

LAKE SEDIMENT GEOLOGY

LLOYD'S RIVER AREA, SOUTHWEST NEWFOUNDLAND

by

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LOCATION AND SAMPLING STATISTICS

The Lloyd's River area, for purposes of this report, covers approximately 20,600 km² of southwest Newfoundland, south of latitude 49°30'N and west of longitude 57°00'W.

The sampling phase of the project began on May 30, 1979, and was completed on August 8, 1979. During that period 255 hours of helicopter time was used and 2877 profundal lake sediment samples were collected. The average sampling density for the project was one sample per 7.1 km².

SAMPLING METHOD

Sampling was conducted from the float of a helicopter by allowing a weighted, hollow, pipelike sampler (Figure I) to free fall through the water to penetrate the organic rich sediment accumulations at the lake centre bottom. The sampler was retrieved by means of a rope attached to a metal loop at the upper section of the sampler near the stabilizing fins. During retrieval a butterfly valve, located at the extreme lower end of the sampler, was closed by the weight of the sample and prevented sample loss. After the sampler was retrieved, a plastic scoop was inserted into a tapered notch cut near the centre of the sampler which was then inverted to allow the sample to slide into the scoop. The sample was examined and then transferred to a pre-numbered kraft paper sample bag. Some features of the sample, such as color and composition, and the sample site, such as water depth, general water level and nature of the surrounding terrain, were recorded. Other features,

such as UTM co-ordinates of the sample site and the area of the lake from which the sample was collected, were recorded from NTS 1:50,000 scale maps on returning to camp.

SAMPLE PREPARATION

The samples were air dried in the field and then forwarded to the Department of Mines and Energy laboratory in the Howley Building, St. John's for final drying in ovens at approximately 40°C. The samples were then disaggregated using a rubber mallet and a porcelain mortar and pestle, and the sample material passed through a 180 µm stainless steel sieve. The <180 µm fraction was stored in a plastic vial prior to analysis. One gram portions of these samples were weighed and placed in special vials for uranium analyses.

ANALYTICAL METHODS

Uranium was determined by neutron activation/delayed neutron counting at Nuclear Activation Services Limited, Hamilton, Ontario. The elements Cu, Pb, Zn, Co, Ni, Ag, Mn, Fe and Mo were determined by a method developed at the Geological Survey of Canada. For Cu, Pb, Zn, Co, Ni, Ag, Mn and Fe, a 1 g sample aliquot was digested in 6 ml of 4M HNO₃ - 1M HCl solution at 90°C for 2 hours, and the final solution made up to 20 ml. For Mo, 0.5 g was digested in 1.5 ml of concentrated HNO₃ at 90°C for 30 minutes, followed by 0.5 ml of concentrated HCl at 90°C for an additional 90 minutes, and the addition of 8 ml of 1250 µg/ml Al solution when cool. A Varian Techtron AA5 atomic absorption spectrometer was used for the

Figure I. Lake Sediment Sampler.



determination of these metals, and automatic simultaneous background correction using a hydrogen continuum lamp was used for the determination of Pb, Ni, Co and Ag. Loss on ignition was determined on the samples by heating a 0.5₀g aliquot of the sample material to 500°C and maintaining this temperature for 4 hours; the weight loss is then expressed as a percentage of the initial sample weight. Determination of the F concentration of the sample was done using a method modified from Ficklin (1970) which includes fusing a 0.25 g aliquot of sample with a KNO₃/Na₂CO₃ flux and the residue dissolved in a citrate buffer. The solution was then analysed using Phillips fluoride ion selective electrodes and an Orion Research digital millivoltmeter, connected via an electrode switch.

CONTROLS

The accuracy and precision of all analyses were monitored by the use of blind duplicates and bulk control samples. A pair of blind duplicate samples was prepared from one of the field duplicate samples and placed in two separate vials with non-adjacent sample numbers. This constituted the first and second members of a blind duplicate pair. Control samples were bulk samples of lake bottom sediments.

