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Mercury deposition and mercury isotopes in sections straddling the Cretaceous–Paleogene boundary: link to volcanism

Sial, A.N.[1], Chen, JB[2], Lacerda, L.D.[3] , Tewari, V.C.[4] , Pandit, M.K.[5], Gaucher, C.[6], Frei, R.[7], Ferreira, V.P.[1], Cirilli, S.[8], Peralta, S.[9], Korte, C.[7], Barbosa, J.A.[10], Pereira, N.S.[1]

[1] NEG–LABISE, Dept. Geology, Federal Univ. of Pernambuco, Recife, PE, 50740-530, Brazil (sial@ufpe.br)
[2] State Key Laboratory of Environmental Geochem., Institute of Geochemistry, Guiyang 550002, China
[3] LABOMAR, Institute of Marine Sciences, Federal University of Ceará, Fortaleza, 60165-081, Brazil
[4] Dept. Geology, Sikkim University, 6th Mile, Samdur, Tadong Gangtok, Sikkim, India
[5] Dept. of Geology, University of Rajasthan, Jaipur, India, 302004
[6] Dept. Geología, Facultad de Ciencias, Universidad de La República, Montevideo, Uruguay
[7] Dept. of Geoscience and Natural Resource Management, Univ. of Copenhagen, Copenhagen, Denmark, 1350
[8] Dept. Physics and Geology, University of Perugia, 06123 Perugia, Italy
[9] Instituto de Geología, Universidad Nacional de San Juan-CONICET, Argentina, 5400
[10] LAGESE, Dept. Geology, Federal University of Pernambuco, Recife, 50740–530, Brazil

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We investigate the use of Hg as a proxy for volcanism, using four distal and two proximal sections in relation to the Deccan volcanic center, straddling the Cretaceous–Paleogene (KPg) boundary: (a) Højerup, Bottacione and Padriciano, Europe, (b) Meghalaya and Jhilmili, India and (c) Bajada del Jagüel, Argentina. There is a strong linear correlation in sediments between Hg and total organic matter (TOC %) contents as Hg is sequestrated by organic matter or adsorbed onto clays resulting in constant Hg/TOC ratio. Enhanced Hg amounts that depart from this linear relationship may represent true Hg anomalies. There are notable Hg/TOC spikes (all TOC <1%) in the studied near-complete sections: (a) a spike (I) in the Meghalaya, Bottacione and Stevns Højerup sections within the CF2 planktic foraminiferal biozone, (b) another large Hg/TOC spike (II) at the KPg boundary in these same sections and (c) a third Hg/TOC spike (III) within the P1a planktic foraminiferal subzone in these three and Jhilmili sections. There is no clear correlation between Hg/TOC and Al_2O_3 in all studied sections. These three Hg anomalies probably resulted from distinct stages of the Deccan phase-2 (started 250 kyr before the KPg and lasted for 750 kyr), when sulphuric aerosols, carbon dioxide and other toxic agents reached a critical threshold, and they represent true Hg loading to the environment. Spikes I and II are absent from the Bajada del Jagüel section and a prominent Hg/TOC spike in the volcaniclastic sandstone that marks the KPg transition is probably related to local volcanism. A post-depostional origin of Hg enhancements generated from scavenging by anoxia on the seafloor and penetration downward into sediments does not find support in the stratigraphic record of Mo/Al redox proxy.

Hg isotopes were analyzed in 23 samples (Højerup, Bottacione and Bajada del Jagüel, besides Bidart, France, for comparison). Fifteen of these samples allowed δ^{202}Hg values from -1 to -2 ‰ and Δ^{201}Hg from 0 to 0.5‰ (Højerup and Bottacione KPg layers, Bajada del Jagüel KPg sandstone transition layer) within the box for volcanic emission of Hg (0 to -2 ‰). Two samples from Bajada del Jagüel and 4 from Bidart lie within the box for volcanic emission/chondrite Hg. Three samples lie in the field for sediment, soil and peat and are likely reworked samples. Most samples show small (but significantly higher than analytical precision of 0.04‰) positive Δ^{201}Hg, in favor of long-term atmospheric transport prior to

deposition, supporting volcanic origin for the Hg. This study broadens the potential use of Hg as stratigraphic marker and confirmation of Hg loading to the environment by Deccan phase-2 in three distinct stages.