

Current Research

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Current Research

Current Research by Department of Geology, Memorial University of Newfoundland, St. John's Newfoundland compiled by A.F. KING.

Newfoundland offers the most complete and superbly exposed cross section through the Appalachian System. Also, Precambrian rocks of the Grenville and Nain Provinces and the Labrador Trough are only a few hours by air from St. John's. As shown in a compilation of research workers elsewhere in this volume, the great variety of geology within this region allows wide scope for research in stratigraphy, sedimentology, paleontology, mineralogy, petrology, structure, Quaternary geology, geophysics, economic geology and applied geophysics.

Much of the current research in M.U.N.'s Department of Geology is directed towards the major earth science problems of the Atlantic Region -- particularly those of Newfoundland and Labrador. In order to focus on studies on the major problems, some 13 faculty, 20 graduate students and 3 research fellows are pursuing joint projects in selected areas of the system.

Projects on the Avalon Platform in southeast Newfoundland are concerned with the stratigraphy, petrology and structural history of the Precambrian volcanic and sedimentary rocks, the description and interpretation of Precambrian fossils and the stratigraphy, paleontology and sedimentary features of the Lower Paleozoic cover rocks. Dr. V.S. PAPEZIK is carrying out research on sedimentary rocks associated with ash flow tuffs of Precambrian age in the Conception Bay area. Dr. W.D. BRUECKNER is co-operating with Prof. M.M. ANDERSON, Dr. C.J. HUGHES, and graduate students J. MALPAS and J. MAHER on the paleogeography of the Harbour Main and Conception Groups. Dr. A.F. KING is currently working on paleocurrent analyses in the Eocambrian Cabot, Hodgewater and Musgravetown Groups. Y.C. HSU is studying the stratigraphy of the St. John's shales.

During the 1969 field season, B. GREENE commenced detailed stratigraphic and sedimentologic analysis of the Eocambrian Random Formation. In the type section at Hichman's Harbour, the Random is 500 feet thick and consists of white quartzite, slate, siltstone and sandstone. Paleocurrent directions indicate a source to the northwest but polymodal directions away from the type section indicate the need for further field work.

Recent geological investigations by Dr. H. WILLIAMS and M. CALCUTT of the Belleoram area have established new geological relationships, including reassignment of the Long Harbour Group from the Palaeozoic to late Precambrian and the recognition of an important unconformity between the Cinq Isle Group and the Baie du Nord Batholith.

In the Central Mobile Belt, Dr. E.R.W. NEALE's efforts are concentrated on the relationship of volcanism and intrusion to tectonism in the area between Halls Bay and Green Bay. His project is closely integrated with the stratigraphic and structural studies of Dr. H. Williams and Dr. M.J. KENNEDY, and also with some of the economic and volcanic investigations of Drs. W.G. SMITHERINGALE, V.S. Papezik and C.J. Hughes and graduate students H. URADHYAY, U.A. SAYEED, B. MARTEN, G. McARTHUR and J.R. DeGRACE.

On the Western Platform, Dr. H. Williams, together with graduate student R. COMEAU, is commencing studies of the stratigraphy and structure of the autochthonous and klippe terranes of west-central Newfoundland. W.R. SMYTH, a graduate student working on the Hare Bay klippe, has found metamorphosed rocks believed to be part of the Fleur de Lys Supergroup. Mrs. F.H.C. O'BRIEN completed her stratigraphic and paleontological studies of the Clam Bank Formation, Port au Port Peninsula. Z.M. SHAIKH and A. WEERASINGHE recently completed theses on the stratigraphy and paleontology of the Long Point Formation which underlies the Clam Bank Formation. Dr. R.S.W. NEVILLE is continuing qualitative and quantitative studies of HF-resistant microfossils collected from the Codroy Valley, the Port au Port and Great Northern Peninsulas. Acritarchs, Chitinozoa, graptolite fragments and scolecodonts have been obtained; Chitinozoa are very abundant and well preserved, but acritarchs with the exception of the long ranging genus *Leiosphaeridia* (Eisenack, 1958) Downie and Sarjeant 1961, have proved extremely rare. Dr. L. FAHRAEUS intends to continue paleontological studies on the west coast during the summer.

The Lower Cambrian succession in the Strait of Belle Isle, represents the northeast extremity of the deformed Appalachian miogeosynclinal belt. A. WARING is presently conducting a stratigraphic and sedimentological study of the Bradore Formation exposed between Blanc Sablon and Pinware.

In northern Labrador, Dr. J.S. SUTTON and graduate students B. MARTEN and A. CLARK are concerned with the structure and petrology of the metasedimentary rocks and granite gneisses of the Makkovik - Hopedale area. I. KNIGHT is working on the Proterozoic cover rocks and Grenville gneisses of the Seal Lake area.

Current Research in Geology and Related Subjects in the Province of Newfoundland and Labrador and in Offshore Areas compiled by M.J. KENNEDY, Department of Geology, Memorial University of Newfoundland:

University research workers are affiliated to Geology Departments unless otherwise specified.

