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The composition of nanogranitoids in migmatites overlying the Ronda peridotites (Betic Cordillera, S Spain): the anatectic history of a polymetamorphic basement

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The study of the composition of primary melts during anatexis of high-pressure granulitic migmatites is relevant to understand the generation and differentiation of continental crust. Peritectic minerals in migmatites can trap dropless of melt that forms via incongruent melting reactions during crustal anatexis. These melt inclusions commonly crystallize and form nanogranitoids upon slow cooling of the anatectic terrane. To obtain the primary compositions of crustal melts recorded in these nanogranitoids, including volatile concentrations and information on fluid regimes, they must be remelted and rehomogenize before analysis. A new occurrence of nanogranitoids was recently reported in garnets of mylonitic metapelitic gneisses (former high pressure granulitic migmatites) at the bottom of the prograde metamorphic sequence of Jubrique, located on top of the Ronda peridotite slab (Betic Cordillera, S Spain). Nanogranitoids within separated chips of cores and rims of large garnets from these migmatites were remelted at 15 kbar and 850, 825 or 800 °C and dry (without added H_2O), during 24 hours, using a piston cylinder apparatus. Although all experiments show glass (former melt) within melt inclusions, the extent of rehomogenization depends on the experimental temperature. Experiments at 850-825 °C show abundant disequilibrium microstructures, whereas those at 800 °C show a relatively high proportion of rehomogenized nanogranitoids, indicating that anatexis and entrapment of melt inclusions in these rocks was likely close to 800 °C. Electron microprobe and NanoSIMS analyses show that experimental glasses are leucogranitoid and peraluminous, though define two distinct compositional groups. Type I corresponds to K-rich, Ca- and H_2O-poor leucogranitic melts, whereas type II represents K-poor, Ca- and H_2O-rich granodioritic to tonalitic melts. Type I and II melt inclusions are found in most cases at the cores and rims of large garnets, respectively. We tentatively suggest that these former migmatites underwent two melting events under contrasting fluid regimes, possibly during two different orogenic periods. This study demonstrates the strong potential of melt inclusions studies in migmatites and granulites in order to unravel their anatectic history, particularly in strongly deformed rocks where most of the classical anatectic microstructures have been erased during deformation.