ADDITIONAL OBSERVATIONS ON THE IMPACT BRECCIAS OF THE CHICXULUB EJECTA BLANKET FROM THE UNAM-7 DRILL CORE, YUCATÁN, MEXICO. F. Schönian[1], T. Salge[1], D. Stöffler[1] and J. Urrutia Fucugauchi[3], [1]Museum of Natural History, Humboldt-University of Berlin, Invalidenstr. 43, D-10115 Berlin, Germany, [3]Instituto de Geofísica, UNAM, Mexico, e-mail: frank.schoenian@museum.berlin.de.

Introduction: In 1994/95 a shallow drilling program was carried out by the Universidad Nacional Autonoma de Mexico (UNAM) within and around the Chicxulub crater. 7 drill cores where recovered (2800 m in total), only three of which encountered impact breccias (UNAM-5 at Santa Elena, 110 km S from center, UNAM-7 near Tekax, 125 km SE from center, UNAM-6 near Peto, 150 km SSE from the center, [1,2,3]). These breccias provide an excellent opportunity to compare the proximal Chicxulub ejecta with that of the well studied Ries crater in Germany.

In the Ries crater (24 km) two types of proximal ejecta facies are present. The continuous ejecta blanket consists of a lithic impact breccia without melt particles and rare clasts of deeper target lithologies [4]. This 'Bunte Breccia' is thought to have been deposited from the ejecta curtain by 'Ballistic Sedimentation' [4,5]. Close to the crater rim it is overlain with a sharp contact by a lithic breccia with melt particles ('Flaedle') and abundant basement clasts, the Suevite. The Suevite is believed to have been deposited by a collapse of the ejecta plume [5,6].

The breccias of the proximal Chicxulub ejecta blanket from the UNAM wells have been described as Suevite (UNAM-5 and upper breccia in UNAM-7) or as Bunte-Breccia-like deposit (UNAM-6 and lower breccia in UNAM-7, [2,3]). These two facies of the proximal ejecta blanket have been distinguished based on (a) abundance of basement versus evaporitic clasts and (b) variations in magnetic susceptibility [2,3]. The UNAM-6 and UNAM-7 drill cores still lack a detailed description. The UNAM-7 core is particularly interesting since it is thought to represent a Bunte Breccia / Suevite sequence similar to that of the Ries Crater. Recent observations on the UNAM-7 core and sample material require a revisions of the original descriptions.

Matrix properties: Three principal matrix types of the impact breccias can be distinguished within the UNAM-7 core: (a) a usually poorly consolidated, greenish-grey, lithic matrix, (b) a poorly to well consolidated, greenish-yellowish-ocre vitreous or pelitic matrix, and (c) a well consolidated, greyish brown to dark brown carbonate-rich matrix. However, none of these types is exclusive, there are transitions between all of them (Fig. 2). In the upper part of the succession sometimes gradual sometimes abrupt changes from one to another type can be observed. Sometimes there is a complex interfingering of units or pockets of different matrix types, displaying a inhomogeneous textures or breccia-in-breccia-type structures. In the lower part of the succession the matrix becomes more carbonaceous, homogeneous, and very well consolidated. Nevertheless, intercalations of lithic or vitreous, less consolidated breccias can still be observed.

Basement clasts and melt fragments: Basement clasts do preferentially occur in the upper breccia, mainly within lithic or vitreous matrix types. However, they are also present within the carbonate-rich matrix and down to the lower parts of the breccia succession. Basement clasts are subangular to subrounded and do often display 'reaction rims' or coatings of yellowish-green to greenish altered melt.

Melt fragments occur within all matrix types but are more abundant within the lithic and vitreous ones. In the upper and middle parts they are sometimes not clearly distinguishable from the matrix. They show different shapes and do not rarely contain lithic cores or clasts. There appear to be three distinct types of melt particles (alteration products?): a light-yellow / ocre to greenish, a green to greenish grey, and a dark green to brownish one. The most important observation is, that they occur in the entire succession down to its base (Fig. 1). However, the frequency and size of melt fragments decreases downwards. Matrix samples from the proposed 'Bunte Breccia' display melt fragments with lithic cores of anhydrite and carbonates.

Sedimentary clasts: There is an inverse relationship in abundance of sedimentary versus basement clasts. However, although more frequent in the lower succession, sedimentary clasts are abundant in the upper breccia as well. This applies for carbonate (dolomite and limestone) clast as well as for evaporitic (anhydrite and gypsum) clasts. Sedimentary clasts are usually less rounded. Carbonates are angular to subrounded and sometimes display a rim of altered impact glasses. Anhydrite clasts are generally angular to highly angular (Fig. 2) and do not show such rims. The size and frequency of anhydrite clasts increases within the lower breccia towards the bottom. 'Intercalations' or beds of anhydrite and marls have been reported from the lower part of the drill core [2,3]. These sediments show irregular or inclined contacts with the impact breccias and are internbally strongly disturbed, in part brecciated. This favors an allochthonous interpretation as large clasts or boulders as supposed earlier [1].

