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Gold resources on Ringvassøy, western Troms-
III: Geochemistry of heavy-mineral concentrates
from stream sediments and potential gold
sources.

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REPORT

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Title:
Gold resources on Ringvassøy, Troms-III: Geochemistry of heavy-mineral concentrates from stream sediments and potential gold sources.

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Summary:
The geochemistry of heavy-mineral concentrates panned from stream sediments on Ringvassøy is reported. The presently known occurrences of gold inside the RGB comprise mostly quartz-vein mineralisation with a low economic potential. The stratabound Au-As-Zn mineralisation at Sørdalshøgda-South is the only one that, under favourable conditions, can be of economic interest. All of these gold occurrences were detected by the panning method together with most of the deposits carrying high concentrations of Ag, Cu, Zn, As and Sb.

The geochemistry of the heavy-mineral concentrates shows that the metal enrichment is mainly confined to rivers inside the RGB, whereas those in the DTC and the Caledonides carry normal background levels. The following distribution patterns can be recognised:

- Se, As, Bi, Te, U and Th appear to be enriched in the greenschist facies domain.
- Au is the only element which shows a clear enrichment in the amphibolite facies domain.
- Ag, Sb, Cu, Co, Ni, Zn, Pb, Hg, Tl, W and Mo show no clear enrichment trends between the two metamorphic domains.
- The till geochemistry confirms the enrichment of gold in the western part of the RGB.
- Strongly anomalous concentrations of Pb, Sb and Tl in Gamvikdalen valley within the Helgøya shear zone suggest the presence of these elements in a vein mineralisation. The shear zone appears, with the exception of some weakly anomalous samples of gold, to be barren.
- Gold in heavy-mineral concentrates, tills and chip samples shows no covariance with any of the other elements, suggesting that gold occurs in a number of different geological settings and mineral parageneses.
- Se shows a good correlation with sulphur and thus, represents an alternative to monitor the presence of sulphides in the heavy-mineral concentrates.

A short follow-up campaign is proposed for gold in the anomalous areas in the western part of the RGB.

Keywords: Geochemistry	Heavy minerals	Stream sediments
Gold metallogeny	Ore deposits	Archean greenstone belt

SAMMENDRAG

De kjente gull mineraliseringene på Ringvassøy er vurdert å ha et relativt lavt økonomisk potensial. For å sjekke mulighetene for andre og hittil uoppdagete forekomsttyper av gull gjennomførte NGU i 1998 og 1999 en regional innsamling av tungmineralkonsentrater fra elvene og bekkene ved pannevasking. Prøvene er analysert for gull, sølv, svovel, selen, arsen, antimon, vismut, tellur, kopper, kobolt, nikkel, sink, bly, cadmium, kvikksølv, thallium, wolfram, molybden, uran og thorium samt en rekke andre elementer som bare er delvis analysert.
Av analyseresultatene kan følgende slutninger trekkes:

- De fleste av de kjente forekomster med høye konsentrasjoner av gull, sølv, antimon, kopper og sink lar seg påvise ved pannevaskingsmetoden.
- Gull er spesielt anriket i den vestlige del av Ringvassøy grønnsteinsbelte og i områder hvor det tidligere ikke er kjent gullmineraliseringer. Gull konsentrasjonen i prøvene fra disse områder er generelt høyere enn de som er samlet i bekker som drenerer de kjente gullforekomstene. De gullanrikete områdene i vest fremkommer også gjennom geokjemiske undersøkelser av C-horisonten i morene som NGU utførte i 1998.
- Gull viser ingen sammenvariasjon med andre elementer noe som antyder at gullet i vaskekonsentratene stammer fra flere forskjellige geologiske miljø og forekomster med ulike mineralselskap eller element kombinasjoner.
- Det er god samvariasjon mellom svovel og selen. Selen inneholdet i prøvene kan derfor brukes som et uttrykk for mengden av sulfider i tungmineralkonsentratene.
- Områdene i vest som fører forhøyede konsentrasjoner gull kjennetegnes også ved lave til moderate konsentrasjoner av sulfider noe som antyder at gullet stammer fra mineraliseringer i fast fjell med lavt sulfid innehold. De mest sannsynlige mineraliseringstyper er skjærsoner og jernformasjoner.

En mindre oppfølgningsaksjon med reprøvetakning av elvene i vest er foreslått med vektlegging av mineralogiske undersøkelser av innsamlete tungmineralkonsentrat og kvartærgeologisk kartlegging.

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Appendix 2: Normalised values according to a sample weight of 5 grams.

1. INTRODUCTION

Panning of stream sediments was conducted during two 14-day periods in 1998 and 1999. The work was carried out on a wide scale within the Ringvassøy Greenstone Belt (RGB) and surrounding tonalite complexes situated within the West Troms Basement Complex (WTBC) in northern Norway (Fig. 1).

Numerous geological investigations and exploration campaigns have been conducted on Ringvassøy over the last 50 years by various mining companies, university groups and NGU. These surveys, as summarised by Sandstad and Nilsson (1998), have focused on stratabound base-metal deposits and more recently on gold. In spite of the reported widespread distribution of gold in tills and stream sediments, and the large resources invested in the area by industry during the 1980ies, no major gold deposit has, so far, been discovered.

The present report focuses on gold and other heavy metals in panned heavy-mineral concentrates, in order to assess the presence of gold occurrences other than those described by Sandstad and Nilsson (1998). Secondly, to use the chemistry of the heavy-mineral concentrates and geochemical results from the till survey (Finne 2000) and chip sampling (Sandstad and Nilsson 1998; Ihlen 2000; Motuza 2000) to trace other elements that may have coprecipitated with the gold and thus assist in the interpretation of possible new mineralisation types. Thirdly, to check previous gold-grain counts of heavy-mineral concentrates from tills and stream sediments (Lieungh 1985). A full treatment of the secondary dispersion of gold in Quatenary deposits on Ringvassøy, and assessment of the best sampling media for detecting gold mineralisation will be given in a forthcoming M.Sc. thesis by Jeppe Nygaard, Copenhagen University, Denmark.

2. GEOLOGICAL SETTING

The RGB represents one of several Archaean supracrustal belts within the WTBC (Zwaan and Bergh 1994; Zwaan 1995) which is structurally overlain by Caledonian nappes to the east (Fig. 1). The WNW-ESE-trending RGB is surrounded by a complex of tonalitic intrusives and orthogneisses (Dåfjord Tonalite Complex, DTC) which contain members of Archaean age (Zwaan and Tucker 1996). The geochronology of the upper tectonostratigraphic unit (Skogsfjord Gp.; see below) of the RGB was recently determined by U/Pb dating of zircons from a felsic metavolcanic unit, yielding an Archaean age (Motuza 2000).

The WTBC is intersected by numerous high- and low-angle shear zones (Fig. 1) which started to evolve during the Svecokarelian orogeny (Dallmeyer 1992). High-angle shear zones occur widespread in both the RGB and DTC, whereas thrust zones are mainly encountered in the western part of the RGB where one of them separates the RGB into two major tectonostratigraphic units (Fig. 2) (Zwaan 1989; Bergh and Armitage 1999). The Skogsfjord Group. which represents the upper unit, comprises mainly garnetiferous quartzofeldspatic hornblende gneisses (felsic meta-volcanites?), whereas the lower unit, the Skogsfjordvatn Group, is composed of strongly deformed mafic metavolcanites with subordinate interlayers of felsic metavolcanic and metasedimentary rocks. The last group is, in the east, affected by greenschist facies metamorphism giving way westwards to amphibolite facies rocks which prevail in the central and western part of the RGB (Fig. 3). In addition, lower amphibolite facies contact-metamorphism has affected the greenstones along the contact of the DTC, and

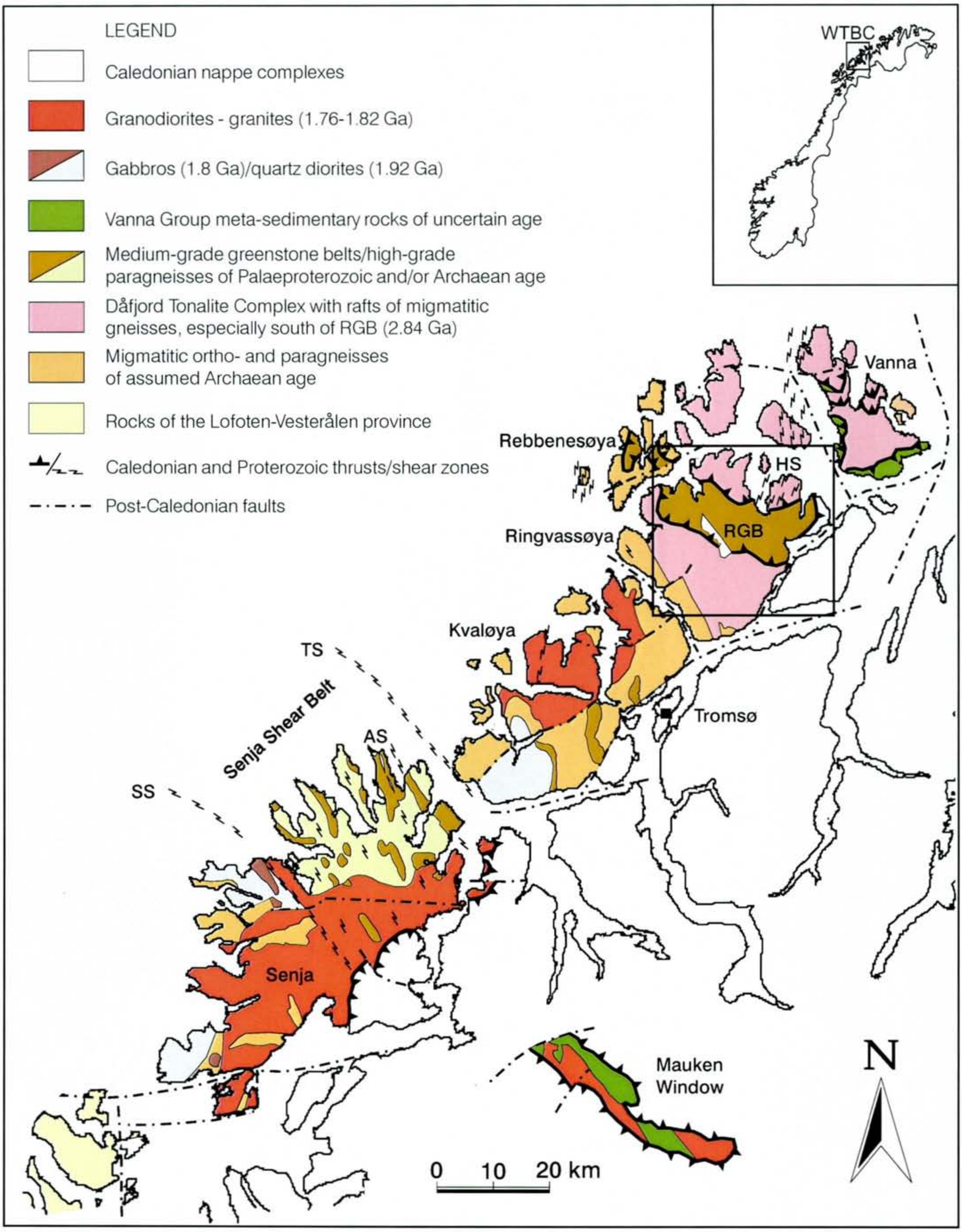


Fig. 1. Simplified geological map of the West Troms Basement Complex (WTBC); redrawn from Zwaan (1995). AS: Astridal shear zone; HS: Helgøya shear Belt. RGB: Ringvassøy Greenstone Belt; SS: Svanfjell shear zone; TS: Torsnes shear zone.

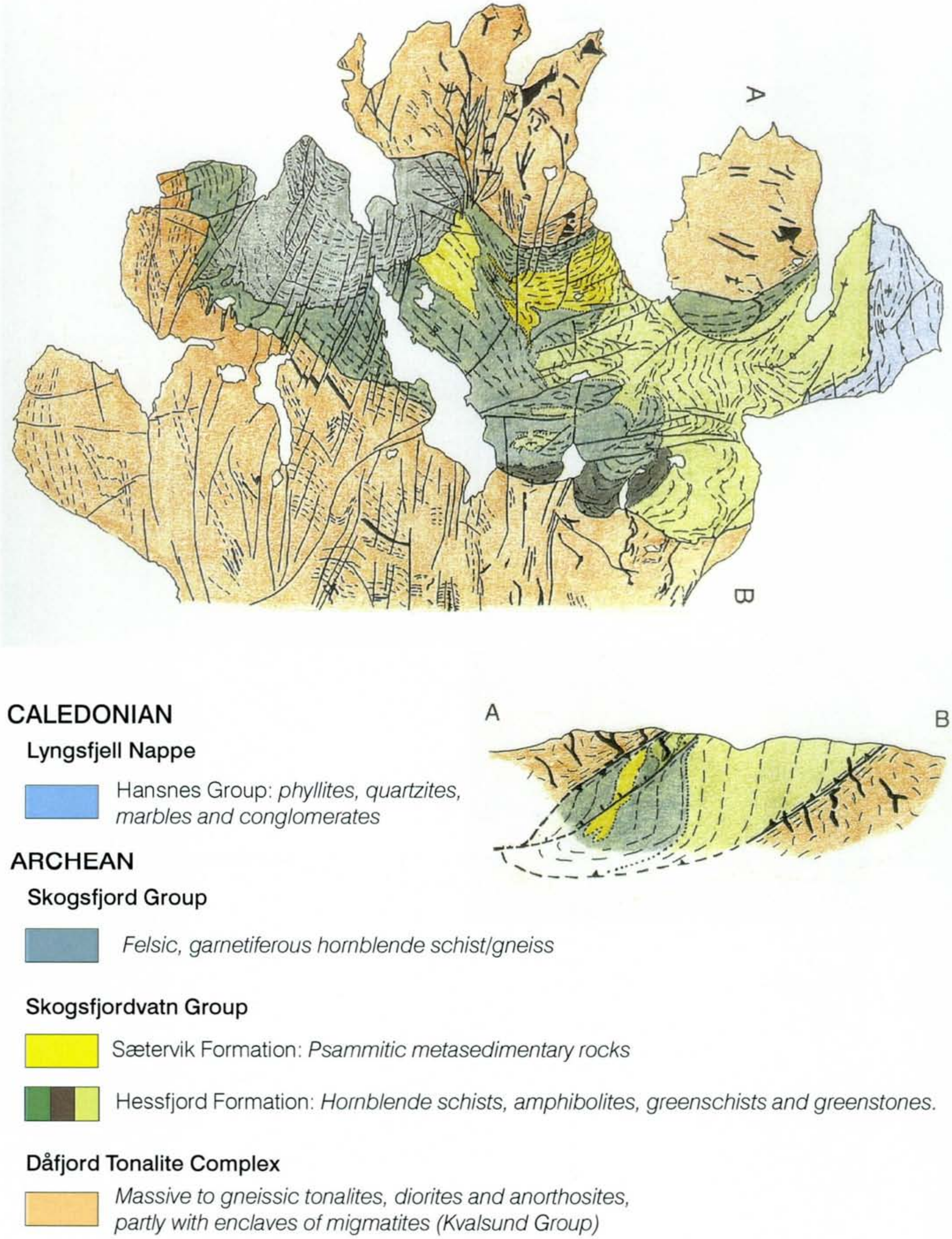


Fig. 2: Simplified geological map of the Ringvassøy Greenstone Belt, taken from Zwaan (1989).

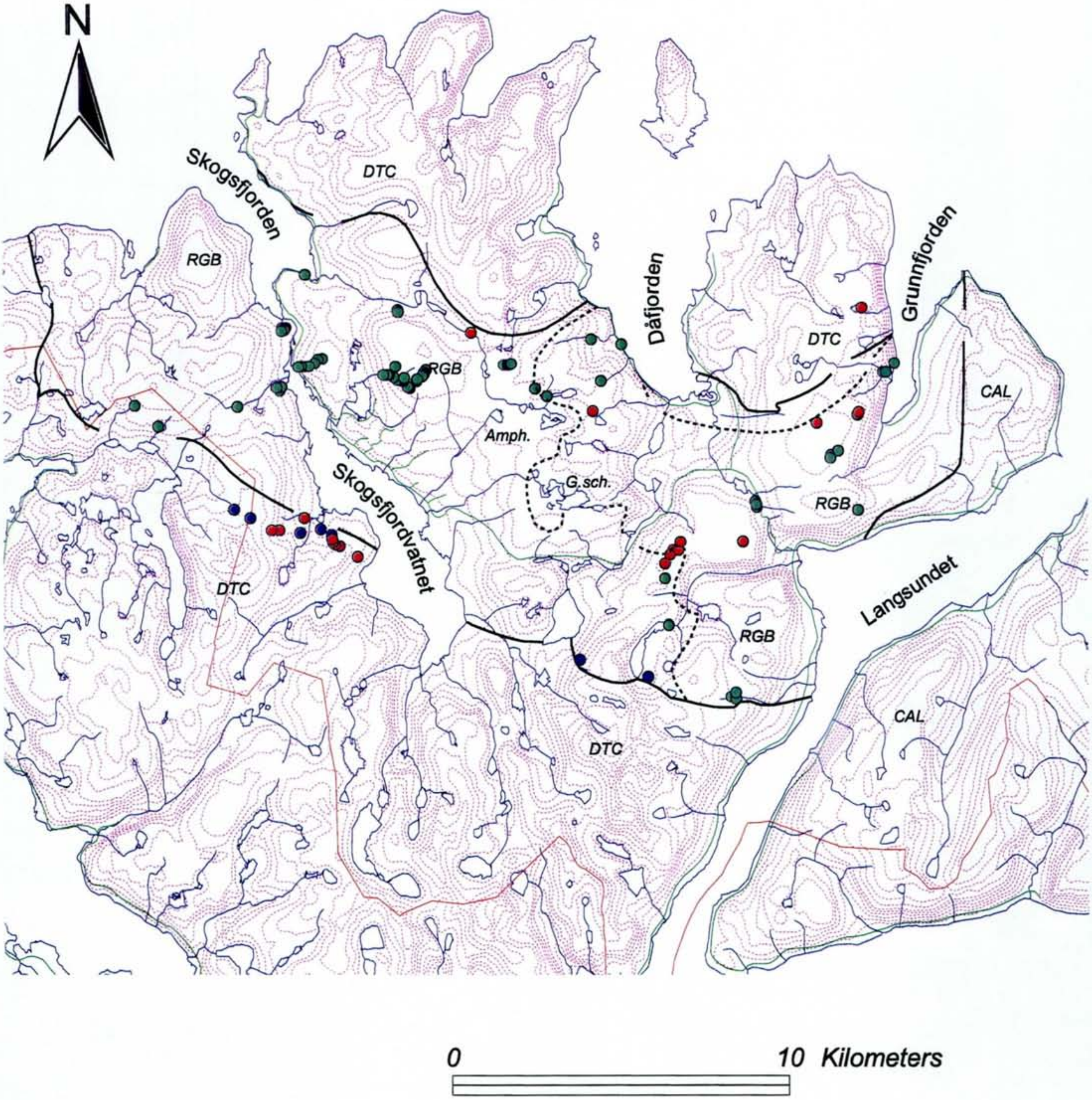


Fig. 3: Map showing the distribution of prospected mineralisation types and the main geological boundaries of the RGB, including those of the greenschist and amphibolite domains (dashed lines).
Compiled from data given by Sandstad and Nilsson (1998), NGU ore database and Ihlen (2000).
Green: Stratabound sulphide deposits. Red: Epigenetic gold and base-metal deposits. Dark blue: Orthomagmatic Fe-Ti deposits.

adjacent to gabbroic dykes and bodies inside the greenschist facies domain of the RGB. The amphibolite facies rocks are, in a number of places, intersected by shear zones with associated retrogradation to greenschist facies assemblages.

The contact between the RGB and the DTC was considered by Zwaan (1989) to represent a regional tectonic unconformity related to the emplacement of the RGB as a nappe complex. However, recent geological work in the north and eastern part of the RGB found evidence of intrusive contacts overprinted by shearing and crosscut by dolerite dykes (Ihlen 2000). These belong to a suite of gabbroic intrusives which occur abundantly in both the RGB and the DTC, and which comprise multiple generations of larger massifs, bodies and dykes. Contact relationships indicate that they include pre-, syn- and post-shearing generations; all of assumed Palaeoproterozoic age (Bergh and Armitage 1999)

Massive to disseminated and stratabound Fe-sulphide ores are widely distributed within the RGB (Fig. 3), particularly inside the Skogsfjordvatn Gp. These deposits, which are mainly hosted by units of metakeratophyres and black shales, are generally low in gold and combined base-metals (Cu+Zn+Pb) rarely exceeding 200 ppb and 0.1%, respectively (Sandstad and Nilsson 1998; unpublished data from NGU ore database). Epigenetic mineralisation consisting of As-, Sb- and Cu-sulphides and sulphosalts are most commonly encountered in the eastern, greenschist facies part of the RGB where several gold mineralisations are also known to occur.

The Quatenary deposits on Ringvassøy consist mainly of a thin veneer of till and scree material along the steep hill sides. The well-exposed DTC is characterised by a patchy cover of bouldery till. The transport direction for the ice during the Weichselian was according to Andersen (1968), mainly towards the northwest. It became, however, progressively more controlled by local valleys and fjords, trending N-S to NE-SW, as the deglaciation proceeded. Some valleys carry thick deposits of till and glacifluvial material at their mouths. Development of terraces, as at the head of Grunnfjorden, is common where these deposits occur below former beach lines which are situated up to a maximum altitude of 38.5 m above present sea level in the east and 12.5 m in the west. These features are important in the interpretation of element sources and distribution patterns.

3. KNOWN GOLD OCCURRENCES

Several gold occurrences have previously been detected inside the RGB by industry during several prospecting campaigns. These include the Hårskoltan, Klondyke, and Sørdalshøgda occurrences which are found near the transition between the greenschist and amphibolite facies domains (Fig. 3 and 4). The occurrences in Nonsdagsdalen and Upper Leirbogdalen valleys, lie inside the amphibolite facies domain close to the contact of the DTC (Sandstad and Nilsson 1998). These mineralisations are confined to single veins or systems of veins composed of quartz, some coarse-grained, but mostly fine-grained with a saccharoidal texture. The veins at Hårskoltan and Sørdalshøgda occur inside and along the contact of porphyritic tonalite sills.

Native gold occurs commonly as microscopic grains intergrown with erratically distributed aggregates and veinlets of pyrite, pyrrhotite, chalcopyrite and/or accessory Sb-sulphosalts as

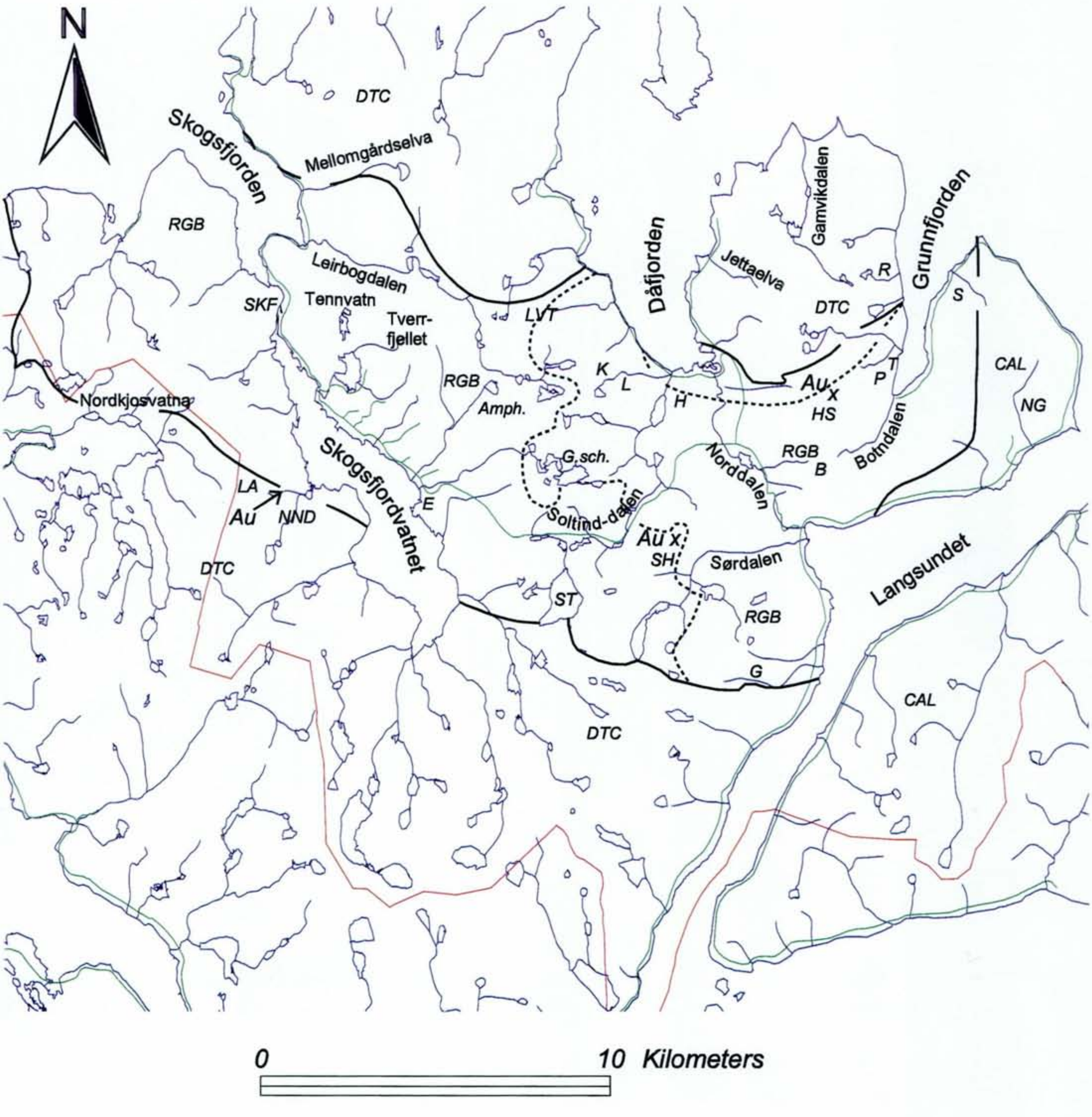


Fig. 4 : Map showing names of localities mentioned in the text and borders between the main geological megaunits. Abbreviations: Amph/G.sch.=Border between amphibolite and greenschist facies domains, B=Blåfjell Mt., CAL=Caledonian nappe complexes, DTC= Dåfjord Tonalite Complex, E=Elvebakken area, G=Gamnes, H=Haugen hill, HA=Hamnelva river, HS=Hårskoltan Mt., K=Klondyke area, L=Litleelva river, LA=Langryggen Mt., LVT=Lavinatind Mt., NDD= Nonsdagsdalen valley, NG=Nordgårdselva river, P=Pesselva river, R=Risdalsvatn lake, RGB= Ringvassøy Greenstone Belt, S=Slettelva river, SH= Sørdalshøgda, SKF=Skogsfjordelva river, ST=Soltindvatn lake.

well as, in rare cases, visible gold grains, e.g. at Hårskoltan and Sørdalshøgda. Arsenopyrite is missing in the gold-bearing veins, but form an important constituent in the stratabound Au-As-Zn mineralisation at the southern side of Sørdalshøgda ridge (Sandstad and Nilsson 1998). This arsenopyrite-sphalerite mineralisation (Sørdalshøgda-South) is found associated with a rusty and fractured quartz-amphibole-chlorite schist containing abundant Fe-sulphides and some disseminated magnetite. The mineralised zone is surrounded by massive to schistose greenstones and may either represent a volcanic exhalative type or a shear-related mineralisation. Similar As-Zn mineralisation at Hårskoltan is low in gold.

The occurrences at Klondyke, Sørdalshøgda and Sørdalshøgda-South have been tested by core-drilling, but apparently without any success regarding grades and dimensions, since all of these exploration campaigns are presently dormant. All of the above mentioned occurrences yield samples with more than 1g/t Au (see Fig. 9e) and frequently above 10 g/t with a maximum of 64 g/t Au from the Sørdalshøgda occurrence (Sandstad and Nilsson 1998). However, the small dimensions of the mineralised veins/zones, the wide spacing of the veins and the erratic distribution of economic gold grades suggest that they have a low economic potential (Ihlen 2000).

4. SAMPLING

Stream sediments were panned in most of the larger rivers and creeks within the RGB and within some of the adjacent areas of the DTC and the Caledonides, especially in the northeast (Fig. 5). A total of 159 localities were panned, i.e. 1-87 (1998) and 88-159 (1999). Sample localities were chosen in high energetic parts of the streams where the sediments were anticipated to contain necessary amounts of heavy minerals. Stream beds in low energetic parts of the rivers containing well-sorted silty and sandy material, were avoided wherever possible. The pebbly stream sediments were sieved through a 5mm screen until the pan was filled up. Thus, at each locality one full pan with about 5-6 litres of <5mm material was washed and the resulting heavy-mineral concentrates were transfered to small paper bags. Due to rather steep hillsides with patchy cover of boulder-rich tills and screes, the amount of sandy material in the stream beds is generally small. Thus, in most cases it was a time-consuming task to fill the washing pan with sieved material which varies considerably in amount relative to the total amount of sediments put on the screen.

The method used for panning the sediments is schematically shown in Fig. 6 and comprise two main steps: 1) filling the pan with water and shaking it first in a horizontal position and 2) gradually tilting it while moving it back and forth through the water. This procedure is continued until any red garnet present in the material is washed out and black sand (Fe-Ti-oxides) is the main component of the concentrate. The final concentrates, ranging in weight from 0.9 to 23.4 grams, were checked for visible grains of gold, before being transferred to sample bags. However, no grains of gold was detected in any of the samples. Ringvassøy is well-known for its abundance of grouse which are hunted all over the island. Thus, mm-sized lead bullets and fragments of such are frequently encountered in the heavy mineral concentrates. The bullets and visible fragments are removed from the concentrate before being bagged. Normally, 15-20 minutes were used on panning the samples and a total of one hour when including sieving. This means that 8-12 samples were collected per day. Since both the sampling and panning techniques certainly would be applied somewhat differently from

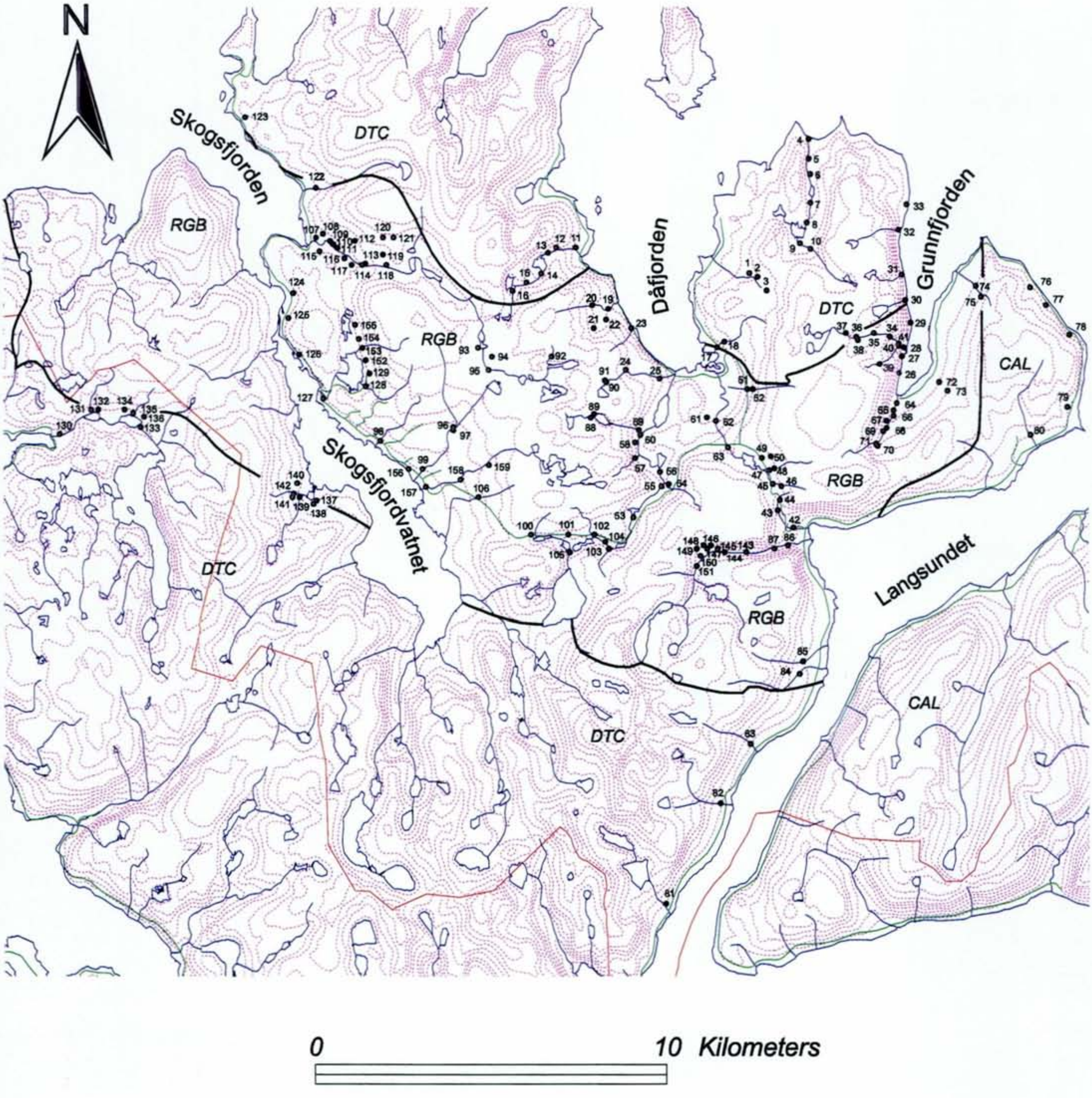


Fig. 5: Map of Ringvassøy showing sample localities and sample numbers; 1-87 (1998) and 88-159 (1999).

