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Bacterial Hopanoids as Markers for Depositional Environments

Hopanoids are important biomarkers, occurring wherever there is organic matter in the geosphere. They are derived from bacteriohopanepolyols (biohopanoids) synthesised by a diverse range of bacteria. Different bacterial groups possess recognisable biohopanoid distributions, giving hopanoids marker potential for specific bacterial populations and environmental conditions. We report the abundance and composition of bacterial biohopanoids in Recent sediments from a large suite of depositional environments, and relate them to specific bacterial inputs in different settings.

Biohopanoids are determined by GC-MS following cleavage of the polyfunctionalised side chain with periodic acid/sodium borohydride (forming simple hopanol products that define the number and position of the functional groups in the biohopanoid side chain).

Tetrafunctionalised compounds, including bacteriohopanetetrol and hopanoids with a more complex terminal functional group, dominate the biohopanoids of marine sediments. In contrast, hexafunctional biohopanoids are particularly abundant in small highly productive lakes, whilst 'transitional' settings (fjords, coastal lagoons) tend to be enriched in pentafunctional biohopanoids compared to marine settings.

Analysis of methanotrophic bacteria show that their biohopanoids are dominated by penta- or hexafunctionalised biohopanoids. Two types of methanotrophs can be distinguished by their hopanoids: Type I (abundant in aquatic environments with high methane fluxes) produce almost exclusively hexafunctionalised biohopanoids, whilst Type II methanotrophs (terrestrial environments) synthesise penta- and tetrafunctionalised biohopanoids. Thus, we can characterise depositional environments in terms of bacterial inputs of hopanoids: (1) water column Type I methanotrophs (small methane-rich water bodies), (2) terrestrial Type II methanotrophs (soil/peat input to aquatic systems), and (3) other, less specific bacterial inputs (marine settings).