SEDIMENT-LADEN FLOW OF MOOREVILLE CHALK WITHIN THE INTERIOR OF WETUMPKA MARINE TARGET IMPACT STRUCTURE, ALABAMA: EVIDENCE FOR A SHALLOW WATER RESURGE. J. Ormö [1], D. T. King, Jr.[2], R. S. Harris[3], L. W. Petruny[1], and J. K. Markin[1] [1]INTA Centro de Astrobiología (CSIC-INTA), Madrid, Spain [ormo@inta.es], [2]Geology Office, Auburn University, Auburn, AL 36849 [kingdat@auburn.edu], [3]Geosciences, Georgia State University, Atlanta, GA 30303 [rsharris@gsu.edu].

Introduction: The approximately 5-km wide Wetumpka impact structure in central Alabama formed in a near-shore marine environment during Late Cretaceous. The crater is characterized by a megablock slump unit that fills most of the crater interior and a structurally disturbed, exterior terrain to the southwest, which is interpreted as source area for much of the megablock slumps (Fig. 1) [1, 2]. Paleogeographic reconstructions and facies analysis of marine target sediments have suggested that the target water depth increased from about 30 m on the shore-facing side to about 100 m on the ocean-facing side. The target stratigraphy has been estimated to have included 30 m of Mooreville Chalk, pre-Mooreville Upper Cretaceous sand units (~90 m), and basement crystalline rock (pre-Mesozoic schists and gneisses) [1, 2]. Both the crater interior and the extra-structure terrain contain significant aerial tracts of Upper Cretaceous chalk (Fig. 1). This unit, specifically the Mooreville Chalk, is a distinctive inner Coastal Plain formation that crops out, except for the Wetumpka area, in an east-west outcrop belt across central Alabama. This outcrop belt is present approximately 25 to 30 km south of the Wetumpka impact structure. Therefore, the Mooreville Chalk within the Wetumpka impact structure is an anomalous occurrence that is not a part of the outcrop belt. Prior to an impact interpretation of the Wetumpka feature, previous workers have all thought that post-Cretaceous erosional effects account for the distance between the east-west outcrop belt and the significant Mooreville Chalk tracts within the Wetumpka impact structure because, in their view, the Mooreville Chalk was deposited within the Wetumpka structure by the same marine processes [3, 4, 5]. King et al. [2, 6] interpreted the occurrences of Mooreville Chalk tracts within the interior as displaced megablocks akin to megablocks of the Eutaw and Tuscaloosa. King et al. [6] interpreted the elongate-shaped Mooreville Chalk tracts of the extra-structure terraine as fault-bounded blocks that are part of a sort of limited 'decollment zone' that is akin to the concentric decollment zone at Chesapeake Bay impact structure, a larger but in many ways comparable marine impact structure in Virginia. Interestingly, sediment infill of this crater was reported to contain impact-damaged dinocysts [7]. At a GSA Field Forum held at Wetumpka, Edwards [8] reported similar possible impact damage to dinocysts recovered from site IT-1 (Fig. 1). This was the first indication that the Mooreville Chalk within the crater, and perhaps in the exterior terrain as well, may be impact related.

Objective, material, and method: Here we report from a core drilling (#09-03) through one of the Mooreville Chalk tracts within the crater that was carried out in order to understand the relation of this deposit to the formation of the crater. It was drilled near the IT-1 sampling site during summer 2009 and recovered approximately 90 m of continuous core. In addition to a first photographic documentation of the core we have also performed a sedimentological line-log following the technique described by Ormö et al. [9] for resurge deposits at marine-target craters. In brief, a line is drawn along the core. The depth, lithology, and visual length of every clasts over a certain cut-off size (in this instance, ≥ 1mm) that touches the line is plotted. Due to the very low clast content in the logged unit, a meaningful statistical treatment similar to that described by Ormö et al. [9] could not be done. Instead only the occurrences can be plotted. In addition, we have also line-logged the matrix content following the method described by Ormö et al. [10], as well as a log of the sediment-filled fractures that intersects much of the logged interval of the core. Throughout the core we have also taken periodic samples to investigate the distribution of shocked mineral grains. All results will be presented at the meeting.

Results and discussion: The upper 6 m of the #09-03 core is comprised of tan chalk similar to the more chalky beds of the Mooreville Chalk. Below the tan chalk is an 18.5 m thick green-grey, glauconitic mud and calcareous, sandy shale. On several levels throughout this unit there are quartz and zircon grains with planar deformation features .

