

## ORIGIN AND SIGNIFICANCE OF LATE NORITIC DYKES IN THE BALDISSERO PERIDOTITE MASSIF (IVREA-VERBANO ZONE)

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### ABSTRACT

The Baldissero Peridotite Massif (Southern Ivrea-Verbano Zone) is a depleted lherzolite (ol 65÷70, opx 16÷20, cpx 10÷11, sp 2÷2.5,  $La_N/Yb_N$  0.003÷0.26,  $\epsilon_{Nd}270 = 6.4\div14$ ,  $^{87}Sr/^{86}Sr = 0.7021\div0.7035$ ). It is cross-cutted by a swarm of 5÷15 cm thick, fine grained (<1mm), NNE trending noritic dykes. Contacts peridotite-dyke are sharp. Dyke texture is hypidiomorphic and their mode consists of domi-

nant plagioclase (31÷45 %, An 40÷48), orthopyroxene (25÷37%, En = 78.9÷87.8, Wo = 0.6÷1.1), subordinate clinopyroxene (14÷18 %, En = 42.7÷44.0, Wo = 47.9÷52.4), interstitial pargasitic amphibole (10÷15 %) and opaques (1÷2 %, Fe-Ni sulfides). Re-equilibration conditions are 0.8÷1 GPa and 800÷900°C, like those of the ambient peridotite.

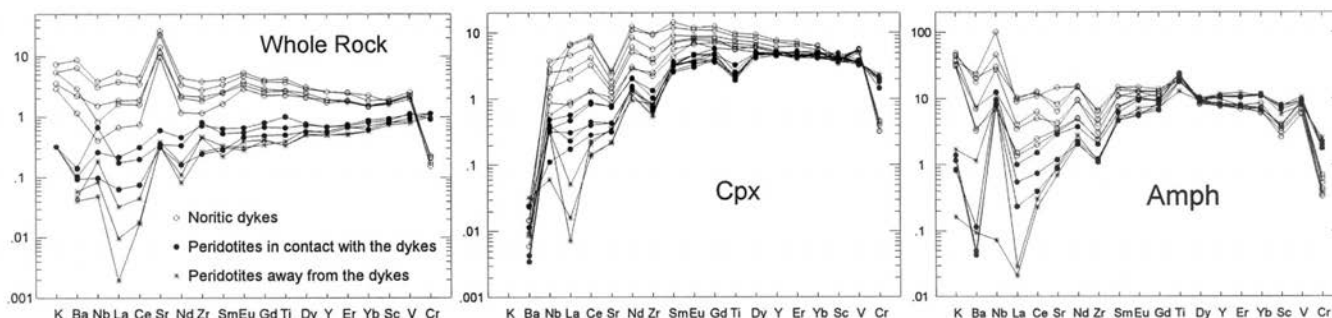


Fig. 1 - Incompatible trace element diagram of Whole Rock, Clinopyroxene and Amphibole.

Major element (wt%) dyke composition is characterized by high MgO (10÷16) and high Mg# values (0.81÷0.89). In the observed MgO range, SiO<sub>2</sub>, CaO and K<sub>2</sub>O vary negligibly (52÷53, 9÷10 and <0.2, respectively). With decreasing MgO, TiO<sub>2</sub> varies randomly from 0.8 to 0.4, Al<sub>2</sub>O<sub>3</sub> increases from 15 to 21, Na<sub>2</sub>O from 3 to 4.5 and FeO decreases from 5 to 2. Bulk rock incompatible trace element patterns (Fig. 1) vary from weakly LREE depleted to weakly LREE enriched ( $La_N/Yb_N = 0.5\div2.4$ ) and have marked positive Sr anomaly ( $Sr/Sr^* = 5.6\div10.4$ ), smaller Eu anomaly ( $Eu/Eu^* = 1.3\div1.5$ ) and negative Nb anomaly ( $La_N/Nb_N = 1.2\div2.2$ ). Incompatible element concentration increases, and the magnitude of the negative Nb and of the positive Sr anomalies decrease, with increasing MgO or Mg#. Main incompatible trace element carriers are clinopyroxene and hornblende, which display patterns varying from slightly LREE depleted to enriched. Orthopyroxene is LREE depleted and plagioclase is LREE and Sr enriched. Clinopyroxene is Nb-depleted ( $La_N/Nb_N = 1.0\div5.9$ ) and amphibole is Nb enriched ( $La_N/Nb_N = 0.09\div0.35$ ). The latter phases have negative Zr spikes. Incompatible element concentration in the mafic phases show correlations with Mg# similar to those of bulk rock (Fig. 2). The only available isotope determination refers to a Sm-Nd internal isochron which results in an age of 180Ma and  $\epsilon_{Nd} = 7.8$ . In spite of the contacts being sharp, peridotite mineral assemblage and composition varies over a distance of 7 cm. In the peridotite, toward the dyke contact, modal orthopyroxene increases and clinopyroxene decreases,

