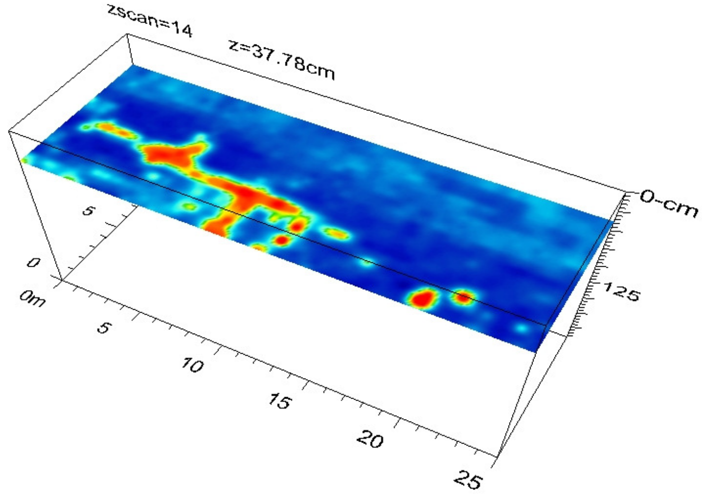
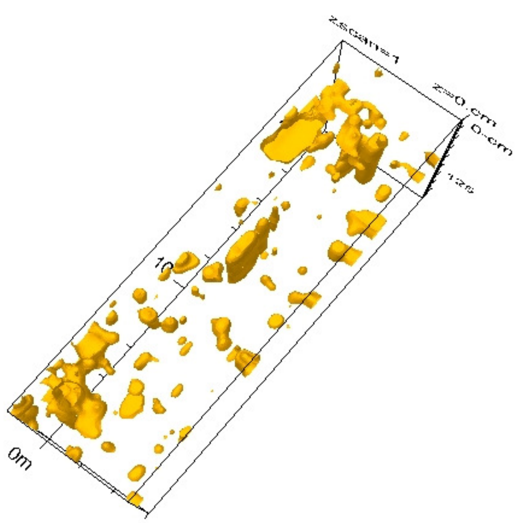
GPR Sample Survey at Palachacolas Town (38HA2), Hampton County, South Carolina





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The LAMAR Institute

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Introduction

Palachacolas Town (38HA2) is a large archaeological site located on the Savannah River bluff in rural Hampton County, South Carolina (Figure 1). This report details Ground Penetrating Radar (GPR) survey of a portion of this important archaeological site.

Palachacolas refers to a people and a place. The people were members of the Apalachicola tribe, who settled in two villages around 1680 on the lower Savannah River region. The tribe left the region by 1719 as a result of the Yamasee War (Swanton 1979; Caldwell 1948:321). The place refers to a prominent bluff on the Savannah River in present-day Hampton and Jasper counties, South Carolina, also known as Stokes Bluff.

The University of South Carolina at Lancaster conducted three archaeological field school seasons at Palachacolas Town and surrounding areas (Cobb 2009, 2011). During the 2010 season the field school discovered an interesting subsurface feature at the Savannah River bluff at 38HA2, which begged for additional study. The 2011 field session was taught by Kimberly Wescott. Student enrolled in the class attended the Columbia and Lancaster, South Carolina campuses. In 2011, the LAMAR Institute was invited to participate in this work by providing a GPR demonstration, in which field school students were familiarized with the technology and allowed to collected field data with the GPR equipment. Archaeologists selected a sample grid for the GPR survey on a portion of a large parking lot at the Stokes Bluff boat landing. Here, in 2010, field school students had located a large linear feature that was suspected to be a palisade ditch. The GPR survey sought to better define this feature and it extended out from the feature that was exposed at the Savannah River bluff. Another portion of 38HA2, located in a residential yard downstream from the main search area, also was covered by a GPR grid. The methods and results of the GPR study are detailed in this report.

Previous Research

Among the items collected in the 19th century by Colonel Charles Colcock Jones, Jr. were items from Palachacolas in South Carolina. The Peabody Museum collection contains a string of glass and shell beads that are attributed to Jones from Palachacolas, Jasper County, South Carolina. These are shown in Figure 2. The glass beads include wire and drawn and tumbled cane beads, which are typically associated with 18th century Native American sites in the Southeast. These beads were manufactured in Italy and shipped to America for the Indian trade.

