DANMARKS OG GRØNLANDS GEOLOGISKE UNDERSØGELSE RAPPORT 2010/126

Status on stream sediment sample material and geochemistry from the Psammite and Pelite zone of the Ketilidian Orogen, South Greenland

Bo Møller Stensgaard & Per Kalvig

GEOLOGICAL SURVEY OF DENMARK AND GREENLAND
MINISTRY OF CLIMATE AND ENERGY

G E U S

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GEUS

Contents

Background

In a meeting held at GEUS on November 15, 2010, Ironbark, represented by Adrian Byass, and the GEUS representatives Bo Møller Stensgaard, Per Kalvig and Jochen Kolb, discussed the possible Sn-mineralisation potential associated with rocks within the Psammite and Pelite zones of the Ketilidian orogen in South Greenland.

In the meeting, a two-step project proposal was developed; on November 4 GEUS received the go-ahead for the first phase. The project proposal is enclosed (Appendix 1).

Various geological and geochemical campaigns have been undertaken in the region during the past three decades, targeting different commodities, such as nickel, PGE, gold and uranium, but aspects of tin mineralization has never been considered. Today GEUS holds the view that the region may well contain Sn-greisen mineralisation, and therefore renewed research is scientifically justified.

The initial step in the work-plan is (i) to get an overview of the sample material available and to assess, if sufficient material will be available for follow-up geochemical analysis, (ii) to outline the geochemical data available, and (iii) to interview key-personnel involved in the previous campaigns. On this basis, it will be considered if a Phase 2 is justified.

This report is confidential; release date no later than December 31, 2011.

Samples

Stream sediment samples

All geochemical data from south of 62°N has been extracted from GUES' 'GEUSGREEN' database, followed by a screening for the stream sediment samples, and finally the samples from within and adjacent to the Psammite and Pelite zone were selected (Fig. 1).

A total number of 875 stream sediment samples (fraction <100 µm; 80 mesh) are located within the Psammite and Pelite zone, and have previously been analysed in nine different batches of geochemical analysis. The specifications for the analysed elements in the various batches are given in Appendix 2.

Of the total number of 875 samples representing the target zone, 612 have been analysed for Sn by 'Instrumental neutron activation analyses' (INA; batch nos 4 and 10) with a detection limit of 100 ppm. The samples analysed for Sn (lower detection limit = 100 ppm) are shown in Figure 2. None of these samples have yielded Sn values above the detection limit.

Remaining material, after sieving and analysis, for many of the 875 samples were registered as still being present in GEUS´ sample archives. However, the fraction and weight of the remaining material were not available. Consequently, the samples were extracted from the archives and information on fraction and weight of the remaining material were registered manually. A summary of this information is given in Table 1 and Appendiks 3.

	Numbers	**Comments**
Samples from the Psammite and Pelite zones	875	
In the sample archive:		
Containers with remaining material from the samples	1513	This include containers with different fractions and duplets of the same sample
Number of samples with material of fractions size <100 µm	122	In cases were there are duplets of the same sample these are here included as one sample
Number of samples with material of fractions size between 100-1000 µm and/or fractions >100 µm (with no information on upper size fraction)	541	In cases were there are duplets of the same sample these are here included as one sample; remaining material above 5 grams
Number of samples that appear not to be sieved	323	In cases were there are duplets of the same sample these are here included as one sample; remaining material above 5 grams

