

ODP LEG207 – A SURPRISINGLY PRISTINE K-T BOUNDARY. I - SEDIMENTOLOGY, MINERALOGY, Sr-Nd ISOTOPE SYSTEMATICS.

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Introduction: Six cores from ODP Leg 207, Demerara Rise, tropical W Atlantic, recovered a 2-3 cm thick Chicxulub ejecta deposit marking the Cretaceous-Paleogene (“K-T”) boundary. The stunning feature of this sedimentary sequence is its uniformity over an area of ~30 km², and the total absence of bioturbation. Our high-resolution study reveals the remarkable complex composition and distinct microstratigraphy of the spherule deposit.

The spherule layer: The slightly graded K-T boundary layer consists predominantly of spherules fining upwards from ≤1 to ≥0.4 mm in diameter. Texture of the spherules ranges from hollow over vesicle-rich to massive; some show in-situ collapse. They are generally altered to aluminian di-octahedral Na-rich smectite, occasionally distinct globules rich in Fe and Mg, and pseudomorphs after quench crystals are present. Spherules are more Fe-Mg-enriched in the uppermost few mm of the layer, which contain abundant calcite and dolomite spherules, as well as shocked quartz and feldspar grains. Among others, we have discovered specific sponge-like, porous carbonate spherules whose textures resemble experimentally degassed calcites [1]. Some of the carbonate spherules are rimmed by now altered silicate melts indicating strong thermal overprint during ejection; others are polycrystalline with equilibrium textures, or consist of loosely accreted, μm-sized calcite and dolomite crystallites.

Sr-Nd isotope data: The altered glass spherules, and the clayey matrix (site 1259B) display strongly negative $\varepsilon_{\text{Nd}}^{\text{T}=65 \text{ Ma}}$ values with consistent $T_{\text{Nd}}^{\text{DM}}$ ages of ~1.9 Ga – much older than any model age reported so far for target or melt lithologies from Chicxulub (cf. [2]). The Sr-Nd isotope data for the ODP 207 samples are very different from those for spherules in other K-T ejecta deposits, obviously reflecting the uptake of Nd from the contemporaneous ocean water during alteration of the glass.

Interpretation: Overall characteristics (grading, excellent preservation of delicate textures) indicate that the K-T spherule bed drilled by ODP Leg 207 is an air-fall deposit with settling in quiet, ~2000 m deep water, followed only by minor soft-sediment deformation-drilling disturbance. The microstratigraphy is unlike to most other distal marine K-T boundary records that are affected by turbidity currents or/and bioturbation. In contrast, the ODP 207 K-T record strongly resembles the dual-layer K-T boundary in the terrestrial Western Interior that also yields a thick basal spherule layer overlain by clay enriched in Iridium, shocked minerals, and Fe-Mg-rich spherules. We emphasize that we provide the first evidence of shocked carbonates and dolomites in Chicxulub ejecta deposits.

References: [1] Agrinier P. et al. 2001. *Geochimica Cosmochimica Acta* 65:2615-2632. [2] Kettrup B. and Deutsch A. 2003 *Meteoritics & Planetary Science* 38:1079-1092. [3] Berndt J. et al. 2008. *Meteoritics & Planetary Science* this volume.

Acknowledgements: The Ocean Drilling Program (ODP) provided the samples, and the DFG funding for this research (SCHU 2248/2; DE 401/13). We acknowledge ODP, J. Erbacher (BGR Hannover), the ODP 207 curators, and H. Brinkhuis (Univ. Utrecht) who made the samples available.