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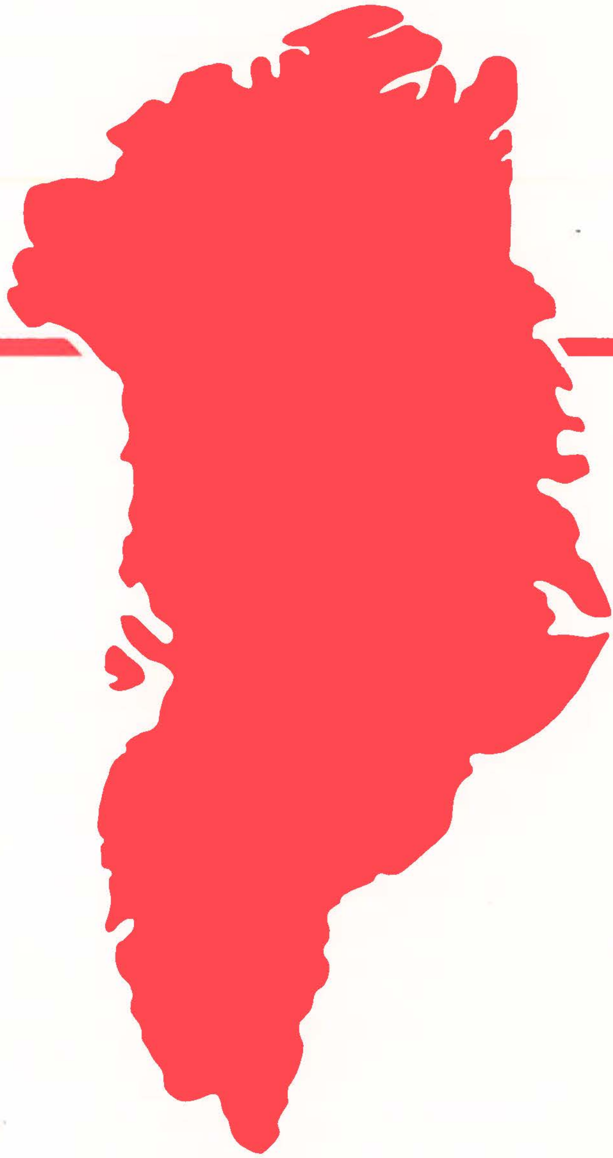

Open File Series 92/3

March 1992

GRØNLANDS GEOLOGISKE UNDERSØGELSE
Ujarassiortut Kalaallit Nunaanni Misissuisoqarfiat
GEOLOGICAL SURVEY OF GREENLAND

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Abstract

Gold mineralisation was discovered 1991 in Precambrian supracrustal rocks near the settlement Saqqaq on southern Nuussuaq. The supracrustal sequence comprises a lower, ultramafic to mafic volcanic unit and an upper, predominantly clastic unit. A 3-4 m wide, rusty weathering metachert horizon of exhalative origin occurs at the transition between the volcanic and clastic units. This horizon contains disseminated pyrrhotite, pyrite, arsenopyrite and gold grains up to 20 microns in size, and chip samples collected at five localities over a strike length of 1.6 km average 1 ppm Au. The supracrustal unit thus has a potential for sedimentary-exhalative-derived gold deposits and constitutes a new exploration target in the Disko Bugt area.

Contents

1. Introduction

In the beginning of the Disko Bugt Project 1988-92 carried out by the Geological Survey of Greenland (GGU) (Kalsbeek & Christiansen, in press), a fairly large unit of supracrustal rocks was found in the Precambrian basement of southern Nuussuaq (Fig. 1). Initial analyses of stream sediment and sulphide mineralised samples from the supracrustal unit showed enrichment in arsenic and traces of gold (A. Steenfelt, pers. comm. 1991). As participants in the project in 1991, one of the tasks of the present authors was to investigate the economic significance of these initial indications.

The area investigated is situated in the Ilulissat/Jakobshavn municipality some 100 km NNW of Ilulissat at c. 70^{o}N near the settlement Saqqaq (Fig. 2). The area is mountainous with altitudes up to 1300 m a.s.l. and local glaciers. Field work carried out in the period 3-10 July 1991 from two fly camps located in the best exposed parts of the supracrustal unit comprised mainly chip and grab sampling of outcrops and local scree boulders, and stream sediment sampling.

This report presents the preliminary results of the 1991 field work, including a complete set of chemical analyses (Tables 1, 2, 4). Lithological and mineralogical terms used are strictly field terms. A more comprehensive account on the Saqqaq supracrustal rocks and mineralisation is being prepared.

2. Geology

The Saqqaq supracrustal rocks constitute a NW-SE striking, c. 29 km x 5 km belt enclosed in the Precambrian gneiss complex (Fig. 1). Locally the supracrustals are capped by Tertiary basaltic flows.

Exposures of relatively undisturbed supracrustal rocks occur in a NE-facing, 400-500 m high, steep mountain wall at Qaqugdluit (Fig. 2). Six different sections were cursorily examined over a strike length of 1.6 km along this slope (rock samples nos 350301-26). The examined part of the supracrustal sequence generally dips 30^{o} SW.

All six localities show similar rock sequences, as illustrated in Fig. 3. Nowhere is the basement/cover contact exposed. At the southeasternmost locality, isolated outcrops of amphibolite protrude beneath the scree fans that cover the lower parts of the slopes. An ultramafic-mafic sequence dipping 30^{o} SW with a true thickness of c. 50 m occurs above the scree. The lowest part of this unit consists of a massive, yellowish to greyish brown weathering ultramafic rock rich in carbonate, serpentine and talc (350310). The ultramafic rock often contains large tremolite crystals and in places it displays conspicuous growth patterns of mafic minerals (spinifex structures or metamorphic recrystallisation phenomena). Layers of a dark olive green hornblende-rich rock (350306-07) occur higher up in the sequence. The frequency and thickness (millimetres to decimetres) of these layers increase upwards so that uppermost the hornblende-rich rock becomes the predominant rock type. Also, the rocks become more foliated upwards.

The ultramafic-mafic sequence is overlain by a few metres thick garnet-rich pelite with centimetre-thick layers of garnet and mica. Euhedral garnet porphyroblasts, up to 2 cm in diameter, vary in colour from dark red to pitch black.

This is followed by a 3-4 m thick, rusty weathering horizon of assumed metachert with occasional small-scale folds with near-horizontal, NW striking axes. The rock is finely laminated and consists of quartz with variable amounts of mafic minerals, garnet, micas including fuchsite, and sulphides. At one locality (scree samples nos 350320-26) the horizon is not accessible due to the steep topography.

Above the metachert c. 40 m of slightly migmatised grey, garnet-bearing pelitic rocks occur. This sequence is interrupted by a whitish, homogeneous, slightly foliated granodiorite sheet, perhaps 50 m thick. The upper part of the mountain wall is inaccessible, but from a distance it can be seen that above the granodiorite, supracrustal rocks continue for 200-300 m to the top of the mountain.

Further north, at the lake Iluliagdlip tasia, the same rock types were observed. They are least disturbed south of the lake, where they form a large recumbent fold with a horizontal, NW-SE axis. Further north, the rocks become increasingly deformed and mixed by disharmonic folding.

The supracrustal rocks represent a sequence of ultramafic and mafic lavas changing upwards into pyroclastic and exhalitic deposits and finally into epiclastic sediments. The sequence has been intruded by a sheet of granodiorite, folded and metamorphosed. The age of the supracrustal rocks is believed to be Archaean, but neither age nor definite correlations with other supracrustal units in the region are certain.

3. Mineralisation

The metachert horizon contains a few per cent disseminated, fine-grained sulphides. Loose blocks indicate that semi-massive sulphide concentrations do occur, but none have been observed in outcrop. The main sulphide minerals are pyrrhotite and pyrite, accompanied by minor amounts of arsenopyrite and chalcopyrite. Preliminary microscopy has revealed grains of native gold up to 20 microns in size occurring both unrelated to sulphides and included in arsenopyrite (350319, 350324). A tendency to lateral pyrite/pyrrhotite zonation with an increase of pyrrhotite towards NW is observed. Sphalerite and galena are known from boulders at two localities where they occur in migmatised rocks, possibly originally chert (350350-51), and in vein quartz (350341) respectively.

