

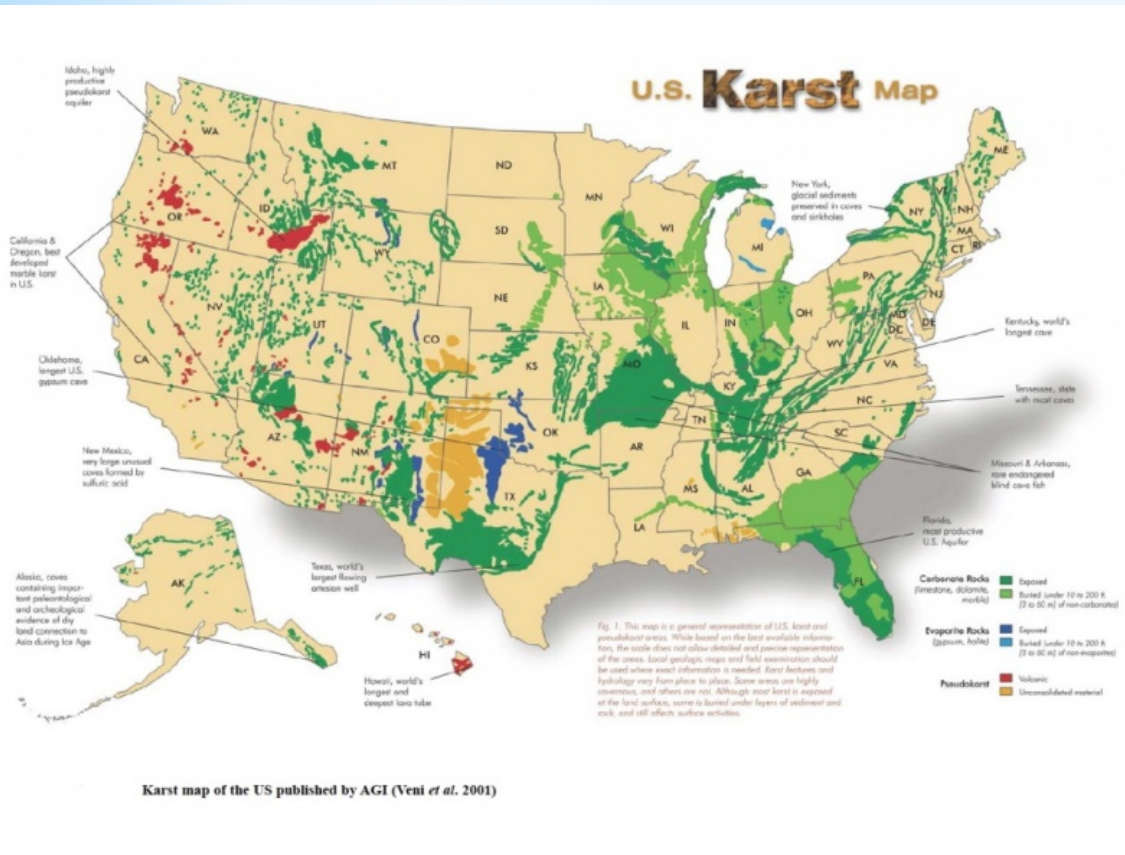
* SHALLOW KARST DETECTION IN SOUTH CENTRAL TEXAS USING GROUND PENETRATING RADAR

Evelynn J. Mitchell*, Harold S. Campbell, and Gamaliel O. Rodriguez
Department of Physics and Environmental Sciences,
St. Mary's University, San Antonio, TX
emitchell1@stmarytx.edu

ST. MARY'S UNIVERSITY



* Geologic Setting



* San Antonio and the Hill Country to the north of the city are well known karst areas.

* Austin Chalk - Outcrops to the west of town

* Glenrose Limestone - Outcrops in much of the Hill Country north of San Antonio

Figure taken from Wheeler et al. (2001)

