

# Nearshore Sediment Dynamics and Sedimentation: An Interdisciplinary Review

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## Environmental Change in the Maritimes

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Edited by J. G. Ogden II and M. J. Harvey  
*Nova Scotian Institute of Science,  
 Halifax, Nova Scotia, 109 p.,  
 \$5.00*

Reviewed by Michael J. Risk  
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The concept of the immensity of geologic time may have been geology's major contribution to science: the present and the past are keys to each other, provided that we have some knowledge of the relevant processes. We are now experiencing tremendously-accelerated anthropogenic environmental changes, and it has become necessary for us to narrow our temporal focus so as to better decipher the Holocene squiggles superimposed upon the Quaternary wiggles. This little volume, from a symposium held at Dalhousie University in 1971 (why did it take four years to publish it?), is an attempt at such a synthesis for the Maritime Provinces.

Each of the papers in the symposium is concerned, in some way, with the Quaternary history of the Maritimes. Within these broad limits, there is quite a range of subjects, from isotope geochemistry to beetles, and from littoral invertebrates to pollen. The scientific "meat" of the papers shows a similar range.

The volume begins with an interesting paper by Byers on prehistoric man in the Maritimes, which discusses possible food sources and cultural concentrations; Terasmae then presents an excellent summary of late Quaternary climatic changes, and the likely effect on human settlement. Two very short contributions follow. (Throughout the volume, there is a strange mixture of two-page and twenty-page papers. Did some authors only submit summaries of their talks?) Raiton summarizes the post-glacial pollen zones for the region, and Mann presents a somewhat arm-waving discussion of the impact of man on the environment.

Another good summary follows: Bousfield and Thomas' discussion of the effect of postglacial climatic changes on the distribution of littoral marine invertebrates. Distributions of many species are disjunct and discontinuous, and the authors do a good job of correlating the present observed populations with past environmental changes. My only quibble with the paper concerns the mixture of data from different surveys, at different times, using different methods. For example, the paper records 100 species per station in the Minas Basin, whereas the vast bulk of the mud flats in the area support less than 30 species per station. The paper also states that the isopod *Chiradotea caeca* is "virtually lacking in the Fundy region" (p. 57), while our work shows it to be ubiquitous in sands of the lower beach and lower intertidal, making copious tracks identical to *Cruziana*, the common Paleozoic trace fossil made by crawling trilobites.

A short contribution by Howden is next, on the late Quaternary history of some of the insect groups, in which the importance of man as an agent of dispersal is noted, and some comments made on possible Pleistocene distributions. Mott then presents the results of some palynological investigations in New Brunswick, and Grant follows with a first-class summary of recent coastal submergence. The volume concludes with Ogden's brief review of some of the principles of isotope geochemistry.

Although a somewhat modest attempt, this little volume does succeed in emphasizing the effect of Quaternary history on our present environment. About four of the papers make the volume worth five dollars.

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## Nearshore Sediment Dynamics and Sedimentation: An Interdisciplinary Review

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Edited by J. Hails and A. Carr  
*John Wiley and Sons, 816 p., 1975.  
 \$36.50*

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On open coasts the nearshore zone is essentially the zone of breaking waves and wave induced currents - the submarine section of the beach system: in the estuarine or embayment situation tidal currents may assume greater importance in sediment transport and deposition. The morphology, sediments and dynamics of this zone have been extensively studied in recent years and the book stems from an interdisciplinary symposium organized by the editors, in Southampton, England, to review some of the recent developments in the field. It contains 11 papers of varying length and sophistication and, though the contributors do represent a number of disciplines, the collected papers do not constitute a review. If the book is to be judged on these criterion, which is urged upon the reader by its subtitle and in the editor's preface and introduction, then it cannot be considered successful.

There is only one review paper proper, "Dynamics and Sedimentation: the Tay in comparison with other estuaries" by A. T. Butler, C. D. Green and J. McManus, and the dilemma which faced these authors (all the authors?) is nicely pointed to in their introduction. They were encouraged to frame their topic within the style of an essay-cum-review of estuarine sedimentology rather than produce an isolated contribution on the Tay estuary. Scotland and also to provide an assessment of research problems requiring attention. In responding to this challenge they realized the danger that the end result would neither be a comprehensive review of the Tay, nor a comprehensive review of estuarine dynamics and sedimentation. In fact, the end result is the longest and one of the best papers in the book. Would that the

authors of the other four papers which relate to studies of parts of the British coast have set their work in a broader context. These papers provide accounts of: sediment mobility and erosion on a multibarred foreshore in S. W. Lancashire (W. R. Parker); cyclical changes at the entrance to Teignmouth Harbour, Devon (A. H. W. Robinson); a Holocene chenier plain in Essex (J. T. Greensmith and E. V. Tucker); and suspended sediment transport and deposition over the intertidal flats of the Wash (G. Evans and M. B. Collins). The only case study from outside Britain, of marine bars in Kouchibouguac Bay, New Brunswick by B. Greenwood and R. G. D. Davidson-Arnott, concludes with an evaluation of the specific results in the light of other studies of bar genesis and migration.

