Cratonic eclogite perspectives on cratonic crust formation

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Formation of continental crust has been linked to collisional processes and, in the Archaean with higher mantle potential temperatures, may have involved generation of granitoids by partial melting of amphibolite or eclogite with oceanic crust precursors, either in thick oceanic plateaus or in subduction zones [1]. Unfortunatley, pre-Phanerozoic exhumed high-pressure terranes are rarely available for study to test these hypotheses. In contrast, eclogite xenoliths are frequently entrained in kimberlites that have intruded the cratonic crust throughout Earth's history. Despite metasomatic overprints during their long mantle residence [2], these eclogites preserve diagnostic signatures of variably seawater-altered, plagioclase-bearing crustal protoliths, including low ΣREE contents, flat HREE patterns, positive Sr and Eu anomalies and fractionated O isotopes [3]. Some eclogite xenolith suites further show depletions consistent with loss of a granitoid melt at ages mirroring those of the overlying crust [e.g. 4]. However, in some eclogite xenolith suites, LREE-depletion mimicking partial melt loss could point to interaction with deserpentinisation fluids [5], similar to modern examples, and would therefore not directly result in continental crust formation.

We will present new major- and trace-element data for ~100 eclogite xenoliths from the Lace kimberlite (Kaapvaal craton) and combine these with published values from various cratons to examine (1) the viability and nature of crustal precurors consistent with a subduction origin, (2) evidence for partial melt loss that could have resulted in granitoid formation and if so, (3) potential signatures in the eclogite residue that can distinguish between partial melting in the amphibolite vs eclogite stability field. These results will not only provide important constraints on the nature and origin of continental crust, but also have implications for early Earth geodynamics.

[1] Moyen and Martin (2012) Lithos **148**, 312–336 [2] Huang *et al* (2012) *Lithos* **142-143**, 161-181; [3] Jacob (2004) *Lithos* **77**, 295-316 [4] Tappe *et al* (2011) *Geology* **39**, 1103-1106 [5] Aulbach *et al* (2011) *Lithos* **126**, 419-434