ST. MARY'S UNIVERSITY

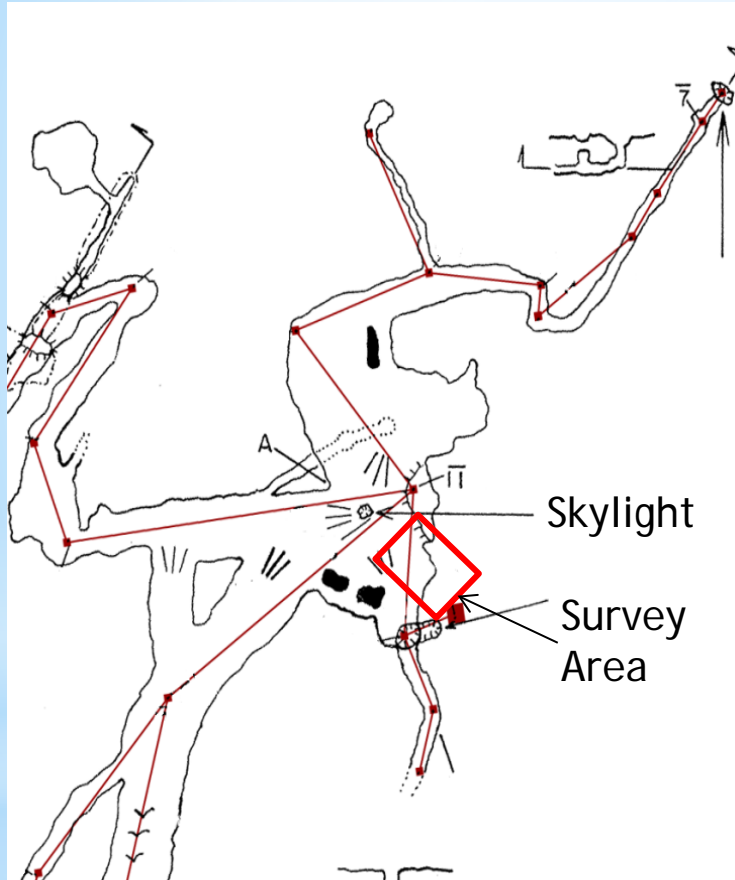


* GPR Unit Specifications

- * GSSI 270 MHz Unit
- * SIR 3000 Interface
 - * Dielectric Constant ranged from 11.71 to 23.4 due to different soil conditions
 - * Moisture
 - * Clay
 - * Range of 75 to 175 ns depending on desired depth.

