

CHARACTERISTICS OF THE MULTI-RING IMPACT BASIN OF CHICXULUB, MEXICO, AS DERIVED FROM DRILL CORE DATA AND NUMERICAL MODELING.

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Introduction: The ~200 km Chicxulub multi-ring impact basin has been drilled commercially (PEMEX drillings C1, S1, Y1, Y2, Y4, Y5A, Y6, T1) and scientifically (UNAM 1–7 and recently ICDP drilling Yaxcopoil-1). The drill cores, in part incompletely preserved, cover a radial range of 23 to 205 km from the center of impact (Table 1) and are structurally located in the central basin, in the annular trough, at the final crater rim, and in the ejecta blanket.

TABLE 1: Drill core data at the Chicxulub impact basin [1]

No.	Radial dist. (km)	Total depth (m)	Main lithologies from top to bottom, figures (approx.) are in m
C1	23	1581	1075 P.c., 175 suev., 330 melt r.
S1	29	1530	1060 P.c., 360 suev., 110 melt r.
Y6	47	1631	1100 P.c., 130 suev., 360 m.r., 40 d. br.
Yax-1	60	1510	795 P.c., 100 suev., 615 C.c.
T1	95	3575	545 P.c., 930 C.d.a.br., 2100 C.d.a.
U5	110	503	173 P.c., 30 melt r., 300 suev.
U7	125	700	250 P.c., 150 suev., 300 C.c.a.br.
Y2	135	3474	260 P.c., 660 C.d.a.br., 2555 C.d.l.a.
Y5A	140	3003	450 P.c., 490 C.d.a.br., 2065 C.d.l.a.
U6	150	702	260 P.c., 25 gypsum br., 417 C.c.a.br.
Y1	156	3221	335 P.c., 610 C.d.a.br., 2275 C.d.l.a.
Y4	205	2398	380 P.c., 310 C.d.a.br., 1710 C.d.l.a.

P.c.=Post-impact carbonates, suev.=suevite, melt r.=melt rock,

C=Cretaceous, d.=dolomite, l=limestone, a=anhydrite, br.=breccia

Type, stratigraphy, and geologic setting of impact formations: From the data a consistent pattern emerges as a function of depth and radial distance from the impact center: Coherent impact melt of unknown thickness (C1, S1) topped with suevite inside the peak ring located at ~40 km from the center; moderately thick impact melt overlain by suevite outside the peak ring (Y6), thin suevite layer with very minor layered impact melt on top of megabreccia in the outer zone of the annular trough (Yax-1); suevite plus minor impact melt of variable thickness (0-330 m) on top of polymict breccia in the continuous ejecta blanket (1-2 crater radii: T1, U5, 7, 6) which ranges in thickness from ~900 to 300 m at 1-2 crater radii.

Origin and mode of emplacement of the impact formations: Numerical modeling suggests that after 100 – 130 sec the falling ejecta curtain passes through the position of the Yax-1 drilling. Simultaneously, i. e. some 70 – 100 sec after the central uplift started to form, the target surface beyond the central region subsides as part of a growing circular depression. All ground surged material (suevite, coherent melt, megablocks etc.) was emplaced during this time and the deposition of the main mass of ballistic ejecta (polymict dolomite-limestone-anhydrite (mega)breccias) took place on a slowly subsiding surface. Some 6 min after impact the 20 km high central uplift collapses probably causing high speed mass transport radially outward shortly before the peak ring forms. The collapse of the ejecta plume and the deposition of the suevite layers inside and outside the final crater is a later process which may continue for hours. The petrographic, geologic and geophysical data are compatible with this model.

References: [1] Urrutia Fucugauchi, J. et al. (2001) The Chicxulub scientific drilling project. ICDP proposal, 34 pp. and references therein, [2] Hecht et al. (2003), this volume.