DETRITAL GOLD OCCURRENCES, NORTHERN NEWFOUNDLAND SHELF

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Detrital Gold Occurrences, Northern Newfoundland Shelf

Centre for Cold Ocean Resources Engineering, 1992

This Open File contains a contractor's report which assesses detrital gold occurrences of five inner shelf sites along the northeast coast of Newfoundland. The research was sponsored and funded by the Canada-Newfoundland Cooperation Agreement on Mineral Development 1990-1994 and was carried out by the Centre for Cold Ocean Resources Engineering under contract to the Geological Survey of Canada. The report has not been edited by the Geological Survey of Canada to establish any revisions and/or additions and therefore, statements contained herein may not necessarily reflect the views of the Government of Canada.

John Shaw,
Scientific Authority

DETRITAL GOLD OCCURRENCES, NORTHERN NEWFOUNDLAND SHELF

Contract Report
prepared for

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C-CORE

Centre for Cold Ocean Resources Engineering
Memorial University of Newfoundland
St. John's, NF, A1B 3X5, Canada
Tel. (709) 737-8354 Fax. 709-737-4706

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Project Team

Margot Emory-Moore, M.Sc.
Laurence Davis, M.Sc.

Group Leader, Seabed Geotechnics: Jacques Guigné, Ph.D., P.Geosc.

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SUMMARY

During the 1991 field season the Geological Survey of Canada conducted two regional mapping and sampling surveys on the northern Newfoundland shelf. One of the principal objectives of the surveys was to assess the regional gold placer potential of the inner shelf zone. The textural and geochemical properties and the gold content of seventy-four surficial sediments samples collected during the surveys are reported herein.

Surficial samples were collected using van Veen and IKU grab samplers. Radar, LORAN C and GPS were used for navigation and an echosounder was used to record water depths. The percentage by weight of gravel (>2mm), sand (0.063-2mm) and mud (<0.063mm) was determined using wet sieving techniques. Gold and trace elements of the sand and the mud fraction were analysed using neutron activation. A large volume split of each sample was panned to a concentrate of 50 - 150 grains and gold grains, where present, were picked and mounted for examination using the scanning electron microscope.

Surficial seabed samples were collected in five regions: White Bay, Baie Verte and Mings Bight, the shelf zone off the northeastern Baie Verte Peninsula, the Halls Bay area and the northeastern Newfoundland shelf, extending from New World Island to Cape Freels. The geochemistry of the surficial sediments varies by region and closely reflects the lithologies of the coastal rock suites. The concentrations of most elements, including gold, were greatest in the mud fraction of the sediment.

No gold was recovered from panning the samples collected in White Bay and only minor gold detected in the mud fraction of two samples around Coney Head (10 and 85 ppb). Gold grades were also low in Mings Bight and on the northeastern Newfoundland shelf.

The highest concentrations of gold were found in Deer Cove, a small coastal embayment in eastern Baie Verte and offshore La Scie, on the northeastern Baie Verte Peninsula. Thirty gold grains were recovered from the two samples in Deer Cove; gold was also detected in the mud fraction (95-121 ppb). Particulate gold was recovered from six samples collected offshore La Scie. Gold grades in the mud fraction of the sediment ranged from 7-249 ppb. Two populations of gold grains were evident in the samples from both areas; one group were relatively fresh and poorly travelled, the second, more dominant group, exhibited considerable evidence of mechanical and chemical alteration. Gold was also detected in the mud fraction of sediments offshore from Tilt Cove (up to 400 ppb) and Betts Cove (25-28 ppb).

A comparison of the observed distribution of gold in the surficial sediments of the study area with known mineral occurrences (primary source), sediment thickness (secondary source) and wave fetch (energy) suggests that Deer Cove and Dog Bay are the most likely sites for placer gold development in the study area (primary autochthonous and secondary autochthonous deposit types respectively). Future work should include detailed investigations of these sites using small boats and diver support.

1.0 INTRODUCTION

The Geological Survey of Canada has recently completed the second year of a three year nearshore mapping and sampling program designed, in part, to assess the regional placer gold potential of the northern Newfoundland shelf (Figure 1). The objective of the program has been to acquire baseline data for placer assessment and to develop depositional models for gold placer mineralization in this and similar geologic settings. This report presents results of sediment analyses carried out following year two of the program.

The northern Newfoundland shelf was initially chosen as a likely site for gold placer formation by Emory-Moore and Solomon (1989). The authors suggested that secondary autochthonous beach and nearshore gold deposits may occur along the northern shelf of Newfoundland and that gold placer deposits offshore Nome Alaska provide a useful analogue.

The Nome deposits were formed through marine reworking and deflation of auriferous glacigenic sediment. The highest concentrations of particulate gold off Nome occur in a thin (30 - 60 cm) layer of relict lag gravels that overlie glacial drift (Nelson and Hopkins, 1972). The amount of gold within the gravels is spatially quite variable but over 30% of samples were found to contain greater than 600 ppb gold and some as much as 2,500 ppb (Nelson and Hopkins, 1972). The site has recently been mined and the reported ore grade is 1813 ppb (Bosse, 1990). The underlying, non-reworked glacigenic sediment is characterized by an average gold content of 70 ppb, this being typically one tenth that of the overlying lag gravels. Sediment deflation on the order of 1.5 to 2.5 m can

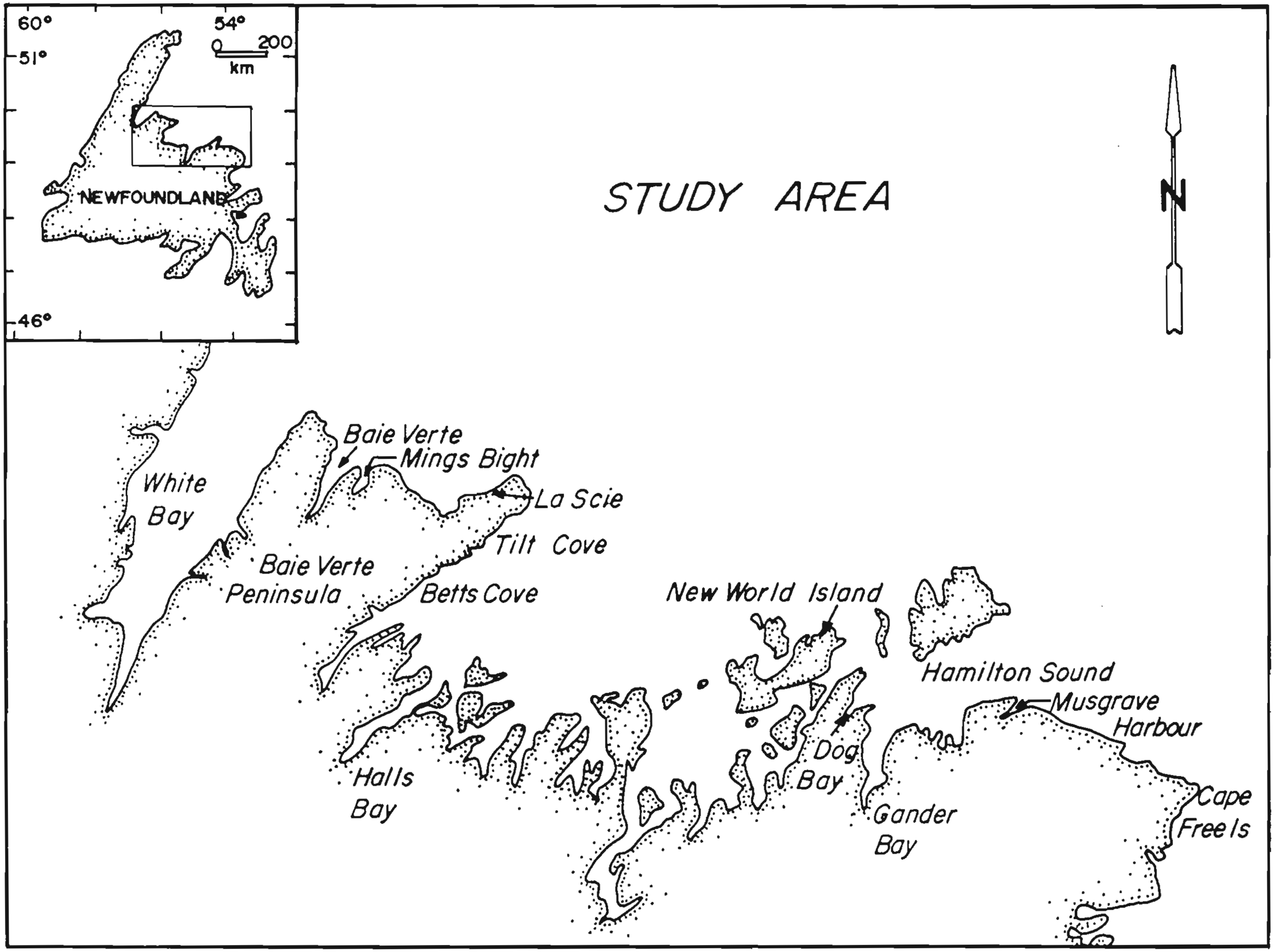

Figure 1 Location of the Study Area

account for the increase in grade within the lag gravels (Kaufman and Hopkins, 1989).

It has also been suggested that primary autochthonous placer deposits may occur on the northern Newfoundland shelf (Emory-Moore and Solomon, 1989). These deposits form on beaches and in the nearshore zone through wave erosion of mineralized bedrock. Detrital gold occurs very close to the source and is generally entrapped in bedrock crevices and depressions.

A discussion of the depositional controls on marine gold placer formation, the geologic setting of the northern Newfoundland coastal zone, and the results of sample analysis undertaken during the first phase of the program are presented by Emory-Moore (1991). Several of the surficial sediment samples collected during the 1990 surveys were found to contain particulate gold. Sites were chosen for follow-up work, the results of which are presented in this report.

The methods of sample collection and sediment analysis are presented in Section 2. The results of this year's sample analysis are integrated with data from the 1990 surveys and presented for five geographic areas (Figure 2): White Bay (Section 3.1), Baie Verte and Mings Bight (Section 3.2), the shelf zone off northeastern Baie Verte Peninsula (Section 3.3), the Halls Bay area (Section 3.4) and the northeastern Newfoundland shelf, extending from the northwestern portion of New World Island to Cape Freels (Section 3.5). A discussion of the results and recommendations for further work is provided in Sections 4 and 5 respectively.

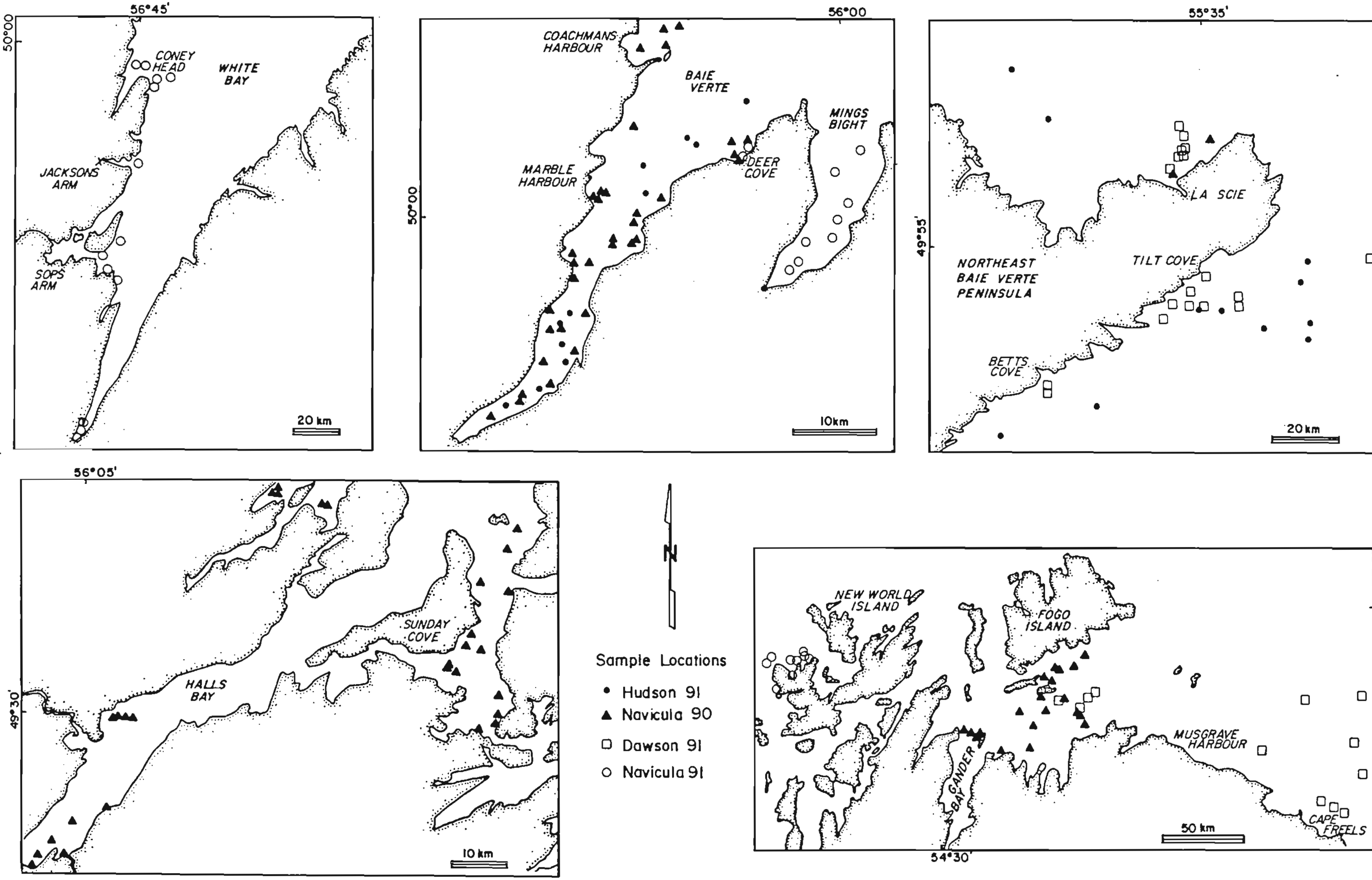

Figure 2 Sample Location Map

2.0 METHODS OF SAMPLE COLLECTION AND ANALYSIS

Surficial seabed samples analysed in the present study were collected during two Geological Survey of Canada research cruises (Shaw et al., 1992; Edwardson et al., 1992). The first survey was undertaken onboard the *CSS Dawson* where thirty-six seabed samples were collected using an IKU grab. The IKU samples are representative of the upper 1.0 m of the seabed. The *MV Navicula* was used to collect a further 38 surficial seabed samples using a van Veen grab sampler. The van Veen grab samples were approximately 0.02 m^3 in volume and are representative of the upper 5-10 cm of seabed sediment. At some sites, multiple van Veen samples were collected and combined to ensure a large enough sample volume for meaningful gold analysis. Radar, LORAN C and GPS were used for navigation on both surveys and an echosounder was used to record water depth at each sample station. Positional accuracy was approximately 10 m. Locations and water depths for the 1991 sample suite are provided in Appendix A with sample locations for the 1990 and 1991 surveys illustrated in Figure 2.

Included in the sample analysis are six samples collected from subareal coastal sediment suites. The location of two of the samples, one at the head of White Bay (91-032-013) and one at the head of Mings Bight (91-032-001), are shown on Figure 2. Samples 91-032-50 and 91-032-51 were collected from a quarry in Sops Arm. Sample 91-032-52 was collected near the mouth of Main River, at the head of Sops Arm and sample 91-032-53 was collected along the western shore of Giles Cove.

A small split of each sample was archived for future reference. The percentage by weight of gravel (>2mm), sand (0.063-2mm) and mud (<0.063mm) within a 5 kg split of each sample was determined using wet sieving techniques. A 30 gram subsample of the sand fraction and a 30 gram subsample of the mud fraction of each of the sieved samples were analyzed for gold and trace elements using Neutron Activation Analysis. Duplicate splits of seven of the gold-bearing samples were re-analysed to evaluate analytical precision and repeatability.

A third split of each sample was weighed and panned to a concentrate of 23-25 grams. The concentrate was further panned to a final concentrate of 50-150 grains. Gold grains were then picked and mounted for examination under the scanning electron microscope. The dry weight of the total panned sample was estimated by subtracting the moisture content of each sample (as determined by the difference in wet and dry weights of small sample splits) from the total wet weight of the sample.

3.0 RESULTS

Textural, geochemical and gold data are provided in Appendices B - G respectively. Autochthonous placer gold is typically found in association with a seabed armour. The textural data from the 1990 and 1991 surveys are hence classified according to the percentage by weight of gravels, here assumed to reflect the degree of seabed armouring (Figure 3). It is unlikely that relative sea level was lower than 20 m below present (the shoreward limit of most samples) in the recent past and hence it is probable that where there is a high percentage (>60-80 wt%) of gravels, they are the product of modern reworking processes.

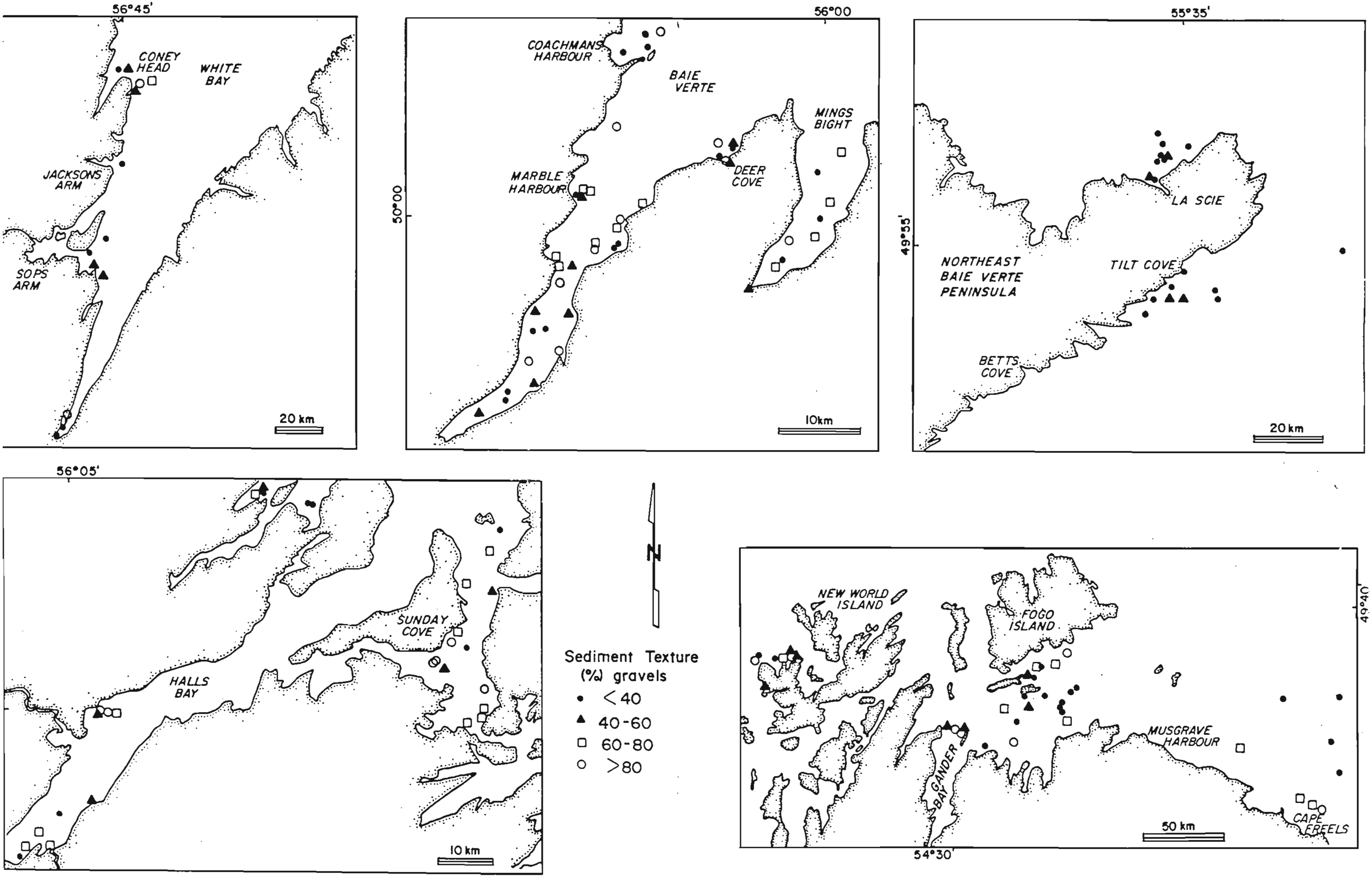

Figure 3 Distribution of Textural Classes

However, gravel abundances do not always exhibit a direct correlation with water depth. For example, gravels within the relatively protected waters of Halls Bay can be found in water depths of up to 110 m. These gravels are the product of ice rafting and, although they result in a strongly bimodal sediment texture, they do not constitute more that 60 wt% of the sediment.

The results of geochemical analyses are listed in Appendix C. Analyses of blind duplicates suggest that the analytical precision was generally very good. The repeatability of gold assays was good for both the sand and mud fraction. Concentrations of all elements, with the exception of Cr, Rb, Sc and Na, were significantly higher in the mud fraction than in the sand fraction (Appendix D). For all but two samples, Au concentrations were highest in the mud fraction.

The geochemical sample data were grouped geographically into five regions: White Bay, Baie Verte and Mings Bight, the shelf zone off the northeastern Baie Verte Peninsula, the Halls Bay area and the northeastern Newfoundland shelf, extending from the northwestern portion of New World Island to Cape Freels (Figure 2). A Kruskal-Wallis one-way analysis of variance was run on the geochemical assays of the mud fractions of the 1990 and 1991 samples to determine the variation in element concentration between each region. The elements Ag, As, Cs, Hg, Ir, Sn, Ta, U, W, Eu, Tb, Yb were found to exhibit insignificant (at a 99% confidence level) regional variation and were hence eliminated from further analysis. For those elements within the mud fraction which exhibited significant regional variation, box and whisker plots (Appendix E) and discrete-symbol maps of element distribution (Appendix F) are provided. The classification used in the discrete symbol plots corresponds to natural breakpoints in the cumulative frequency curves of each element.

The texture and morphology of gold grains were examined in an attempt to interpret the transport distances of gold from the point of liberation and to assess inter- and intra-sample variation (Appendix G); the rationale and approach used is outlined in Emory-Moore (1991). The distribution of gold in the mud fraction of the 1990 and 1991 sample suites is illustrated in Figure 4. The distribution of gold in the sand fraction of the 1991 samples and within the panned 1991 samples are illustrated in Figures 5 and 6 respectively.

A brief summary of results, by region, is provided below.

3.1 White Bay

Fourteen surficial grab samples from White Bay were analysed in the present study. The samples were collected in water depths of 38-62 m in areas offshore from known gold occurrences in the coastal rock suites. Unlike most of the northern shelf region, the coastline of White Bay runs parallel to the strike of the bedrock and is hence fairly regular. The coastal relief is, however, very high with towering cliffs and steep slopes.

The inner shelf extending from Sops Arm to Coney Head is characterized by extensive bedrock exposures with a thin discontinuous veneer of sand and gravel (Edwardson et al., 1992). Thicker sequences of finer grained material occur within the coastal embayments of Sops Arm and Jacksons Arm and at the head of White Bay. The surficial samples which exhibit the highest gravel content occur

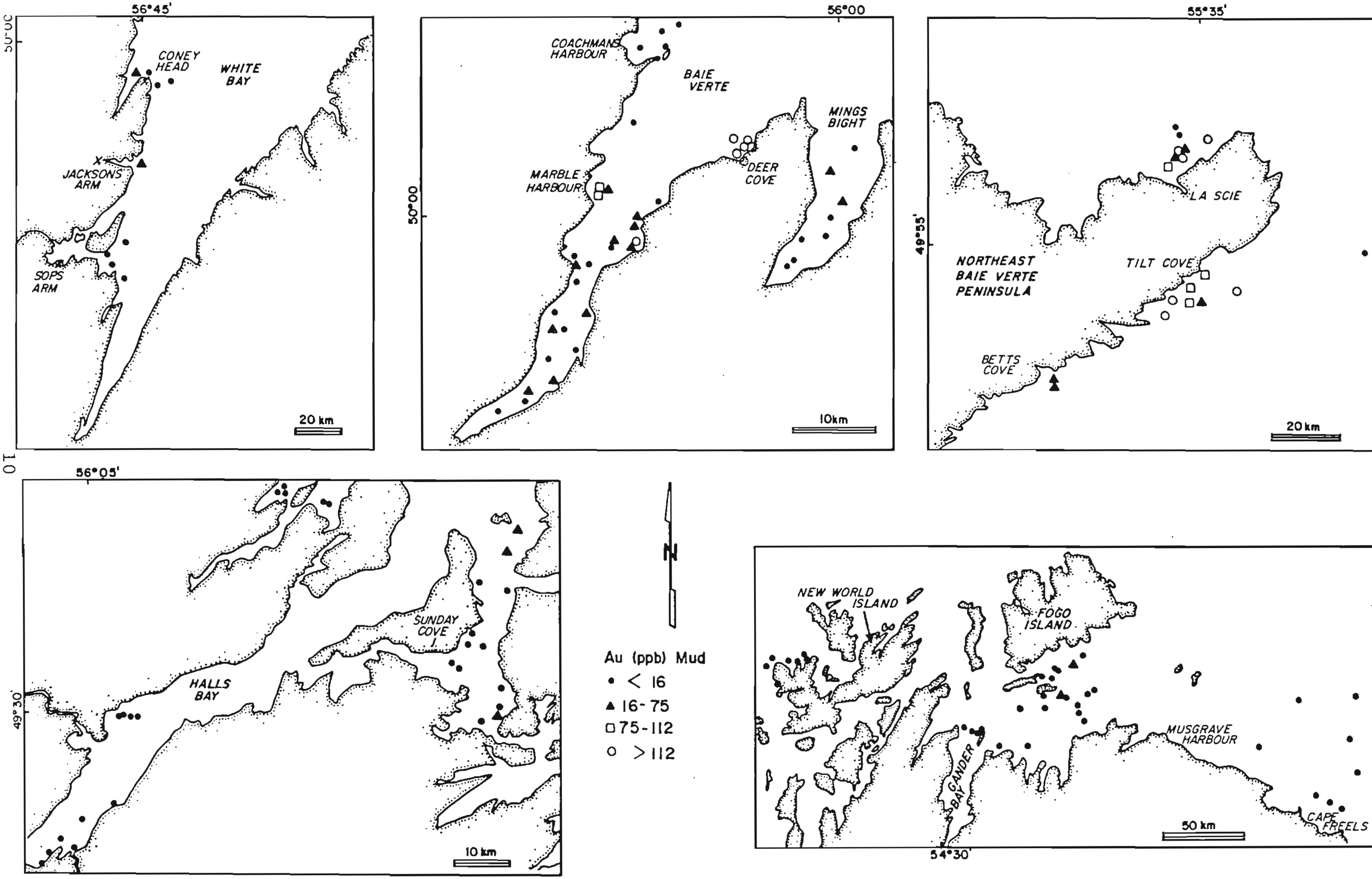

Figure 4 Distribution of Gold in the Mud Fraction (1990 and 1991 samples)

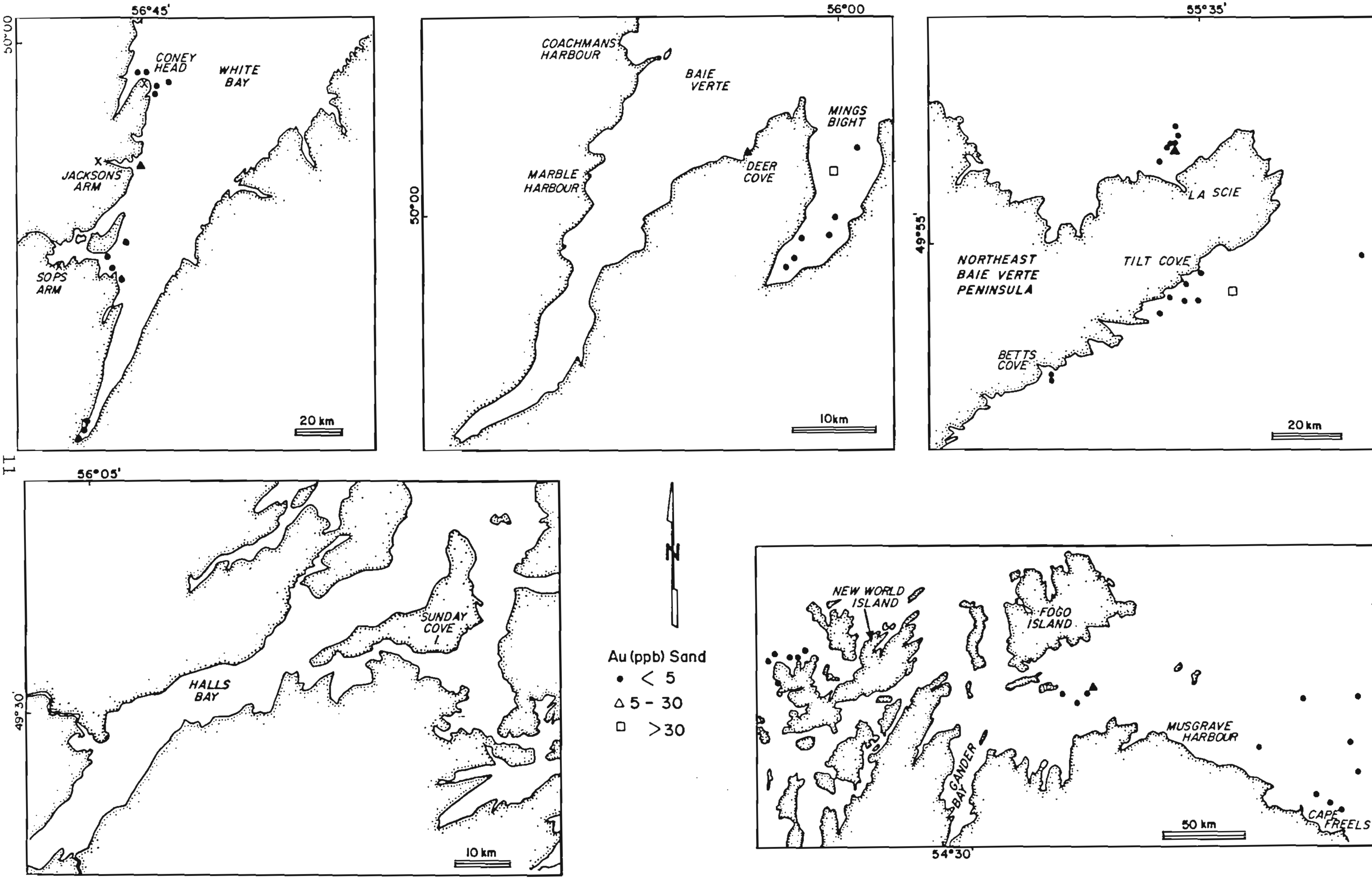

Figure 5 Distribution of Gold in the Sand Fraction (1991 Samples)

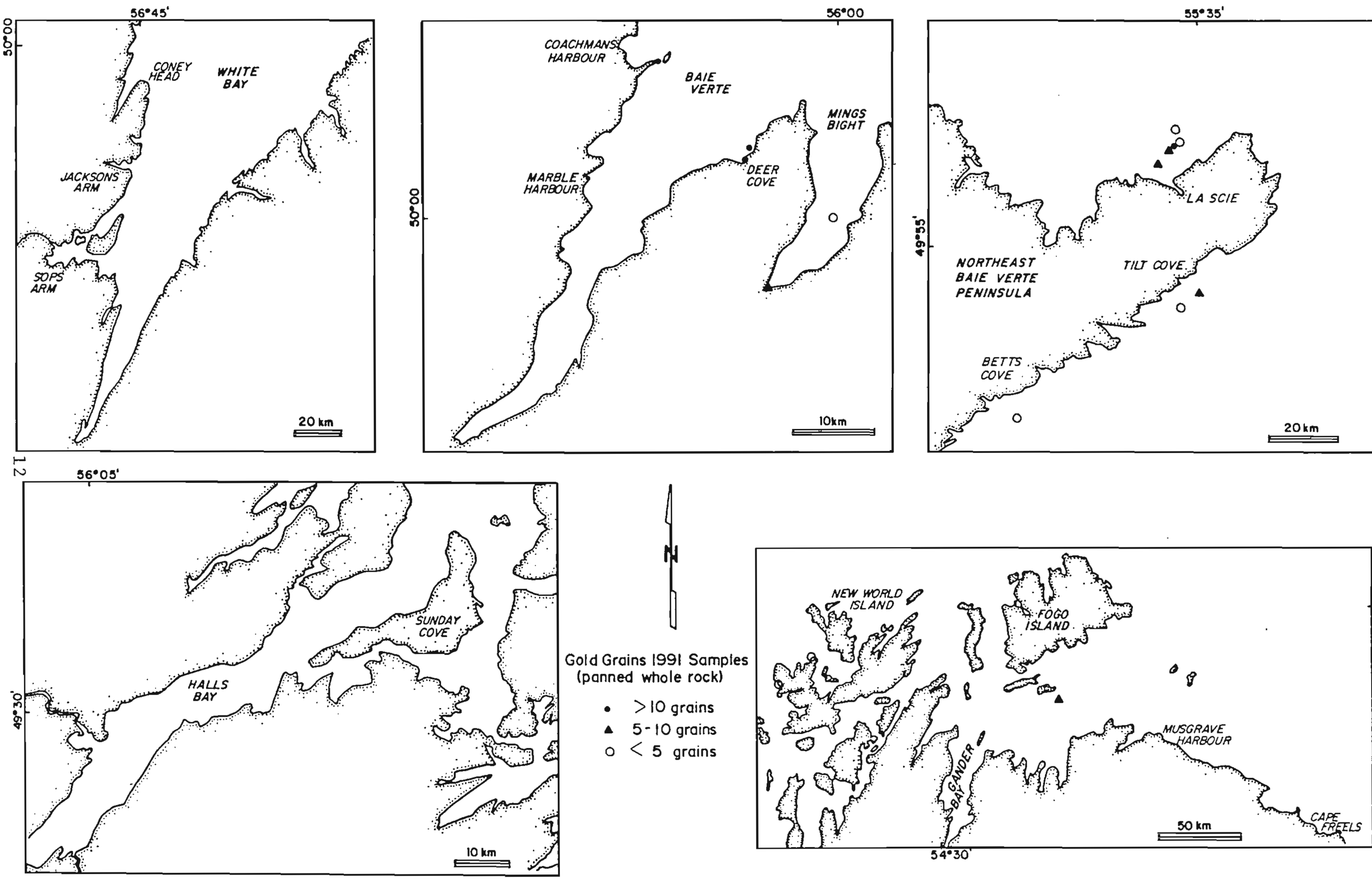

Figure 6 Distribution of Gold in the Whole Sample
(as determined by panning; 1991 samples)

around Coney Head and along the southern perimeter of the mouth of Sops Arm (Figure 3).

