

# **QUATERNARY SEDIMENTS AND SEABED CONDITIONS OFFSHORE FROM LA SCIE, NEWFOUNDLAND.**

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- Fig. 2** Extract from a Seistec seismic reflection record showing iceberg turbated sediments in the northwest of the study area, in a water depth of 120 m.
- Fig. 3** Sidescan sonogram showing gravel ripples offshore from La Scie Harbour in water depths of 50 to 55 m. The scale lines are 15 m apart.

## ENCLOSURES

- Encl. 1** Sidescan sonar interpretation.
- Encl. 2** Total Quaternary sediment thickness (m).

## **INTRODUCTION**

Under the auspices of the Canada-Newfoundland Cooperation Agreement on Mineral Development, a program was initiated by the Geological Survey of Canada during 1990 to determine the potential of Newfoundland inner shelf areas to host marine placers. The inner shelf off northeast Newfoundland was selected as a priority target for the three year program (SOLOMON et al., 1989), and initial surveys in this region were completed during 1990 by vessels based at the Bedford Institute of Oceanography, Dartmouth, N.S.

This report describes the Quaternary sediments and seabed conditions within a small area offshore from La Scie. It has been prepared with a view to providing a geological context for seabed samples which are presently being assayed and subjected to geochemical analyses. It is based on only a small amount of data and must be regarded as a preliminary assessment.

## **SURVEY METHODS**

Part of the area described in this report was surveyed using CSS Hudson. The cruise report (SHAW and WILE, 1990) contains full details of operational methods. Hudson's equipment included Hunttec DTS - a high-resolution seismic reflection system, and a sidescan sonar system which, unfortunately, was inoperative due to winch malfunctions.

Subsequently, a survey was completed using CSS Navicula, a smaller vessel. Again, the cruise report (SHAW, BEAVER and WILE, 1990) fully documents the operational methods. Navicula was equipped with two seismic reflections systems, and a Klein sidescan sonar system. The three grab samples from the study area were collected using a Van Veen grab sampler. Seabed photographs which were taken at grab sample sites are shown in the cruise report.

## **THE SURVEY AREA**

The location of the survey area is indicated on Figure 1. It lies within the area covered by the chart entitled "Approaches to La Scie Harbour", part of CHS chart 4522 (Enclosure 1). The study area shallows from 140 m in the northwest to about 70 m about 1 km offshore in the southeast, and to 100 m the same distance offshore in the southwest. Seabed relief is relatively subdued, the most marked feature being a ridge with a relief of 50 m in the north of the chart area. The coastline consists of high, rugged bedrock cliffs, with no beaches. La Scie harbour is entered through a

narrow bedrock inlet. The tracks of cruises 90-013 (CSS Hudson) and 90-035 (CSS Navicula) within the study area are shown on Enclosure 1.

## QUATERNARY SEDIMENTS AND SEABED CHARACTERISTICS

Based on the type of Quaternary sediments which are present and on the character of the seabed, two zones can be defined in the survey area (Enclosure 1):

**Outer Zone:** In this, the relatively deep outer zone, Quaternary sediment cover is generally thin but continuous, averaging several metres, with a maximum thickness of 10 m. An exception to the rule occurs in the northeast of the area surveyed, where several bedrock ridges are devoid of unconsolidated sediment. The Quaternary sediment cover consists of a unit with incoherent reflections on seismic records (Figure 2). The upper surface is highly irregular, with relief up to 3 m. Sidescan sonar data show that this irregular morphology is due to the presence of linear features, typically up to approximately 5 m wide, interpreted as iceberg furrows (Enclosure 2). The tone of the unit on sidescan sonar records is dark (reflective), except for the inner part of furrows, which are light-toned. Although the unit is acoustically unstratified, below about 190 m depth (outside the limits of the study area) it passes laterally into a unit containing low- to moderate-intensity, continuous, coherent reflections, conformable with the surface of the underlying bedrock. Furrows are not evident below about 190 m. At the landward margins of the zone, iceberg pits are more prevalent. These are often about 15 m wide, occasionally up to 30 m. They are circular to oval in plan and are usually fringed with berms within which the seabed has a light tone on sidescan sonar records, signalling the presence of fine-grained sediment, probably fine sand. The iceberg furrows and pits are not seen above about 90 m depth.

