COMPONENT ANALYSIS OF SORTED SUEVITE IN THE CHICXULUB IMPACT CRATER.
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Introduction: The uppermost impactite deposit in the 200 km K-Pg Chicxulub impact crater is sorted suevite [e.g. 1–10]. This sorted suevite has been interpreted as a tsunami deposit [4,9], the result of melt-fuel-coolant interaction [10], and fallback along with aqueous reworking [2–8]. Continuous drill core sections of sorted suevite are 26 m thick (794.63–823.25 m) in the International Continental Scientific Drilling (ICDP) Yaxcopoil-1 (Yax-1) drill core, and 92 m thick in the International Ocean Discovery Program (IODP) –ICDP M0077 drill core [11–12]. In the Yax-1 core, which is located onshore in the structure's annular moat ca. 60 km S' of the crater's center, sorted suevite grades downwards into unsorted suevite that is progressively annealed with depth towards a 24 m thick intercalation of brecciated impact melt rock [8]. In the M0077 core that was drilled offshore into the peak ring, 38 km W' of the center of the crater, 92 m [617.34–709.06 mbsf (meters below sea floor)] of sorted suevite overlies 13 m of unsorted suevite and 25 m of hyaloclastite-like fractured impact melt rocks [11–13]. We studied sorted suevites in M0077 and compare them to those in Yax-1 to constrain conditions of their emplacement.

Samples and Methods: We analyzed components of sorted suevites in 7 thin sections from the M0077 drill core and one sample from the uppermost sorted suevite in the Yax-1 drill core with an optical microscope and ca. 10× enlarged images of the 8 thin sections. We outlined each component larger than ~0.2 mm on a transparent foil and regarded smaller components and sparitic carbonate void-fill as matrix. After digitizing the transparent foils, we used the ImageJ software to determine the modal proportions of components and the orientations and shape parameters for all 2031 component particles. To verify particle identification, we X-ray mapped all samples with the JEOL JXA-8530F electron microprobe at Arizona State University's Eyring Materials Center.

Results: *Petrography:* We distinguished 7 clast types: Vitric impact melt clasts (**VMC**) that may contain vesicles; these particles are pervasively altered to phyllosilicates with compositions close to montmorillonite and crystallized few to no phenocrysts. Crystallized impact melt particles (**CMC**) contain small plagioclase +/- pyroxene phenocrysts and various amounts of melt mesostasis; vesicles are rare in this clast type. Dark, aphanitic impact melt particles (**AMC**) are crystallized with very fine plagioclase +/- pyroxene phenocrysts and exhibit finely dispersed Fe-oxide particles. Basement clasts (**BC**) are fragments of silicate target rocks that are variably altered granite, gneiss, dolerite, and schist. SiO_2 clasts (**SiO_2**) occur as single crystals that rarely exhibit decorated PDF, or with microcrystalline, chert-like textures. Carbonate particles occur as primary carbonate clasts (**PCC**) with micritic matrixes that may show slight recrystallization but typically retain sedimentary features and fossils. Reacted carbonate clasts (**RCC**) are composed of euhedral, µm-size calcite crystals and concentric zones of cellular clay minerals. RCC exhibit Ca-enriched halos in the surrounding suevite matrix in samples C49 to C81 (644–709 mbsf) [12]. No RCC were identified in the Yax-1 sample; no Ca-sulfate was identified in these samples and dolomite clasts only occur in the Yax-1 sample (Fig. 1).

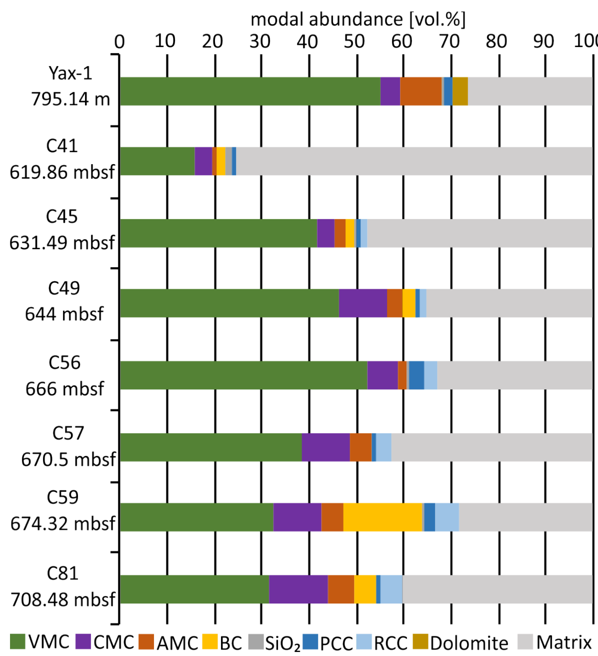

Fig. 1. Chicxulub sorted suevite modal composition.

