INTRODUCTION

The impact breccias outside the Chicxulub crater (Yucatan, Mexico, Ø 180 km, 65 Ma), recovered by a scientific drilling program of the Universidad Nacional Autonoma de Mexico (UNAM) (1, 2, 3), are the only known examples of the proximal ejecta blanket of a large impact basin on Earth. The breccias have been subdivided into a lower ‘Bunte Breccia’-like unit (UNAM 6 and 7; here ‘megabreccia’) and an upper suevite (UNAM 7 and 5; [1, 2, 3]; Fig. 2, 3). We report a detailed petrographic description of the suevites in UNAM 5 and 7 with special emphasis on: (a) matrix properties and internal structures, (b) grain size distribution, (c) sedimentary characteristics as bedding, lamination or grading, and (d) distribution of sedimentary clasts, impact melt, and crystalline basement clasts at variable degrees of shock metamorphism. Based on the amount of sedimentary and crystalline clasts, the type and distribution of melt particles, and matrix composition, 6 units in UNAM 5 and 4 units within the suevites of UNAM 7 could be distinguished (Fig. 2, 3, 4). These are combined into a redeposited suevite (middle), and a lower suevite which can be correlated with each other and, in part, with the units identified in the Yaxcopoil-1 core (Fig. 1; [4]).

THE REDEPOSITED SUDEVITES

The upper units in both cores comprise suevites that display features of secondary processes, such as sorting, grading, stratification, or laminating. Unit 1b of UNAM 5 is a fairly well sorted, graded conglomerate that rests with a sharp, erosional (7) contact upon the upper suevite and is overlain by a poorly sorted, crudely stratified pebbly sandstone (unit 1b, Fig. 2 and 5c) which is in turn topped by a well stratified succession of muddy breccias, poorly sorted sandstones, and well sorted, cross-stratified sandstones (Fig. 5c). In contrast, the unit 1b in UNAM 7 gradually shows an increasing abundance of crude stratification and irregular laminations and tends to contain more marls and clays (Fig. 3). The uppermost unit 1a is an irregularly stratified succession of alternating marl-rich portions and breccias that resemble the upper suevite (Fig. 3 and 5b). No significant sorting is recognizable. The redeposited suevites can be correlated with unit 1 and maybe 2 of Yax-1 (4).

THE UPPER SUEVITES

The units 2 of UNAM 5 and 1b of UNAM 7 are represented by massive bodies of unsorted, poorly consolidated, and highly mixed suevites with a marly-sandy (US) or marly-dolomitic (UT) matrix (Fig. 2, 3, 4a). Faint, irregular laminations are observable. In both cases the content of sedimentary clasts increases to the top (incl. an anhydrite megabreccia of 110 cm in UT7; Fig. 2) and crystalline lithologies diminish. Melt particles of different types (e.g. greyish green, yellowish grey) do occur as rather large clasts or coatings that in part display aerodynamic shaping. These units represent fall-back suevites and are correlated with units 2 and 3 of Yax-1.

THE MEGABRECCIA / SUDEVITE TRANSITION

In UNAM 7 the suevites rest upon a 330 m thick sedimentary megabreccia with a dolomitic matrix (1, 2, 3, 6). This breccia does not contain any crystalline clasts, whereas greyish-grey to greenish-black melt fragments do occur down to the base [6]. It is composed of 61% of anhydrite megabreccias of up to 34 m, that display styliolitic dissolution features, injections of lime-mud, and karst dissolution breccias (70% in unit 6a; Fig. 3). The contact with the suevites is transitional (Fig. 3, 4). In unit 5 the first larger melt clasts >3 cm occur well below the base of unit 4 (Fig. 6a, 6d). The upper part of this unit is an alternating succession of melt-rich, irregular suevitic lenses and the dolomitic, sedimentary breccia (Fig. 6c). Large melt clasts are well present in the lowermost suevites (Fig. 6b), but dolomitic matrix clasts dominate up to m 327 and karstified anhydrite clasts up to m 318 (Fig. 3). The actual contact should be placed in the middle or at the base of row 3 of Box 124 (Fig. 6c). The intact, aerodynamically shaped, and laminated melt clasts indicate, that the mixing process was turbulent and not friction-controlled (Fig. 6e).

CONCLUSIONS

The description of the UNAM 5 and 7 drill cores does provide an insight to the timing of events that followed the emplacement of the megabreccia by secondary cratering upon a karstified target of the evaporitic platform. While the glasses within the megabreccia might be ballistically emplaced, the large melt particles in unit UT-6 are probably derived from the ejecta plume. Mixing of the lowest suevites with the upper breccia and deposition of unit UT-4 might eventually be related to atmospheric ring-vortices that mixed plume material with the upper megabreccia by scouring [7]. This is followed by a crater-derived ground-surge of suevite, rich in sedimentary clasts and melt [4]. While the middle suevites may be related to a lateral ejecta flow [5], the upper suevites represent late stage air-fall-deposits, which were redeposited by a laminated mud-flow (U7) or in a turbulent, high-energy environment (U5).

REFERENCES