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The Nature of the Cameroon Volcanic Line: Evidence from Seismic Anisotropy and Receiver Functions

I.D. Bastow, R.S.M. De Plaen, and R.J. Gallacher
School of Earth Sciences, University of Bristol, Bristol, BS8 4RJ, UK

The Cameroon geological record spans more than 3 billion years, from Congo Craton basement formation during the Archean, to Cenozoic volcanism along the Cameroon Volcanic Line (CVL). Intriguingly, the CVL, which straddles the continent-ocean boundary in central West Africa, displays no age-progression along its length. Analogies with other hotspot chains worldwide are thus not well established. To help address this issue, we present a receiver function study of bulk crustal structure, and an SKS shear wave splitting study of seismic anisotropy using data from a recent broadband seismic experiment in Cameroon.

Within the cratonic Cameroon, crustal Vp/Vs ratios show little variation between Archean and Proterozoic domains, perhaps indicating similar mechanisms of crustal formation during more than 2 billion years of the Precambrian. The edge of the Congo Craton, however, is characterized by an abrupt change in crustal thickness of $\sim$5 km, which constrains the northern and western edges of the craton to be $\sim$4N and $\sim$10E respectively. Along the CVL, Vp/Vs ratios are low ($\sim$1.74) compared to other hotspots worldwide, providing no evidence for either partial melt, or mafic crustal intrusion due to Cenozoic volcanism. The anisotropy study indicates that fast polarisation directions parallel the trend of the Central African Sear Zone (CASZ), which developed during the breakup of the Pangea supercontinent during Cretaceous times. Beneath much of the CVL, however, we observe only null SKS splitting observations. The lack of lithospheric fabric here may be the result of it being destroyed during Cenozoic hotspot tectonism. However, there is no evidence for anisotropic aligned melt within the lithosphere, unlike hotspots such as Ethiopia, with the implication that neither a CASZ-related lithospheric fabric nor horizontally oriented asthenospheric fabrics exist beneath the line. This finding is in agreement with the receiver function study, and petrological studies that suggest CVL lavas experience little interaction with the lithosphere prior to eruption. The null observations along the CVL also indicate the asthenosphere beneath Cameroon is either isotropic, or it is characterized by a vertically oriented olivine LPO fabric due, for example, to a mantle plume or the upward limb of a small-scale convection cell.