

# What are 'Orsten' Faunas?

**Orsten faunas are assemblages – not a single fauna!** – of secondarily phosphatized fossil organisms – and different localities (samples from different nodules) may contain different animals living on the bottom of the Alum-Shale-Sea in the Cambrian, Cambrian, ca. 500 Million years ago.

Initially only arthropods were sorted out (focus laid on these), but later also other organisms were discovered in such preservation, f. e., even cyanobacterians (only Sweden until today), cnidarian (only China) and, more recently, nemathelminths (remarkably only Australia and China, but not yet Sweden).

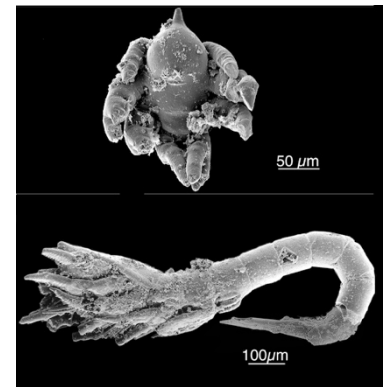
Primarily phosphatic microfossils, which may be similarly three-dimensionally preserved are, in first instance, skeletal elements of organisms – many of them so-called small shellies –, and are also found in the material, but are, in most cases, not considered here. SMs include a wide range of fossils, from unicellular organisms such as foraminiferans and dinoflagellates to sponge spicules, echinoderms skeletal elements to molluscs or uncertain taxa, such as hyoliths. Also the phosphatized embryonic stages discovered in the last decades, mainly from the late Precambrian lower Cambrian, are not considered to represent Orsten faunal elements.

Because of the small size of the fossils, mostly below 2 mm (but this means specimens not species), these were initially interpreted as representatives of a so-called meiofauna. This seems no longer be the case for the majority of the finds, though not all can be excluded. It is also noteworthy that the noticed size limitation to small fossils is a matter of size selection due to the use of only small-sized sieves by Klaus J. Müller, the discoverer of the 'Orsten' fossils in Sweden, – at least partly a process bias.

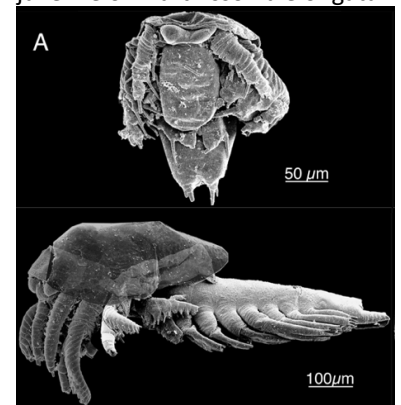
The biggest advantage of 'Orsten' preservation, however, is the **presence of larval stages** (see on the right), sometimes even in series and in one instance of 30 successive stages, which is extremely valuable for interpretations of the evolution of Cambrian animals. In either way, various forms are known exclusively and clearly from larval stages, but estimations of their later stages indicate that the adults exceeded the range defining membership to a meiofauna. Only few forms can be considered really small adults. Accordingly, each case has to be evaluated separately, and it is not possible, just to claim that the Orsten faunas belonged to a meiofauna (discussed in more detail in another chapter in the future, also discussing papers by other authors on this matter – who claimed this, but have never worked on this material).

Again, 'Orsten' fossils demonstrate the co-occurrence of representatives of different evolutionary levels, for example stem and crown crustaceans in the same samples – as is the case today. Therefore we have ontogenetic and morphological and data from different levels to follow up features along development and evolution, a big advantage over other fossil lagerstätten. With their exceptional 3D preservation of many morphological details of the fossils, they helped to improve and expand our knowledge and evolutionary interpretations significantly.

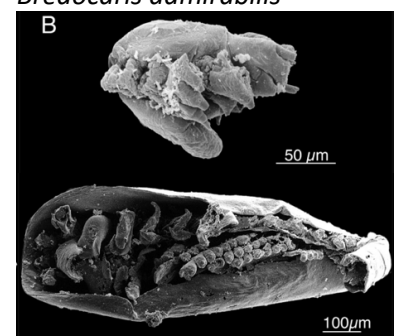
The continuing work of Chinese colleagues, but also from Europe has demonstrated that the initial C.O.R.E. activity did not cease after the general agreement of the C.O.R.E. members to close down its website and dissolve the research group.



first larva (non-feeding) and juvenile of *Martinssonia elongata*



first larva and adult of *Bredocaris admirabilis*



first larva and late juvenile of *Rehbachella kinnekullensis*



top: lobopod tardigrade  
middle: larval pentastomid,  
larval pantopod  
lower left: *Rehbachella* larva