

## Depth Imaging of Foothills Seismic Data

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the modern array of continents and oceans as described in Chapter 7, entitled "An Ocean is Born." The photos of colourful Triassic and early Jurassic red beds and columnar basalts of the Fundy Basin enhance the description of rifting that heralded the birth of the Atlantic Ocean. Described in some detail are the treasure trove of vertebrate remains that include Canada's oldest dinosaurs, the smallest dinosaur footprints, and the spectacular early Jurassic finds at Wasson Bluff, near Parrsboro, Nova Scotia. I learned here for the first time that the extinction event at the end of the Triassic was much more devastating than that at the K-T boundary. The story of the early Atlantic is interpreted through the record of the 20-km thickness of Mesozoic and Cenozoic sediments deposited in the Scotian Basin. The chapter concludes with a discussion of the K-T extinction, the subsequent Age of Mammals, and an interesting, fairly detailed explanation of the Tertiary cooling trend.

Earlier mentions of the usefulness of rocks and minerals are all tied together in Chapter 8, "From Rocks to Riches," which would be a best seller as a stand-alone booklet. In 29 pages, it touches on most of the great diversity of geological resources, including soils and water, available in the Maritimes. It also covers the historical background of mining, sustainable development and environmental protection, and the risks of mineral exploration. The various origins of metallic ores, industrial rocks and minerals, and hydrocarbon deposits are dealt with in surprising detail. The last contained the only factual blooper I found: the anticlinal theory of oil entrapment was credited to William Logan in 1842, instead of his colleague, Sterry Hunt, in 1862.

The last chapter, devoted to the Ice Age and beyond, brings the latest information to enlighten readers on how climate changes come about and how glaciation and sealevel fluctuations shaped Maritime landscapes. Its final section, entitled "The Future of the Planet" encourages us to heed the warnings of the geological past as we look to the future.

*The Last Billion Years* is a magnificent scientific, literary, and artistic achievement with wide appeal. Leave it on display and even when old Aunt Ida

and the vicar come to tea I guarantee it will promote conversation. You will not want to part with your copy but at \$35.00 it is a great buy, and would be a much appreciated gift to friends and relatives. It has barely been published and already there are rumours of a second printing. Well done Atlantic Geoscience Society!

## Depth Imaging of Foothills Seismic Data

Edited by Laurence R. Lines,  
Samuel H. Gray and Don C. Lawton

*Canadian Society  
of Exploration Geophysicists  
905, 510 5 Street S.W.  
Calgary, Alberta T2P3S2  
1999, 275 p.  
members \$50 paperback, \$75 hardcover  
non-members \$65 paperback, \$90 hardcover  
ISBN 0-9692354-1-0 (paperback)*

Reviewed by Glen Stockmal

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As the editors explain in the preface, this compilation of published papers and unpublished manuscripts is designed to provide an outline for a short course on the techniques and applications of depth imaging in Foothills exploration. Published by the Canadian Society of Exploration Geophysicists (CSEG) as part of that organization's 50th Anniversary Project, this volume clearly succeeds in meeting its goal.

At issue is the optimum approach, in terms of effort and cost, to processing seismic reflection data in the structurally complex Alberta Foothills of the Cordilleran Orogen. The motivation for these efforts is introduced first, followed by papers that discuss migration concepts and approaches by increasingly sophisticated means. Of particular note are the emphases placed on pre-stack depth migration, migration from topography, and appropriate techniques for layered rocks displaying significant velocity anisotropy. Pre-stack depth migration, using modern velocity analysis tools, is shown to be far superior to the "standard"

processing flow of NMO (normal moveout) / DMO (dip moveout) /stack/ migration in structurally complex settings. Of the various migration techniques discussed, Kirchhoff migration is generally favoured in the balance between quality and cost. Migration from topography, as opposed to from a (conventional) flat datum, results in remarkably improved resolution in the shallow portion of the section, allowing substantial improvements in the velocity model and hence imaging of deeper targets. Migration velocity models that account for velocity anisotropies are shown to significantly improve resolution of synthetic and physical analogue models, with clear implications for Foothills structures.

Lines, Gray and Lawton have organized 28 contributions into 6 chapters: 1) Introduction, 2) Prestack Migration Concepts, 3) Migration in Structurally Complex Areas, 4) Case Histories, 5) Anisotropic Migration, and 6) Conclusions and Future Work. Each chapter comprises brief introductory remarks by the editors, and two or more papers. Of these 28 contributions, 13 are reprints from peer-reviewed journals (eight from *Geophysics*, three from the *Canadian Journal of Exploration Geophysicists*, one from the *Journal of Seismic Exploration*, and one from the CSEG *Recorder*), one is reprinted from a Society of Exploration Geophysicists volume, one appeared as an article in *The Leading Edge*, four are expanded abstracts from CSPG and CSEG meetings, four are reprints from CREWES and FRP research reports (two each), and five are previously unpublished manuscripts. An enclosed compact disc includes files to perform reverse-time depth migration of a synthetic Foothills seismogram data set. These include Fortran77 source code and executable files, data files, and instructions for users. The files are intended for use on a UNIX-based machine.

