PARTICLE ABRASION WITHIN THE CHICXULUB EJECTA BLANKET: IMPLICATIONS FOR THE EMPLACEMENT PROCESS. F. Schönian[1], D. Stöffler[1] and T. Kenkmann[1], [1]Museum of Natural History, Humboldt-University of Berlin, Invalidenstr. 43, 10115 Berlin, frank.schoenian@museum.hu-berlin.de

Introduction: The ejecta blanket of the Chicxulub impact crater was identified and mapped over a large area on the Southern Yucatán Peninsula [1, 2, 3]. Because of its good and widespread preservation and its large runout, its has been regarded as a ground truth for the processes of ejecta emplacement and the formation of fluidized ejecta blankets (FEB) on Earth and other planets [3, 4]. The ejecta blanket has been described as a *diamictite* due to the apparent abrasion of dolomite and limestone clasts. Abrasion features, such as polish and striations, were reported from several localities [5, 6]. They have been interpreted as being the result of either ablation and particle interactions within the ejecta curtain [5, 6] or internal shearing in a cohesive and erosive secondary ejecta flow [3, 7]. Despite their importance for the depositional processes of ejecta emplacement, no detailed study on the regional distribution of these features has yet been done.

Samples and methods: We collected a total number of 1575 clasts from 14 localities of the ejecta blanket as mapped in Southern Quintana Roo, Mexico [3]. These localities cover a range of distances of 296-349 km with respect to the impact center (3.2-3.9 crater radii at a given crater diameter of 180 km). All clasts have been carefully cleaned and analyzed for superficial abrasion features. In order to statistically assess the degree of abrasion, their roundness and sphericity have been determined using the detailed roundness scale and the intercept sphericity of [8].

Observations: *Polish and striations.* At localities <3.3 crater radii (cr) from the impact center polished and striated clasts are very rare (<2% and <1%). Their amount slightly rises to about 5% and 2.5% at 3.6 cr. However, at distances of 3.64 to 3.7 cr a significant rise from 15% and 9% (Sarabia) to 22% and 12% (Ucum) and to 29% and 25% (Palmar) of polished and striated clasts respectively can be observed. Beyond 3.7 cr and up to 3.9 cr the amount diminishes again and is highly variable from one to another locality (10-26% of polished and 3-15% of striated clasts).

Roundness. The clasts of the Chicxulub ejecta blanket are usually angular tu subangular. Figure 1a shows a shift from proximal localities with mainly angular clasts to distal ones with subangular or subrounded clasts. Between 3.2 and 3.6 cr very angular clasts (r=0-0.5) are present and the average roundness r rises from 1.9 (angular) to 2.2 (angular,) and to 2.5 (subangular; Fig.1a). Beyond 3.6 cr very angular clasts disappear and the amount of subangular clasts rises significantly. The average roundness spans values from 2.6 to 2.7. At 3.69 cr a slight drop in average roundness can be observed (2.65). Up to distances of 3.8 cr the values remain relatively constant (Fig. 1b). The most distal of the localities again show a slightly higher roundness (around 2.8). These higher roundness values are due to the rising amount of subangular and subrounded clasts. However, the amount of angular clasts is nearly constant from 3.7 to 3.9 cr (Fig. 1b).

Sphericity. Most of the clasts are platy or blocky fragments with more or less rounded corners, which biases sphericity towards higher values. Only a slight trend for the sphericity could be observed: At <3.3 cr it is highly variable spanning values from 0.48 to 0.94. Between 3.6 and 3.7 cr sphericity rises to values between 0.56 and 0.97, remains rather high from 3.7 to 3.8 cr with values of 0.59 to 0.94, and displays again a slightly higher variability beyond 3.8 cr (0.5 to 0.96).

Discussion and conclusions: In the area studied, the observed proximal-distal relationship of clast abrasion does not support an origin by particle interaction within the ejecta curtain. The higher abundance of clasts with abrasion features towards distal localities and the rising roundness with distance can best be explained by increasing internal friction as was inferred from observed shearplanes in the ejecta blanket material [7]. The occurrence of striated and polished clasts along such shearzones [3, 7] further strengthens this view. The slight drop in average roundness at 3.7 cr coincides with a pronounced Upper Cretaceous paleorelief beyond this distance [3]. This and the constant amount of angular fragments beyond 3.7 cr is probably related to the erosion of material from the karstified subsurface. In summary, the observations on particle abrasion within the Chicxulub ejecta blanket are consistent with a cohesive and erosive secondary ejecta flow following ballistic emplacement, that involves an increasing viscosity and strain localization [3].

