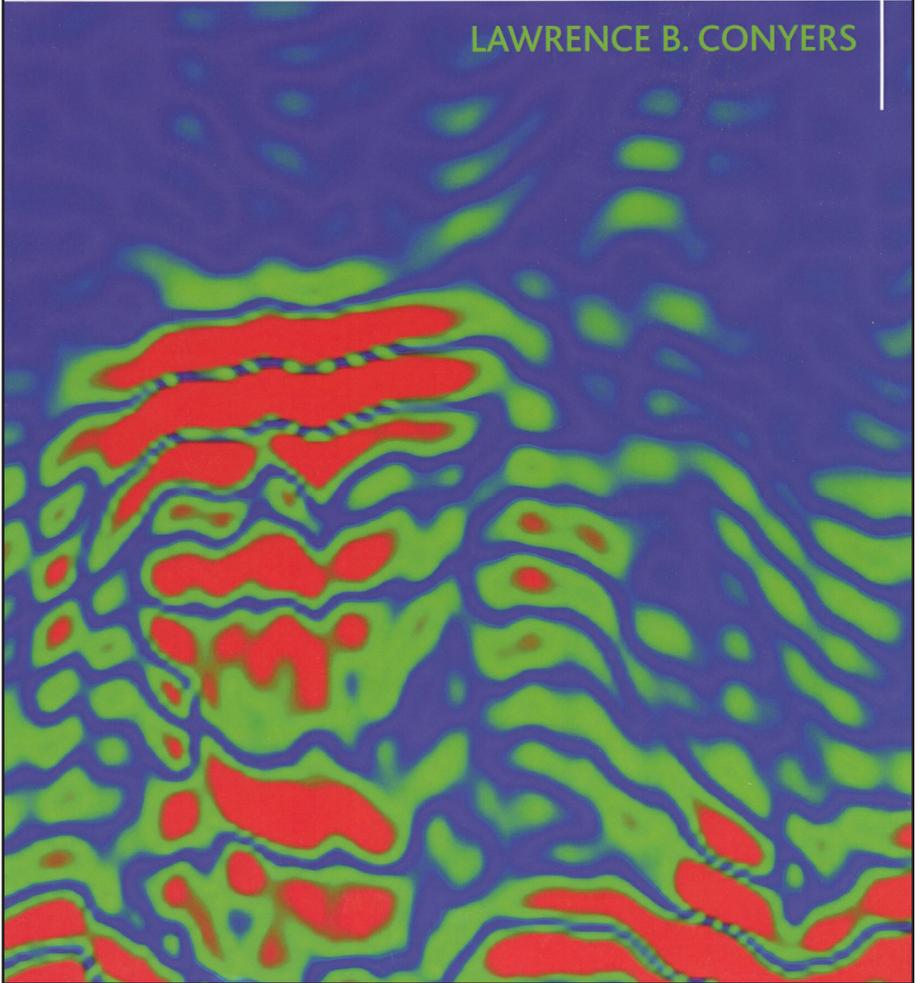


Interpreting Ground-penetrating Radar for Archaeology

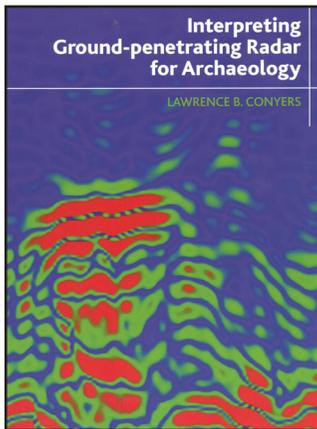
LAWRENCE B. CONYERS



CONTENTS

Illustrations.....	7
Preface	13
Acknowledgments	16
CHAPTER 1. INTRODUCTION	17
Factors Affecting GPR Interpretation	17
The Importance of Understanding the Basic GPR Images.....	19
Interpretation Themes.....	19
CHAPTER 2. BASIC METHOD AND THEORY OF GPR	25
Production of Reflections, Depth of Penetration, and Resolution.....	25
Data Collection and Recording	28
Interpretation of GPR Reflections.....	28
Describing Reflections Geophysically.....	30
Describing Reflections Based on Their Genesis.....	32
Water Retention and Distribution as the Key to GPR Reflection Origins	34
Basic Data Processing Steps for Interpretation	40
More Advanced Data Processing Steps	42
CHAPTER 3. A PERSONAL HISTORY OF GPR INTERPRETATION	47
Early Processing and Interpretation Methods	47
Amplitude Maps Become Standard Tools for Interpretation	52
Amplitude Mapping in Conjunction with Profile Interpretation	54
Many Innovative Image Types Invented for Interpretation	56
CHAPTER 4. GEOLOGICAL COMPLEXITIES	57
Sand Dunes.....	58
Rivers and River Terraces	59
Bedrock.....	65
Beaches	70
Tar Pits	71
Lakes.....	74
Volcanoes	77
Conclusions.....	78
CHAPTER 5. CULTURAL COMPLEXITY	81
Pipes, Foundations, and Metal	81
Air Waves Generated from Surface Objects	84
Ground Surface Variations	86
Excavation Disturbances	89
Background Noise.....	91
Conclusions.....	94
CHAPTER 6. ATTENUATION AND DEPTH OF PENETRATION.....	95
Determining Depth of Energy Penetration	96
Energy Attenuation as a Function of Ground Conditions.....	96
Conclusion	107

CHAPTER 7. HISTORIC SITES	109
Cellars and Basements.....	109
Trash Middens	110
Unusual Features: Ponds and Waterworks	113
Structure Walls and Floors.....	115
Using GPR Images in Conjunction with Historic Maps and Photos.....	121
Historic Gardens.....	125
Conclusions	126
CHAPTER 8. GRAVES AND CEMETERIES	129
Formal Cemeteries	129
Graves Beneath Floors.....	142
Bones and Forensic Studies	144
Informal Cemeteries and Culturally Diverse Burial Practices	147
Conclusions	150
CHAPTER 9. PREHISTORIC SITES	153
Floors and Pit Structures	153
Cooking Features and Hearths.....	153
Walls.....	155
Features Associated with Above-Ground Structures	158
Shell Mounds and Middens.....	161
Irrigation Canals	165
Rock Shelters.....	167
Conclusions	169
CHAPTER 10. CAVES, TUNNELS, AND VOID SPACES	171
Complex Reflections from Void Spaces: Bridges and Catacombs.....	171
Synthetic Modeling as an Interpretation Tool for Voids.....	175
Complex Small-Scale Voids.....	175