Dr. Roland A. Steiner, another avid early antiquarian and proto-anthropologist from Georgia, also collected material from Palachacolas, South Carolina in 1901. Steiner's collection from this site, which includes beads and pottery vessels, is housed at the Smithsonian Institute (Figures 3 and 4). The collection was reconnoitered in 1993 by the author, as part of a long-term study of Steiner and his works (Elliott 2011).

Figure 1. Project Location Map.

Figure 2. Beads Collected by Charles Colcock Jones, Jr. from 38HA2.

Marmaduke Floyd, a local historian from Savannah, Georgia, made several visits to Palachacolas in the 1930s (Floyd 1937a-b). Floyd collected artifacts from the surface and made some excavations and documented cultural resources at areas of the bluff that were being eroded and destroyed by waters of the Savannah River. In 1937, Floyd also corresponded with anthropologist John R. Swanton, who was employed at the Smithsonian Institution in Washington, D.C. Marmaduke Floyd prepared and submitted to Swanton a, "Sketch of the present appearance at Pallachocolas called now Parachucla, or Stokes Bluff, on Savannah River, Hamton [sic, Hampton] County, South Carolina" in 1937. Floyd also created a "Sketch of elevation of a part of the bluff at Pallachocolas now called Parachucla or Stokes Bluff, Hampton County, South Carolina" in June, 1937 (Floyd 1937a-b). Floyd's letter to Swanton is transcribed below:

113 East Taylor St.
Savannah, Ga.
July 2, 1937

Dr. John R. Swanton,
Smithsonian Institution
Washington, D.C.

Dear Dr. Swanton:

Enclosed are two sheets and sketches from notes made at Pallacholas, or Parachucla, as the place is now called, where the beads came from that Mrs. Floyd and I left with you when we saw you a week or ten days ago. At the first opportunity we will try to secure and forward to you the other beads secured from the exposed burial by a negro man and a small boy. Also securing quite a few sherds by sifting the sand at the fort bluff.

For the past thirty years I have heard of the burials being exposed by the erosion of the bluff at Pallachocolas but my first visit there was in the spring of 1936. I have made five visits to the place since then and one or two partly exposed burials have been reported to me or seen by me since then on each visit. The house floors I saw last summer have fallen into the river. A much larger one is now visible which may remain in sight for several years. From now on I shall visit the place often and keep a record of whatever I can see without disturbing anything except surface potsherds and whatever is exposed by the elements. The collection of sherds is becoming astonishing.

Mrs. Floyd joins me in kind wishes.

Sincerely yours,

Marmaduke Floyd

Archaeologist Joseph R. Caldwell, accompanied by Marmaduke Floyd, conducted a brief examination of Palachacolas in 1939, which was documented in a brief journal article (Caldwell 1948). Caldwell's and Floyd's collections from the site are curated at the Smithsonian Institution. Caldwell was active in the lower Savannah River region as part of the

It is apparent from the observations of Floyd and Caldwell that the historic aboriginal occupation at 38HA2 was actively eroding into the Savannah River. Important cultural resources were being lost with a bare minimum of recordation.

Subsequent archaeological studies of the Palachacolas vicinity have yielded some additional proof of this historic Native American settlement. Leland Ferguson visited the site around 1971. Dennis Blanton made a small surface collection at the site in 1975. Chester DePratter and Keith Derting visited the site in 1989. Kathryn Bolen conducted a systematic shovel test survey of portions of the site in 1990. The results of these efforts by Ferguson, Blanton, DePratter, Derting, and Bolen were summarized in an *Early Georgia* article by Elliott (1991:71-72). The author made a brief visit to the site in 1990, but no artifacts were observed and no collection was made. The general consensus among professional archaeologists at that time was that Palachacolas was a lost cause, erased by modern land use and centuries of river erosion.

