PERIDOTITES, PYROXENITES AND GABBROS ASSOCIATION WITHIN HIGH-GRADE CRYSTALLINE BASEMENT ROCKS FROM THE CALABRIAN THYRRENIAN COASTAL CHAIN, CALABRIAN ARC, SOUTHERN ITALY

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ABSTRACT

Small peridotite and gabbro bodies outcrop within medium-high grade, Grt- and Sil-bearing granulitic and migmatitic rocks of the Calabrian Thyrrenian Coastal Chain, northern sector of the Calabrian-Peloritan Arc, southern Italy. These bodies generally have sharp contacts with the country rocks. The peridotites, which sometimes include folded, transposed and boudinated pyroxenite veins and/or gabbroic dykes, are heavily serpentinized, although small, less serpentinized portions are locally preserved. These fresher portions show porphyroclastic microstructure, with olivine (Fo 90-93), orthopyroxene (En 89-91; Al_2O_3 = 1.1 - 2.9 wt%), brown spinel (Cr/(Cr+Al) 0.07-0.75), very rare clinopyroxene (Ca/(Ca+Mg) = 0.51-0.52; Al_2O_3 = 2.36-3.22 wt%), amphibole (Mg-hornblende - pargasite), chlorite, antigorite, lizardite 1T and magnetite. The pyroxenite veins are represented by abundant orthopyroxenites, Amph-pyroxenites and scarce Spl-websterites. The orthopyroxenites have porphyroclastic to granoblastic polygonal microstructures, with porphyroclasts of orthopyroxene (En 88-89; Al_2O_3 = 3.06-3.92 wt%), olivine (Fo 90) and hercynitic spinel set up in a well-recrystallized, polygonal matrix of orthopyroxene (En 88; Al_2O_3 = 3.5 wt%), olivine (Fo 90), amphibole (Mg - hornblende), serpentine, chlorite and diaspore. The Amph-pyroxenites show porphyroclastic texture with large porphyroclasts of amphibole (Mg-hornblende) and clinopyroxene (Ca/(Ca+Mg) = 0.49-0.51; Al_2O_3 = 1.9-2.1 wt%) set up in a well-recrystallized matrix of amphibole (pargasite to Mg-hornblende), clinopyroxene (Ca/(Ca+Mg) 0.58; Al_2O_3 = 1.94-2.1 wt%), orthopyroxene (En 86-87; Al_2O_3 = 2.75-3.05 wt%), hercynitic spinel (Cr/(Cr+Al) = 0.09-0.13) and magnetite. The Spl-websterites have a porphyroclastic microstructure, with clinopyroxene (Ca/(Ca+Mg) 0.48; Al_2O_3 = 0.6 wt%), orthopyroxene (En 89; Al_2O_3 = 0.6 wt%) and brown spinel (Cr/(Cr+Al) 0.54).

The serpentinized peridotites have MgO/FeO_t values ranging from 5.1 to 7.6, which coupled with their Ni-Co-Sc patterns suggest a residual character. The REE patterns, in spite of some zig-zag behaviour of L - and MREE, possibly due to the serpentinization process, are also indicative of a depleted character (Ce_N/Yb_N = 0.03-0.65).

The metagabbros show a tholeiitic fractionation trend. Incompatible elements spider diagrams normalized against MORB show more or less flat patterns around 1, except for a conspicuous negative Th anomaly. The REE normalized patterns show either a positive slope from La to Eu followed by a more or less flat trend at about 10 x Ch, or almost flat trend at around 10 x Ch. Some samples show slight, positive Eu anomaly. The La_N/Yb_N ratios range from 0.07 to 2.39. Their geochemical signature would be consistent with an underplating magmatism. The REE abundances of the pyroxenites, as well as their Ni-Co-Sc patterns, suggest a derivation from reacting melts and/or fluids.

Temperatures of equilibration of about 800°C and 750°C have been calculated for the peridotites - pyroxenites and metagabbros, respectively. These data fit quite well the inferred physical conditions (750-800°C and about 0.9 - 1.1 GPa) for the metamorphic climax of the granulitic country rocks (Piluso et al., 1998). Preliminary barometric data are also consistent with these estimates.

From the above considerations and in the light of the evolution model proposed for the northern sector of the Calabrian Arc by Piluso and Morten (1999), we suggest that: i) astenophere upwelling, responsible for the thermal anomaly, melting, and granulitic metamorphism in the crustal rocks, produced lithosphere thinning (after Variscan orogenic collapse) and underplating gabbroic magmatism in the northern sector of the Calabrian Arc; ii) rising melts/fluids formed pyroxenitic and gabbroic dykes in the underlying mantle peridotites, which were coupled with the crustal rocks before or during the migmatitic-granulitic event dated at 295 Ma (Shenk, 1989); iii) the peridotites-pyroxenites-gabbros and the crustal rocks subsequently shared in a common exhumation history through HT and LT detachment shear zones (Piluso and Morten, 1999), under high amphibolite, amphibolite and greenschists facies conditions.

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