Hg ENRICHMENTS AND Hg ISOTOPES IN CRETACEOUS–PALEOGENE BOUNDARY SUCCESSIONS: FINGERPRINTS OF THE DECCAN VOLCANISM

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We investigate the use of Hg as a proxy for volcanism by studying four distal and two proximal sections in relation to the Deccan volcanic center, straddling the Cretaceous–Paleogene (KPg) boundary at (a) Højerup (Denmark), Bottaccione and Padriciano (Italy), (b) Meghalaya and Jhilmili (India), and (c) Bajada del Jagüel (Argentina). Hg sequestration by organic matter results in constant Hg/TOC ratio and linear correlation between Hg content of the sediments and total organic content (TOC). Elevated Hg concentrations that deviate from this linear relationship represent most likely true Hg anomalies and these notable Hg/TOC spikes (all TOC <1%) are found in the Meghalaya, Bottaccione and Højerup sections within the CF2 planktic foraminiferal biozone (spike I), at the KPg boundary (spike II), and within the P1a planktic foraminiferal subzone (spike III). Spike III occurs also in the Jhilmili section. No clear correlation between Hg/TOC and Al_2O_3 exists in any of the studied sections. The Hg anomalies probably result from strong volcanic episodes of the Deccan phase-2 (started 250 kyr before the KPg boundary and lasted for 750 kyr) that exhaled sulphuric aerosols, carbon dioxide and other toxic agents which reached a critical threshold, represented in true Hg enrichments in the palaeoenvironments. The possibility that Hg enrichments resulted from anoxia scavenging on the seafloor and penetration downward into sediments is not supported in the stratigraphic record of Mo/Al ratios redox proxy.

Hg isotopes were analyzed in samples from all KPg boundary sections in this study and from Bidart, France, the latter for comparison. Hg isotopes yielded δ^{202}Hg values ranging from -1 to -2 ‰ and Δ^{201}Hg signatures from 0 to 0.05‰ (spike II in Højerup, Bottaccione and Meghalaya KPg boundary layers) consistent with volcanic emission of Hg (0 to -2 ‰). δ^{202}Hg in spike I in Meghalaya and Padriciano and spike III in Jhilmili is consistent with volcanic emission of Hg. Two samples from Bajada del Jagüel and four from Bidart, however, display isotope signals compatible with volcanic emission/chondrite Hg. The results of three other samples are characteristic for reworked sediment, soil and/or peat. Most of the data show small positive Δ^{201}Hg, in favor of long-term atmospheric transport prior to deposition, supporting volcanic origin for the Hg. The present study broadens, therefore, the potential use of Hg as stratigraphic marker and, moreover, confirms that in the critical KPg transition, Hg was enriched in palaeoenvironments at three distinct stages during the Deccan phase-2. The data also suggest that Hg poisoning from enhanced volcanism have contributed (or even caused) the KPg boundary mass extinction.

PALAVRAS-CHAVE: KPg boundary; quimioestratigrafia; isótopos de Hg