Reconnaissance geochemical mapping of Lambert Land and southern Kronprins Christian Land (79° to 80°55′N, 18°50′ to 25°W), eastern North Greenland

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Abstract

Geochemical sampling of stream sediment and water collected at a density of 1 sample per ~ 55 km^2 has been carried out over the northernmost parts of the Caledonian fold belt and its foreland in eastern North Greenland. The < 0.1 mm fractions of the sediment samples were analysed by X-ray fluorescence, instrumental neutron activation and inductively coupled plasma emission techniques, and are reported for 37 major and trace elements together with conductivity and fluoride contents of stream water samples.

The element distributions largely reflect compositions of drained bedrock lithologies, except for a 30–40 km wide belt along the margin of the Inland Ice characterised by low, flat topography and very high SiO_2 contents in the stream silt samples. The fine-grained sediment in this belt is dominated by quartz sand and silt deposited on the platform by Quaternary – recent glacio-fluvial and aeolian processes. The high content of exotic clastic quartz depresses the true geochemical signature of the underlying lithologies.

The element distribution patterns suggest possibilities for: (1) Cr and Ni mineralisation associated with voluminous Middle Proterozoic basic igneous rocks in parts of their outcrop area; (2) Au mineralisation associated with shear zones; (3) base metal mineralisation along thrust planes of Caledonian nappes.

Contents

Introduction

The sampling of silt and water from streams in Lambert Land and Kronprins Christian Land (Fig. 1) in 1993 is part of ongoing regional drainage geochemical mapping by the Geological Survey of Greenland (GGU). This programme provides reconnaissance geochemical data that may be used together with geophysical and geological information to outline provinces or areas with a potential for mineral resources.

The geochemical sampling project was carried out during the first field season of a three-year GGU mapping campaign to eastern North Greenland (Henriksen, 1994). The expedition was based in a tent camp at Centrum Sø (Fig. 1) and used a Bell 206 Jet Ranger helicopter for transportation within the operational area. Helicopter-borne sampling tours were flown in Kronprins Christian Land and adjacent areas by S. M. Jensen and N. Henriksen, and in Lambert Land by J. D. Friderichsen and J. C. Escher.

Geology

Lambert Land and Kronprins Christian Land constitute the northern extremities of the East Greenland Caledonian fold belt, and are foreland to the slightly younger Canadian - North Greenland Franklinian mobile belt.

The geology of the surveyed area has been described by Adams & Cowie (1953), Fränkl (1954, 1955), Hurst *et al.* (1985) and Jepsen *et al.* (1994). General descriptions of the geology of the adjacent North Greenland Franklinian mobile belt are given in Dawes (1976), Higgins *et al.* (1985), Henriksen (1992) and in *Bulletin Grønlands geologiske Undersøgelse* **160** (1991). The northern parts of the East Greenland Caledonian fold belt are described in Henriksen & Higgins (1976), Friderichsen *et al.* (1990, 1991), Strachan *et al.* (1991) and in *Rapport Grønlands geologiske Undersøgelse* **162** (1994). The most recent of the above-mentioned papers and publications contain comprehensive literature references.

No recently published geological map covers the whole of the surveyed region (79°–80°55´ N). Modern 1:500 000 maps cover North Greenland north of 81° N (Bengaard & Henriksen, 1984; Henriksen, 1989, 1992), and parts of Kronprins Christian Land are included on a 1:1 000 000 geological map published in *Bulletin Grønlands geologiske Undersøgelse* **160** (1991). An outdated geological / tectonic 1:1 000 000 map, parts of which were compiled

in the early 1960's, covers North-East Greenland from 75° to 82° N (Haller, 1983). The geological map used in this report (Fig. 1) is simplified after a new, preliminary compilation by Jepsen (1994).

The surveyed region is dominated by sedimentary and volcanic successions that record a Middle Proterozoic – Lower Palaeozoic history of basin evolution (continental rifting and formation of a shelf on a passive plate margin) prior to the mid-Palaeozoic Caledonian and Ellesmerian orogenies. In the western parts of the region an undisturbed succession of Middle Proterozoic continental sandstones and basic volcanic rocks, Late Proterozoic mainly shallow marine sedimentary rocks, and Lower Palaeozoic shelf carbonate rocks is exposed. In eastern Kronprins Christian Land Late Proterozoic siliciclastic trough sediments are preserved in westward-transported Caledonian nappes that overlie the Late Proterozoic – Lower Palaeozoic shelf carbonate rocks. In the eastern coastal region the Middle Proterozoic continental sandstones and basic igneous rocks are interfolded with underlying Archaean – Lower Proterozoic crystalline rocks (Jepsen & Kalsbeek, 1985). The crystalline basement is transected by a large NNE–SSW trending Caledonian shear zone which appears to be the continuation of the Storstrømmen shear zone of Dronning Louise Land some 300 km to the south of Lambert Land (Jepsen *et al.*, 1994).

The oldest sedimentary units exposed within the surveyed region belong to the more than 2 km thick Middle Proterozoic Independence Fjord Group. The Independence Fjord Group consists of fluvial and aeolian sandstones that were deposited on a sagging, peneplained Archaean – Lower Proterozoic crystalline basement (Sønderholm & Jepsen, 1991). Rb/Sr dating of clayey material from the middle parts of the Independence Fjord Group indicates an age of ~ 1380 Ma (Larsen & Graff-Petersen, 1980). The sandstone sequence is cut by voluminous basic sills and dykes (Midsommersø Dolerites) and overlain by extensive flows of the Zig-Zag Dal Basalt Formation (Jepsen & Kalsbeek, 1979; Jepsen *et al.*, 1980; Kalsbeek & Jepsen, 1983, 1984). The dolerites and the basalts are considered to have been emplaced contemporaneously 1230 ± 25 Ma ago (Jepsen & Kalsbeek, 1979). The Middle Proterozoic sedimentary and basic igneous rocks are correlatable with Middle Proterozoic continental sedimentary and basic igneous successions in western North Greenland and in North-East Greenland (Sønderholm & Jepsen, 1991).

An erosional unconformity that represents a hiatus of perhaps 400–500 Ma forms the base of Late Proterozoic conglomerates and turbidites (Rivieradal sandstones) and partly

equivalent shallow marine shelf siliciclastic and carbonate rocks of the Hagen Fjord Group (Clemmensen & Jepsen, 1992). The ~ 1 km thick Hagen Fjord Group sequence is well exposed around Danmark Fjord, but the Rivieradal sandstones are only seen in the Caledonian nappes in eastern Kronprins Christian Land, where the several kilometre thick sequence passes upwards into carbonate rocks of the middle parts of the Hagen Fjord Group (Jepsen & Sønderholm, 1994; Jepsen *et al.*, 1994).

Middle Ordovician – Lower Silurian platform carbonates and a N–S trending belt of Lower Silurian carbonate reefs overlie the Hagen Fjord Group sequence. In the Caledonian foreland to the west of Centrum Sø 'thin-skinned' thrusts with minor displacements and localised folding transect the Lower Palaeozoic carbonate platform (Higgins & Soper, 1994), and in eastern Kronprins Christian Land Rivieradal sandstones in Caledonian nappes overlie the carbonate platform.

Exploration in North Greenland

During regional mapping campaigns GGU has explored western and central North Greenland by reconnaissance stream silt geochemistry (Jakobsen & Stendal, 1987; Steenfelt, 1985, 1987, 1991). In parts of eastern North Greenland to the north-west of Danmark Fjord GGU has carried out limited reconnaissance stream silt geochemistry (Henriksen, 1980; Steenfelt, 1980), and stream sand geochemistry and microscopy studies that have revealed widespread copper anomalies associated with the Middle Proterozoic basic igneous rocks and the Late Proterozoic sandstones and mudstones (Ghisler *et al.*, 1979; Ghisler & Stendal, 1980; Ghisler, 1994). Recent follow-up on an occurrence of chalcopyrite in stream sand in Campanuladal (Fig. 1) led to two sandstone beds with small amounts of disseminated chalcopyrite and galena, respectively, in the Campanuladal Formation of the Late Proterozoic Hagen Fjord Group (Lind & Tukiainen, 1994).

In the Lower Palaeozoic Franklinian mobile belt of North Greenland a number of stream sediment Zn anomalies and Zn-Pb sulphide showings occur along the E–W trending Navarana Fjord escarpment which separates platform carbonates to the south from deep-water siliciclastic trough sediments to the north (Jakobsen & Steenfelt, 1985; Jakobsen, 1989; Steenfelt, 1991; Lind *et al.*, 1994). At Citronen Fjord some 350 km to the north-west of Centrum Sø a major discovery was made in 1993 by the private company Platinova A/S: a

large stratiform zinc deposit hosted by Lower Palaeozoic shales on the basinward side of the Navarana Fjord escarpment was revealed by exposed giant gossans; the deposit is currently being evaluated by drilling and geophysical methods (Schønwandt, 1994).

Physiography

The surveyed region shows a very wide range of physiographical conditions. In a NNE–SSW striking belt between Centrum Sø and Danmark Fjord flat-lying Ordovician – Silurian limestones and dolomites form a 300–500 m high plateau cut by a few, deep E–W trending valleys. The streams on the plateau are wide and shallow with gently flowing water derived from local snow fans and shield-shaped ice caps (Figs 42 – 44). Fine-grained sediment in the streams is sparse and often characterised by a very high content of organic matter. Exotic blocks and cobbles (gneisses and dolerites) are common in the streams. A thin blanket of Quaternary – recent fluvial and aeolian transported sand and silt may be seen in wide valleys in the western parts of the plateau. Wind-eroded outcrops and faceted pebbles on rocky pavements attest to frequent sand and dust storms.

The Caledonian nappe complexes in eastern Kronprins Christian Land are characterised by more rugged topography (Figs 43 & 44), and the streams are generally narrow and deep, with high water flows. In streams cutting the Upper Proterozoic Rivieradal sandstones blocks, cobbles and gravel appear to be of local origin.

In eastern Kronprins Christian Land and along the fjords on the east coast the Middle Proterozoic Independence Fjord Group sandstones and Midsommersø Dolerites form a topographical high with altitudes up to about 1500 m. The exposures are steep, rugged peaks with no vegetation (Fig. 45), and glaciers and glacier tongues cover about half of the surface area. All streams discharge from the fronts or sides of glaciers and are short, steep and deep, and carry a high load of suspended sediment.

The streams in Lambert Land are similar in character to those in the nappe complexes east of Centrum Sø.

West of Danmark Fjord, flat-lying, block-faulted Independence Fjord Group sandstones, Zig-Zag Dal basalts and Hagen Fjord Group sand- and siltstones and dolomites form a plateau-like landscape cut by deep, steep valleys (glacial troughs). The streams discharging into the valleys flow in canyons and tend to be deep and have high water flows (Fig. 46).

Sampling

Stream silt and water samples were collected at 220 sampling sites (of which 200 were reached by helicopter) over an ice-free area of approximately 12 000 km^2; this corresponds to a density of 1 sample per 55 km^2. A total helicopter flying time of 22 hr 30 min corresponds to 6 min 45 s per sampling site, or 8 s per km^2 of the sampled area.

The sample sites were selected and marked on aerial photographs prior to the field work, using selection criteria such as even geographical distribution, representation of major lithological units, size of upstream drainage area, and topography.

At each sampling site *c.* 500 g of fine-grained stream sediment was collected in a paper bag and 100 ml of stream water in a polyethylene bottle. Each numbered sediment sample is a composite of several subsamples collected from about 5 sand and silt accumulations within a few tens of metres' distance from the recorded sampling site. Duplicate silt and water samples were collected at 12 localities, i.e. at 5.5 % of the total number of localities. Radioactivity (total gamma-radiation) was measured on representative outcrops or stream boulders, where available, using a scintillometer (Table 1).

Sample preparation and analysis

Sediment. In the expedition base camp at Centrum Sø the sample bags were laid out to dry in open air on plywood boards, and at the end of the field season sent by Royal Danish Air Force (RDAF) transport aircraft to GGU, Copenhagen. Here, the samples were further dried at 65°C and sieved into three grain size fractions using sieve apertures of 1 mm and 0.1 mm. The coarse fractions were discarded, the medium grain size fractions archived, and the fine grain size fractions submitted for analysis. The samples were analysed by instrumental neutron activation (INA) and inductively coupled plasma emission (ICP) methods for Au and 47 other elements by Activation Laboratories Ltd., Canada (Table 2). Major elements and 6 trace elements were determined at GGU by X-ray fluorescence spectrometry on fused discs (using sodium tetraborate). The GGU laboratory further determined Na_2O and Cu by atomic absorption spectrometry (AAS).

Water. The water samples were sent by RDAF transport aircraft to GGU, Copenhagen, where conductivity and fluoride concentrations were measured *c.* 3 months after collection (Table 1).

Data presentation

The analytical results are presented in this report as element distribution maps together with summary statistical parameters and histograms of the frequency distribution for each element (Figs 2 – 41).

In the element distribution maps each sample is represented by a dot, the size of which is proportional to the element concentration. For each element distribution map the scaling of dot sizes has been chosen so as to display as clearly as possible the regional variations in geochemical signatures.

For elements that have been determined by more than one analytical method, only one set of data is shown: the data set that is considered the most reliable or determined at the lowest detection limit. Major elements have been recalculated to volatile-free oxides; the arithmetic mean of volatile contents (determined as loss on ignition) is a high 7.5 %, and the median is 5.2 %. High volatile contents are common in samples from the placid streams on the carbonate platform, where the fine-grained sediment is often very rich in organic matter.

Comments on the element distribution patterns

In western Kronprins Christian Land and western Lambert Land a 30–40 km wide belt parallel to the margin of the Inland Ice is characterised by very high SiO_2 contents (commonly ~ 80 %; Fig. 2), irrespective of the compositions of bedrock lithologies. This indicates that the fine-grained sediment is largely exotic quartz deposited by Quaternary – recent fluvio-glacial and aeolian processes. The quartz-rich sediment has probably been derived mainly from Independence Fjord Group sandstones that are partly buried under the Inland Ice. An analogous quartz sand / silt blanketing effect has been noted over parts of the deeply eroded Archaean – Lower Proterozoic gneiss region to the south of Lambert Land (A. Steenfelt, unpublished data); Proterozoic sandstone formations broadly correlatable with

those of the Independence Fjord Group are exposed on the westernmost nunataks of this region.

The quartz sand / silt blanketing depresses the main constituents (MgO and CaO) of the carbonate platform bedrock in the silt samples (Figs 7 & 8), and will tend to depress the geochemical signal of any anomalous element concentration. Levels of SiO_2, MgO and CaO believed to truly represent the carbonate platform are seen in the northern parts of the surveyed region which are characterised by higher altitudes and streams that cut canyons through the bedrock.

Most of the exposed Hagen Fjord Group rocks in the region lie around Danmark Fjord, and are affected, in part, by the glacial and aeolian sand / silt blanketing discussed above. High MgO and CaO contents characterise samples from streams draining the Fyns Sø Formation (dolomites) that dominate the narrow, arcuate belt of Hagen Fjord Group outcrops between Ingolf Fjord and Dijmphna Sund (Figs 1, 7 & 8).

The Rivieradal sandstones in the Caledonian nappes in eastern Kronprins Christian Land are enriched, relative to the carbonate platform, in most elements except SiO_2, MgO and CaO. Relative to the Independence Fjord Group and the crystalline basement in the coastal region, the Rivieradal sandstones have slightly higher levels of TiO_2, Al_2O_3, Fe_2O_3, Na_2O, K_2O, As, Cs, Pb, Rb, Sb, Th, U, Zn and rare earth elements. The moderate enrichment in several elements may be explained by the generally immature nature and varied composition (conglomerates, turbidites, dark mudstones) of the Rivieradal sandstones.

The Independence Fjord Group rocks are characterised in all outcrop areas by high contents of SiO_2 and medium-high contents of MnO, Na_2O, P_2O_5, Co, Hf, Sc, V, Y and rare earth elements. Distinctly elevated Cr and Ni contents characterise the Independence Fjord Group outcrop areas on Lynn Ø and Hovgaard Ø, but apparently not those in Lambert Land and in the area to the west of Danmark Fjord. It is possible that this marked geochemical contrast represents a regional difference in composition of the voluminous Middle Proterozoic basic rocks associated with the Independence Fjord Group.

Gamma radiation is very low over the carbonate platform (Fig. 39). The distribution of gamma radiation levels closely follows the distribution of Th and U in stream sediments, and the highest levels (max. 125 cps) occur over the Rivieradal sandstones.

Water conductivity is very low in streams in Lambert Land and in the Rivieradal sandstones in general (Fig. 40). Higher values occur in the Rivieradal sandstones around the

inner parts of Ingolf Fjord, around the inner parts of Danmark Fjord, and on the carbonate platform along some of the wider valleys. The distribution pattern of fluoride in stream water (Fig. 41) closely follows the water conductivity distribution pattern.

Element distribution indicating mineralisation

No mineralisation is directly indicated by the geochemical survey, but, as discussed in the previous section, any anomaly in a 30–40 km wide belt along the margin of the Inland Ice would have been depressed by a large proportion of exotic quartz in the fine-grained sediment.

A few occurrences of just detectable Au are scattered throughout the surveyed region (Fig. 13); in central Lambert Land a Au anomaly of 110 ppb appears to be related to strongly sheared crystalline basement rocks (Lind & Tukiainen, 1994).

A possibility for minor Cr and Ni mineralisation in the Middle Proterozoic basic igneous rocks on Lynn Ø and Hovgaard Ø is suggested by geographically well-defined anomalies (Figs 16 & 20), and a regional difference in composition of the basic magmas can not be ruled out.

The area around the inner parts of Ingolf Fjord is characterised by some enrichment in many trace elements, particularly As, Cu, Pb, Rb, Sb, Th, U, V, Zn and rare earth elements. In addition, some of the highest levels of gamma radiation, water conductivity and fluoride contents have been recorded here (Figs 39 – 41). This suggests element redistribution along the thrust contact between the Caledonian nappe and the underlying platform. Several rusty weathering zones have been observed in this area, but no trace of sulphide mineralisation has yet been found (Jensen, 1993; Lind & Tukiainen, 1994).

Conclusions

The reconnaissance geochemical survey of Lambert Land and southern Kronprins Christian Land largely reflects bedrock compositions of lithologies drained by the sampled streams. However, most of the silt samples collected in a 30–40 km wide belt along the margin of the Inland Ice are dominated by exotic quartz that has been glacially eroded from Independence Fjord Group sandstones partly buried under the Inland Ice and transported by

Quaternary – recent glacio-fluvial and aeolian processes. The exotic detrital quartz depresses the geochemical signal of underlying lithologies. The terrain in this belt, a combination of flat-lying, unmetamorphosed and easily eroded sedimentary rocks exposed along the margin of the Inland Ice, and sandstone formations buried under the ice, has not been adequately represented by the silt geochemical survey.

The element distribution patterns combined with earlier geological field observations in the region point to the following as targets for mineral exploration:

- Au in shear zones (Au anomalies in Lambert Land)
- Cr, Ni and Cu in Middle Proterozoic basic igneous rocks (Cr and Ni anomalies on Lynn Ø and Hovgaard Ø; native Cu and Cu sulphides observed in the region to the north-west of Danmark Fjord)

In addition, speculation based on the overall geological setting, as yet not corroborated by reconnaissance geochemistry or field observations, suggests a possibility of finding the following equivalents to known mineralisation along the Navarana Fjord escarpment in the North Greenland Franklinian mobile belt:

- Epigenetic Pb-Zn in the Lower Palaeozoic carbonate platform
- Syngenetic Zn-Pb in the Rivieradal sandstones

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Table 1. Instrumentation at the Geological Survey of Greenland

Field measurement of gamma-radiation: Saphymo-Srat SPP-2 scintillometer

Water samples:

Conductivity: Chemotest JK 8800

Fluoride concentration: Orion EA 920 pH/ion analyzer

Table 2. Analytical detection limits

'Au + 47', combination INA / total digestion - ICP (Activation Laboratories Ltd.)

INA (instrumental neutron activation analysis)

Au	2	ppb	As	0.5	ppm	Ba	50	ppm	Br	0.5	ppm
Ce	3	ppm	Co	1	ppm	Cr	5	ppm	Cs	1	ppm
Eu	0.2	ppm	Fe	0.01	%	Hf	1	ppm	Hg	1	ppm
Ir	5	ppb	La	0.5	ppm	Lu	0.05	ppm	Na	0.01	%
Nd	5	ppm	Rb	5	ppm	Sb	0.1	ppm	Sc	0.1	ppm
Se	3	ppm	Sm	0.1	ppm	Sn	100	ppm	Ta	0.5	ppm
Th	0.2	ppm	Tb	0.5	ppm	U	0.5	ppm	W	1	ppm
Yb	0.2	ppm									

Total digestion - ICP (inductively coupled plasma emission)

Ag	0.4	ppm	Al	0.01	%	Be	2	ppm	Bi	5	ppm
Ca	0.01	%	Cd	0.5	ppm	Cu	1	ppm	K	0.01	%
Mg	0.01	%	Mn	1	ppm	Mo	1	ppm	Ni	1	ppm
P	0.001	%	Pb	5	ppm	Sr	1	ppm	Ti	0.01	%
V	2	ppm	Y	2	ppm	Zn	1	ppm			

XRF, X-ray fluorescence spectrometry on fused discs (Geological Survey of Greenland)

Cr	5	ppm	Ni	2	ppm	Rb	2	ppm	Sr	1	ppm
V	5	ppm	Zn	10	ppm						

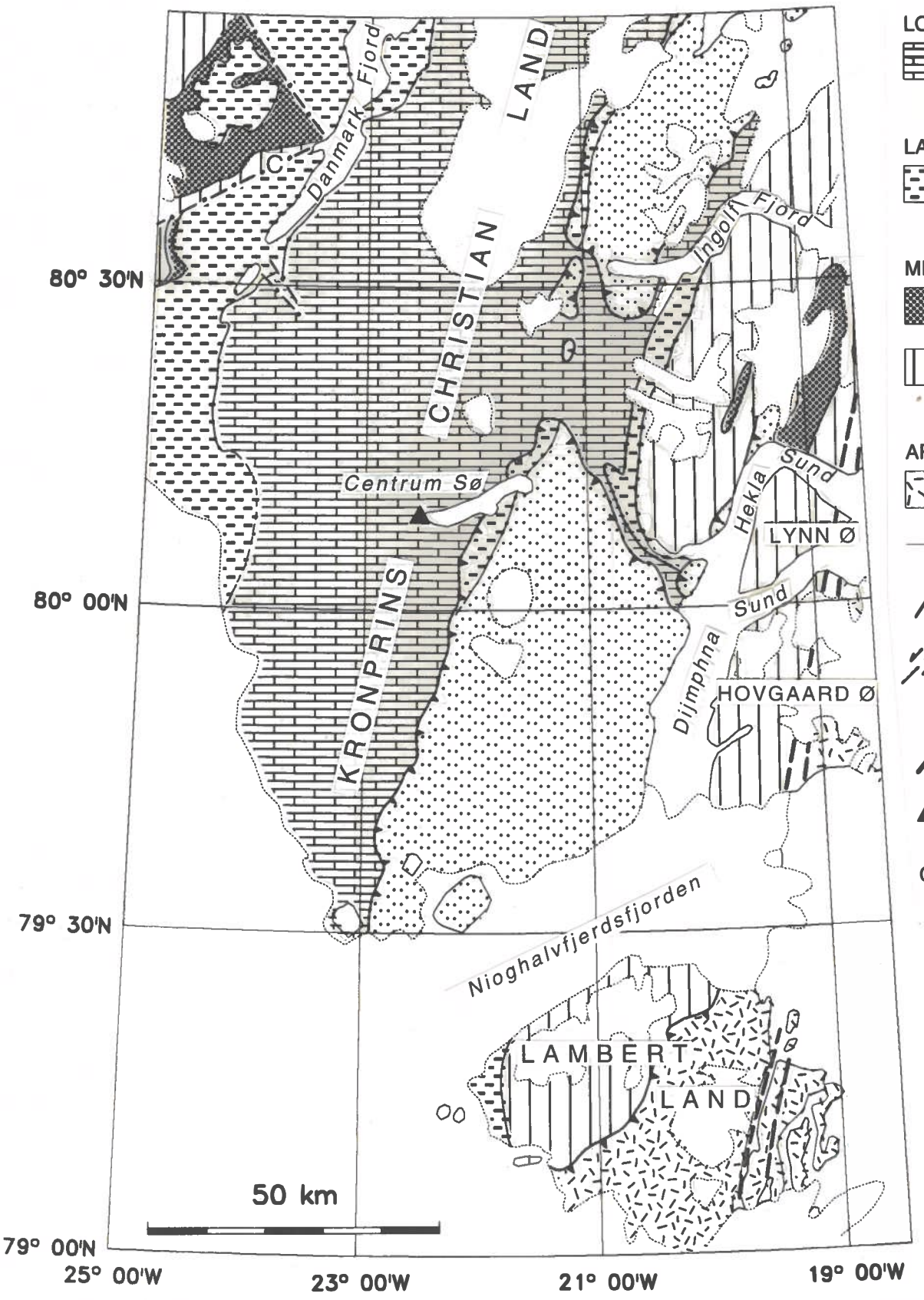
AAS, atomic absorption spectrometry (Geological Survey of Greenland)

Cu	3	ppm

List of figures

Grønlands Geologiske Undersøgelse

Geological map



LOWER PALAEOZOIC
Ordovician - Silurian carbonate platform

LATE PROTEROZOIC
Hagen Fjord Group
Rivieradal sandstones

MIDDLE PROTEROZOIC
Zig-Zag Dal Basalt Formation
Independence Fjord Group and Midsommersø Dolerites

