FIELD EXPLORATION OF THE BRUSHY CREEK FEATURE: POSSIBLE IMPACT STRUCTURE IN LOUISIANA. A. Webb (awebb6@lsu.edu)[1] and D. R. Hood (dhood7@lsu.edu)[1], P. James[2], A. Ermakov[3], P. Heinrich[4], S. Karunatillake[1], [1]Louisiana State University Geology and Geophysics [2]Department of Geosciences, Baylor University [3]NASA Jet Propulsion Lab [4] Lousisana Geologic Survey.

Introduction: The Brushy Creek feature (BCF) is an anomalous, 2-km wide depression in St. Helena Parish, LA, originally described in a 1996 Lousiana Geologic Survey mapping project [1]. An initial investigation into the feature revealed shocked quartz in creekbed sediments flowing from the interior of the basin [2]. The quartz was thoroughly fractured, and Planar Deformation Features were seen on some grains. The absence of similarly fractured grains in the nearby sediments suggests that the basin may have been formed in a late Pleistocene impact. The feature is superimposed on ridge-and-ravine topography of the citronelle formation, locally ~300 ft thick of poorly sorted sediment [3]. No investigation has found evidence for local igneous or carbonate units that could suggest a volcanic or karst origin respectively. Also, a regionally thin salt layer [4] would not allow salt diapirism at a scale to form such a basin and regional oil exploration finds no salt-assocaited structures.

To date, the presence of shocked quartz and anomalous morphology of the structure have been the only evidence that shed light on the origin of the BCF. The geophysical signature of an impact basin of this size would be relatively shallow and existing seismic survey data have insufficient vertical resolution to show the <1km expected structure [5]. To find evidence for such a basin, we performed a shallow geophysical survey that included a gravity survey and a 100 MHz Ground Penetrating Radar (GPR) survey across the feature. This represents the first focused geophysical survey of the feature. This study was done along with a gravity survey [6].

Field Site: On December 9th, 2017 we set out to the BCF from Louisiana State Unviersity in Baton Rouge, LA. The BCF lies on privately owned land with several dirt roads that interect the feature. The main road travereses the entire feature from west to east, intersecting both edges of the feature and slightly north of the apparent center. In addition, two more roads cut through the interior of the structure to the south. These roads intersect the southern edge of the structure, but on adjoining property that could not be accessed at the time of the fieldwork. In addition to roads, areas cleared of trees for powerlines and pipelines intersect the feature at several locations. The eponymous Brushy Creek runs from the NW to SE of the structure intersecting several roads and the SE rim of the structure.

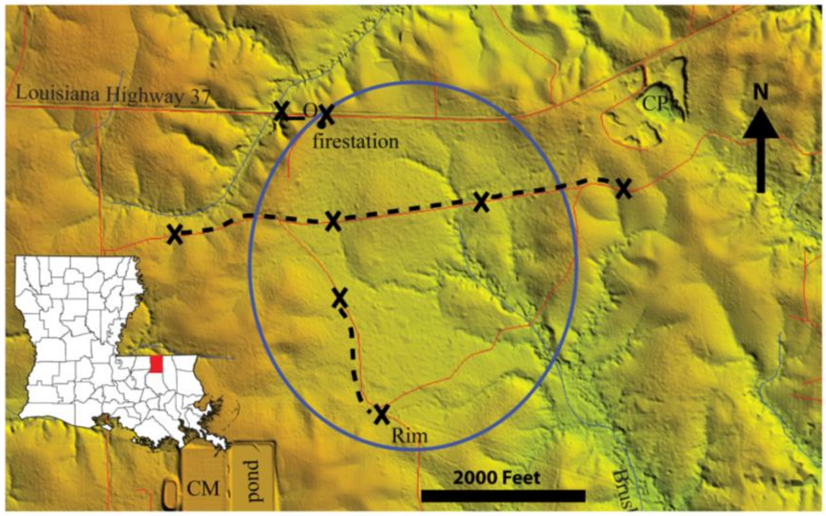
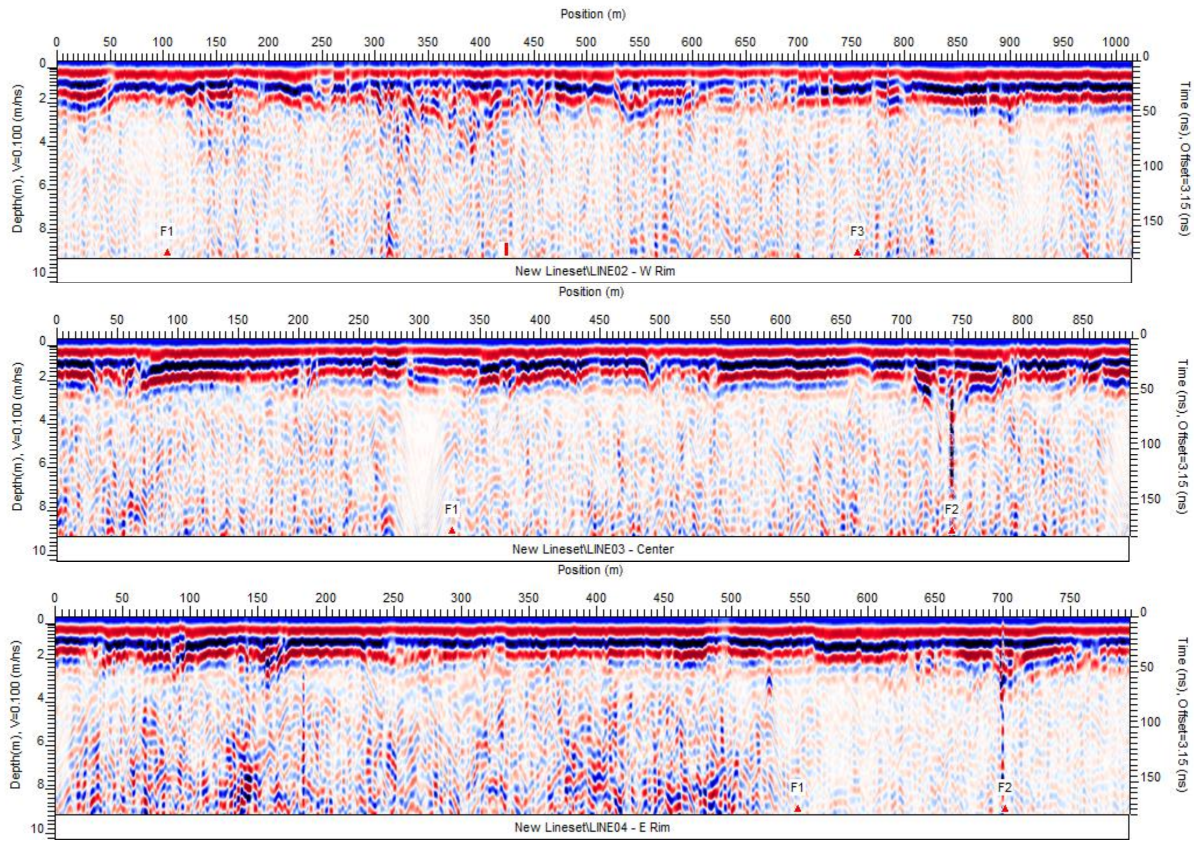


