

# **Geophysical Remote Sensing in Archaeology: An Overview and Practical Guide for Beginners and Intermediate Users, Teachers, and Consumers**

This two-hour, online seminar will provide a basic understanding of how to (1) collect, (2) process, and (3) interpret geophysical data from the three main instruments used by archaeologists: magnetometers, ground-penetrating radar, and electrical resistance meters. An emphasis will be placed on doing this with an archaeologist's eye to understanding the archaeological record.

## **Educational Focus:**

Geophysics is finally starting to take hold in American archaeology, but there are very few opportunities for good training on how to operate the instruments, process the data, and interpret the results. The primary goal of this seminar is to provide a basic introduction to geophysics in archaeology for archaeologists including : Undergraduate and graduate students with an interest in learning more about geophysics in archaeology; Site managers interested in non-destructively inventorying their in situ archaeological resources; And agency reviewers and project managers who produce or review scopes of work and research designs.

## **Course Outline:**

**I.** The seminar will begin with a basic review of what is geophysics for archaeology—a little history, a variety of good examples, where the field is today and where it is going.

**II.** When should geophysics be done? Under this topic we will consider the importance of having objectives, defining targets of interest, and understanding soils and the archaeological record. (Sections I and II-15 mins)

**III.** Doing good geophysics means knowing some basic concepts about how the instruments work, how to process data, and how the archaeology "looks" to the instruments

## **Magnetometers (20 mins)**

1. What they are and how they work

2. How to collect, process, and interpret data (what do good and bad data look like?)
3. Summary of expectations for area that can be surveyed and types of detectable archaeology

#### **Ground-Penetrating Radar (20 mins)**

1. What they are and how they work
2. How to collect, process, and interpret data (what do good and bad data look like?)
3. Summary of expectations for area that can be surveyed and types of detectable archaeology

#### **Electrical Resistance Meters (20 mins)**

1. What they are and how they work
2. How to collect, process, and interpret data (what do good and bad data look like?)
3. Summary of expectations for area that can be surveyed and types of detectable archaeology

#### **Other instruments to perhaps consider (15 mins)**

#### **IV. Interpreting geophysical data (15 mins)**

- a. Basic strategies—picking anomalies, sampling, anomaly verification/ground truthing
- b. Integrating data sets with other information—aerial photos, old maps, artifact distributional data, etc.

#### **V. Reporting your results and archiving your data (15 mins)**

- a. Best practices

#### **Expert Instructors:**

Dr. Jarrod Burks, RPA is an archaeologist who has been conducting geophysical surveys on archaeology sites since 1998, both in his previous job with the National Park Service in Chillicothe, Ohio and in his current job in cultural resource management. While the bulk of his survey work has occurred in the Ohio Valley, he has traveled all over the country doing surveys, as well as to distant shores such as Poland, England, and the Solomon Islands. This

range of experience has exposed him to a wide variety of survey settings in terms of geology/soils and archaeological targets. His work and research in geophysics has been published in national and international journals such as American Antiquity, Archaeological Prospection, and the Journal of Archaeological Science; additional publications have appeared in several regional journals, and many other archaeologists have used his data in their published research; and he also has reviewed manuscripts relating to geophysics in archaeology for a wide variety of journals (American Antiquity, Journal of Archaeological Science, Archaeological Prospection, MCJA, SHA Technical Briefs, etc.). However, he is most proud and excited about teaching geophysics to anybody who wants to listen and learn. Since about 2000 he has been a regular instructor at the National Park Service's geophysics workshop for archaeology, hosted annually by the Midwest Archeological Center at a wide range of venues around the country. There he has taught hundreds of students, professors, and archaeologists from the worlds of CRM, SHPO, and federal agencies. He has also been an instructor at other archaeology and forensics workshops in the U.S., England, and South Africa. Dr. Burks gives about 30-40 public lectures per year, most of which include geophysics. All of these experiences—the practical day-to-day work, the research, and the wide variety of audiences with whom he has worked—make him an excellent candidate for teaching geophysics in archaeology as part of an online SAA seminar.

### **Lack of Commercialism:**

Participants can take this seminar without purchasing or owning any books, instruments, or software. The seminar will include examples of instruments and software from a wide variety of manufacturers, highlighting some of the more popular and easy to access. Tips on how to get access to free services and software will also be provided. Books and articles of particular interest to the various topics covered will be highlighted, should seminar attendees wish to seek them out.

### **Instruments to be discussed:**

-Magnetometers made by-Geoscan Research, Geometrics, Foerster Instruments, Bartington

-Ground-Penetrating Radar: GSSI, Sensors and Software, US Radar, MALA

-Electrical Resistance Meters: Geoscan Research, TRC

### **Software Packages to be discussed:**

-Geoplot (Geoscan Research)

-TerraSurveyor (DW Consulting)

-Radan (GSSI)

-Ekko\_Mapper and Ekko\_Project (Sensors and Software)

-GPR-Slice (Geophysical Archaeometry Laboratory, Inc.)

-Surfer (Golden Software)

**Books and articles to be mentioned:**

- Aspinall, Arnold, Chris Gaffney, and Armin Schmidt 2008 Magnetometry for Archaeologists. Altamira Press, New York.
- Bevan, Bruce 1998 Geophysical Exploration for Archaeology: An Introduction to Geophysical Exploration. Special Report No. 1. Midwest Archaeological Center, Lincoln, Nebraska.
- Breiner, Sheldon 1973 Applications Manual for Portable Magnetometers. Geometrics, San Jose, California.
- Clark, Anthony 2000 Seeing Beneath the Soil: Prospecting Methods in Archaeology. Revised Edition. Routledge, New York.
- Conyers, Lawrence B. 2004 Ground-Penetrating Radar for Archaeologists. Altamira Press, Walnut Creek, California. 2012 Interpreting Ground-penetrating Radar for Archaeology. Left Coast Press. Walnut Creek, Colorado.
- Dalan, Rinita A., and Subir K. Banerjee 1998 Solving Archaeological Problems Using Techniques of Soil Magnetism. Geoarchaeology 13:3-36.
- Gaffney, Chris, and John Gater 2003 Revealing the Buried Past: Geophysics for Archaeologists. Tempus, Stroud, England.
- Heimmer, Don H., and Steven L. De Vore 1995 Near-Surface, High Resolution Geophysical Methods for Cultural Resource Management and Archaeological Investigations. National Park Service, Rocky Mountain Region, Denver.
- Johnson, Jay K. (editor) 2006 Remote Sensing in Archaeology: An Explicitly North American Perspective. The University of Alabama Press, Tuscaloosa.
- Kvamme, Kenneth L. 2008 Remote Sensing Approaches to Archaeological Reasoning: Pattern Recognition and Physical Principles. In Archaeological Concepts for the Study of the Cultural Past, edited by A. P. Sullivan, pp. 65-84. The University of Utah Press, Salt Lake City, Utah.
- Schmidt, Armin 2013 Earth Resistance for Archaeologists. Altamira Press, New York.
- Witten, Alan J. 2006 Handbook of Geophysics and Archaeology. Equinox Publishing, London.