NEWFOUNDLAND

- M.M. ANDERSON, Memorial University of Newfoundland, (1) Precambrian fossils of the Conception Group, Avalon Peninsula; (2) Geology of the southeastern Avalon Peninsula; (3) Coastal morphology of Newfoundland (with W.D. Brueckner).
- G. BARTLETT, see J. Butler.
- W.L. BALSAM, Brown University, Paleocology of Lower Cambrian Archeocyathid reefs. (Ph.D. study).
- H.H. BOSTOCK, Geological Survey of Canada, Operation Strait of Belle Isle - Precambrian rocks.
- I.A. BROOKES, York University, Dept. of Geography, (1) The glaciation of southwestern Newfoundland (Ph.D. study); (2) Pleistocene geology and the effects of glaciation in western Newfoundland; (3) Mass wasting processes and forms in varying rock terranes of western Newfoundland.
- W.D. BRUECKNER, Memorial University of Newfoundland, (1) Regional geology of the Avalon Peninsula; (2) Geomorphology of Newfoundland with emphasis on the Avalon Peninsula and in features related to post-glacial changes in sea level; (3) Sedimentological studies in Newfoundland concerning till, beaches and recent bay deposits; (4) Aspects of the regional geology of western Newfoundland.
- J.M. BIRD, State University of New York at Albany, West Newfoundland klippen and regional tectonic relations.
- J.T. BURSNALL, University of Cambridge, Structural relations between the Fleur de Lys, Baie Verte and Ming's Bight sequences between Coachman's Cove and Ming's Bight, Burlington Peninsula (Ph.D. study).
- J. BUTLER, G. BARTLETT and C. FONG, Nfld. Dept. of Mines, Agriculture and Resources, Silica Assessment Project.
- J. BUTLER and G. BARTLETT, Nfld. Dept. of Mines, Agriculture and Resources, Bibliography of the Geology of Newfoundland and Labrador, 1814 through 1968.
- M.J. CALCUTT, Memorial University of Newfoundland, Stratigraphy and sedimentology of the Cinq Isle Group, Fortune Bay. (M.Sc. study).
- W.R. CHURCH, University of Western Ontario, (1) Crustal evolution of western Newfoundland; (2) Eclogites, ariegites and associated ultramafic rocks.
- H.J. COATES, Memorial University of Newfoundland, Structure and petrology of the Cape Brule - Grand Cove area, Burlington Peninsula. (M.Sc. study).
- G. COCKBURN, University of Western Ontario, Geology of the Confusion Bay - Tilt Cove region of the Burlington Peninsula (Ph.D. study).
- J.A. COLLINS, Queen's University, Carbonate lithostratigraphy, diagenesis and zinc deposits of the upper St. George's and lower Table Head formations, western Newfoundland (M.Sc. study).
- L.M. CUMMING, Geological Survey of Canada, Operation Strait of Belle Isle - Paleozoic stratigraphy and structure.
- N.T. DEAN, Geological Survey of Canada, Cambro-Ordovician trilobites of Newfoundland and their stratigraphical distribution.
- E.R. DEUTSCH, Memorial University of Newfoundland, Dept. of Physics, Rock- and paleomagnetism, crustal structure, continental drift, polar wandering.
- J.F. DEWEY, University of Cambridge, Structural and stratigraphic relations between the major rock units of the Burlington Peninsula and western Notre Dame Bay.
- B-D, ERDMANN, Indiana University, Fort Wayne, Graptolites from Newfoundland
- L.E. FAHRAEUS, Memorial University of Newfoundland, Stratigraphic and taxonomic studies of Paleozoic conodonts from Newfoundland.
- J. FLEMING, Nfld. Dept. of Mines, Agriculture and Resources, Petroleum and natural gas, Newfoundland and Labrador.
- T.P. FLETCHER, University of Cambridge, (1) The Cambrian of the Cape St. Mary's Peninsula (Ph.D. study); (2) The geology of southwest Avalon (Bull Arm Formation-Upper Cambrian) 1:50,000 N.T.S. sheets 1M/1 S.E.1/4., 1N/4 S.1/2, 1L/16 E.1/2, 1K/13 W.1/2; (3) Litho- and biostratigraphic analysis of the "Acado-Baltic Cambrian" of southeastern Newfoundland its importance with regard to correlation, paleogeography and paleoecology within the Cambrian System; (4) Monographic study of the Lower and Middle Cambrian trilobites from southeastern Newfoundland.
- D. FOGWILL, Nfld. Dept. of Mines, Agriculture and Resources, Metallogenic provinces of Newfoundland.
- C. FONG, see Butler, J.
- J. de GRACE, Memorial University of Newfoundland, Structural and petrological studies of the Lush's Bight Group, west of Springdale, Newfoundland (M.Sc. study).
- D.R. GRANT, Geological Survey of Canada, Surficial geology of northern Newfoundland and adjacent Labrador between latitudes 51° and 52° N.
- B.A. GREENE, Memorial University of Newfoundland, Stratigraphy, age and origin of the Random Formation of eastern Newfoundland (Ph.D. study).

