Response of continental biogeochemical processes to short- and long-term global warming

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Much work on past hyperthermals, and especially the Paleocene-EoceneThermal Maximum (PETM), illustrates that rapid global warming caused dramatic changes in the continental hydrological, erosional and weathering regime. Evidence for such changes include higher plant δD records indicative of increased moisture transport to the poles, lithlogical and organic geochemical evidence for increased erosion and transport of sediments to marginal marine settings, and osmium isotopic evidence for increased chemical weathering. Here we compare the impact of these transient events to that of the longer term global warming that occurred from the mid-Paleocene to mid-Eocene.

New short-term records from Tanzania and NZ provide further evidence for a reorganisation of the global hydrological cycle coinciding with the onset of the PETM. They also document increased inputs of terrigenous biomarkers into marginal sediments, complementing previous work from, for example, the North American margin, the Arctic Ocean and the Tethyan realm.

In contrast, longer term terrigenous biomarker records document no difference between relatively cooler (Late Paleocene, Middle Eocene) and warmer (Early Eocene) intervals. Where the records do exhibit variability, they do not inidcate elevated terrigenous inputs during warm intervals. This is expected as the long-term control on erosion will be dictated by the temperature-mediated balance between uplift and denudation. By comparison, the dramatic perturbations at the PETM must reflect the consequence of temporary but dramatic deviations from this steady state due either directly to elevated temperatures or consequential changes in hydrology. This highlights the importance of examining the rapid climate change events of the past if we wish to understand the consequences of comparably rapid Anthropocene climate change.

Chlorine and CO_2 rich Fluids in 2.5 Ga amphibolite-granulite facies basement below the Killari earthquake region, India and seismogenesis

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Halogens form an important component in the upper mantle fluids and play a significant role in understanding the evolutionary processes of the earth's crust and upper mantle. Killari-Latur earthquake (M 6.2) region of Maharashtra (central India), concealed below a thick suite of Deccan volcanics, is one such region where massive exhumation of mafic crust has taken place [1]. In order to understand the role of mantle fluids in the seismogenesis, we have carried out a detailed mineralogical investigation on the 2.5 Ga Archean basement core samples from a 617m deep Killari borehole, drilled in the epicentral region for seismotectonic studies. Our study indicates that the crystalline basement, covered by a 338m thick Deccan volcanics, is made up of CO_2, Cl, FeO and CaO-rich, high density (2.82 g/cm^3) - high velocity (avg. Vp: 6.20 km/s) amphibolite-granulite facies rocks, which underwent pervasive Ca-metasomatism due to infiltration of mantle fluids. Primary source of such fluids apparently existed in the upper mantle, from where it moved to lower crust due to thermal remobilization. Input of mantle heat flow in this region is estimated to be quite high at about 32 mW/m^2. Present study reveals an interesting possibility that nucleation of large intraplate earthquakes may be related to the regional metasomatism, which is also fluid controlled and alters the basic fabric and composition of the rocks considerably due to recrystallisation.

[1] Pandey O.P. *et al.* (2009) *J.Asian Earth Science* **34**, 781–795.