

Current Research

Volume 5, numéro 3, december 1969

URI : https://id.erudit.org/iderudit/ageo05_3res01

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Éditeur(s)

Maritime Sediments Editorial Board

ISSN

0843-5561 (imprimé)

1718-7885 (numérique)

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Citer ce document

(1969). Current Research. *Atlantic Geology*, 5(3), 129–137.

Current Research

Current Research by Geological Survey of Canada during 1969 compiled by D. G. BENSON, G. S. C., Ottawa.

Seismic Program by G. D. HOBSON:

The seismic section of the Exploration Geophysics Division of the Geological Survey undertook conventional marine refraction seismic surveys within the Gulf of St. Lawrence commencing the operation in 1964. Two ships have been used over varying periods of time during the field seasons until 1969. The project was completed in September of 1969. The purpose of the project is to determine the thickness and attitude of the sediments overlying crystalline basement. The end result should be an interpretative seismic map of the eastern Canadian Maritimes with the water removed. The refraction technique has been used exclusively with some continuous profiling in the reflection mode being obtained during the 1969 season. Two ships have been used, one as a platform for the instruments and the other as a platform for setting off charges of explosives in the water. A map showing the locations of all the refraction profiles is included with this presentation.

It is intended that a map of basement topography will be the end product. There will be sections showing seismic velocity through the various layers and the thickness of these layers; where possible these sections will be tied to wells on shore. It is anticipated also that a fence diagram will be presented of all the data within the Gulf as perhaps being an easier presentation to comprehend the geological structure.

The Magnetics Program by P. J. HOOD:

The Magnetic Methods Section was concerned with three different projects in Eastern Canada during 1969. Approximately 11,000 line miles of aeromagnetic data were obtained in conjunction with the National Aeronautical Establishment between Newfoundland and the southern Tip of Greenland. The aeromagnetic data shows that the magnetic stripes in the North Atlantic Ocean, which are found in all deep-ocean basins, bend around the southern tip of Greenland. It therefore follows that the Labrador Sea and Baffin Bay widened at the same time that the North Atlantic Ocean itself was being formed by the separation of Europe and North America. This movement probably started about 160 million years ago.

In situ susceptibility measurements were made at 307 sites in southern New Brunswick and Nova Scotia by P. H. McGrath during 1969. Seventy-two rock cores were also obtained for remanent magnetism determinations. The magnetic properties of the Goldenville quartzite is due to a single magnetic phase of almost pure magnetite, caused by pyrrhotite produced from pyrite by thermal metamorphism and by sulphurous degassing within shear zones.

P. H. McGrath has continued development of automatic methods of depth determination using the computer to obtain best-least square fits to observed data. A paper describing the method for the dipping-dyke case is in preparation for publication in Geophysics. These methods are being used by P. H. McGrath in an interpretation of aeromagnetic data in the Appalachian region of Canada, and also by L. J. Kornik in the Western Shield region.

The Earth Science Symposia by P. J. HOOD:

The 386-page proceedings of the Earth Science Symposium on Hudson Bay was published in May 1969, and was well received by industry. The proceedings received good reviews in a number of journals, see for instance page 797 of the October 1969 issue of the journal Geophysics.

In view of the success of the first symposium, it is planned to hold an Earth Science Symposium on Offshore Eastern Canada in Camsell Hall, 588 Booth Street, Department of Energy, Mines and Resources, Ottawa on February 22-24th, 1971. The main objective of the Symposium will be to summarize the present knowledge of the continental shelves and slopes of eastern Canada so that emphasis will be on results rather than techniques, although descriptions of new techniques will be encouraged. Areas to be discussed are the Bay of Fundy, Scotian Shelf, Gulf

of St. Lawrence, Grand Banks, Flemish Cap, Labrador Sea, Ungava Bay, Baffin Bay and Greenland Shelf. The topics will include Surficial Geology, Geochemistry, Repetitive-Source Seismic, Bedrock Geology and Tectonics, Seismic Reflection & Refraction, Gravity, Magnetics, Magnetotellurics, Crustal Seismic, Heat Flow, Continental Drift, and Offshore Drilling. Abstracts should be submitted before November 1st, 1970. A number of papers have already been offered mainly by government agencies and the universities, and there has been some response from industry. It is recognized that the symposium will be a greater success by widespread industry participation. It is therefore urged that individuals and representatives of exploration companies indicate to Dr. Hood their degree of interest. The symposium is being sponsored by the NRC Associate Committee on Geodesy & Geophysics (through the Exploration Geophysics subcommittee) and the National Advisory Committee on Research in the Geological Sciences.

