Ofioliti, 2008, 33 (2), 187-207

CORSICA OPHIOLITES: GEOCHEMISTRY AND PETROGENESIS OF BASALTIC AND METABASALTIC ROCKS

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Keywords: *Ophiolite, geochemistry, petrogenesis, Piedmont-Ligurian Ocean, Alpine Corsica.*

ABSTRACT

This paper presents a systematic geochemical characterization of the basaltic and metabasaltic rocks from the Alpine Corsica ophiolites. The various ophiolitic units of Alpine Corsica can basically be subdivided into two main types: (1) high-pressure/low-temperature, metamorphic ophiolites belonging to the Lower Schistes Lustrés (LSL) and Upper Schistes Lustrés (USL) Complexes and (2) the non-metamorphic, upper ophiolitic units.

Basaltic and metabasaltic rocks from all these units display many common geochemical characteristics, which indicate a common genesis in a mid-ocean ridge setting. However, on the bases of their high field strength element (HFSE) and rare earth element (REE) distribution, two main geochemical types can be recognized. One type has normal MORB-type (N-MORB) geochemical features, being characterized by flat N-MORB normalized HFSE patterns, slight depletion in Th, U, Ta and variable depletion of light REE (LREE) with respect to medium REE (MREE). This type is volumetrically prevalent and is found in metabasalts from the LSL and USL, as well as in basalts from the upper ophiolitic units. The other type has transitional MORB-type (T-MORB) geochemical features, as it shows slightly enriched N-MORB normalized HFSE patterns, slight enrichment in Th, U, Ta and LREE enrichment with respect to MREE. This type is observed in metabasaltic rocks from the Santo Pietro di Tenda Unit (USL) and in basalts from the Nebbio and from the bottom of the Balagne units.

A distinguishing geochemical feature of basaltic and metabasaltic rocks from the Alpine Corsica ophiolites is a marked heavy REE (HREE) fractionation with respect to MREE. The $(Sm/Yb)_N$ ratios range from 1.1 to 2.6, but in most cases are > 1.5. This feature is interpreted as a garnet signature, which can be related to the melting of a heterogeneous mantle source characterized by garnet-bearing mafic/ultramafic layers. Semi-quantitative modelling of the REE data for the N-MORBs indicates that these rocks may have derived from small-degree (< 8%) partial melting of a depleted MORB-type peridotitic source bearing small volumes of garnet-pyroxenite relics. The differential degree of partial melting of this source can explain the significant range of variation of LREE/MREE ratios, as well as the high $(Sm/Yb)_N$ ratios observed in the studied N-MORB rocks. In addition, the N-MORB rocks most likely derived from compositionally similar mantle sources and much of the internal chemical variation in these rocks is more likely due to differential partial melting rather than different enrichments of their mantle sources. Semi-quantitative modelling of the REE data for the T-MORBs indicates that these rocks may have been derived from small-degree (< 5%) partial melting of a lithospheric mantle source bearing garnet-pyroxenite relics. They could represent products extruded in the ocean-continent transition zone during the initial stage of oceanic opening, whereas N-MORBs may represent volcanic sequences formed in more internal paleo-oceanic positions after the onset of the oceanic spreading.