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# Nature and Evolution of the lithospheric mantle beneath the Hoggar swell (Algeria): a record from mantle xenoliths.

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The mantle xenoliths sampled by the Quaternary alkaline volcanics from the Tahalgha district (Central Hoggar) represent the subcontinental lithospheric mantle beneath the boundary between two major structural domains of the Tuareg Shield: the "Polycyclic Central Hoggar" to the East and the "Western Hoggar", or "Pharusian Belt", to the West. Samples were collected from volcanic centres located on both sides of the 4°10, a major lithospheric shear zone separating these two domains. Although showing substantial variations in their deformation microstructures, equilibrium temperatures, and modal and chemical compositions, the studied samples do not display systematic variations of these features across the 4°10. The observed variations rather record small-scale heterogeneities distributed throughout the whole studied area and mostly related to the asthenosphere-lithosphere interaction events associated with the evolution of the Hoggar swell, in the Cenozoic. These features include partial annealing of pre-existing deformation microstructures, post-deformation metasomatic reactions, and trace-element enrichment, coupled with heating from 750-900°C (low-temperature lherzolites) to 900-1150°C (intermediate-T lherzolites and high-T harzburgites and wehrlites). Trace element modelling confirms that the whole range of REE fractionation observed in the Tahalgha xenoliths may be accounted for by reactive porous flow involving a single stage of basaltic melt infiltration into a LREE-depleted protolith. The striking correlations between equilibrium temperatures and trace-element enrichments favor a scenario whereby the high-temperature peridotites record advective heat transport along melt conduits while the intermediate- and low-temperature lherzolites would represent more conductive heating of the host Mechanical Boundary Layer. This indicates that the lithosphere did not reach thermal equilibrium, suggesting that the inferred heating event was transient and rapidly erased by thermal relaxation down to the relatively low-temperature present-day geotherm.
The low-T equilibrium temperatures (< 900°C) deformed lherzolites (porphyroclastic to granuloblastic) are characterized by only incipient annealing and LREE-depleted clinopyroxene compositions. They were only weakly affected by the Cenozoic events and would represent relatively well-preserved samples from rejuvenated Pan-African lithosphere. Extensive lithospheric rejuvenation occurred either regionally during the Pan-African orogeny, as a result of lithospheric delamination or thermo-mechanical erosion after thickening, or more locally along the meridian shear zones. The low-T Tahalgha lherzolites are comparable to those of the lherzolite from Etang de Lherz (southern France), interpreted as lithospheric mantle rejuvenated by igneous refertilization during a late stage of the Variscan orogeny.