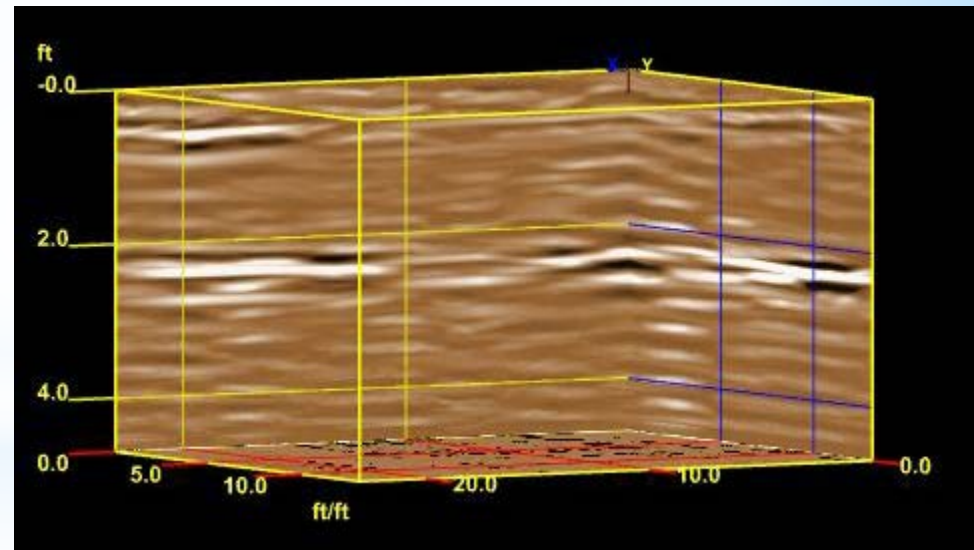


* Austin Chalk Exploration



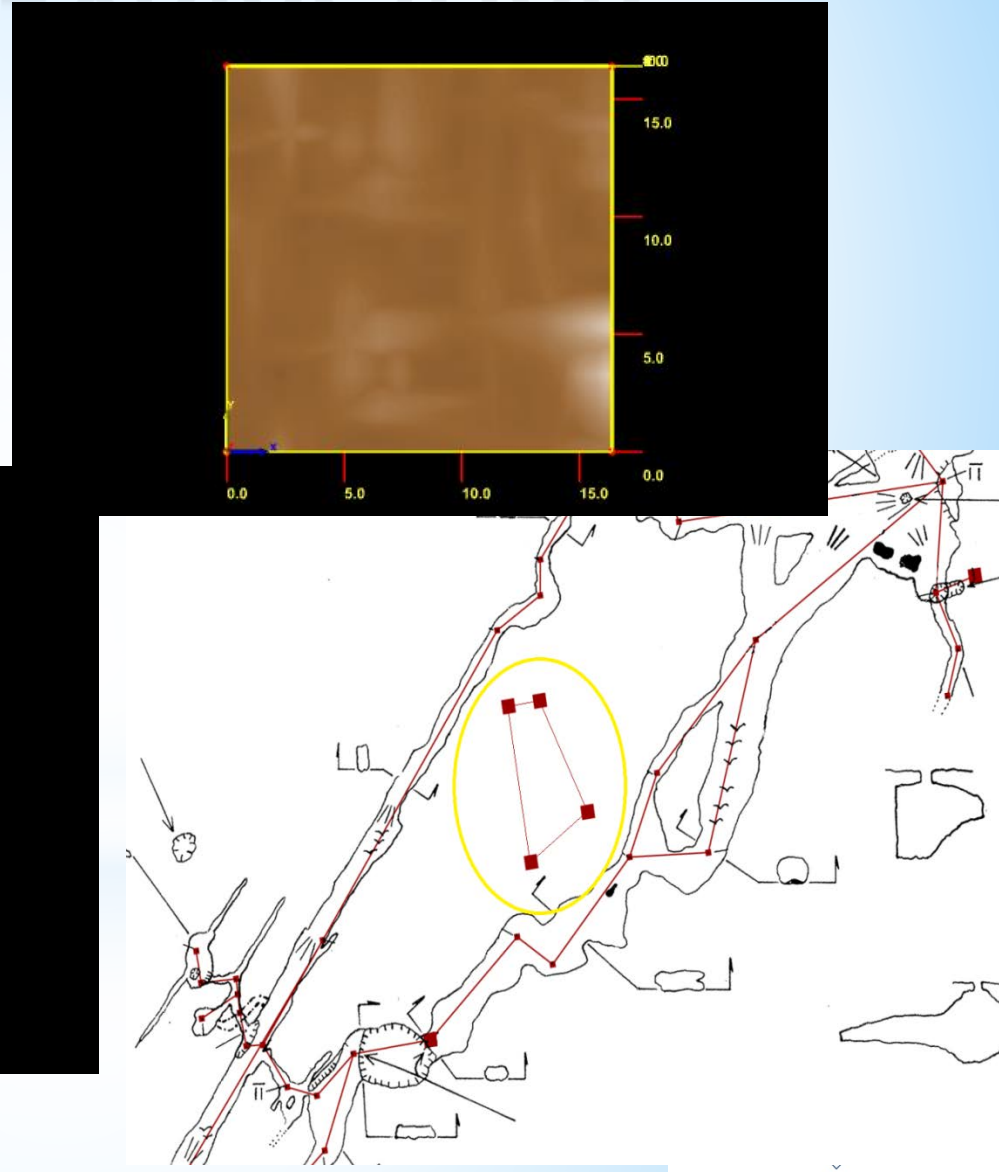
Wurzbach Bat Cave

- * Range - 75 ns
- * Dielectric Constant - 23.4
- * Saw the ceiling of the cave at approximately 1m depth



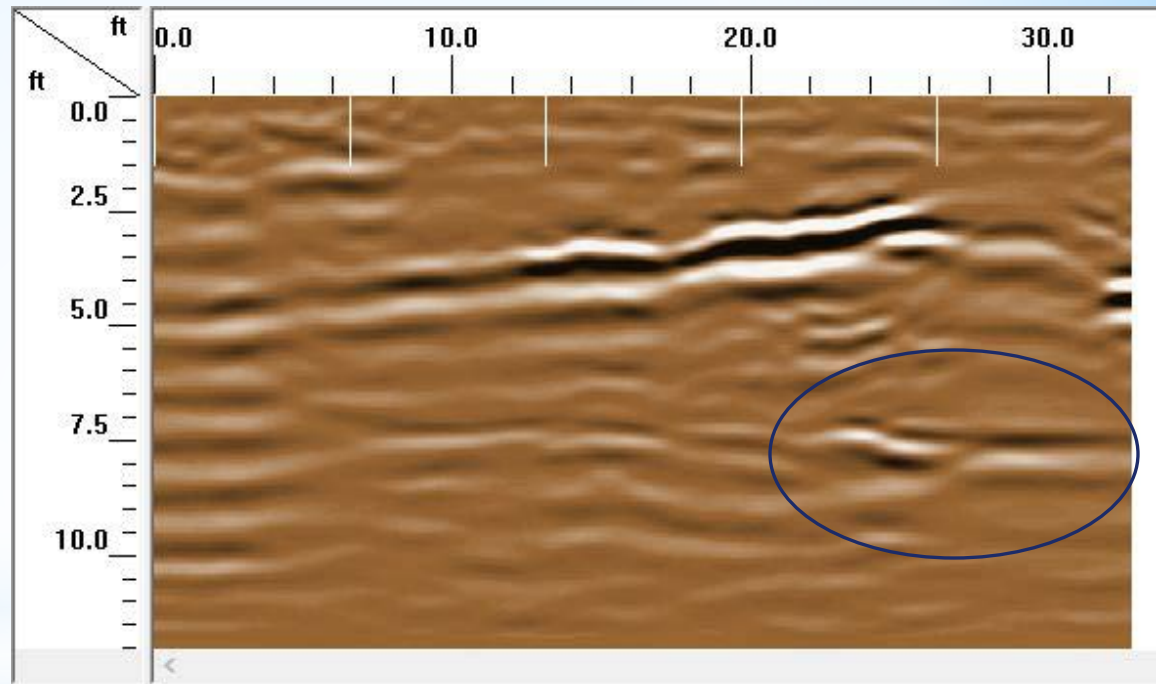
* Austin Chalk Exploration

- * A second site at Wurzbach Bat Cave was chosen to analyze, but the survey results were confusing.



