Re-Os geochemistry of cherts and chalks spanning the K-Pg, Stevns Klint, Denmark

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The coastal chalk cliffs at Stevns Klint, Denmark, expose the stratigraphic succession straddling the Cretaceous-Paleogene (K-Pg) boundary [1]. Here the K-Pg "Fish Clay" boundary layer hosts the classic Ir anomaly linked to the 66 Ma Chixculub meteorite impact [2,3]. Chalk successions above and below the K-Pg boundary in northern Europe also feature beds of nodular chert formed by dissolution of chalk.

To study the variation in marine $^{187}Os/^{188}Os$ across the K-Pg boundary; samples of chalk and chert were analyzed over a 3-meter section centered on the Fish Clay. Initial Os isotopic compositions (Os_i) vary significantly across the K-Pg boundary, dropping to a low of ~0.2, correlative with the impact horizon, and recovering to ~0.4 two meters above the Fish Clay. Os_i records across the K-Pg boundary from deep marine sections fall close to a mixing hyperbola defined by Upper Cretaceous carbonates (Os ~50 pg/g, $^{187}Os/^{188}Os$ ~0.4) and chondritic material (Os ~1000 ng/g, $^{187}Os/^{188}Os$ ~0.127) [4]. In contrast, our shallow-water Fish Clay data are displaced from the hyperbola toward higher Os_i for a given Os concentration. This may be explained by (i) post-depositional loss of Re due to oxidation, (ii) input of highly radiogenic ejecta fallout from vaporization of crustal rocks at the Chixculub impact, (iii) tsunamite addition of distal marine organic-rich muds, (iv) significant input of soot, and/or (v) post-depositional mixing of local chalk detritus with the clay at the impact horizon.

We also explored the potential for Re-Os dating in cm- to dm-scale chert nodules, given their fresh, glassy character. Most have very low Re and Os concentrations, but multiple splits from two black chert nodules yield a Model 3 isochron age of 66.4 ± 3.7 Ma, with an Os_i of 0.34. Large uncertainty on the chert age may reflect (i) variable Os_i during genesis and/or (ii) time required for closure of the system. The approach holds promise.

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[1] Surlyk et al (2006) Bull. Geol. Soc. Den. **54**, 1-48.
[2] Alvarez et al (1980) Science **208**, 1095-1108.
[3] Kuiper et al (2008) Science **300**, 500-504.
[4] Ravizza&VonderHaar (2012) Paleoceanogr. **27**, PA3219.