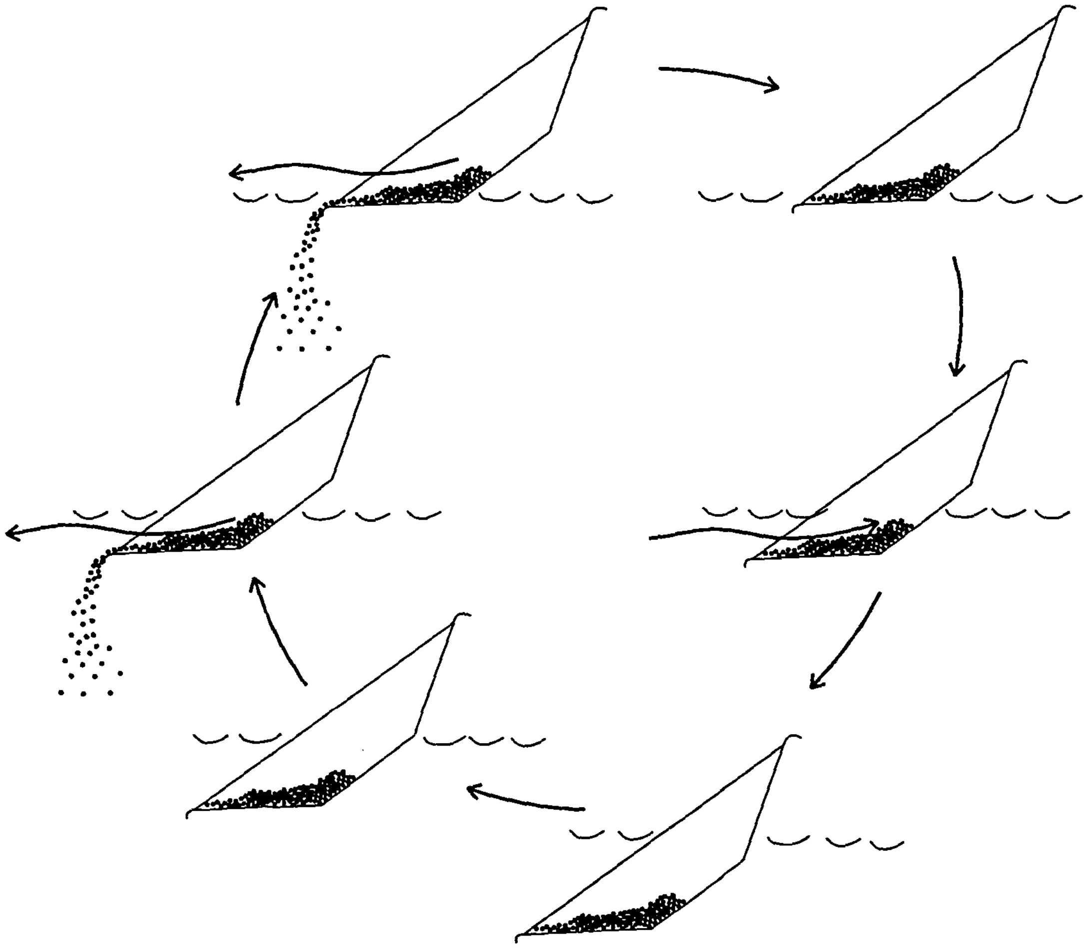


Fig. 6: Schematic drawings illustrating the panning method.

person to person, all samples, in both field seasons, have been collected by one person (LF). This also means that the way of concentrating the heavy minerals would roughly be the same. No systematic mineralogical investigations of the heavy-mineral concentrates have yet been conducted.

5. CHEMICAL ANALYSES

Both sample batches were analysed at Acme Analytical Laboratories, Vancouver, Canada according to the same method, i.e. 35 element ICP package (Geo 4). Sulphur was included as an additional element for the 1999 batch.

No attempts have been made to normalise the analytical values of the two batches by running parallel samples from the same locality. Experience from scheelite panning in the Caledonides by industry (Ihlen 1973, unpubl.) showed that scheelite and other heavy minerals of the panned concentrates varied considerably at the same locality of the stream.
Due to low total contents of sample material, doublicate samples were not included in the analyses, but internal standards were used.

5.1. Analytical procedure

The heavy-mineral concentrates were pulverised and the total sample digested in 30 ml 2 - 2 - 2 HCl - HNO_3 - H_2O at 95°C for one hour, before being diluted to 100 ml with water and then analysed by ICP for Al, **Ti**, **Fe**, **Mn**, **Mg**, **Ca**, Na, K, **Ba**, **Sr**, **P**, V, **Cr**, Ni, Co, **La**, U, Th, **W** and **B**. The elements Au, Ag, Cu, Zn, Pb, As, Sb, Bi, Cd, Tl, Hg, Se, Te, Mo and Ga are extracted from the leach with MIBK-aliquot 336 and analysed by ICP, with the exception of Au, which was analysed by graphite-furnace atomic absorption. Detection limits for the individual elements are given in Appendix 1. It should be noted that the leach is partial for the elements marked in bold types and limited for those being underlined. For this reason only the elements S, Se, Au, Ag, As, Sb, Bi, Te, Cu, Co, Ni, Zn, Cd, Pb, Hg, Tl, Mo, U and Th are dealt with in this report which, as an exception, also includes tungsten (W), since it frequently occurs together with gold.

5.2. Analytical results and data presentation

The analytical results for all elements are given in Appendix 1 together with the weight of the heavy-mineral concentrates. Due to different total contents of heavy minerals in the stream sediments, and thereby different weights of the final heavy-mineral concentrates, analytical results have been normalised to a 5g sample as shown in Appendix 2. This have been done for the purpose of comparing samples with the same fraction of up-graded minerals relative to the total amount of -5 mm sediments. This means that samples weighing less than 5g will appear diluted and give lower values than the analytical ones, whereas the opposite will be the case for samples weighing more than 5g.

Those elements which occur in concentrations exceeding normal background values for mafic and accessory rock-forming minerals, have been plotted in Figs. 7-21 which shows the regional distribution of both analytical and normalised values for S, Se, Au, Ag, As, Sb, Bi, Cu, Co, Zn, Pb, Hg, Tl, W and Mo. Most of these elements may occur enriched in gold mineralisation. For comparison, and facilitating the interpretation of the metal distribution, each of these figures also contain plots (c and d) of the distribution of the same elements in tills (C-horizon) and chip samples of sulphide ores, tectonites and unmineralised bedrock. Maximum analytical values are used for the chip samples when several have been collected at the same locality, rather than a weighted average. In addition, grain counts of visible gold in panned stream sediments reported by ASPRO are shown below in Fig. 9d (Liungh 1985). Selected scatter diagrams showing possible inter-element correlation trends within the different geological units and sample media are depicted in Figs. 22-27.

6. DISTRIBUTION PATTERNS FOR THE INDIVIDUAL ELEMENTS

The distribution patterns of the individual elements are described below. The description of the metal distribution patterns is mainly based on the normalised values (Fig. a) rather than the analytical results (Fig. b), though both types of patterns are in most cases very similar. Specific values given in the text represent the analytical results or the raw data. The concentrations of each element were grouped by a computer-assisted statistical clustering program. Mafic minerals and Fe-Ti-oxides as well as zircon, titanite and monazite are commonly the main carriers of heavy metals in the panned concentrates. Published trace-element contents of rock-forming minerals have been used, where available, to set the upper limit of expected background values or the upper limit of the lowermost group. The possible presence of sulphide minerals representing an additional contributor of heavy metals can be judged from the contents of sulphur in the 1999 batch (Fig. 7a) or from the distribution of Se in both batches (Fig. 8a).

It is assumed that most of the heavy minerals in the stream sediments are derived from till and scree deposits intersected by the rivers. Some contribution to the total mineral contents is in some areas also given by deeply weathered and sheared schistose rocks, e.g. occurring abundantly in the eastern greenschist facies part of the RGB. The comparison with other sets of geochemical data is done mainly for the purpose of testing the anomaly patterns given by the heavy-mineral concentrates. Secondly, to test the panning method and its ability to pick up gold and other elements from known ore occurrences. A direct comparison of the analytical values is not recommended because the different sample media monitor different aspects of the metal dispersion, and since the application of different analytical procedures and standards inevitably will lead to discrepancies between the batches which include one batch of C-horizon till and six batches of chip samples.

The common high variance of heavy minerals in the stream sediments at the same locality, as discussed above, infer that clusters of anomalies inevitably become more important for the definition of potential mineralised areas, than do single ones.

6.1. Sulphur, S, and selenium, Se

Heavy-mineral concentrates panned in 1999 were analysed for sulphur, but not in 1998 when its importance as an potential indicator of sulphide mineralisation, was overlooked. Sulphides are important carriers of heavy metals and also, in particular, of selenium. Thus selenium is a good indicator of sulphides and is treated first together with sulphur.

Heavy minerals - Sulphur

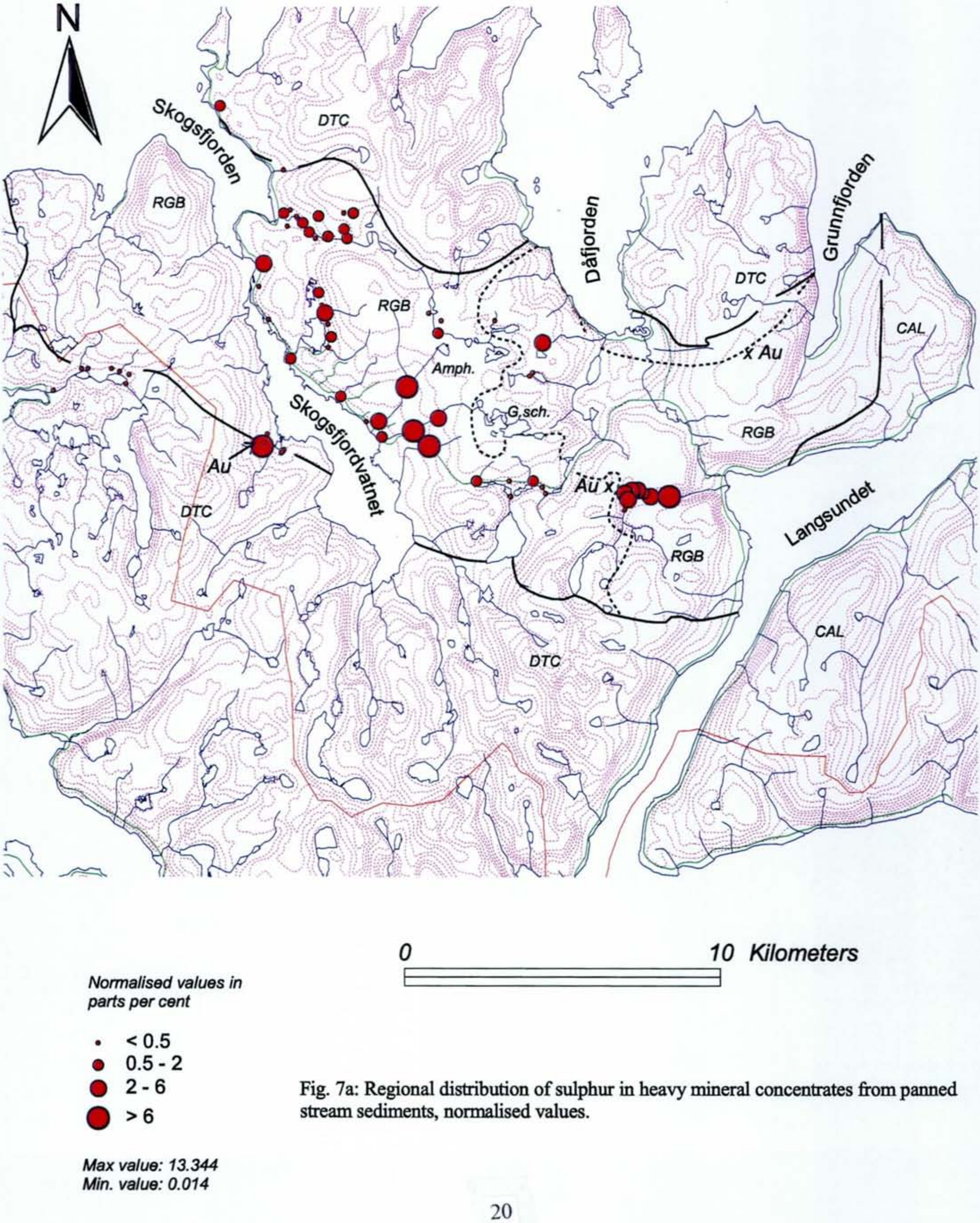
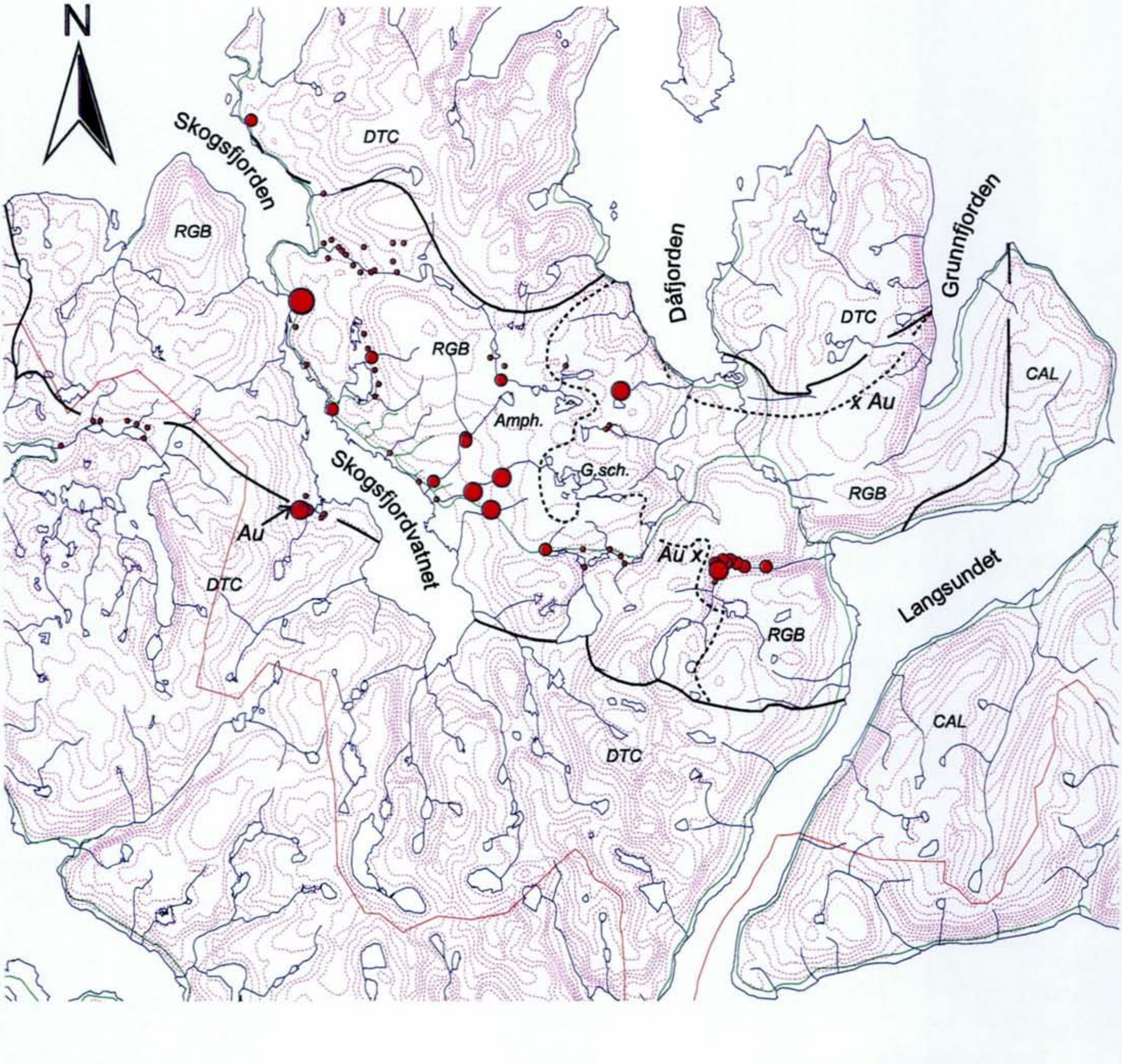


Fig. 7a: Regional distribution of sulphur in heavy mineral concentrates from panned stream sediments, normalised values.

Heavy minerals - Sulphur



Analytical values in parts per cent

- < 0.5
- 0.5 - 2
- 2 - 6
- > 6

Max value: 6.43
Min. value: 0.01

Fig. 7b: Regional distribution of sulphur in heavy mineral concentrates from panned stream sediments, analytical values.

Heavy minerals - Selenium

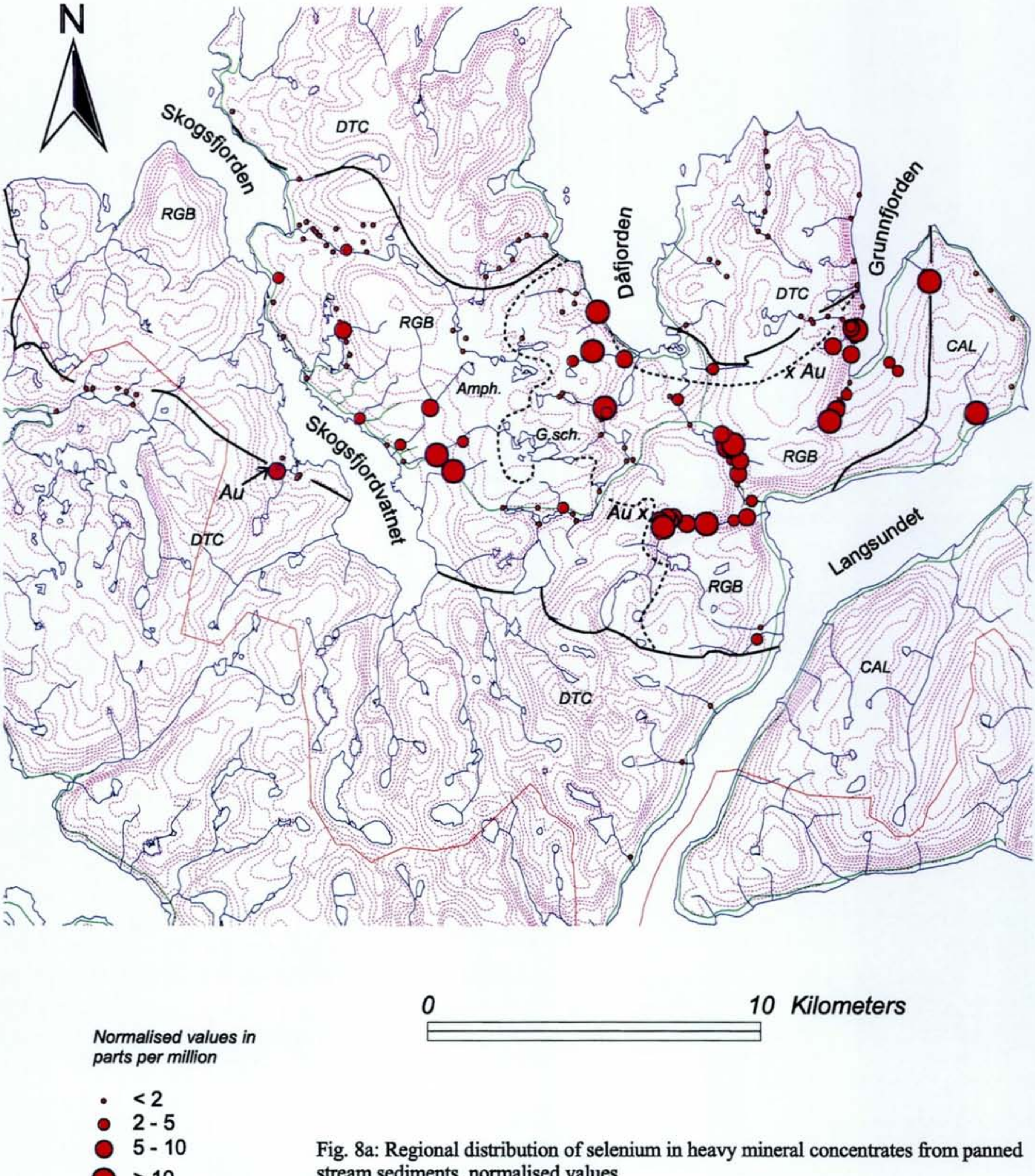


Fig. 8a: Regional distribution of selenium in heavy mineral concentrates from panned stream sediments, normalised values.

Heavy minerals - Selenium

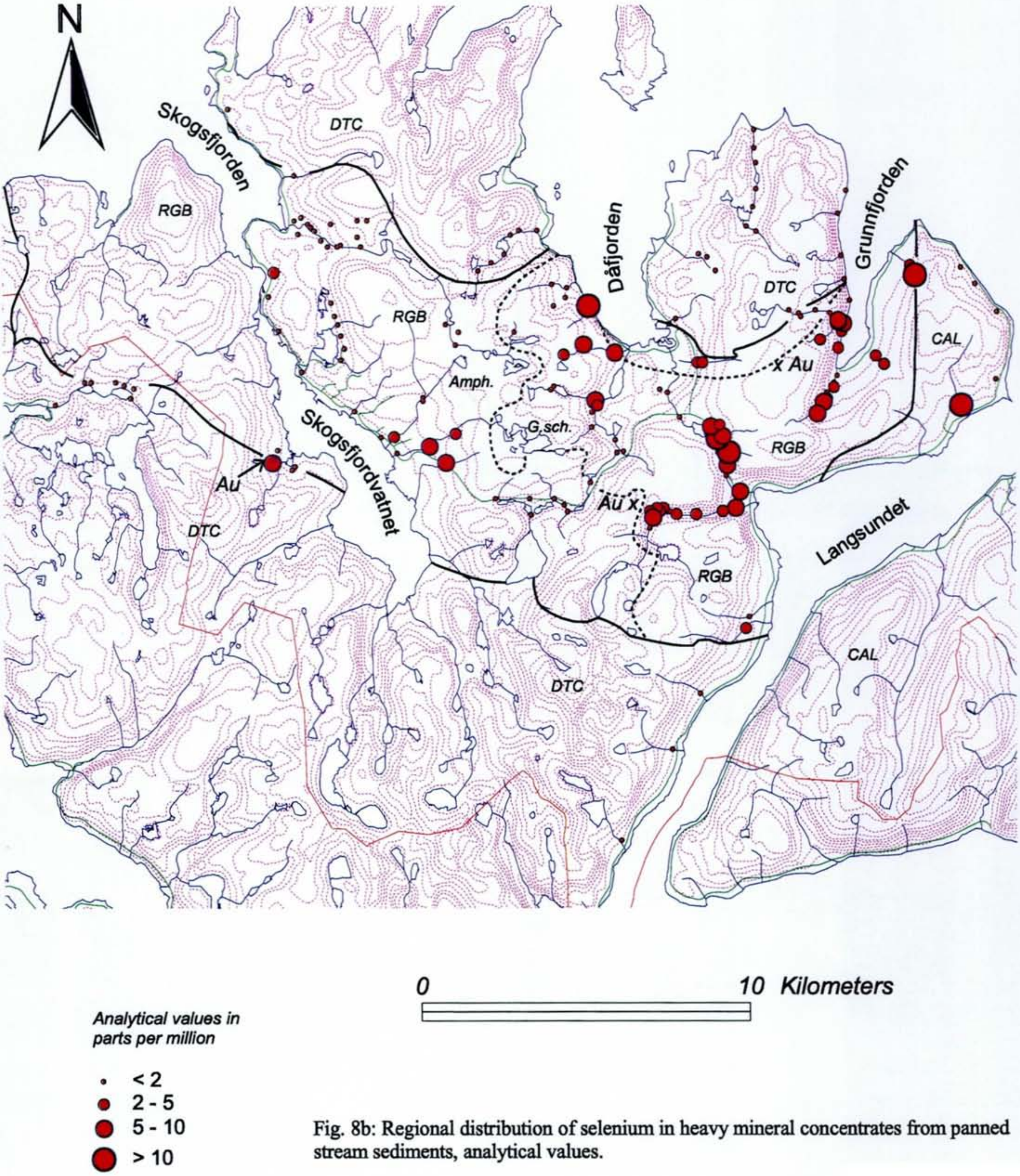


Fig. 8b: Regional distribution of selenium in heavy mineral concentrates from panned stream sediments, analytical values.

Till - Selenium

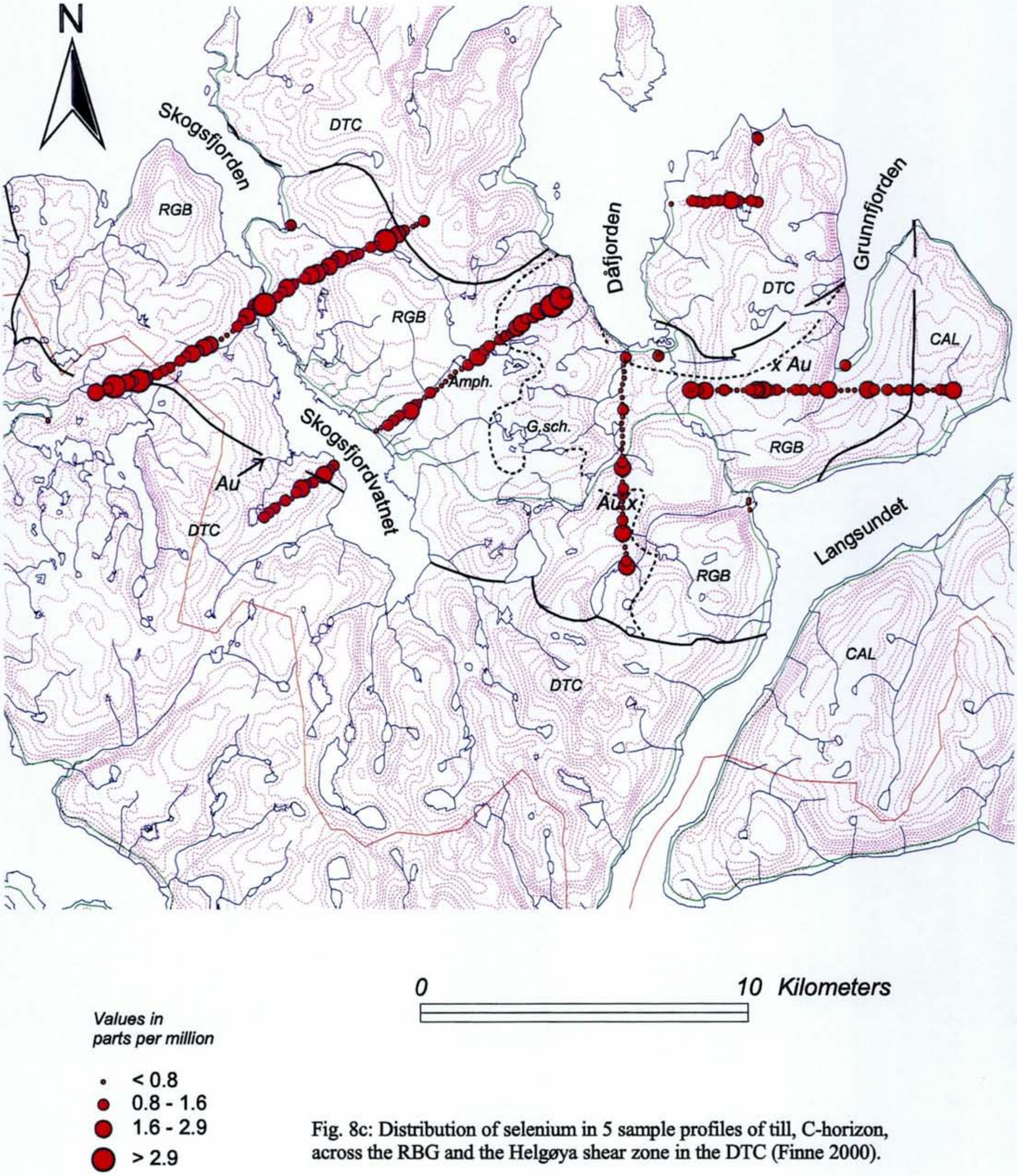


Fig. 8c: Distribution of selenium in 5 sample profiles of till, C-horizon, across the RBG and the Helgøya shear zone in the DTC (Finne 2000).

Normal contents of sulphur in rock-forming silicates and oxides are less than 0.01% S (Schneider 1978). About one third of the samples in the 1999 batch contain more than 0.5% sulphur (Fig. 7b). Those with intermediate to high concentrations form clusters along the Sørdalen river and the rivers north of Elvebakken (Fig. 4). The strong anomalies below the sulphide occurrences in Nonsdagsdalen valley and in the tributary to the Skogsfjordelva river further north clearly demonstrate their presence.

All samples were analysed for selenium which is a chalcophile element, generally occurring enriched in sulphide minerals. This is also clearly the case on Ringvassøy where all samples enriched in sulphur also carry enhanced concentrations of selenium, though selenium only reach a maximum of 19 ppm in comparison with 64000ppm for sulphur. However, in spite of the low concentrations of selenium it appear to roughly mimic the variability of sulphur as an indicator of sulphides (Fig. 7a and 8a). From the selenium distribution on a regional scale it becomes clear that selenium is mainly enriched in the greenschist facies domain and that several additional rivers appear to be enriched in sulphides, including those south of Dåfjord and at the head of Grunnfjorden as well as in the Nordalen, Slettelva and Nordgårdselva rivers. The rivers inside the DTC and the Caledonides are low in selenium which confirms the general absence of major sulphide mineralisation, e.g. inside the Helgøya shear zone.

The till samples with a maximum content of 7.7 ppm selenium show a more even distribution of values with no specific clustering of anomalous samples in the greenschist facies domain (Fig. 8c). Rather it seems that the highest number of anomalous samples are found within the amphibolite facies domain, e.g. in the westernmost profile. Due to low number of chip samples analysed for sulphur and selenium from the dominantly sulphide-rich ores, further discussion of their importance is unwarranted.

