

Culture-independent methods reveal the primary sources of hopanoid lipid biomarkers

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Hopanes found in the geologic record are clues to ancient biological communities. The ubiquity of these lipid products appears to result from their recalcitrance, rather than a preponderance of hopanoid biosynthesis among Bacteria. We have estimated that fewer than one in ten bacterial cells in soils and fewer than one in twenty bacterial cells in the ocean contains the gene squalene-hopene cyclase (*sqhC*), suggesting that hopanoids might serve well as taxonomic markers if they can be linked to their source species. In previous work we developed a method to survey the phylogenetic diversity of hopanoid producers using culture-independent methods to sequence the *sqhC* gene [1]. The initial survey suggested that most environmental sequences were putatively derived from Proteobacteria or from unknown taxonomic groups. To continue this work, here we surveyed a land-sea gradient across the Bahamian island of San Salvador. Samples were taken from soil, a hypersaline lake, a tidal creek, and the shallow open ocean. The environmental *sqhCs* average < 65% translated amino acid identity to their closest relatives in public databases, and putatively proteobacterial sequences continue to dominate. Similar phylogenetic distributions for *sqhC* are found within the 13 Gbp of metagenomic data from the Global Ocean Sampling (GOS) project [2]. To compare our *sqhC* results with biomarker lipids, we also have profiled the composition of intact bacteriohopanepolyols (BHPs) from each sample using high-performance liquid chromatography (HPLC). Hopanoids detected include the ubiquitous tetrol (bacterio-hopanetetrol), an aminotriol, a furanone, and a cyclitol ether. Correlations between these lipid profiles and the genetic profiles of *sqhC* will be discussed in the context of deciphering the ancient rock record of microbial lipids.

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[2] Rusch D.B. *et al.* (2007) The Sorcerer II Global Ocean Sampling Expedition, Northwest Atlantic through Eastern Tropical Pacific. *PLOS Biology* **5**, e77.

Isotopic constraints on the source regions of alkaline volcanics

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Radiogenic isotopes are powerful tracers of the sources of alkaline and associated magmas [1]. Combinations of Sr-Nd-Hf-Pb-Os isotope systematics have been used to convincingly demonstrate the role of vein plus peridotite melting in the generation of some alkaline magmas [2, 3].

Lamproites show a wide range of Sr-Nd-Hf-Os isotope systematics. Sub-horizontal lamproite Hf-Nd arrays and variably radiogenic Os isotopes can be interpreted as mixing lines reflecting interaction of melts derived from a mixed ancient pyroxenitic/mafic endmember and a metasomatised peridotite lithospheric source. The nature of the arrays requires a mixing line with extreme curvature, which in turn implies the pyroxenitic and peridotitic source endmembers have very different Hf/Nd ratios. Mixing of melts derived from peridotite and vein melt can also explain the coupled Hf-Os isotope systematics observed in lamproites.

Group I kimberlites show significantly less isotopic variation than lamproites. They show clear evidence of mixing with an ancient peridotite components and this must be deciphered from source variations. New major element data for fresh, hypabyssal kimberlites from the Lac de Gras (LDG) region (Canada) reveal that primitive kimberlite melts are sub-alkaline, MgO and water-rich, suggesting an origin from a source containing hydrous harzburgite. Such an origin is ostensibly at odds with the OIB-like Os-Nd-Hf isotopes of many kimberlites but can be reconciled by models involving a combination of a water-rich harzburgitic protolith, located within the transition zone, plus a more enriched component that may originate from ancient oceanic crust or pyroxenite veins.

Recent work on Sr-Nd isotopes in diamond-forming fluids [4] reveal that, in contrast to indications from carbon and nitrogen isotopes, a significant fluid source for diamonds is from old enriched lithosphere, with radiogenic Sr and very unradiogenic Nd, similar to the signature of many lamproites.

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[3] Tappe, S. *et al.* (2007) *EPSL* **256**, 433. [4] Klein-BenDavid *et al.* (2008) *GCA*, this volume.