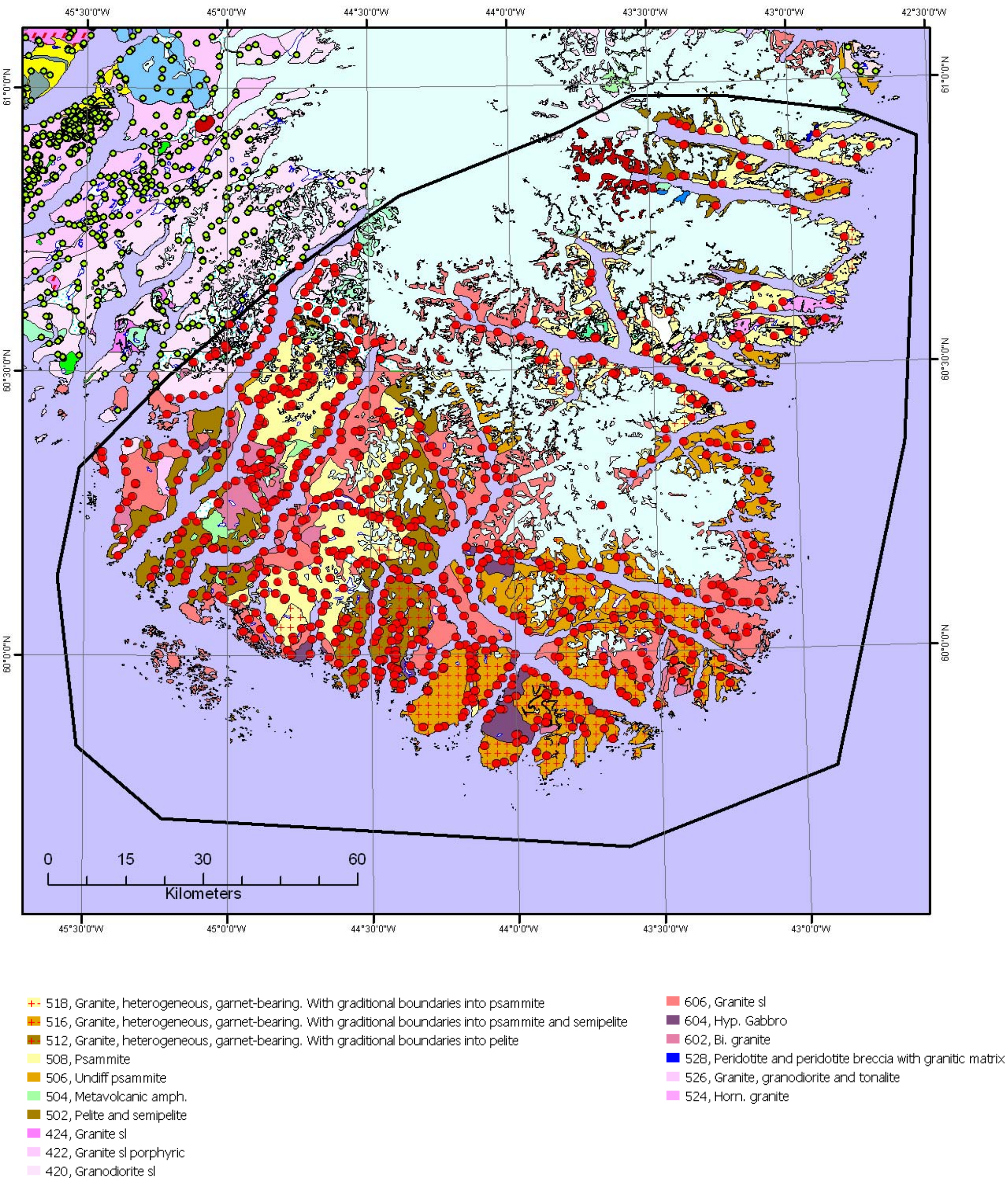

Figure 1 *Southern part of the Ketilidian mobile belt in South Greenland. The black line indicates the polygon that encloses the Psammite and Pelite zone (and some adjacent area to the north). Red circles are sediment sample locations within this polygon (n = 875; green circles are samples outside.*

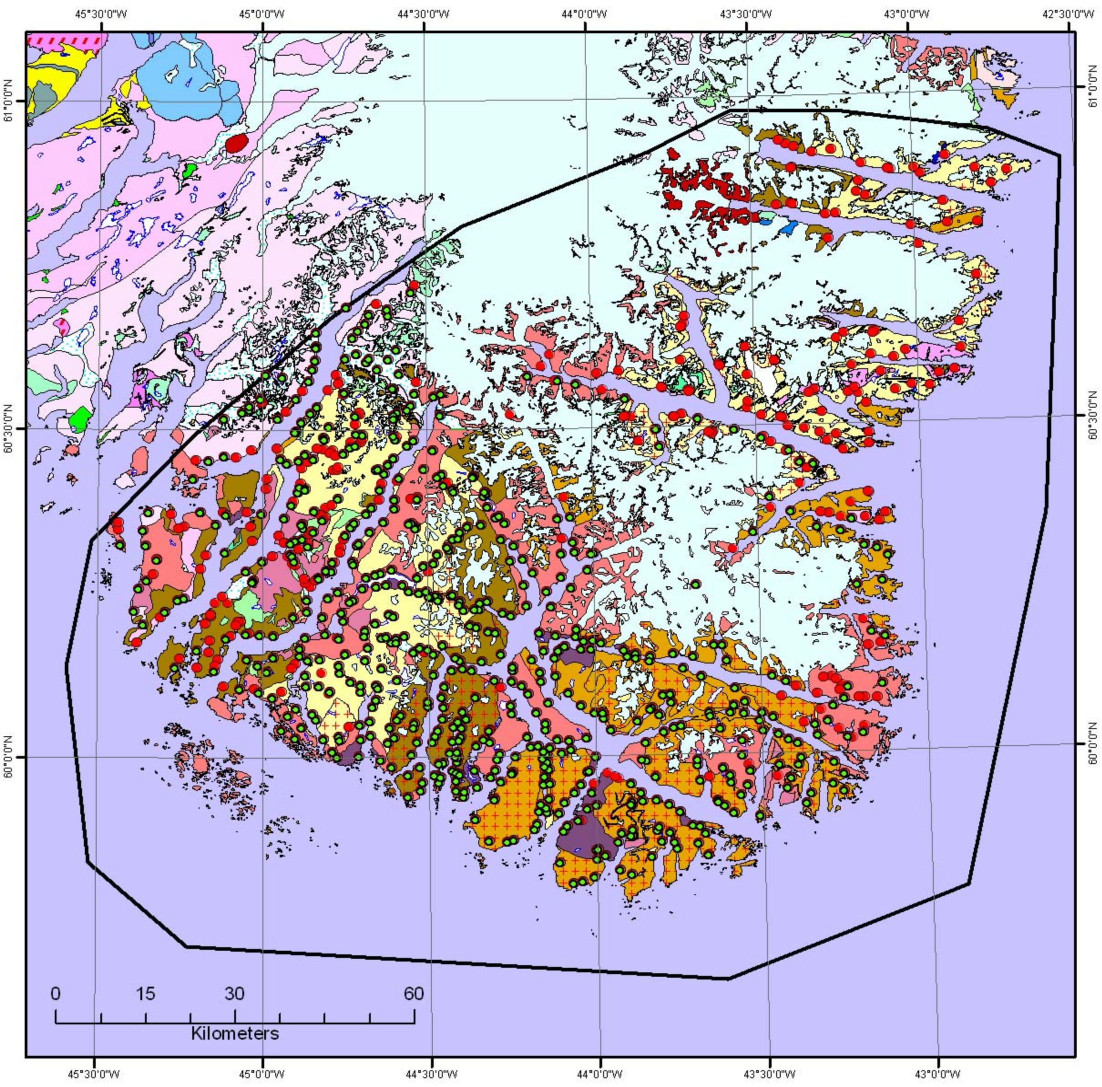

***Figure 2** Stream sediment samples: Southern part of the Ketilidian mobile belt in South Greenland. Legend as in Fig.1. The green circles are stream sediment samples analysed for Sn.*

