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Discovery of metamorphic diamonds in garnets from the Edough massif (northeastern Algeria): LA-ICP-MS U-Pb constraints

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Inclusions in a garnet megacryst ($\geq$ 5cm) from the Edough Massif (NE Algeria) have been studied and we report for the first time the discovery of diamond inclusions (5-30 micrometer in size), identified by Raman spectroscopy and the characteristic sharp band at 1332 cm-1 for crystalline diamond. The garnet is adjacent to actinolite and ultramafic boudins and slices of marbles that are inserted within a major mylonite-ultramylonite band. This tectonic contact sharply delineates the Kef Lakhal oceanic unit from the granite-gneiss core below This 1 km thick slab of amphibolites and pyrigarnites, derived from layered gabbros of MORB affinity, rest above the granite-gneiss units from the core complex. Garnet-forming reactions and dehydration melting are the oldest metamorphic stages recognized in the Kef Lakhal mafic complex ($\geq$ 800 °C, $\geq$ 17 Kbar). The diamond-bearing garnets display a dense rutile acicular network interpreted as exsolutions. Zircons inclusions have been also observed in this garnet megacryst. Diamond crystals, up to 50 micrometer across, were identified first by optical microscopy and later by Raman spectroscopy. Major and trace elements show a gradual but significant zonation from core to rim, and a sharp increase in grossular component in the rim. Trace element analyses of prismatic rutile inclusions up to 300 micrometer in size indicate that the host metamorphic rock was a mafic protolith of MORB affinity. The Zr-in-rutile thermometry indicates a temperature range of 724-778°C that we relate to rutile growth, either during prograde metamorphism or under peak UHP metamorphic conditions of $\geq$ 3.6 GPa that were reached during subduction of the UHP-rock precursors. In situ U-Pb dating obtained on rutile inclusions yield a 32.4+/ 3.3 Ma interpreted as the age of the UHP metamorphic event. LA-ICP-MS U-Pb ages on zircon provide a 20.9 +/- 2.2 Ma age attributed to the thrusting onto the North-African margin. We suggest that the mafic protolith of the analyzed garnet megacryst originates from the subducted retreating Tethyan slab, which broke or tore, and which fragments were dragged upward and thrust onto the North African margin along with the Kef Lakhal unit, shortly followed by building up of the Edough dome and opening of the Algerian basin.