- R.G. GREGGS, Queen's University, Detailed biostratigraphy of the Upper Cambrian of the Pacific Faunal Realm (includes Newfoundland).
- R.H. HOWIE, Geological Survey of Canada, Oil and gas in eastern Canada - data gathering and statistics in Newfoundland, Labrador and offshore areas.
- Y.C. HSU, Memorial University of Newfoundland, Stratigraphy and sedimentary features, including *Aspidella terranovica* of the St. John's Formation eastern Avalon Peninsula (M.Sc. study).
- C.J. HUGHES, Memorial University of Newfoundland, Aspects of the petrology of the Holyrood Granite Complex, Avalon Peninsula. The petrology of Fogo Island, eastern Notre Dame Bay.
- C.P. HUGHES, University of Cambridge, Ordovician trilobites from the St. George Formation and the Cow Head Conglomerate, western Newfoundland.
- M. KAY, Columbia University, (1) Stratigraphic studies in Notre Dame Bay; (2) Stratigraphic studies in western Newfoundland.
- H.F. KEATS, Memorial University of Newfoundland, Mineralogy and origin of a pyrophyllite deposit, Manuels, Conception Bay (M.Sc. study).
- M.J. KENNEDY, Memorial University of Newfoundland, Structural studies of the metamorphic rocks of the Newfoundland Appalachians: (a) the Fleur de Lys Group, (b) the Grand Lake Schists, (c) the Gander Lake - Baie D'Espoir region.
- W.S.F. KIDD, University of Cambridge, Evolution of the Baie Verte Lineament between Baie Verte and Mic Mac Lake, Burlington Peninsula (Ph.D. study).
- A.F. KING, Memorial University of Newfoundland, Stratigraphical and sedimentological studies in the Eocambrian of Newfoundland.
- H.M. KLUYVER, Queen's University, Ordovician erosional hiatuses in eastern North America and northwest Europe (Ph.D. study).
- J.G. McARTHUR, Memorial University of Newfoundland, Geology of the Stirling prospect, Springdale Peninsula (M.Sc. study).
- P.H. McGRATH, Geological Survey of Canada, Utilization of geological, aeromagnetic, ground magnetic and rock magnetic data to delineate the regional crustal structure of the Canadian Appalachian region.
- J.G. MALPAS, Memorial University of Newfoundland, Geochemistry of the Bull Arm Volcanics, Avalon Peninsula (M.Sc. study).
- B.E. MARTEN, Memorial University of Newfoundland, The Structure, Stratigraphy and petrology of the Lush's Bight Group at Western Arm, Green Bay (M.Sc. study).
- H.G. MILLER, Memorial University of Newfoundland (Dept. of Physics), Gravity study in Notre Dame Bay (M.Sc. study).
- G.S. MURTHY, Memorial University of Newfoundland, Dept. of Physics, Rock magnetism in Newfoundland and the North Atlantic region.
- E.R.W. NEALE, Memorial University of Newfoundland, (1) Correlation of Lower Paleozoic volcanic sequences in western Notre Dame Bay; (2) Details of cross-section through the Appalachian System in Newfoundland for proposed International Geological Congress field trip.
- R.S.W. NEVILLE, Memorial University of Newfoundland, Reconnaissance study of HF-resistant microfossils in the sedimentary formations of Newfoundland.
- F.H.C. O'BRIEN (Mrs.), Memorial University of Newfoundland, Stratigraphy and paleontology of the Clam Bank and Long Point Formations, western Newfoundland (M.Sc. study).
- V.S. PAPEZIK, Memorial University of Newfoundland, Petrology, stratigraphy and petrochemistry of the Harbour Main Group, Avalon Peninsula.
- W.E.A. PHILLIPS, Trinity College, Dublin, Structural studies of the Goose Cove Schist and its relationship to other allocthonous rocks north of Hare Bay.
- G. POPPER, Eastern Connecticut State College, Paleobasin analysis and tectonic history of the Anguille Group, west central Newfoundland (Ph.D. study).
- I. PRINGLE, University of Cambridge, Dept. of Geodesy and Geophysics, Rb/Sr Geochronology of Newfoundland.
- K.V. RAO, Memorial University of Newfoundland, Dept. of Physics, Paleomagnetism of Ordovician sedimentary rocks of Bell Island (M.Sc. study).
- L. RICCIO, University of Western Ontario, The Bett's Cove ophiolite complex, Burlington Peninsula (M.Sc. study?).
- R.B. RICHARDS, University of Cambridge, Graptolites from the Cow Head Conglomerate.
- R.J. ROGERSON, Memorial University of Newfoundland, Dept. of Geography, (1) Debris slopes and mass movement in eastern Newfoundland; (2) Deglaciation and marine overlap in eastern Newfoundland.
- U.A. SAYEED, Memorial University of Newfoundland, The tectonic setting of the Colchester Plutons, Green Bay (M.Sc. study).
- Z.M. SHAIKH, Memorial University of Newfoundland, Stratigraphy and paleontology of the Long Point Formation southwest of Black Duck Brook, Port au Port Peninsula (M.Sc. study).
- T. SCHROETER, University of Western Ontario, The Trout River Pond ophiolite complex (M.Sc. study).
- D.E. SMIT, University of Iowa, Stratigraphy and sedimentary petrology of the Cambrian and Ordovician shelf facies of western Newfoundland (Ph.D. study).
- W.G. SMITHERINGALE, Memorial University of Newfoundland, Mineral deposits in the central mobile belt of Newfoundland; their environment, geochemistry and origin.
- W.R. SMYTH, Memorial University of Newfoundland, Structure, stratigraphy and petrology of the Hare Bay Klippe, south of Hare Bay (Ph.D. study).

- R.K. STEVENS, University of Toronto, The Taconic Problem in western Newfoundland (Ph.D. study).
- K. SWETT, University of Iowa, A comparison of the sedimentary and diagenetic features of the Cambro-Ordovician rocks of western Newfoundland with those of northwest Scotland.
- W.R. TAYLOR, Memorial University of Newfoundland, Geology and geochemistry of a uranium rich granitic area, southwest Newfoundland (M.Sc. study).
- G. THEOKRITOFF, Rutgers University, Cambrian biogeography and biostratigraphy in the North Atlantic region (includes Newfoundland).
- H.D. UPADHYAY, Memorial University of Newfoundland, Structural and stratigraphic studies in the southeastern Burlington Peninsula (Ph.D. study).
- A. WEERASINGHE, Memorial University of Newfoundland, Stratigraphy and paleontology of the Long Point Formation northeast of Black Duck Brook, Port au Port Peninsula (M.Sc. study).
- H.C. WEIR, Memorial University of Newfoundland, Dept. of Physics, Gravity profile across Newfoundland (M.Sc. study).
- J.M. WESSEL, University of Massachusetts, Stratigraphy and sedimentary petrology of the Silurian rocks of the Springdale area (Ph.D. study).
- H.B. WHITTINGTON, University of Cambridge, Ordovician trilobites from the St. George Formation and the Cow Head Conglomerate, western Newfoundland. Graptolites from the Cow Head Conglomerate.
- H. WILLIAMS, Memorial University of Newfoundland, (1) Geology of the Belleoram map area (1M/11), Fortune Bay; (2) The Appalachian System in Newfoundland; (3) Geology of Western Newfoundland.
- M.J. de WIT, University of Cambridge, Structural and metamorphic history of the Fleur de Lys sequence in the western Burlington Peninsula (Ph.D. study).
- J. WRIGHT, Memorial University of Newfoundland, Dept. of Physics, Magnetic and electric field measurements in Newfoundland related to crustal structure.
- G.B. YOUNCE, Cornell University, Structure and stratigraphy of a portion of Bonavista Bay from Deer Island to Newman Sound (Ph.D. study).

