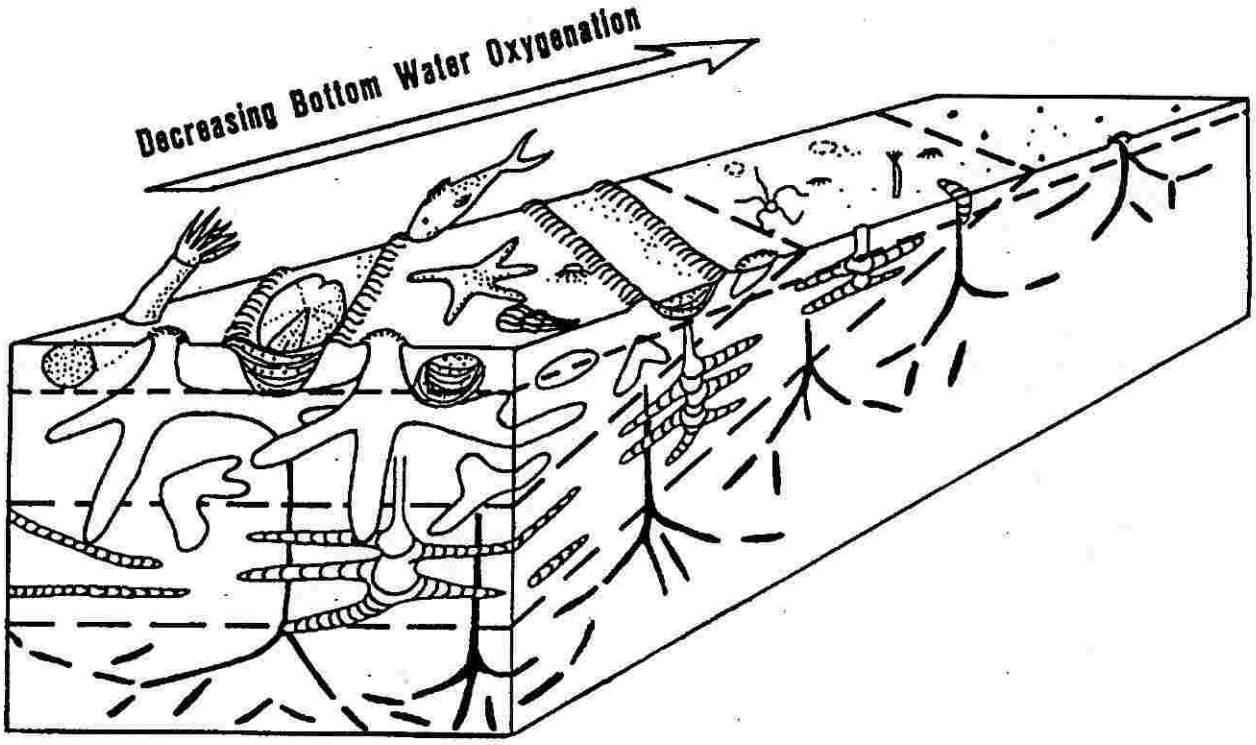

Fig. 3 – A model case of ichnoassemblages put across the oxygenation gradient. After Savrda and Bottjer (1989).

Change of activity as a possible consequence of crisis of biota (example: behavior of ophiuroids documented by the trace fossils)

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Tracemakers of some ichnofossils are not known at all, or we only speculate about them. Makers of other traces are explicitly verified (e.g., by joint finds of the trace and the maker). In these cases, the question, how the character of the trace of certain organism changes during the geological time, can be put. Modifications of dimensions, variability, or basic morphological features of the trace need not document the change of the maker's morphology; they can document the changes of behavior.

If these changes appear in a period of crises of biota, the question can obtain the following form: Can the biospecies (or evolutionary linked species) dispose of a crisis by a change of some aspects of its behavior (way of feeding, dwelling, resting, crawling)?

Resting and dwelling burrows of ophiuroids can be an example. Shallow resting trace (cubichnion) of ophiuroids was named as Asteriacites (Fig. 1). This ichnogenus has been studied by Mikuláš (1992). This study stated a conspicuous decrease of asteriacites in the Cretaceous and the Cenozoic. However, their tracemakers prosper, and till the Recent they belong to important components of benthos.

