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Emplacement of the Central Atlantic Magmatic Province at the edges of cratonic keels

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In this study we discuss the case of the Central Atlantic Magmatic Province (CAMP), emplaced in tropical-equatorial Pangea prior to the opening of the Central Atlantic Ocean. There is a strong spatial correlation between most CAMP outcrops at surface and the edges of the cratonic keels of the West African and the North and South American cratons imaged by recent tomographic studies [1,2,3], suggesting a potential control of the lithospheric architecture on mantle melting dynamics. Geochemical modelling of trace elements and isotopic compositions of CAMP samples suggest a derivation of the basalts by partial melting of an asthenospheric mantle source enriched by recycled continental crust (1-4%) beneath a lithosphere of ca. 80 km. In contrast, melting under a significantly thicker lithosphere (>110 km) does not produce magmas with compositions similar to those of CAMP basalts. Therefore, our results suggest that CAMP magmatism was produced by asthenospheric upwelling along the deep cratonic keels and subsequent decompression-induced partial melting in correspondence with thinner lithosphere. Moreover, mantle potential temperatures, melting degrees and mantle source compositions obtained by our model are compatible with shallow mantle processes in the case of the Low-Ti CAMP basalts, while they could be indicative of a deeper mantle source (i.e., mantle plume) for the high-Ti CAMP basalts. In general, the variations in lithospheric thickness (i.e., the juxtaposition of stable thick cratonic keels and lithospheric thinspots) appear to play a primary role for localizing mantle upwelling and partial melting during large-scale magmatic events such as the CAMP.

[1] Celli, Lebedev, Schaeffer & Gaina (2020), *Nature Communications* 11

[2] Celli, Lebedev, Schaeffer, Ravenna & Gaina (2020), *Geophysical Journal International* 221, 178–204.

[3] Schaeffer & Lebedev (2014), *Earth and Planetary Science Letters* 402, 26–41.