New views on the neogene harvesting and burial of terrestrial organic carbon

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The temporal evolution of the $\delta^{13}C$ of marine carbonate bears contains valuable informations about on the global size of the organic carbon (OC) pool. C-cycle models based on the coupling of atmospheric CO_2 consumption and the fertilisation of coastal seas by continental silicate weathering enhanced by mountain building, suggest a rise in the marine OC burial rate for the entire Neogene that played a role in global cooling [1]. However, such tectonic-climate link relies primarily on the inorganic cycle, which has proven to be particularly inefficient to drawdown atmospheric CO_2 in the Himalayas [2] and only enhanced in the late Miocene as recorded in the Indian Ocean [3]. Other hypothesis linking OC burial and global cooling have been suggested, requiring changes in the biogeochemistry of the ocean [4]. Here, we show that terrigenous OC could play a role since its export from land is climatically sensitive. In Taiwan, the climatic control on the erosion and export of OC from the biosphere is moderated by the catchment geomorphology (proportion of steep hillslopes) [5]. In the Swiss Alps, we find that supply of OC from soil becomes active at a moderate threshold and runoff delivers OC to the stream with a long-term efficiency comparable to Taiwan [6]. As observed in the modern Bay of Bengal depositional system [7] or in the mid-Miocene turbidites of the Apennine (Italy), burial efficiency of terrigenous OC is particularly high. The respective role of climate and tectonic forcing and their feedbacks will be discussed with implications for the preservation of C3 biomes.

[1] Raymo (1994), *Paleoceanography,* **9**, 399-404 ; [2] Galy & France-Lanord (1999), *Chem Geol*, **159**, 31-60 ; [3] Gourlan *et al* (2008), *Earth Planet Sc Lett,* **267**, 353-364 ; [4] Vincent & Berger (1985), *Geophys Monogr Ser*, **32**, 455-468 ; [5] Hilton *et al* (2012), *Global Biogeochem Cy,* **26**, GB3014, 1-12 ; [6] Smith *et al* (2013), *Earth Planet Sc Lett,* **365**, 198-208 ; [7] Galy *et al* (2007), *Nature*, **450**, 407-410

New insights into environmental characterization of bauxite residues (red mud) from Greece

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Bauxite metallurgical tailings (red mud from alumina production) were provided by Aluminium of Greece S.A. plant at central Greece (www.alhellas.gr) and characterized by using a combination of microscopic, analytical, and advanced spectroscopic techniques (SEM-EDS, XRF, ICP-OES/MS, HR γ-ray Spectrometry and EXAFS). Particular emphasis was given on investigating actinides, and other elements of potential environmental interest. According to XRF (performed at the PANalytical laboratories) and ICP-OES/MS measurements, the material contains Cr (2025 ppm), V (1081 ppm), Ni (933 ppm), As (164 ppm), Pb (120 ppm) and Th (111 ppm). The latter, and also minor U (15 ppm) are responsible for radioactivity (352 and 134 Bq/Kg for ^{232}Th and ^{238}U respectively) with total dose rate 285 nGy/h. Specific leaching experiments, using seawater from Greece, in conjunction with ICP-MS (performed at the INE/KIT), indicated significant release of V, which seems to be the most mobile element. Minor quantities of As and Cr may also be released in seawater. On the other hand, the release of Th, and therefore of significant radioactivity, was found to be negligible. The immobility of Th can be explained by its position in the crystal structure of Ti-oxides, as proved by the the Th L_{III}-edge EXAFS data, obtained at the ANKA Synchrotron Radiation Facility (KIT) and evaluated using the ATHENA and the EDA software packages.

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