North Carolina Archaeological Society

Newsletter

4619 Mail Service Center, Raleigh, N.C. 27699-4619

SUMMER 1999, Volume 9, Number 2

Geophysical Surveys In North Carolina Archaeology

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Archaeologists borrow eclectically from many fields of science and technology, including chemistry, geology, botany, zoology, climatology, medical research, computer science, and physics. From applied physics and computer science, we have learned to use radar and advanced photographic techniques to detect some types of archaeological sites from airplanes and orbiting satellites. Closer to earth we have learned how to sweep the ground surface for small magnetic or electrical disturbances and translate those anomalies into the signs of buried walls, pits, ditches, and other features. In North Carolina, Archaeological Research Consultants, Inc. has used these near-surface geophysical survey techniques on several archaeological sites.

Magnetometers detect cultural anomalies in the form of patterned, localized disturbances set against the background magnetic field. Substances that produce distinctive magnetic anomalies include ferromagnetic artifacts (iron, for example) or iron oxides such as hematite, magnetite, and maghemite. When soils, clays, or stones with some magnetic mineral content are subjected to intense heat (as in a prehistoric hearth, a chimney, or a pottery kiln), they become strongly magnetic and stand out as anomalies (Clark 1990).

Pottery kiln sites are especially good subjects for magnetometer surveys because their walls, floors, and contents are made of clays that have undergone intense and repeated firings. In 1997, we had the opportunity to use the magnetometer to look for a significant kiln site near New Salem in Randolph County. The William Dennis pottery kiln site (31RD981**) is near the present-day New Salem pottery of Hal and Eleanor Pugh (Pugh 1988). The remains of the kiln, which produced earthenwares from the 1780s into the 1830s, are in a grassy field with no surface traces of the kiln structure. Its exact location was unknown two years ago. In November 1997, we worked with Linda Carnes-McNaughton, Eleanor Pugh, Hal Pugh, and Tom Beaman to pinpoint the kiln's location. The survey instrument was a Geoscan FM 18 fluxgate gradiometer, which uses a pair of magnetometers: a lower, measurement detector for sensing localized magnetic disturbances, and an upper, reference detector for keeping track of background magnetic changes. After we set up the 20-meter square grid, the fluxgate gradiometer survey took about an hour to collect 3,200 magnetic readings, which were processed on the spot with a laptop computer. The results showed a well-defined, highly positive magnetic anomaly, a classic kiln signature (Figure 1). From the printouts, we speculated that the kiln might be round. Later excavations by Linda Carnes-McNaughton and volunteers confirmed that this anomaly was the kiln, but that the walls formed a 10-foot-square kiln, constructed of large fieldstones and lined with brick (Linda Carnes-McNaughton, personal communication).

Resistance meters transmit small electrical charges through the ground and measure the different rates of electricity's passage through the soil and through cultural features in the soil. Under the right conditions and with appropriate sampling intervals, these features can show up as more resistant or less resistant anomalies set against a natural background. Moisture is the crucial factor. Buried stone foundations that shed water will show up as dry, highly resistant anomalies set in wetter, low resistance soil, and buried ditches that tend to retain more water show up as low resistance anomalies (Clark 1990).

In 1997, we tried a resistivity survey and a magnetometer survey at the Pettigrew site (31OR464; RLA-OR412) on the campus of the University of North Carolina at Chapel Hill. The university had scheduled the construction of a new building on the site near Franklin Street, and the Research Laboratories of Archaeology planned to carry out excavations in the summer of 1997. A fraternity house occupied the site at the last turn of the century, but RLA archaeologists suspected that the site might contain remains connected with the early history of Chapel Hill and the university. The upcoming excavations offered an excellent opportunity to carry out a geophysical survey followed by "ground-truthing," so ARC conducted the surveys one Sunday morning before the start of excavations. We used a Geoscan RM 15 resistivity meter to look for archaeological features in a square measuring 20 meters (about 66 feet) on a side, taking resistance readings at half-meter intervals, resulting in 1,600 samples across the site. This spacing allowed us to complete the 0.1-acre survey in about one hour and 15 minutes.

