Remains of stegocephalians from the Kama River

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In 1928 Prof. M. E. Nohinskii sent to the North Dvina Gallery of the Geological Museum, a collection from Kazan University, the collection gathered in the Kargalinsk mines and at various points in the vicinity of the Caucasus. The collection consisted of fragments of the bones of Permian vertebrates, among which were pieces of a skull and a femur, referable to Stegocephalia, which were graciously given to me to be studied by A. P. Hartman-Weinberg, curator of the North Dvina Gallery. The bones have been determined with difficulty, but in view of the great geographical interest they deserve a short comment.

(1) Fragment of a skull. The Kama River, Vandovka. The tow-path near excavation 52. The specimen was enclosed in a compact concretion of a very hard, fine-grained sandstone of yellowish-grey color. The sandstone petrographically is very much like the concretionary sandstone from the North Dvina excavations of Amalitskii. Concerning the stratigraphic characteristics of this discovery, Prof. Nohinskii points out that: "The horizon can be determined with difficulty, since the bone was found on the tow-path. Above Vandovka along the banks of the Kama are [being] developed excavations of the Permian system. On the tow-path there crop out marls faunistically characteristic of the spiriferous horizon. Above these lies a strong layer of frequently and alternately lensing [lit: wedging one upon the other] grey, brown, pinkish-tan and greenish marls, clays, and sandstones with hard seams of yellowish-gray sandy oolitic limestones with marine fauna of a *tsehkshteynovovo* type. In the midst of the clays are found seams containing remains of Anthracosidae, fish, and shells of *Lingula orientalis* Gol. According to the age of the deposit it is possible to correlate this layer with the marine deposits of the conchiferous horizon P_2 of the region near the Caucasus." Thus, to definitely ascribe the discovery to this or that layer mentioned is impossible. In all

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probability the fragment was washed out from the above-mentioned or a similar continental Permian layer of marls, clays, and sands, where concretions are often found.

The fragment (fig. 1 and Table I, A, B) shows a rather crushed piece of the left temporal part of a skull belonging to a huge labyrinthodont. The break proceeded in two directions: longitudinally in the articulation of the left pterygoid with the parasphenoid, and crosswise in front of the edge of the infratemporal cavity.

A part of the dermal bones on the dorsal surface of the skull fragment was exposed to the elements and subjected to weathering.

Among the bones of the roof of the skull there were distinguished a part of the tabular forming the deep aural cavity, the large massive squamosal, an almost equally large quadratojugal, and poorly preserved parts of the jugal and maxilla.

Fig. 1. Fragment of skull from below 1/2 natural size: pt.- the palatal branch of the pterygoid, rqpt. - quadrate branch of the pterygoid; mx - mallary; tab. - tabulare q. - quadrate, qj. - quadratojugal; parsp. - plane of the parasphenoid articulation.

THE ROUGH SCULPTURE OF THE CELL-BRAIN-FISSURE TYPE

The ventral surface of the fragment (Fig. 1) possesses almost all of the left pterygoid, quadrate, and quadratojugal. The palatal branch of the pterygoid is of considerable width with the outer edge slightly turned downward. From the front it [the branch] is broken at the very beginning of the suture with the ectopterygoid, adjoining to the ill-preserved, opaque bony part of the edge of the infratemporal cavity. To this bone mass from the outside, there adjoins the tiny piece of maxilla bearing traces of the two last teeth of the jaw process. In its entire expanse the pterygoid bears no kind of traces of sculpture or shagreen.

The quadrate branch of the pterygoid is of considerable length. Its curved and thickened edge toward the top traverses into the thin layer that joins with the descending ridge [“comb”] of the squamosal, and that forms the outer wall of the division of the inner ear.

Unfortunately, this part of the skull is disturbed and the details are spoiled. In the right rear edge of the infratemporal cavity the quadrate branch adjoins the quadrate on the inner side by means of an oblique suture, the branch extending backward by means of a slight outgrowth. The quadrate is massive and well developed. Its articular surface is greatly distorted as a result of deformation and mineralization. By means of an indiscernible suture the quadrate fuses with the quadratojugal, which forms the inner part of the maxillary muscle [attachment] system. The available remains of the tabular bear remains of the inner processes [lit. "combs"] of the powerful tabular descending process.

The overall length of the fragment from the rear edge of the quadrate to the middle of the transverse break is 185 mm. By comparing the size of the infratemporal cavity of our animal in respect to these cavities to the skull in the various labyrinthodonts, it can be established that the fragment belongs to a skull about 1/2 meter in length.

The length of the quadrate branch of the pterygoid permits us to conclude that this animal possessed maxillary muscles located rather far back judging by the wide palatal branch of the pterygoid (in the region) at the edge of the infratemporal cavity, its front outgrowth is it extended rather far forward toward the palatine.

Just as both these traits are extremely characteristic in the evolution of the specialization of the Rhachitomi-Stereospondyli series they also serve as an index to the known primitiveness of our specimen. Being guided by all these data, it is possible to conclude that our fragment belonged to a large, late Rhachitomi in the family Rhinesuchidae with the skull having maxillary muscles extending far back and large infratemporal cavities. The aural depressions are of small size, but deep. The teeth of the maxillary series came up to the edge of the infratemporal cavity.