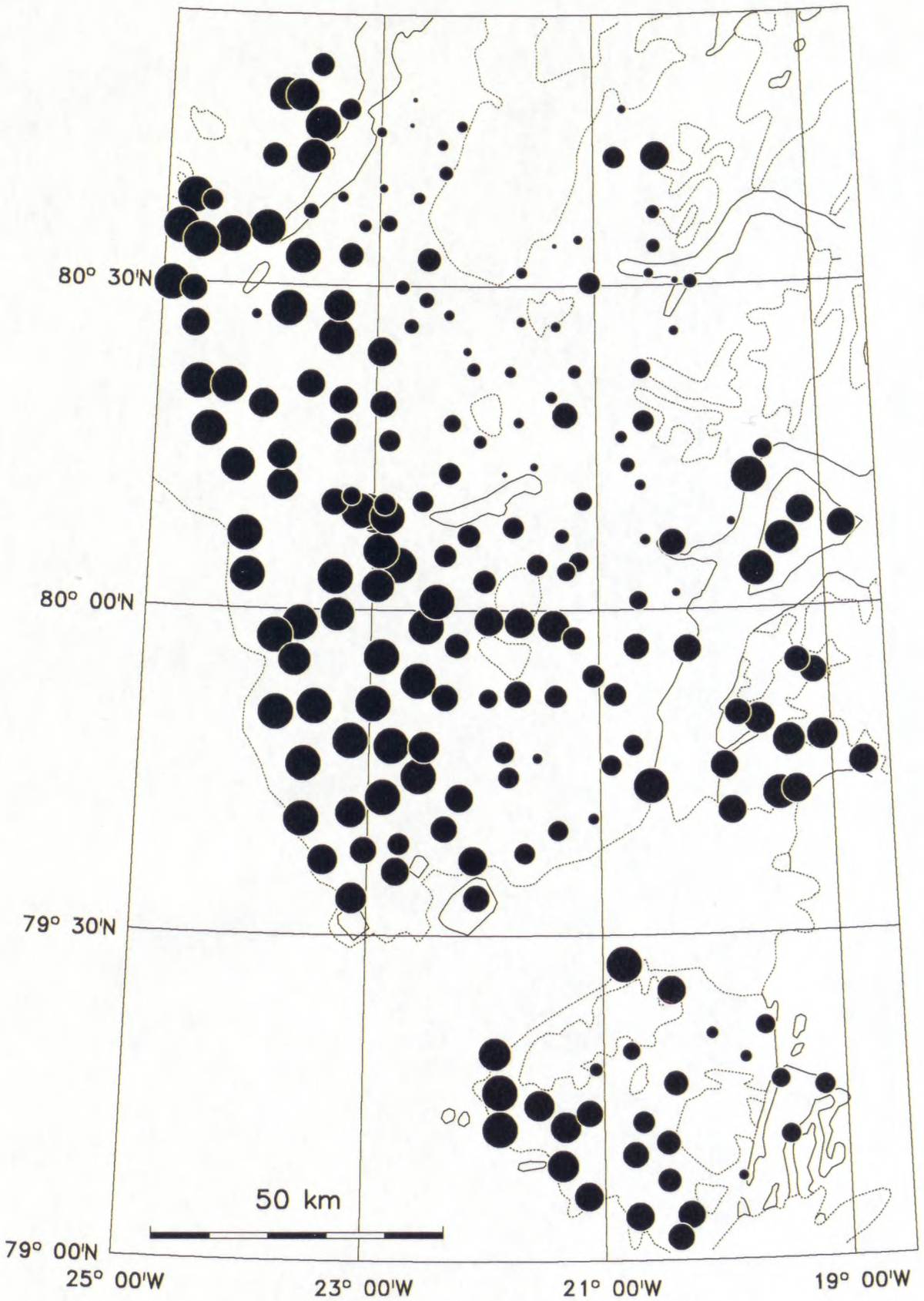
ARCHAEAN - EARLY PROTEROZOIC
Crystalline basement

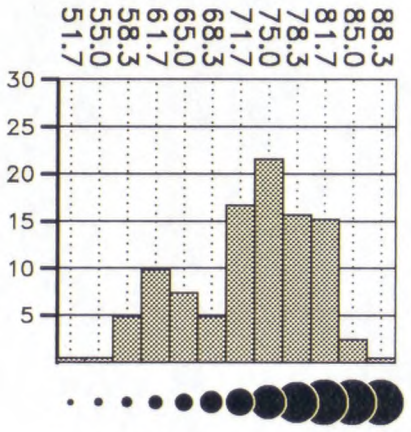
Caledonian thrusts
Caledonian Storstrømmen shear zone
Faults
Expedition base camp
C Campanuladal

Fig. 1

Grønlands Geologiske Undersøgelse

SiO_2 in stream sediment





SiO_2 pct

XRF

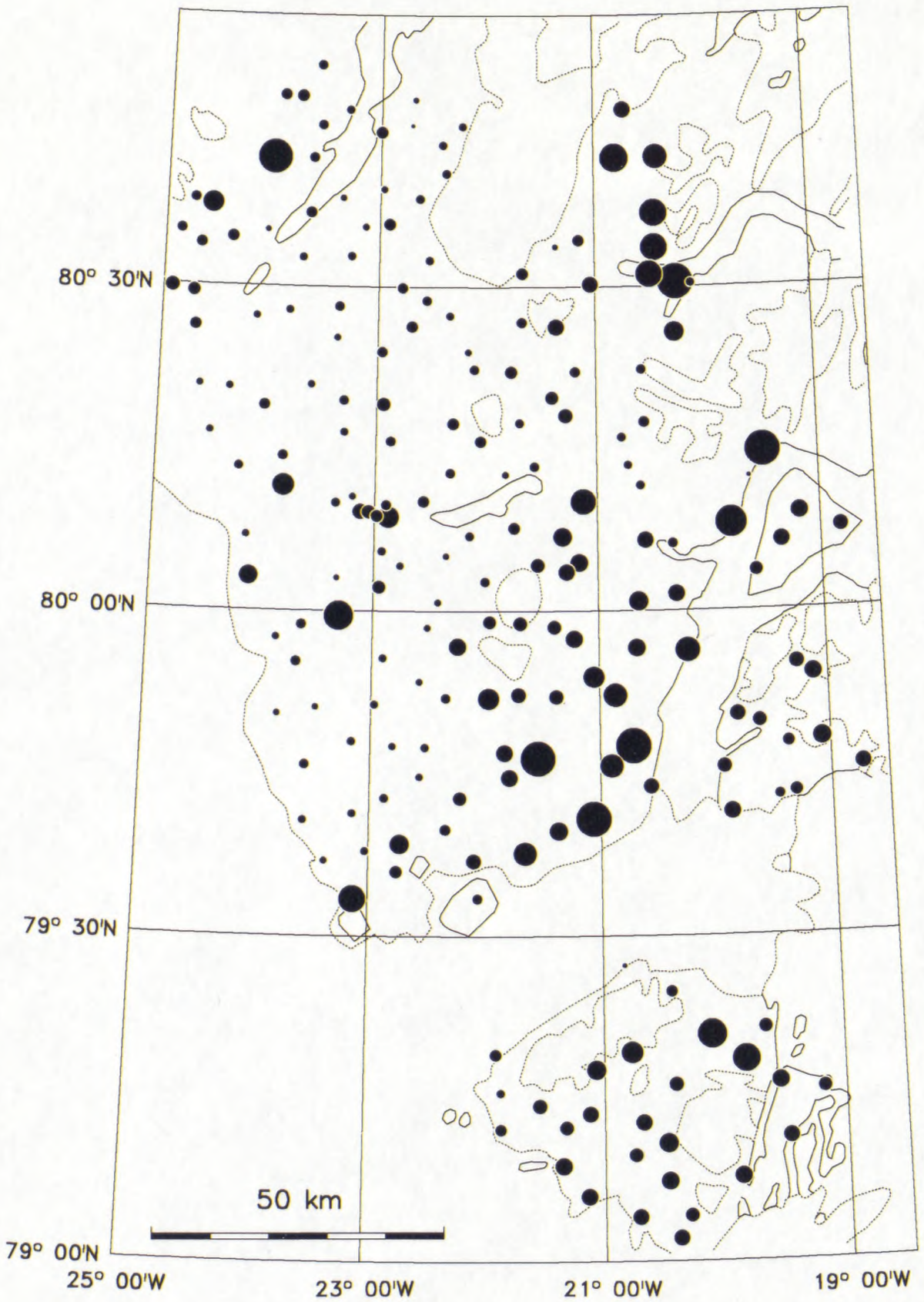
Number of samples:	207
Min. value:	26.2
Max. value:	87.1
Mean:	72.4
Median:	74.4
Variance:	72.9
Std. Dev.:	8.5

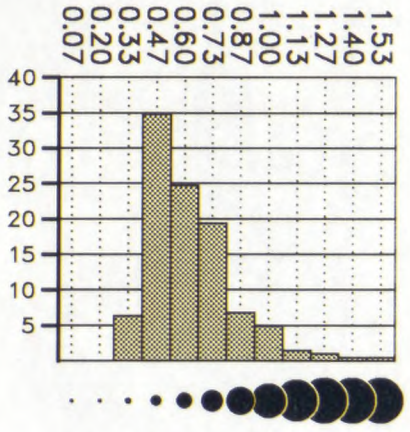
Fig. 2

Grønlands Geologiske Undersøgelse

GGU

TiO_2 in stream sediment





TiO_2 pct

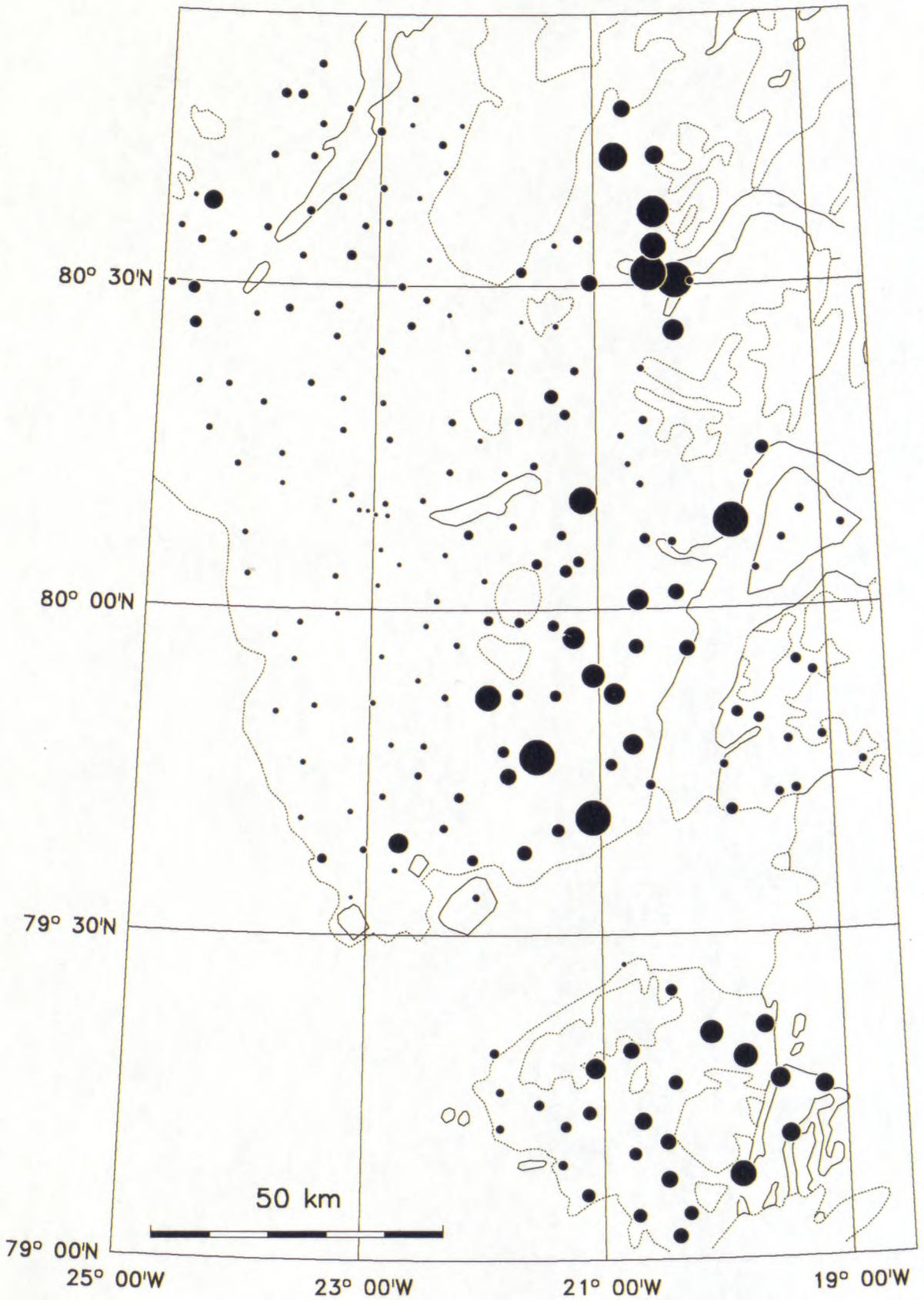
XRF

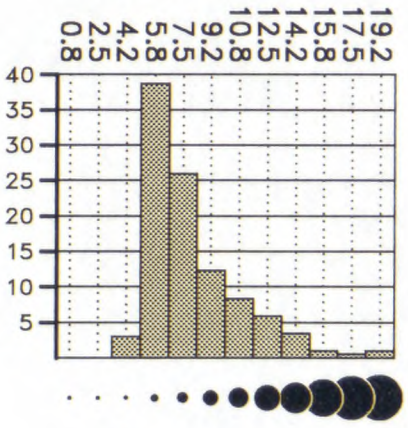
Number of samples:	207
Min. value:	0.28
Max. value:	1.55
Mean:	0.62
Median:	0.58
Variance:	0.04
Std. Dev.:	0.21

Fig. 3

Grønlands Geologiske Undersøgelse

Al_2O_3 in stream sediment





Al_2O_3 pct

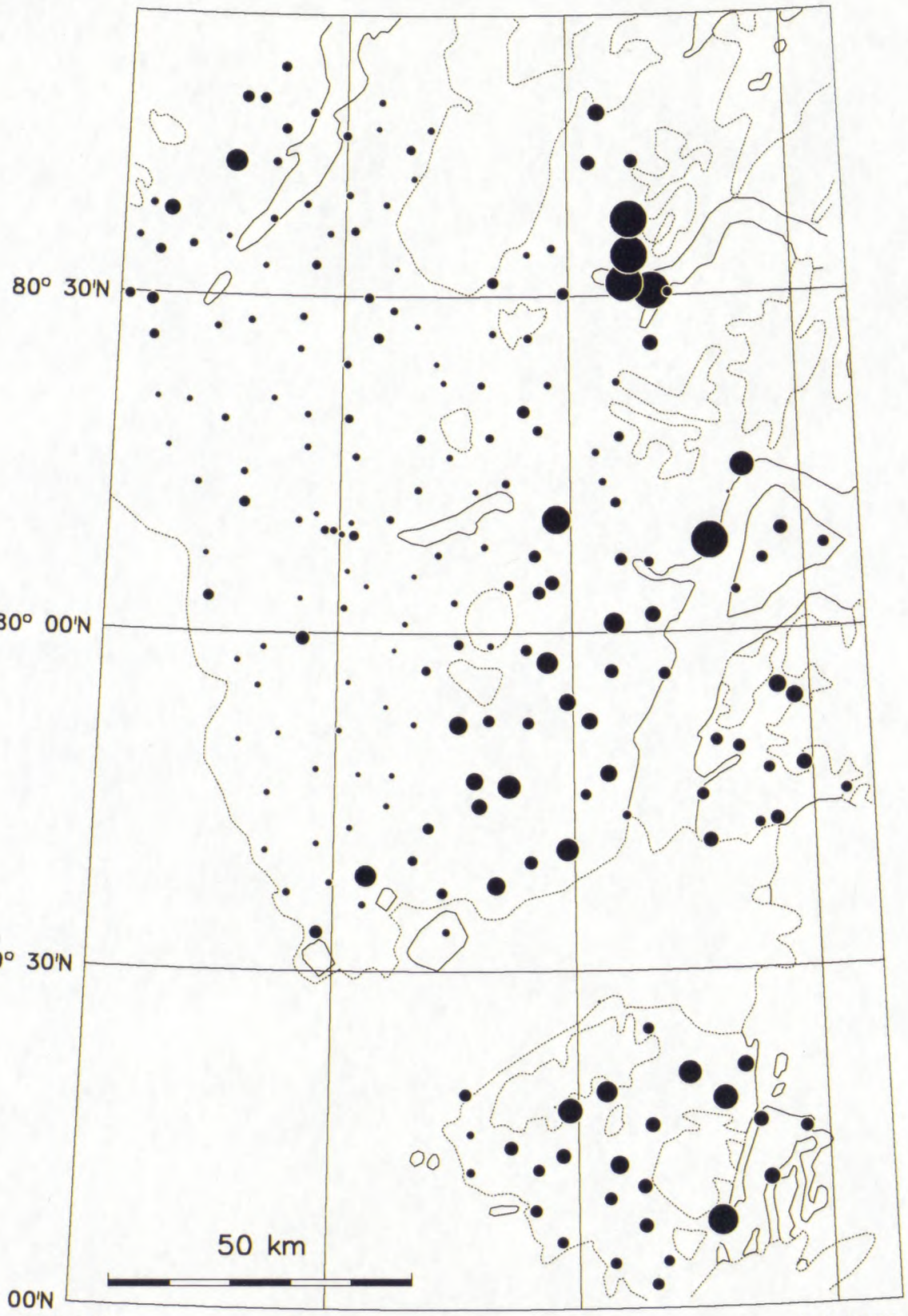
XRF

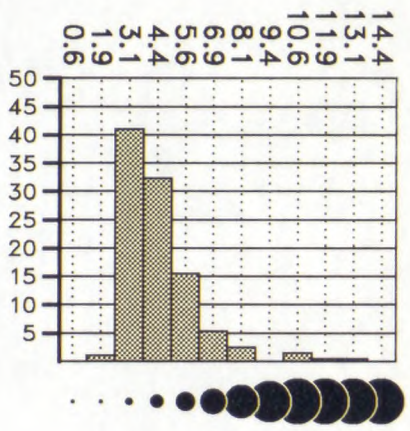
Number of samples:	207
Min. value:	4.6
Max. value:	24.2
Mean:	8.2
Median:	7.1
Variance:	10.9
Std. Dev.:	3.3

Fig. 4

Grønlands Geologiske Undersøgelse

Fe_2O_3 in stream sediment





Fe_2O_3 pct

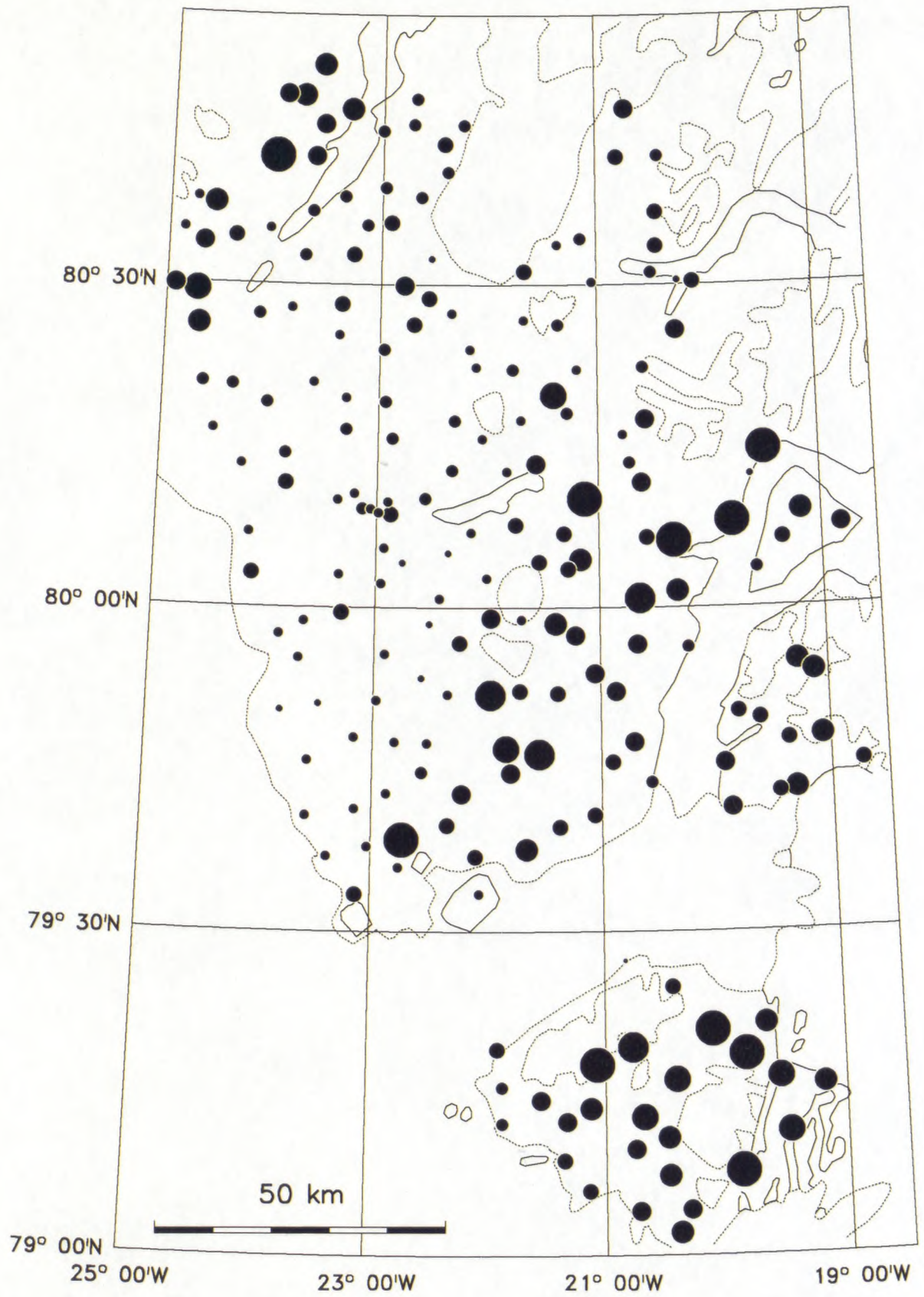
XRF

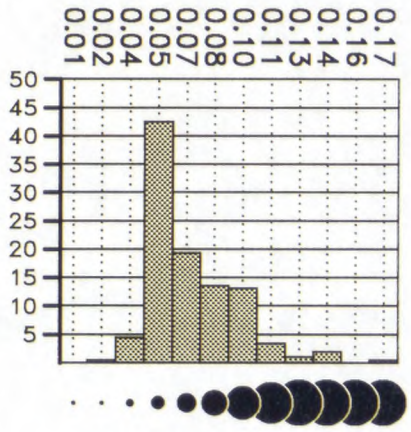
Number of samples:	207
Min. value:	1.8
Max. value:	12.7
Mean:	4.4
Median:	4.0
Variance:	2.9
Std. Dev.:	1.7

Fig. 5

Grønlands Geologiske Undersøgelse

MnO in stream sediment





MnO pct

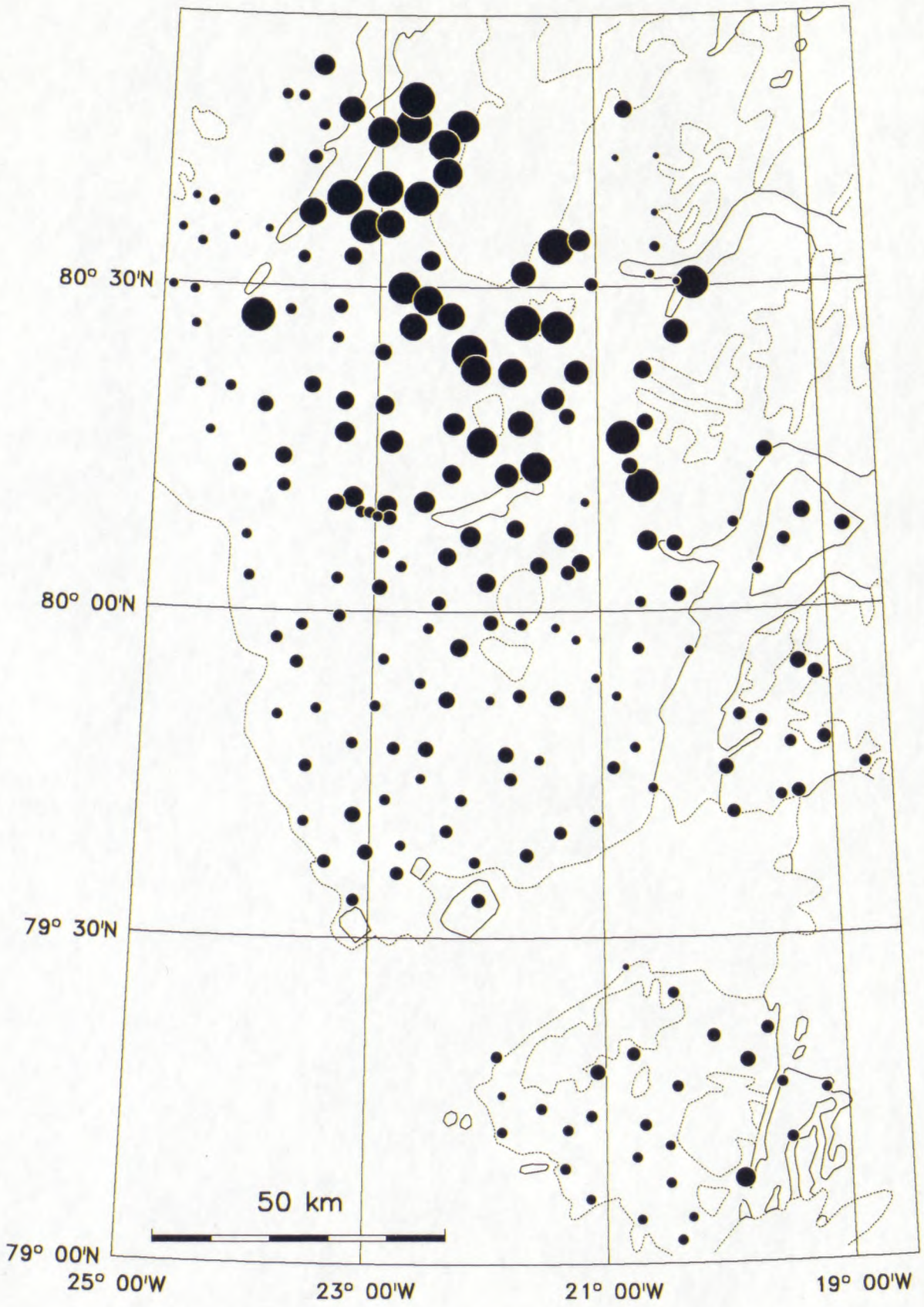
XRF

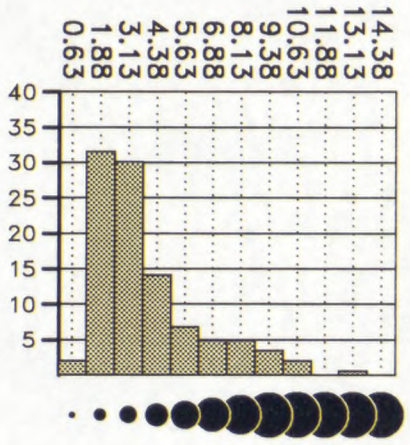
Number of samples:	207
Min. value:	0.03
Max. value:	0.17
Mean:	0.07
Median:	0.07
Variance:	0.00
Std. Dev.:	0.02

