MARINE RESURGE SEQUENCES IN DRILL CORES FROM FLYNN CREEK IMPACT STRUCTURE, TENNESSEE, USA.

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Introduction: Roddy [1-4] first presented evidence that the Flynn Creek impact structure is a Late Devonian, 3.8-km diameter, complex impact crater, which formed in an epicontinental shelf sea. To our knowledge, it is the first crater to be attributed a marine target setting. The Flynn Creek impact structure is located in north-central Tennessee (36° 17' N; 85° 40' W) and is well exposed at the surface. The crater rim has an asymmetric ("pear-shaped") outline and displays a central uplift, breccia-filled crater moat, and terraced crater rim [4-6]. The target stratigraphic section was nearly flat-lying, mostly poorly consolidated, Upper Ordovician carbonates ranging from Knox Group through Catheys-Leipers Formation [4-6]. Almost all rim exposures consist of Catheys-Leipers Formation, whereas the central uplift exposures consist primarily of Knox and Stones River Groups [4-6]. Central uplift flanking breccias are mainly coarseing upward slump deposits [7], whereas the moat show normally graded breccias subject to this study. Upper Devonian Chattanooga Shale deposition had likely begun at the time of impact, but with a main deposition occurring within the crater and across the area when the crater formed a topographic feature on what was otherwise a shallow marine shelf [4-6, 8].

Methods and results: A first analysis of core-box photographs from two drill cores, one in the northeastern moat area (FC77-3) and one in the southwestern moat area (FC67-3), show a graded sequence that is much thicker in drill core FC-67-3 than in FC77-3 This has now been complemented with a granulometric line-logging of the two cores following the method applied to similar deposits in Lockne, Tvären and Cheseapeake Bay impact craters (Ormö et al. 2007, 2009). Preliminary results from our analysis of core-box photographs and line-logging shows that there is a general fining upward sequence in both crater-moat drill cores examined and that there two main types of breccia in both cores, namely a coarser, poorly sorted, basal chaotic breccia and a finer, better sorted, bedded breccia above. However, the thickness of comparable units varies between the drill cores. Overall, the entire crater moat-filling sequence is fining upward, but there are departures from this overall trend in both drill cores studied.

Conclusions: In analogy with similar sequences at other marine-target craters, mainly Lockne [11, 12], the lower chaotic breccia is interpreted to be a slump deposit possibly partially moved by traction from the overriding suspension-load resurge flow that we suggest led to the deposition of the upper, bedded breccia. Asymmetry of the crater shape, varied proximity to resurge gullies, and possible obliquity of impact may have played a role in the differences observed between the two drill cores studied, which are located on opposite sides of the central uplift area. Further statistical analysis of the line-logging data will help us better understand the modification processes at Flynn Creek.

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