Each block of 20 samples comprised 18 unknown samples, the second member of a blind duplicate pair of samples and one control reference sample. A measure of the precision 'p' for each duplicate pair was calculated from the formula:

$$p = \frac{[V_1 - V_2]}{\bar{V}_{1,2}} \times 100\%$$

where:

V_1 = first value of an analysis of a blind duplicate pair,

V_2 = second value of an analysis of a blind duplicate pair,

$\bar{V}_{1,2}$ = mean of V_1 and V_2

The analyses of all bulk control reference samples were compiled until each control was analysed at least 25 times. Means and standard deviations were then calculated for these samples.

For a block of 20 samples to be accepted two requirements had to be met:

1) The value of 'p' for each duplicate pair in a block was required to be within the limits given in Table 1.

2) The results of the analysed bulk control samples had to fall within ± 3 standard deviations of the mean for each control sample.

If either of these requirements were not met the block of 20 samples in which the anomalous control or blind duplicate sample was contained, were re-analysed.

In order to determine overall the reproducibility of the data, including the variability due to sampling and analysis, duplicate lake sediment samples were collected at a frequency of 1 sample in 18; and statistically analysed, following the method of Garrett (1973).

GEOLOGY

The rocks of this area range in age from Helikian to Carboniferous (Williams, 1967). Cambrian and Ordovician sedimentary rocks are located mainly in the northwest section of the area and overlie Helikian gneisses and schists of the Long Range Complex. These sedimentary rocks are in turn structurally overlain by the transported mafic and ultramafic rocks of the Bay of Islands allochthon. Carboniferous rocks occur to the southwest, in the Codroy Basin, and to the northeast, in the Deer Lake Basin. The southeast section of the area contains Ordovician to Devonian sedimentary and volcanic rocks and their metamorphosed equivalents. Many Devonian and earlier granite bodies occur throughout the area, but predominate along the south coast and in the Topsails area east of Grand Lake. Mafic and ultramafic rocks occur in the Port aux Basques area, in the Lloyd's Lake area, in the Bay of Islands area and in association with the Topsails granite. Foliated granites and anorthositic occur in the Stephenville area.

TABLE 1

Element	Range ($V_{1,2}$)	Tolerance
Cu (ppm)	2-5	$\pm 100\%$
	5.1-10	$\pm 50\%$
	10.1-30	$\pm 30\%$
	30.1-200	$\pm 20\%$
	200.1-10,000	$\pm 25\%$
	>10,000	$\pm 25\%$
Pb (ppm)	2-10	$\pm 100\%$
	10.1-20	$\pm 50\%$
	20.1-100	$\pm 30\%$
	100.1-1000	$\pm 25\%$
	1000.1-10,000	$\pm 30\%$
	>10,000	$\pm 30\%$
Zn (ppm)	2-5	$\pm 100\%$
	5.1-20	$\pm 50\%$
	20.1-100	$\pm 25\%$
	100.1-300	$\pm 20\%$
	300.1-10,000	$\pm 25\%$
	>10,000	$\pm 25\%$
Co (ppm)	2-10	$\pm 100\%$
	10.1-20	$\pm 50\%$
	20.1-100	$\pm 25\%$
	100.1-300	$\pm 20\%$
	300.1-10,000	$\pm 25\%$
	>10,000	$\pm 25\%$
Ni (ppm)	2-5	$\pm 100\%$
	5.1-10	$\pm 50\%$
	10.1-20	$\pm 40\%$
	20.1-100	$\pm 25\%$
	100.1-300	$\pm 20\%$
	300.1-10,000	$\pm 25\%$
Ag (ppm)	0.2-1.0	$\pm 100\%$
	1.1-5.0	$\pm 50\%$
	5.1-10.0	$\pm 30\%$
	10.1-100	$\pm 25\%$
	100.1-200	$\pm 20\%$
	200.1-10,000	$\pm 25\%$
	>10,000	$\pm 25\%$

TABLE 1 (contd)