Fig. 6

Grønlands Geologiske Undersøgelse

MgO in stream sediment



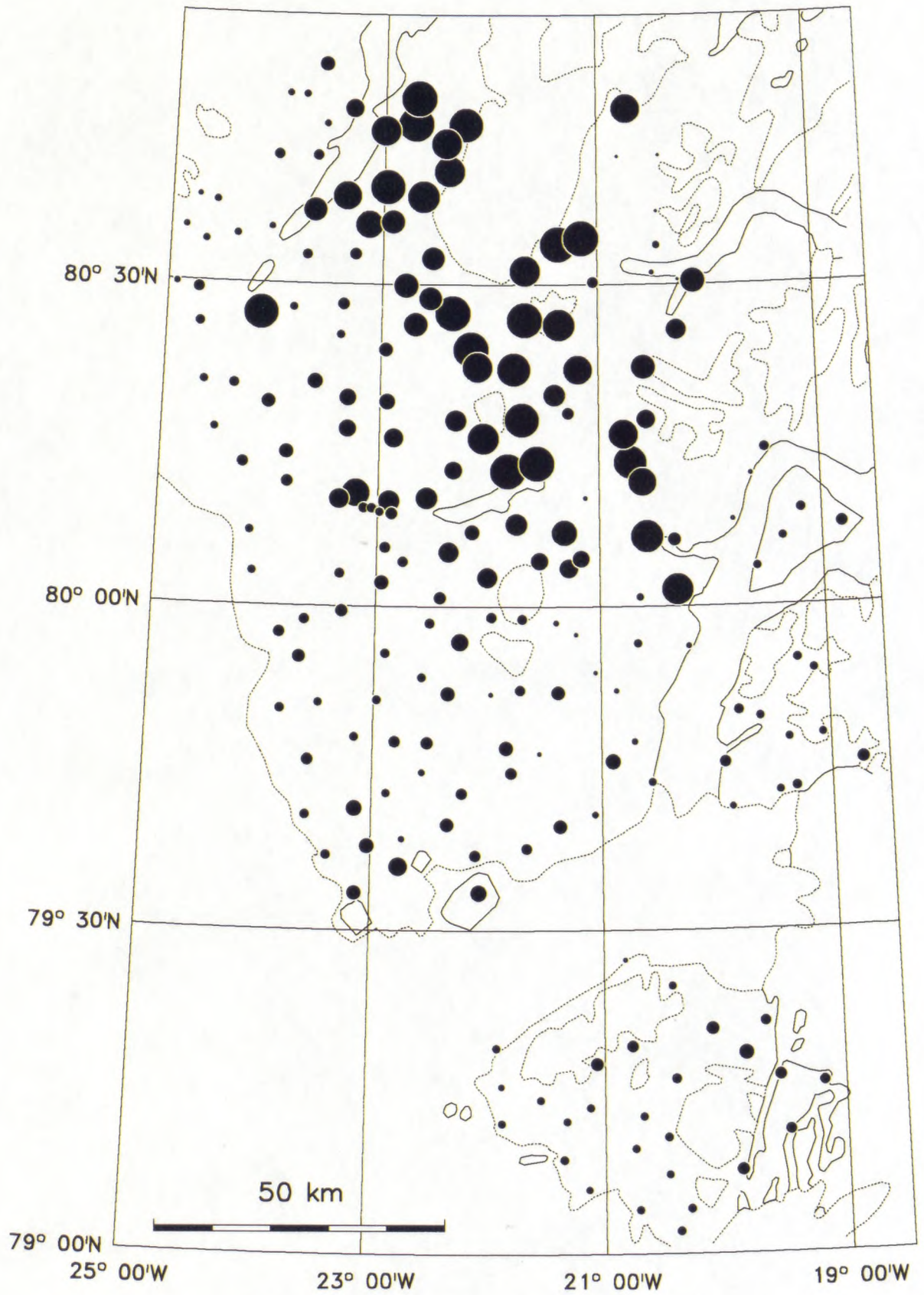


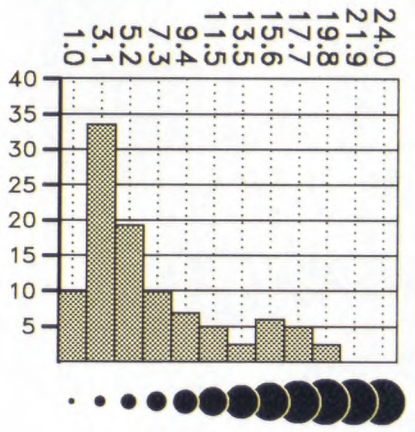
Number of samples:	207
Min. value:	0.98
Max. value:	24.82
Mean:	3.95
Median:	3.01
Variance:	7.24
Std. Dev.:	2.69

Fig. 7

Grønlands Geologiske Undersøgelse

CaO in stream sediment





CaO pct

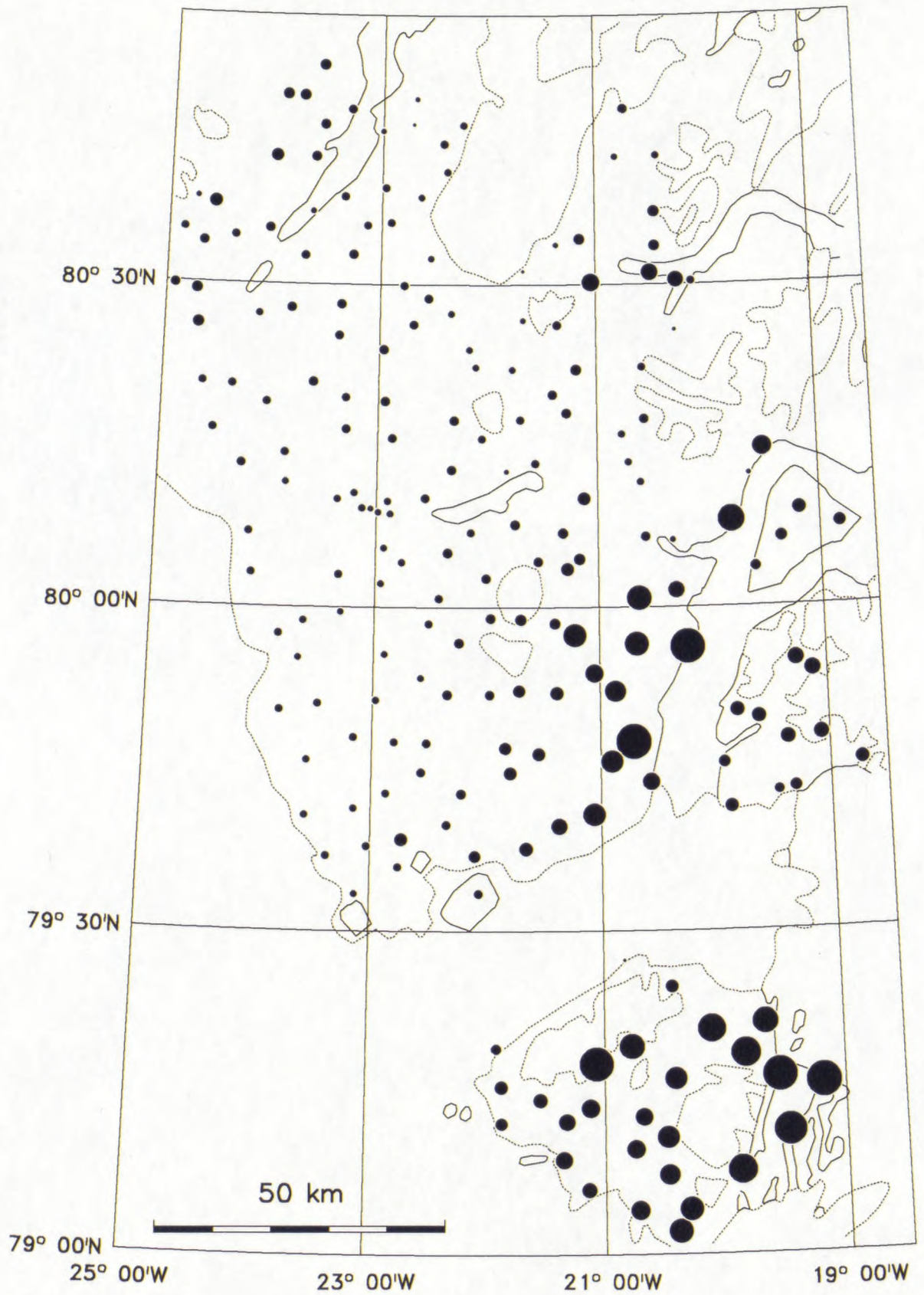
XRF

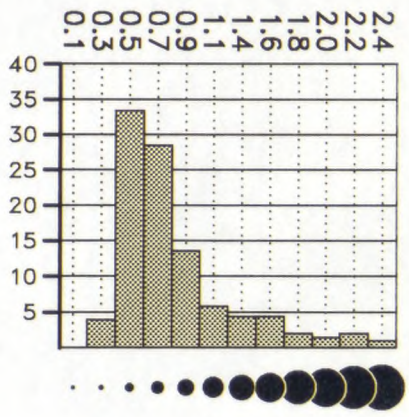
Number of samples:	207
Min. value:	0.2
Max. value:	38.5
Mean:	7.2
Median:	4.9
Variance:	39.5
Std. Dev.:	6.3

Fig. 8

Grønlands Geologiske Undersøgelse

Na_2O in stream sediment





Na_2O pct

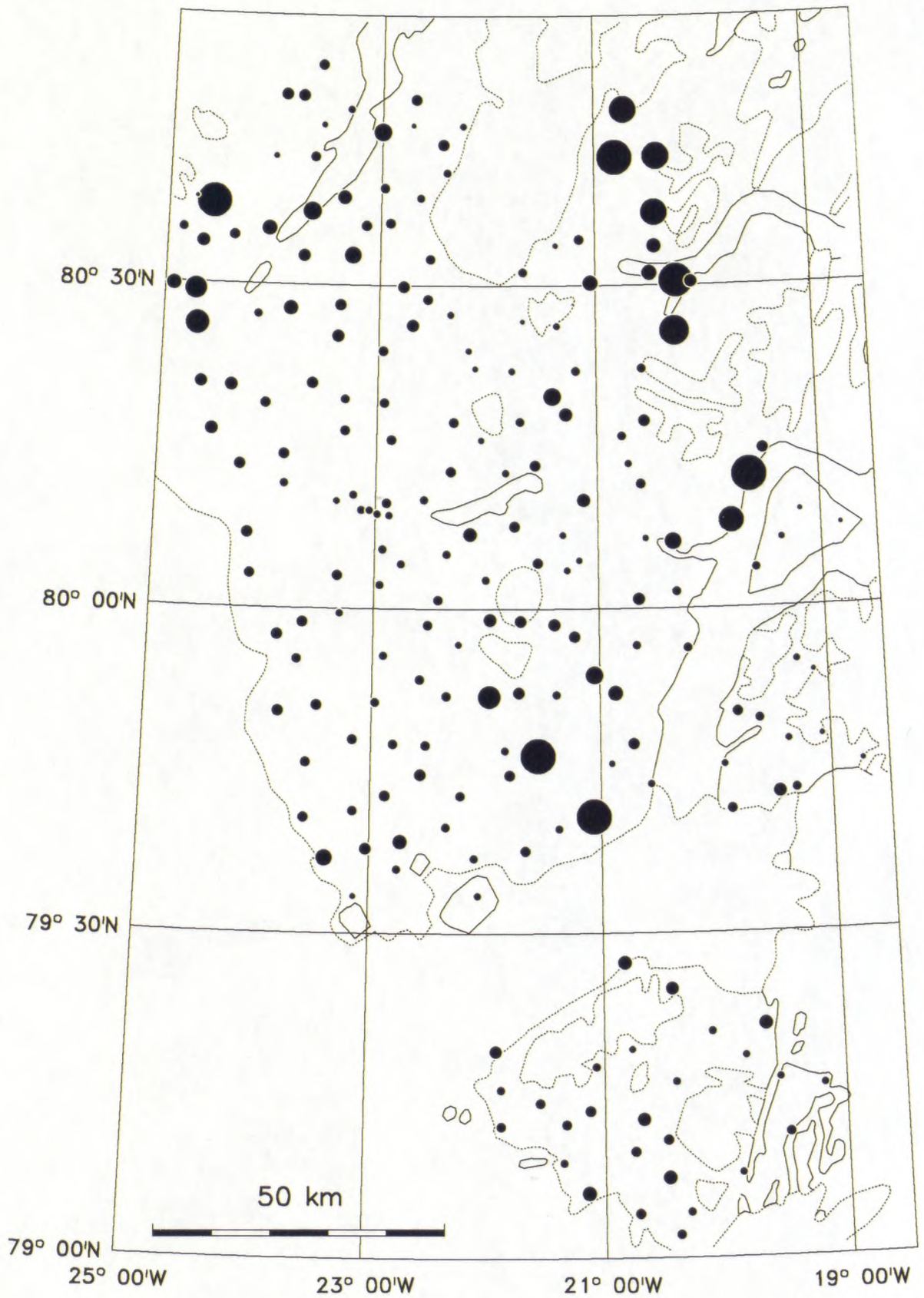
AAS

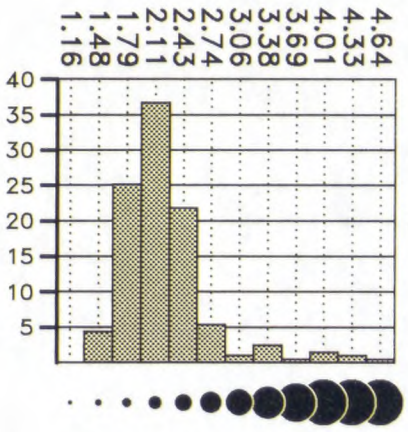
Number of samples:	207
Min. value:	0.3
Max. value:	2.5
Mean:	0.8
Median:	0.7
Variance:	0.2
Std. Dev.:	0.4

Fig. 9

Grønlands Geologiske Undersøgelse

K_2O in stream sediment





K_2O pct

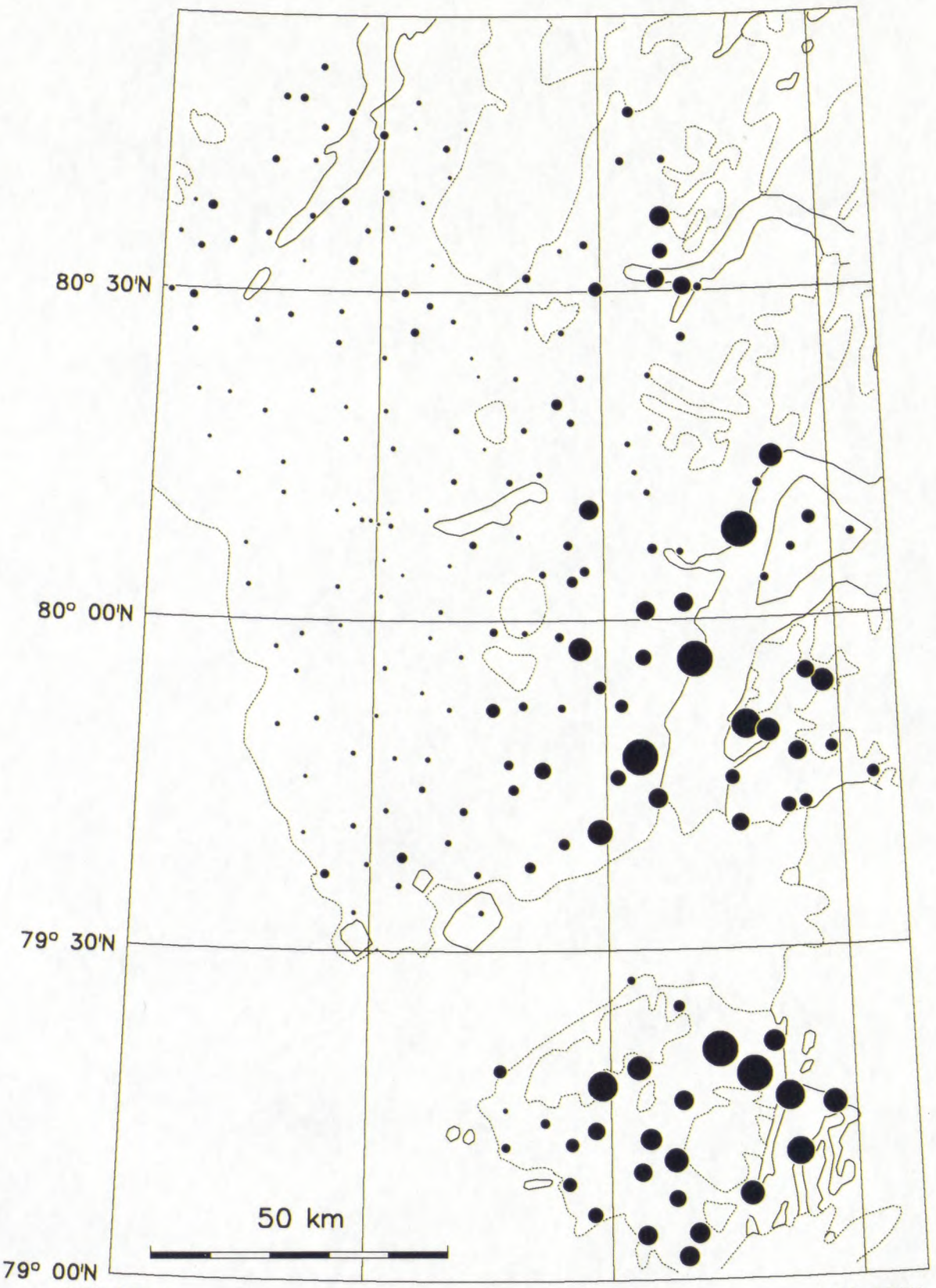
XRF

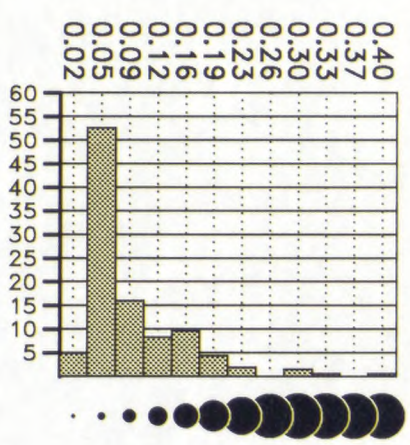
Number of samples:	207
Min. value:	1.33
Max. value:	4.74
Mean:	2.21
Median:	2.11
Variance:	0.26
Std. Dev.:	0.51

Fig. 10

Grønlands Geologiske Undersøgelse

P_2O_5 in stream sediment





P_2O_5 pct

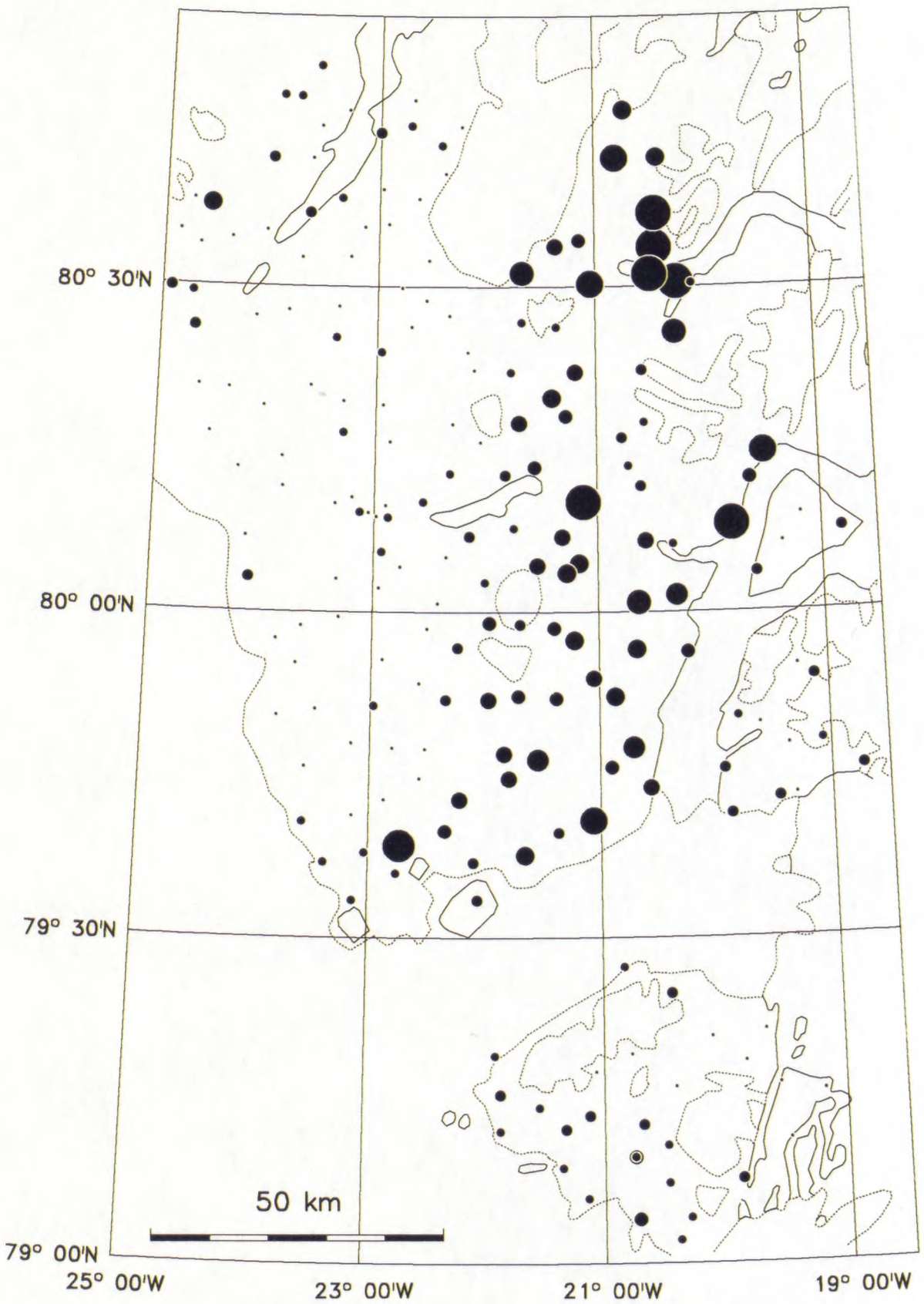
XRF

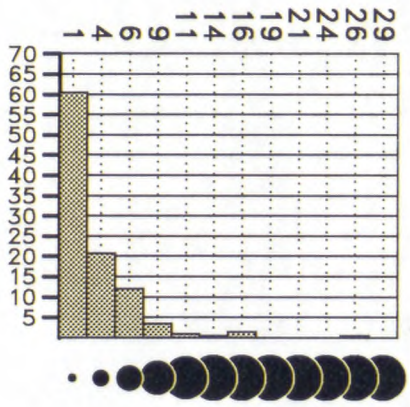
Number of samples:	207
Min. value:	0.03
Max. value:	0.41
Mean:	0.08
Median:	0.06
Variance:	0.00
Std. Dev.:	0.06