Structure and Regional Mapping:

- F. D. ANDERSON continued a structural study of the major faults in central New Brunswick.
- D. G. BENSON completed field work in the Antigonish map-area including scuba diving in St. Georges Bay. A preliminary paper is now being edited.
- H. H. BOSTOCK has started a study of the Precambrian rocks of the Great Northern Peninsula of Newfoundland. The part of the Long Range that he has mapped consists chiefly of granitic, amphibolitic and quartzitic gneisses.
- N. R. GADD has completed field work on the surficial geology in the Fredericton 4-mile map-area (southwestern New Brunswick). Publication at 4 miles to the inch is expected.
- H. HELMSTAEDT is carrying out a structural study of the Tetagouche Group (Ordovician) in the Bathurst area of New Brunswick. He also investigated the contact relationships between the Ordovician folded belt and the Silurian-Devonian folded belt (Davies, 1966).
- R. SKINNER completed mapping of the Tuadook Lake map-area in New Brunswick which is underlain by Ordovician (?) and Devonian granites, metamorphosed Cambro-Ordovician sediments and minor Devonian gabbro flanked by Siluro-Devonian volcanics.

Stratigraphy and Paleontology:

- M. S. BARSS is nearing completion of a detailed palynological study of the Horton Group (Upper Devonian and Lower Carboniferous) of the Atlantic Provinces.
- T. E. BOLTON is studying the macrobiostratigraphy of the Ordovician and Silurian of Anticosti Island.
- M. J. COPELAND has been concerned with the micropaleontology of the Ordovician and Silurian of Anticosti Island. He has also done preparatory work for paleontological studies by T. E. Bolton, G. W. Sinclair and himself in Gaspé, Southampton Island and the Hudson Bay Lowlands.
- L. M. CUMMING commenced field investigation of the lower Palaeozoic strata in the Strait of Belle Isle region.
- W. T. DEAN is investigating the lower Palaeozoic (Cambrian and Ordovician) paleontology and stratigraphy of the Atlantic Provinces with particular reference to trilobites.
- R. D. HOWIE is continuing a study of the subsurface stratigraphy of the Albert Formation (lower Carboniferous) in southern New Brunswick.
- D. C. MCGREGOR is nearing completion of a report on the palynology of the Gaspé sandstone (Devonian) in Gaspé and northern New Brunswick, as part of a continuing study of the Devonian palynology of the Atlantic Provinces.

Economic Geology and Geochemistry:

- R. W. BOYLE has completed a manuscript entitled "The Geology, Geochemistry, and Origin of the Barite, Manganese and Lead-Zinc-Copper-Silver Deposits of the Walton-Cheverie Area, Nova Scotia", which contains information on the geochemistry of the Horton and Windsor Groups (Carboniferous) and the Triassic sandstones. This manuscript is presently being prepared for publication.
- P. A. HACQUEBARD and J. R. DONALDSON have submitted a paper to the Canadian Journal of Earth Sciences on their study of rank variations of coal in the Atlantic Provinces. This study relates the search for oil and gas to the degree of organic metamorphism as indicated by rank of coal interpreted from reflectance measurements.
- H. W. LITTLE is involved in a thorough investigation of uranium mineralization in Canada. His interest in the Atlantic Provinces is directed mainly toward the possibility of uranium in

the Carboniferous basins.

- A. NIGRINI is investigating the transport and deposition of Cu, Pb, and Zn in the surficial environment. This study involves three streams associated with sulphide deposits in the Bathurst area of New Brunswick.
- D. F. SANGSTER is studying all lead-zinc deposits in Canada. This study includes all lead-zinc deposits in the Atlantic Provinces, some of which are regarded to be of sedimentary origin.

