Extraction of molecular fossils from the Proterozoic/Phanerozoic boundry section in the Three Gorges area, South China

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Proterozoic/Phanerozoic boundary (or Pc/C boundary) is one of the most important intervals for the evolution of life. The first multicellular animal appeared after Marinoan glaciation (˜600Ma), and Cambrian-type shelly biota were diversified just after the Pc/C boundary (c. 540 Ma). It is essential to understand link between the global environmental changes and early animal evolution. Molecular fossils (or biomarker) are molecules derived from a specific biosynthesis and preserved in sedimentary rocks, which could be useful for reconstructing past ecosystems. However, extraction of biomarker from such old sedimentary rocks has continuously suffered from the poor preservation due to weathering and post-depositional thermal alteration as well as problems of contamination during diagenesis and even in laboratory. In order to minimize these contaminations, pristine drill core samples collected from the Three Gorge area, South China, was used for biomarker extraction in this study. Exceptionally well-preserved Neoproterozoic to Early Cambrian sedimentary rocks occur in this area. Acyclic isoprenoids (pristane and phytane), n-alkanes and diamondoid hydrocarbons were identified in almost samples. The concentration of diamondoids depends on lithofacies of the rock samples. A white dolomite sample with no detectable organic carbon was used for reference. The sample did not yield any biomarker molecules, indicating contaminations during drilling procedure and in laboratory extraction should be negligibly small. The distributions of n-alkanes often show bimodal distributions with two peaks at around nC17 and nC27. This distribution pattern suggests the presence of two different source of hydrocarbon. Peaks around nC27 are usually interpreted to be originated from the wax of higher terrestrial plants, but no higher terrestrial plants cannot have been expected in this age. These long-chain n-alkane possibly derived from some eukaryotic algae. Furthermore, unusual distribution pattern of n-alkanes was discovered in black shale samples collected around the Pc/C boundary and just above Nd/T boundary, where major biological diversifications have been known to occur. In these samples, long-chain n-alkanes with a peak around nC27 predominate over short-chain ones having a maximum at nC27. Although the origins of the long-chain n-alkanes are still poorly understood, these predominant occurrences of long-chain hydrocarbons at biostratigraphic boundaries may suggest blooming of single or a few species in the Pc/C and Nd/T boundary oceans. Such a short-time decline of biodiversity is likely to occur due to severe environmental stress like oceanic anoxia (Pc/C) and global cooling (Nd/T). Hence, the timing of the nC16-18/nC26-28 anomalies at the two boundaries is consistent with the blooming scenario.