New Deal archaeology work. Site 38HA2 was peripheral to Caldwell's main geographic focus and he apparently never returned to the site for additional investigations. For the next two decades Palachacolas was completely neglected by professional archaeologists and no activities are documented there for the 1950s and 1960s.

That picture of 38HA3 began to change in 2009, when the University of South Carolina field school explored the site. Although their efforts at the Stokes Bluff landing in 2010 were quite limited, the students did manage to locate a tantalizing clue. A cross section of a large ditch-like feature was exposed at the river bluff. Charles Cobb, Chester DePratter, Chris Judge, James Legg, Kimberly Wescott and others suspected that this feature represented a palisade wall, likely associated with the historic Apalachicolas town. Plan and profile photographs of this feature are shown in Figures 4-6.The following year the LAMAR Institute was invited to explore this feature using non-destructive GPR technology.

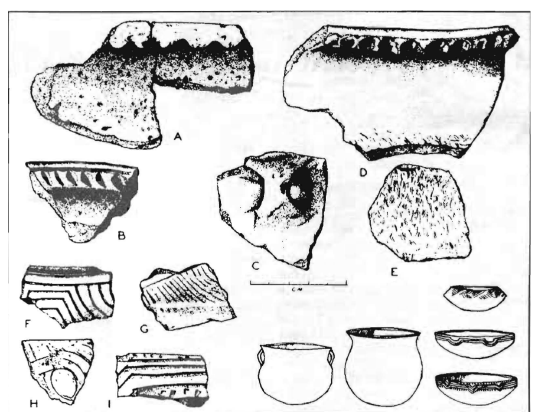

Figure 3. Historic Aboriginal Ceramics from 38HA2 (Caldwell 1948: Figure 1).

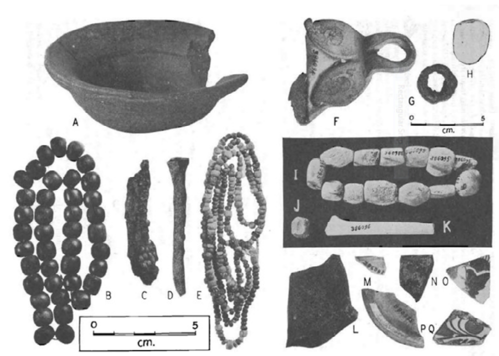

Figure 4. Examples of Artifacts from 38HA2 in the Smithsonian Institution (Caldwell 1948).

Figure 5. Possible Fortification Ditch, 38HA2 (Courtesy of Charles Cobb 2011).

Figure 6. Plan View, Facing South, of Feature 3, 38HA2 (Courtesy of Kim Wescott 2010).

Figure 7. West Profile of Feature 3, 38HA2 (Courtesy of Kim Wescott 2010).

Methods

The equipment used for this study consisted of a RAMAC/X3M Integrated Radar Control Unit, mounted on a wheeled-cart and linked to a RAMAC XV11 Monitor (Firmware, Version 3.2.36). A 500 megahertz (MHz) shielded antenna was used for the data gathering. MALÅ GeoScience's Ground Vision software (Version 1.4.5) was used to acquire and record the radar data (MALÅ GeoScience USA 2006). The radar information was displayed as a series of radargrams. Output from the survey was first viewed using GroundVision. This provided immediate feedback about the suitability of GPR survey in the area and the effective operation of the equipment. The same RAMAC X3M GPR system as that used in the present study has been used successfully by the author on numerous archaeological sites in the southeastern United States. The methods employed for the GPR survey were consistent with similar projects conducted by the LAMAR Institute.

Ground Penetrating Radar (GPR) is an important remote-sensing tool used by archaeologists (Conyers and Goodman 1997). The technology is particularly effective in mapping historic cemeteries. The technology uses high frequency electromagnetic waves (microwaves) to acquire subsurface data. The device uses a transmitter antenna and closely spaced receiver antenna to detect changes in electromagnetic properties beneath them. The antennas are suspended just above the ground surface and are shielded to eliminate interference from sources other than directly beneath the device. The transmitting antenna emits a series of electromagnetic microwaves, which are distorted by differences in soil conductivity, dielectric permitivity, and magnetic permeability. The receiving antenna records the reflected waves for a specified length of time (in nanoseconds, or ns). The approximate depth of an object can be estimated with GPR, by adjusting for electromagnetic propagation conditions.

