

so forth, are covered very well in the context of elastic waves. Short surface waves, internal waves, or planetary waves which could equally well be the vehicle for this material are hardly touched on at all.

Taken as a whole, the book presents a solid foundation for a wide range of geophysics; but it is best in its sections on seismic waves and the traditional solid earth geophysics subjects such as gravity and the figure of the earth. I suspect this book will have wide use as a graduate text in departments where "geophysics" essentially means seismology.

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LORING, D. H., AND D. J. G. NOTA. 1973. **Morphology and sediments of the Gulf of St. Lawrence.** Bull. Fish. Res. Bd. Can. 182. 147 p. + 7 charts. \$5.00.

The Gulf of St. Lawrence belongs to a particularly interesting class of large coastal embayments whose geography and geological history are primarily determined by the presence of a major river. It has definite estuarine characteristics; yet because of its considerable size it is an inland sea with a complex system of water masses influenced more by the North Atlantic circulation than by the land drainage. Its location is unique: as a sedimentary basin, it has developed along a major lithological boundary between the Canadian shield (Laurentian region) and the Appalachian province. It so happens that it also stretches over an important and geologically unstable climatic boundary, along what is now the southern limit of the subarctic zone. Consequently, it has borne the full impact of the last glaciation, while at the same time keeping record of the late fluctuations of the ice margin. Under the ice scars, and reshaped into long troughs by the Wisconsin ice-sheets and glaciers, the old Mesozoic drainage is still clearly outlined, indicating the very old origin of this region.

Setting their work against this background, Loring and Nota have given a well balanced and intricate account of the Quaternary evolution of the gulf, integrating new information on its morphology, sedimentology, major element distribution, and depositional history. Before going through the text, one would do well to look at the two large maps which accompany it and nicely bring together the main conclusions reached by the authors. The beautiful bathymetric chart made by the Canadian Hydrographic Service allows one to appreciate at a glance the striking morphology of the sea floor, dominated by the broad U-shaped valleys of the Laurentian Trough system, which are poked with depressions and partly buried under Recent pelites, while the dissected shelves display many features of a well preserved glaciated

topography under a mantle of coarse residual deposits. By looking next at the detailed sedimentological map drawn on the same scale, one appreciates fully, as stressed by the authors, how the distribution of the various kinds of surface deposits is intimately determined by the physiography. By controlling the textural properties of the sediments, it in turn ultimately affects the geochemical and mineralogical characteristics of the bottom deposits.

Throughout their study Loring and Nota make much use of textural analysis. This approach is particularly appropriate in an area such as the gulf where marked textural differences exist. It helps to clearly identify the dominant depositional processes on the basis of the contrasting sediment types. There is a wealth of sedimentary facies: modern and relict pelites, residual sands of glaciofluvial origin, reworked tills, glaciomarine sediments, etc. The fairly thick layer of Recent pelites (up to 40 m) in the deeper regions of the Laurentian Trough contrasts with the modest supply of suspended sediments contributed by the actual drainage, emphasizing the importance played by the reworking and winnowing of shelf and slope deposits in modern sedimentation processes.

The information retrieved from the sedimentological data culminates in a careful analysis of the late glacial history of the gulf. The retreat of the ice margin was by no means simple, and several oscillations may have occurred. For a study of this critical period, the upper slope of the Laurentian Trough yields much useful knowledge, particularly the northern edge of the Magdalena shelf which the authors have explored in great detail. Piston cores and seismic profiling have helped to establish the substructure and stratigraphy of vast coalescing fans developed in late Wisconsin times. The presence there of a young till, buried in places under Recent pelites, above a shell horizon which provides one of the few  $^{14}\text{C}$  dates available in the gulf, supports the occurrence of a glacial readvance sometime after 10,200 years B.P. This correlates well with the post-Champlain St. Narcisse readvance documented elsewhere, and, surprisingly, with a cold phase in northern Europe.

In comparison with regional monographs assembled from the work of many contributors, the organization and presentation of this study are enhanced by the fact that it is the result of the close collaboration of only two authors. Yet it is thorough; the information which it contains has been compiled over a period of 10 years. It is based on a large collection of well distributed sediment samples—some 1,500 of them—including piston cores up to 20 m long, and on many kilometers of echograms and seismic profiling. In analyzing the samples, special techniques were used, in addition to standard laboratory methods, to evaluate for each major element the relative contributions from detrital and nondetrital sources. The numerous charts and diagrams are well drawn and easy to read.

