EARLY MODIFICATION STAGE DYNAMICS OF SHALLOW CRATER-FILLING UNITS, WETUMPKA IMPACT STRUCTURE, ALABAMA. E. Heider[1], D.T. King, Jr.[1], and J. Ormö[2], [1]Geology Office, Auburn University, Auburn, Alabama 36849-5305; eheider@auburn.edu; [2]Centro de Astrobiología, Torrejon de Ardoz, 28850, Spain.

Introduction: Wetumpka impact structure is a ~ 5 km diameter, Late Cretaceous, marine-target impact crater [1, 2, 3]. Recent special permission for access to land along utility lines and local roads and a review of recent core drilling led to construction of a shallow geological half-transect across the western part of the crater (Figs. 1 and 2). From northwest to southeast, the half-transect encompasses deformed crystalline rim terrain, steeply inclined sedimentary target formations, folded and faulted sedimentary target layers (parts of a transported, overturned sedimentary flap), a central impact breccia, and resurge chalk deposits. The formative events that generated the uppermost units in the geological half-transect are all related to late stage modification of the Wetumpka impact structure (very large mass movements and aqueous resurge) and likely represent the last few minutes in Wetumpka's sequence of events.

Geological half-transect methods: A LiDAR dataset with ~ 2 m resolution was acquired from the Elmore County Revenue Commissioner's office in Wetumpka, Alabama, and used to produce a digital elevation model (DEM) of the impact structure. Then, a published geologic map made by Tony Neathery and others [4] was digitized and placed over the LiDAR-based DEM (Fig. 1). Using spatial analyst tools in ArcGIS, a topographic profile was made for the half transect. Finally, field observations along the half transect and related shallow core-drilling results [including 3, 5, 6] were synthesized to generate the shallow geological cross section (i.e., the geological half transect) in Figure 2.

Interpretation: From the core-drilling results, we know that there is an impactite sand unit overlying the sedimentary megablock unit (and there is a crystalline block unit below those layers; see Fig. 2). From field studies, we have observed that above the impactite sand unit, there is a highly deformed sequence of layers that is comprised of sediments of the Tuscaloosa Group (Kt) overlain by Eutaw Formation (Ke), and above that, more Tuscaloosa Group (Kt). This sequence of Tuscaloosa-Eutaw-Tuscaloosa or "Kt-Ke-Kt" is best explained as a classic "overturned flap" stratigraphy, which could have developed only at the southern and southwestern quadrant of the early Wetumpka crater rim [3]. This area is presently the site of a structurally disturbed region lying just outside the present crater [2, 3]. We think that the overturned flap developed in that area and rapidly moved into the crater interior as a result of a very large mass movement event similar to the development of the "impact-modified sediments" comprising the "inverted sombrero" at the Chesapeake Bay Impact structure [7]. The present structurally disturbed area is therefore the material that was directly underlying the mobilized overturned flap. As the Kt-Ke-Kt layer mobilized and spread across the structure's interior region, it was deformed and subsequently covered the crater fill, including the impactite sands penetrated by shallow core drilling [3, 5, 9]. This hypothesis accounts for the phenomenon previously called "broken formations" that has been reported within the structure's interior for several years [1-3]. Proximal ejecta, including large, shocked crystalline megablocks that landed upon the overturned flap, were transported into the impact structure's interior as well, thus forming the "central breccia unit" [3]. Resurge chalk deposition [3, 10] immediately followed the very large mass-movement event.

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Figure 1. – Next page – LiDAR-based DEM with digitized geologic map from [4]. Geologic half-transect line is marked (red). Also, locations of key shallow core holes are marked.

Figure 2. – Next page – Geological cross section from northwest to southeast along the geological half transect, the red line, in Figure 1. Drill core 09-03 is from [5]; drill cores 09-01 and 02 from [3]; and drill core 98-01 from [6]. Steeply dipping sedimentary formations near the crater wall are modified from [5]. Crystalline rim terrain described by [8].

