they are 6 cm wide. In the middle part of the right clavicle, there are traces of bone fracture during the animal's life, i.e., a knob (secondary osseous–cartilaginous expansion) formed as a result of fester. Subsequently, this resulted in the formation of a false joint.

The interclavicle is T-shaped, as those of all advanced ichthyosaurs. Posteriorly, it is strongly flattened and expanded. The lateral rami weakly curve posteriorly. The bone is 13.6 cm long, and the distance between the endings of the lateral rami is 17.9 cm.

The left fin (Fig. 3) is relatively completely preserved. The bones are in a natural articulation. The humerus is 15.4 cm long. The proximal and distal epiphyses are 10.4 and 10.6 cm wide, and the diaphysis is 8.5 cm wide. The proximal epiphysis is trapezoid in cross section. The epiphyses are not twisted with reference to one another. The anteroventral surface of the humerus bears a well-pronounced deltopectoral crest. A stout and long (approximately 9.5 cm long) dorsal crest obliquely extends to the anterior to the facet for the radius. The distal epiphysis of the humerus has four facets for the radius, intermedium, ulna, and the basale distale of digit 5. The facets are 4.7, 3.0, 4.0, and 1.0 cm long, respectively. Anterodistally, the radius provides

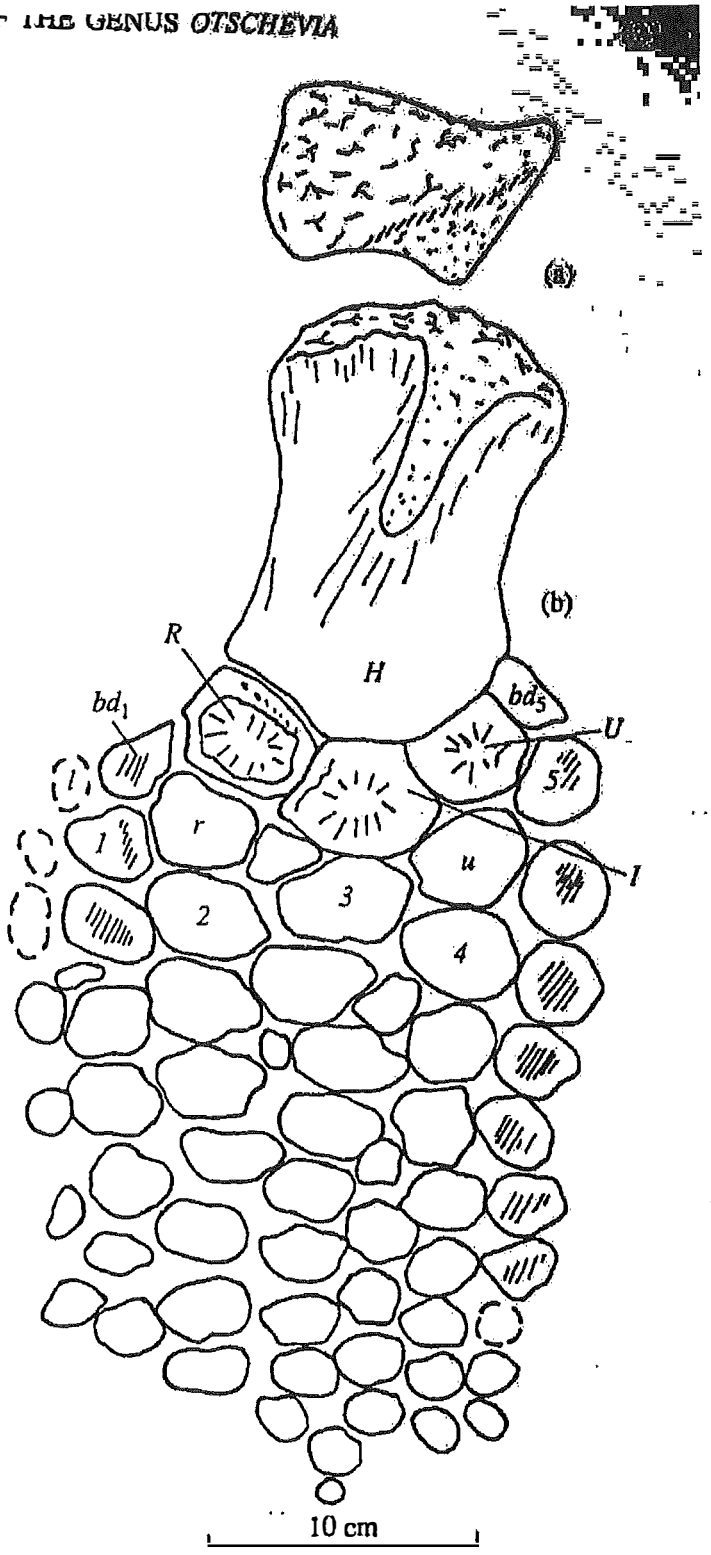

Fig. 3. *Otschevia alekseevi* sp. nov., left forelimb, holotype URM, no. 56702: (a) cross section of the proximal epiphysis of the humerus and (b) dorsal surface of the limb. Designations: (bd_1) basal element of digit 1; (bd_5) basal element of digit 5; (*H*) humerus; (*I*) intermedium; (*l*) lageniformis; (*R*) radius; (*r*) radiale; (*U*) ulna; (*u*) ulnare; and (*1–5*) principal digits.

the attachment area for the basal element of digit 1 (located in the preaxial position); medially and distally, the radius adjoins the intermedium and the radiale, respectively. Digit 2 deviates from the radiale. The

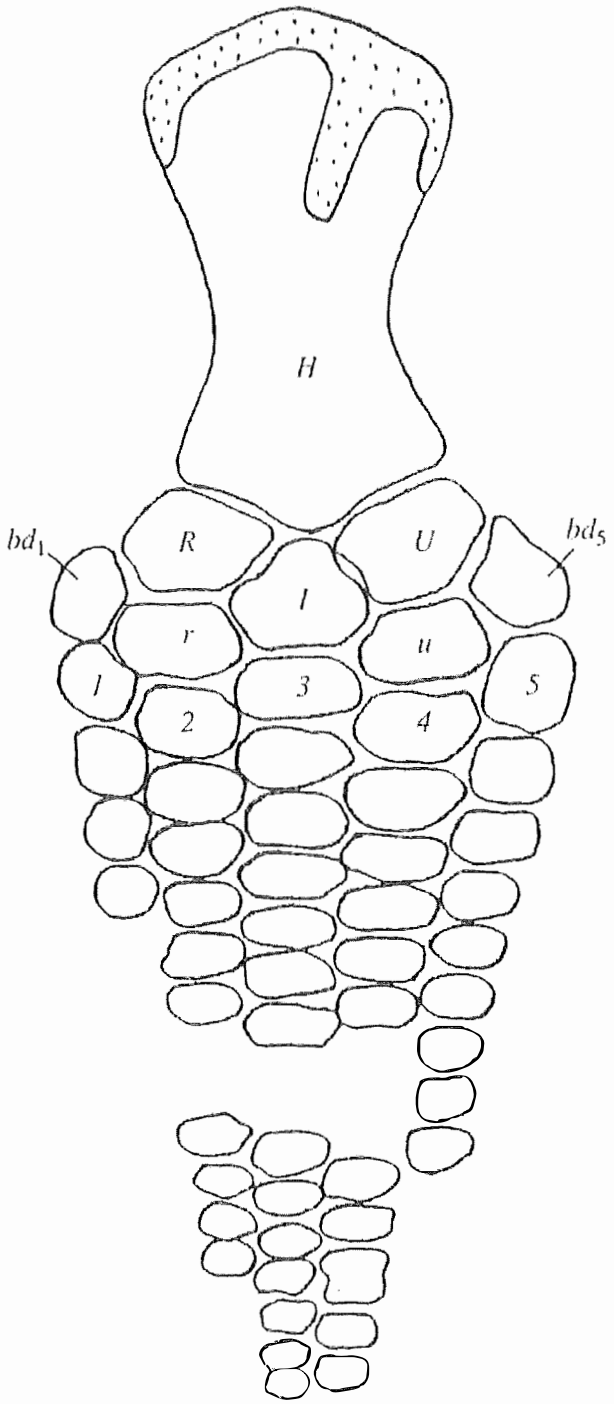

Fig. 4. *Otschevia pseudoscythica* Efimov, 1998, left forelimb, dorsal surface (after Efimov, 1998, modified). For designations, see Fig. 3.

intermedium forms an extensive attachment area for the humerus and adjoins the ulna, ulnare, and (distally) the basal element of digit 3. Anterodistally, the intermedium adjoins a supplementary ossicle that is located between the radiale and the basale distale of digit 3. Thus, in the specimen under study, the radiale lacks direct contacts with the intermedium.

