Geological Calibration Attempt of Side-Looking Sonar, North Shore of Minas Basin, Nova Scotia*

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In July and August, 1965, attempts were made to obtain background information getween geology of the sea bottom and records made with a side-looking sonar system on tidal flats in Parrsboro Harbour and north of the Five Islands, in Minas Basin, Nova Scotia (Figure 1).

The purpose of the project was to make side-looking sonar scans of the bottom at high tide, and then to compare these records directly with the bottom, which is exposed to direct observations at low tide. The tidal range in the areas concerned varies from 35 to 45 feet. A companion study involving detailed mapping of the bottom in the Five Islands area (as well as other subjects, as reported separately) was carried out by DR. GEORGE DeVRIES KLEIN of the UNIVERSITY OF PENNSYLVANIA.

The side-looking sonar records compare favorably with the bottom as mapped by Dr. Klein's geology party. The trip revealed several deficiencies in the design of the electronic systems, however, so quantitative comparisons between areas of different reflectivity were not possible.

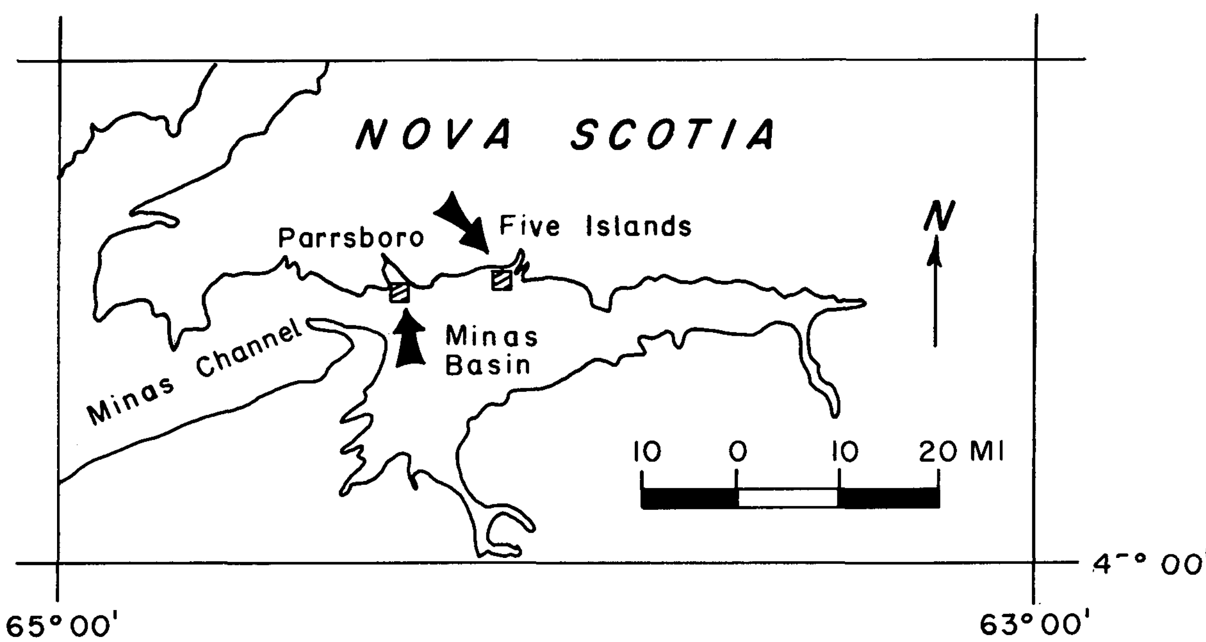

Figure 1. Index map showing location of Parrsboro Harbour and Five Islands areas.

