The influence of metasomatized mantle wedge related to flat-subduction processes in extra back-arc basalts in Patagonia, Argentine

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During the Cenozoic age, there were relatively large volumes of basaltic lava eruptions in the eastern Andes along the Chile trench, South America, which generated extensive volcanic plateaus in a geotectonic environment of continental "extra" back-arc. The outcropping volcanic products in the studied area are displaced from 34ºS to 46º30'S and host ultramafic xenoliths. Twenty-three samples of volcanic basalts from 11 different localities were analyzed. These rocks are basanites-tefrites, trachybasalts and basalts of the alkaline series, with phenocrysts and/or xenocrysts of olivine, orthopyroxene and clinopyroxene. In general, REE patterns for these rocks present similar variation with an expressive enrichment in light REE in relation to the heavy REE. The multi-elemental diagram analyses allow the individualization of the basalts into two groups with distinct behaviors. Group I shows OIB-like characteristics with Th enrichment and Pb depletion, while Group II presents OIB-like characteristics with Pb, Ba and Sr enrichment, which is related to some influence of the subduction zone. Isotopic data for both group present low $^{87}Sr/^{86}Sr$ isotopic ratios (0.7031-0.7049) and moderate $^{143}Nd/^{144}Nd$ values (0.512689 to 0.512983) that are comparable to typically mantelic basalts with OIB characteristic, according to Hart and Zindler (1989). However, Group I generally exhibit higher $^{143}Nd/^{144}Nd$ and lower $^{87}Sr/^{86}Sr$ isotopic ratio compared to the majority of samples from Group II. These characteristic are similar to the ones observed to Pliocene-Pleistocene post-plateau basalts studied by Gorring and Kay (2001). However, our data suggest that some of these basalts in Group II are generated from depleted mantle wedge with some influence of the subduction event when flat-subduction of Nazca plate might be temporally occurring under the South American plate during the Miocene. Our conclusions are very close to the one reached by Stern *et al*. (1990) who classified the basalts in "cratonic" and "transicional" observing a geographic distribution for them. However, our basalts from both groups resemble the "cratonic" basalts of Stern *et al.* (1990), and we address the difference from one to the other to different contribution proportion of fluids originated from the subducting slab. We do not observe samples with "transitional" characteristic or any geographic distribution for them.

Controls on weathering rates by reaction-induced hierarchical fracturing

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Weathering takes place through several stages that include mechanical disintegration of the rocks, and subsequent interactions between the exposed rock surface, the hydrosphere and the biosphere. Here we demonstrate how physical and chemical weathering processes are intimately coupled during weathering of basaltic intrusions (dolerites) in the Karoo Basin in South Africa. Incipient chemical weathering of the dolerites occurs around water-filled fractures originally produced by thermal contraction or by externally imposed stresses. This chemical weathering causes local expansion of the rock matrix, which generates elastic stresses. On mm to cm scales, these stresses lead to mechanical layer-by-layer spalling, producing the characteristic spheroidal weathering patterns. However, our field observations and computer simulations demonstrate that in confined environments, chemical weathering drives a much larger scale hierarchical fracturing process in which fresh dolerite undergoes a continuous domain division that effectively regenerates fresh surfaces in a self-accelerating manner. This process produces the characteristic weathering patterns seen in Karoo and a wide-range of other geological environments, and provides a first-order control on the total weathering rate.