The GPR samples in this study area were composed of a series of parallel transects, or traverses, which yielded a two-dimensional cross-section or profile of the radar data. These samples are termed radargrams. This two-dimensional image is constructed from a sequence of thousands of individual radar traces. A succession of radar traces bouncing off a large buried object will produce a hyperbola, when viewed graphically in profile. Multiple large objects that are in close proximity may produce multiple, overlapping hyperbolas, which are more difficult to interpret.

The GPR signals that are captured by the receiving antenna are recorded as an array of numerals, which can be converted to gray scale (or color) pixel values. The radargrams are essentially a vertical map of the radar reflection off objects and other soil anomalies. It is not an actual map of the objects. The radargram is produced in real time and is viewable on a computer monitor, mounted on the GPR cart.

GPR has been successfully used for archaeological and forensic anthropological applications to locate relatively shallow features, although the technique also can probe deeply into the ground. The machine is adjusted to probe to the depth of interest by the use of different frequency range antennas.

Higher frequency antennas are more useful at shallow depths, which is most often the case in archaeology. Also, the longer the receiving antenna is set to receive GPR signals (measured in nanoseconds, or ns), the deeper the search. The effectiveness of GPR in various environments on the North American continent is widely variable and depends on solid conductivity, metallic content, and other pedo-chemical factors. Generally, South Carolina's coastal soils have good properties for GPR application. This project represents the first application of GPR technology to archaeological sites in Hampton County, South Carolina.

GPR signals cannot penetrate large metal objects and the signals are also significantly affected by the presence of salt water. Although radar does not penetrate metal objects, it does generate a distinctive signal that is usually recognizable, particularly for larger metal objects, such as a cast iron cannon or man-hole cover. The signal beneath these objects is often canceled out, which results in a pattern of horizontal lines on the radargram. For smaller objects, such as a scatter of nails, the signal may ricochet from the objects and produce a confusing signal. Rebar-reinforced concrete, as another example, generates an unmistakable radar pattern of rippled lines on the radargram.

The time window that was selected allowed data gathering to focus on the upper 1.5 meters of soil, which was the zone most likely to yield archaeological deposits. Additional filters were used to refine the radar information during post-processing. These include adjustments to the gain. These alterations to the data are reversible, however, and do not affect the original data that was collected.

Upon arrival at the site on May 26,, 2011 the RAMAC X3M Radar Unit was set up for the operation and calibrated. Several trial runs were made on parts of the site to test the machine's effectiveness in the site's soils. Equipment settings and other pertinent logistical attributes included the following:

- Time Window: 80.7 ns
- Number of Stacks: 4
- Number of Samples: 632
- Sampling Frequency: 7,462.13 MHz
- Antenna: 500 MHz shielded
- Antenna Separation: 0.18 m
- Trigger: 0.04 m
- Radargram orientation: Block A-South to North; Block B-West to East; Block C-West to East
- Radargram progress: Block A-West to East; Block B-South to North; Block C-North to South
- Radargram Spacing: 50 cm
- Total Radargrams: Block A- 54; Block B-17; Block C-12
- Linear coverage (m): Block A- 448; Block B- 450; Block C-252

Weather conditions at the time of the survey were drought. No precipitation had fallen in the area for at least two weeks, so residual rainfall as shallow groundwater was not a significant issue. Furthermore, most of the area of Blocks A and B was asphalt pavement. The ground conditions at Block C were grass and other yard vegetation. Soils in all three GPR blocks were sandy loam and sand grading to sandy clay.

Figure 8. GPR Survey of Block B, 38HA3 (Courtesy of Charles R. Cobb 2011).

Three GPR blocks were collected by the survey team on May 26, 2011 and these were designated blocks A-C (Figures 7 and 8). The survey team was directed by Daniel Elliott and included several students in the USC at Lancaster field school. The specific details of the data collection for each sample block are presented in the following.

Figure 9. Modern Aerial View Showing Location of GPR Areas 1 and 2, 38HA2.

