ACCRETIONARY LAPILLI FROM THE KT BOUNDARY SITE OF GUAYAL, MEXICO: PRELIMINARY INSIGHTS OF EXPANSION PLUME FORMATION.

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Stratigraphy: The deep marine Guayal section [1] is located 550 km southwest of the Chicxulub crater. The KT boundary sequence is marked by a >30 m thick limestone megabreccia composed of centimeter to decameter-sized blocks grading upward towards a microbreccia rich in shocked quartz and glass fragments. The top of the microbreccia is formed by a 1 m thick carbonate unit containing rounded or elongated accretionary lapilli up to 2 cm in size. This lapilli bed is covered by a 1.5 m laminated unit also rich in ejecta debris. In terms of petrography and major and trace element chemistry, this unit resembles the upper part of the Chicxulub suevite from well Yucatan 6. The KT boundary clay layer with its classical enrichment in PGE marks the top of the sequence. This coarse KT sequence abruptly interrupts a succession of deep water marls and was most likely deposited as a single rapid event related to the fracturing and collapse of the edge of the Yucatan platform due to the Chicxulub impact [1; 2].

Accretionary Lapilli: Accretionary lapilli form within a turbulent volcanic wet ash plume, when solid particles with condensed liquid layers collide and agglomerate by binding forces [3]. The Ries crater fall-back suevite contains lapilli similar in composition but smaller in size than those of Guayal. The Ries lapilli formed in the turbulent expansion plume raising above the crater [4]. The Guayal KT boundary lapilli show a concentric structure with a continuous layer of finer material. In the center, mineral fragments are randomly distributed. Towards the edges, elongated minerals are aligned tangential to the lapilli rim. Broken lapilli fragments are common indicating some degree of transport and reworking before deposition. SEM studies show that the lapilli are formed of 100 µm to < 1 µm sized, angular grains of calcite, dolomite, quartz and clay minerals dispersed in an amorphous silica matrix. On average, the lapilli consist of 64% quartz, 19% clay minerals, 9% calcite, and 8% dolomite. The clay mineral phases resemble small glass shards and most likely represent altered melt phases. They are often found surrounding or closely associated with calcite grains. Some of the larger calcite grains have a morphology reminiscent of the melt “frazzles” found in the Ries suevite. The majority of the calcite grains are rounded and less than a few microns in size. The lapilli are enriched in PGE compared to their host sediment.

Conclusions: We interpret the lapilli bed and overlying unit as probable fall-out suevite transported in the expansion plume and deposited more than 550 km from the crater center. The composition of the lapilli suggests that they formed in a region of the expansion plume that contained vaporized and molten target and vaporized meteoritic material. The matrix of the lapilli may have formed from the vaporized silica-rich basement by condensation of highly viscous quartz liquids. It can be speculated that the small calcite phases result from quenching of melt carbonate liquids also after condensation from a vapor phase. Vaporization, condensation and agglomeration processes play a major role in the impact lapilli origin. These grains may thus reflect some of the chemical reactions taking place in the expanding plume. Their composition should help constrain condensation models such as those of [5,6] developed for the Chicxulub expansion plume.

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