LABRADOR

- M.A. BARUA, Queen's University, Geology of Uranium-molybdenum zones, Makkovik area (M.Sc. study).
- J.H. BOURNE, Queen's University, The position of the Grenville Front between longitudes 58°W and 60°W (M.Sc. study).
- J.E. CALLAHAN, Queen's University, Heavy mineral fractions in stream sediments and a stream sediment geochemical survey applied to mineral exploration in the Churchill Falls area (Ph.D. study).
- A.M.S. CLARK, Memorial University of Newfoundland, The status and nature of the Aillik Series, Makkovik area (Ph.D. study).
- D.B. CLARKE, University of Alberta, Petrochemical investigations of Tertiary volcanism and its relationship to continental drift between Canada and Greenland.
- M.R. DENCE, Dominion Observatory, Fossil crater studies - Mistastin Lake.
- W.A. ELDERS, see Rucklidge, J.C.
- G. BARTLETT, see Butler, J.
- H.H. BOSTOCK, Geological Survey of Canada, Operation Strait of Belle Isle - Precambrian rocks.
- J. BUTLER and G. BARTLETT, Nfld. Dept. of Mines, Agriculture and Resources, Bibliography of the geology of Newfoundland and Labrador, 1814 through 1968.
- L.M. CUMMING, Geological Survey of Canada, Operation Strait of Belle Isle - Paleozoic stratigraphy and structure.
- E.R. DEUTSCH, Memorial University of Newfoundland, Dept. of Physics, Rock- and paleomagnetism, crustal structure, continental drift and polar wandering.
- R.F. EMSLIE, Geological Survey of Canada, Study of anorthosite intrusions between Michikamau Lake and Nain.
- J. FLEMING, Nfld. Dept. of Mines, Agriculture and Resources, Petroleum and natural gas, Newfoundland and Labrador.
- D.R. GRANT, Geological Survey of Canada, Surficial geology of northern Newfoundland and adjacent Labrador between latitudes 51° and 52° N.
- R.W. HORNAL, Dominion Observatory, Labrador Coast Gravity Survey - between Schefferville and the Labrador Coast.
- R.H. HOWIE, Geological Survey of Canada, Oil and Gas in Eastern Canada - data gathering and statistics in Newfoundland and Labrador and offshore areas.
- I. KNIGHT, Memorial University of Newfoundland, Stratigraphic and sedimentological studies of the Seal Lake Group (M.Sc. study).
- B.E. MARTEN, Memorial University of Newfoundland, The relationship between the Aillik Series and the Hopedale Gneiss, west of Makkovik (Ph.D. study).
- S.A. MORSE, Franklin and Marshall College, (1) Chemistry of the Kiglapait layered intrusion; (2) Chemistry of the Nain anorthosite; (3) High pressure metamorphic mineral assemblages near Wilson Lake.
- J.C. RUCKLIDGE, University of Toronto and W.A. ELDERS, University of California, Riverside, Petrological investigations on layered minor intrusions on the coast of Labrador between Makkovik and Hamilton Inlet.

- IM. STEVENSON, Geological Survey of Canada, Operation Northwest River, Labrador and Quebec. Major geological features and their relationships to mineral occurrences. Includes Minipi Lake, Goose Bay, Lac Brule, Winokapau Lake, Rigolet and Groswater Bay map areas.
- J.S. SUTTON, Memorial University of Newfoundland, Structural and metamorphic studies of the Western Nain Province and its contact relationships to surrounding rocks.
- J.G. TANNER, Dominion Observatory, Gravity studies over anorthosites.
- F.C. TAYLOR, Geological Survey of Canada, Operation Torngat - major bedrock and surficial geology features, assessment of mineral potential of northern Labrador and Quebec, east of 68° W. Long.; north of 55° N. Lat.
- A. WARING, Memorial University of Newfoundland, Stratigraphy and sedimentology of the Bradore Formation, southeast Labrador (M.Sc. study).
- N.D.S. WESTALL, Queen's University, Anorthosites and calc-alkaline plutonism in the Grenville Province.
- E.P. WHEELER, Box 205, Blue Mountain Lake, New York, U.S.A., Geologic mapping of the Nain anorthosite complex and associated rocks.
- F.M.G. WILLIAMS, McGill University, A structural, metamorphic and petrological study of the Naskaupi and older fold belts of the Grenville and Nain provinces (Ph.D. study).

OFFSHORE AREAS

- G.A. BARTLETT, Queen's University, Geology of the Canadian Atlantic continental margins.
- M.E. BOWER, see Hood, P.J.
- R.V. COOPER, see Goodacre, A.K.
- R.A. GEES, Dalhousie University, Marine geology of the eastern seaboard of Canada with special emphasis on the continental slope and rise (includes M.Sc. and Ph.D. studies by graduate students).
- A.K. GOODACRE and R.V. COOPER, Dominion Observatory, Underwater gravity measurements in the Gulf of St. Lawrence.
- G.D. HOBSON, Geological Survey of Canada, Air gun reflection seismic profiles and conventional marine refraction profiles, Strait of Belle Isle region.
- P.J. HOOD, and M.E. BOWER, Geological Survey of Canada, High resolution aeromagnetic surveys over the Canadian continental shelves to delineate sedimentary basins.
- H.H. HOWIE, Geological Survey of Canada, Oil and gas in Eastern Canada - data gathering and statistics in Newfoundland, Labrador and offshore areas.
- M.J. KEEN, Dalhousie University, Geophysical studies on the eastern seaboard of Canada (includes M.Sc. and Ph.D. studies by graduate students).
- D.L. SMITH, Queen's University, Mesozoic and Tertiary sequences of the Grand Banks of Newfoundland.
- G.W. WEBB, University of Massachusetts, Continental shelf and slope structure off Newfoundland.

Marine Geological Projects of the Atlantic Oceanographic Laboratory, Bedford Institute, Dartmouth, N.S., compiled by B.R. PELLETIER.

During the past year a number of projects have continued, and have been augmented by the initiation of new ones, particularly in the high Arctic of Canada. Present studies in the laboratory and field are described according to discipline and the participating investigators.

Geochemistry:

D.E. BUCKLEY and R.E. CRANSTON continued to develop geochemical techniques for the analysis of marine samples. During the period under report the atomic absorption spectroscopy was used for six thousand elemental determinations of aluminosilicates, water samples, sediment samples and organo-metallic complexes. The X-ray diffraction studies were done on a large number of samples. A report is under preparation now covering the analytical results of Alaskan fiord samples. A manuscript describing the silicate analysis by atomic absorption spectroscopy is being prepared. The method developed in the inorganic geochemistry laboratory is not only simple but versatile enough to determine about 19 different cations of the same sample. D.E. Buckley and R.E. Cranston have developed a computer program for calculation, analysis and compilation of geochemical data. With D. Walker, Buckley submitted a manuscript "Some Techniques and Applications of Scanning Electron Microscope in the Field of Marine Sciences" to Maritime Sediments.

M.A. RASHID completed his studies on metal complexing phenomenon of humic compounds of marine origin for various di- and trivalent metals, and is being reviewed for publication in Soil Science. In an attempt to characterize the humic acids associated with marine sediments, studies were initiated to ascertain the ratio of aliphatic to aromatic structure because many physical and chemical properties of organic matter are associated with its aromaticity. M.A. Rashid and A. Prakash of the Marine Ecology Laboratory, Bedford Institute continued their collaborated efforts on the influence of humic compounds on the growth of marine organisms. They have completed studies on the nature and characteristics of humic acids formed by the decay and decomposition of phytobenthic and planktonic organisms. The following manuscripts submitted earlier were published recently: (1) M.A. Rashid (1969), Contribution of humic substances to the

cation exchange capacity of different marine sediments. *Maritime Sediments*, Vol. 5: 44-50.
 (2) M.A. Rashid and L.H. King (1970), Major oxygen containing functional groups present in humic and fulvic acid fractions isolated from contrasting marine environments. *Geochim. Cosmochim. Acta.* 34: 192-201. (3) A. Prakash and M.A. Rashid, The influence of humic substances on coastal phytoplankton productivity. In *Coastal Lagoon-symposium UNESCO and unam Mexico City.*

Physical Geology:

V. ASTHANA has been occupied with the examination of samples and data analysis collected during the summer of 1969 at Clam Harbour Beach, N.S. Monitoring of this beach is being continued to study the seasonal and long term coastal processes and geomorphological changes. Interesting short term changes have been noted and will be reported shortly.