Fig. 11

Grønlands Geologiske Undersøgelse

As in stream sediment





As ppm

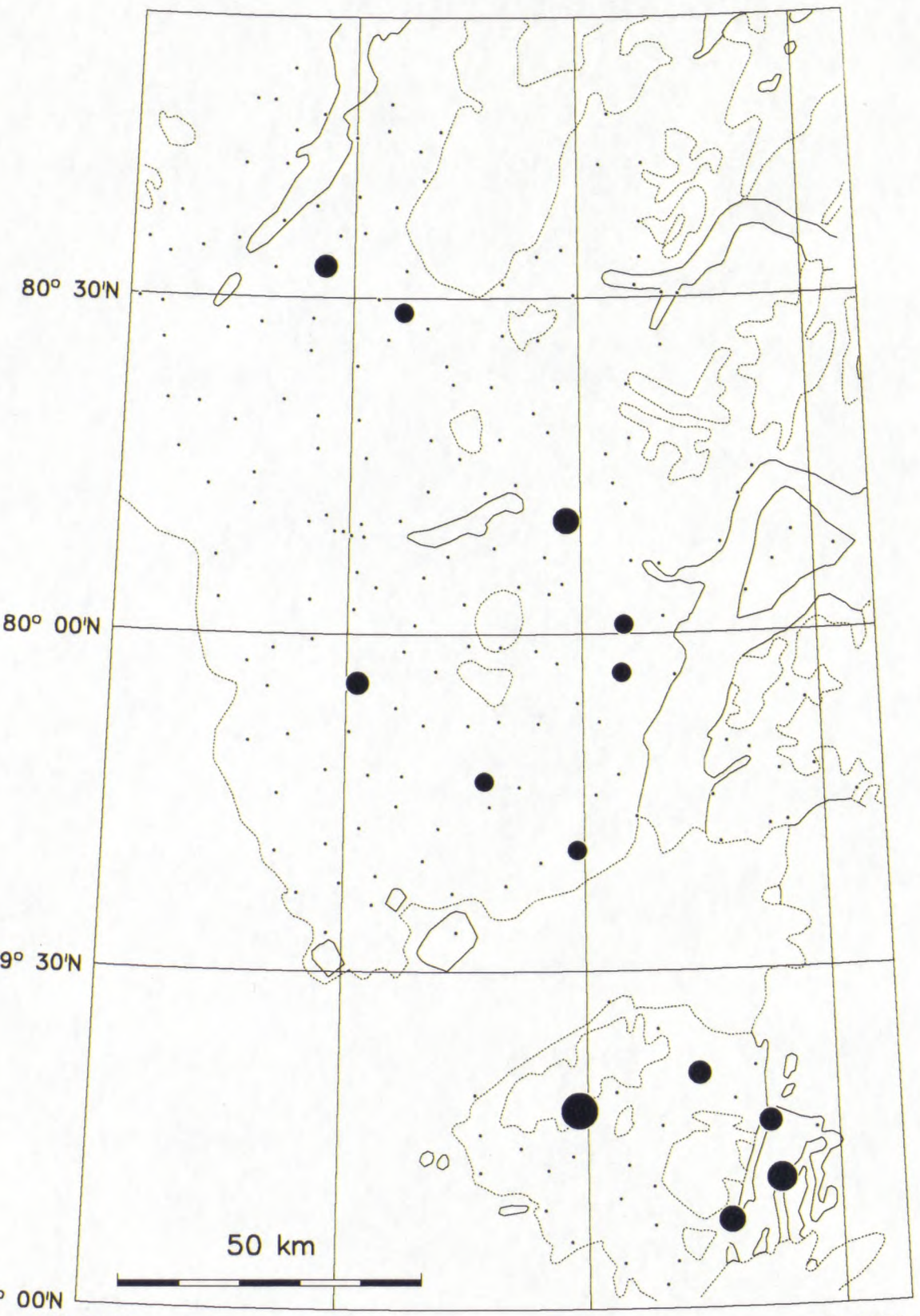
INAA

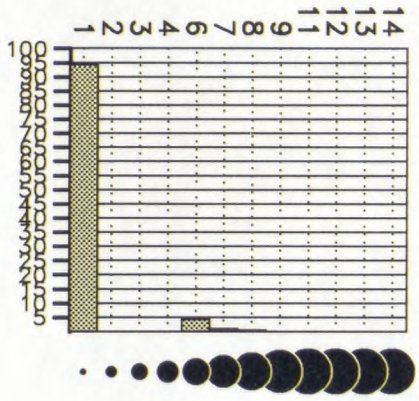
Number of samples:	207
Min. value:	0
Max. value:	26
Mean:	3
Median:	2
Variance:	12
Std. Dev.:	3

Fig. 12

Grønlands Geologiske Undersøgelse

Au in stream sediment





Au ppb

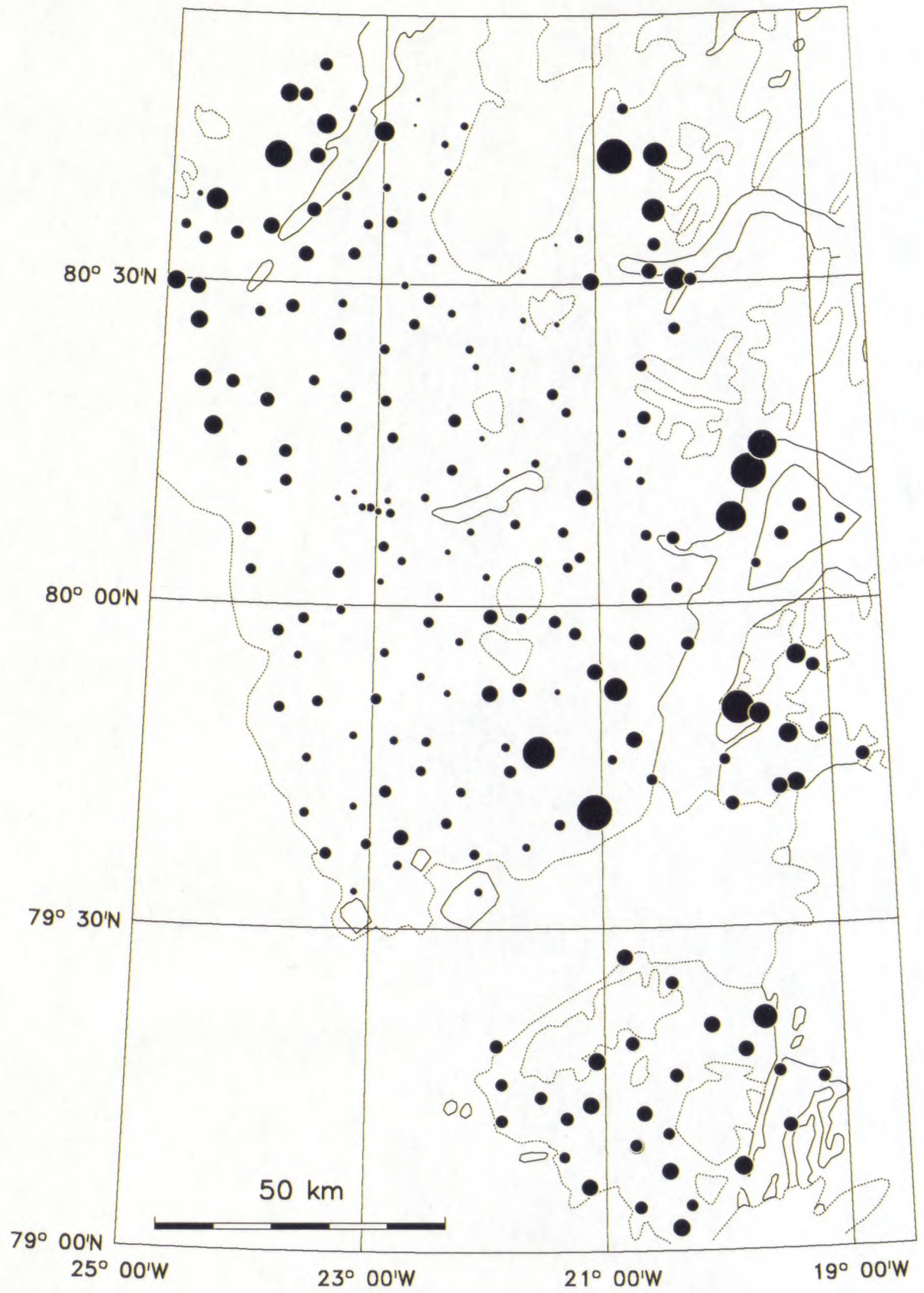
INAA

Number of samples:	207
Min. value:	0
Max. value:	110
Mean:	1
Median:	0
Variance:	60
Std. Dev.:	8

Fig. 13

Grønlands Geologiske Undersøgelse

Ba in stream sediment



Ba ppm

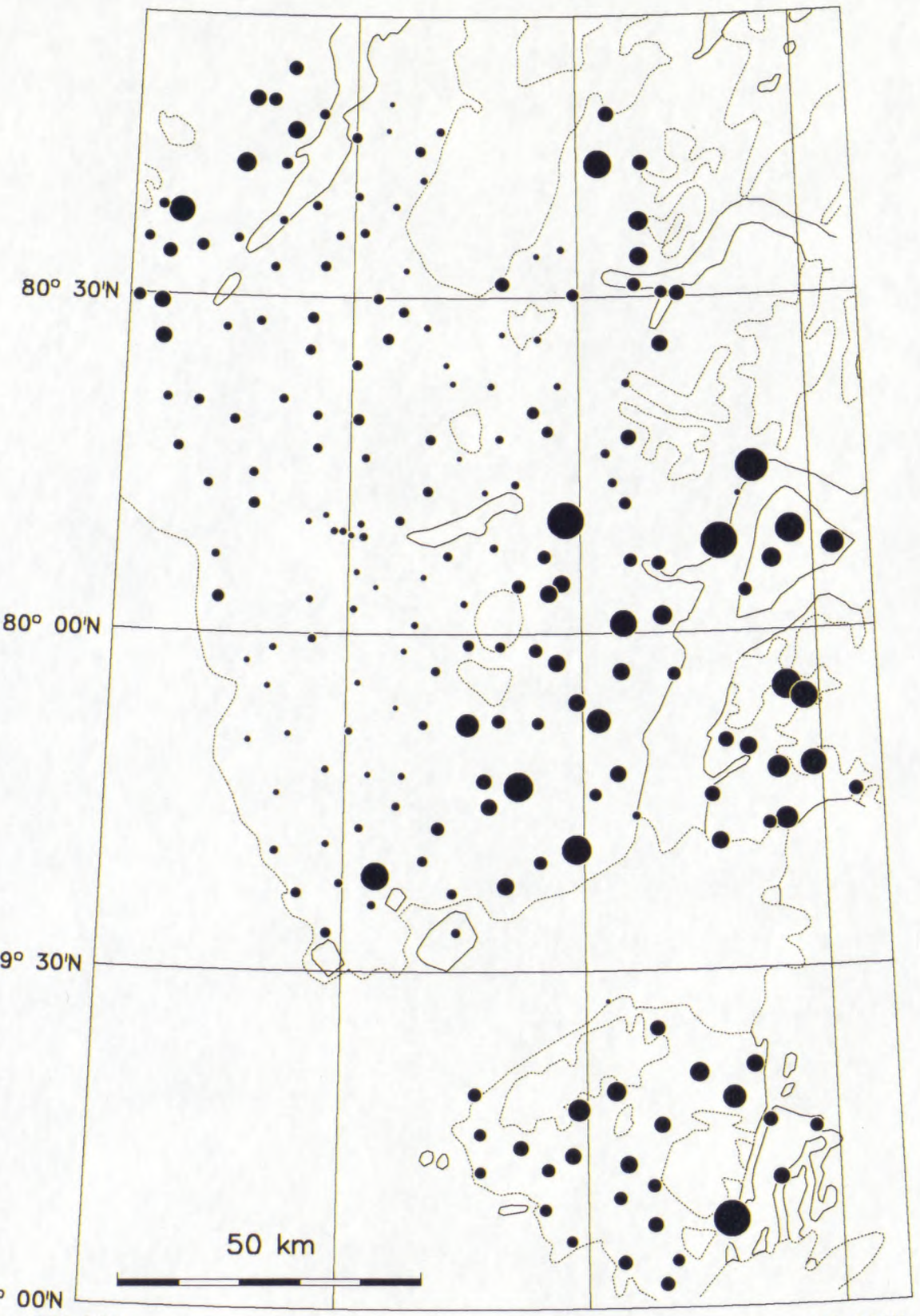
INAA

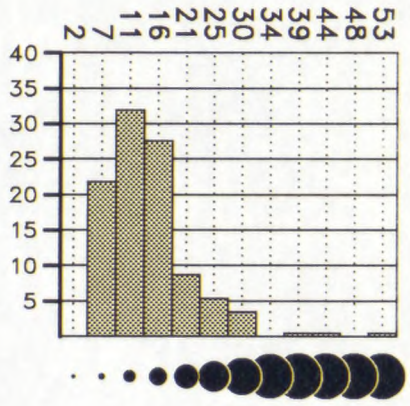
Number of samples:	207
Min. value:	110
Max. value:	1000
Mean:	347
Median:	330
Variance:	12245
Std. Dev.:	111

Fig. 14

Grønlands Geologiske Undersøgelse

Co in stream sediment





Co ppm

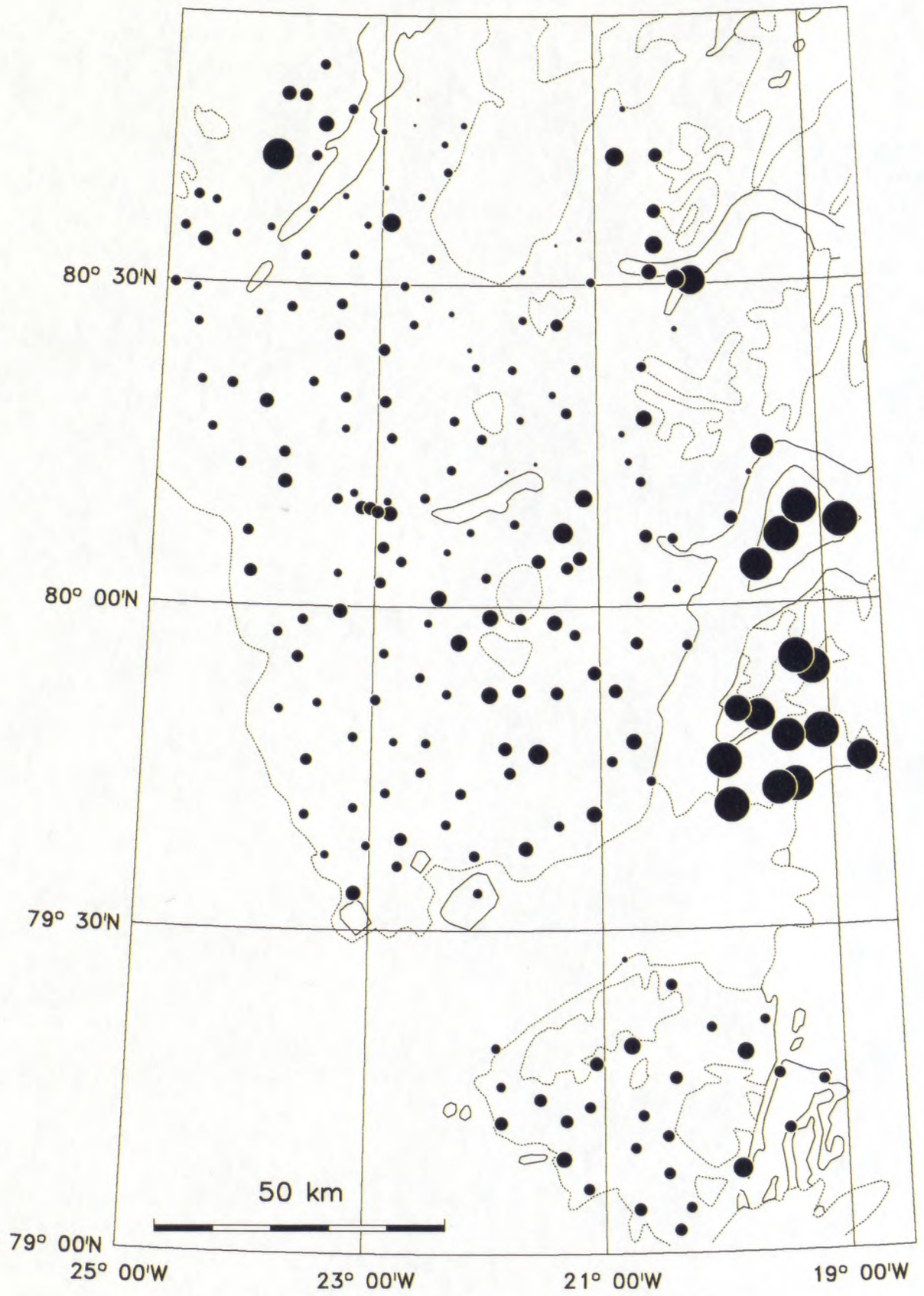
INAA

Number of samples:	207
Min. value:	6
Max. value:	54
Mean:	14
Median:	13
Variance:	43
Std. Dev.:	7

Fig. 15

Grønlands Geologiske Undersøgelse

Cr in stream sediment



Cr ppm

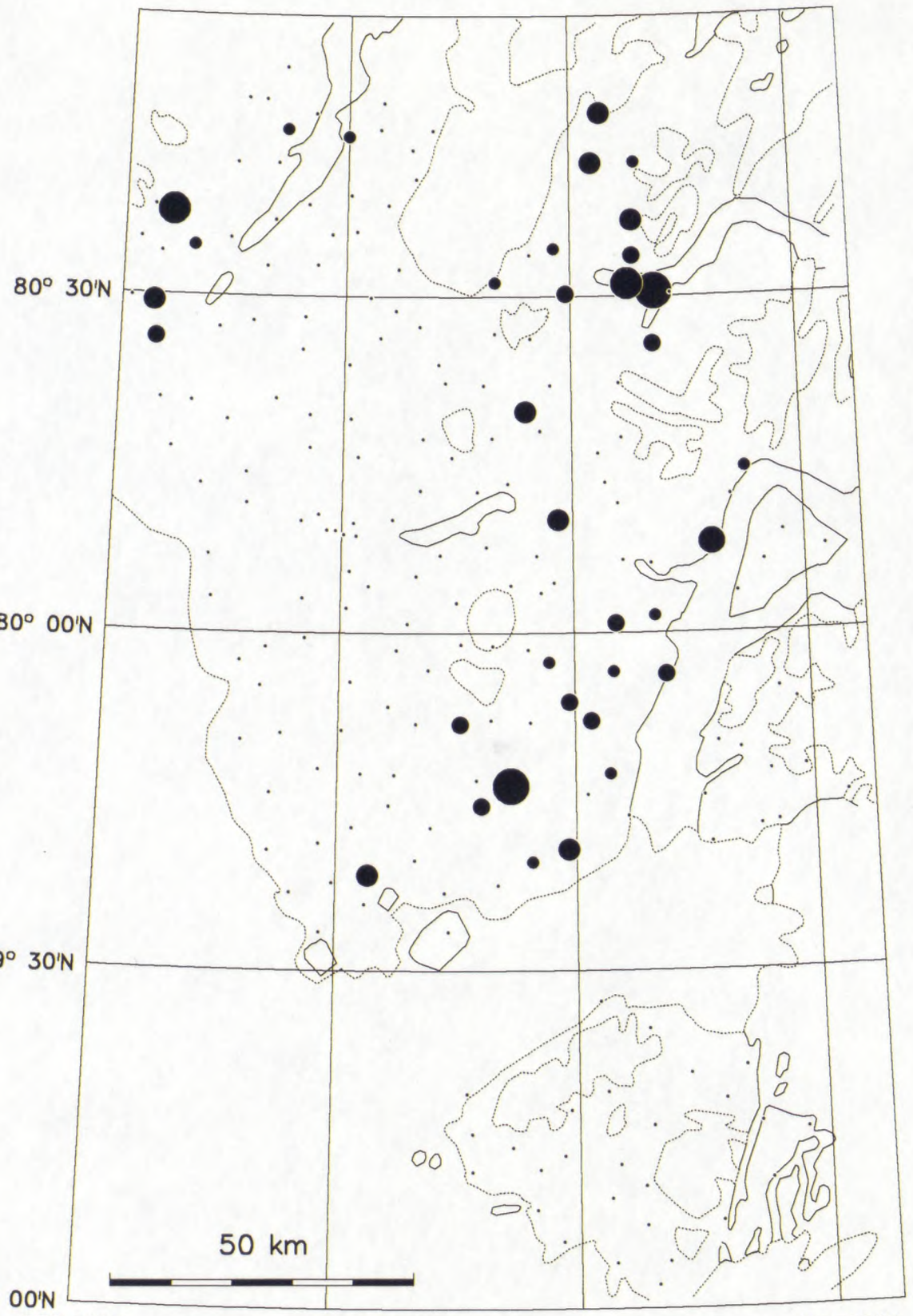
XRF

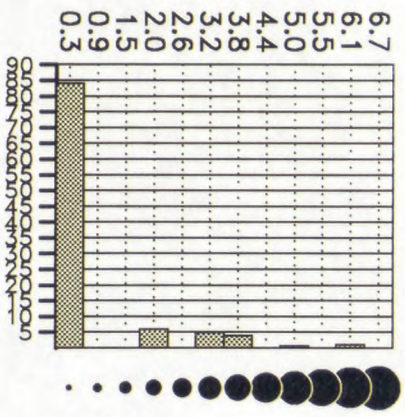
Number of samples:	207
Min. value:	20
Max. value:	526
Mean:	133
Median:	113
Variance:	6673
Std. Dev.:	82

Fig. 16

Grønlands Geologiske Undersøgelse

Cs in stream sediment





Cs ppm

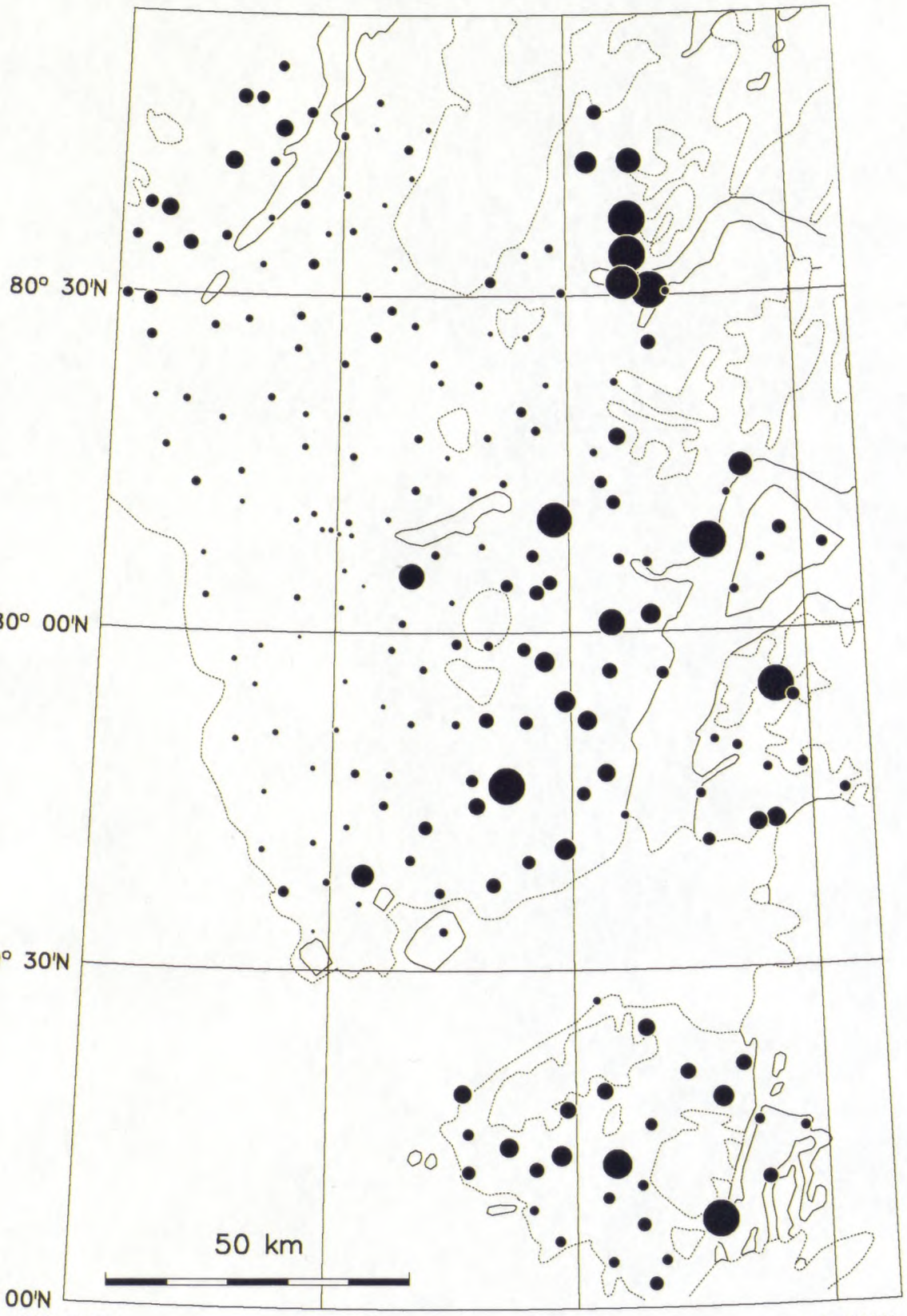
INAA

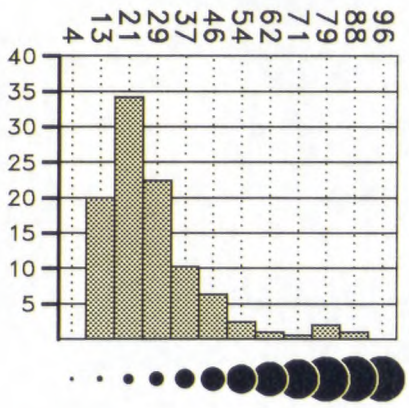
Number of samples:	207
Min. value:	0.0
Max. value:	7.0
Mean:	0.6
Median:	0.0
Variance:	1.9
Std. Dev.:	1.4

