The OIB signature in Central America: Old lithospheric and young asthenospheric mantle reservoirs

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Although most Central American magmas have a depleted MORB-source mantle (fluxed by subduction-derived fluids), magmas in southern Central America have isotopic and trace element compositions with a Galapagos affinity. How Galapagos-influenced signature was introduced into the Central American mantle is at the heart of conflicting theories [e.g. 1, 2, 3]. Our new data for Costa Rica suggest that this signature has a relatively recent origin (~6 Ma) [4, 5]. REE inverse modelling [6] results indicate that garnet is not present in the distal back-arc region. In contrast, adakites from Central America, as well as volcanic front lavas and alkaline lavas from central Costa Rica (Fig. 1) and Panama, require garnet in the source. Garnet-present sources (<6 Ma) close to the volcanic front in Costa Rica and Panama suggest that the Galapagos-related reservoir can be either asthenospheric or recycled (subducting Galapagos tracks). The garnet-free source (>12 Ma) in the distal back-arc suggests that there is another enriched reservoir stored in the lithosphere, predating any recent subduction-generated or asthenospheric flow enrichment.

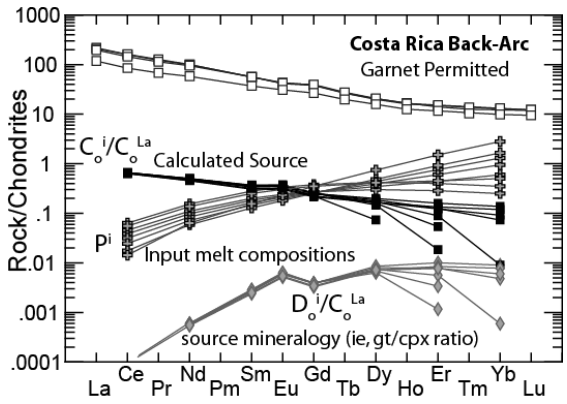

Figure 1: Example of a REE inverse model. Details in ref. [6]

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Minerals under attack: From ions to eukaryotes

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Atomic Force Microscopy (AFM) was used to visualize the effects of a wide range of weathering agents, from protons to filamentous fungi, on phyllosilicates. The effects of protons and oxalate on the basal and {hk0} surfaces of these minerals have been followed in *real-time*. On biotite, weathering process consisted in the retreat of {hk0} surfaces and in the formation of etch-pits on basal surface. For the first time, we have been able to follow the dynamics of the formation of etch-pits which consisted in a progressive removal of the first tetrahedral layer, followed by the octahedral and then the second tetrahedral sheet. The removal of the first tetrahedral layer takes place through the detachments of building blocks, suggesting that some Si-O-Si bonds are not broken. The presence of the underlying octahedral layers also implies that even if some cations could have been removed, this layer is relatively intact before the removal of the first tetrahedral sheet.

AFM have been also used to extensively characterize an ectomycorrhizal fungus, *Paxillus involutus*, colonizing mineral surfaces. Basal surfaces of both biotite and chlorite present channels created by the fungus. High-resolution imaging allowed us to detect channels that are only one basal layer deep (1.5 nm) and to identify non-mineral material, probably of fungal origin, associated with the channels. The latter often presented lateral, smaller channels. While the central part of hypha could be involved in the formation of the main channels, the lateral channels could participate to their enlargment.

Here we show how the direct visualization of mineral surfaces during weathering processes is fundamental in order to interpret the possible mechanisms involved in the process, both at atomic (protons on surface) and multicellular (fungi on surface) levels.