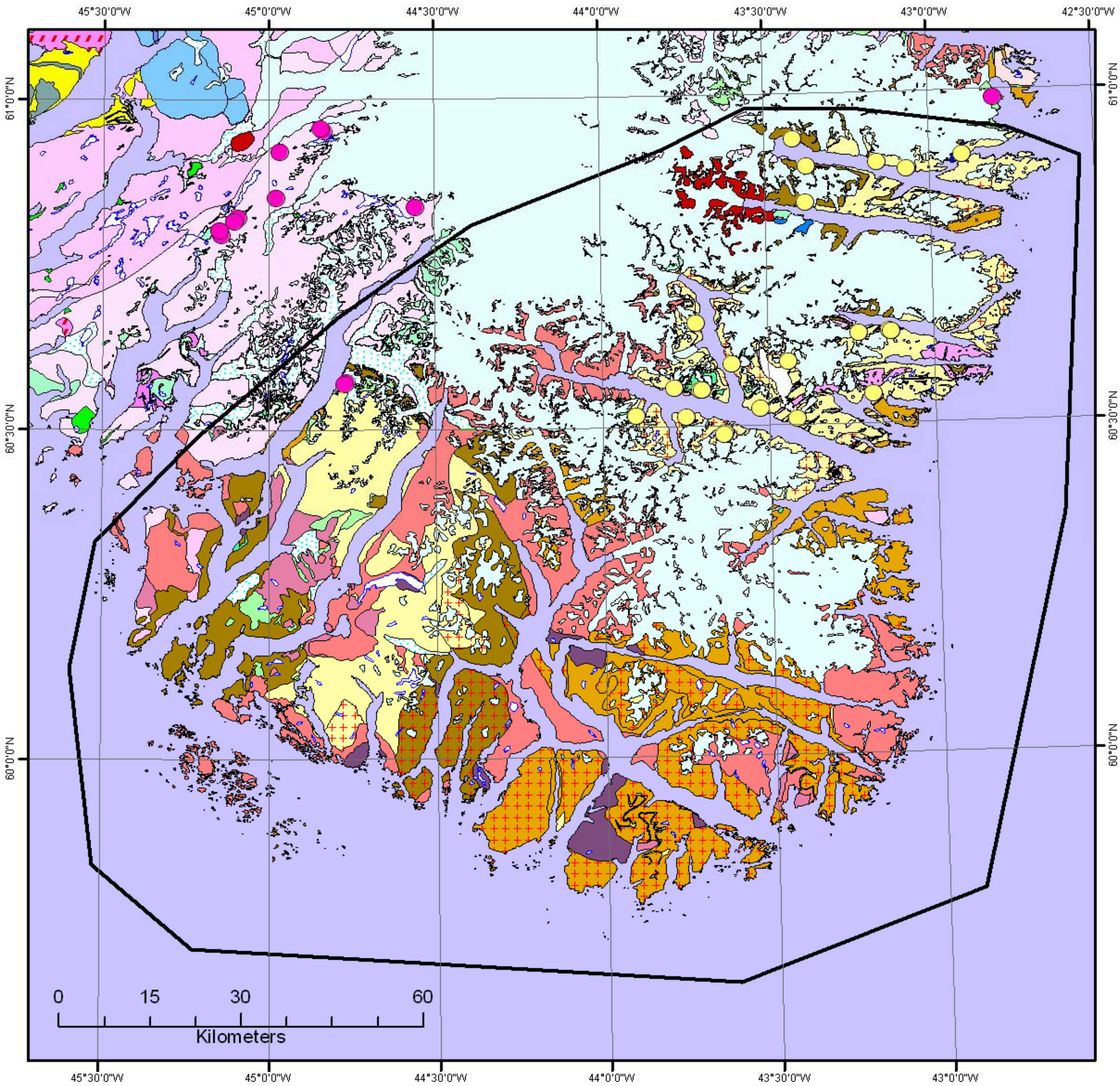

Figure 3 *Heavy mineral concentrate samples: Southern part of the Ketilidian mobile belt in South Greenland. Legend as in Fig. 1. The yellow circles represent heavy mineral concentrate samples analysed for Sn; purple circles those not analysed for Sn.*

Heavy mineral concentrate samples

A total number of 46 heavy mineral concentrate samples are located within the Psammite and Pelite zone. The samples have been analysed in 3 different batches of geochemical analysis.

22 samples of the 46 samples in the Psammite and Pelite have already been analysed for Sn by 'Instrumental neutron activation analysis' with a detection limit of 100 ppm. The samples analysed for Sn (lower detection limit = 100 ppm) are shown in Fig. 3. No of these samples have yield Sn values above the detection limit of 100 ppm.

Soil sediment samples from the Psammite and Pelite zone

No soil sediment samples have been collected/analysed within the Psammite and Pelite zone.

Interviews

Comments by Agnete Steenfelt

Agnete Steenfelt (retired Senior Researcher from GEUS) has been responsible for the geochemical surveys at GEUS (and GGU). The data from South Greenland have been collected and processed by her team and have been incorporated as grids and/or georeferenced raster images of grids in the 'Geochemical Atlas of South and West Greenland' (Steenfelt 2001) and the digital compilation of data from South Greenland (Schjøth et al. 2000).

Most of the stream sediment samples were obtained during the regional sampling program carried out in 1979 as part of the SYDURAN project (all samples analysed for Sn is from this sampling program; SYDURAN ~ 'South Greenland Uranium Exploration Project'). The samples were analysed for U by delayed neutron counting and trace elements by isotope excited energy dispersive X-ray fluorescence spectrometry. Later, the samples were analysed for trace and major elements in the early 90ties by neutron activation analyses and X-ray fluorescence spectrometry on fused glass discs using sodium tetraborate as flux. Na_2O and Cu were determined by atomic absorption spectrometry.

Agnete Steenfelt holds the view that a lower detection limit for Sn of 100 ppm probably is to high to make the data useable for evaluation of a possible Sn potential in the Psammite and Pelite zone. A reanalysis of possible remaining stream sediment material with a lower detection limit will be needed to make an evaluation. Agnete suggests investigating what semi-regional stream sediment geochemistry datasets, as the one from South Greenland, yields for other Sn-bearing provinces (Finland, England).

Findings

Results from review of stream sediment geochemistry and samples

For the analysed stream sediment samples from the Psammite and Pelite zones in South Greenland, there are no Sn values above the detection limit of 100 ppm, which were the one obtained from the analytical package ('Instrumental neutron activation analyses') used at the time the analysis were carried out.

For most of the stream sediment samples remaining material were found to be present in the GEUS' sample archive. However, only a limit number of the samples have remaining <100 µm material left. In most cases the remaining material is in the fraction 100 to 1000 µm or non-sieved.

