

continent! Here the volume compares unfavorably with, for instance, Phillipson's (2005) and Connah's (2001) books, both of which are much better illustrated. Similarly, some illustrations are not very helpful. Scott MacEachern, for example, includes a photo of "abandoned stone structures in the Mandara Mountains" [p. 452], but why? What is the importance of this site in comparison to many of the other sites he describes? This is only a minor quibble, and in conclusion, Stahl is right to state [p. 16] that "this is an exciting time to be involved in African archaeology." Her edited volume at last begins to show African archaeological material to be diverse and actually created by people; it is packaged in a way that will help, hopefully, to bring more people into African archaeology.

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## Ground Penetrating Radar for Archaeology

LAWRENCE B. CONYERS. 224 pages, 71 figures, bibliography, index. Walnut Creek, CA: Altamira Press, 2004. \$32.95 paper, \$85.00 cloth. ISBN 0-7591-0773-4 paper, 0-7591-0072-6 cloth.

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Near-surface geophysical techniques for the discovery and analysis of archaeological sites have become essential tools for archaeological studies in Europe, particularly in Great Britain, and their use is growing in the Americas. The techniques include methods such as resistivity, magnetometry and electromagnetic conductivity. Another technique, ground penetrating radar (GPR), involves the transmission of high frequency radar pulses from an antenna pulled across the surface into the ground where they are reflected differentially by soils with different properties as well as by archaeological and natural features. The reflected waves are recorded by a second antenna and, properly interpreted, their characteristics allow the delineation of subsurface stratigraphy, features, and surfaces. Arguably GPR is both the most complex and, potentially, the most valuable geophysical technique used in archaeology. GPR's earliest use in archaeology was as a technique to locate "anomalies." The precise nature, including depth, composition and orientation of the anomalies were often unknown. The result of an early GPR survey was simply the suggestion to "dig here." Today the situation is quite different. As Conyers himself states: "In contrast to these early 'anomaly hunting' GPR studies, most recent work has been conducted for the purpose of noninvasively mapping buried features in detail, sometimes without ever having to excavate" [p. 99].

Lawrence Conyers' book is designed to serve as an introduction to GPR for all archaeologists—specifically, it is focused on helping them to become informed consumers of the method. It also serves very effectively as an essential first volume for any student wishing to become a GPR practitioner. The best description of the goal of the book is Conyers' own: "This book is not intended to be a complete 'how-to,' step-by-step manual to the GPR method for archaeological mapping. Its goal, instead, is to introduce archaeologists to the method both theoretically and methodologically with examples of both successes and failures" [p. 7].

Conyers admirably achieves his goal in a volume that is structured into eight chapters. The first reviews the general use of geophysical methods in archaeology. After that,

the book traces the history of GPR use and then provides a chapter-length overview of GPR theory and method. This chapter contains clear, intuitive explanations of the fundamental processes that are involved in the interaction of radar waves and the soil. At its most basic, GPR essentially measures the speed at which the radar waves pass through soils and are reflected by more impermeable materials. While simple in concept, the process is wildly complicated by the fact that the radar waves radiate not just directly downward but outward and by the fact that they travel through different materials at different speeds. A single object will have the first radar reflections return to the receiving antenna when the reflecting object is some distance in front of the antenna. Because the signal has to travel a long distance it will appear as if the object is deeper than it is. As the antenna moves forward and then directly over the object the transmission time of the reflections of the object will become shorter (and stronger) and then as it passes over the object and moves on it will once again take longer as the distance increases and the signal becomes weaker. At all points along the track the signal that is received will include some component from the reflected object. A single small object, therefore, may appear as a complex hyperbolic shape in the radar results.

This all assumes that the soils through which the radar waves are traveling are homogenous with respect to their radar propagation properties and, of course, this is not normally the case. To this end, Conyers provides an excellent discussion of the role of relative dielectric permittivities (RDP). Essentially a material's RDP is a measure of the speed at which a radar wave can pass through it. Since the GPR measures the time a signal takes to travel out and return, different RDPs affect the results in fundamental ways. In addition to reducing the speed at which a wave can pass, a greater RDP also serves to attenuate the signal. All of this is obviously quite complex, but Conyers provides enough detail so that the process can be understood by the typical archaeological reader, but not so much detail that the issues are obscured. At the end of the first three chapters the reader is left with a clear appreciation for the complexities and enough information to comprehend how various field conditions can affect the outcome.

The next chapter covers GPR hardware and software, with the majority of the chapter covering the key software functions. Major advances in the capabilities of GPR systems have been made in the last few years. Without discussing specific brands Conyers reviews the key capabilities that should be present in a system. This is followed by a lengthy discussion of the functions provided by modern GPR software. The analytical processing capabilities of GPR software have dramatically altered the ways in which

these systems can be used and the level of detail they can provide. This section is particularly valuable to the new practitioner or data consumer as it steps through each function and provides examples of what can be done, the implications of different analyses, and the effects that they may have on the quality of the results. The discussion of range gating [pp. 91–95] illustrates the way Conyers approaches these topics. After presenting a clear explanation of what range gating is and what role it plays, he provides the following practical guidance:

If one decides to set range gains in the field, it is very important to move the antennas over much of the ground to be surveyed during the calibration procedure before any reflection data are acquired... the gains can be set at the location where the highest reflection amplitudes will likely be recorded and one can be fairly well assured that the remainder of the amplitudes recorded in all the reflection profiles within the grid to be surveyed will be 'on scale' and not lost to overgaining, resulting in amplitude clipping [p. 93].

