Partial melting of UHP eclogites, Sulu belt, China: *P–T* conditions, fluid-melt evolution, deformation and implications for exhumation dynamics

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We summarize results of the past 12 years of integrated research on eclogites of the Sulu belt, one of the most deeply-subducted (possibly > 7 GPa, Ye *et al.*, 2000) UHP eclogites known in the world. Our studies have determined a peak pressure > 5.5 GPa (Xia *et al.*, 2018), confirming that continental crust was subducted to and exhumed from great depth, and developed a new understanding of the role of fluid-melt associated with deformation, and the implications for exhumation dynamics in collisional belts.

The eclogites at Yangkou Bay are unique as the first example of UHP rocks with intergranular coesite, indicating a locally 'dry' environment throughout the exhumation process. The intergranular coesite survived in rootless intrafolial isoclinal F1 fold noses. Comparison of the water content of nominally anhydrous minerals (NAMs), plus microstructural, petrological and structural features within and outside fold noses, indicates these structures have the lowest inherited H_2O content and preserve the largest amount of intergranular coesite (Wang *et al.*, 2018). The inherited drier environment limited fluid connectivity along garnet and omphacite grain boundaries in the fold noses, which themselves acted as rigid low strain sites and remained immune to grain-scale fluid infiltration. These serendipitous conditions allowed coesite to survive.

Migmatites formed by partial melting of UHP eclogite and gneiss were first discovered and reported from General's Hill, central Sulu belt (Wang *et al.*, 2014). Deeply subducted eclogites in continent–continent collisional belts experience various fluid–melt evolutionary processes along the exhumation P–T path. The UHP eclogites, whether or not they contain hydrous minerals (*e.g.*, phengite, zoisite), can develop a solute-rich supercritical fluid or melt along grain boundaries by dehydroxylation of nominally anhydrous minerals during the early stage of decompression (Wang *et al.*, 2020), and/or trigger partial melting by breakdown of phengite and/or omphacite (Feng *et al.*, 2021) during later stages of exhumation. The dominant deformation mechanism of eclogite at Taohang changes from dislocation creep during the near peak metamorphism to diffusion creep with increasing fluid-melt mobility during exhumation. Fluid-weakening activates diffusion creep; the generation of melt promoted dehydroxilation of garnet and omphacite, which enabled deformation by diffusion creep in eclogite. This is consistent with the hypothesis that fluid exsolution and partial melting were important in facilitating exhumation of UHP metamorphic rocks from mantle depths, as indicated by numerical modelling and experimental petrology studies.

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