ISSN 0031-0301, Paleontological Journal, 2006, Vol. 40, No. 4, pp. 434–437. © Pleiades Publishing, Inc., 2006.
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A New Dicynodont (Anomodontia, Eotherapsida) from the Upper Permian of Tatarstan

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Received April 14, 2004

Abstract—A new dicynodont genus and species, *Idelesaurus tataricus* sp. nov. (Cryptodontidae), from the Semin Ovrag locality (Tatarstan, Tetyushinskii District; Upper Permian, Upper Tatarian Substage, Severodvinian Horizon) is described. The skull patterns of the East European and South African Cryptodontidae and Aulocephalodontidae are compared from the morphofunctional point of view.

DOI: 10.1134/S0031030106040095

Key words: Dicynodontia, Cryptodontidae, new taxa, Upper Permian, Tatarstan, Eastern Europe, Russia.

INTRODUCTION

Late Permian dicynodonts of Tatarstan are a group of low-cranium dicynodonts which are similar in cranial morphology to the earlier genus *Australobarbarus* Kurkin, 2000 from the Kotelnich locality (Kurkin, 2000). The low-cranium dicynodonts are characteristic of most of the Sokolki Assemblage (Kotelnich and Ilinskoe subassemblages) of terrestrial tetrapods of eastern Europe (Golubev, 1996; Ivakhnenko et al., 1997; Kurkin, 1998). All of them are similar in general skull proportions. The skull is low, with an elongated postorbital region, a wide occiput, and, as a result, wide temporal fossae; the greatest skull width is in the posterior third, so that the skull is frequently subtriangular in outline.

SYSTEMATIC PALEONTOLOGY

Family Cryptodontidae Owen, 1859

Genus *Idelesaurus* Kurkin, gen. nov.

Etymology. From the Tatar *Idel* (Tatar name of the Volga River) and the Greek *sauros* (lizard).

Type species. *Idelesaurus tataricus* sp. nov.

Diagnosis. Medium-sized dicynodont. Skull almost isometric in outline, ratio of skull length to maximal width 0.9 : 1. Upper jaw with caniniform outgrowths or tusklike canines, sometimes large canines. Caniniform outgrowths directed anteroventrally. Jaws without rudimentary teeth. Preorbital region almost twice as long as orbital region. Nasals with very small lateral expansions, not forming pronounced lateral projections.

Species composition. Type species.

Comparison. The new genus is distinguished from the majority of genera presently assigned to the morphologically similar families Cryptodontidae and Aulocephalodontidae (*Oudenodon, Rhachiocephalus, Pelanomodon*, and *Australobarbarus*) by the skull shape, the width of which is substantially greater than the length. In the genus *Tropidostoma*, this ratio is not known; however, the new genus differs from *Tropidostoma* in the absence of rudimentary teeth in the jaws. In addition, it differs from *Aulacephalodon*, which is most similar in skull proportions (see Cluver and King, 1983, pp. 227–230), in the much longer preorbital region and very weakly developed lateral expansions on the nasals.

Idelesaurus tataricus Kurkin, sp. nov.

Etymology. From the Tatarian Republic.

Holotype. PIN, no. 156/114, skull without lower jaw; Tatarstan, Tetyushinskii District, Semin Ovrag locality; Upper Permian, Upper Tatarian Substage, Severodvinian Horizon.

Description (Figs. 1, 2). The most completely preserved skull (holotype PIN, no. 156/114) belongs to a medium-sized dicynodont; its basicranial length is 230 mm, and the greatest skull width (at the occipital plane) is 280 mm. The skull is subtriangular in horizontal projection, with a tapering snout. The preorbital region of the skull is short. The dorsal process of the premaxilla is not long, hardly reaches the middle of the nares. The nares are large, with clearly outlined posterior and ventral borders, which are strengthened by a ridge on the premaxilla and maxilla. The maxilla has a depression in the posteroinferior corner of the naris. This structure is particularly clearly pronounced in the holotype. The depression is conical funnel-shaped and longitudinally extended. In the area of the alveolus of the canine, the maxillae have small expansions on the lateral surface. The maxillae have relatively small canines, circular in cross section, which are directed almost anteriorly, so that their longitudinal axes, along