Conyers goes on to provide specific examples from his own fieldwork of the effect of different gain setting strategies and their advantages and disadvantages. This approach is common throughout. Conyers first introduces a particular technical element in the acquisition or processing of GPR data. He then shows how the technical elements of the process relate to the various physical properties of the soil or the types of archaeological materials that would be involved. This is followed by a discussion of the pros and cons associated with that element, illustrated with specific field and analytical examples drawn from Conyers' work. At the end of each section the reader feels that he or she has a solid understanding of the complex issue and a sense of the impact that it would have on a specific archaeological site.

Using the basic material presented in the first four chapters, Conyers then goes into more detail on the fundamental element of GPR in archaeology—velocity analysis. Understanding GPR velocity and the factors that influence it is a key aspect of the developments that have moved the technique from simple anomaly hunting into true subsurface mapping. As the GPR wave propagates through various materials it travels at different speeds. When a material's transmissive properties are understood it is possible to convert the time parameters of the received GPR signal to actual depth measurements and thus map the actual locations of stratigraphic changes, house floors, and other archaeological features and buried topography. Not only do different materials have different properties, but the relative presence or absence of water has a dramatic effect on GPR transmission. Conyers allocates 20 pages to this important topic.

Chapter 6 deals with post-acquisition processing. If there is a weakness in the text, it is in the modest treatment (12 pages) given to this very important topic. Archaeological materials are almost at the level of "noise" in the traditional sense of the GPR signal analysis. As a result, post-processing of the data is essential to recover the information. As Conyers states: "One should never attempt to use processing programs 'off the shelf' without understanding the implications of each data manipulation technique. That is because many techniques were written for very specific objectives, and some or even all may not be applicable to one's archaeological or geological objectives" [p. 120].

The final substantive chapter, Chapter 7, covers the interpretation of GPR data. In this chapter Conyers provides a range of specific examples and walks the reader through an understanding of how the complex GPR traces can be interpreted. He provides case studies showing how interactions between stratigraphy and various archaeological features can lead to complex GPR outcomes with a thorough analytical deconstruction of these back to the essential archaeological evidence. This chapter, more than any other, illustrates that while "basic" GPR results may be useful to almost any informed person, complex sites and those with varying soils and materials can present data that, at first, may be unintelligible. An analysis of these data by an experienced practitioner using a range of post-processing capabilities and knowledge of the deposits and the system's responses can often, but not always, extract a truly surprising amount of information.

Chapter 8 is a short concluding chapter. Of particular value is a table that lists a wide range of archaeological targets (e.g., site features and properties such as "clay house floor") and the feasibility of using GPR in their discovery and assessment. The 21 page bibliography covers not only the archaeological GPR literature but also key technical articles about GPR principles, studies of materials and their GPR properties, and related uses in other fields such as geology. There is a short (four page) but useful index.

The well-chosen and extensive graphics are a critical part of the volume. There are 10 color plates and 61 black and white illustrations. Many of the black and white illustrations are actual GPR reflection profiles. The other figures illustrate complex ideas including the ways in which various signals interact with features. The great majority of these figures are very useful and substantially add to the text. In fact, there are a number of topics that very likely could not have been properly explained without the graphics.

A particularly admirable and valuable aspect of Conyers' book is his willingness to report on the "failures" of GPR as well as its successes. Enthusiasts of any approach are

usually loath to point out weaknesses and, not surprisingly, there are often well-meaning attempts to "oversell" a method. In contrast, Conyers provides a balanced and nuanced understanding of both the strengths and weaknesses of the method. This book is an excellent introduction to the method for new practitioners and the archaeological community in general and it should increase the use of this very important archaeological technique.

## Dialogues in Cuban Archaeology

L. ANTONIO CURET, SHANNON LEE DAWDY, AND GABINO LA ROSA CORZO, editors. 241 pages, 45 tables, 7 figures, references, index. Tuscaloosa: University of Alabama Press, 2005. \$26.95 paper. ISBN 0-8173-5187-6.

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As the iron hand of foreign pressure still clutches Cuba tightly in its grasp, the assessment of all aspects of life in the country, including archaeological research, remains very difficult for many in the outside world. Yet within the country archaeology has moved forward at a pace that would be admirable in the eyes of archaeologists everywhere. Advances have embraced both the theoretical and the applied faces of the discipline, and much of the progress on the two fronts has significance that stretches far beyond the island itself, and in a good many cases beyond the Caribbean as well. All of this has taken place in an atmosphere that most would find limiting in the extreme; the wonder is, in fact, that any archaeological fieldwork occurs, for the setting is one in which locating sufficient fuel for a vehicle in order to journey to a site is a challenge in itself. Then if data do emerge from an excavation, the opportunities for publication within the country are very few and far between, for neither ink nor paper are likely to be available for production of a report. In such circumstances, compounded by language barriers which often stand in the way of communication among various parts of the Caribbean world, it has for many years been difficult if not impossible to assess Cuba's place in the growing but still fragmentary picture of Antillean archaeology.

How welcome, therefore, *Dialogues in Cuban Archaeology* is as a significant plank in what has thus far been a rather slim bridge across the communications gap. Like the late Ramón Dacal Moure and Manuel Rivera de la Calle's