

Sterols in the red and green algae and their relevance for interpretation of Paleozoic steranes

ROBIN B. KODNER¹, ANDREW H. KNOLL¹ AND
ROGER E. SUMMONS²

¹26 Oxford St. Department of Organismic and Evolutionary
Biology, Harvard University, Cambridge, MA 02138
USA (kodner@fas.harvard.edu; aknoll@oeb.harvard.edu)

²E34 42-44 Carleton St., Department of Earth Atmospheric
and Planetary Sciences, MIT, Cambridge, MA 02139
USA (rsummons@mit.edu)

Steroids are a diverse class of lipid with high preservation potential and that are abundantly preserved in the geologic record. These molecules are among the few traits that are shared across all eukaryotes; and thus, they are also important for understanding the molecular evolution of this group. Sterols most commonly used by eukaryotes are C27, C28, and C29 molecules which correspond to C27, C28, and C29 steranes. A diversity of these molecules is found in oils and sedimentary bitumens. Because all three classes of molecules are used by evolutionarily diverse eukaryotes, it can be difficult to ascribe any particular molecular class to a single group of organisms. Many geochemists and paleontologists, however, have tried to draw connections between the presence of C29 steranes in the latest Precambrian and Paleozoic to green algae.

Though C29 sterols have a cosmopolitan distribution among photosynthetic eukaryotes, the known diversity of C29 producing organisms is restricted prior to the Mesozoic. Using a large survey of sterol profiles from the most ancient lineages of algae, we investigate the hypothesis that green algae are the likely source of C29 sterols through the Phanerozoic. We discuss the phylogenetic and ecological relationships of the distribution of C27, C28, and C29 sterols in these groups, and how this impacts the current interpretation of the importance of green algae in pre-Mesozoic ecosystems.

Geochemistry of ocean-floor serpentinites: Implications for subduction zone inventory

J. KODOLÁNYI, C. SPANDLER AND T. PETTKE

Institute of Geological Sciences, University of Bern, Bern,
CH-3012 Switzerland

Hydrated oceanic mantle is a significant carrier of H₂O in subduction zones. Experimental studies and field observations demonstrate that serpentinites undergo major dehydration over a restricted -P-T interval (ca. 2-5 GPa, 650-700 °C; Ulmer and Trommsdorff, 1995; Trommsdorff *et al.*, 1998). Fluids released during serpentinite dehydration may have a considerable effect on element recycling through subduction zones. Whole rock and mineral major and trace element data (EMPA, LA-ICP-MS) of 39 samples from 6 ODP drill sites representing different geodynamic settings (fast and slow spreading ridges, passive margins and forearcs) constrain the geochemistry of ocean-floor serpentinites, which are a proxy for the chemical inventory of subducted hydrated mantle.

The degree of serpentinization in the ODP samples varies between 65 and 100 vol%. Besides serpentine minerals (srp) and magnetite (mag), the most common secondary phases are chlorite (chl), brucite (brc), calcite (cal) iowaite (iow) and sulfides (sul). Excess brc component in srp is commonly observed in mesh rims and mesh cores. In few samples, the presence of iow has been inferred from high Cl and Fe content accompanying low silica. Minor and trace element compositions of srp in different textural settings generally reflect that of the precursor mineral (olivine and orthopyroxene). However, there are considerable variations due to varying degrees of element mobility and mass change during serpentinization. Elements like B, Sr, Rb and Ba show orders of magnitude enrichments in srp compared to the precursor minerals (B: 35-88 ppm, Sr: 1.0-1.3 ppm, Rb: 0.03-0.07 ppm and Ba: 0.1-0.7 ppm). Bastites tend to have about 1.5-4 times higher trace-element concentrations than mesh rims. This is probably related to local fluid chemistry, with relatively high dissolved SiO₂ and relatively low pH around orthopyroxene during serpentinization. Boron values are highly variable even on the 100 μm scale, which may reflect structural effects besides srp mineral chemistry. By contrast, elevated Sr concentrations are fairly constant on the sample scale, which indicates that srp minerals may incorporate Sr.

Our results show that ocean floor serpentinization may be accompanied by appreciable incompatible trace-elements enrichment (e.g., B, Sr). Therefore, serpentinites may be important reservoirs for many trace elements in subducting slabs and, hence, may be of great consequence to geochemical recycling through subduction zones.

References

- Ulmer P. & Trommsdorff V. (1995) *Science* **268**, 858-861.
Trommsdorff V. *et al.*, (1998), *CMP* **132**, 139-148.