Current Research

Eastern Section, S.E.P.M. Short Course on Littoral Processes, Baltimore, March 20, 1974 by G.V. MIDDLETON.

This one day short course was sponsored by the Eastern Section of the S.E.P.M. and was given by Cyril J. Galvin, Jr., Chief, Coastal Processes Branch, Coastal Engineering Research Center, the day before the Annual Meeting of the northeastern section of the Geological Society of America. It was attended by 28 registrants, each of whom payed a fee of $5.00 to cover part of the cost of room rental, reproduction of course notes and morning and afternoon coffee.

The focus of the lectures was on the concept of the sediment budget for the littoral zone. Shores erode, accrete or remain stable depending on the rates at which sediment is supplied or removed from the shore by wave action, currents, and wind. The Coastal Engineering Research Center (CERC) is very much concerned with processes that affect the sediment budget, because of its responsibilities for the coastal engineering research, particularly concerning control of coastal erosion. CERC and its forerunner, the Beach Erosion Board, have become well known for basic and applied research on sediment movement in the coastal zone. The results have been published as a series of reports, and the major practical conclusions were summarized in Technical Report No. 4, "Shore Protection Planning and Design", originally published in 1954. A new, three volume edition of this work (entitled "Shore Protection Manual") is now in press and should be available this summer. Dr. Galvin's lectures were based mainly on one section of this forthcoming report.

Dr. Galvin began by pointing out that the basic theory of waves was developed more than a century ago, but that progress in applying the theory to the practical problems of sediment budget in the littoral zone has been slow. After summarizing some of the properties of waves, Dr. Galvin discussed how the theory may be used to predict the maximum water velocity at the bed as waves move into shallow water. At the outer edge of the shoaling zone, where the depth is equal to one sixth the wave length, the bottom velocity can be shown to be sufficient to move the bottom sediment under conditions of moderate to heavy seas. Further inshore, the movement of sediment can be related to the dimensionless fall time for a grain in the surf zone, $F_o = H_o/(vT)$ where H_o is the deepwater height of the waves, v is the fall velocity of the sand grains, and T is the wave period. H_o/v is the nominal time that the sand grain takes to settle a distance about equal to the depth in the surf zone. If this time is much longer than the wave period, the grain tends to remain in suspension, if it is much less the grain is likely to be deposited. Thus it might be expected that a dimensionless fall time about equal to one would be a suitable criterion to separate conditions of deposition onshore (growth of beach and berm) from conditions of deposition offshore (growth of offshore bars). Experimental data confirms that this is the case, for a wide range of wave steepness and height.

Dr. Galvin next reviewed the main formulae that have been proposed for the longshore transport rate of sand (the sand is littoral drift, its movement along the coast is longshore transport). The rate may be predicted from measurements of the wave energy flux entering the surf zone. Alternatively, a simple empirical formula, $Q = 2H^2$, where Q is the longshore transport rate in 100,000 yds^3/yr and H is the mean breaker height in feet, appears to fit gross transport rates obtained from 11 long-term field relationships. There followed a discussion of the various possible sources and sinks of sediment that must be considered offshore, onshore or within the littoral zone itself, together with estimates of their probable orders of magnitude for some real examples. It was pointed out that longshore transport of sand is the most important element of the littoral sediment budget at most coastal localities.

One fascinating aspect of Dr. Galvin's lectures was his presentation of the results of a compilation of data on wave climate and coastal processes for the entire coastline of the United States. Data on breaker height, period and direction have been collected routinely for several years by relatively unskilled observers of the U.S. Coast Guard. Despite the inherently inaccurate nature of such data, they proved to be internally consistent and to yield valuable generalizations about wave climate along major parts of the United States coastline. For example, mean wave heights and periods are approximately twice as great on the Pacific as on the Atlantic coast, largely because the dominant winds over both oceans have a westerly component.

In summary, the participants found Dr. Galvin's presentation full of interest both for its explanation of the fundamentals of wave action in the littoral zone, and for the wealth and variety of the illustrative material, which was drawn from all parts of the United States coastline, as well as from experimental studies. The small group attending the course included representatives from several disciplines (geology, geomorphology, engineering). This, together with the informality encouraged by the instructor resulted in vigorous discussion. Hopefully, similar short courses will be held in connection with future S.E.P.M. and other meetings.

Research Program of the Atlantic Geoscience Centre by B.R. PELLETIER.

The research program at the Atlantic Geoscience Centre continues in both field and laboratory components in three specific areas: (1) Environmental Marine Geology; (2) Regional and Reconnaissance Geology; and (3) Petroleum Geology.

The environmental program is underway in the Bay of Chaleur and comprises mainly an investigation into modern ecology based on foraminiferal studies, and an assessment on the sedimentation and geochemical aspects.

Another important environmental program deals

with an investigation of the beaches around the Gulf of St. Lawrence. Both morphology and sedimentation are the main components of this study.

