On the orgin of intraplate volcanism in Antarctica

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The origin of basalt in continental intraplate settings like the Basin & Range and East Africa rift remains enigmatic. Debate is on whether melt is produced in asthenosphere or lithospheric mantle, melting is triggered by extension, lithospheric drip or plumes, and melt is modified by fractionation as it rises to the surface. Cenozoic alkaline basalts in the West Antarctic rift system have been explained in the context of ~200 Myr of tectonism. Importantly, mantle dynamics and tectonic changes during magmatism (<48 Ma) are relatively simple compared to the other rifts. Moreover, the basalts have relatively uniform compositions that are comparable to ocean island basalt of HIMU-like affinity.

The origin of basalt in West Antarctica is explained by a multi-stage model [1] that calls for amagmatic rifting and metasomatism of the lithosphere by small degree asthenospheric melts. Volcanism occurs after metasomatism by >20 Myr when lithosphere is warmed to melt amphibole-rich metasomes. The silica-undersaturated melt is modified by reaction with peridotite to an extent controlled by lithospheric age and thickness.

In contrast, basalt from Earth's southernmost volcanoes Mt. Early and Sheridan Bluff (87°S), which have been grouped with West Antarctic volcanism but lie within East Antarctica, require a different explanation. Beneath these volcanoes lithospheric mantle may not exist as a result of delamination [2], and while the composition of basalts are broadly similar to those erupted within the rift, differences support an origin with little or no lithospheric influence. These findings have important implications to our understanding of sub-lithospheric sources in both West and East Antarctica.

[1] Panter *et al*. (2018) *Journal of Petrology*, doi: 10.1093/petrology/egy036; [2] Shen *et al*. (2017) *Geology*, doi: 10.1130/G39555.1