Ground Penetrating Radar Survey Report:

Ancient Native American Canal System
Ortona, Florida

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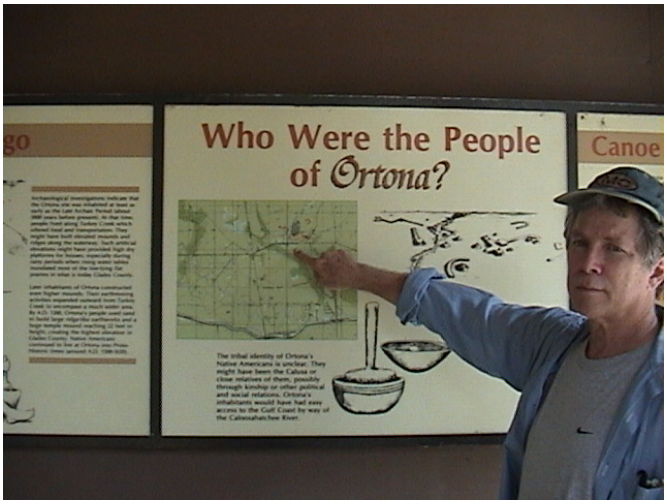
Introduction

Ortona Sand Company in Ortona, Florida, in adherence to Florida law, has contracted the Archaeological and Historical Conservancy, Inc. (AHCI) to complete an archaeological survey of a nearby area in which it wishes to expand its lake. Archaeological excavations and surveys have been completed by AHCI which show evidence of an ancient canal system which has been elsewhere documented and studied since the 1800's. At the request of Bob Carr, Executive Director of AHCI, a ground penetrating radar (GPR) survey was completed by Mnemotrix Systems, Inc. to aid in the further understanding of this ancient canal system seen in the sub-surface.

It is known that Native Americans populated this region as far back as 200 – 400 AD, and that they built a large man-made canal system to circumvent traffic from a nearby river, and take them from surrounding areas to their "town" center. The canal system is too large to excavate in its entirety, but is important as the major feature left behind from this old Caloosa Indian culture. Therefore if it is possible to see a sub-surface signature in terms of GPR signal imaging, it would make it feasible to consider ways of identifying the course of this canal and perhaps others in similar terrain in other regions, without the need to do a complete excavation.



What follows is a report of the results from this geophysical survey, where it was found that such a signature, at least in this case, could be seen rather clearly.

Actions Taken

During test excavations completed by AHCI, remnants of an ancient canal system dating to 400 AD were discovered. According to Mr. Carr, the canals run throughout the archaeologically surveyed area and were seen in test trenches, in addition to being clearly seen on the surface terrain of the site. Because GPR has proven to be an efficient means of imaging the sub-surface of a large area before excavation, it was hoped that by completing a GPR survey of a known canal, this would enable geoarchaeologists to identify other signature areas of the canal system non-invasively and economically.

The test area is characterized by dry, sandy soils, wet sandstone, limestone, a high iron content, in addition to a distinct hardpan horizon, and water table about three feet below the surface. Through excavation, it was found that the ancient canal cut shallowly into the hardpan and then rose to the surface. According to excavation, the canal was about three feet deep. In the area chosen for the GPR survey, the canal ranged from 10-15 feet wide on the surface.

The area of the site was first cleared of large plants and a 30 x 50 foot grid was laid out. This grid was then recorded into the AHCI survey notes of the entire area surveyed. Seen in the picture above is a part of the area surveyed with guide lines superimposed in red. North is in the direction of the white sand in the foreground.

Surveyed Area

A 400 MHz GSSI (Geophysical Survey Systems, Inc.) antenna was chosen for all GPR work at this time with a 60 NS (nanosecond) time window. The profile settings were chosen to provide a shallow setting which would focus with high resolution at a relatively shallow depth of three to nine feet below the surface. The survey lines were spaced 1.5 feet apart.