Comparison with other regional stream sediment sampling programs

In the EuroGeoSurveys-FOREGS geochemical baselines project the Sn content in regional stream sediment geochemistry is reported to be in the range from <1 to 188 ppm; with only five samples out of 852 samples having content above 100 ppm Sn. High Sn values in the stream sediment (>4 ppm Sn) occur mostly from areas with known tin ore deposits or tin-bearing districts. Tin is reported to have a good positive correlation (<0.4) with Ta, W, Y, Rb, U and Th and weak correlation with (>0.3) with Cd, Tl, Cs and most REEs (De Vos et al. 2006). This relationship is interpreted to be caused by the leucogranitic/greisen association characterising tin mineralisation or enrichment, which may have been enhanced in the stream sediments by gravity concentration of Sn-bearing heavy minerals.

Maps from Schjøth et al. (2000) showing the gridded distribution of Ta, W, Y, Rb, U and Th in stream sediment samples from South East Greenland are available in Appendix 4.

Recommendations

The detection limit for Sn of 100 ppm is believed to be too large to detect anomalies related to Sn mineralisation in the stream sediment data. Taking into account the regional sample density of the data, the little weathering of resistant minerals in an arctic environment and the transportation distance of heavy minerals a lower detection limit is warranted. Modern analytical ICP/MS packages give detection limits of 1 ppm (e.g. ActLabs ICP/MS Analytical Package 'Trace Element 4B2-std').

Consequently, it makes sense to proceed with an evaluation of the potential for Sn mineralisation within the Psammite and Pelite zone, based on the stream sediment data, it is recommended to:

- analyse the 122 stored sediment samples with sufficient already-sieved remaining <100 µm fraction material (by modern analytical package)

- sieve the 323 stored sediment samples with remaining non-sieved material and analyse the samples that returns <100 µm fraction material (by modern analytical package)

Furthermore, it can be recommended to:

- produce a heavy mineral concentrate and analyse this of the 531 samples sediment samples with remaining 100–1000 µm and > 100 µm fraction material (the latter with no information on upper limit), plus a unknown number of samples from the sediment samples with remaining non-sieved material that needs to be sieved (see above recommendations).

The listed cost price of the analytical package that could be suggested is around 80 USD pr. sample (example is here based the analytical package ‘ICP/MS WRA+trace 4Litho’ + ‘Pulverization RX4’ from the commercial laboratory Actlabs).

The resulting data set should be controlled and quality assessed, processed and interpreted and evaluated in relation to the potential for the presence of a Sn mineralising system in South Greenland.

References

Schjøth, F., Garde, A.A., Jørgensen, M.S., Lind, M., Moberg, E., Nielsen, T.D.F., Rasmussen, T.M., Secher, K., Steenfelt, A., Stendal, H., Thorning, L. & Tukiainen, T. 2000: Mineral resource potential of South Greenland: the CD-ROM. Danmarks og Grønlands Geologiske Undersøgelse Rapport **2000/57**, 36 pp., 1 CD-ROM.

Steenfelt, A., 2001:Geochemical atlas of Greenland - West and South Greenland. Danmarks og Grønlands Geologiske Undersøgelse **Rapport 2001/46**, 39 pp., 1 CD-ROM.

De Vos, W., Tarvainen, T. (Chief-editors), Salminen R., Reeder S., De Vivo B., Demetriades A., Pirc S., Batista M.J., Marsina K., Ottesen R.T., O'Connor P.J., Bidovec M., Lima A., Siewers U., Smith B., Taylor H., Shaw R., Salpeteur I., Gregorauskiene V., Halamic J., Slaninka I., Lax K., Gravesen P., Birke M., Breward N., Ander E.L., Jordan G., Duris M., Klein P., Locutura J., Bel-lan A1, Pasieczna A., Lis J., Mazreku A., Gilucis A., Heitzmann P., Klaver G., Petersell V., 2006: Geochemical Atlas of Europe. Part 2 - Interpretation of Geochemical Maps, Additional Tables, Figures, Maps, and Related Publications. 692 pages, 56 figures, 77 tables, 15 maps, 6 annexes.

Appendix 1 - Project proposal

Ironbark Ltd.

Att: Adrian Byass, Technical Director

Referring to our meeting at GEUS, November 15, regarding the potential Sn-mineralisation associated with rocks within the psammite and pelite zone of the Ketilidian orogen in South Greenland, we hereby forward a quote on the first steps in a step-by-step work plan for your consideration. As discussed in the meeting, various geological campaigns have been undertaken in the region, targeting different commodities, such as nickel, PGE, gold and uranium, but the aspects of tin mineralization has not been considered previously. However, it is our view that the region may well contain Sn-greisen mineralisation which may have been overlooked in the previous campaigns, and thus we find that renewed research is scientifically justified. Moreover, the vast majority of the samples are supposed to be available from the GEUS storage facilities, and therefore the initial research can be undertaken on in-house material/data.

In order to minimize the costs, we suggest as follows:

· Step 1: Identification of all sediment samples (stream/soil/heavy) available covering the Ketilidian region and compilation of geochemical data. Additionally, we will undertake small interviews with Agnete Steenfelt and Henrik Stendal – both key-personnel, no longer with GEUS, with longstanding experience (from) in the region.

o The output will be a small data report/note, providing geochemical results and location of samples; samples analyzed for Sn will be shown on map. The possible numbers of samples not analyzed for Sn will be given and the status on the sample/material left will be investigated.

· Step 2: Petrological indices and major element chemistry as a tool to select individual plutons within the batholiths, identifying the most likely for tin endowment. Despite the majority of rock samples and geochemical data are in possession of the individual researchers, and compilation of these data are going to be more cumbersome, we believe this route could be very successful. In the event we may realize that the work is not justified, the work will be terminated.

o The output is a small report showing the identified tin targets.

One year of confidentiality will be guaranteed. The work will be executed in accordance with GEUS standard conditions.

In the event, the outcome of the above research is positive and providing we find that the research aspects justifies our involvement we will be pleased to discuss further co-operation on this project.