The small number of samples taken in White Bay make the recognition of geochemical trends within the shelf sediments difficult. There is, however, a marked distinction in the geochemistry of the seabed sediments surrounding Coney Head where the sediments are rich in Ca, Ba, Br, Cr, Nd and Zn relative to the other samples from White Bay (Appendix F). This variation in the geochemistry reflects a change in geology of the coastal rock suites; the Coney Head Peninsula is composed of granitoid intrusions while the rest of western White Bay is underlain by sedimentary siliciclastic rock with minor volcanics (Colman-Sadd et al., 1990).

No particulate gold was recovered from panning of the samples from White Bay. The mud fraction of two samples from the Coney Head area contained anomalous gold concentrations (10 and 85 ppb) and the single sample offshore from Jacksons Arm contained minor gold in both the mud and sand fraction (21 ppb and 7 ppb respectively; Figures 4 and 5). No gold was detected in the suite of samples off Sops Arm or at the head of White Bay.

3.2 Baie Verte and Mings Bight

Baie Verte has been a focus of the work during both the 1990 and 1991 surveys. The numerous occurrences of gold in the coastal rock suite and in the till cover of some areas make Baie Verte one of the most likely sites for placer development. Baie Verte, like much of the Baie Verte Peninsula, is characterized by an irregular coastline with steep rock cliffs bordering much of the shoreline. During the 1990 surveys 35 surficial grab samples were collected from Baie Verte (Figure 2) and 8 were found to contain particulate gold. Only two additional samples were collected during the 1991 survey, both at Deer Cove.

A review of the surficial geology of Baie Verte is provided by Shaw (1992). He divides the Bay into two zones, an inner zone extending from the mouth of the Bay to Grassy Island (near the centre of the Bay) and an outer zone extending from Grassy Island to the mouth of the Bay. The outer zone is characterized by a large northeast trending trough bordered by a narrow rocky, shelf zone. The trough is filled with up to 74 m of glacial and postglacial sediment. The inner shelf is characterized by extensive bedrock exposures with the only significant sediment cover restricted to small isolated embayments (e.g., Deer Cove) where sediment thickness rarely exceeds 10 m. Water depths decrease in the inner bay where the sediment cover is more extensive. Seabed sediments rich in gravel are found in the small coastal embayments of the outer bay and blanketing glacial diamict in some areas of the inner bay (Shaw, 1992; Figure 3).

There are marked differences in the geochemistry of the inner and outer bay sediments in Baie Verte. The outer bay sediments are rich in Sc, Th, and Ca while the inner bay sediments are rich in Na, Ba and Co. Sm and La concentrations are highest along the western side of the outer bay, particularly in Coachmans Harbour. Cr concentrations are greatest in Deer Cove and Marble Cove. The changes in geochemistry of the seabed sediments correspond with changes in the bedrock geology. The inner bay and most of the western shore of Baie Verte is underlain by mafic volcaniclastic rocks (Hibbard, 1983). Near Coachmans Harbour, the geology changes with the occurrence of greenschist and amphibolite rock suites. In contrast the eastern shore of the outer bay is dominated by diabase dykes, gabbros and metagabbros, many of which have been subjected to calc-silicate alteration (Hibbard, 1983).

The small coastal embayments of the outer bay were found to contain the highest concentrations of gold. The most notable site for gold enrichment is Deer Cove where all of the samples collected (5 from the 1990 survey and 2 from the 1991 survey) contain anomalous gold. Gold concentrations within the mud fraction of the two samples collected this year range from 95 to 121 ppb while gold concentrations within the sand fraction are less than 6 ppb. Panning of the two samples collected this year at Deer Cove yielded thirty gold grains per sample. Examination of gold grains revealed similar characteristics to those described from samples collected during the 1990 survey in the area (Emory-Moore, 1991). Two distinct populations of gold grains were evident; a small number of fresh grains which displayed low levels of chemical and mechanical alteration (Plate 1) and a second, more dominant group which were highly abraded and extensively etched and pitted (Plate 2). The former population of grains do not appear to have travelled far from the point of liberation whereas the latter group have probably travelled distances of greater than 0.5 km. The grain size of the gold varies from 0.05 to 0.25 mm and the Ag content ranges from 0-8 wt%.

The other coastal embayments which were identified in the 1990 survey as containing anomalous gold, and for which some SEM examination of grains was undertaken, include Green Cove and Marble Cove. All of the samples in the inner bay of Baie Verte contain less than 75 ppb gold in the mud fraction and none

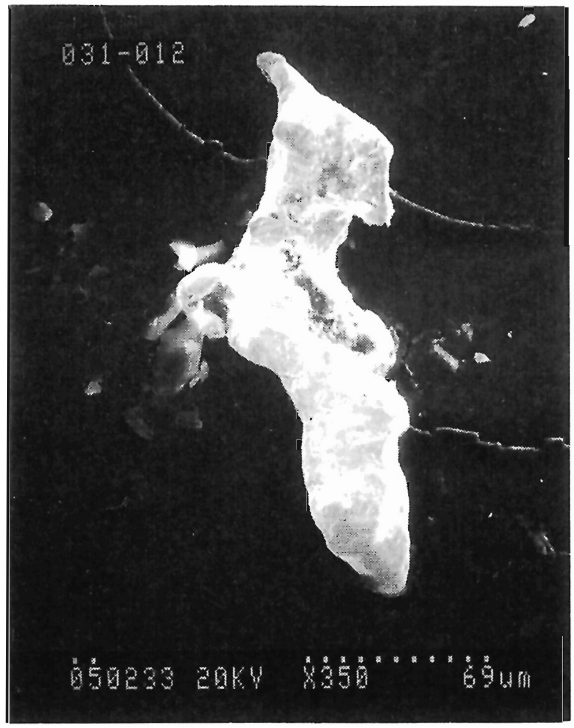

Plate 1. A relatively fresh gold grain from Deer Cove. Minor mechanical and chemical alteration, suggesting transport distances of less than 0.5 km

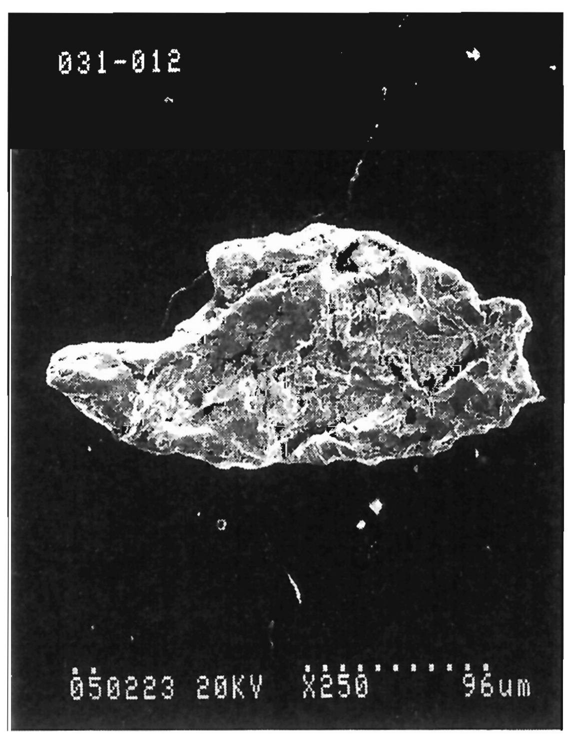

Plate 2. A well travelled gold grain from Deer Cove with evident pitting, chemical etching and folding of grain edges

contain recoverable gold in the panned concentrates.

The 1991 survey was expanded to include a survey of the previously uncharted waters of Mings Bight where 8 van Veen grab samples were collected. Mings Bight was chosen as a good target for placer formation because it is a likely repository for glacigenic sediment eroded from a prominent mineralized lineament located to the southwest of the bay.

Water depths in Mings Bight vary from 110 m near the mouth to 50 m near the head of the bay. The seabed is characterized by extensive bedrock exposures with pockets of thin sediment cover (Edwardson et al., 1992). Sediment texture varies from a silty mud in the protected head of the bay to a much more coarse sandy gravel near the mouth of the bay (Edwardson et al., 1992). Of the 8 samples analysed, 5 contain greater than 60% gravel (Figure 3).

Concentrations of Cr and Ni within the surficial sediments of Mings Bight are consistently higher than the rest of the study area (with the exception of a few samples from Baie Verte). Co concentrations are also elevated while the elements Hf, Sm and Sb are depleted. The Cr and Ni-bearing sediments are probably a derivative of the mafic and ultramafic rocks exposed along the western shore and at the head of the bay.

Gold concentrations in all samples from Mings Bight were low, ranging from 7 to 44 ppb in the mud fraction with negligible gold in the sand fraction. One gold grain was recovered from sample 91-031-006. The gold grain measured 0.070 mm in diameter and exhibited moderate to high levels of abrasion and chemical etching with a probable transport distance of greater than 0.5 km. A grab sample collected from a river bar at the head of Mings Bight was found to contain anomalous gold concentrations within the mud fraction (102 ppb); 7 grains were recovered from panning. Two sub-populations were represented, one with very fresh mechanical and chemical characteristics and the other exhibiting a moderate to high degree of abrasion and chemical etching. The grains ranged in size from 0.060 to .15 mm.

While particulate gold within both Baie Verte and Mings Bight is concentrated in the mud fraction, the gold-bearing muds are closely associated with gravel-rich samples. This is not surprising given the nature of the entrapment process which serves to concentrate placer gold.

3.3 Northeastern Baie Verte Peninsula

Two areas around the northeastern Baie Verte Peninsula were surveyed: the shelf area offshore from La Scie and the shelf area offshore from Tilt Cove and Betts Cove (Figure 1).

Two samples were collected offshore from La Scie during the 1990 survey; one was found to contain gold (684 ppb). A further 7 samples were collected during 1991. The Quaternary sediments of the shelf area have been investigated by Shaw (1991) who describes an outer zone (>90 m water depth) characterized by a thin (<10 m) but continuous cover of glaciomarine sediment and an inner zone (<90 m water depth) characterized by numerous bedrock exposures and a thin laterally extensive cover of sand and gravel. Most of the samples collected in the present study contain less than 40 wt% gravel although two samples from the inner zone are characterized by 40-60 wt% gravel (Figure 3).

The surficial sediments offshore La Scie are rich in Cr, Ce, Sm, Th, Hf and Fe and are depleted in Na, Br, and Sb (Appendix F). The coastal rock suite varies from rhyolitic and trachytic tuffs near La Scie to pyroxene gabbro to the east of La Scie (Hibbard, 1983).

Six of the seven samples collected during the 1991 survey contain gold in the mud fraction (7 to 249 ppb; Figure 4) with only one of the samples assaying > 7 ppb in the sand fraction (Figure 5). Particulate gold was recovered from all six samples (Figure 6). Samples 91-026-26 and 91-026-27 were characterized by a bimodal population of gold grains with a large proportion of the grains being abraded and well travelled and a small number of fresh, less abraded grains (Plates 3 and 4). The other samples contained gold grains that were well travelled exhibiting strong evidence of both mechanical abrasion and chemical etching.

The shelf areas off Tilt Cove and Betts Cove were chosen as possible targets for gold placer formation due to the high coastal exposure and the presence of several gold showings, including two old mine sites. Twelve samples were collected in water depths of >100 m during one of the 1990 surveys. The highest concentration of gold (510 ppb) was found offshore Betts Cove in a muddy sample collected at a water depth of 288 m. Three samples offshore Tilt Cove had minor gold, measuring less than 60 ppb. During the 1991 survey, 9 IKU grab samples were collected in water depths ranging from 25-100 m.

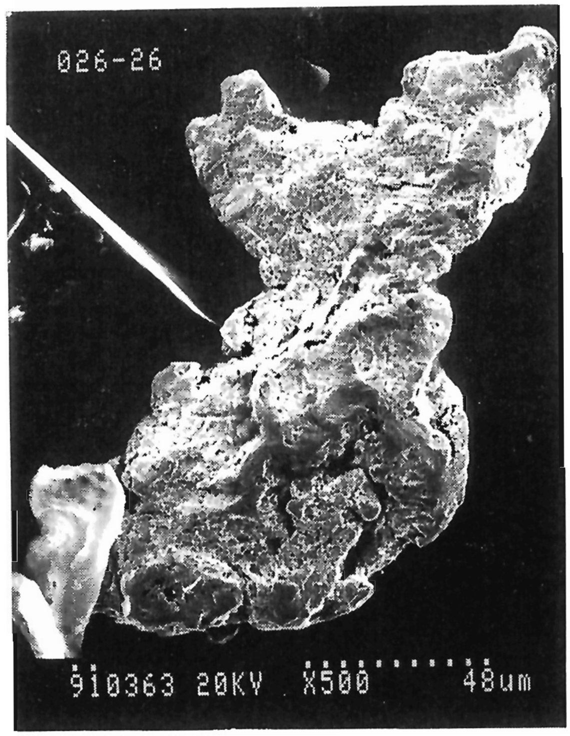

Plate 3. Abraded and extensively etched gold grain from offshore La Scie area

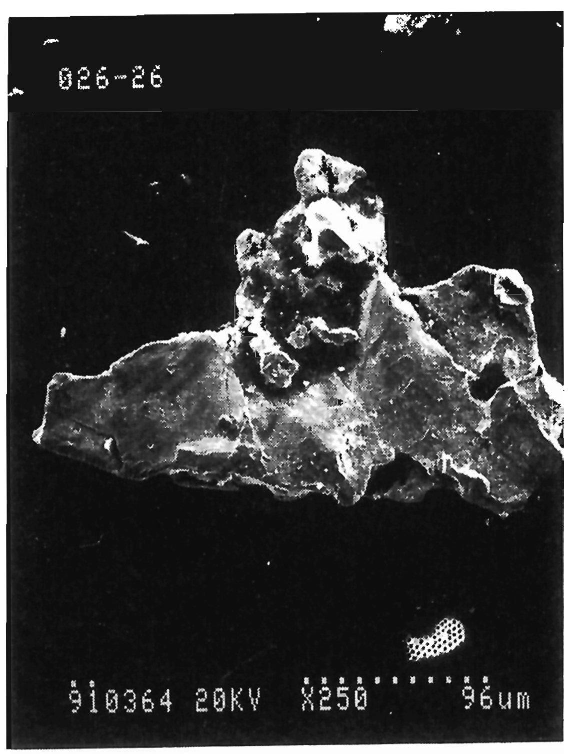

Plate 4. A gold grain from offshore La Scie which exhibits both a fresh grain surface with minor chemical etching and a more heavily abraded, pitted and etched grain surface

Like most of the Baie Verte Peninsula coast, the Tilt Cove, Betts Cove area is characterized by a rocky shelf with isolated pockets of sand and gravel (Shaw et al., 1992). Six of the samples collected off Tilt Cove have a low percentage of gravel (<40 wt%) while the two samples offshore from Betts Cove are characterized by 40-60 % gravel (Figure 3).

The surficial sediments off Tilt Cove exhibit elevated concentrations of Co, Sb, Zn and Fe. The two samples off Betts Cove are slightly rich in Cr. The geology of the coastal zone is complex and the number of samples small, making possible geochemical trends difficult to distinguish. The high Cr content of the sediments off Betts Cove is probably associated with the Betts Cove ophiolitic complex (see Hibbard, 1983) while the high Fe, Co and Zn in the Tilt Cove area may reflect sulphide mineralization within the coastal rock suites (e.g., the Tilt Cove mine site which is situated very close to the coast).

The highest concentrations of gold were found in the Tilt Cove area where the mud fraction of three samples assayed at over 400 ppb gold; the two samples offshore from Betts Cove contained 25-28 ppb gold (Figure 4). In all samples the gold grade was significantly less in the sand fraction (Figure 5). Particulate gold was recovered from two samples in the Tilt Cove area and one sample in the Betts Cove area (Figure 6). Gold grains from both samples in the Tilt Cove area exhibited moderate to high levels of abrasion, a moderate degree of chemical etching and ranged in grain size from 0.09 to .17 mm (Plate 5). Sample 91-026-24 from Tilt Cove was divided into an upper (0-0.5 m depth) and lower (0.5-1.0 m depth) split and each split was panned in an attempt to evaluate possible variations in gold concentrations with depth. The abundance and

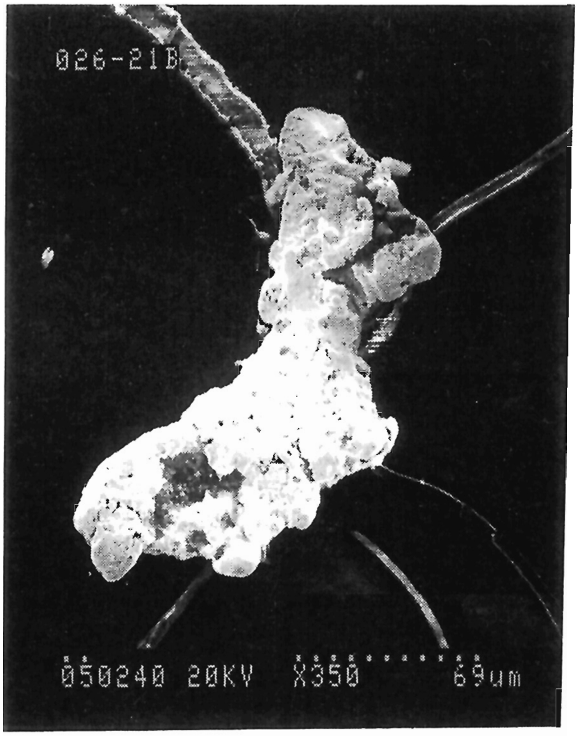

Plate 5. Abraded, pitted and etched gold grain from offshore Tilt Cove. Note growth of secondary mineral phases within the recessed areas

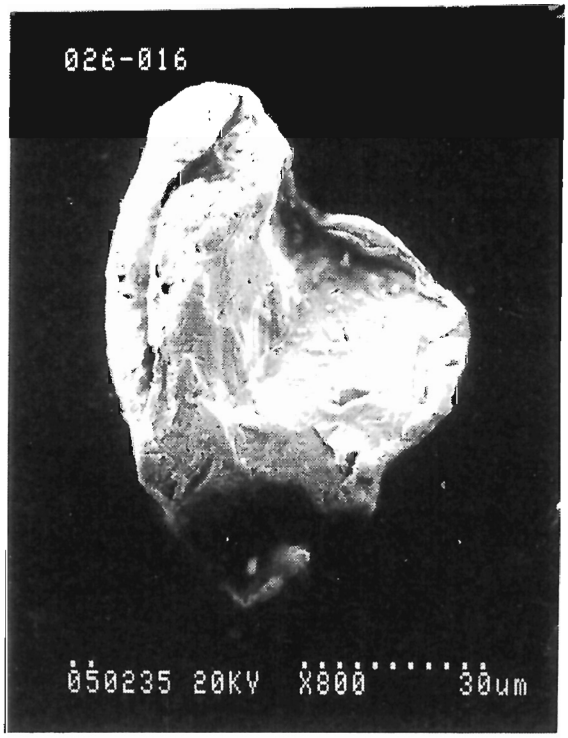

Plate 6. A heavily abraded gold grain from offshore Betts Cove. Note the contrast in chemical alteration between the fresh grain cast and more heavily etched left edge of the grain. A 'sandwich' texture can also be seen where two grain edges have been folded onto each other (upper left hand corner of the grain)

character of gold grains in both splits was found to be very similar. Two of the gold grains found within the sample offshore Betts Cove were well worn and highly etched while one grain was moderately abraded with little evidence of chemical etching (Plate 6).

In contrast to Baie Verte, particulate gold within the northeastern Baie Verte Peninsula samples is closely associated with mud-rich sediments.

3.4 Halls Bay Area

Twenty-nine surficial samples were collected from the Halls Bay area during the 1990 surveys. No additional samples were collected in 1991. The area was initially chosen as a potential site for gold placer formation because of the numerous gold showings, particularly near the more exposed areas around Sunday Cove Island. Further work was not undertaken in the area because all but one of the 1990 samples contained less than 8.5 ppb gold; it was suggested that gold associated with massive sulphide deposits such as those found in the Halls Bay area may be poor sources of placer gold (principally due to the characteristically fine grain size of the gold; Emory-Moore, 1991). The results of the 1990 geochemical assays and textural analysis are illustrated in Figures 3 and 4 and in the box and whisker plots (Appendix E). A detailed review of the results can be found in Emory-Moore (1991).

3.5 Northeastern Shelf

Twenty surficial grab samples were collected from Hamilton Sound during the 1990 survey with anomalous gold concentrations found in only one sample, located southeast of East Indian Island. The survey area was expanded in 1991 to include the shelf area offshore northwestern New World Island and offshore from the Cape Freels-Musgrave Harbour area (Figure 2).

Offshore the Musgrave Harbour-Cape Freels area extensive bedrock exposures characterize the inner shelf while the outer shelf region is blanketed by glacial and glacialmarine deposits (Shaw et al., 1992). The gravel content of the shelf sediments decreases from > 65 % gravel on the inner shelf to < 40 % gravels in the offshore (Figure 3). The Hamilton Sound area is characterized by a thin discontinuous cover of Quaternary sediments (Shaw and Russell, in prep). Well sorted sands occur within bedrock depressions and a coarse gravel mantles glacial diamict in many areas. The seabed around the north end of New World Island is very irregular and is covered by 5 to 10 m of Quaternary sediment with some bedrock knolls exposed (Edwardson et al., 1992). The surficial sediment generally contains a high percentage of gravel (Figure 3).

The geochemistry of the surficial sediments in the northeastern Newfoundland shelf region differ significantly from the rest of the study area. The sediments are rich in Hf, Nd, Sm and Th with the highest concentrations occurring in deep waters off the Musgrave Harbour-Cape Freels coast. The Musgrave Harbour-Cape Freels coastline is underlain by a large granitic intrusion which may account, in part, for the unique element suite. Br concentrations are elevated off the mouth of the Gander River and northwest of New World Island; both areas are underlain by sedimentary rock suites.

The concentration of gold in samples from this area were all low, both in the mud and sand fractions (Figure 5 and 6). Two samples located east of East Indian Island contained minor concentrations of gold in the sand and mud fraction (<33 ppb). Particulate gold was also recovered from these samples. The gold was quite coarse-grained, ranging in size from 0.1 to 0.15 mm. In sample 91-026-036, the gold grains were worn and etched (Plate 7), while in sample 91-026-037 the grains appeared less travelled. Gold was also detected in the sand fraction in two of the samples offshore from northwestern New World Island. One grain from each sample was recovered. The grains were heavily abraded and etched (Plate 8).

4.0 DISCUSSION

Factors such as mineral occurrences (primary source), sediment thickness (secondary source) and wave fetch (energy) provide useful constraints for regional target discrimination in placer exploration. For example, primary autochthonous deposits form under conditions of high wave energy where mineralized bedrock is exposed on the seabed or in coastal cliffs. Alternatively, secondary autochthonous deposits form in high energy areas where there is a cover of glacigenic sediment that has been derived from, and is within a few kilometres down-ice of, a mineralized source rock. In an attempt to relate coastal wave energy, sediment thickness and primary mineral occurrences to the observed distribution of gold within the northern Newfoundland shelf sediments, a Geographic Information System (GIS) was used to create and overlay thematic

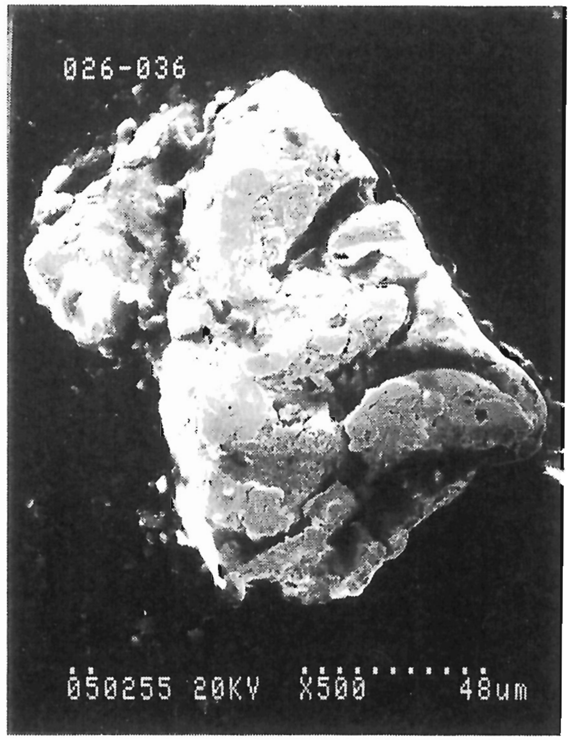

Plate 7. A highly altered gold grain from Hamilton Sound exhibiting extensive folding of grain edges, matting of the grain surface and chemical pitting and etching

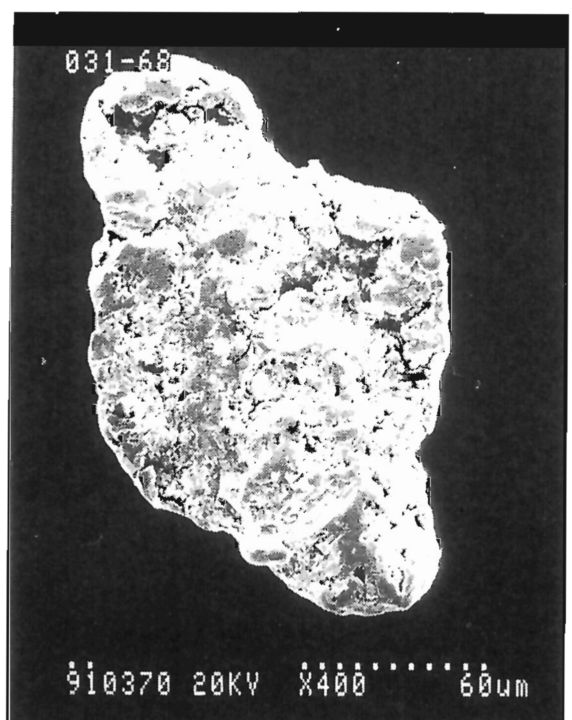

Plate 8. A highly abraded and chemically altered grain from offshore New World Island

layers of each.

Gold occurrence data was provided by the Newfoundland Department of Mines and classified as volcanogenic and epigenetic types. Preliminary studies of the present study area (Shaw et al. 1992; Edwardson et al., 1992; Shaw, 1992) suggest that sediment thickness on the inner shelf closely reflects the sediment cover within the coastal zone and hence a simplification of the surficial geology map of Newfoundland (Liverman and Taylor, 1990) was used to approximate sediment thickness. The coastal sediment suites were broadly grouped into areas characterized by extensive bedrock exposures with thin discontinuous sediment cover, and areas characterized by a moderate to thick sediment cover.

As a first approximation of wave energy, mean fetch was calculated by determining the minimum distance from a point on the coast to all points that intersect the coastline seaward of it (seaward is defined here as the area delineated by vectors drawn from the point of interest to adjacent points). Where no intersection points are found, a maximum fetch of 500 km was assigned. The mean of all the seaward intersections was calculated and used as an estimate of mean fetch.

The likelihood of primary autochthonous gold formation was evaluated by calculating the mean coastal fetch for those areas dominated by little or no sediment cover, and then superimposing known mineral occurrences (Figure 7). An assessment of secondary autochthonous gold potential was provided by calculating the mean coastal fetch for those areas characterized by a moderate to thick sediment cover and then superimposing known mineral occurrences (Figure 8).