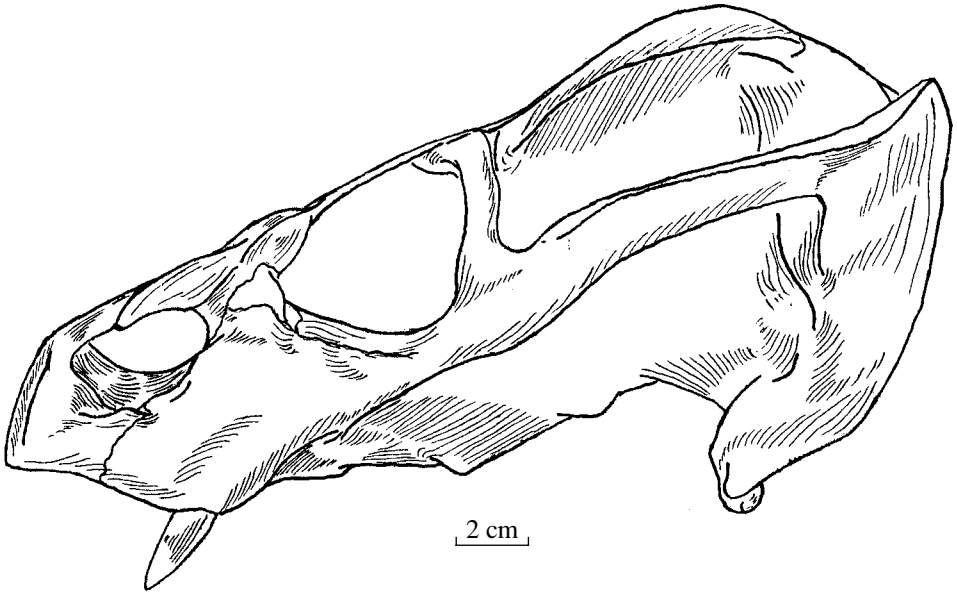

Fig. 1. *Idelesaurus tataricus* sp. nov., holotype PIN, no. 156/114, skull, lateral view.

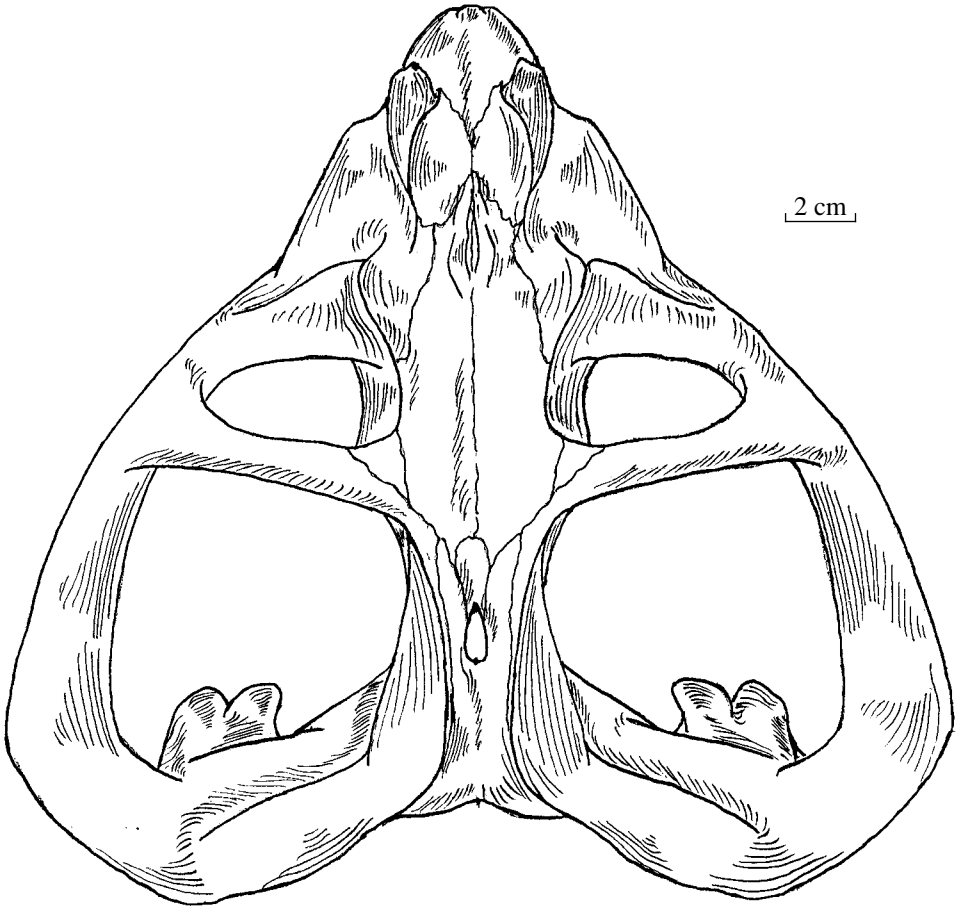

Fig. 2. *Idelesaurus tataricus* sp. nov., holotype PIN, no. 156/114, skull, dorsal view.

