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Volatile-rich melts as markers of the asthenospheric influx prior to rifting events: the case of the alkaline-carbonatitic lamprophyres of the Dolomitic Area (Southern Alps, Italy)

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The appearance of alkali- and volatile-rich melts often marks the opening of major magmatic cycles, always reflecting the partial melting of heterogeneously enriched mantle domains. In these cases the study of highly alkaline, H_2O-CO_2-rich magmatic pulses provide important insights on the composition and behavior of the sub-continental lithospheric mantle (SCLM) prior to rift initiation. The camptonitic dykes cropping out at Predazzo (Dolomitic Area, NE Italy) are among the oldest examples of lamprophyric rocks in Italy, and were historically related to the orogenic-like Middle Triassic magmatism of the Southern Alps. A detailed petrological, geochemical and geochronological characterization of these rocks was developed to frame them inside the articulated geodynamic evolution of the Southern Alps domain during Triassic. Whole-rock and mineral phase geochemistry, together with $^{40}Ar/^{39}Ar$ data showed that Predazzo lamprophyres represent an alkaline-carbonatitic magmatic event temporally isolated (~220 Ma) from the major Ladinian orogenic-like magmatism of the Southern Alps (~238 Ma). Lamprophyres can thus be attributed to the volumetrically limited alkaline magmatic phase that infiltrated several portions of the Southern Alps lithosphere between 225 and 190 Ma. Partial melting models and Sr-Nd isotopes demonstrate that Predazzo lamprophyres were produced by low partial melting degree of a garnet-amphibole-bearing mantle source interacting with a significant asthenospheric contribution. In the light of these new findings, they are interpreted as the geochemical/geochronological bridge between the orogenic-like Ladinian magmatism and the rifting phase related to the opening of the Alpine Tethys. This study highlights the paramount importance of alkaline magmas for tracking the volatiles cycle in the SCLM and the potential lithosphere-asthenosphere interactions during large-scale geodynamic processes.