Research in Arctic Canada. The Polar Continental Shelf Project, Department of Energy, Mines and Resources, Ottawa.

Heading the endeavours in Arctic Research are those programmed through the Polar Continental Shelf Project under its co-ordinator, Dr. E. F. Roots. This project, which is carried out over the sea ice and Archipelago, has now completed 11 field seasons and as it moves into its twelfth year of continuous operations it embraces an ever increasing number of scientific and technological disciplines. These are summarized as follows:

- G. VILKS, Atlantic Oceanographic Laboratory, Bedford Institute, and J. IQBAL, Dalhousie University - Marine geology in the Beaufort Sea - continuing study of the sediments, the processes of sedimentation, and the present and past organisms of the sea floor in an arctic environment.
- J. HIGGINBOTHAM, Geological Survey of Canada, - Geomorphology in the Inuvik (Mackenzie Delta area) forest fire area - a study of the physiographic effects of the partial or complete removal of the organic surface layer in a permafrost area. The severe forest fire in the Inuvik area in 1968 destroyed in many places the thick layer of organic matter that develops on permafrost in taiga zones, and provides a unique opportunity to study comparative erosion, land form development and permafrost and vegetation development in protected and unprotected areas.
- D. C. MCGREGOR and T. UYENO, Geological Survey of Canada - Paleontology in the Arctic Archipelago - detailed paleontological and stratigraphic study of selected Palaeozoic formations on Bathurst, Devon, Ellesmere, Prince of Wales, Axel Heiberg, Prince Patrick and Cornwallis Islands.
- J. R. MACKAY, University of British Columbia and Geological Survey of Canada - Physical geography and geomorphology in the Mackenzie delta - a continuing study of the nature and distribution of permafrost in the Mackenzie Delta area, of the characteristics and mechanics of permafrost landforms, with special reference to the development of pingoes, the occurrence of permafrost around lakes and offshore.
- J. G. FYLES, Geological Survey of Canada, L. V. HILLS, University of Calgary, and H. FRENCH - Quaternary geomorphology, Banks Island - A continuing study of the Recent geological history and the development of landforms in northwestern and central Banks Island.
- M. KUC, Geological Survey of Canada - Quaternary geobotanical studies, Banks Island - Mapping of vegetation types and study of peat deposits, to determine Recent geological evolution of western Arctic Islands.
- J. R. MACKAY and G. D. HOBSON, Geological Survey of Canada - Seismic studies of permafrost, Mackenzie Delta - A hammer seismic and sparker survey of the thickness of permafrost on the Tuktoyaktuk peninsula.
- C. YORATH, Geological Survey of Canada - Stratigraphy, Caribou Hills - A study of the stratigraphy and structure of the Mesozoic formations in the lower Mackenzie River Valley.
- J. DELAURIER and R. NIBLETT, Dominion Observatories Branch - Geomagnetism, Meighen Island and Cape Morris Jessup - To determine extent and nature of the geomagnetic and electromagnetic conductivity anomaly, previously studied in the Alert-Robeson Channel area.
- W. E. B. PATERSON, Polar Continental Shelf Project - Glaciology, Melville Island ice cap - A continuing study of the mass balance of these thinnest and driest of North American arctic glaciers. Surveys of accumulation, wastage and movement, with detailed aerial photography.
- B. BARGE, National Research Council, McGill University and W. S. B. PATERSON, Polar Continental Shelf Project - Glaciology, Meighen Ice caps - A continuing study of the behaviour of a small dry high arctic ice cap and its influence on and reaction to the local climate; mass balance measurements; temperature and deformation in a borehole that penetrates the ice cap.