Burrowing of temporary star-shaped structures is undoubtedly just one of possible manifestations of hiding of ophiuroids. Recent representatives hide often in vacant mollusk shells, in rock crevices, a.o., or they live temporarily or permanently in the sediment, where they leave traces of other than Asteriacites type (fig. 2 - see Frey et al. 1987). Development of more effective hidings of ophiuroids should accompany the decrease of Asteriacites in the Cretaceous and the Cenozoic. Influence of new predators could be a cause; another explanation consists in that the possibilities of deep bioturbation ophiuroids were limited in pre-Cretaceous time by insufficient oxygenation of ocean basins (which is presumed by Frey and Pemberton 1984). Therefore, the ophiuroids were not able to stay deep in weakly oxygenated sediment and they formed only surface shelters. This proposition seems to be too generalized and speculative. However, the presumed better oxygenation of large parts of the ocean basins might enable

not only the better shelters of ophiuroids, but also a generally deeper bioturbation and well-evidenced expansion of some activities to deep parts of basins (dwelling burrows Ophiomorpha are an example - see Bottjer et al. 1988).

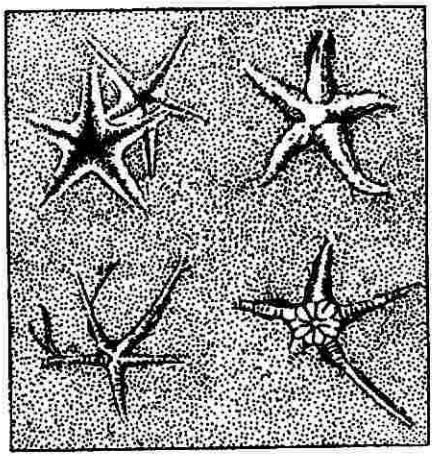

Fig. 1 – Surface resting trace Asteriacites von Schlotheim, 1820. – of natural size. After Seilacher (1953) and Mikuláš (1992).

The presumed change of ophiuroid behavior is very probably joined with the crisis of biota, but it can be incidental only. In addition, the study concerns only a taxon of a high order (subclass Ophiuroidea); if we had considered changes of individual ophiuroid genera and species and their activities (that is impossible in present-day stage of knowledge), the problem would be very probably much more complicated. However, the above-mentioned case is, in my opinion, an interesting exhibition of change of activity and of documentation of the change by trace fossils.

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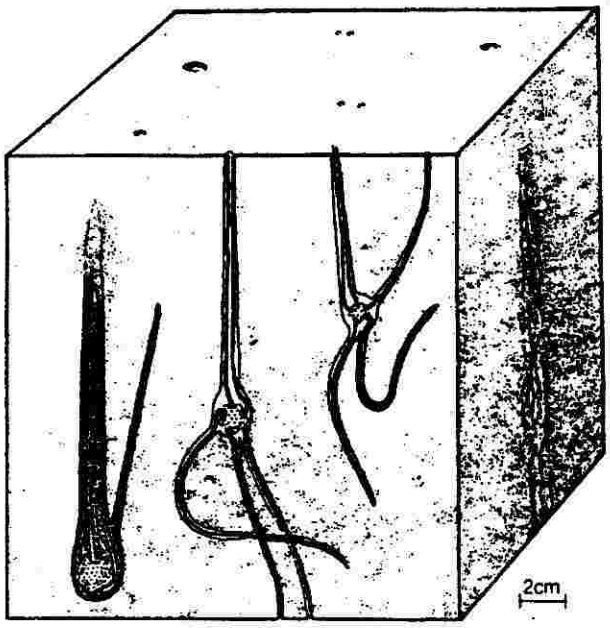

Fig. 2 – Recent hidings of ophiuroids inside the sediment and corresponding dwelling adnd escape traces. After Frey et al. (1987).

Ichnology and its possibilities in the study of crises of biota

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Trace fossils were (and sometimes still are) evaluated as a part of their makers, as "non-fullvalue biotaxa". Their character is, however, different: an ichnotaxon is often made by more biotaxa; maker of the particular trace should change in a geological time, and on the contrary, particular organism often formed various types of traces (in dependence on conditions of the moment, or on longstanding circumstances). Therefore, ichnofossil is not a part of the tracemaker – it is a record of certain type of behaviour. This type should be peculiar to organisms of various systematic appurtenance (namely in different time and place).

Present-day stage of ichnological research in the Bohemian Massif consists namely in collection and description of the material, in environmental conclusions following the characteristics of individual ichnoassemblages, and in gradual recognizing the problems which are important not only for regional study. In ichnological literature, the interest in the topic of this workshop is also rather low. Yet the traces might give a certain information in that line. I have tried to define this information value in replies to four questions put to the participants of the workshop.