Fig. 17

Grønlands Geologiske Undersøgelse

Cu in stream sediment





Cu ppm

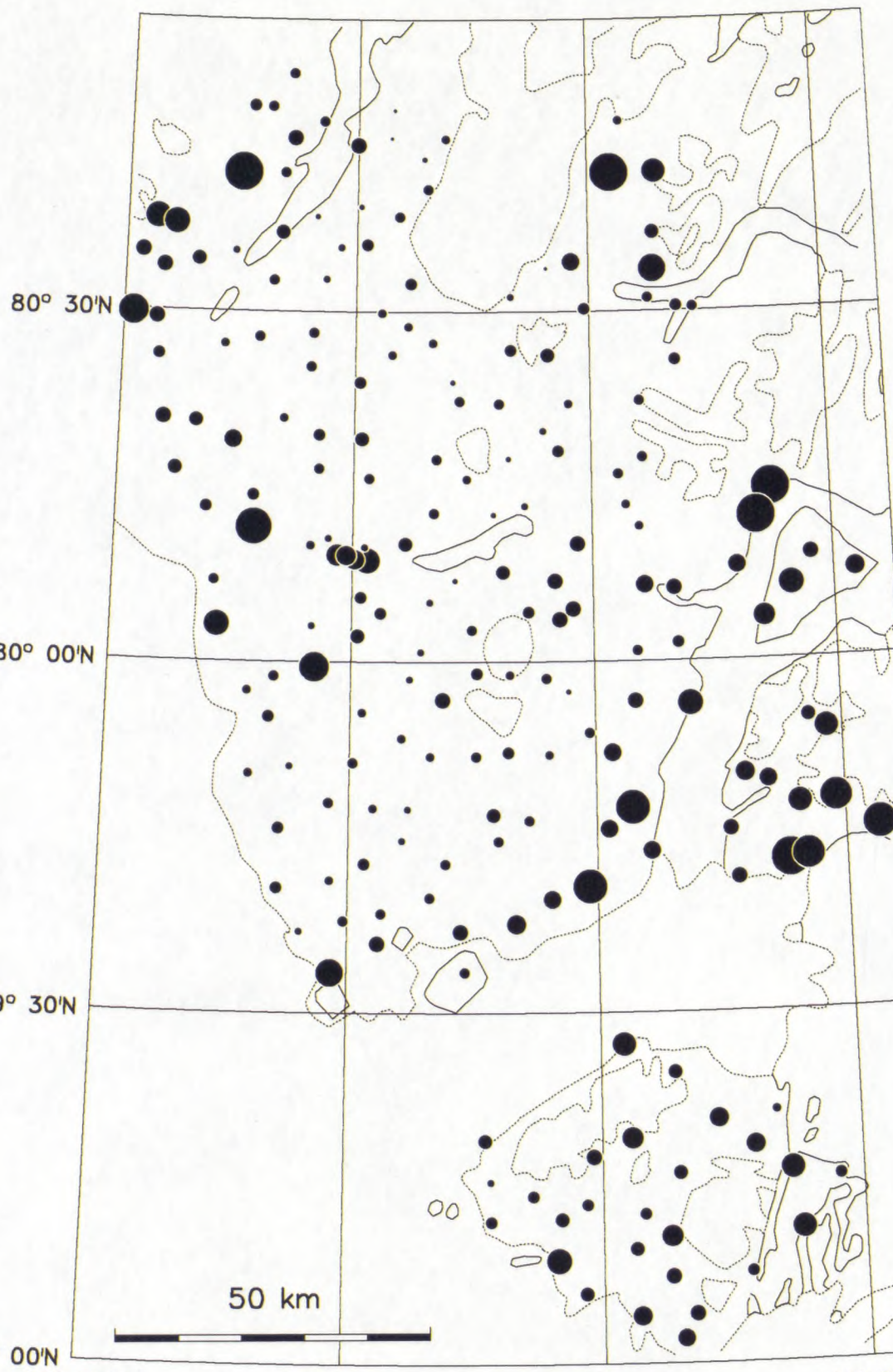
AAS

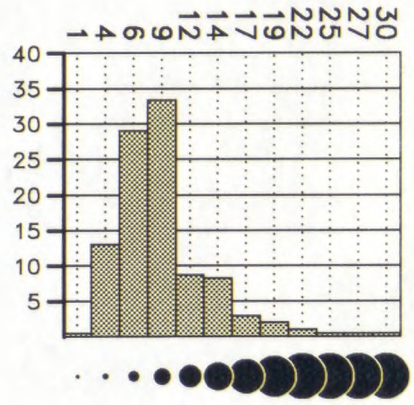
Number of samples:	207
Min. value:	10
Max. value:	135
Mean:	29
Median:	23
Variance:	311
Std. Dev.:	18

Fig. 18

Grønlands Geologiske Undersøgelse

Hf in stream sediment





Hf ppm

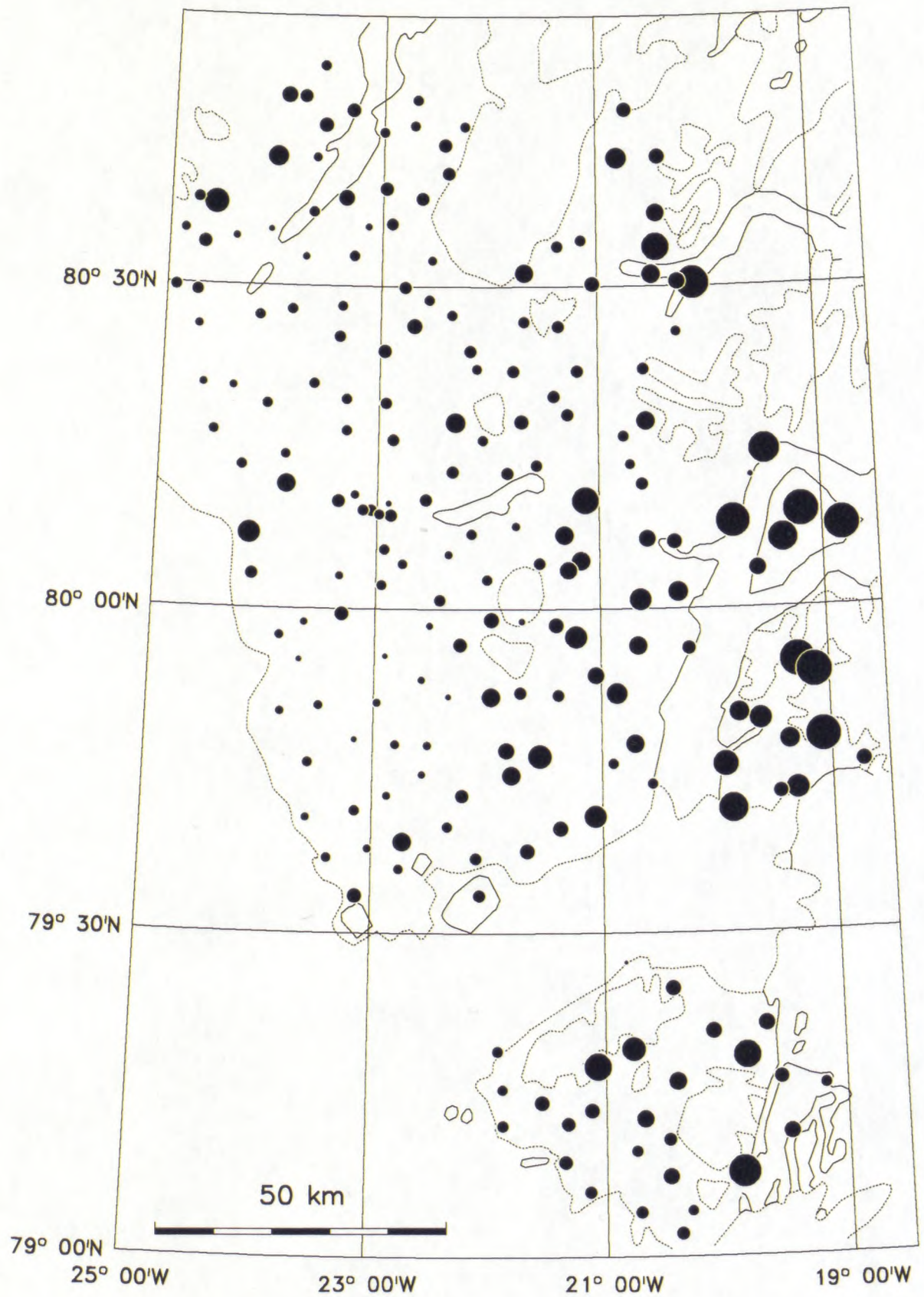
INAA

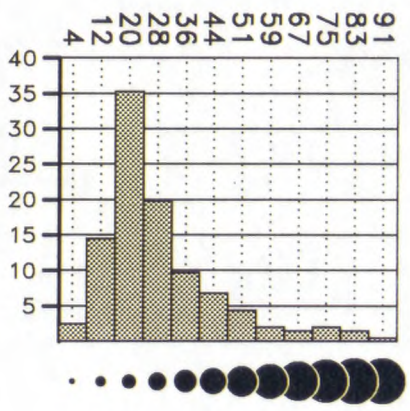
Number of samples:	207
Min. value:	2
Max. value:	30
Mean:	9
Median:	8
Variance:	18
Std. Dev.:	4

Fig. 19

Grønlands Geologiske Undersøgelse

Ni in stream sediment





Ni ppm

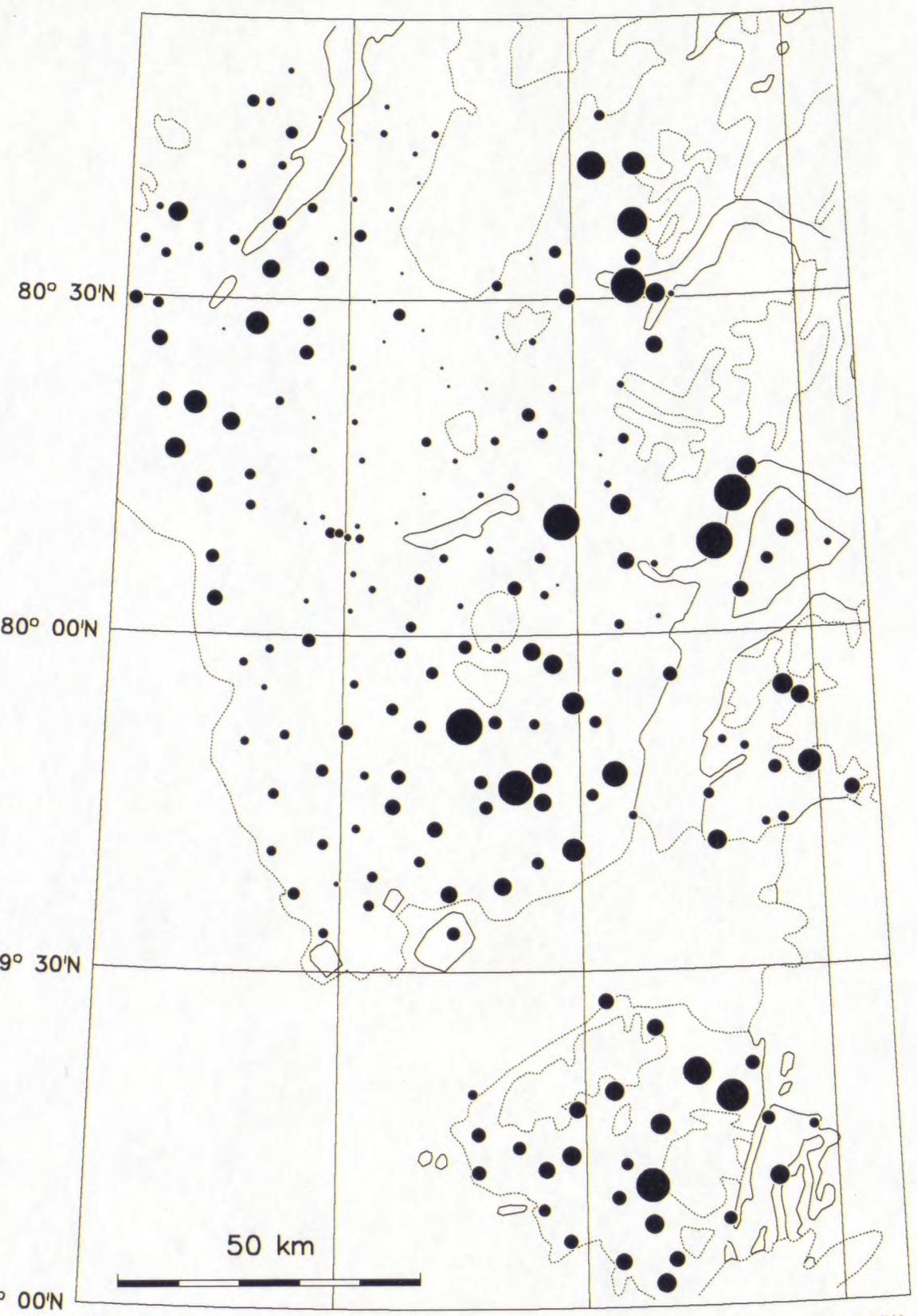
XRF

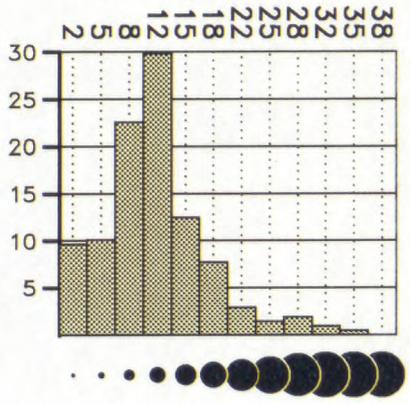
Number of samples:	207
Min. value:	3
Max. value:	93
Mean:	28
Median:	23
Variance:	265
Std. Dev.:	16

Fig. 20

Grønlands Geologiske Undersøgelse

Pb in stream sediment





Pb ppm

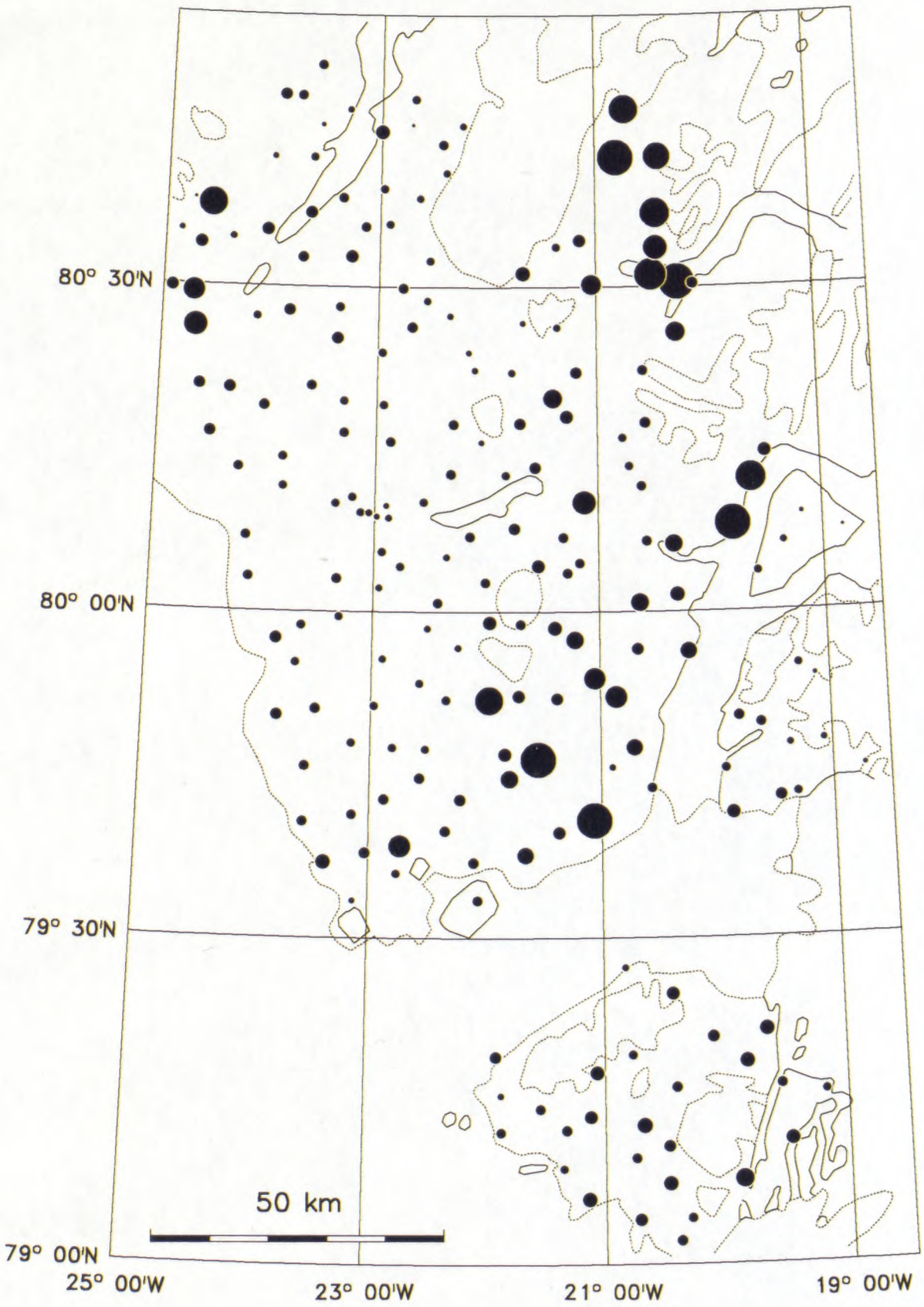
ICP

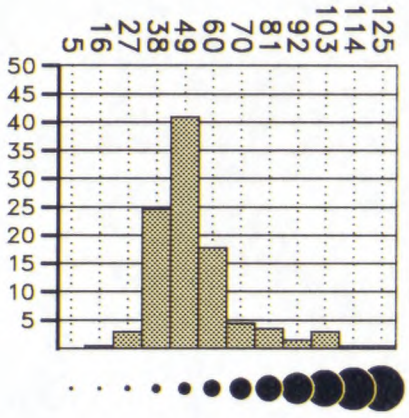
Number of samples:	209
Min. value:	0
Max. value:	76
Mean:	11
Median:	10
Variance:	60
Std. Dev.:	8

Fig. 21

Grønlands Geologiske Undersøgelse

Rb in stream sediment





Rb ppm

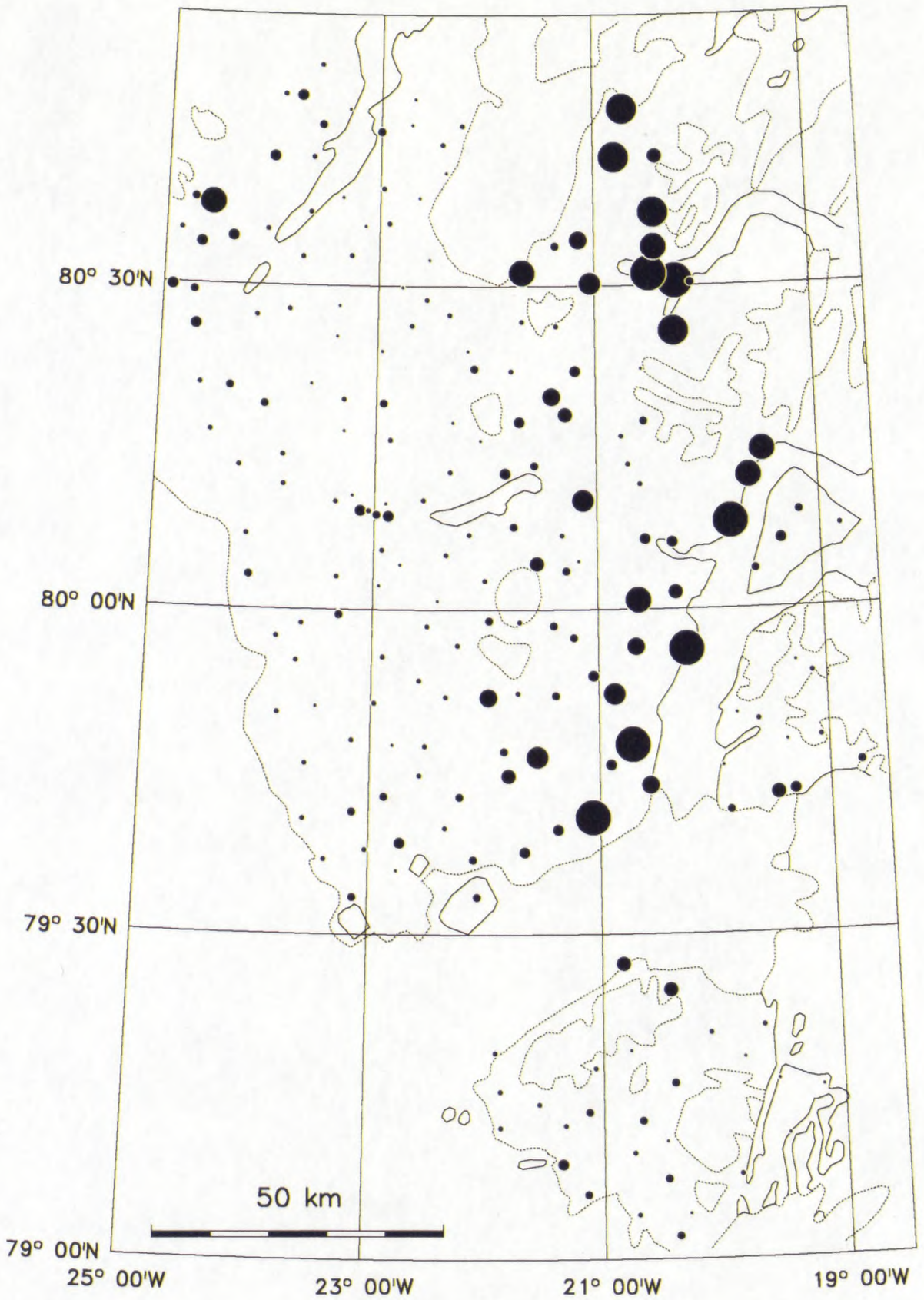
XRF

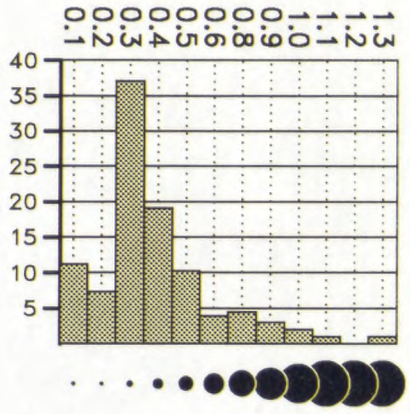
Number of samples:	207
Min. value:	16
Max. value:	176
Mean:	54
Median:	48
Variance:	460
Std. Dev.:	21

Fig. 22

Grønlands Geologiske Undersøgelse

Sb in stream sediment





Sb ppm

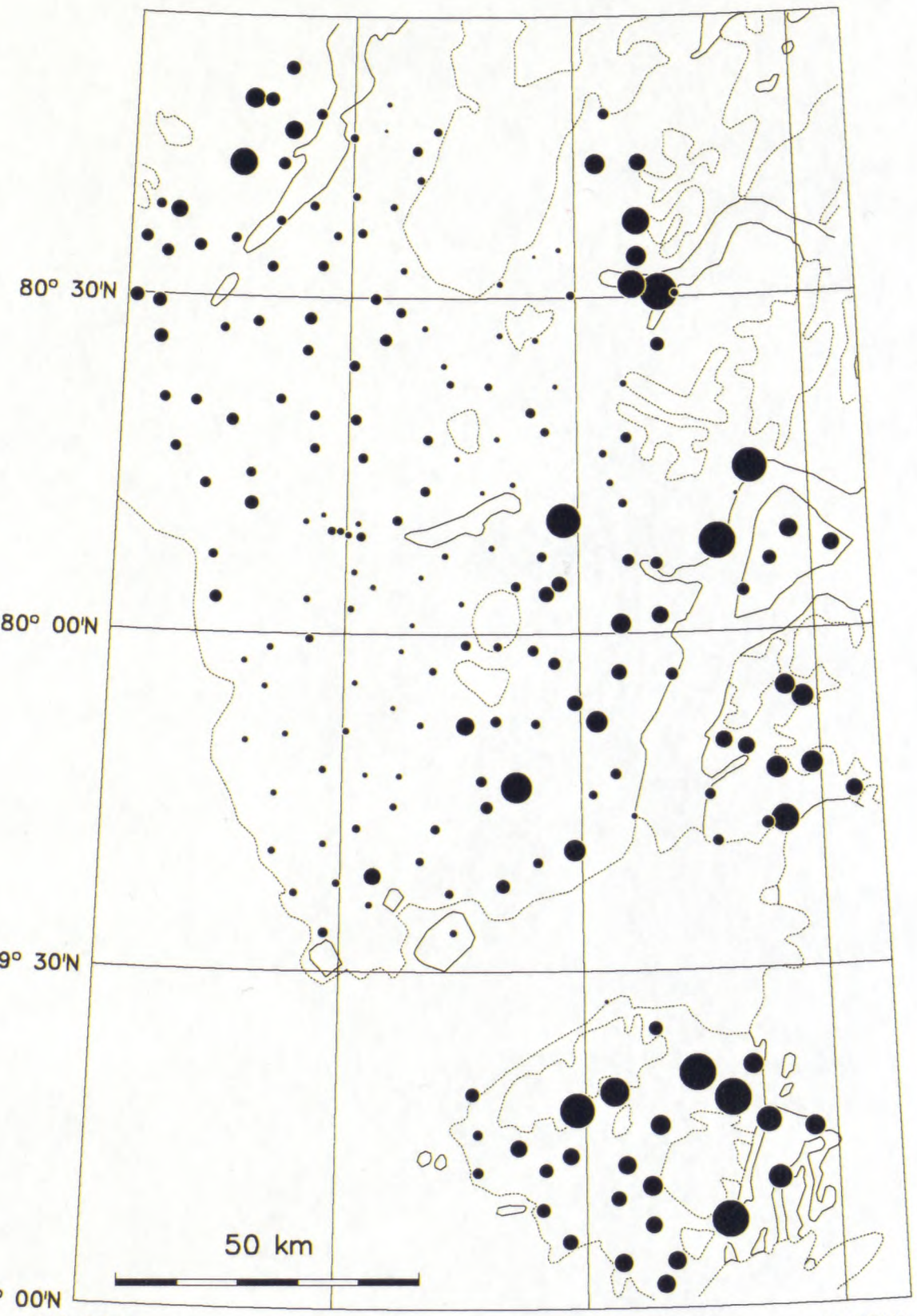
INAA

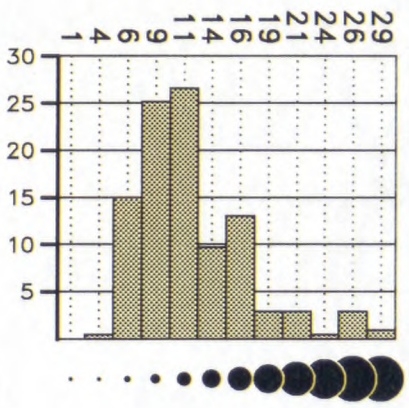
Number of samples:	207
Min. value:	0.0
Max. value:	2.2
Mean:	0.4
Median:	0.3
Variance:	0.1
Std. Dev.:	0.3

