



Canada and the Ocean Drilling Program

M.J. Keen, Director
 Atlantic Geoscience Centre
 Geological Survey of Canada
 Bedford Institute of Oceanography
 Dartmouth, Nova Scotia B2Y 4A2

The Ocean Drilling Program will start to drill more holes in the floors of the oceans in late 1984. Why do we care? Should we join? Should anyone join?

Canada's Oceans in Ferment

Canada climbed on board the planning phase of the Ocean Drilling Program by signing a Memorandum of Understanding with the United States on October 20, 1983 in Ottawa. Why? What is the Ocean Drilling Program? What is in it for us?

Metal-rich hydrothermal deposits were found off British Columbia's coast by Canadians and Americans in 1982 and 1983. Environmental review hearings on Venture gas developments off Nova Scotia were completed last fall; Beaufort Sea hearings are underway; Hibernia hearings are planned for 1984. The International Court of Justice has before it the boundary dispute between Canada and the U.S. concerning the Gulf of Maine and Georges Bank. A French seismic vessel has been exploring St. Pierre Bank south of Newfoundland, a bank which both Canada and France claim as their own. The federal government has proposed to apply federal customs' laws on designated goods which enter Canada's outermost limits. The Minister of External Affairs, Mr. Allan MacEachen, announced last November 7 that the International Centre for Ocean Development would be established in Halifax, at a cost of \$20 million, fulfilling a pledge to developing nations made by Mr. Trudeau.

Canada has a huge coastline and an offshore half the size of its landmass. The events I note here reflect the ferment about this offshore. We must be interested in any program which has as its claim the increase in geological knowledge of the floors of the oceans. That is the aim of the new Ocean Drilling Program.

The World's Oceans In Ferment

Many—most—nations signed the Law of the Sea Convention in December 1982. This Convention was surely humankind's most ambitious attempt to bring law and order to the oceans. Who will control the resources of the seabed of the world's oceans? If the Convention is ratified by enough nations, the International Seabed Authority of the United Nations will. How are the boundaries between the seabed of the world's oceans, the common heritage of humankind, according to the Convention, and a coastal nation's seabed defined? If the Convention is ratified by enough nations, its Article 76 tells us how to do this. Even if the Convention is *not* ratified, and does *not* become part of a formal codified legal system accepted by all nations, much of it will surely become part of customary international law; we see that now in our own Canada Oil and Gas Act, in which our outer limits are defined in ways clearly modelled after Article 76 of the Convention. Will the Convention affect the Canadian mineral industry? If mining mineral resources on the ocean floor ever becomes a significant economic reality, the Convention certainly may affect it; Canada is, on the one hand, a land-based *producer* of nickel, copper and cobalt and, on the other hand, a potential *miner* of seabed resources.

Exploration and exploitation of seabed resources needs geological knowledge and understanding, including a geological map of the sea-floor. The Ocean Drilling Program is a vital part of any program which will provide that knowledge and understanding, that geological map of the seabed.

The Ocean Drilling Program

The new Ocean Drilling Program is a successor to the Deep Sea Drilling Project in which, since 1968, the drilling vessel *Glomar Challenger* has drilled several hundred holes into the sea-floor. The venture was a scientific program, and so will be the new Ocean Drilling Program. The venture proved that the conceptual revolution of the past twenty years in the earth sciences was based on truth—ocean floors *do* spread, the volcanic rocks which form the top of the earth's crust beneath the oceans are systematically older the further away they are from the crests of the mid-ocean ridges. The ocean floor, the Deep Sea Drilling Project showed, is part of a vast plumbing system, as had been predicted. The oceans circulate through the ocean's crust once every few million years, which controls the ocean's chemical composition and salinity, and which leads to mineral deposits on the seafloor through the action of hot, corrosive saline water on the rocks beneath the ocean floor. It has been an extraordinarily successful pro-

gram, and has involved many of the world's best earth scientists and technologists from many nations.

The *Glomar Challenger* has aged, and has just been laid up; the last hole of the Deep Sea Drilling Project was drilled in November on the Mississippi fan. A new vessel with space for more scientists and the potential for more modern technology was needed. The Project needed redefining. The Project also needed stability: in its last few years it had operated on a one- or two-year basis which provided no opportunity for long-term planning. It was an *international* experiment, with Britain, Japan, West Germany, France and, for a time, the U.S.S.R., as partners. These partners were unsettled by the uncertainty. The result is the new Ocean Drilling Program.

The United States and its international partners will operate a new vessel, the Sedco/BP 471, built in Halifax in 1978. This ship is larger than *Challenger*, with space for forty to fifty scientists on board, with the capability of handling riser and blow-out prevention systems as funds permit their acquisition, and with excellent programs of well logging. The new vessel will operate in worse weather than did the *Challenger*, and perhaps in ice. The program of drilling in the first eighteen months has been defined by a series of formal and informal conferences and gatherings. Nations other than the U.S. are joining now for the planning phase, with a view to joining as full members in late 1984, when drilling starts again. The Federal Republic of Germany has joined ODP as a full member. Canada, the U.K. and a consortium of European members (Switzerland, Sweden, Holland, Norway and Italy) are candidate members. Japan is likely to join as a full member after April, 1984. Brazil, Australia, New Zealand and Finland all have expressed interest.