with the zygomatic process of the maxilla, form a gentle arch. The nasals have relatively small, elongated conical rugose bulges. The frontals are long, wedged in between the nasals, reaching the level of the posterior border of the nares. In the anterior part, the frontals have relatively small longitudinal tubercles, which are separated from each other by a narrow, relatively deep groove that extends from the place of contact with the nasals to the line of the anterior third of the orbit. The lacrimal is relatively small, its anterior process terminates short of reaching the naris. The prefrontals are relatively small, form the anterodorsal orbital rim, and have moderately developed rugose conical expansions. The orbits are large, oriented mostly anteriorly because the postorbital skull region is very wide. The postfrontals are small and their posterior processes probably do not come in contact with the parietals. The parietal region is approximately as wide as the interorbital region, although the minimum width of the parietal region is at the postorbital arches, while, posteriorly, the skull expands abruptly. The narrowest place of the interorbital region is just anterior to the postorbital arches; anteriorly, it increases in width. The parietal foramen is large, longitudinally extended, oval in shape. The preparietal is relatively small; its anterior margin is rounded, reaches the line of the posterior border of the postorbital arches and forms the anterior quarter of the border of the parietal foramen. Anteriorly, the parietals do not reach the level of the postorbital arches, they are clearly visible from above, and form a short flat groove posteriorly. The elevated medial margins of the parietal processes of the postorbitals along with the lateral margins of the parietals form low, gently sloping crests. The postorbitals substantially widen posteriorly, forming subtriangular areas, which probably provided attachment for the superficial portions of the parietal musculature.

M a t e r i a l. In addition to the holotype, the type locality yielded a skull without a lower jaw (PIN, no. 156/4) and lower jaws (PIN, nos. 156/16, 156/17).

DISCUSSION

The genus *Idelesaurus* is undoubtedly closely related to *Australobarbarus* (see Kurkin, 2000). It is probably a more advanced representative of the same evolutionary lineage, since the basic character distinguishing it from *Australobarbarus* is the loss of all postcanines. These genera are similar not only in skull proportions, but also in a number of structural characters. In particular, the canines of *Idelesaurus* are directed almost anteriorly and along with the zygomatic processes of the maxilla form in horizontal projection a gentle arch. The new species is rather similar in these characters to *Australobarbarus kotelnitshi* Kurkin, 2000, the holotype of which lacks canines, however, its caniniform outgrowths are directed similarly (Kurkin, 2000). The abrupt widening of the skull in the postorbital region is associated with an unusual orientation of the orbits, which basically face anteriorly. This results in considerable constructional and physiognomical similarity to the genus *Australobarbarus*.

