Platinum group elements and Re-Os isotopes in the K-Pg transition of the Chicxulub peak-ring rocks

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The presence of extraterrestrial material in terrestrial sediments is usually indicated by an enrichment of platinum group elements (PGEs: Os, Ir, Ru, Pt, Pd) due the PGE concentrations in chondrite are about three orders higher than those of the upper continental crust. The K-Pg boundary clay layer exhibiting PGE anomalies, containing Ni-rich spinels and spherules, has been found in sites worldwide and interpreted as the ejecta layer produced by large impact that formed the Chicxulub crater and marks the end of the Cretaceous. However, the spatial distribution and amount of projectile materials within the crater is still poorly constrained. In order to determine the distribution and abundance of the projectile component within the impact site, we examined PGE concentrations and Re–Os isotope ($^{187}Os/^{188}Os$) compositions in the Cretaceous–Paleogene transitional layer of the Chicxulub peak ring rocks obtained from IODP–ICDP expedition 364 cores.

Platinum group element (PGE) concentrations and $^{187}Os/^{188}Os$ compositions show systematic variations across the transitional layer. The upper part (616.59–616.63 mbsf) is characterized by about one order of magnitude higher Os, Ir, and Ru contents compared to the average continental crust abundances, but much lower than for the typical Ir-enriched Cretaceous–Paleogene boundary distal sites (e.g., Gubbio and Caravaca: Alvarez et al., 1980; Smit and Hertogen, 1980). Relatively flat CI chondrite–normalized PGE patterns are observed in the upper part of the layer. Meanwhile, the PGE concentrations in the lower part of the transitional layer (617.315–617.34 mbsf) are almost equivalent to those of upper continental crust showing pronounced step CI chondrite-normalized PGE patterns (0.8–1.2 $\times 10^{-4}$ for Ir, and 1.2–2.7 $\times 10^{-3}$ for Pt and Pd). $^{187}Os/^{188}Os$ and Re/Os ratios in the transitional layer gradually decrease from 0.33 to 0.25 and 35.45 to 1.14, respectively, from bottom to top. These results suggest that the projectile component, with chondritic composition, is enriched in the uppermost part of the transitional layer just below carbonate rocks that are early Paleogene in age, but could be distributed over a thicker interval than for the Ir-enriched sites. Further detailed studies of PGE and $^{187}Os/^{188}Os$ compositions through the stratigraphic sequence will reveal the distribution and dilution effect of the projectile component.

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