Apart from one brief contribution on coastal engineering problems the papers in the book fall into two groups: those discussed above are essentially sedimentological and geomorphological. The other four papers approach the complex problems of the nearshore zone from a more theoretical, hydrodynamic viewpoint and deal with waves and wave generated currents. P. D. Komar considers the two modes of generation of longshore currents – by an oblique wave approach to the shore line and by longshore variations of wave breaker height, and D. A. Huntly and A. J. Bowen compare the hydrodynamics of steep and shallow beaches. P. Holmes outlines methods of evaluating wave characteristics appropriate to the computation of littoral transport, and P. H. Kemp evaluates the effects of wave asymmetry in the nearshore zone and breaker area.

Taken overall, the book is a useful collection of papers which provides a sense of the complexity of the problems of the nearshore zone and indicates some of the ways in which research is progressing.

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## The Study of Trace Fossils

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Edited by Robert W. Frey  
*Springer-Verlag, 562 p., 1975.*  
 \$57.80

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This book was in the works a long time, and its publication was eagerly awaited by those of us interested in trace fossils. One thing that strikes the reader immediately on picking up a copy of this book is the intriguing dust-cover photo: a human footprint which, to the viewer's surprise, turns out to have six toes! The genesis of this strange print is not explained in the text; Frey frustrates us by thanking R. G. Bromley for the cover photo, and directing further inquiries to him.

In a way, that photo is symbolic of a lot of the significance of the study of trace fossils (also known as ichnology). Trace fossils are often mundane phenomena such as footprints or burrows, which sometimes may be attributed to a specific organism. All too often, however, trace fossils which we supposedly had under control either show up in the wrong place, or develop strange modifications; for example, a *Zoophycos* in the intertidal, a "shoreline-indicator" shrimp burrow in abyssal sediments, and a sixth toe on a human footprint. Frey's book is the first attempt to chart an integrated pathway through the pockmarked, burrowed, and fecal pellet-laden landscape of trace fossils.

The rationale of the book is set out in the prologue: rather than being a collection of papers on trace fossils, it is a genuine cooperative approach, by a number of specialists, to the study of trace fossils, emphasizing relationships with other disciplines. The book is organized into five major parts, with chapters written by most of the well-known workers in trace fossils and animal-sediment relationships. Part I, Introduction to Ichnology, contains chapters on the history and scope of ichnology, classification and preservation of trace fossils, and (a very useful, cautionary addition) false or misleading traces. Part II, The

Geological Significance of Trace Fossils, discusses aspects of their paleontological, stratigraphical, sedimentological and paleoecological significance. As in Part I, most of this is review material, albeit comprehensive, well-written review. There are some interesting observations in this section. Crimes points out that trilobite traces (often of a relatively simple nature) commonly occur well below the first occurrence of trilobite body fossils, and suggests that this is evidence for early, soft-bodied trilobites (although it seems to me that the tremendous hurdle involved in going from the hydraulic skeleton of the presumed polychaete-like ancestor to the external skeleton of the arthropods is not sufficiently discussed). Howard emphasizes that trace fossils are sedimentary structures, often containing valuable information on deposition rates and sediment characteristics, and Rhoads discusses how trace fossils may allow us to predict factors such as salinity, temperature, dissolved oxygen and mass properties of the sediment. This section basically emphasizes what is becoming apparent: the use of traces as guide or index fossils is limited, and hampered by lack of sufficient studies in the geologic record; on the other hand, traces as facies fossils are beginning to assume an importance greater, in many cases, than body fossils.

Part III, Selected Groups of Trace Fossils, contains a systematic review of the major groups of trace-producing organisms. This section contains some extremely interesting, even provocative, chapters. To choose a few from many; Sarjeant discusses plant trace fossils, and Voorhies vertebrate burrows; a fascinating chapter on "unusually large Burrows", by Bromley, Curran, Frey, Gutschick and Suttner, describes burrows for which we must seemingly postulate organisms up to nine m long, and only a half-centimetre in diameter! (Nemertean seem the only possible modern organism capable of assuming these dimensions.) The section concludes with related papers by Kennedy and Bromley, on the general topic of hardgrounds – a subject of increasing interest.

Part IV, Recent Aquatic Lebensspuren, could have been greatly expanded, for it is specifically these studies which allow us to develop trace