The right limb is characterized by the same structural pattern; in particular, the facet on the intermedium for the supplementary ossicle is developed to an even greater extent. The presence of such supplementary ossicles is probably an individual skeletal anomaly of ichthyosaurian forefins. Appleby (1979, text-figs. 1 and 2) described similar elements in *Ichthyosaurus* and attached taxonomic significance to this parameter; however, the latter was not corroborated by subsequent studies. In each forefin of the new species, digit 3 bifurcates. Distally, the ulnare has a facet for the basal element of digit 4. In addition to the articulation with the intermedium and ulnare, the ulna contacts with two elements of digit 5 (originating from the humerus and, consequently, occupying a postaxial position). An incompletely preserved prepollex is present; it is formed by small sesamoid ossicles. In addition, small supplementary ossicles are observed in the region of the digits. The elements of the epipodium and autopodium are rounded polygonal and extend mainly transversely.

Measurements. The animal body is approximately 5.25 m long.

Comparison. The new species differs from the other species of the genus by the presence of direct contact between digit 5 and the humerus. In addition, it is characterized by a weakly developed supplementary digit, a well-developed deltopectoral crest, and by a weak ventral expansion of the scapulae. *O. alekseevi* differs from *O. pseudoscythica*[1] by longer and broader forefins. In the type species, the ratio between the fin length and the trunk length [estimated on the basis of vertebral measurements given by Efimov (1997)] is approximately 0.11; in the new species, this ratio is approximately 0.15. In addition, *O. alekseevi* is characterized by a relatively short humerus with an expanded distal epiphysis, stout and long dorsal crest, and extensive articular area for the intermedium. The new species differs from *O. zhuravlevi* by nontwisted humeral epiphyses and the absence of crests for the attachment of muscles on the dorsal and ventral surfaces. A comparison with *O. volgensis* (Kazansky) is hampered by extremely poor preservation of material used for the description of this species (Kazansky, 1903; Efimov, 1997).

Remarks. *Otschevia* strongly resembles in forelimb structure *Caypullisaurus* discovered a year before from the Tithonian of Argentina (Fernandez, 1997). This genus was assigned to the Ophthalmosauria. However, the presence of four principal digits in the forelimbs, only one of which articulates with the intermedium (Motani, 1999, text-figs. 7C and 7C'), indicates that this form should belong to the family Stenopterygiidae. I think that the interpretation of the forelimb elements of *Caypullisaurus* should be changed (Figs. 5c and 5d). It is clear that *Caypullisaurus* has additional rows of ossicles and the total number of digits is more than five. Therefore, it seems unlikely that this is

[1] The interpretation of the fin structure proposed in the present study (Fig. 4) differs from that in the original description. Efimov (1998, text-fig. 4) took the basalia distalia of digits 1 and 5 for the prepollex and pisiformis, respectively.

