

Book Review for GEOARCHAEOLOGY

Ground-Penetrating Radar for Archaeology. Lawrence B. Conyers, 2004, Alta Mira Press, Walnut Creek, California, xiv + 203 pp. \$32.95 (paper).

Reviewed by:

Gerald F. Schroedl
250 South Stadium Hall
Department of Anthropology
University of Tennessee
Knoxville, Tennessee 37996-0720

865 974-4408
865 974-2686
gschroel@utk.edu

One important reason why the application of geophysical techniques in archaeological research has progressed so far in the past several decades is the development of small, powerful computers that make it comparatively easy to gather and process data with sophisticated software designed specifically for the instrument being used. A second and equally important reason are changes in the conduct of archaeology. Geophysical techniques make it possible to investigate and map, often with considerable precision, subsurface deposits so expansive that it is simply too time consuming and costly to excavate them or adequately assess them with more traditional methods such as shovel test pits or test excavations. Obtaining geophysical signatures greatly improves the precision and economy of time devoted to subsequent testing or excavation. Geophysical techniques, furthermore, permit archaeological data acquisition at sites where, for cultural or management reasons, the disturbance of subsurface deposits is severely restricted or forbidden. This is especially true where human burials are likely to occur. There is no doubt that future archaeological practitioners will have to employ geophysical techniques to remain current and competitive.

Ground penetrating radar (GPR) is one of several techniques rapidly finding greater application in archaeological research. It is incumbent that archaeologists learn how to use geophysical equipment or that they employ people who do. In either case, they need to understand the fundamental capabilities of the instrument, and how data are obtained, processed, and interpreted. For GPR, there is no finer source for doing this than Larry Conyers' book. This book, as technical as some sections are, can be readily understood even by those not at the top of their class in physics (perhaps explaining their choice of archaeology as a career). Nevertheless, for this same reason, this book would benefit greatly from having a glossary.

In the first chapter Conyers makes clear the rapid development of computing technology that has made modern geophysics possible, readily accessible, and cost effective. Realizing that technologically challenged archaeologists may think that GPR always produces infallible results, Conyers is careful to set the stage for both the successes and failures of the technique. His goals in doing so are explicit: (1) to introduce archaeologists to the promises, problems, and possibilities of GPR studies; (2) to provide adequate information for the correct conduct of GPR surveys and; (3) to inform archaeologists how to evaluate GPR data. The second chapter provides a brief history of the use of GPR in archaeological studies and describes how GPR works in layperson's terms.

In Chapter 3, Conyers explains in detail the nature of radar energy, how it is generated, and what happens to it when it is introduced into the ground. This is the most technically rigorous, but most essential chapter in the book. Among the important topics covered is a review of antenna choice because, as Conyers indicates, this can often "make the difference between success and failure of a GPR survey... (p. 41)". Generally speaking, higher frequency antennas are smaller and lighter, but lower frequency antennas penetrate to greater depths. A second critical topic covered in this chapter is dielectric constant, which for all would-be GPR users translates to how well radar energy penetrates a given material. Conyers makes clear that a number of variables must be accounted for to insure the best possible detection of different-sized targets at different depths. For example, this involves calculating the relationship between the size or footprint of the radar beam and the size of different targets at different depths. It also means assessing alterations in radar waves resulting from buried surfaces and scattering from subsurface irregularities such as pit features and trenches.

Chapter 4 provides practical information about GPR units and their field calibration for data acquisition. Even experienced operators should find this review valuable, while novices using recently acquired instruments will want this material at hand. Here one can find some practical considerations that are either left out of or difficult to locate in user manuals. This chapter illustrates well that the learning curve on gathering GPR data requires greater effort than most other geophysical techniques commonly used in archaeology. Failing to understand and appreciate the importance of making the proper adjustments and settings results in both frustration and inefficiency, and most likely failure to identify subsurface patterning as well.

Conyers argues that the focus of GPR surveys has progressed from the location of buried objects (anomalies) to broader interests in subsurface mapping. He emphasizes the important point that in order to do this successfully, GPR data gathered as wave velocity must be converted to depth. In Chapter 5 he describes a variety of tests to greatly improve making these conversions.

Chapters 6 and 7 are devoted to data processing and interpretation. These include discussion of the causes of unwanted noise in reflection profiles and techniques for correcting scale as well as removing horizontal banding, distortion, high frequency noise, and multiple reflections. Important to data processing is each corrective measure and its application sequence. Most importantly, Conyers cautions that all but the simplest processing has potential to distort data out of recognition.

Using a variety of examples from his own as well as other published work, Conyers reveals the subtleties and effort necessary to interpret GPR data in Chapter 7. He is critical of on-the-fly analysis that characterize, in his opinion, too much GPR work, resulting in incorrect interpretations and too often leaving the impression that GPR surveys are not worth the effort. Conyers shows that careful consideration of the variables affecting GPR data and well-planned

analyses can achieve good if not excellent results in most instances. Conyers makes the case that successful GPR interpretation requires judicious application of synthetic modeling, amplitude time slicing, and three dimensional rendering. In the short concluding chapter, Conyers restates the case for GPR studies in straight forward, realistic, and convincing terms. Included in this chapter is a very useful chart that identifies in general terms the feasibility of using GPR under differing conditions.

Conyers has done a marvelous job of communicating in plain and sober language a very complex subject. Ground penetrating radar is not a mystery, but it does require effort and concentration to master its use and to produce useful interpretations from the resulting data. Conyers' book will encourage researchers contemplating the acquisition of radar equipment, will greatly assist the learning process for radar novices, and will help sharpen the efforts of experienced users. Consumers of radar data will find in this book the language and concepts needed to make intelligent choices about its use, reliability, and results.

Gerald F. Schroedl
250 South Stadium Hall
Department of Anthropology
University of Tennessee
Knoxville, Tennessee 37996-0720