

**WETUMPKA'S ANNUAL "CRATER TOURS" -- AN UNUSUAL EDUCATIONAL OUTREACH ACTIVITY IN PLANETARY SCIENCE.** D. T. King, Jr.<sup>1</sup>, L. W. Petruny<sup>2</sup>, R. C. Johnson<sup>1</sup>, A. T. Gilomen<sup>1</sup>, J. C. Gibson<sup>1</sup>, and G. de Villiers<sup>1</sup>, <sup>1</sup>Dept. Geology, Auburn University, Auburn, AL 36849 [kingdat@auburn.edu], <sup>2</sup>AstraTerra Research, Auburn, AL 36831-3323 [lpetruny@att.net].

**Introduction:** After a hiatus in research activity at Wetumpka impact structure (Alabama) between 1973 and 1997, investigations were resumed with the goal of drilling the structure to look for impact breccias, shocked minerals, and imbued meteoritic components. From the outset of the renewed research effort, the city of Wetumpka, Alabama, was a partner with investigators, for example, city officials acted to facilitate land access for drilling sites. After shocked materials were discovered in drill core [1] and the structure was on its way to international acceptance as a bona fide impact feature, the city of Wetumpka, working with a local outdoors club, the Trail of Legends, began to lay plans for an annual celebration of this unique natural feature. Since 1999, annual "crater tours" have been conducted for the general public as part of this annual event. This year, the tours will be conducted by a city-county crater commission, which is a six-member body established to advise city and county officials on the preservation and best use of this local natural feature. This report reviews the origins, objectives, and future prospects for the annual "crater tours," a rather unusual educational outreach activity.

**Background:** Wetumpka's "disturbed geology" was noted by the eminent geological scientist, Eugene Allen Smith, second state geologist of Alabama, during his field work of July 1891 [2]. He speculated that the Wetumpka disturbed area was related to a rather deep "depression" of unknown origin. The map that Smith produced [2] showed unusual stratigraphic and structural relationships in the impact area, but later geological maps of the area either completely ignored the structure [3] or reinterpreted the structure as an anomalous L-shaped fault zone [4]. The 1969-70 re-mapping of the Wetumpka area, part of the long-running effort to produce a new state geological map, yielded the first field data suggesting an astrobleme [5]. A detailed account of this field data, regrettably without clear petrographic evidence of shock deformation, was published in 1976 [6]. Over two decades later, the matrix of impact breccias drilled during 1998 yielded

shocked quartz and elevated concentrations of Ir, Cr, Co, and Ni. These discoveries were published in 2002 [7], thus helping establish Wetumpka as a structure of unambiguous impact origin. Wetumpka was subsequently listed on the Earth Impact Database as the 157<sup>th</sup> established terrestrial impact feature. Recent research, has established the stratigraphic age of the Wetumpka impact as Late Cretaceous and that the crater is a marine impact structure. Oddly, the name Wetumpka means "rumbling waters" in the Creek native peoples' language, thus making Wetumpka perhaps the most appropriately named marine impact feature.

**Geology:** Wetumpka impact structure, 7.6 km in diameter, consists of a broad crystalline rim, which forms a 270-degree arc (Fig. 1) that encloses an intra-structure terrain comprised of broken Upper Cretaceous formations and impactite sands of mixed sedimentary origin. Wetumpka's rim is open (incomplete) in the southwestern quadrant. Extending south and southwest from this open breach is an enigmatic, structurally disturbed extra-crater terrain. The main features of this extra-crater terrain are linear grabens, tilted blocks of intact stratigraphic section, and zones of inverted stratigraphy [7, 8].

**Crater tours:** Annual crater tours have been organized on a Saturday during late February or early March. This timing takes advantage of the local climate, which is usually mild at this time, and the lack of leaves and other spring vegetation. The structure is heavily vegetated, therefore this timing allows for better visibility of crater features during the field trips.

Tours are advertised in advance and reservations taken by mail and telephone. There is a small fee charged to participants, who receive a guidebook along with their tour experience. Participants are taken in 12-passenger vans to five field-trip stops. At these stops, graduate students from Auburn University discuss the meaning of what is being seen there and what the stop means in context of the impact structure and its origin. Participants are a mixture of teachers, senior citizens, parents with a young child or children, and other interested persons.

