Witness of UHP metamorphism in the Western Mediterranean

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We report the recent discovery of metamorphic diamonds (5–30 μm in size) included in a garnet megacryst from the Edough Massif (NE Algeria). The studied megacryst was taken from a weathered actinolitite horizon inserted within a major mylonite–ultramylonite band, which outcrops at the base of an allochtonous oceanic unit thrust onto the African paleomargin. The host garnet is almandine-dominant with a sharp increase in grossular component in the rim. Major and trace elements show a gradual zonation from core to rim characterized by a decrease in HREE, Y and Mn, typical of a prograde growth in a closed system. Trace element analyses of large prismatic rutile indicate that the host metamorphic rock was a mafic protolith of MORB affinity and the Zr-in-rutile thermometry yields a temperature range of 724–778°C. U-Pb analyses of these large rutile crystals provide an age of 32.4 ± 3.3 Ma interpreted as dating the prograde to peak subduction stage of the mafic protolith. Minute zircons (≤ 30μm), disseminated in the garnet, display a multifaceted appearance and low Th/U ratios consistent with a metamorphic origin. Trace element analyses indicate that they formed in equilibrium with garnet at a temperature of 740-810°C, most likely during HP retrograde metamorphism. U-Pb analyses indicate they nucleated at 20.9 ± 2.2 Ma during near isothermal decompression related to exhumation of the UHP units. This study allows bracketing the age of UHP metamorphism in the Western Mediterranean to the Oligocene/early Miocene, thus unambiguously relating UHP metamorphism to the Alpine history. Exhumation of these UHP units is coeval with the counter clockwise rotation of the Corsica-Sardinia block, which is associated to the extensional opening of the Ligurian Sea as a result of slab rollback driven by slab pull. The later is taken as the best plausible scenario for the exhumation of the UHP rocks.