6.2. Gold

Background contents of gold in rock-forming minerals are normally less than 50 ppb which occurs occasionally in magnetite from gold provinces (Crocket 1991). 39% of the samples exceed this limit and reach a maximum of 10234 ppb in sample 114 (6.7 grams) collected in a tributary to the Leirbogdalen river on its southern side (Fig. 9a). The second highest concentration, 8777 ppb, was encountered in sample 122 (16.9 grams), further to the north in the Mellomgårdselva river. The regional distribution pattern demonstrates clearly the widespread occurrence of anomalies within the RGB in comparison with the DTC which only carry two weak anomalies within the Helgøya shear zone in Gamvikelva river and Jettaelva river between Grunnfjorden and Dåfjorden. The drainage systems in the Caledonides are also typified by background values.

The eastern greenschist facies domain of the RGB is characterised by a few single anomalies of intermediate concentration (12.5% in the range 1500-6000 ppm, see Fig. 9a), which occur intermingled with localities showing background or weakly anomalous levels. Single intermediate anomalies of unknown origin are found in the upper part of Norddalen drainage system and at Høgda hill. There is a tendency to clustering of anomalies in the upper parts of Sørdalen valley. These are according to spatially associated zinc and arsenic anomalies, possibly related to stratabound Au-Zn-As mineralisation; one of them occurring in the valley to the south of Sørdalshøgda ridge (Sandstad and Nilsson 1998). The Au-Cu mineralisation associated with quartz veins and shear zones at the ridge is not readily detected in the small tributaries to the Sørdalen river which drain the mineralised area (Fig. 9e). The gold contents are of normal background or weakly anomalous levels similar to those of Cu (see Fig. 14a). The weak anomalies in the Tverrelva river west of Grunnfjorden are probably related to the northeastern extension of the auriferous Hårskoltan quartz-vein system situated along tributaries to the Tverrelva river (Fig. 9e).

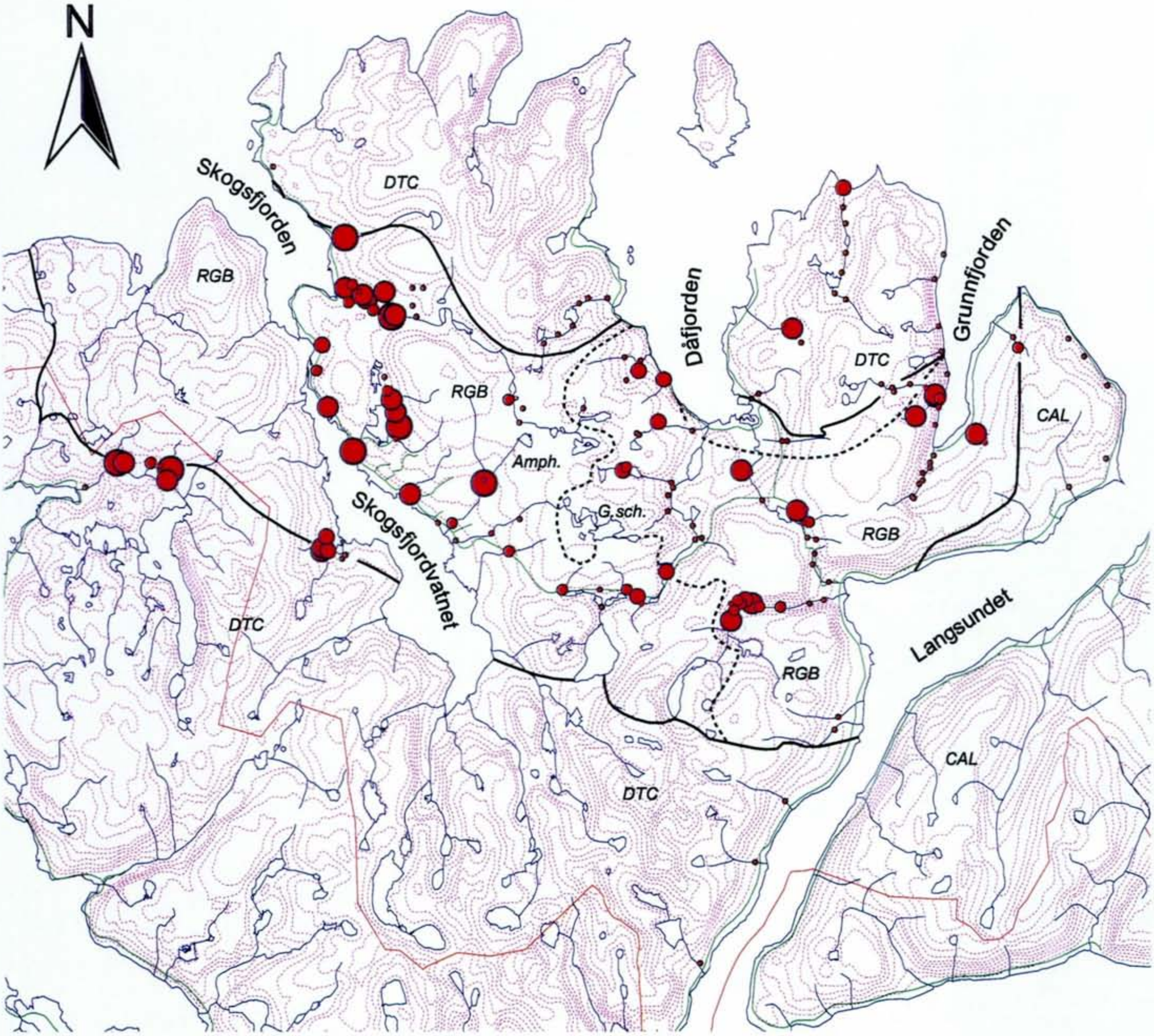
The amphibolite facies domain, especially the westernmost part, is in contrast to the rest of the RGB, recognised by widely distributed strong to intermediate anomalies (30% of samples > 1500 ppb and 13% of samples > 6000. 43% of the samples contain background values in contrast to 66% in the greenschist facies domain. A conspicuous clustering of anomalous rivers is found at Nordkjosvatna lakes, Tennvatn lake and at the mouth of Leirbogdalen valley. The cluster of weak gold anomalies in the Nonsdagsdalen area is most likely related to shear-controlled auriferous Fe-sulphide mineralisation. The strong Cu anomaly in one of the localities (see Fig. 14a) is assumed to be related to a known Cu-rich shear zone, containing locally up to 3 g/t Au (Fig. 9e) (Sandstad and Nilsson 1998).

The distribution pattern of gold in heavy-mineral concentrates compared with its regional distribution in tills (Fig. 9c) and as visible gold grains in panned stream sediments (Fig. 9d) show both similarities and discrepancies. The gold anomalies of the C-horizon in the till profiles (Finne 2000) fall roughly in the same area as the heavy-mineral geochemical anomalies (Fig. 9a and c). The main exception is the middle part of the Soltinddalen valley where the tills give anomalous values both for the C-horizon and for panned gold grains (Fig. 9d), whereas the stream sediments only contain heavy minerals with background concentrations of gold.

The presence of visible gold grains in the stream sediments of the Tverrelvdalen, Soltinddalen, and Nonsdagsdalen rivers as well as those west of Dåfjord are partly reproduced by anomalous heavy-mineral concentrates in the same general areas (Fig. 9a-b). This suggests that the latter type of anomalies are caused by fine-grained gold in the sediments, since no visible grains of gold were detected in the 1998 and 1999 concentrates. Discrepancies between the two methods are shown by streams with geochemical background values but several visible gold grains may be due to the misidentification of fine-grained pyrite and chalcopyrite for gold. This may be the case in Norddalen valley where fine-grained massive to disseminated sulphides occur widespread in keratophyres and black shales at its upper reach. The opposite type of discrepancy (geochemical anomalies vs. no visible gold grains) is probably caused by the presence of heavy minerals containing microscopic inclusions or lattice substitution of gold (submicroscopic). This may for instance be the case for the streams west of Tennvatn lake and along the Sørdalen river.

The chip samples from different types of sulphide mineralisation, shear zones and unmineralised bedrock are generally low in gold with the exception of the gold occurrences discussed above (Fig. 9e). The phyllonitic and mylonitic tonalites as well as their albite-epidote altered equivalents within the Helgøya shear belt contain invariably less than 50 ppb gold. The source of the gold in the anomalous heavy-mineral concentrates outside the gold mineralised areas is presently unknown, although several possibilities exist as will be discussed later.

Heavy minerals - Gold



0 10 Kilometers

Normalised values in parts per billion

- < 50
- 50 - 500
- 500 - 1500
- 1500 - 6000
- > 6000

Max value: 29613
Min. value: 0.1

Fig. 9a: Regional distribution of gold in heavy mineral concentrates from panned stream sediments, normalised values.

Heavy minerals - Gold

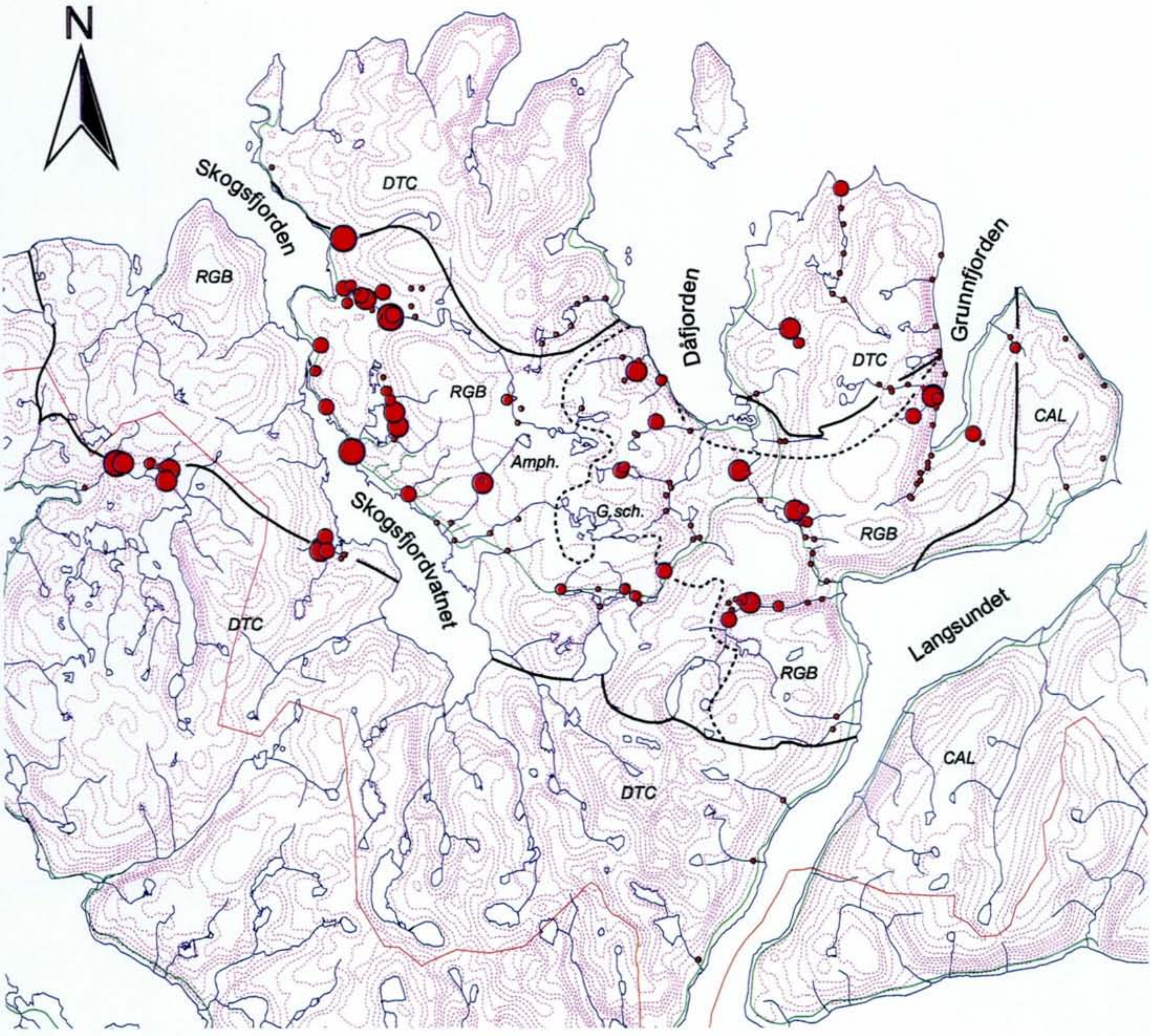
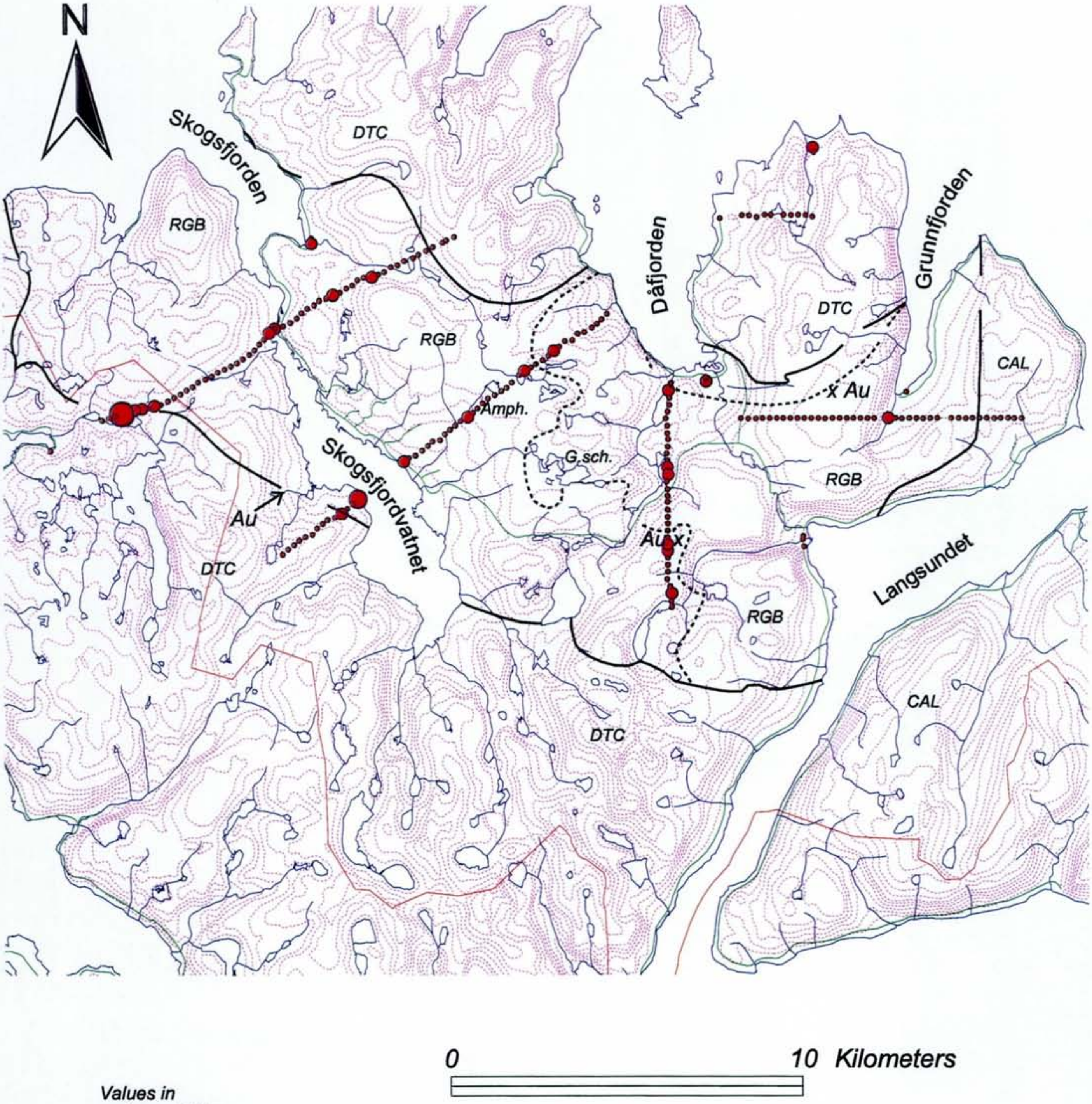


Fig. 9b: Regional distribution of gold in heavy mineral concentrates from panned stream sediments, analytical values.

Till - Gold



Values in parts per billion

- < 11
- 11 - 35
- 35 - 120
- > 120

Max value: 257
Min. value: 0.1

Fig. 9c: Distribution of gold in 5 sample profiles of till, C-horizon, across the RBG and the Helgøya shear zone in the DTC (Finne 2000).

Heavy minerals - Gold grains

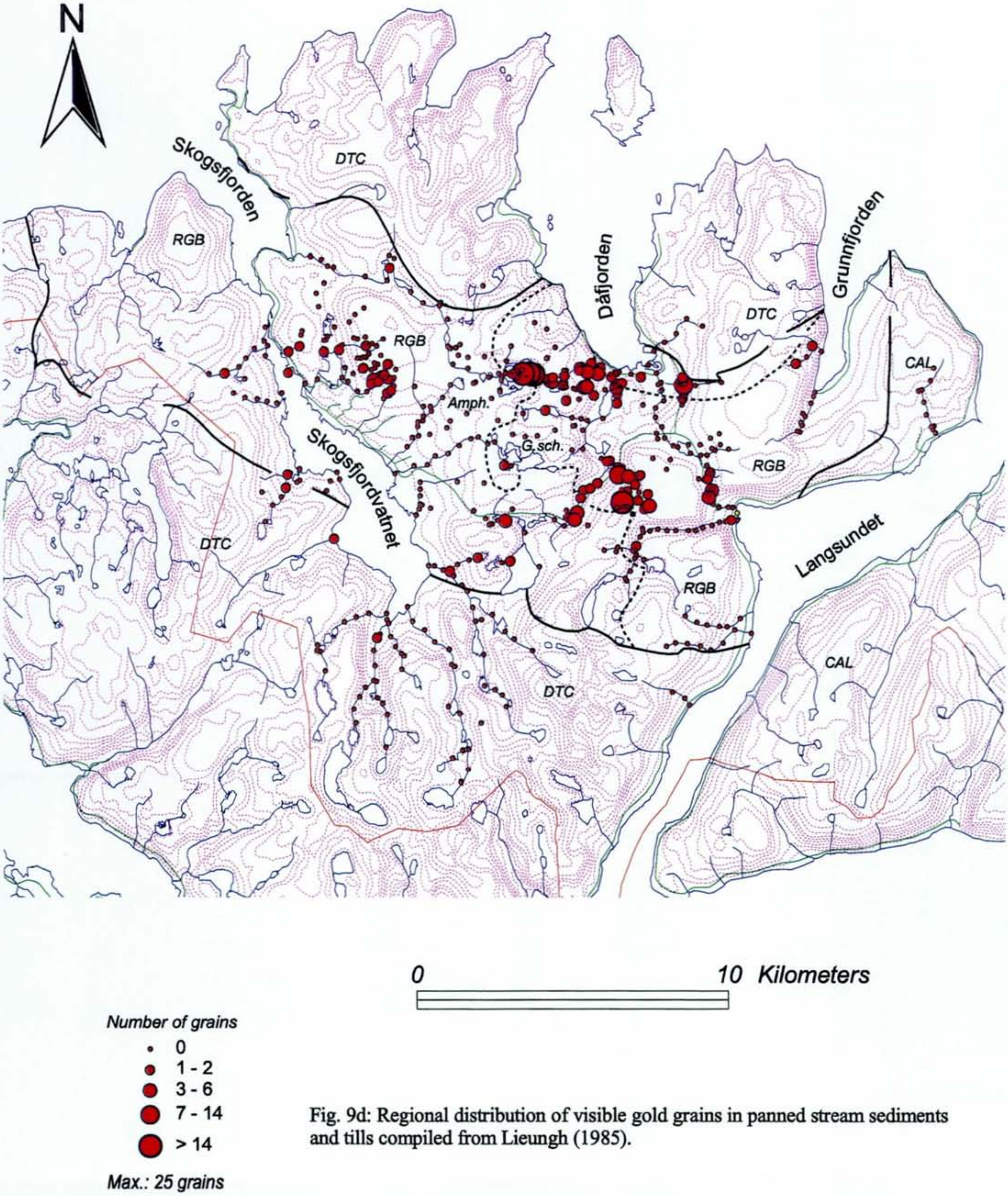
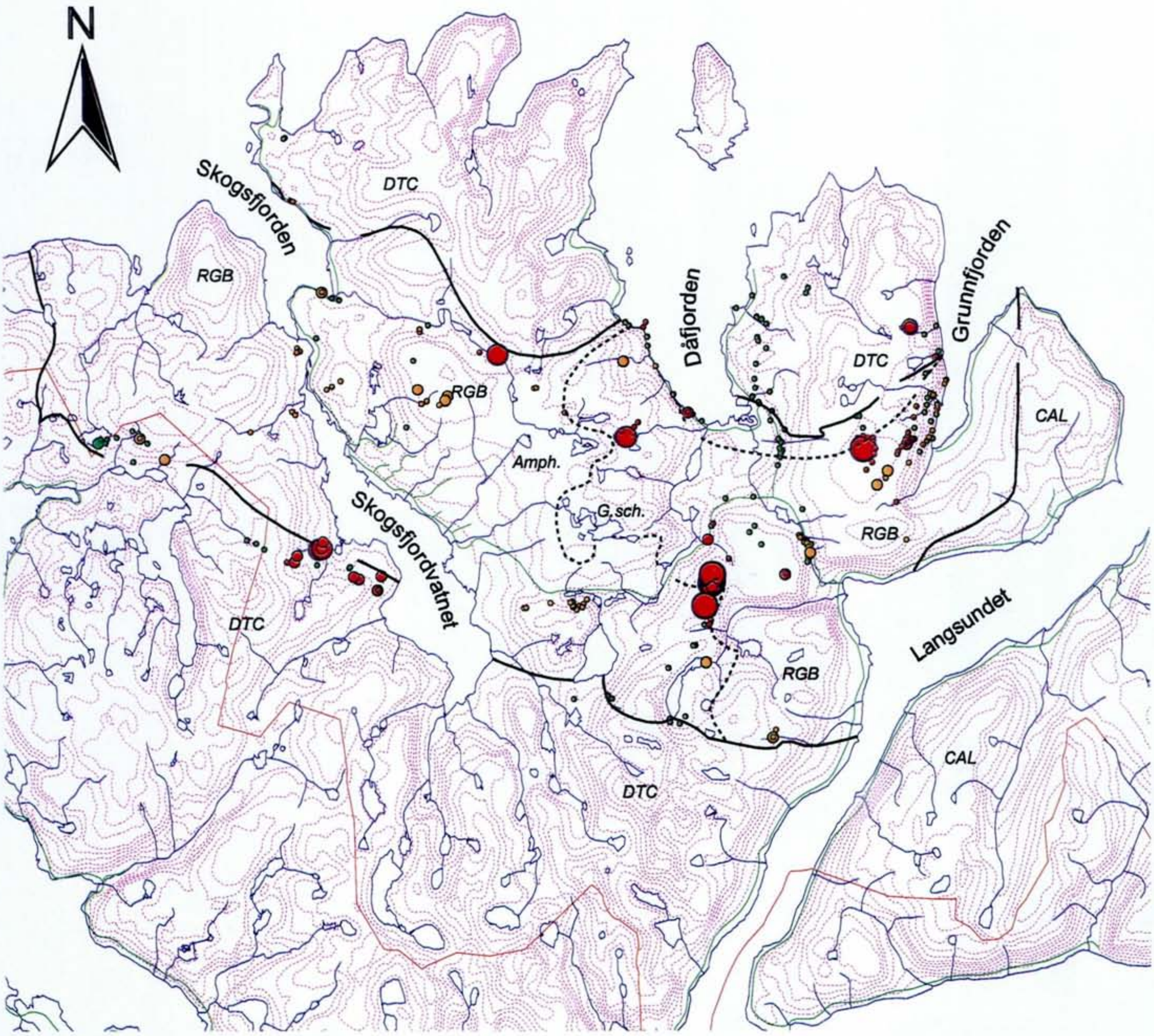


Fig. 9d: Regional distribution of visible gold grains in panned stream sediments and tills compiled from Lieungh (1985).

Chip samples - Gold



Stratabound sulphides
- < 100
- 100 - 500
- 500 - 1000
- 1000 - 5000
- > 5000

Epigenetic min.
- < 100
- 100 - 500
- 500 - 1000
- 1000 - 5000
- > 5000

All tectonites
- < 100
- 100 - 500
- 500 - 1000
- 1000 - 5000
- > 5000

Values in parts per billion

Max.value: 64210
Min. value: 1

0 10 Kilometers

Fig. 9e: Regional distribution of gold in chip samples. Orange: Stratabound sulphides. Red: Epigenetic mineralisation. Green: Tectonites, hydrothermal alteration and bedrocks with accessory ore minerals as well as Fe-Ti deposits. Analytical values compiled from Sandstad and Nilsson (1998), Ihlen (2000) and NGU ore database.

6.3. Silver, Ag

Silver contents of rock-forming minerals are highly variable, but generally less than 500 ppb in unmineralised areas (Vincent 1974). Samples containing more than 500 ppb Ag, are rather evenly distributed within the RGB (Fig. 10a-b), whereas the rivers within the DTC and the Caledonides normally contain background concentrations. The rivers at the head of Grunnfjord, in Norddalen, in Sørdalen and in the Elvebakken area at Skogsfjordvatn appear particularly anomalous with abundant samples exceeding 1000 ppb. In comparison, most of the till samples contain almost invariably less than 540 ppb Ag (Fig. 10c), which appear to be rather evenly distributed in the RGB, DTC and the Caledonides. Chip samples with Ag contents exceeding 12 ppm occur associated with Cu-sulphide mineralisation at Risdalsvatn, Gamnes, Nonsdagsdalen, Sørdalshøgda, and Hårskoltan (Fig. 10d). Only the last three mineralisations detected in the heavy-mineral concentrates whereas the former, attaining an overall maximum of 38 ppm Ag, shows no response.

6.4. Arsenic, As

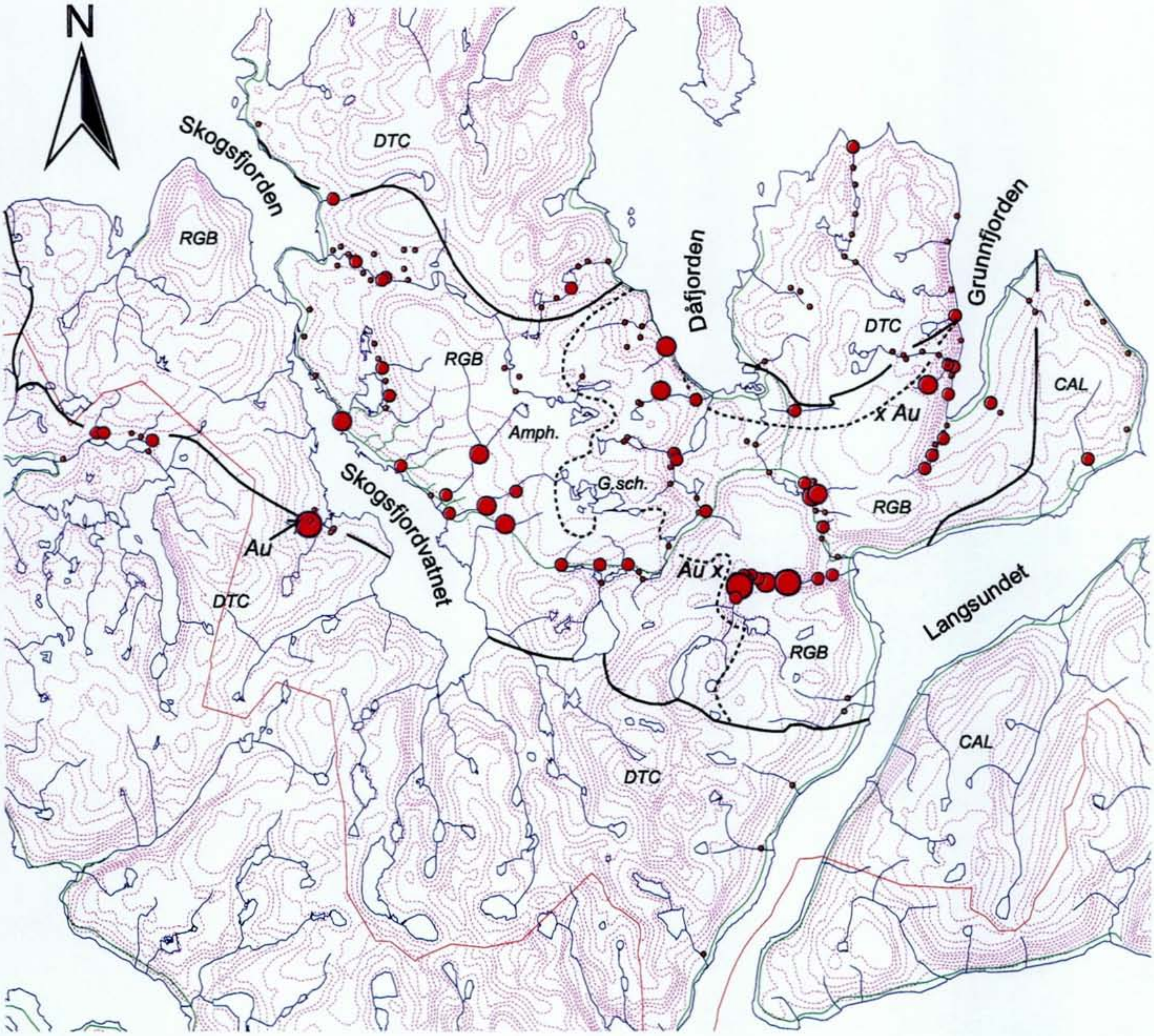
Most mafic silicates contain less than 3 ppm As, whereas Fe-oxides may reach 40 ppm (Onishi 1969). The last value has, therefore, been used as an upper limit for the normal background. The heavy-mineral concentrates on Ringvassøy yield arsenic values in the range 0.8 ppm to 1716 ppm, with the highest values located in the Norddalen river system (Fig. 11b). Intermediate to strong arsenic anomalies are mainly concentrated in the the greenschist facies domain and particularly in the rivers west of Dåfjord, at the head of Grunnfjorden, in Nordalen, and in Sørdalen (Fig. 11a). The samples from the rivers in the DTC and the Caledonides contain, with the exception of the Nordgårdselva locality, background concentrations. The sample from the Nordgårdselva river carries enhanced concentrations of As as well as of Se, Ag, Sb, Co, Ni, Zn, and Pb.

The distribution of As in the till C-horizon (Fig. 11c), confirms the general enrichment of arsenic in heavy-mineral concentrates panned in the greenschist facies domain and the invariably low arsenic contents of the DTC and the Caledonides. Arsenopyrite-bearing sulphide occurrences showing As contents in excess of 0.1% (Fig. 11d), are also normally reflected in anomalous heavy-mineral concentrates in the river systems draining the mineralised areas.

