New isotopic constraints on Amsterdam-St. Paul hotspot activity: Evidence for a deep-seated mantle plume and implications for the DUPAL anomaly origin

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The Amsterdam-St Paul oceanic plateau (ASP) results from the interaction between the ASP hotspot and the Southeast Indian ridge. A volcanic chain, named the chain of the dead Poets (CDP), lies to its northward tip and is related to the hotspot intraplate activity.

The ASP plateau and CDP study reveals that ASP plume composition comes from oceanic crust and pelagic sediments recycled in the mantle through a 1.5 Ga subduction process. The ASP plateau lavas have a composition (major and trace elements and Sr-Nd-Pb-Hf isotopes) reflecting the interaction between ASP plume and the Indian MORB mantle, with some clear DUPAL input [1].

The Indian upper mantle below ASP plateau is heterogeneous and made of a depleted mantle with lower continental crust strips probably delaminated during the Gondwana break-up. The lower continental crust is one of the possible reservoirs for the DUPAL anomaly origin [2-3-4-5] and our data support it. The three endmembers involved (plume, upper mantle and lower continental crust) and their mixing in different proportions enhances an important geochemical variability in the plateau lavas.

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Development of an active mine water treatment technology by use of schwertmannite

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As a residual of microbial ferrous iron oxidation, large amounts of schwertmannite (Fe_8O_8 $(OH)_6SO_4$) were produced in a pilot plant for lignite mine water treatment in Tzschelln (Lusatia, Germany). The secondary mineral has excellent properties for removal of arsenic and other oxoanions from mine water and rapidly transforms into ferric hydroxides of high specific surface area once exposed to water containing at least some alkalinity. Therefore, the research project SURFTRAP was carried out to investigate the applicability of schwertmannite for the treatment of ground- and surface water contaminated with arsenic.

Following to fundamental, hydrochemical and structural investigations in the laboratory, a pilot scale test was performed in the bypass of an active water treatment plant for contaminated flooding water from uranium ore mining. About 25 mg Fe/L as schwertmannite were necessary to undershoot the governmental described effluent limits (0.3 mg As/L and 0.5 mg U/L). The costs of the higher demand of schwertmannite compared to the conventional $FeCl_3$ additon (10 mg Fe/L) could be compensated by a reduction of lime milk requirement of about 25%.

Furthermore, dumping experiments with arsenic-loaded schwertmannite-sludges were performed. A discontinuous irrigation scenario and a continuous groundwater equilibration scenario was investigated. After one year, no significant arsenic release was observed.