Although the editorial comments that lead off each chapter are perhaps too brief (the entire contents of Chapter 6 consist of a mere eight sentences), the contributions are well organized, and encompass the range of topics intended. One could quibble that the few previously unpublished contributions could have been more tightly edited, that the year of publication appears nowhere in

the volume or on the cover (!), and that one paper (by Zhu *et al.*) makes liberal reference to colour figures unfortunately reproduced in black and white (eight of the other contributions *are* reproduced with colour figures), but none of these points detracts from the value of this compilation. This book is a must-read for any petroleum geologist or geophysicist interested in Foothills plays, and at a cost of only CDN\$50 (CSEG member price, paperback) it should be a must-have, also.

## Beaches and Dunes of Developed Coasts

By Karl F. Nordstrom  
Cambridge University Press  
40 West 20<sup>th</sup> Street  
New York, NY 10011-4211 USA  
2000, 338 p., US\$74.95 hardcover  
ISBN 0-521-47013-7

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Partway through this book, the author observes that Great Britain has effectively *no* entirely natural coastal dune systems, even in areas that casual visitors might consider to be undisturbed by humans. The complexity and extent of human influence on coastal dune and beach systems are profound, and *Beaches and Dunes of Developed Coasts* provides an encyclopedic review of the subject. The author takes a holistic view, incorporating data from such fields as history, geomorphology, sociology, and ethics. The end result is a reasonably successful book.

The first two chapters are largely introductory. Chapter 1 reviews trends in human influence on the coastal zone from antiquity to the present day, while Chapter 2 reviews the numerous ways in which modern coastal landforms are influenced by human activity. The following two chapters look more closely at human action in the coastal zone. Chapter 3 discusses efforts at replenishing coastal landforms by introducing extraneous material (generally sand), while Chapter 4 documents the effects of

anthropogenic structures on sediment supply and landform evolution. This section of the book provides interesting reading, including a cautiously favourable reassessment of the use of hard structures, such as the much-maligned groin.

Chapter 5 opens by discussing the characteristics (dimensions, location, orientation, variability, mobility, and sediment characteristics) of human-altered beaches and dunes. This is followed by an interesting treatment of the decreasing distinction between natural and anthropogenic coastal landscapes. Many human influences are subtle, and what the casual user sees as a natural environment may be or have been strongly affected by human activity. The complex interaction of natural and human influences makes it difficult to place coastlines definitively on the continuum between entirely natural and entirely anthropogenic.

Chapter 6 discusses landscape change over various time frames. These range from coastal modification by storms and subsequent recovery projects to the pressing issue of how to manage developed shorelines in the face of rising sea level. Management questions provide a transition to Chapter 7, which selectively reviews coastal management policies and programs, primarily using examples from the United States. This section is not always easy to read, but it provides useful insights into how good policies can be thwarted by lack of funding, and good projects hobbled by lack of regional coordination. An additional difficulty is that the main consideration of most shore-protection programs is perceived social or economic benefit, rather than maintenance of natural ecosystems including sedimentary systems.

Chapter 8 considers how best to maintain and enhance natural coastal features. The author emphasizes the need to preserve the processes of dynamic natural systems, rather than adopting a static approach aimed at preserving individual landforms. The discussion ranges from the ethics of landscape restoration to the technical problem of protecting shoreline development while maintaining landforms in something like a naturally functioning state. The final chapter offers suggestions for future research. Most focus on science and engineering, but there is a strong empha-

sis on interdisciplinary research that includes the humanities and social sciences.

A major theme of the book is pragmatic coexistence of natural processes and landforms with human structures and activities. The author argues that because human influence is pervasive it must be included as a factor at all scales of modeling and planning. Indeed, in a proposal that may displease environmental purists, the author proposes that humans should be considered intrinsic rather than extrinsic factors in coastal evolution.

The book is well produced. Photographs are well chosen, although some are too dark or need additional explanation or annotation. Line diagrams lack scale bars. The text is grammatically sound and generally well argued, with few typographic errors. In some instances the prose is dense and difficult to follow. Additional stylistic editing might have produced a more user-friendly work. In view of the wide intended readership, a glossary would be a useful addition. More than 900 publications are cited and about half are from 1990 or later.

*Beaches and Dunes of Developed Coasts* contains little new data, but digests a great deal of information from diverse disciplines into a single source. I doubt that it will find much use as a teaching text, but it could be a useful reference for students studying coastal development issues. Those concerned solely with scientific aspects of coastal sedimentation will probably find the book to be of limited interest. However, professionals actively dealing with coastal development and preservation should find it a useful addition to their bookshelves, and may even find that it becomes a standard reference.