Fig. 23

Grønlands Geologiske Undersøgelse

Sc in stream sediment





Sc ppm

INAA

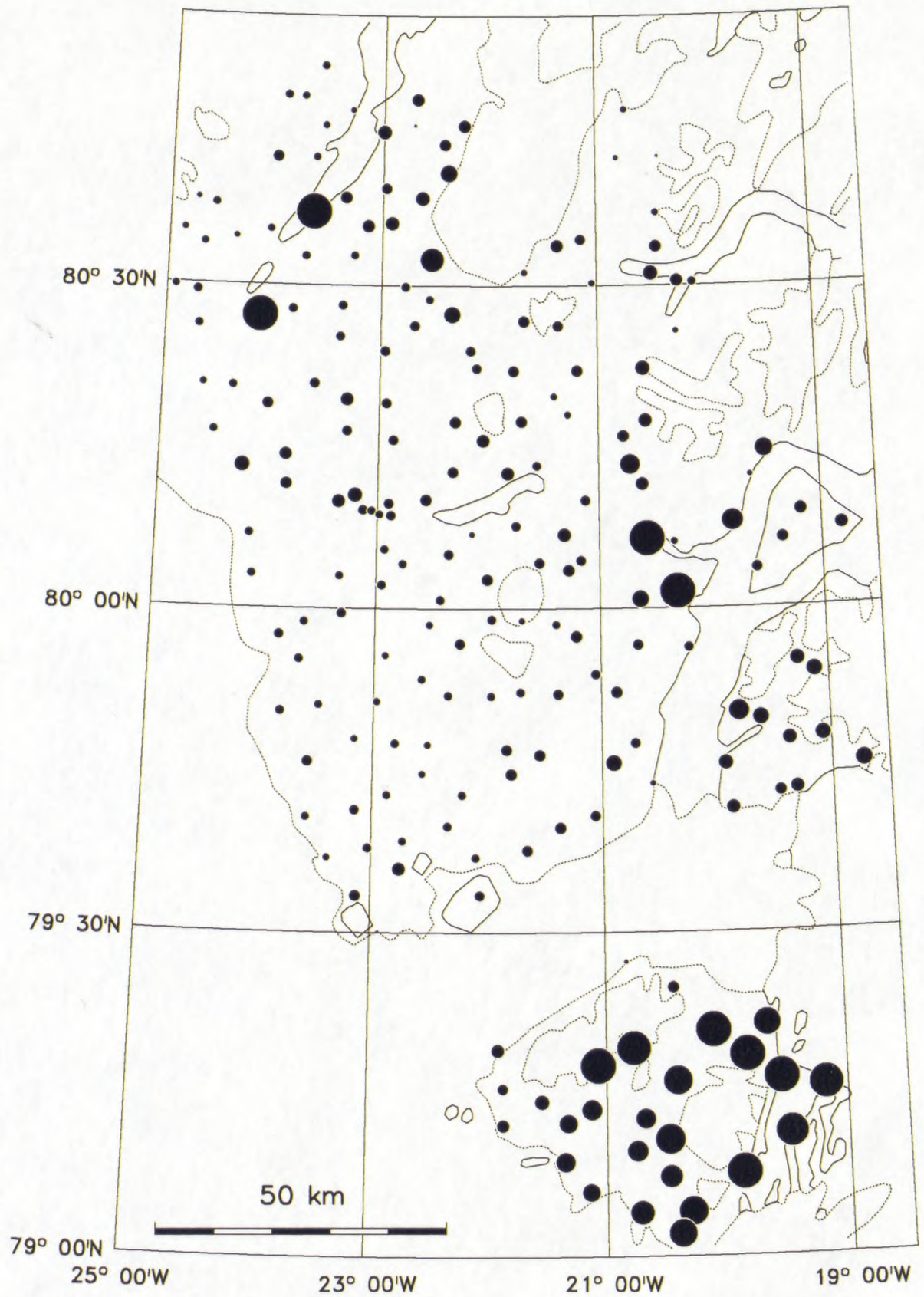
Number of samples:	207
Min. value:	5
Max. value:	29
Mean:	12
Median:	10
Variance:	23
Std. Dev.:	5

Fig. 24

Grønlands Geologiske Undersøgelse

GGU

Sr in stream sediment



Sr ppm

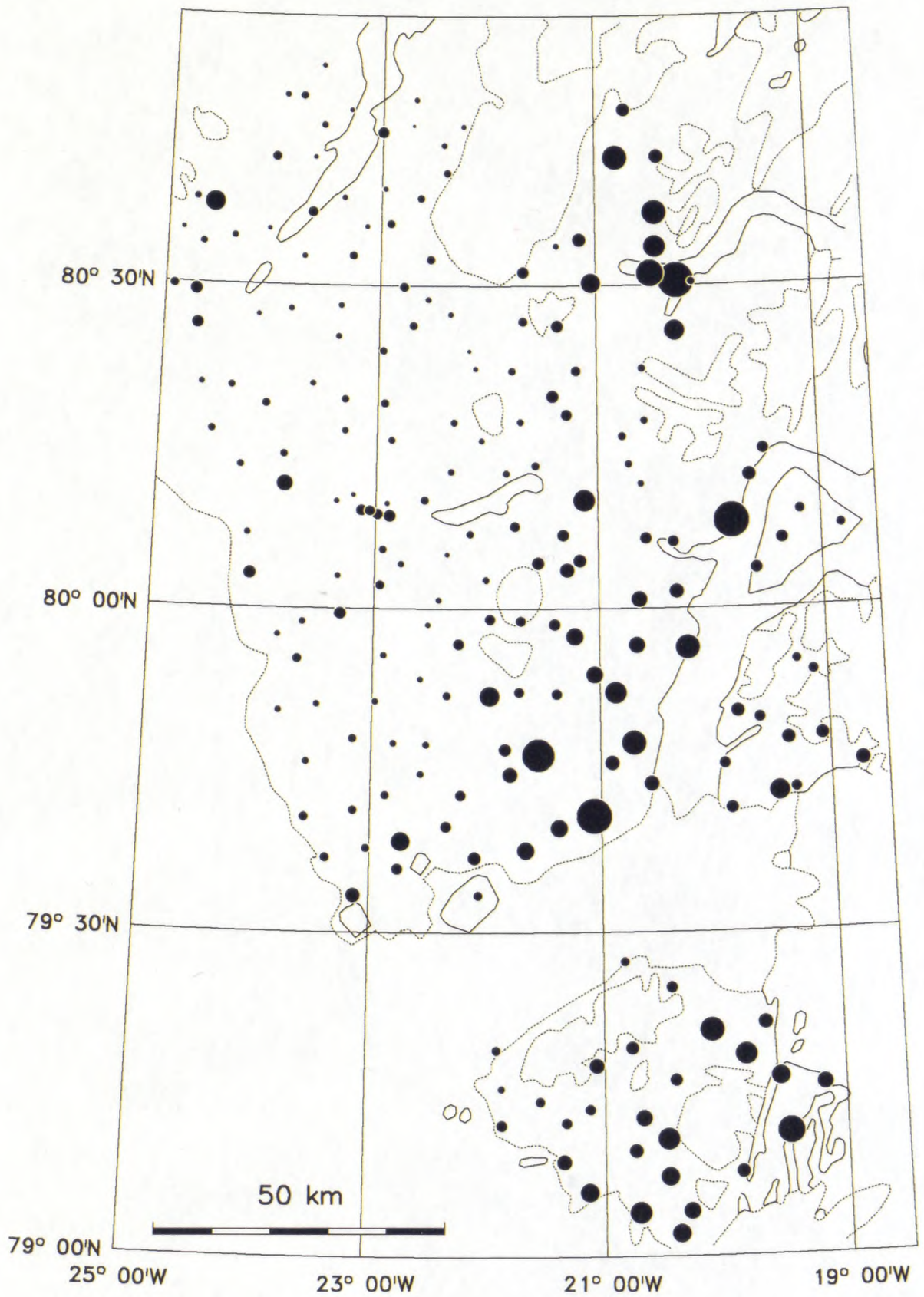
XRF

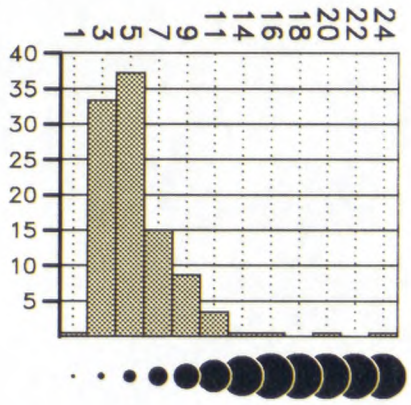
Number of samples:	207
Min. value:	50
Max. value:	985
Mean:	131
Median:	107
Variance:	8208
Std. Dev.:	91

Fig. 25

Grønlands Geologiske Undersøgelse

Th in stream sediment





Th ppm

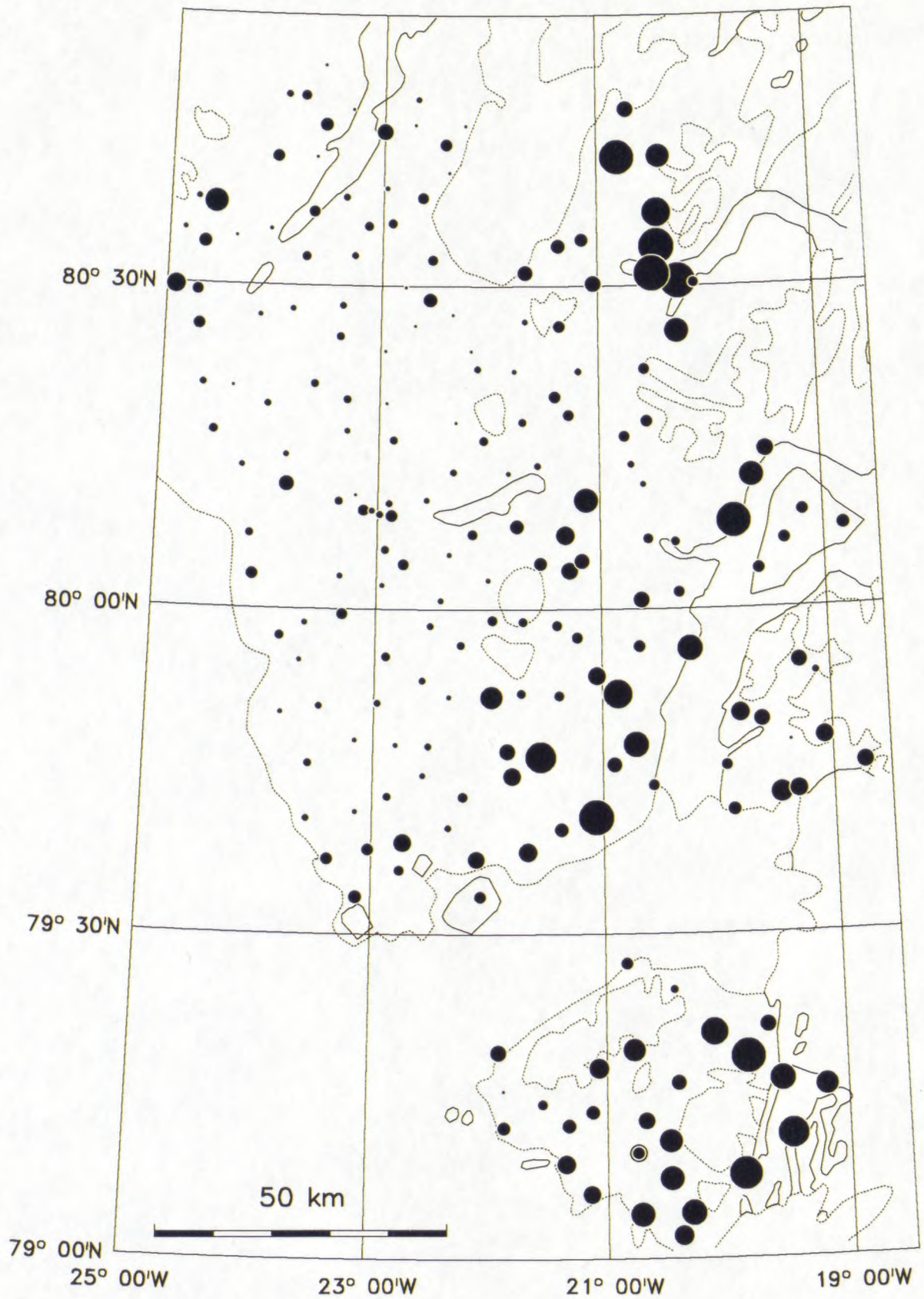
INAA

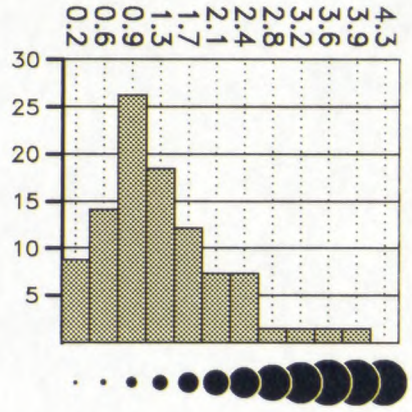
Number of samples:	207
Min. value:	2
Max. value:	24
Mean:	6
Median:	5
Variance:	8
Std. Dev.:	3

Fig. 26

Grønlands Geologiske Undersøgelse

U in stream sediment





U ppm

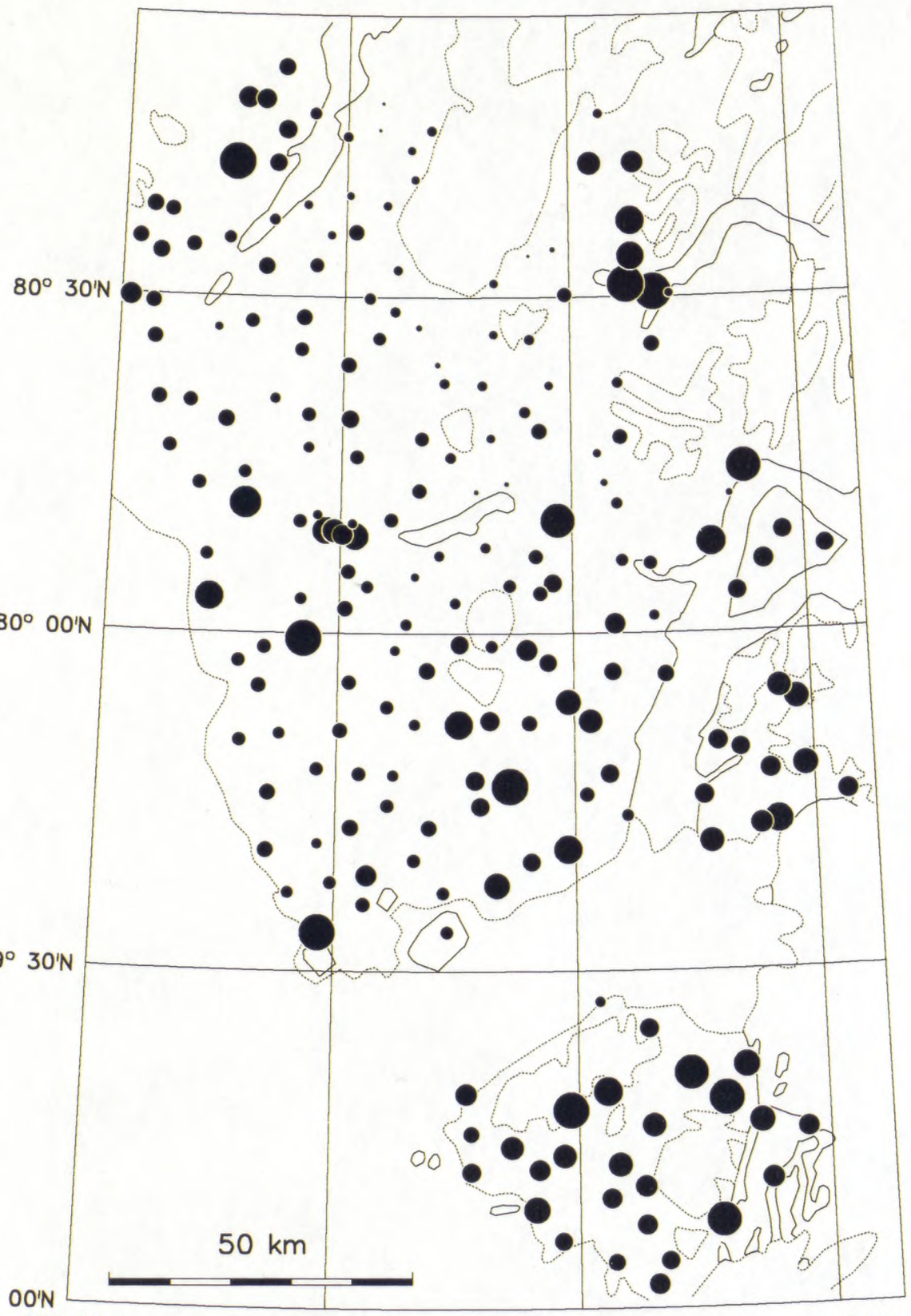
INAA

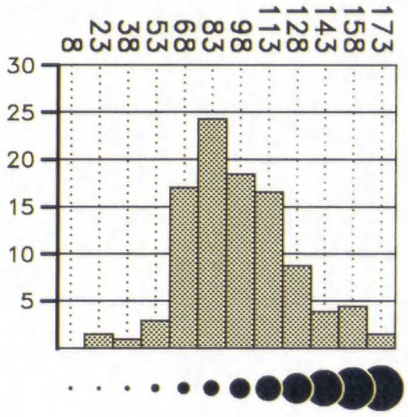
Number of samples:	207
Min. value:	0.0
Max. value:	5.4
Mean:	1.3
Median:	1.2
Variance:	0.7
Std. Dev.:	0.9

Fig. 27

Grønlands Geologiske Undersøgelse

V in stream sediment





V ppm

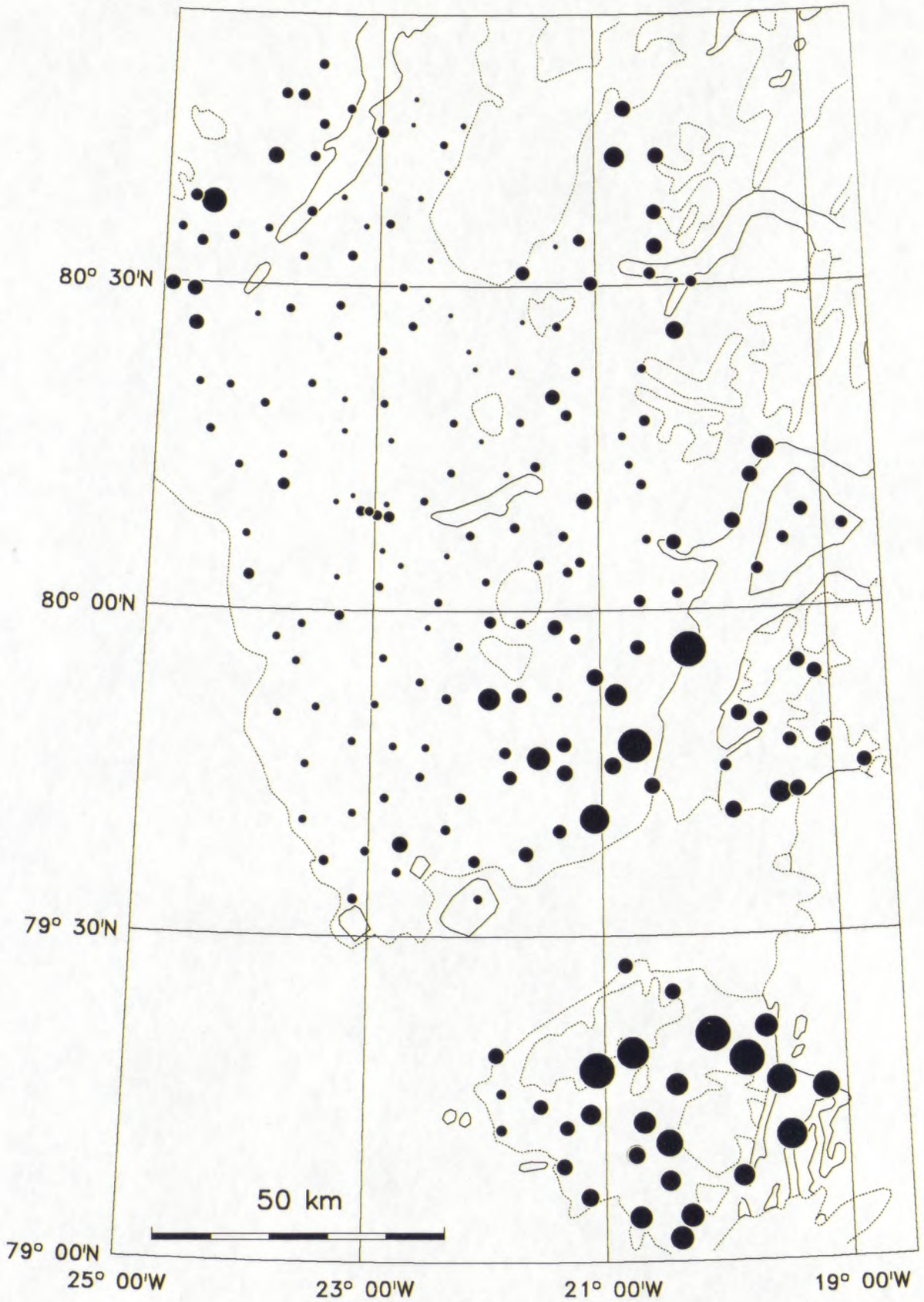
XRF

Number of samples:	207
Min. value:	20
Max. value:	224
Mean:	97
Median:	92
Variance:	893
Std. Dev.:	30

Fig. 28

Grønlands Geologiske Undersøgelse

Y in stream sediment



Y ppm

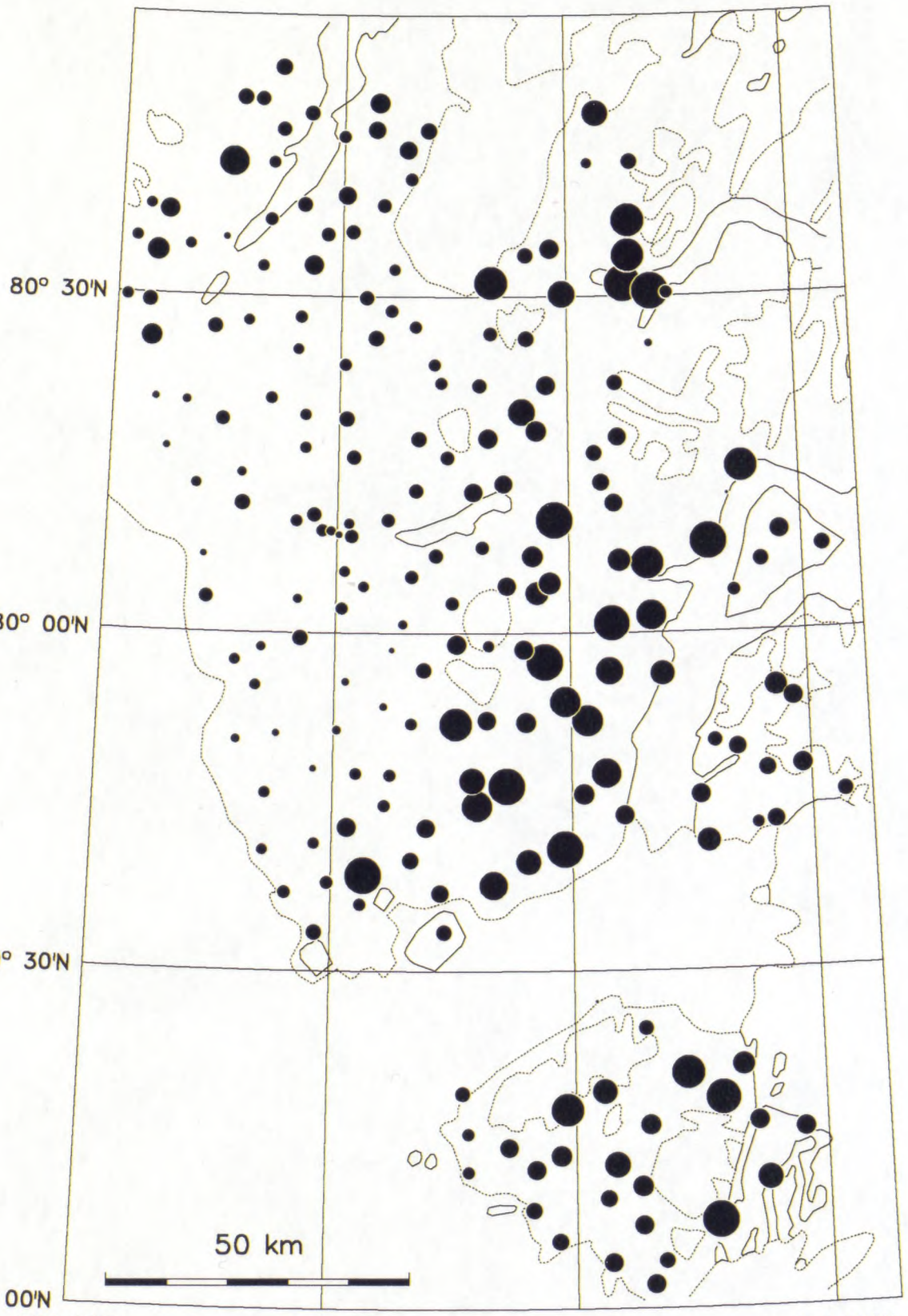
ICP

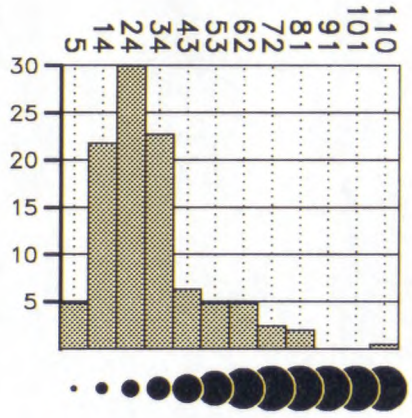
Number of samples:	209
Min. value:	6
Max. value:	41
Mean:	14
Median:	12
Variance:	41
Std. Dev.:	6

