Partial melting of pyroxenite domains in peridotitic mantle - not all pyroxenites are born equal

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Discrete bodies of pyroxenite have been proposed in magma sources in intraplate and mid-ocean ridge settings [1]. The pyroxenite formed when recycled, mafic, oceanic crust (eclogite) in upwelling mantle partially melted at higher pressures than the host peridotite along an adiabat, produced siliceous liquids which are out of equilibrium with enclosing peridotite and reacted to form garnet pyroxenite at high pressures [2,3].

Several high pressure experimental studies attempted to test this model by partially melting a range of pyroxenite compositions and establishing solidus temperatures and partial melt compositions. However, many of these studies used inappropriate pyroxenite compositions. Pyroxenites formed as described above lie on the thermal divide in the normative high pressure eclogite projection [2]. They will be refractory, melting at a binary pseudo-eutectic on the *Garnet-Orthopyroxene* join (the thermal divide). Compositions explored experimentally to date, projected either on the *Olivine*-normative or *Quartz*-normative sides of the diagram, meaning they will melt at lower temperatures at pseudo-eutectics, at given pressure.

We predict the order of melting during adiabatic decompression of a hybrid mantle (peridotite enclosing discrete bodies of eclogite) will be as follows. Eclogite will melt first at the highest pressures. Extraction of that melt will form garnet pyroxenite on reaction with peridotite. Melting will next occur at boundaries between unreacted peridotite and the garnet pyroxenite at lower pressures, with further decompression melting normal peridotite and/or residual eclogite, depending on the solidus temperature of the latter. The garnet pyroxenite itself will melt at the shallowest pressures.

This scenario is consistent with a recent model [4] explaining the compositionally distinct double tracks of lavas on Hawaii (Loa and Kea) and other Pacific hotspot locations.

[1] Sobolev *et al.* Science 316, 412-417 (2005)

[2] Yaxley and Green, SBMP 78, 243-255 (1998)

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