The unit is interpreted as an iceberg turbate, that is, glacial marine sediment, formerly stratified, but subsequently sufficiently impacted and disturbed by icebergs to destroy acoustic stratification. In the extreme northwest of the chart area the unit is underlain by a seismo-stratigraphic unit with incoherent reflections and a darker tone on the Huntex high resolution seismic reflection record. This unit is about 5 m thick in places, overlies bedrock, and has an irregular upper surface. It is believed to be glacial diamict.

A veneer of sediment overlies the iceberg turbate in places, especially in shallower water close to the upper limit of the zone. Sample 138 is from such a zone, where acoustically unstratified sediment about 1 m thick overlies the iceberg turbate in a depression. The sample is described as fine to medium sand with a few pebbles (SHAW, BEAVER and WILE, 1990).

**Inner Zone:** The second zone extends inshore from the first, from depths of about 90 m to the inner survey limits. In this zone, bedrock occurrences are common on the seabed. Offshore from La Scie, an extensive area of bedrock extends towards the northeast. On several survey lines the bedrock has steep seaward escarpments, 12-15 m high, up to 25 m high in one area. In places, bedrock depressions up to 15 m deep contain acoustically unstratified sediment with an irregular upper surface. This is probably the iceberg turbate. It is typically overlain by a veneer of sand 1 m thick, but up to 3 m thick in the sandy area just north of the location of sample 136.

Close to the coast, gravel is also common at the seafloor, in places overlain by sand. The gravel commonly is rippled (Figure 3). Immediately offshore from La Scie relatively large patches of gravel ripples occur in water depths of 45 to 55 m (Figure 3). Wavelength at one location is measured at 2.8 m. Sample 140 was collected in an area of gravel ripples, and consisted of a polymodal sandy gravel. It contained detrital carbonate and anthropogenic debris (beer can). Just seaward of this area, smaller patches of gravel ripples occur in depths of 67 to 71 m.

To the northeast of La Scie, extensive areas of rippled gravel occur in depths of 76 to 82 m. Sample 136 was from this area and was described as medium sand with some fine gravel. Wavelength observed on the sidescan sonogram was approximately 1.7 m at one location.

## DISCUSSION

Based on the limited amount of data available, it appears that the Quaternary sediment cover is thin and discontinuous in this region. In the outer zone, below about 90 m water depth, the seabed consists of highly-furrowed iceberg turbate in which furrows and pits contain small amounts of fine-grained sediment. In shallower water, the turbate is overlain by sand in places.

