Continental Crust at Mantle Depths

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Identification of the high-pressure polymorphs of SiO_2 and C, coesite and diamond, in crustal rocks is persuasive evidence that continental crust has visited mantle depths. Such rocks have experienced ultrahigh-pressure (UHP) metamorphism, and over 20 UHP terranes are now recognized around the world. Pressure–temperature–time (P–T–t) paths are used to discriminate among possible mechanisms of formation and exhumation. Continental subduction during plate collision is the reigning paradigm for the formation and exhumation of UHP terranes. The idea is that UHP metamorphism forms early in collision at the leading edge of the down-going continent, which is pulled into the mantle by the attached, oceanic crust that converts to eclogite at depth. Continental UHP terranes tend to follow medium temperature P–T paths (T<800 °C) at plate tectonic rates. The subduction channel provides a pathway for UHP material transport back to Earth's surface. Exceptions to every aspect of the paradigm are now known, prompting the exploration of alternative tectonic settings. E.g., the possibility of Precambrian UHP metamorphism [1] influences our interpretation of when subduction began on Earth. Long-lived UHP metamorphism in the overriding plate at the end of collision argues for intracontinental subduction [2]. In addition to continental collisions, UHP metamorphism may also occur in accretionary orogens [3]. Even the tiniest hint of diamond or coesite in continental crust should be investigated for the possibility that it will lead to discoveries of plate tectonic importance.

[1] Perchuk & Morgunova (2014) *Gondwana Res*. **25**, 614-629 [2] Gilotti *et al* (2014) *Gondwana Res*. **25**, 235-256 [3] Wang *et al* (2014) *Lithos* **190-191,** 420-429