Appendix 2 – analytical specifications

Table of analytical batch numbers and their analysed elements, detection limit of the elements, analytical method and sample preparation

Batch no.	Element	Unit	Detection Limit	Analytical Method[1]	Sample preparation
2	Au	PPB	2	ICP	PBF
2	Pd	PPB	2	ICP	PBF
2	Pt	PPB	10	ICP	PBF
4	Ag	PPM	5	INA	NON
4	As	PPM	0.5	INA	NON
4	Au	PPB	2	INA	NON
4	Ba	PPM	50	INA	NON
4	Br	PPM	0.5	INA	NON
4	Ca	WT%	1	INA	NON
4	Ce	PPM	3	INA	NON
4	Co	PPM	1	INA	NON
4	Cr	PPM	5	INA	NON
4	Cs	PPM	1	INA	NON
4	Eu	PPM	0.2	INA	NON
4	Fe	WT%	0.01	INA	NON
4	Hf	PPM	1	INA	NON
4	Hg	PPM	1	INA	NON
4	Ir	PPB	5	INA	NON
4	Ir	PPB	5	INA	NON
4	La	PPM	0.5	INA	NON
4	Lu	PPM	0.05	INA	NON
4	Mo	PPM	1	INA	NON
4	Na	WT%	0.01	INA	NON
4	Nd	PPM	5	INA	NON
4	Ni	PPM	20	INA	NON
4	Rb	PPM	5	INA	NON
4	Sb	PPM	1	INA	NON
4	Sc	PPM	0.1	INA	NON
4	Se	PPM	3	INA	NON
4	Sm	PPM	0.1	INA	NON
4	**Sn**	PPM	100	INA	NON
4	Sr	PPM	500	INA	NON
4	Ta	PPM	0.5	INA	NON

Batch no.	Element	Unit	Detection Limit	Analytical Method[1]	Sample preparation
4	Tb	PPM	0.5	INA	NON
4	Th	PPM	0.2	INA	NON
4	U	PPM	0.5	INA	NON
4	W	PPM	1	INA	NON
4	Yb	PPM	0.2	INA	NON
4	Zn	PPM	50	INA	NON
5	Al	OXI	0.01	FLI	PWD
5	Ba	PPM	5	XRF	PWD
5	Ca	OXI	0.01	FLI	PWD
5	Co	PPM	5	XRF	PWD
5	Cr	PPM	5	XRF	PWD
5	Cu	PPM	5	XRF	PWD
5	Fe3	OXI	0.01	FLI	PWD
5	Ga	PPM	5	XRF	PWD
5	K	OXI	0.01	FLI	PWD
5	Mg	OXI	0.01	FLI	PWD
5	Mn	OXI	0.01	FLI	PWD
5	Na	OXI	0.01	FLI	PWD
5	Nb	PPM	2	XRF	PWD
5	Ni	PPM	5	XRF	PWD
5	P	OXI	0.01	FLI	PWD
5	Pb	PPM	5	XRF	PWD
5	Rb	PPM	2	XRF	PWD
5	Si	OXI	0.01	FLI	PWD
5	Sr	PPM	2	XRF	PWD
5	Ti	OXI	0.01	FLI	PWD
5	V	PPM	5	XRF	PWD
5	Vo	WT%	0.01	FLI	PWD
5	Y	PPM	2	XRF	PWD
5	Zn	PPM	5	XRF	PWD
5	Zr	PPM	5	XRF	PWD
7	Al	OXI	0.1	XRF	NAF
7	Ba	PPM	100	XRF	NAF
7	Ca	OXI	0.05	XRF	NAF
7	Cr	PPM	50	XRF	NAF
7	Cu	PPM	5	XRF	HFH
7	Fe2	OXI	0.2	XRF	NAF
7	Fe3	OXI	0.2	XRF	NAF
7	K	OXI	0.01	XRF	NAF

Batch no.	Element	Unit	Detection Limit	Analytical Method[1]	Sample preparation
7	Mg	OXI	0.07	XRF	NAF
7	Mn	OXI	0.05	XRF	NAF
7	Na	OXI	0.08	AAS	HFH
7	Ni	PPM	50	XRF	NAF
7	P	OXI	0.01	AAS	NAF
7	Rb	PPM	50	XRF	NAF
7	Si	OXI	0.2	XRF	NAF
7	Sr	PPM	50	XRF	NAF
7	Ti	OXI	0.03	XRF	NAF
7	V	PPM	50	XRF	NAF
7	Vo	OXI	-1	XRF	LOI
7	Zn	PPM	50	XRF	NAF
7	Zr	PPM	50	XRF	NAF
10	Ag	PPM	5	INA	NON
10	As	PPM	0.5	INA	NON
10	Au	PPB	2	INA	NON
10	Ba	PPM	50	INA	NON
10	Br	PPM	0.5	INA	NON
10	Ca	WT%	1	INA	NON
10	Ce	PPM	3	INA	NON
10	Co	PPM	1	INA	NON
10	Cr	PPM	5	INA	NON
10	Cs	PPM	1	INA	NON
10	Eu	PPM	0.2	INA	NON
10	Fe	WT%	0.01	INA	NON
10	Hf	PPM	1	INA	NON
10	Hg	PPM	1	INA	NON
10	Ir	PPB	5	INA	NON
10	La	PPM	0.5	INA	NON
10	Lu	PPM	0.05	INA	NON
10	Mo	PPM	1	INA	NON
10	Na	WT%	0.01	INA	NON
10	Nd	PPM	5	INA	NON
10	Ni	PPM	20	INA	NON
10	Rb	PPM	5	INA	NON
10	Sb	PPM	1	INA	NON
10	Sc	PPM	0.1	INA	NON
10	Se	PPM	3	INA	NON
10	Sm	PPM	0.1	INA	NON

