



**NEARSHORE MORPHOLOGY AND HEAVY MINERAL DEPOSITS,
JUAN DE FUCA STRAIT, SOOKE TO PORT RENFREW
(92B/5; 92C/8, 9)**

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INTRODUCTION

The purpose of this study is to examine the nearshore morphology, geology and evolution of northern Strait of Juan de Fuca between Sooke Basin and Port Renfrew, from the beach seawards to the edge of the prominent platform (near the 100-metre isobath). Various field and analytical techniques have been and will be employed, including: offshore dredging and grab sampling, sidescan sonar, high-resolution bottom profiling (seismic), magnetic susceptibility, textural analyses and mineralogical determinations. A determination of the heavy mineral assemblages and their distribution in the area will be completed as well as an evaluation of the potential for nearshore placer deposits.

Preliminary work on this 2-year study began in the summer of 1988. Grab and dredge sampling from various oceanographic vessels produced a total of 186 samples from three cruises in 1979, 1981 and 1988. Eight transects of French Beach provided 104 samples corresponding to magnetic susceptibility survey stations. Samples were collected or obtained from archives at the Pacific Geoscience Centre and subjected to textural analysis. A study of information obtained from the first 1988 cruise, which included sidescan sonar and bottom profiling, has begun.

PREVIOUS WORK

The glacial history of the Strait of Juan de Fuca, as well as a general description of the character of its sediments, was discussed by Anderson (1968) and Mayers and Bennett (1973). The geomorphology of southwestern Vancouver Island and its late Pleistocene history are described by Alley and Chatwin (1979). A study of the nearshore surficial geology along the northern Strait has not been done, though north of Port Renfrew numerous studies of the shelf sediments have been completed. The surficial geology of the

continental shelf off northwestern Vancouver Island was examined by Bornhold and Yorath (1984), and off south-central Vancouver Island by Herzer and Bornhold (1982).

A summary of investigations of beach sand magnetite content was completed by Holland and Nasmith (1958) for several locations on the British Columbia coast, including Graham Island where placer gold was also of interest. Nearshore heavy mineral assemblages and the potential for nearshore placer gold deposits on the shelf off Vancouver Island have not, however, been previously examined. Recent work by Barrie *et al.* (in press) studied the heavy mineral deposits of Hecate Strait and Queen Charlotte Sound. A study of the magnetic susceptibility of shelf sediments off central Vancouver Island revealed areas of anomalously high readings (Currie and Bornhold, 1983) which could be of potential economic interest due to the association between magnetite and heavy mineral placers.

GEOLOGIC SETTING

Southwest Vancouver Island is underlain by Tertiary Metchosis volcanics and the Jura-Cretaceous Leech River Formation, both of which are juxtaposed against the Leech River complex by the Leech River fault (Muller, 1980). Along the coast these older rocks are overlain by a narrow fringe of Tertiary clastic strata of the Carmanah Group. At the southeastern edge of the study area intrusions of the Tertiary Sooke gabbro are present.

Late Wisconsinian (Fraser) glaciation produced the major Pleistocene deposits and landforms on southwestern Vancouver Island (Alley and Chatwin, 1979). During the maximum extent of glaciation (Vashon stage), southern Vancouver Island lay completely under a cover of ice which moved in a south-southwesterly direction across the Strait of Juan de Fuca to the edge of the continental shelf. Deglaciation resulted in downwasting of the glacial debris onto the continental shelf and subsequent reworking of these sediments has concentrated heavy minerals locally.