The metachert horizon was chip sampled (c. 3 kg samples) at eight localities distributed over a lateral distance of c. 8.5 km. Short descriptions and chemical analyses of the samples are presented in Table 2 and summarized in Table 3, from where it appears that the metachert is enriched in gold (average 757 ppb, range 95-1831 ppb), arsenic (average 404 ppm), nickel (average 652 ppm), chromium (average 1403 ppm) and antimony (average 9.4 ppm). The five chip samples from Qaqugdluit alone, collected over a strike length of 1.6 km, have the following average values: 1063 ppb Au (range 384-1831 ppb Au), 572 ppm As, 812 ppm Ni, 1640 ppm Cr and 11.9 ppm Sb. The chip samples do not show elevated base metal contents. However, the scree boulders of possible chert origin from the Iluliagdlip tasia area with sphalerite, galena and chalcopyrite contain up to 1.57% Zn, 1.22% Pb, 0.13% Cu, 61.7 ppm Ag and 247 ppb Au (350350-51).

Minor amounts of fine-grained sulphides and scheelite occur in the garnet-rich pelite below the metachert (350312). Analysis of this sample shows relatively high contents of arsenic (0.18%), nickel (0.18%), gold (116 ppb), antimony (93 ppm) and tungsten (46 ppm).

The amphibolitic parts of the ultramafic-mafic sequence contain rust zones with disseminated to semi-massive pyrrhotite and pyrite. Analyses of five chip samples from such mineralisation are summarized in Table 3. The samples are low in gold (average 12 ppb, range 1-38 ppb), but somewhat higher in base metals than the metachert.

Rock samples with gold contents of 0.1 ppm or greater are shown on Fig. 4. They can nearly all be related to the metachert unit. One exception is a boulder of chalcopyrite-bearing ultramafic rock from Iluliagdlip tasia with 0.3% Cu and 235 ppb Au (350347). Other noble metal contents in the rock samples are modest, max. 9 ppb Pt, 28 ppb Pd and 62 ppm Ag.

4. Drainage geochemistry

Eight stream sediment/pan sample pairs were collected in the local streams (Fig. 2). The c. 500 g stream sediment samples were dry sieved in the laboratory and the -0.1 mm fractions were analysed (Table 4). Pan samples are heavy mineral concentrates produced by panning of the -1.0 mm fraction of c. 20 kg stream sediment. From pre-concentrates produced in the field, concentrates were separated by heavy liquid (d=2.95) in the laboratory and analysed (Table 4).

The chemical results are summarised in Table 5, and gold values of 5 ppb or greater are shown on Fig. 4. Gold is registered by moderately high values in both sample types in the Qaqugdluit area (max. 28 ppb in stream sediment samples and 83 ppb in pan samples), but only by stream sediment samples (max. 9 ppb) in the Iluliagdlip tasia area. Up to 96 ppm W appears in scheelite-bearing pan samples from the Qaqugdluit area. In comparison to samples from other parts of the Disko Bugt area, contents are relatively high for elements such as gold, arsenic, tungsten, nickel, cobalt, chromium, manganese, antimony, copper and zinc (Appel & Knudsen, 1988; Steenfelt, 1987, 1988).

5. Metallogenetic considerations

The gold-bearing metachert horizon of the Saqqaq supracrustal rocks is located at the transition from volcanic to sedimentary rocks. It is therefore possible that the auriferous chert was deposited from seafloor exhalitive discharge accompanying ultramafic-mafic submarine volcanism. The elevated chromium and nickel contents of the metachert certainly point towards a contribution from the ultramafic-mafic lavas.

Comparable gold mineralisation hosted by chemical-sediment or by arsenical sulphide-silicate iron formation is important in Archaean greenstone belts on a worldwide scale. Known examples occur at Lupin Mine, N.W.T., Canada and Homestake, South Dakota, USA (Thorpe & Franklin, 1984). In this type the gold is in part uniformly disseminated in the host units, and in part in minor quartz veins which may be irregularly distributed or structurally controlled. Remobilised gold is typically deposited in fold hinges. Various authors e.g. Sawkins & Rye (1974) have proposed a genesis by syngenetic precipitation of gold in chemical sediments, where many of the chemical components have been introduced by hydrothermal exhalations on the sea floor.

It seems that the Saqqaq supracrustal rocks hold a potential for gold deposits; they thus constitute a new exploration target in the Disko Bugt area. The potential lies in primary gold concentrations rich enough to be mineable in the metachert horizon, or the horizon might constitute an important pre-enriched source of gold available for later metamorphic remobilization. The larger part of the area underlain by the supracrustal rocks remains untested and certainly warrants investigation.

6. Acknowledgements

A. A. Garde and A. Steenfelt are thanked for the introduction to the geology of the investigated area and for critical comments.

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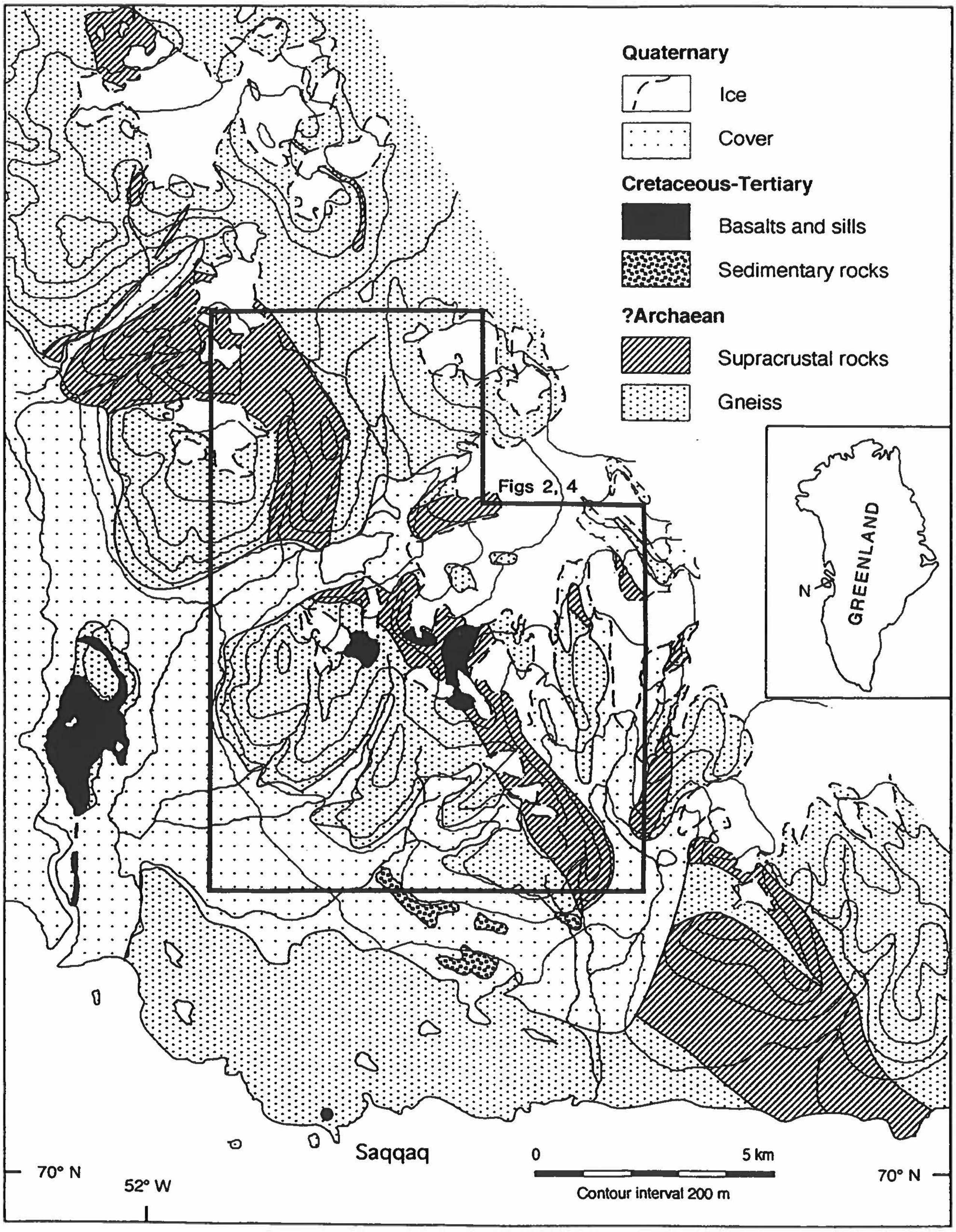

Fig. 1. Geological map of the Saqqaq area, prepared by A. A. Garde. The location on the peninsula Nuussuaq is marked with N on inset map.