Canada and the New Ocean Drilling Program

What is in it for us? This, clearly, is a fair question. It will cost a nation \$250,000 (Canadian) to be a member during the planning phase; this buys the right to be involved in the *planning*, to nominate Canadians to panels and working groups in the scientific and technological advisory structure. It pays for a small part of the expenses of the Program during the planning year. The U.S. is paying the lion's share, for example, of ship conversion. It will cost \$3,000,000 (Canadian) per year for a nation (other than the U.S.) to be a full member during the drilling program itself. If five nations are members, in addition to the U.S., they will pay about one-third the cost, with the U.S. paying the rest. In addition to this "subscription", a nation must

surely spend one to two million per year in studies by its scientific and technological communities on work associated with the Program, if that nation is to reap any real benefit.

What is in it for us? To begin with, we can be bluntly commercial. To tie down the geological evolution of the east coast offshore from Georges Bank to Northern Baffin Bay would be a step forward in defining future petroleum provinces. This demands drilling in deep water offshore, where no company with shareholders to face would dare to venture. In the first eighteen months the Program has firmly in its plans holes in the Labrador Sea, which will go a long way to settling the essential aspects of the geological evolution of the Labrador Sea. A good deal of interest was expressed by the Ocean Drilling Program Planning Committee in drilling in Baffin Bay. The Labrador Sea proposals were formulated on behalf of the Canadian Planning Committee by a group led by Felix Gradstein (GSC) which included earth scientists from Dalhousie, Memorial, Petro-Canada and the Geological Survey of Canada. They were presented to the Sediments and Oceans panel of ODP by Ali Aksu (Dalhousie) and to the ODP Planning Committee by John Malpas (Memorial) and Lubomir Jansa (GSC). What would be the cost of doing this alone, with no international Program? The cost surely would be many tens of millions of dollars, much more than a full subscription would be over the ten years envisaged by the Program.

A program to drill in the region of the Kane Fracture Zone of the Mid-Atlantic Ridge in 1985 is being planned, and one of the proponents is Larry Mayer, Department of Oceanography, Dalhousie University. Pat Ryall (Dalhousie) may join him on a

site-survey in December 1984, using his (and Bedford Institute of Oceanography's) rock-core drill. One may write to Larry Mayer for details. Opportunities to drill off the west coast will arise in about 1989 (after the vessel has wended her way back from the Antarctic via the Indian and Pacific oceans).

Many economic geologists would agree that to understand the processes which led to the formation of certain ore-bodies on our landmass one should understand the processes which led to the present mineral deposits forming *now* at the crests of mid-ocean ridges. This demands drilling. Most potential sea-bed miners would agree that to assess the potential of these seabed resources demands drilling. This is expensive, and the economic returns may be distant. However, holes planned by the Ocean Drilling Program will be drilled in these sorts of sites in the next five years; Canadian participation means Canadian influence on the exact locations of these sites. Canadians naturally will be interested in sites globally, but will have particular interest in sites close to home, on the Juan de Fuca Ridge off British Columbia, for example.

We need not be crassly commercial to see the benefit in participation for Canadians. Good geological mapping in the western Cordillera and the Shield demand good facies models: How *does* the geological system work? How *did* it work? This knowledge demands participation in work on modern geological processes. The Program provides this opportunity. Canada will be affected by climate change; the geological history of the earth is our best teacher of the effects of such changes, and the Program through its studies of sedimentary sequences will teach us that. Some nations want to dispose of their radio-

active wastes in the sediments of the ocean floor. What do we, Canadians, think of that? The best way to acquire the knowledge to answer *that* question fully is by drilling holes into the uppermost few hundred metres of sediment beneath the deep sea-floor. This will be done by the Program. Who else will pay for that? Do you care? Will your children care?

The Cost of Not Joining

The nations that are likely to participate in the Ocean Drilling Program from its start are the United States, Japan, West Germany, France, Britain, Sweden, Norway, Italy, the Netherlands and Switzerland. This forms a community of some 600 million people. Austria, Australia, Finland and New Zealand have all expressed interest. Suppose we do not become involved? It will mean that Canada will be the *only* substantial western, industrialized nation whose marine scientists and technologists are *not* participating with the world's best in the exploration of the ocean floors. That will mean that the base of knowledge and the level of expertise will be inadequate in Canada: there will be no cadre of graduate students, our future professionals, who have been influenced by participation in the program. It will mean that the Canadian mineral industry and the Canadian petroleum industry will not have the same access to the most up-to-date information on the ocean floors as will the mineral and petroleum industries of *all* those other nations. It will mean that Canadian policy makers and negotiators will not be as well informed as their counterparts in international discussions concerning the London Dumping Convention or the Law of the Sea. I think the cost of *not* joining is extremely high.

Canadian Planning for the Ocean Drilling Program

We must answer three related questions: How can we contribute to the planning of the Program? Should we, Canada, join the Program in its operational phase? How should we be organized in the planning and operational phases?

