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Dense, residual davemaoite in the lowermost mantle: implications for ULVZs and LLSVPs

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The liquidus field of davemaoite (*dm*, composition close to $CaSiO_3$) expands with increasing pressure, making it the most residual phase during partial melting of recycled oceanic crust (ROC) of basaltic to picritic composition. ROC slivers, which have higher density and lower solidus temperature than peridotite, may sink relative to peridotite in the lateral low-viscosity flow above the core mantle-boundary towards the large low shear-wave velocity provinces (LLSVPs) and undergo partial melting in the hottest regions near their margins. We review the relevant liquidus phase relations and have determined mineral and melt densities. Partial ROC melting above the ultra-low velocity zones (ULVZs), preferentially located at or near LLSVP margins, may disaggregate the source lithology, causing dense *dm*-rich residues and even denser silicate and metallic melts to sink relative to buoyant seifertite and Fe-poor post-bridgmanite. The ULVZs may thereby become enriched in refractory *dm* with interstitial silicate melt and tiny fractions of Fe-dominated metallic melt. During the late-stage crystallization of a basal magma ocean, *dm* was probably also incorporated into dense cumulates dominated by Fe-rich bridgmanite, post-bridgmanite and ferropericlase. Such cumulates might be an essential part of the two antipodal LLSVP base layers, in addition to accumulated piles of ROC and ROC residues. The high *dm*-melt partition coefficient for radioactive U and Th, which produces radiogenic He and nucleogenic Ne, imply that the primordial He and solar Ne isotopic compositions in deep-rooted plumes are unlikely to be sourced in either the ULVZs or the LLSVPs.