- J. R. WEBER, Dominion Observatories Branch - Gravity (Oceanography), Geodesy, North Pole - A multi-discipline investigation of the area of the North Pole and the meridian 60°W to determine the shape of the geoid, the tilt of the ocean surface and deflection of the plumb line, the fine and gross structure of sea ice drift, with studies of oceanography, hydrography, gravity, and sub-bottom sediment structure, and a comparison of celestial, satellite, and electromagnetic (Omega) methods of position determination.
- L. W. SOBCZAK, Dominion Observatories Branch - Gravity, Beaufort Sea - A regional gravity survey with measurements at intervals of approximately 8 km, for mapping at a scale of 1:500,000, tied to base stations on the mainland and Banks Island.
- P. FERNANDEZ-DAVILA, Dominion Observatories Branch - Gravity, Mackenzie Delta - A regional gravity survey of the lower Mackenzie River Valley and delta with measurements at intervals of approximately 8 km, for mapping at a scale of 1:250,000.
- A. JUDGE, Polar Continental Shelf Project/Observatories Branch - Heat flow, Melville Island, Ellesmere Island and Greenland - Measurements of the flow of geothermal heat from the earth's crust in the Arctic Archipelago, and Greenland, with readings taken in drill holes and at the bottom of thermally stable lakes.
- G. YEATON, Canadian Hydrographic Service - Hydrography, Beaufort Sea and Arctic Ocean - Hydrographic mapping by sounding through the ice at intervals of approximately 6 km, for charting at a scale of 1:500,000.
- G. YEATON, Canadian Hydrographic Service - Hydrography, Beaufort Sea (coastal) - hydrographic mapping by continuous profile sounding along lines spaced approximately 1 kilometer apart, for charting at a scale of 1:100,000.
- K. C. ARNOLD, Inland Waters Branch - Photogrammetry of glaciers, Axel Heiberg Island, Ellesmere Island - Surveys of selected glaciers of Axel Heiberg and Ellesmere Island, as part of an investigation of the applicability of terrestrial photogrammetry to the measurement of glacier movement and volume change.
- R. L. LILLESTRAND, Control Data Corp., E. F. ROOTS, Polar Continental Shelf Project, F. W. ADAMS, Department of Transport - Position determination, North Greenland, Alert to Kaffeklubben Island - The determination of the position of a number of locations along the northwestern and northern coasts of Greenland, to check suspected errors in the present maps and to compare the results of celestial and Omega navigation.
- F. W. ADAMS, Department of Transport - Position determination and navigation, Omega tests, Arctic Ocean and Beaufort Sea - An evaluation of signal strength and stability obtainable with the Omega navigation system in high latitudes (to 90°N .) and in the western arctic; and a comparison of its repeatability and accuracy with that of the Decca Lambda system.
- K. PEISTER, Department of Transport, seconded to Polar Continental Shelf Project - Sea ice studies, Arctic Archipelago - A systematic aerial survey of the distribution, nature and movement of sea ice in all the main channels of the Canadian Arctic Archipelago, and in the adjacent Beaufort Sea and Arctic Ocean, supplemented by surface studies.
- L. COLBY, Polar Continental Shelf Project - Sea Ice Investigations on Manhattan Project, Parry Channel and Prince of Wales Strait - Determination of thickness, temperature profile, salinity, and general structure and nature of sea ice at selected locations along the proposed route of the tanker U. S. S. MANHATTAN, to obtain data on the early-season strength and physical characteristics of the ice, which can be related to measurements taken at the time of the ship passage late in the season.
- P. F. COOPER, Jr., Polar Continental Shelf Project - Sea Ice Dynamics, Tuktoyaktuk - A continuing study of the stress and strain relationships of the annual sea ice in Kugmallit Bay and immediately offshore from Mackenzie River Delta, to determine the forces transmitted to the ice by the wind, by the resistance of the shoreline, and other factors.
- A. PAULIN, Cold Regions Research and Engineering Laboratory - Thermal Imagery, Tuktoyaktuk and Arctic Ocean - A study of the thermal characteristics of the surfaces of snow-covered frozen land, frozen fresh water lakes, and various types of sea ice, as recorded from aircraft, and compared with ground temperature profiles along selected test lines.

Investigations of other Canadian Government Agencies supported or assisted by the Polar Continental Shelf Project.