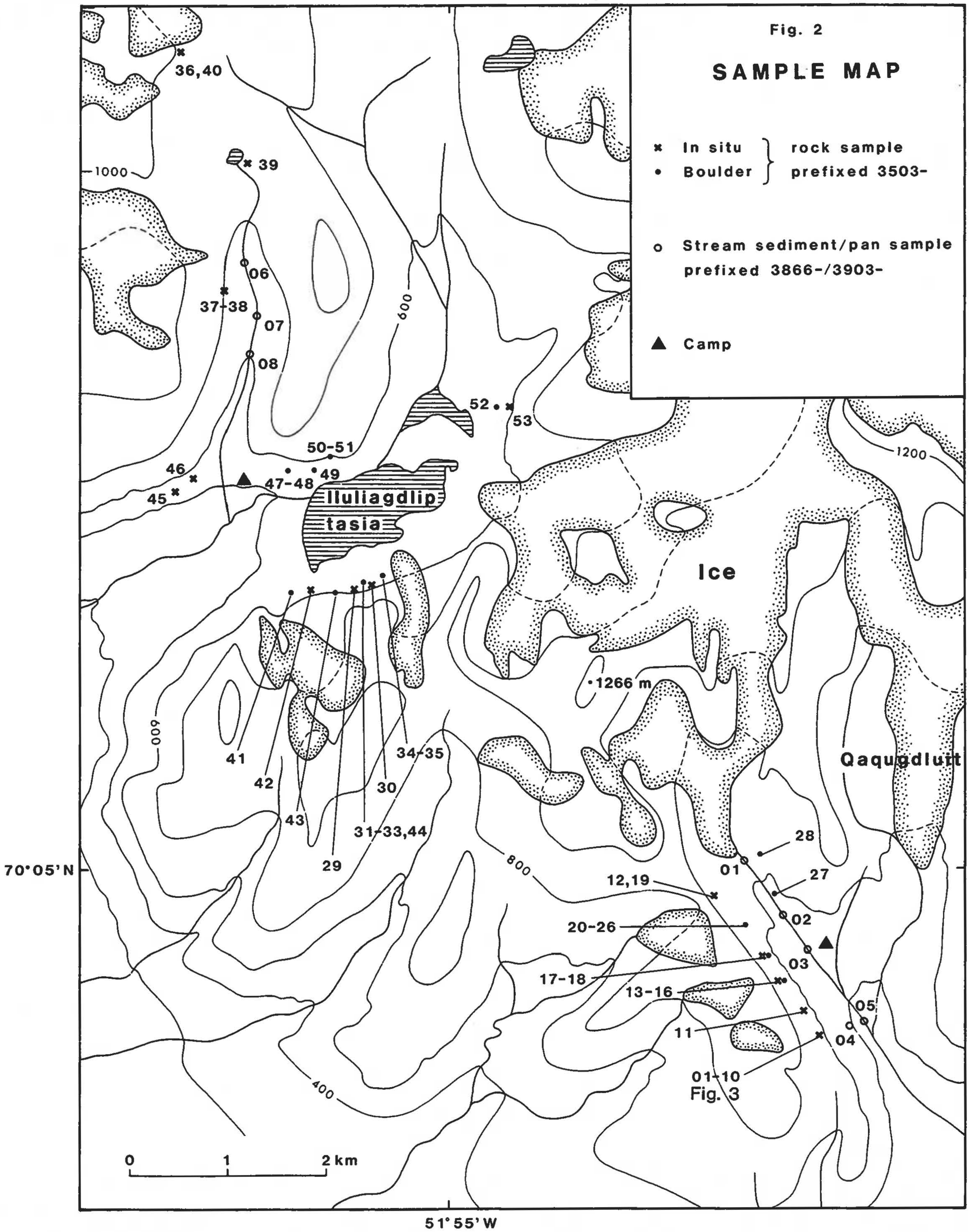
Fig. 2
SAMPLE MAP
In situ
Boulder
rock sample
prefixed 3503-
Stream sediment/pan sample
prefixed 3866-/3903-
Camp
Iluliagdlip
tasia
Ice
Qaqugdluit
•1266 m
1000
1200
800
600
400
36,40
39
06
37-38
07
08
52
53
50-51
46
49
47-48
45
41
42
43
29
31-33,44
30
34-35
28
01
27
12,19
02
20-26
03
17-18
13-16
05
11
04
01-10
Fig. 3
70°05'N
51°55'W
0
1
2 km

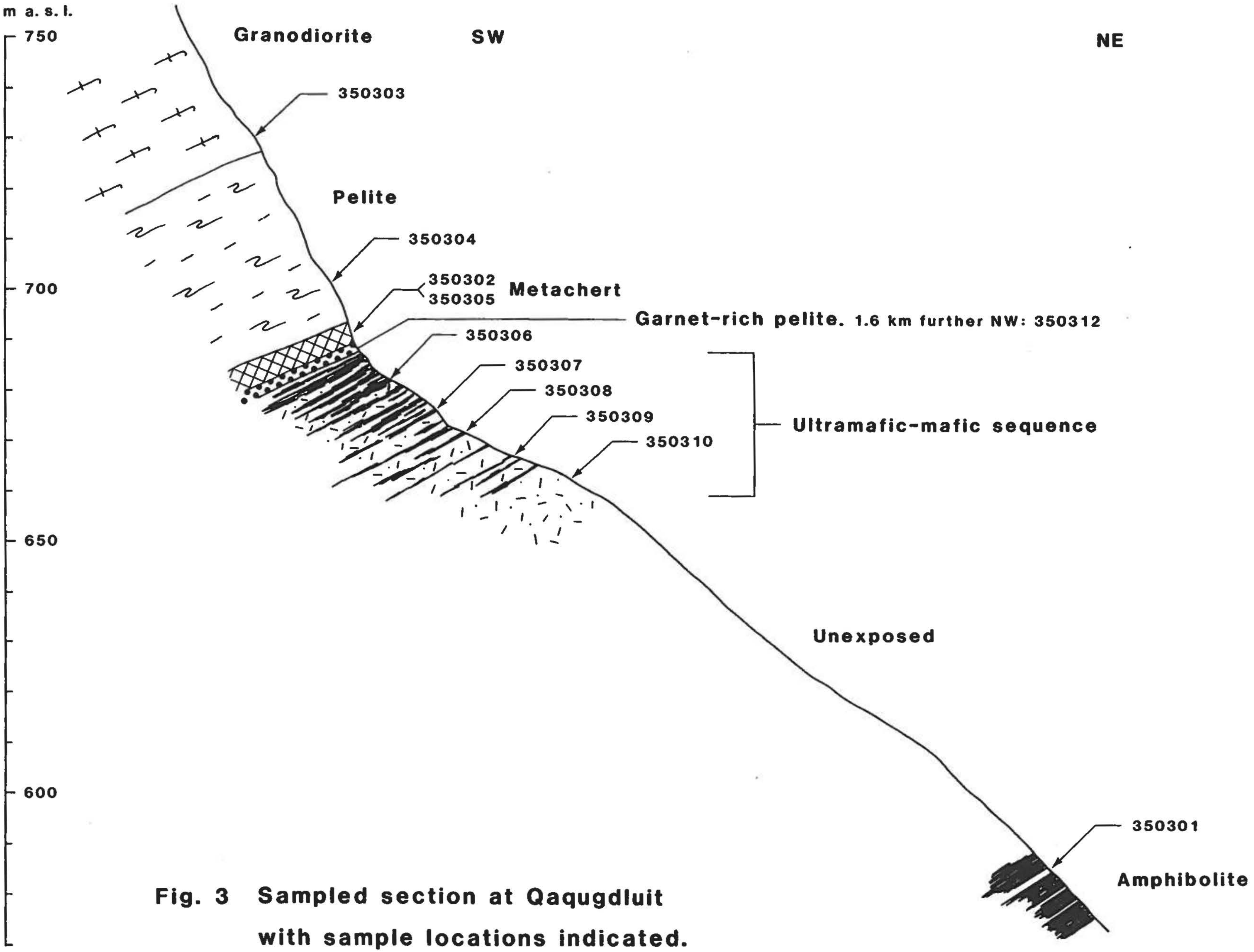

Fig. 3 Sampled section at Qaqugdluit with sample locations indicated.