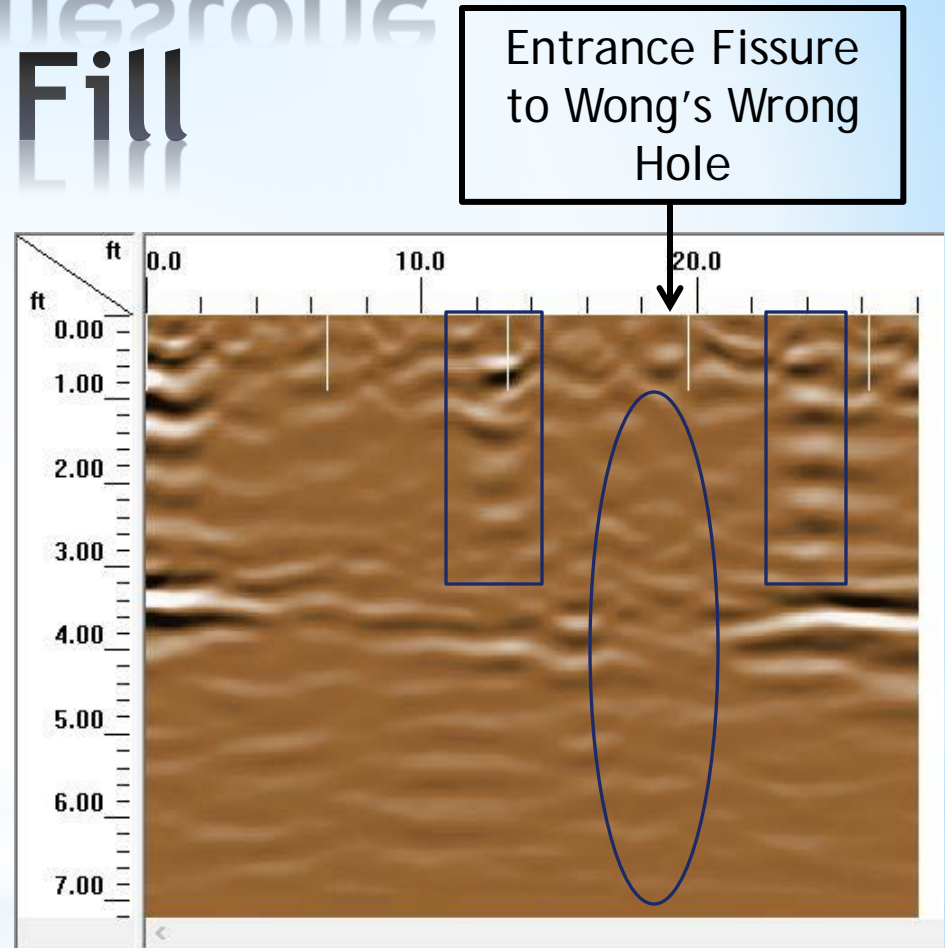
* Glen Rose Limestone - Voids

- * First test in the Glen Rose Limestone
- * Joe's Diet Hole, a small shaft to a room about 7.5 feet below the ground
- * Survey was run past the hole and picked up a feature at 7.5 feet



* Glen Rose Limestone Exploration - Fill

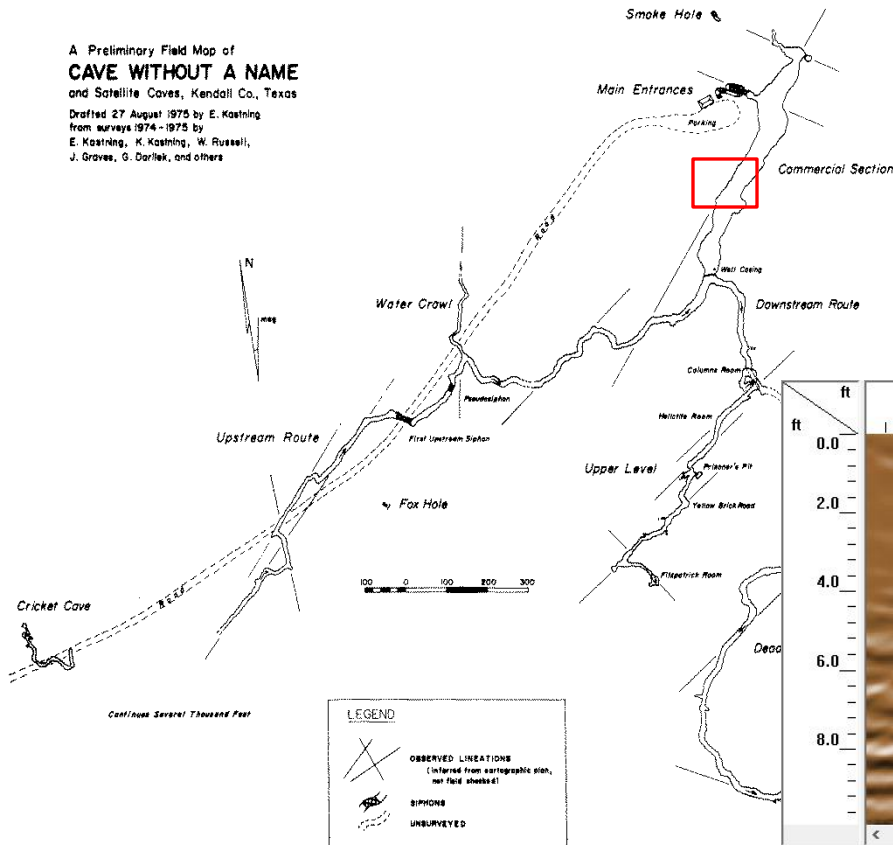
- * The area near a fissure sinkhole was surveyed
 - * Showed a set of signals equidistant from the line of the fracture
 - * Soil fill seems to break through a stratigraphic layer at about 4 feet deep
- * When survey was attempted during wet conditions:
 - * No surface features were detected
 - * The layer at 4 feet was undetectable