Department of National Defence:

- A. R. MILNE, Defence Research Establishment Pacific - Sub-ice acoustics, Parry Channel - A study of underwater sound generation and propagation beneath various types of sea ice in channels of the Arctic Archipelago.

National Museums of Canada:

- R. J. McGHEE, National Museums of Canada - Archaeology, Mackenzie Delta region - An investigation of archaeological sites near Inuvik, Tuktoyaktuk, and Point Atkinson.
- H. MULLER-BECK, National Museums of Canada - Archaeology, Banks Island - A re-investigation of an archaeological site near Shoran Lake central Banks Island.
- S. D. MacDONALD, National Museum of Canada, in collaboration with scientists from: University of Alberta, Department of Agriculture, Canadian Wildlife Service, Federation of Ontario Naturalists, University of Kansas - Biological and Ethological Studies, Bathurst Island - A continuation of the comprehensive biological and ethological investigations of central Bathurst Island, started in 1968, including studies of the ethology and territorial behaviour of rock ptarmigan, a study of the breeding of ivory gulls, sanderlings and other shorebirds, of overwintering insects, arctic hares, muskoxen and wolves.
- D. J. FABER (on zooplankton) and R. K. LEE (on algae) National Museums of Canada - Marine Biology, Western Arctic coastlines - To make a collection of Arctic Ocean zooplankton and study the dominant forms of algae along the coasts of Banks Island, Victoria Island, and the mainland shores between Amundsen Gulf and Demarcation Point.
- P. M. YOUNGMAN, National Museums of Canada - Zoology, western Mackenzie and coastal Yukon - A survey of the small mammals of coastal Yukon and western Mackenzie district.

Province of Quebec Wildlife Service:

- J. D. HEYLAND, Quebec Wildlife Service - Zoology (ornithology) Baffin Island, Ellesmere Island - Investigations of greater snow geese at various nesting sites along eastern Arctic Archipelago.

Investigations by universities or non-government research agencies assisted by the Polar Continental Shelf Project.

- P. BARRETT, University of British Columbia (botany), R. BRAITHWAITE, McGill University (glaciology), I. WHILLANS, Ohio State University (glaciology), D. HUSSELL, University of Michigan (ornithology) - Devon Island Research Program, Arctic Institute of North America - A multi-discipline investigation of the north coast and the central ice cap of Devon Island.
- D. OVERLAND and R. TIDMARSH, McGill University, under direction of R. MEUNCH, University of Washington - North Water Project, Arctic Institute of North America - A study of the physical oceanography of Kane Basin, southern Nares Strait.
- E. KLOVAN, University of Calgary - Geology, Banks Island - A study of the paleontology and petrology of the Palaeozoic formations of northern Banks Island.
- S. TABATA, Hokkaido University - Sea Ice studies, northern Archipelago - Assistance to Forzen Sea Research Group in arranging for a visit and tour to observe sea ice research in Arctic Archipelago, Alert, Tanquary Fiord, and Resolute.
- R. T. WILCE, University of Massachusetts - Marine botany, Grise Fiord - A study of the occurrence, distribution and behaviour of algae under the heavy seasonal sea ice cover of Jones Sound.
- F. MULLER, McGill University - Glaciology, Axel Heiberg Island - A continuing multi-discipline study of the glaciers and glacial environment of Axel Heiberg Island, including mass balance, geophysical, meteorological, biological hydrological and glacial geology investigations.
- P. LANGLEBEN, McGill University - Sea Ice Albedo Studies, Tuktoyaktuk - A study of the albedo and radiation from a melting cover of sea ice, as measured from aircraft.
- H. B. McCANN, McMaster University - Geomorphology and pedology, Devon Island - A continuation of a study of coastline and land form development, and soil formation in southwestern Devon Island.
- S. APPOLLONIO, Yale University and State of Maine Department of Fisheries - Oceanography, Grise Fiord - A study of the physical and biological oceanography of northern Jones Sound in late winter.

Marine Sciences Branch - Arctic Program.