Batch no.	Element	Unit	Detection Limit	Analytical Method[1]	Sample preparation
10	**Sn**	PPM	100	INA	NON
10	Sr	PPM	500	INA	NON
10	Ta	PPM	0.5	INA	NON
10	Tb	PPM	0.5	INA	NON
10	Th	PPM	0.2	INA	NON
10	U	PPM	0.5	INA	NON
10	W	PPM	1	INA	NON
10	Yb	PPM	0.2	INA	NON
10	Zn	PPM	50	INA	NON
18	Ca	***	-1	XPU	NON
18	Cr	***	-1	XPU	NON
18	Cu	***	-1	XPU	NON
18	Fe	***	-1	XPU	NON
18	Ga	***	-1	XPU	NON
18	K	***	-1	XPU	NON
18	Mn	***	-1	XPU	NON
18	Ni	***	-1	XPU	NON
18	Pb	***	-1	XPU	NON
18	Ti	***	-1	XPU	NON
18	V	***	-1	XPU	NON
18	Zn	***	-1	XPU	NON
21	U	***	-1	DNC	NON
22	Mo	***	-1	XCD	NON
22	Nb	***	-1	XCD	NON
22	Rb	***	-1	XCD	NON
22	Sr	***	-1	XCD	NON
22	Y	***	-1	XCD	NON
22	Zr	***	-1	XCD	NON

[1]XRF: X-ray fluorescence spectrometry, INA: Instrumental neutron activation, ICP: Inductively coupled plasma emission spectrometry, AAS: Atomic absorption spectrometry, FLI: X-ray Fluoresence with Lithium tetra-borate as flux, XCD: Energy Dispersive Xray – Radioactive Cd-isotope as radiation source, XPU: Energy Dispersive Xray – Radioactive Pu-isotope as radiation source, DNC: Delayed neutron counting

Appendiks 3 – Stream sediment samples with remaining material

The following 122 stream sediment sample have remaining material <100 µm (more than 5 gram and already sieved):

280601	280673	281240	281573
280604	280674	281249	281574
280605	280676	281257	281577
280606	280677	281258	281579
280607	280678	281260	281581
280608	280679	281263	281583
280609	280680	281265	281584
280610	280681	281266	281590
280611	280682	281269	281591
280620	280687	281270	281594
280626	280689	281277	281598
280637	280693	281279	281599
280641	280695	281282	281752
280642	280696	281285	281761
280646	280700	281287	
280647	281201	281291	
280648	281203	281293	
280650	281205	281295	
280651	281206	281296	
280652	281207	281506	
280653	281208	281510	
280654	281212	281514	
280655	281213	281515	
280656	281214	281516	
280657	281215	281518	
280660	281216	281519	
280661	281217	281522	
280662	281220	281547	
280663	281223	281563	
280665	281224	281564	
280666	281225	281565	
280667	281226	281567	
280668	281227	281569	
280669	281228	281570	
280671	281229	281571	
280672	281230	281572	

The follwoing 323 stream sediment samples have material (above 5 gram) which appear not to have been sieved:

281566	281981	282027	282076	282162	282823
281567	281982	282028	282077	282163	282825
281568	281983	282029	282078	282164	282826
281569	281984	282030	282079	282165	282827
281570	281985	282031	282080	282166	282828
281571	281986	282032	282081	282167	282830
281572	281987	282033	282082	282168	282831
281573	281988	282034	282083	282169	282832
281574	281989	282035	282084	282171	282833
281575	281990	282036	282085	282172	282834
281576	281991	282037	282086	282173	282835
281577	281992	282038	282087	282174	282836
281578	281993	282039	282089	282175	282837
281579	281994	282040	282090	282176	282838
281580	281995	282041	282091	282177	282839
281581	281996	282042	282092	282178	282840
281582	281997	282043	282093	282179	282841
281583	281998	282044	282094	282180	282842
281584	281999	282045	282095	282181	386702
281585	282000	282046	282096	282182	386703
281586	282001	282047	282097	282183	386704
281937	282002	282048	282098	282401	386705
281958	282003	282049	282099	282402	386706
281959	282004	282050	282107	282404	386707
281960	282005	282051	282110	282405	386708
281961	282006	282052	282111	282406	386709
281962	282007	282053	282116	282407	386710
281963	282008	282054	282142	282408	386711
281964	282009	282055	282143	282802	386712
281965	282010	282056	282144	282803	386713
281966	282011	282057	282145	282804	386714
281967	282012	282058	282146	282805	386715
281968	282013	282059	282147	282806	386716
281969	282015	282060	282148	282807	386717
281970	282016	282061	282149	282808	386718
281971	282017	282062	282150	282809	386719
281972	282018	282063	282151	282810	386720
281973	282019	282064	282152	282811	386721
281974	282020	282065	282153	282812	386722
281975	282021	282066	282154	282813	386723
281976	282022	282067	282156	282817	386724
281977	282023	282069	282158	282818	386725
281978	282024	282070	282159	282820	386726
281979	282025	282071	282160	282821	386727
281980	282026	282072	282161	282822	386728

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386762
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386783
386845

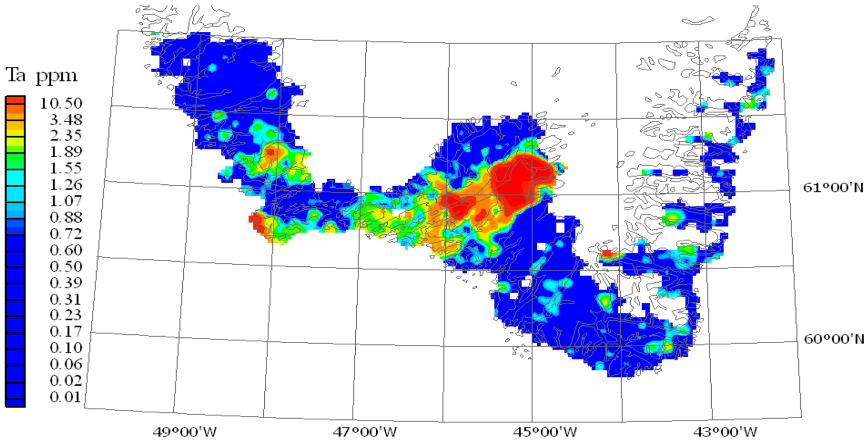
The follwoing 541 stream sediment samples have material >100 µm (more than 5 gram; already sieved):