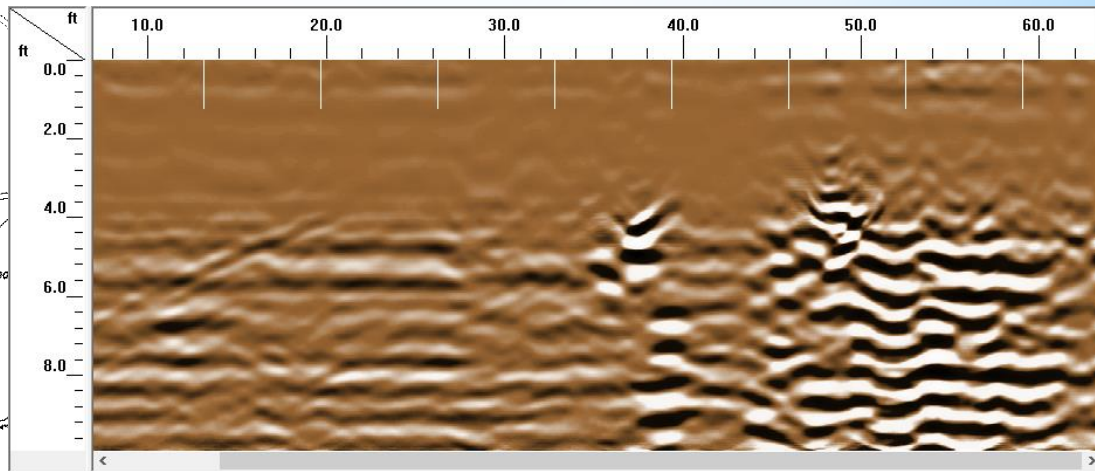
* Glen Rose Limestone - Detection of a Large Void

A Preliminary Field Map of
CAVE WITHOUT A NAME
and Satellite Caves, Kendall Co., Texas

Drafted 27 August 1975 by E. Koshling
from surveys 1974-1975 by
E. Koshling, K. Koshling, W. Russell,
J. Graves, G. Darilek, and others



* System was used to determine if the highest room in the cave could be detected.