Within the grid, which was marked out in the dimensions of 30 feet (roughly East-West) by 50 feet (roughly North-South), GPR signal data was acquired in a set of 21 parallel lines taken South to North, then North to South, in a zig-zag pattern moving East from the origin point. These profile lines were put together into a 3D cube for follow-up study in a post-processing environment. During post-processing, the GPR signal data collected was analyzed closely as to depth (vertical axis) and movement along the horizontal axis in a 3D cube.

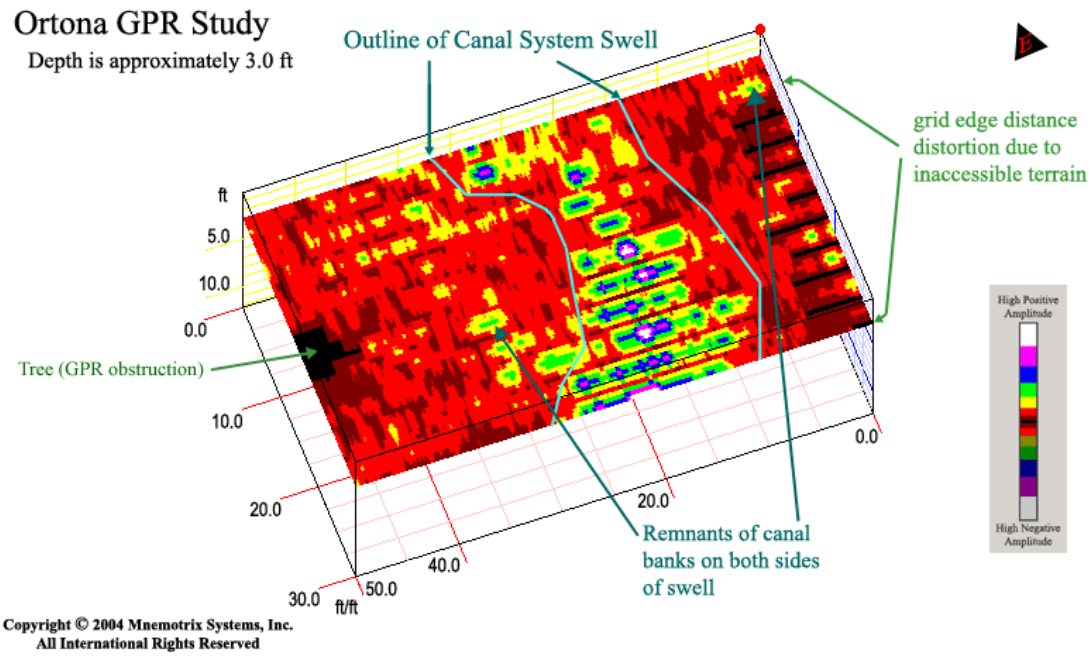
The direction of this grid was chosen in order to transect the known feature of the canal, which runs in this area in an approximate E/W direction.

Visualization and Analysis

During post-processing several features were able to be seen. Our prime goal was to locate and image the remnant canal system in the GPR grid that had been excavated by AHCI in a nearby location, and was assured to be continuing beneath the surface of our chosen area.

The deepest part of the canal (the swell) seemed to cut directly into the iron-rich hardpan sediment layer near the surface. This outline is shown in GPR Figure 1 below,

along with remnants of the canal's shallow banks. The deepest part of the swell is evidenced in the GPR survey as white areas (high amplitude reflections).