The Canadian Geoscience Council is the umbrella organization for the earth scientists in Canada, composed of representatives of all the earth science societies and institutions in Canada, such as the Canadian Society of Petroleum Geologists, the Geological Association of Canada, the Geology Division of C.I.M., the Canadian Well Drillers' Association, the Canadian Geophysical Union, the Geological Survey of Canada, etc. The voices of about ten thousand earth scientists are heard in this Council. Under its auspices an "Ad hoc" Planning Committee was established in the summer of 1983; its Chairman is

Table 1. Facts and Figures on the Canadian Offshore

Our long, long coastline: the length in km.

Pacific coast:	25,717	:	10.5%
Arctic coast:	172,950	:	70.9%
Atlantic coast:	45,369	:	18.6%
Total:	244,036		100.0%

Our huge continental margin: the area in square kilometres

	Continental shelf and Enclosed marine waters	Continental slope
Atlantic:	1,138,000	446,000
Arctic:	2,335,000	950,000
Pacific:	101,000	41,000
Totals:	3,574,000	1,437,000
Grand Total:	5,011,000	

Source: Marine Geosciences in Canada: Geological Survey of Canada, Paper 81-6, Part 1.

Dr. John Malpas of Memorial University. This Committee has the responsibility of making the scientific and technological case for Canadian participation, and for seeing that the plans leading to drilling in the Labrador Sea in 1985 are well made. Malpas represents Canada at the Program's international planning meetings.

The present paymaster for Canadian participation in the planning phase is the Federal Department of Energy, Mines and Resources. Dr. W.W. Hutchison, Assistant Deputy Minister for the Earth Science Sector in E.M.R., who along with myself represents Canada in the Program's Executive Committee internationally, is now seeing that a Canada-wide "Executive" Committee is established, designed to assess the political and economic case for Canadian participation, oversee and provide policy direction to the *Ad Hoc* Planning Committee, and plan the future organization for the operational phase of the Program. Like the *Ad Hoc* Planning Committee, this too has been organized under the auspices of the Canadian Geoscience Council.

One central question to ask is whether our marine scientific and technological community is large enough to support full membership. If the new drilling vessel has space for twenty-five to thirty scientists and technologists on board (in addition to permanent technical staff) and there are six nations including Canada as full members, we would have "rights" to four or five people on board all the time. That's a good many, I think, and a guess of mine is that we could not support it. What we could more easily support, perhaps, is participation in a consortium with one or more other nations which, because of the size of their populations, have relatively small marine scientific communities. Some of us had hoped that Australia and New Zealand would be interested in consorting with us, but it is not clear if they will participate initially. A group of European nations—Sweden, Norway, Netherlands, Switzerland and Italy—has, however, suggested that we should join them as a partner, with Canada taking half or a little more of the costs and rights in such a consortium. This

will be explored in the next few months.

There is one urgent task: If drilling is to take place in the Labrador Sea in 1985, site surveys must be done in 1984, to add to the data bases which already exist for the proposed site. These surveys will be carried out by CSS HUDSON in August, 1984, employing people from government agencies, universities and, we hope, industry.

What is in it for You?

What is your interest? Tying wells in the Beaufort Sea to European "type" sections? State-of-the-art developments in well-logging? Drilling in difficult rock in 5 km of water, 1 km below the sea floor? Do you have a drill bit to test and show to the world? Are you a whiz-kid in fibre-optic cables? Or, do you have a model of ore deposition which requires comparison with a "real-life", modern situation on a mid-ocean ridge? Are you concerned with production of organic matter during the Cretaceous in the Atlantic Ocean? The list is endless.

Dave Ross (NORDCO Ltd., St. John's) and John Harrison (EMR, Dr. W.W. Hutchison's office) have consulted extensively with industry and with the Ocean Drilling Program about opportunities for Canadian industry. Any enquiries should be directed to one of them.

The Canadian economy is a relatively small one by comparison with the economies of the other nations involved thus far, and our scientific and technological communities are smaller, too. Consequently, any decision to join cannot be taken lightly. The task of our Planning Committee and Executive Committee is to see that the Government of Canada has a well reasoned case before it within the next few months, a case which clearly presents the advantages and disadvantages of participation, so that a decision can be made. Firm proposals for Canadian membership will go to A) NSERC, led by the Canadian Planning Committee (Malpas) and B) to the Federal Government, led by the Department of Energy, Mines and Resources. These, of course, will be closely coordinated. For further information, one may write to me, or to Dr. W.W. Hutchison, E.M.R., 580 Booth Street, Ottawa, Ontario K1A 0E4, or Dr. J. Malpas, Department of Earth Sciences, Memorial University of Newfoundland, St. John's, Newfoundland A1B 3X5.

Table II. Ocean Drilling Program: The First Eighteen Months

1984	<i>Gulf of Mexico—Bahamas</i>
1985	<i>Bahamas—Barbados—Mid-Atlantic Ridge Labrador Sea—Norwegian Sea—Mediterranean</i>
1986	<i>Equatorial fracture zones, Atlantic—N.W. Africa Costa Rica and Venezuela—Columbia—Peru/Chile trench—triple junction off Chile—Weddell Sea, Antarctica</i>