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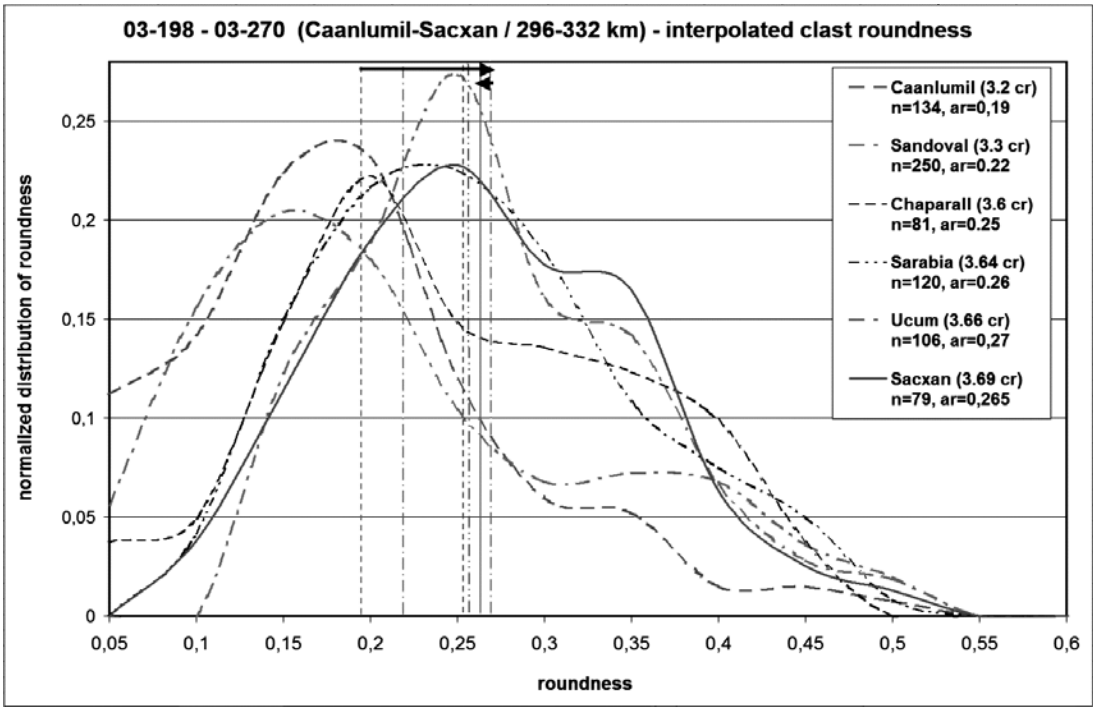

Fig. 1a: Normalized distribution of roundness for clasts of the Chicxulub ejecta blanket between 3.2 and 3.69 crater radii (cr). Note the presence of highly angular clasts (r=0-0.5) in proximal localities and the rising abundance of subangular clasts (r=0.25-0.4) with increasing distance. The average roundness (ar) for is shown with vertical lines.

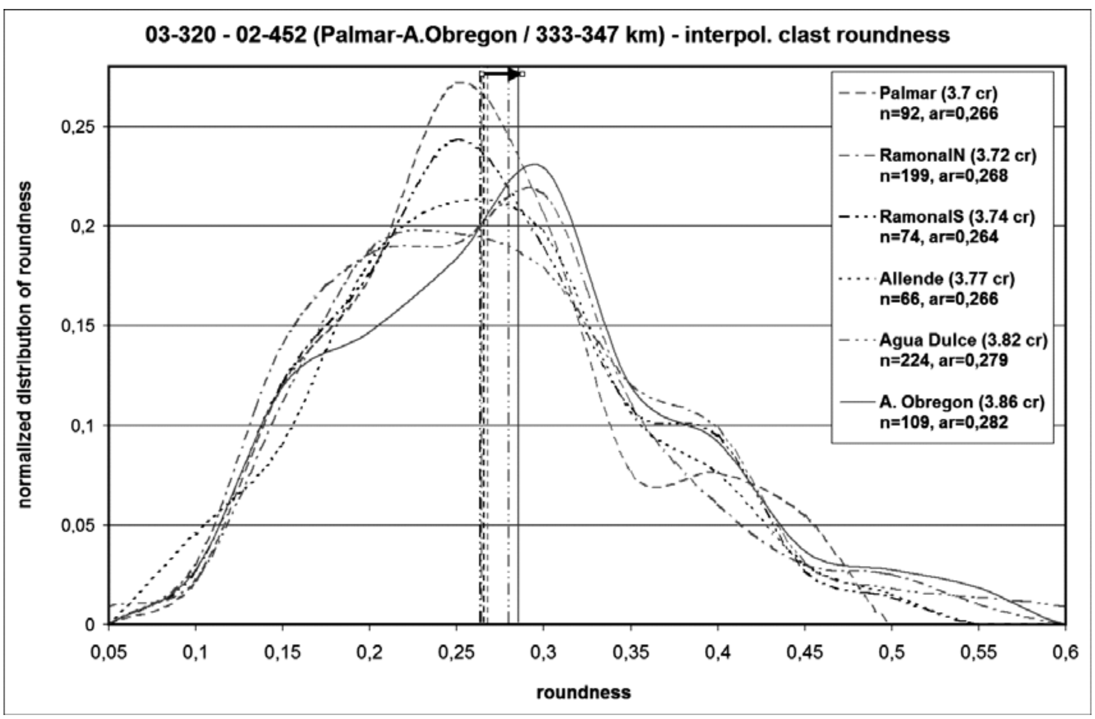

Fig.1b: Normalized distribution of roundness for clasts of ejecta localities between 3.7 and 3.9 crater radii (cr). Note the presence of angular (0.1-0.2) clasts in all localities and the rising abundance of subangular (r=0.25-0.4) and subrounded (r=0.45-0.6) clasts with increasing distance. Average roundness (ar) is shown with vertical lines.