- A. Cruise of HUDSON 70
- B. Role of CSS BAFFIN, CSS PARIZEAU and CSS RICHARDSON in the western Arctic

- C. Role of CSS DAWSON and CSS BAFFIN in Eastern Arctic
- D. Role of Canadian Coast Guard Icebreaker of the DOT

Palynological studies by J. TERASMAE of the Department of Geological Sciences, Brock University, St. Catharines, Ontario, and R. J. MOTT of the Geological Survey of Canada, Ottawa, Ontario.

A palynological study and postglacial geochronology in the St. John River Valley, New Brunswick:

A manuscript of this report has been submitted to the Geological Survey for publication. Results of studies made in the St. John River valley during the past 10 years indicate that deglaciation occurred in the interval of 11,000 to about 13,000 radiocarbon years B. P., with halts and readvances of the ice margin. This study supports the postulated presence of local ice in the highland areas during late-glacial time, as proposed by V. K. Prest of the Geological Survey. Palynological studies have been used to establish a sequence of development and history of the vegetation since deglaciation, and a chronological correlation of late- and post-glacial events has been attempted between the St. John valley and the St. Lawrence lowland on the basis of palynological evidence and radiocarbon dating.

Sable Island Project: Postglacial history and palynological studies:

Field studies were made in 1967 and preliminary results obtained were presented at the annual meeting of the American Association of Stratigraphic Palynologists, October 19-22, 1969, Penn State University.

Sable Island holds especial interest in postglacial palynology because it lies about 180 miles east of Halifax, Nova Scotia, near the edge of the continental shelf and is the only emerged part left of an extensive archipelago which existed on the shelf during the last glaciation. A series of buried soil and peat horizons, ranging in age from about 200 to 11,000 radiocarbon years, has been studied palynologically in addition to surface samples and atmospheric pollen deposition. This study has failed to substantiate the claimed presence of interglacial surfaces (soils) on the island and supports instead the hypothesis of a continuously changing and slowly eastward migrating complex of sand deposits. The absence of trees on the island facilitates studies of long distance atmospheric transport of pollen and spores from the mainland; a quantitative study of atmospheric pollen is now continued by J. C. Ritchie of Dalhousie University at Halifax.

The University of Pennsylvania, Faculty of the Graduate School: Abstracts of M. Sc. Theses in Geology, 1969.

Perry Formation, St. Andrews Peninsula, St. Andrews, New Brunswick, Canada by Paul R. Shluger:

The Perry Formation (Devonian) of New Brunswick consists of a series of fining-upward cyclic sequences of fluvial sedimentary rocks deposited in a fault trough produced by the Acadian Orogeny. It crops out discontinuously along the shore of Passamaquoddy Bay.

The Perry Formation on the St. Andrews Peninsula, New Brunswick, is subdivided into seven members from the bottom to the top: 1) a lower sedimentary member of red conglomerates, sandstones and shales; 2) a lower diabase; 3) a middle sedimentary member of red conglomerates, sandstones, and shales; 4) a middle diabase member; 5) a middle-upper sedimentary member; 6) an upper diabase flow; and 7) an upper sedimentary member of red conglomerates, sandstones and shales.

Primary sedimentary structures including current ripple marks, mudcracks, imbricate pebbles, micro-cross laminae, and cross-bedding are present in fining-upward cycles. Analysis of directional current structures indicates a paleocurrent flow to the southeast and a sediment source northwest of the Perry Formation outcrop belt. Primary sedimentary structures suggest fluvial environmental conditions comparable to the lower flow regime. Facies changes indicate a lateral shift from alluvial fan to floodplain conditions.

One lithology (previously not reported) consists of a small calcareous biogenic unit of wormtubes and algal ? forms.

Heavy mineral analysis reveals a zircon-tourmaline-rutile ratio of 100 percent.

The red color of the sedimentary rocks were derived both from diagenetic alteration of mafic minerals which left a residue of clay minerals and hematite.

Luminescence petrography shows the presence of minor amounts of 1) fracture healing in quartz; 2) overgrowth in quartz; 3) zoned sparry calcite cement; 4) possible fossil forms; and 5) the presence of dolomite.