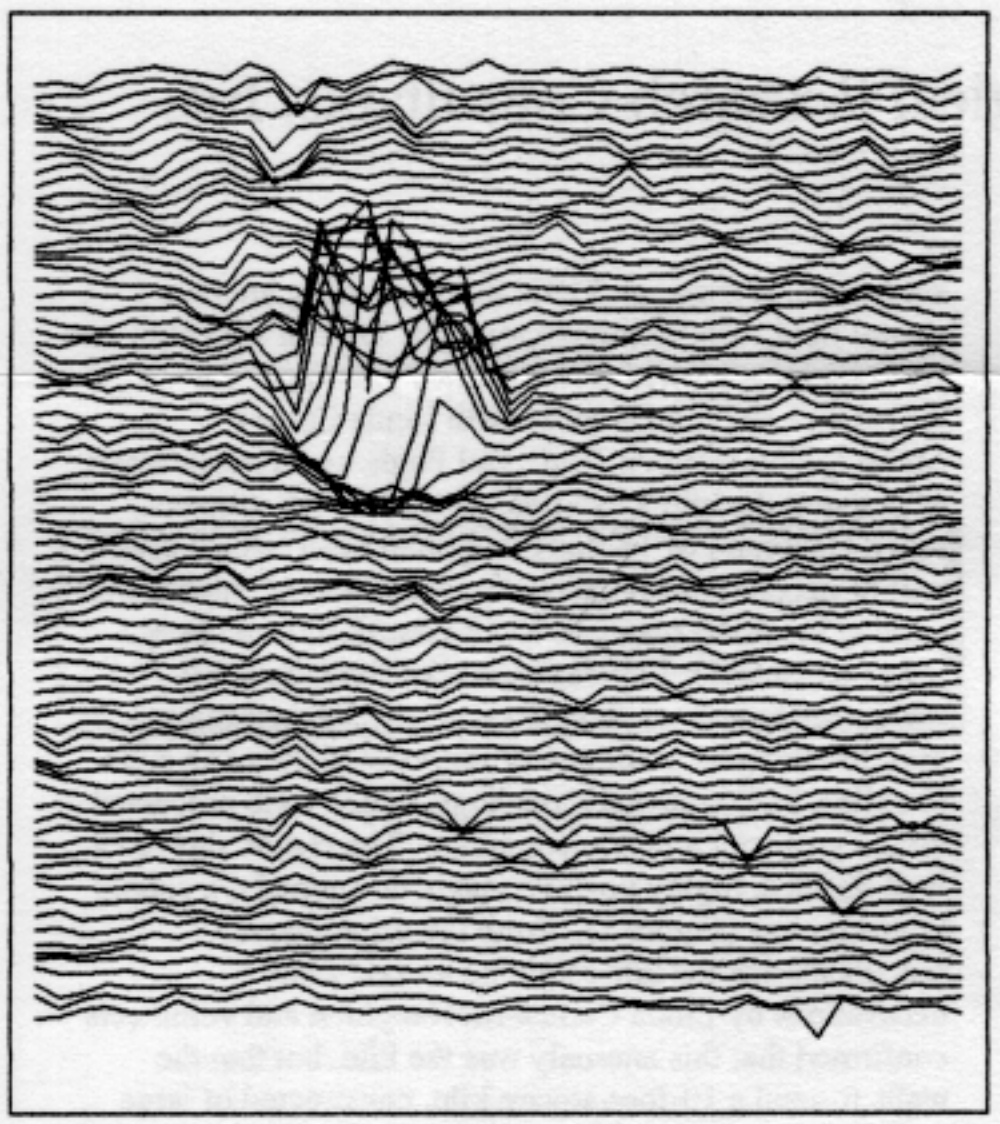

Figure 1: The magnetometer survey of the William Dennis pottery kiln site.

The resistivity results provided a window into the soil and a look at stone foundations that turned out to be the remains of "The Poor House," a hotel-like structure built with private backing to house university students in the ante-bellum period. (The full story of The Poor House and its excavations can be found on the RLA's Web site – http://www.unc.edu/depts/rlaweb/) Figure 2 shows the resistivity survey results compared with the feature map drawn after the RLA excavations (Jones et al.1998: Figure 23). Most of the stone foundations and chimney bases show up clearly as dark, high resistance anomalies set against damp clay. The linear, low resistance (lighter) anomalies turned out to be utility trenches dug through the site and later filled with moisture-retaining dirt.

Geophysical surveys are still novelties in North Carolina archaeology, but they have demonstrated that the techniques work well in finding features on a variety of sites. The techniques don't work equally well, however, on all types of sites. At the Pettigrew site, for instance, the magnetometer survey readings were overwhelmed by extreme magnetic anomalies created by metal utility pipes and underground electrical lines. Resistivity surveys may fail on sites where extended drought has completely dried out the soil. The strict sampling requirements mean that surveys normally cannot be carried out on sites covered by trees or vines dense enough to block the survey lines. For many North Carolina sites, however, geophysical survey remains a potentially important if still unrecognized tool for discovery.

Clark, Anthony
1990 *Seeing Beneath the Soil: Prospecting Methods in Archaeology*. B.T. Batsford, London.

Pugh, Hal E.
1988 The Quaker Ceramic Tradition in the North Carolina Piedmont: Documentation and Preliminary Survey of the Dennis Family Potters. *The Southern Friend: Journal of the North Carolina Friends Historical Society* 10(2): 1-26.