GPR Block A was located in the Stokes Bluff landing and parking lot at 38HA in GPR Area 1. This GPR block examined an area 26 m East-West by 8 m North-South. Radargrams were collected from south to north and progressed from west to east (Figure 10). Block A covered an area of 208 m^2. The starting point for Block A (Southwest corner) was at UTM 473341.39 E, 3602039.65 N. The ending point (Southeast corner) was at 473365.12 E, 3602049.19 N.

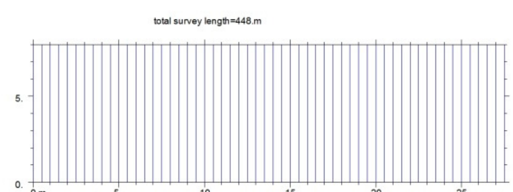

Figure 10. Radargram Plan of GPR Block A, 38HA2 (North is up).

GPR Block B covered nearly the same area of 38HA2 as Block A but the radar grams were collected along a West to East axis (Figure 11). The southwest corner of Block A served as the southeast corner of Block B, and the northwest corner of Block A served as the southwest corner of Block B. This block measured 8 m North-South by 25 m East-West. Block B covered an area of 200 m^2.

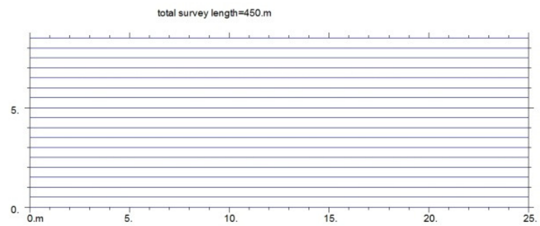

Figure 11. Radargram Plan of GPR Block B, 38HA2 (North is up).

GPR Block C was located on a residential lot, immediately downstream from the Stokes Bluff parking lot at 38HA2, GPR Area 2. Block C measured 21 m East-West by 5.5 m North-South. Block C covered an area of 115.5 m^2. Radargrams were collected from west to east and progressed from north to south (Figure 12). The starting point for Block C (Northwest corner) was at UTM 473468.77 E, 3602077.33 N. The ending point (Northeast corner) was at UTM 473468.99 E, 3602072.33 N.

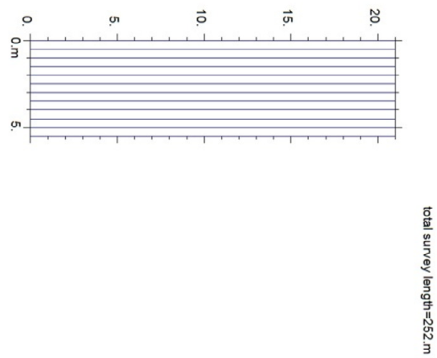

Figure 12. Radargram Plan of GPR Block C, 38HA2 (North is to right of page).

The GPR data from Blocks A, B and C were post-processed using GPR-Slice software. This imaging software, developed by Dean Goodman, is the industry leader. Goodman and this author collaborated on several previous GPR surveys in Georgia, which resulted in refinements in the GPR-Slice processing capabilities.

GPR Survey Results

GPR Block A revealed several potentially cultural subsurface features that may relate to the early settlement at 38HA2. These are evident in Figure 13. The most prominent feature is a linear form, which extends from the western edge of the grid block to 17 m east. This feature varies in width from less than 50 cm to about 1 m. Two well defined circular features are positioned about 4 m and 5 m east of the linear feature. The circular features are approximately 1 m in diameter.

GPR Block B covered most of the same ground as GPR Block A but the radargrams in Block B were collected along a west to east axis, perpendicular to the collection method in Block A. Consequently, radar plan maps from these two sample blocks are similar in many respects. Two overlay plan views from Block B are shown in Figures 14and 15. The linear feature and the two circular features observed in Block A are also clearly visible in Block B. An additional linear feature, which is oriented perpendicular to the main linear feature, appears in Block B. This second linear feature is similar in width to the first one and it extends approximately 3 m to the southern edge of the sample grid. The second overlay plan view of block B continues to show these linear and large circular features, along with many additional features, including several of possible cultural origin.