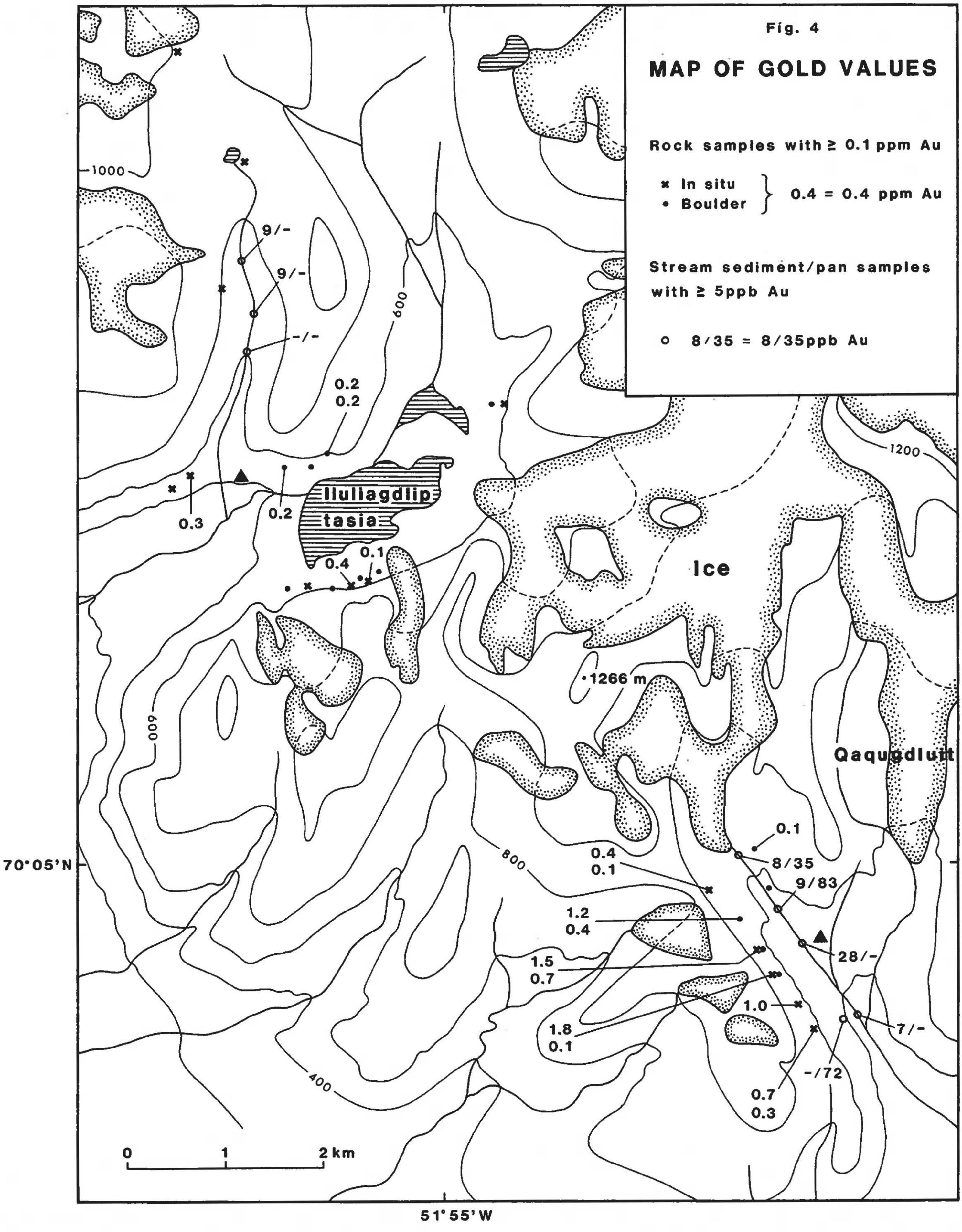
Fig. 4
MAP OF GOLD VALUES
Rock samples with ≥ 0.1 ppm Au
In situ
Boulder
0.4 = 0.4 ppm Au
Stream sediment/pan samples
with ≥ 5ppb Au
8/35 = 8/35ppb Au
1000
600
800
400
1200
9/-
9/-
-/-
0.2
0.2
0.3
0.2
Iluliagdlip
tasia
0.4
0.1
Ice
1266 m
Qaqugdluit
0.1
8/35
9/83
0.4
0.1
1.2
0.4
28/-
1.5
0.7
1.0
7/-
1.8
0.1
-/72
0.7
0.3
0
1
2 km
70°05'N
51°55'W

Table 1. Analytical methods and detection limits

All analyses are by Activation Laboratories Ltd., Ontario. The following methods have been used:

(1) Instrumental neutron activation analysis

Stream sediment samples, pan samples, rock samples.

Element	Detection limit	Element	Detection limit
Au	5 PPB	Sb	0.2 PPM
Ag	5 PPM	Sc	0.1 PPM
As	2 PPM	Se	5-20 PPM
Ba	100-200 PPM	Sn	100 ppm
Br	1-5 PPM	Sr	0.05-0.2 %
Ca	1 %	Ta	1 PPM
Co	5 PPM	Th	0.5 PPM
Cr	10 PPM	U	0.5 PPM
Cs	2 PPM	W	4 PPM
Fe	0.02 %	Zn	50-200 PPM
Hf	1 PPM	La	1 PPM
Hg	1-5 PPM	Ce	3 PPM
Ir	5-50 PPB	Nd	5-10 PPM
Mo	5-20 PPM	Sm	0.1 PPM
Na	500 PPM	Eu	0.2 PPM
Ni	50-200 PPM	Tb	0.5-2 PPM
Rb	30-50 PPM	Yb	0.05-0.2 PPM
		Lu	0.05-0.1 PPM

(2) Aqua regia extraction/inductively coupled plasma emission spectrometry (icp)

Stream sediment samples, pan samples, rock samples.

Element	Detection limit
Cu	1 PPM
Zn	1 PPM
Pb	1 PPM
Ag	0.2 PPM
Mn	2 PPM
Ni	1 PPM
Cd	0.5 PPM

Table 1. Analytical methods and detection limits

(3) Fire assay/icp analysis (fa)

Rock samples.

Element	Detection limit
Pd	2 PPB
Pt	5 PPB
Au	1 PPB

(4) Fusion/icp analysis

Rock samples.

Elements: SiO_2, TiO_2, Al_2O_3, Fe_2O_3, MnO, MgO, CaO, Na_2O, K_2O, P_2O_5, Ba, Sr, Zr, Y, Sc, LOI

Note. 0 or 0.0 in the analytical results indicates a value below the detection limit.
- means no analysis.