Element	Range ($V_{1,2}$)	Tolerance
Mn (ppm)	5-10	$\pm 100\%$
	10.1-100	$\pm 50\%$
	100.1-500	$\pm 30\%$
	500.1-1000	$\pm 25\%$
	1000.1-2000	$\pm 20\%$
	2000.1-10,000	$\pm 25\%$
	>10,000	$\pm 25\%$
Fe (%)	0.02-0.1	$\pm 100\%$
	0.11-0.5	$\pm 50\%$
	0.51-1.0	$\pm 40\%$
	1.01-3.0	$\pm 30\%$
	3.01-10.0	$\pm 20\%$
	10.01-100	$\pm 25\%$
Mo (ppm)	2-4	$\pm 100\%$
	4.1-6	$\pm 50\%$
	6.1-10	$\pm 40\%$
	10.1-25	$\pm 30\%$
	25.1-100.0	$\pm 25\%$
	100.1-10,000	$\pm 30\%$
	>10,000	$\pm 30\%$
F (ppm)	<40	$\pm 100\%$
	40-100	$\pm 50\%$
	100-200	$\pm 40\%$
	200-500	$\pm 30\%$
	>500	$\pm 25\%$
LOI (%)	1-5.0	$\pm 120\%$
	5.1-10.0	$\pm 100\%$
	10.1-20.0	$\pm 50\%$
	20.1-100.0	$\pm 25\%$
U (ppm)	0.20-0.50	$\pm 100\%$
	0.51-1.00	$\pm 60\%$
	1.01-2.50	$\pm 40\%$
	2.51-5.00	$\pm 30\%$
	5.01-15.00	$\pm 25\%$
	>15.00	$\pm 20\%$

MINERAL POTENTIAL

The most significant base metal occurrences are located at Tulk's Pond south of Red Indian Lake and York Harbour in the Bay of Islands (Douglas, 1976). Numerous smaller copper showings have been recorded in the Gregory River area and in several localities along the south coast. Lead occurrences are located on the Port au Port Peninsula, in the Goose Arm area of the Bay of Islands and associated with the Cape Ray Fault. Known zinc occurrences predominate on the Strickland property in La Poile Bay and near Cape Anguille. A significant occurrence of wolframite associated with several base metals is located at Grey River on the south coast. Further exploration work is being done on a gold prospect north of Isle aux Morts and a large scale exploration program is underway for uranium in the Carboniferous rocks of the Deer lake Basin.

Minor occurrences of arsenic, molybdenum, nickel and fluorine are also known in the area. Chromite showings are abundant in the Lewis Hills, south of Corner Brook.

Many of these showings are indicated in Figure II.

RELEASE OF SURVEY DATA

This information will be released as a set of six open files in the spring of 1980*. Each open file will include single element distribution maps of each of 11 elements plus a sample location map, in accordance with the National Topographic System (Figure II) on a scale of 1:250,000 for a total of 72 maps, together with a microfiche of the

*The exact time of release will be published approximately four weeks in advance, and notifications of it will be sent to all companies on our mailing list.

field and analytical data and explanatory notes. Also included in this release will be the reanalysed results of open File Nfld. 787 (McArthur *et al.* 1975), the Carboniferous Codroy - St. George Bay area, and part of Open File Nfld. 708 (Davenport *et al.* 1974), south of Gros Morne National Park. The title "LLOYD'S RIVER AREA, SOUTHWEST NEWFOUNDLAND" will NOT be used on the open file release next spring. The maps will be named as shown in Figure III.

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LEGEND

- C Carboniferous - undivided conglomerate, sandstone, siltstone, shale, limestone.
- ID Lower Devonian - undivided conglomerate, arkose, acid volcanic rocks
- OSD Ordovician, Silurian, Devonian and earlier - undivided sandstone, slate, graywacke, and acid to mafic volcanic rocks
- OS Ordovician, Silurian and earlier - undivided sandstone, slate, graywacke, and acid to mafic volcanic rocks
- O₂ Ordovician - volcanic rocks, slate, graywacke, siltstone, chert, Central Newfoundland
- O₁ Ordovician - limestone, dolomite, quartzite, sandstone, shale, Western Newfoundland
- Cambrian - undivided limestone, shale, quartzite, slate, some basalt
- H Helikian or earlier - Long Range Complex
- 4 Granite and granitic derivatives
- 3 Mafic and ultramafic sequences
- 2 Foliated granitic rocks of Indian Head Complex
- 1 Anorthosites and related rocks