Fig. 29

Grønlands Geologiske Undersøgelse

Zn in stream sediment





Zn ppm

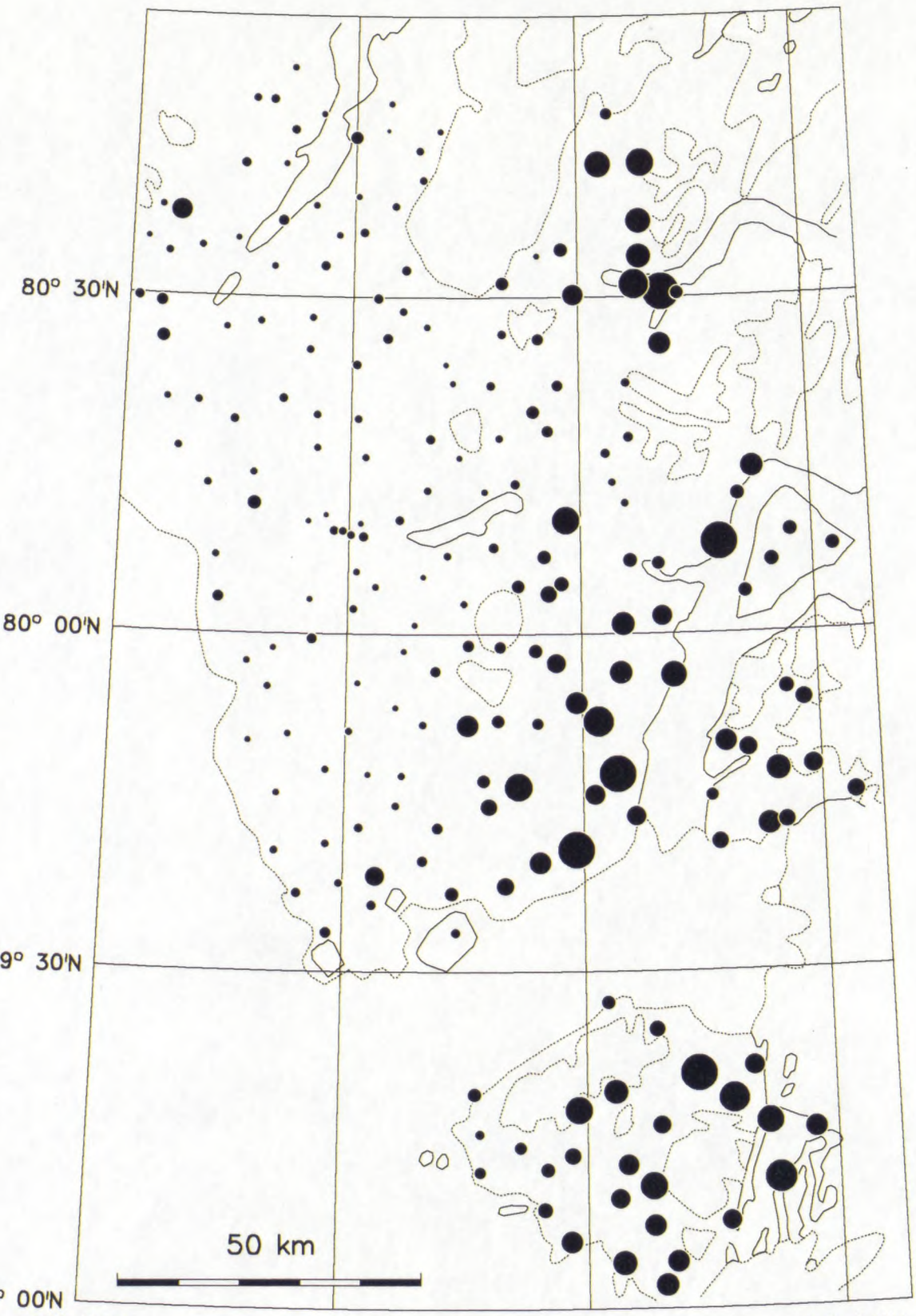
XRF

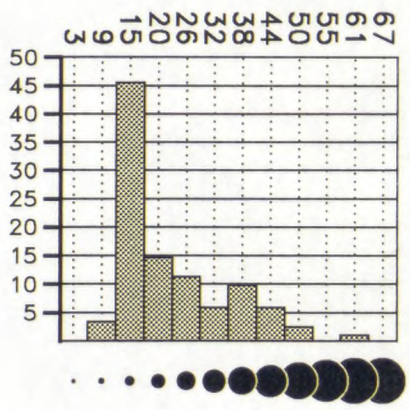
Number of samples:	207
Min. value:	0
Max. value:	110
Mean:	31
Median:	26
Variance:	295
Std. Dev.:	17

Fig. 30

Grønlands Geologiske Undersøgelse

La in stream sediment





La ppm

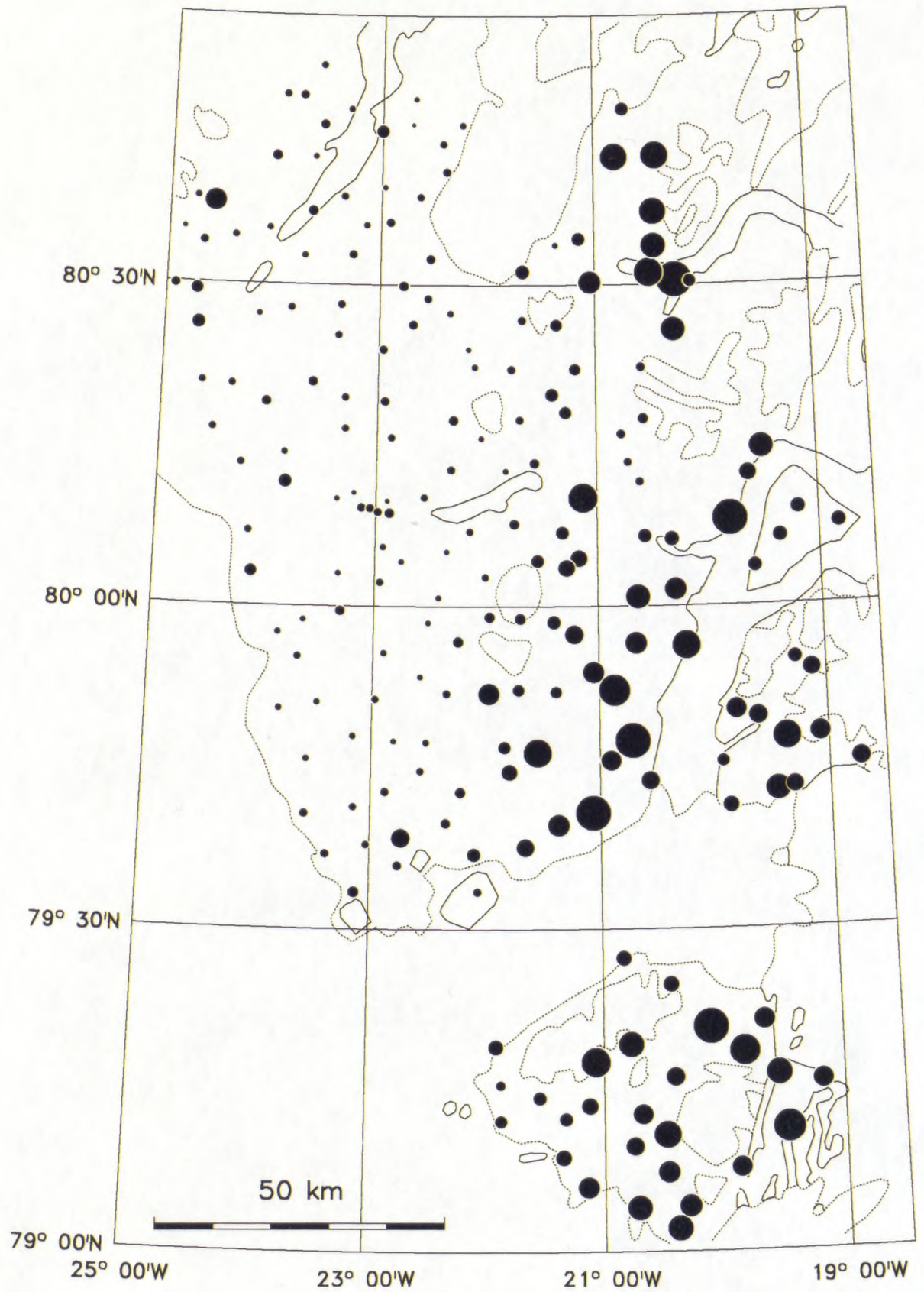
INAA

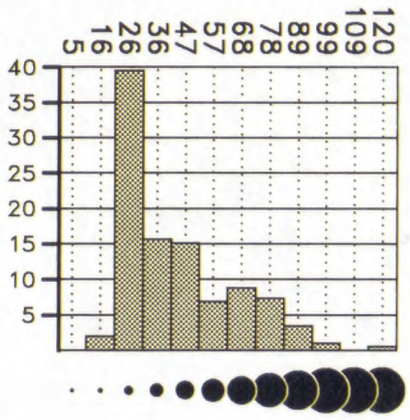
Number of samples:	207
Min. value:	8
Max. value:	130
Mean:	24
Median:	18
Variance:	207
Std. Dev.:	14

Fig. 31

Grønlands Geologiske Undersøgelse

Ce in stream sediment





Ce ppm

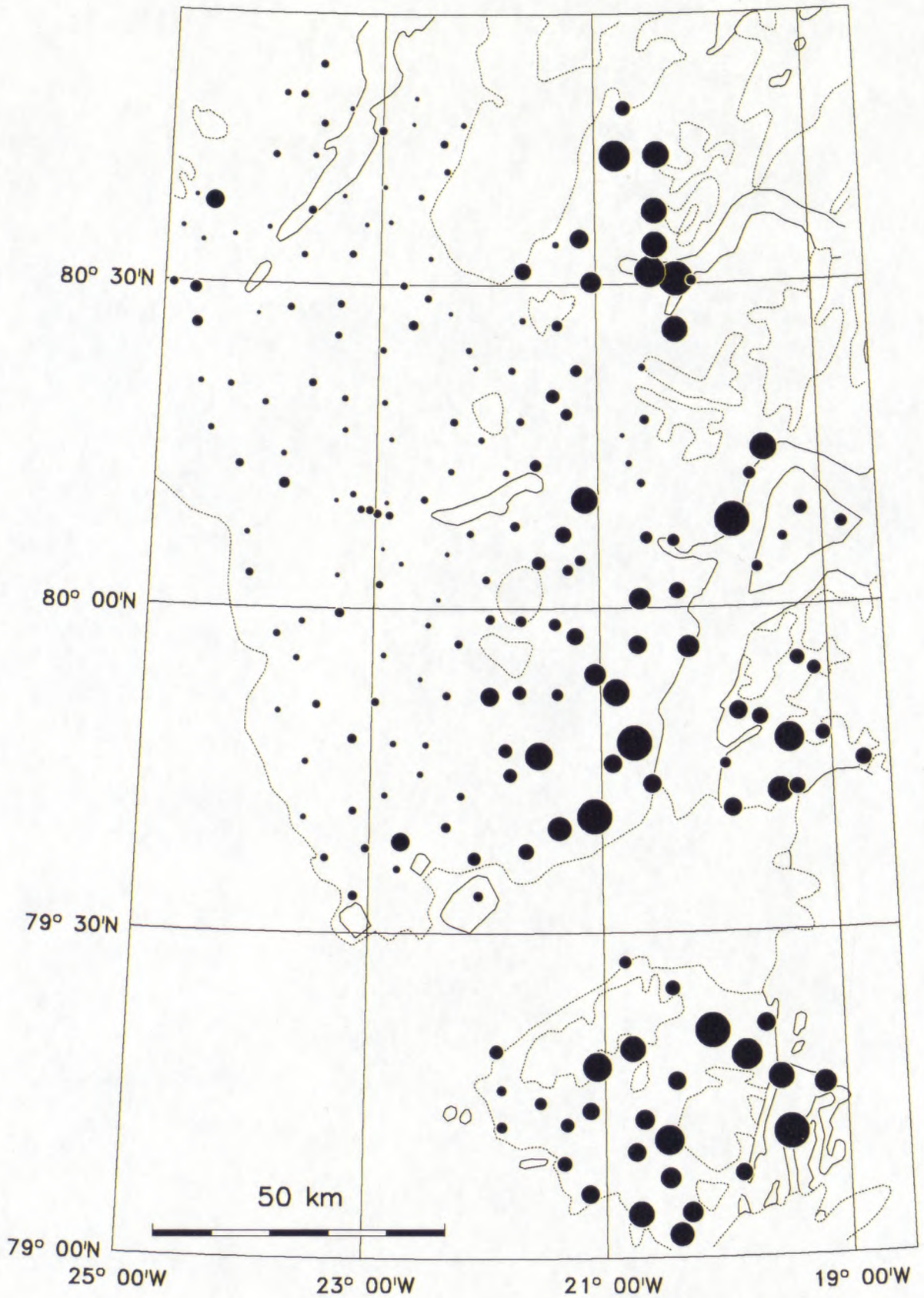
INAA

Number of samples:	207
Min. value:	17
Max. value:	230
Mean:	44
Median:	35
Variance:	623
Std. Dev.:	25

Fig. 32

Grønlands Geologiske Undersøgelse

Nd in stream sediment



Nd ppm

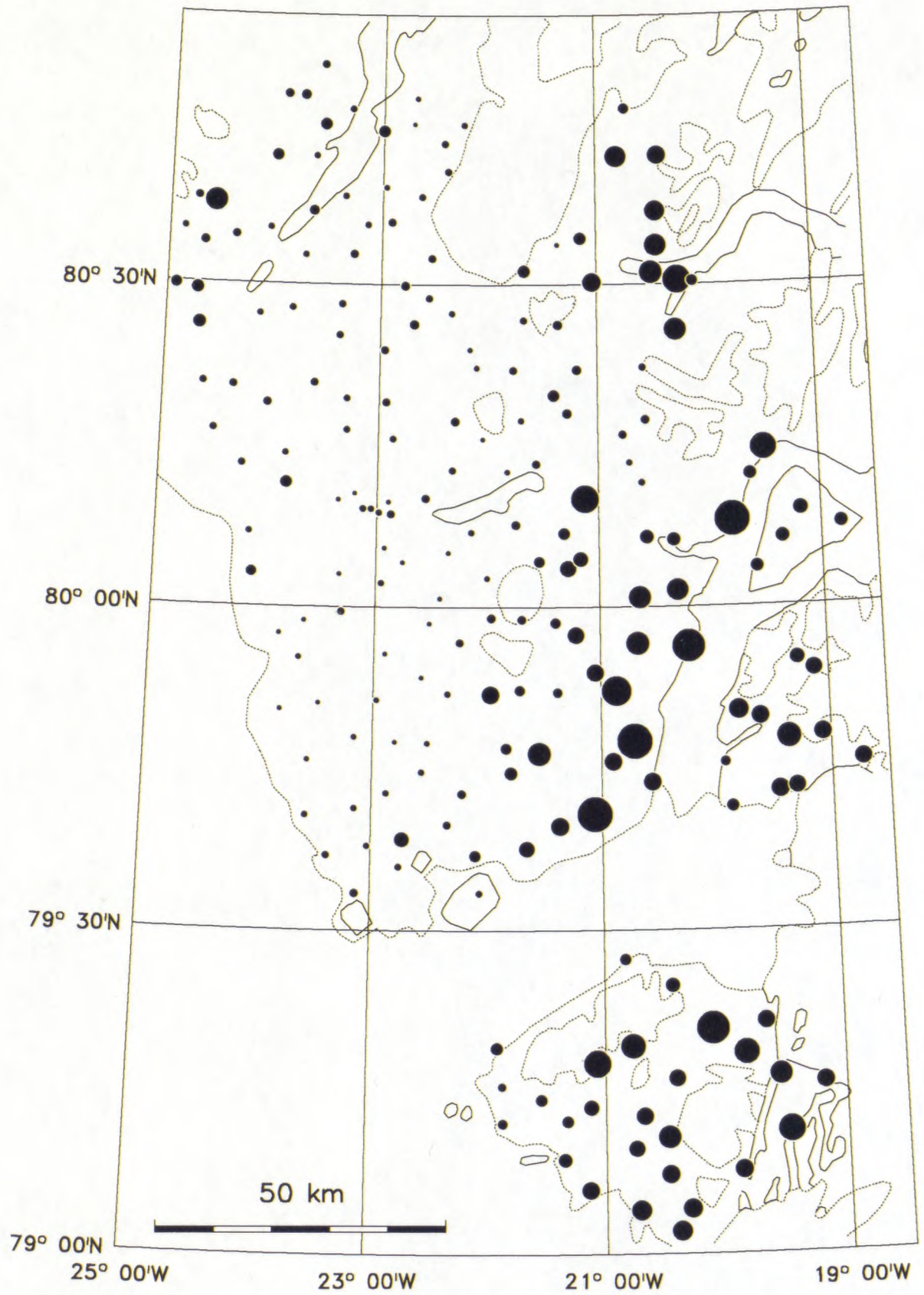
INAA

Number of samples:	207
Min. value:	7
Max. value:	96
Mean:	19
Median:	15
Variance:	133
Std. Dev.:	12

Fig. 33

Grønlands Geologiske Undersøgelse

Sm in stream sediment



Sm ppm

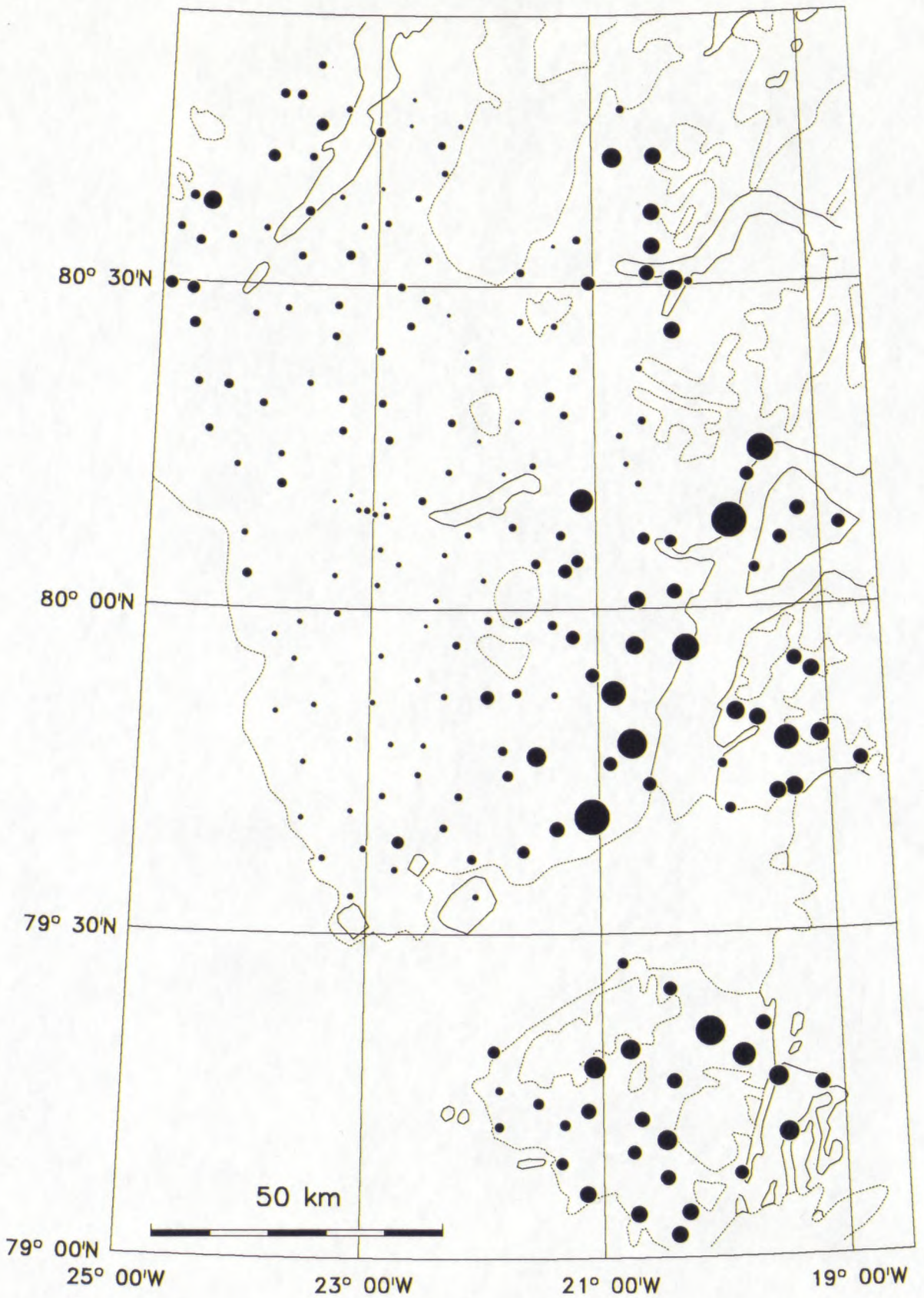
INAA

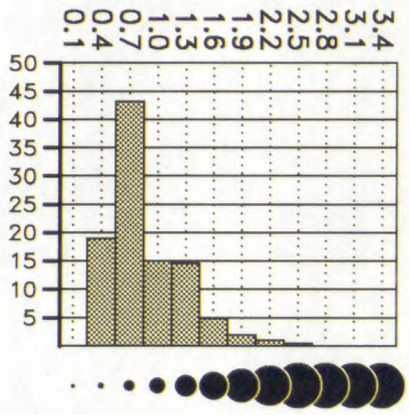
Number of samples:	207
Min. value:	1.4
Max. value:	16.0
Mean:	3.2
Median:	2.5
Variance:	3.1
Std. Dev.:	1.8

Fig. 34

Grønlands Geologiske Undersøgelse

Eu in stream sediment





Eu ppm

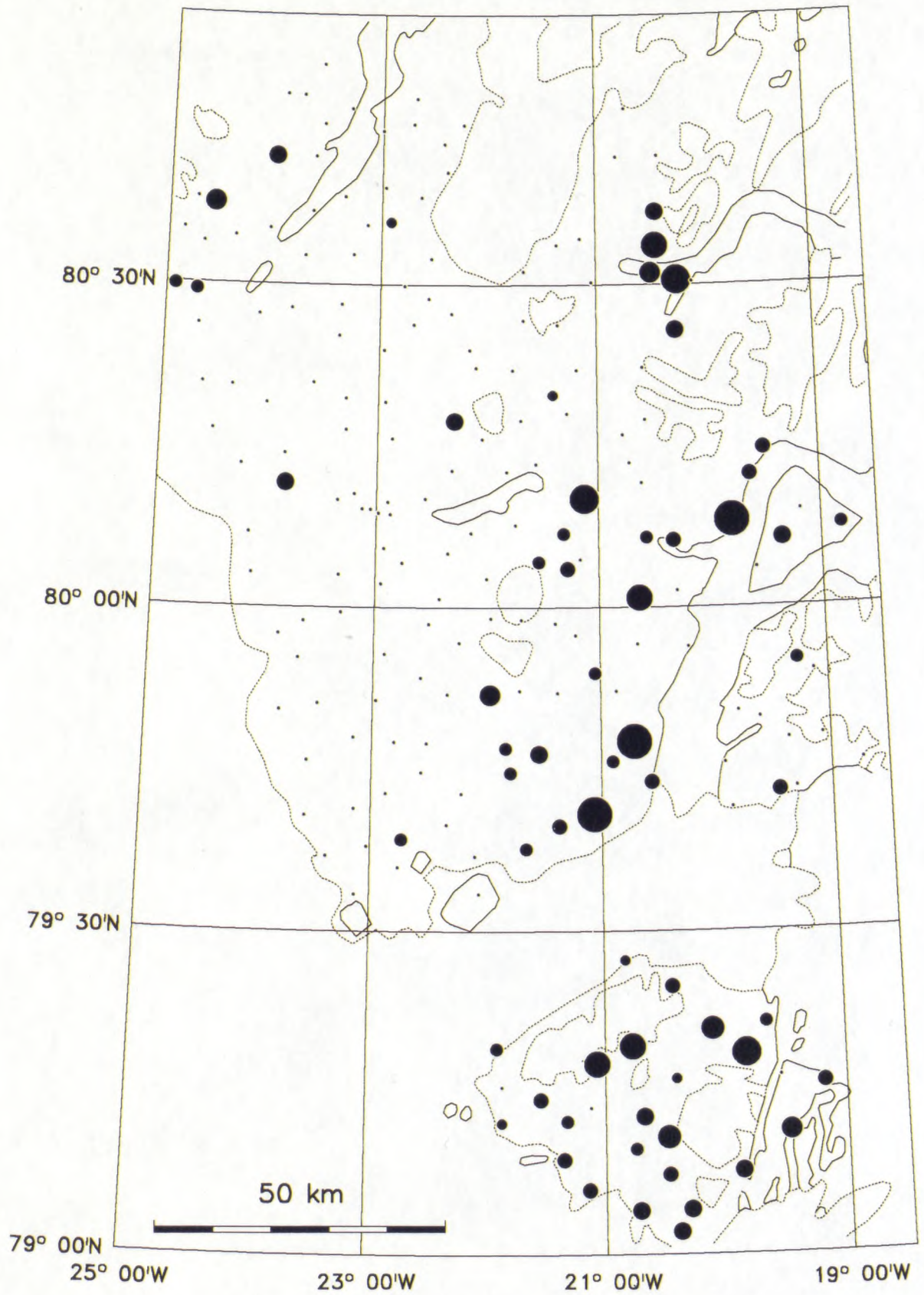
INAA

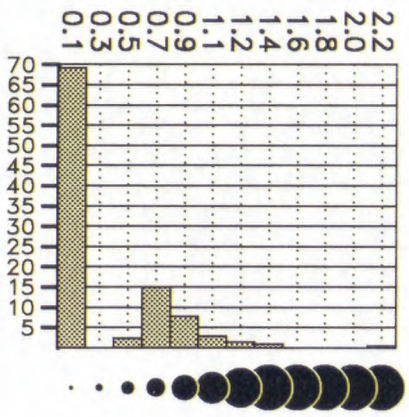
Number of samples:	207
Min. value:	0.4
Max. value:	3.5
Mean:	0.9
Median:	0.7
Variance:	0.2
Std. Dev.:	0.4