Most have little or no knowledge of geology in general or the impact structure in particular when going into the trip. To help address this problem, a city-sponsored public lecture is given on Thursday night preceding the trip. The trip leaders also go over the main aspects of the impact history and evidence therefore before and during the tours. Trip leaders make use of posters and maps, as well as verbal descriptions during each stop. Permission from landowners for access during these tours is obtained by the city and/or the commission prior to each trip and a waiver is signed by each participant before the trip begins.

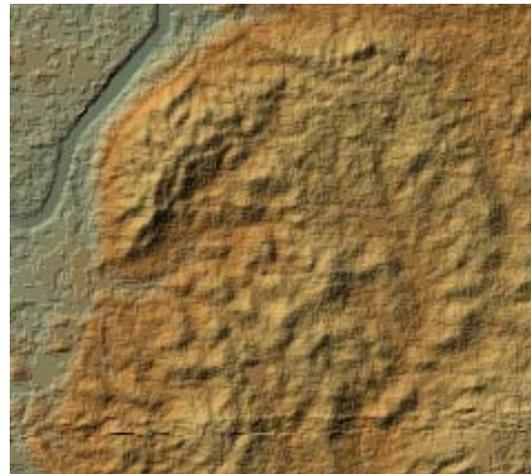
Stops on the crater tours are arranged in a logical order and planned to show specific features. Stop 1 shows participants good outcrops of the crystalline rim rock. Trip leaders discuss the uplift of bedrock that forms the crater rim and begin discussing the energy of impact and its effects. Stop 2 takes participants to an overlook on the northeastern rim where the surrounding plains can be seen outside the structure on the west and they also have a view across the crater floor toward the east. The central uplift and eastern rim are visible from this stop. Stop 3, a stop just inside the northwestern rim, shows participants large, deformed mega-blocks of Cretaceous formations that are not in stratigraphic order. Stop 4 takes participants to a small outcrop of impact breccia near crater center. Finally, Stop 5 visits the geographic center of the structure on a hill that may be part of the central uplift. A natural gas pipeline, which runs east-west, is the avenue for access to this stop. The lack of trees along the pipeline cut allows participants to see the crater floor topography looking east as well as the eastern rim. Two tours are conducted in the morning and two in the afternoon repeating the stop itinerary. Each tour takes about two hours and participants are returned to the starting point, a park near the center of the city of Wetumpka. The city is located directly adjacent to the crater on its western side.

**Impact of the impact:** Participants on the crater tours say that they did not fully appreciate the size of the structure and many say that they are amazed that they have seen the hills of the crater rim for years and not appreciated what they represented. Although participants sometimes ask rather pointed questions about how researchers know what happened at Wetumpka so long ago, most who would take

the time to go on a crater tour are open minded about the interpretation of what they are seeing. Many participants do not have a good grasp of the scientific method and the nature of scientific research. This experience helps put them in touch with this kind of work. The crater tours and associated public lectures have introduced Wetumpka impact structure and the science of impact geology to hundreds of persons who otherwise would not have had any exposure to this new aspect of planetary science. The annual event usually generates many requests for classroom visits by impact geology researchers and graduate students from Auburn University. Wetumpka impact crater, above all other natural features in Alabama, has educated a large number of citizens about planetary geology.

**Acknowledgements:** We thank the city of Wetumpka, Alabama, the Wetumpka city-county crater commission, and the Trail of Legends Association. Also, we thank the many donors to the Wetumpka Impact Crater Fund (WICF) at Auburn University for their continued support.

**References:** [1] King D. T. Jr. et al. (1999) *Met. & Planet. Sci.*, 34 sup., A63-64. [2] Smith E. A. (1894) *Ala. Geol. Survey Spec. Rept.* 6. [3] Smith E. A. (1904) *State Geol. Map.* [4] Stose G. W. (1926) *State Geol. Map.* [5] Bentley R. D. et al. (1970) *EOS Trans.*, 51, 342. [6] Neathery T. L. et al. (1976) *Geol. Soc. Amer. Bull.*, 87, 567-573. [7] King D. T. Jr. (2002) *Earth & Planet. Sci. Lett.*, 202, 541-549. [8] King D. T. Jr. et al. (2003) *Springer-Verlag Impact Studies*, 97-112.



**Fig. 1.** Digital elevation model of Wetumpka impact structure showing arcuate rim composed of crystalline rock and the knobby intra-crater terrain. Coosa River is at left. North is up.