Tracing the efficiency of chemical weathering through magnetic properties of sediment: An Eocene case study

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Eocene climate was characterized by progressive cooling from the early Eocene climatic optimum (EECO, ~52–50 Ma) to the Eocene-Oligocene transition. Long-term climate changes are inferred to be modulated through the greenhouse effect by the pCO_2 of the atmosphere, which in turn depends on the balance between large fluxes of sources and sinks [1]. The main long-term source of CO_2 is global outgassing from sea-floor spreading, subduction, hotspot activity, and metamorphism. The ultimate sink is the weathering of silicates on land, followed by deposition of carbonates.

We studied rock-magnetic properties of the Eocene marine sediments outcropping in different localities in the Tethyan realm and the southwest Pacific Ocean. Rock-magnetic data indicates peaks in detrital hematite content of sediments relative to other magnetic phases that correlate with climate optima. Hematite is a common end-product of land weathering processes under continental aerobic conditions. Recent studies show a direct correlation between hematite production and the mean annual temperature [2]. We believe that the observed increase of hematite content in Eocene sediments reflects increased chemical weathering conditions on land during climate maxima. The enhanced hydrological cycle associated with the warming provides the medium to transport and deposit the hematite grains into the adjacent ocean basins. Our climate-controlled rock-magnetic curve reflects the efficiency of the silicate weathering mechanism to buffer pCO_2 variations, and thus Earth's climate.

[1] Berner (1999) *GSA Today* **9**, 1-6. [2] Torrent *et al* (2010) *Eur. J. Soil. Sci.* **61**, 161-173.