

CEMETERY OF THE PERMIAN REPTILES

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In the Permian period that finished long before dinosaurs appeared, amazing creatures lived on the Earth. Huge unarmoured pareiasaurs, small weaselly "lizards" with enormous eyes, and sabre-toothed monsters, stuck half-way between amphibians and mammals. We know about these animals in many ways from unique locations in Russia. One of them is situated in the Kirov region, near the city of Kotel'nich.

[Right] Sculptural reconstruction of the pareiasaur *Deltavjatia vjatkensis*. The author of the sculpture is Andrey Skvortsov.

About 20 species of vertebrates, which were found in several Permian layers, are known from the location of Kotel'nich. These layers formed at different times. The most ancient of them is represented by strata of red siltstones. Bones of phytivorous dromasaur and dicynodonts as well as of predaceous theromorph theriodonts are found here. But more often you can come across remains of the primitive pareiasaur *Deltavjatia*, so-called after the letter of the ancient Greek alphabet, 'delta' and the river Vyatka. The thing is that the outline of the skull of this pareiasaurus, if you look at it from above, looks like the letter 'delta'.

Deltavjatia is the most ancient and the most primitive out of all pareiasaurus known in the territory of Russia. They were not of large size, and rarely reached more than two metres length. The characteristic feature of pareiasaurs is dermoossification or osteoderms. *Deltavjatia* has it less developed than the later species, for instance *Scutosaurus*. Some of the osteoderms were attached to the skull bones and to vertebral neural arches, the rest were situated in thickened skin. Dermoossification is one of the signs that indicate relationship of pareiasaurs with turtles. Some palaeontologists consider that osteoderms of pareiasaur-like reptiles could have accreted into a



* Original reference: Khlyupin, A. Yu. 2007. Cemetery of the Permian reptiles. *Paleomir*, **1**, 50-57 (in Russian and English). English version edited by Michael J. Benton, 2011.

united bony armour in the process of evolution. *Deltavjatia* differ from later pareiasaurs by a lighter and more gracile body. Probably they could move overland, something that according to some scientists' opinion, scutosaurs could not do.

[Below] A skull of the pareiasaur *Deltavjatia vjatkensis* from the Kotel'nich location

It is curious that in the location of Kotel'nich there are usually found absolutely complete skeletons of *Deltavjatia* and often in a 'living' pose, with the back upwards. Possibly, these animals perished sinking in viscous mud, when the level of water suddenly went up after pouring rains, and a solid substratum turned into a silted marsh. Thus, natural traps were created in which *Deltavjatia* was trapped. These animals were adapted for swimming and for



moving over- land. But in a marsh you can neither swim nor walk, and there is too little water there but the bottom is squashy. And pareiasaurs were dying. Their remains were covered by new layers of silt, and thanks to this, their skeletons are preserved perfectly. 255 million years after *Deltavjatia* perished, palaeontologists find in Kotel'nich not only their smallest bones, but even osteoderms of these creatures.

However, Kotel'nich is famous not only for ancient pareiasaurs. Locally, nycteroleters, small predators that looked like lizards, are well known too. "Nycteroleter" is translated as "night thief". This name was given to those extinct animals by the remarkable palaeontologist and writer, Ivan Antonovich Efremov. Efremov, studying the remains of many skeletons of nycteroleters that had been discovered in the 1930s in Middle Permian deposits, paid attention to the huge eye-sockets of these reptiles and supposed that they had a nocturnal habit, feeding on insects. Later, remains of nycteroleters, skulls and separate bones, were found in many Late Permian locations in Eastern Europe and South Africa. They were found also in Kotel'nich. The first "thief" discovery, an incomplete skull, a few maxillary bones and skeletal fragments, were made at the beginning of the nineties. The findings were passed to Moscow to the Paleontological Institute of the Russian Academy of Sciences (RAS). According to palaeontologist, Mikhail Feodosjevich Ivakhnenko, engaged in the studies and description of these fossils, a new genus and species of nycteroleter was discovered. He called it *Emeroleter*, which means "day thief", translated from the Ancient Greek.

