Additional Observations on the Impact Breccias of the Chicxulub Ejecta Blanket from the UNAM-7 Drill Core, Yucatán, Mexico

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INTRODUCTION

The Chicxulub Crater (~180 km, Fig. 2) is one of the rare cases where the continuous ejecta blanket of large impact structures on Earth can be studied. It is buried by 200 to >300 m of Tertiary sediments and is only accessible by drilling. 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) of which 3 encountered impact breccias (Fig. 2, UNAM-5, 110 km S from center, UNAM-7, 125 km SE from center, UNAM-6, 150 km SSE from the center, [1,2,3]). These breccias have been compared with the proximal ‘Bunte Breccia’ - ‘Suevite’ succession of the well studied Ries Crater in Germany [5,6].

THE BRECCIAS OF THE UNAM WELLS

The breccias from the UNAM wells have been described as ‘Suevite’ (UNAM-5 and upper breccia in UNAM-7) or 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]. (Fig. 1)

Only the UNAM-7 core is thought to represent a complete Bunte Breccia / Suevite sequence similar to that of the Ries Crater (Fig. 1).

1. MATRIX PROPERTIES

Three matrix types of the impact breccia can be distinguished within the UNAM-7 core: (a) a poorly consolidated, greenish-grey, lithic matrix, (b) a poorly to well consolidated, greenish-yellowish-orevaceous to pelitic matrix, and (c) a well consolidated, greyish brown to dark brown carbonate-rich matrix. None of these types is exclusive, there are transitions between all of them (Fig. 3a, 3b and 3d). In the upper part of the succession gradual to abrupt changes from one to another type can be observed (Fig. 3a). Sometimes there is a complex interfingering of units or pockets of different matrix types, displaying a inhomogeneous textures or breccia-in-breccia-type structures (Fig. 4b and 4c). In the lower succession the matrix becomes more carbonaceous, homogeneous, and well consolidated. Nevertheless, intercalations of lithic or vitreous, less carbonaceous matrix occur (Fig. 3a).

2. THE ‘BUNTE BRECCIA’ - ‘SUEVITE’ CONTACT AND THE BASE

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 (Fig. 1). Lithologically, no sharp contact between the two different units can be observed (Fig. 3a).

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. 3a). The basal contact occurs 100 m deeper than proposed ([1,2,3] at around 681 m (Fig. 3b). This implies a total ejection thickness of at least 459 m. The total depth of UNAM-7 is 702.4 m. The 21 m of anhydrite and marls at the base appears to be evenly horizontally bedded. Anhydrite clasts within the overlying breccia unit show as well an apparent horizontal bedding (cf. Fig. 1a).

CONCLUSIONS

The two breccia units of UNAM-7 are lithologically different from the Ries ejecta and can not be described as a sequence of ‘Bunte Breccia’ and ‘Suevite’. The complete succession should be defined as ‘Suevite’ (lithic impact breccia with melt particles, cf. [7]). A distinct, melt-rich, highly polymeric unit can be defined with a gradational instead of a sharp contact to the underlying breccia unit. The high melt production indicated by melt fragments throughout the succession is consistent with scaling laws that predict an unproportionally increase of melt with increasing crater diameter [9]. Impact angle and atmospheric turbulences might have had 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, Fig. 2) outside the Chicxulub crater would provide the opportunity to better understand the processes that acted during crater excavation and early stage ejection.