The most pronounced linear feature that is imaged in Blocks A and B may represent a fortification ditch that once surrounded an aboriginal town. Alternatively, it may be associated with the South Carolina Ranger fort that was built here soon after the Apalachicolas had abandoned the region. Additional excavation would be needed to fully determine its age and function.

GPR Block C explored an area east of the Stokes Bluff landing parking lot in what is the yard of a residence. The sample covered an area 21 m north-south by 5.5 m east-west. Radar anomalies within Block C included numerous circular and irregular-shaped features. These are evident in Figure 16. These were not homogenously distributed but were most concentrated in the southwestern portion of the sample block. The largest anomaly in this cluster is irregular in plan outline and it may represent a large tree disturbance. Several smaller circular anomalies in this cluster are more likely of cultural origin. A secondary cluster, composed of irregular-shaped anomalies, was located in the northwestern portion of the block. While some of these anomalies may be cultural in origin, no clearly obvious structure patterns were observed. In general terms, the subsurface in the vicinity of Block C is less active than that observed for Blocks A and B. The GPR data in Block C do not indicate the presence of any fortification ditch. Some of the radar anomalies may represent features associated with aboriginal households.

GPR technology shows great promise for understanding the buried cultural resources at Palachacolas town (38HA2). A tantalizing glimpse of the site’s subsurface is shown in Figure 17, in which GPR data from Blocks B and C are superimposed on an aerial view of the archaeological site. The soils are conducive for excellent imaging of radar anomalies.

Although the site's buried resources were damaged by the grading and construction of the large parking lot and boat landing, and by centuries of riverbank erosion, the GPR data indicates considerable resources may remain intact. The shallow geophysics at 38HA2 represents a non-destructive means for mapping, understanding and managing these important cultural resources. A complete remote sensing map of 38HA2, including GPR, EM, Soil Conductivity and other non-invasive techniques, is highly recommended.

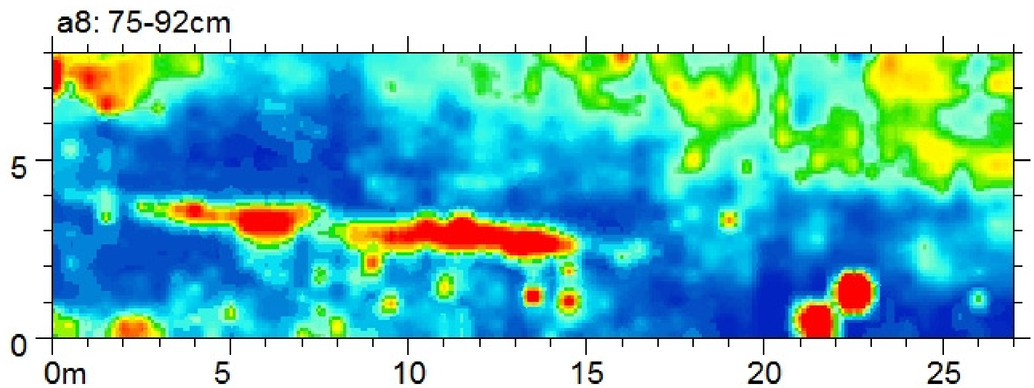

Figure 13. Plan of GPR Block A, 75-92 cm Depth, 38HA2.

