

S burden in CFBs: A new approach

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Most Phanerozoic Large Igneous Provinces (LIPs) are associated in age with, and may have triggered, major mass extinctions. This is epitomized by the synchronicity of the Central Atlantic magmatic province (CAMP; c. 201 Ma) and the Deccan Traps (c. 66 Ma) with the end-Triassic and the end-Cretaceous biotic crises, respectively. However, LIPs not associated to mass extinctions are also recorded, as in the case of the Paranà-Etendeka (PE; c. 134 Ma). Although climatic forcing caused by huge emissions of volcanic gases such as SO₂ and CO₂ is now accepted, precise estimates of gas contents of the basalts and their gas emission masses and rates are still poorly constrained. The differences in environmental impact of these three LIPs may reflect their different gas outputs. Here we illustrate a new approach of estimating magmatic SO₂ emissions. First, the pyroxene/melt S partition coefficient was measured by micro-XRF (Diamond synchrotron, UK) and ion microprobe (WHOI, USA) on experimentally crystallized augites and basalts. S contents were then measured by in-situ micro-XRF in augite phenocrysts from representative rocks of the three considered LIPs. Selected natural clinopyroxene crystals were verified to be devoid of fluid or sulphide inclusions through Transmission electron microscopy (TEM, Siena) thus legitimating the applicability of the partition coefficient and the extrapolation of S burden in primitive magmas starting from S measured on augites. S in the pristine magmas ranges between 100 and 1500 ppm, consistently with results obtained by Self *et al.* (2008) on melt inclusions from Deccan basalts. CAMP and Deccan magmas seem systematically richer in S than PE ones, an observation that correlates well with the severity of the associated biotic crises. Thus, emissions of S (along with other volatiles) appear as important factors for assessing the global environmental changes and may play a significant role in triggering mass extinctions.

[1] Self S., Blake S., Sharma K., Widdowson M., Sephton S., 2008. *Science* **319**, 1654-1657.

Recycling of subducted crust in the source of within-plate CAMP basalts from southeastern North America

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Basaltic dykes and sills of the Central Atlantic magmatic province (CAMP) were intruded between 202 and 195 Ma in southeastern North America (SENA) during Pangea break-up. We aim to constrain the mantle source of these magmatic bodies and their evolution path with new combined geochemical data (major and trace elements, Sr-Nd-Pb-Os isotopes). While Sr-Nd isotopic compositions for SENA rocks (⁸⁷Sr/⁸⁶Sr_{200Ma} 0.70438-0.70880 and ¹⁴³Nd/¹⁴⁴Nd_{200Ma} 0.51251-0.51204) fall within the low-Ti CAMP field, Pb-Pb isotopes (²⁰⁶Pb/²⁰⁴Pb_{200Ma} = 17.46-18.85, ²⁰⁷Pb/²⁰⁴Pb_{200Ma} = 15.54-15.65, ²⁰⁸Pb/²⁰⁴Pb_{200Ma} = 37.47-38.76) are peculiar for this area of the CAMP and span a wide range of compositions, notably extending towards low ²⁰⁶Pb/²⁰⁴Pb_{200Ma} values. Based on the generally unradiogenic Os isotopic compositions (¹⁸⁷Os/¹⁸⁸Os_{200Ma} = 0.127-0.144) and the lack of correlation between these and other geochemical markers, the role of crustal contamination in the evolution of SENA tholeiites is constrained to be less than 10%. Hence, the isotopic variation is interpreted to reside within the mantle source and a process other than crustal assimilation was responsible for conveying the observed continental trace element signature (positive anomaly in Pb and negative anomalies in Ti and Nb) to these magmas. For this process, we hypothesize shallow recycling of subducted lower and upper crustal materials within the upper mantle. Pseudo-ternary mixing models show that a maximum of 10% recycled crust is enough to explain both the SENA dyke trace element patterns and their isotopic heterogeneity. Furthermore, though a thermal contribution of a mantle plume is not completely excluded due to the relatively high mantle potential temperatures (1430°-1480° C) calculated from SENA primitive olivines, its chemical contribution was negligible (less than 5%).