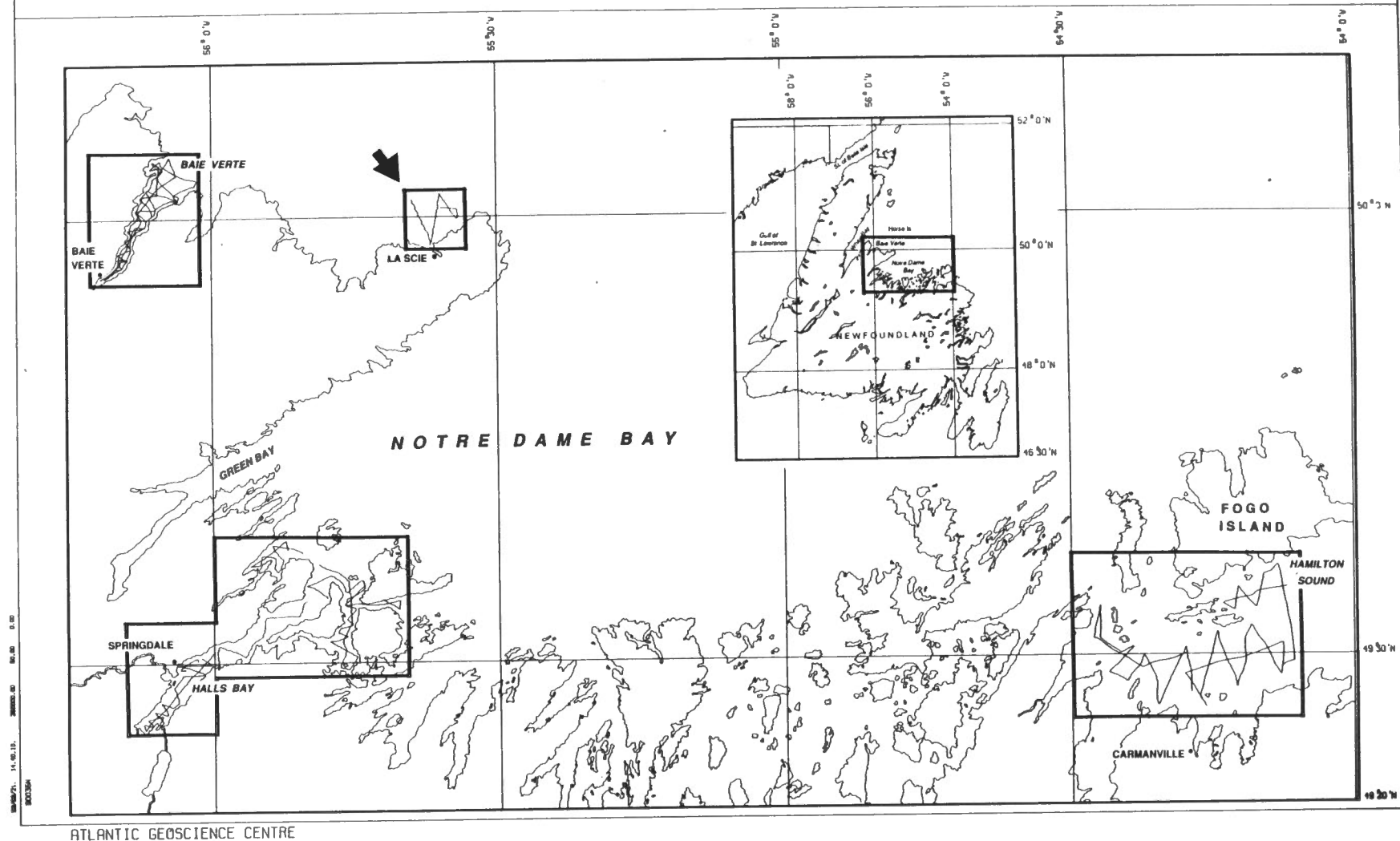
In contrast to the outer zone, the inner zone contains numerous seabed exposures of bedrock and a thin, laterally extensive veneer of sand and gravel, usually about 1 m deep, but locally up to three metres. In seabed depressions the sand and gravel overlie glacial sediments. The extensive occurrences of rippled gravel appear to testify to the mobility of the sediments. FORBES and BOYD (1986) reported gravel ripples with wavelengths ranging from 1.3 to 3.0 m in water depths from 15 to 65 m on the inner Scotian Shelf. They noted that other authors had reported coarse-grained symmetrical bedforms in water depths down to 120 m.

The marine limit in this region lies between +75 and +100 m (GRANT, 1989), and the relative sea-level curve is probably similar to that for western Newfoundland (ibid.). Probably, relative sea level has been falling since deglaciation, albeit at a reduced rate in recent millenia. It is unlikely that relative sea level was lower in the recent past, and probable that the gravel ripples observed in the La Scie region are active. The mobility of gravel and sand in the area may be responsible for the lack of iceberg furrows and pits on the seabed, in a region heavily impacted by icebergs.

This preliminary study indicates that sand and gravel are present on the seabed in a narrow zone peripheral to the coast, in depths generally above about 90 m. Analysis of data from the inlet of Baie Verte, about 35 km to the west, shows that while it contains greater thicknesses of unconsolidated sediment than the study area, areas of sand and gravel analogous to those off La Scie are restricted to narrow shelves at the mouth of the bay. It is probable that the pockets of sediment at the mouth of Baie Verte, and the more extensive deposits off La Scie, are part of a zone, up to 2.5 km-wide in places, which extends around the north coast of the Baie Verte Peninsula, in depths down to 90 m. This zone is exposed to relatively high levels of wave activity and may have some potential to host marine placers.