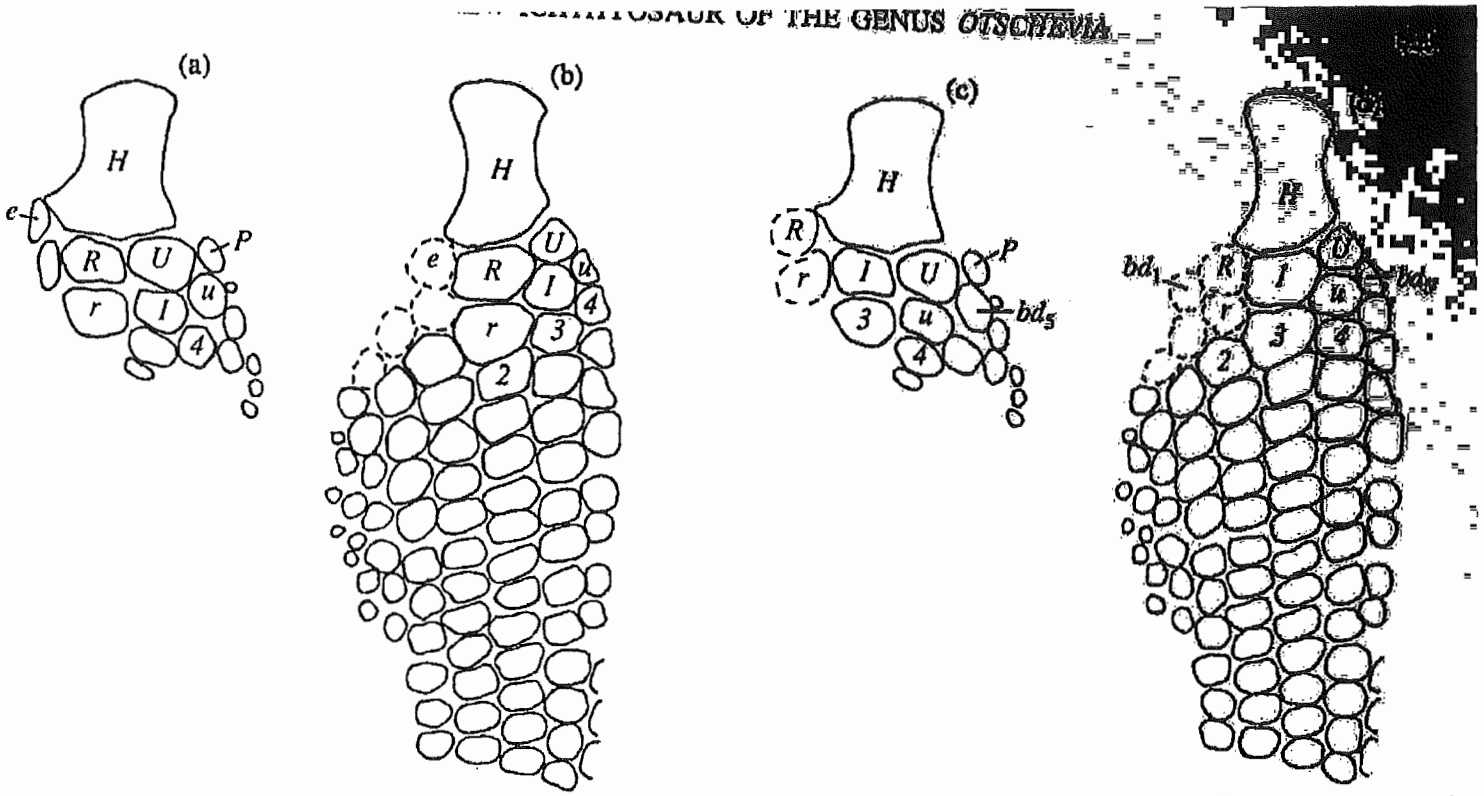

Fig. 5. *Caypullisaurus bonapartei* Fernandez, 1997, forelimbs: (a and b) interpretation after Motani (1999) and (c and d) original interpretation proposed in the present study. For designations, see Fig. 3.

accompanied by a reduction of the principal digits. In my opinion, the bone taken by Motani (1999) for the radius is in actual fact the intermedium, forming an extensive articular area with the distal epiphysis of the humerus, and the true radius was taken by Motani for the basal element of digit 1, designated in the present paper by the letter *e* (Figs. 5a and 5b). In the first forelimb, this bone is fragmentary (Fig. 5a); in the second, it is not preserved (Fig. 5b). Thus, the forelimbs of *Caypullisaurus* most likely contained the entire set of five principal digits (digits 1 and 5 were in the preaxial and postaxial positions, respectively), an incompletely developed prepollex, and an additional row of small sesamoid ossicles; this is probably characteristic of the Undorosauridae (Arkhangelsky, 1999; Efimov, 1999).

Our interpretation appears to be at variance with small measurements of the radius and large measurements of the intermedium and the facet for this bone on the humerus of *Caypullisaurus*, the forefin of which is completely preserved (Motani, 1999, text-fig. 7C; Fig. 5d). However, the fact that such an abnormal pattern may be an individual variant is substantiated by the structure of another incomplete fin (Motani, 1999, text-fig. 7C'; Fig. 5c). The figure shows that the facet for the intermedium (in our interpretation) on the distal epiphysis of the humerus and the intermedium itself are relatively small, whereas the articular surface for the radius is relatively large. At the same time, the general outlines of the intermedium are similar to those of *Otschevia zhuravlevi* (Arkhangelsky, 2000).

The interpretation of the *Caypullisaurus* forefins proposed in the present study implies the presence of five principal digits and the displacement of digits 1 and 5 from the axial position. Consequently, it substantiates the assignment of this genus, together with the Tithonian (Volgian) genera from the Volga Region, to the family Undorosauridae. The presence of a contact between the intermedium a d the humerus indicates close relationships between *Caypullisaurus* from Argentina and *Otschevia*, discovered a year later (Efimov, 1998). However, notwithstanding the similarity between these forms, it seems likely to recognize *Otschevia* as a separate genus (rather than a junior synonym) until new detailed morphological data on both forms are obtained.

