(G) - IAG - *International Association of Geodesy*

GS004 **Poster presentation** **3854**

Contemporary High-Resolution LiDAR Derived DEMs Could Inspire Developments in the Study of Impact Structures

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In the mid-continent of the United States there are eight peculiar geological structural features whose geneses have been variously accounted for yet most likely appear to be crater impacts (Snyder, 1964; Snyder and Gerdeman 1965; Unkelsday and Vineyard, 1992; Kenkmann, 2001; Plymate, 2004; Evans et al., 2005a, 2005b; Planetary and Space Science Center, 2005). The primary alternative interpretation is of cryptovolcanic origin. We have used a primary Geographic Information Science (GIScience) technique of creating a digital elevation model (DEM) of two of these eight features that both occur in Missouri: the Crooked Creek Structure and the Weaubleau Disturbance (also known as the Weaubleau-Osceola Impact Structure Chamot, 2003; Plymate, 2004; Evans et al., 2005a, 2005b). Crooked Creek is a ring like structure in formations of Cambrian and Ordovician age and is located in Crawford County, approximately 5 kilometers miles northeast of Cook Station on Highway VV. Weaubleau is a larger structure in beds from the Mississippian Period and is located in St. Clair County, approximately centered on the villages of Vista and Gerster (Beveridge, 1978, 1990; Unklesbay and Vineyard, 1992; Evans et al., 2005a). For the US, the nominal, publicly available DEM is based on 1 arc second posting of latitude and longitude with varying higher resolution DEMS available at 1/3 arc second and even a few at 1/9 arc second available. These DEMs have nominal postings of 30-meter, 10-meter, and 3-meter, respectively (Gesch et al., 2002; USGS, 2005). We hypothesized that a very high resolution DEM derived from airborne light detection and ranging, or LiDAR, would allow GIScience to contribute in some manner to the study of these structures and also be of benefit to scientists in other disciples studying them as well. Through contract mechanisms, we have acquired airborne LiDAR data at nominal 1.4 m pulses (ground sample distance) and have processed these data to a DEM at 1.6 m posting, representing a statistically rigid solution based on samples collected at 90 percent, in two directions, of the final post spacing. These new high resolution DEMS are accurate enough to allow for precise measurements of geological structures, particularly jointing in the carbonate rocks and ultimately stimulating advancements in knowledge of these meteorite impact structures. REFERENCES: Beveridge, Thomas R. (1978) [Vineyard, Jerry D., revised edition, 1990] Geologic Wonders and Curiosities of Missouri. Missouri Department of Natural Resources, Division of Geology and Land Survey, Education Series Number 4. Chamot, Josh (2003) Jumbled Missouri geology linked to impact. Geotimes, July. American Geological Institute. Evans, Kevin R., Patrick S. Mulvany, James F. Miller, Kevin L. Mickus, and George H. Davis (2005a) SEPM Research Conference: The Sedimentary Record of Meteorite Impacts, May 21-23, 2005, Springfield, Missouri, Field Trips Guide Book. Evans, Kevin R., J. Wright Horton, Jr., Mark F. Thompson, and John E. Warme (2005b) The Sedimentary Record of Meteorite Impacts: An SEPM Research Conference. The Sedimentary Record, Volume 3, Number 1 (March). SEPM Society for Sedimentary Geology. Gesch D., m. Oimoen, S. Greenlee, C. Nelson, M. Steuck, and D. Tyler (2002) The National Elevation Dataset. Photogrammetric Engineering and Remote Sensing, Volume 68, Number 1, pp. Kenkmann, T. (2001) Deformation mechanisms during impact crater modification inferred from the Crooked Creek Impact Structure, Missouri, USA. In Lunar and Planetary Science XXXII, Abstract #1560, Lunar and Planetary Institute, Houston (CD-ROM). Planetary and Space Science Center, UNB (2005) Earth Impact Database. Internet at: http://www.unb.ca/passc/ImpactDatabase/index.html. Last accessed 21 November 2005. Plymate, Thomas G. (editor) (2004) Field Trip Guidebook of the Association of Missouri Geologists 50th Annual Meeting, Springfield, Missouri, September 26-27, 2003.

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