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Preservation of fossils in the Šárka Formation (Darriwilian, Czech Republic)

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The Šárka Formation is a well-known, fossiliferous Ordovician deposit in Bohemia. It has been targeted by fossil collectors since the 19th century due to the excellent preservation of many fossils. As a result, mainly well-preserved and interesting specimens have been deposited in collections. Many fragments, typical fossil accumulations but also complete specimens belonging to common taxa, have been ignored because they were considered poorly preserved compared to others. That is why some palaeoecological and taphonomical aspects of faunas are insufficiently represented in the existing collections.

The Šárka Formation is early to middle Darriwilian in age and reflects an overall deepening of the Prague Basin, an Early Palaeozoic peri-Gondwanan basin, with a relic of its fill situated roughly between Plzeň and Prague as a part of the Teplá-Barrandian unit in Central Bohemia, Czech Republic. The Šárka Formation is typified by the prevalence of grey to dark grey shales that are 50 m thick in the south-western part of the basin and up to 300 m in the north-eastern part of it. Locally, these shales contain levels with predominantly siliceous nodules. Both, shales and nodules, are fossiliferous, but fossils demonstrate different modes of preservation, primarily resulting from different degrees of compaction accompanied by other processes such as the dissolution of shells.

The highly diverse fauna in the formation is dominated by trilobites. Rhynchonelliformean brachiopods, bivalves, gastropods, cephalopods, ostracods, hyoliths, and echinoderms are very abundant; other groups such as conulariids, monoplacophorans, rostroconchs, machaeridans, and graptolites are less frequent. The fossils occur as isolated specimens, in clusters, or in larger concentrations of transported shells on the bedding planes. Fossils, the shells of which were originally composed of several parts (trilobite exoskeletons, bivalve molluscs, crustaceans, hyoliths, etc.), are often disarticulated. Disarticulated parts of skeletons are mostly complete, with a low degree of fragmentation. This is the prevailing mode of preservation, but some localities yielded also abundant complete trilobites. In general, allochthonous material transported to short distances prevails in the Šárka Formation.

Preservation in shales. The fossils in shales are variably compacted. Specimens of the groups producing organic protective structures, such as graptolites, range from predominantly flattened to relief when pyritized. The material of phosphatic shells (phyllocarid crustaceans, linguliformean brachiopods, conulariids) is usually preserved, primarily deformed depending on its solidity, and secondarily slightly flattened. Calcareous shells are often dissolved and the fossils cracked. Although primary cracking also occurs, many shells are collapsed indicating their deformation due to the sediment compaction before dissolution of a shell during late diagenesis.

Preservation in nodules. Nodules are of early diagenetic origin and fossils in them are preserved in full relief because they were protected from compaction. All deformations of fossils, such as cracking, can be considered primary, i.e. formed before the nodule formation. Only phosphatic shells occur in the nodules, organic and calcareous shells are not preserved with only minor exceptions. Thus, the dominating preservation mode of fossils in the nodules is as internal and external moulds or only external moulds with a cavity inside. However, there is one special type of internal mould, which has been known for a long time but ignored because of its 'worse' preservation. This is related to many articulated brachiopods and bivalves but often also to some parts of trilobites, hyoliths and gastropods. It is formed by a porous spongiform material, sometimes forming irregular structures resembling the crumble. This taphonomic feature, unique for the nodules, represents a specific type of preservation. It can fully or partly fill in the cavities inside the closed two-valved shells, some enrolled trilobites, adapical parts of hyolith conchs, and gastropod shells but also glabellae, axes, or other parts of trilobites. This preservation is therefore common in enclosed spaces of shells where the presence of organic substances, especially remains of tissues can be expected to occur even after their burial in the sediment. Subsequent decay of tissues in an open geochemical system, such as inside a muddy substrate that is a precursor of shales, would not be traced under normal conditions due to the migration of matters. The nodules were apparently of a very early diagenetic origin and their formation ceased the migration system of decaying tissue substances. The products of these processes remained *in situ* and fossilized in the form of the 'taphonomic crumble', which has a considerable potential for several research directions.

ABSTRACT

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