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Preserved MORB affinity in amphibolite-facies metabasites: Insights into the role of extensional basins in the growth of Phanerozoic Continental Crust (IVZ, Central Alps)

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In the continental realm, HT metamorphism and associated melt/fluid circulation may markedly change the pristine geochemical signature of the magmatic protolith of metabasites, leaving critical gaps in the understanding of the geological environments and processes leading to the growth of continental crust. Amphibolite- to granulite-facies metabasites are abundant in the Ivrea-Verbano Zone (IVZ; Central Alps), an iconic section of the lower continental crust-upper mantle transition of the Adriatic plate.

This contribution aimed at presenting new petrochemical and isotopic constraints on the metabasites belonging to amphibolite-facies Kinzigite formation, where they are interbedded with dominant metasediments of both terrigenous (metapelites) and carbonate (marble) nature. For this study, we selected 12 metabasites and 1 siliciclastic metasediment samples from the borehole 5071_1_B at Ornavasso (Italy; Greenwood et al., 2024) to track the magmatic signature and metamorphic changes. The selected metabasites can be grouped as follows: (i) amphibolite s.s. (Amph+Cpx+Pl±Qz), (ii) garnet-bearing amphibolite, (iii) biotite-bearing amphibolite, and (iv) carbonate-rich amphibolite.

Bulk rock major and trace element compositions suggest that garnet-bearing amphibolites and amphibolites s.s. derived from two distinct basaltic protoliths, having N-MORB and E-MORB affinities, respectively. This conclusion is consistent with pioneering studies on the Ivrea-Verbano Zone amphibolite-facies metabasites carried out by Sills & Tarney (1984) and Mazzucchelli & Siena (1986). Selective enrichments in Pb and alkalis highlight contamination from metamorphic fluids. Biotite-bearing and carbonate-rich amphibolites result from interaction with melt/fluid components derived by terrigenous and carbonate metasediments, respectively. Isotopic data were used to better discriminate the magmatic signature and metamorphic overprinting. The MORB signature is preserved in garnet-bearing amphibolites and amphibolite s.s. by Nd isotopes (eNd=5.16–6.86). In contrast, more enriched $^{87}Sr/^{86}Sr_{400}$ (0.70492–0.71562) and $^{206}Pb/^{204}Pb_{400}$ (18.4200–18.9536) ratios imply partial overprinting during collisional and post-collisional metamorphism.

Our results suggest that IVZ sequence formed in extensional basins experiencing large terrigenoeus sedimentation intercalated with the development of carbonate platforms and MORB volcanism, being successively buried at ~20 km depth in the continental crust.

References:

Mazzucchelli M & Siena RC (1986), TMPM, 35, 99-116
Greenwood et al. (2024), Sci. Drill., 33, 219-236
Sills & Tarney DD (1991), Tectonophysics 107, 187-206