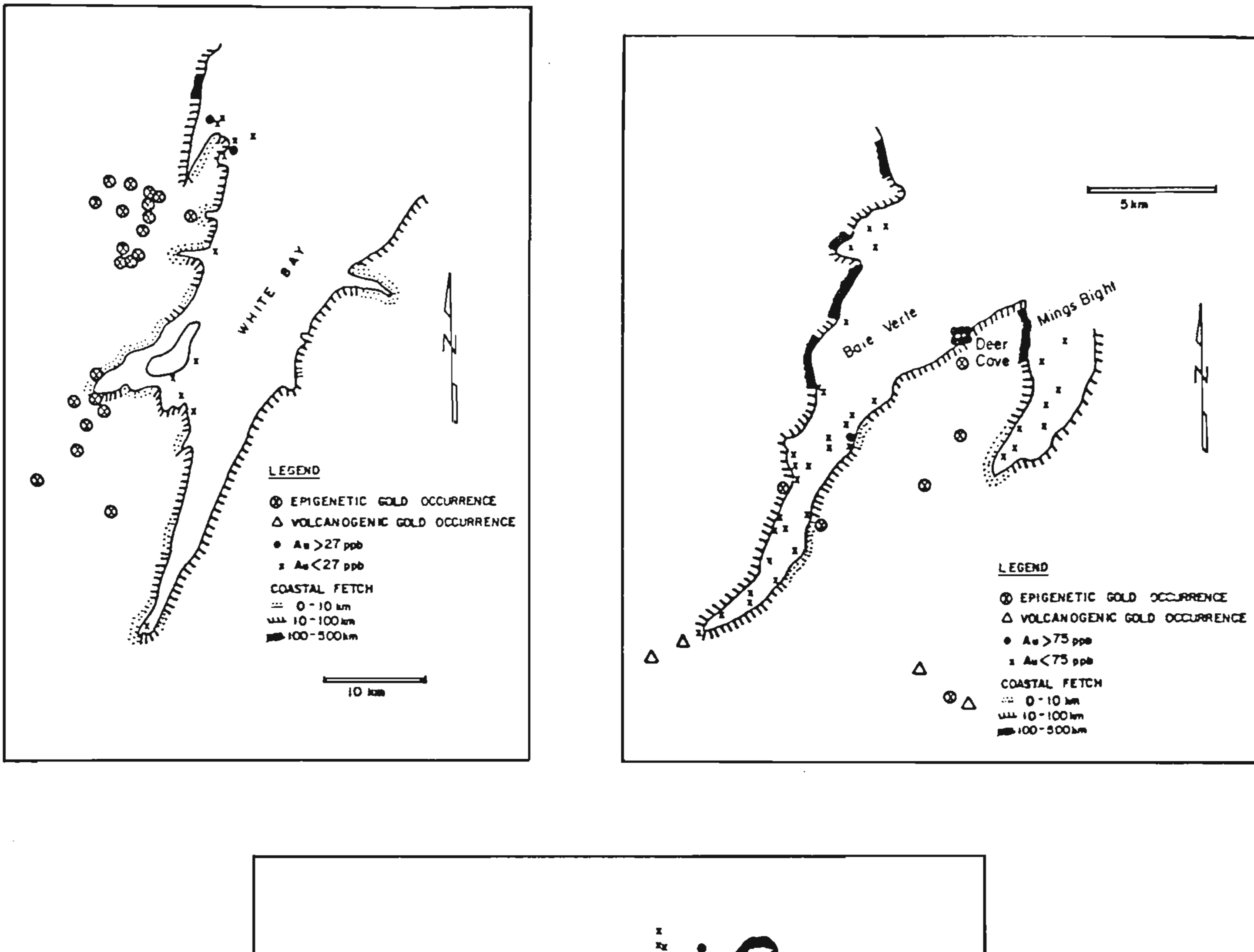

Figure 7 Coastal Fetch and Mineral Occurrences in Areas with No Sediment Cover: Areas of High Primary Autochthonous Gold Potential

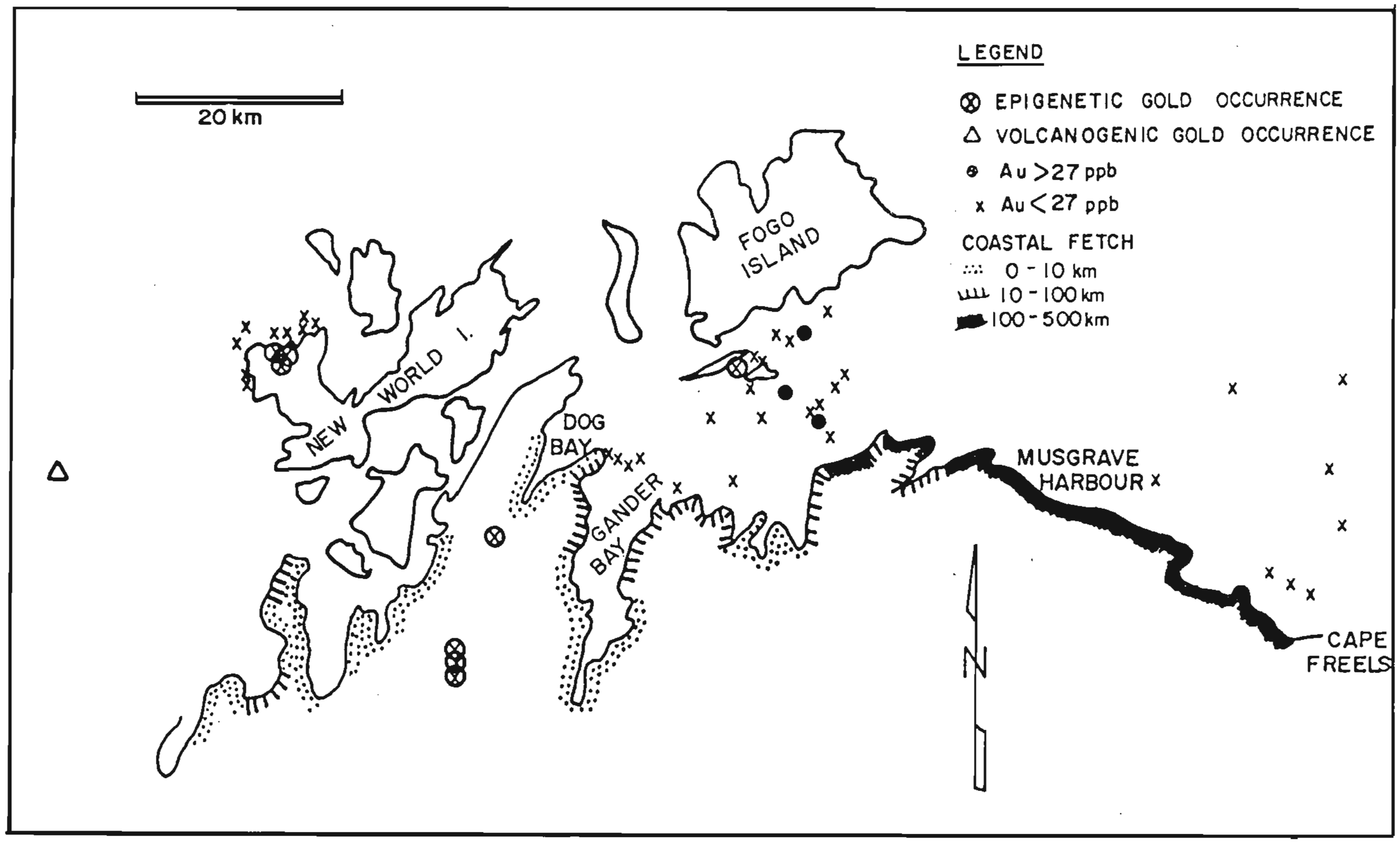

Figure 8 Coastal Fetch and Mineral Occurrences in Areas with Sediment Cover: Areas of High Secondary Autochthonous Gold Potential

In comparing the GIS generated maps with the distribution of gold identified within the shelf sediments of northern Newfoundland, several interesting, albeit equivocal, relationships emerge. Firstly, the Baie Verte Peninsula, White Bay and most of the Halls Bay area (except the head of Halls Bay) are characterized by a very thin discontinuous cover of sediment and hence placers that do form in these areas will likely be primary autochthonous deposits or perhaps, small, localized secondary deposits. The Hamilton Sound, Cape Freels-Musgrave Harbour area is characterized by a fairly continuous sediment cover and is hence the most likely site in the present study area to host secondary autochthonous deposits.

Not surprisingly, proximity to source appears to be the most important control on primary autochthonous placer formation. In the samples collected in White Bay, gold was found in sediments offshore the northeast tip of Coney Head, within 1.3 km of a known gold occurrence and where the fetch is greater than 100 km. The samples collected offshore from Sops Arm and Jacksons Arm were collected at distances of more than 7 km from known sources and despite being in areas of comparable fetch, the samples were barren. Unfortunately, the low energies of the inner bay regions, which lie within 1-4 km of the rich hinterland sources, may preclude placer formation. In Baie Verte, the highest concentrations of gold were found in Deer Cove, within 1 km from a known source, in a moderate energy environment. Similarly, the two gold-bearing samples offshore the north coast of New World Island were collected in a high energy setting, within 1 km of a known source. The richest samples offshore Tilt Cove were 1.5 , 3 and 6.5 km from known onland sources.

While primary mineral occurrences are clearly an important control, caution must be taken in eliminating areas on this basis alone. For example, the numerous gold-bearing samples collected offshore La Scie are not associated with known occurrences of primary mineralization. The samples were, however, collected in a high energy environment and in an area with a geologic setting conducive to gold mineralization. The richest samples fall more than 1.5 km from the coast, suggesting possible mineralization within exposed bedrock on the seafloor. The fresh character of some of the gold grains from the area also suggests a proximal and perhaps as yet unknown source.

Very little gold was found in the Hamilton Sound and Musgrave Harbour-Cape Freels region. Again, proximity to source appears to be an important factor. All the samples collected in Hamilton Sound are greater than 13 km away from the main zone of mineralization in the area (a mineralized lineament extending southeast from Dog Bay). The barren samples collected offshore Musgrave Harbour-Cape Freels, while collected in a high energy environment, are greater than 20 km from any known source. The only gold-bearing sediment identified in the area occurred east of East Indian Island, approximately 5 km from a known source of gold mineralization on the island. Given the constraint of proximity to source, Dog Bay would seem a likely placer target. The mouth of Dog Bay is, however, a low energy setting with a mean fetch of under 10 km and hence may not be a suitable environment for sediment reworking.

In summary, the lack of a glacigenic sediment cover on the inner shelf regions of White Bay and the Baie Verte Peninsula preclude extensive secondary autochthonous placer development. The small pockets of sand and gravel on the inner shelf regions may hold some potential for small secondary or primary autochthonous deposits, but they are constrained by close proximity to sources of gold mineralization. Clearly the most attractive site for placer development of this kind is Deer Cove where anomalous gold concentrations were identified in all seabed samples.

In Deer Cove, particulate gold is concentrated in the mud fraction of the surficial sediments. The gold grade of the muds averages 462 ppb. Using the percentage by weight of mud in the total sample, the samples at Deer Cove yield an estimated average whole rock grade of 5 ppb, a value clearly below mining grades. What is not known is the variability of gold with depth. Particulate gold would generally be expected to reach maximum concentrations 30-60 cm below the seabed; samples collected to date are representative of the upper 10 cm of the seabed. In any case, if deposits of this type are present, they will likely be low-volume deposits which, at best, may sustain small-scale operations.

Secondary autochthonous deposits are constrained by the presence of glacigenic sediment cover and proximity to source. Secondary autochthonous placer deposits, such as the Nome deposit, can hold substantial economic promise for gold. Based on current evidence, it is unlikely that a large secondary deposit exists in the current study area. Dog Bay represents what is perhaps the most likely site for secondary autochthonous placer development although the low energy setting of the Bay may have precluded extensive gold enrichment. No surveys have been run in the Dog Bay to date.

5.0 RECOMMENDATIONS FOR FURTHER WORK

It is recommended that the next phase of the northern Newfoundland marine placer study include detailed, site-specific investigations using small boat operations with diver support. Side-scan sonar mapping of the seabed should be undertaken to map the areas where seabed armouring is present. Systematic sampling and mapping of the surficial and subseabed sediments by divers could be undertaken in water depths of up to 20 m. A diver-operated suction dredge would be a very useful tool to obtain large volume samples and could easily be connected to a sluice at the surface. Indeed, if any of these occurrences were to be mined, it would most probably be a small scale operation and would possibly involve similar extraction techniques. A detailed sampling program would also benefit from the use of the hydraulically-actuated bucket sampler developed by Scott et al. (1991) which can penetrate hard gravelly seabeds and can be deployed off a small vessel.

The areas recommended for detailed work are Deer Cove and Dog Bay. These represent what are perhaps the most likely sites for primary and secondary autochthonous placer development (see section 4.0). It is important that results of the next phase of study provide some measure of the tonnages and grades of gold that might be expected to occur in these types of deposits and hence the likelihood that they represent a mineable resource.

6.0 ACKNOWLEDGEMENTS

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Appendix A

Sample Type, Location and Water Depth

SAMPLE LOCATIONS:
DAWSON 91-026 AND NAVICULA 91-031

Sample Number	Latitude	Longitude	Water Depth (m)	Sample Type
91-031-001	49.97666	56.04566	0.5	hand grab
91-031-002	49.98333	56.03317	40	van Veen
91-031-003	49.99217	56.02467	48	van Veen
91-031-004	49.99317	56.01067	51	van Veen
91-031-005	49.98567	56.02867	62	van Veen
91-031-006	49.99967	56.00850	77	van Veen
91-031-007	50.00500	56.00217	35	van Veen
91-031-008	50.01533	56.00883	46	van Veen
91-031-009	50.02200	55.99550	110	van Veen
91-031-011	50.01867	56.05500	29	van Veen
91-031-012	50.02367	56.05333	47	van Veen
91-031-013	49.54083	56.87183	0	scoop
91-031-014	49.94333	56.72617	31	van Veen
91-031-016	49.95100	56.72100	33	van Veen
91-031-020	49.95467	56.69883	50	van Veen
91-031-024	49.96650	56.74400	50	van Veen
91-031-026	49.96800	56.75700	120	van Veen
91-031-028	49.96867	56.73950	53	van Veen
91-031-034	49.85850	56.75183	87	van Veen
91-031-036	49.75483	56.81267	66	van Veen
91-031-038	49.77067	56.78083	45	van Veen
91-031-040	49.55117	56.86017	38	van Veen
91-031-042	49.56483	56.85417	62	van Veen
91-031-046	49.72617	56.78750	51	van Veen
91-031-048	49.74000	56.80417	47	van Veen
91-031-050	49.77633	57.92117	0	scoop
91-031-051	49.77517	57.92167	0	scoop
91-031-052	49.76817	57.93200	0	scoop
91-031-053	49.75500	57.90500	0	scoop
91-031-054	49.60683	54.90783	110	van Veen
91-031-056	49.60133	54.86633	80	van Veen
91-031-058	49.60217	54.84717	59	van Veen
91-031-060	49.61233	54.83033	55	van Veen
91-031-062	49.60733	54.82900	50	van Veen
91-031-064	49.60367	54.82867	55	van Veen
91-031-066	49.60250	54.82733	54	van Veen
91-031-068	49.60183	54.81767	43	van Veen
91-031-070	49.55500	54.89783	55	van Veen
91-031-072	49.56083	54.89767	40	van Veen
91-031-076	49.59750	54.91983	49	van Veen
91-026-011	49.98817	55.60250	77	IKU
91-026-012	49.87600	55.53800	42	IKU
91-026-013	49.86817	55.53680	77	IKU
91-026-014	49.80067	55.77117	65.8	IKU
91-026-016	49.80683	55.77117	65.8	IKU
91-026-019	49.86833	55.58117	79	IKU

91-026-020	49.87083	55.61750	44	IKU
91-026-021	49.87950	55.59483	47	IKU
91-026-023	49.85833	55.62933	62	IKU
91-026-024	49.89117	55.57667	61.4	IKU
91-026-025	49.86900	55.59817	68	IKU
91-026-026	49.97667	55.62117	66	IKU
91-026-027	49.99067	55.60583	76	IKU
91-026-029	49.99233	55.59933	75	IKU
91-026-030	49.99183	55.60050	73	IKU
91-026-031	49.98650	55.61017	76.8	IKU
91-026-033	50.00167	55.60300	108	IKU
91-026-034	50.01050	55.60783	117	IKU
91-026-035	49.90483	55.37367	228	IKU
91-026-036	49.52417	54.19217	20	IKU
91-026-037	49.52200	54.19183	25.6	IKU
91-026-038	49.50933	54.15167	55	IKU
91-026-039	49.52467	54.12733	40	IKU
91-026-040	49.52467	54.12767	40	IKU
91-026-043	49.53400	54.11217	51	IKU
91-026-044	49.49850	53.44883	293	IKU
91-026-045	49.49800	53.59100	62.2	IKU
91-026-046	49.49933	53.59317	62.2	IKU
91-026-047	49.42333	53.70567	38.4	IKU
91-026-048	49.42667	53.47383	108	IKU
91-026-049	49.37500	53.46133	90	IKU
91-026-050	49.31833	53.51167	51	IKU
91-026-051	49.32750	53.53567	49	IKU
91-026-052	49.33883	53.56500	49	IKU

Appendix B

Textural Data

GRAIN SIZE DATA
(weight percent)

Sample Number	>2mm	2 -.063mm	<0.063mm
91-026-011S	0.05	52.41	47.54
91-026-011B	0.06	45.58	54.36
91-026-012S	0.00	20.47	79.53
91-026-012M	0.00	9.02	90.98
91-026-013	0.30	49.79	49.91
91-026-014	46.76	46.04	7.20
91-026-016	55.60	40.24	4.15
91-026-019	41.73	54.56	3.71
91-026-020	31.03	67.04	1.94
91-026-021	37.89	58.96	3.15
91-026-023	38.89	56.28	4.83
91-026-024S	24.40	72.33	3.27
91-026-024B	45.82	51.09	3.09
91-026-025S	47.52	48.79	3.70
91-026-025B	44.64	53.04	2.32
91-026-026	47.67	50.20	2.14
91-026-027	0.62	98.04	1.34
91-026-029	50.48	46.21	3.32
91-026-030	48.38	50.33	1.29
91-026-031	4.04	95.18	0.78
91-026-033	0.00	91.70	8.30
91-026-034	0.78	83.64	15.58
91-026-035	35.80	58.48	5.72
91-026-036	34.35	64.30	1.35
91-026-037	21.87	76.66	1.47
91-026-038S	0.40	80.07	19.53
91-026-038B	1.01	60.55	38.44
91-026-039	33.74	60.75	5.51
91-026-040	56.21	42.23	1.56
91-026-043	2.94	80.57	16.50
91-026-044	24.88	74.79	0.33
91-026-045	0.68	99.32	0.00
91-026-046	70.24	29.61	0.16
91-026-047	63.61	36.08	0.31
91-026-048	0.89	97.88	1.23
91-026-049	26.86	72.64	0.50
91-026-050	80.47	19.37	0.16
91-026-051	75.07	24.81	0.12
91-026-052	63.95	35.90	0.15
91-031-001	41.89	56.71	1.40
91-031-002	73.98	16.36	9.66
91-031-003	84.69	10.18	5.13
91-031-004	61.93	28.55	9.52
91-031-005	0.10	43.15	56.75
91-031-006	0.86	57.01	42.13
91-031-007	61.88	29.75	8.37

91-031-008	20.87	75.25	3.87
91-031-009	62.36	33.21	4.42
91-031-011	57.98	39.80	2.22
91-031-012	21.31	75.82	2.86
91-031-013	26.22	72.27	1.50
91-031-014	43.89	55.48	0.63
91-031-016	82.17	17.81	0.02
91-031-020	62.43	35.36	2.21
91-031-024	90.77	9.12	0.11
91-031-026	0.07	49.67	50.25
91-031-028	42.13	54.28	3.60
91-031-034	0.19	95.44	4.37
91-031-036	20.62	71.97	7.41
91-031-038	34.78	58.54	6.69
91-031-040	22.01	48.93	29.06
91-031-042	79.94	11.52	8.54
91-031-046	58.61	38.96	2.44
91-031-048	58.71	37.54	3.75
91-031-050	11.42	87.94	0.63
91-031-051	17.31	81.42	1.27
91-031-052	36.45	63.39	0.15
91-031-053	60.24	37.39	2.37
91-031-054	33.54	62.11	4.35
91-031-056	38.78	57.07	4.15
91-031-058	60.30	38.44	1.25
91-031-060	43.96	53.62	2.43
91-031-062	67.22	31.34	1.44
91-031-064	13.23	86.25	0.52
91-031-066	32.27	66.53	1.20
91-031-068	55.27	44.07	0.66
91-031-070	54.29	42.87	2.84
91-031-072	93.07	6.42	0.51
91-031-076	95.38	4.19	0.43

S - Surface

M - Middle

B - Bottom

Appendix C

Geochemical Assays of the Mud and Sand Fraction

Element	Au	Ag	As	Ba	Br	Ca	Co	Cr	Cs	Fe	Hf	Hg	Ir	Mo	Na	Ni	Rb	Sb	Sc
Units	PPB	PPM	PPM	PPM	PPM	%	PPM	PPM	PPM	%	PPM	PPM	PPB	PPM	PPM	PPM	PPM	PPM	PPM
Detection Limit	5	5	2	100	1	1	5	10	2	0.02	1	1	5	5	500	50	30	0.2	0.1
91-031-1 MUD	102	-5	11	-100	11	2	49	3000	-2	5.98	3	-1	-5	-5	9150	740	-30	0.5	21
91-031-2 MUD	-5	-5	7	230	140	5	26	1100	-2	3.98	3	-1	-5	-5	11700	300	-30	0.4	18
91-031-3 MUD	8	-5	8	230	180	6	23	770	-2	3.52	3	-1	-5	-5	11400	270	-30	0.4	17
91-031-4 MUD	7	-5	10	280	150	4	23	880	-2	3.69	4	-1	-5	-5	11900	250	-30	0.3	16
91-031-5 MUD	9	-5	6	270	130	3	24	950	-2	3.71	3	-1	-5	-5	12700	270	-30	0.4	18
91-031-6 MUD	15	-5	7	250	110	3	24	830	-2	3.75	4	-1	-5	-5	13500	180	39	0.5	20
91-031-7 MUD	25	-5	6	180	100	7	20	870	-2	3.34	6	-1	-5	-5	10900	190	-30	0.4	18
91-031-8 MUD	44	-5	3	160	38	8	29	2000	-2	4.51	7	-1	-5	-5	9030	190	-30	0.7	24
91-031-9 MUD	9	-5	9	240	150	4	18	480	-2	3.13	5	-1	-5	-5	11600	150	-30	0.4	15
91-031-11 MUD	121	-5	6	170	95	9	21	940	-2	3.59	3	-1	-5	-5	13000	130	-30	1	27
91-031-12 MUD	95	-5	6	-100	200	10	16	460	-2	3.12	5	-1	-5	-5	13300	130	-30	0.7	22
91-031-13 MUD	7	-5	4	380	17	2	20	100	3	4.49	16	-1	-5	-5	15200	-50	59	0.4	18
91-031-14 MUD	85	-5	14	500	250	16	12	45	-2	3.87	7	-1	-5	-5	13000	-50	30	0.6	14
91-031-16 MUD	-19	-5	30	680	910	18	14	220	-2	4.9	6	-2	-6	-8	17000	-70	-30	2	12
91-031-20 MUD	-5	-5	7	440	190	8	9	57	-2	2.67	8	-1	-5	-5	15200	-50	41	0.4	10
91-031-24 MUD	10	-5	7	710	300	12	13	96	4	4.28	8	-1	-5	-5	18700	-50	53	0.6	18
91-031-26 MUD	19	-5	7	420	140	6	8	55	-2	2.62	9	-1	-5	-5	17200	-50	39	0.3	11
91-031-28 MUD	-5	-5	6	390	140	6	9	59	-2	2.97	10	-1	-5	-5	15600	-50	49	0.3	12
91-031-34 MUD	21	-5	3	450	34	4	8	55	-2	4.07	36	-1	-5	-5	15500	-50	-30	0.3	16
91-031-36 MUD	6	-5	3	390	61	5	9	48	-2	3.34	24	-1	-5	-5	17400	-50	33	0.3	11
91-031-38 MUD	-5	-5	11	310	160	11	8	48	-2	2.43	10	-1	-5	-5	12900	-50	38	0.2	9
91-031-40 MUD	-5	-5	9	270	110	3	17	96	2	4.43	8	-1	-5	-5	15400	-50	58	0.3	19
91-031-42 MUD	-5	-5	7	450	93	3	16	120	2	4.35	12	-1	-5	-5	17800	-50	56	0.4	20
91-031-46 MUD	-5	-5	5	410	87	4	11	92	-2	3.96	29	-1	-5	-5	18100	-50	37	0.3	12
91-031-48 MUD	-5	-5	6	370	140	4	11	77	-2	4.45	37	-1	-5	-5	17700	-50	40	0.4	12
91-031-50 MUD	14	-5	19	510	6	3	34	71	6	9.69	48	-1	-5	-5	17200	-50	84	0.4	26
91-031-51 MUD	8	-5	5	420	-1	3	21	71	-2	6.49	42	-1	-5	-5	20000	-50	46	-0.2	21
91-031-52 MUD	18	-5	12	650	86	5	52	120	5	9.47	24	-1	-5	7	21400	-50	59	0.8	27
91-031-53 MUD	12	-5	410	570	4	4	30	71	6	7.08	16	-1	-5	-5	20400	-50	88	1.6	20
91-031-54 MUD	-5	-5	8	330	48	4	12	150	-2	3.76	9	-1	-5	-5	24200	-50	-30	1.4	24
91-031-56 MUD	13	-5	11	240	24	5	10	190	-2	4.16	18	-1	-5	-5	20800	-50	-30	1.8	24
91-031-58 MUD	-5	-5	18	290	130	12	12	130	-2	3.49	6	-1	-5	-5	18800	-50	-30	1.2	19
91-031-60 MUD	15	-5	11	240	180	12	13	130	-2	3.35	5	-1	-5	-5	17500	-50	-30	0.9	17
91-031-62 MUD	-5	-5	14	240	220	12	13	150	-2	3.34	4	-1	-5	-5	16200	-50	-30	1	16
91-031-64 MUD	-5	-5	15	260	49	12	18	730	-2	5.81	38	-1	-5	-5	20600	-50	-30	1	27
91-031-66 MUD	-5	-5	8	210	26	9	17	810	-2	5.52	26	-1	-5	-5	19900	-50	-30	1	30
91-031-68 MUD	-5	-5	7	290	82	12	16	420	-2	4.46	16	-1	-5	-5	19000	-50	-30	0.7	23
91-031-70 MUD	-5	-5	4	400	55	6	10	260	-2	3.07	30	-1	-5	-5	17600	-50	-30	1.4	18
91-031-72 MUD	9	-5	13	380	310	13	10	120	-2	2.72	12	-1	-5	-5	14800	-50	-30	1.1	12
91-031-76 MUD	-5	-5	25	350	500	18	11	51	-2	2.55	1	-1	-5	-5	8300	-50	38	0.8	6.2
91-026-0115 MUD	190	-5	160	110	16	2	230	340	-2	16.6	2	-1	-5	6	3410	200	-30	5.7	25
91-026-0115-2 MUD	251	-5	210	-100	22	-1	320	410	-2	23	4	-1	-5	-5	4580	170	-30	8	37
91-026-0115-3 MUD	240	-5	220	-100	23	1	330	410	-2	23.2	3	-1	-5	-5	4620	210	47	8	38

(negative values are below detection limits)

Element	Se	Sn	Sr	Ta	Th	U	W	Zn	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu
Units	PPM	%	%	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM
Detection Limit	5	0.01	0.05	1	0.5	0.5	4	50	1	3	5	0.1	0.2	0.5	0.05	0.05
91-031-1 MUD	-5	-0.01	0.05	-1	1.4	-0.5	-4	85	7	14	9	1.6	0.6	-0.5	1.36	0.28
91-031-2 MUD	-5	-0.01	-0.05	-1	3.8	1.7	-4	100	18	36	15	2.9	0.8	0.5	2	0.31
91-031-3 MUD	-5	-0.01	-0.05	1	4.5	1.6	-4	90	19	38	12	2.9	1	-0.5	1.9	0.36
91-031-4 MUD	-5	-0.01	-0.05	-1	4.7	1.7	-4	89	20	41	18	3.1	1	-0.5	2.06	0.34
91-031-5 MUD	-5	-0.01	-0.05	-1	4.3	1.9	-4	104	19	38	15	3	0.9	0.6	2.02	0.35
91-031-6 MUD	-5	-0.01	-0.05	-1	4.5	2	-4	70	21	41	17	3.2	1	-0.5	2.15	0.35
91-031-7 MUD	-5	-0.01	-0.05	-1	4.1	1.9	-4	84	18	34	14	2.7	0.8	0.7	1.85	0.35
91-031-8 MUD	-5	-0.01	0.06	-1	3.3	1.1	-4	113	13	28	8	2.1	0.6	-0.5	2.17	0.39
91-031-9 MUD	-5	-0.01	-0.05	1	4.8	1.7	-4	122	22	43	15	3.2	1	-0.5	2.01	0.34
91-031-11 MUD	-5	-0.01	-0.05	-1	2	0.8	5	69	9	20	7	1.8	0.6	-0.5	2.07	0.31
91-031-12 MUD	-5	-0.02	-0.05	-1	3.8	-0.5	-4	86	18	34	15	2.8	0.9	-0.5	2.23	0.35
91-031-13 MUD	-5	-0.01	-0.05	-1	7.9	4.1	-4	113	35	78	31	6	1.9	1.2	4.47	0.68
91-031-14 MUD	-5	-0.01	0.08	-1	5.8	-0.5	-4	110	32	70	22	5	1.6	0.8	3.1	0.51
91-031-16 MUD	-5	-0.04	-0.05	-1	6.8	3.7	-9	1400	27	68	52	4.6	1.1	-0.5	3.4	0.47
91-031-20 MUD	-5	-0.01	-0.05	-1	7.1	2.1	-4	97	36	73	29	5	1.3	0.9	2.79	0.48
91-031-24 MUD	-5	-0.03	-0.05	-1	8	-0.6	-4	180	43	88	39	6.8	1.7	-0.5	3.65	0.71
91-031-26 MUD	-5	-0.01	-0.05	-1	6.5	2.4	-4	74	33	65	24	4.8	1.2	0.9	3.46	0.57
91-031-28 MUD	-5	-0.01	-0.05	-1	7.2	2.3	-4	87	38	77	27	5.3	1.3	0.8	3.49	0.58
91-031-34 MUD	-5	-0.01	-0.05	-1	11	3.8	-4	60	52	100	44	7.4	1.9	1.4	6.09	0.99
91-031-36 MUD	-5	-0.01	0.05	-1	7	2.7	-4	63	36	75	33	6.5	1.5	1.3	5.14	0.79
91-031-38 MUD	-5	-0.01	0.1	-1	6.9	3.1	-4	86	34	66	23	4.8	1.3	0.8	3.08	0.52
91-031-40 MUD	-5	-0.01	-0.05	-1	6.2	1.8	-4	128	28	62	23	4.9	1.6	1	3.41	0.5
91-031-42 MUD	-5	-0.01	-0.05	1	7.3	2.7	-4	99	33	68	25	5.6	1.7	1	3.96	0.64
91-031-46 MUD	-5	-0.01	0.06	1	8.7	3.2	-4	63	39	79	35	6.4	1.7	1.3	5.55	0.89
91-031-48 MUD	-5	-0.01	-0.05	-1	7.9	3.9	-4	89	38	82	32	6.4	1.6	1.2	5.82	0.93
91-031-50 MUD	-5	-0.01	-0.05	2	16	12	-4	245	89	160	92	18	4.2	3	10.9	1.73
91-031-51 MUD	-5	-0.01	-0.05	1	14	4.4	-4	130	55	140	51	10	2.5	2	8.96	1.31
91-031-52 MUD	-5	-0.03	-0.05	-1	10	7.2	-4	262	53	130	58	11	3.1	1.8	7.91	1.24
91-031-53 MUD	-5	-0.01	0.1	2	11	2.6	-4	479	58	150	52	10	2.7	1.8	6.62	1.02
91-031-54 MUD	-5	-0.01	-0.05	-1	4.5	1.6	-4	54	24	48	16	4.1	1.6	-0.5	2.91	0.48
91-031-56 MUD	-5	-0.01	-0.05	1	5.6	2.4	-4	76	28	56	24	4.6	1.7	1	3.7	0.63
91-031-58 MUD	-5	-0.01	-0.05	-1	3.9	1.4	-4	105	22	45	18	3.9	1.3	0.5	2.48	0.41
91-031-60 MUD	-5	-0.01	0.09	-1	4.2	2.2	-4	82	23	46	17	3.8	1.4	0.8	2.29	0.41
91-031-62 MUD	-5	-0.01	-0.05	-1	4	-0.5	-4	125	22	44	16	3.6	1.2	0.8	2.16	0.36
91-031-64 MUD	-5	-0.01	-0.05	-1	16	4.3	12	140	53	100	38	7	2.1	1.3	5.01	0.84
91-031-66 MUD	-5	-0.01	-0.05	-1	11	3.6	-4	119	42	83	33	6.2	2.2	1.1	4.7	0.78
91-031-68 MUD	-5	-0.01	0.11	-1	7	2	-4	100	29	57	23	4.7	1.5	0.9	3.48	0.51
91-031-70 MUD	-5	-0.01	-0.05	1	8.1	2.6	-4	81	33	62	25	4.7	1.5	-0.5	4.38	0.76
91-031-72 MUD	-5	-0.01	0.12	1	6.2	1.7	-4	201	29	55	25	4.2	1.2	0.7	2.89	0.44
91-031-76 MUD	-5	-0.01	0.09	-1	3.5	-0.5	-4	153	21	44	21	3	0.8	-0.5	1.47	0.27
91-026-011S MUD	8	-0.01	-0.05	-1	0.9	-0.5	9	699	6	15	5	1.6	0.5	-0.5	2.1	0.39
91-026-011S-2 MUD	11	-0.02	-0.05	-1	1.7	-0.5	11	1050	9	16	8	2.1	0.4	0.6	2.81	0.54
91-026-011S-3 MUD	14	-0.02	-0.05	-1	1.8	-0.5	8	989	9	15	9	2.1	0.5	-0.5	2.78	0.5

