Enhanced growth of *Acidovorax delafieldii* 2AN during nitrate-dependent Fe(II) oxidation in continuous-flow systems

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It is not clear if microbial, NO_3^- -dependent, Fe(II) oxidation (NDFO) is energetically beneficial to cells or if it is primarily a fortuitous, side-reaction, involving both abiotic and enzymatic reactions during heterotrophic growth. Although recent batch experiments by others have suggested that NDFO may provide an energetic benefit through a mixotrophic physiology, it is not known if long-term growth yields can be enhanced by Fe(II) oxidation, and if this enhancement can be realized at environmentally relevant Fe^{2+}, NO_3^-, and organic C concentrations. *Acidovorax delafieldii* 2AN was incubated anoxically in batch reactors using a bicarbonate-buffered, artificial groundwater medium containing 5-6 mM nitrate, 8-9 mM Fe(II) and 1.5 mM acetate. A novel, continuous-flow culture system was also used to evaluate growth on low concentrations of substrates, e.g. 100 μM nitrate, 20 μM acetate and 50-250 μM Fe(II).

In batch reactors, almost 90% of the Fe(II) was oxidized with concomitant reduction of NO_3^- and complete consumption of acetate. However, cells became encrusted with Fe(III) (oxy)-hydroxides, lost motility and formed aggregates. Encrusted cells could neither oxidize more Fe(II) nor utilize further additions of acetate. In batch experiments using chelated iron [Fe(II)-EDTA], aggregated and encrusted cells were not produced and further additions of acetate and Fe(II) could be oxidized. This suggests that the cell encrustations prevent substrate entry into the cell or otherwise render cells physiologically inactive. In the continuous-flow system, the growth yield of *A. delafieldii* 2AN was always greater in the presence of Fe(II) than in its absence and ESEM examination showed that encrustation was minimized. This suggests that cell encrustations may be an artifact of the high concentrations of Fe(II) and NO_3^- used in batch cultures. Our results provide evidence that, under environmentally relevant concentrations of Fe(II) and NO_3^- , NDFO can enhance growth without the formation of cell encrustations that may limit viability in batch culture.

Kimberlites, flood basalts and mantle plumes: New insights from the Deccan Large Igneous Province

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A temporal and spatial relationship between small-volume, volatile-rich and highly potassic continental melt fractions, such as kimberlites and related rocks, and large-volume continental flood basalts exists in several Large Igneous Provinces (LIPs). Many of these LIPs are also widely regarded as products of mantle plume-lithosphere interactions. The small-volume melts either immediately pre-date or post-date or even are co-eval with the main flood basalt event. The overlap of ages between the flood basalts and the kimberlites very likely reflects a cause and effect relationship via mantle plumes.

Recently discovered end-Cretaceous diamondiferous kimberlites (orangeites) in the Bastar craton of central India which are synchronous with the flood basalts, carbonatites, lamprophyres and alkaline rocks of the Deccan LIP provide an opportunity to re-evaluate the role of mantle plume-lithosphere interactions in the generation of these disparate magmas. The geographical zonation of the kimberlite-lamprophyre-carbonatite-alkaline rock spectrum in the Deccan LIP is inferred to reflect variable thickness of the pre-Deccan Indian lithosphere with a thinner lithosphere along the known rift zones of northwestern and western India and a thickened lithosphere underlying the Bastar craton of central India. This heterogeneity is thought to have controlled the volume of melt generation and melt ascent, as well as the ultimate alkaline magma type.

These findings are supported by the regional lithospheric thickness map, generated from converting seismic shear wave velocities into temperature profiles, which depicts that the present-day lithosphere beneath the Bastar craton is thicker than that in western and NW India where the centre of the Deccan plume-head was located. Thermal weakening of the sub-Bastar craton due to mantle plume-lithosphere interaction at the end-Cretaceous resulting in a thin-spot is suggested to have controlled the Deccan-related mafic dyke emplacement in the Bastar craton