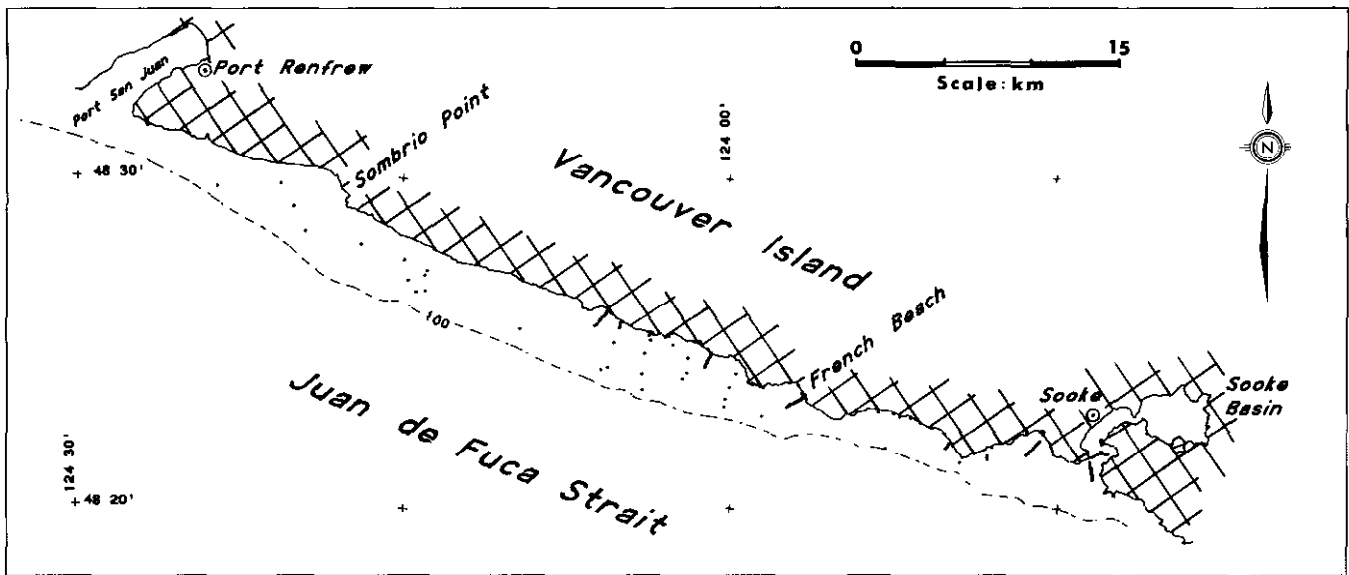


Figure 3-9-1. Samples in study area collected from cruises and beach reconnaissance in 1979, 1981 and 1988 (186 samples). Bathymetry is in metres.