The reduction of the paroccipital was already considerable, which fact is indicated by the processes [lit. combs.] of the powerful tabular descending process. Because of the distribution of the various Rhachitomi types in the Permian it is fitting to suppose that our discovery had to originate from the upper divisions of the Permian P_3 and by no manner of means lower than the very uppermost coniferous horizon of the Kazanian series.

2. Femur. The Kama River, north Kama Valley, is the base of the coastal slope about one verst [about 1.067 km] below the village. The bone, in excellent preservation, was taken from a very soft and loose sandstone of a greenish-gray color. According to the

description of Prof. Nohinskii this sandstone belongs to the continental facies of the coniferous horizon of the Kazanian series. In the region of the Kama valleys, there were discovered no traces of marine fauna, but on the Asha River 11 km south, in the varicolored marl series similar to the layers cutting the sandstone of the Kama valleys, Professor Nohinskii turned up a layer containing the characteristic forms of the coniferous horizon of the Kazanian series.

Fig. 2. Femur from the outside: cf. – head of the femur; tcd. – tibial muscle attachment; fcd. – fibular muscle attachment.

Fig. 3. Femur from the inside and side: t – trochanter; ft. – trochanteric fossa, ac. – process [lit. comb] of the flexor [“driving”] muscles; lf. – pit for the ligaments of the knee joint. The rest of the explanations are the same as for Fig. 2.

The bone represents a left femur of stegocephalian type, and is 110 mm long (Table I, C.D.). The front surface of the proximal part is destroyed almost up to the middle of the diaphysis (in the photograph it is filled in with plastic material). The femur is proportioned like a light type with very tall ossified epiphyses. The distal end is divided by a deep groove bending to the rear into two distinct muscle attachments [*Myshcheka*], of which the fibular one is longer than the tibial (Fig. 2.).

The articulating surfaces of the muscle base are (beveled) cut back. The head is modeled much more delicately than that of the flat-rounded type [lit. “flatly-rounded type”] and is located on the vertical axes of the hip.

From the inner side of the femur from the upper edge of the head up to the end of the first one-third of the bone is located the massive trochanter which is found almost exactly on the vertical midline. The trochanter proceeds downward into a high sharp ridge to the middle of the distal epiphysis that branches into two (low) short ridges with very broad bases. These ridges run along the inner sides of the muscle-bases and are obliterated near the border of the articular surfaces. From the right (inner aspect) side of the trochanter runs the transverse ridge forward to the external surface of the femur; the transverse ridge marks the lower boundary of the strongly marked trochanteric fossa. The

entire bone is covered in various places with little furrows for securing muscles and ligaments. On the outward side of the fibular muscle base there is a rather large pit, evidently , for the ligaments of the knee joint.

It is not possible to ascribe the described femur to any of the known forms, before obtaining new material from these same places. The postcranial skeleton of labyrinthodonts as a general thing has been very poorly studied and there is a decided lack of available comparative material.

I am inclined to think that our femur belongs to an agile and very highly differentiated form of labyrinthodont, since it has the characteristic of stegocephalian structural proportions.

Out of all the Permian reptiles bearing similarities to our femur, it is possible to point out only the group Pelycosauria. However the general great massiveness and the modeling of the proximal and distal epiphyses, the oblique (in relation to the vertical axis) position of the head and trochanter, and the great fore-aft flattening, all distinguish the femurs of reptiles from our specimens. Generally the reptiles of Permian age are distinguished by the massive and comparatively short bones of the limbs, as yet not having developed the light skeleton.

The great activity of our form is the basis for the general modernity (very great for stegocephalians) of the femur, good development of ligaments, of powerful ridges on the trochanter and of flexor and extensor muscles. The latter is indispensible for coping with (overcoming) the considerable time during which the femur was supported in a leaning position in a terrestrial animal, and for developing a powerful push of the adductor muscles backward during swimming in the case of an aquatic form.

According to the general configuration, the femur decidedly reminds us of the femur in the family Dissorophidae, especially *Cacops*, being distinguished from them only by a somewhat greater differentiation of the epiphyses. The well-ossified epiphyses of our specimen are explained by the very old age of the individual.

All the above-mentioned facts mean that the continental “mute” [undescribed?] layers of the Kama-Kazan region hold within themselves a no less interesting fauna of vertebrates than those that existed before “the mute ones”, [i.e.] the north Dvina and the Vetluga varicolored series. The discoveries of the fragment of a huge labyrinthodont

skull and the exceedingly interesting femur in the continental layers of the Kama furnish us new data on the ever more clearly charted evolutionary-migratory path of development of the fauna of ancient vertebrates of Russi—from the Permo-Triassic and Upper Permian layers of the North Dvina region through the middle and lower Permian of the Urals into the Carboniferous Asiatic continental massif to Gondwana.

Without any doubt the outcroppings of continental Permian layers of the Kama region need an attentive faunistic examination during geological investigations.

Explanation of Plate:

A. Fragment of skull, view from above, 1/2 nat. size; sq. – Squamosal; j. – jugal; rqpt. – quadrate branch of pterygoid; qj. – quadratojugal; tab.– tabular; ia – aural depression.

B. Fragment of skull, view from below, l/2 nat. size; explanation, as above, and pt. – palatal branch of pterygoid; parsp – articulating plane of parasphenoid; x. – maxillary.

C. Femur, view from the front, little more than 1/2 nat. size.

D. Femur, view from the side and from the rear, l/2 nat. size.