Geochemistry and mineralogy of volcanic ash red paleosol from Fogo island (Cape Verde)

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Introduction

Red paleosols developed on volcanic ashes occur in Fogo island (Cape Verde, semi-arid climate). Four samples were collected in a vertical profile (70 cm depth) of paleoweathered volcanic ashes (Monte Almada, western Fogo) with decreasing grain size upwards and varying in colour: P1-1- dark gray + dark reddish brown; P1-2 – dark yellowish brown + yellowish brown; P1-3 – red; and P-4 – weak red at the top. The paleosol is underlayed by carbonatite and covered by nephelinite lavas. Chemical and mineralogical analyses were done by INAA, Mössbauer spectroscopy and XRD.

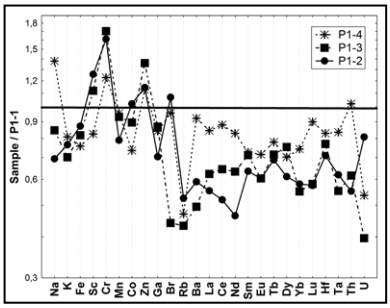

Figure 1: Chemical variations with depth.

Discussion of Results

A general decrease of the analysed chemical elements (rare earth elements included) occur in the upper levels (Fig.1, where sample P1-1, collected at the bottom, was used as reference). Exceptions were found for Cr and Zn. Na is enriched at the top level. Quartz, augite and phyllosilicates are ubiquitous. Magnetite is present in the lower P1-1 and P1-2 levels and gradually oxidizes towards maghemite in P1-3 and P1-4. Hematite is observed in all samples, its content increasing upwards. Fe^{2+} is incorporated in phyllosilicates and augite throughout the profile. The Fe^{2+}/Fe^{3+} ratio is slightly lower in the surface level.

Horozontial and vertical water mass tracing of the SW Pacific Ocean during the last deglaciation

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We have measured Mg, Al, Mn, Zn, Sr and Ba/Ca ratios for *Globigerina bulloides* by LA-ICPMS, in a high-resolution marine sediment core (MD97-2121, 40°22.935′S; 177°59.68′E; 25 ka to present) from the SW Pacific Ocean at centennial scale resolution. The core site resides beneath two major, interacting surface water masses (Subtropical Water [STW], Sub-Antarctic Water [SAW]). Mg/Ca ratios record a change in mean ocean temperature of 6°C from the last glacial period to the Holocene, with a maximum regional temperature difference of 11°C. Alkenone paleo-ocean temperatures from the same core record significant differences with an earlier (2 kyr) onset of deglaciation, subdued short-term temperature variability and do not define the Antarctic Cold Reversal, which is clearly visible in the Mg/Ca record. Mg/Ca ratios in the final (*f*) and antepenultimate (*f-2*) chamber of *G. bulloides* appear to reflect its migration through the water column at differing stages of its life cycle. Holocene Mg/Ca values have a 20% difference between chambers f and f-2 compared to 10% during the last glacial period, suggesting a reduction in the glacial surface ocean thermal stratification. Measurement of Mn, Ba and Zn in *G. bulloides* from a regional suite of core-tops potentially discriminates STW and SAW. The down-core results demonstrate a dominance of SAW during the last glaciation when enhanced winds forced northward transport of surface waters, accompanied by increased upwelling, and a prominence of STW during the Holocene.