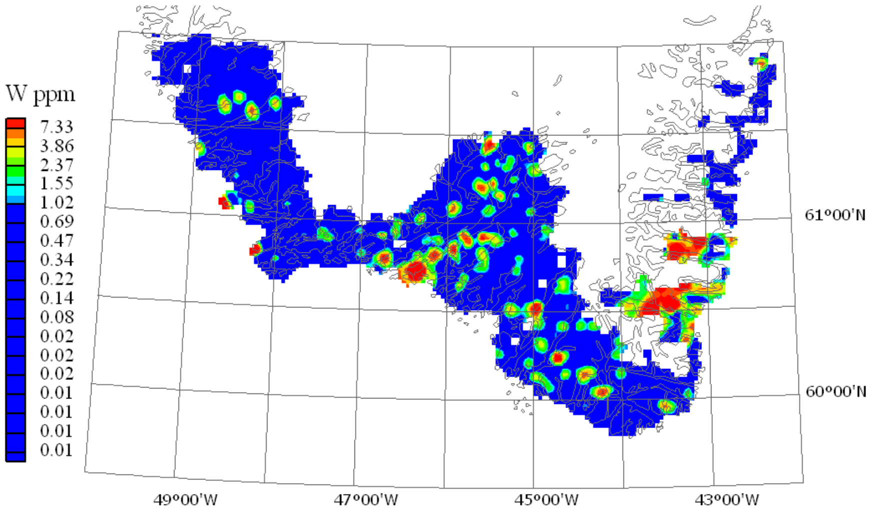
280601	280656	281207	281286	281788	281849
280602	280657	281208	281287	281789	281850
280603	280658	281209	281288	281792	281851
280604	280659	281210	281289	281793	281852
280605	280660	281211	281290	281794	281853
280606	280661	281212	281291	281795	281855
280607	280662	281213	281293	281796	281856
280608	280663	281214	281294	281797	281857
280609	280664	281215	281295	281798	281858
280610	280665	281216	281296	281803	281859
280611	280666	281217	281506	281804	281861
280612	280667	281219	281507	281805	281864
280613	280668	281220	281508	281806	281865
280614	280669	281221	281509	281808	281866
280615	280670	281222	281510	281809	281867
280616	280671	281223	281513	281810	281868
280617	280672	281224	281514	281813	281869
280619	280673	281225	281515	281814	281870
280620	280674	281227	281516	281815	281871
280621	280676	281228	281517	281816	281872
280623	280677	281229	281518	281818	281873
280624	280678	281230	281519	281819	281874
280625	280679	281231	281522	281820	281875
280626	280680	281232	281547	281821	281876
280627	280681	281234	281563	281822	281877
280628	280682	281235	281598	281823	281878
280629	280683	281236	281599	281824	281879
280630	280684	281237	281600	281825	281880
280631	280685	281238	281752	281826	281881
280632	280686	281239	281754	281827	281882
280633	280687	281240	281756	281828	281883
280635	280688	281243	281757	281829	281884
280636	280689	281244	281759	281830	281885
280637	280690	281246	281760	281831	281886
280638	280691	281249	281761	281832	281887
280639	280692	281250	281762	281833	281888
280640	280693	281258	281763	281835	281889
280641	280694	281260	281765	281836	281890
280642	280695	281263	281766	281837	281891
280643	280696	281269	281769	281838	281892
280645	280697	281276	281771	281839	281893
280646	280698	281277	281772	281840	281894
280647	280699	281278	281774	281841	281895
280648	280700	281279	281775	281842	281896
280650	281201	281280	281776	281843	281897
280651	281202	281281	281777	281844	281898
280652	281203	281282	281778	281845	281899
280653	281204	281283	281779	281846	281900
280654	281205	281284	281784	281847	281901
280655	281206	281285	281786	281848	281902

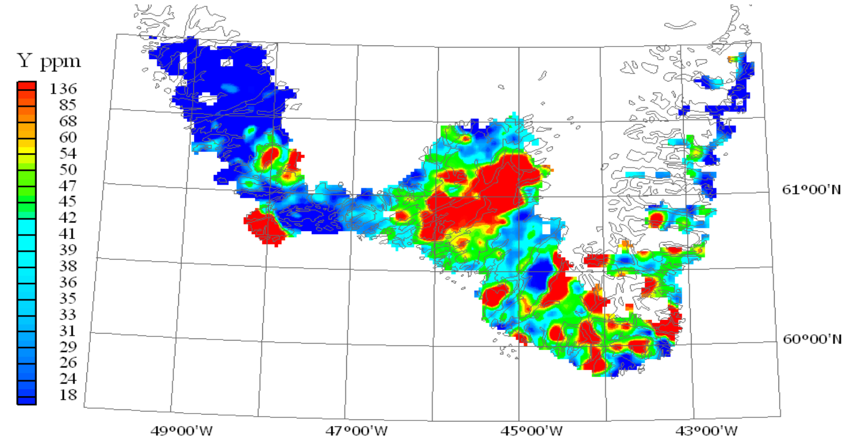
281903	281961	282127	282228	282273	386741
281904	281964	282128	282230	282274	386742
281905	281965	282129	282231	282275	386743
281906	281966	282130	282232	282276	386744
281907	281967	282131	282233	282277	386745
281908	281968	282132	282234	282278	386748
281909	281969	282133	282235	282279	386749
281910	281970	282134	282236	282280	386750
281911	281971	282135	282237	282281	386752
281912	281975	282136	282240	386702	386753
281913	281976	282137	282241	386703	386754
281914	281979	282138	282242	386704	386755
281915	281986	282139	282243	386705	386756
281916	281990	282140	282244	386707	386757
281917	281991	282141	282245	386708	386760
281918	281992	282201	282246	386710	386761
281919	281993	282202	282247	386711	386762
281922	281999	282203	282248	386712	386763
281923	282101	282204	282249	386713	386764
281924	282102	282205	282250	386717	386765
281926	282104	282206	282251	386718	386766
281929	282105	282207	282252	386719	386767
281930	282107	282208	282253	386720	386768
281934	282108	282209	282254	386721	386769
281935	282109	282211	282255	386722	386770
281936	282110	282212	282256	386723	386773
281937	282111	282213	282257	386724	386774
281938	282112	282214	282258	386725	386775
281939	282113	282215	282259	386726	386776
281942	282115	282216	282260	386727	386778
281943	282116	282217	282261	386728	386779
281944	282117	282218	282262	386729	386781
281948	282118	282219	282263	386730	386782
281950	282119	282220	282264	386732	386783
281951	282120	282221	282265	386733	388055
281952	282121	282222	282266	386734	388056
281955	282122	282223	282267	386735	
281956	282123	282224	282268	386736	
281957	282124	282225	282269	386737	
281958	282125	282226	282270	386739	
281959	282126	282227	282271	386740	