Fig. 35

Grønlands Geologiske Undersøgelse

Tb in stream sediment





Tb ppm

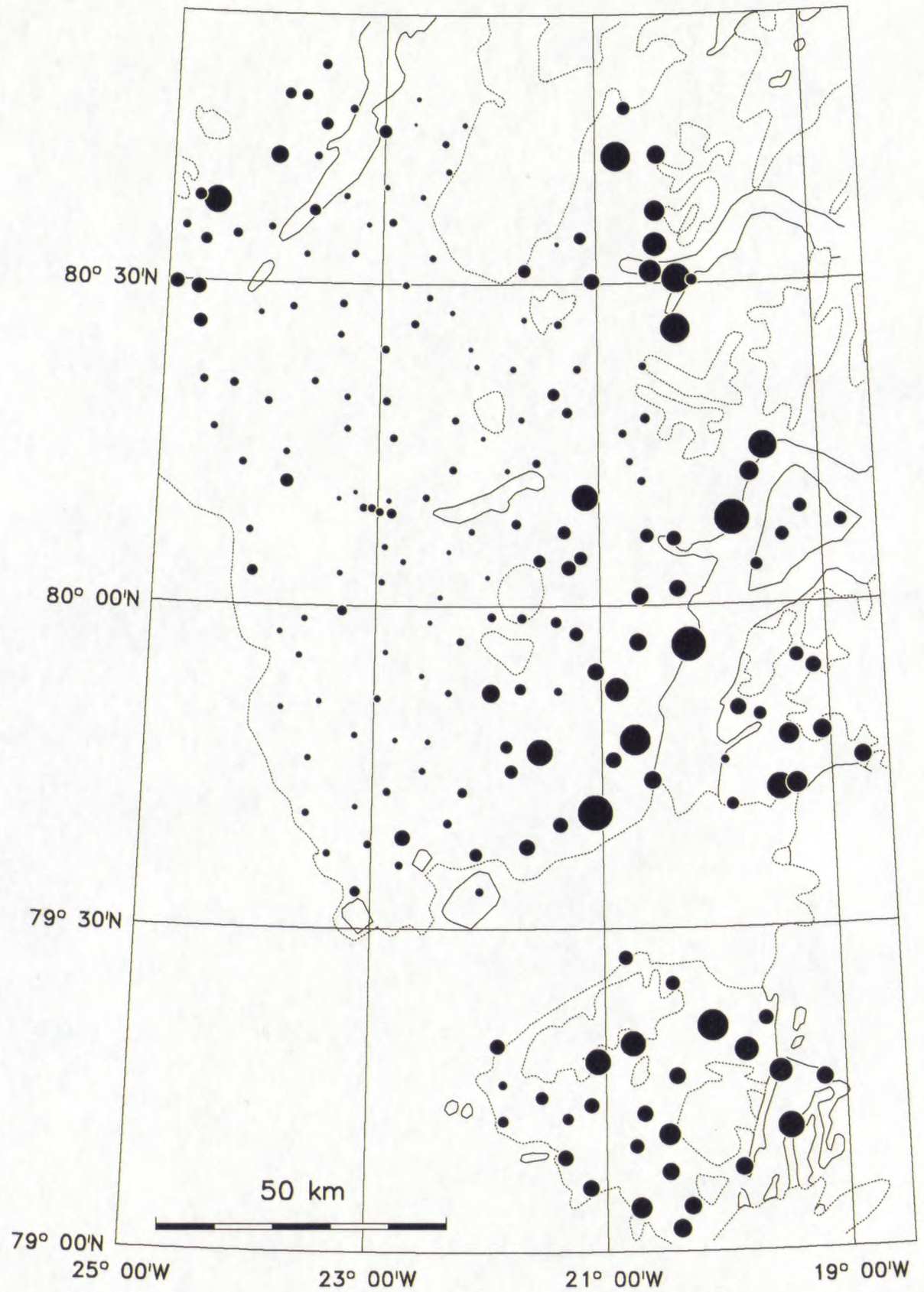
INAA

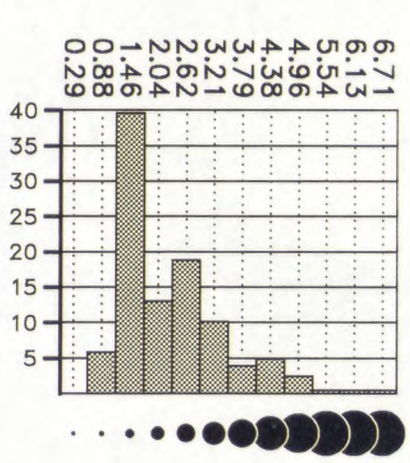
Number of samples:	207
Min. value:	0.0
Max. value:	2.2
Mean:	0.2
Median:	0.0
Variance:	0.2
Std. Dev.:	0.4

Fig. 36

Grønlands Geologiske Undersøgelse

Yb in stream sediment





Yb ppm

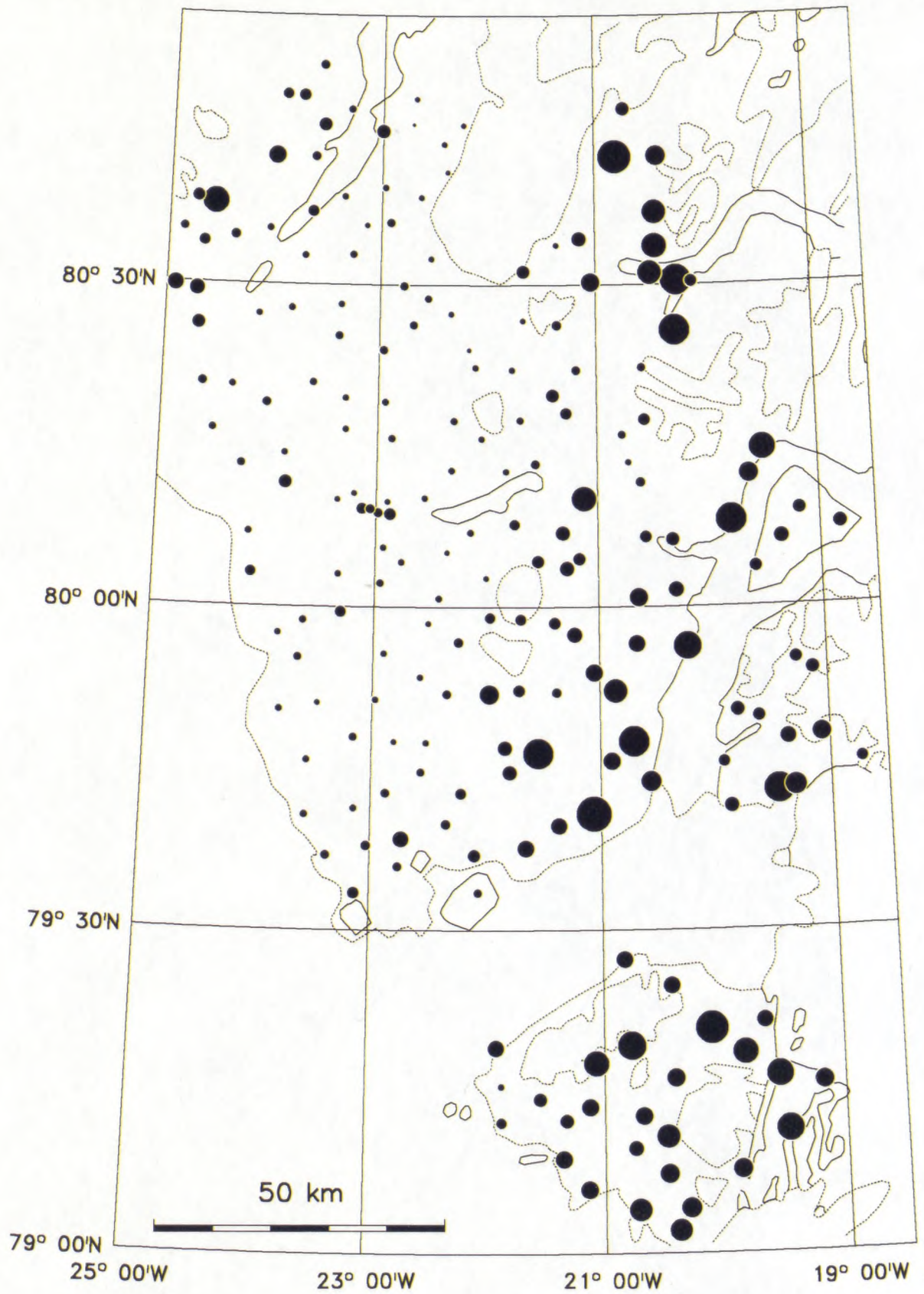
INAA

Number of samples:	207
Min. value:	0.82
Max. value:	6.60
Mean:	2.28
Median:	1.95
Variance:	1.16
Std. Dev.:	1.08

Fig. 37

Grønlands Geologiske Undersøgelse

Lu in stream sediment



Lu ppm

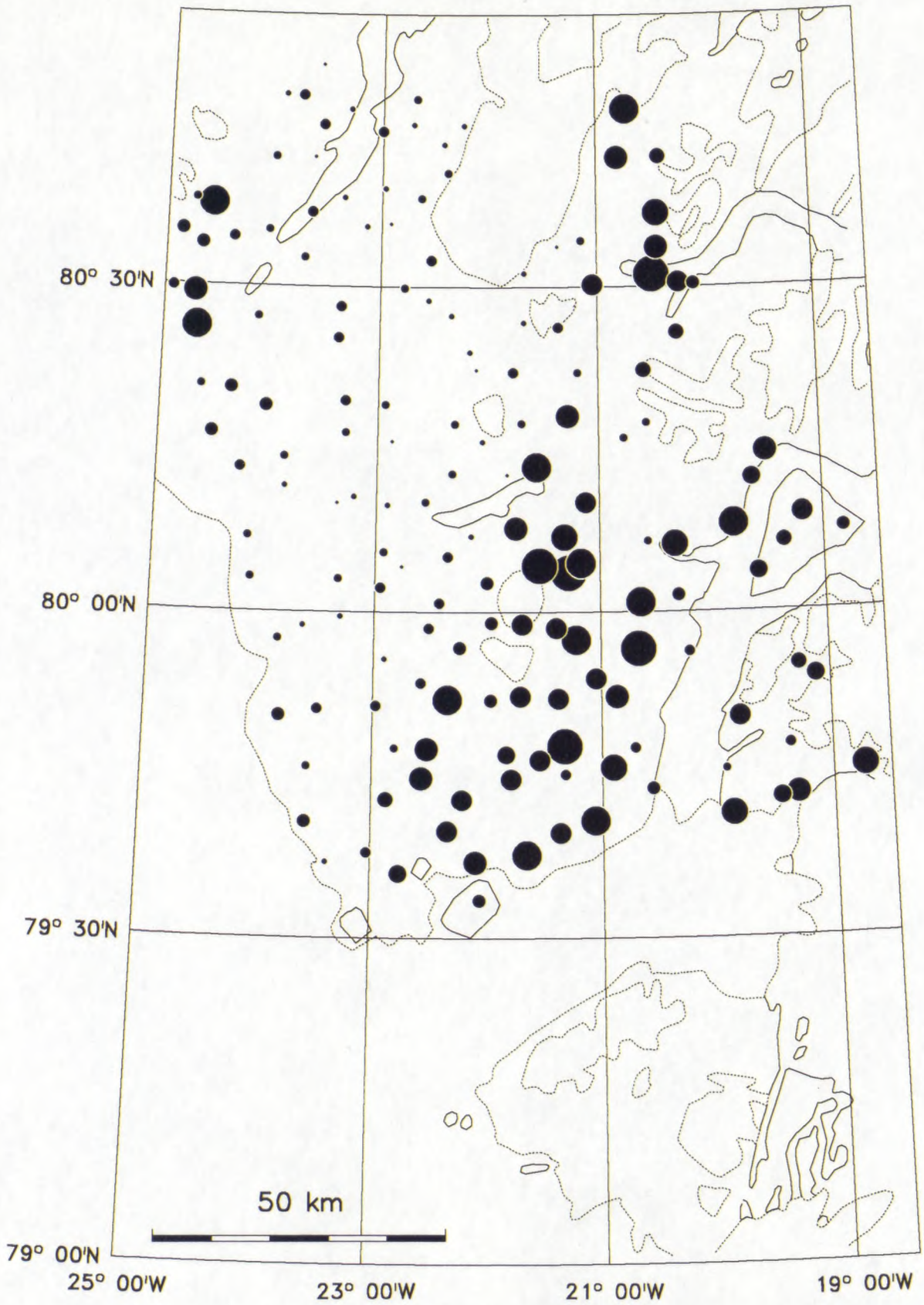
INAA

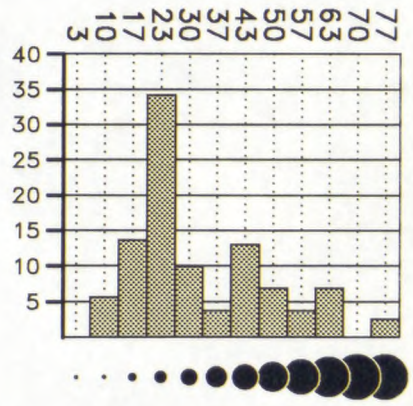
Number of samples:	207
Min. value:	0.11
Max. value:	1.02
Mean:	0.34
Median:	0.30
Variance:	0.02
Std. Dev.:	0.16

Fig. 38

Grønlands Geologiske Undersøgelse

Total radiation





Counts per sec.

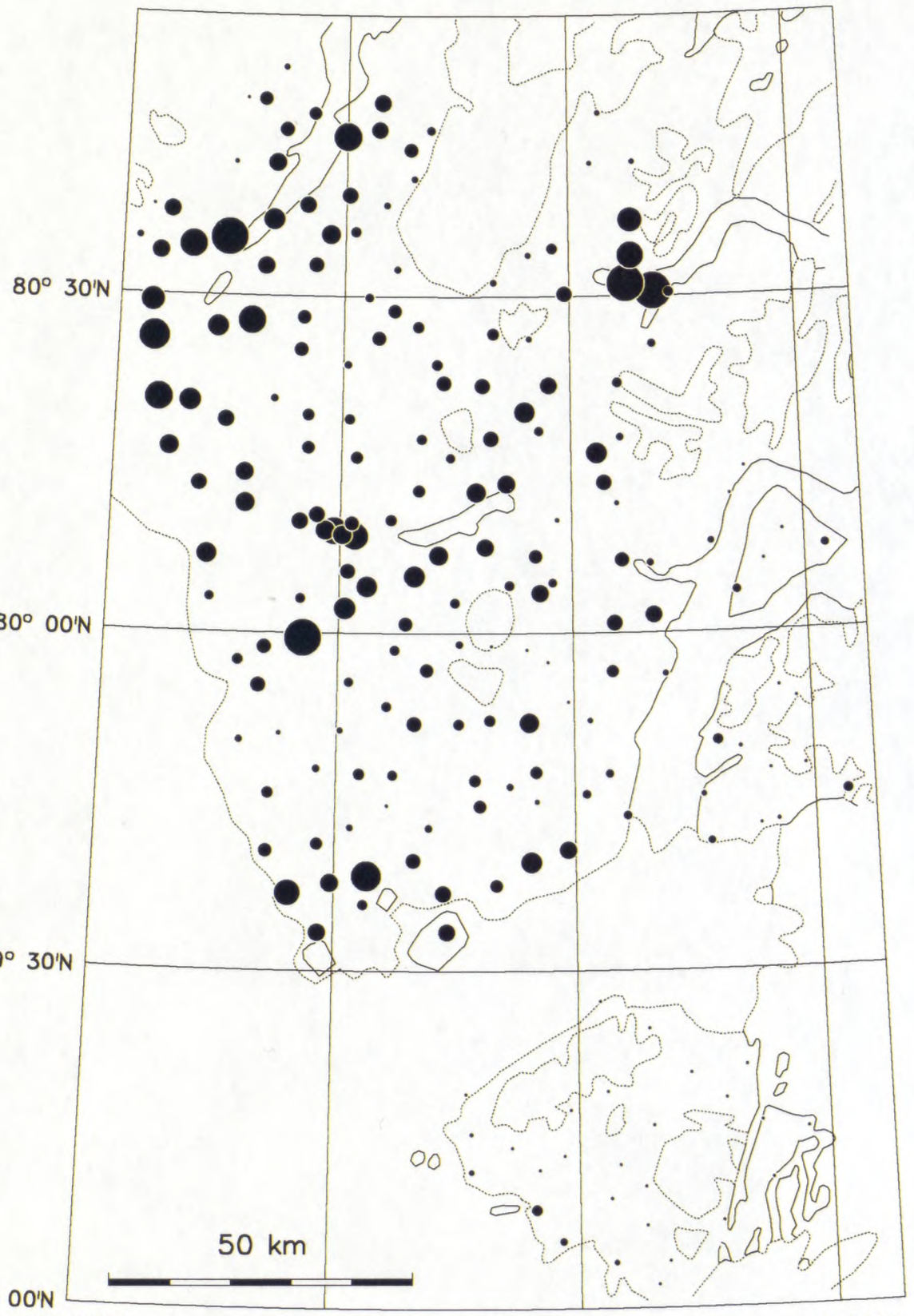
Scintillometry

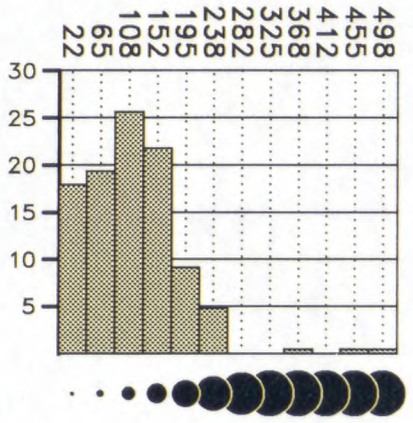
Number of samples:	162
Min. value:	10
Max. value:	125
Mean:	32
Median:	25
Variance:	315
Std. Dev.:	18

Fig. 39

Grønlands Geologiske Undersøgelse

Conductivity in stream water





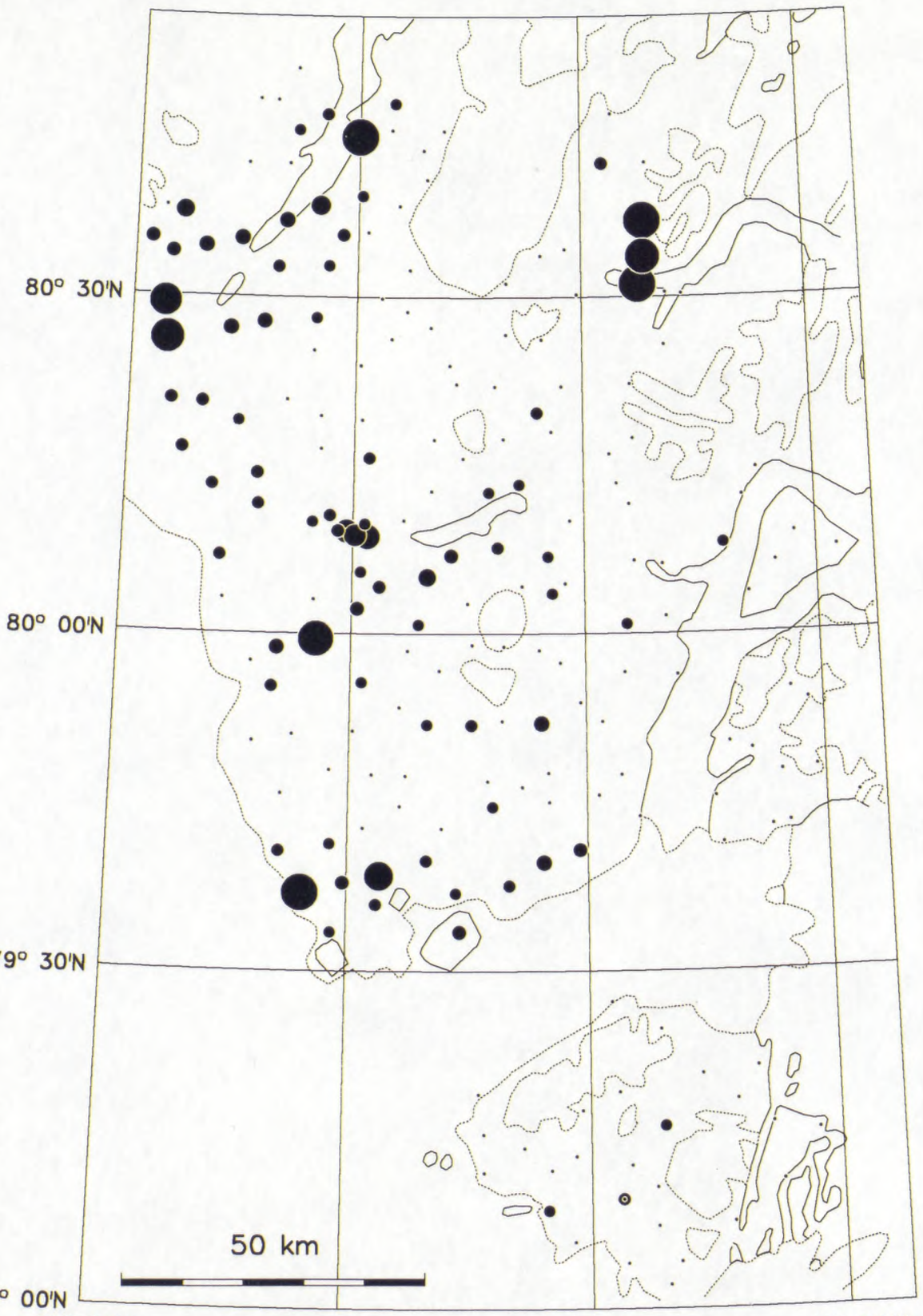
Micro Sievert

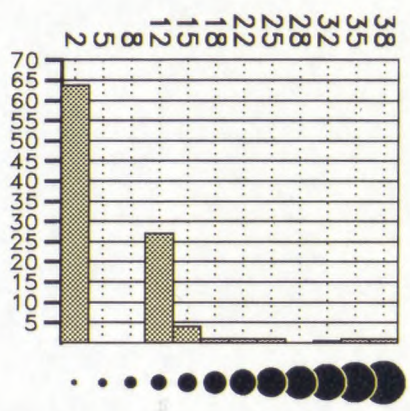
Number of samples:	208
Min. value:	8
Max. value:	4670
Mean:	134
Median:	107
Variance:	104878
Std. Dev.:	324

Fig. 40

Grønlands Geologiske Undersøgelse

F in stream water





F ppb

Ion sensitive electrode

Number of samples:	208
Min. value:	0
Max. value:	61
Mean:	6
Median:	0
Variance:	96
Std. Dev.:	10

Fig. 41

Fig. 42 Drainage system typical of the Ordovician – Silurian carbonate platform in central Kronprins Christian Land: gently flowing, braided streams with little sediment transport. Height of valley section in background is ~ 400 m.

Fig. 43 Looking north along Caledonian nappe front in southern Kronprins Christian Land. The Ordovician – Silurian carbonate platform (light grey) is overlain by the Late Proterozoic Rivieradal sandstones (black). Height of cliff face is ~ 250 m.

Fig. 44 View to the south-east from central Kronprins Christian Land. Foreground: Quaternary deposits in wide valley on the Ordovician – Silurian carbonate platform. Background: up to ~ 1500 m high peaks of the coastal region between Hekla Sund and Ingolf Fjord.

Fig. 45 Alpine topography typical of the eastern coastal region. View of the north side of Ingolf Fjord: Independence Fjord Group sandstones (grey) with voluminous basic dykes and sills (Midsommersø Dolerites, black). Height of section is ~ 1100 m.

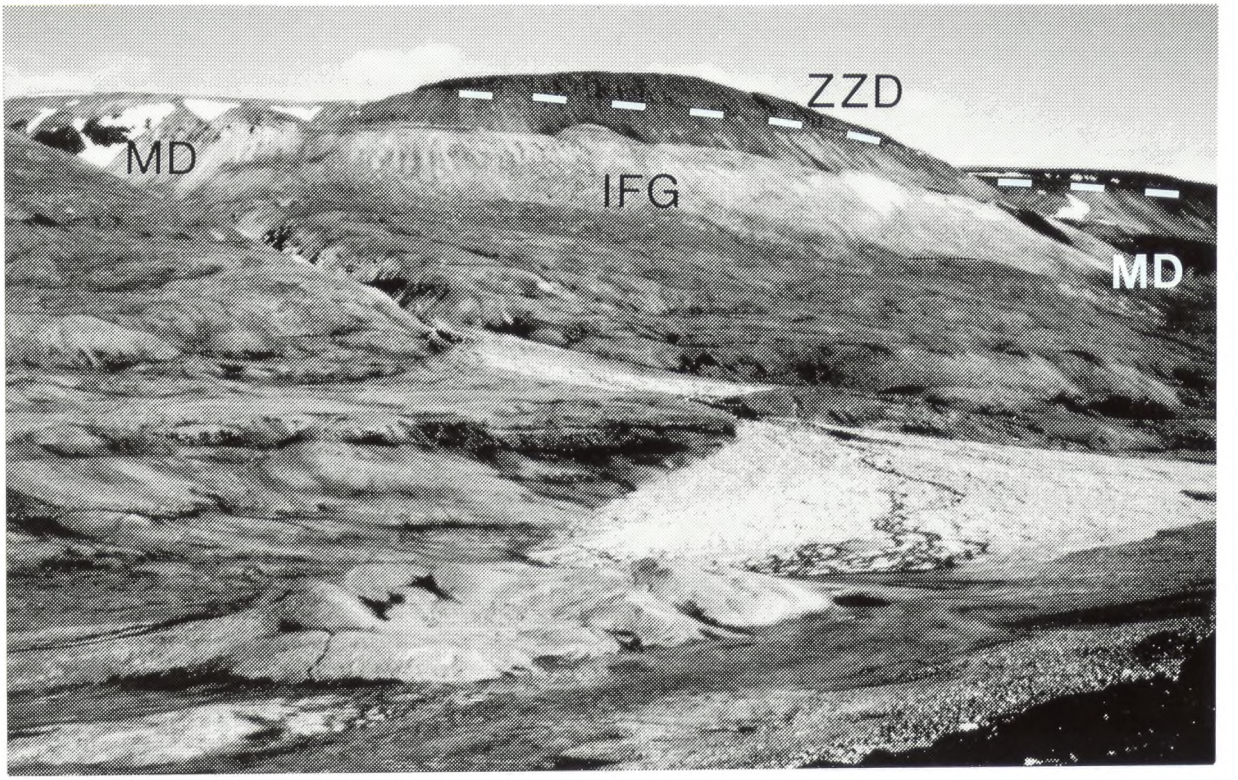


Fig. 46 Undisturbed Middle Proterozoic sequence in Campanuladal. Midsommersø Dolerites (MD) cut the Independence Fjord Group (IFG) which is overlain by the Zig-Zag Dal Basalt Formation (ZZD). Height of section from valley bottom to top of basalts is ~ 700 m; height of alluvial cone in the foreground (right) is ~ 200 m.

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