Element	Au	Ag	As	Ba	Br	Ca	Co	Cr	Cs	Fe	Hf	Hg	Ir	Mo	Na	Ni	Rb	Sb	Sc
Units	PPB	PPM	PPM	PPM	PPM	%	PPM	PPM	PPM	%	PPM	PPM	PPB	PPM	PPM	PPM	PPM	PPM	PPM
Detection Limit	5	5	2	100	1	1	5	10	2	0.02	1	1	5	5	500	50	30	0.2	0.1
91-026-011B MUD	420	-5	220	-100	14	2	380	280	-2	20.9	1	1	-5	-5	1910	150	-30	12	23
91-026-011B-2 MUD	495	-5	300	-100	18	-1	490	310	-2	26.9	-1	-1	-5	10	2320	240	-30	16	32
91-026-011B-3 MUD	480	-5	290	-100	17	-1	480	310	-2	26.1	2	-1	-5	-5	2350	170	-30	16	31
91-026-012S MUD	340	-5	220	190	8	1	410	310	-2	20.8	-1	1	-5	5	1600	-50	-30	8.8	25
91-026-012S-2 MUD	404	-5	280	-100	9	1	520	350	-2	26.7	1	-1	-5	10	1800	200	32	11	35
91-026-012S-3 MUD	417	-5	280	-100	10	2	510	330	-2	25.9	2	-1	-5	-5	1810	290	-30	11	34
91-026-012M MUD	234	-5	230	-100	3	2	330	410	-2	20.2	-1	-1	-5	6	1220	320	-30	8	27
91-026-012M-2 MUD	230	-5	240	-100	4	2	350	430	-2	23.5	-1	-1	-5	-5	1400	-50	-30	9.7	39
91-026-012M-3 MUD	234	-5	250	-100	4	2	350	420	-2	23.5	1	-1	-5	-5	1400	310	-30	9.6	38
91-026-013 MUD	425	-5	200	-100	26	1	400	270	-2	20.1	2	-1	-5	8	2990	170	-30	11	21
91-026-013-2 MUD	536	-5	270	-100	36	1	520	290	-2	26	4	2	-5	11	4010	110	-30	15	30
91-026-013-3 MUD	500	-5	260	-100	34	2	490	280	-2	24.5	3	1	-5	10	3880	90	-30	14	28
91-026-014 MUD	25	-5	5	300	39	4	14	360	-2	3.63	13	-1	-5	-5	16500	74	-30	0.6	18
91-026-016 MUD	28	-5	6	290	46	4	16	400	-2	3.84	14	-1	-5	-5	15600	70	31	0.7	19
91-026-019 MUD	53	-5	9	340	39	4	13	250	-2	4.14	16	-1	-5	-5	14600	-50	36	0.8	13
91-026-020 MUD	246	-5	110	-100	97	4	220	250	-2	13.4	4	-1	-5	9	5810	-50	31	5	18
91-026-020-2 MUD	367	-5	160	-100	140	7	310	320	-2	18.8	9	1	-5	-5	8420	200	-30	6.8	28
91-026-021 MUD	95	-5	40	330	130	5	72	210	-2	7.58	9	-1	-5	-5	11100	67	30	2.5	16
91-026-023 MUD	145	-5	67	220	90	3	100	220	-2	9.63	6	-1	-5	-5	8590	-50	-30	2.9	17
91-026-024S MUD	81	-5	33	390	120	5	61	190	-2	6.66	11	-1	-5	-5	11700	-50	36	1.9	15
91-026-024B MUD	76	-5	30	320	100	5	45	200	2	6.62	12	-1	-5	-5	13100	-50	40	1.8	15
91-026-025S MUD	75	-5	34	380	170	5	48	180	-2	6.83	7	-1	-5	-5	11500	-50	35	1.7	15
91-026-025B MUD	113	-5	31	390	120	5	50	210	-2	6.76	12	-1	-5	-5	12300	86	37	1.7	16
91-026-026 MUD	109	-5	6	360	100	7	10	77	-2	4.66	13	-1	-5	-5	15300	-50	34	0.5	14
91-026-027 MUD	249	-5	4	230	6	3	14	500	-2	20.3	74	-1	-5	-5	5660	-50	-30	0.7	19
91-026-029 MUD	35	-5	5	400	94	6	10	140	-2	4.74	12	-1	-5	-5	15000	-50	-30	0.4	15
91-026-030 MUD	48	-5	5	330	89	6	10	200	-2	6.66	22	-1	-5	-5	12100	-50	-30	0.5	15
91-026-031 MUD	26	-5	2	270	4	4	10	270	-2	8.23	38	-1	-5	-5	14600	61	-30	0.6	19
91-026-033 MUD	11	-5	2	330	11	4	10	700	-2	5.16	24	-1	-5	-5	13800	90	-30	0.4	17
91-026-034 MUD	5	-5	3	330	12	3	8	400	-2	3.78	17	-1	-5	-5	14400	58	32	0.4	13
91-026-035 MUD	7	-5	8	430	66	3	9	170	-2	2.94	8	-1	-5	-5	14000	58	51	0.5	9.9
91-026-036 MUD	33	-5	6	250	140	6	-5	180	-2	1.56	14	-1	-5	-5	13700	-50	-30	0.5	7.3
91-026-037 MUD	-5	-5	8	230	97	4	6	300	-2	1.94	25	-1	-5	-5	15100	-50	31	0.6	9
91-026-038S MUD	-5	-5	6	250	100	3	5	200	-2	1.79	22	-1	-5	-5	16000	-50	36	0.6	8.8
91-026-038B MUD	-5	-5	5	300	84	3	6	180	-2	1.8	18	-1	-5	-5	16500	-50	33	0.5	8.8
91-026-039 MUD	-5	-5	11	290	220	7	5	120	2	1.77	10	-1	-5	-5	14400	-50	34	0.7	7.5
91-026-040 MUD	-5	-5	10	310	150	6	6	130	-2	1.68	11	-1	-5	-5	15300	-50	39	0.5	7.3
91-026-043 MUD	-5	-5	9	260	150	5	5	160	-2	1.71	14	-1	-5	-5	14600	-50	-30	0.5	7.8
91-026-044 MUD	15	-5	13	510	170	2	8	110	2	2.96	43	-1	-5	-5	17700	-50	64	0.7	9
91-026-046 MUD	-5	-5	19	520	220	8	8	110	-2	3.92	37	-1	-5	-5	15400	-50	82	0.5	8
91-026-047 MUD	11	-5	16	310	270	14	5	87	-2	1.41	10	-1	-5	-5	11900	-50	36	0.5	4.6
91-026-048 MUD	10	-5	6	440	70	2	-5	130	-2	3.38	76	-1	-5	-5	16000	-50	73	0.5	8.5
91-026-049 MUD	-5	-5	6	450	43	2	-5	130	-2	3.85	100	-1	-5	-5	16900	-50	77	0.4	8.3
91-026-050 MUD	-5	-5	4	380	190	14	5	76	-2	1.6	6	-1	-5	-5	12700	-50	57	0.6	5.1
91-026-051 MUD	-5	-5	5	460	88	10	6	94	-2	1.36	13	-1	-5	-5	14300	-50	55	0.5	4.9
91-026-052 MUD	-5	-5	4	250	120	13	5	110	-2	1.58	10	-1	-5	-5	14300	-50	48	1	5.2

Element	Se	Sn	Sr	Ta	Th	U	W	Zn	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu
Units	PPM	%	%	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM
Detection Limit	5	0.01	0.05	1	0.5	0.5	4	50	1	3	5	0.1	0.2	0.5	0.05	0.05
91-026-011B MUD	19	-0.01	-0.05	-1	-0.5	-0.5	6	1830	4	7	-5	1.2	0.3	-0.5	1.48	0.3
91-026-011B-2 MUD	28	-0.02	-0.05	-1	0.9	-0.5	9	2220	5	12	7	1.4	0.4	-0.5	2.2	0.35
91-026-011B-3 MUD	26	-0.02	-0.05	1	-0.5	-0.5	9	2150	5	12	6	1.4	0.5	-0.5	2.11	0.3
91-026-012S MUD	16	-0.01	-0.05	-1	-0.5	2	-4	2260	3	5	-5	0.8	0.3	-0.5	1.79	0.22
91-026-012S-2 MUD	13	-0.02	-0.05	-1	0.9	-0.5	6	2800	4	10	6	1.3	-0.2	0.8	2.42	0.36
91-026-012S-3 MUD	16	-0.02	-0.05	-1	-0.5	-0.5	-4	2820	4	6	6	1.2	-0.2	-0.5	2.28	0.33
91-026-012M MUD	11	-0.01	-0.05	-1	-0.5	-0.5	5	750	2	7	-5	0.9	0.2	-0.5	1.52	0.3
91-026-012M-2 MUD	15	-0.02	-0.05	-1	-0.5	-0.5	7	928	3	7	-5	1.1	-0.2	0.8	2.15	0.23
91-026-012M-3 MUD	8	-0.02	-0.05	-1	0.9	-0.5	7	866	3	6	-5	1.1	-0.2	-0.5	2.24	0.38
91-026-013 MUD	15	-0.01	-0.05	-1	1.3	-0.5	-4	2870	6	13	6	1.5	0.4	-0.5	1.82	0.33
91-026-013-2 MUD	23	-0.02	-0.05	-1	1.5	-0.5	9	3430	8	16	7	1.9	-0.2	-0.5	2.26	0.44
91-026-013-3 MUD	22	-0.02	-0.05	-1	1.1	-0.5	7	3300	7	17	7	1.6	-0.2	-0.5	2.19	0.28
91-026-014 MUD	-5	-0.01	-0.05	-1	6.6	2.6	-4	94	27	57	22	4.7	1.4	1	3.87	0.65
91-026-016 MUD	-5	-0.01	-0.05	1	6.7	2.6	-4	133	28	59	21	4.9	1.4	1.1	4.02	0.66
91-026-019 MUD	-5	-0.01	-0.05	1	7.9	4	-4	95	35	72	29	5.7	1.6	1.1	4.8	0.75
91-026-020 MUD	5	-0.01	-0.05	-1	2.6	1.9	5	1330	13	28	8	2.5	0.7	0.6	2.15	0.42
91-026-020-2 MUD	13	-0.02	-0.05	-1	4.4	-0.5	-4	1810	20	35	16	3.5	1	-0.5	3.24	0.56
91-026-021 MUD	-5	-0.01	-0.05	-1	5.5	2.5	-4	414	26	54	19	4.4	1.4	0.9	3.33	0.56
91-026-023 MUD	-5	-0.01	-0.05	-1	4	1.1	5	708	19	37	12	3.4	1	-0.5	2.73	0.43
91-026-024S MUD	-5	-0.01	-0.05	-1	6.1	2.7	-4	383	28	61	22	4.9	1.4	1	3.78	0.67
91-026-024B MUD	-5	-0.01	-0.05	2	6.5	2.3	-4	269	30	62	27	5.3	1.6	1	4.27	0.69
91-026-025S MUD	-5	-0.01	-0.05	-1	6	1.6	-4	282	26	54	22	4.3	1.2	0.7	2.95	0.47
91-026-025B MUD	-5	-0.01	-0.05	1	6.3	2.4	-4	298	29	64	23	4.9	1.4	1	3.73	0.6
91-026-026 MUD	-5	-0.01	-0.05	2	6.7	2.9	-4	79	35	76	32	6.8	2.1	1.5	5.32	0.84
91-026-027 MUD	-5	-0.01	-0.05	4	15	5.3	5	116	48	94	35	6.6	1.8	1.4	9.36	1.57
91-026-029 MUD	-5	-0.01	-0.05	-1	6.7	2.7	-4	77	34	71	31	6.1	2	1.3	4.6	0.69
91-026-030 MUD	-5	-0.01	-0.05	1	7.9	2.5	-4	76	35	73	28	6.1	1.9	1.1	5.21	0.85
91-026-031 MUD	-5	-0.01	-0.05	3	8.3	3.6	-4	89	43	92	39	8.1	2.6	1.6	8.01	1.26
91-026-033 MUD	-5	-0.01	-0.05	2	7.4	2.6	-4	53	35	72	32	6.3	2.1	1.4	5.65	0.86
91-026-034 MUD	-5	-0.01	-0.05	1	6.8	2	-4	-50	33	66	28	5.7	1.8	1.2	4.7	0.77
91-026-035 MUD	-5	-0.01	-0.05	-1	7.6	2.6	-4	90	32	65	25	4.6	1.2	0.8	2.81	0.44
91-026-036 MUD	-5	-0.01	-0.05	1	5.8	3.2	-4	64	26	50	21	3.9	1.1	0.7	3.11	0.48
91-026-037 MUD	-5	-0.01	-0.05	-1	8.3	3.3	-4	60	34	71	26	5.2	1.4	0.9	4.35	0.7
91-026-038S MUD	-5	-0.01	-0.05	-1	8.2	3.3	-4	-50	33	69	27	5.2	1.4	1.1	4.52	0.69
91-026-038B MUD	-5	-0.01	-0.05	1	7.6	2.6	-4	-50	29	61	24	4.8	1.3	0.9	3.83	0.6
91-026-039 MUD	-5	-0.01	-0.05	1	6.4	4	-4	64	27	54	20	4.1	1.1	0.6	2.67	0.44
91-026-040 MUD	-5	-0.01	0.06	-1	6.2	1.9	-4	85	25	52	20	4	1.1	0.6	2.83	0.44
91-026-043 MUD	-5	-0.01	-0.05	1	7	2.7	-4	55	28	58	23	4.5	1.1	0.9	3.3	0.54
91-026-044 MUD	-5	-0.01	-0.05	2	19	4.5	-4	77	51	120	46	8.7	1.8	1.4	6.24	1.04
91-026-046 MUD	-5	-0.02	-0.05	3	25	9	-4	110	68	160	53	9.5	2	1.2	5.77	0.89
91-026-047 MUD	-5	-0.01	0.13	-1	8	1.6	-4	135	27	57	27	4.5	1	-0.5	2.4	0.43
91-026-048 MUD	-5	-0.01	-0.05	3	31	7.7	5	66	67	160	61	11	2	1.9	9.52	1.46
91-026-049 MUD	-5	-0.01	-0.05	2	36	10	-4	-50	70	170	75	13	2.2	2.2	11.1	1.73
91-026-050 MUD	-5	-0.01	0.07	-1	9.2	4.2	-4	81	31	61	28	4.5	1.1	0.7	2.56	0.34
91-026-051 MUD	-5	-0.01	0.09	2	8.2	-0.5	-4	110	28	64	28	4.5	1	-0.5	2.54	0.42
91-026-052 MUD	-5	-0.01	0.09	-1	8.5	-0.5	-4	109	30	64	26	4.9	1.1	0.8	2.86	0.37

Element		Au	Ag	As	Ba	Br	Ca	Co	Cr	Cs	Fe	Hf	Hg	Ir	Mo	Na	Ni	Rb	Sb	Sc
Units		PPB	PPM	PPM	PPM	PPM	%	PPM	PPM	PPM	%	PPM	PPM	PPB	PPM	PPM	PPM	PPM	PPM	PPM
Detection Limit		5	5	2	100	1	1	5	10	2	0.02	1	1	5	5	500	50	30	0.2	0.1
91-031-1	SAND	-5	-5	5	110	3	2	38	2100	-2	4.07	1	-1	-5	-5	14500	530	-30	0.3	16
91-031-2	SAND	-5	-5	6	170	29	2	31	1300	-2	3.45	2	-1	-5	-5	11800	470	-30	0.3	12
91-031-3	SAND	-5	-5	3	110	39	6	20	660	-2	3.01	1	-1	-5	-5	16600	200	-30	0.3	15
91-031-4	SAND	-5	-5	10	170	18	2	30	1400	-2	3.29	2	-1	-5	-5	9740	550	-30	0.3	9
91-031-5	SAND	-5	-5	5	250	34	2	25	840	-2	3	2	-1	-5	-5	11800	400	-30	0.4	13
91-031-6	SAND	-5	-5	4	260	20	4	21	680	-2	2.82	2	-1	-5	-5	14200	270	38	0.3	16
91-031-7	SAND	-5	-5	6	320	50	12	26	760	-2	3.4	3	-1	-5	-5	18100	260	33	0.6	20
91-031-8	SAND	32	-5	-2	100	6	6	23	1000	-2	3.06	-1	-1	-5	-5	10900	190	-30	0.6	23
91-031-8-2	SAND	-5	-5	3	180	9	9	32	1200	-2	4.17	2	-1	-5	-5	16700	240	-30	0.8	34
91-031-8-3	SAND	5	-5	2	300	9	8	32	1200	-2	4	1	-1	-5	-5	15100	210	-30	0.8	32
91-031-9	SAND	-5	-5	6	100	7	3	24	480	-2	3.89	1	-1	-5	-5	21200	270	-30	0.3	18
91-031-11	SAND	6	-5	3	100	11	5	20	690	-2	3.28	-1	-1	-5	-5	17100	150	-30	0.9	22
91-031-12	SAND	-5	-5	2	-100	9	5	12	320	-2	2.68	1	-1	-5	-5	21900	-50	-30	0.7	24
91-031-13	SAND	-5	-5	3	380	3	1	8	41	-2	2.34	4	-1	-5	-5	18200	-50	53	-0.2	8.8
91-031-14	SAND	-5	-5	2	500	8	4	8	12	-2	3.26	4	-1	-5	-5	23600	-50	31	0.4	17
91-031-16	SAND	-5	-5	3	280	2	4	10	-10	-2	3.4	3	-1	-5	-5	25000	-50	-30	0.3	18
91-031-20	SAND	-5	-5	2	260	10	7	-5	23	-2	1.42	3	-1	-5	-5	18000	-50	37	0.3	4.3
91-031-24	SAND	-5	-5	3	230	2	3	7	53	-2	2.74	2	-1	-5	-5	24600	-50	-30	0.3	13
91-031-26	SAND	-5	-5	2	370	86	4	6	32	-2	1.89	3	-1	-5	-5	21200	-50	35	-0.2	8.2
91-031-28	SAND	-5	-5	3	270	8	4	5	36	-2	2.07	3	-1	-5	-5	23500	-50	31	-0.2	8.2
91-031-34	SAND	7	-5	2	370	7	2	-5	24	-2	2.12	5	-1	-5	-5	19900	-50	35	0.3	9.8
91-031-36	SAND	-5	-5	2	420	9	2	5	24	-2	1.88	7	-1	-5	-5	21300	-50	53	0.3	6.3
91-031-38	SAND	-5	-5	3	250	27	25	-5	21	-2	1.19	3	-1	-5	-5	10300	-50	-30	0.2	3.8
91-031-40	SAND	-5	-5	6	450	21	2	13	72	-2	3.37	4	-1	-5	-5	19600	-50	50	0.3	14
91-031-42	SAND	-5	-5	8	500	61	3	16	100	2	4.03	6	-1	-5	-5	24500	-50	71	0.6	17
91-031-46	SAND	-5	-5	5	370	7	3	7	62	-2	2.45	6	-1	-5	-5	21200	65	56	0.2	8
91-031-48	SAND	-5	-5	32	460	-1	2	9	21	-2	2.73	5	-1	-5	-5	22500	-50	61	0.4	8.8
91-031-50	SAND	-5	-5	3	310	9	3	6	47	-2	2.23	6	-1	-5	-5	20700	-50	59	0.2	7.4
91-031-51	SAND	-5	-5	-2	420	-1	3	12	32	-2	3.79	5	-1	-5	-5	23100	-50	32	-0.2	13
91-031-52	SAND	-5	-5	-2	440	2	2	9	23	-2	2.53	4	-1	-5	-5	22800	-50	30	-0.2	9
91-031-53	SAND	-5	-5	30	460	-1	2	8	22	-2	2.69	5	-1	-5	-5	22400	-50	63	0.3	8.7
91-031-54	SAND	-5	-5	8	280	8	4	11	70	-2	3.43	3	-1	-5	-5	27400	-50	-30	1.6	19
91-031-56	SAND	-5	-5	9	290	9	4	10	68	-2	3.61	4	-1	-5	-5	32200	-50	38	1.8	20
91-031-58	SAND	-5	-5	5	160	13	10	12	77	-2	3.76	2	-1	-5	-5	22400	-50	-30	0.8	18
91-031-60	SAND	-5	-5	3	120	7	9	17	100	-2	4.18	2	-1	-5	-5	21400	-50	-30	0.4	18
91-031-62	SAND	-5	-5	6	160	13	10	12	110	-2	3.2	2	-1	-5	-5	19700	-50	-30	0.6	14
91-031-64	SAND	-5	-5	4	230	4	5	13	160	-2	3.67	3	-1	-5	-5	25400	-50	-30	0.6	18
91-031-66	SAND	-5	-5	3	190	6	6	12	97	-2	3.44	2	-1	-5	-5	30800	57	-30	0.6	18
91-031-68	BROKEN	5	-5	6	260	8	7	16	130	-2	4.2	3	-1	-5	-5	32500	-50	-30	0.5	20
91-031-68	SAND	-5	-5	3	170	6	7	16	110	-2	4.24	3	-1	-5	-5	34800	-50	-30	0.3	23
91-031-70	SAND	-5	-5	2	290	7	2	9	89	-2	2.25	4	-1	-5	-5	21600	-50	-30	2.1	13
91-031-72	SAND	-5	-5	3	510	27	5	7	38	-2	2.17	5	-1	-5	-5	28400	-50	44	1.1	10
91-031-76	SAND	-5	-5	6	170	20	13	13	63	-2	2.91	2	-1	-5	-5	19800	-50	-30	0.3	14
91-026-0115	SAND	27	-5	23	320	23	1	22	100	-2	4.38	5	-1	-5	-5	17200	-50	53	1.4	12
91-026-0115-2	SAND	28	-5	31	380	29	2	28	120	-2	5.59	7	-1	-5	-5	24400	-50	64	1.9	17
91-026-0115-3	SAND	25	-5	35	430	29	1	29	120	-2	5.71	7	-1	-5	-5	24200	-50	65	1.8	17

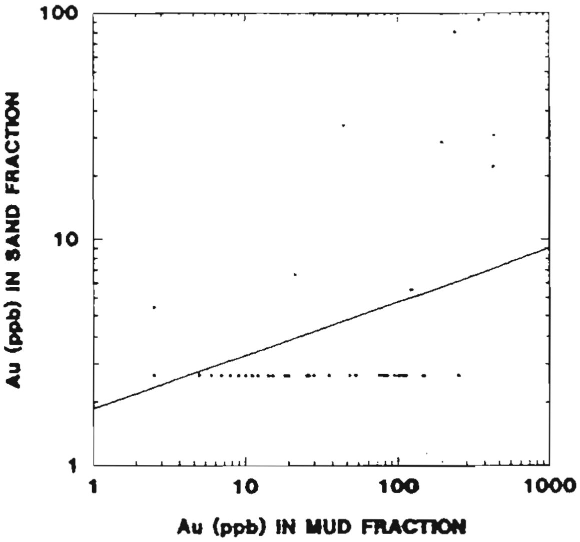
Element		Se	Sn	Sr	Ta	Th	U	W	Zn	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu
Units		PPM	%	%	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM
Detection Limit		5	0.01	0.05	1	0.5	0.5	4	50	1	3	5	0.1	0.2	0.5	0.05	0.05
91-031-1	SAND	-5	-0.01	-0.05	-1	1.1	-0.5	-4	79	4	10	-5	1	0.4	-0.5	1.05	0.15
91-031-2	SAND	-5	-0.01	-0.05	-1	1.9	-0.5	-4	76	8	16	6	1.3	0.5	-0.5	1.08	0.14
91-031-3	SAND	-5	-0.01	-0.05	-1	1.5	1	-4	70	9	16	6	1.4	0.5	-0.5	1.22	0.21
91-031-4	SAND	-5	-0.01	-0.05	-1	1.9	0.8	-4	-50	8	16	6	1.1	0.4	-0.5	0.84	0.16
91-031-5	SAND	-5	-0.01	-0.05	-1	2.1	1.3	-4	65	11	21	8	1.7	0.6	-0.5	1.2	0.19
91-031-6	SAND	-5	-0.01	-0.05	-1	2.3	-0.5	-4	61	11	22	9	1.7	0.6	-0.5	1.25	0.19
91-031-7	SAND	-5	-0.01	-0.05	-1	3	1.8	-4	55	14	23	12	1.9	0.6	-0.5	1.51	0.25
91-031-8	SAND	-5	-0.01	-0.05	-1	0.7	-0.5	-4	55	4	8	-5	0.7	0.3	-0.5	0.96	0.17
91-031-8-2	SAND	-5	-0.01	-0.05	-1	0.9	0.7	-4	98	5	10	6	1	0.4	-0.5	1.15	0.23
91-031-8-3	SAND	-5	-0.01	-0.05	-1	0.9	-0.5	-4	98	5	10	5	0.9	0.4	-0.5	1.27	0.25
91-031-9	SAND	-5	-0.01	-0.05	-1	1.3	-0.5	-4	55	6	13	6	1.1	0.4	-0.5	1.12	0.21
91-031-11	SAND	-5	-0.01	-0.05	-1	-0.5	-0.5	-4	62	3	7	-5	0.8	0.3	-0.5	1.18	0.17
91-031-12	SAND	-5	-0.01	-0.05	-1	1	-0.5	-4	-50	6	11	-5	1	0.5	-0.5	1.29	0.22
91-031-13	SAND	-5	-0.01	-0.05	-1	4.2	1.4	-4	64	18	36	14	2.7	0.9	0.5	2.02	0.31
91-031-14	SAND	-5	-0.01	0.05	1	4.3	1.7	-4	-50	22	43	17	3.3	1.4	0.6	2.51	0.42
91-031-16	SAND	-5	-0.01	-0.05	-1	3.7	1	-4	66	15	29	11	2.2	0.9	0.6	1.93	0.32
91-031-20	SAND	-5	-0.01	-0.05	-1	4.5	1.1	-4	-50	19	35	13	2.3	0.7	-0.5	1.66	0.26
91-031-24	SAND	-5	-0.01	-0.05	-1	2.6	1	-4	64	11	23	8	1.9	0.7	-0.5	1.91	0.32
91-031-26	SAND	-5	-0.01	0.05	-1	3.8	1.2	-4	-50	22	42	16	3	0.8	0.6	2.11	0.35
91-031-28	SAND	-5	-0.01	-0.05	-1	3.7	1	-4	53	18	34	12	2.3	0.7	0.5	2.06	0.34
91-031-34	SAND	-5	-0.01	-0.05	-1	5.2	1.1	-4	-50	23	45	17	3.3	1	-0.5	2.35	0.38
91-031-36	SAND	-5	-0.01	-0.05	-1	5	1.6	-4	53	24	49	17	3.7	1	0.6	3.03	0.49
91-031-38	SAND	-5	-0.01	0.13	-1	3.3	1.4	-4	-50	18	31	14	2.3	0.6	-0.5	1.4	0.23
91-031-40	SAND	-5	-0.01	0.05	-1	4.2	1.6	-4	100	19	38	15	3	1	0.5	2.15	0.34
91-031-42	SAND	-5	-0.01	-0.05	2	6.6	2.1	-4	-50	30	56	19	4.3	1.3	-0.5	3.05	0.35
91-031-46	SAND	-5	-0.01	-0.05	-1	5.7	1.9	-4	59	23	44	16	3.2	1	0.6	2.2	0.37
91-031-48	SAND	-5	-0.01	-0.05	-1	4.8	2	-4	143	24	50	15	3.4	1.2	0.7	2.75	0.4
91-031-50	SAND	-5	-0.01	-0.05	-1	5.7	1.9	-4	61	21	42	17	3.3	0.9	0.7	2.7	0.43
91-031-51	SAND	-5	-0.01	-0.05	-1	1.7	0.9	-4	95	26	43	21	4.2	1.5	0.8	2.9	0.43
91-031-52	SAND	-5	-0.01	-0.05	-1	1.7	-0.5	-4	57	14	27	13	2.5	1.1	-0.5	1.91	0.31
91-031-53	SAND	-5	-0.01	-0.05	-1	4.4	1.7	-4	122	24	48	18	3.4	1.1	0.7	2.55	0.42
91-031-54	SAND	-5	-0.01	-0.05	-1	2.3	0.7	-4	66	16	32	14	3	1.3	-0.5	2.24	0.35
91-031-56	SAND	-5	-0.01	-0.05	-1	3.4	2.5	-4	-50	19	38	10	3.2	1.2	-0.5	2.56	0.25
91-031-58	SAND	-5	-0.01	0.05	-1	2	-0.5	-4	61	14	29	13	2.8	1.1	-0.5	1.99	0.29
91-031-60	SAND	-5	-0.01	-0.05	-1	1.6	-0.5	-4	-50	12	26	10	2.5	1	-0.5	1.83	0.3
91-031-62	SAND	-5	-0.01	0.06	-1	2.8	1.1	-4	71	15	28	12	2.4	1	0.5	1.76	0.29
91-031-64	SAND	-5	-0.01	-0.05	-1	3	0.9	-4	62	17	34	12	3	1.3	0.5	2.15	0.33
91-031-66	SAND	-5	-0.01	0.05	-1	2.1	0.7	-4	66	15	29	11	2.8	1.3	0.6	2.03	0.34
91-031-68	BROKEN	-5	-0.01	-0.05	-1	2.4	-0.5	-4	-50	16	35	18	3	1.5	-0.5	2.24	0.36
91-031-68	SAND	-5	-0.01	-0.05	-1	2.2	-0.5	-4	67	17	33	9	3	1.3	-0.5	2.32	0.4
91-031-70	SAND	-5	-0.01	-0.05	-1	3.4	1.1	-4	-50	17	33	13	2.7	1.1	0.5	1.94	0.35
91-031-72	SAND	-5	-0.01	-0.05	-1	5.1	2.2	-4	80	23	40	17	3	1	0.6	2.53	0.46
91-031-76	SAND	-5	-0.01	0.09	-1	2.3	0.9	-4	65	13	25	10	2.1	0.8	-0.5	1.41	0.23
91-026-0115	SAND	-5	-0.01	-0.05	1	5.2	1	-4	135	19	42	16	3.6	1	0.9	3.22	0.5
91-026-0115-2	SAND	-5	-0.01	-0.05	2	7.6	2.2	-4	170	27	57	21	4.8	1.2	1.2	4.4	0.73
91-026-0115-3	SAND	-5	-0.01	-0.05	1	7.3	1.9	-4	146	26	55	19	5	1.3	-0.5	4.39	0.73

Element	Au	Ag	As	Ba	Br	Ca	Co	Cr	Cs	Fe	Hf	Hg	Ir	Mo	Na	Ni	Rb	Sb	Sc
Units	PPB	PPM	PPM	PPM	PPM	%	PPM	PPM	PPM	%	PPM	PPM	PPB	PPM	PPM	PPM	PPM	PPM	PPM
Detection Limit	5	5	2	100	1	1	5	10	2	0.02	1	1	5	5	500	50	30	0.2	0.1
91-026-011B SAND	21	-5	15	340	11	2	25	92	-2	3.97	5	-1	-5	-5	19200	71	55	1.6	12
91-026-011B-2 SAND	33	-5	19	350	15	2	32	100	-2	4.97	8	-1	-5	-5	25300	-50	57	1.9	16
91-026-011B-3 SAND	24	-5	19	440	15	-1	31	97	-2	4.99	8	-1	-5	-5	25200	-50	52	2	16
91-026-012S SAND	93	-5	60	-100	28	2	89	310	-2	13.4	1	-1	-5	-5	4940	93	-30	3.1	26
91-026-012S-2 SAND	100	-5	76	100	36	3	110	350	-2	17.2	2	-1	-5	-5	6350	130	-30	4.2	37
91-026-012S-3 SAND	112	-5	83	-100	36	3	120	360	-2	18	2	-1	-5	-5	6560	-50	-30	4.2	38
91-026-012M SAND	83	-5	61	-100	7	2	91	340	-2	12.7	-1	-1	-5	-5	2460	-50	-30	3.3	26
91-026-012M-2 SAND	117	-5	90	-100	12	3	130	430	-2	18.6	-1	-1	-5	-5	3880	180	-30	4.8	40
91-026-012M-3 SAND	105	-5	88	-100	13	2	130	440	-2	19.1	2	-1	-5	5	3920	210	-30	4.9	41
91-026-013 SAND	29	-5	19	320	14	2	33	110	-2	4.12	5	-1	-5	-5	18500	-50	49	1.7	12
91-026-013-2 SAND	40	-5	19	390	19	3	37	110	-2	4.88	7	-1	-5	-5	23600	-50	65	2.3	16
91-026-013-3 SAND	36	-5	22	450	19	3	40	120	-2	4.91	7	-1	-5	-5	24300	-50	61	2.1	17
91-026-014 SAND	-5	-5	3	250	7	4	13	280	-2	2.62	3	-1	-5	-5	16300	63	34	0.3	14
91-026-016 SAND	-5	-5	5	280	8	3	14	380	-2	2.96	3	-1	-5	-5	18000	97	33	0.3	16
91-026-019 SAND	-5	-5	7	320	6	3	8	83	-2	2.83	5	-1	-5	-5	21300	-50	44	0.9	12
91-026-020 SAND	-5	-5	7	130	11	17	10	160	-2	2.3	2	-1	-5	-5	13800	-50	32	1.2	10
91-026-021 SAND	-5	-5	7	320	9	6	7	65	-2	1.96	4	-1	-5	-5	14900	-50	39	1	9
91-026-023 SAND	-5	-5	7	250	9	5	13	84	-2	3.59	4	-1	-5	-5	18400	-50	-30	0.7	16
91-026-024S SAND	-5	-5	6	350	9	5	7	72	-2	2.48	5	-1	-5	-5	16800	-50	46	1	9.4
91-026-024B SAND	-5	-5	6	390	9	6	6	64	-2	2.47	5	-1	-5	-5	17500	-50	42	1.2	9.5
91-026-025S SAND	-5	-5	6	230	8	4	12	85	-2	3.26	5	-1	-5	-5	20900	-50	40	1	16
91-026-025B SAND	-5	-5	5	220	7	4	12	78	-2	3.16	4	-1	-5	-5	20000	-50	42	1.1	15
91-026-026 SAND	-5	-5	3	230	8	7	6	36	-2	2.6	5	-1	-5	-5	18000	-50	38	0.3	8.8
91-026-027 SAND	-5	-5	2	160	4	4	9	140	-2	6.69	5	-1	-5	-5	16000	-50	-30	0.5	21
91-026-029 SAND	-5	-5	3	280	7	6	11	180	-2	3.29	3	-1	-5	-5	19400	-50	31	0.5	16
91-026-030 SAND	-5	-5	-2	240	6	5	10	140	-2	3.76	4	-1	-5	-5	18600	-50	-30	0.4	17
91-026-031 SAND	-5	-5	-2	240	-1	2	-5	45	-2	1.93	4	-1	-5	-5	20900	-50	40	0.4	8.7
91-026-033 SAND	-5	-5	4	330	5	2	8	490	-2	1.92	4	-1	-5	-5	16500	70	30	0.3	9.2
91-026-034 SAND	-5	-5	6	300	9	1	11	430	-2	2.09	3	-1	-5	-5	14700	190	32	0.3	6.7
91-026-035 SAND	-5	-5	-2	330	7	2	7	200	-2	1.84	3	-1	-5	-5	15400	84	34	-0.2	7
91-026-036 SAND	-5	-5	3	530	10	4	6	24	-2	2.2	10	-1	-5	-5	27000	-50	63	0.3	8
91-026-037 SAND	-5	-5	-2	220	6	2	6	120	-2	1.9	2	-1	-5	-5	15100	-50	39	0.4	7.3
91-026-038S SAND	-5	-5	4	270	130	3	-5	86	-2	1.54	5	-1	-5	-5	17100	-50	39	0.5	6.8
91-026-038B SAND	-5	-5	-2	260	48	2	-5	67	-2	1.38	3	-1	-5	-5	15900	-50	46	0.5	6
91-026-039 SAND	-5	-5	4	210	7	5	7	96	-2	2.34	2	-1	-5	-5	12500	-50	44	0.4	8.1
91-026-040 SAND	-5	-5	7	270	9	4	8	100	2	2.62	3	-1	-5	-5	12500	-50	54	0.5	8.7
91-026-043 SAND	5	-5	3	280	32	7	5	100	-2	1.66	3	-1	-5	-5	14700	-50	38	0.3	6.7
91-026-044 SAND	-5	-5	-2	390	3	1	-5	26	-2	0.77	5	-1	-5	-5	19000	-50	75	-0.2	2.4
91-026-045 SAND	-5	-5	-2	470	2	-1	-5	16	-2	0.75	2	-1	-5	-5	19000	-50	120	-0.2	2.4
91-026-046 SAND	-5	-5	-2	470	2	2	-5	24	2	0.83	3	-1	-5	-5	20000	-50	110	-0.2	2.6
91-026-047 SAND	-5	-5	-2	410	3	3	-5	50	-2	0.75	1	-1	-5	-5	18800	-50	90	-0.2	2.6
91-026-048 SAND	-5	-5	-2	410	4	-1	-5	16	-2	0.37	3	-1	-5	-5	18300	-50	87	-0.2	1.7
91-026-049 SAND	-5	-5	-2	420	2	1	-5	21	-2	0.52	4	-1	-5	-5	21100	-50	96	-0.2	1.7
91-026-050 SAND	-5	-5	2	420	2	3	-5	19	2	0.72	2	-1	-5	-5	21700	-50	110	-0.2	2.3
91-026-051 SAND	-5	-5	-2	410	3	6	-5	19	-2	0.52	1	-1	-5	-5	17700	-50	88	-0.2	1.7
91-026-052 SAND	-5	-5	-2	380	2	3	-5	25	2	0.65	1	-1	-5	-5	21100	-50	120	-0.2	2.2