Underlying the green-grey unit is a section of 65.6 m of tan-brown medium to coarse sand. This sand, like many interior outcrops of the megablock slump deposit [2, 6, 11], contains intervals of disaggregated sand that are structureless (block boundaries) and intervals of sand with intact sedimentary structures and burrows (blocks). Based on the abundance of the ichnofossil *Ophiomorpha*, the Eutaw Formation is thought to be the main source for the impactite sands in the lower part of this well.

The green-gray unit is interpreted as an aqueous resurge deposit (sediment-laden flow) of mainly coeval, more marine (high glauconite content) Mooreville Chalk and distal ejecta that was washed back into the impact structure by returning sea water flow. This interpretation is based on its similar stratigraphic position as resurge units at Lockne (500 m water; 6 km transientdiameter), Tvären (100 m water; 2 km transient diameter), and Chesapeake Bay (30-300 m; 28 km transient diameter) craters [12, 13, 14], which also are known to hold significant amounts of shocked material. Further support to the resurge interpretation is given by the circumstance that the mapped Mooreville Chalk tracts within the crater and the extra-crater terrain all appear in lower terrain between topographic highs formed by the megablock slump unit. The patchy aereal occurrence confined to low terrain, the poor sorting, and high matrix content of the green-gray unit indicate a transport with comparably much higher sediment to water ratio than the Lockne and Tvären craters, which both show graded clast supported units deposited mainly out of suspension [12, 13, 14]. More similar are the resurge deposits of the Chesapeake Bay crater, which show in some places a debrisflow character [15]. The resurge of distal marine sediments and ejecta at Wetumpka must have occurred as a mudflow entering the crater on the collapsed seaward side and then following low terrain within the crater. In this respect, a target water depth of 100 m on the seaward side in this only 5 km wide structure seem as an overestimation. Therefore, a more shallow, near-shore position is suggested here than has been suggested in previous work.

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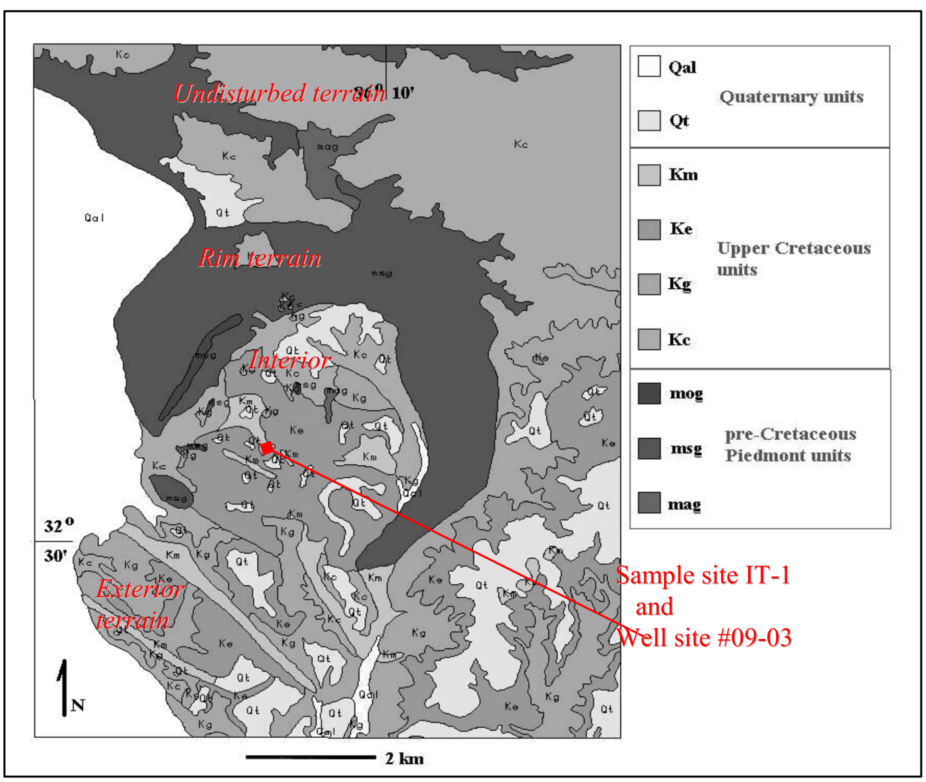

Fig. 1 Geological map of Wetumpka impact structure showing terrains and locations mentioned in the text (from [4, 5].