Thermal stability of maghemite: fingerprint for basalt weathering

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Maghemite (γ-Fe_2O_3) is formed by topotactic oxidation of magnetite (Fe_3O_4). In weathering environments these two phases often occur as endmembers in oxidative solid solutions.

The thermal stability of maghemite in lithic fragments of the Karoo flood basalt which were deposited in the Namibian desert in SW Africa is determined by using ferromagnetic resonance (FMR) and micro Raman spectroscopy as well as magnetic measurements. The spectroscopic data are characteristic for a solid solution. The five active Raman bands (712, 665, 507, 380, 344 cm^{-1}) for maghemite indicate well defined structural properties. Thermomagnetic and hysteresis measurements reveal a Curie temperature of about 890 K and the thermal conversion of the maghemite into hematite is found at about 1000 K.

The high thermal stability is unique for maghemite as weathering product. Such well defined maghemite suggests a relatively slow weathering rate and stable climatic conditions. Such premises are fulfilled in hyperarid areas such as the Namibian desert. Based on the above findings, maghemite with well defined structural and magnetic properties has potential as fingerprint indicating arid/hyperarid conditions during weathering.

A map of recent terrigenous fluxes to Southern Ocean sediments: Application of $^{230}Th_{xs}$-normalized ^{232}Th as a dust flux tracer

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Dust fluxes to the ocean have been identified as one of the controlling factors of marine bioproductivity. Therefore, both palaeoceanographical studies as well as numerical models of ocean biogeochemistry aim at quantifying the effect of dust onto iron-limited marine ecosystems, especially the Southern Ocean. However, recent dust fluxes to the open ocean are still not well constrained. This applies in particular to the Southern Ocean, where few observational data are available. The limited information about absolute dust fluxes and their effect on productivity means a serious obstacle for linking the sedimentary record to our understanding of ocean biogeochemistry as reflected in models. Therefore, a better knowledge about recent dust fluxes to marine sediments can provide a link between models and palaeoceanographic data. Here, we present a map of recent terrigenous fluxes to the sediments of the Southern Ocean. We use $^{230}Th_{xs}$- normalized fluxes of ^{232}Th to calculate lithogenic fluxes from a comprehensive sample set of sediment surfaces. In addition to a map of dust fluxes in the Atlantic and Pacific sector of the Southern Ocean, our presentation will include an example for the generation of the ^{232}Th-signal in the ocean, studied by means of water column measurements in the dust-affected subtropical Atlantic. We also present evidence for the close correlation between dust-transported biomarkers (n-alkanes) and inorganic proxies like ^{232}Th.