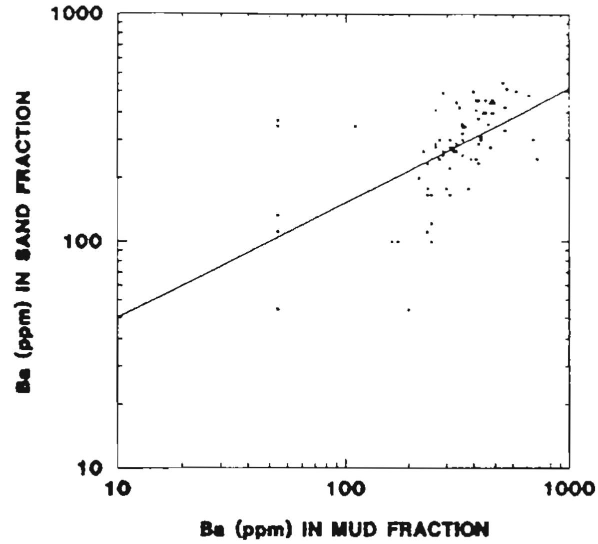
Element	Se	Sn	Sr	Ta	Th	U	W	Zn	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu
Units	PPM	%	%	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM
Detection Limit	5	0.01	0.05	1	0.5	0.5	4	50	1	3	5	0.1	0.2	0.5	0.05	0.05
91-026-011B SAND	-5	-0.01	-0.05	-1	5.6	1.9	-4	193	21	44	19	3.8	1.1	0.8	3.23	0.52
91-026-011B-2 SAND	-5	-0.01	-0.05	-1	7.2	2.7	-4	293	28	52	16	4.8	1.4	0.8	4.53	0.73
91-026-011B-3 SAND	-5	-0.01	-0.05	-1	7.5	2.8	-4	211	27	55	17	4.8	1.3	0.8	4.58	0.75
91-026-012S SAND	-5	-0.01	-0.05	-1	0.6	-0.5	-4	436	4	10	6	1.2	0.3	-0.5	1.85	0.3
91-026-012S-2 SAND	-5	-0.01	-0.05	-1	1.2	1.3	5	528	5	11	7	1.5	0.5	-0.5	2.37	0.37
91-026-012S-3 SAND	-5	-0.01	-0.05	-1	0.9	-0.5	8	586	5	9	5	1.6	0.4	-0.5	2.37	0.43
91-026-012M SAND	11	-0.01	-0.05	-1	-0.5	-0.5	-4	334	2	7	-5	0.9	0.2	-0.5	1.38	0.26
91-026-012M-2 SAND	-5	-0.02	-0.05	-1	0.6	-0.5	-4	473	4	7	8	1.3	0.3	-0.5	2.28	0.43
91-026-012M-3 SAND	-5	-0.02	-0.05	-1	-0.5	-0.5	-4	463	4	10	-5	1.4	0.3	-0.5	2.06	0.39
91-026-013 SAND	-5	-0.01	-0.05	1	4.6	1.6	-4	239	19	42	18	3.7	1.1	0.8	3.09	0.52
91-026-013-2 SAND	-5	-0.01	-0.05	-1	6.2	2	-4	256	25	49	18	4.4	1.2	0.9	3.78	0.52
91-026-013-3 SAND	-5	-0.01	-0.05	-1	6.3	2.2	-4	306	25	52	14	4.5	1.2	-0.5	3.97	0.65
91-026-014 SAND	-5	-0.01	-0.05	-1	3.1	1.1	-4	-50	13	26	10	2.2	0.7	-0.5	1.91	0.31
91-026-016 SAND	-5	-0.01	-0.05	-1	3.3	0.9	-4	87	14	28	12	2.2	0.7	-0.5	1.96	0.29
91-026-019 SAND	-5	-0.01	-0.05	-1	4.5	1.3	-4	56	19	39	19	3.5	1.1	0.8	3.18	0.5
91-026-020 SAND	-5	-0.01	0.12	-1	2.3	1.3	-4	57	12	23	9	1.9	0.7	-0.5	1.72	0.27
91-026-021 SAND	-5	-0.01	-0.05	-1	5.1	2.2	-4	64	17	36	11	2.8	0.8	0.7	2.45	0.38
91-026-023 SAND	-5	-0.01	-0.05	-1	3.6	1.3	-4	97	16	33	15	3.1	1.1	0.8	2.71	0.42
91-026-024S SAND	-5	-0.01	0.05	1	5.7	1.8	-4	59	22	46	20	3.8	1.1	0.8	3.22	0.5
91-026-024B SAND	-5	-0.01	0.06	-1	5.6	1.8	-4	78	22	44	19	3.7	1.2	0.8	3.16	0.48
91-026-025S SAND	-5	-0.01	-0.05	1	4.5	1.8	-4	78	17	37	16	3.6	1.1	1	3.39	0.55
91-026-025B SAND	-5	-0.01	-0.05	1	3.8	1.3	-4	79	15	32	15	3.2	1.1	0.9	3.19	0.48
91-026-026 SAND	-5	-0.01	-0.05	-1	4.2	1.5	-4	58	22	45	20	4	1.3	0.9	3.13	0.49
91-026-027 SAND	-5	-0.01	-0.05	-1	3	1.1	-4	65	16	36	16	3.7	1.5	0.7	2.69	0.41
91-026-029 SAND	-5	-0.01	-0.05	-1	3	1.2	-4	56	14	32	12	2.8	1	0.5	2.09	0.36
91-026-030 SAND	-5	-0.01	-0.05	1	2.8	1.2	-4	54	14	31	13	3	1.1	0.5	2.3	0.37
91-026-031 SAND	-5	-0.01	-0.05	-1	3.1	0.8	-4	51	16	34	14	3	1.2	-0.5	2.33	0.34
91-026-033 SAND	-5	-0.01	-0.05	-1	3	0.9	-4	-50	14	31	13	2.6	1	0.7	2.1	0.32
91-026-034 SAND	-5	-0.01	-0.05	-1	3.2	1.4	-4	-50	14	29	12	2.3	0.8	0.5	1.68	0.28
91-026-035 SAND	-5	-0.01	-0.05	-1	3.2	0.9	-4	-50	15	30	10	1.9	0.7	-0.5	1.44	0.21
91-026-036 SAND	-5	-0.01	-0.05	-1	6.4	1.3	-4	-50	30	56	18	4.4	1.2	1	3.69	0.47
91-026-037 SAND	-5	-0.01	-0.05	-1	3.6	1.3	-4	-50	16	35	12	2.4	0.8	-0.5	1.54	0.24
91-026-038S SAND	-5	-0.01	-0.05	-1	4.2	2	-4	51	20	40	17	3	0.9	0.7	2.12	0.33
91-026-038B SAND	-5	-0.01	-0.05	-1	3.5	1.2	-4	-50	17	32	12	2.5	0.8	-0.5	1.62	0.27
91-026-039 SAND	-5	-0.01	0.05	-1	4.6	1.7	-4	57	18	35	13	2.5	0.8	0.6	1.76	0.26
91-026-040 SAND	-5	-0.01	-0.05	-1	4.5	1.1	-4	58	20	39	13	2.8	0.9	0.5	1.76	0.28
91-026-043 SAND	-5	-0.01	0.07	-1	4	1	-4	50	19	38	15	2.8	0.9	0.6	1.76	0.27
91-026-044 SAND	-5	-0.01	-0.05	-1	6.5	1.8	-4	-50	26	58	22	4	1.1	0.6	2.07	0.32
91-026-045 SAND	-5	-0.01	-0.05	1	6	1	-4	-50	27	61	25	4.3	1.2	0.8	1.99	0.29
91-026-046 SAND	-5	-0.01	-0.05	1	5.8	1.2	-4	-50	24	50	20	3.3	1	-0.5	1.57	0.25
91-026-047 SAND	-5	-0.01	-0.05	1	4.4	1.2	-4	-50	22	52	21	3.8	1.1	0.6	1.96	0.25
91-026-048 SAND	-5	-0.01	-0.05	-1	4.5	0.9	-4	-50	19	45	17	3	0.9	0.5	1.57	0.21
91-026-049 SAND	-5	-0.01	-0.05	-1	5.3	1.1	4	-50	25	56	21	3.8	1.1	0.6	1.84	0.27
91-026-050 SAND	-5	-0.01	0.07	-1	5.6	1.2	-4	-50	23	48	18	2.9	1	0.5	1.3	0.18
91-026-051 SAND	-5	-0.01	0.06	-1	4.4	0.9	4	-50	20	44	17	2.8	0.8	-0.5	1.16	0.19
91-026-052 SAND	-5	-0.01	0.05	-1	4.7	0.9	-4	-50	21	39	14	2.2	0.9	-0.5	0.98	0.15

Appendix D

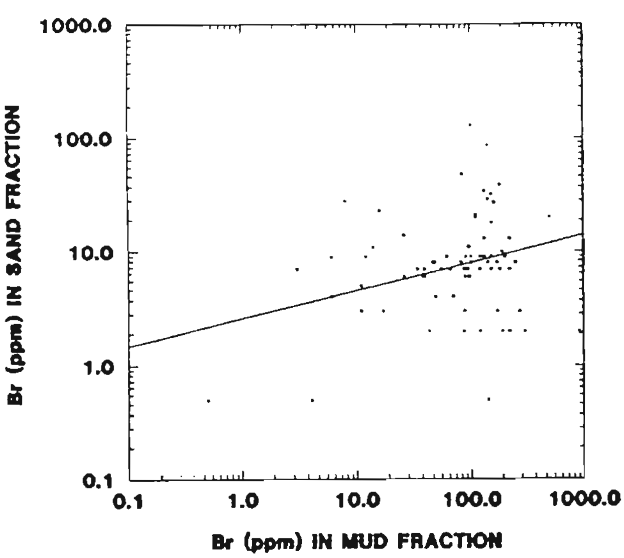
Scatter Plots of Element Concentrations in the Mud Fraction Versus Element Concentrations in the Sand Fraction



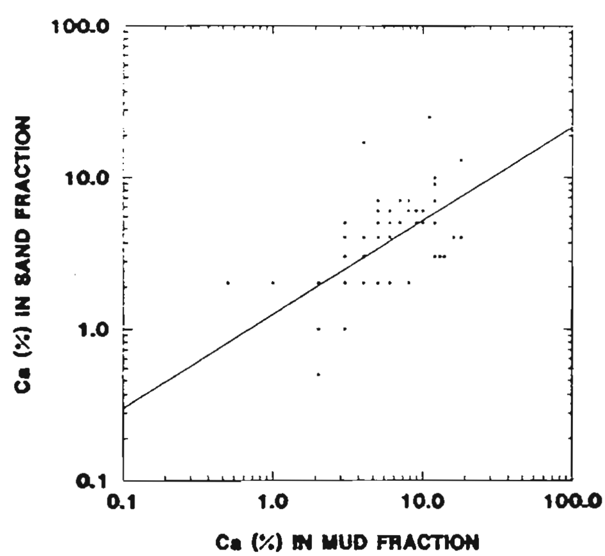
Au (ppb) IN SAND FRACTION
Au (ppb) IN MUD FRACTION



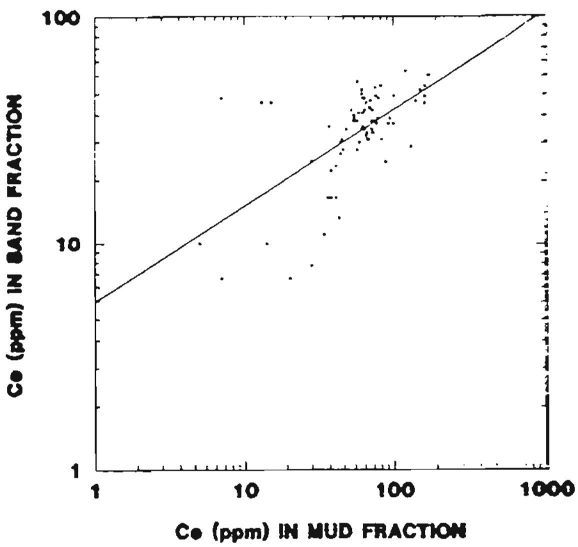
Ba (ppm) IN SAND FRACTION
Ba (ppm) IN MUD FRACTION

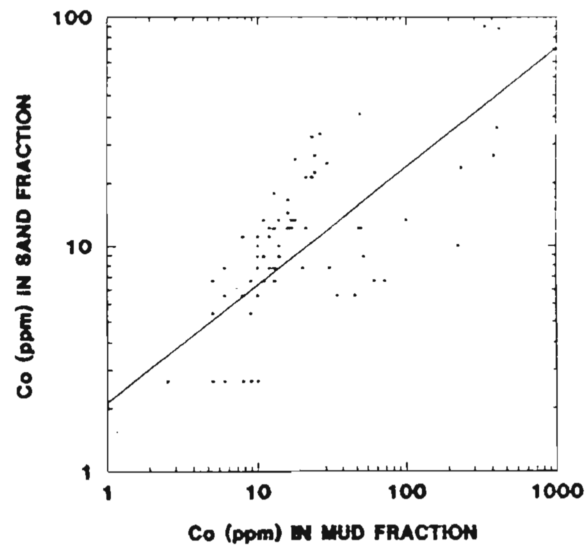


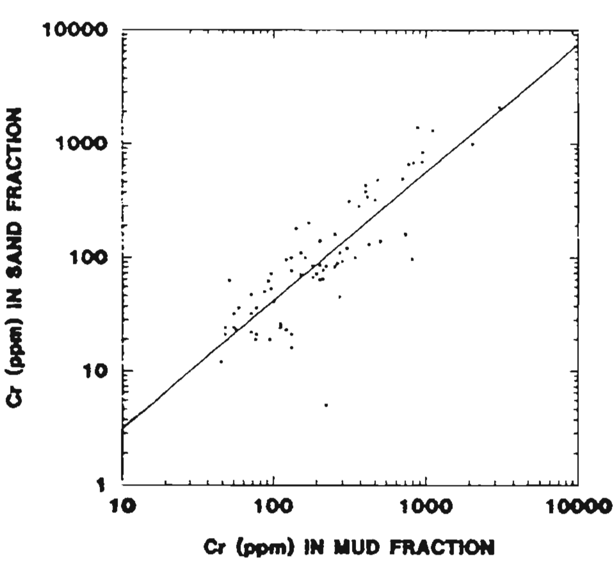
Br (ppm) IN SAND FRACTION
Br (ppm) IN MUD FRACTION

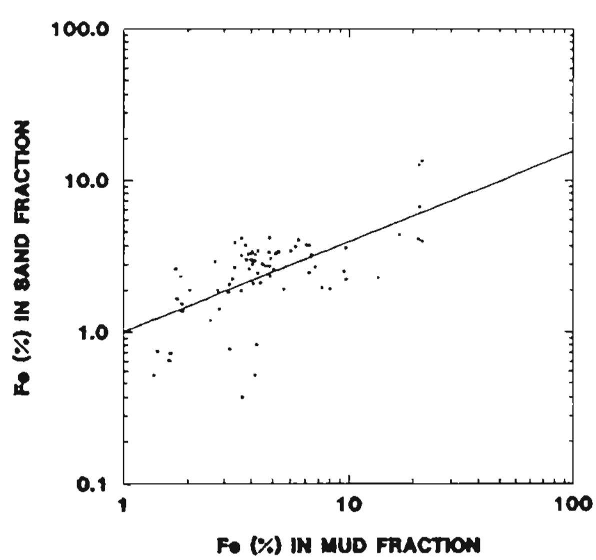


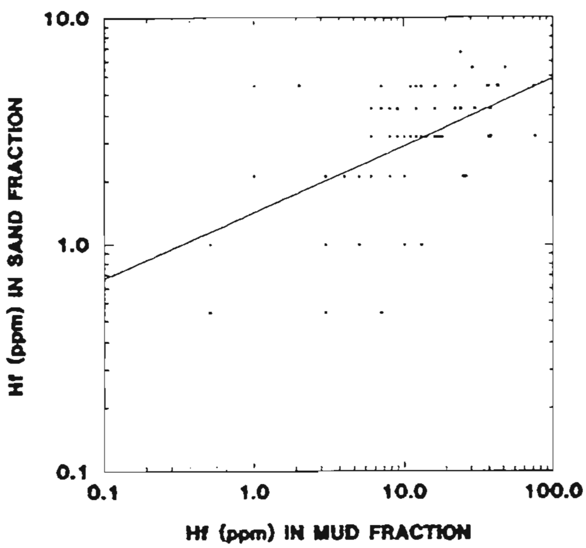
Ca (%) IN SAND FRACTION
Ca (%) IN MUD FRACTION


Ce (ppm) IN SAND FRACTION
Ce (ppm) IN MUD FRACTION
100
10
1
1
10
100
1000

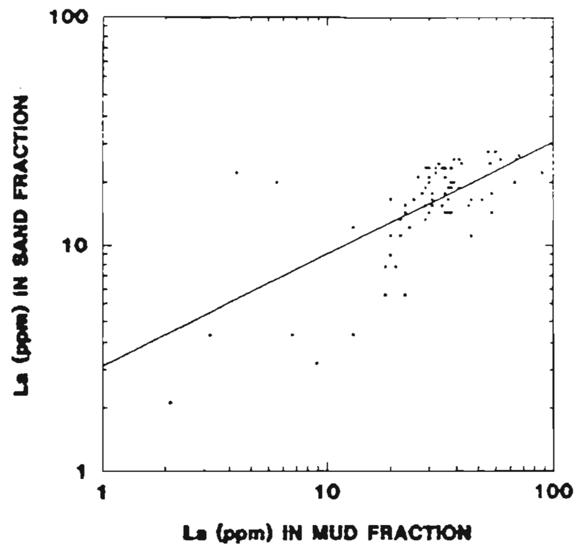

Co (ppm) IN SAND FRACTION
Co (ppm) IN MUD FRACTION
100
10
1
1
10
100
1000


Cr (ppm) IN SAND FRACTION
Cr (ppm) IN MUD FRACTION
10000
1000
100
10
1
10
100
1000
10000

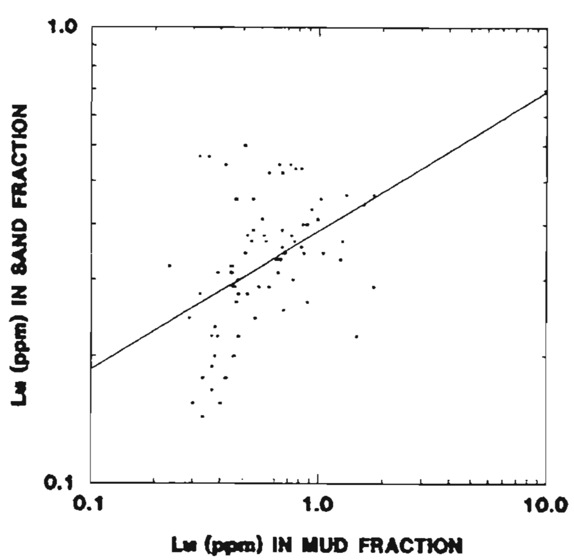

Fe (%) IN SAND FRACTION
Fe (%) IN MUD FRACTION
100.0
10.0
1.0
0.1
1
10
100



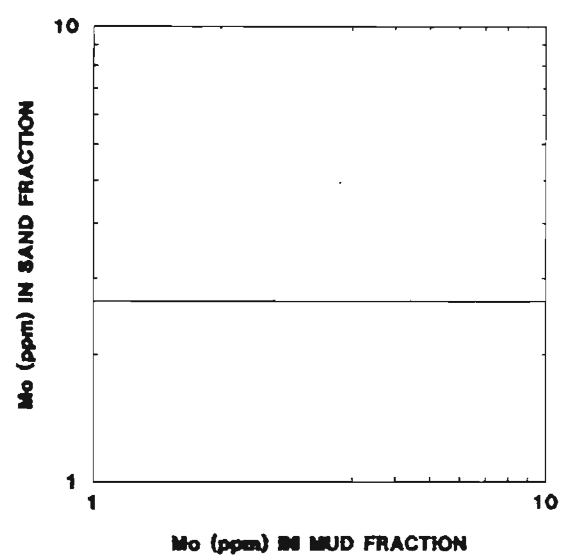
Hf (ppm) IN SAND FRACTION
Hf (ppm) IN MUD FRACTION
10.0
1.0
0.1
0.1
1.0
10.0
100.0



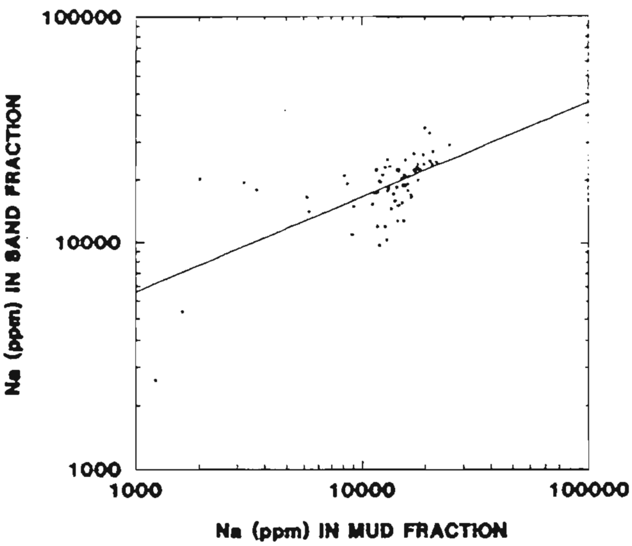
La (ppm) IN SAND FRACTION
La (ppm) IN MUD FRACTION
100
10
1
1
10
100

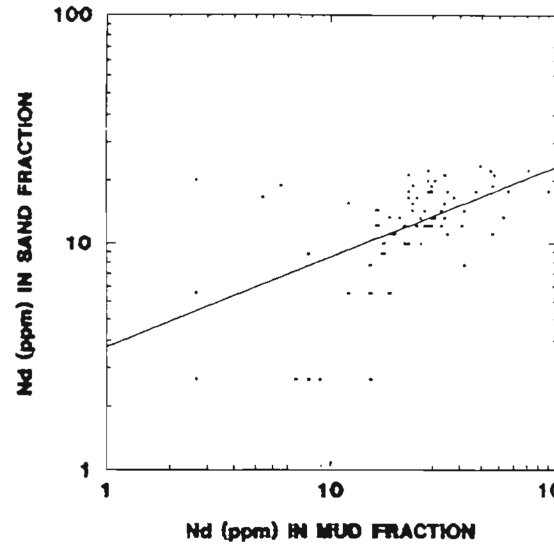


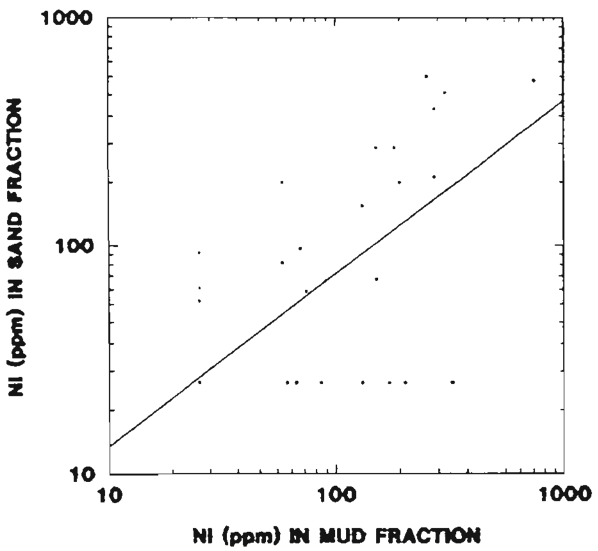
Lu (ppm) IN SAND FRACTION
Lu (ppm) IN MUD FRACTION
1.0
0.1
0.1
1.0
10.0

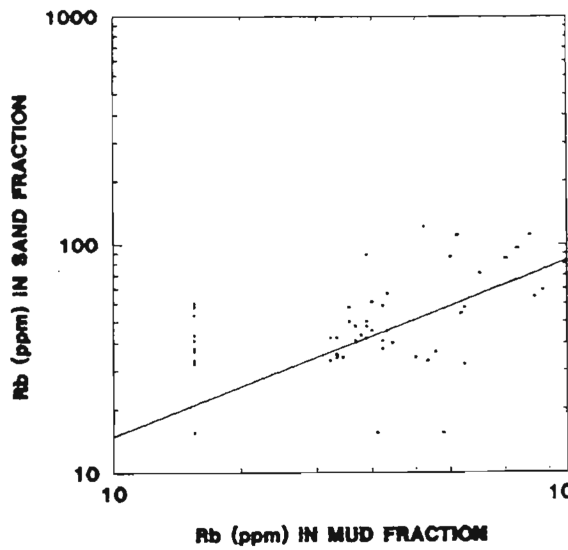


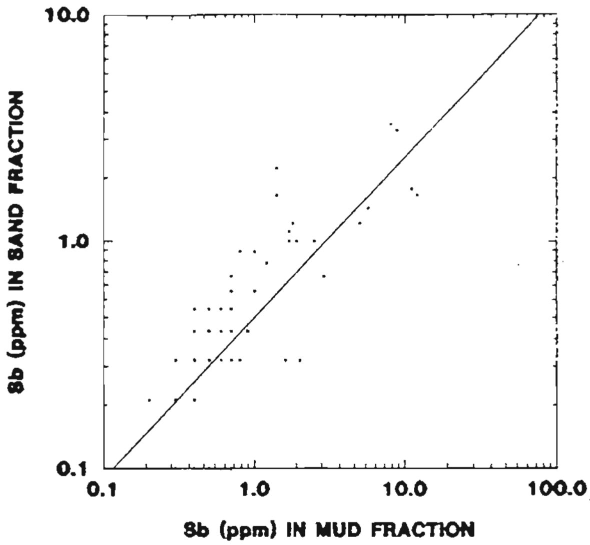
Mo (ppm) IN SAND FRACTION
Mo (ppm) IN MUD FRACTION
10
1
1
10

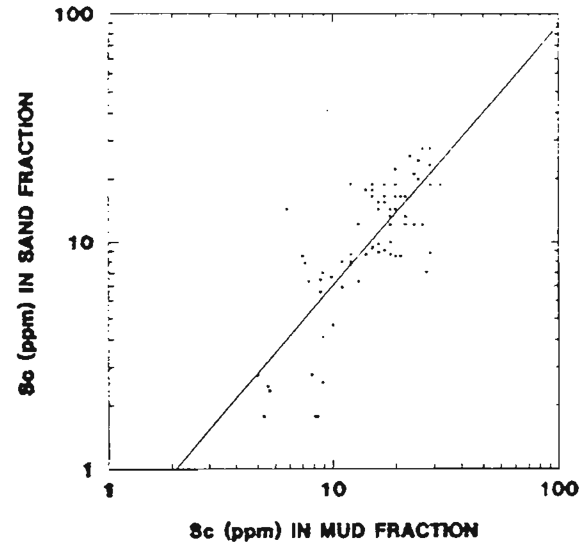

100000
10000
1000
Na (ppm) IN SAND FRACTION
1000
10000
100000
Na (ppm) IN MUD FRACTION

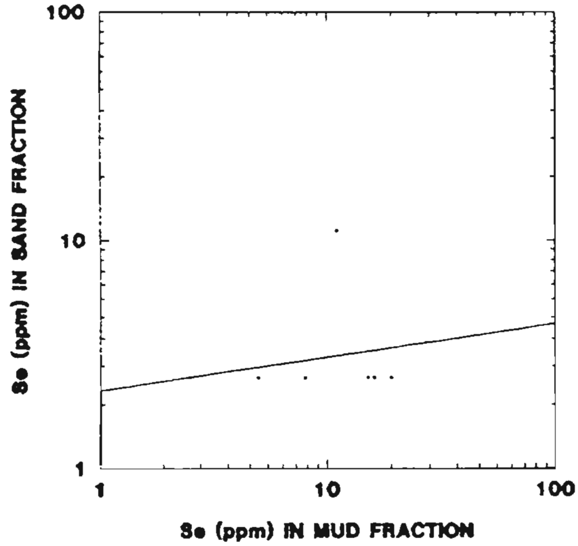

100
10
1
Nd (ppm) IN SAND FRACTION
1
10
100
Nd (ppm) IN MUD FRACTION

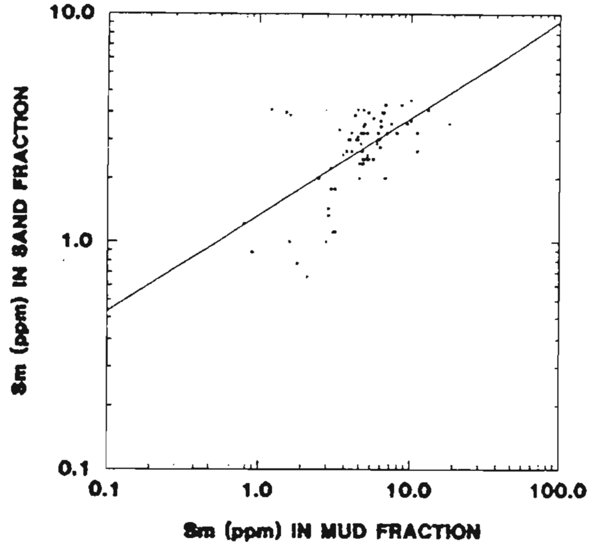

1000
100
10
Ni (ppm) IN SAND FRACTION
10
100
1000
Ni (ppm) IN MUD FRACTION

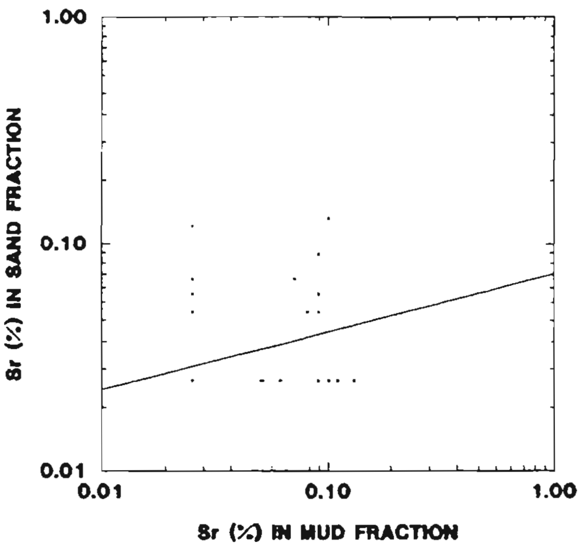

1000
100
10
Rb (ppm) IN SAND FRACTION
10
100
Rb (ppm) IN MUD FRACTION

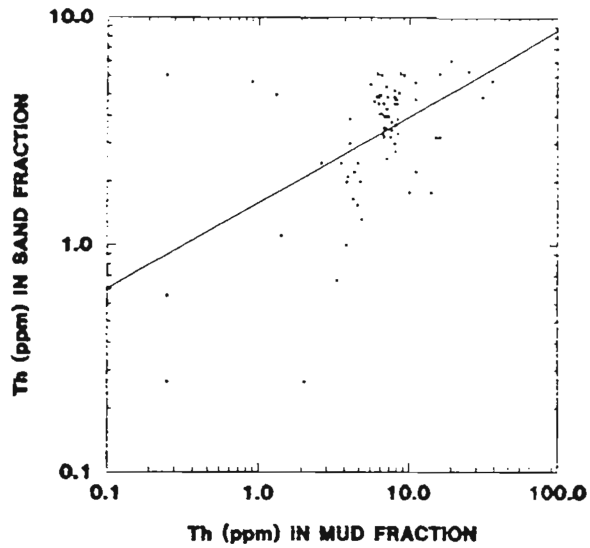

10.0
1.0
0.1
0.1
1.0
10.0
100.0
Sb (ppm) IN SAND FRACTION
Sb (ppm) IN MUD FRACTION

