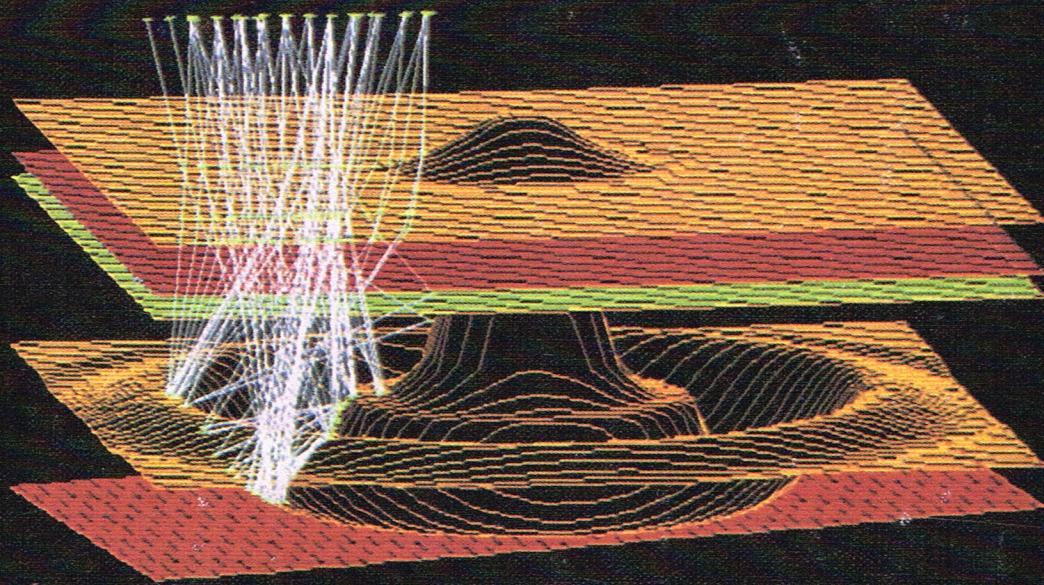


# New Technologies in Exploration Geophysics



Trends and new developments in exploration  
methods using reflection seismology

H. Roice Nelson, Jr.

12 March 1983

To Mom and Dad,

with thanks for  
making me what I am and  
every thing you've done to help  
me and my family.

love,

Ron

## **New Technologies in Exploration Geophysics**

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# Preface

The purpose of this book is to review the new technologies that are impacting oil and gas exploration now, and how they are expected to continue to do so. The title specifies exploration geophysics because the new technologies described apply to studying the earth using quantitative physical methods. This is the basic definition of geophysics. Although there are many disciplines covered by this definition, the most common is reflection seismology. Perhaps, a more correct title would be "New Technologies in Exploration Seismology," but the term seismology, in practice, is not as frequently used as geophysics.

The book is specifically written for oil exploration managers who find themselves removed from the new developments that are now influencing and will continue to affect their decisions. However, it does give a comprehensive overview of new technologies in each of the major areas of acquisition, processing, and interpretation of seismic data. Students, new geophysicists, and experienced explorationists who feel isolated from some part of the field will find this book a worthwhile review of those items that are expected to most affect their careers over at least the next decade.

There is an emphasis on changes in methods of seismic interpretation, mainly because most past developments have been in acquisition and processing. For the most part, seismic interpretation is still done with colored pencils, as in the 1950s. It is reasonable to project that there will be more changes in interpretation techniques than in either of the other areas over the rest of this decade. There have been important developments in the areas of direct

hydrocarbon detection (bright spot analysis) and seismic stratigraphy. However, these topics have been covered by other authors. The emphasis of this book is on the anticipated effect of interactive computer graphics on seismic interpretation. Another reason for this emphasis is that most of my geophysical experience has involved seismic interpretation.

The book is organized around the same steps that are used to work with seismic data. These steps are learning the science, collecting data, processing and modeling the data, computer handling and display of results, and finally integrating interpretations in order to define the subsurface geology. Chapter 1 is an introduction that reviews the basic principles used in reflection seismology. It is specifically for exploration managers who have come from other fields and want to get a non-mathematical review of the science their people use. Chapter 2 previews the technological trends that are discussed in detail in the remainder of the book. Acquisition developments are emphasized in Chapters 3 (telemetry and other large multi-channel acquisition systems) and 4 (3D or areal seismic techniques). Seismic processing techniques are relatively more advanced than either of the other areas. The biggest anticipated changes in processing, i.e., increased computation speeds via hardware improvements and new numerical modeling techniques, are reviewed in Chapters 5 and 6. The use of new computer graphics hardware promises to have a major effect on working with seismic data in all three application areas. Chapters 7 and 8 review developments in computer controlled methods of displaying seismic data. Interpretation techniques, particularly interactive interpretation techniques for integrated geophysical interpretations, are analyzed in Chapters 9 and 10. The concluding chapter discusses how universities and industry must work together in order to train the scientists needed to work with these new technologies in exploration geophysics.

It is not the intention of this book to directly compare different products or systems. There is no recommendation as to which of any comparable systems is the best buy for any specific reason. Throughout the book reference to company product names is made simply as examples of the equipment under discussion. For instance, there are hundreds of graphics hardware vendors, and therefore the only mention is of those systems with which I am

somewhat familiar. No product endorsement is intended. In some cases, like Chapter 1 (an introduction to reflection seismology) and Chapter 6 (numerical and physical modeling), where the historical development of a subject is traced, some significant subjects and contributors will certainly have been missed. I apologize in advance. There will also be new developments that are not covered in this book, and if you, as a reader, have corrections or contributions in these areas, please forward them to me in care of the publisher for possible inclusion, with due credit, in future editions.

*H. Roice Nelson, Jr.  
Houston, Texas*

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