

Osmium isotopic composition and platinum group element abundances of Cretaceous-Paleogene boundary section at Site U1514C on the Mentelle Basin, SW Australia

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During IODP Expedition 369, Cretaceous and Paleogene sediments were recovered at Site U1514 in the Mentelle Basin, off SW Australia. Shipboard micropaleontological investigation revealed that Cretaceous–Paleogene boundary (K–Pg boundary, 66.0 Ma) is located at 369-U1514C-23R-2, 2-3 cm interval, at 393.52 m depth (core depth from seafloor, CSF-A). Here, uppermost Maastrichtian light gray chalk is overlain by Paleocene greenish gray claystone with a heavily bioturbated contact. In this study, we analyzed abundances of platinum group elements (PGEs)—including Ru, Pd, Os, Ir and Pt—and the radiogenic isotopic composition of Os ($^{187}\text{Os}/^{188}\text{Os}$) for the sediments across the K–Pg boundary section. According to the shipboard studies on bio- and magnetostratigraphy, applying ages from the Geologic Time Scale 2012, our samples cover a time interval from 68.1 Ma (Maastrichtian) to 65.9 Ma (Danian). Our data show a clear peak in Ru (4.8 ng g^{-1}), Os (1.4 ng g^{-1}) and Ir (5.3 ng g^{-1}) concentrations at 393.52 m CSF-A, with values two orders of magnitude higher than background concentrations during the Maastrichtian. Abundances of PGEs of the sample from 393.52 m CSF-A show a flat pattern when normalized to CI chondrite values, while the other samples show patterns similar with the upper continental crust. The sample from 393.52 m CSF-A also marks a clear drop in the $^{187}\text{Os}/^{188}\text{Os}$ value of 0.18. Our data on the PGE abundances and Os isotopes clearly shows that the sediment at 393.52 m CSF-A contains PGEs from an extraterrestrial source, most likely associated with the well-known bolide impact at the K–Pg boundary.

The $^{187}\text{Os}/^{188}\text{Os}$ values in the uppermost Maastrichtian interval show two [LKO1] gradual decreases from 0.6 to 0.4 and 0.4 to 0.2, while those in the lowermost Danian interval show a gradual increase from 0.2 to 0.4. The gradual variation in Os isotopic composition suggests that sediment was deposited continuously without significant hiatus. The decreasing trends of $^{187}\text{Os}/^{188}\text{Os}$ values in the Maastrichtian interval is slightly different from those reported from other sites previously, which may be attributed to either 1) heavy bioturbation or 2) some local or regional volcanic events at this site.

Keywords: Os isotope, PGE, K-Pg boundary