Table 2a. Rock samples: field description

GGU no	Altitude metre	In situ /length	Description
350301	580	1.5 m	Amphibolite with 1% sulphides.
350302	690	4.0 m	Metachert with disseminated sulphides.
350303	730	+	Granodiorite.
350304	700	+	Garnet mica schist.
350305	690	+	Metachert corresponding to 350302.
350306	680	+	Hornblende-rich rock.
350307	675	+	Hornblende-rich rock.
350308	670	+	Ultramafic rock.
350309	665	+	Ultramafic rock.
350310	660	+	Ultramafic rock.
350311	655	4.5 m	Metachert with disseminated sulphides.
350312	720	+	Pelite, 3 cm almandine band, scheelite.
350313	620	-	Semi-massive pyrrhotite, trace chalcopyrite.
350314	630	-	Mica schist, disseminated arsenopyrite.
350315	720	3.0 m	Metachert with disseminated sulphides.
350316	730	-	Vein quartz, trace chalcopyrite.
350317	650	-	Metachert with disseminated pyrite.
350318	700	3.0 m	Metachert with disseminated sulphides.
350319	730	4.0 m	Metachert with disseminated sulphides.
350320	670	-	Garnet-rich metachert with pyrrhotite.
350321	540	-	Garnet-rich metachert with pyrrhotite.
350322	590	-	Hornblende-rich rock, garnet, pyrrhotite.
350323	670	-	Hornblende-rich rock, garnet, sulphides.
350324	580	-	Metachert with pyrrhotite and arsenopyrite.
350325	580	-	Hornblende-rich rock, garnet, pyrite.
350326	570	-	Metachert, garnet, pyrrhotite, arsenopyrite.
350327	620	-	Semi-massive pyrrhotite.
350328	630	-	Metachert with fuchsite and pyrite.
350329	570	3.0 m	Metachert with disseminated sulphides.
350330	575	3.0 m	Metachert with disseminated sulphides.
350331	480	-	Metachert, pyrrhotite, trace chalcopyrite.
350332	480	-	Metachert with pyrrhotite.
350333	480	-	Metachert, pyrrhotite, trace chalcopyrite.
350334	450	-	Metachert with pyrrhotite.
350335	455	-	Metachert rich in pyrrhotite.
350336	1000	+	Metachert with trace pyrrhotite.
350337	790	1.0 m	Amphibolite rich in pyrrhotite.
350338	850	+	Metachert rich in pyrrhotite.
350339	880	+	Ultramafic rock, disseminated pyrrhotite.
350340	1000	+	Semi-massive pyrrhotite.
350341	460	-	Vein quartz, sphalerite, pyrite, chalcopy.
350342	530	2.0 m	Garnet amphibolite with pyrite.
350343	600	+	Metachert, garnet, pyrrhotite.
350344	520	-	Metachert rich in pyrrhotite.
350345	500	3.0 m	Amphibolite and metachert with pyrite.
350346	530	1.5 m	Metachert with garnet and pyrite.
350347	480	-	Ultramafic rock with minor chalcopyrite.
350348	490	-	Amphibolite with minor chalcopyrite.
350349	520	-	Ultramafic rock with malachite coating.
350350	565	-	Paragneiss, sphalerite, galena, chalcopyrite
350351	570	-	Paragneiss, sphalerite, galena, chalcopyrite
350352	520	-	Metachert with pyrrhotite.
350353	580	5.0 m	Amphibolite, metachert, garnet, pyrrhotite.

Note. + = sample from outcrop.
- = scree or boulder sample.
4.0 m = chip sample from 4 m thick horizon.

Table 2b. Rock samples: analyses

GGU no	Au ppb	Au ppb (fa)	As ppm	W ppm	Ni ppm	Ni ppm (icp)	Co ppm	Pt ppb	Pd ppb
350301	0	1	190	0	0	-	19	0	0
350302	745	693	92	13	580	-	68	5	3
350305	377	290	190	24	1400	1188	110	0	4
350306	27	-	400	0	950	302	120	-	-
350307	0	32	9	0	2600	682	82	0	7
350308	0	-	4	0	1500	480	89	-	-
350310	0	4	29	0	2000	967	110	5	6
350311	1250	954	280	7	540	-	53	5	3
350312	166	116	1800	46	1800	1482	150	0	2
350313	95	91	45	0	390	211	190	0	14
350314	39	-	2700	0	200	73	15	-	-
350315	2000	1831	1600	9	1500	-	86	6	3
350316	146	95	24	0	140	64	21	0	3
350317	633	659	84	7	190	168	27	0	3
350318	2170	1451	390	9	1000	-	110	0	4
350319	543	384	500	15	440	-	71	6	7
350320	12	-	0	0	120	113	64	-	-
350321	20	-	54	0	140	90	26	-	-
350322	97	92	30	0	290	207	66	5	4
350323	17	-	4	0	180	133	74	-	-
350324	1000	1155	3000	0	420	295	200	0	15
350325	72	52	43	0	350	237	76	0	3
350326	365	368	1100	0	420	269	120	6	7
350327	13	27	5	0	1500	1125	170	0	28
350328	133	102	250	8	880	766	240	7	6
350329	371	351	240	0	710	-	93	5	5
350330	90	95	120	0	420	-	38	0	4
350331	111	49	0	0	820	502	170	0	6
350332	93	71	3	0	450	321	140	0	4
350333	39	-	66	0	480	426	150	-	-
350334	75	37	10	0	0	226	53	7	4
350335	81	65	27	0	810	490	160	0	11
350336	25	-	0	0	0	50	16	-	-
350337	0	5	5	11	0	-	50	5	2
350338	9	-	0	0	590	466	150	-	-
350339	0	-	8	0	930	627	67	-	-
350340	0	-	2	0	640	513	150	-	-
350341	7	-	0	0	0	22	12	-	-
350342	0	9	0	5	0	-	50	5	0
350343	40	44	8	13	240	204	63	0	4
350344	28	-	19	0	600	404	140	-	-
350345	0	8	12	5	0	-	35	0	2
350346	364	299	9	10	0	-	9	0	9
350347	283	235	27	0	410	233	37	6	9
350348	71	61	56	0	150	68	75	9	12
350349	10	-	0	0	1200	564	120	-	-
350350	247	200	4	0	160	74	31	0	4
350351	266	247	5	0	150	127	42	0	7
350352	16	26	0	0	1400	1060	140	0	12
350353	37	38	5	7	470	-	70	7	7

Table 2b. Rock samples: analyses

GGU no	Ir ppb	Cr ppm	Fe %	Mn ppm	Cu ppm	Zn ppm	Zn ppm (icp)	Cd ppm	Pb ppm
350301	0	190	9.2	-	111	88	20	-	16
350302	0	1100	3.2	-	124	50	11	-	12
350305	0	790	6.1	58	503	67	35	0	2
350306	0	2900	10.0	202	49	172	43	0	2
350307	0	4200	11.1	296	72	161	90	0	2
350308	0	1900	7.5	304	18	109	95	0	3
350310	0	2500	8.9	460	18	138	179	1	3
350311	0	1700	5.8	-	116	71	9	-	14
350312	0	240	13.6	384	21	163	27	0	2
350313	0	110	22.5	537	2429	111	57	2	2
350314	0	45	3.3	196	120	152	129	1	4
350315	0	800	4.3	-	106	95	28	-	21
350316	0	280	3.5	93	731	0	29	0	27
350317	0	170	2.7	28	30	0	5	0	4
350318	0	1800	7.5	-	96	134	23	-	15
350319	0	2800	10.2	-	64	101	11	-	13
350320	0	130	16.8	1212	706	108	17	0	2
350321	0	110	21.6	281	255	825	570	5	8
350322	0	210	16.5	760	812	124	95	1	3
350323	0	250	23.2	1642	1687	142	27	1	3
350324	0	99	20.9	328	213	141	92	2	9
350325	0	240	17.2	760	295	151	90	1	8
350326	0	86	19.5	362	598	185	73	1	6
350327	0	110	28.3	57	361	127	12	1	9
350328	0	1600	11.9	12	17	135	14	0	2
350329	0	1700	11.2	-	406	91	12	-	16
350330	0	1200	8.4	-	105	0	14	-	17
350331	0	170	32.9	186	959	226	143	2	20
350332	0	97	23.3	87	688	156	34	1	2
350333	0	190	28.3	266	1277	153	112	3	17
350334	0	100	17.0	860	204	103	68	1	7
350335	0	110	36.0	161	999	375	237	4	11
350336	0	23	3.4	279	69	81	67	0	3
350337	0	330	12.9	-	350	276	26	-	35
350338	0	410	23.9	115	1055	299	58	1	6
350339	0	2200	13.1	488	141	391	66	0	2
350340	0	120	21.4	86	1016	144	18	1	3
350341	0	19	1.6	159	800	11000	11200	43	100
350342	0	180	13.2	-	498	279	58	-	18
350343	0	440	13.9	518	417	279	159	1	4
350344	0	160	26.1	265	476	0	57	1	8
350345	0	180	14.4	-	230	221	104	-	114
350346	0	120	10.8	-	80	149	42	-	52
350347	0	1400	8.3	743	3011	121	102	7	350
350348	0	300	7.7	170	1734	233	41	1	7
350349	0	1800	11.4	130	350	151	159	1	8
350350	0	210	3.6	88	1300	14100	13400	119	5300
350351	0	160	4.2	77	1200	15800	15700	151	12200
350352	0	250	25.0	323	181	169	154	1	83
350353	0	1000	11.7	-	150	356	66	-	31

