Record of melt-rock interaction in the extending lithosphere (Ligurian mantle sequences, N Apennine, Italy)

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The External Ligurian (EL) mantle sequences consist of spinel-plagioclase lherzolites, with tectonite to mylonitic structures, and diffuse pyroxenite layering. The deformed pyroxenites have been previously related to recycling of old crustal material in Lower Palaeozoic to Triassic times. The lherzolites of this study (Monte Gavi) are undeformed and show evidence of melt infiltration and crystallization of Ca-rich Pl + Opx at the expense of Spl and Cpx. They include swarms of pyroxenites that are up to ~ 0.7 m thick. The pyroxenite primary assemblage consists of Cpx + Al-Spl. Cpx is resorbed and variably replaced by Opx + Pl. Spl-rich domains are often transformed into Pl + Fe-rich olivine + Cr-Spl ± ilmenite. Clinopyroxene has low Mg# (81-83) and up to 10 wt% Al_2O_3. Close to the main pyroxenite body, the lherzolite includes cm-thick spinel pyroxenite layers containing Mg-rich Cpx (Mg# = 89-90) and, locally, Mg-rich olivine incorporated from the host lherzolite. REE compositions of melts in equilibrium with the primary Cpx display a slight LREE enrichment and negative HREE fractionation requiring a garnet-bearing source. The Fe-rich pyroxenites have “melt-like” HSE patterns, whereas the Mg-rich pyroxenites are more enriched in Os and Ir. Bulk rock $^{187}Os/^{188}Os$ ratios recalculated at the age of the Alpine Tethys opening (165 Ma) show increasingly radiogenic composition from Mg- to Fe-rich pyroxenites ($^{187}Os/^{18}$= 0.185-0.518). We propose that the pyroxenites formed by crystallization of Al-Fe-rich melts derived from aged pyroxenite/eclogite-rich sources. The thick pyroxenites represent melt-dominated systems, whereas the thin layers formed by melt/peridotite hybridization. The Monte Gavi peridotite-pyroxenite sequence preserves high T (1200-1250°C) recorded by slowly diffusing elements (REE,Y), presumably in response to the melt infiltration event, followed by a rapid subsolidus cooling until 900°C. Partial replacement of the primary assemblages of both pyroxenites and enclosing peridotite is consistent with reactive migration of depleted MORB-type melts under plagioclase-facies conditions (P ~ 0.6 GPa) during rifting-related exhumation of the EL mantle sequence in Jurassic times.