The contact 'Bunte Breccia'/'Suevite': The contact between the lower and the upper breccia unit is considered to be situated at 348.4 m [3] or 350.5 m [2] because of a significant drop in magnetic susceptibility within this interval. Lithologically, no sharp contact between the two distinct units can be observed. The transition between the highly variable upper and the more lower breccia is transitional and covers almost 5 core boxes (122-126, appr. 344 m – 358 m, Fig. 2).

The basal contact: In lithological columns the basal contact of the impact breccias was indicated at a depth of around 575 m [1,2,3]. However, massive brownish, carbonaceous, polymict impact breccias with abundant anhydrite clasts can be observed down to 680 m (Fig 1). The basal contact occurs >100 m deeper than proposed at around 681 m. This implies a total ejecta thickness of at least 459 m. The total depth of UNAM-7 is 702.4 m. The 21 m thick anhydrite/marl sequence in the lower part appears to be evenly horizontally bedded. It contains some minor dissolution breccias. However, anhydrite clasts within the overlying breccia unit show an apparent horizontal bedding as well. At present it is not clear if the UNAM-7 well bottomed out in upper Cretaceous bedrock or if this lower part represents another sedimentary megaclast.

Discussion: The two distinct breccia units of UNAM-7 could be confirmed within this report. However, they are lithologically very different from the Ries ejecta and cannot be described as a sequence of 'Bunte Breccia' and 'Suevite'. Following the strict definition of impact lithologies [7] the complete succession should be defined as 'Suevite' (lithic impact breccia with melt particles). Nevertheless, a distinct, melt-rich upper unit can be defined, but with a more or less gradational contact to the underlying breccia unit. The high melt production in comparison to smaller craters like the Ries is consistent with scaling laws that predict an unproportionally increase of melt with increasing crater diameter [9]. Additionally, impact angle and atmospheric turbulences might have a significant effect on melt distribution within the ejecta blanket. A detailed description and analysis of the impact breccias of the UNAM wells and, if accessible, the PEMEX drill cores (T1, Y1, Y2, Y5a, and Y4) outside the Chicxulub crater would provide the opportunity to better understand the processes that acted during crater excavation and early stage ejecta emplacement.

References: [1] Urrutia Fucugauchi et al. (1996) *Geofísica Internacional, 35(2),* 125-133. [2] Urrutia Fucugauchi et al. (1996) *Geophys. Res. Let., 23(13),* 1565-1568. [3] Rebolledo Vieyra M. et al. (2000) *Int. Geol. Rev., 42(10)*, 948–978. [4] Hörz F. et al. (1983) *Rev. Geophys. Space Phys., 21*, 1667-1725. [5] Oberbeck V. R. (1975) *Geophys. Space Phys., 13*, 337-362. [6] Von Engelhardt W. (1990), *Tectonophysics, 171*, 259-273. [7] Stöffler D. and Grieve R. A. F. (1994), *LPSC, XXV,* 1347-1348. [8] Melosh H. J. (1989), *Oxford Monogr. Geol. Geophys., 11*, 245 p.

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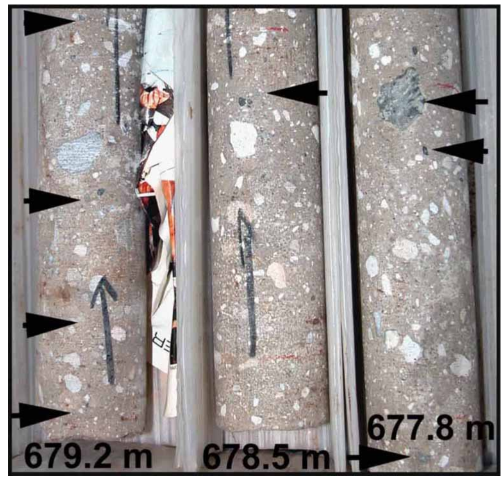

Fig. 1: Polymict impact breccia with carbonate-rich, brown matrix in the lower part of the breccia succession (box 219). Note the abundant greenish-grey melt fragments (only some of them are marked).

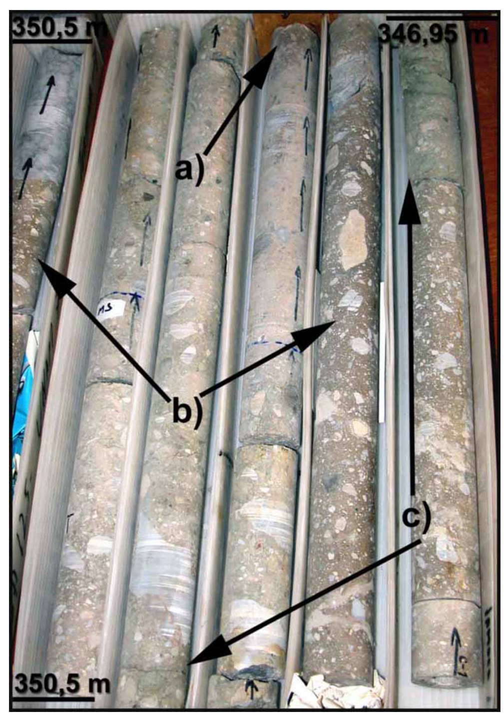

Fig. 2: Box 124 (346.95 m – 350.5 m). a) proposed contact of Bunte Breccia / Suevite (348.4 m). Note repetition of lithologies b) and c)