Table 2b. Rock samples: analyses

GGU no	Ag ppm	Ag ppm (icp)	Sb ppm	Se ppm	Mo ppm	Sn ppm	Na %	Ca %	Ba ppm
350301	0	-	0.0	0	0	0	1.23	5	310
350302	0	-	29.0	0	0	0	0.09	0	0
350305	0	1	27.0	0	0	0	0.21	0	130
350306	0	0	28.0	0	0	0	0.11	6	0
350307	0	0	3.6	0	0	0	0.60	9	520
350308	0	0	1.1	0	0	0	0.00	7	0
350310	0	0	1.8	0	0	0	0.11	5	0
350311	0	-	5.0	0	7	0	0.08	1	0
350312	0	0	93.0	0	0	0	0.11	0	360
350313	0	3	0.6	0	0	0	0.92	5	0
350314	0	0	0.6	0	0	0	0.09	0	0
350315	0	-	1.7	7	0	0	0.31	0	0
350316	0	2	0.3	0	0	0	1.29	2	200
350317	0	0	5.8	0	0	0	0.23	0	140
350318	0	-	14.0	0	0	0	0.14	2	0
350319	0	-	10.0	0	0	0	0.00	0	0
350320	0	0	0.0	0	0	0	0.24	4	0
350321	0	1	0.3	0	0	0	0.00	0	0
350322	0	3	0.8	0	0	0	0.93	2	330
350323	0	1	0.0	7	0	0	0.28	5	0
350324	0	3	0.0	8	0	0	0.14	2	0
350325	0	2	0.6	0	7	0	0.36	2	0
350326	0	3	0.0	0	0	0	0.20	2	110
350327	0	1	0.3	10	0	0	0.36	2	0
350328	0	0	3.3	0	0	0	0.10	0	0
350329	0	-	1.5	0	0	0	0.12	0	0
350330	0	-	0.4	0	0	0	0.06	0	0
350331	0	8	0.0	0	0	0	1.24	0	0
350332	10	4	0.4	0	0	0	0.23	5	0
350333	10	8	0.5	8	0	0	1.03	0	0
350334	0	2	0.4	9	0	0	0.30	2	160
350335	43	36	0.5	0	0	0	0.34	0	140
350336	0	1	0.0	0	0	0	0.20	0	0
350337	0	-	0.0	0	0	0	0.62	6	0
350338	0	2	0.0	5	0	0	0.35	4	0
350339	0	1	0.3	0	0	0	0.77	8	180
350340	0	2	0.2	13	0	0	0.54	6	0
350341	0	3	0.0	0	0	0	0.15	1	0
350342	0	-	0.0	0	0	0	0.58	5	0
350343	0	3	0.6	0	0	0	0.82	3	0
350344	0	4	0.3	0	0	0	1.26	0	0
350345	0	-	0.0	0	0	0	0.57	2	0
350346	0	-	0.0	0	0	0	0.20	2	150
350347	15	12	1.2	0	0	0	0.73	13	220
350348	0	6	0.0	0	0	0	1.88	9	0
350349	0	0	0.0	0	0	0	0.24	8	0
350350	31	28	2.9	7	11	0	0.48	2	0
350351	58	62	6.1	19	11	0	0.61	2	0
350352	0	3	0.2	7	0	0	0.07	2	560
350353	0	-	0.0	0	0	0	0.36	7	380

Table 2b. Rock samples: analyses

GGU no	Br ppm	Sc ppm	Rb ppm	Cs ppm	Hf ppm	Ta ppm	U ppm	Th ppm	La ppm
350301	0	44.0	0	0	2	0	0.0	0.0	3
350302	0	4.7	0	0	0	0	1.6	0.6	0
350305	0	7.0	0	0	1	0	0.0	0.6	0
350306	0	36.0	0	0	1	0	0.0	0.0	2
350307	0	41.0	0	2	1	0	0.0	0.0	1
350308	0	24.0	0	0	1	0	0.0	0.0	1
350310	4	25.0	0	0	0	0	0.0	0.0	0
350311	0	15.0	0	0	0	0	0.0	1.7	2
350312	0	64.0	57	0	3	0	0.0	0.0	5
350313	0	24.0	0	0	0	0	0.0	0.0	3
350314	0	4.0	57	2	2	0	0.0	4.0	9
350315	0	9.6	46	0	1	0	0.0	1.4	3
350316	0	10.0	0	0	2	0	0.0	2.0	11
350317	0	4.8	0	0	1	0	0.0	1.5	5
350318	0	20.0	0	0	0	0	2.0	0.0	2
350319	0	29.0	0	0	1	0	2.7	0.0	2
350320	0	26.0	0	0	0	0	0.0	0.0	3
350321	0	16.0	0	0	2	0	0.0	4.1	15
350322	0	35.0	63	3	2	0	0.0	1.8	6
350323	0	43.0	0	0	2	0	0.0	0.0	2
350324	0	11.0	0	0	0	0	0.0	0.0	4
350325	0	35.0	45	3	2	0	0.0	1.5	8
350326	0	17.0	41	2	1	0	1.7	1.8	5
350327	0	11.0	0	0	1	0	0.0	0.9	4
350328	0	5.6	0	0	0	0	0.0	0.0	0
350329	0	28.0	0	0	3	0	5.1	3.3	6
350330	0	15.0	0	0	3	0	8.2	5.5	7
350331	0	12.0	39	3	2	0	0.0	1.3	4
350332	0	24.0	0	0	2	0	0.0	0.9	6
350333	0	13.0	32	4	2	0	0.0	1.8	7
350334	0	15.0	48	7	2	0	0.0	3.9	7
350335	0	12.0	49	2	2	0	0.0	3.1	7
350336	0	2.5	62	6	2	2	1.0	0.9	3
350337	0	29.0	0	0	1	0	1.4	0.8	4
350338	0	27.0	0	0	0	0	0.0	1.2	7
350339	0	47.0	0	3	0	0	0.0	1.5	3
350340	0	23.0	42	3	0	0	0.0	1.0	5
350341	0	1.3	0	0	0	0	0.0	0.0	5
350342	0	30.0	0	0	1	0	3.9	0.8	4
350343	0	28.0	72	6	2	0	2.1	3.5	6
350344	0	12.0	43	2	2	0	0.0	1.6	4
350345	0	22.0	0	0	2	1	0.0	1.5	4
350346	0	15.0	65	0	2	0	1.9	2.3	5
350347	0	36.0	140	45	1	0	1.4	0.0	4
350348	0	41.0	0	0	2	0	0.0	0.0	5
350349	0	33.0	0	0	0	0	0.0	0.0	3
350350	0	9.1	0	4	0	0	0.0	1.3	8
350351	0	8.6	0	3	1	0	1.6	2.7	5
350352	0	13.0	47	3	3	0	2.3	2.4	6
350353	0	31.0	0	0	0	0	0.0	1.0	4