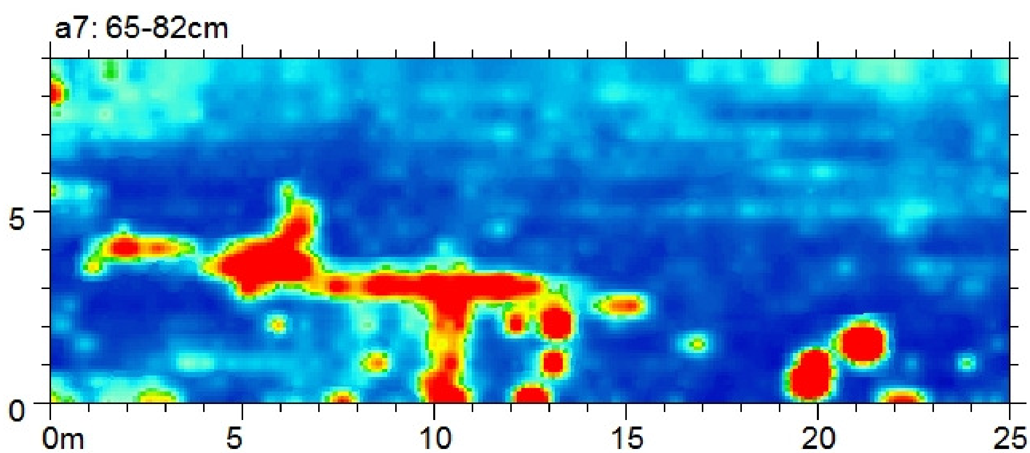

Figure 14. Plan of GPR Block B, 65-82 cm Depth, 38HA2.

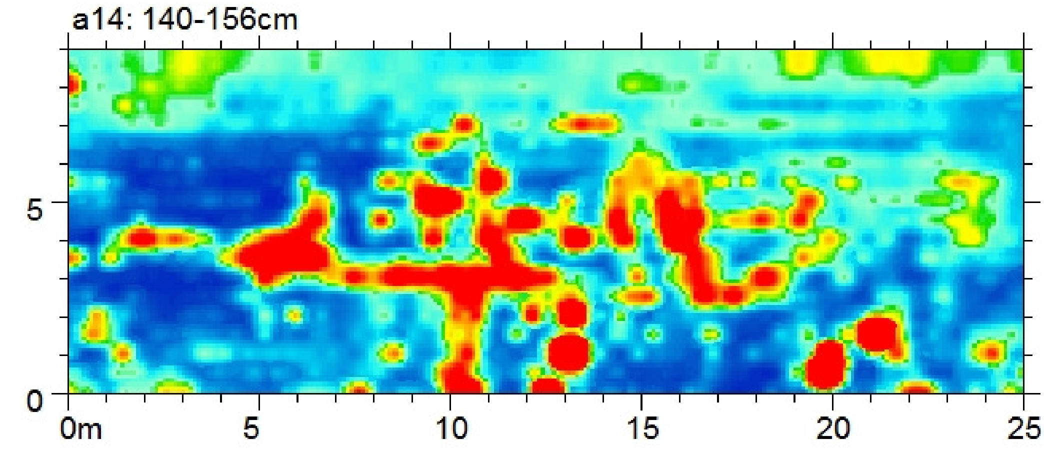

Figure 15. Plan of GPR Block B, 140-156 cm Depth, 38HA2.

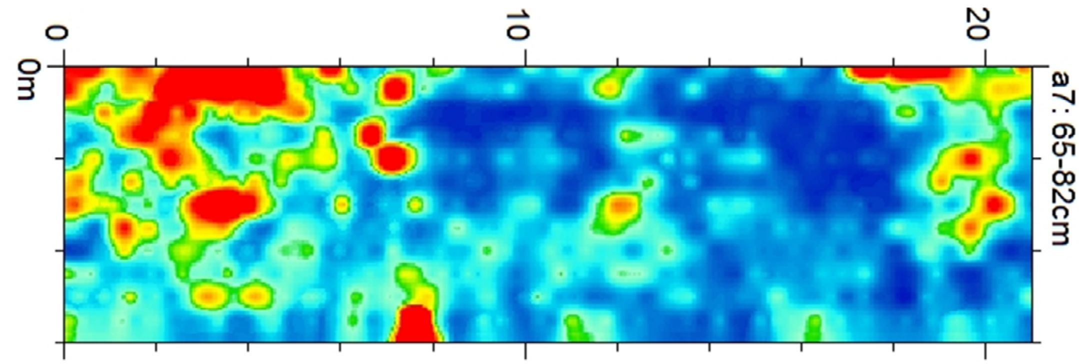

Figure 16. Plan of GPR Block C, 65-82 cm Depth, 38HA2.

Figure 17. GPR Views of Blocks B and C on Aerial of 38HA2.

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