This extraordinary set of characters probably reflects functional features of the entire cranial design and, thus, implies a syndrome of characters that describes a distinct group of forms. In addition to *Australobarbarus*, this group includes a number of South African genera traditionally assigned to two families, the Cryptodontidae Owen, 1859 (*Tropidostoma* Seeley, 1889 and *Oudenodon* Owen, 1876) and Aulacephalodontidae Toerien, 1953 (*Aulacephalodon* Owen, 1844 and *Pelanomodon* Broom, 1936). The group Cryptodontia was originally established by Owen as a family that comprised dicynodonts without canines, in particular, the genus *Oudenodon*. The morphologically similar genus *Aulacephalodon*, which, however, has canines in the upper jaw, was assigned to the family Aulacephalodontidae. Subsequently, it was found that the presence or absence of canines in such taxa as *Aulacephalodon* could have been a manifestation of sexual dimorphism (Tollman et al., 1980). The genus *Pelanomodon*, which is assigned to the family Aulacephalodontidae, lacks canines. The variants distinguished by the presence–absence of canines are also recorded in *Australobarbarus* (Kurkin, 2000). The same is true of the new genus from the Upper Permian of Tatarstan; some individuals have canines, while others do not. The forms without canines usually have more or less developed caniniform outgrowths of the maxillae. Thus, the presence (or absence) of canines should not be taken as a significant taxonomic character that divides low-cranium dicynodonts into two families. Moreover, representatives of these families have a number of other characters uniting them into the same group (Keyser, 1975; Cluver and King, 1983; Brink, 1988). The genera *Oudenodon, Aulacephalodon*, and *Pelanomodon* are similar in the wide parietal region (in *Oudenodon*, the postorbitals closely approach each other, but the parietals are exposed in the depression between them) and opposed to *Rhachiocephalus*, the parietal region of which is narrow and the parietals form a crest. In contrast to *Pelanomodon*, which lacks anterior ridges on the palatal surface of the premaxilla, the other three genera have well-pronounced parallel ridges. In *Rhachiocephalus* and *Aulacephalodon*, the parietal foramen is located on a special tubercle, while *Oudenodon* and *Pelanomodon* lack such a tubercle. All the above shows that, on the one hand, representatives of both families show overlapping sets of characters, in particular, those included earlier in the diagnoses of groups (King, 1988) and, on the other hand, all of them (including *Australobarbarus* and *Idelesaurus*) share a general syndrome of characters of dicynodonts with low and wide skulls and probably deserve to be assigned to one group.

All genera included in the families Cryptodontidae and Aulacephalodontidae realize the same general cranial design, i.e., they are dicynodonts with a low and

wide skull. At the same time, different genera represent distinct variants of this cranial design. The genera *Tropidostoma* (Keyser, 1973) and *Australobarbarus* show the basic design, while *Oudenodon* and *Idelesaurus* are the advanced taxa that are most similar to them. This similarity is rather profound and is manifested in the arrangement of the parietal region and the symphysis of the lower part. The two genera are also similar in the presence of paired longitudinal ridges on the premaxilla, the absence of a parietal tubercle, the absence of a transverse crest on the snout at the level of prefrontals, the presence of narrow areas on the dorsal surface of the dentaries and deep grooves posterior to them.

When considering the evolution of the skull design in connection with the improvement of the jaw apparatus and the growth of the muscle bulk (Watson, 1948; Crompton and Hotton, 1967; De Mar and Barghusen, 1972), the two genera seem to improve the ancestral design in parallel by widening the occipital skull region along with the development of the superficial portions of the parietal musculature. The other genera substantially deviate from this general trend. *Aulacephalodon* has acquired a higher skull (particularly, in the postorbital region), which is probably connected with a more vertical position of a certain portion of the jaw muscles and, consequently, with the improvement of the direction of forces exerted on the lower part when the mouth is closed. In this respect, *Aulacephalodon* resembles dicynodontids that have a high skull. At the same time, it retains the trend towards lateral expansion of the musculature; its skull is wide, though in the middle part of the postorbital region rather than in the occipital region. In this case, in contrast to *Oudenodon* and *Idelesaurus*, the profound portions rather than the superficial portions of the adductors are probably predominantly developed. Finally, *Rhachiocephalus* followed the route of elongation of the initial skull, increasing the space for the jaw muscles by the elongation of the temporal fossa (with the greatest width of the fossa in the occipital region). As a result, the muscles acquire a more horizontal position. A comparison between *Aulacephalodon* and *Rhachiocephalus* suggests that the differences in their skull patterns are probably connected with the improvement of different stages of food treatment. *Aulacephalodon*, with a more vertical position of its jaw muscles and extremely shortened preorbital region of the skull, increased the crushing force of food treatment, particularly at the stage of food fragmentation; it probably consumed relatively coarse plants. *Rhachiocephalus*, on the contrary, had a more horizontal position of the jaw muscles, which provided a more efficient use of longitudinal jaw movements during food processing. The elongated preorbital region increases the area of the premaxilla, the cornified surface of which provided a longer and, hence, more efficient food treatment. It is possible to assume that *Rhachiocephalus* consumed relatively soft food. Additional data for or against the above hypotheses could have been obtained by a special comparative study of the jaw articulation and areas for muscle insertion on the lower jaw of these genera.

ACKNOWLEDGMENTS

This study was supported by the Russian Foundation for Basic Research (project no. 22-15-97754) and the Board of the President of the Russian Federation (project no. NSh-1840.2003.4).

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