Lava Tubes and Caves.....	178
CHAPTER 11. USING GPR INTERPRETATIONS TO UNDERSTAND PEOPLE	183
Testing Hypotheses about Behavior and Cultural Connections in Utah	184
Architectural Changes Related to Urbanization at Petra.....	186
Conclusions	190
CHAPTER 12. INTERPRETATION IN COLLABORATIVE VENTURES	191
The Relationship between Geophysics and Archaeology	191
Poor Communication about Site Conditions.....	194
Unrealistic Expectations on the Precision of Results and the Scale of Survey Areas	197
Skeptics, True Believers, and the Mass Media.....	199
Unusual and Downright Crazy Requests for GPR.....	200
Conclusions	203
A Checklist of How to Approach and Be Successful in Collaborative Ventures.....	204
CHAPTER 13. CONCLUSION	207
REFERENCES.....	209
INDEX	213
ABOUT THE AUTHOR	218



Interpreting Ground-penetrating Radar for Archaeology

Lawrence B. Conyers. 2012. Left Coast Press. 220 pp., \$99.00 (hardcover) \$49.95 (e-book).

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Lawrence Conyers is recognized by archaeo-geophysical practitioners as one of the most knowledgeable, broadly experienced specialists in the use of Ground Penetrating Radar (GPR). He has authored or co-authored many

articles and several widely used books on GPR, but this one is his most ambitious effort. It will appeal to some readers whose casual interest in GPR may have been sparked by popular media, but is more suited for professional researchers who are considering the benefits of integrating the technique into their own investigations, or who wish to more thoroughly understand the results of a GPR survey at a relevant site. Conyers' new book will certainly be a valuable resource for GPR users who are working their way up the learning curve, and for many such individuals it may provide the boost needed to reach the next level.

With some study, considerable practice, and the help of a willing mentor, any archaeologist can learn to collect, process, and display GPR data. This book is unique in its focus on helping GPR users learn how to properly interpret data from archaeological sites. Conyers' examples are drawn from more than 600 surveys (much of the data was reprocessed for inclusion here) that he and his students have conducted through the years at locations throughout the U.S., Central and South America, the Middle East, and Africa. Such an effort is necessarily somewhat autobiographical, and one chapter tracks his professional development against the backdrop of ongoing advances in GPR technology and its more gradual and still imperfect integration into archaeological fieldwork.