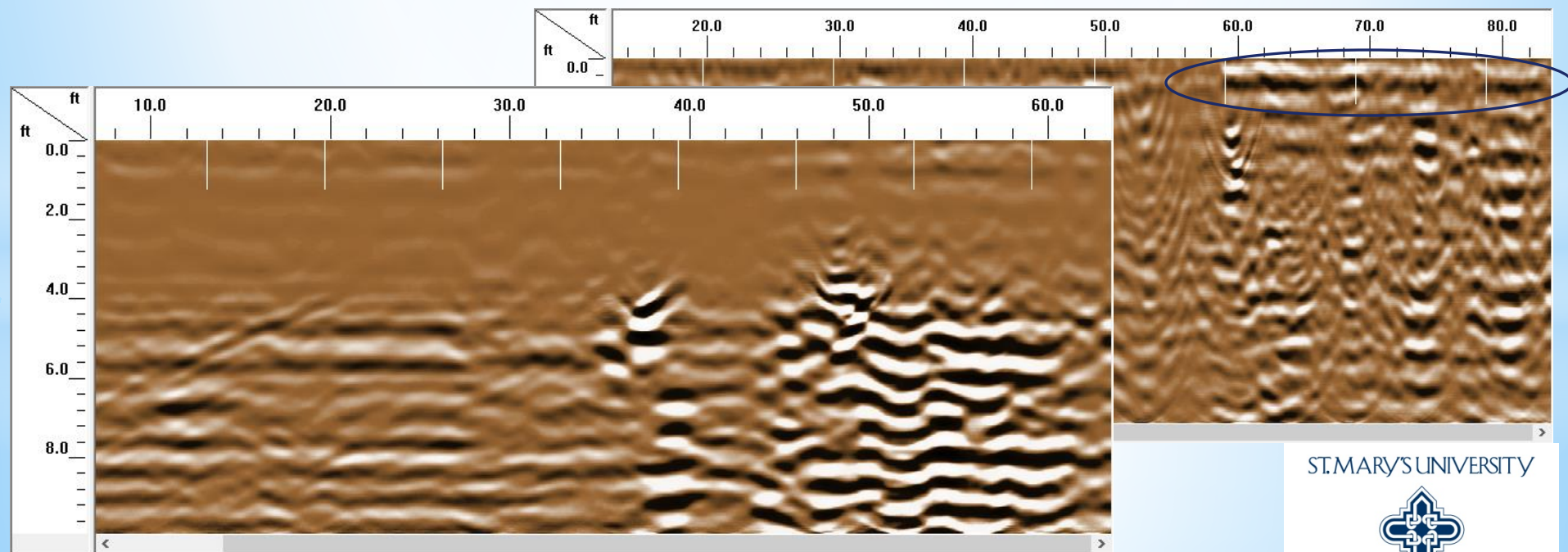


ST. MARY'S UNIVERSITY

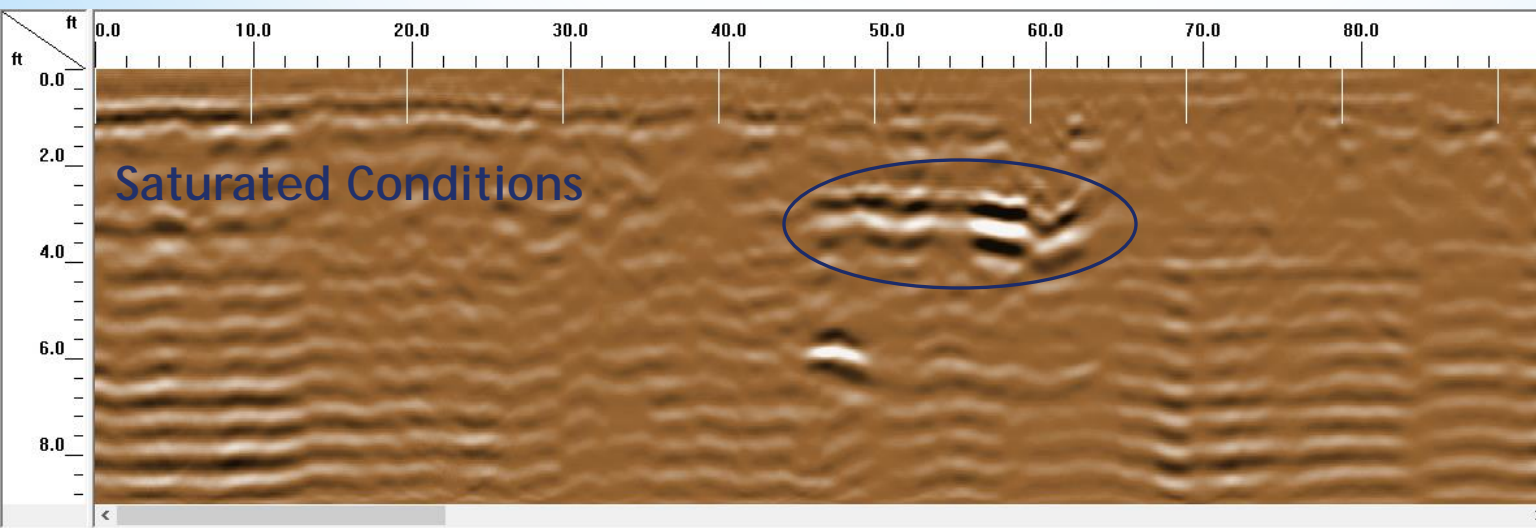
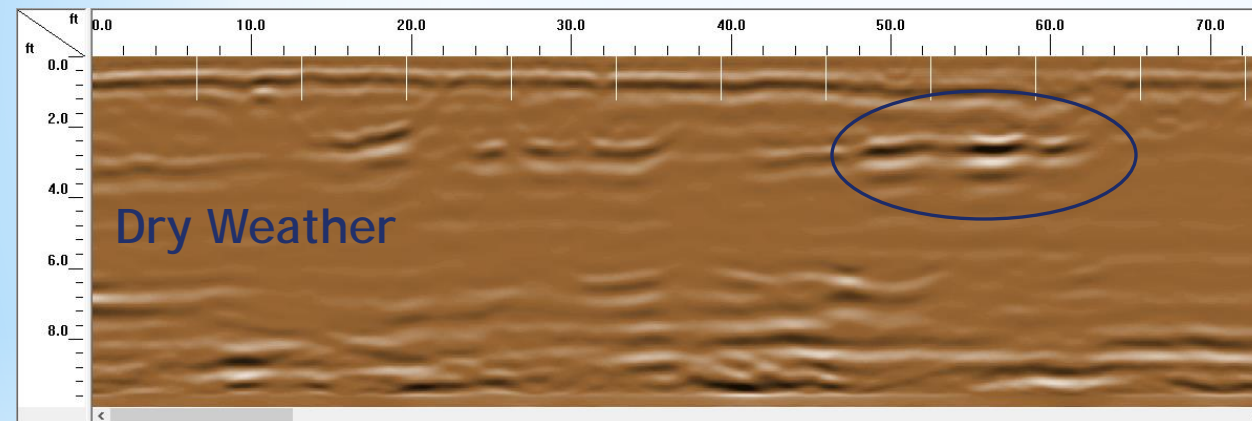


* Glen Rose Limestone - Detection of a Large Void

- * In Dry conditions, large voids were easy to detect, but the saturation of surface soils made it a challenge in saturated conditions.