G. DRAPEAU in September attended a symposium at Cambridge, U.K. dealing with data storage and retrieval of geological data. An effort has been made to extract maximum information from surveys carried out from the submersible "Shelf Diver" last summer. Analysis of sand waves on Browns Bank is completed and work is progressing on comparative analysis of submersible surveys carried out at the edge of the Scotian Shelf. Plans have been drawn for the construction by the Systems Engineering Section of a settling tube to measure the settling velocity, in fresh or sea water, of marine sediment particles. Part of this period was spent on a continuing study of surficial sediments of the southwestern portion of the Scotian Shelf.

A.C. GRANT is engaged in compiling and interpreting bathymetric, geological and geophysical data from the continental margin off Labrador and Newfoundland. A paper dealing with geophysical investigations in the Ungava Bay-Hudson Strait region by A.C. Grant and K.S. Manchester, has recently been submitted for publication. In March 1970, Grant attended a symposium on "The Geology of the East Atlantic Continental Margin", held in Cambridge, England.

J.I. MARLOWE completed his research into the diagenesis of carbonate rocks from seamounts on Aves Swell, Caribbean Sea, and has submitted a report for publication. During January and February, he gave a series of lectures at Dalhousie University on the geochemistry and petrology of carbonate sediments. He also continued to participate in the Coastal Geodynamics study program and to supervise the overall program of the Physical Geology group.

B.R. PELLETIER gave a seminar on "Mineral resources of the sea and of the sediments and geological formations beneath it" to Queen's University. Talks on A.O.L. marine geological operations were given to St. Mary's University, McGill, Queen's, Waterloo, DEMR in Ottawa and Burlington (CCIW). Presently he is working with Dr. R.M. McMullen on a paper dealing with sediment transport in Minas Basin-Bay of Fundy area. With C.A. Godden he completed a paper entitled "A Submersible Electric Coring Drill for Geological Exploration on the Continental Shelf". He is presently completing studies on sediment sampling from the submersible "Shelf Diver".

J.M. SHEARER carried out in October a continuous reflection seismic survey in the northern Gulf of St. Lawrence. He recently completed his M.Sc. thesis "Detailed Grain Size Analysis of Sediments and Post Glacial History of Port au Port Bay, West Newfoundland". During January and February he carried out general compilation work on field and laboratory data for members of the Physical Geology group and has just begun the compilation and interpretation of the Gulf of St. Lawrence reflection profiles. In this respect, a paper dealing with the deglaciation events in the Gulf is well underway.

Regional Geology:

During the period under review the group has been concerned with the compilation and synthesis of data and writing of reports. The following publications have appeared during this period:

(1) King, L.H., MacLean, B., Bartlett, G.A., Jeletzky, J.A. and Hopkins, W.S., 1970, Cretaceous strata on the Scotian Shelf. *Can. J. Earth Sci.*, v. 7, pp. 145-155. (2) King, L.H. and MacLean, B., 1970, Observations on Cretaceous Outcrop from a submersible - Scotian Shelf. *Can. J. Earth Sci.*, 7, pp. 188-190. (3) King, L.H., 1970, Surficial geology of the Halifax-Sable Island map-area; with accompanying chart. Marine Sciences Branch, Dept. of Energy, Mines and Resources, Ottawa, Paper No. 1, 16 pp.

L.H. KING is also co-author on a geochemical paper listed elsewhere. In addition, two papers are in press, one paper has been submitted for publication and two papers are currently being reviewed. Miss K. KRANCK joined the group in November and is continuing her project in the Northumberland Strait. This work is at the final compilation and synthesis stage.

Micropaleontology:

Miss F. FRAPE started work in the Micropaleontology Laboratory in October 1969 and has been processing sediment samples from Portugal, Venezuela, the Gulf of St. Lawrence, and the Mid-Atlantic Ridge. She is also organizing the laboratory facilities for curatorial purposes.

C.T. SCHAFER is currently co-ordinating a multidisciplinary analysis program of carbonate and basalt cores collected on the crest of the Mid-Atlantic Ridge, and is completing a quantitative analysis of living benthonic foraminifera in samples collected by divers from the submersible "Shelf Diver". He has also presented a paper, dealing with the initial analyses of the Mid-Atlantic Ridge cores, at the November meeting of the American Geophysical Union in San Francisco.

G. VILKS finished a joint paper with Allan W.H. Be and Leroy Lott from Lamont Geological Observatory entitled "Winter distribution of Living planktonic foraminifera along a North-South transect between the Grand Banks and the Caribbean Sea," which will be published in *Micropaleontology*. Vilks also participated in HUDSON 70, Phase II, in which he collected plankton samples for a study of planktonic foraminifera in the South Atlantic Ocean.

Miss F.J.E. WAGNER completed the examination of molluscs and foraminifera from northern Hudson Bay-Foxe Basin-Hudson Strait (CCGS LABRADOR collections, 1959) and Exeter Bay, Baffin Island (CSS BAFFIN collections, 1959) and is currently preparing a paper on the "Labrador" collections. These faunas are being compared with those collected in northern Hudson Bay during the Hudson Bay Oceanographic Project, 1965. During this period, she gave a talk on the Hudson Bay-Tyrrel Sea faunas at Mount Allison University.

D.A. WALKER continued his assignment in the living foraminiferal laboratory. Observations and experimentation of long-term cultures established during the summer of 1969 were continued, particularly regarding the micro-habitats and rates of reproduction of the foraminifera being maintained. Ecological patterns were closely followed in an effort to determine preferred substrates. The foraminiferal populations under study were collected from the infralittoral fringe along the shores of Point Pleasant Park and Sandy Cove, N.S., and were maintained successfully since early summer 1969. Walker participated in a cruise on CSS DAWSON off Bermuda to collect planktonic foraminifera. Scanning electron microscopy of foraminifera being maintained in culture was carried out.