It should be noted that the new species *Otschevia alekseevi* and *Caypullisaurus* possess supplementary digits. This feature is noncharacteristic of early (Jurassic) undorosaurids of the subfamily Undorosaurinae, in contrast to the late (Cretaceous) forms of the subfamily Platypterygiinae Bardet (nom. transl. Arkhangelsky, nov., ex Platypterygiidae Bardet, 1995).[2] However, in *Otschevia*, as in *Caypullisaurus* from the Tithonian of Argentina (presumably belonging to undorosaurids), the supplementary digits are weak and formed by small sesamoid ossicles, which are distinct from those of the Platypterygiinae (in which stout and polygonal phalanges of supplementary digits strongly expand the blade of the forefin). These features distinguishing the subfamilies should be included in the diagnoses.

Material. Holotype.

[2] Previously, Arkhangelsky (1999) erroneously indicated the subfamily Platypterygiinae Arkhangelsky.

ACKNOWLEDGMENTS

I am sincerely grateful to G.N. Uspenskii, I.A. Shumilkin (Ulyanovsk State University), O.E. Borodina, and E.G. Chernova (Nature Department of the Ulyanovsk Regional Museum) for their permission to examine the material described in this paper and for practical help.

This study was supported by the Paleontological Society International Research Program, 1999, project no. RGO-822-1.

REFERENCES

Appleby, R.M., The Affinities of Liassic and Later Ichthyosaurs, *J. Palaeontol.*, 1979, vol. 22, no. 4, pp. 921–946.

Arkhangelsky, M.S., On Ichthyosaurs from the Volgian Stage of the Volga Region near Saratov, *Paleontol. Zh.*, 1998, no. 2, pp. 87–91.

Arkhangelsky, M.S., On the Evolution of the Forefin Skeleton of Ichthyosaurs and the Phylogeny of the Group, *Vopr. Stratigr. Paleontol., Nov. Ser.* (Saratov), 1999, vol. 2, pp. 20–37.

Arkhangelsky, M.S., On the Ichthyosaur *Otschevia* from the Volgian Stage of the Volga Region, *Paleontol. Zh.*, 2000, no. 5, pp. 78–81.

Efimov, V.M., Late Jurassic and Early Cretaceous Ichthyosaurs from the Middle Volga and Moscow Regions, *Cand. Sci. (Geol.–Min.) Dissertation*, Saratov: Saratovsk. Gos. Univ., 1997.

Efimov, V.M., An Ichthyosaur *Otschevia pseudoscythica* gen. et sp. nov. from the Upper Jurassic Beds of the Volga Region near Ulyanovsk, *Paleontol. Zh.*, 1998, no. 2, pp. 82–86.

Efimov, V.M., A New Ichthyosaurian Family Undorosauridae fam. nov. from the Volgian Stage of European Russia, *Paleontol. Zh.*, 1999, no. 2, pp. 51–58.

Fernandez, M., A New Ichthyosaur from the Tithonian (Late Jurassic) of the Neuquen Basin, Northwestern Patagonia, Argentina, *J. Paleontol.*, 1997, vol. 71, pp. 479–484.

Gerasimov, P.A. and Mikhailov, N.P., The Volgian Stage and the Uniform Stratigraphic Scale of the Upper Part of the Jurassic System, *Izv. Akad. Nauk USSR, Ser. Geol.*, 1966, no. 2, pp. 118–135.

Kazansky, P., On Ichthyosaurian Bones Discovered in the Syzran District of the Simbirsk Province, *Tr. O–va Estestvoispyt. Imper. Kazan Univ.*, 1903, vol. 37, no. 3, pp. 1–33.

McGowan, C., The Cranial Morphology of the Lower Liassic Latipinnate Ichthyosaurs of England, *Bull. Brit. Mus. Nat. Hist., Geol.*, 1973, vol. 24, no. 1, pp. 1–109.

Motani, R., On the Evolution and Homologies of Ichthyopterygian Forefins, *J. Vertebr. Paleontol.*, 1999, vol. 19, no. 1, pp. 28–41.

Pervushov, E.M., Arkhangelsky, M.S., and Ivanov, A.V., *Katalog mestonakhozhdenii ostatkov morskikh reptilii v yurskikh i melovykh otlozheniyakh Nizhnego Povolzh'ya* (Catalogue of Localities of Marine Reptiles from the Jurassic and Cretaceous Beds of the Lower Volga Region), Saratov: Kolledzh, 1999.

View publication stats