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Eclogite-facies metamorphism of garnet-websterites in the Early Proterozoic Sharyzhalgai block, SW margin of Siberian

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The Saramta massif in the Early Proterozoic Sharyzhalgai block, the southwestern margin of the Siberian craton, is mainly composed of spinel-peridotites and garnet-websterites, and is enclosed within granitic gneiss and migmatite with granulite-facies grades. The garnet-websterites occur as lens or layer intercalated within spinel-harzburgite and spinel-lherzolite. They consist mainly of clinopyroxene (Cpx) and garnet (Grt): Grt often includes Cpx, orthopyroxene (Opx) and pargasite (Prg), and has margins with low Mg/(Mg+Fe) ratios. Opx occurs in matrix, as inclusion in Grt, and as kelyphite with plagioclase (Pl), spinel, olivine, Prg and biotite (Bt). Compositions of Opx significantly vary in Al contents (Al2O3=0.74-5.02 wt.%) by grains and within individual grains: The Al contents tend to increase towards the rims, with slightly decreasing Mg/(Mg+Fe). The Opx inclusions in Grt are high in Mg/(Mg+Fe) compared with the matrix Opx. Cpx is less variable in composition irrespective of its mode of occurrence, but is mostly rich in Al at the rims. These suggest the following metamorphic history; stage 1 (pre-peak): thermobarometry with compositions of inclusion minerals and Grt-core yields 0.9-1.5 GPa at 640-780 degrees C. Stage 2 (peak): core compositions of the matrix Grt, Opx and Cpx give 2.3-3.0 GPa at 920-1030 degrees C as the minimum estimate. Stage 3 (post-peak): compositions of Grt- and Opx-rims yield 750-820 degrees C at 0.6-0.9 GPa, and those of Grt-rim, and kelyphitic Opx, Prg and Pl does 780-830 degrees C at about 0.5 GPa. Finally, the garnet-websterites are veined with lower amphibolite- to greenschist-facies minerals (stage 4). On the other hand, the host granitic gneiss, containing Bt, Pl, Grt, Opx, quartz and less common alkali feldspar, sillimanite, ilmenite and rutile, gives P-T estimates of 850-940 degrees C at about 0.9 GPa for the peak stage with migmatization, and those of 770-820 degrees C at about 0.5 GPa for the post-peak stage.

Integrating these results and the previous works suggest that the Saramta massif derived from mantle materials depleted by partial melting under a relatively high-pressure conditions, and were buried down to deeper levels by plate subduction. Subsequently, it was adiabatically exhumed to mid-crustal depths along a surface of the subducting plate, prior to uplifting to the surface.