whereas trace element concentration and  $La_N/Yb_N$  increase (from 0.003÷0.017 to 0.1÷0.26) and Mg# decreases from 0.9 to 0.8. The dyke at the peridotite contact does not show sizeable chemical or modal variations. There is no clear relationship between the Mg# variation of the dyke and the chemical trends observed in the contact peridotite.

The high Mg# numbers of the dykes and the Mg# value of orthopyroxene, lower than that of bulk-rock, indicate that these norites are not melts, but rather represent mineral segregates possibly retaining some interstitial liquid. Estimates of the Mg# values of the parental melts, made assuming  $^{opx/liq}D_{Mg\#} = 1.2$ , indicates a Mg# range from 0.66 to 0.74, which is consistent with that of primary mantle-derived magmas. Since olivine does not occur even in the more MgO-rich dyke composition, the parent melt had to be, furthermore, SiO<sub>2</sub>-rich and hydrous, as indicated by the amphibole abundance. Whatever the set of solid/melt partition coefficient used for estimating trace elements in the parent melts, the calculated REE profiles would vary from slightly LREE depleted to variably LREE enriched. The HFSE characteristics of the primary melts cannot be precisely constrained because of the strong dependence of their partition coefficient on the melt composition. For example, using available partition coefficients for basaltic compositions, the estimated parental melts would have a weak Nb and Zr anomaly, which disappears using D sets for intermediate compositions and become positive if the D's are referred to high-silica compositions. In any case, the geochemical

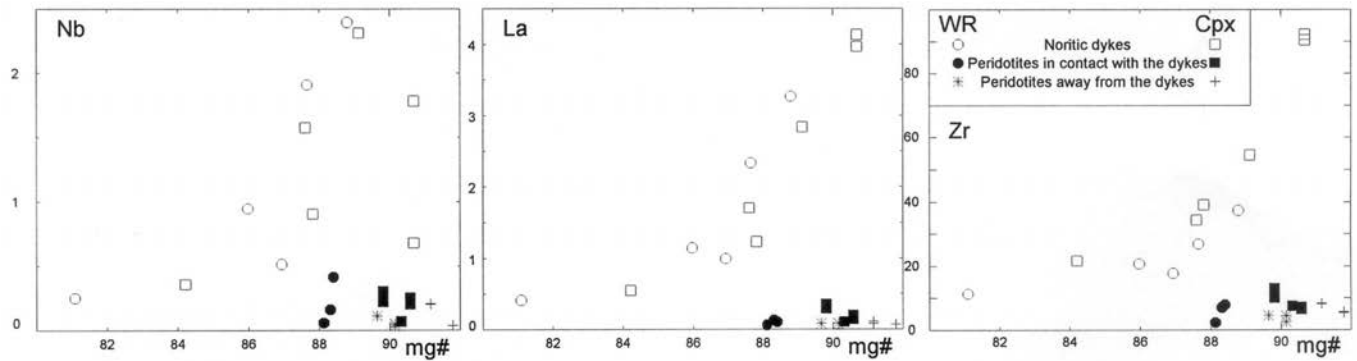


Fig. 2 - Selected incompatible element vs. Mg# for Whole Rock and Clinopyroxene.

trends shown by bulk rock and mineral phases (i.e. the increase of incompatible element concentration with increasing Mg#) are qualitatively maintained. We propose that this peculiar feature can be explained either by fluid-assisted melting of a depleted peridotite source, where melting degree increases with the increasing supply of hydrous fluid (which is the incompatible element carrier), or by fluid-peridotite reaction during porous flow percolation in a mantle column at a deeper and higher temperature level than that actually observed. If confirmed by new isotopic data, the occurrence of post-Hercynian gabbroic rocks in the Aus-

tralpine and South Alpine domains will support the involvement of the marginal units of the Adria plate in the pre-oceanic extensional regime (Piccardo et al., 1994).

## REFERENCES

- Piccardo G.B., Rampone E., Vannucci R. and Cimmino F., 1994. Upper mantle evolution of ophiolitic peridotites from the Northern Apennine: petrological constraints to the geodynamic processes. *Mem. Soc. Geol. It.*, 48: 137-148.