Sedimentology of the Deltas of the Moose and Diligent Rivers, Minas Basin, Bay of Fundy, Nova Scotia;

Two intertidal-zone deltas form at the mouths of the Diligent and Moose Rivers, Bay of Fundy, Nova Scotia. Sand and gravel eroded from the bedrock cliffs and glacial deposits provide the deltaic sediments in the two study areas. Although the deltas are formed in the same geographic location, have similar sediment sources, and are affected by similar sedimentary processes, differences in the intensities of the current velocities associated with these processes account for the differences in the sediments of the two study areas.

The processes of intertidal-zone delta formation include axial-jet, plane-jet, and open-channel flow, and wave-generated and tidal currents. Sediment deposited by ice-rafting and by settling from suspension modifies the deltaic deposits. Low sediment influx and high rates of erosion result in slow rates of deposition and thin accumulation of sediment.

The deposits formed in the two study areas consist of two types: (1) intertidal-zone deltaic and (2) intertidal-zone marine. Intertidal-zone deltaic deposits reflect deposition by open-channel, plane-jet, and axial-jet flow, operating in conjunction with wave-generated and tidal currents. Intertidal-zone marine deposits reflect deposition by wave-generated and tidal currents operating alone. The intertidal-zone sedimentary sequence consists of the alternation of these two sediment types.

Physiographic Classification of the Bay of Fundy Coast Based on Air-Photo Interpretation - A Progress Report by J. WELSTED, Geography Department, Brandon University, Brandon, Man.

Introduction:

Several classifications of coasts have been suggested (Johnson, 1919; Shepard, 1948; Valentin, 1952; Cotton, 1954). Few attempts have been made to apply these general classifications to particular stretches of coast, but recently more specific classifications have been devised (McGill, 1958; Byrne, 1964) and used to produce maps of coastal landforms; McGill producing a world map and Byrne one of the northern Oregon coast.

Although the Bay of Fundy is easily accessible and displays a variety of geomorphic processes, study of it has been neglected by the geomorphologist. There have been a few small, detailed studies in recent years (Swift and Borns, 1967), but the most comprehensive works (Goldthwait, 1924; Johnson, 1925) are well out of date. Classification of the Bay of Fundy coast has not previously been attempted. Moreover, although air photographs have been widely used in morphological studies, little attention has been given to their use as a means of studying coastal and shore morphology. However Alexander (1966) has shown that air-photographs can be used in the study of coastal and shore morphology and as an aid in constructing a descriptive shore classification. On the basis of three summers spent investigating the Fundy coast, the writer decided that the existing ground control would be sufficient to warrant the use of air photographs to interpret physiography.

Objectives:

The principal objectives of this study are outlined as follows: (1) To assess the usefulness of air-photographs in the interpretation and mapping of coastal and shore morphology; (2) To assess the usefulness, in terms of speed and accuracy, of simple air-photo interpretation apparatus; (3) To produce a classification of the Bay of Fundy coast that can be plotted on a map of scale 1:500,000.

The scientific objectives, focussed mainly on physiography, may be outlined as follows: (1) To determine whether the coast is cliffed or not; (2) If there is a cliff, to determine whether it is cut into bedrock or surficial material; (3) If there is a cliff, to calculate its height and steepness (gradient); (4) To distinguish wave-cut platforms; (5) If there is a wave-cut platform, to determine whether it is bare or covered by beach material which was divided into three categories: (a) boulders and pebbles, (b) sand and, (c) silt and clay; and (6) To determine the vegetation cover of the coast. Three categories were distinguished: (a) little or no vegetation (e. g. on steep cliffs), (b) forest and, (c) marsh vegetation.

Equipment and Materials:

To carry out this study the following basic materials were made available. Stereographic air-photo coverage of the Fundy coast on a scale of 1:15,850. Photographs of Nova Scotia, which were obtained from the National Air-Photo Library, Ottawa; and photographs of New Brunswick which were obtained from the New Brunswick Department of Lands and Mines, Fredericton, N. B.; complete topographic map coverage on scales of 1:250,000 and 1:50,000; and geological map coverage of the Fundy coast, published by the Geological Survey of Canada, at a variety of scales. The T. M. Pocket Measuring Stereoscope and the standard N2 Mirror Stereoscope were used to observe the physiographic features and to make the necessary stereographic measurements.