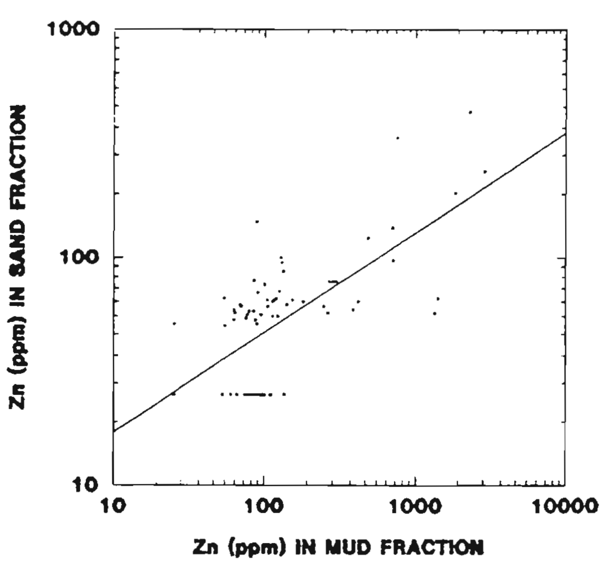

100
10
1
1
10
100
Sc (ppm) IN SAND FRACTION
Sc (ppm) IN MUD FRACTION


100
10
1
1
10
100
Se (ppm) IN SAND FRACTION
Se (ppm) IN MUD FRACTION


10.0
1.0
0.1
0.1
1.0
10.0
100.0
Sm (ppm) IN SAND FRACTION
Sm (ppm) IN MUD FRACTION

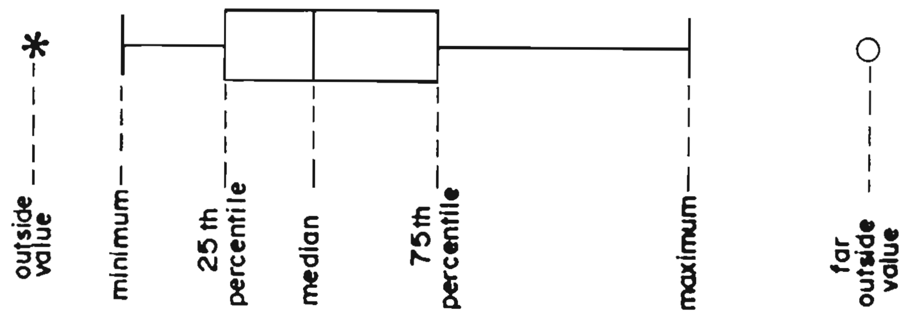

1.00
0.10
0.01
0.01
0.10
1.00
Sr (%) IN SAND FRACTION
Sr (%) IN MUD FRACTION


10.0
1.0
0.1
0.1
1.0
10.0
100.0
Th (ppm) IN SAND FRACTION
Th (ppm) IN MUD FRACTION


1000
100
10
10
100
1000
10000
Zn (ppm) IN SAND FRACTION
Zn (ppm) IN MUD FRACTION

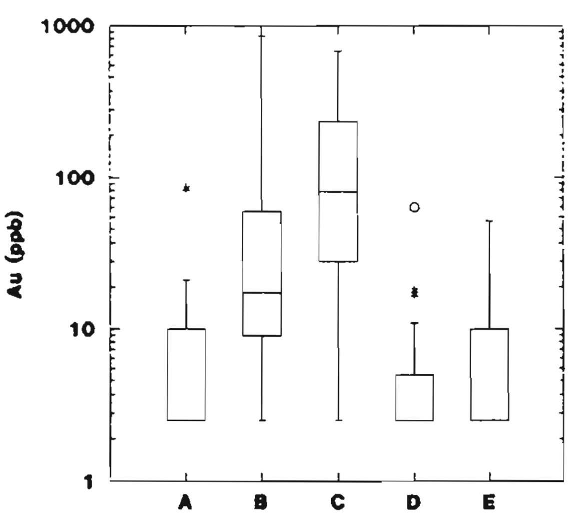
Appendix E

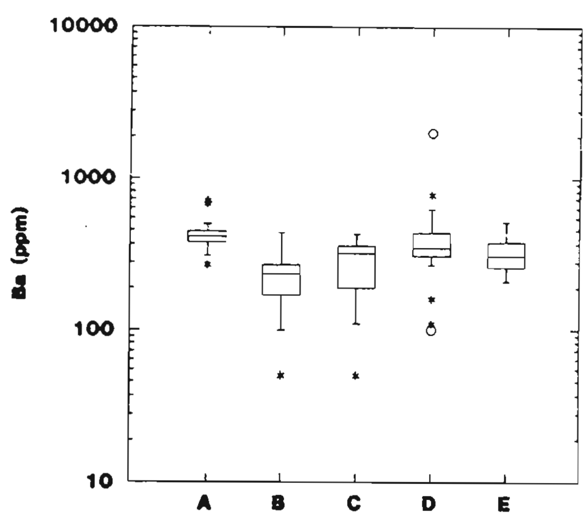
Box and Whisker Plots of Elements in the
Mud Fraction (1990 and 1991 data integrated)

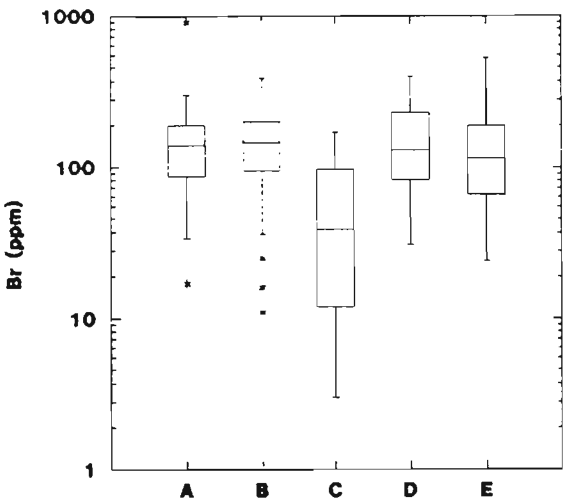


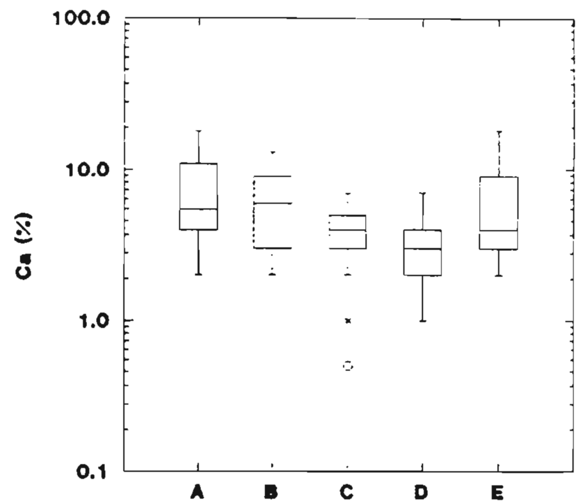
A: White Bay B: Baie Verte/Mings Bight C: La Scie/Tilt Cove area

