BIOMARKER TAPHONOMY AND TERRESTRIAL ORGANIC MATTER FLUXES IN MID-NEOPROTEROZOIC ROCKS

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Abstract

The Neoproterozoic Era (1000–542 Ma) was marked by drastic environmental turbulence and witnessed not only a pulse of eukaryotic radiation but also the advent of complex life in the form of the first animals (Knoll et al., 2006). Two global and long-lasting Snowball Earth glaciations (Rooney et al., 2015) during the Cryogenian (720–635 Ma) put life under severe pressure and it has been variably debated how life either survived these events or became reorganized by them. Particularly sessile aerobiotic demosponges, considered to be the most basal metazoa (Love et al., 2009; but see other submitted contribution by Neumann et al., 2017: this abstract volume), would have been heavily affected by a 'hard snowball' glacial scenario (Hoffman et al., 1998). While molecular clocks place the origin of metazoa back to the Tonian (Peterson et al., 2008), chemical evidence in form of the sponge biomarker 24-isopropylcholestane has only been reported for rocks of the Marinoan glaciation, the second glaciation during the Cryogenian (650–635 Ma; Love et al., 2009). The novel and only recently described 24-desmethyl-26-methyl sterane, named cryostane, was reported in Tonian sediments and tentatively attributed to early demosponges (Brocks et al., 2015). In this study we set out to obtain a greater understanding of possible environmental, facies or lithological controls on the occurrence and relative abundance of cryostane in a Tonian rock sequence, in order to shed more light on its potential biological sources and their ecological habitat.

Eleven samples from five different outcrops of the Tonian Visingsö Group were studied using conventional organic geochemical techniques. The indigeneity of biomarkers was corroborated by separately analyzing sample interiors *vs*. exteriors, which was achieved by either sawing or by micro-ablation depending on the lithology. In addition to organic marker molecules, various inorganic redox-sensitive elements were quantified in order to obtain a complementary view of depositional redox conditions. All samples were characterized by an advanced stage of thermal maturity, yet still contained indigenous hopanoid and steroid biomarker hydrocarbons. Apart from the focus on cryostane, which will be discussed in this presentation, we observe an appreciable amount of sedimentary steranes (up to around 20% in comparison to the sum of hopanes), suggesting that eukaryotes were abundant in the studied littoral, shallow-marine environment. The most interesting observation involved an anti-correlation between organic and inorganic parameters susceptible to oxidation, which can only be explained by periodic input of basin-ward fluxes of terrigenous organic matter

and oxidized metals. This points towards a mildly oxidizing atmosphere during the Tonian and provides some of the first indicators of terrigenous organic matter fluxes into the marine realm prior to the much later advent of land plants, whose cuticular and molecular remnants strongly facilitate the recognition of terrigenous organic matter in Phanerozoic, marine sediments.

References

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