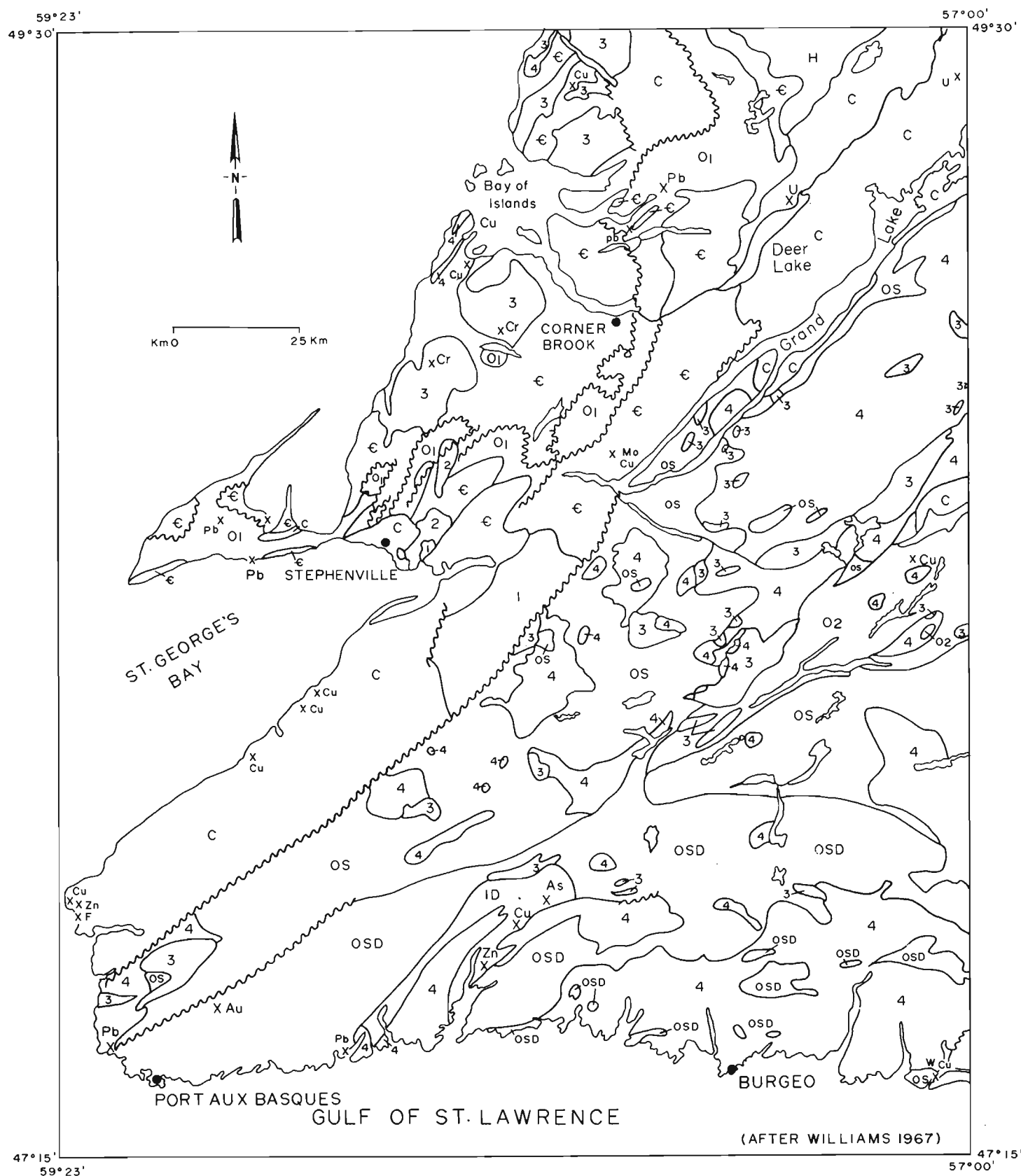
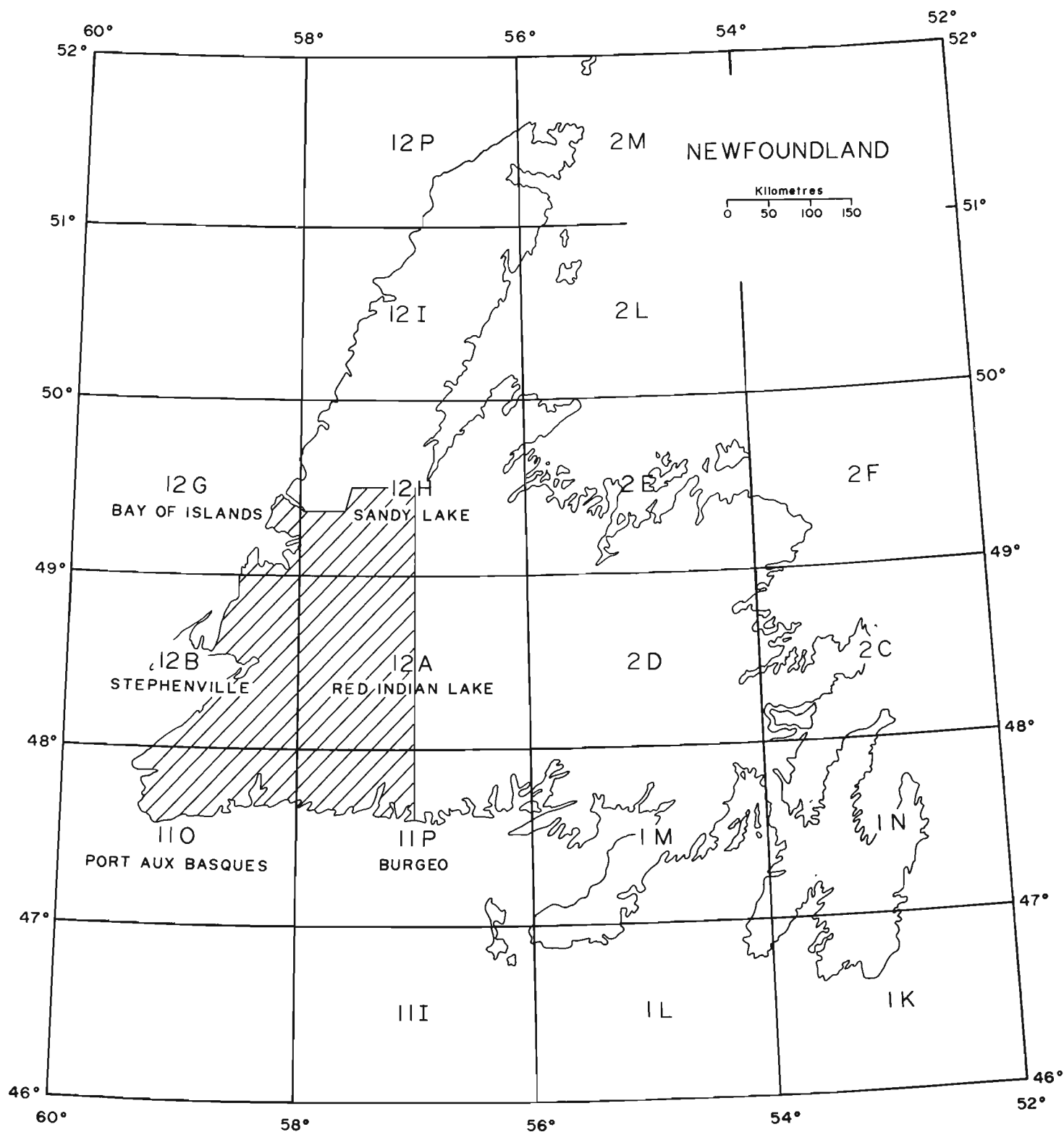


Figure II. General geology of the Lloyd's River area, southwestern Newfoundland.

Figure III. Index to map sheets included in Lloyd's River geochemical lake sediment survey, southwestern Newfoundland. Map sheets indicated by name will be available individually upon request when the file becomes available in late spring, 1980.



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