C-isotopic studies of hydrocarbons in Neoproterozoic to Cambrian samples

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Much of recent Neoproterozoic research has been focused on understanding the timing and extent of the oxidation of the global ocean. Recently, carbon and sulfur isotopes have been used to suggest ventilation of the water column by ~ 550 Ma [1, 2]. Molybdenum concentration data support these results [3]. The work presented here concerns the timing and global nature of this phenomenon using an independent form of measurement, compound specific $\delta^{13}C$ isotopes of hydrocarbon isoprenoids and *n*-alkanes. It has been hypothesized that the change in isotopic fractionation between these molecules is related to the oxidation state of the ocean [4]. To obtain a more global perspective we studied a range of rocks and oils from Australia, Eastern Siberia and the South Oman Salt Basin (SOSB).

We found that in sediments and oils older than ~550 Ma *n*-alkanes are enriched in ^{13}C relative to isoprenoids, while in younger sediments the *n*-alkanes are comparatively depleted. In sediments from the carbonate platform of the SOSB, this switch coincides with the termination of the Shuram Excursion [1]. This corroborates previous studies that have suggested that the global ocean became ventilated ~550 Ma. However, in the deeper Athel Sub-basin of the SOSB, the switch occurs about 8 Ma later. We are now attempting to identify the processes behind these isotopic phenomena. In order to help constrain these processes we are also examining samples from the more ancient Bitter Springs Fm. in Australia and Chuar Gp. in Arizona, USA.

[1] Fike *et al.* (2006) *Nature* **444**, 744-747. [2] McFadden *et al.* (2008) *Proc. Natl. Acad. USA* **105**, 3197-3202. [3] Scott *et al.* (2008) *Nature* **452**, 456-459. [4] Logan *et al.* (1995) *Nature* **376**, 53-56.

A geobiological comparison of high- and low-Silica containing weathered volcanic glass

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The weathering of volcanic rocks plays a dominant role in carbon dioxide drawdown from the atmosphere and the long-term climate cycle, yet the role of microorganisms in rock weathering is still poorly elucidated. We have compared terrestrial volcanic glass with low (basalt glass) and high (obsidian) Si content from an Icelandic lava flow (Valafell) and obsidian outcrop (Dómadalshraun). Scanning electron microscopy (SEM) detected the presence of endolithic phototrophs in obsidian, however despite the higher abundance of microbial cells in basalt glass (up to 3.19 $\pm$ 0.67 x 10^7 cells/g) no phototrophs were observed. By contrast, community 16S rDNA clone library analysis revealed the presence of phototrophs in both rock types suggesting that phototrophs may be only a minor component in basalt glass communities and form less structured communities. Clone library analysis has, in addition, revealed major differences in prokaryotic community composition between the two environments. Although *Actinobacteria* were abundant members in both communities, the obsidian community contained abundant *Acidobacteria, Verrucomicrobia* and *Cyanobacteria*, while *Proteobacteria* and *Bacteroidetes* were prominent in basalt glass. Using a high-density oligonucleotide microarray we have confirmed that large differences exist between these two habitats, with obsidian supporting a less diverse bacterial community. Both types of glass exhibit alteration textures, but irregular alteration textures were much less common in obsidian compared to basalt. We postulate that these differences are driven by: 1) longevity of habitat. Obsidian is less easily weathered than basaltic glass, which will favour stable endolithic communities, 2) microbial accessibility of nutrients. Basalt glass weathers to soft, clay-like palagonite, unlike obsidian and may favour more copiotrophic organisms, and 3) porosity, which in our samples reduce accessibility of the material. These data yield insights into the biological mechanisms of volcanic glass weathering in terrestrial environments.