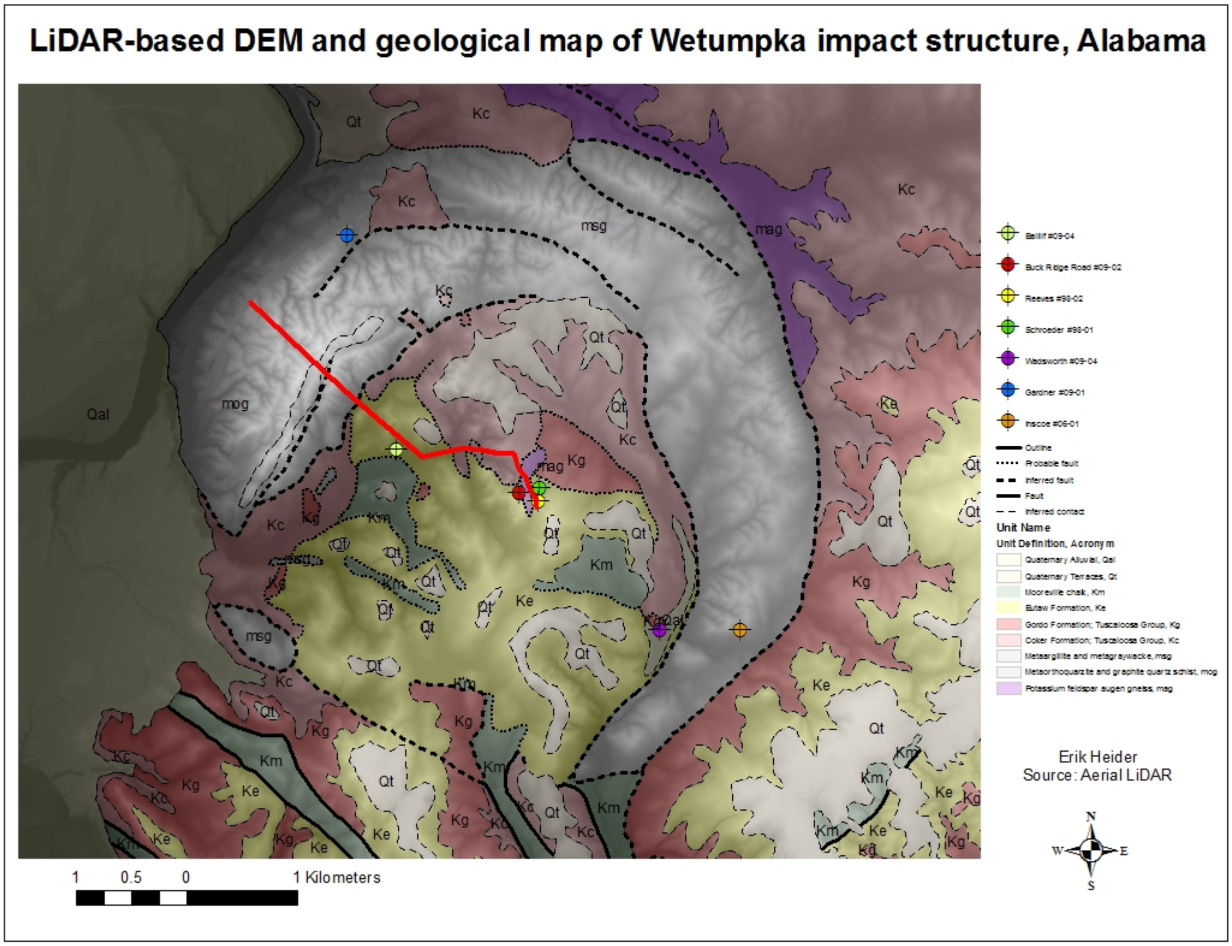

Figure 1.

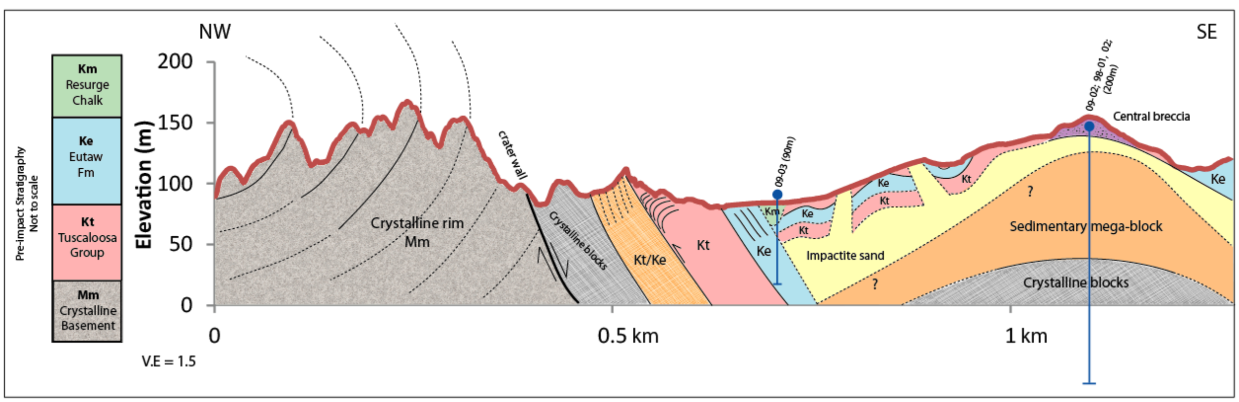

Figure 2.