

Demosponge steroidal biomarkers: primary biological origin or secondary diagenetic products?

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Given their paucity in bacteria, and absence from archaea, sterols, and their sterane diagenetic products, are biomarkers diagnostic for eukaryotes. Sterane distributions in oils and sediments can provide information regarding paleo-depositional conditions, how ecosystems respond to these changes, the evolution of new organisms and the extinction of others [1]. The earliest putative animal biomarkers were reported in sedimentary rocks from Neoproterozoic [2]. Some specific fossilized C_{30} steranes (e.g. 24-isopropylcholestane (24-ipc) and 26-methylstigmastane (26-mes)) were proposed to be diagnostic biomarkers for demosponges. However, reports questioning the origin of 24-ipc via various alternative scenarios have followed (e.g., [3]).

In the present study we investigated whether 24-ipc isomers could have a direct biological origin or be secondary diagenetic products formed through thermally-driven rearrangement processes. To this end, we studied and compared the isomer distributions of C_{30} steranes in the free hydrocarbon and S-bound fractions in bitumens extracted from thermally immature Neoproterozoic sediments and oils. The fact that 24-ipc and sometimes 26-mes were observed in the S-bound fraction of low maturity samples, (Fig. 1), directly and unambiguously refutes the proposal [3] which postulated a diagenetic/catagenetic transmethylation of C_{29} steranes could lead to production of 24-ipc isomers. This is because sulfurized sterols are formed directly from functionalized precursor sterols during the earliest stages of diagenesis and well before sediments ever see elevated geothermal gradients [4]. Moreover, the high 24-ipc/24-npc ratio (0.2-3), and the abundances of 26-mes confirm that the C_{30} steranes in the studied samples originate from biological precursors such as demosponge sterols [5].

References

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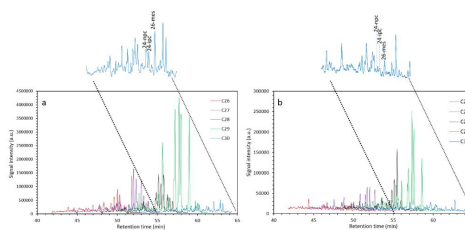


Figure 1. Chromatographic comparison of C26-C30 sterane profiles from the (a) non-polar fractions and (b) S-bound fractions extracted from an immature Neoproterozoic sediment from Oman (OMR 229).