6.5. Antimony, Sb

On a global scale, mafic minerals and Fe-Ti-oxides contain generally less than 1 ppm Sb. Black shales are normally ten times higher in Sb, i.e. 1-2 ppm, compared to average crustal abundance of 0.1-0.2 ppm Sb (Onishi 1978). The contents of Sb in the samples are mostly below 10 ppm and with a maximum of 484 ppm within the Helgøya shear belt in Gamvikdalen (Fig. 12b). The anomalous sample in Grunnfjorden is collected in a small stream draining an area with As-Sb sulphide mineralisation (Sandstad and Nilsson 1998, Ihlen 2000) as indicated by the Sb enrichment in chip samples (Fig. 12d). Heavy-mineral concentrates with Sb contents in the range 1-10 ppm appear to be evenly distributed in the RGB whereas the DTC is dominated by samples with less than 1 ppm Sb. There appears to be no particular enrichment of Sb in the heavy-mineral concentrates compared with the till

Heavy minerals - Silver



0 *10 Kilometers*

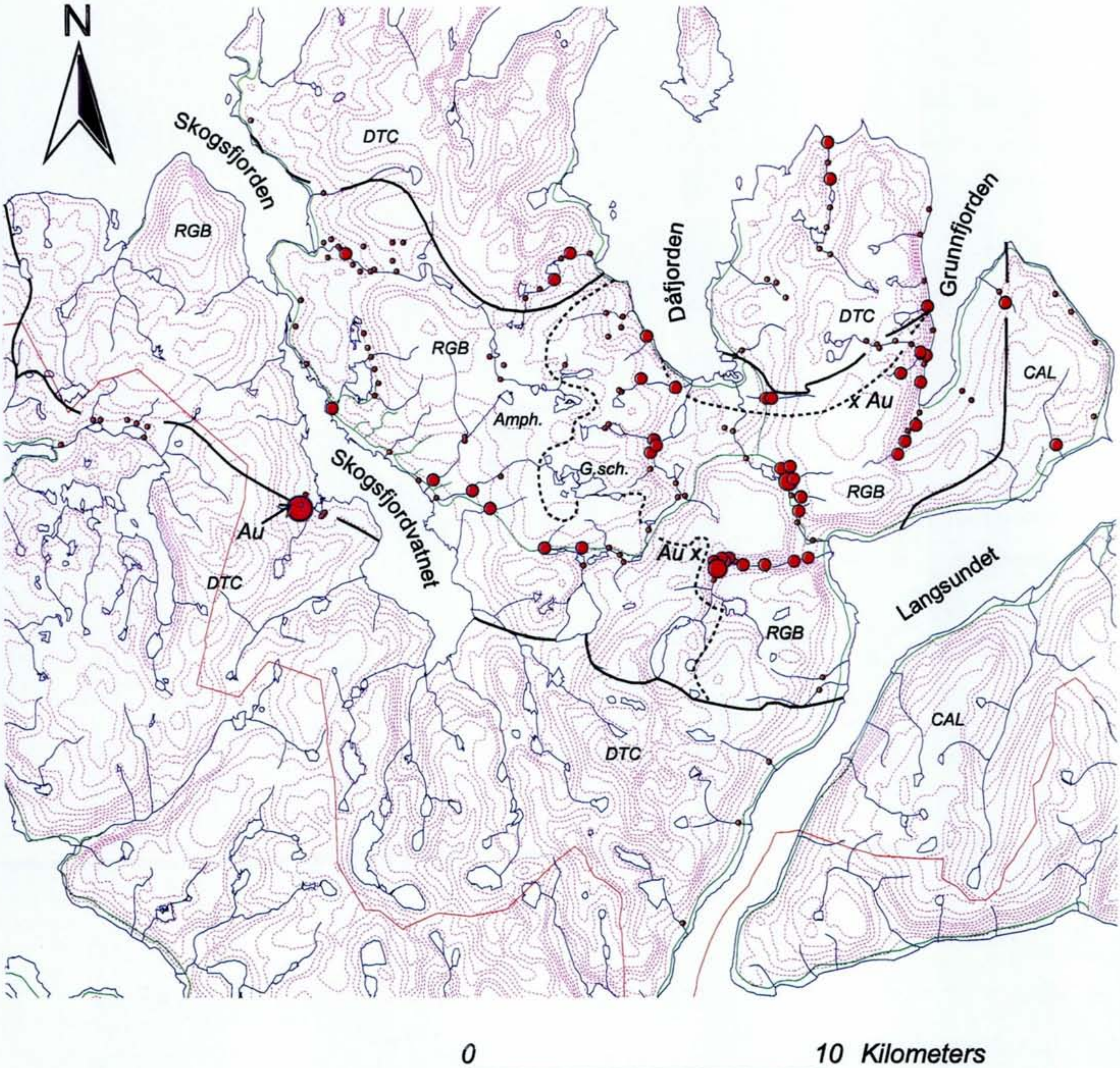
Normalised values in parts per billion

- < 500
- 500 - 1500
- 1500 - 3000
- > 3000

Max value: 5926
Min. value: 15

Fig. 10a: Regional distribution of silver in heavy mineral concentrates from panned stream sediments, normalised values.

Heavy minerals - Silver



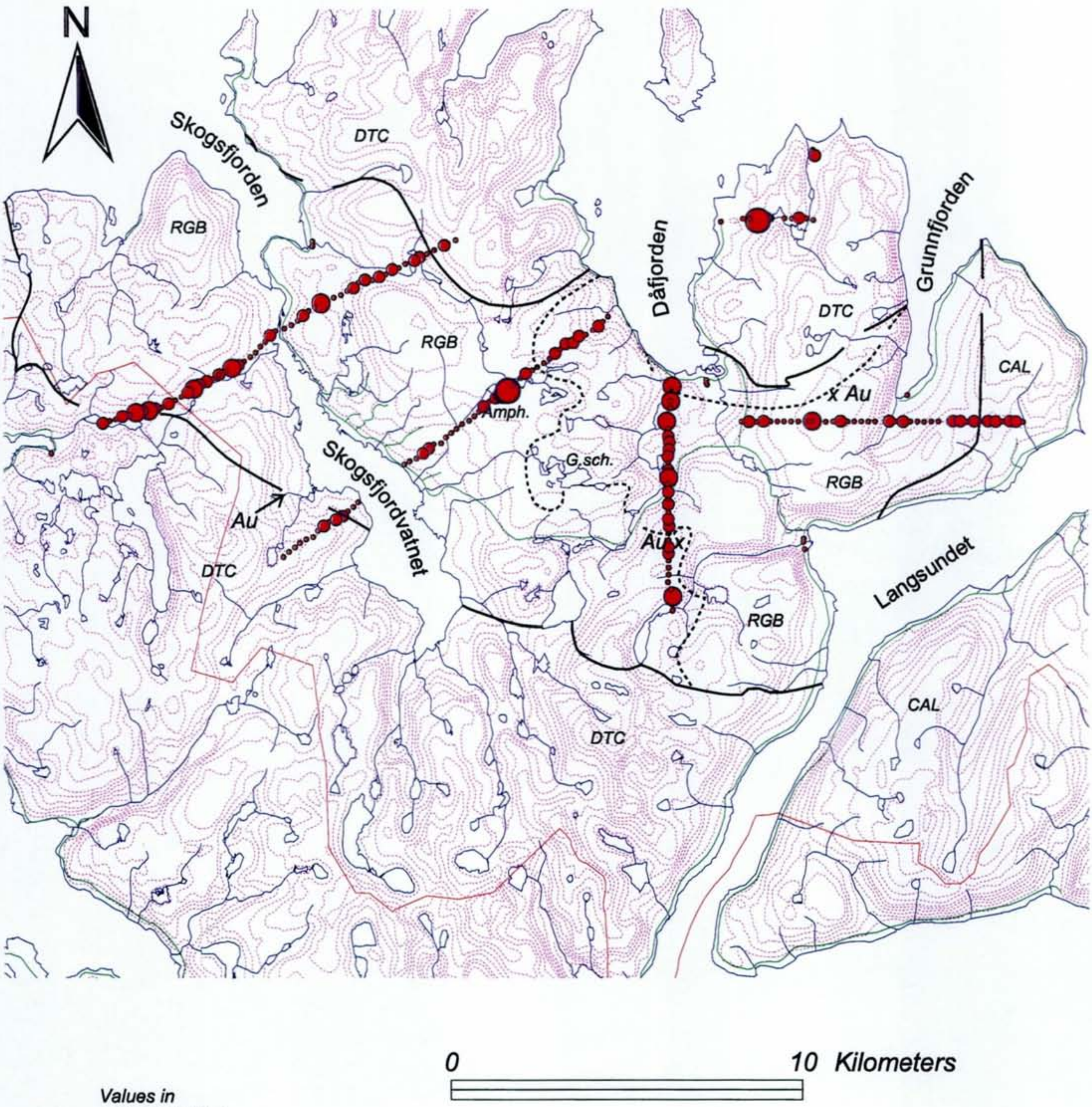
Analytical values in parts per billion

- < 500
- 500 - 1500
- 1500 - 3000
- > 3000

Max value: 3898
Min. value: 15

Fig. 10b: Regional distribution of silver in heavy mineral concentrates from panned stream sediments, analytical values.

Till - Silver



Values in parts per billion

- < 70
- 70 - 180
- 180 - 540
- \> 540

Max value: 1516
Min. value: 15

Fig. 10c: Distribution of silver in 5 sample profiles of till, C-horizon, across the RBG and the Helgøya shear zone in the DTC (Finne 2000).

Chip samples - Silver

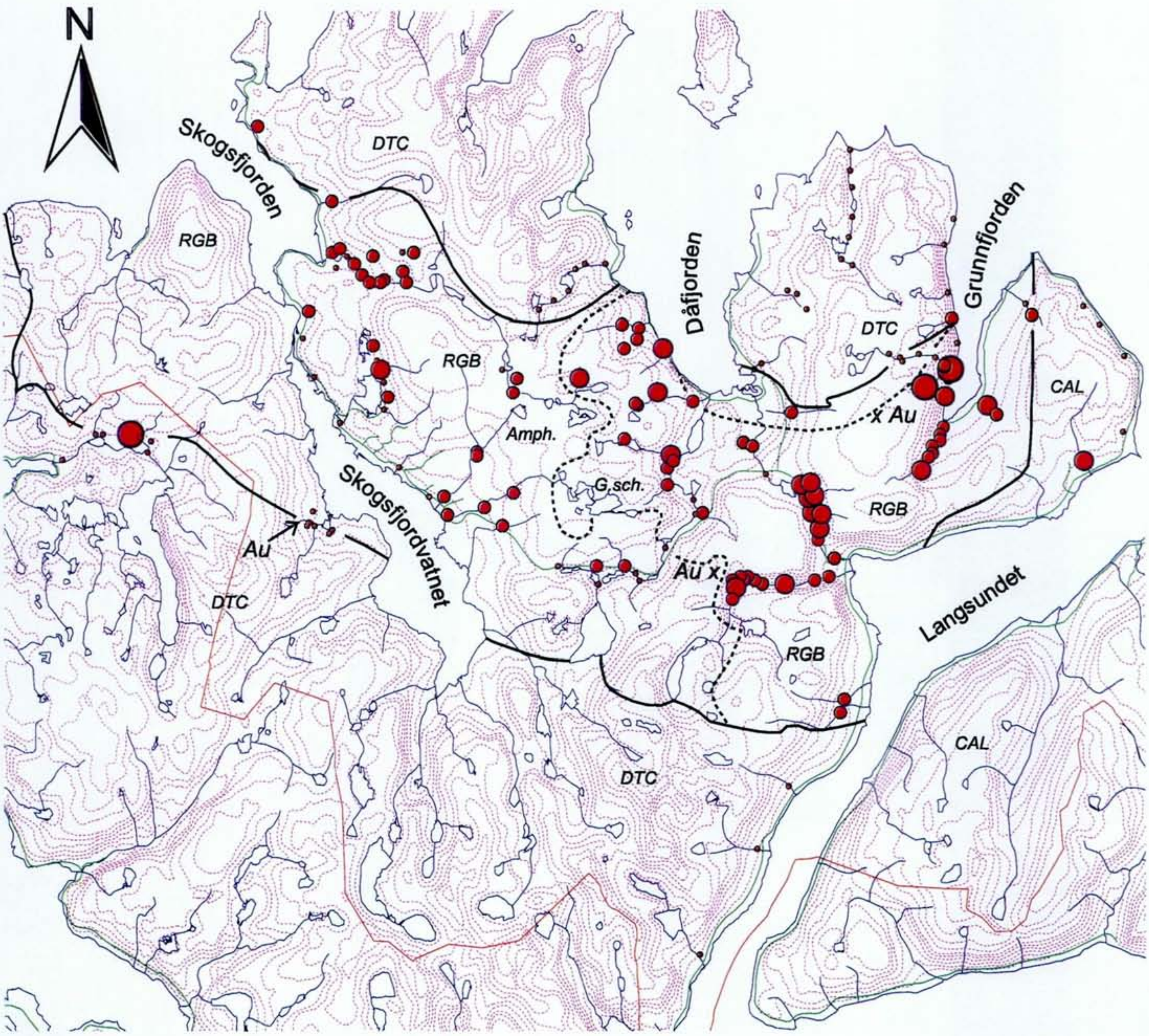
Values in parts per million

- < 2
- 2 - 10
- 10 - 20
- > 20

Max value: 37.9
Min. value: < 0.3

Fig. 10d: Regional distribution of silver in chip samples. Analytical values compiled from Sandstad and Nilsson (1998), Ihlen (2000) and NGU ore database.

Heavy minerals - Arsenic



0 10 Kilometers

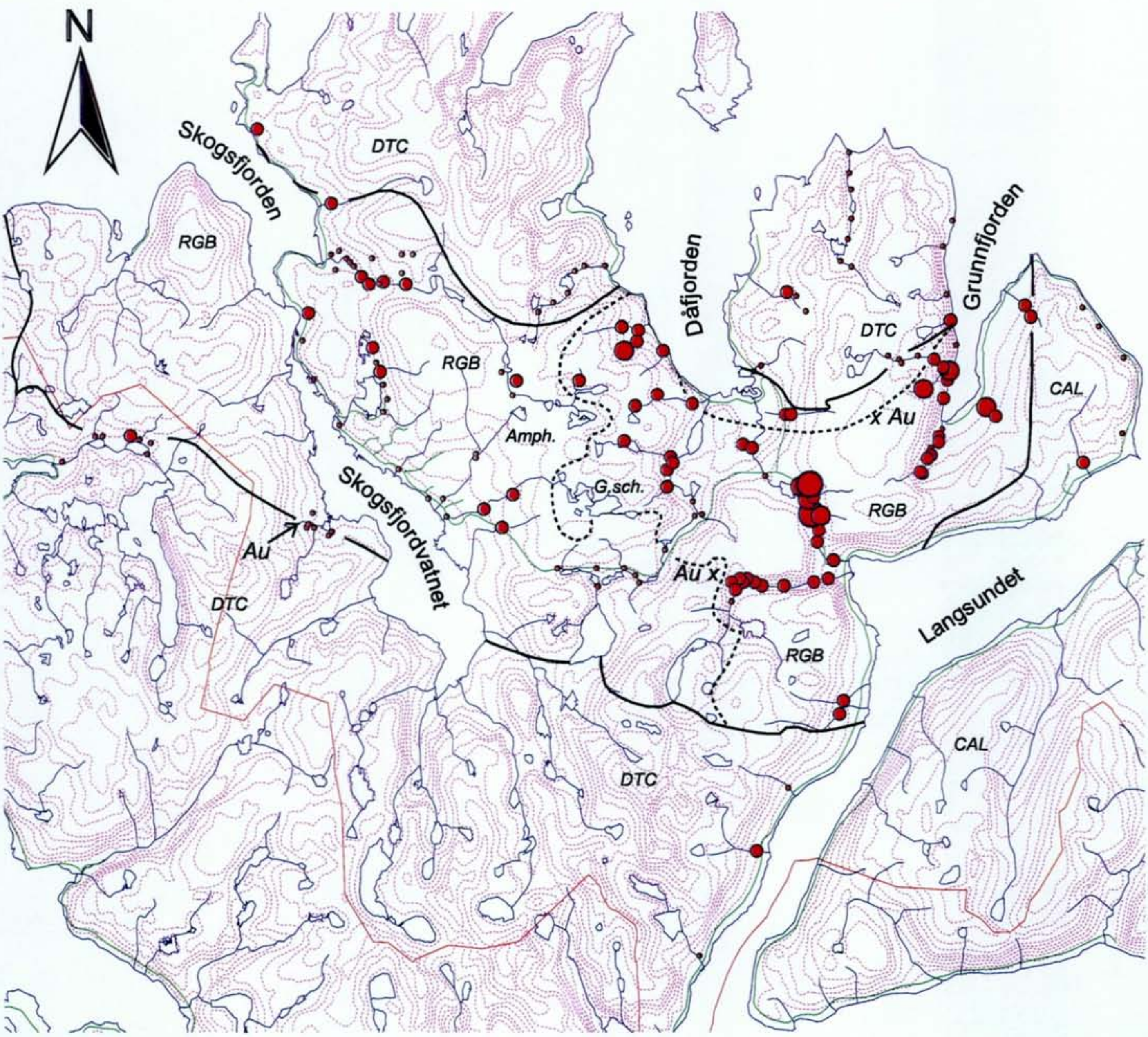
Normalised values in parts per million

- < 40
- 40 - 500
- 500 - 1000
- > 1000

Max value: 1708
Min. value: 0.2

Fig. 11a: Regional distribution of arsenic in heavy mineral concentrates from panned stream sediments, normalised values.

Heavy minerals - Arsenic



0 10 Kilometers

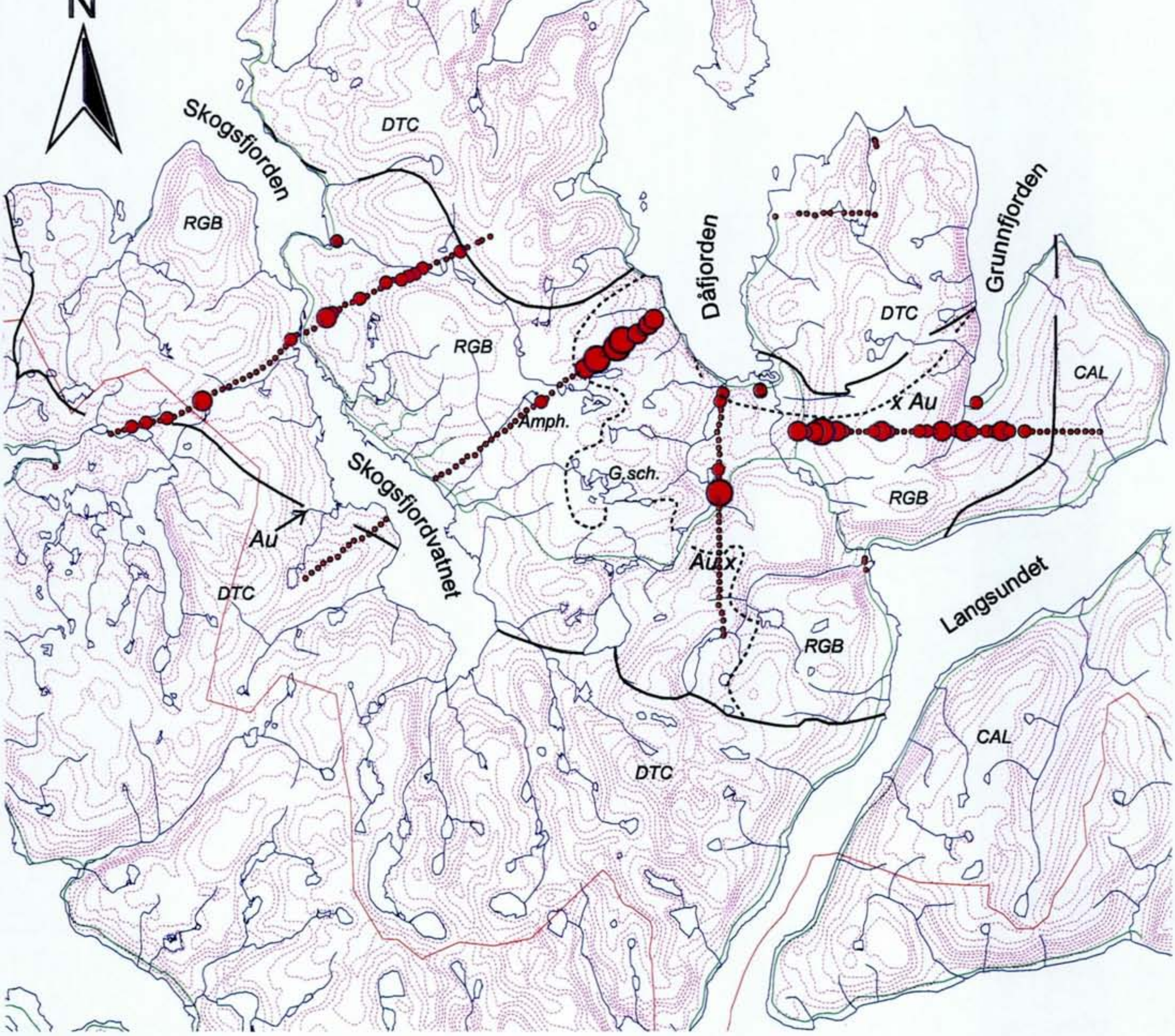
Analytical values in parts per million

- < 40
- 40 - 500
- 500 - 1000
- > 1000

Max value: 1716
Min. value: 0.8

Fig. 11b: Regional distribution of arsenic in heavy mineral concentrates from panned stream sediments, analytical values.

Till - Arsenic



0 10 Kilometers

Values in parts per million

- < 30
- 30 - 110
- 110 - 230
- > 230

Max value: 518.8
Min. value: 0.3

Fig. 11c: Distribution of arsenic in 5 sample profiles of till, C-horizon, across the RBG and the Helgøya shear zone in the DTC (Finne 2000).

Chip samples - Arsenic

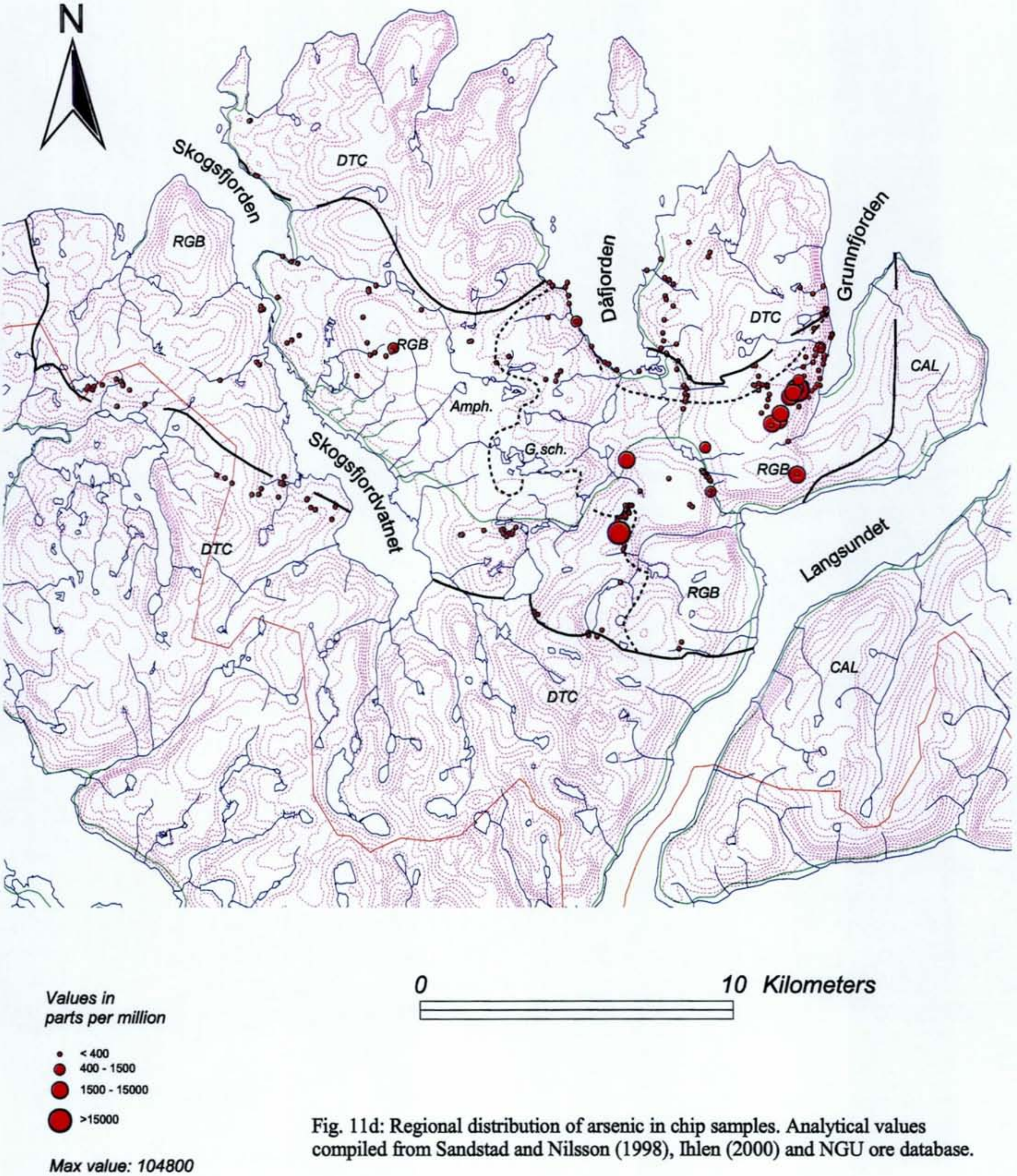


Fig. 11d: Regional distribution of arsenic in chip samples. Analytical values compiled from Sandstad and Nilsson (1998), Ihlen (2000) and NGU ore database.

Heavy minerals - Antimony

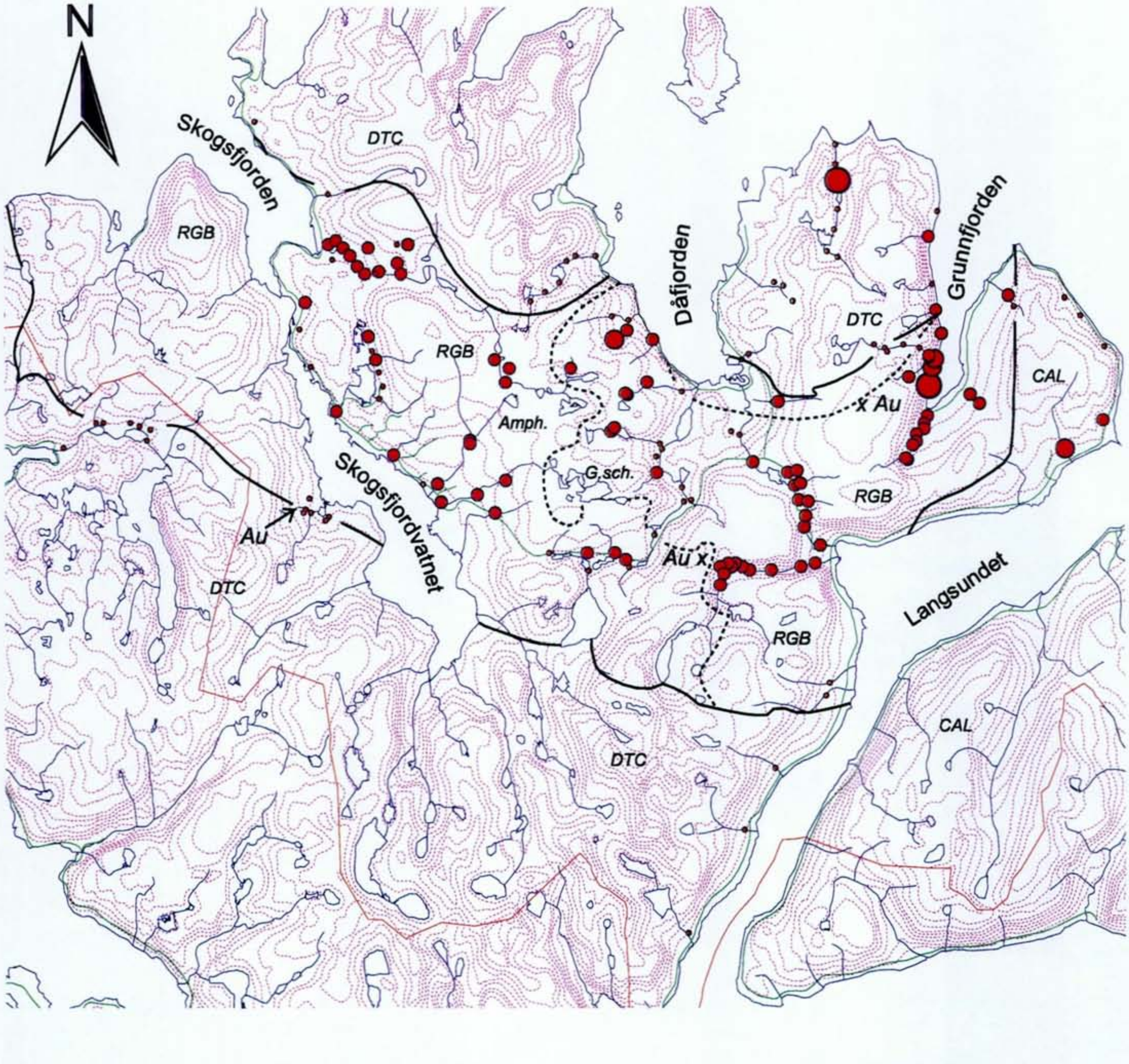
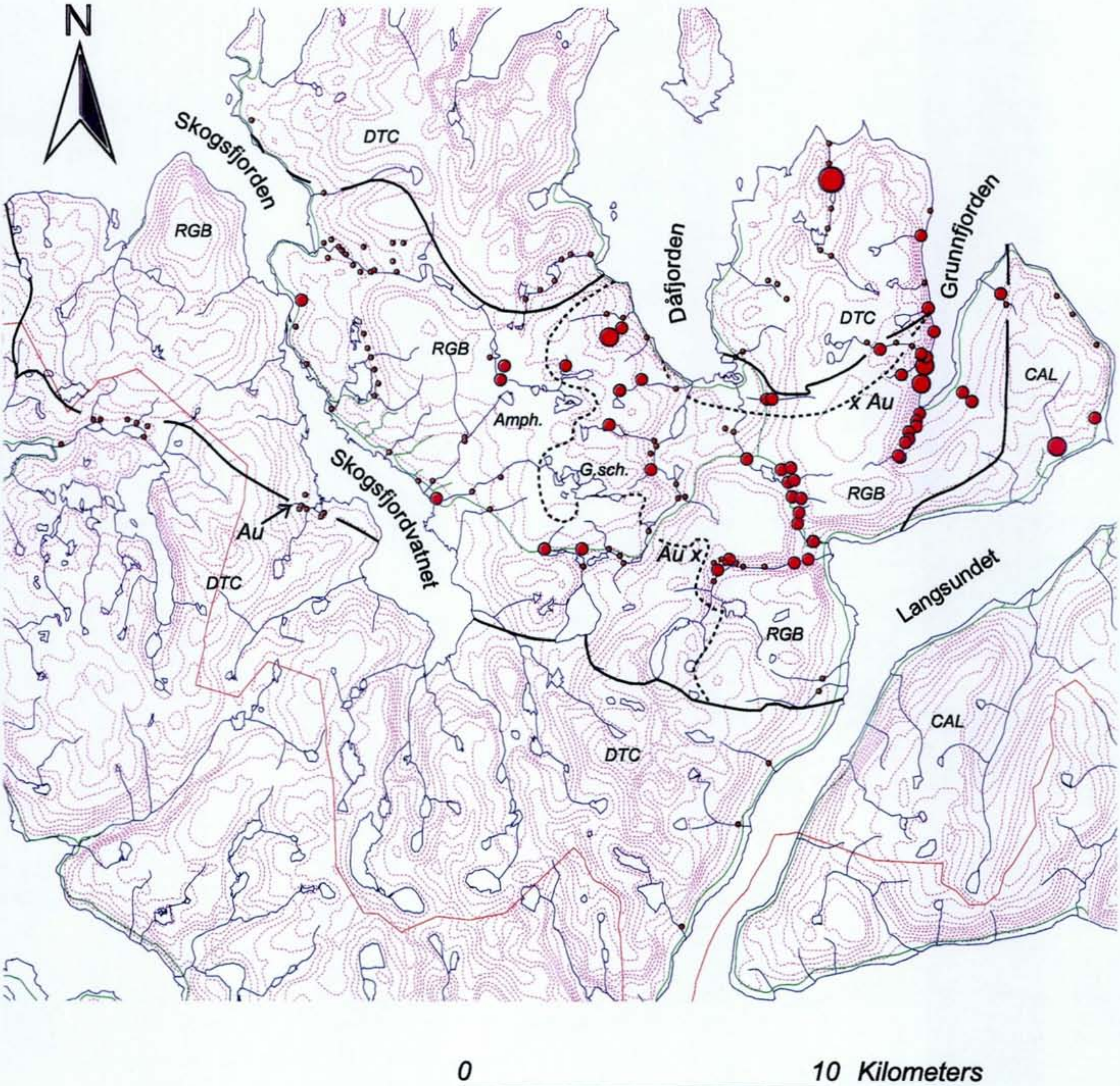


Fig. 12a: Regional distribution of antimony in heavy mineral concentrates from panned stream sediments, normalised values.