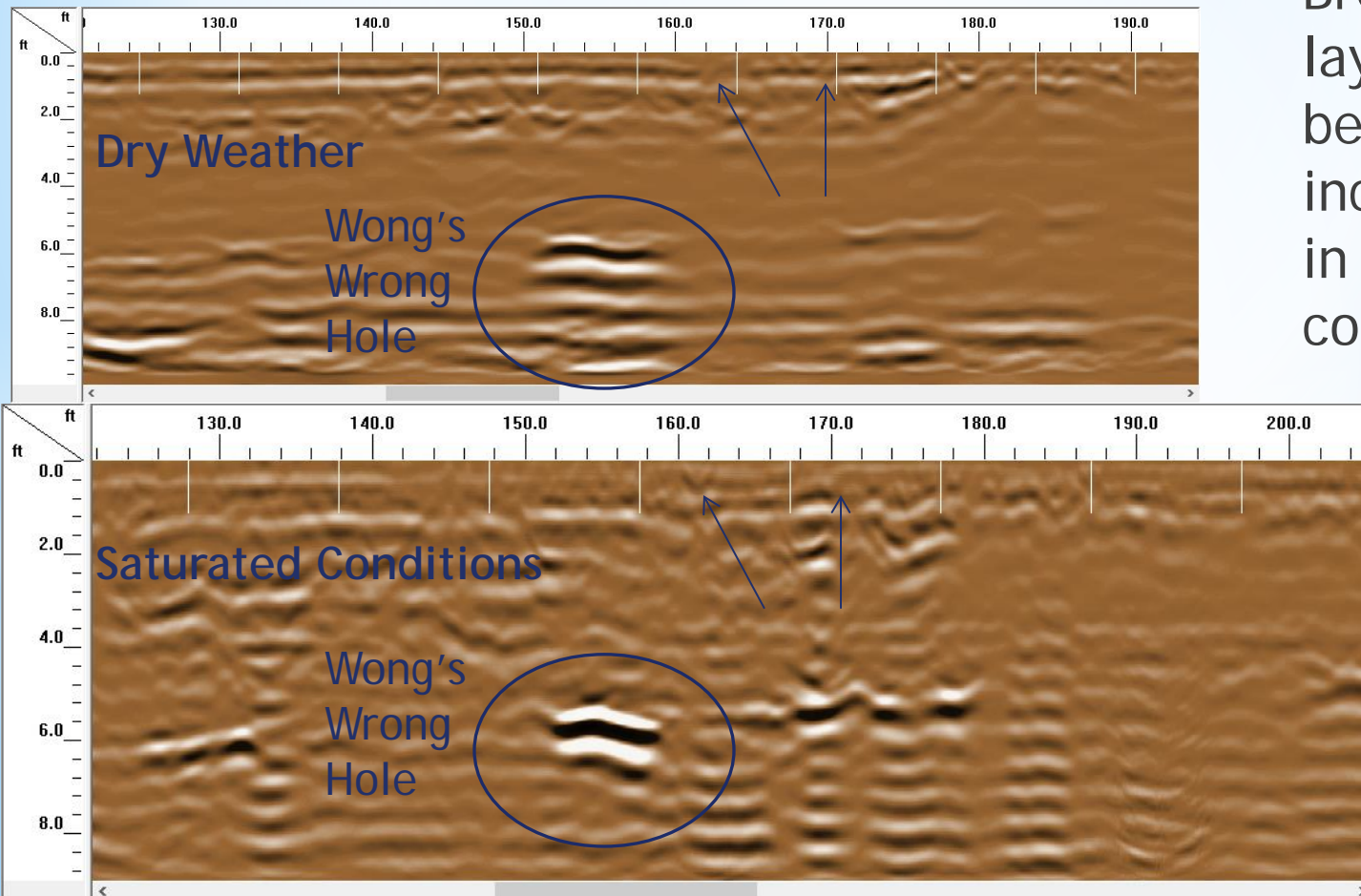
* Glen Rose Limestone Exploration - Surface Cracks



- * Range - 75 ns
- * Dielectric Constant - 11.17 dry, 13.54 wet
- * Obvious layering in the top image, but not as obvious in wet conditions



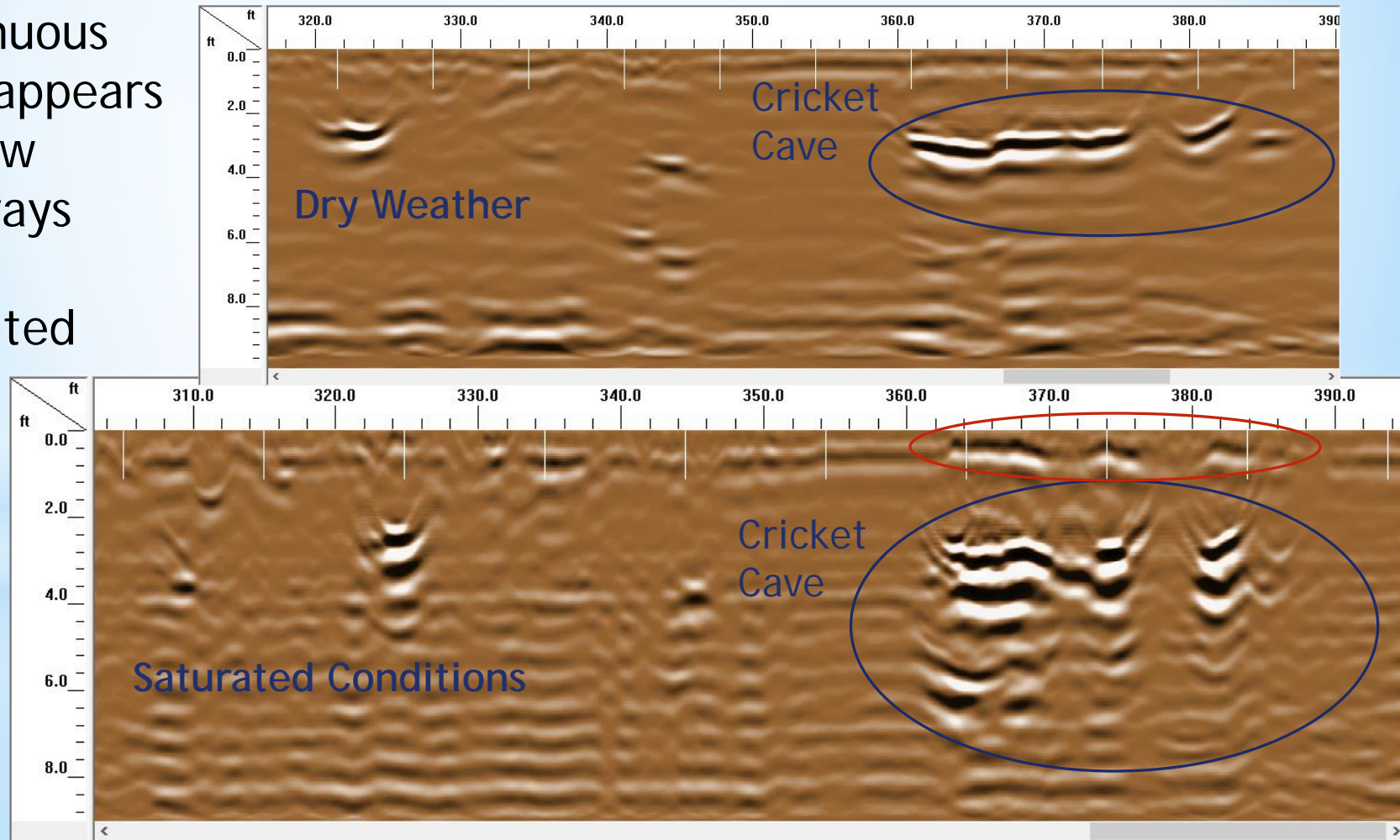
* Glen Rose Limestone Exploration - Surface Cracks