Table 2b. Rock samples: analyses

GGU no	Sr %	Ce ppm	Nd ppm	Sm ppm	Eu ppm	Tb ppm	Yb ppm	Lu ppm	Hg ppm
350301	0.00	10	6.0	2.1	0.6	0.0	3.51	0.23	0
350302	0.00	0	5.0	0.0	0.0	0.0	0.15	0.08	0
350305	0.00	0	0.0	0.2	0.0	0.0	0.46	0.11	0
350306	0.00	7	0.0	1.2	0.7	0.0	1.67	0.24	0
350307	0.00	0	0.0	0.9	0.5	0.0	1.86	0.27	0
350308	0.00	9	0.0	0.6	0.2	0.0	0.92	0.13	0
350310	0.00	0	0.0	0.6	0.3	0.0	0.86	0.15	0
350311	0.00	0	0.0	0.5	0.0	0.0	0.91	0.17	0
350312	0.00	10	0.0	2.3	1.1	0.0	4.17	0.68	0
350313	0.00	6	0.0	1.1	0.5	0.0	1.99	0.32	0
350314	0.00	15	10.0	1.0	0.3	0.0	1.10	0.17	0
350315	0.00	8	0.0	0.4	0.0	0.0	0.40	0.00	0
350316	0.00	24	10.0	1.8	0.5	0.0	0.95	0.23	0
350317	0.00	9	0.0	1.1	0.3	0.0	0.71	0.12	0
350318	0.00	0	0.0	0.5	0.0	0.0	1.01	0.10	0
350319	0.00	7	6.0	0.6	0.4	0.0	1.37	0.21	0
350320	0.00	8	0.0	1.5	0.5	0.6	4.88	0.87	0
350321	0.00	28	9.0	2.3	0.5	0.0	1.85	0.34	0
350322	0.00	15	6.0	2.2	0.7	0.7	3.44	0.60	0
350323	0.00	7	0.0	1.6	0.5	0.7	2.80	0.44	0
350324	0.09	11	15.0	0.9	0.6	0.0	1.23	0.18	0
350325	0.00	19	0.0	2.1	0.7	0.0	3.55	0.60	0
350326	0.00	11	7.0	1.3	0.6	0.0	1.68	0.30	0
350327	0.00	8	0.0	0.8	0.4	0.0	0.93	0.15	0
350328	0.00	0	0.0	0.1	0.0	0.0	0.25	0.00	0
350329	0.00	14	6.0	1.0	0.0	0.0	2.30	0.41	0
350330	0.00	15	7.0	1.0	0.4	0.0	1.75	0.25	0
350331	0.00	8	0.0	0.9	0.4	0.0	1.49	0.31	0
350332	0.00	14	0.0	1.7	0.6	0.0	2.14	0.33	0
350333	0.00	11	0.0	1.1	0.7	0.0	1.45	0.30	0
350334	0.00	12	12.0	1.7	0.3	0.0	2.54	0.41	0
350335	0.00	14	0.0	1.4	0.5	0.0	1.18	0.14	0
350336	0.00	5	0.0	0.4	0.0	0.0	0.43	0.08	0
350337	0.00	11	6.0	1.4	0.8	0.0	2.55	0.40	0
350338	0.00	13	7.0	1.8	0.7	0.0	2.53	0.47	0
350339	0.00	10	0.0	1.1	0.6	0.0	1.99	0.31	0
350340	0.00	10	0.0	1.3	0.7	0.0	1.88	0.11	0
350341	0.00	9	0.0	0.9	0.2	0.0	0.29	0.06	0
350342	0.00	10	6.0	1.6	0.8	0.0	3.31	0.28	0
350343	0.00	13	0.0	2.0	0.8	0.0	2.95	0.51	0
350344	0.00	9	6.0	0.8	0.0	0.0	0.83	0.15	0
350345	0.00	7	0.0	1.1	0.5	0.0	1.94	0.34	0
350346	0.00	12	6.0	1.0	0.4	0.0	1.29	0.25	0
350347	0.00	8	0.0	1.2	0.4	0.0	1.72	0.35	0
350348	0.00	12	0.0	1.7	0.8	0.0	2.40	0.38	0
350349	0.00	6	0.0	1.3	0.6	0.0	1.56	0.29	0
350350	0.00	16	0.0	1.1	0.4	0.0	0.69	0.07	0
350351	0.00	11	0.0	0.7	0.4	0.0	1.05	0.18	0
350352	0.00	15	0.0	1.0	0.5	0.0	1.16	0.20	0
350353	0.00	11	0.0	1.1	0.5	0.0	1.72	0.24	0

Table 2b. Rock samples: analyses

GGU no	SiO2 %	TiO2 %	Al2O3 %	Fe2O3 %	MnO %	MgO %	CaO %	Na2O %	K2O %	P2O5 %
350301	48.26	1.27	14.27	15.52	0.31	4.99	9.32	1.85	0.56	0.12
350302	87.14	0.21	2.82	3.67	0.05	0.45	0.14	0.16	0.72	0.00
350306	60.98	0.34	4.81	12.63	0.35	11.74	7.39	0.13	0.16	0.00
350307	46.30	0.49	7.90	14.18	0.23	14.31	12.44	0.73	0.34	0.06
350308	38.37	0.25	3.71	10.33	0.19	22.86	8.99	0.06	0.02	0.00
350310	43.95	0.28	4.35	11.25	0.18	27.16	4.43	0.11	0.04	0.00
350311	84.67	0.22	3.04	6.90	0.19	1.51	0.93	0.09	0.20	0.02
350312	51.32	1.65	18.58	20.18	0.64	3.93	0.62	0.15	2.22	0.12
350315	84.23	0.20	3.70	5.79	0.12	1.20	0.15	0.38	0.72	0.00
350318	77.62	0.26	3.63	9.60	0.29	2.99	1.87	0.16	0.56	0.04
350319	77.00	0.35	4.29	13.61	0.38	2.24	0.46	0.05	0.30	0.04
350329	74.50	0.35	4.86	15.22	0.22	2.90	0.80	0.15	0.08	0.04
350330	78.71	0.22	3.67	12.95	0.30	2.59	0.51	0.08	0.12	0.02
350337	49.25	0.54	11.83	18.92	0.26	3.86	7.51	0.83	0.36	0.08
350342	50.54	0.66	11.92	21.12	0.63	4.61	7.17	0.83	0.10	0.12
350345	55.25	0.51	8.31	18.56	0.43	3.38	2.47	0.75	0.44	0.12
350346	66.47	0.46	6.78	15.04	0.17	1.71	3.12	0.28	1.70	0.06
350353	50.74	0.43	9.17	16.25	0.30	6.90	9.29	0.44	0.36	0.06

Table 2b. Rock samples: analyses

GGU no	Ba ppm	Sr ppm	Zr ppm	Y ppm	Sc ppm	LOI %	Total %
350301	106	74	63	40	54	2.60	99.06
350302	61	8	22	6	5	2.15	97.52
350306	46	22	22	8	36	0.27	98.81
350307	565	55	22	4	44	1.08	98.06
350308	31	82	12	0	2	25.00	98.27
350310	33	30	12	0	2	26.00	97.70
350311	37	6	36	14	14	1.26	99.04
350312	184	36	70	26	66	0.43	98.83
350315	92	11	31	22	10	2.04	98.53
350318	56	9	14	0	2	21.00	98.19
350319	43	3	8	10	30	0.93	99.65
350329	37	6	59	20	29	1.33	100.44
350330	35	0	1	82	22	15.00	100.47
350337	101	103	63	22	32	5.67	99.11
350342	79	40	56	36	36	2.23	99.91
350345	88	28	48	34	25	7.96	98.17
350346	130	41	59	22	14	4.93	100.71
350353	292	80	42	16	33	3.87	97.81

Table 3. Summary of chip sample geochemistry

	Metachert (8 samples)				Amphibolite (5 samples)			
	Min.	Max.	Average	Median	Min.	Max.	Average	Median
Width (m)	1.5	4.5	3.3	3.0	1.0	5.0	2.1	2.0
SiO2%	66.5	87.1	78.8	78.2	48.3	55.3	50.8	50.5
MgO%	0.5	3.0	2.0	2.0	3.4	6.9	4.7	4.6
Fe2O3%	3.8	15.2	10.3	11.3	15.5	21.1	18.1	18.6
Au ppb	95	1831	757	539	1	38	12	8
As ppm	9	1600	404	260	<2	190	45	5
W ppm	<4	15	8	9	<4	11	6	5
Ni ppm	<50	1500	652	560	<50	470	109	<50
Co ppm	9	110	66	70	19	70	45	50
Pt ppb	<5	6	5	5	<5	7	5	5
Pd ppb	3	9	5	4	<2	7	3	2
Cr ppm	120	2800	1403	1450	180	1000	376	190
Cu ppm	64	406	137	106	150	498	268	230
Zn ppm	9	42	19	13	20	104	55	58
Pb ppm	12	52	20	16	16	114	43	31
Sb ppm	<0.2	29	9.4	3.4	<0.2	<0.2	<0.2	<0.2

Table 4a. Stream sediment samples and pan samples: description

GGU no	Altitude metre	-1.0 mm fract. litre	Preconc. gramme	Conc. gramme	Analysis gramme
386601	630				8.2
386602	580				9.4
386603	500				8.4
386604	380				6.1
386605	380				7.8
386606	760				7.2
386607	620				7.0
386608	600				8.2
390301	630	1.5	35.7	25.6	11.2
390302	580	2.0	36.0	24.4	14.7
390303	500	2.0	47.3	33.1	15.8
390304	380	5.0	30.9	27.0	15.8
390305	380	8.0	21.8	11.5	4.4
390306	760	2.0	97.6	87.2	14.1
390307	620	1.5	43.5	39.9	14.7
390308	600	3.5	72.7	55.5	17.0

Notes. 386601-08 are stream sediment samples. The -0.1 mm (-150 mesh) fraction is analysed.
390301-08 are pan samples.