Heavy minerals - Antimony



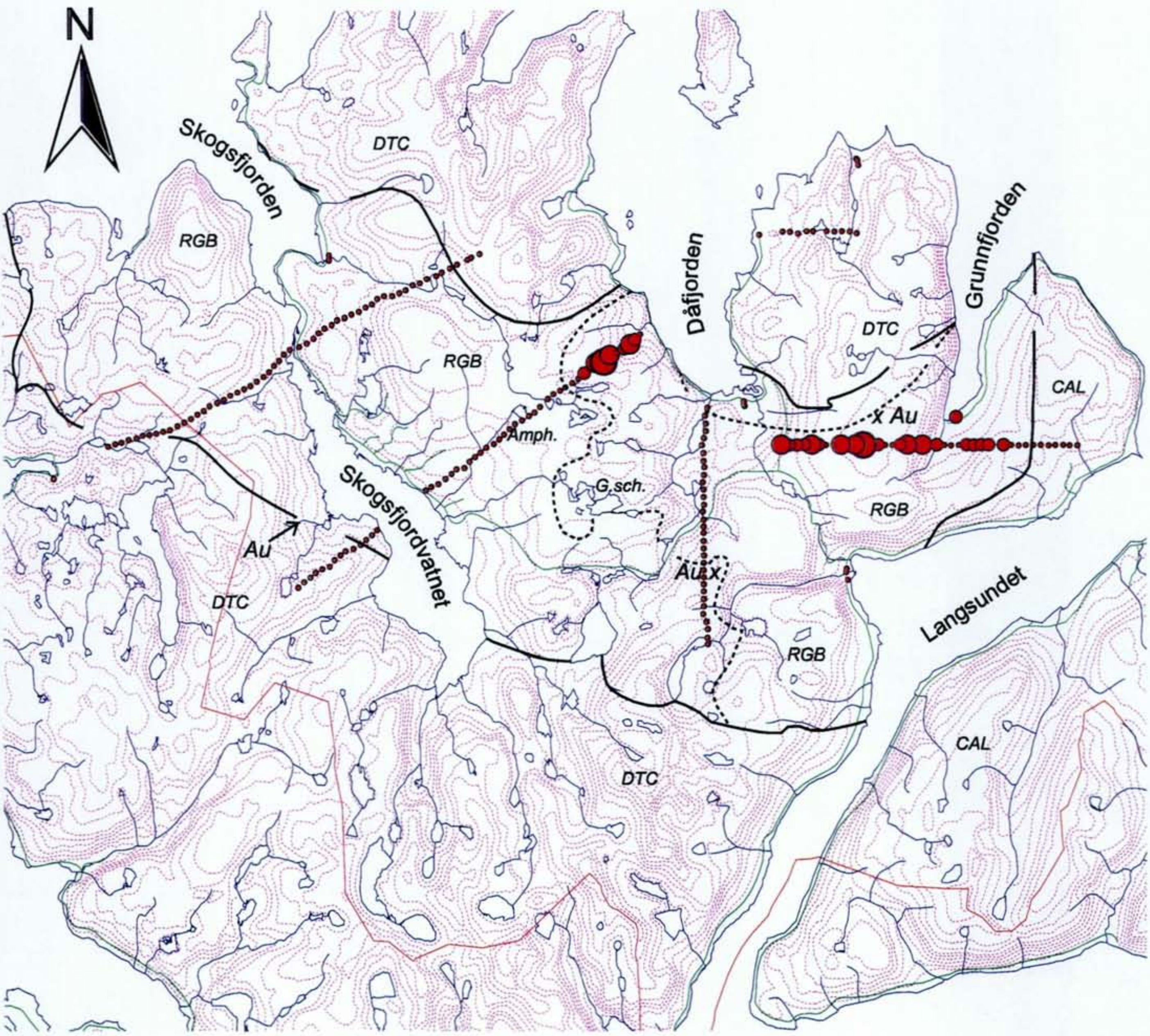
Analytical values in parts per million

- < 1
- 1 - 10
- 10 - 30
- > 30

Max value: 485
Min. value: 0.1

Fig. 12b: Regional distribution of antimony in heavy mineral concentrates from panned stream sediments, analytical values.

Till - Antimony



0 10 Kilometers

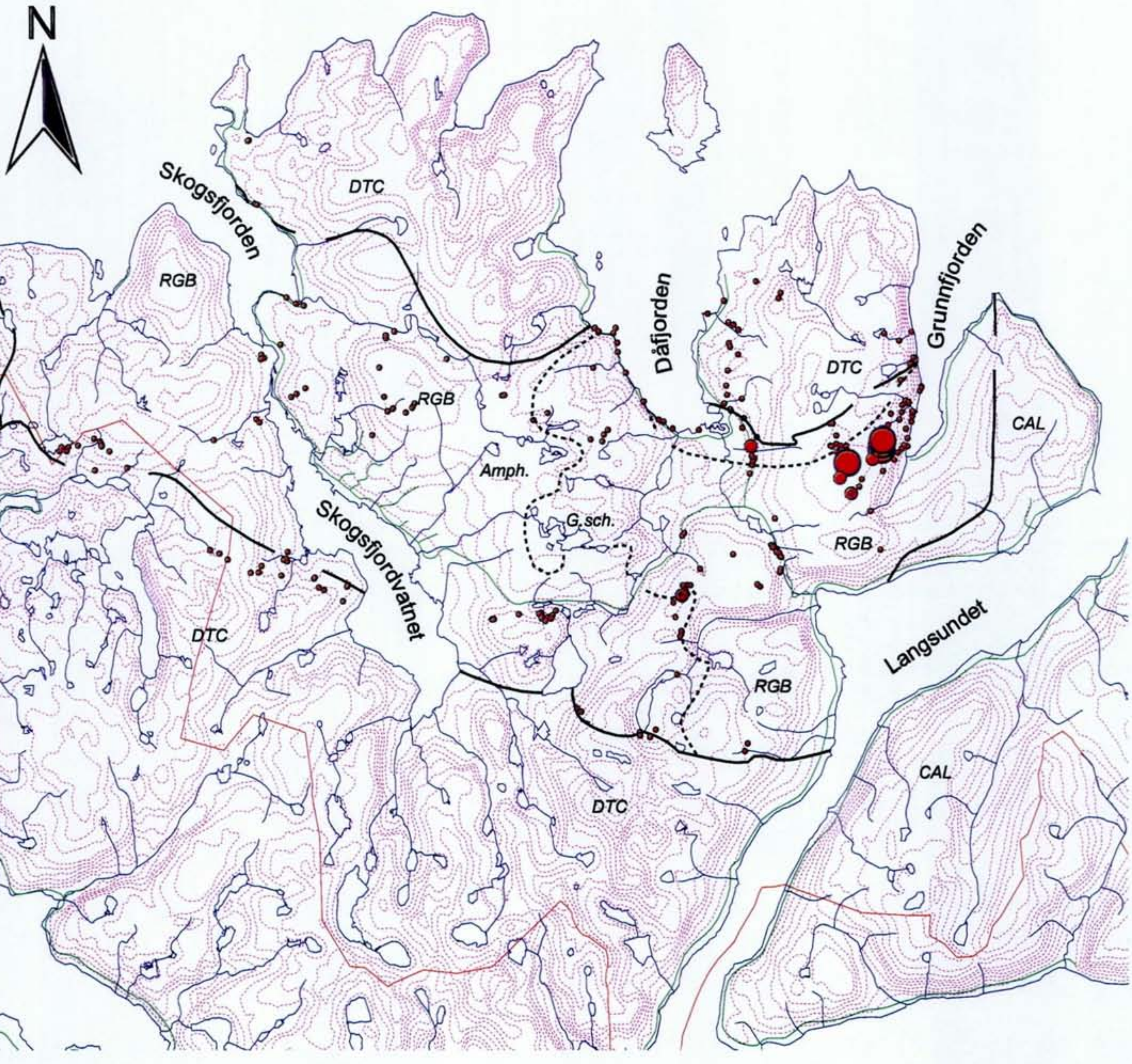
Values in parts per million

- < 3
- 3 - 7
- 7 - 14
- > 14

Max value: 28.6
Min. value: 0.1

Fig. 12c: Distribution of antimony in 5 sample profiles of till, C-horizon, across the RBG and the Helgøya shear zone in the DTC (Finne 2000).

Chip samples - Antimony



Values in parts per million

- < 500
- 500 - 4000
- 4000 - 20000
- > 20000

Max.value: 175600
Min. value: < 3

0 10 Kilometers

Fig. 12d: Regional distribution of antimony in chip samples. Analytical values compiled from Sandstad and Nilsson (1998), Ihlen (2000) and NGU ore database.

samples which show the highest values (29 ppm) in the greenschist facies domain, and in the same segments of the profiles showing enhanced As.

6.6. Bismuth, Bi

Bismuth contents are generally below 2 ppm with a maximum of 19 ppm in the Norddalen river. Most rock-forming minerals contain less than 1 ppm Bi (Ahrens and Erlank 1978). On Ringvassøy, samples enriched in Bi are mainly confined to the greenschist facies domain with only a few anomalous samples in the amphibolite facies domain and inside the DTC (Fig. 13a-b). The Caledonides are characterised by less than 1 ppm Bi. The till profiles show no systematic distribution of Bi on a regional scale, except that the tills covering the DTC and the Caledonides are low in Bi. The chip samples show enhanced contents of Bi in the Cu-sulphide occurrences at Nonsdagsdalen valley, at Gamnes, at Sørdalshøgda mountain,

Risdalsvatnet lake, at Blåfjell mountain, and at the eastern side of Hårskoltan mountain. Few of these occurrences appear to be reflected in enhanced Bi contents of the heavy minerals in rivers draining them.

6.7. Tellurium, Te

Tellurium is normally, on a global scale, found associated with sulphides or separate (gold)-telluride mineralisation. The crust contains an average of about 2 ppb Te. However, specific enrichment trends of Te among the rock-forming minerals are missing due to absence of analytical data (Leutwein 1972a,b). The heavy-mineral concentrates from the RGB reach a maximum of 2 ppm Te which appears to be concentrated in the greenschist facies domain. Most of the samples in the RGB contain less than 1 ppm and 55% of them are below detection limit at 0.1 ppm. Samples taken inside the DTC and the Caledonides yield normally values below 0.2 ppm Te. The till samples with a maximum of 0.6 ppm Te show no characteristic enrichment in the greenschist facies domain. Rather the opposite seems to be the case. None of the chip samples have been analysed for Te. For reasons of the low concentration, Te distribution is not shown on the figures.

6.8. Copper, Cu

Background levels of copper in ferromagnesian silicates and Fe-Ti-oxides are normally below 250 ppm Cu (Wedepohl 1974a). The heavy-mineral concentrates contain Cu in the range 9 to 9868 ppm. The element is rather evenly distributed within the RGB with some local clusters of anomalous samples exceeding 500 ppm in its eastern part, e.g. in Hamnelva river in Grunnfjord, in Norddalen, and in Sørdalen (Fig. 14a-b). The two former areas contain zones of stratabound sulphide ores which are intersected by streams (Fig. 14d), wheras the anomalous point in Nonsdagsdalen river is caused by a known auriferous and Cu-rich mineralisation along the river (Sandstad and Nilsson 1998). The streams in the westernmost part of the RGB, and in the DTC and the Caledonides carry mostly background values with the exception of some weakly anomalous streams along the western side of Grunnfjord which drain sheared meta-dolerites and tonalites.

Heavy minerals - Bismuth

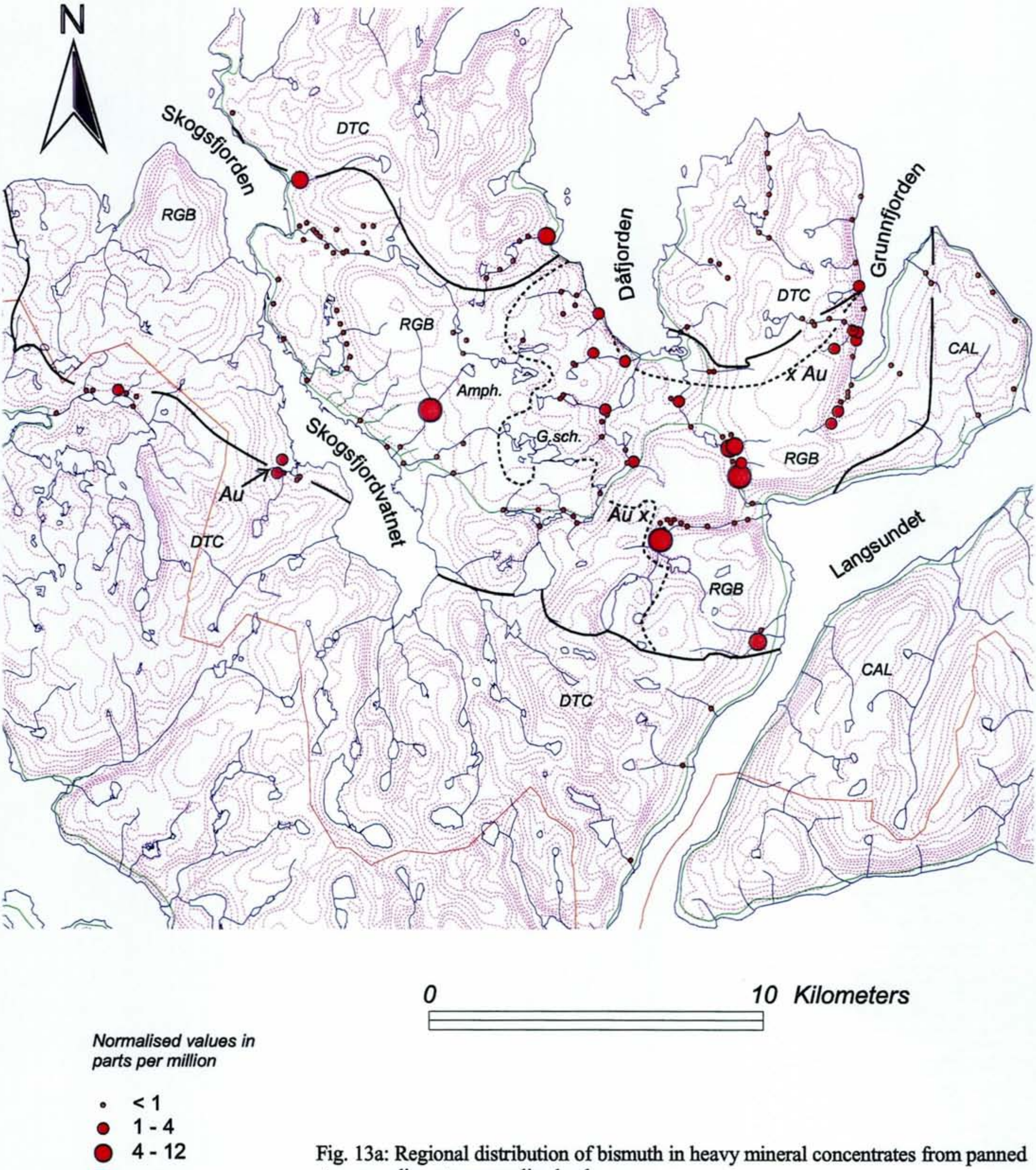
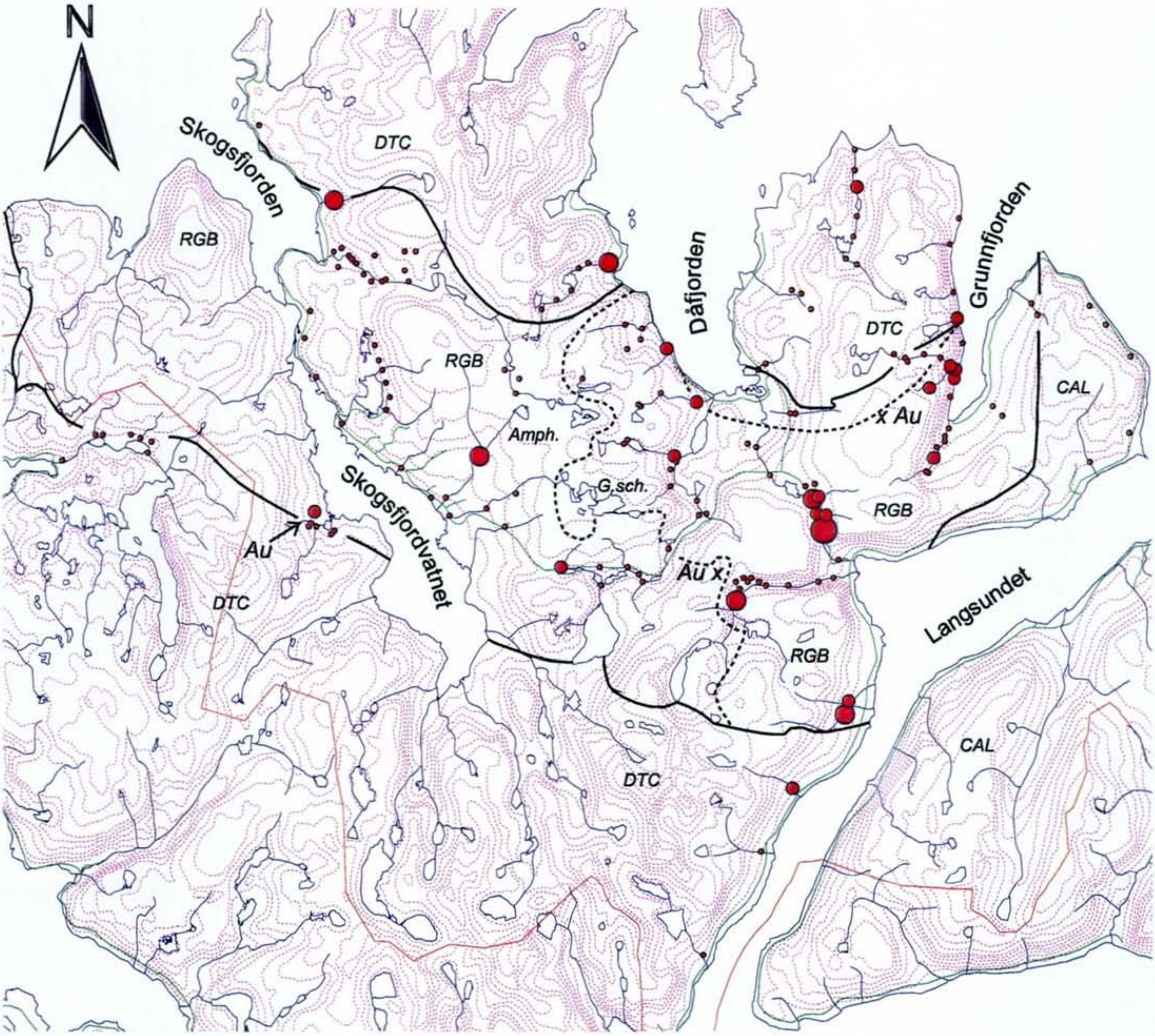


Fig. 13a: Regional distribution of bismuth in heavy mineral concentrates from panned stream sediments, normalised values.

Heavy minerals - Bismuth



0 10 Kilometers

Analytical values in parts per million

- < 1
- 1 - 3
- 3 - 6
- > 6

Max value: 19
Min. value: 0.1

Fig. 13b: Regional distribution of bismuth in heavy mineral concentrates from panned stream sediments, analytical values.

Till - Bismuth

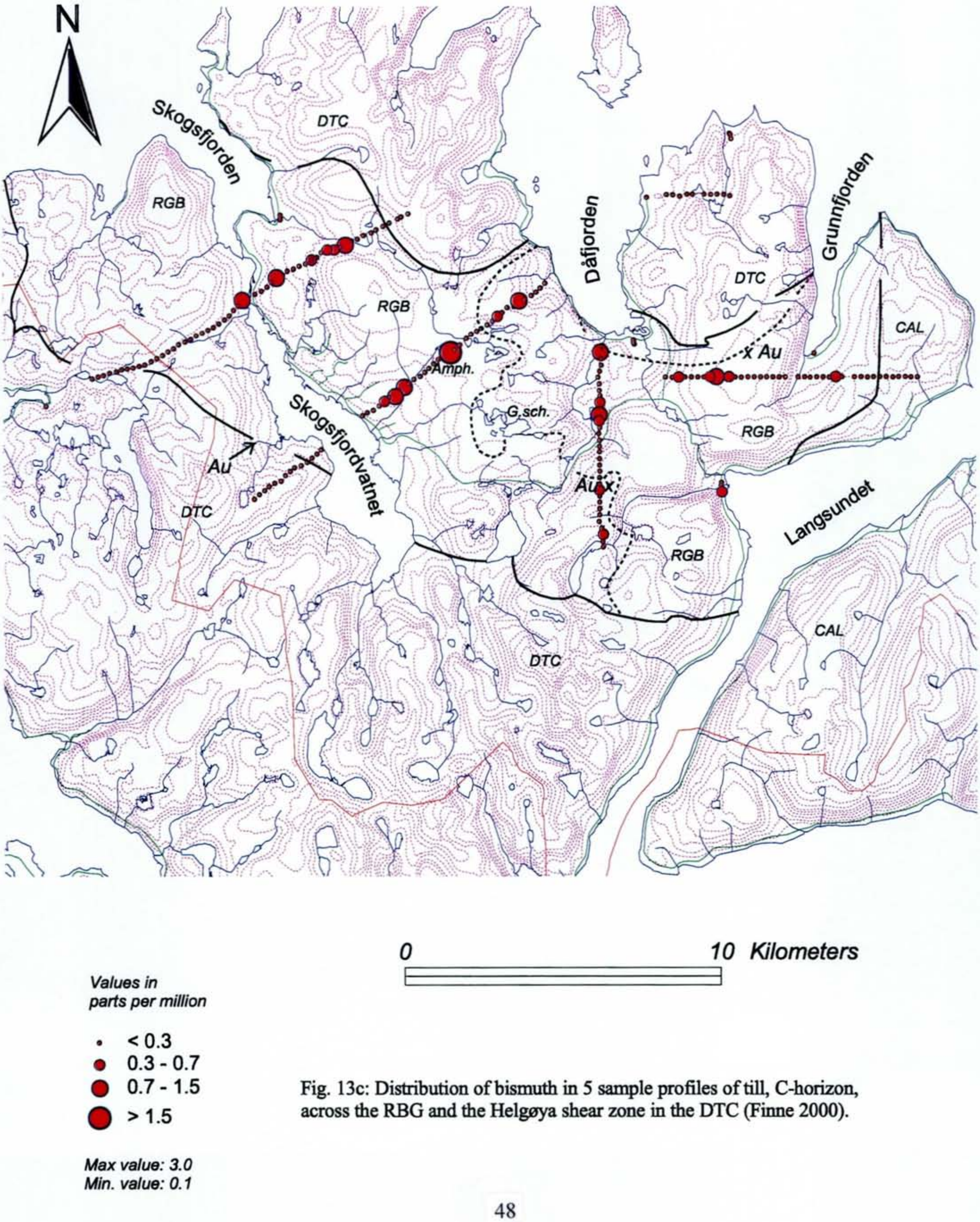


Fig. 13c: Distribution of bismuth in 5 sample profiles of till, C-horizon, across the RBG and the Helgøya shear zone in the DTC (Finne 2000).

Chip samples - Bismuth

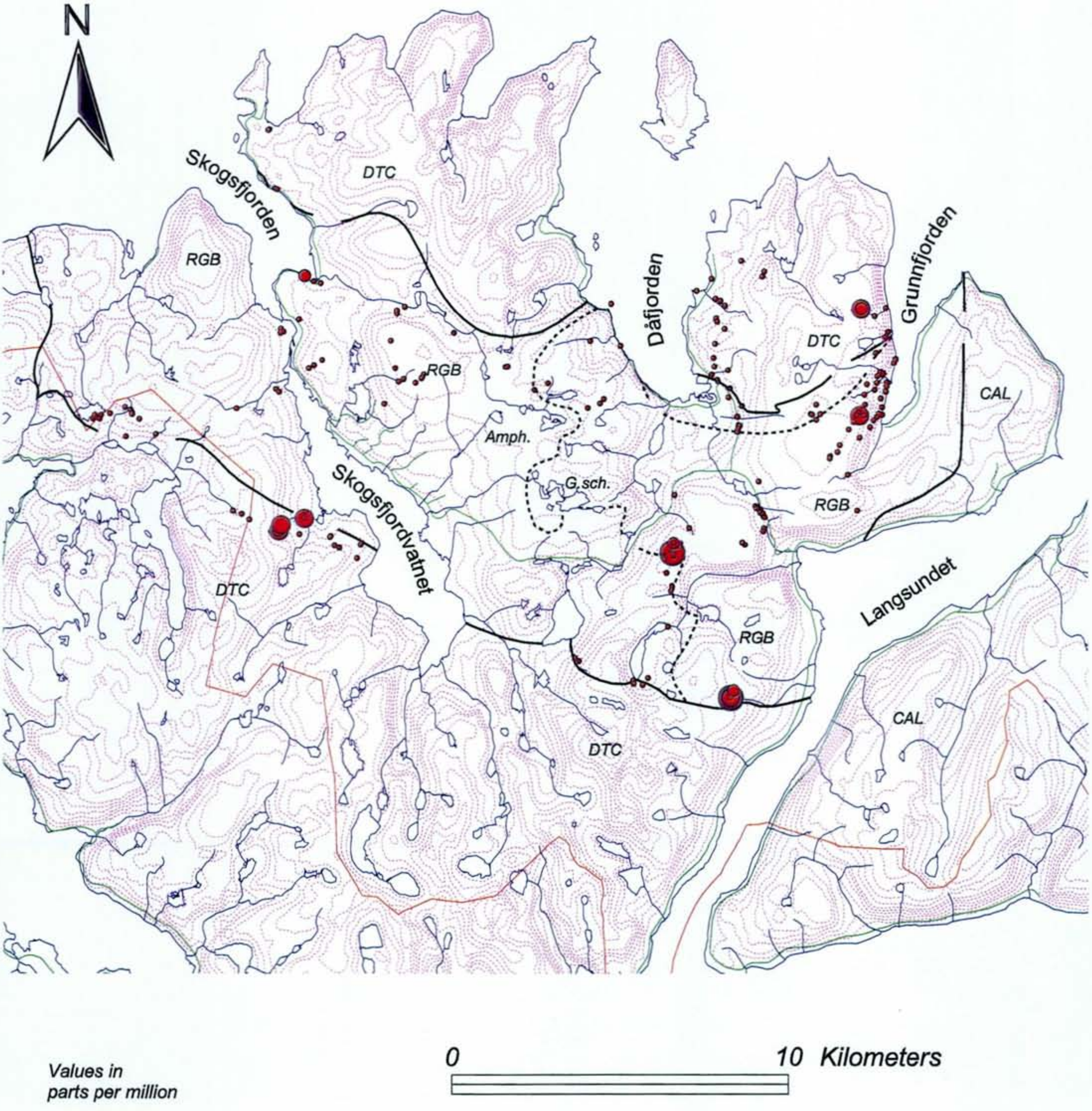
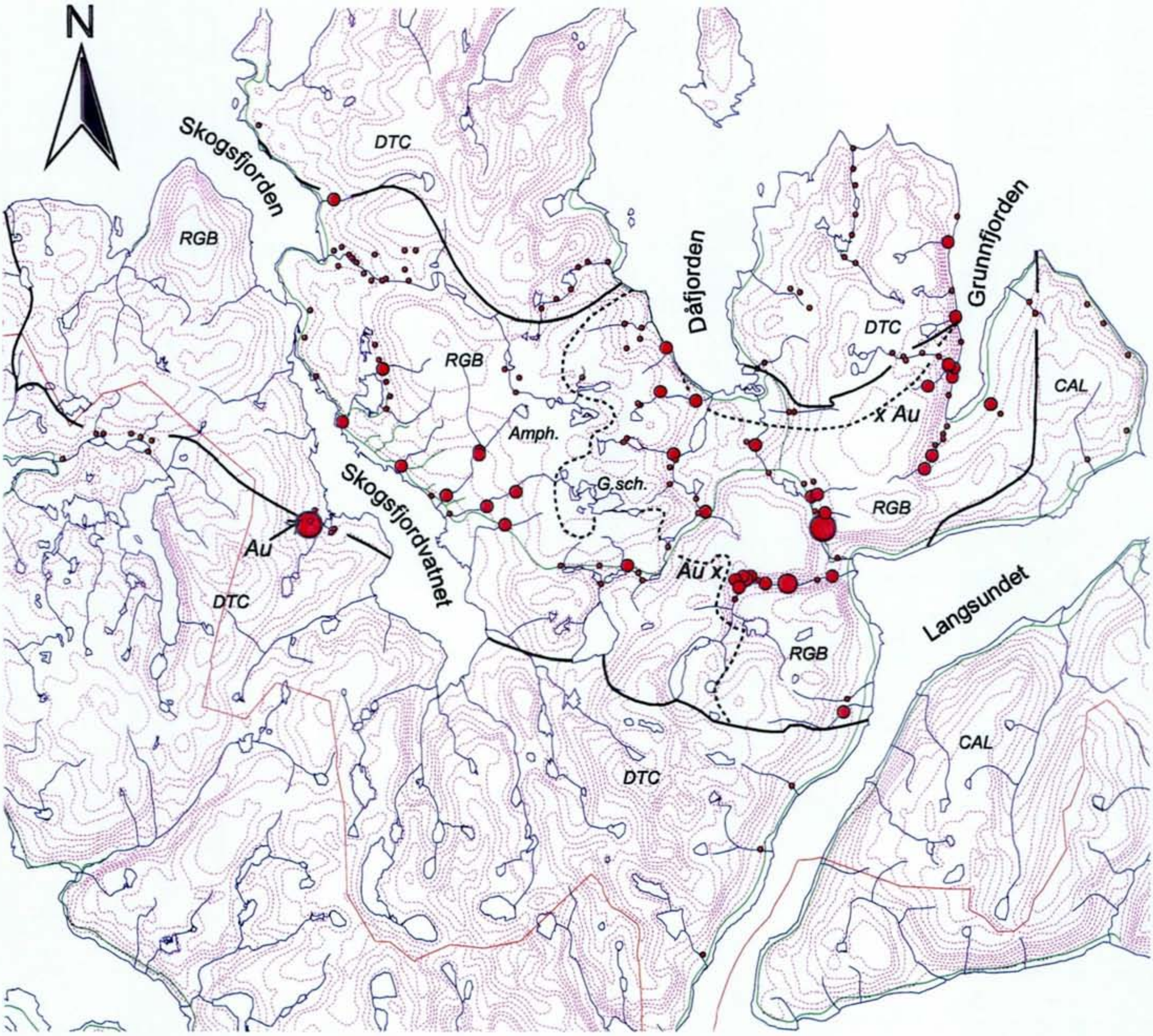


Fig. 13d: Regional distribution of bismuth in chip samples. Analytical values compiled from Sandstad and Nilsson (1998), Ihlen (2000) and NGU ore database.

Heavy minerals - Copper



0 10 Kilometers

Normalised values in parts per million

- < 250
- 250 - 1500
- 1500 - 5000
- > 5000

Max value: 13874
Min. value: 5

Fig. 14a: Regional distribution of copper in heavy mineral concentrates from panned stream sediments, normalised values.

