Evidence for Shocked Carbonates and Sulfates From the UNAM-7 Core, Chicxulub Impact Structure, Mexico, and Ocean Drilling Program (ODP) Leg 207, West Atlantic

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Chicxulub is considered as an exceptional impact due to its cause-effect relation with the Cretaceous-Paleogene (KPg) mass extinction, which in turn may be related to the remarkable target properties, i.e., <3 km platform sediments consisting to ˜1/3 of anhydrite. In this context, shock metamorphism of carbonates and anhydrite - including impact-induced dissociation and re-combination - is of basic interest (Deutsch and Langenhorst 2007).

Drilled at the outer rim, 126 km off the crater centre, core UNAM-7 contains an impactite sequence consisting of 126.2 m suevite on top of a polymict silicate melt-poor breccia with anhydrite megablocks (Salge 2007). ODP Leg 207 (˜4500 km distance) has recovered a complete, pristine K-Pg boundary with a 2 cm-thick ejecta deposit (MacLeod et al. 2007). Samples from both locations were analyzed by SEM JEOL JSM-6490LV using a QUANTAX EDS system with a silicon drift detector (SDD) that generates fast elemental maps (4096x3072 pixel resolution, ˜0.5 μm/pixel) at an input count rate of 500,000 cps. In addition, EDS spectra for each pixel were stored for further processing.

UNAM-7: The microcrystalline breccia matrix is dominated by anhydrite (52.1%) and carbonates (30.7% dolomite, 15.0% calcite) with minor silicates. Other important features are (i) a silicate melt particle with an anhydrite core and carbonate globules, (ii) the high porosity of the core indicating partial dissociation of the anhydrite, and (iii) sulfates and carbonates showing liquid immiscibility textures. ODP 207: The ejecta consist mainly of clay-altered spherules but the uppermost mm comprise abundant porous carbonate spherules and few shocked quartz and feldspar grains. The texture of the carbonates resembles experimentally produced degassing textures.

We conclude that UNAM-7 provides the first evidence for melting and dissociation of sulfates at the Chicxulub crater. The carbonates from the OPD 207 ejecta deposit are a clear proof for impact-induced melting, dissociation, and possibly back-reactions of carbonates. The abundant presence of shocked sulfates from UNAM-7 in combination with their absence at the ODP 207 deposit indicates that similar processes for sulfates are restricted to a region close to the crater.

References

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Abs. No. **391**
Meeting: **DMG 2008**
submitted by: **Salge, Tobias**
email: **Tobias.Salge@bruker-axs.de**
date: **2008-06-02**
Req. presentation: **Poster**
Req. session: **S03**