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# Stagnation and Storage of Strongly Depleted Melts in Slow-Ultraslow Spreading Oceans: Evidence from the Ligurian Tethys

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Our studies of Alpine-Apennine ophiolite massifs (i.e. Lanzo, Voltri, Ligurides, Corsica) show that the Jurassic Ligurian Tethys oceanic basin was a slow-ultraslow spreading basin, characterized by the exposures on the seafloor of mantle peridotites with extreme compositional variability. The large majority of these peridotites are made of depleted spinel harzburgites and plagioclase peridotites. The former are interpreted as reactive peridotites formed by the reactive percolation of under-saturated, strongly trace element depleted asthenospheric melts migrated by porous flow through the mantle lithosphere. The latter are considered as refertilized peridotites formed by peridotite impregnation by percolated silica-saturated, strongly trace element depleted melts. Strongly depleted melts were produced as low-degrees, single melt increments by near fractional melting of the passively upwelling asthenosphere during the rifting stage of the basin. They escaped single melt increment aggregation, migrated isolated through the mantle lithosphere by reactive porous or channeled flow before oceanic opening, and were transformed into silica-saturated derivative liquids that underwent entrapment and stagnation in the shallow mantle lithosphere forming plagioclase-enriched peridotites. Widespread small bodies of strongly depleted gabbro-norites testify for the local coalescence of these derivative liquids. These melts never reached the surface (i.e. the hidden magmatism), since lavas with their composition have never been found in the basin. Subsequently, aggregated MORB melts upwelled within replacive dunite channels (as evidenced by composition of magmatic clinopyroxenes in dunites), intruded at shallow levels as olivine gabbro bodies and extruded as basaltic lavas, to form the crustal rocks of the oceanic lithosphere (i.e. the oceanic magmatism). Km-scale bodies of MORB olivine gabbros were intruded into the plagioclase-enriched peridotites, which were formed in the mantle lithosphere under plagioclase-facies conditions, at shallow lithospheric levels, under brittle conditions and, frequently, after serpentinization.

The presence and abundance of strongly depleted melts, which stagnated and were stored in the shallow mantle lithosphere, represent characteristic features of the Ligurian Tethys slow-ultraslow spreading basin.

In modern oceans, plagioclase-enriched peridotites are abundant at slow-ultraslow spreading ridges (i.e. Mid-Atlantic Ridge, South-West Indian Ridge and Gakkel Ridge) and were recognized as melt-impregnated peridotites. Moreover, a peculiar gabbro-norite suite was found at MAR DSDP Site 334, indicating the presence of rocks formed by silica-saturated, strongly trace element depleted melts. So far, few studies have been devoted to abyssal plagioclase peridotites despite their relatively high abundance (30% of abyssal peridotites), because of their widespread sea-floor alteration. In some cases, rock freshness allowed us to recognize that the compositions of the plagioclase and clinopyroxene were in equilibrium with the percolated, strongly trace element depleted melts, which were stagnated in the shallow oceanic mantle lithosphere. The presence, abundance and stagnation of silica-saturated, strongly trace element depleted melts in the shallow mantle lithosphere to form plagioclase-enriched peridotites and gabbro-norites, seem to be characteristic and discriminant features of fossil and modern slow-ultraslow spreading basins.