

United States            Soil  
Department of        Conservation  
Agriculture            Service

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Subject: Ground-penetrating radar  
          archaeological site investigation  
          of Old Fort Congaree, Cayce, SC;  
          March 19 to 24, 1989.

Date: March 28, 1989

To: Billy R. Abercrombie  
      State Conservationist  
      SCS, Columbia, SC

File code:330-20

**Purpose:**

To determine the effectiveness of the ground-penetrating radar (GPR) techniques for detecting areas of historic, massive soil disturbances in areas of forested, alluvial soils along a major flood plain.

**Participants:**

Jim Doolittle, Soil Specialist (GPR), NENTC, SCS, Chester, PA.  
Jim Michie, Archaeologist, South Carolina Institute of  
            Archaeology, USC, Columbia, SC.

**Location:**

Fort Congaree was an earthen fortification built in 1718. It briefly served as a major trading center until its abandonment in 1722. The location of the fort has been poorly preserved. However, the general location of Fort Congaree is believed to be near Columbia, South Carolina, in an area bounded by the Congaree River and Congaree Creek.

**Activities:**

The GPR unit arrived in Cayce during the evening of 19 March 1989. Sites believed to be probable locations of Fort Congaree were viewed and a plan for a GPR survey was developed during the morning of 20 March. The most probable of these sites was prepared for an intensive GPR survey on 20-22 March. This site had been clear-cut. However, it was covered by dense brush and fallen timbers. Four, 700 foot transect lines were established across this site. The brush was cleared and 284 observation flags were placed at 10 foot intervals along the lines. The GPR survey was completed on 22 March. At the conclusion of the survey, preliminary interpretations of the graphic profiles were made in the field. On 23 March, random, "wild-cat" surveys were conducted across two additional sites. The GPR unit returned to Chester, PA, during the night of 23-24 March.

## **Equipment:**

The equipment used was the SIR-System-8 radar. This unit consists of the model 4800 control unit, ADTEK SR-8004H graphic recorder, and the ADTEK DT-6000 tape recorder. In addition, the 120 MHz antenna with the 705DA transceiver was used. The unit was mounted in a 4WD-vehicle and powered off of a vehicular battery. The antenna was towed behind the vehicle at an average speed of about 3 km/h. The scanning time on the control unit was set at 80 nanoseconds (ns). This provided a one-way scanning time of 40 ns and a profiling depth of about 5 feet (based on a calculated velocity of propagation of 0.13 ft/ns)

A 500 MHz antenna was available for this study. Compared with the 120 MHz antenna, this antenna provides higher resolution of subsurface features but is more depth restricted. As the principal concern of this investigation was locating the forts rather than charting internal features within a delineated site, the 500 MHz antenna was not used.

## **Discussion:**

The GPR performed well and provided highly resolved imagery of the subsurface at each site to depths of 5 feet. The identity of many of these images will be confirmed through ground-truth observations conducted by James Michie.

Numerous subsurface features were recorded on the graphic profiles. The identity of some of these images were confirmed in the field. The images are from subsurface interfaces. These interfaces are categorized as being either linear or point reflectors. Linear reflectors are generally broader than one meter and represent soil horizons, geologic strata, and layers of debris or earthen fill. Smaller objects, such as stones, roots, buried artifacts or foundation walls (when crossed perpendicular to their long axis) having limited horizontal extent produce hyperbolic images and are referred to as point reflectors.

Earthen embankments and areas of fill materials or unique occupational history will produce linear, subsurface reflections. While many subsurface reflection are apparent on the graphic profiles and their patterns of occurrence may be attributed to the fort, none could be readily and unmistakably identified as belonging to Fort Congaree.

Care must be taken in making interpretations from the GPR profiles. The profiles contain detailed and complex imagery. It is very easy to read too much into these profiles or to extend our interpretations too far. Also, it is very possible that the fort is situated in an area not surveyed. Over two hundred and sixty years of biological activities and fluvial processes may have erased much of the fort. Many of the numerous short and often segmented strata appearing on the graphic profiles are related to fluvial processes and clear-cutting operations, and produce reflections similar to earthen embankments or buried cultural strata. Tree roots and buried stumps produce hyperbolic patterns similar to walls or small buried artifacts.

## Results:

The GPR provided almost two miles of highly resolved graphic profiles from probable sites of old Fort Congaree. These profiles have been turned over to Jim Michie and the South Carolina Institute of Archaeology and Anthropology for further analysis. The graphic profiles will help to facilitate exploratory planning, locate observation points, and expedite field work. With sufficient ground-truth observations, these profiles may help to reduce field work and to pinpoint the location of Fort Congaree or buried artifacts.

This field experience provided an excellent opportunity to further understand the areas of GPR applications, to improve GPR interpretations, and to maintain SCS's position of technological leadership in site evaluations with the GPR. The opportunity to work with Jim Michie on an archaeological investigation was most rewarding.

James A. Doolittle  
Soil Scientist (GPR)

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