THE GORGONILLA CRETACEOUS/PALEOGENE (K/PG) BOUNDARY SECTION, SW COLOMBIA, AND ITS SIGNIFICANCE FOR THE CHICXULUB IMPACT SCENARIO

Stinnesbeck, W.[1], Bermúdez, H.D.[2], García, J.[2], Rodríguez, J.V.[2], Vega, F.J.[3]

1. Universität Heidelberg; 2. Paleoexplorer s.a.s.; 3. Instituto de Geología, Universidad Nacional Autónoma de México.

ABSTRACT

Recent high-resolution stratigraphic description and geological mapping of sedimentary sequences at Gorgonilla Island, Southwest Colombia, now extends the occurrence of the Chicxulub spherule deposits to the Pacific off northwestern South America. Here we discuss the significance of this new K/Pg boundary section.

Key words: Gorgonilla, Colombia, K/Pg, Spherules, Chicxulub.

INTRODUCTION

Andesitic glass-smectite spherules are known from many Cretaceous/Paleogene (K/Pg) boundary sections in North and Central America as well as the Caribbean, and are commonly interpreted as ejecta from the Chicxulub impact in Yucatán, Mexico. A new Cretaceous/Paleogene (K/Pg) boundary locality recently discovered at Gorgonilla Island, SW Colombia, now extends the presence of a Chicxulub spherule deposit to the Pacific region of northwestern South America.

RESULTS

In South America, K/Pg boundary sections are exceedingly rare and only two sections have been formally associated to the Chicxulub impact event: in the Neuquén basin, Argentina, Scasso *et al.* (2005) described a coarse-grained sandstone bed, which occurs in a homogeneous neritic shelf mudstone sequence. The authors suggested that this siliciclastic layer represents a tsunami deposit, triggered by the Chicxulub impact. In a subsequent analysis, however, Keller *et al.* (2007) detected no evidence of the Chicxulub impact (e.g. microspherules, iridium anomaly, shocked quartz) or related tsunami deposition. Rather, the K/Pg boundary is marked by an erosional surface and sediments overlying the sandstone unit contain diverse planktic foraminifera of Early Paleogene zone P1c and nannofossils of zone NP1b. This suggests that deposition of the sandstone occurred 500 kyr after the K/Pg hiatus and is unrelated to Chicxulub.

At Poty Quarry, Pernambuco, NE Brazil, Albertão and Martins (1996) described a shallow-marine marl and limestone succession with impact-derived exotic products (microtektite-like microspherules and shock-metamorphosed quartz) associated with a possible impact-generated tsunamite. However, subsequent work by Albertão *et al.* (2004) and Gertsch *et al.* (2013) concluded that there is no evidence of impact origin for these spherules. The breccia unit interpreted as a tsunamite is composed of intraformational lime- and marlstone clasts but also contains bones, phosphatic lumps, phosphatised foraminifera, glauconite and small pyrite concretions which indicate reworking and erosion from near-shore areas (Stinnesbeck and Keller, 1996). Gertsch *et al.* (2013) suggested that this layer represented a gravity flow during the latest Maastrichtian lowstand. Thus the Gorgonilla section represents the first unequivocable evidence for a Chicxulub ejecta layer in South America.

Gorgonilla spherules constitute a ~2 cm thick layer with normal size-gradation and were deposited in a deep water basinal environment rich in radiolarians and sponge spicules (Bermudez *et al.* this volume). Their extraordinarily good preservation with approximately 90% of spherules still completely vitrified, differs from most other Chicxulub spherule layer known from the southern US, Mexico, or the Caribbean, in which spherules are frequently altered to smectite clay, thus making it difficult to deduce original compositions. Similar to spherules in North and Central American (e.g. northeastern Mexico) deposits, the Gorgonilla spherules also show complex petrologic features, geochemical ranges, and mixing trends. Their fluidal-shaped forms, smooth surfaces, and internal textures, such as vesicles and streaked schlieren are indicative of an origin as molten droplets from a highly fluid melt with subsequent exsolution of a gas phase due to pressure release and cooling (Schulte *et al.* 2002, 2009). Round to tear- and even drum-belled shapes, abundant at Gorgonilla, also suggest a range of ballistic paths and cooling histories consistent with an impact-origin.

The normal size-gradation of the Gorgonilla spherule layer is also outstanding; almost all Chicxulub spherule layers documented to present date from North- and Central America and the Caribbean are affected by erosion and redeposition. The disturbance of these deposits, located proximal to the impact site in northern Yucatan, was interpreted to result from gravity flows, slumps or liquefaction triggered by an impact-generated tsunami (Schulte *et al.* 2010). Alternative explanations attribute the consistancy of individual layers to independent sedimentological events, related to a sea-level fall near the end of the Maastrichtian (Keller *et al.* 2003, 2013). In this long-term scenario shallow water sediment was transported and redeposited in the deeper ocean. Spherule deposits which would potentially represent a primary airfall layer were only reported from a few locations, but even these deposits (e.g. La Sierrita, Demerara Rise) are subject to considerable controversy. The Gorgonilla spherule layer appears to have remained unaffected from tsunami-reworking or backwash and may thus represent the first parauchtochthonous primary fallout deposit of the Chicxulub impact known to date.

CONCLUSIONS

A new locality at Gorgonilla Island, SW Colombia, now extends the presence of a Chicxulub spherule deposit to the Pacific region of northwestern South America.

The spherule layer is ~2 cm thick and presents normal size-gradation, suggesting that the unit represents an almost unaltered primary air-fall ejecta deposit not affected by significant reworking.

About 90 % of the spherules are still completely vitrified which is also unique among Chicxulub ejecta deposits known to date.

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