Heavy minerals - Copper

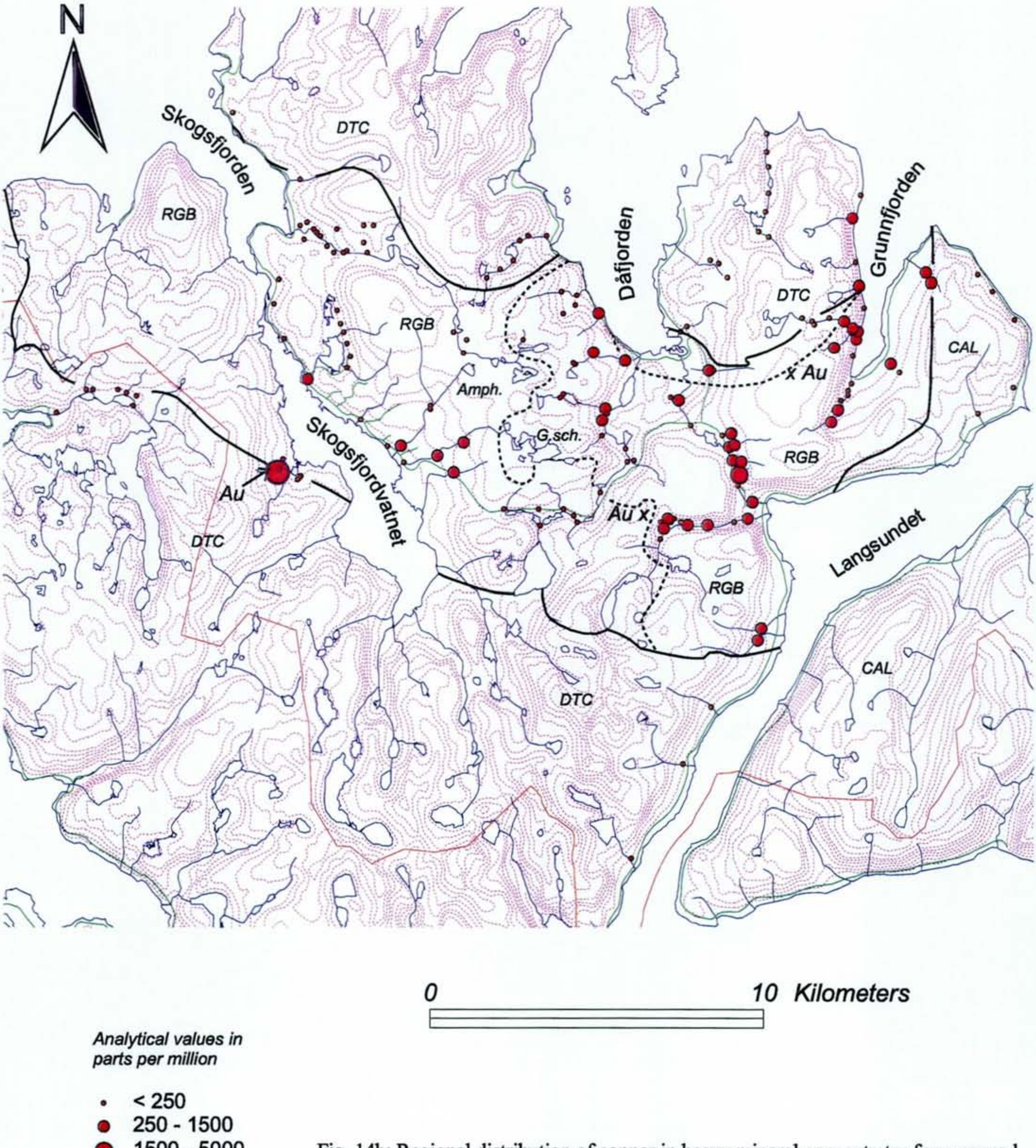


Fig. 14b: Regional distribution of copper in heavy mineral concentrates from panned stream sediments, analytical values.

Till - Copper

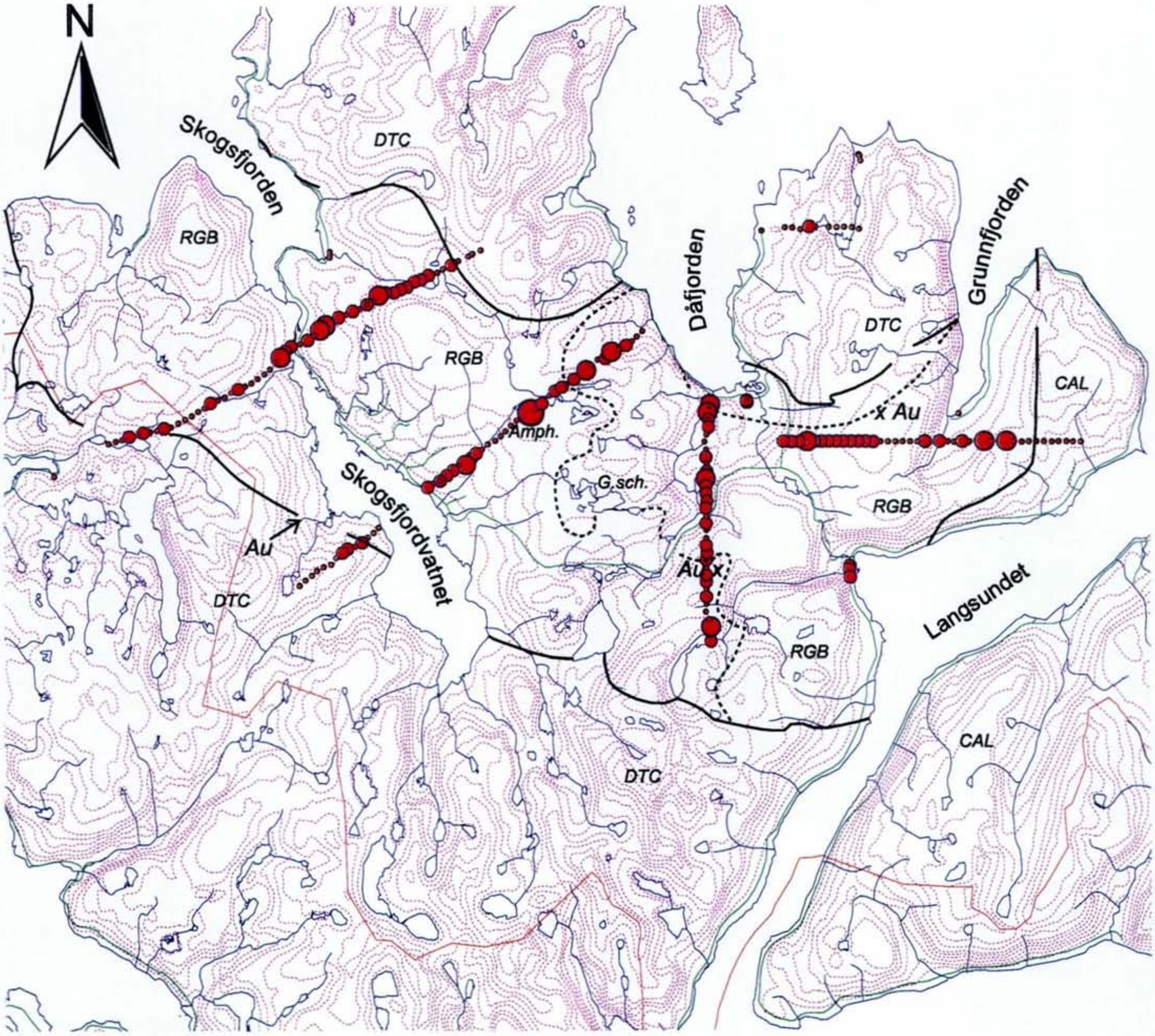


Fig. 14c: Distribution of copper in 5 sample profiles of till, C-horizon, across the RBG and the Helgøya shear zone in the DTC (Finne 2000).

Chip samples - Copper

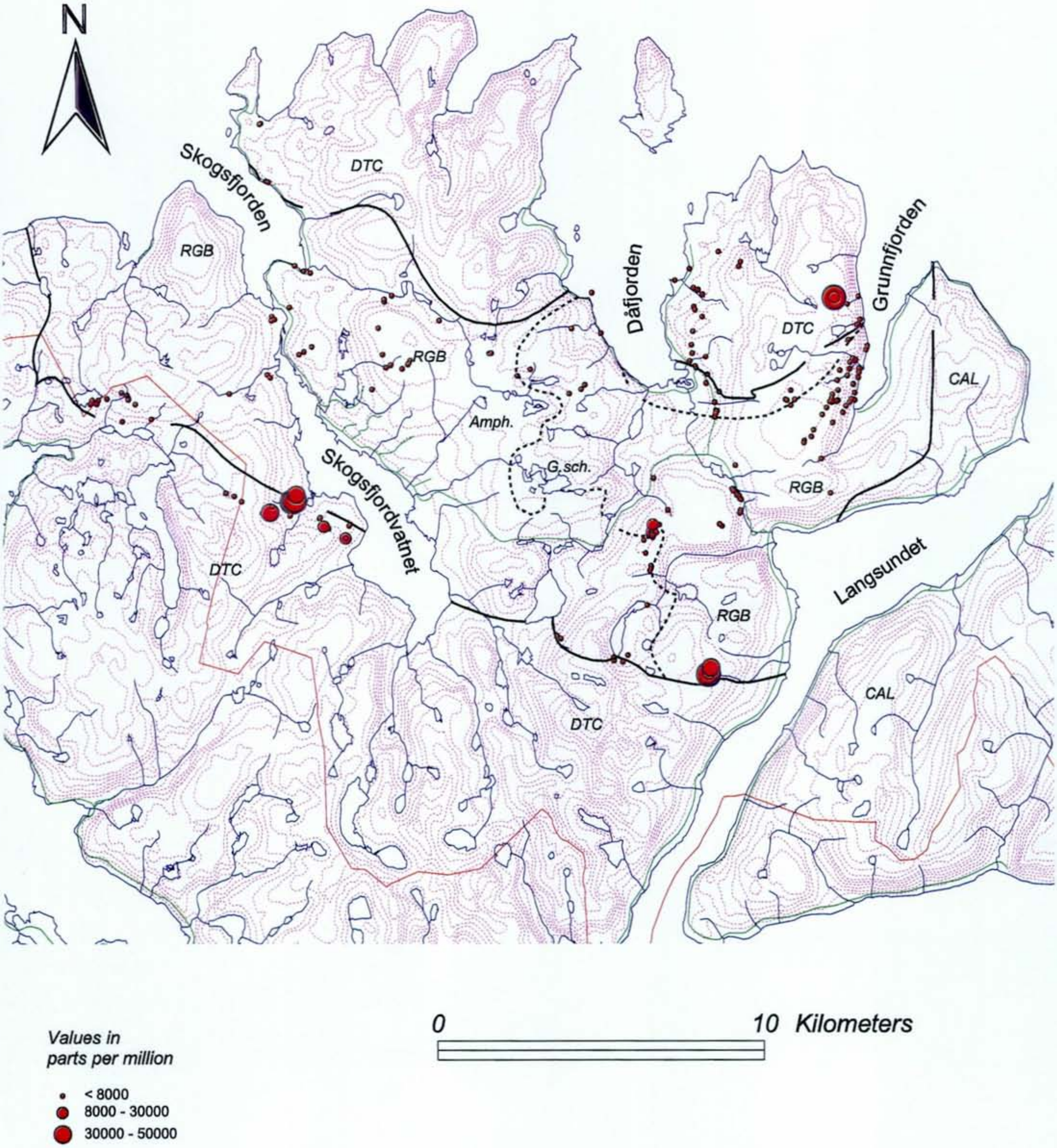


Fig. 14d: Regional distribution of copper in chip samples. Analytical values compiled from Sandstad and Nilsson (1998), Ihlen (2000) and NGU ore database.

The copper contents of the till C-horizon inside the RGB (Fig. 14c), which reach a maximum of 1600 ppm Cu, are more evenly distributed between the metamorphic domains than shown by the heavy-mineral concentrates.

Chip samples with less than 2.5% Cu are evenly distributed throughout the RGB. High concentrations exceeding 5% Cu are typical for the samples from Risdalsvatn, Nonsdagsdalen and Gamnes prospects. Most of the Cu-rich ore occurrences are reflected in anomalous Cu contents of the heavy minerals in the neighbouring river systems, although some of them escaped detection, e.g. the Cu-sulphide occurrences at Risdalsvatn and Nordkjosvatn.

6.9. Cobalt, Co, and Nickel, Ni

Cobalt and nickel are both chalcophile elements which substitute for iron and magnesium in mafic rock-forming minerals and for iron in sulphides and oxides. The Co contents of mafic silicates and Fe-Ti-oxides in intrusives, volcanites and metamorphic rocks are generally below 100 ppm (Turekian 1978a) whereas the Ni concentrations are normally 5-10 times

higher, with an overall average of about 500 ppm, excluding olivine and secondary minerals after olivine (Turekian 1978b).

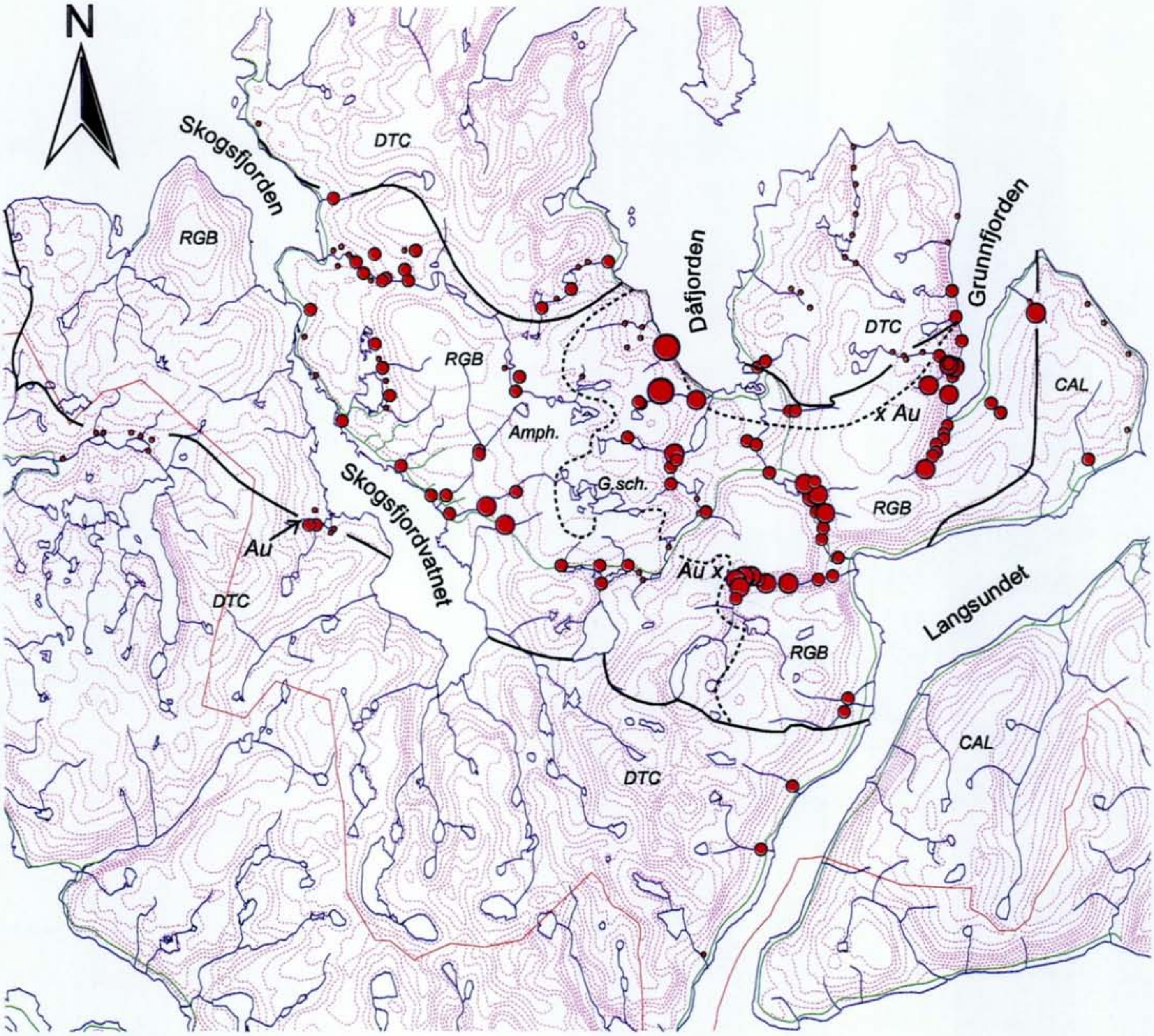
A very high proportion of the heavy-mineral samples contain more Co than the normal background level for rock-forming minerals (Fig. 15a-b). Cobalt appears overall to be evenly distributed, although a large proportion of samples within the Caledonides and the DTC show background levels of Co, whereas strongly anomalous samples are mainly confined to the greenschist facies domain with a maximum of 2136 ppm in a small stream running into Dåfjord from the west. A similar, even distribution of Co is also shown by the till samples with abundant strong anomalies in the range 70-150 ppm in both metamorphic domains and low values in the DTC (Fig. 15c). The Co contents of the chip samples are distributed in a similar way as the other sample media and with maximum contents (330-1710 ppm) in Ni-enriched pyrrhotite mineralisation at Nonsdagsdalen and Soltindvatn lake. Most of the stratabound sulphide mineralisations carry less than 100 ppm Co (Fig. 15d).

The heavy minerals in the stream sediments contain a maximum of 182 ppm Ni which is considered well within the background range for rock-forming minerals. Nickel appear to be evenly distributed within the RGB, the DTC and the Caledonides, including samples of heavy-mineral concentrates, tills (max. 730 ppm) and hard-rocks (max. 960 ppm). Figures showing the distribution of Ni in heavy-mineral concentrates and tills, have been excluded due to the general background levels of Ni. High concentrations of Ni in the chip samples are found in pyrrhotite-bearing amphibolites and greenstones in the Nonsdagsdalen area and at Grunnfjorden, respectively (Fig. 15e).

6.10. Zinc, Zn, and cadmium, Cd

Zinc values in the range 12 ppm to 534 ppm occur evenly distributed throughout the RGB with the highest value in the heavy-mineral concentrate from a small stream running into Grunnfjorden from the east. Normal background values of Zn in mafic minerals and Fe-Ti oxides on a global scale fall in the range 25-4000 ppm and with particular enrichment in Fe-oxides of igneous rocks, averaging about 550 ppm Zn (Wedepohl 1972). This means that most

Heavy minerals - Cobalt



0 10 Kilometers

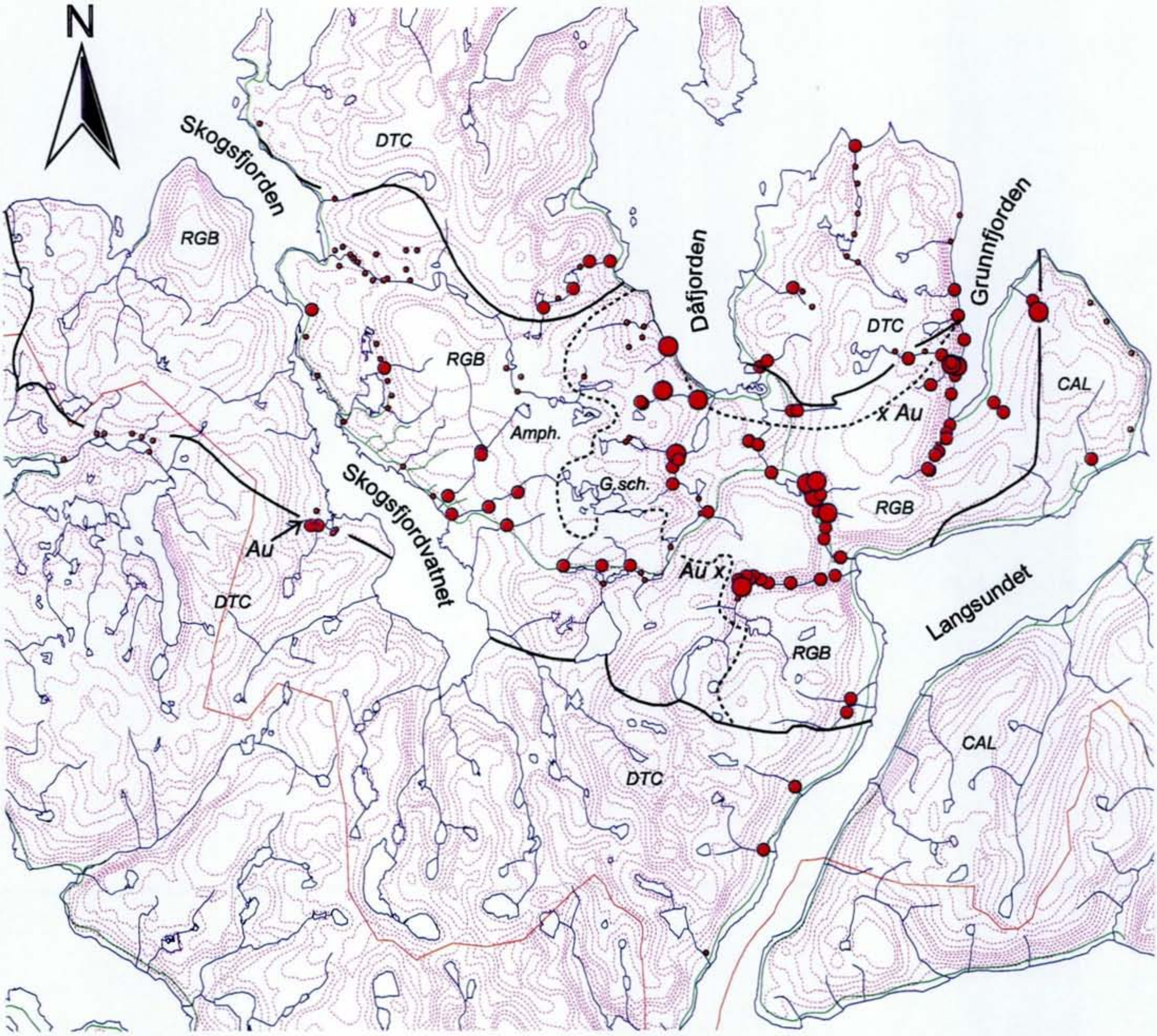
Normalised values in parts per million

- < 100
- 100 - 1000
- 1000 - 3000
- > 3000

Max value: 4614
Min. value: 2

Fig. 15a: Regional distribution of cobalt in heavy mineral concentrates from panned stream sediments, normalised values.

Heavy minerals - Cobalt



0 10 Kilometers

Analytical values in parts per million

- < 100
- 100 - 1000
- 1000 - 3000
- > 3000

Max value: 2136
Min. value: 4

Fig. 15b: Regional distribution of cobalt in heavy mineral concentrates from panned stream sediments, analytical values.

Till - Cobalt

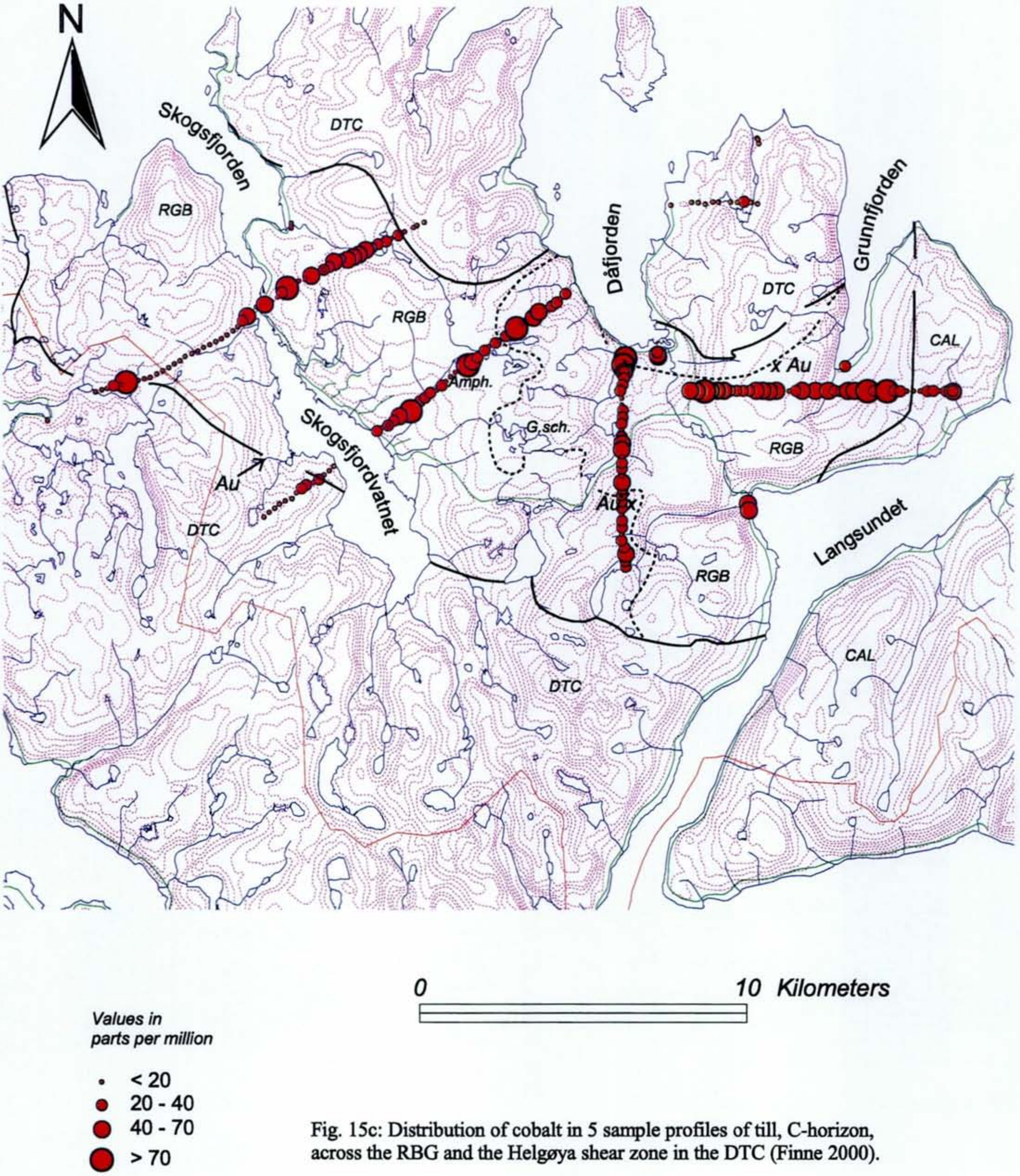


Fig. 15c: Distribution of cobalt in 5 sample profiles of till, C-horizon, across the RBG and the Helgøya shear zone in the DTC (Finne 2000).

Chip samples - Cobalt

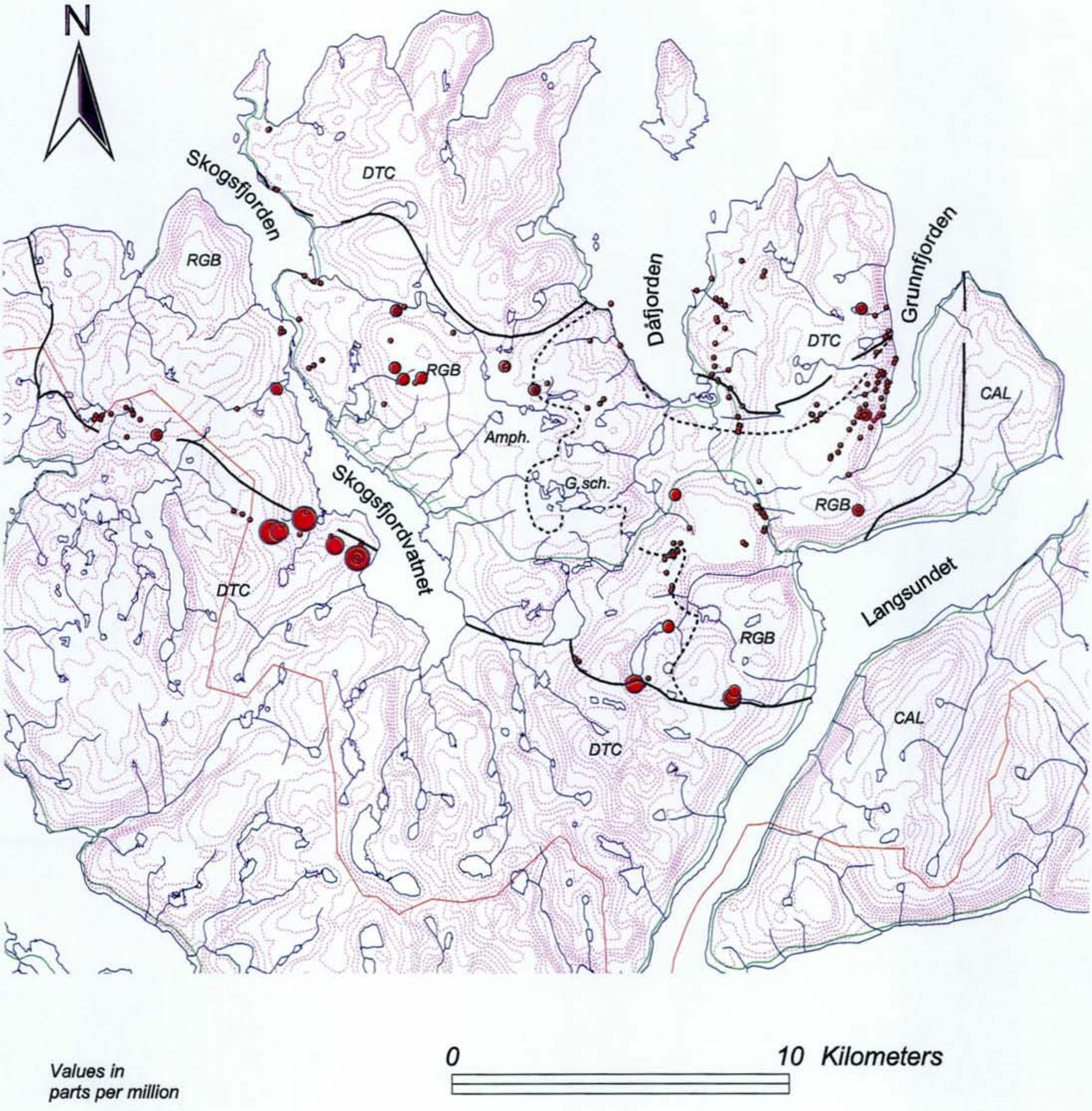


Fig. 15d: Regional distribution of cobalt in chip samples. Analytical values compiled from Sandstad and Nilsson (1998), Ihlen (2000) and NGU ore database.

