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Pyroclasts

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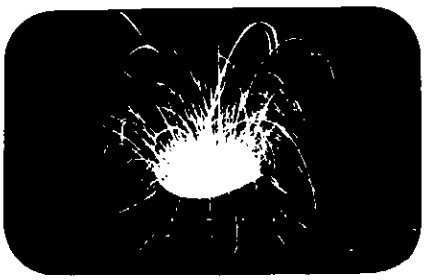

Pyroclasts

We are proud to announce that Graham Williams and Digby McLaren have accepted appointments as joint Pyroclast columnists, and will be contributing to this space on a regular basis. It is the least they can do, having just relinquished an Editorship and a Director Generalship, respectively, and now obviously having little else to fill those tax-paid hours. Guest columnists may also make occasional appearances, and unsolicited contributions, in the Nealeian tradition of commenting, complaining or cajoling, will be welcomed.

– Editor

Introduction

How does anyone step into Ward Neale's field boots? It's impossible, I mused, as I read Andrew Miall's letter of invitation. And why me? Had our fledgling editor been spurned by the beavercrats and elders of the Glorious Academic Combine? Was my friend Herbie (hiding behind his shield) unwilling to come out of retirement? Or was it a clever plot to have *Geoscience Canada* become a viable alternative to *Geolog*?

Whatever the reason for this invitation to be an occasional contributor to "Son of Pyroclasts," I realize my limitations. That is why I accepted. If I survive, I shall try to justify this decision in Pyroclasts II.

My immediate concern is, what shall I write about? Initially I was tempted to produce a chip off the old block, but then I realized that the column, as written by Ward, was unique. His inimitable style cannot be imitated, nor can his contacts ever be duplicated (did I hear some sighs of relief?). What are my alternatives? An erudite contribution is out of the question as long as I am the author. That, I shall leave to my alternate, Digby McLaren, with the hope that I get the last word. I am continually amused by Robert Bates's (correct according to Strunk) "Geologic Column", but only a genius could write it. For a radically different approach, I toyed with the idea of modelling a column on the Great Wall, the effort produced by Fu-Manchu for Open Earth. This I decided was too radical, however, and would be merely an excuse for filling a page.

My final decision regarding format was influenced by previous versions of "Pyroclasts". After photocopying each of Ward's articles, I read through them carefully and came up with some interesting statistics (more of this in a later column). I also realized that there is a need for a column which highlights aspects of geology or geological events rather than politics. Will it be controversial? That depends on both writer and reader. Please send me your views, even if they disagree with mine, and please consider writing the occasional article. That will give me a break, and make life more entertaining for the vast potential readership hanging on my every word.

All at Sea: My Baptism in Marine Geology

Beached

I had smiled sceptically when Michael Keen uttered his famous phrase, "It takes considerable knowledge and skill to be a marine geologist." In my ignorance, I had always assumed that I was one of these rare animals, since I did study sediments deposited in both marine and non-marine environments. What crass ignorance I displayed. A marine geologist, I was informed, went to sea. So be it. If going to sea would transform me into one of these deities, I was willing to make the sacrifice.

The above is the only explanation I could offer, in my saner moments, for being marooned on a "beach" at Pond Inlet one mild (for Baffin Island) fall day. The term *beach* is used with scant regard for reality in the Arctic. Surely, the ice-strewn desolation upon which I was standing was not akin to those magnificent stretches of sand over which Editor Miall went into rhapsodies. What, I wondered, am I doing in Pond Inlet on a Friday afternoon when I could be relaxing in that tropical paradise, Halifax? My reasons had seemed so simple the previous week. I was going to become a marine geologist, but this was frightening reality after being deskbound for several years.

My first day in my new profession was teaching me a basic tenet of marine geology: the difficult part of going to sea is getting to and from the ship. To board *C.S.S. Hudson* at Pond Inlet I had left Bedford Institute the previous day. I, along with several other condemned men, had arrived in Montreal at 11 p.m., only three hours late. Since our flight to Frobisher Bay did not leave until 8 a.m. the following morning, we had decided to spend the night in Montreal. That was when we discovered our guaranteed reservations were not.

Wandering around Montreal late at night with excessive amounts of luggage is not to be recommended, but nothing untoward happened, and we finally found some rooms. The previous occupants of mine had obviously been in the middle of a party when raided by person or persons unknown. There were beer bottles (unfortunately empty) and wine carafes (fortunately full) liberally scattered around the room, a setting not conducive to sleep. Nothing, however, would have kept me awake, and I fell asleep dreaming of *Loveboat*.

