HIBERNATION AS A FACTOR RESPONSIBLE FOR PRESERVATION OF PAREIASAURIA IN THE KOTEL'NICH LOCALITY

By D. L. Sumin*

[Abstract.] Two taphonomic complexes were distinguished in the clay layer exposed in the Kotel'nich locality of Permian tetrapods. Behaviorial factors (hibernation) are suggested to play the main role in forming mass burial of complete pareiasaur skeletons in life position.

Many researchers worked on pareiasaurs at the Kotel'nich locality on the River Vyatka up to 1990, as reported by I.A. Efremov (1955) and V.P. V'yushkov (1953, 1955), who paid attention to the absence there of large animals and small forms, including also young individuals of pareiasaurs. In 1990-1995 a joint expedition of the Paleontological Institute of the Russian Academy of Sciences and the cooperative society "Stone flower" under the leadership of N.N. Kalandadze and D.L. Sumin, revealed many small vertebrates, including young pareiasaurs. Thus the problem of a selective burial place of the large forms presented exclusively by one species (or, probably, two species), noted by previous researchers, is apparently resolved. However, with the accumulation of taphonomic observations, it has re-emerged. Within one and the same layer, in which the remains of large pareiasaurs occur, we are compelled to identify two taphonomic complexes, distinguished clearly between themselves by spatial localization, conditions of burial place, and systematic and size composition. The first complex includes the remains of large pareiasaurs; the second, the remains of other animals, mainly small and only sometimes of medium sizes.

For pareiasaurs, it is characteristic of the burial of complete skeletons that are in natural position, to be belly-downwards, and the majority show lateral curvature, but some are straight. The head is above the pelvis. Originally it seemed that the layer directly containing pareiasaurs did not differ from other parts of the corresponding layer. However, on more detailed research, it was possible to establish that this difference is not only in the sediment; bedding indicates the presence of lens-like bodies of approximately 1.5-2 m thickness and 3-5 m width. At the top of this lens is often observed thicker laminae, up to 5 mm, enriched with coarse-grained material, sometimes with large pebbles and the remains of small vertebrates in different preservation whose conditions of burial differ markedly from those in which there are remains of pareiasaurs.

The second complex contains, as a rule, scattered bones, incomplete skeletons and very rare complete skeletons. The average size of animals is about 30 cm; the maximum (only a few examples) — about 1 m. In the same complex we meet several specimens of pareiasaurs, representing disarticulated skeletons with highly weathered bones. The rock enclosing the remains of this complex, sometimes do not differ from surrounding parts of the bed, and sometimes also contain a large number of clay-calcareous pellets, associated with the skeletal remains, and in some cases represent small flat lenses up to 20 cm thick and at most 5 m wide.

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Layers located at the top of the large lens, containing remains of pareiasaurs, are a special case described above. Thus, within the limits of a single depositional environment, we are obviously confronted with two mechanisms of burial, each of which operated selectively not only on animals belonging to different size groups, but also on animals belonging to particular taxa, as representatives of pareiasaurs buried mainly in terms of the first type, and representatives of other groups — in terms of the second type. In the second type the burials look quite normal, as the size and condition of the remains generally corresponds to the volume and grain sizes of the deposit, and so the scale of the streams. The relationship between the sizes of objects and grain sizes of a deposit as a whole is well recognized in Upper Permian terrestrial vertebrate localities — in sandy coarse-grained lenses, sometimes containing conglomerates, as a rule, are mostly found large animals, as, for example, at the sites of Ocher, Isheevo, Semin Ravine, Sokolki, and Vyazniki. In mudstones, is basically the burial place for small forms, for example, on the River Mezen' or at the Donguz-6 site.

As regards the burial places of complete skeletons of pareiasaurs, some clear exceptions to the general laws are noted. The height of the body of a lying animal could not be less than 30 cm. Accordingly, in a channel in which such an object is buried there should have been dropped instantly not less than 30 cm of rainfall. A stream with such characteristics, namely the volume and speed of the current, inevitably would have to sort the sediment towards increasing grain size, cause erosion of the sides and bottom of the channel (most likely, with the formation of conglomerates), and it should change the orientation of a corpse in comparison with the position that it had at the moment of death. Burial flows of this kind should lead to the burying together of remains of animals of different taxonomic groups, even with sorting of the remains according to size, which is observed in most cases. It is very likely also to find congested masses of skeletons overlapping each other and a joint burial place both of complete skeletons, and their fragments. None of these listed phenomena is observed in this case. It should be noted that the layers containing the remains of small forms are more coarse-grained than those containing the remains of large forms. The skeletons of pareiasaurs, except for 3–5% of the finds, are strictly oriented: as a rule, there is one in a lens, very rarely two, but even in those cases they do not overlap each other. Often in close proximity to a skeleton this layering is broken, sometimes with the formation of folds up to 3 cm high.

Thus, the specificity of the burials of the Kotel'nich vertebrates of the second type is not connected with their systematic assignment and, hence, behavioural and other biological characteristics, and can be explained readily by normal taphonomic rules. On the other hand, the specificity of burials of the first type cannot be explained from this standpoint, and regular selectivity of burials of this type obviously relates to particular biological, and in particular behavioural, properties of animals of the given kind. Because the sediment surrounding the carcass of an animal at the time of burial apparently was not carried in by a stream after its death, the only way for an animal to enter a mass of rock, is that it penetrated into the thickness of the sediment while it was alive, to ensure the maintenance of one or other normal physiological need. This particular physiological need, known for the reptilian level of organization, could be the need to reduce the metabolic rate during particularly adverse conditions associated with the onset of the dry season, that is to hibernate (Ochev, 2002). Among modern reptiles and amphibians that live in areas where the climatic cycle includes a dry season, such behavioural responses are well established as digging into the mud for a period of rest. Among animals of the mammalian level of organisation, the ability to slow down the metabolism during adverse periods is observed only in connection with the approach of the cold season. Thus, the abundance of complete skeletons of pareiasaurs in life position, and the absence of remains of other animals for which such a form of

safety might be characteristic, shows clearly that the pareiasaurs were not abandoned at this site of the reservoir when it drained, but had excavated into clay silt in channels of the remaining water currents where they were still soft, and began to hibernate. The weakened animals most probably died during this period, and their skeletons were buried without water transport while the remains of other animals remained in their final resting channels.

Probably this change is connected with differences in features of physiology and behaviour of large planktonophages of reptilian level at the boundary of Isheevo and Kotel'nich time (Sumin, 2002). Most likely, the general drainage of the Preural Trough connected both with its filling by deposits, and with reduction in the height of the palaeo-Urals, first of all led to an increase in the contrast between dry and damp seasons that made the continuous maintenance of physiological activity of planktonophages impossible all year round.

Literature

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