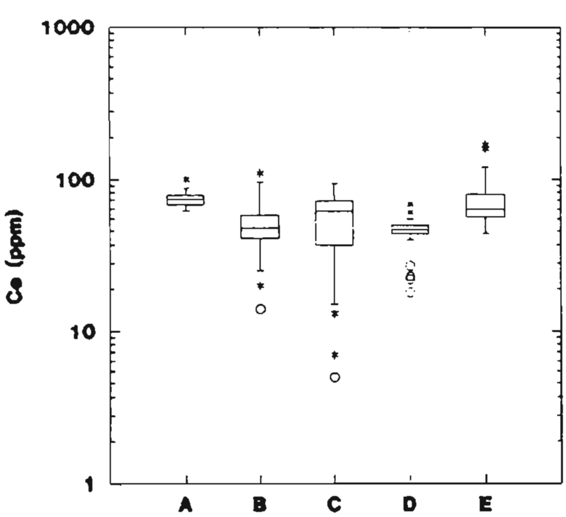
D: Halls Bay E: northeast shelf

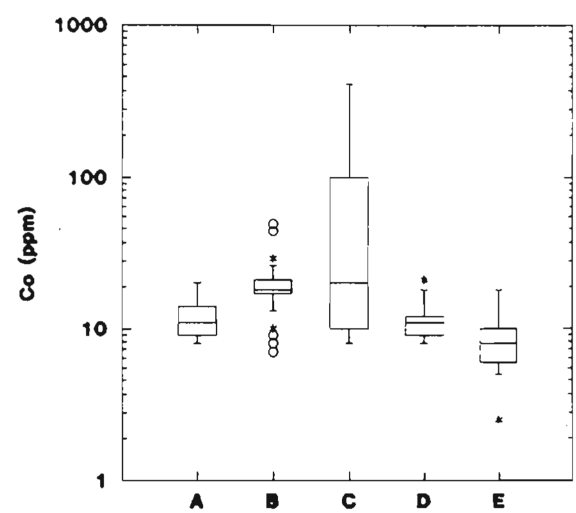


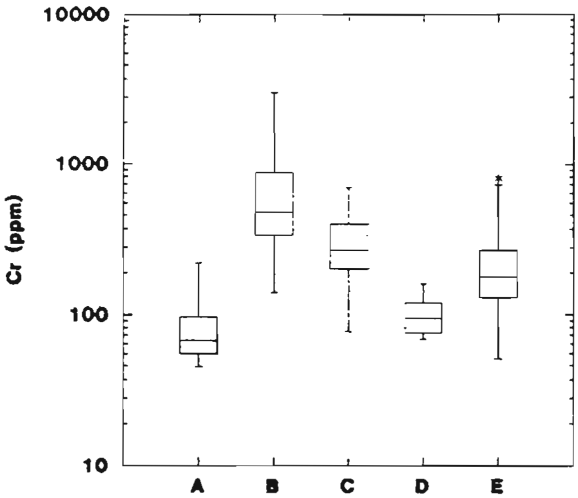


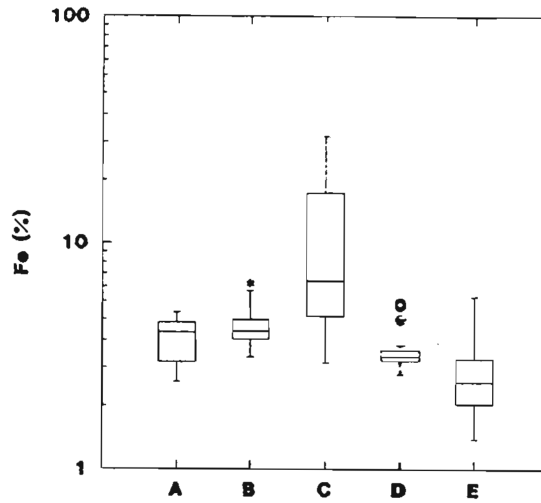

1000
100
10
1
Br (ppm)
A
B
C
D
E

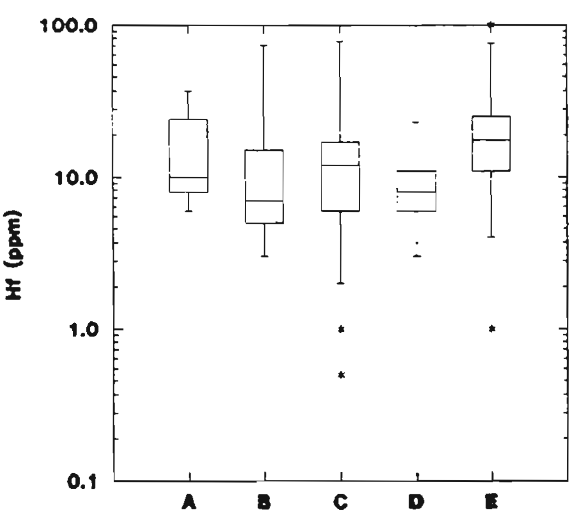

100.0
10.0
1.0
0.1
Ca (%)
A
B
C
D
E

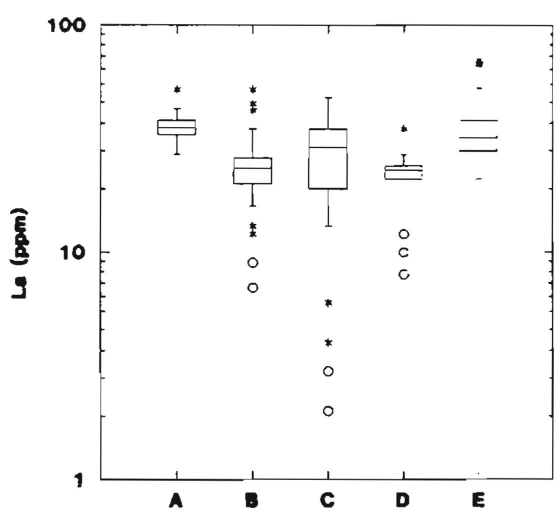

1000
100
10
1
Ce (ppm)
A
B
C
D
E

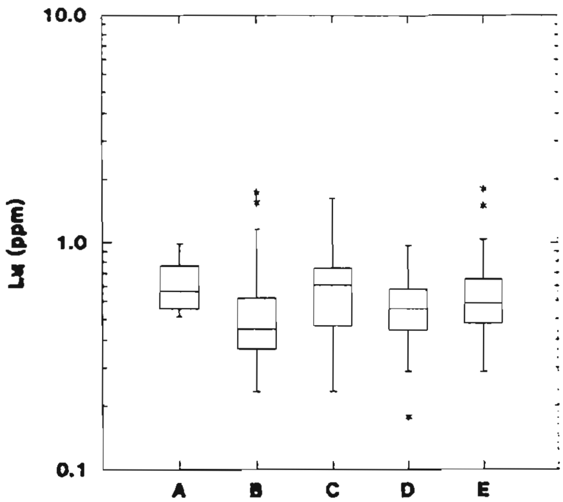

1000
100
10
1
Co (ppm)
A
B
C
D
E

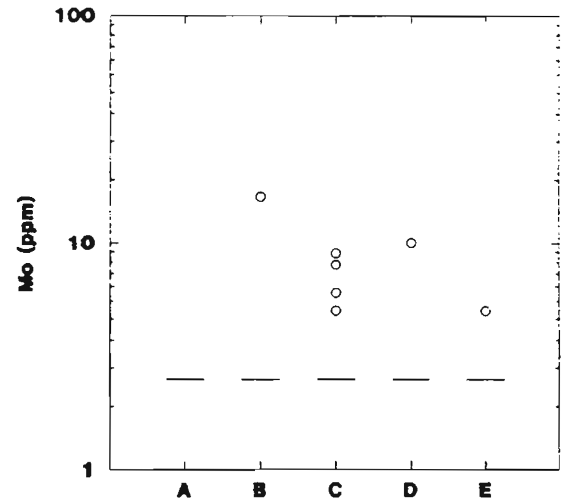

Cr (ppm)
10000
1000
100
10
A
B
C
D
E

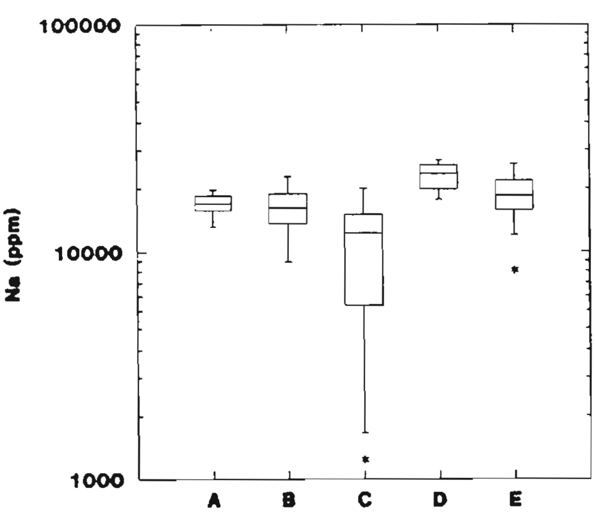

Fe (%)
100
10
1
A
B
C
D
E

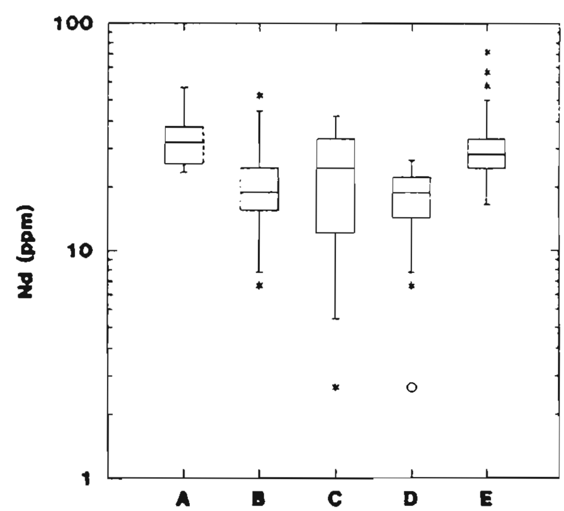

Hf (ppm)
100.0
10.0
1.0
0.1
A
B
C
D
E

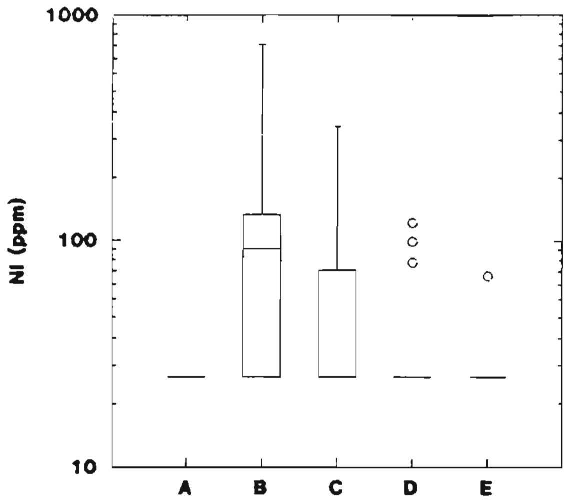

La (ppm)
100
10
1
A
B
C
D
E


10.0
1.0
0.1
Lu (ppm)
A
B
C
D
E

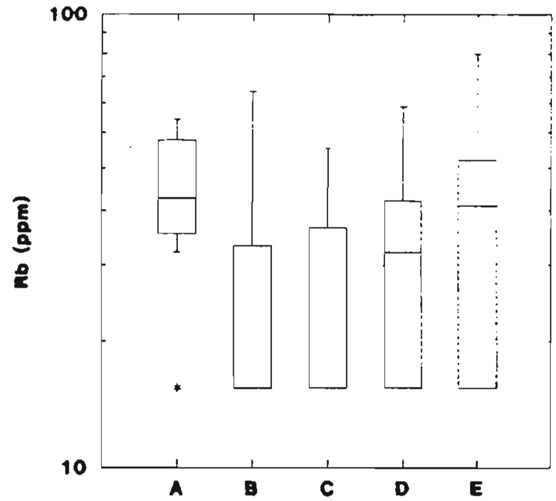

100
10
1
Mo (ppm)
A
B
C
D
E


100000
10000
1000
Na (ppm)
A
B
C
D
E

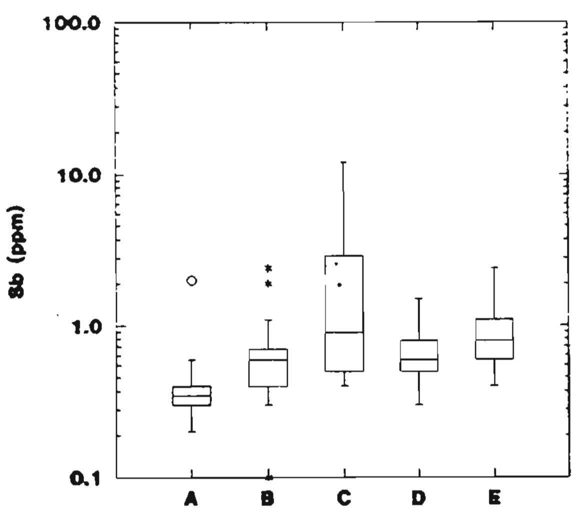

100
10
1
Nd (ppm)
A
B
C
D
E



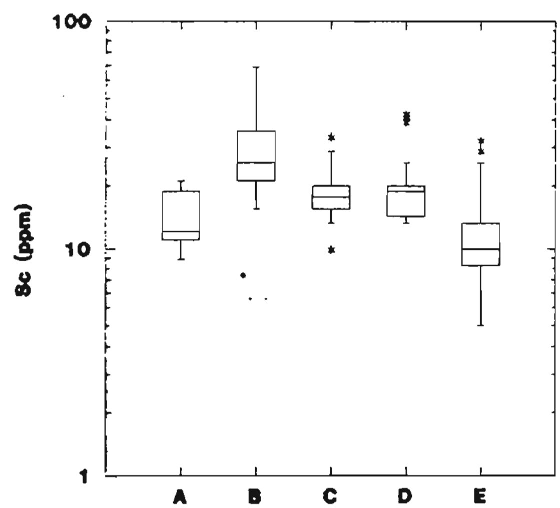
1000
100
10
Ni (ppm)
A
B
C
D
E



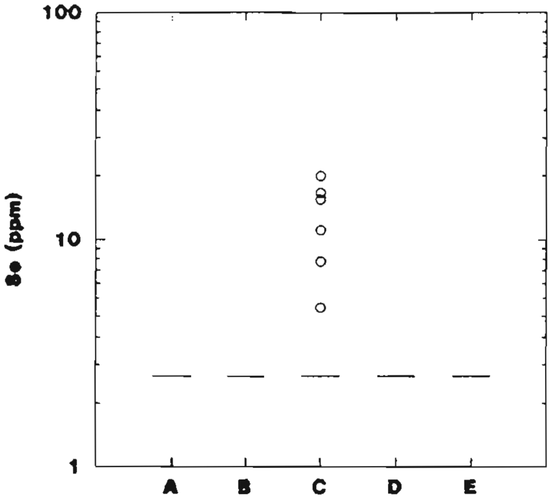
100
10
Rb (ppm)
A
B
C
D
E

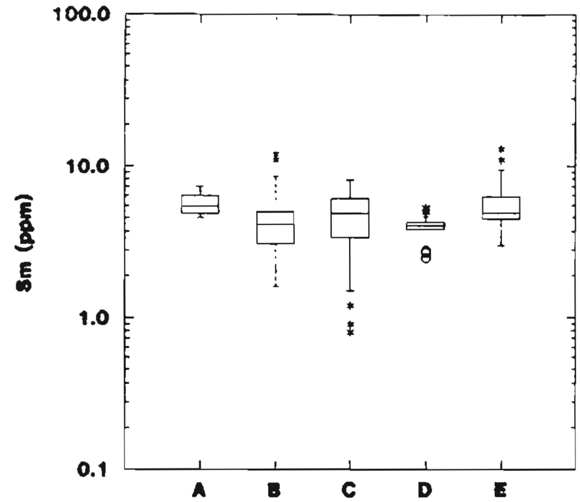


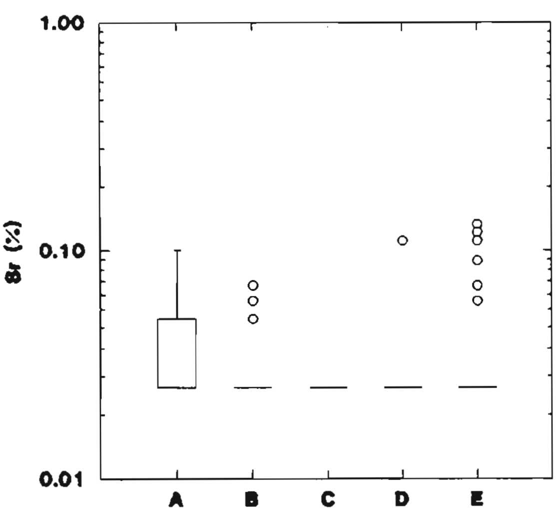
100.0
10.0
1.0
0.1
Sb (ppm)
A
B
C
D
E

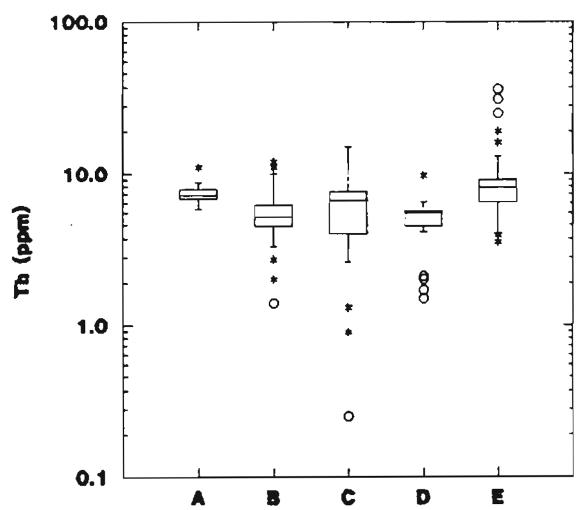


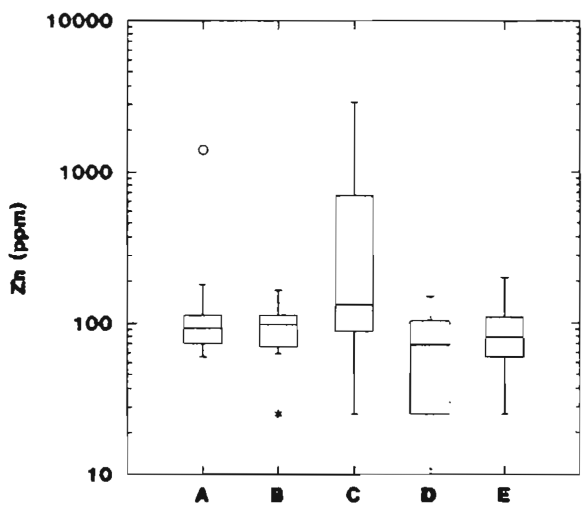
100
10
1
Sc (ppm)
A
B
C
D
E


100
10
1
Se (ppm)
A
B
C
D
E


100.0
10.0
1.0
0.1
Sm (ppm)
A
B
C
D
E

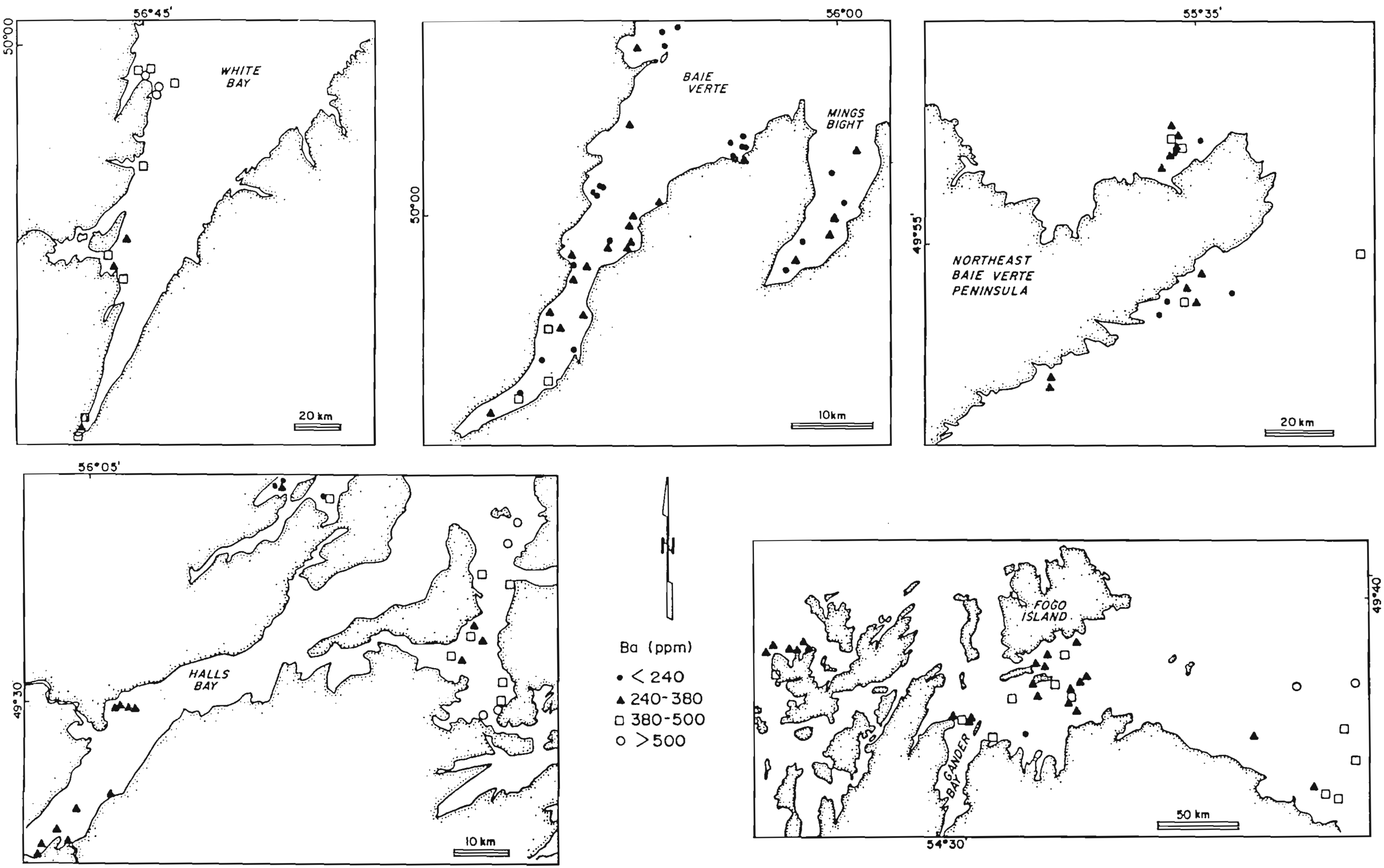

1.00
0.10
0.01
Sr (%)
A
B
C
D
E

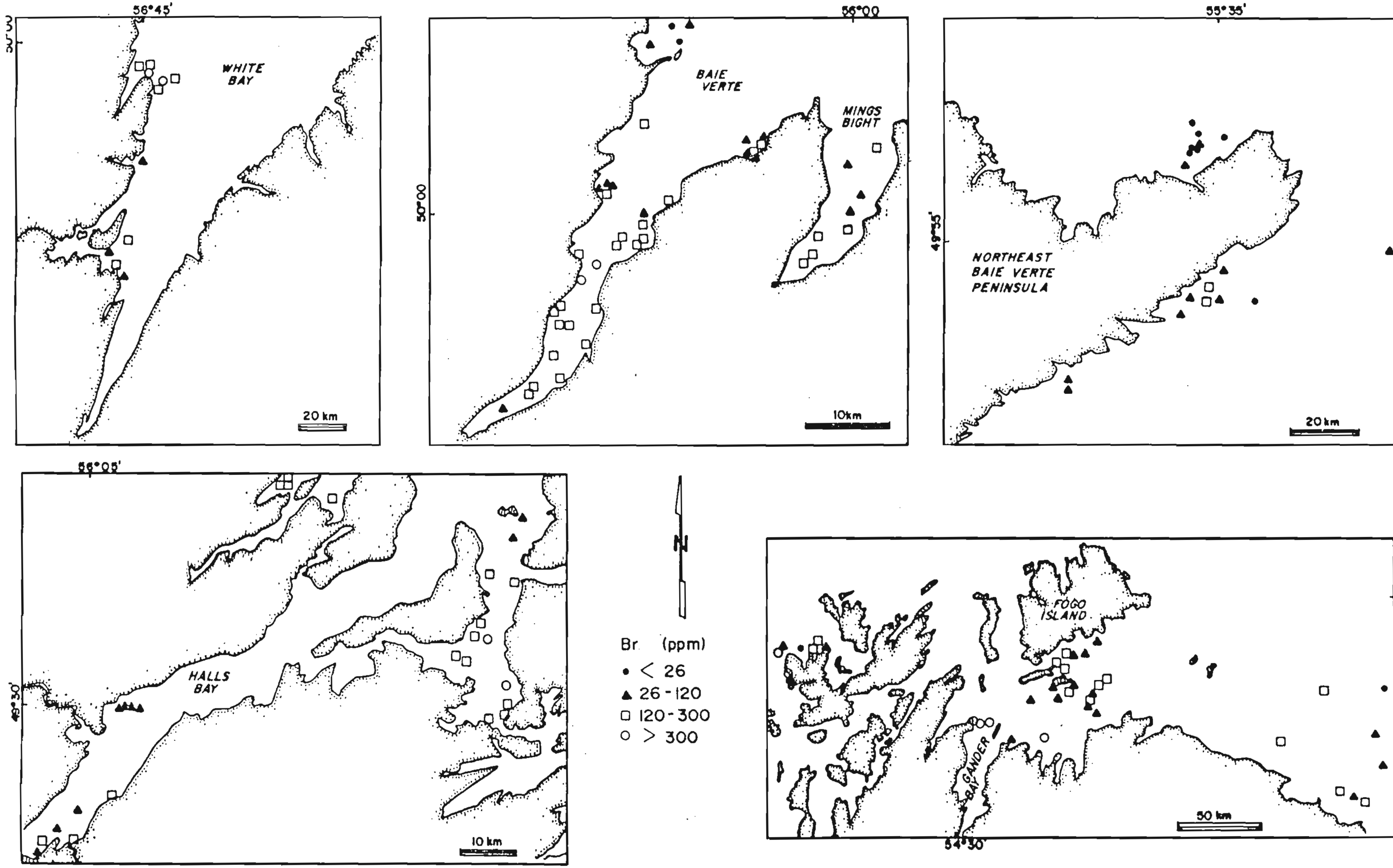

100.0
10.0
1.0
0.1
Th (ppm)
A
B
C
D
E

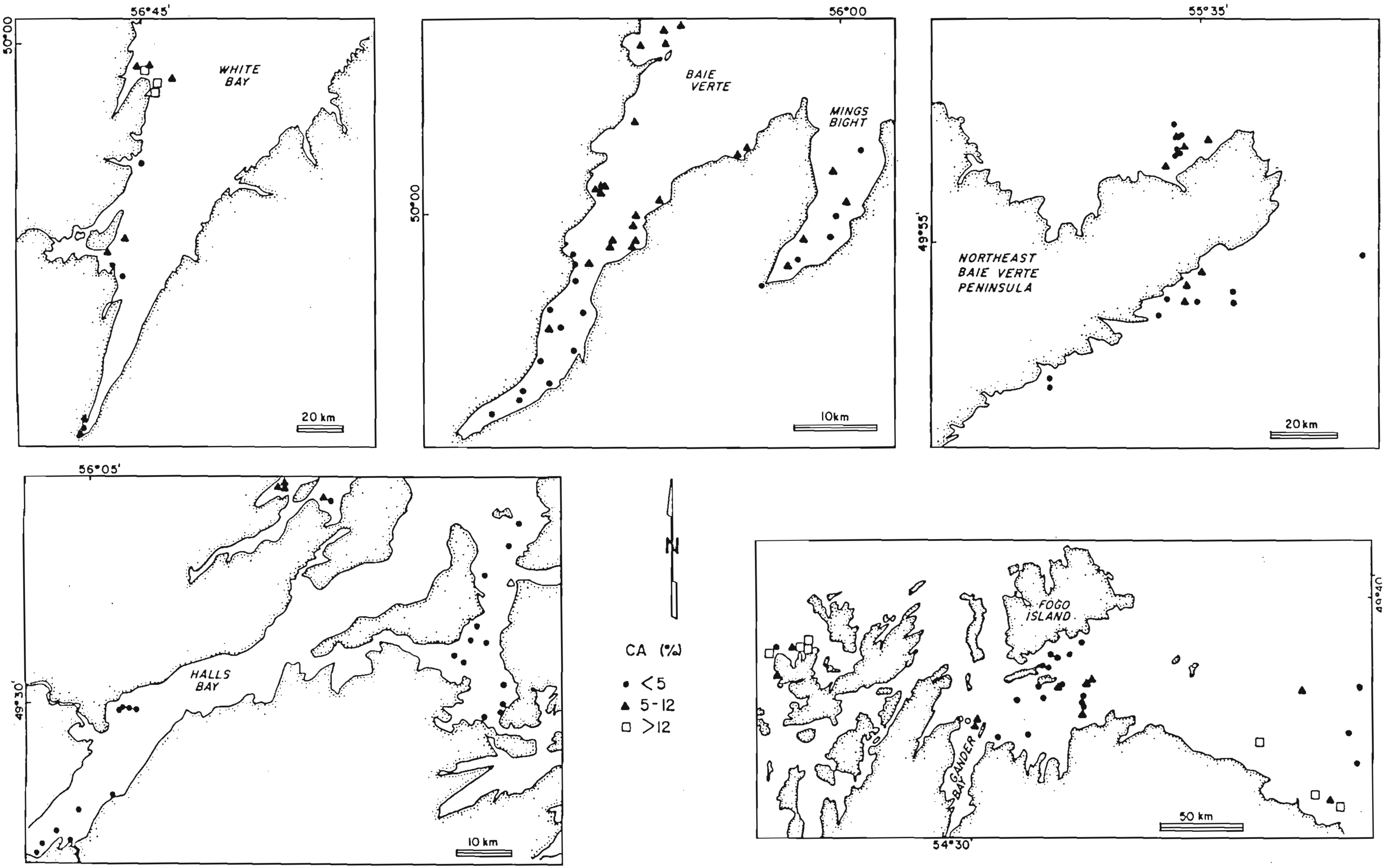

10000
1000
100
10
Zn (ppm)
A
B
C
D
E

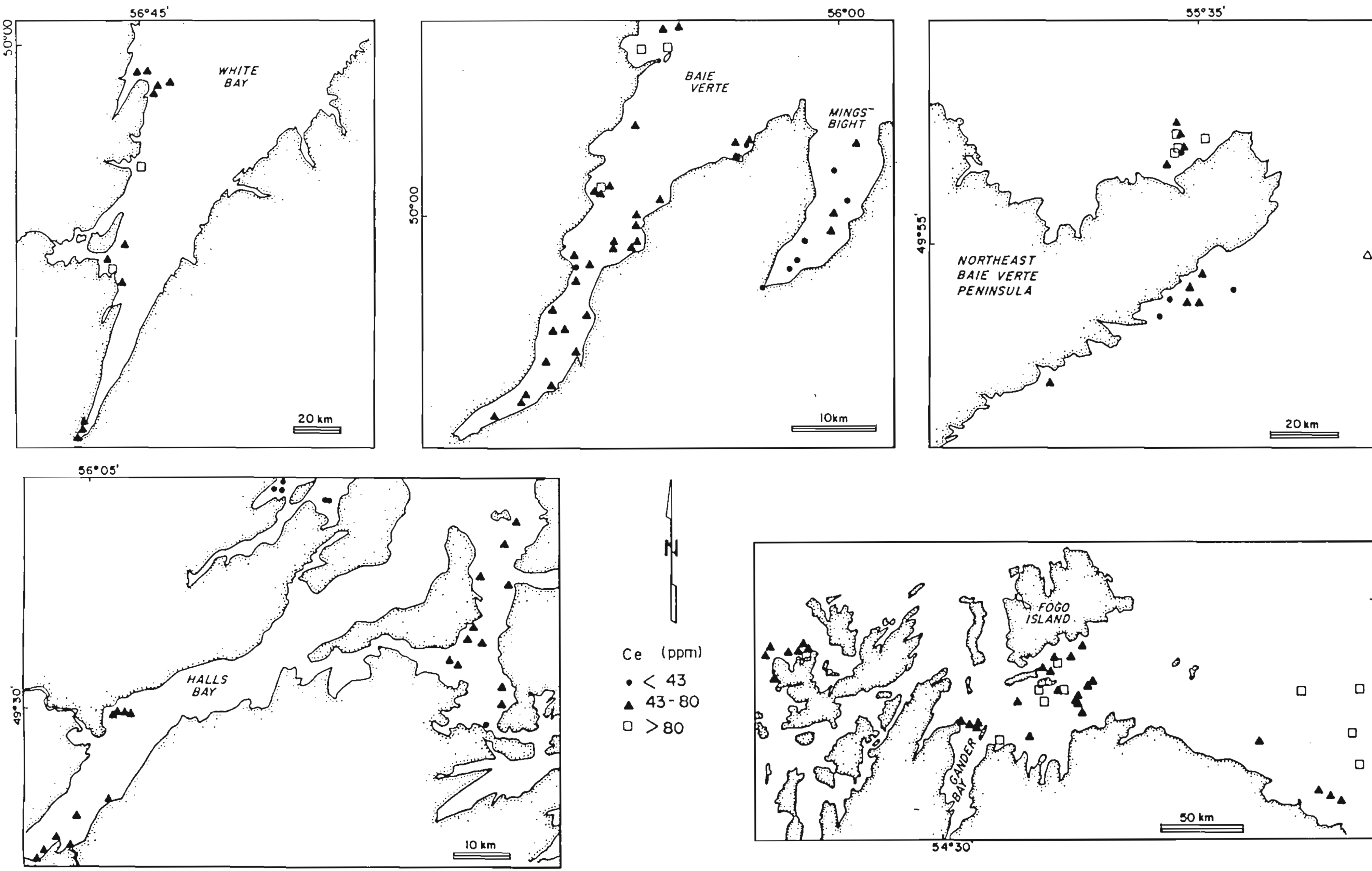
Appendix F

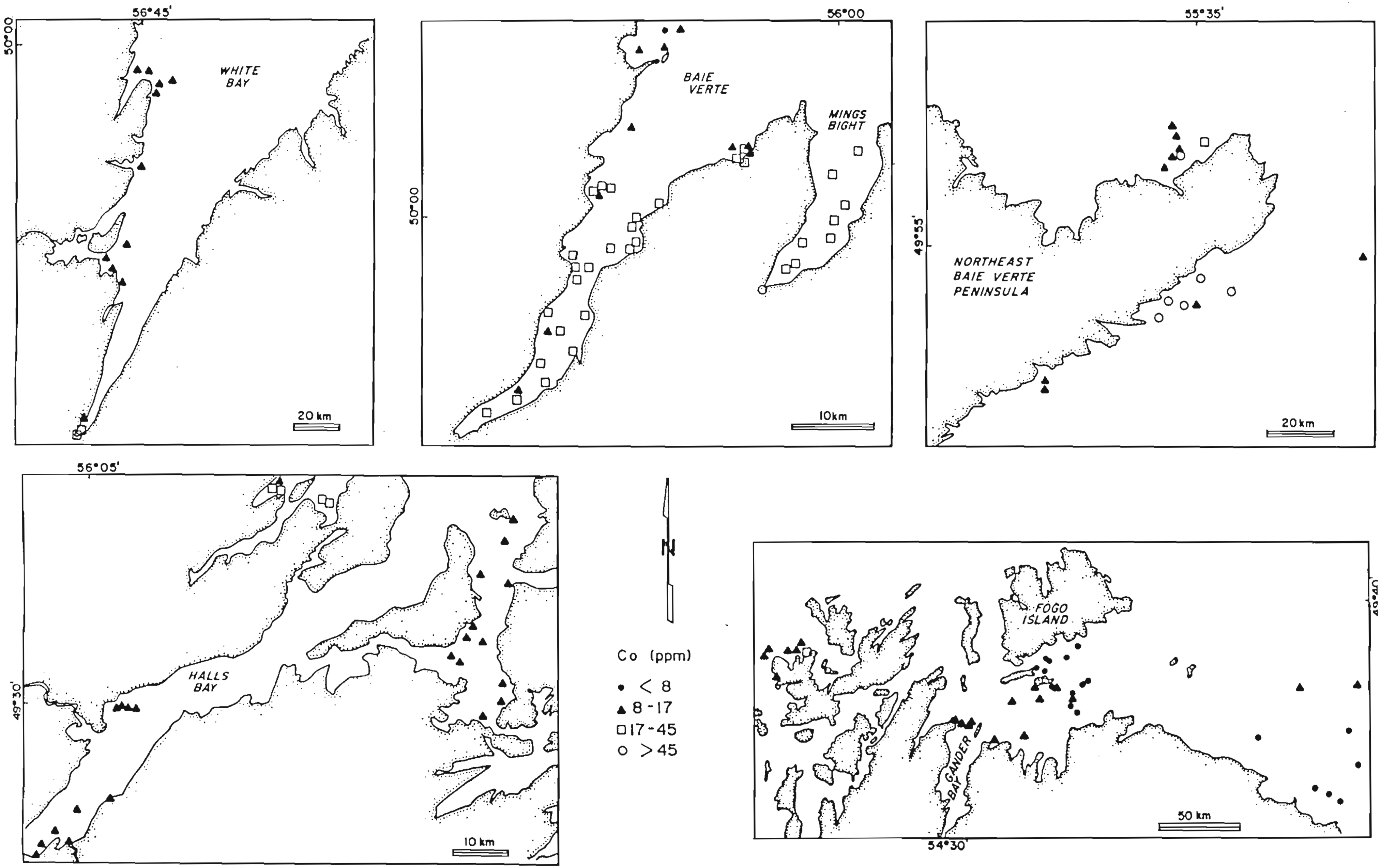
Element Distribution Maps (1990 and 1991 samples)

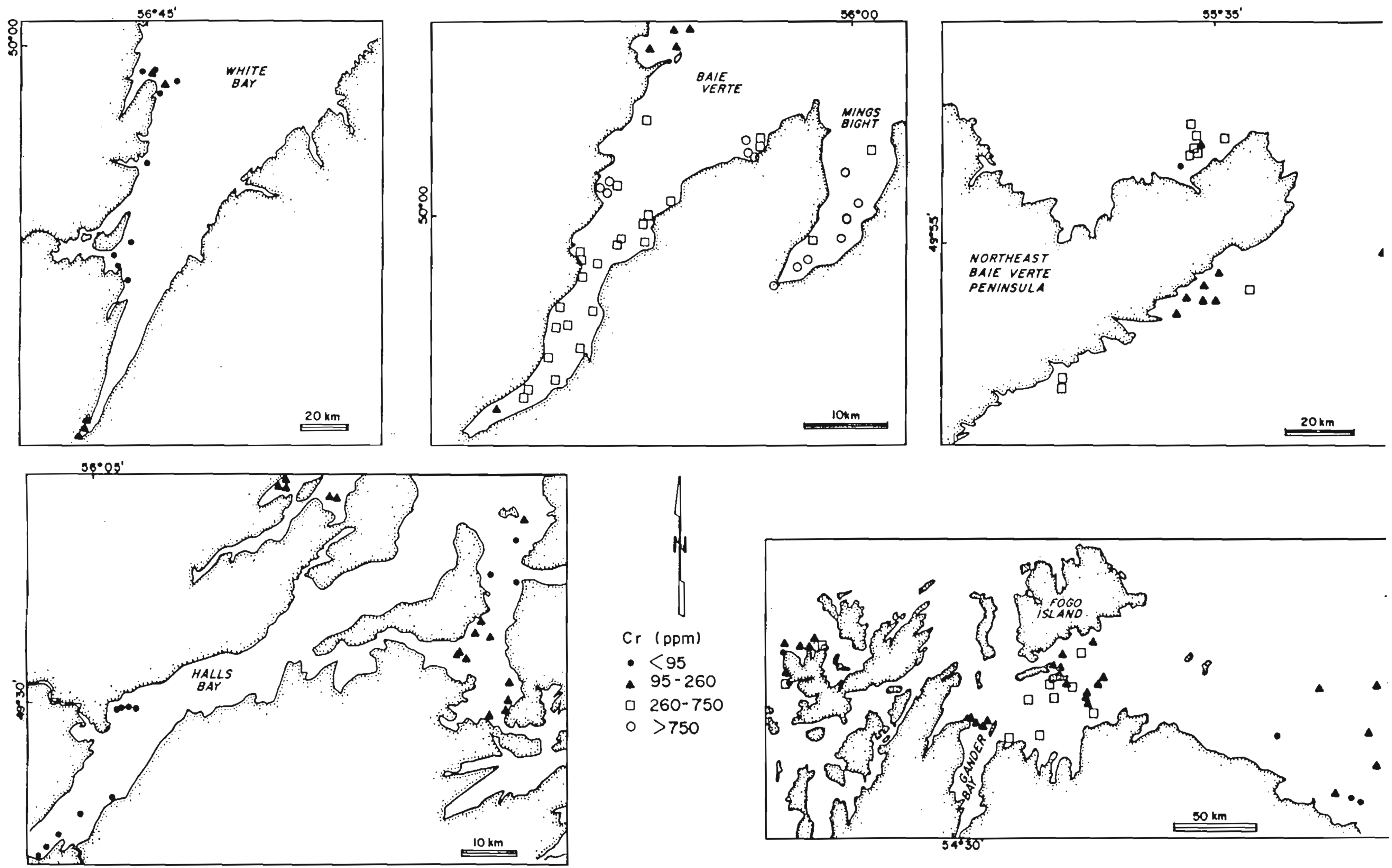

56°45'
50°00
WHITE BAY
20 km
56°00
50°00
BAIE VERTE
MINGS BIGHT
10km
55°35'
49°55'
NORTHEAST BAIE VERTE PENINSULA
20 km
56°05'
49°30
HALLS BAY
10 km
Ba (ppm)
< 240
240-380
380-500
> 500
FOGO ISLAND
GANDER BAY
49°40
54°30'
50 km


56°45'
50°00'
WHITE BAY
20 km
56°00'
50°00'
BAIE VERTE
MINGS BIGHT
10km
55°35'
49°55'
NORTHEAST BAIE VERTE PENINSULA
20 km
56°05'
49°30'
HALLS BAY
10 km
N
Br (ppm)
< 26
26 - 120
120 - 300
> 300
49°40'
FOGO ISLAND
GANDER BAY
54°30'
50 km

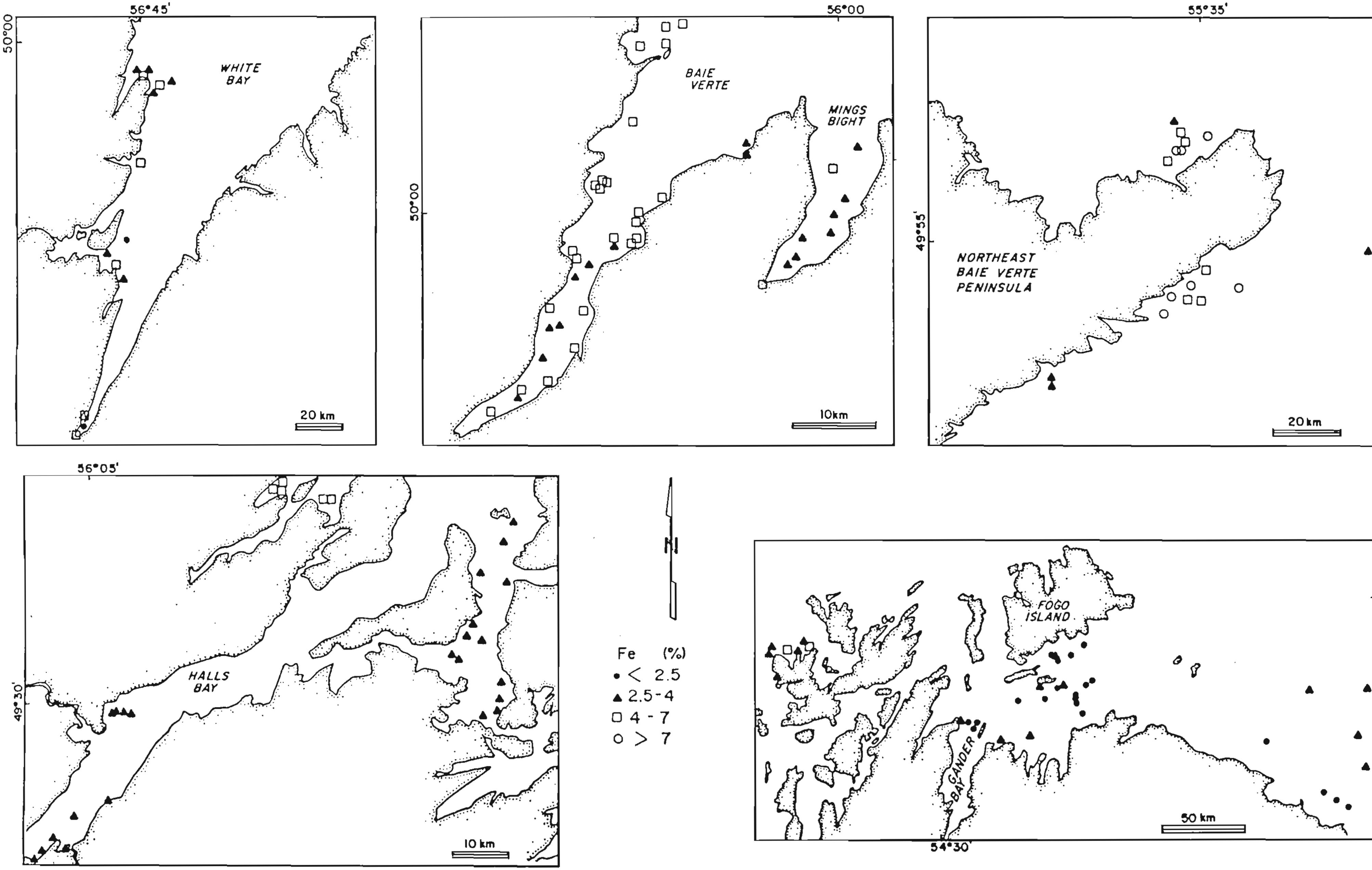

56°45'
50°00'
WHITE BAY
20 km
56°00
50°00
BAIE VERTE
MINGS BIGHT
10km
55°35'
49°55'
NORTHEAST BAIE VERTE PENINSULA
20 km
56°05'
49°30'
HALLS BAY
10 km
N
CA (%)
< 5
5-12
> 12
FOGO ISLAND
GANDER BAY
54°30'
49°40'
50 km

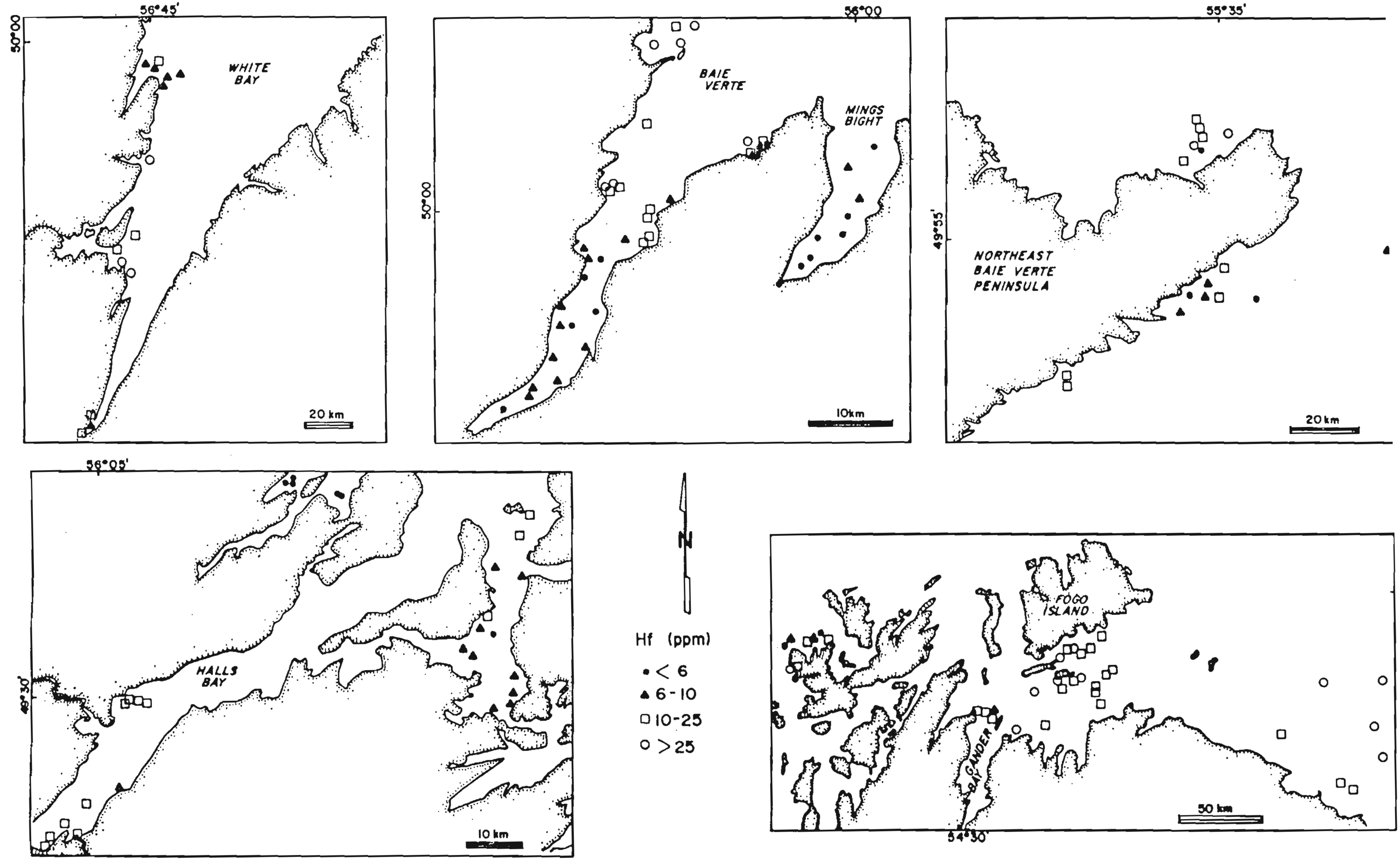

56°45'
50°00'
WHITE BAY
20 km
56°00
50°00'
BAIE VERTE
MINGS' BIGHT
10km
55°35'
49°55'
NORTHEAST BAIE VERTE PENINSULA
20 km
56°05'
49°30'
HALLS BAY
10 km
N
Ce (ppm)
< 43
43-80
> 80
49°40'
FOGO ISLAND
GANDER BAY
54°30'
50 km

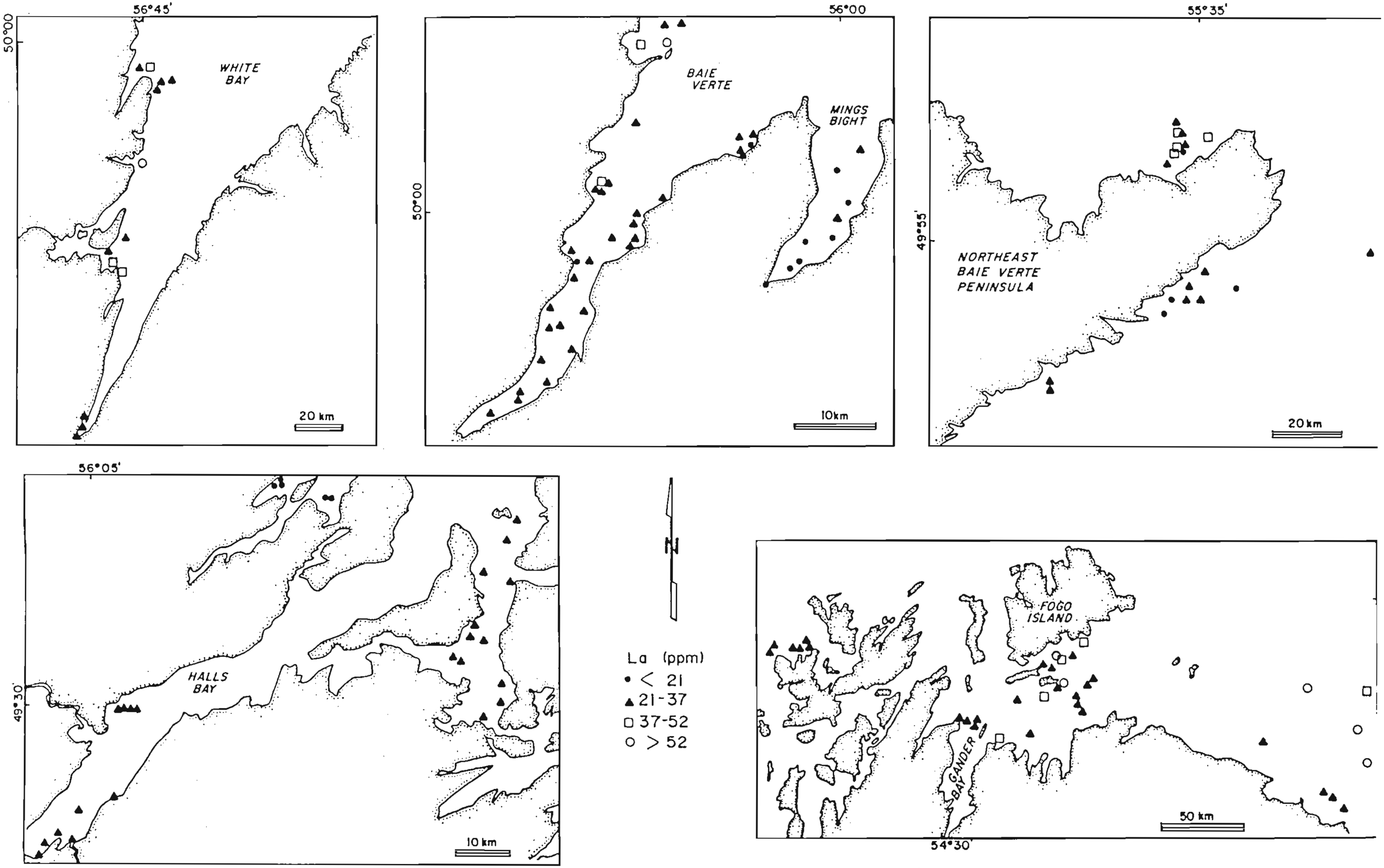

56°45'
50°00'
WHITE BAY
20 km
56°00
50°00
BAIE VERTE
MINGS BIGHT
10km
55°35'
49°55'
NORTHEAST BAIE VERTE PENINSULA
20 km
56°05'
49°30'
HALLS BAY
10 km
N
Co (ppm)
< 8
8-17
17-45
> 45
FOGO ISLAND
GANDER BAY
49°40'
54°30'
50 km

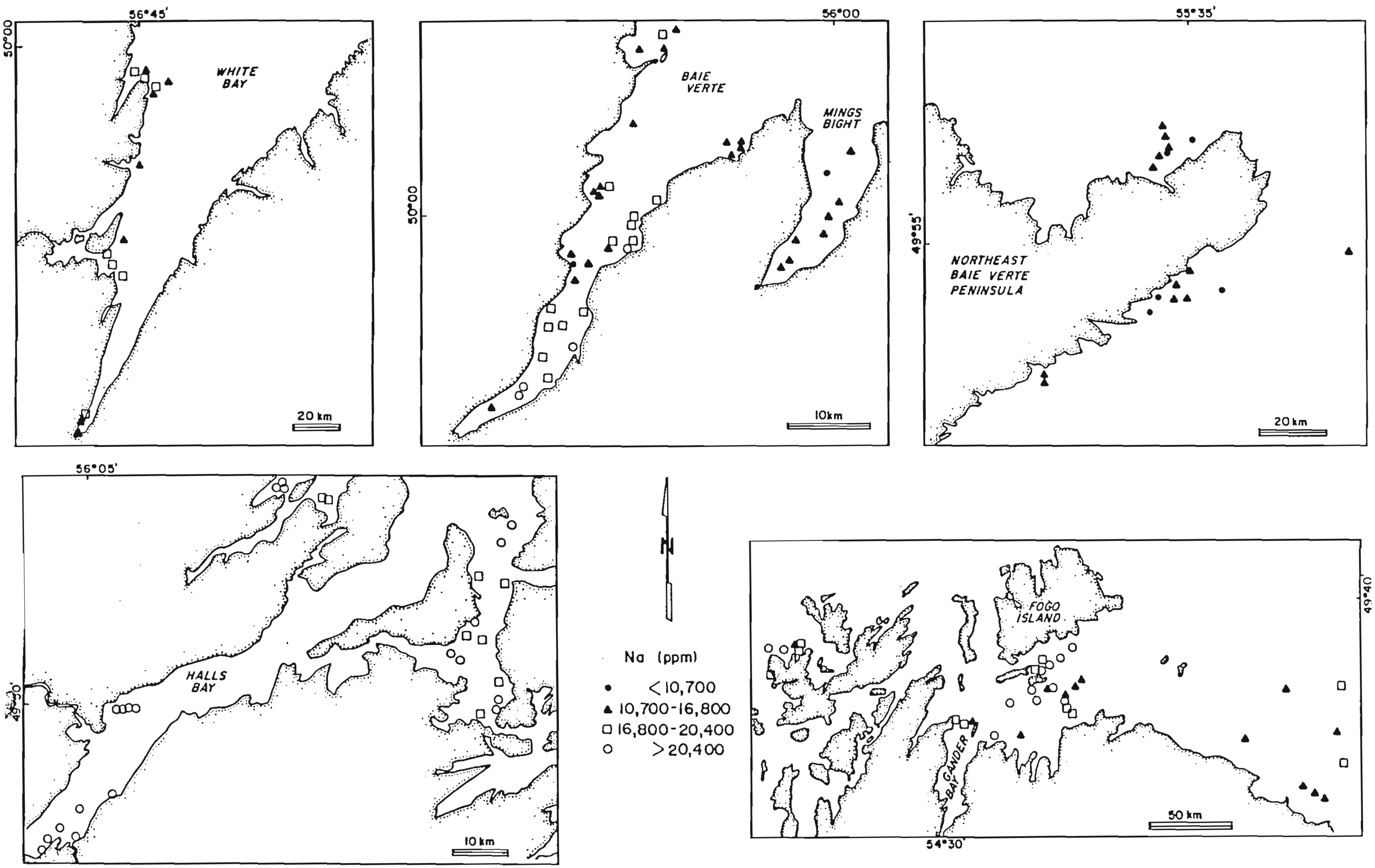


56°45'
50°00'
WHITE BAY
20 km
56°00
50°00
BAIE VERTE
MINGS BIGHT
10km
55°35'
49°55'
NORTHEAST BAIE VERTE PENINSULA
20 km
56°05'
49°30'
HALLS BAY
10 km
N
Cr (ppm)
● <95
▲ 95-260
□ 260-750
○ >750
FOGO ISLAND
GANDER BAY
50 km
54°30'

