

FINAL TECHNICAL REPORT

External Grant Award Number G11AP20178

Title

Eastern Section of the Seismological Society of America 2011 Field Trip –
Trenching Support for Paleoliquefaction Stop in the Marianna, AR, Area
October 16-18, 2011

Principal Investigators:

Haydar Al-Shukri
Arkansas Earthquake Center
University of Arkansas at Little Rock
2801 South University Avenue
Little Rock, AR 72204
March, 2012

Eastern Section of the Seismological Society of America 2011 Field Trip – Trenching Support for Paleoliquefaction Stop in the Marianna, AR, Area

G11AP20178

Haydar Al-Shukri and Hanan Mahdi, University of Arkansas at Little Rock
Martitia Tuttle, M. Tuttle & Associates, Georgetown, ME

Introduction

This grant was in support of trenching a paleoliquefaction site for the fieldtrip of the 83rd Eastern Section (ES) meeting of the Seismological Society of America (SSA). The University of Arkansas at Little Rock hosted the annual meeting at the Peabody Hotel downtown Little Rock, AR on October 16 to 18, 2011. The meeting was co-chaired by Haydar Al-Shukri and Hanan Mahdi. The ES-SSA meeting was one of several meetings held in the central U.S. in 2011 and 2012 in recognition of the bicentennial of the 1811-1812 New Madrid earthquakes. The meeting included a one-day fieldtrip to east central Arkansas to allow participants to examine firsthand liquefaction evidence for large earthquakes that struck the region during the Early and Middle Holocene. In addition, the fieldtrip included a demonstration of Ground Penetrating Radar (GPR) and how the geophysical technique is used to study earthquake-induced liquefaction features, such as sand blows, dikes, and faults, and related ground failures. Thirty meeting participants attended the fieldtrip.

Three stops were previously planned; two minors with about an hour each and the major stop at a trench site that was excavated specifically for the fieldtrip. The first stop was about 7 kilometers northwest of Marianna, AR, to observe several relatively small size (~20 meters in diameters) sand blows and learn how to spot sand blows through surface observation. The second stop was about 8 kilometers southwest of Marianna, AR, to observe very large sand blows and to discuss a lineament discovered by the research team and possibly related to a deep-seated fault. Below is a detail description of the third stop at the trench site. Three days before the fieldtrip, Drs. Tuttle, Al-Shukri, and three graduate students conducted comprehensive survey of the site and collected GPR profiles to relocate the trench that we excavated in 2008 and planned to reopen for the field trip. Geophysical Survey System Inc. GPR system was used with a 400 MHz antenna and a high speed data acquisition system.