Chip samples - Nickel

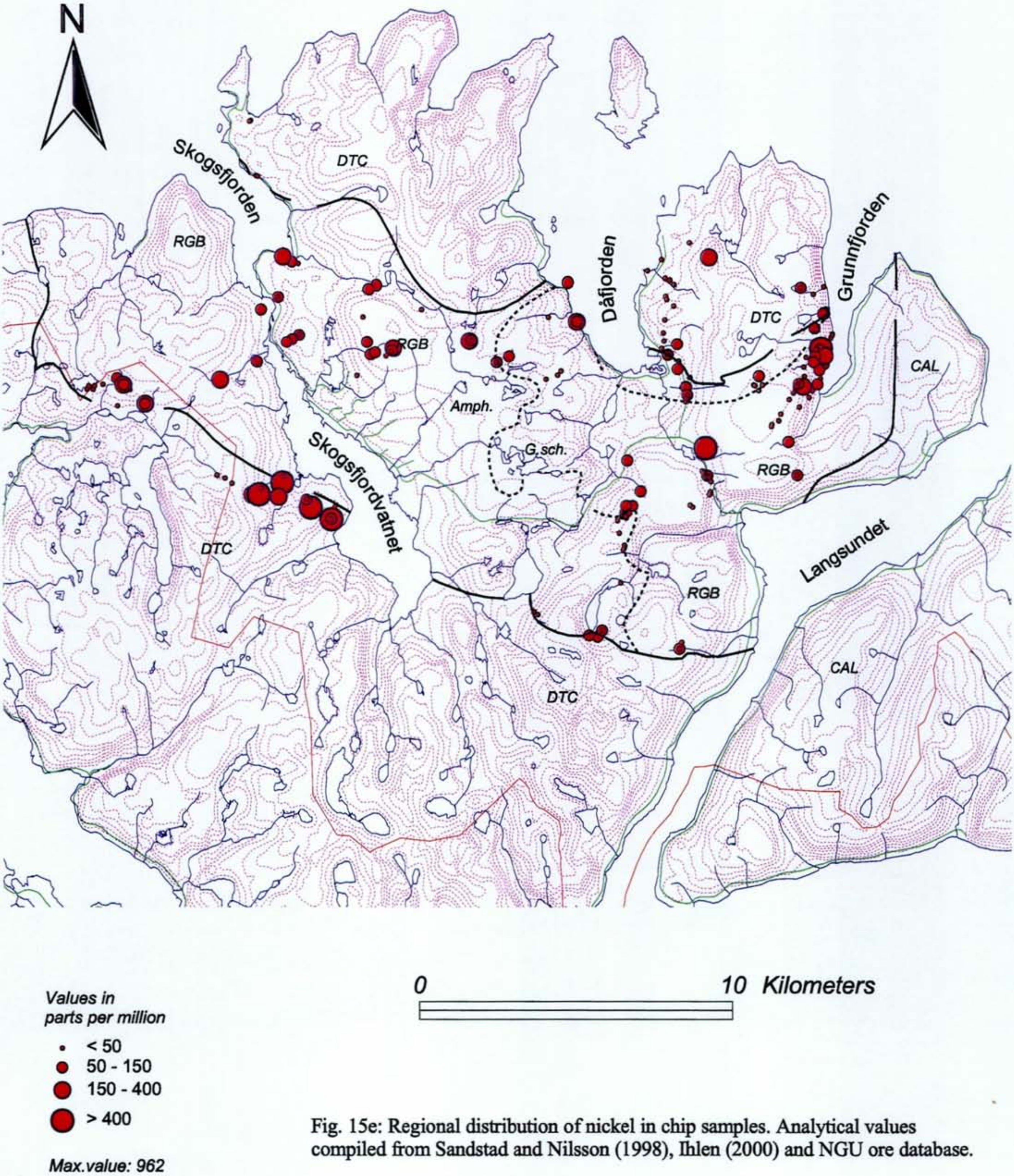


Fig. 15e: Regional distribution of nickel in chip samples. Analytical values compiled from Sandstad and Nilsson (1998), Ihlen (2000) and NGU ore database.

of the heavy-mineral concentrates from Ringvassøy contain normal backgound levels of zinc (Fig. 16a-b). The DTC and the Caledonides are general low in Zn compared with the RGB where clusters of anomalous samples occur particularly in Sørdalen, upper Soltinddalen, Tennvatn and Leirbogdalen areas. Zinc in till samples shows enhanced contents in most samples within the greenschist facies domain of the RGB (Fig. 16c). The distribution within the amphibolite facies domain, and in the DTC and the Caledonides is similar with background values intermingled with some anomalies containing more than 100 ppm Zn. Zn contents of the chip samples are generally low with a maximum value of 6.65% Zn in the Hårskoltan Zn-As prospect (Fig. 16d). The stratabound sulphide mineralisation within the RGB contain invariably less than 0.65% Zn (Sandstad and Nilsson 1998). Only a few of these sulphide occurrences are detected by the panned heavy minerals.

Cadmium which is a strongly chalcophile element, substituting for Zn in sphalerite, reaches, normally, maximum contents of 0.5 ppm in rock-forming silicates and Fe-Ti-oxides (Wakita and Schmitt 1970). This may be regarded as the upper limit of the background level. The distribution of cadmium on a regional scale roughly mimics that of Zn in heavy-mineral concentrates, tills and chip-samples in spite of much lower Cd concentrations, e.g. maximum of 1.6 ppm Cd *versus* 534 ppm Zn in the heavy minerals and 402 ppm Cd *versus* 66490 ppm Zn in chip samples or Zn:Cd ratios of 333 and 165, respectively.

6.11. Lead, Pb

Lead contents of the heavy-mineral concentrates fall normally below 30 ppm which represents, approximately, the upper limit of Pb in rock-forming ferromagnesian silicates and Fe-Ti-oxides (Wedepohl 1974b). Single localities in Slettelva at the eastern side of Grunnfjord, in Gamviksdalen (max. value 10389 ppm), in Norddalen and at Hansnes and Elvebakken show anomalous contents exceeding 210 ppm Pb. The high proportion of samples with background values is a characteristic feature (Fig. 17a-b). It is possible that the scattered anomalous samples are due to the presence of fine-grained fragments of lead bullets which may have been overlooked when the sample was checked for visible gold. However, high levels of Sb in some of these samples, e.g. in Gamvikdalen river (485 ppm Sb) may suggest the presence of Pb-Sb sulphide mineralisation. The till samples contain generally less than 5 ppm Pb with anomalous samples mainly distributed in the DTC and the Caledonides (Fig. 17c).

The chip samples reach a maximum of 700 ppm Pb in the Pesselva As-Sb occurrence, west of Grunnfjorden (Fig. 17d). The other sulphide occurrences contain less than 120 ppm Pb with the higher values frequently associated with mineralisation being enriched in Zn. With the exception of the Norddalen sulphide mineralisation, none of the occurrences with enhanced Pb can be recognised from the Pb contents of the heavy-mineral concentrates.

6.12. Mercury, Hg, and thallium, Tl

Mercury and thallium are both common minor elements in different types of sulphide deposits. They are frequently enriched in fault-controlled epigenetic deposits and in epithermal deposits formed in the upper crust and near the surface, and are characteristic trace elements in «Carlin-type» gold deposits.

Heavy minerals - Zinc

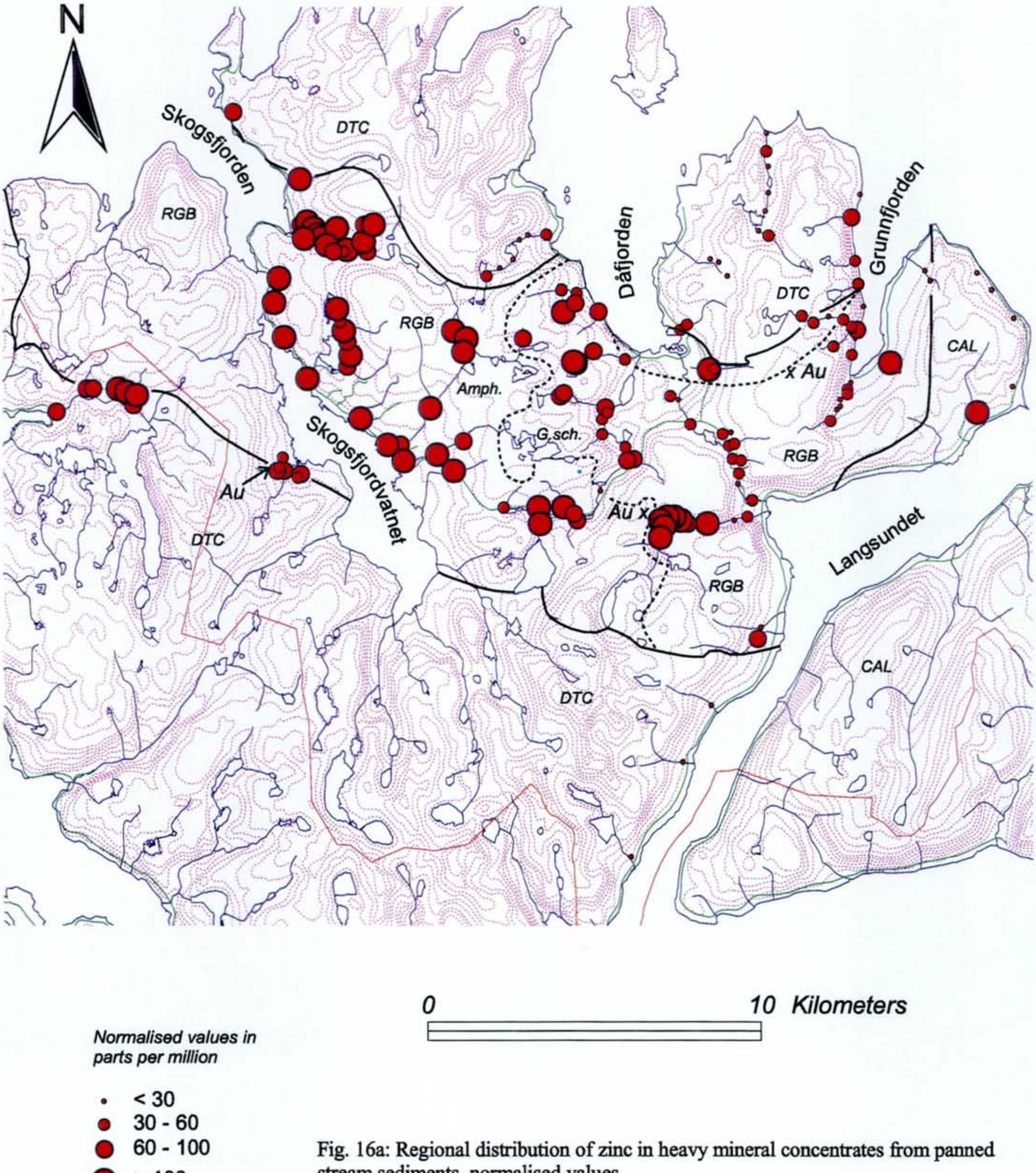
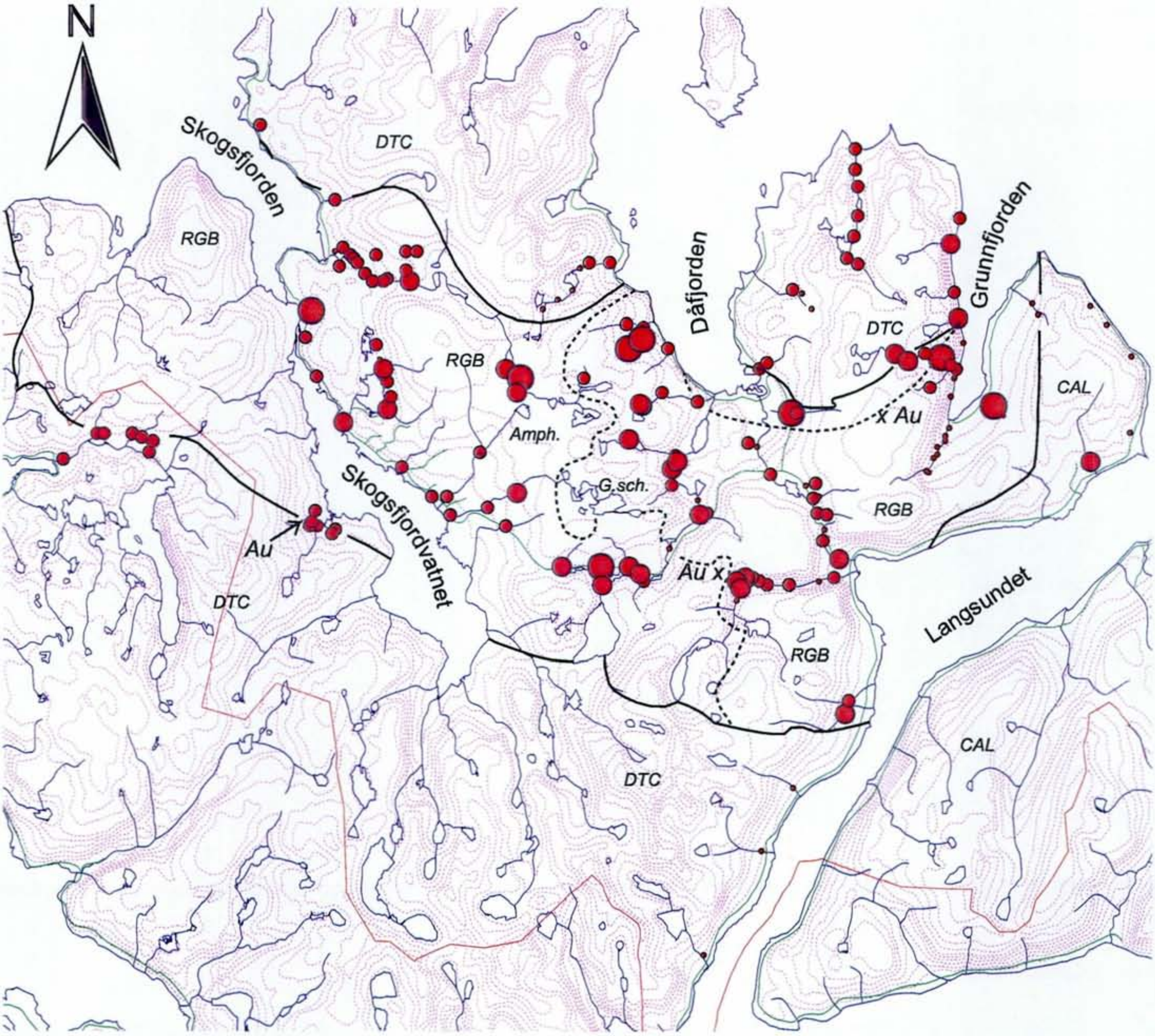


Fig. 16a: Regional distribution of zinc in heavy mineral concentrates from panned stream sediments, normalised values.

Heavy minerals - Zinc



0 10 Kilometers

Analytical values in parts per million

- < 30
- 30 - 60
- 60 - 100
- > 100

Max value: 5926
Min. value: 15

Fig. 16b: Regional distribution of zinc in heavy mineral concentrates from panned stream sediments, analytical values.

Till - Zinc

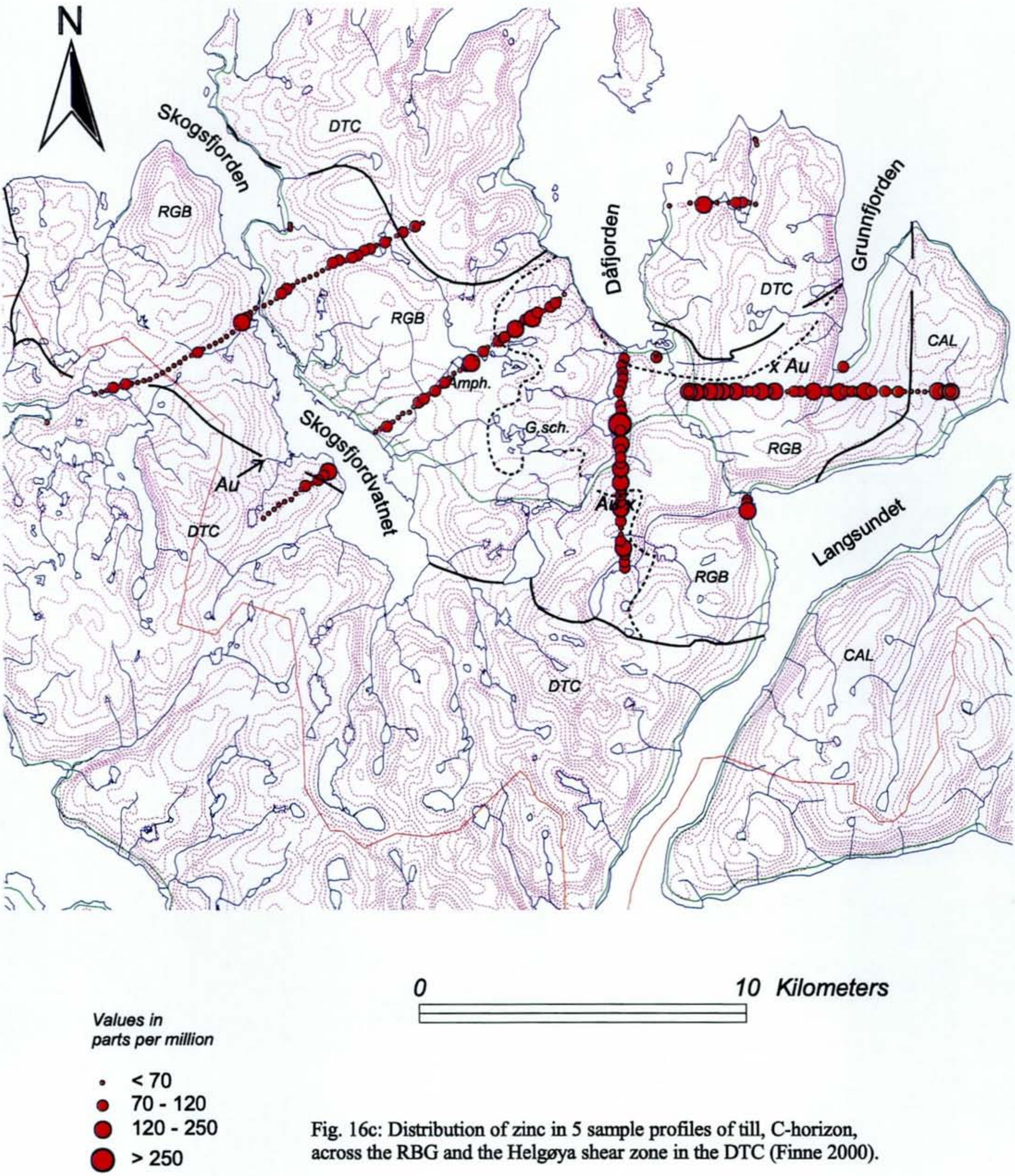


Fig. 16c: Distribution of zinc in 5 sample profiles of till, C-horizon, across the RBG and the Helgøya shear zone in the DTC (Finne 2000).

Chip samples - Zinc

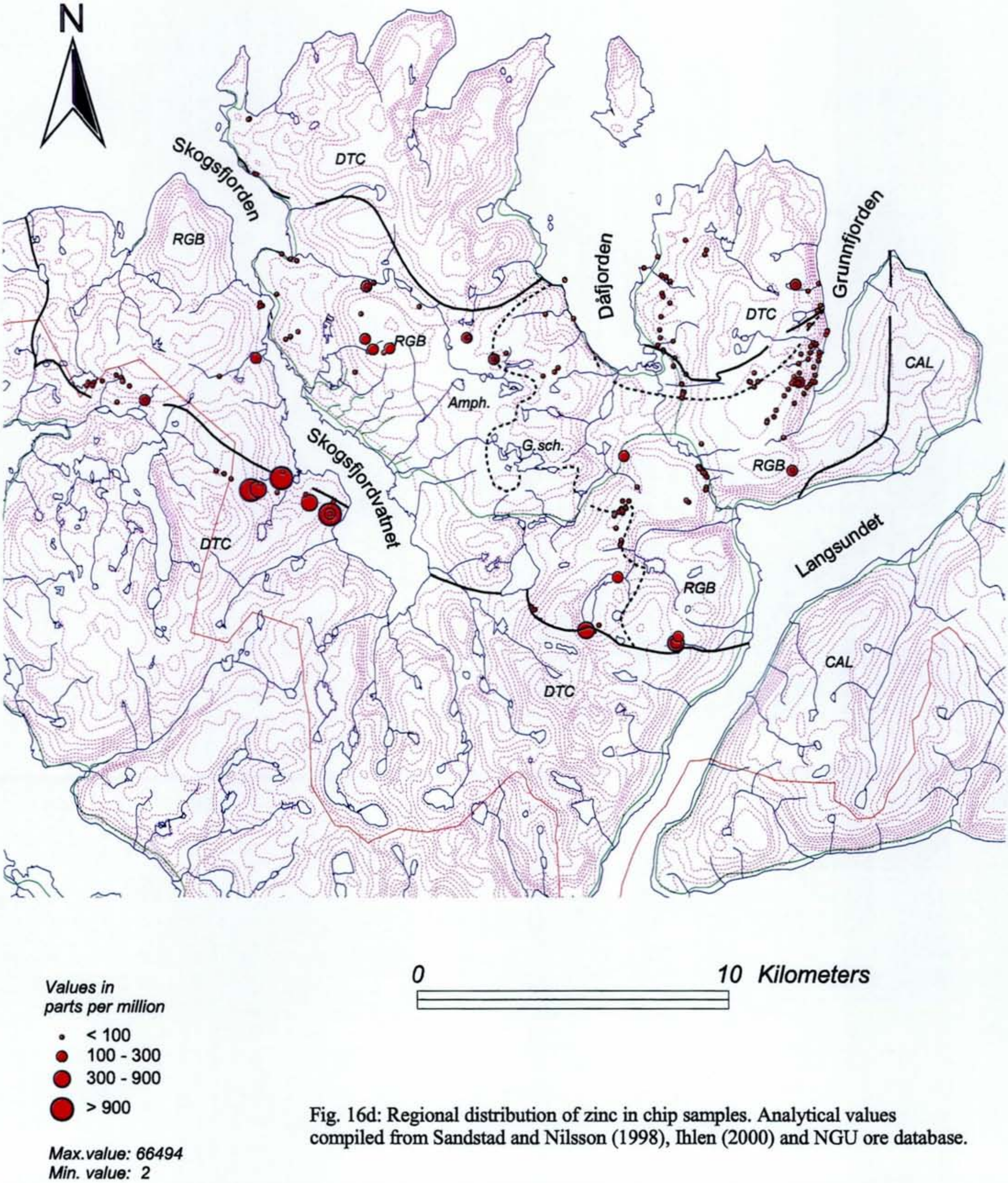
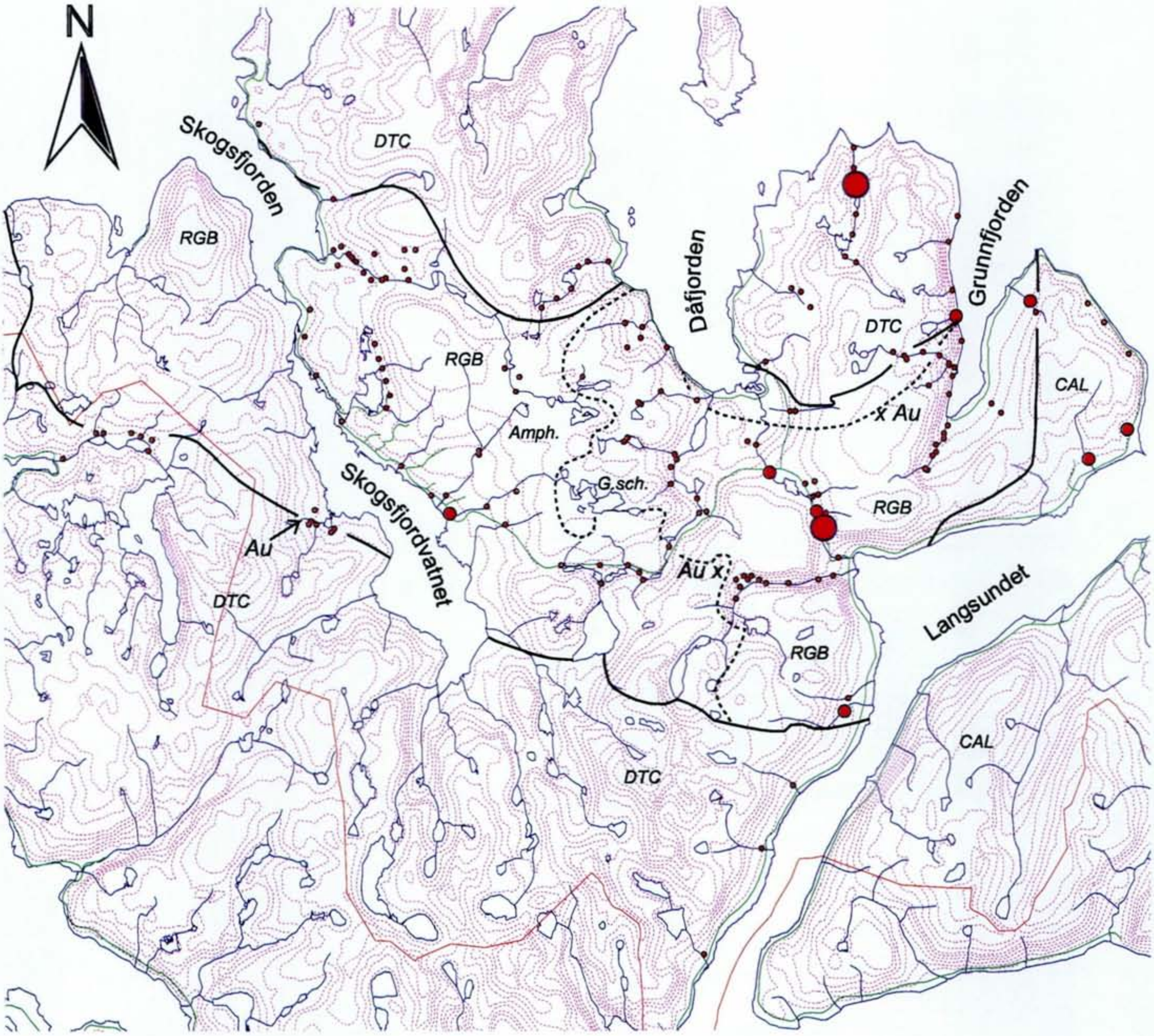


Fig. 16d: Regional distribution of zinc in chip samples. Analytical values compiled from Sandstad and Nilsson (1998), Ihlen (2000) and NGU ore database.

Heavy minerals - Lead



0 10 Kilometers

Normalised values in parts per million

- < 30
- 30 - 350
- 350 - 1000
- > 1000

Max value: 5195
Min. value: 2

Fig. 17a: Regional distribution of lead in heavy mineral concentrates from panned stream sediments, normalised values.

Heavy minerals - Lead

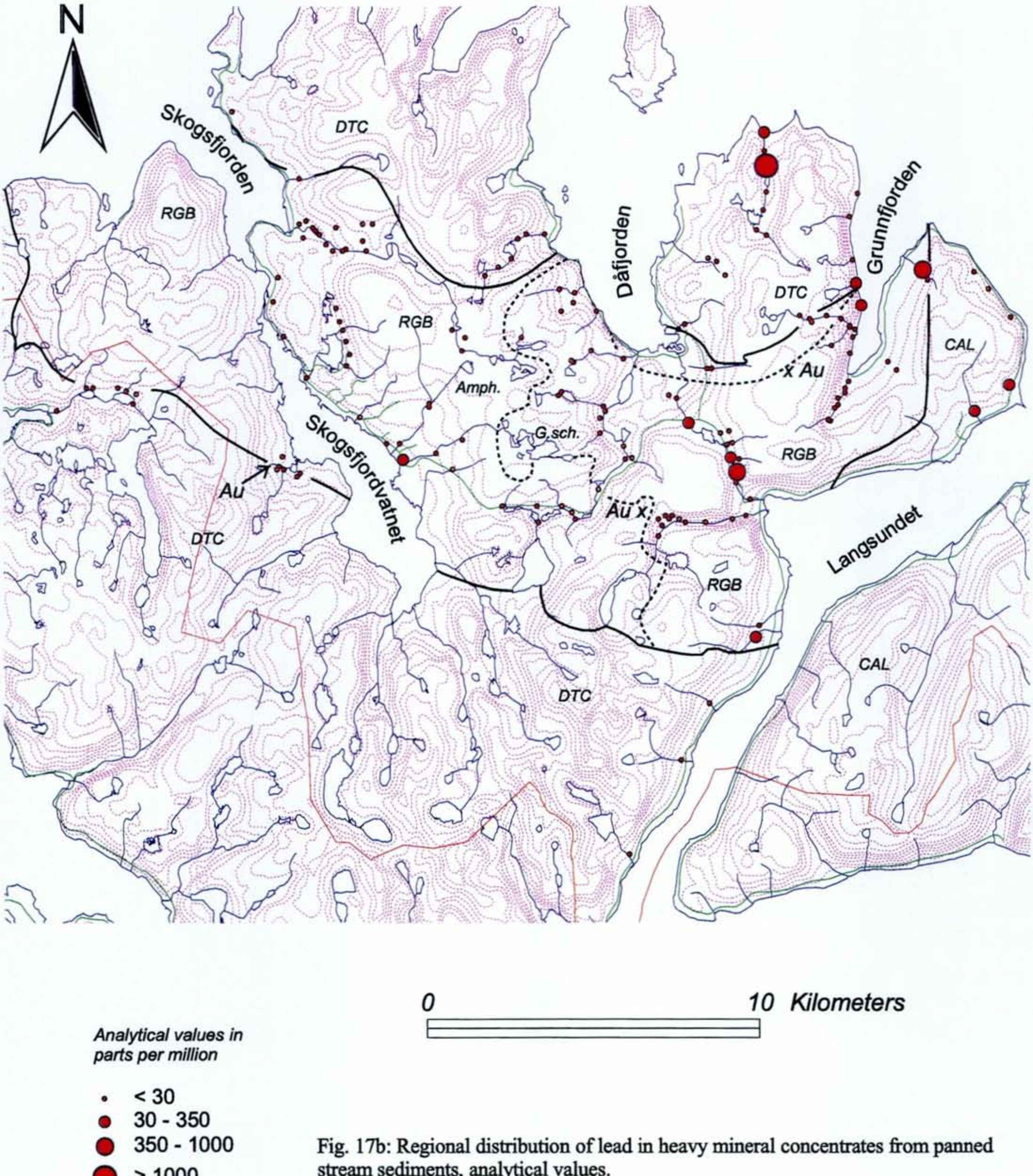


Fig. 17b: Regional distribution of lead in heavy mineral concentrates from panned stream sediments, analytical values.

Till - Lead

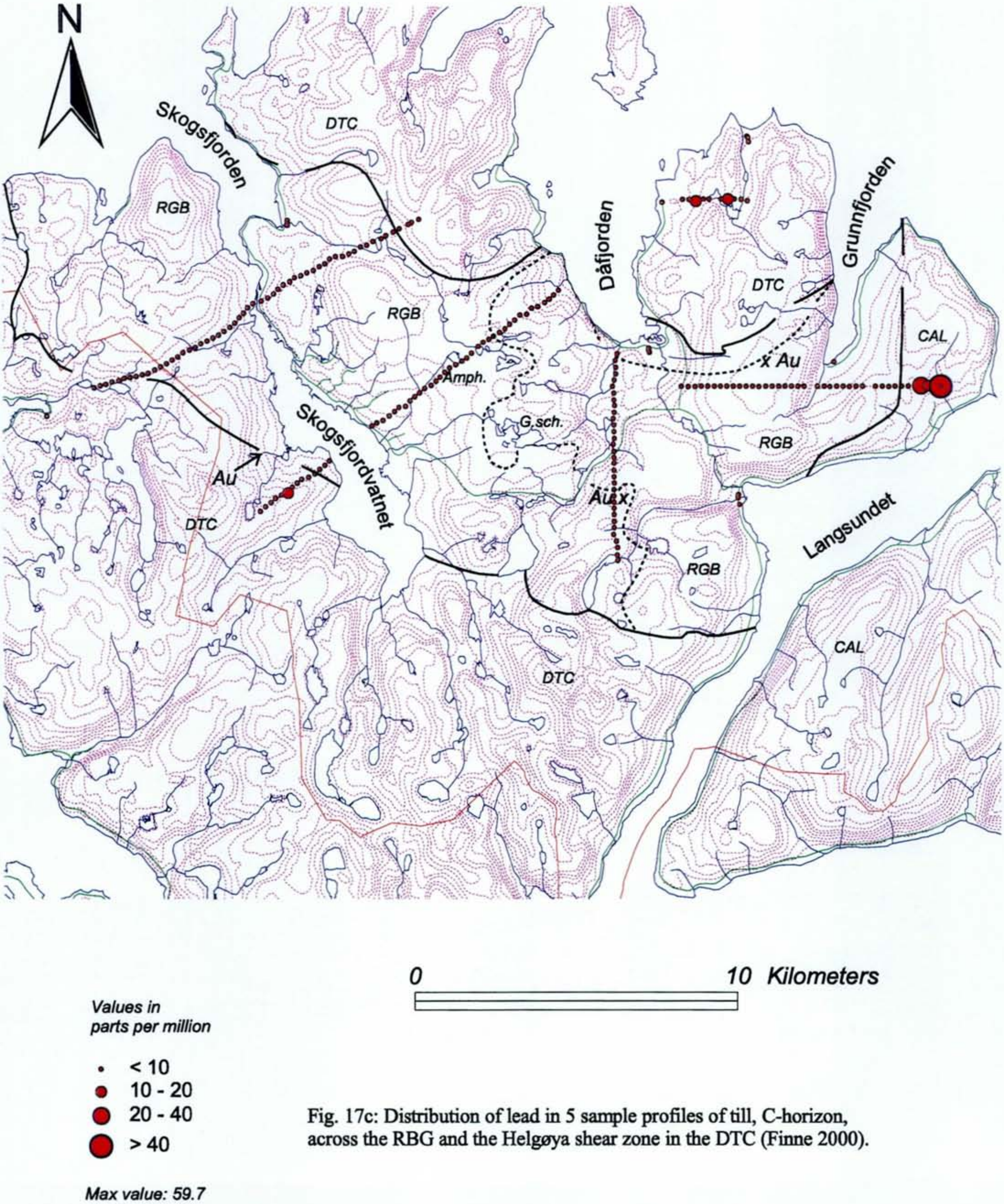


Fig. 17c: Distribution of lead in 5 sample profiles of till, C-horizon, across the RBG and the Helgøya shear zone in the DTC (Finne 2000).

