ANALYSIS OF BIOMARKERS FROM EDIACARAN FOSSILS: BRINGING TOGETHER PALAEONTOLOGY AND ORGANIC GEOCHEMISTRY

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The emergence of modern animal phyla in the Cambrian was preluded by the appearance of large architecturally complex organisms, the Ediacara biota (571 to 541 Ma). These fossils might hold clues to the understanding of history of the animal lineage and the evolution of complex life on Earth. However, most of them have evaded taxonomic classification, with interpretations ranging from marine animals or giant single-celled protists to bacterial colonies and terrestrial lichens (Xiao and Laflamme, 2009).

A technique of analysing biomarkers from individual fossils opens a new dimension in the study of these enigmatic fossils. Instead of looking at their morphology, it allows to analyse remains of organic molecules produced by these organisms. Biomarkers represent skeletons of biomolecules produced by all living organisms; as different groups of organisms possess different lipids, biomarkers can be used to unravel their biological origins (Brocks and Pearson, 2005; Volkman, 2005). Thus, based on morphology, Ediacaran fossils *Beltanelliformis* have been variably interpreted as bacterial colonies, planktonic algae, benthic algae, fungal colonies, jellyfish bodies, sponge-like animals and sedentary coral polyps. Biomarker analysis showed that *Beltanelliformis* contain abundant hopanes and long-chain *n*-alkanes with odd-over-even predominance, indicating that these fossils represent large spherical colonies of cyanobacteria similar to modern *Nostoc* (Bobrovskiy et al., 2018b). Biomarkers from the most iconic Ediacaran macrofossil *Dickinsonia*, along with two other dickinsoniid genera, *Andiva* and *Yorgia*, indicate that they were not lichens or giant protists, but in fact belong among the oldest animals preserved in the rock record (Bobrovskiy et al., 2018a).

The proposed technique has broader applications than uncovering the biological origins of ancient organisms. In addition to sterols they produce, animals may contain molecules from what they have eaten. Indeed, using biomarkers, we were able to detect the presence of a gut in some of Ediacaran macroorganisms and distinguish the lipid composition of their last meal. Gut content analysis is one of the most powerful tools for deciphering trophic structure of ancient ecosystems and ecology of their members (Butterfield, 2001; Vannier, 2012). Biomarkers provide a new dimension to these studies, allowing to analyse the gut content of ancient macroorganisms even when it is not fossilized.

References

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