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THE CONTRIBUTION OF DEEPLY SUBDUCTED CONTINENTAL CRUST TO MANTLE METASOMATISM AND DEEP CARBON CYCLE

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Primary inclusions of metasomatic melt from melting of continental crust are trapped in garnets of ultra-high pressure (UHP) eclogites of the Erzgebirge, Bohemian Massif (Germany). Here we estimate the contribution of the subducted continental crust to mantle metasomatism and deep carbon fluxes via the characterization of these melt inclusions. They are micrometric and occur in cluster in the inner part of the garnet as both nanogranitoids (i.e. polycrystalline inclusions) and glassy, often with a shrinkage bubble. Nanogranitoids contain kumdykolite, quartz, kokchetavite, biotite, white mica, calcite and rare graphite. The inclusions are in the same microstructural position of polycrystalline quartz, interpreted as pseudomorph after coesite suggesting entrapment at UHP conditions. The melt is granitic, hydrous and slightly peraluminous; its H₂O and CO₂ content were measured with NanoSIMS. CO₂ concentration, after vapor reintegration, is 19552 ± 772 ppm, the highest content of CO₂ measured so far in crustal melt inclusions. The melt shows trace elements enrichment consistent with a continental origin, high amounts of incompatible elements (Cs in particular), Pb, Th, U, Li and B. This trace elements pattern is similar to other metasomatic melts in mantle eclogites, metasomatized mantle rocks and post-collisional ultrapotassic plutonic rocks in the Bohemian Massif, suggesting widespread mantle metasomatism from melts originated in the continental crust. We argue that a large amount of volatiles, carbon in particular, are stored at the base of the orogen during the deep subduction of the continental crust. We modelled the carbon flux during subduction of the continental crust during the formation of the Bohemian Massif (i.e. Variscan orogeny) and obtained an endogenic flux of 65 ± 28 Mt C yr⁻¹, similar, within error, to the one calculated for the oceanic crust. Thus, in collisional settings, the deep continental crust acts as a long-term carbon storage unit, preventing the completion of the carbon cycle.