

Reciprocal symbiotic relations between organisms that took place during their lives are extremely difficult to capture in the fossil record. Symbiosis is a very important ecological and evolutionary force in the modern biosphere; however, direct preservation of this phenomenon in the fossil record is dependent on the processes governing fossil preservation. Hence, direct evidence in the form of organisms fossilized in the form “caught in the act” is so desirable.

Organisms colonizing other organisms are called epibionts. Such organisms have been present since the Cambrian, colonizing a variety of animals and plants, and sometimes such relations were symbiotic. A majority of epibionts bear an external calcareous skeleton which can easily be fossilized. However, soft-bodied epibionts have also a chance to be preserved in the process of bioclastration (a process of *syn vivo* embedment of the symbiont within the host’s skeleton), which provides a unique glimpse into the morphology and abundance of small, soft-bodied organisms. The scope of the present research are fossils preserved in the process of bioclastration in the form of traces after soft-bodied hydroids which symbiotically interacted with sessile polychaetes (commonly called serpulids).

Association between hydroids and serpulids has been described several times from different geological periods since the Early Jurassic up to the Recent. Thus, its evolutionary history goes over 190 million of years back. Interestingly, all these fossils were referred to a single species – *Protulophila gestroi*. This makes these organisms fit into the terminologically controversial concept of “a living fossil”. This term suggests that the species defined in this way remained unchanged for a very long - even on a geological scale – time. However, evolutionary changes could proceed at a similar pace as in other organisms, and the similarities between different-aged representatives are only superficial. Well-known examples of “living fossils” are *Latimeria*, horseshoe crab and tadpole shrimp. Nevertheless, the concept of a living fossil indicates some interesting similarities of contemporary organisms in relation to their fossil ancestors – as in the case of *Protulophila gestroi*, without careful deliberation on anatomical details. Maintenance of the anatomical body plan itself is very interesting. However, the term itself is somewhat imprecise as to what leads to controversies.

It seems to be extremely unlikely, that a single species, usually described as being selective in the choice of the host over a specific stratigraphic interval, would have colonized so diverse serpulid species throughout 190 millions of years in different regions around the world. Here appears a dilemma: despite very high probability that the specimens classified under one species actually belong to different species, we are unable to distinguish potential intraspecific diversity basing solely on the external appearance, due to processes involved in fossil preservation and insufficient data on the modifications of these fossils in different geological periods.

Recent studies have shown that computed microtomography and scanning of the fossils’ internal structures formed in the process of bioclastration may be helpful in unraveling the mysteries of this relationship, including the evolutionary history of *Protulophila gestroi* and its phylogeny. It will allow to trace the genuine morphology of the hydroid colonies embedded within their hosts, because appearance of their traces left on the external surface of the host’s tube may be dependent on many palaeoenvironmental factors and doesn’t reliably reflect potential species variability. By comparisons of both different-aged and coeval fossils, potential evolutionary changes in the hydroid colonies’ morphology may be traced, as well as factors influencing morphological diversity within coeval specimens may be determined. Thus, the main aims of the project are: 1) deciphering the key features, which then could be used to determine actual species of particular colonies. The analysis of the symbiotic relationship between hydroids and serpulids investigated in the herein project will provide valuable insight into the dependence of these organisms’ appearance on environmental factors and evolutionary changes; 2) to determine the influence of all analyzed factors on the final appearance of the fossil, as well as providing supplementary information on the character of symbiotic relationship; 3) an attempt to trace the phylogeny of symbiont hydroids and verification of species variability, both in time and across environments based on variability of hydroid colonies.