Jones, Elizabeth A., Patricia M. Samford, R.P. Stephen Davis, Jr., and Melissa A. Salvanish
1998 Archaeological Investigations at the Pettigrew Site on the University of North Carolina Campus, Chapel Hill, North Carolina. *Research Laboratories of Archaeology, Research Report* 20.

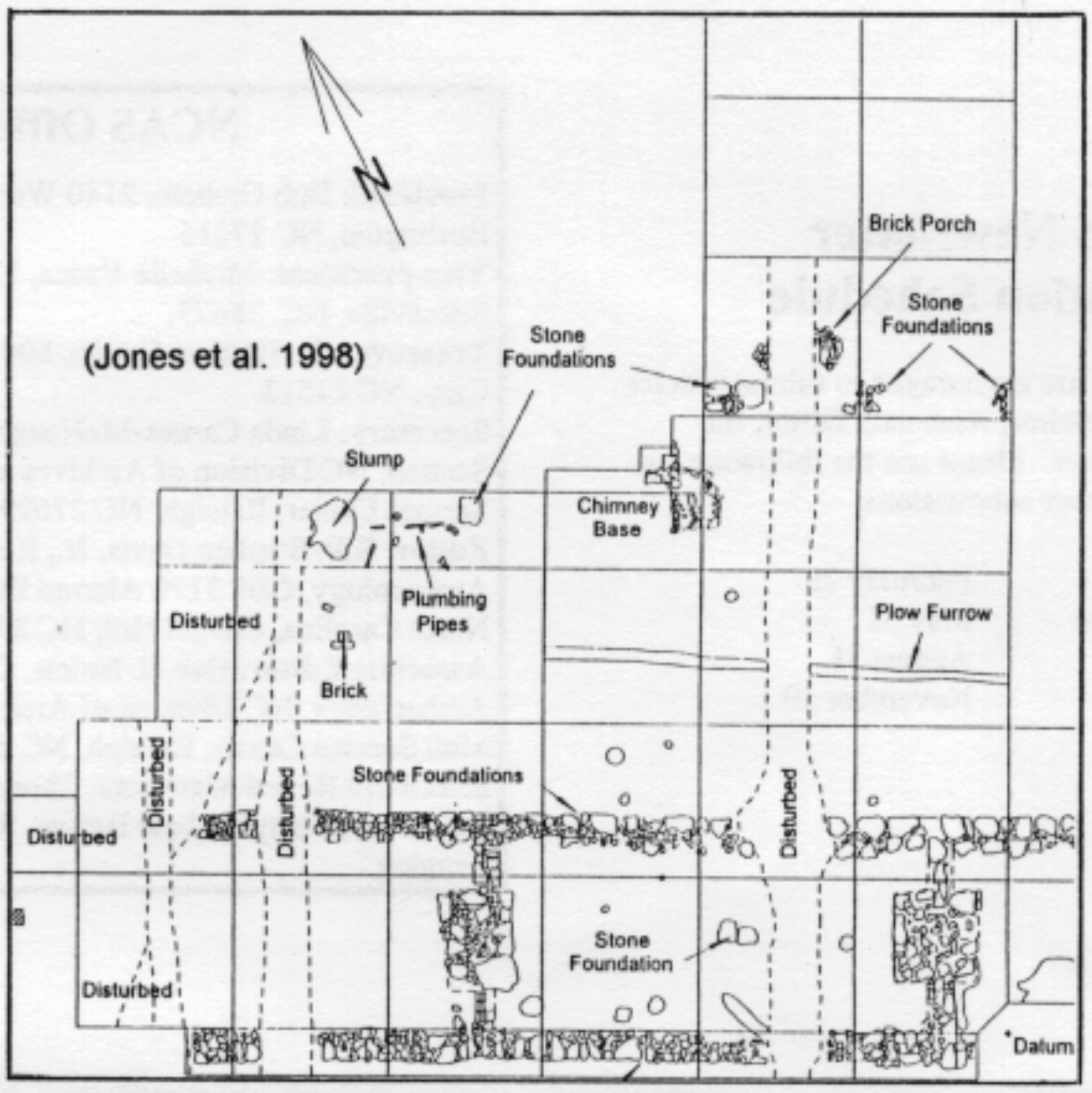

Figure 2: Comparison of the Pettigrew site feature map (top) with the resistivity results (bottom).

NCAS Newsletter Publication Schedule

All NCAS members are encouraged to submit articles and news items to Dee Nelms, Associate Editor, for inclusion in the *Newsletter*. Please use the following cut-off dates as guides for your submissions:

Spring Issue	February 28
Summer Issue	May 31
Fall Issue	August 31
Winter Issue	November 30

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