Progress:

Work was started in the summer of 1968 by commencing with an examination of the photographic series beginning at the New Brunswick - United States border, and continuing around the Bay of Fundy in a clockwise direction. In this year interpretation of the photographs was carried out by Mr. T. Carter, then a graduate student at the University of Saskatchewan, Saskatoon. During the previous summer, Mr. Carter had acted as fieldwork assistant for the writer who was studying the Fundy coast. During 1969, the interpretation has been done by Mr. G. Saunders, Miss V. J. Sharratt and Mr. K. Dando, all of whom were students at Brandon University. Information gained from the air-photographs has been plotted on the 1:50,000 maps - 44 of them in all. During the course of the work, air-photographs were used to advantage in studying coastal and shore morphology especially for those parts of the coast which are not readily accessible from the land. However, as might be expected, the amount of information that can be derived is largely dependant on the ground control available.

Classification:

It was originally intended to plot the coastal classification on a map of scale 1:500,000, but it has been found that there is far too much detail for a map of this scale, so it has been decided to increase the scale of the final map to 1:250,000. Even so, there will be too much detail in some areas and it is proposed to produce one map of scale 1:250,000 to show the whole coast and one map of scale 1:50,000 of one of the complex coastal areas. It will be necessary to limit the classification to a simple descriptive one rather than attempting a partly genetic one as was originally intended.

Future Work:

Work on the project will continue during the winter of 1969. It will be chiefly concerned with the cartographic problem of devising a graphical method of portraying the classification and transferring it to the final 1:250,000 and 1:50,000 maps.

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Acknowledgement:

The research for this paper was supported by the Defence Research Board of Canada (Grant Number 9511-80).

Canadian Invention Aids Oceanographers, Ottawa.

A revolutionary new oceanographic tool, developed and built at the Department of Energy, Mines and Resources' Atlantic Oceanographic Laboratory, has proved its worth on a two-month North Atlantic cruise by the Canadian Scientific Ship Hudson. The new tool is a rock-core drill developed over a four-year period by John Brooke of AOL's mechanical design group. Operated by the department's Marine Sciences Branch, AOL is part of the Bedford Institute at Dartmouth, N. S. For the first time, the Brooke drill enables scientists to obtain rock cores from outcrops on seamounts--submerged mountains rising from the ocean floor. Previously, rock samples from the deep ocean could be collected only by dredging up loose boulders.

Completely automatic, the drill is powered by the pressure of the ocean itself. A timing mechanism opens a valve allowing sea water to flow through a hydraulic power unit into a low-pressure reservoir. Another mechanism regulates the drill pressure on the rock face. The drill stem extends up to 65 inches, allowing it to go through several feet of sediment before drilling into the rock. The cores obtained are 7/8 inch in diameter. The progress of the drilling is telemetered to the ship by sound signals. Photographs of the ocean floor are taken from the drilling rig during the initial phases of the operation.

During the Hudson's 11,000-mile cruise the drill was lowered on nine peaks of the Mid-Atlantic Ridge near the 45th parallel. Twelve of the 29 lowerings obtained rock samples from depths of 2,500 to 5,500 feet. Their average length was nine inches, and the total drilled over a nine-day period was 114 inches. The cores consisted of coralline limestone, basalt fragments and consolidated foraminiferal sediment--the shells of countless tiny one-celled animals. The longest core was 12 inches of basalt drilled during one eight-minute operating cycle. The rock cores recovered by CSS Hudson are expected to add a new dimension to our understanding of the recent geological history of the ocean floor.

Hydrostatic rock core drill being lowered into Atlantic Ocean from deck of C.S.S. HUDSON which was used in the 11,000 mile transatlantic cruise to Portugal and return. Cameras are shown mounted beneath ladder and pre-aimed at prospective drilling site.