In 1998 in Kotel'nich two complete skeletons of *Emeroleter* were found, the only complete skeletons of these parareptiles. One of them belonged to a small animal, probably a baby, and the other one to a bigger species. The skeletons were found at a distance of a few centimetres from each other and in the same positions: with the skull drawn in to the tail and hind legs. Most likely, both species died, being in a burrow in a dormant state or anabiosis.



Discovery of an *Emeroleter levis* skull in a piece of marl from the river Vyatka bank

Skeleton of a new species of nycteroleter, found at Kotel'nich, called *Emeroleter levis*

The skeletons of *Emeroleter* were already starting to turn into fossils, when the second layer of Permian deposits started to form in Kotel'nich, represented by sand lenses within the marl. Fossils of rather different animals were also found in this layer. Among them there were single bones of the amphibians *Dvinosaurus* and *Chroniosaurus*, as well as the pareiasaur *Proelginia*, more advanced than *Deltavjatia*. The animal world of Kotel'nich had changed, but the landscape, by all appearances, remained the same: the same marshy meadows and thickets of lush herbaceous vegetation.

Pareiasaurs remained the most typical inhabitants of this landscape. Even so, they looked a bit different from *Deltavjatia*. They became larger. Some species could reach six metres in length and as separate findings of isolated bones prove, this wasn't the limit. According to the constitution of the palatal part of the skull, pareiasaurs did not have separate buccal and nasal cavities. Apparently, *Proelginia* was the same as most reptiles in that it could not breathe and chew food at the same time. The eye-sockets should be mentioned among other special features of the skull: they were very large in pareiasaurs, just as in nycteroleters. But the eyes themselves seemed to have been small. Apart from their eye-sockets and nostrils, pareiasaurs had one further small opening in their skulls, which is called the pineal. The pineal opening is present in skulls of all Permian vertebrates. These animals had there an additional multifunctional sensory organ, which is sometimes called "the third eye" (by its construction it reminds one of a small eye).

The surface of the pareiasaur skull is torose, covered with osteoderms, diverse in shape. The biggest osteoderms are situated on the squamosal, parietal and nasal bones. Sometimes, large excrescences can be seen on the supraorbital bones and almost always on the base of the mandible. Hedonic glands, exposing specific slime for moisturizing the skin, were probably situated in cavities between the osteoderms. Maybe there were also venom glands to scare predators off.

The mode of life of pareiasaurs was similar to that of the hippopotamus: they spent most of the time in the water, occasionally coming out. They lived in herds, covering huge distances in search of food. *Proelginias* possibly fed on weeds, which they separated from the water with the

help of a peculiar dentition. Apart from rather petal-like teeth, pareiasaurs had multiple palatal teeth, which served for grasping bunches of plants.

It should be noted that, in spite of an abundance of fossil material, pareiasaurs are poorly studied. Many details of their structure, modes of feeding and reproduction are not clear yet. Probably, future findings at Kotel'nich will allow us to answer these questions. One thing is known without doubt: pareiasaurs were very specialized animals, occupying a strictly defined ecological niche. Maybe at the end of the Permian when the climate became dryer, that niche disappeared and it was a reason pareiasaurs died out.

большие расстояния в поисках пищи. Вероятно, проелгинии питались водорослями, которые отделяли от воды с помощью своеобразно устроенной зубной системы. Кроме зубов, похожих на лепестки растений, у парейазавров имелись многочисленные небные зубы, служившие для удержания пучков растений.

Стоит отметить, что, несмотря на обилие ископаемого материала, парейазавры изучены ещё явно недостаточно. До сих пор не ясны многие детали их строения, способ питания и размножения. Возможно, будущие находки в Котельниче позволят ответить на эти вопросы. Одно несомненно - парейазавры были очень специализированными животными, занимавшими строго определённую экологическую нишу. Возможно, в конце пермского периода, когда климат стал более сухим, эта ниша исчезла, что и стало причиной вымирания парейазавров.

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