Discussion: Chicxulub sorted suevites are dominated by VMC, which were rapidly quenched, plausibly due to rapid fragmentation and dispersion in a cool medium. The presence of CMC and AMC indicates reworking of more slowly quenched impact melt that crystallized under variable water pressures [14]. The occurrence of PCC that must have been transported into their present location from original locations that were not subjected to the thermal processing during compression and crater excavation contrast with RCC that record impact-related thermal processing of carbonate and sulfate target rocks; RCC decomposed and subsequently back-reacted to microcrystalline calcite. The reaction of RCC with the cement-like suevite matrix indicates immediate rapid deposition until ~644 mbsf. Sorted suevite above may have undergone extended reworking because the carbonation reaction of CaO clasts did not affect their matrix. RCC were not observed in the Yax-1 sample and the uppermost M0077 sample at 619.86 mbsf.

The Yax-1 sorted suevite sample, taken 0.5 m below the boundary to a transitional carbonate unit [3,4,6] is distinct from the M0077 sorted suevite, showing a relative depletion of matrix and coarser components than the sorted suevite samples from the upper ~14 m of the M0077 core (Fig. 2).

Conclusions: The distribution of RCC in drill core M0077 yields additional evidence for the immediate reworking of impact ejecta deposits in the Chicxulub crater by repeated tsunami or seiche waves [9,15]. Deposition and reworking dynamics of suevite were different between the peak ring and the annular moat of the Chicxulub crater. Reworking due to ocean resurge affected the offshore peak-ring suevite more severely than the onshore annular moat.

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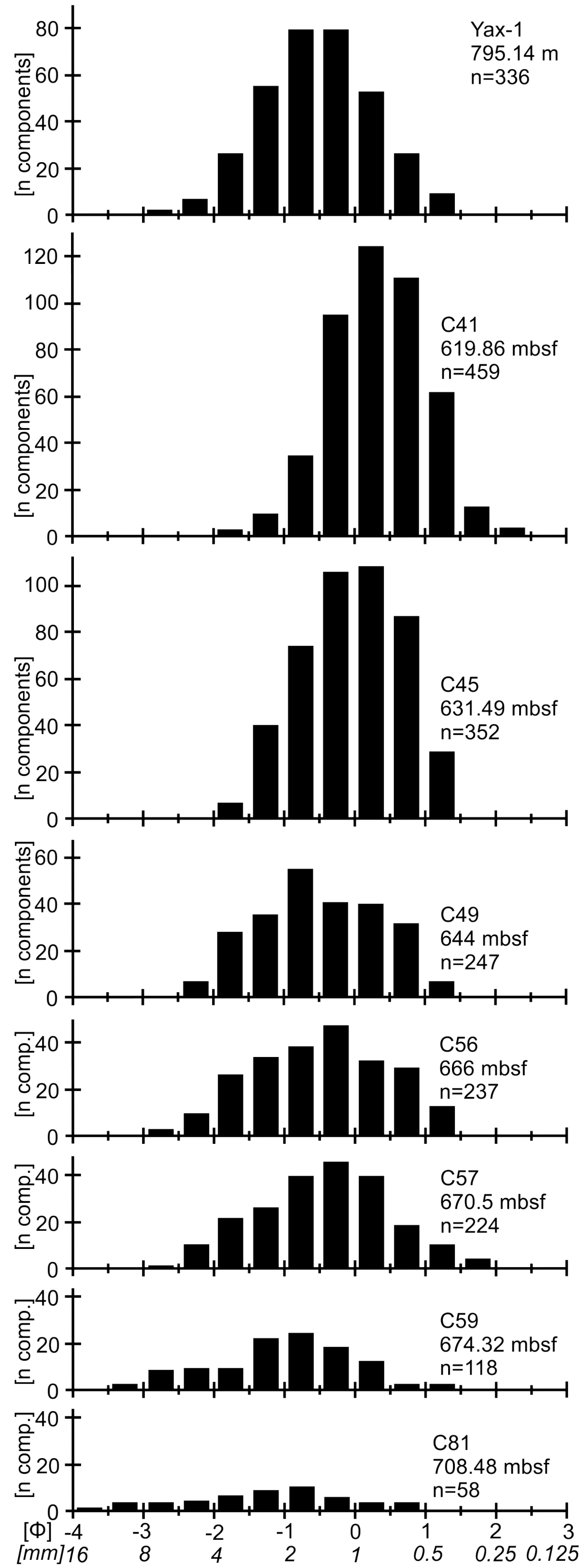

Fig. 2. Component size distributions of Chicxulub sorted suevite; Φ is -log₂ of component size.