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Fluid/rock interaction during migmatitization of carbonatite dikes, Fuerteventura, Canary Islands

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The Basal Complex of Fuerteventura, Canary Islands, contains an ultraalkaline complex formed by alkaline pyroxenites, melteigites, ijolites, alkaline gabbros, syenites and carbonatite dikes cut by a basaltic dike swarm. A later pyroxenite pluton intruded the entire series and caused partial melting in the contact zone. The migmatitization appears in the form of "zebra rocks" in the contact metamorphosed silicate rocks. Carbonatite dikes have been found in the migmatite zone during recent field work. Some of the dikes developed a typical skarn mineralogy, including diopside, grossular garnet and wollastonite. The metamorphic reactions were also associated with trace element mobilization resulting in Sr enrichment in the carbonatite ($>$8% SrO).

Significant variations of stable isotope compositions have been detected between carbonatite occurrences of Fuerteventura that are located about 50 km away from each other (Demény et al., 1998). These variations were attributed to assimilation of sedimentary material. However, the finding of contact metamorphosed carbonatites raised the question whether these variations can be related to the late pyroxenite intrusion. More than 40 carbonatite dikes were sampled and analysed from and around the migmatite zone of a pyroxenite pluton in the central part of Fuerteventura. Most of the dikes with coarse-grained calcite preserved close-to-primary isotopic compositions, whereas the fine-grained carbonate at carbonate-silicate contacts show significant C and O isotope deviations, due to late fluid/rock interactions. The dike with wollastonite has δ^{13}C and δ^{18}O values indicating CO_2 release in agreement with the developed skarn mineralogy. Beside these small-scale variations, spatial distribution of the isotopic compositions was observed. Carbonatite dikes close to a zone of MORB-like ocean crust relics show systematic δ^{13}C and δ^{18}O shifts from primary compositions

(cf. Demény et al., 1998). This shift can be explained by mobilization of sedimentary carbonate contained in the ocean crust blocks and interaction with the spatially close carbonatite dikes. This mobilization was related to circulation of fluids heated by the pyroxenite intrusion that produced also the metamorphic-metasomatic reaction resulting in skarn formation. The resulted change in the stable isotopic compositions is similar to those observed by Demény et al. (1998) that calls attention to the effect of late pyroxenite intrusions in the entire island.

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Reference:

Demény, A., Ahijado, A., Casillas, R., Vennemann, T.W. (1998): Crustal contamination and fluid/rock interaction in the carbonatites of Fuerteventura (Canary Islands, Spain): a C, O, H isotope study. Lithos, 44, 101-115.