The flight to Frobisher Bay the following morning was uneventful. There, we caught a charter flight to Pond Inlet so that we saw most of Baffin Island. It's a magnificent place, but not the friendliest looking terrain in the world.

Pond Inlet was the place chosen for a change of scientific personnel on *C.S.S. Hudson*. This ship, launched in 1963,

is operated out of Bedford Institute by the Department of Fisheries and Oceans. She is an ocean-going vessel with a Lloyds Ice Class I hull, a gross weight of 3721 tons and, luckily for me, sailing in her is the next best thing to being on land. When viewed from the dockside, *Hudson* is an impressive vessel; when one is stranded in freezing weather on Pond Inlet beach, to board her seems an impossible dream.

Why were we stranded? The reason was simple. The launch scheduled to rescue us from this wilderness had lost its steering and was going around in circles (perhaps one should say Arctic Circles).

A beach on Baffin Island in late September can seem cold after two minutes. After an hour, the time it took to repair the launch, it becomes wretched. To stay warm we resorted to violent exercise, wearing socks on hands (I had lost my gloves) and debating where we could steal some antifreeze.

The trip from Pond Inlet "beach" to *Hudson* was achieved in two stages. In the first, one had to jump from the beach onto a Boston whaler and cling precariously to the side while heading out to sea. We then transferred to the launch which took us out to *Hudson*, about one mile offshore. To board the ship, we climbed a Jacob's-ladder before falling into the waiting arms of the grinning crew. Finally I was aboard and on the way to realizing my cherished ambition to become a marine geologist. As *Hudson* weighed anchor that night, I began to appreciate some of the truth of Mike Keen's statement. I also decided to learn more about this strange science, and how important it was to a country with the second largest coastline in the world.

Historical Perspectives

Marine geology traces its formal history back to the voyage of *H.M.S. Beagle* from 1831 to 1836. The first marine geologist may therefore have been Charles Darwin. Subsequent cruises in the nineteenth century initially concentrated on producing bathymetric charts. Then, in 1872, marine geology came of age when *H.M.S. Challenger* left England on her circumnavigation of the globe. *H.M.S. Challenger*, a sailing ship of 2300 tons with auxiliary steam power, was financed by the Royal Society of London. The objectives of the cruise were to study the deeper parts of the world's oceanic basins.

Even by today's standards, the accomplishments of the *Challenger* are impressive. In four years she covered almost 70000 miles, carried out about 500 deep water soundings and collected numerous dredge samples. The value of the survey was such that scientific papers are still being published on the data. Her successes led to some other cruises, but for 70 years most marine geology was carried out by biologists.

This was true in Canada where some of the research was directed by the Fisheries Research Board of Canada, whose forerunner, the Biological Board of Canada, was founded in 1912. In the 1950s the increasing interest in the Canadian offshore as a source of oil and gas led to an acccelerated program in marine geology. This was reflected (no pun intended) in the growth of the Institute of Oceanography at the University of British Columbia, which had been established in 1949. Some of the early studies offshore were refraction surveys of the Scotian Shelf-Grand Banks carried out by Lamont Doherty Geological Observatory.

The awarding of offshore leases around Sable Island to Mobil Oil in 1959 led to further progress. In 1960 Dalhousie University, with the support of the National Research Council, founded its Institute of Oceanography, so that Canadian marine science was formally in place on both east and west coasts. Arctic studies meanwhile had been given a boost with the birth in 1958 of the Polar Continental Shelf Project.

The Geological Survey of Canada, in conjunction with the Canadian Hydrographic Service, began sea magnetometer surveys in 1959. These and subsequent studies have generated potential field and bathymetric maps for most of offshore Canada.

In 1962 the Department of Mines and Technical Surveys established the Bedford Institute of Oceanography in Dartmouth. This became home base for the vessels *Baffin*, *Kapuskasing*, *Acadia* and *Maxwell*, to which were later added *Hudson* (1963) and *Dawson* (1967). Further boosts to Canadian studies came from the opening of the Institutes at Burlington, Ontario and Patricia Bay, Vancouver Island, and the greater involvement of the universities and G.S.C.

Today Canadian ships and scientists are in the forefront of marine geology. The early voyages, where bathymetry and magnetics were the only requirements, have given way to multiparameter cruises. On these, sophisticated gravimeters and seismic refraction and seismic reflection equipment allow scientists to map both the sea floor and the sediments beneath in great detail. New developments in sampling devices for taking undisturbed surficial sediment and bedrock also are providing new insights into submarine geology.