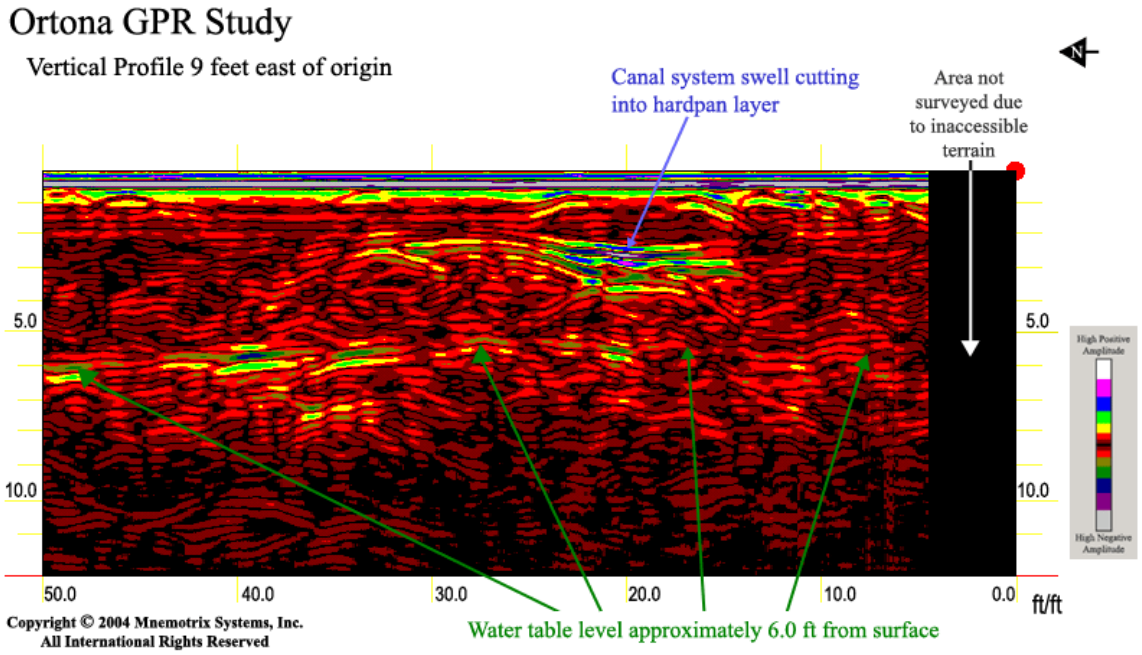


GPR Figure 1

It is here important to note that high positive amplitude colors on the GPR maps and depth profiles signify a strong reflection of the material, while low positive amplitude colors signify a weak reflection in the surrounding material or matrix. Each positive amplitude color has a reciprocal negative amplitude color, and can be seen in the color table included in the figures. Low positive and negative amplitude colors also signify an object or feature of homogenous material. Where colors of white, magenta, or blue are present, there exists a strong difference between layers of sub-surface material, which can be viewed as an anomaly.

Based on the known sediments in the area of the GPR study, an approximate depth is known. A full depth analysis was not able to be acquired while in the field, and

as such, we have relied on an approximate depth scale according to the geologic sediments recorded by AHCI through excavation. In GPR Figure 2, the hardpan layer is a strong reflector and is located about three feet below the surface.



GPR Figure 2

The water table also shows up as a horizontal reflection across the vertical profile about six feet below the surface. This is not out of accord with field observations which had been made by Mr. Carr and his team, who had seen the water table elsewhere in the site at about three or more feet below the surface, along with seeing the hardpan layer evident at a shallower depth (i.e. less than three feet).

Due to some variation in length of acquisition lines (due to inaccessible terrain consisting of tree stumps and other plants), our 3D view as seen in GPR Figure 1 contains some distortion on the south end which we did not have the opportunity to reconcile. Regardless of this distortion, the overall feature of the canal appears to be clear, with

some portions of the south bank remnants accurate within a maximum N/S displacement of five feet. It is likely that some of the canal remnants pointed out on the south side in GPR Figure 1 are in fact a few feet farther to the north. Nevertheless, the overall shape and signature of the canal can be clearly seen as the large sub-surface feature that it is.

Summary and Recommendations:

Before doing the survey, we did not know how much clay or water would present an interference to useful GPR signal acquisition. However, we were very pleased to see how relatively easy it was to acquire a GPR grid which could show us the shape and course of the canal in this area. As it is known that the canal continues for many miles, this makes it plausible to believe one could chart the course of the canal by spot-checking intermittent areas to find where a similar GPR signature shows the probability of the canal remnants continuing underground in a particular direction. A public hiking trail or other such marking could then be posted to record this historic feature for posterity, even as civilization continues to grow around it.

Additionally, we have found from doing GPR surveys in the Florida area, that there seems to be a consistency to data acquisition in different areas. Therefore we are hopeful that looking for canals in other areas might also appear with a similar signature that could make such investigations possible without causing much interference in the plans of daily life here in Florida.