A considerable amount of laboratory and office work is being devoted to studies on Arctic sedimentation and paleoecology. The significant area is the Beaufort Sea with some emphasis being placed on studies of the Northwest Passage and Baffin Bay.

Also in the laboratory, research is being carried out on the hydrogen-carbon compounds obtained from offshore wells drilled by the petroleum industry. Inorganic geochemists are continuing their work on determining the pathways of various metallic ions in the sea. They are also examining the processes which permit the exchange of these ions from sea water to suspended particulate matter and bottom sediments.

The regional geology and geophysics comprises the main elements on the cruises along the eastern seaboard. A major hydrographic-geophysical survey is underway off the Labrador coast. A scientific cruise into Baffin Bay and the Arctic Archipelago is presently underway and will include shallow bedrock drilling, gravimetric and magnetic surveys, bottom sampling and some biological dredging. This work will be done aboard CSS HUDSON over a four-month period.

Earlier surveys were continued in the Grand Banks area and, at the same time, compilation of cruise work in the Bay of Fundy-Gulf of Maine area is being completed.

In the laboratory assigned to carry out the examination of the offshore drill cores, a broad stratigraphic framework for the eastern offshore is being established. This is supported by deep seismic reflection results, detailed study of the fauna in the cores, and sedimentological analysis to correlate with the paleontological studies. All studies, exclusive of some of the environmental program, are devoted to the investigation of the continental margin off the eastern coast of Canada.

The program at AGC is presently being documented in a special paper of the Geological Survey of Canada (Paper 74-30) entitled "Offshore Geology of Eastern Canada". This paper comprises two volumes: (1) "Concepts and Applications of Environmental Marine Geology", and (2) "Regional Geology".

Volume 1 - Part I - Concepts:

1. B.R. PELLETIER and D.E. BUCKLEY: The Development of Environmental Marine Geology at the Bedford Institute of Oceanography
2. E.H. OWENS: A Framework for the Definition of Coastal Environments in the Southern Gulf of St. Lawrence.
3. B.R. PELLETIER: Sedimentary Textures and Relative Entropy and their Relationship to the Hydrodynamic Environment, Bay of Fundy System.
4. I. McK. HARRIS: Iceberg Marks on the Labrador Shelf.
5. C.T. SCHAFER and F.E. (FRAPE) COLE: Distributions of Benthonic Foraminifera: Their Use in Delimiting Local Nearshore Environments.
6. G. VILKS: The Distributions of Planktonic Foraminifera in the Sediments and Water of the Northwest Passage and Northern Baffin Bay: A Tool for Paleo-oceanographic Synthesis.
7. M.A. RASHID: Humic Compounds of the Sedimentary Environment: Their Chemical Nature and Geochemical Significance.

Volume 1 - Part II - Applications:

8. D.E. BUCKLEY, E.H. OWENS, C.T. SCHAFER, G. VILKS R.E. CRANSTON, M.A. RASHID, F.J.E. WAGNER, and D.A. WALKER: Canso Strait and Chedabucto Bay: A Multidisciplinary Study of the Impact of Man on the Marine Environment.

Volume 2 - Part I - Gulf of St. Lawrence:

1. R.T. HAWORTH: Structural Synthesis of the Gulf of St. Lawrence from Geophysical Data.
2. R.D. HOWIE and M.S. BARSS: Carboniferous in the Gulf of St. Lawrence and Atlantic Provinces.
3. D.H. LORING: Marine Geology of the Gulf of St. Lawrence.

Volume 2 - Part II - Continental Margin off Nova Scotia and Newboundland:

4. C.E. KEEN, B.L. BARRETT and D.E. HEFFLER: The Continental Margin of Eastern Canada.
5. L.F. JANSA and J.A. WADE: Geological History of the Continental Margins off Nova Scotia and Newfoundland.
6. I.A. HARDY: Geology of the Tertiary System on on the Scotian Shelf.
7. L.H. KING and B. MacLEAN: Stratigraphic interpretation of the Central Grand Banks from High-Resolution Seismic Reflection Profiles.
8. L.H. KING and B. MacLEAN: Geology of Scotian Shelf and Adjacent Areas-Map.
9. D. MONAHAN and R.F. MACNAB: Macro-and mesomorphology of Flemish Cap and Flemish Pass.
10. P. ASCOLI and G.L. WILLIAMS: Biostratigraphy of the Mesozoic-Cenozoic Sediments of the Scotian Shelf and Grand Banks.

Volume 2 - Part III - Labrador Sea and Baffin Bay:

11. W.J.M. VAN DER LINDEN and S.P. SRIVASTAVA: The Crustal Structure of the Continental Margin off Central Labrador Coast.
12. A.C. GRANT: Structural Modes of the Western Margin of the Labrador Sea.
13. D.I. ROSS and B.R. PELLETIER: Geology of Baffin Bay.

Volume 2 - Part IV - Hudson Bay:

14. B.V. SANFORD: Paleozoic Geology of Hudson Bay and Adjacent Regions.