Canadian marine geologists have not restricted their interests to the Canadian offshore. There have been major commitments to the Deep Sea Drilling Program and cruises the the mid-Atlantic Ridge and other parts of the Atlantic and the Pacific. Continuing involvement in the D.S.D.P. program, and its successor, the *J.O.I. Explorer* program, is imperative if Canada wishes to remain a leader in marine geology. So much for pontification; now to continue my saga.

Back to *Hudson*

How did my going on a Hudson cruise relate to the science of marine geology? It gave me a new insight into the complexity of the science and the scope of the resources needed to carry out even small surveys. Being on *Hudson* did not make me a marine geologist, but it highlighted some of the difficulties, such as, where are we? Where is the ship? How deep is the water? Are there surficial sediments? Where is bedrock? What is bedrock? I discovered the answers to some of these questions during three weeks of cruising in Baffin Bay and Hudson Strait.

"Where are we?" can be resolved by intricate navigation, but not at any time of day or night in northern latitudes. Satellite fixes can only be obtained when satellites are around, not as simple as it sounds. Other navigational techniques such as LORAN-C are dependent on fixes from surface stations, often too far away to give reliable readings, while positioning by radar is limited by distance from shore and the physiography of the coast.

What is the topography and nature of the sea floor? On *Hudson*, routine surveys that give such information include echo sounding, sidescan sonar and the Huntec deep tow seismic system. The Huntec deep tow provides information on the thickness and general composition of the surficial sediments and sometimes the bedrock structure. Knowledge of the bedrock and subsurface in general is obtained from single channel reflection surveys and gravity and magnetic data. Interpretation of the seabed geology, however, usually demands integration of data from the various acoustic systems.

On the Baffin Bay cruise, the above surveys indicated several promising areas for sampling. To recover surficial sediments we took gravity cores, piston cores and grab samples. The sampling of bedrock, however, was much more complicated. For this we relied on the electric rock core drill developed at Bedford Institute. This drill, which sits on the sea floor, is powered and controlled from the ship through a single umbilical cord, a triaxial cable.

The drill was used 35 times on the Baffin Bay cruise, with recovery of bedrock cores being achieved on 13 lowerings. Although the drill will operate in depths greater than 2500 metres, we generally used it in water depths up to 750 metres. The maximum core obtainable is theoretically more than 28 feet; in practice, we obtained

five feet at one hole and considerably less at all the others.

Operation and maintenance of the drill are enlightening experiences, especially in Baffin Bay where the wind can be on the cool side. Our initial, laborious overhauls were gradually replaced by a slick, well-oiled (in more ways than one) performance that earned us extra time in the bar. It also meant the difference between life and death, since we were able to get back inside before being overcome by the weather.

The pace of marine geology is much more variable than that of land geology. Periods of prolonged inactivity are succeeded by bursts of frenetic movement, apparently chaotic but all conforming to a master plan. Weeks of preparation may culminate in euphoria if bedrock samples are recovered at a key location, or misery if the drill returns from the sea floor without core and with a bent barrel. Even the initial euphoria may have been misplaced if the samples are devoid of fossils, so that the age remains a mystery.

Field work on a ship is much more difficult than on foot. The weather plays a key role in everything, including what condition you are in and whether you can still function. Drilling operations require relatively calm seas, a captain capable of maintaining station and a crew skilled in the handling of the drill. Surveys are dependent on sea state and continued trouble-free operation of equipment, which is impossible unless one has first class technical support. There are so many things to go wrong that I was constantly amazed when everything ran smoothly.

Operating a ship cannot be compared to running a four-wheel drive. The crew needed to run *Hudson*, about 60 in number, must be organized to keep everything proceeding normally on a twenty-four hour basis. The Captain is the supreme being; the chief scientist is his acolyte. Usually there is agreement between the two. I would not like to be on a cruise where there was a personality clash. The scientific staff must work well with the crew and with each other, a difficult task when thrown together for the first time, but not impossible, as shown by the excellent *esprit de corps* on our cruise.

What does it cost to go to sea? It depends in part on the size of the ship and crew, and on the length and location of the cruise. With the rapid escalation in fuel costs over the last decade, the daily rate for a vessel such as *Hudson* now runs into several thousand dollars. Such increases in cost mean fewer cruises, fewer staff and better utilization of potential. Thus, Bedford Institute has become a leader in organizing multiparameter cruises, with scientific input from numerous disciplines. The total operation reflects an efficient, well run organization.

My most enduring memories of the *Hudson* cruise are the comradeship of the participants and the sense of achievement in adding to our geological knowledge of Baffin Bay. As I climbed into the launch at Frobisher Bay and headed for shore, I felt that I was finally on my way to becoming a marine geologist. That probably explains why I am now planning my next cruise, and why this time I shall go to Bermuda.

G.L. Williams