Geochemical Segmentation of the Pacific Antarctic Ridge

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Samples collected during the PACANTARCTIC 2 (PAC2) cruise fill a sampling gap from 53° to 41° S on the Pacific Antarctic Ridge (PAR). Therefore it becomes possible to have a picture of the geochemical variations along the PAR from 65°S to the Juan Fernandez microplate.

PAC 2 data together with a compilation of published Sr, Nd, Pb, Hf and He isotopic analyses show geochemical variations related to first order tectonic discontinuities. One example occurs at the Eltanin fracture zone. Another example is within the PAC2 study area at 50°S where a major transform fault, Menard TF, marks the boundary between two geochemical domains. To the south of Menard TF, trace element and isotope ratios are depleted and more variable than to the north where the variations are more subdued and the geochemical parameters indicate a more enriched source.
These geochemical variations reveal large-scale chemical and morphological divisions of the Pacific mantle.

At a smaller scale, the regular sampling of the different segments, limited by overlapping spreading centers along the 53-41°S ridge section, shows regular variations in geochemical parameters. Most of the 100-260 km long segments are depleted with $(Nb/Zr)_N < 1$. The centers of the segments have higher $(Nb/Zr)_N$ and more radiogenic Sr isotope ratios than the segment ends where the ridge becomes less robust. This small-scale geochemical segmentation together with observed variations of geophysical parameters suggests small-scale mantle flow below the ridge. However, this regular small-scale variation is locally affected by the presence of nearby off-axis volcanoes which define a pseudo-microplate. The consequences at the ridge axis are both morphological and geochemical. They are revealed by a slight change in the ridge axis direction associated with atypical geochemical signatures of the ridge basalts. Kinematic reorganization of the pacific antarctic plate boundary is likely responsible for these features.

Isotope evidences for the origin of Cape Verde oceanic carbonatites

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Carbonatite rocks are found on every continents, except Antarctica. However, their occurrence in an oceanic setting is very rare and oceanic carbonatites have been reported only at the Cape Verde and Canary archipelagos. More precisely, they have been found on five out of ten islands of the Cape Verde archipelago, and on only one (Fuerteventura) amongst seven islands of the Canaries.

Geochemical studies based on stable, radiogenic and noble gas isotope systematics have led to the general consensus that parental magmas to continental carbonatites originate in the mantle. For oceanic carbonatites, their mantle origin is not debated either. They have been associated with the mantle plumes at the origin of the Cape Verde and Canary archipelagos (Hoernle *et al*., 2002; De Ignacio *et al*., 2006).

Here, we report new Sr-Nd isotope data, as well as major- and trace-element contents measured on 15 Cape Verde carbonatites (whole-rock samples and separate phases) collected on the islands of Brava, Fogo, Santiago and São Vicente. We discuss the relationship that exists between isotope data and the geographical location of carbonatites in the Cape Verde archipelago. That way we determine the best representative isotopic composition of the carbonatites parental magmas (pristine melts) and focus on the comparison between distributions of (i) carbonatite chemical compositions and (ii) basaltic rocks of the Cape Verdes. Finally, we discuss two alternative models for the origin of carbonatites: (1) partial melting of a HIMU-like Cape Verde plume component; and (2) plume-induced melt generation within carbonatitic metasomatized oceanic lithosphere domains.

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References

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