In addition to these regular staff programs, two additional projects are underway by Queen's University under the direction of the Atlantic Oceanographic Laboratory. Professor Grant A. Bartlett is completing an inshore foraminiferal ecological study in which he has been involved over the past five years, and is also participating in the foraminiferal analysis of sediment cores obtained from Arctic regions. Mr. David Slessor, an M.Sc. candidate of Queen's University is commencing a foraminiferal ecological study on cores obtained in the Gulf of St. Lawrence, with a view toward interpreting Recent geological history.

New Chart Gives Key to Ocean Floor - News Release by the Department of Energy, Mines and Resources, Ottawa, Canada.

HALIFAX -- A scientist with the federal Department of Energy, Mines and Resources has produced a valuable new aid for east coast fishermen, geologists and engineers. This is a nine-color chart showing the surface geology of the ocean floor between Halifax and Sable Island.

The first of its kind produced in Canada, the chart was prepared by Dr. Lewis H. King, a geologist at the department's Atlantic Oceanographic Laboratory at Dartmouth, N.S.

The chart provides detailed information about the nature of the ocean bottom, useful in the laying of cable and in helping fishermen to avoid damaging their trawls. It will also assist mineral exploration, research in marine biology, geology and physical oceanography.

Similar charts have been produced outside Canada, but few if any have provided such fine detail. Dr. King has been able to achieve this by combining findings from three different exploration methods -- echo sounding, seismic profiling and bottom sampling.

Echo sounding is normally used in hydrographic surveying to determine depths of water, but Dr. King has studied the energy reflections to determine what kind of material forms the bottom sediments. For this purpose he has used echograms from a number of recent hydrographic surveys in the area.

Seismic profiles, taken on several cruises by Dr. King and his assistants, allowed a deeper probing of the sediments. At the same time, samples collected from the ocean floor made possible a confirmation of the sediment type interpreted from the echograms.

Chart 4040G is issued along with Dr. King's scientific paper, "Surficial Geology of the Halifax-Sable Island Map Area", published by the Marine Sciences Branch of the Department of Energy, Mines and Resources. The paper and chart are available for three dollars from the Queen's Printer, any Queen's Printer Bookshop or the Hydrographic Chart Distribution Office, Department of Energy, Mines and Resources, Ottawa. Telephone number is 994-5594, area code 613. Chart 4040G is available separately, at two dollars a copy, only at the last address.

FORTHCOMING MEETINGS

The Geological Association of Canada and The Mineralogical Association of Canada, Joint Annual Meetings, Winnipeg, Manitoba, August 30 - September 2, 1970.

The 1970 Joint Annual Meetings of the Geological Association of Canada and Mineralogical Association of Canada will be held on the campus of The University of Manitoba in Winnipeg from August 30 to September 2.

Three pre-meeting and five post-meeting field trips are planned in Manitoba. Four trips will include the geology and mineral resources of selected Precambrian terrains, and others will examine Paleozoic and Paleozoic-Mesozoic strata, Pleistocene stratigraphy, and industrial mineral deposits.

Twelve scientific sessions will be held including a symposium on Geoscience Studies in Manitoba. Recent research and summary papers on the structure and composition of the Precambrian Shield and the overlying Paleozoic-Mesozoic rocks, as well as in the fields of hydrogeology and Quaternary geology of Manitoba will be presented at this session.

Most of the Canadians involved in investigating Apollo lunar materials will speak on their work at a Special Session on Canadian Investigations of Apollo Lunar Materials. A display of lunar materials is planned which will add immeasurably to the timeliness of this session.

A Special Session on Pegmatite Minerals will include papers describing Ta and Li minerals from the Tanco (Chemalloy) pegmatite at Bernic Lake, Manitoba and rare earth element minerals from the Evans-Lou pegmatite in Portland-West Township, Quebec and from pegmatites of the South Platte District, Colorado.

Further information is available from: R.F.J. Scoates, General Chairman, GAC/MAC '70, Room 901, Norquay Building, 401 York Avenue, Winnipeg 1, Manitoba.

24th International Geological Congress, Montreal, Canada, August 21-30, 1972.

By mid-June 1970, 6,344 responses had been received to the First Circular of the 24th International Geological Congress which will be held in Montreal from August 21st to 30th, 1972. The responses have come from 107 countries. Almost 3,100 adults and 1,300 children will accompany the more than 6,000 registrants planning to attend.

Congress field trips will be held before and after the technical sessions. Almost 5,000 people will participate in the field excursion program. The most popular excursion based on the returns obtained thus far is one of the most distant -- the Geology of the Arctic Islands. More than 230 requests have been obtained for this excursion which is listed as being able to accommodate 36 persons. An attempt will be made to accommodate more applicants on this particular excursion.

It is also evident that geologists are interested in most of the excursions dealing with the mineral deposits of Canada. Trips on which the themes are a general overview of stratigraphy and structure, are also quite popular. Some very specialized excursions which received a high response include those dealing with vertebrate paleontology and engineering geology. An "excursion" dealing with computer applications in geology has been fully-subscribed.

Leaders of field excursions are now engaged in finalizing their itineraries, schedules, accommodations and travel arrangements. Excursions to remote regions pose special problems: weather in the northern latitudes and in the mountains of Western Canada is unpredictable, and those excursions using charter aircraft and helicopters may require last minute modification. The use of helicopters marks the first time this mode of transport will be used in a Congress of this kind.

Field Guide books will have the same format as those used at previous Congresses. Each book will be approximately five inches by eight inches and will consist of approximately 60 pages which will include line drawings, maps, sections, etc. Supplementary information in the form of detailed geologic maps of the area of the excursion, a geologic map of Canada (recently published by the Geological Survey of Canada) and other data pertinent to the individual excursion, will be supplied.

The organization of the field excursion program is under the direction of M.E. Hriskevich of

Calgary who is being assisted by the following regional chairman: J.O. Wheeler (Vancouver); E.W. Best (Calgary); R.F. Jon Scoates (Winnipeg); J.A. Donaldson (Ottawa); R. Bergeron (Quebec) and A.L. McAllister (Fredericton).

Participants will gather at the dispersal centres -- Vancouver, Calgary, Edmonton, Winnipeg, Montreal and Halifax in order to minimize the many problems including registration, group assembly, orientation, money-changing facilities, initial accommodations and such mundane matters as lost luggage.