The volume begins with a discussion of method and theory that includes clear explanations of how energy introduced into the ground is reflected at the interfaces of different materials, and how these reflections provide a basis for interpretation. Conyers does this effectively without using equations or dense jargon, yet avoids oversimplification. Much attention is devoted to factors that cause energy to be attenuated, limiting the depth of penetration, the amplitude of reflections, and in broad terms, the technique's applicability to particular sites and research questions. Separate chapters are devoted to "geological complexities" (including sand dunes, rivers and terraces, bedrock, beaches, lakes, and even tar pits and volcanoes), as well as "cultural complexity," meaning factors in urban and rural settings that complicate data collection and interpretation. These factors include the presence of pipes, reinforced concrete roads and foundations, other metal, uneven ground surfaces, impacts from previous land modification, radio broadcasts, cell phones, and "air waves" (energy reflected into the ground and visible in the imagery from trees, buildings, cars, and even people). Subsequent chapters focus on issues that characterize historic sites

Book Review

(including an interesting discussion of the interpretive value of Sanborn fire insurance maps), prehistoric sites (often far more challenging than historic deposits, but house floors and associated features are highly detectable), tunnels and caves. An excellent discussion of cemetery surveys will help one differentiate metal from intact and collapsed wood coffins, and to use profiles to detect possible stratigraphic evidence for early graves whose contents have disintegrated.

Conyers is dissatisfied with the widespread focus on “anomaly hunting” among archaeo-geophysical practitioners. By this he means that the geophysical specialist can and must progress from simply identifying anomalous deposits to interpreting their character in geological, archaeological and cultural terms. In some ways, GPR offers greater potential for this than other geophysical techniques because of its 3-dimensional character. Conyers views geophysics in general, and GPR in particular, as a source of detailed information concerning variation in the character and layout of subsurface features that can be used directly to address research questions about social and cultural change.

Conyers argues cogently for a thoughtful, iterative, and often conservative approach to data processing and interpretation. This begins with a careful scrutiny and description of the reflection profiles. Often little processing is needed to do this beyond horizontal and vertical rescaling, manipulating gain to enhance certain amplitudes, removing background noise, and basic frequency filtering. Inspecting the profiles allows one to see individual objects and features, and to assess velocity and depth. Only then should one produce amplitude slices that are based on combined profiles and allow one to view in plan the reflections of deposits that occur within narrow depth ranges. Non-experts may finalize their interpretations at that point, and sometimes even skip over an inspection of the profiles to focus on more familiar plan views. Conyers returns for a second careful examination of the profiles, ensuring that he understands which of their characteristics are producing the features that appear to be important in the slices. He then often refines the parameters used to produce the slices, focusing on the geological and archaeological processes that influence the deposits indicated in the slices.

This approach explains his extensive inclusion of interpreted profiles and amplitude slices. More than 200 figures (most showing GPR data) include a number of GPR profiles and amplitude slices juxtaposed with actual soil profiles and features. The data imagery are extensively labeled and thoughtfully captioned to support the text and clarify the bases for his interpretations.

Conventional wisdom has long asserted that dry sandy deposits are ideal for GPR, and that surveys at locations characterized by abundant soil moisture and clayey soil are doomed to be unproductive. Conyers' work at a number of sites contradicted those assumptions, and led him to undertake experimental research that yielded important, nuanced insights about the factors that influence energy attenuation, survey depth, and reflectance amplitude. In the dry, sandy soils of coastal Peru, for example, he inferred that the attenuation of energy at surprisingly shallow depths was caused by the presence of hydrous clays and salts that caused the soil to be highly conductive. In later experimental studies at test sites, he found that some deposits in clay soils were far more discernible after a rainfall than when dry. It is the soil's conductivity and potential

Book Review

to hold or distribute water on either side of a soil interface that most influences the amplitude of the reflected signal.

Conyer's specialized skills, disposition, and intellectual curiosity have led him to collaborate throughout his career with large and varied group of colleagues. He concludes this book with detailed advice on effective collaboration that is aimed at the geophysical practitioner, but which should be read and re-read by archaeologists who hope to develop productive relationships with geophysical colleagues. The essence of successful collaboration is ongoing communication. One cannot overemphasize the importance of providing accurate and detailed descriptions of site conditions before the survey, and the value of frequent updates on findings as excavation progresses. Excavators who fail to provide such feedback squander a valuable opportunity to benefit from the geophysicist's fine-tuned and sometimes greatly improved interpretations based on excavation results.