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Don’t blame it on Fluorine: Low F concentrations in Deccan Traps magmas straddling the extinction interval estimated from in situ analyses on clinopyroxene

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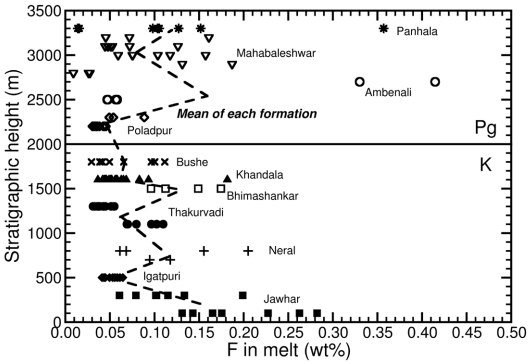

Clinopyroxenes from a ~ 3500 m thick composite Western Ghats section of the Deccan Traps were analyzed for fluorine using the NORDSIM ion microprobe. These results were combined with newly determined partition coefficients [1] to estimate fluorine concentrations in coexisting melts. Concentrations of F in the melts for each formation are variable, typically from ~ 0.03 to ~ 0.15 wt.%, although one melt appears to have contained more than 0.4 wt.% F (see figure). Both the maximum and the mean fluorine concentrations for each formation display a zig-zag pattern through the section, but a broad minimum in concentration is seen near the Cretaceous-Paleogene boundary (K-Pg) [2, 3]. Because F remains highly soluble in silicate melts even during degassing at low pressures, the large variations are unlikely due to volatile loss, and the low crystallinity of the rocks (<15 %), their similar MgO concentrations (5 – 8 wt%), and the small range of clinopyroxene compositions argue against fractionation enrichment as an explanation for the variations. Instead, we attribute these variations in melt F concentrations to changes in the magmatic plumbing system that fed the lava flows. The low F concentrations near the K-Pg combined with the volumes of each formation suggest that the outgassing of F alone from the Deccan was not a significant factor in the K-Pg extinction event. However, the F released from the Deccan Traps eruption in combination with other mechanisms may have contributed to global environmental perturbations from shortly before the K-Pg through post-extinction recovery.

1. Baker, D.R. et al. (in press) Fluorine partitioning between quadrilateral clinopyroxenes and melt. American Mineralogist. https://doi.org/10.2138/am-2021-7868

2. Schoene, B. et al. (2019) U-Pb constraints on pulsed eruption of the Deccan Traps across the end-Cretaceous mass extinction. Science, 363, 862-866.

3. Sprain, C.J. et al. (2019) The eruptive tempo of Deccan volcanism in relation to the Cretaceous-Paleogene boundary. Science, 363, 866-870.