CORE DRILLING ON THE RIM OF WETUMPKA IMPACT STRUCTURE, ALABAMA USA.

D. T. King, Jr.[1], J. Ormö[2], and L. W. Petruny[3]. [1]Geology Office, Auburn University, Auburn, Alabama 36849-5305 USA [kingdat@auburn.edu], [2]Centro de Astrobiolgía, INTA/CSIS, Madrid, Spain [ormo@inta.es], [3]Astra-Terra Research, Auburn, Alabama 36831-3323 USA [lpetruny@att.net].

Introduction: Wetumpka is a Late Cretaceous marine-target impact structure in the inner Coastal Plain of Alabama [1]. The structure is characterized by a wide, horseshoe-shaped crystalline rim terrain (Fig. 1), an interior region of broken and disturbed sedimentary formations, and an extra crater terrain on the south-west composed of structurally disturbed target formations [1, 2]. The extant crater rim, which is a distinctly positive topographic feature, spans 270 degrees of arc and is open on the southwest, the same side as the structurally disturbed terrain just noted. The northwest-southeast diameter of the crystalline rim is approximately 5 km.

In 2002, the Eason well was drilled on the northwestern part of the rim and, in 2006, the Inscoe well was drilled on the southeastern rim of the structure (Fig.1).

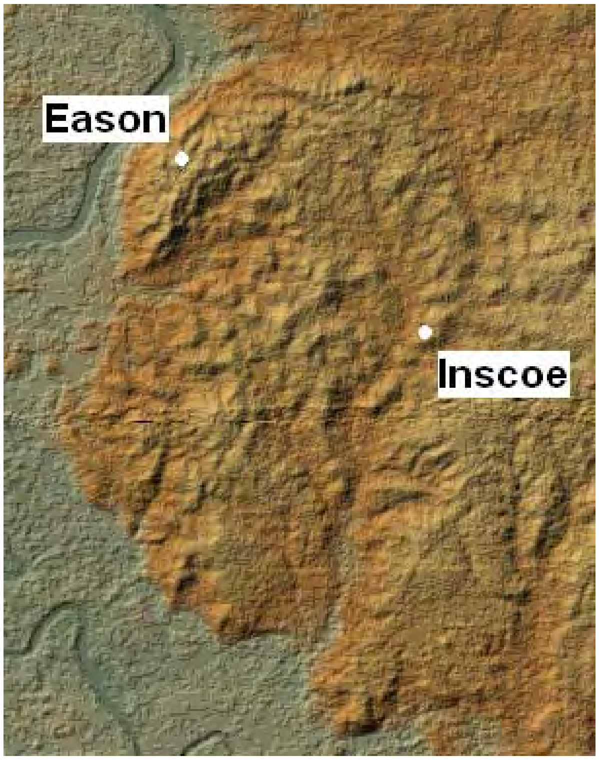

Figure 1. DEM of Wetumpka impact structure, Alabama USA. Eason and Inscoe well locations are shown by white dots. North is up.

Well logs: The Eason well was drilled to a depth of ~ 30m and penetrated a continuous section of weathered, westerly dipping schists of the pre-Cretaceous basement. Samples from the Eason well consist of mixed cuttings collected in multi-meter intervals. The Inscoe well was drilled to a depth of ~ 36m and penetrated highly weathered schist blocks and intercalated sands, which included some clay layers and sedimentary clasts. Samples from the Inscoe well include cuttings from the upper few meters and some continuous core recovery from the lower part (about 10% recovery).

Structure of the rim near the Eason well: Outcrops created during pre-construction excavation for new local businesses sited on the structure's western rim show that the dip of foliation in the pre-Cretaceous bedrock schist is west-northwest (Fig. 2). This dip strongly contrasts with prevailing regional dip, which is easterly outside the impact structure.

Figure 2. Westerly dipping foliation in schist near Eason well site on the northwestern rim of structure.

Structure of the rim near Inscoe well: The rim near the Inscoe well has relatively low relief compared to the rim at the Eason well. The rim crops out as hills of highly weathered schist blocks in the soil. Near the base of some hills, where the hills are dissected by small streams, isolated masses of Cretaceous sedimentary target material crop out below soils with the crystalline materials (Fig. 3). These sedimentary target rocks are underlain by more indurated schists and gneisses, which have dips approximately consistent with the regional Appalachian trend.

Interpretation of the rim at the two sites: The rim near the Eason well is more like an "overturned flap" of crystalline basement rocks, which has been observed at the comparable marine-target Lockne crater, Sweden [3]. At Eason well, the rocks are strongly re-oriented, and perhaps flipped upside down judging from the dip of outcrops.

Figure 3. Sedimentary target rocks with near vertical dip exposed along creek in topographic position below the polymict breccias of the Inscoe well.

Unfortunately, the Eason well did not penetrate to sufficient depth to show sediments under this flap, so this interpretation and its implied comparison with Lockne remain speculative.

The rim near the Inscoe well consists of less well indurated and intact schist fragments, and is more likely polymict ejecta with fragments from both the sedimentary and crystalline target resting on top of disturbed sedimentary strata. The relation between the polymict ejecta and the disturbed target sediments shows that there is hardly any structural uplift contributing to the topographic rim in this sector of the crater. This can be interpreted in one of two ways: that the drill site is located on the outer flanks of a now mainly eroded rim, or that there was never much structural uplift, which is in analogy with the Lockne crater. At Lockne, this is an effect of the layered target with a thick upper layer of sea water. At Wetumpka, there is no evidence for a great water depth [1], but the combination of sea water and thick, poorly consolidated sediments may have together behaved the same way and thus had a similar effect.

As noted, the Inscoe well did not encounter any large masses of crystalline rock that could have been interpreted as an overturned flap. If a flap had existed in this sector of the rim, then perhaps it was constrained to the crater rim's "hinge" and thus likely slumped back into the crater due to the lack of a strong foundation (*i.e.*, the high content of poorly consolidated sediments in the hinge zone). We think that the existence of possible ejecta just outside the basement crater is of great importance for the reconstruction of the pre-erosional structure and, thus, for evaluations of the magnitude of the impact event.

Implications: The differences in rim structure and heterogeneity between the two well sites suggests that the "rim" of the Wetumpka impact structure is of a complex and varied origin, possibly due to the increasing thickness of target sediments and increasing target water depth towards the south [2]. The origin of the rim varies from possibly overturned, intact schist mega-blocks (on the west and north) to schistose and sedimentary ejecta (on the southeast). What has been referred to as the "crystalline rim terrain" at Wetumpka [1] is therefore of mixed origin and clearly deserves more careful study as to its nature and mode of emplacement in relation to this marine impact event.

References: [1] King Jr. D. T. et al. (2002) *EPSL, 202,* 541-549. [2] King Jr. D. T. et al. (2006) *Meteoritics & Planet. Sci., 41,* 1625-1631. [3] Lindström M. et al. (2005) *Impact Studies,* 357–388.

Acknowledgments: We thank Christian Brothers Testing Laboratories of Montgomery, Alabama, for drilling the Inscoe well, which was drilled with the kind permission of the landowner, Mr. Jim Inscoe. We thank Eason Construction Company of Wetumpka, Alabama, for making the samples available from the Eason well.