The response to the Congress's field trips has been most enthusiastic. Comments have been received about the high cost of some of the excursions which is due to the distance involved. Field excursion leaders have been requested to estimate their costs as precisely as possible in order to keep expenses at a minimum. The wish of the Congress is to draw to the attention of all earth scientists wishing to attend that only those replying to the First Circular will receive additional information regarding the Congress.

C. Gordon Winder,
Chairman for Publicity,
University of Western Ontario,
London, Ontario, Canada.

REPORTS ON RECENT MEETINGS

Geology Working Group, Resource Satellites and Remote Airborne Sensing, Ottawa, Ont.

A working group concerned with geological applications of remote sensing from aircraft and satellites was organized recently at a meeting in Ottawa. The Geology Working Group is one of twelve such groups that will review the technology and applications of remote sensing and make recommendations to the Federal Government for a national program.

Interagency Committee on Resource Satellites and Remote Airborne Sensing:

Such a broad study was initiated by the Cabinet Committee on Science Policy and Technology when it instructed the Department of Energy, Mines and Resources to convene an interagency committee on resource satellites and remote airborne sensing. This committee, chaired by Dr. J.M. Harrison, has the primary goals of:

- (1) co-ordinating and funding federal government plans for advancing remote-sensing technology in Canada;
- (2) recognizing applications of remote sensing in the assessment of Canada's natural resources, in the monitoring of ecological conditions and pollution, in the inventorying of farm and forest productivity and in the planning and monitoring of land use;
- (3) extending remote sensing technology to assist developing nations;
- (4) planning and recommending a pertinent organization to carry out a national program as warranted by the study.

Program Planning Office:

Supporting the interagency committee is a Program Planning Office (PPO) directed by Dr. L.W. Morley. This interim organization will phase out of existence upon submission of its final report for inclusion in the 1971-72 Estimates. This report is to contain recommendations for the organization and support of a national program. The PPO will also manage certain urgent projects until such time as permanent management is established. It is also to consider the need for pertinent symposia and training sessions.

In order to assure a broad technical input, the PPO has set up working groups with representation from appropriate disciplines in governments, universities and industries (see organizational chart attached). Such working groups will function for about one year, presenting their final reports on March 1st, 1971.

Geology Working Group:

The Geology Working Group is concerned with defining practical applications of remote sensing from aircraft or spacecraft to the study of terrestrial and coastal geology. It is not concerned with the operation of conventional airborne geophysical or photographic surveys, or similar mission-oriented surveys. Major interest is directed to sensors detecting electromagnetic radiations between the microwave and ultra-violet bands, with special emphasis on multi-spectral observations in the visible spectrum.

The objective of such planning is to identify the common interests of many user agencies across Canada and to consider the means of focussing the research effort, centralizing major flight, sensor and processing facilities and minimizing the overall cost of essential but

expensive experiments.

The Geology Working Group has the following general terms of reference:

- (1) To consider how Canadian geologists should be prepared for handling and interpreting data from NASA's Earth Resource Technology Satellites and recommend action necessary to achieve this preparation before the initial launch in March, 1972.
- (2) Consider, describe and report on geologic and geophysical parameters that might be measured by remote sensing, giving some indication as to their relative importance and value.
- (3) Identify on-going Canadian programs that could benefit from either resource satellite or remote airborne sensing and forecast the improvements in service that might accrue.
- (4) Make recommendations for a national program on remote sensing that would provide optimum service to the geological community.
- (5) Recommend the kind of a management organization and budget which would be required to carry out the above program.
- (6) Consider and report on the case for an independent Canadian resource satellite.
- (7) Pursue a program of education of the potential users in remote sensing by organizing symposia, or causing them to be organized, by arranging special laboratory tours and by distributing special bibliographies and notices of meetings on remote sensing.
- (8) To undertake, or cause to be undertaken, special pilot projects pertinent to the interpretation of remotely sensed data in order to develop Canadian expertise prior to the launching of ERTS.

The Geology Working Group is comprised of 12 members with equal representation from industry, provincial governments, universities and the federal government. They will prepare individual statements for compilation into a preliminary brief. This brief will be circulated beyond the working group for additions and revisions. The final report will be drafted by December, 1970. Comments and questions will be welcomed by members of the working group, a list of which follows:

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In this number we were delighted to receive the following departmental news from Arthur King, Memorial University of Newfoundland. Dr. E.R.W. Neale, Head of M.U.N.'s Department of Geology, is preparing contributions for the 1972 G.A.C. Symposium on Tectonic Styles in Canada and guidebooks for the 1972 International Geological Congress. Dr. W.D. Brueckner, who in 1968 was chosen as Memorial University's first J.P. Howley Professor, will be spending the summer researching on sedimentological problems in the Schaechtal, Switzerland. Dr. Charles J. Hughes, returned on May 28 from a second visit to Morocco, where he participated in an international colloquium involving a two-week field excursion followed by a three-day conference on the Precambrian rocks of the Anti-Atlas and their correlation. A point of some interest in the proceedings was the considerable resemblance of volcanic and sedimentary rocks there to rocks of similar age occurring both in the Avalon Peninsula of Newfoundland and on the Great Bank of Newfoundland where they had been reconnoitered during expeditions by the late Hugh Lilly. These resemblances lead to the hypotheses that Avalon once lay in close proximity to Morocco before the old and new worlds were separated by "continental drift" and that Avalon together with the Great Bank once formed part of the mainland and continental margin of the former African continent. Several new faculty members are interested in fields related to ancient and modern sediments: L.E. Fahraeus from Lund, Sweden and recently a postdoctorate fellow with the University of Western Ontario, is a specialist in micropaleontology; Dr. J.S. Sutton from Trinity College, Dublin, is doing research in metamorphic petrology; Dr. D. Strong, a recent graduate of Edinburgh, is locum tenens for Dr. W.G. Smitheringale who is on sabbatical leave at the University of Colorado. Research grants at the disposal of Dr. Brueckner permit him to support two postdoctorate fellows: Dr. R.S.W. Neville, a graduate of the University of Sheffield, is interested in palynological problems in Newfoundland; R.M. Slatt has just completed his Ph.D. programme at the University of Alaska and intends to study sedimentological aspects of Pleistocene till deposits of Newfoundland. Dr. John Dewey of Cambridge will be a Commonwealth Fellow in the Department from July 1, 1970 through to January 30, 1971.