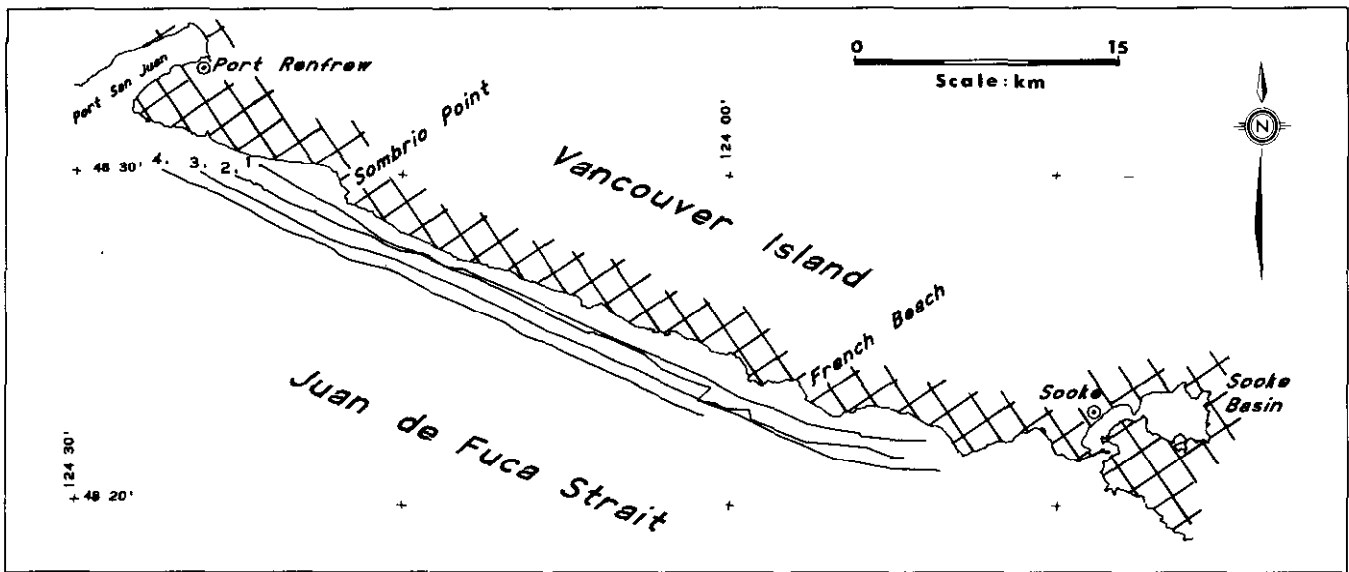


Figure 3-9-2. Four survey lines of C.S.S. Tully in January 1988. Information obtained included sidescan swaths and sub-bottom profiles (3.5 kHz).

Heavy mineral placer potential off the British Columbia coast is uncertain. Beach deposits are mined in the Gulf of Alaska, and gold has been successfully mined offshore from the Stephens Passage area in southeastern Alaska (Clifton and Luepke, 1987). Offshore mineral-related exploration in the State of Washington has centred on areas of titanium and iron-rich black sands (Lasmanis, 1988). However, gold and platinum were mined from beach placers earlier in this century on the northern Washington coast, south of Cape Flattery. These placer deposits are thought to have been derived from glacial sediment brought southward from British Columbia (Clifton and Luepke, 1987).

METHODS

Samples were collected from 175 sites during two survey cruises off the southwestern coast of Vancouver Island in 1979 and 1981. These samples are stored in the marine sample archives of the Pacific Geoscience Centre and were utilized for this study. An additional 11 samples were obtained during a cruise in January 1988 (Figure 3-9-1). During this cruise (Tully 88A) four survey lines of detailed high-resolution sidescan sonar, sub-bottom profiling and echosounding were completed (Figure 3-9-2). In November 1988 an additional 2-week cruise (Tully) is scheduled for fill-in

sampling and to complete additional geophysical surveys in the study area.

Preliminary provenance studies of unconsolidated beach material were initiated in the summer of 1988. A magnetic susceptibility survey was completed along eight transects across French Beach. Specific volume samples (154 cubic centimetres, approximately 250 grams) were collected at every second site to determine density values for the sediments and to examine mineralogy. Shallow hand-trenches were excavated at sites of relatively high magnetic susceptibility. Till bluffs were sampled above the beach berm at Sombrio Beach where such deposits remain abutting the active beach.

Offshore samples were analysed for complete grain-size distribution.

DISCUSSION

At this preliminary stage sample analysis is still in progress. The physical laboratory analyses, including textural studies, have been completed for the 186 offshore samples collected to date. Heavy mineral separation will be performed together with petrological, mineralogical and elemental analyses on the sand-size fraction. A map of detailed bathymetry has been compiled and examination of the sea floor morphology using sidescan sonar is in progress.

In the spring of 1989 sediment transport investigations using tracer techniques (pollucite) in the nearshore and beach zone are planned. Several additional beaches within the study area will be surveyed by transects where sand accumulation is sufficiently thick for examination of magnetic susceptibility. Bulk stream sampling at selected sites above the high tide mark is also planned.

Visual inspection of beach samples from French Beach indicates distinct fining of sands seaward together with a constant decrease of magnetic susceptibility. Highest susceptibility readings coincided, in a general sense, with the high dark-mineral content in the medium-sand-size area which was usually only 1 or 2 metres seaward of the steep gravel berm.

Offshore samples were either predominantly gravel or sand. Twenty-five per cent of the samples contained 50 per cent gravel or more, and had little or no mud. Nearly two-thirds of the samples contained over 75 per cent sand with either low mud content, or more often, with about 20 per cent mud. No distinctly dark sands from the offshore have been sampled to date; vibracoring is planned for future cruises in the area to investigate the possibility of buried heavy mineral concentrations.

Ultimately an interpretation of heavy mineral transport paths from source to deposit will be attempted, along with the sediment distribution, sediment thickness, heavy mineral concentration, mineralogy and zonation of economically interesting placer minerals. Results will provide a detailed description of heavy mineral distribution and help to construct geological models for exploration programs.

ACKNOWLEDGMENTS

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