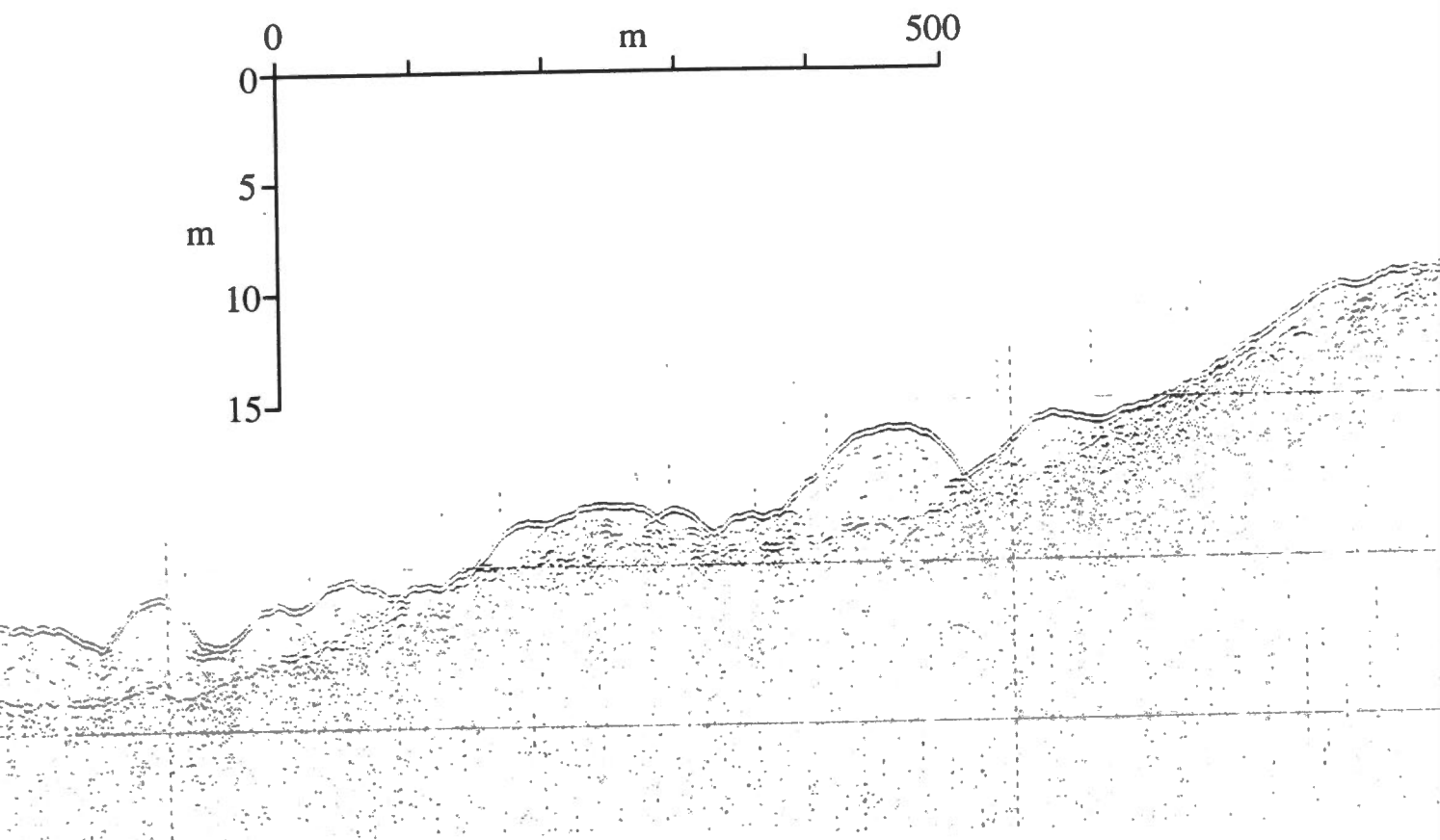
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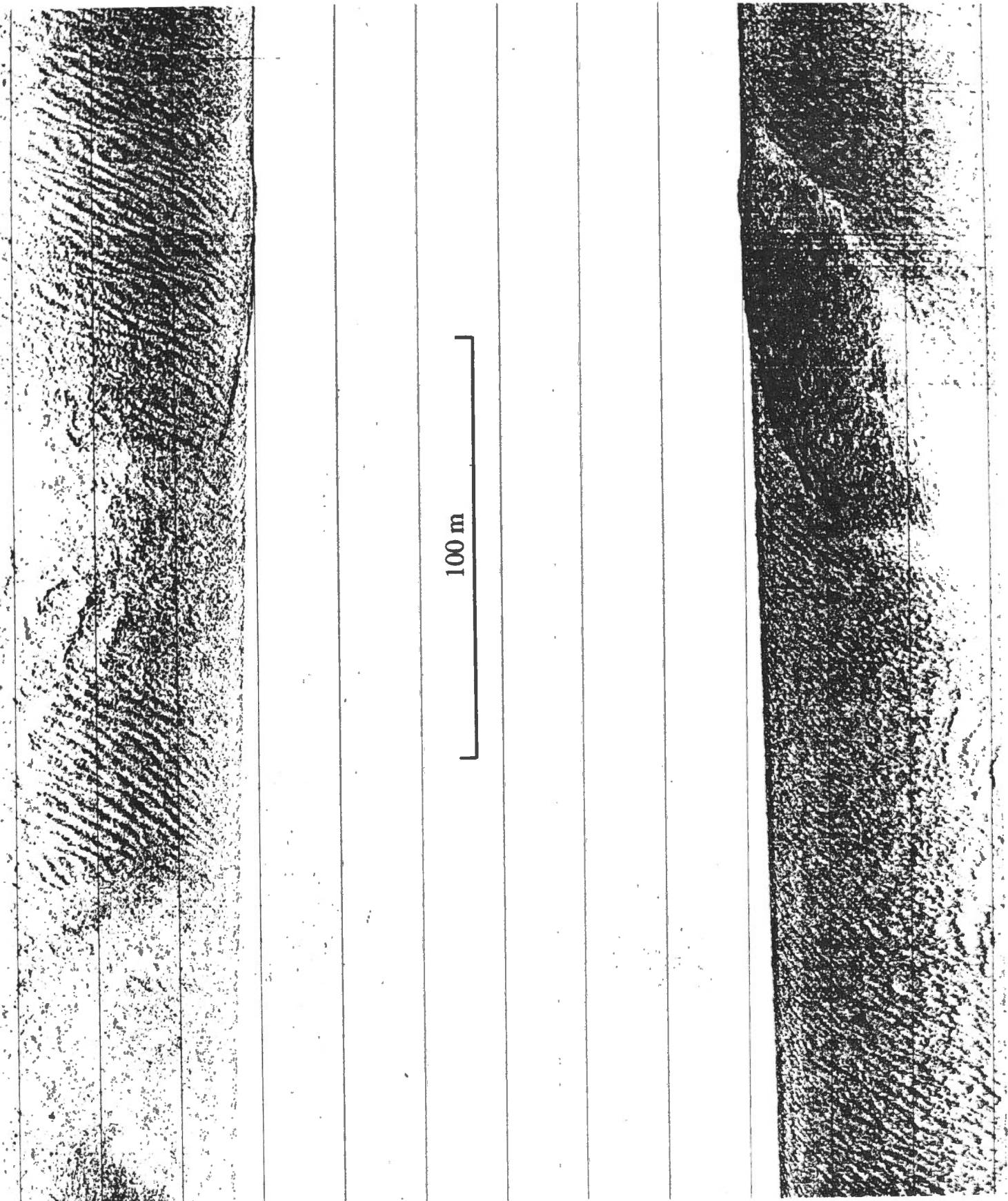


**Figure 1** Map showing the location of the La Scie area (arrowed), and other areas surveyed during cruise 90-035.





**Figure 2** Extract from a Seistec record showing iceberg turbated sediments in the northwest of the study area, in a water depth of 120 m.



**Figure 3** Sidescan sonogram showing gravel ripples offshore from La Scie Harbour in water depths of 50 to 55 m. The scale lines are 15 m apart.