Memorial University's Geology Department was visited by a number of distinguished earth scientists during the past semester. Dr. E.R. Venour, an exploration geology specialist with Chevron Standard Limited of Edmonton, visited the Department in January and lectured on "The significance of geological work in the petroleum industry". His tour was sponsored by the Alberta Society of Petroleum Geologists who nominated him 'Distinguished Guest Lecturer to Eastern Canada Universities'. Dr. C.C. Kilburn, Assistant Vice-President, Exploration and Development, Falconbridge Nickel Mines Limited, paid us a two-day visit in February. His talk, "Origin and environment of nickel deposits in Canada", followed by a munificent supply of 'juvenile water' later in the evening, was thoroughly enjoyed by all. Dr. M.R. Gregory of Dalhousie University lectured on various topics in sedimentology during the period February 3-6. Of particular interest was his review of research on sediment distribution and environmental history of the Scotian Shelf and the Bay of Fundy. Later in the month, Prof. M.J. Keen, Head of the Geology Department of Dalhousie University, gave a series of talks on marine geophysics, plate tectonics and the continental margin of North America. The visits of Drs. Keen and Gregory were part of a MUN - Dalhousie exchange scheme, partly sponsored by APICS. Drs. H. Williams and M.J. Kennedy of Memorial spoke to Dalhousie geologists on major structures in Newfoundland, Appalachian tectonics and intercontinental correlations. Another visitor in February was Prof. F. Beales of the University of Toronto who spoke on "Environmental interpretation of limestones" and "The stratigraphic habitat of Mississippi Valley type ore deposits". Profs. Keen and Beales were guest speakers at the inaugural meeting of the Newfoundland Section of the Geological Association of Canada, held in the Department on February 19 and 20. Papers presented in the technical session dealt chiefly with mineral deposits, structure of the Atlantic Region and continental drift. In March and April, a number of lectures were given to undergraduate students by Dr. A. Oldershaw from the University of Toronto and Dr. M. Schaef from McMaster University. A lady geologist from the Saskatchewan Department of Mineral Resources, complete with a handbag full of rocks, endured the trip on the 'Newfie Expedo' to St. John's; Dr. Ester Jamieson provided a stimulating atmosphere with her "Simple ecological tool for interpreting carbonate rocks". R.K. Stevens, from Erindale, Toronto, took part in seminars on the klippen of west Newfoundland and plate tectonics. J.M. Shearer, from the Bedford Institute, Dartmouth, lectured on 'Recent Sediments in Port au Port Bay'. In May, Prof. Jacques Beland, Head of the Geology Department of the University of Montreal, who had previously spoken to us on stratigraphical and structural complexities in Gaspé, joined about 25 faculty members and graduate students for a trans-island field trip. Dr. W.T. Dean, formerly of the British Museum and now with the Geological Survey of Canada, spent several days in the Department in early June. He is working on Cambro-Ordovician stratigraphy of the Atlantic Provinces with particular reference to trilobites. While in St. John's, Dr. Dean is also investigating the alleged discovery by Bell Island Miners in the early 1900's of a twenty-five foot primitive vertebrate fossil. Dr. N. Haile, Head of the Department of Geology, University of Malaya, Kuala Lumpur, Malaysia, stopped here on a round the world trip to examine Avalon geology.

From George deVries Klein formerly of the geology department at the University of Pennsylvania, the following account has been sent to us. Two of his former colleagues, Arthur

Boucot and J.G. Johnson have joined the geology faculty at Oregon State University and another, Patrick Butler Jr. has joined the Manned Spacecraft Center of NASA in Houston, Texas. Reginald Shagam, also a former colleague, has joined the geology department at the University of the Negev in Beersheba, Israel. Klein, an associate professor of geology at the University of Illinois, has received a grant from the National Science Foundation to undertake a study by means of time-lapse photography of the migration of dunes and sand waves on intertidal sand bars in the Minas Basin at Five Islands and Economy Point. He will be working in Nova Scotia during the summer of 1970 assisted by Rodney Balazs, a graduate student, and two undergraduates, John Hendricks and Bill Skibbe. Daniel J. Stanley has joined, on a 20 percent-time basis, the Geology Department at the University of Illinois (Urbana), while maintaining his permanent connection at the Smithsonian Institution. Stanley's duties require him to be on campus at Urbana for four to six weeks per academic year to give lectures on marine geology. Students at Illinois are eligible to join Stanley on his research cruises. In addition, Ph.D. candidates in Marine Geology at Illinois can work with Stanley at the Smithsonian, and obtain their degrees through the University of Illinois.

In the Halifax-Dartmouth area a variety of geological subjects were presented by speakers from many organizations. At Dalhousie University Dr. H. Loubat from Lake Head University spoke on "The Ophiolitic Association: Some ideas on their modes of emplacement and metamorphism"; Dr. J. Beland from University of Montreal discussed "Tectonic evolution of Gaspé Peninsula, Quebec"; Dr. T.N. Irvine, Geological Survey of Canada, Ottawa spoke on "Recent research in layered intrusions"; Dr. J.W. Morgan of the University of Kentucky gave a special seminar on "Uranium and thorium in eclogites and granulites"; and Dr. S.E. Haggerty of the Carnegie Institution of Washington, D.C., presented a study on "The magnetic and opaque mineralogy of lunar, continental and oceanic basalts. At the Bedford Institute, Dr. A.S. Laughton of the National Institute of Oceanography, England, gave a seminar on the geophysical studies at N.I.O. and the recent survey of King's Trough area of the North Atlantic.

The Society of the Sigma XI announced through the Chairman of its Grants-In-Aid of Research Committee, Dr. Harold G. Cassidy, an award to Mr. Irwin D. Novak of Cornell University. This award has been made to Mr. Novak to assist him in his study of "Sedimentary environment and energy budget of a cobble-gravel beach". Dr. Cassidy, in making this announcement, stated "Sigma XI each year makes a number of grants to promising scientists at critical points in their research careers. We recognize that many needs are relatively too small for the large foundations to consider, yet to the scientist himself the need may be critical. It is to meet these needs that our research fund is maintained".



C.S.S. Hudson of the Atlantic Oceanographic Laboratory, Bedford Institute, Dartmouth, Nova Scotia is presently in Victoria where she is outfitting for her cruise to the Arctic. The program mainly involves geological sampling, underway gravity magnetic and seismics, biology and oceanography and will be completed October 15 when the ship is returned to Halifax.