Variation in $^{187}Os/^{188}Os$ across K-Pg boundary at Stevns Klint, Denmark

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The chalk cliffs at Stevns Klint, Denmark, provide a classical locality for study of a stratigraphic succession containing the Cretaceous-Paleogene (K-Pg) boundary [1]. Here, the K-Pg boundary is marked by a thin clay/marl layer known as the "Fish Clay", famous for its large Ir anomaly linked to the 66 Ma Chixculub meteorite impact [2, 3]. Chalk intervals contain beds of nodular flint (black chert) formed on dissolution and void-filling of chalk. A main goal of our study was to test Re-Os chronometer on black cherts.

To obtain a record of marine $^{187}Os/^{188}Os$ embracing the Stevns Klint K-Pg boundary, samples of flint, chalk and Fish Clay were collected over a 3-meter section. The results show significant variation in initial Os isotopic composition (Os_i) across the K-Pg boundary, with the Fish Clay diving to Os_i values of ~0.2, highlighting a cosmogenic source of Os [4]. The Os_i record held in Maastrichtian chalks below the K-Pg boundary shows a relatively smooth trend matching well with open ocean Os_i records [5]. However, a more chaotic post-K-Pg Os_i trend in the Danian is the likely consequence of a mixture of reworked crustal and cosmogenic materials. Re concentrations for flint nodules, chalks and Fish Clay spanning the late Maastrichtian and early Danian are similar (0.01-0.3 ng/g). Higher Re concentrations have been found in a few flint nodules in the Danian Bryozoan Limestone (0.25-2.7 ng/g). Os concentrations in chalks are higher near the K-Pg boundary, reflecting a seawater doped with cosmogenic debris. A Re-Os isochron for flint nodules from the Bryozoan Limestone yields a Model 3 depositional age of 66.4 ± 3.7 Ma, showing that flint nodules can provide ages for deposition or early diagenesis. The large uncertainty on the age may reflect either (1) variable Os_i during void-filling, or (2) time required for transformation of flint-forming silica gel to cryptocrystalline quartz and closure of the isotopic system.

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