PARTIAL MELTING OF THE ULTRAHIGH PRESSURE ECLOGITE IN THE SULU OROGEN, CHINA: MELT GENERATION AND MIGRIGATION DURING EXHUMATION PROCESS

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ABSTRACT

Large scale partial melting of an ultrahigh pressure eclogite is documented from the Mesozoic Sulu orogen, China. Migmatitic eclogite shows successive stages of initial intragranular and grain boundary pseudomorphs of droplets of melt crystallization, which grow into a three-dimensional interconnected intergranular network, then segregate and accumulate in pressure shadow areas, and merge to form channels and dikes that transport magma higher in the lithosphere. The leucosomes comprise mainly quartz + phengite + albite + allanite/epidote + garnet, with scarce titanite, zircon and apatite.LA-ICP-MS U–Pb dating on new zircon domains from the leucosomes yielded crystallization ages of ca 223–219 Ma, within the well-established range of ages (ca 225–215 Ma) for HP eclogite facies recrystallization in the Sulu belt. Si-in-phengite barometry combined with Ti-in-zircon thermometry yields crystallization P–T conditions for the leucosomes of 3.0–2.5 GPa and 830–770°C. Leucosome compositions are granitic with chondrite-normalized trace element compositions that are enriched in the LREE relative to the HREE and enriched in the LILE relative to the HFSE, consistent with crystallization from a crustally-derived hydrous melt. The leucosomes have Sr–Nd isotope compositions intermediate between those of the host eclogites and surrounding gneisses, implying derivation from a mixed source. During initial exhumation under UHP conditions, exsolution of H_2O from nominally anhydrous minerals generated a grain boundary supercritical fluid in both gneiss and eclogite that increased in volume and solute content with exhumation, ultimately evolving into hydrous melt that crystalized at HP eclogite P–T conditions. During the transition from HP eclogite to amphibolites facies conditions, minor phengite breakdown melting is recorded in leucosomes and both phengite-bearing eclogite and gneiss. Partial melting of deeply subducted eclogite is an important process in determining the rheological structure and mechanical behaviour of subducted lithosphere, controlling rapid exhumation and the flow of deep lithospheric material, and generating melts from the upper mantle, potentially contributing to syn-exhumation magmatism and growth of continental crust.

Keywords: *Partial melting, UHP eclogite, Exhumation, Melt mechanism, Leucosome*