Secrets of the Temple of Doom: new coesite discoveries in western Norway

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The Western Gneiss Region (WGR) of Norway preserves large tracts of ultra-high-pressure (UHP) metamorphic rocks formed in subducted Baltican crust during the Scandian phase of the Caledonian orogeny. In the Nordøyane UHP domain, the deepest and hottest part of the WGR, coesite and microdiamond are locally preserved in eclogitefacies assemblages. Large rafts of mafic eclogite hosted by migmatitic orthogneisses are exposed along the north coasts of the islands of Haramsøya and Flemsøya. Previous studies of eclogites in this area determined pressure-temperature (PT) conditions in the coesite stability field although coesite was preserved only as pseudomorphs. Recent field work suggests that most of the eclogite bodies are partly surrounded by enclave-rich diorite to granodiorite envelopes containing variably digested fragments of eclogite and amphibolite. Dykes continuous with these melt envelopes locally intrude the eclogite bodies, where they are associated with intense folding and incipient disaggregation of the eclogites. At Arhaugen, an outcrop informally referred to as the "Temple of Doom" consists of intensely recrystallised eclogite with a steep lineation, separated from the adjacent melt envelope by a dioritic dyke highly contaminated with xenocrysts of eclogite-facies minerals. We identified coesite in garnet xenocrysts from both the dyke and the adjacent melt envelope; the initial optical identification has since been confirmed by Raman spectroscopy. Coesite has not yet been found in eclogite from this locality, although preliminary PT estimates are compatible with UHP conditions. The coesite-hosting garnet xenocrysts differ in texture, composition, and inclusion assemblage from those in the adjacent eclogite body, and we infer that they were derived from a different, possibly deeper, source. Evidence for in situ melting of the eclogite bodies themselves is sparse, although there is abundant evidence for eclogite-melt interaction at the present level of exposure. These results have implications for current questions concerning the role of melting in exhumation of UHP rocks.

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