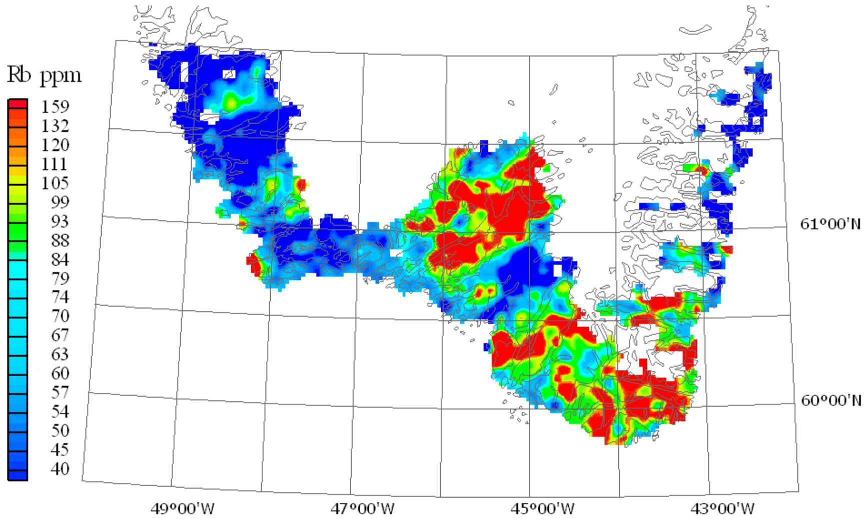
Appendix 4 - Ta, W, Y, Rb, U and Th from stream sediment samples from South Greenland

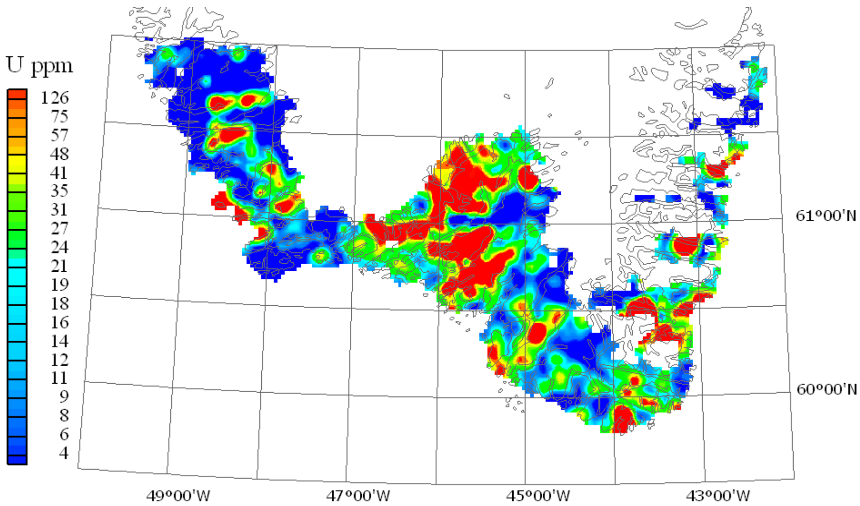
Gridded distribution of Ta, W, Y, Rb, U and Th from stream sediment samples from South Greenland. For more information on the map refer to Schøjth et al. (2000).

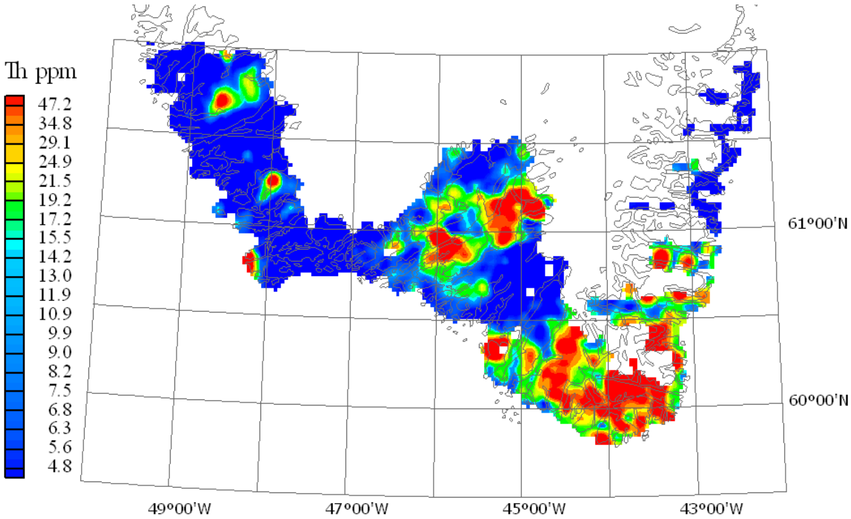





Y ppm
136
85
68
60
54
50
47
45
42
41
39
38
36
35
33
31
29
26
24
18
61°00'N
60°00'N
49°00'W
47°00'W
45°00'W
43°00'W


Rb ppm
159
132
120
111
105
99
93
88
84
79
74
70
67
63
60
57
54
50
45
40
61°00'N
60°00'N
49°00'W
47°00'W
45°00'W
43°00'W


U ppm
126
75
57
48
41
35
31
27
24
21
19
18
16
14
12
11
9
8
6
4
61°00'N
60°00'N
49°00'W
47°00'W
45°00'W
43°00'W



Th ppm
47.2
34.8
29.1
24.9
21.5
19.2
17.2
15.5
14.2
13.0
11.9
10.9
9.9
9.0
8.2
7.5
6.8
6.3
5.6
4.8
61°00'N
60°00'N
49°00'W
47°00'W
45°00'W
43°00'W