Generation and evolution of fluid/ melt during exhumation from UHP conditions

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Melting during subduction and exhumation of continental crust may occur along the prograde and/or retrograde *P–T* path, and may be fluid-present or fluid-absent. In many UHP terranes, multiphase solid inclusions, melt-related micro-structures and macroscopic leucosomes provide evidence of fluid or melt presence. In the literature, partial melting is commonly related to hydrate-breakdown by reactions such as Ph + Cpx + Qz → Bt + Pl + Grt + L. However, at peak *P* nominally anhydrous minerals (NAMs) may store several thousand ppm H_2O (as OH and molecular H_2O), and lower solubility of H_2O with decreasing pressure leads to exsolution of H_2O from NAMs. Thus, fluid-present conditions likely attend exhumation from UHP conditions and evolution of this fluid with decreasing pressure generates hydrous melt.

In the Sulu belt, China, at peak *P* during ultradeep subduction, the continental crust was likely fluid absent. During initial exhumation, exsolution of H_2O from NAMs in gneisses and eclogites would have generated a grain boundary supercritical fluid. As this fluid migrated by diffuse porous flow from grain boundaries into channels, it drained through both gneisses and eclogites, creating a blended composition. As exhumation progressed and the volume of fluid increased, it dissolved more of the silicate mineral matrix, becoming increasingly solute-rich, more 'granitic' and more viscous, as it evolved towards hydrous melt. Once trapped, crystallization began by diffusive loss of H_2O to the host crust concomitant with ongoing exhumation. If the solute-rich fluid intersected the solvus for the granite–H_2O system, phase separation led to formation of composite veins (comprising HP granite and vein quartz); alternatively, if sufficient H_2O was lost via diffusion then the solute-rich fluid/hydrous melt crystallized as HP granite. Subsequent, minor partial melting is evidenced in Ph-bearing rock types by Kfs + Pl + Bt aggregates located around coarse phengite grains and by Kfs veinlets along Qz/Qz and multi-mineral grain boundaries. Phase equilibria modeling of HP granite shows that partial melting records the transition from eclogite to amphibolite facies conditions.