Figure 1. *A LIDAR image of the BCF with the rim of the basin marked by the blue ellipse and the location of the feature shown in the lower left. Xs show beginnings and ends of GPR lines, with dotted lines showing the traverse. Five lines were taken: one on the road (LA 37), three continuous lines crossing the structure from east to west, and another in the southern interior.*

Methodology: A common offset reflection GPR survey of the feature was conducted using Sensors and Software's Pulse Ekko 1000 and SmartCart, allowing for rapid collection. 100 MHz antennae were used in conjunction with an wheel-mounted odometer for consistent shot spacing of 0.25 m. A total of 5 lines were collected: one on the northern rim oriented East-to-West, one on the southern rim oriented North-to-South, and three continuous lines bisecting the feature along the center. Lines were processed using Sensors and Software's Ekko_Project 4 software using a simple recipe to improve signal-to-noise ratio and improve resolution at depth.

Results: The five lines provided clean data with minimal artifacts or unusual features. A number of unnatural objects were encounterd on the traverses, including concrete bridges, buried metal culverts, and other unknown buried objects. In addition, deep ditches



and puddles often interfered with smooth data collection, though points where this occurred are noted in the data.

Figure 2. *Three of the GPR lines conducted across the center of the BCF are shown. Top: West Rim, Middle: Center of the feature, Bottom: East Rim. Locations can be seen in Figure 1.*

Initial interpretations of the transects show 2-3m of layered, unconsolidated sediment with rapid signal loss with depth. Local geologic investigations and commercial clay mining have found a 6m layer of clay and silt beneath 9-12m of fine to coarse sand. The low penetration depth seen in the GPR images is consistent with a clay-rich layer, but is likely too shallow to represent the clay and silt layer seen in the crater exterior.

Conclusions: This work is the first in a set of investigations to identify the origin of the BCF. Aside from GPR and gravity; electric resistvity, and magnetometry surveys are planned for the site. Currently, our GPR imaging does not provide conclusive evidence for an impact origin for the BCF. Clay-rish sediments are likely to blame for signal loss, but further processing of the GPR data, coupled with other geophysical studies could shed light on the origin of the BCF. Further GPR work nearby, or shallow coring within the BCF could greatly enhance these results. Alternative explanations for the basin (karst, salt diapirs, or volcanic) are still highly unlikely and lack geologic evidence. In addition, the local presence of shocked quartz cannot be explained except by impact metamorphism.

References: [1] McCulloh, R.P. et al. (1997) *USGS*, Amite, Louisiana quadrangle. [2] Heinrich, P. (2003) *GCAGS/GCSSEPM Transactions, Vol. 53*, 313–332. [3] Campbell, C.J. (1971) *Tulane Univeristy*, Thesis. [4] Sawyer, D.S., et al. (1991) *The Gulf of Mexico Basin: Geological Society of America, The Geology of North America*, v. J, 53-72 [5] Melosh H.J. (1989) *Oxford University Press*. [6] James P.B. and Ermakov A. I. (2018) *LPSC 49*.