BIOMARKER EVIDENCE FOR EUKARYOTES IN THE EARLY MESOPROTEROZOIC

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In recent years, the Archean biomarker evidence for eukaryotic origin (2.7Ga, Brock et al., 1999) has been re-evaluated and recognized as contaminants and/or indigenous hydrocarbons (Rasmussen et al., 2008; French et al., 2015). This draw us attention to the biomarker research of the Precambrian overmature rocks. However, the essential role of biomarker in elucidating the origin and early evolution can't be ignored, provided that one could recognize the potential indigenous hydrocarbons.

Based on microfossil evidence and molecular clock estimates, A modest diversity of stem group eukaryotes occurs in Early-Middle Mesoproterozoic (ca 1.6–1.3Ga) (Javaux E J, et al., 2001. Yoon et al. 2004; Knoll A H, et al., 2006; Embley T M & Martin W, 2006). However, Many questions remain unknown, especially, reliable biomarker evidence are very limited. Here, we mainly report the sterane biomarker from the early Mesoproterozoic (1.6–1.5 Ga) Gaoyuzhuang Formation (GYZF) in the North China Craton (NCC), which may have provided the robust evidence for the early divergence of eukaryotic algae.

In this study, we used the core samples from well JQ3 (500m in depth) which penetrates the middle-upper intervals of the GYZF. The carbonates are mainly of dark grey and black dolomites well developed in deep-water facies. TOC content of these organic-rich intervals changes from 0.2% to 4.3%, with an average of 0.68%. The H/C atomic ratios of the kerogens from these dolomites are 0.46 in average, indicating the maturities of the organic matters are just around the upper threshold of overmature stage.

The results show that: 1) The major series of biomarkers are assessed to be syngenetic, according to the changes of molecular compositions, maturity proxies, and the correlations with other non-molecular geochemical parameters, as well as their stratigraphic trends. 2) The fact that the carbonates are rich in mid-chain monomethyl branched alkanes suggests the cyanobacteria microbial mats may have been the major contribution to the deep-water facies organic matters. 3) The ubiquitous occurrence of C_{27}–C_{29} regular steranes in the GYZF means that the eukaryotic algae may have become one of the primary production in the 1.6 Ga NCC ocean. 4) C_{30} steranes are mainly composed of 4-me- and 3-me-sterane isomers, with dinosteranes also detected at trace level. This sterane evidence indicates that the early eukaryotes divergence may have occurred since the early Mesoproterozoic.

References

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