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From the Finero phlogopite peridotite to the shoshonitic magmatism of the Dolomites: unveiling the evolution of the Sub-Continental Lithospheric Mantle beneath the Southern Alps (Northern Italy)

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The Mid-Triassic emplacement of shoshonitic magmas at the NE margin of the Adria plate in concomitance with extensional/transtensional tectonics is one of the most intriguing and peculiar aspects typifying the geodynamic evolution of the Western Tethyan realm. Although often hypothesized, the link between this magmatic event and the metasomatised Southern Alps Sub-Continental Lithospheric Mantle (SCLM) has never been constrained.

Geochemical and petrological analyses of lavas, dykes and ultramafic cumulates belonging to the shoshonitic magmatism of the Dolomites, coupled with pre-existing data on peridotite massifs (i.e. Finero, Balmuccia, Baldissero), were used to reconstruct the evolution of the Southern Alps SCLM between Carboniferous and Triassic. According to our model, a metasomatised amphibole + phlogopite-bearing spinel lherzolite, similar to the Finero phlogopite peridotite and likely generated by interaction between a depleted mantle and slab-derived components during the Variscan subduction, was able to produce magmas with orogenic-like affinity during Mid-Triassic. In this context, partial melting degrees of ca. 5-7% were required for producing primitive SiO_2-saturated to -undersaturated melts with shoshonitic affinity ($^{87}Sr/^{86}Sr_i$ = 0.7032-0.7058; $^{143}Nd/^{144}Nd_i$ = 0.51219-0.51235; Mg #~ 70; ~1.1 wt% H_2O). As testified by the H_2O content in mineral phases from the Finero phlogopite peridotite (Tommasi et al., 2017), the modelled Mid-Triassic fertile lithospheric mantle could have been able to preserve a significant enrichment and volatile content (600-800 ppm H_2O) for more than 50 Ma, i.e. since the Variscan subduction-related metasomatism. During the Mid-Triassic partial melting event, the modelled Finero-like mantle exhausted the subduction-related signature inherited during the Variscan subduction. Around 20 Ma later, the same lithosphere portion was affected by an asthenospheric upwelling event related to the Late Triassic-Early Jurassic opening of the Alpine Tethys (Casetta et al., 2019).

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