Subduction-related hybridization of the lithospheric mantle in mantle xenoliths from Tallante (Spain)

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Deep seated ultramafic xenoliths provide clues on the nature and composition of the sub-continental lithosphere; yet, they are rarely found at convergent plate margins. A notable exception is represented by the Betic Cordillera of southern Spain where the eruption at Tallante of xenolith-bearing alkaline basalts during Pliocene post-dated the Cenozoic phase of plate convergence and subduction-related magmatism.

The mantle xenoliths of Tallante display extreme compositional heterogeneities and are locally crosscut by centimeter sized veins that show a peculiar norite paragenesis (± quartz amphibole and phlogopite) sometimes cut by smaller felsic veinlets hosting several exotic accessory minerals such as apatite, thorite, huttonite, rutile, zircon and graphite. This represents the interaction between the mantle and hydrous silica-oversaturated melts, plausibly related to the recycling - via subduction - of continental crust components. The present study reports new detailed major and trace elements and Sr-Nd-Pb analyses of the constituent minerals of the studied xenoliths that are used to clarify the mode in which subduction related components are transferred to the mantle wedge. Radiogenic isotopes show large variation between the centimetric veins, the veinlets and the surrounding peridotite, with docoupling between Sr and Nd isotope ratios. This evidence, together with the unusual trace element patterns measured in key mineral phases (especially ciinopyroxene), indicates complex processes where the distribution of different trace elements in the metasomatised mantle is controlled by the main and accessory phases stabilised within the veins and veinlets.