Mass independently fractionated sulfur isotopes in HIMU lavas reveal Archean crust in their mantle source

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Ocean island basalt (OIB) lavas from Mangaia, Cook Islands (Polynesia) exhibit an extreme HIMU (high-μ, or high $^{238}U/^{204}Pb$) signature that has been attributed to melting of ancient recycled oceanic lithosphere within their mantle source. However, the residence time of subducted materials in the mantle is uncertain and model-dependent, and compelling evidence for their return to the surface in regions of mantle upwelling beneath hotspots is lacking. Here we report new SIMS data supporting our original finding of anomalous sulfur isotope signatures indicating mass-independent fractionation (MIF) in olivine-hosted sulfides from 20-million-year-old ocean island basalts from Mangaia (most extreme $\Delta^{33}S$ measurement = $-0.34 \pm 0.08‰$) [1]. Terrestrial MIF sulfur isotope signatures were generated exclusively through atmospheric photochemical reactions until about 2.45 billion years ago. Therefore, the discovery of MIF sulfur in these relatively young OIB lavas suggests that sulfur once at the Earth's surface was subducted into the mantle before 2.45 billion years ago and recycled into the mantle source of Mangaia lavas. These data provide evidence for ancient materials, with negative $\Delta^{33}S$ values, in the mantle source of Mangaia lavas. Our data also complement evidence for recycling of the sulfur content of ancient sedimentary materials to the subcontinental lithospheric mantle that has been identified in diamond-hosted sulfide inclusions. This Archean age for recycled oceanic crust also provides key constraints on the length of time that subducted crustal material can survive in the mantle, and on the timescales of mantle convection from subduction to upwelling beneath hotspots.

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Heavy metals of the Santiago Island (Cape Verde) topsoils

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In this work we present maps of Estimated Background Value (EBV) of some harmful metals (As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, V, Zn) in the soils of the Santiago Island and analyse their relationships with the geological cartography. We also carried out Risk assessment on the soils. The geochemical survey (sampling of 249 soil samples, sample preparation, analysis, data treatment and mapping) was conducted following the guidelines of the International Project IGCP 259. The concentration of selected elements were determined in the fraction <2mm. Each sample was digested with aqua regia and analyzed by ICP-MS. Heavy metals in Santiago Island topsoils were mostly originated from the weathering of underlying bedrocks. The EBV spatial distribution of the metals allowed us to establish relationships between the geological formations. These relationships were confirmed by the results of Principal Component Analyses (PCA). The metals with higher loadings in PC1 (Co, Cr, Ni, Cu and V) clearly show the influence of a rich lithology in siderofile elements, and metals typical of basic rocks. The high values of Geoaccumulation Indices for these elements demonstrated that the Santiago soils may have higher Co, Cr, Ni, Cu and V risks which are caused by its higher natural origin. The metals with higher loadings in PC2 (As, Hg, Cd, Zn and Pb) are also taken as a natural lithogenic factor, because the metals hot spots are mainly located at areas with soils derived from pyroclastic deposits of MV and AS Formations. However, contamination of As, Hg, Cd, Zn and Pb occurred in some areas that may have a human-influenced source.

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