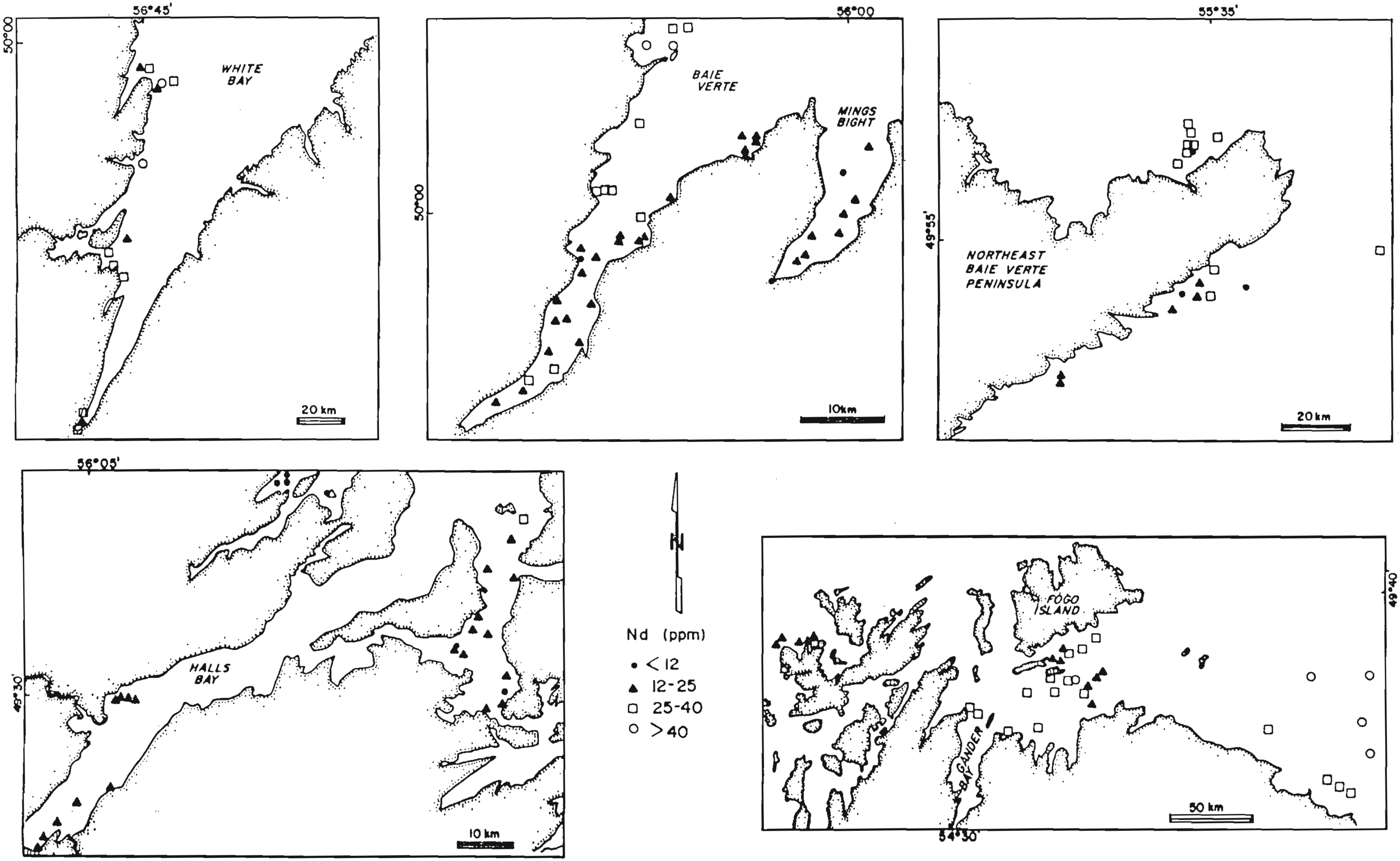

56°45'
50°00
WHITE BAY
20 km
56°00
50°00
BAIE VERTE
MINGS BIGHT
10km
55°35'
49°55'
NORTHEAST BAIE VERTE PENINSULA
20 km
56°05'
49°30'
HALLS BAY
10 km
N
Fe (%)
< 2.5
2.5-4
4 - 7
> 7
FOGO ISLAND
GANDER BAY
49°40'
54°30'
50 km

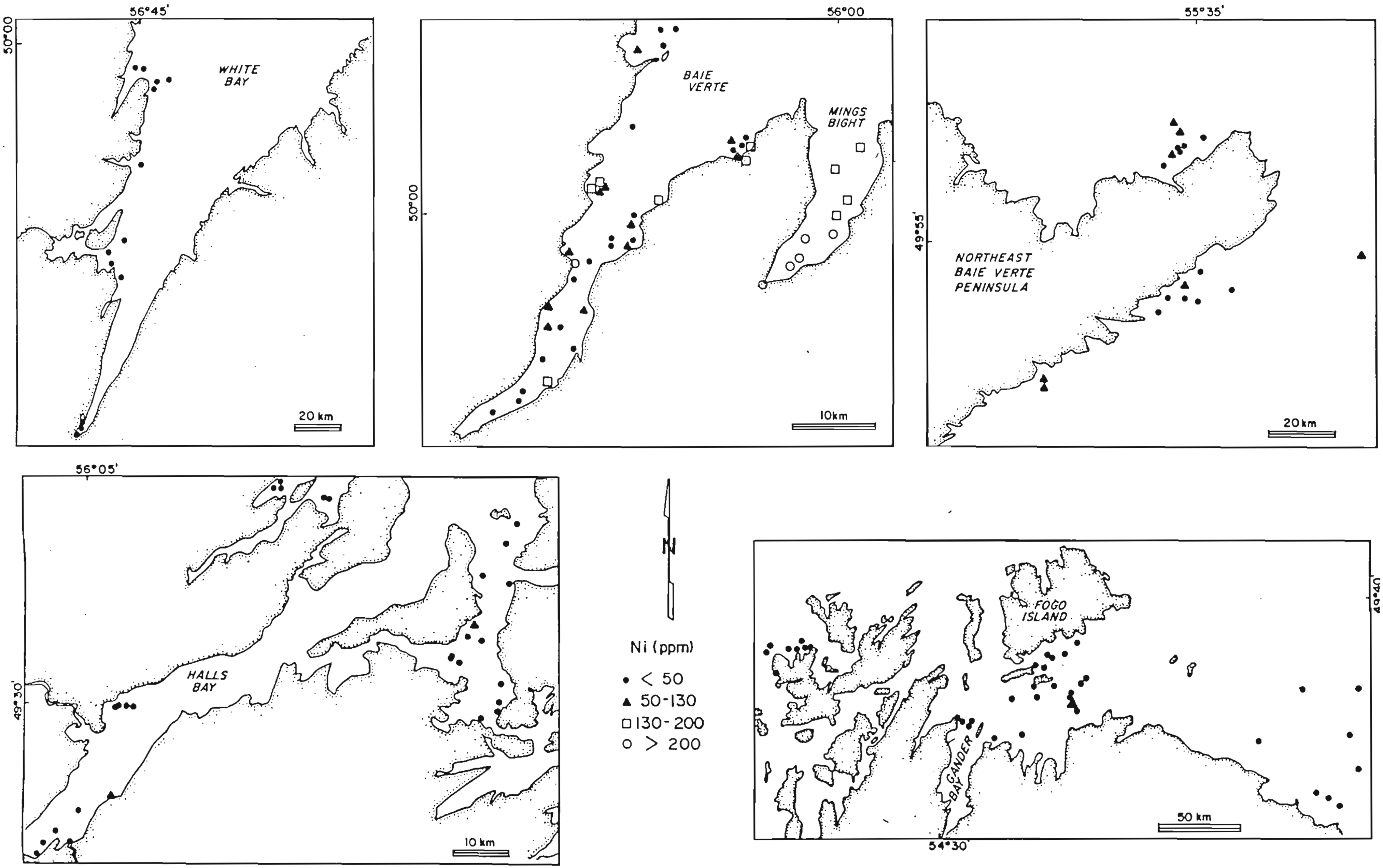

56°45'
50°00
WHITE BAY
20 km
56°00
50°00
BAIE VERTE
MINGS BIGHT
10km
55°35'
49°55'
NORTHEAST BAIE VERTE PENINSULA
20 km
56°05'
49°30'
HALLS BAY
10 km
N
Hf (ppm)
• < 6
▲ 6-10
□ 10-25
○ > 25
FOGO ISLAND
GANDER BAY
54°30'
50 km

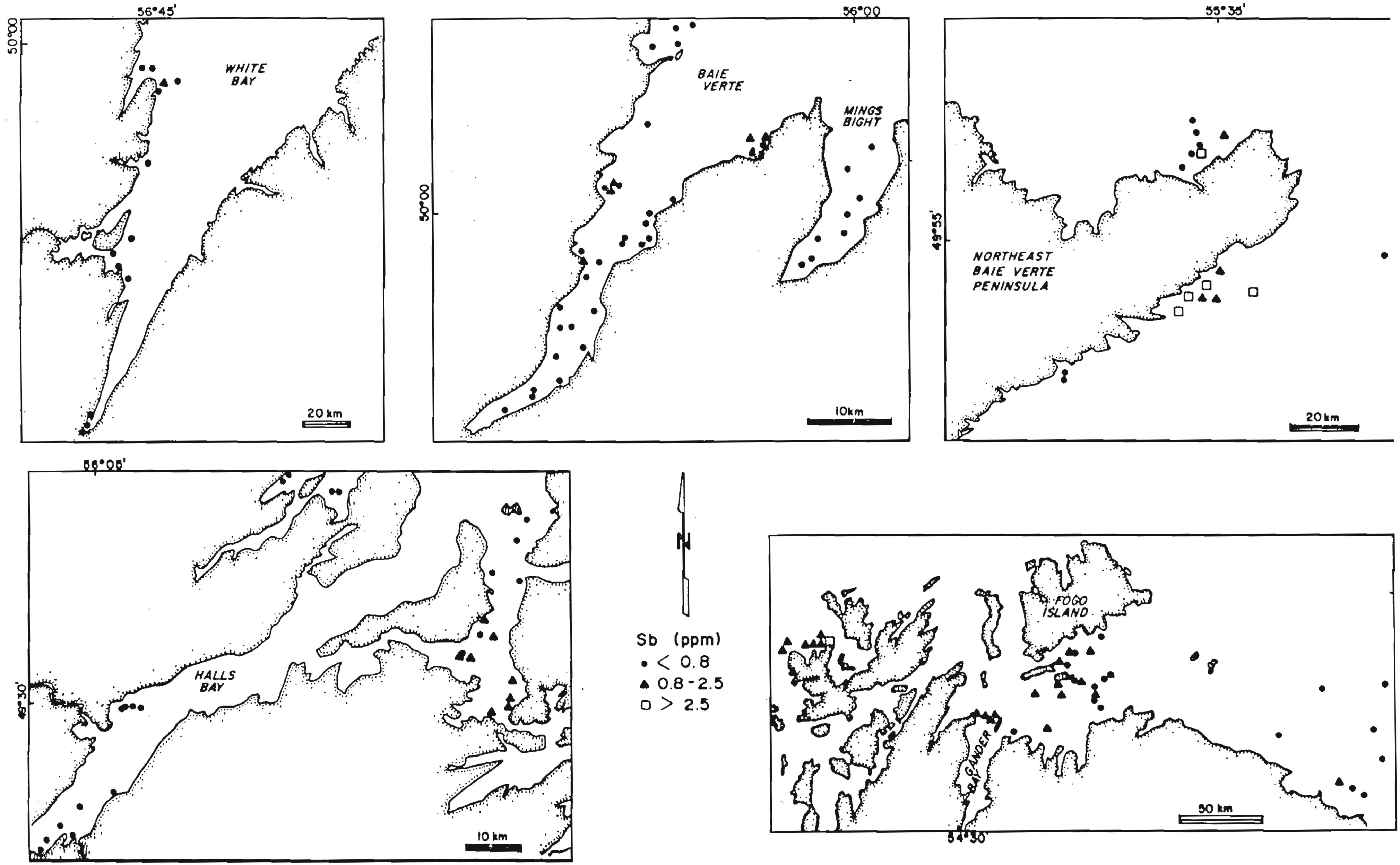

56°45'
50°00
WHITE BAY
20 km
56°00
50°00
BAIE VERTE
MINGS BIGHT
10km
55°35'
49°55'
NORTHEAST BAIE VERTE PENINSULA
20 km
56°05'
49°30'
HALLS BAY
10 km
N
La (ppm)
< 21
21-37
37-52
> 52
FOGO ISLAND
GANDER BAY
54°30'
50 km

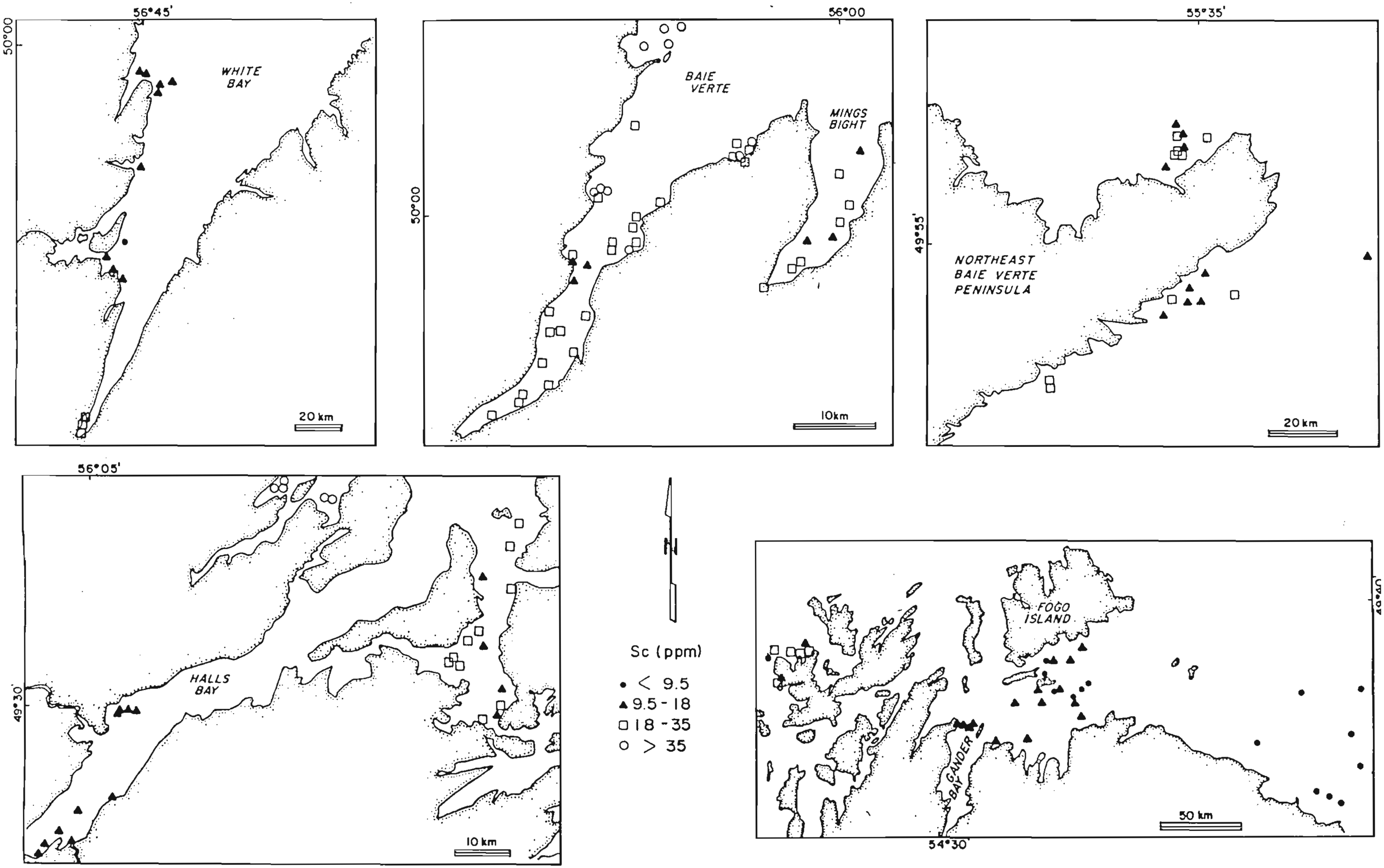


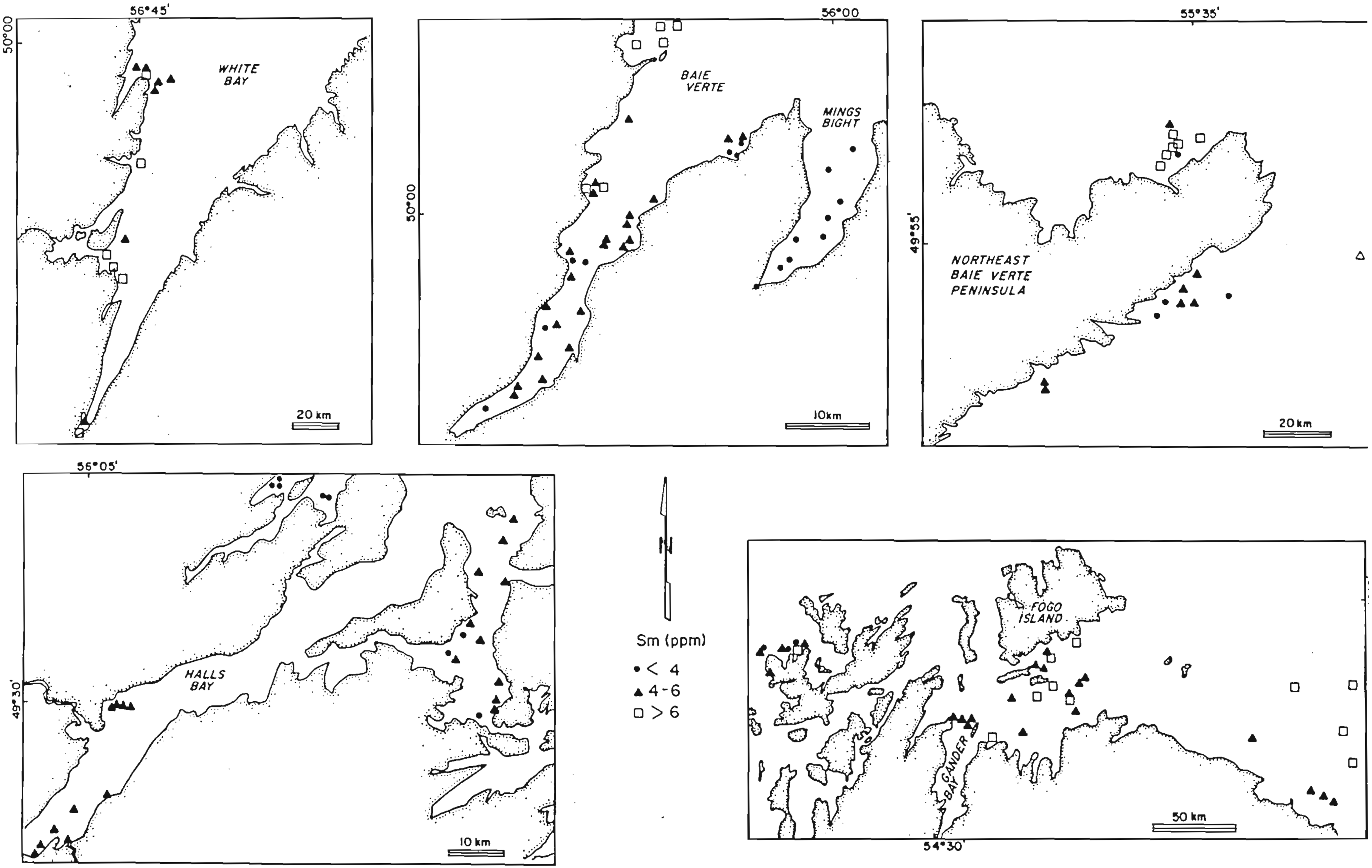
56°45'
50°00
WHITE BAY
20 km
56°00
50°00
BAIE VERTE
MINGS BIGHT
10km
55°35'
49°55'
NORTHEAST BAIE VERTE PENINSULA
20 km
56°05'
49°30'
HALLS BAY
10 km
N
Na (ppm)
< 10,700
10,700-16,800
16,800-20,400
> 20,400
FOGO ISLAND
GANDER BAY
49°40'
54°30'
50 km

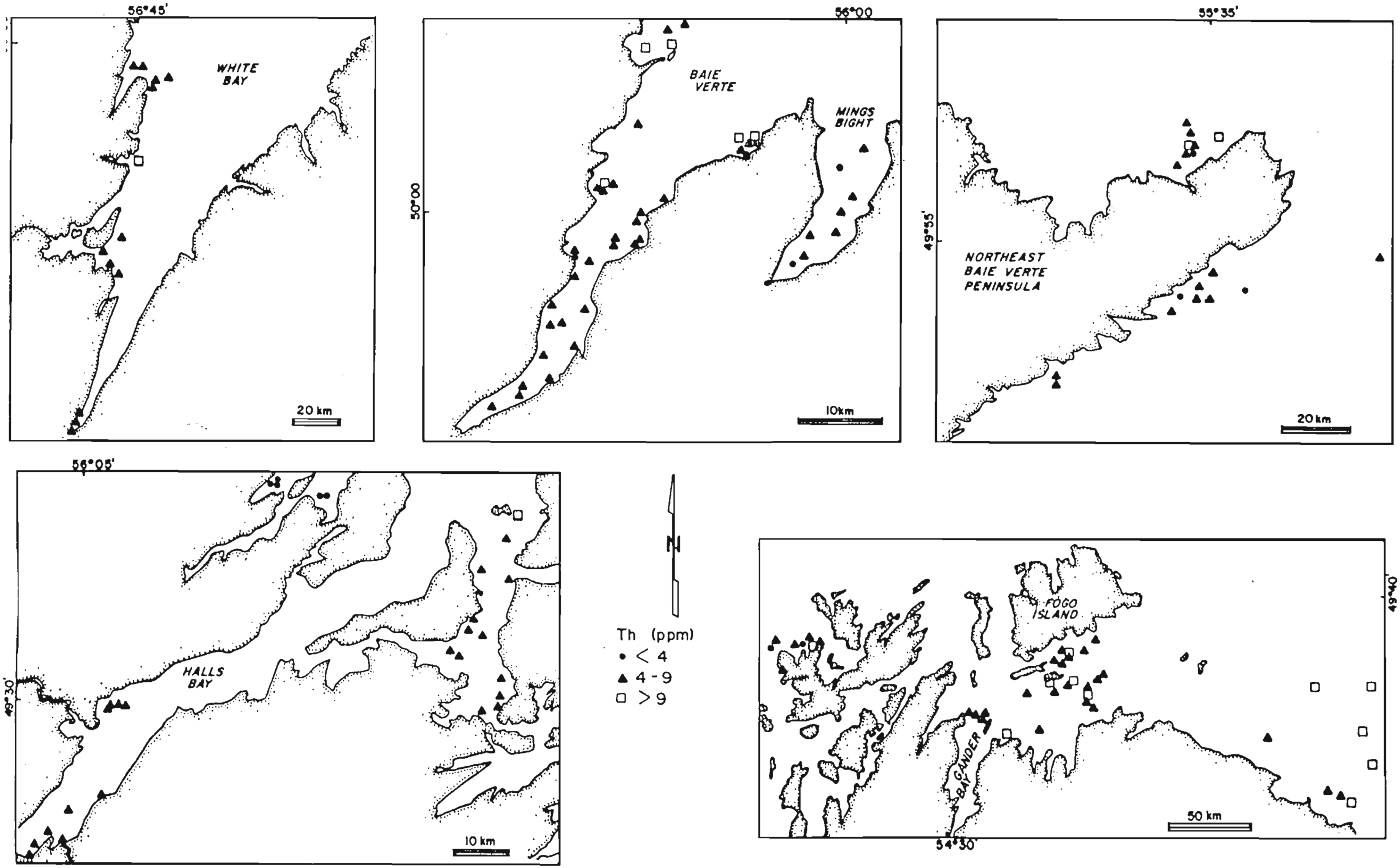

56°45'
50°00'
WHITE BAY
20 km
56°00'
50°00'
BAIE VERTE
MINGS BIGHT
10km
55°35'
49°55'
NORTHEAST BAIE VERTE PENINSULA
20 km
56°05'
49°30'
HALLS BAY
10 km
N
Nd (ppm)
< 12
12-25
25-40
> 40
49°40'
FOGO ISLAND
GANDER BAY
54°30'
50 km


56°45'
50°00
WHITE BAY
20 km
56°00
50°00
BAIE VERTE
MINGS BIGHT
10km
55°35'
49°55'
NORTHEAST BAIE VERTE PENINSULA
20 km
56°05'
49°30'
HALLS BAY
10 km
N
Ni (ppm)
< 50
50-130
130-200
> 200
FOGO ISLAND
GANDER BAY
49°40'
54°30'
50 km

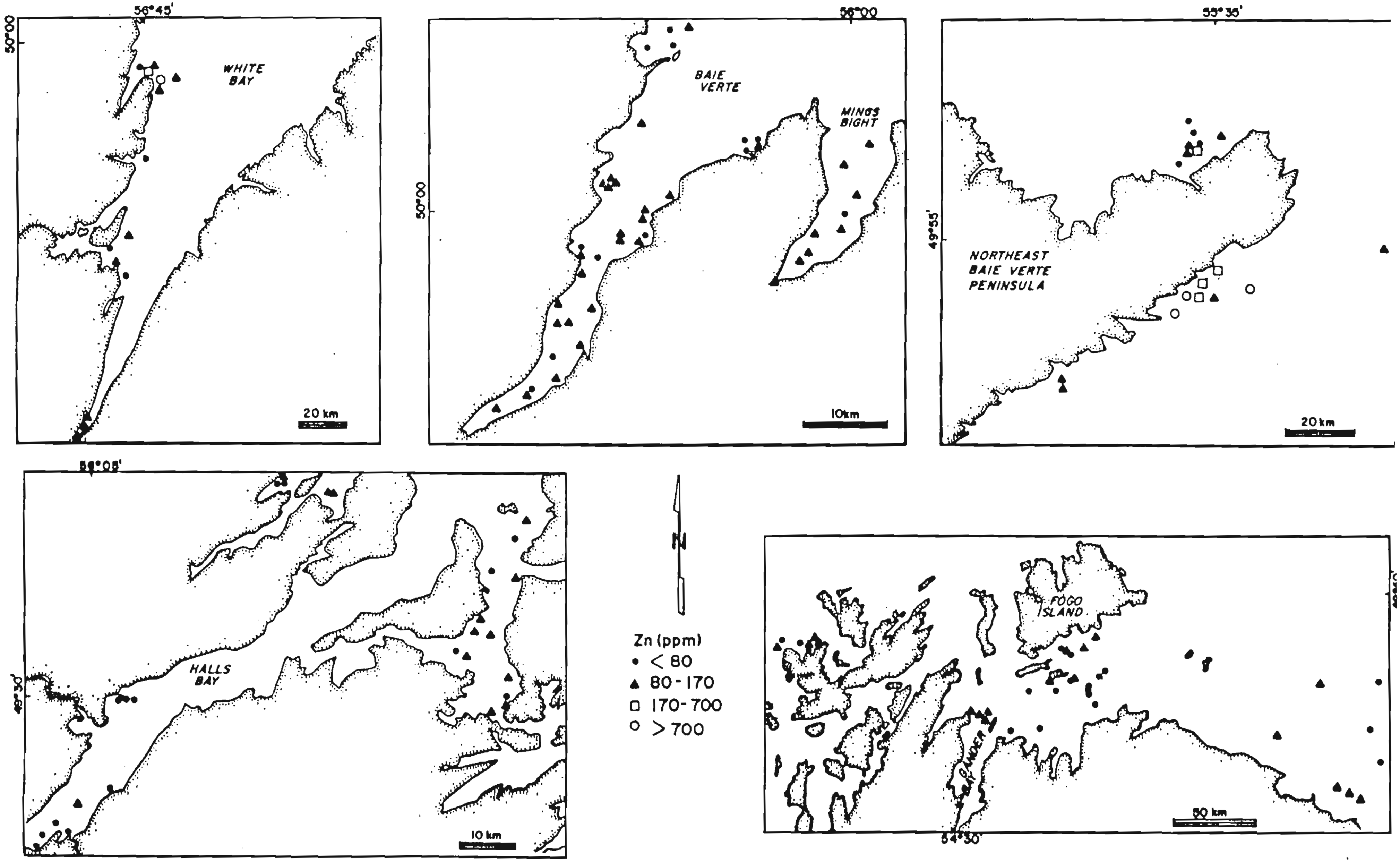

56°45'
50°00'
WHITE BAY
20 km
56°00
50°00
BAIE VERTE
MINGS BIGHT
10km
55°35'
49°55'
NORTHEAST BAIE VERTE PENINSULA
20 km
56°05'
49°30'
HALLS BAY
10 km
N
Sb (ppm)
< 0.8
0.8 - 2.5
> 2.5
FOGO ISLAND
GANDER BAY
54°30'
50 km


56°45'
50°00
WHITE BAY
20 km
56°00
50°00
BAIE VERTE
MINGS BIGHT
10km
55°35'
49°55'
NORTHEAST BAIE VERTE PENINSULA
20 km
56°05'
49°30'
HALLS BAY
10 km
N
Sc (ppm)
< 9.5
9.5 - 18
18 - 35
> 35
FOGO ISLAND
GANDER BAY
54°30'
50 km


56°45'
50°00
WHITE BAY
20 km
56°00
50°00
BAIE VERTE
MINGS BIGHT
10km
55°35'
49°55'
NORTHEAST BAIE VERTE PENINSULA
20 km
56°05'
49°30'
HALLS BAY
10 km
Sm (ppm)
< 4
4-6
> 6
FOGO ISLAND
GANDER BAY
54°30'
50 km



56°45'
WHITE BAY
20 km
56°00
50°00
BAIE VERTE
MINGS BIGHT
10km
55°35'
49°55'
NORTHEAST BAIE VERTE PENINSULA
20 km
56°05'
49°30'
HALLS BAY
10 km
N
Th (ppm)
• < 4
▲ 4 - 9
□ > 9
FOGO ISLAND
GANDER BAY
49°40'
54°30'
50 km


56°45'
50°00
WHITE BAY
20 km
56°00
50°00
BAIE VERTE
MINGS BIGHT
10km
55°35'
49°55'
NORTHEAST BAIE VERTE PENINSULA
20 km
56°05'
49°30'
HALLS BAY
10 km
N
Zn (ppm)
< 80
80-170
170-700
> 700
FOGO ISLAND
54°30'
50 km

Appendix G

Gold Grain Size, Abrasion and Chemistry
(from whole rock panned samples)

GOLD GRAIN SIZE AND WEATHERING

(The abrasion scale ranges from 1 to 4 with 1 being the freshest and 4 the most abraded. The chemical etching scale also ranges from 1 to 4 with 4 being the most weathered. In some cases two populations were recognized in a given sample so two rankings are given.)

Sample Number	# of gold grains	size (microns)	est. dry weight (kg)	abrasion	chemical etching	silver content
91-031-001	7	60-150	5.41	1-2 3	1 3	0-5 wt%
91-031-006	1	70	2.07	3	3	
91-031-011	30	50-250	15.02	2 3-4	1 3	1-8 wt%
91-031-012	30	60-120	15.5	1-2 3-4	1-2 3	0-5 wt%
91-031-068	1	75	2.87	3	4	0 wt%
91-031-070	1	75	2.16	3	4	23 wt%
91-026-016	3	60-80	22.39	3 3	1 3-4	10 wt%
91-026-021B	1	170	27.75	2	2	0 wt%
91-026-024S	3	70-150	15.38	3	2	1-6 wt%
91-026-024B	2	90-110	5.94	3	2-3	0-2 wt%
91-026-026	9	90-220	22.13	3-4 2	3-4 1	0-7wt%
91-026-027	23	70-150	16.84	3-4 2	3-4 1-2	0-13 wt%
91-026-029	2	60-100	10.09	3	3	7 wt%
91-026-030	2	80	6.85	3	3	2 wt %
91-026-031	8	70-140	25.77	3-4	3	0-9wt%
91-026-033	3	50-170	5.23	3-4	3-4	0-12wt%
91-026-036	6	100-150	27.7	3-4	2	1-4 wt%
91-026-037	3	110	11.19	2	1	9 wt%