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In side-looking sonar, the principal sound is directed outward laterally from the ship, so that it strikes the bottom at a low angle instead of being beamed perpendicularly at the bottom as in ordinary echo sounding. Reflections from this low-incident sound are more complex than normal "echoes"; they vary according to composition, slope, and roughness of the bottom, and may be complicated by returns from water-surface waves and those from various multiple travel paths between water-surface and bottom. Temperature boundaries in the water refract the sound and may cause additional complications. The printed time-time chart in side-looking sonar is not a profile as in echo sounding; it is more like a strip "map" of the bottom with one scale distorted with respect to the other. The "map scale" perpendicular to the ship, for example, is usually 4 to 8 times exaggerated with respect to the "scale" parallel to the ship's track. The time-time chart record must be additionally interpreted in terms of the intensity of the print-out of the graphic recorder (which is determined by the intensity of the reflected signal from the bottom, which in turn is a function of bottom composition and slope) and by the shape of areas with different intensity of record. White areas of no sound return are the most important and distinctive features of the side-looking sonar records; these are "sound shadows" behind raised areas on the bottom, from which no sound reflections are possible. They can be used in the same way that dark optical shadows made by low-incident light can be used in air photographs to reveal the shape of objects, indicating height and profile.

The equipment used in the Minas Basin experiments in 1965 consisted of a side-looking sonar system built at HUDSON LABORATORIES by FRED COLE, Associate Electronic Engineer, based on an earlier Clay-Liang system. This array was designed for operations from a small chartered lobster boat. A catamaran float was made to accommodate the stable towing vehicle (a piece of aluminum pipe 6 feet long with stabilizing fins at the back and the 4-foot lead reflectors and transducers at the front) which could be raised or lowered by a hand hoist. Sound frequencies of 27.0 and 30.5 kc/sec were used; by contrast, frequencies used in echo sounders range from 12 to 200 kc/sec. Position of the towing boat was determined by transit sights from shore stations which were taken every two minutes on a broadcast signal and transmitted back to the boat by walkie-talkie radios, where they were plotted on a large-scale chart.

PROFESSOR W.D. CHESTERMAN, Physics Department, HONG KONG UNIVERSITY, one of the pioneers of side-looking sonar, spent July with field parties from BEDFORD INSTITUTE OF OCEANOGRAPHY, Dartmouth, Nova Scotia, principally in Chaleur Bay and the Gulf of St. Lawrence. Professor Chesterman used the Kelvin-Hughes 50-kc lateral echo sounder, which he helped to develop in England before going out to Hong Kong. The Kelvin-Hughes system is much more powerful than the Hudson Laboratories unit; it differs in using only a single-side scan. This provides twice the range (2400 feet) out from the ship as one of the scans of the 2-sided system (at the same 1-sec sweep rate). The Hudson Laboratories system, however, has a "range extend" capability, which by the flip of a switch permits it to become a one-sided scanner with the same range as the Kelvin-Hughes unit. The faster towing speed used in Professor Chesterman's scans produced lateral distortion in excess of 8:1.

The different types of equipment used and different approaches to the geological comparisons were compared and contrasted during an exchange of visits between the Hudson Laboratories group and a party from Bedford Institute of Oceanography, which included Professor Chesterman. The Hudson Laboratories party, which had full access to bottom data based on direct visual observation, and a slightly less sophisticated sonar system, felt keenly the amount of information which was not displayed on the records. The B.I.O. groups, on the other hand, whose previous "detailed" information about the bottom was based on standard oceanographic sampling on grids of various dimensions, were much impressed by how much more about the bottom was revealed by the Kelvin-Hughes lateral echo sounder. The obvious conclusion from this comparison is that side-looking sonar is not "magic," but does provide much more information about the bottom than can be obtained by standard surveying techniques, and does so in much less time and with greater detail.

Acknowledgments

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A Periglacial Eolian Sand at Debert, Northern Nova Scotia: a Preliminary Report.*

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Description of the Sand

Excavation of a paleo-Indian site at Debert, northern Nova Scotia (Figure 1), has revealed the presence of a localized sand body of periglacial origin.

The site is underlain by friable, dusky red Triassic sandstone (Wolfville Formation of KLEIN, 1962). The sandstone is moderately to well sorted, and is locally conglomeratic.

Bedrock is mantled by a dusky red, sandy till of local derivation, ranging from 0 to 5 metres thick. The uppermost metre of the till contrasts lithologically with the lower portion at many places. It

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