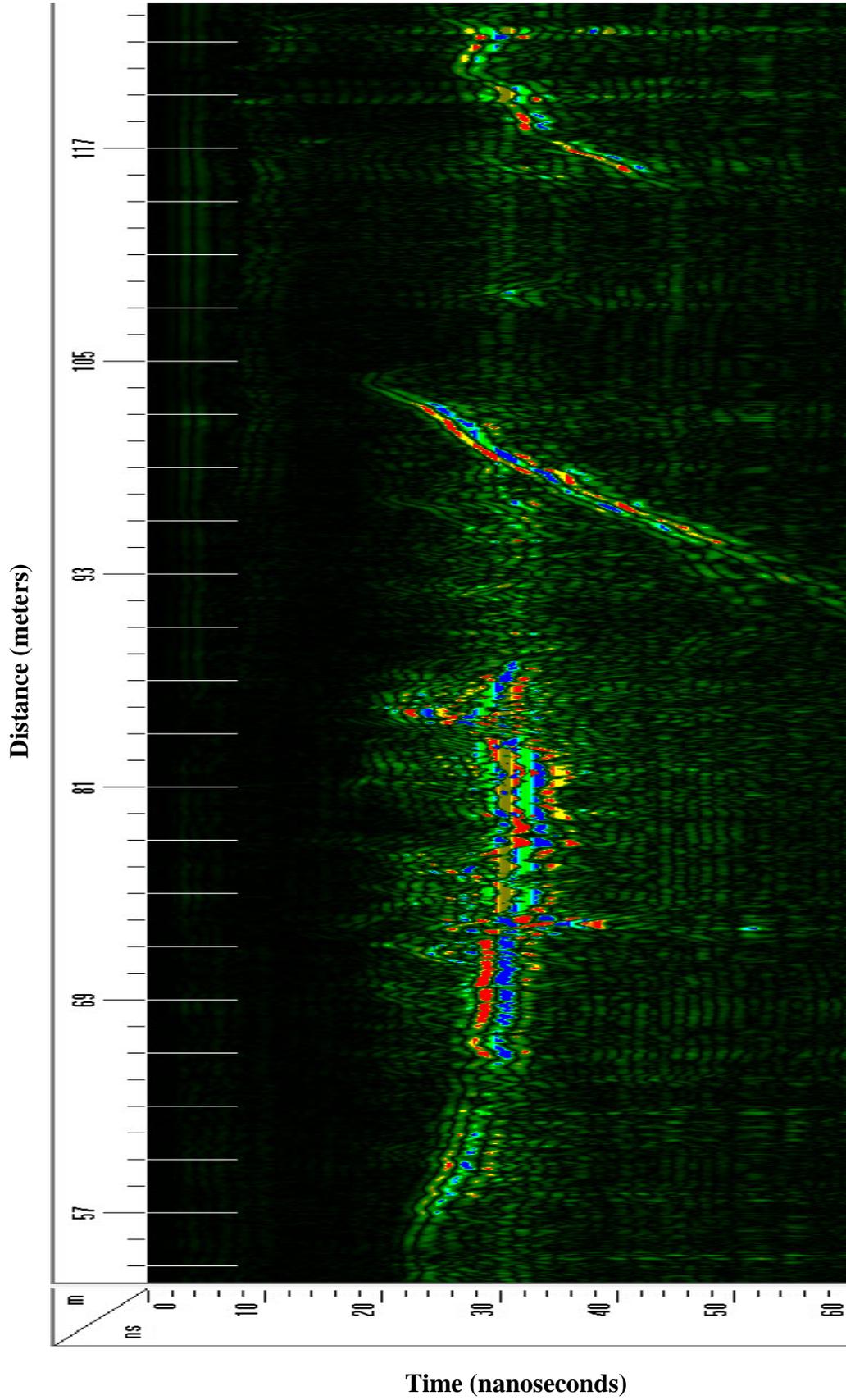


Figure 1. A Ground Penetrating Radar profile of the trench site that was collected for demonstration to the participants during the fieldtrip.

Paleoliquefaction Trench Excavated for ES-SSA Field Trip

The ES-SSA field trip showcased the research of Haydar Al-Shukri, Martitia Tuttle, Hanan Mahdi, and their collaborators at the southern terminus of the Reelfoot Rift in east central Arkansas. The research, previously funded by the NEHRP, led to the discovery of several generations of sand blows, suggesting that very large earthquakes have been centered in this area between 5-10 ka, and possibly earlier (Al-Shukri, *et. al.*, 2005, 2006, and 2009; Tuttle, *et. al.*, 2006). Trenching of a paleoliquefaction site for the field trip provided an opportunity for paleoseismologists, seismologists, earthquake engineers, the media, and others to see and examine some of paleoliquefaction features in the Marianna area and to ask the investigators questions in the field.

As outlined in the proposal, a previously studied paleoliquefaction site, the McClendon site, also known as the Triple Crown site, was selected for the field trip. Although paleoseismic investigations have been conducted at several sites in the area, the McClendon site was selected because it provides excellent examples of very large and very weathered sand blows that clearly pre-date historic and prehistoric earthquakes centered in the New Madrid seismic zone. In addition, the property owner had agreed to let us reopen a trench at the site and to bring the field trip and media to view the exposed paleoliquefaction features.

Preceding trenching, we conducted GPR surveys to relocate the position of the previous trench. Once the position of the old trench was marked on the ground, we opened a new trench in the same location but made it much wider with sloped walls to provide easy viewing and safe entry into the excavation without shoring. The new trench provided excellent exposure of the two generations of sand blows and dikes previously described in Al-Shukri et al., 2009. We took the opportunity to collect additional samples for dating the older sand blow. Those samples have been submitted for dating and the results are expected later this spring.

During the field trip, we discussed prior earthquake research in the area including the preliminary paleoearthquake chronology of the Marianna area based on prior paleoliquefaction research. We presented our observations and interpretations of earthquake-related features at the McClendon site, walking field trip participants through the trench. In addition, we demonstrated field techniques such as mapping of sand blows and related sand dikes with ground-penetrating radar (GPR).

Prior to the field trip, we assisted the USGS in developing a press release for the field trip. The hope was that members of the media would visit the trench site and report the event in local and regional papers. Although we offered to be available to the media before the field trip as we were preparing the trench, the decision was made by the USGS to invite the media to attend during the field trip on Sunday. Unfortunately, none of the media showed up. The USGS later arranged

to have the media visit the trench on the following Tuesday afternoon. None of the investigators (Al-Shukri, Tuttle, and Mahdi) could attend at that time.



Figure 2. Preparing new trench at McClendon site southwest of Marianna, Arkansas, for ES-SSA field trip.



Figure 3. ES-SSA field trip participants above exposure of severe ground failure and large sand blow exposed in new trench excavated at McClendon site.

References Cited

- Al-Shukri Haydar J., Robert E. Lemmer, Hanan H. Mahdi, and Jeffrey B. Connelly (2005). Spatial and Temporal Characteristics of Paleoseismic Features in the Southern Terminus of the New Madrid Seismic Zone in Eastern Arkansas, *Seismo. Research Lett.* **76**, 502-511.
- Al-Shukri, Haydar, Hanan Mahdi, and Martitia Tuttle (2006). Three-Dimensional Imaging of Earthquake-induced Features with Ground Penetrating Radar, Near Marianna, Arkansas, *Seismo, Res, Lett*, **77**, 505-513.
- Al-Shukri, H., H. H. Mahdi, O. Al Kadi, and M. Tuttle (2009). Spatial and temporal characteristics of paleoseismic features in the southern terminus of the New Madrid seismic zone in eastern Arkansas, Final technical report to U.S. Geological Survey, award 1434-07HQGR0069, 24 p.
- Tuttle, Martitia, Hanan Mahdi, and Haydar Al-Shukri (2006). Very Large Earthquakes Centered Southwest of the New Madrid Seismic Zone 5,000-7,000 Years Ago, *Seismo, Res, Lett*, **77**, 664-678.