Hg isotopes at the K-Pg boundary

M. M. M. MEIER*[1], C. CLOQUET[1], B. MARTY[1], L. FERRIÈRE[2] AND C. KOEBERL[23]

[1]CRPG CNRS Nancy, Université de Lorraine, France. *correspondence: mmeier@crpg.cnrs-nancy.fr
[2]Natural History Museum Vienna, Austria.
[3]University of Vienna, Austria.

Mercury (Hg) is present at varying abundances in different types of meteorites [1-3]. Because of the high toxicity of Hg, it had long been suggested that it might be a potential "killing agent" during mass extinctions [4]. Natural Hg poisoning might either be the result of large amounts of Hg expelled during eruptions in Large Igneous Provinces, injected into the terrestrial environment by a volatile-rich asteroidal or cometary impactor, and/or released from terrestrial sediments by acid rain leaching in the aftermath of an impact [4]. If the Hg concentrations measured by [2] [3] in the CI-chondrite Orgueil were typical for the Cretaceous-Paleogene (K-Pg) / Chicxulub impactor as a whole, full release of the highly volatile Hg would correspond to a total injected mass of 10^6 – 10^7 metric tons of Hg (i.e., 10^4 – 10^5 times more than todays annual anthropogenic emissions), and result in a global Hg deposit of several 1000 ng Hg/cm^2, on a par with present-day sites of high Hg contamination (e.g., [5]). Small Hg peaks at the K-Pg boundary have been reported before, and have been attributed to the terrestrial response to the Chicxulub impact [6] or to volcanic activity pulses [7]. However, an impactor contribution could not be excluded because Hg isotopic data were available from neither K-Pg boundary sediments nor meteorites. We have measured the concentration and isotopic composition of Hg in meteorites [2] and at several K-Pg sites, including the distal marine sites Stevens Klint (Denmark), Bidart (France) and the more proximal terrestrial site Teapot Dome (USA). At Teapot Dome, we find a comparatively huge, double-spiked Hg peak of ~1000 ppb, while the Hg peaks at Stevens Klint and Bidart are much smaller (200 ppb and 80 ppb, respectively). The low Hg abundance at the latter two sites suggests a bulk Hg content of the K-Pg impactor certainly much lower than the one measured in Orgueil. While we cannot fully constrain the extraterrestrial Hg contribution, the K-Pg boundary sediments still put constraints on the Hg content and isotopic composition of the impactor. We can thus exclude an impactor similar to Orgueil, but Mighei- and Ornans-type carbonaceous chondrites are possible.

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