Table 4b. Stream sediment samples and pan samples: analyses

GGU no	Au ppb	As ppm	W ppm	Mo ppm	Sn ppm	Ni ppm	Ni ppm (icp)	Co ppm	Ir ppb
386601	8	10	0	0	0	260	69	39	0
386602	9	11	0	0	0	240	68	35	0
386603	28	10	0	0	0	270	71	36	0
386604	0	20	0	0	0	0	98	35	0
386605	7	8	0	0	0	290	88	38	0
386606	9	7	0	0	0	0	47	45	0
386607	9	0	0	0	0	0	48	50	0
386608	0	5	0	0	0	170	36	32	0
390301	35	130	96	0	-	390	147	80	0
390302	83	44	83	0	-	560	145	60	0
390303	0	68	51	0	-	0	149	63	0
390304	72	56	0	0	-	340	47	41	0
390305	0	4	0	0	-	0	133	15	0
390306	0	0	0	0	-	0	37	47	0
390307	0	0	0	0	-	0	34	48	0
390308	0	0	32	0	-	360	32	46	0

Table 4b. Stream sediment samples and pan samples: analyses

GGU no	Cr ppm	Fe %	Mn ppm	Cu ppm	Zn ppm	Zn ppm (icp)	Cd ppm	Pb ppm
386601	630	6.8	154	47	84	19	0	5
386602	620	6.3	147	36	53	19	0	4
386603	510	5.8	152	38	100	20	0	4
386604	260	5.3	266	55	100	52	0	6
386605	580	6.3	180	46	63	24	0	3
386606	240	7.2	267	108	240	151	0	23
386607	290	8.6	229	126	260	112	0	14
386608	180	5.7	230	82	190	90	0	14
390301	1400	20.1	1310	267	311	63	0	37
390302	1400	17.9	1150	210	325	103	0	9
390303	1300	18.8	1235	192	213	62	0	9
390304	450	19.4	2540	218	210	87	0	15
390305	360	4.6	969	106	0	99	0	5
390306	500	13.1	1696	50	309	89	0	6
390307	360	13.4	1801	52	212	88	0	8
390308	400	13.5	1837	46	230	61	0	12

Table 4b. Stream sediment samples and pan samples: analyses

GGU no	Ag ppm	Ag ppm (icp)	Sb ppm	Se ppm	Mo ppm	Sn ppm	Na %	Ca %	Ba ppm
386601	0	0	0.5	0	0	0	1.61	6	270
386602	0	0	0.6	0	0	0	1.52	4	0
386603	0	0	0.6	0	0	0	1.53	5	160
386604	0	0.2	0.6	0	0	0	1.31	4	370
386605	0	0	0.6	0	0	0	1.72	5	210
386606	0	0.2	0.0	0	0	0	1.46	5	290
386607	0	0.2	0.0	0	0	0	1.34	5	190
386608	0	0	0.0	0	0	0	1.70	4	260
390301	0	0.2	1.6	0	0	-	0.51	4	0
390302	0	0	1.1	0	0	-	0.49	8	0
390303	0	0	0.8	0	0	-	0.52	7	0
390304	0	0.2	1.3	0	0	-	0.22	3	0
390305	0	0	0.0	0	0	-	0.14	2	0
390306	0	0	0.0	0	0	-	0.73	8	0
390307	0	0	0.0	0	0	-	0.71	8	0
390308	0	0	0.0	0	0	-	0.66	7	0

Table 4b. Stream sediment samples and pan samples: analyses

GGU no	Br ppm	Sc ppm	Rb ppm	Cs ppm	Hf ppm	Ta ppm	U ppm	Th ppm	La ppm
386601	0	27	46	0	7	0	2.6	5.1	23
386602	0	25	31	0	6	0	1.1	3.7	18
386603	0	25	0	0	5	0	2.2	3.5	18
386604	0	20	65	0	5	0	2.2	5.3	31
386605	0	26	0	2	6	0	1.4	4.5	20
386606	0	32	37	3	3	0	1.5	2.4	16
386607	3	37	0	2	3	1	2.0	2.1	12
386608	0	25	40	3	6	2	2.4	2.8	13
390301	97	56	0	0	4	1	0.0	9.2	22
390302	88	53	53	0	10	3	0.0	4.7	19
390303	160	55	0	0	8	1	0.0	5.8	19
390304	79	66	0	6	8	0	0.0	6.8	19
390305	15	13	0	0	6	2	0.0	3.5	9
390306	170	65	0	0	0	0	0.0	2.2	6
390307	92	62	0	0	0	4	0.0	0.0	3
390308	180	63	0	0	6	0	0.0	8.1	10

Table 4b. Stream sediment samples and pan samples: analyses

GGU no	Sr ppm	Ce ppm	Nd ppm	Sm ppm	Eu ppm	Tb ppm	Yb ppm	Lu ppm	Hg ppm
386601	0	42	14	2.9	0.9	0.6	3.12	0.54	0
386602	0	31	13	2.4	0.7	0.0	2.55	0.48	0
386603	0	34	12	2.4	0.8	0.7	2.38	0.42	0
386604	0	59	23	3.6	1.0	0.6	2.17	0.34	0
386605	0	37	18	2.8	0.8	0.0	2.67	0.47	0
386606	0	27	17	2.8	0.8	0.0	2.83	0.49	0
386607	0	24	8	2.6	0.7	0.0	3.15	0.57	0
386608	0	24	10	2.4	0.8	0.5	3.20	0.53	0
390301	0	57	12	4.7	1.7	2.0	22.80	3.10	0
390302	0	55	25	3.9	1.3	0.0	14.90	2.60	0
390303	0	55	17	4.0	1.3	3.0	17.00	2.80	0
390304	0	57	29	3.8	1.3	2.0	30.80	4.80	0
390305	0	20	10	1.8	0.3	0.0	4.10	0.50	0
390306	0	22	10	2.7	0.8	0.0	8.10	1.50	0
390307	0	19	10	2.5	1.0	0.0	10.90	2.00	0
390308	0	41	15	5.3	0.9	0.0	14.20	2.20	5

Table 5. Summary of drainage geochemistry

	Stream sediment samples (8)				Pan samples (8)			
	Min.	Max.	Average	Median	Min.	Max.	Average	Median
Au ppb	<5	28	9	9	<5	83	25	<5
As ppm	<2	20	9	9	<2	130	39	24
W ppm	<4	<4	<4	<4	<4	96	34	18
Ni ppm	<50	290	163	205	<200	560	256	220
Co ppm	32	50	39	37	15	80	50	48
Cr ppm	180	630	414	400	360	1400	771	475
Fe%	5.3	8.6	6.5	6.3	4.6	20.1	15.1	15.7
Cu ppm	36	126	67	51	46	267	143	148
Zn ppm	19	151	61	38	61	103	82	88
Pb ppm	3	23	9	6	5	37	13	9
Sb ppm	<0.2	0.6	0.4	0.5	<0.2	1.6	0.7	0.5
Ba ppm	<100	370	225	235	<200	<200	<200	<200

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