This report provides an excellent point of departure for further geological and oceanographic research in the gulf. It also supplies the necessary scientific background for potential developers of this vast and economically important region.

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HOOD, D. W., AND E. J. KELLEY [EDS.] 1974.  
**Oceanography of the Bering Sea.** Inst.  
Mar. Sci. Univ. Alaska, Fairbanks. Occas.  
Publ. 2. xxi + 623 p. \$20.00.

In view of the recently expanded interest in the coastal ocean, particularly its living and mineral resources, this symposium volume on the Bering Sea comes at a fortunate time. Those charged with protection and management of marine resources and environments are too frequently handicapped by the lack of scientific data on their area of responsibility. And marine scientists are often bothered by a scattered literature in several different and unfamiliar languages. The Bering Sea is a prime example of the problem, with much of the oceanographic data obtained by Russians and Japanese but with the U.S. having large management responsibilities in the region. This book is thus particularly useful. It is the result of an international symposium held at Hakodate in early 1972 to review the scientific literature and to discuss possible international studies of the region. The 28 chapters and 3 abstracts in the book are organized into eight sections of nearly equal length: physical processes (4 papers), chemical oceanography (5 papers), inventory of renewable resources (4 papers), dynamics of renewable resources (4 papers), ice and its effects (4 papers), meteorological processes (4 papers), geological processes (3 papers), and technical development (3 papers).

This volume closely resembles—in coverage and the inevitable gaps—the recently published *North Sea science* (Goldberg 1973). In comparing the two volumes, one is struck with the richness of our knowledge about the North Sea, because of decades of sophisticated research, and our relatively meager knowledge about the Bering Sea.

The book has a strong focus on the problems of the living resources in the Bering Sea. The papers reflect the diverse and scattered interests of the 51 contributors from Japan, U.S., U.S.S.R., and Canada, with many obvious gaps in coverage; one notable exception is a review chapter by Hood and Reeburgh on the chemistry of the Bering Sea. The book would have been greatly improved by having summaries or review chapters in each of the major parts and a final summary pointing out the various gaps in data and understanding of key processes and indicating the sense of the group to priority. One example of gaps in the book is the limited at-

tention paid to primary productivity. Several papers commented on the apparent high productivity of the Bering Sea, but I was left with the basic question: Why? Is the productivity supported by phytoplankton growth in response to canyon-induced upwelling, or by an abundance of plant debris brought in by river discharge, or some combination?

From reading the book, I was struck with the opportunities that the Bering Sea affords to carry out quantitative oceanographic studies. It is the area where the Arctic and Pacific Ocean waters mix, and the local climate seasonally undergoes extreme changes. The variety of oceanographic conditions is also impressive, ranging from continental shelf on the eastern side to deep ocean basin on the Asiatic side. Secondly, the existence of the Aleutian Islands and associated submarine ridges provides a nearly enclosed sea, permitting effective use of mass balance considerations. Physical oceanographers took advantage of these conditions to contribute papers on mass balance studies. I was surprised, however, that there were no geological studies of comparable nature. The area appears to be a natural laboratory for mass balance studies of sediment transport and deposition.

Despite the abundance of data in this volume, it is clear that much remains to be done in the Bering Sea. And those working in the Bering Sea, or other high latitude coastal ocean areas, will need this book in their work. It provides a rich beginning to large-scale, integrated studies of an important and interesting area.

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GOLDBERG, E. C. [ED.]. 1973. North Sea science. NATO North Sea Sci. Conf., Aviemore, Scotland, 15–20 November 1971. Mass. Inst. Technol. 500 p.

FAULKNER, D. 1974. **This living reef.** Quadrangle/The New York Times Book Co., New York. 179 p. \$27.50.

The bulk of the book is the sumptuous color portfolio of 107 full-page or double-page (a few) plates taken by the author in Palau—called throughout by the native name of Belau. A few of the pictures are air or surface views of representative localities presented. On the great majority are usually several organisms, identified in the section of legends, all photographed in the natural setting and most of them presenting effective aesthetic compositions, some indeed, entirely stunningly so.

There is an introductory text, opening with a short section entitled "Belau genesis," based on