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# Unravelling high-grade metamorphic event(s) in the Tuareg Shield: What granulite xenoliths reveal about supercontinents history

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## Résumé

Cenozoic volcanic activity in the Hoggar region (Hoggar, Algeria) brought deep crustal rocks to the surface. In this study, 18 crustal xenoliths were analysed and classified into four groups, based on their mineralogical assemblages: garnet-, pyroxene-, amphibole- and felsic-bearing xenoliths. Felsic- and garnet-bearing xenoliths are interpreted to have originated from pelitic protoliths, whereas those containing pyroxene and amphibole are of mafic magmatic origin. Whole-rock isotopic analyses (Nd, Sr, Pb and Hf) yielded negative initial  $\epsilon_{\text{Nd}}$  from -1.7 to -36.1 and positive initial  $\epsilon_{\text{Sr}}$  from +8.5 to +921 indicative of a continental crust signature. Petrological evidence and thermobarometric estimates record ultra-high temperature (UHT) conditions in several samples. For instance, the occurrence of the mineralogical assemblage garnet + sapphirine + quartz + spinel + sillimanite in garnet-bearing xenolith X16 suggests equilibration temperature exceeding 1000°C. The garnet bearing sample X91d also records a UHT peak of 944°C, estimated using Ti-in-zircon thermometry. Other samples record medium- to high-grade metamorphism, with temperatures ranging from  $\sim$  675°C for the amphibole-bearing rock X89b to  $\sim$  900°C for the pyroxene-bearing rock X91-22, which argue for amphibolite to granulite facies conditions. LA-ICP-MS U-Pb dating of various accessory minerals shows two main age populations at  $\sim$ 2Ga and  $\sim$ 600Ma. These ages are related to the Eburnean and Panafrican orogenies respectively. The paraderived samples record both orogenic events, whereas the amphibole-bearing rocks record only the Panafrican event. For pyroxene-bearing samples, only apatite and rutile were analysed in five rocks, yielding ages close to 0 Ma, consistent with resetting due to recent volcanic activity related to the Hoggar swell. These results suggest that different levels of the crustal column beneath the Hoggar region were sampled during the various Cenozoic volcanic episodes. The mafic xenoliths are likely derived from deeper crustal levels while the felsic xenoliths probably come from shallower levels, thereby preserving Paleoproterozoic lithologies that remained unaffected by the Panafrican event. Similar geochemical and geochronological characteristics are described in other terrains, such as the Sao Francisco cratons (Brazil) and the North China Cratons, linking these regions to the evolution of the Columbia and Gondwana supercontinents.

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**Mots-Clés:** lower continental crust, xenoliths, granulites, supercontinents, Tuareg shield, Hoggar, Algeria