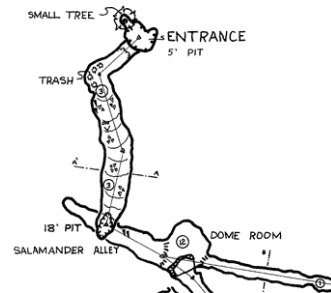
* Breakages in layering seem to be linked to increased signal in saturated conditions

* Glen Rose Limestone Exploration - Surface Cracks

* Continuous layer appears to show pathways when saturated



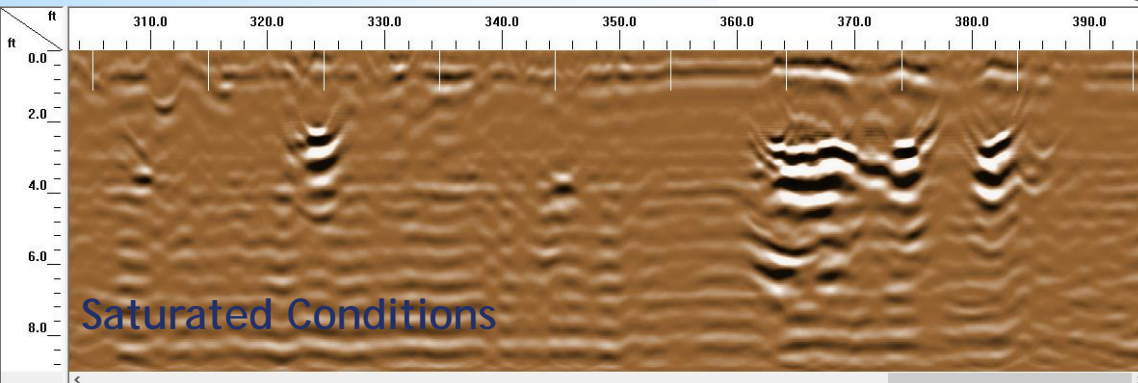
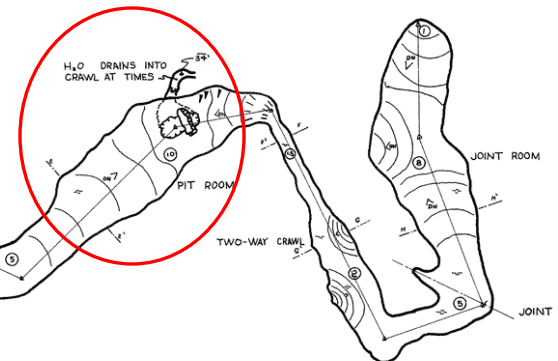
*Cricket Cave



CWTAE CAVE	HORNE RANCH	KENDALL CO. TEX.
COMPASS & TAPE : A. BRANDT - L. BRANDT - O. KNOX : 12-2-62 : PLOT - O. KNOX		

0 5 10 20
FEET

Noted area
where
water can
exist



ST. MARY'S UNIVERSITY



*Conclusions

- *The 270 MHz GGSI GPR is successful at detecting voids in both the Austin Chalk Limestone and the Glen Rose Limestone
 - *Dielectric constant is higher for the more clay rich material of the Austin Chalk
- *Based on the conditions seen in the Glen Rose Limestone, void detection will be easier in dryer soils
- *Comparing the images from the same features in dry soils and saturated soils may give indications of infiltration pathways in karst landscapes



*References

- *Wheeler, B. J., Groves, C. G., Kastning, E. H., Huppert, G. N., Veni, G., Duchene, H., Crawford, N. C., Olson, R. 2001. *Living with Karst: A Fragile Foundation*, American Geological Institute, pp. 69.

*Acknowledgements

- *The Albert and Margaret Alkek Foundation for funding for the GPR purchase
- *Joann De Luna for access to the Wurzbach Bat Cave property
- *Mike Burrell at Cave Without a Name for assistance with the project and access to the property.
<http://www.cavewithoutaname.com/>
- *The Texas Speleological Association for the cave maps



*Questions?

