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Discussion of Precambrian metazoans

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Among conservation deposits, the Vendian occurrences of Ediacara-type fossils stand out for reasons other than their formidable age. They are unique because soft-bodied organisms are preserved not as organic or permineralized films in fine-grained sediments, but as three-dimensional impressions on (and sometimes in) sandstones. Also, they do not reflect unusual physiographic 'accidents', but occur in ordinary sediments, representing well agitated conditions, all over the world. Nor are they restricted to a certain sedimentary régime, since similar impressions have now been found in shallow-marine tempestites as well as deep-water turbidites. We deal rather with a time signature that has no counterparts in the Phanerozoic record.

Our knowledge of these strange biota during the last 60 years has snowballed. The first discoveries in South Africa were followed by those of more diverse assemblages in South Australia. Now the ball seems to have rolled to the Soviet Union, where our Russian colleagues (summarized in Urbanek & Rozanov 1983) have found not only new types of fossils, but also a large number of localities in well studied stratigraphic contexts and in diverse sedimentological settings. Thus we are very fortunate to have this updated review by M. A. Fedonkin, who has become a spokesman of the Soviet working group, as a contribution to this symposium.

In trying to interpret Vendian megafossils, one is faced with two major problems. (i) It is difficult to draw a sharp boundary between body and trace fossils since both are preserved as mere impressions on sandstone surfaces. (ii) With the given limits of morphological resolution, any investigator will be highly influenced by previous experiences and preconceptions.

Being prejudiced myself, not as a taxonomist, but as an interpreter of trace fossils and a constructional morphologist, I see in the Vendian impressions three major groups of fossils.

1. Trace fossils of worm-like organisms

After eliminating inorganic pseudo-trace fossils that have commonly plagued earlier studies (discussion in Seilacher 1956 and Glaessner 1969), there remains a considerable number of undisputably biogenic sediment structures. Among these, we lack not only the trilobite burrows and tracks, but also the vertical worm burrows, which are such important elements in Cambrian ichnocoenoses. What we do find are horizontal structures. However, it would still be wrong to conclude that there was, at that time, no infaunal life. Biostratinomic considerations and preservational details (for example, hypichnial grooves and backfilling) show that we deal with burrows made within the sediment by a peristaltic mode of locomotion, which can be effectively performed only by worm-like coelomates.

Another surprising fact is that patterns of behaviour (guided meanders, radial probing) are

already highly developed in ways that in later times are largely restricted to deep-sea sediment feeding. This might reflect an actual nutritional situation that was in some way similar to what we find in the deep sea today.

2. Benthic coelenterates

A group of hemispherical casts stand out from the rather flat, 'segmented' fossils by their inverted and high relief. They resemble the trace fossil *Bergaueria* from the Lower Palaeozoic, but also similarly shaped sand casts of 'jellyfish' of the same period. We refer both to mud- or sand-sticking coelenterates. Some of them (*Protolyella*; Seilacher 1983, figure 5) stabilized themselves by the ballast of a massive internal sand-'skeleton', the lower side of which is smooth and hemispherical, while the upper side bears concentric growth rings with or without radial ridges for the attachment of soft septa.

The Vendian 'medusoids' are probably a very mixed group. Some of them look like radial feeding burrows; others appear to be radial or concentric versions of 'Vendozoa'. A third group may actually represent coelenterates, though benthic forms rather than the pelagic jellyfish of modern oceans (Seilacher 1984).

3. 'Vendozoa'

These more elaborate forms, such as *Dickinsonia*, are mostly preserved as negative hyporelief (in terms of trace fossil taphonomy). They have been variably interpreted as early, soft-bodied representatives of modern metazoan phyla (sea pens, annelids, arthropods, echinoderms, etc.) or as extinct phyla (Petalonamae, Pflug 1972). If the symmetry classes are disregarded, however, the apparently very different forms can be considered as variants of a single constructional principle: that of foliate pneu-structures whose shapes are held constant by internal 'quilting'. Since no internal organs have been observed, I hypothesize that we are dealing with extrovert benthic organisms, in which the external surface was maximized for the uptake of oxygen and food (perhaps also of light). Rather than being ancestral to modern Metazoa, this group would represent an independent evolution of large organisms along lines that were possible only in a world that in spite of low oxygen pressures was 'paradisaic' by the absence of predators and the ubiquity of bacterial food. The extinction of the Vendozoa would coincide with the radiation of skeleton-bearing coelomates, probably from annelid ancestors, at the beginning of the Phanerozoic (Seilacher 1984).

The main function of this provocative hypothesis is to stimulate research in Precambrian palaeontology and to free it from taxonomic preconceptions. No doubt the Russian material will play a key role in this venture.

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