Chip samples - Lead

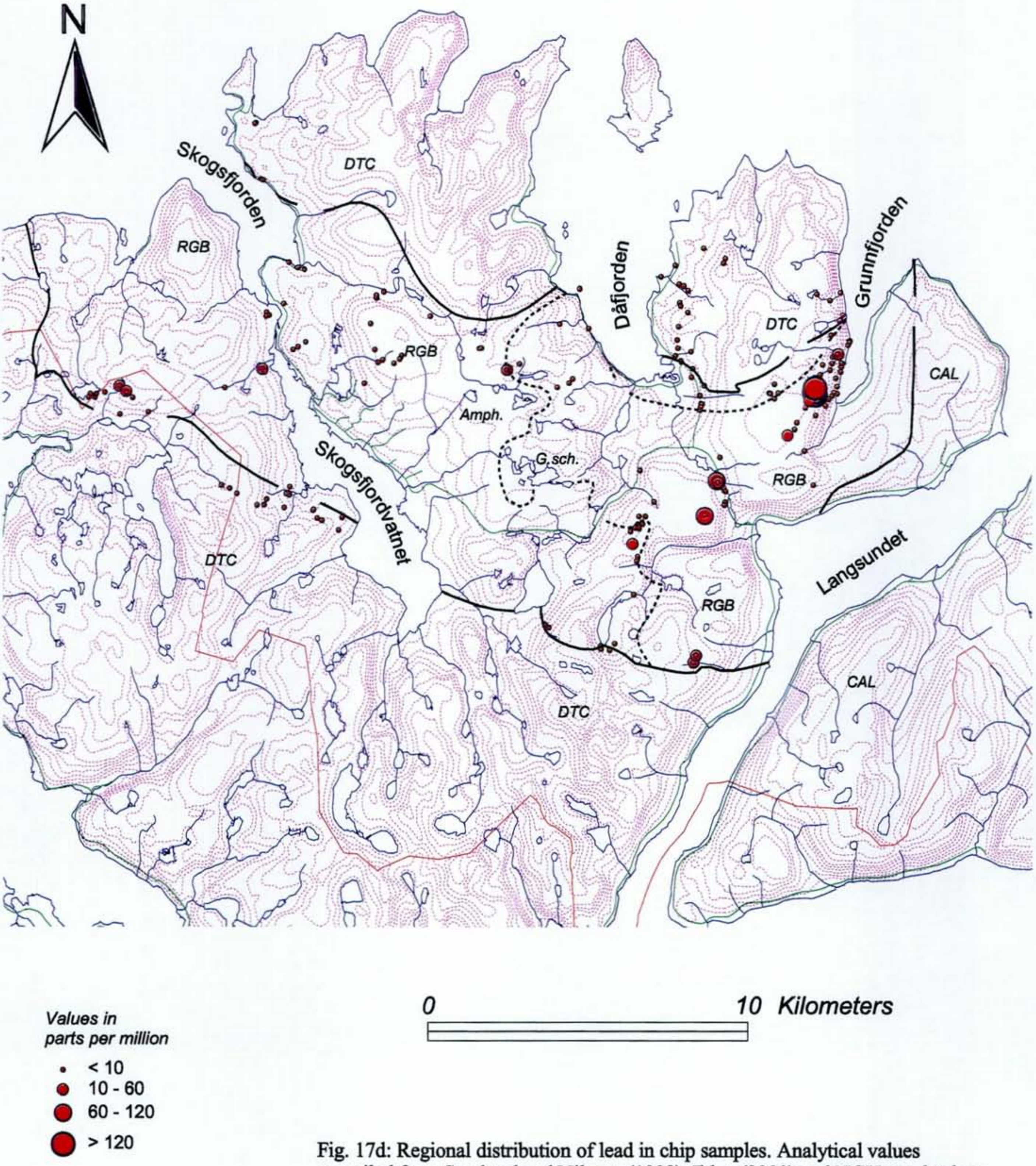


Fig. 17d: Regional distribution of lead in chip samples. Analytical values compiled from Sandstad and Nilsson (1998), Ihlen (2000) and NGU ore database.

Heavy-mineral concentrates with Hg contents exceeding 20 ppb are mainly found in the greenschist facies domain of the RGB where it reaches a maximum of 223 ppb at the eastern side of Grunnfjorden (Fig. 18a-b). Clustering of anomalous samples is typical for the river systems in Sørdalen, Norddalen and at the head of Grunnfjorden. Some additional anomalous samples occur in Mellomgårdselva and Nonsdagsdalen rivers intersecting the sheared contacts between the DTC and RGB. Hg concentrations in the till samples are roughly similar to the those in the heavy minerals although Hg appears to be more evenly distributed on a regional scale with anomalous samples in all of the major geological units (Fig 18c). Unfortunately only a few of the chip-sample batches have been analysed for Hg, giving a maximum value of 840 ppb in sheared sulphidic amphibolites outcropping along the road to Dåfjord (Fig. 18d). Other samples with intermediate concentrations of Hg cluster in area between Hårskoltan mountain and Grunnfjorden where several, minor, shear-related Cu-sulphide mineralisations occur as at Risdalsvatn lake further north. None of the analysed stratabound sulphide ores appear to be enriched in Hg. Thus, it seems to be an overall trend that enrichment of Hg is connected to shear zones and epigenetic sulphide mineralisation.

Thallium shows concentrations normally a little higher than mercury with a maximum value of 1.1 ppm or 1100 ppb Tl in the heavy minerals. Most of the heavy-mineral concentrates contain less than 0.1 ppm which is the detection limit. Except for the anomaly in Gamvik-dalselva river most the anomalous rivers drain stratabound sulphide mineralisation (Fig. 19a-b). The distribution of anomalous samples of till is rather erratic (Fig. 19c).

6.13. Tungsten, W

Tungsten concentrations in mafic silicate minerals and Fe-Ti-oxides, on a global scale, fall normally in the range 1-68 ppm with particular enrichment in Fe-Ti-oxides. Background levels for Fe-Ti-oxides is estimated to about 15 ppm from figures given by Krauskopf (1970). Most of the heavy-mineral concentrates contain background levels of W (Fig. 20a-b). A few clearly anomalous rivers are confined mainly to the contact zone between the DTC and the RGB in its western amphibolite facies domain where a maximum content 454 ppm W is reached in the Mellomgårdselva river (Fig. 20b). Strong clustering of anomalies typifies the Nordkjosvatna and Nonsdagsdalen areas. The anomalies are most likely related to scheelite in the panned concentrates as detected by ASPRO (Lieungh 1985). Most of the till samples (97%) contain less than 1 ppm W with some scattered anomalies in all of the geological units (Fig. 20c). Maximum values of 20 and 28 ppm are found in the samples taken west of Tennvatn. Weakly anomalous heavy-mineral concentrates are found in rivers adjacent to this area whereas the clusters of anomalies in the Nordkjosvatna and Nonsdagsdalen areas are not well reproduced by the till geochemistry. The chip samples contain with a few exception less than 10 ppm W with values exceeding 100 ppm only in the Nonsdagsdalen Cu-Au and Hårskoltan Zn-As mineralisation (Fig. 20d). Only the first of these is detected in the adjacent river system by enhanced tungsten in the concentrates.

6.14. Molybdenum, Mo

The heavy mineral concentrates contain less than 8 ppm Mo (Fig. 21a-b) whereas the chip samples nearly invariably yield concentrations below 10 ppm Mo (Fig. 21d). These values fall within the normal range for rock-forming minerals on a global scale with approximate averages of 45 ppm Mo in titanite, 30 ppm in Fe-Ti-oxides and 8 ppm in mafic silicates (Manheim and Landergren 1978). The Mo contents of the heavy-mineral concentrates are

Heavy minerals - Mercury

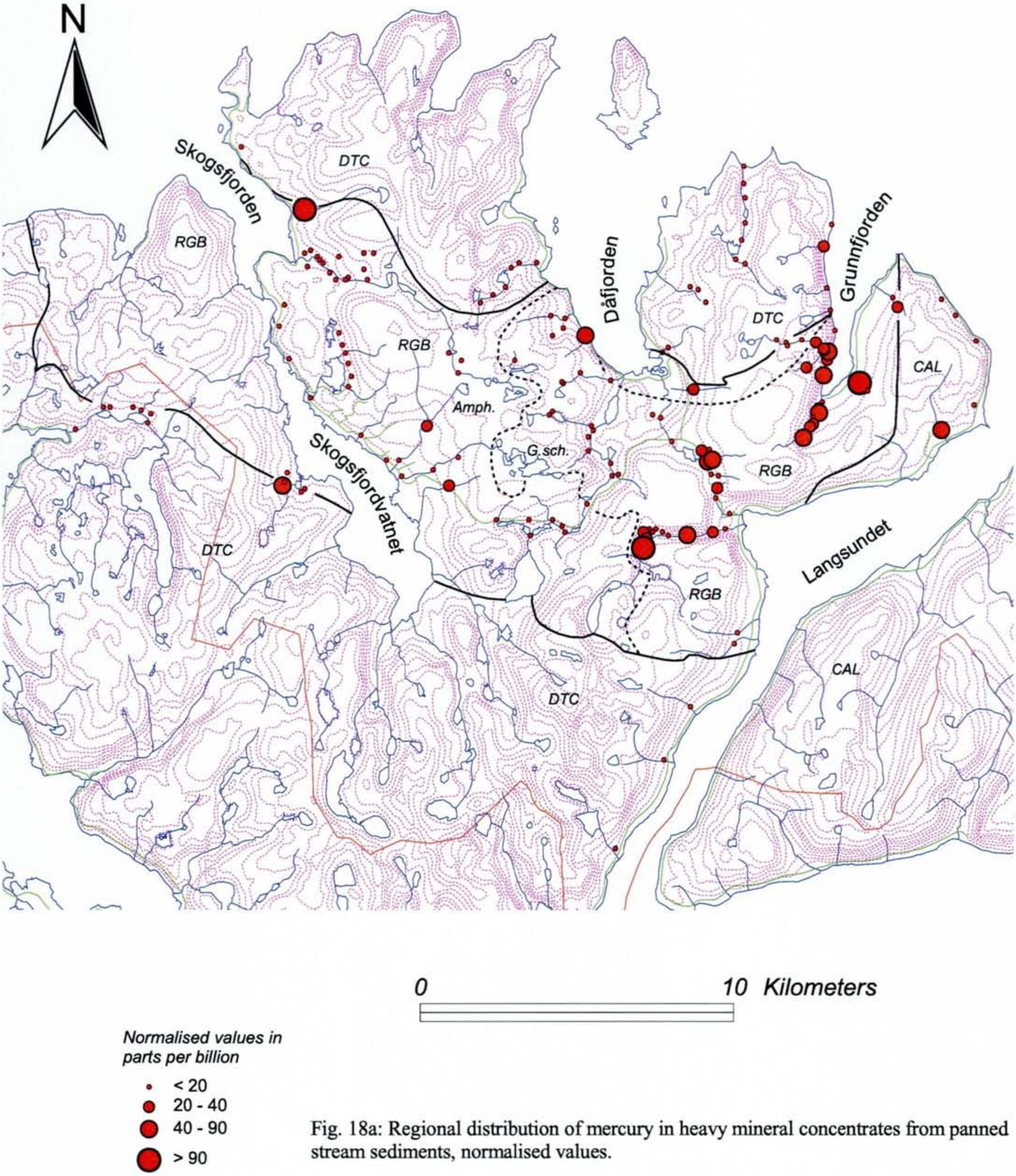


Fig. 18a: Regional distribution of mercury in heavy mineral concentrates from panned stream sediments, normalised values.

Heavy minerals - Mercury

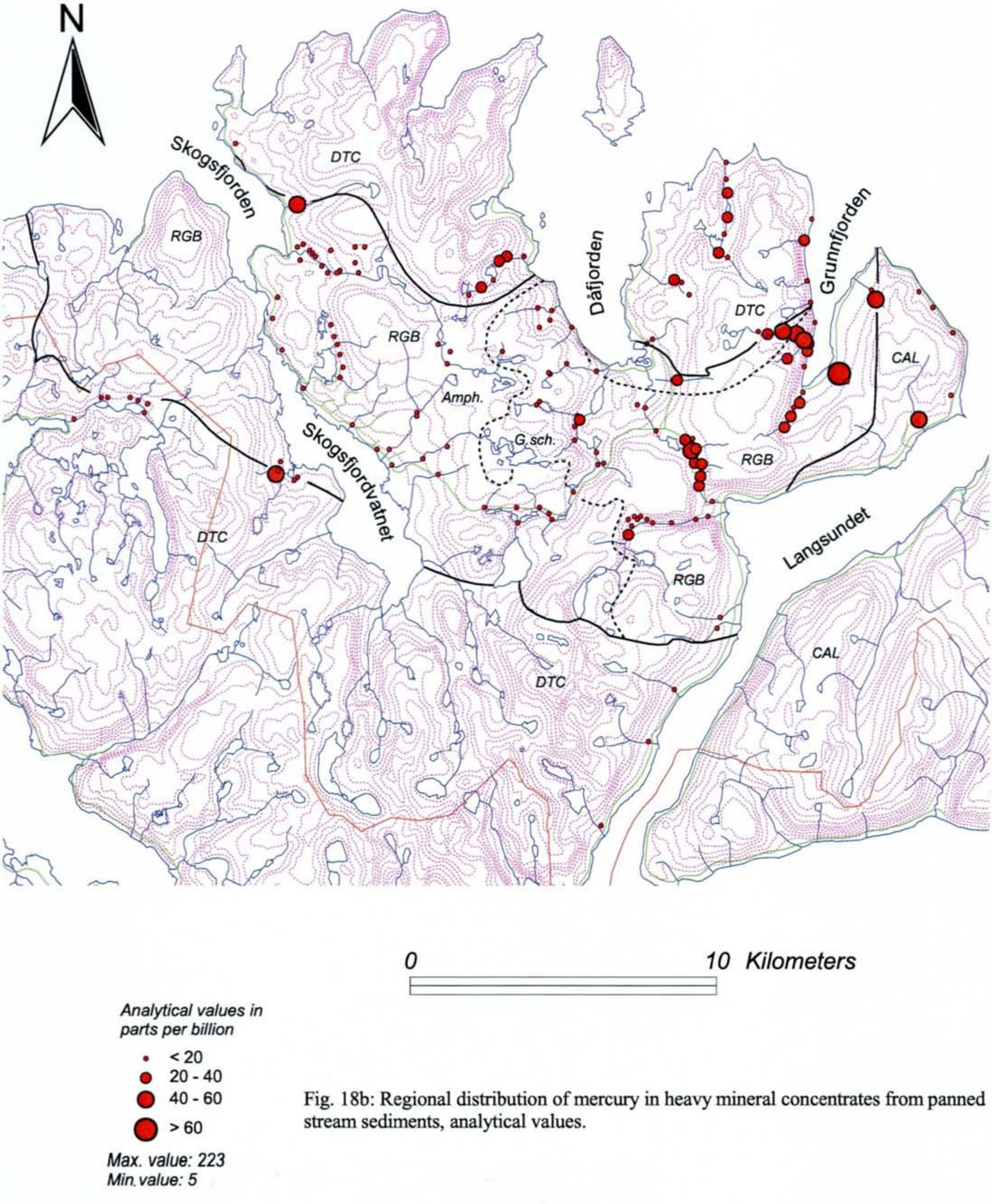


Fig. 18b: Regional distribution of mercury in heavy mineral concentrates from panned stream sediments, analytical values.

Till - Mercury

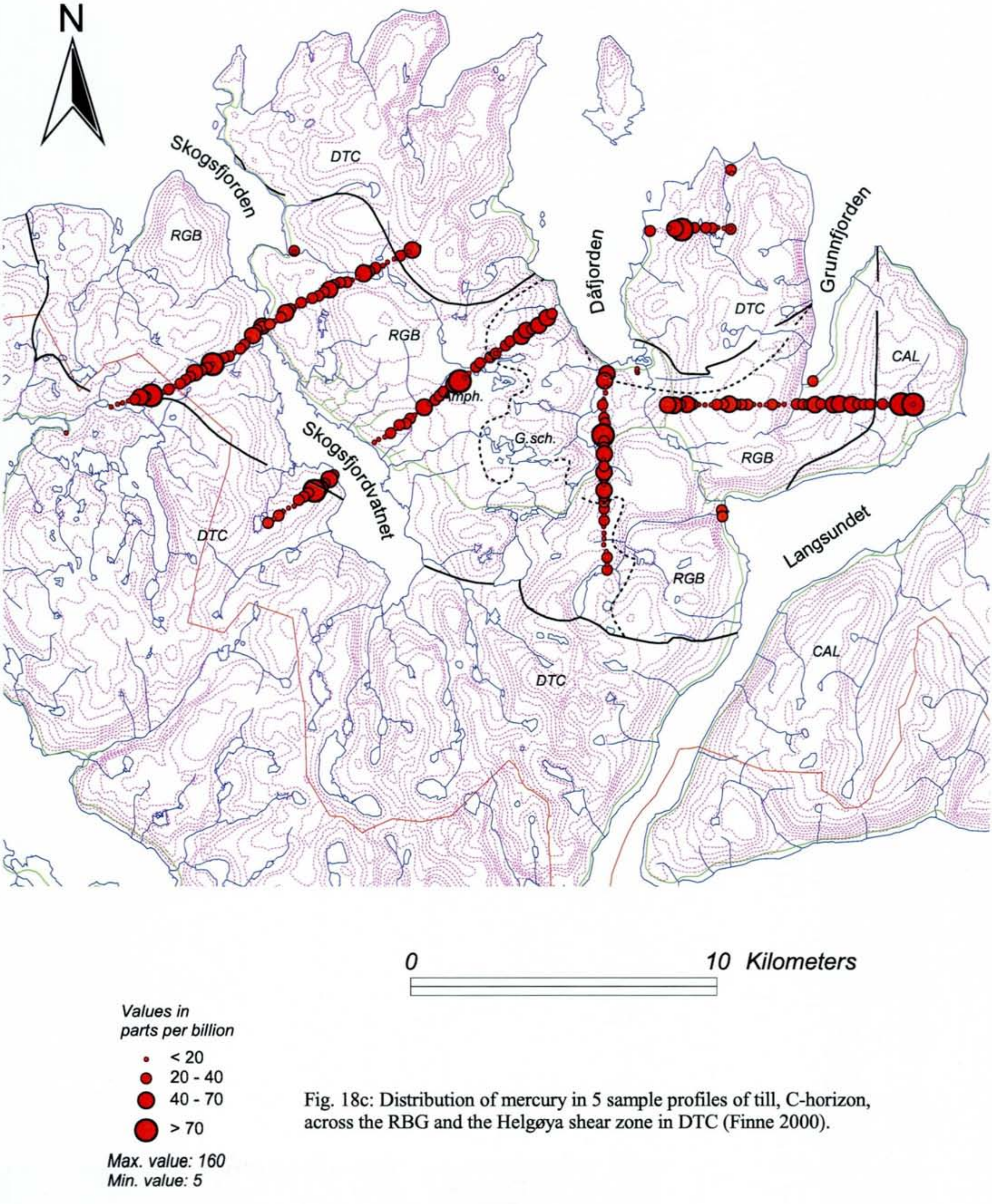


Fig. 18c: Distribution of mercury in 5 sample profiles of till, C-horizon, across the RBG and the Helgøya shear zone in DTC (Finne 2000).

Chip samples - Mercury

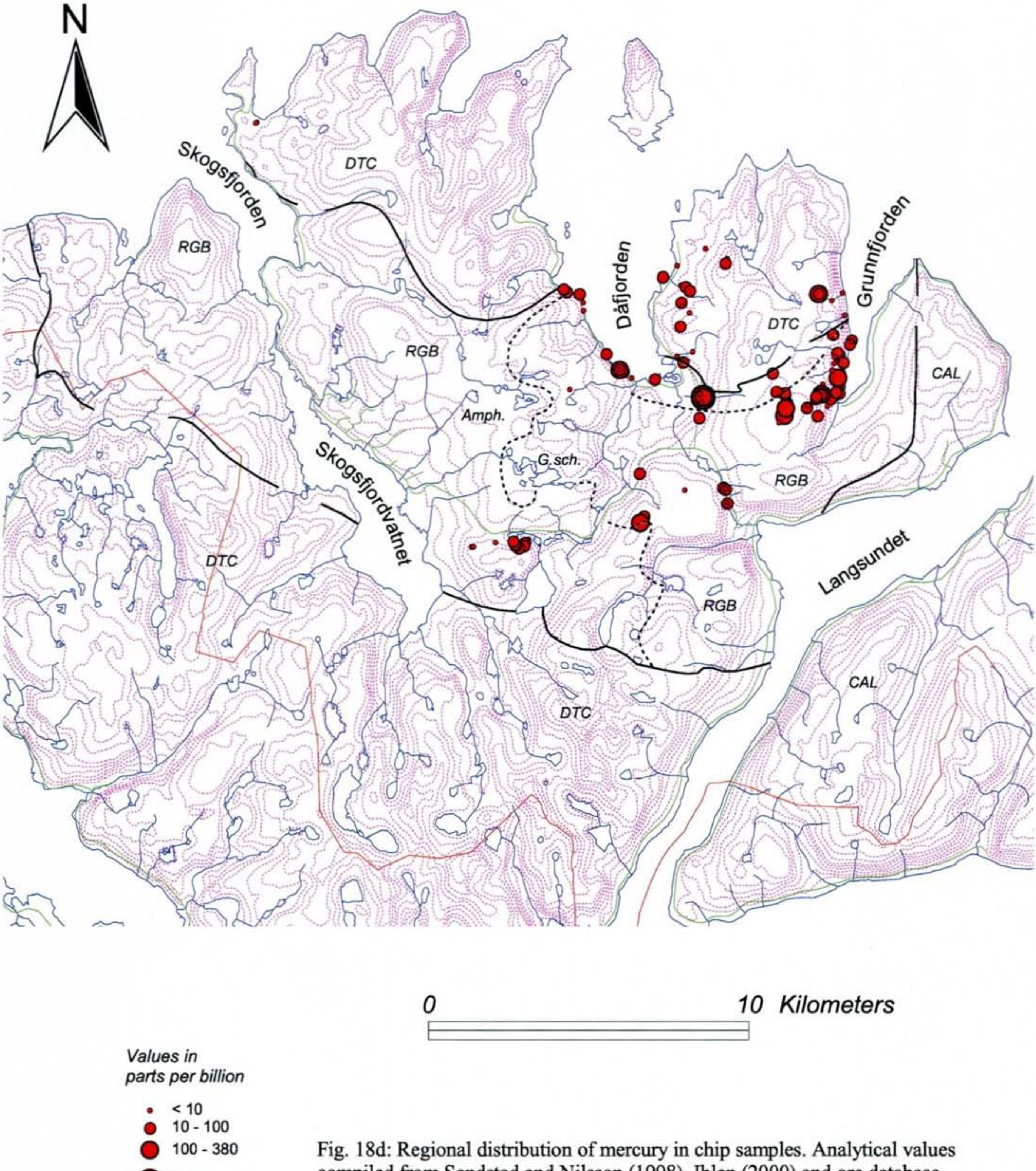


Fig. 18d: Regional distribution of mercury in chip samples. Analytical values compiled from Sandstad and Nilsson (1998), Ihlen (2000) and ore database.

Heavy minerals - Thallium

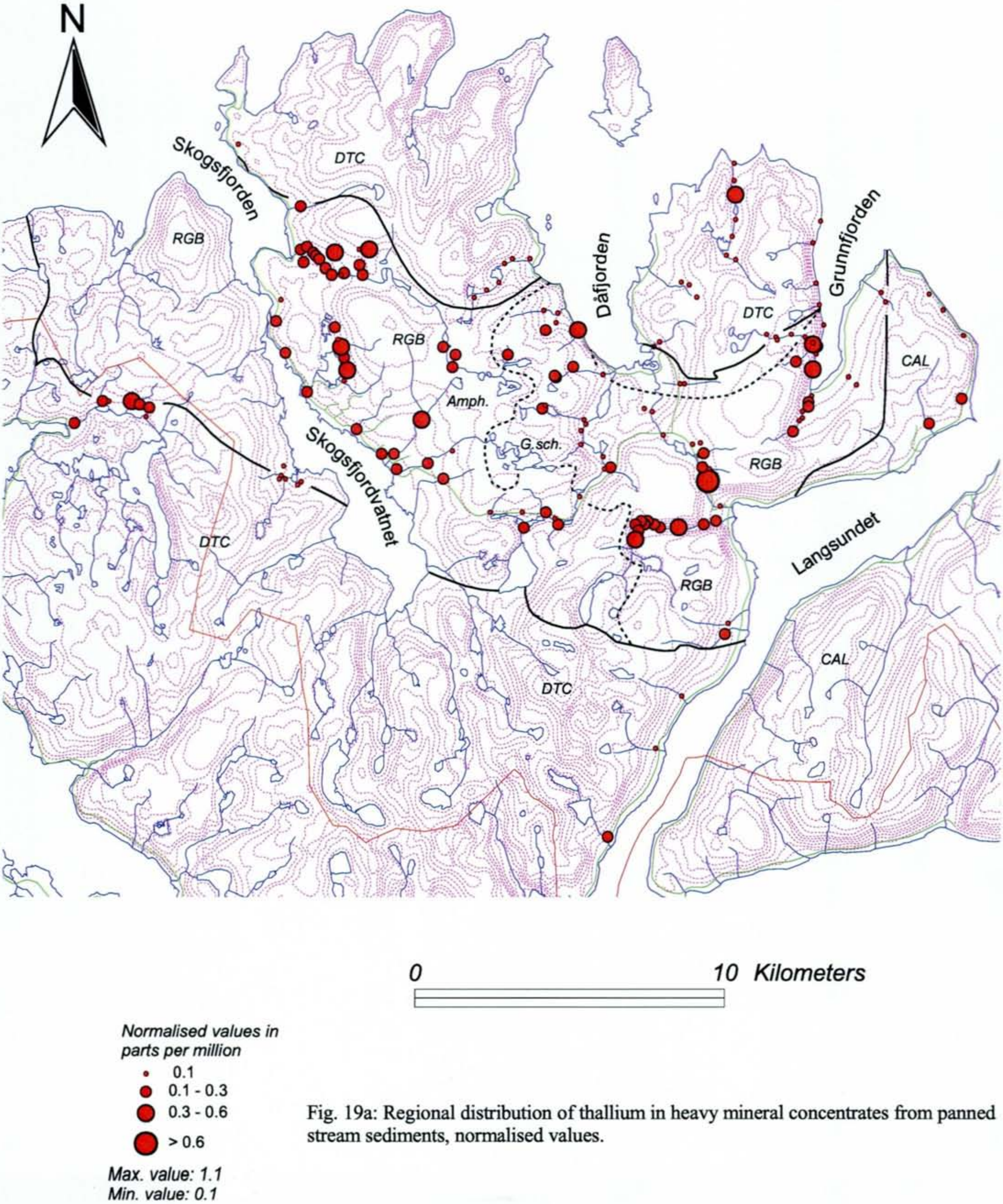


Fig. 19a: Regional distribution of thallium in heavy mineral concentrates from panned stream sediments, normalised values.

Heavy minerals - Thallium

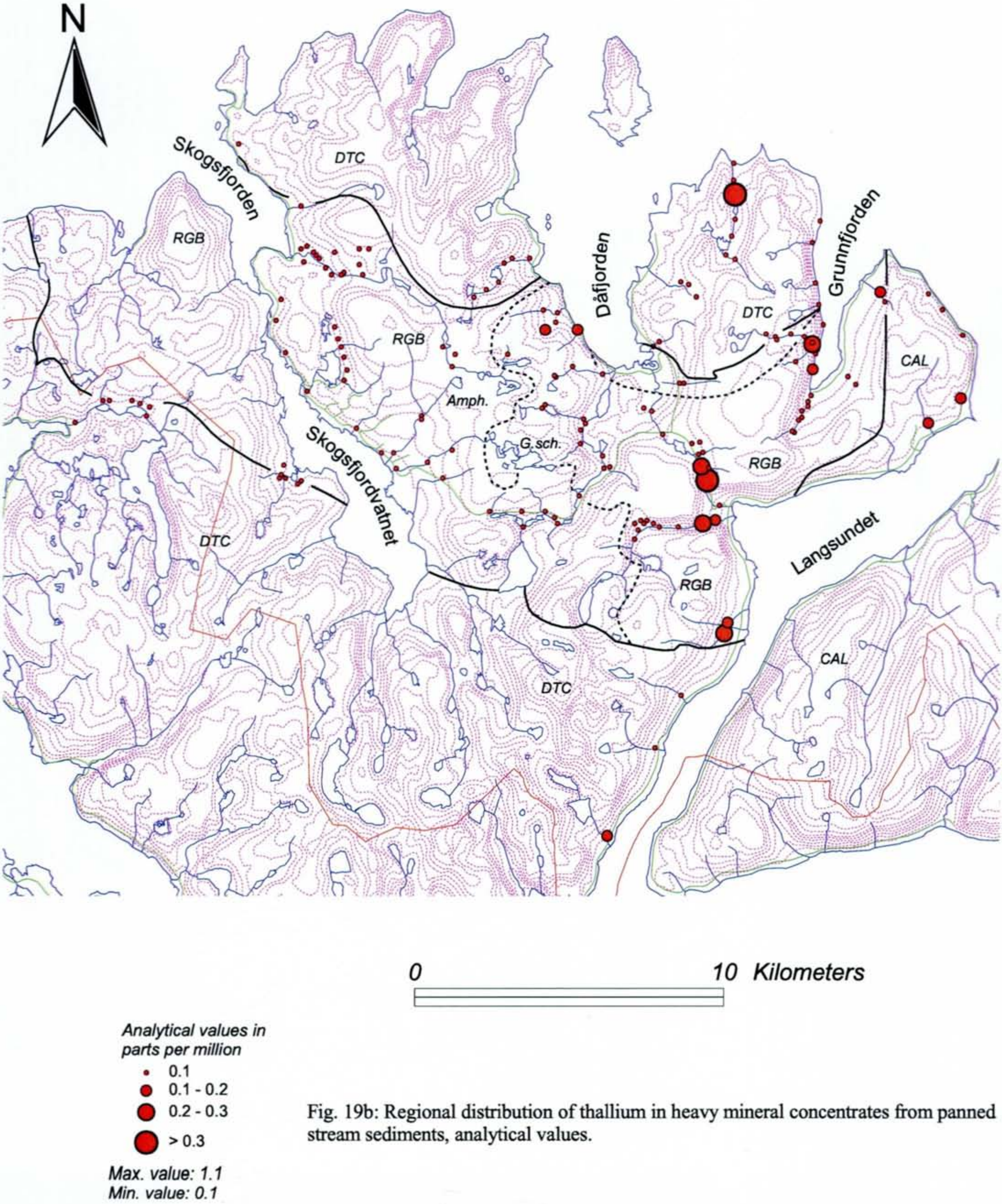


Fig. 19b: Regional distribution of thallium in heavy mineral concentrates from panned stream sediments, analytical values.

Till - Thallium

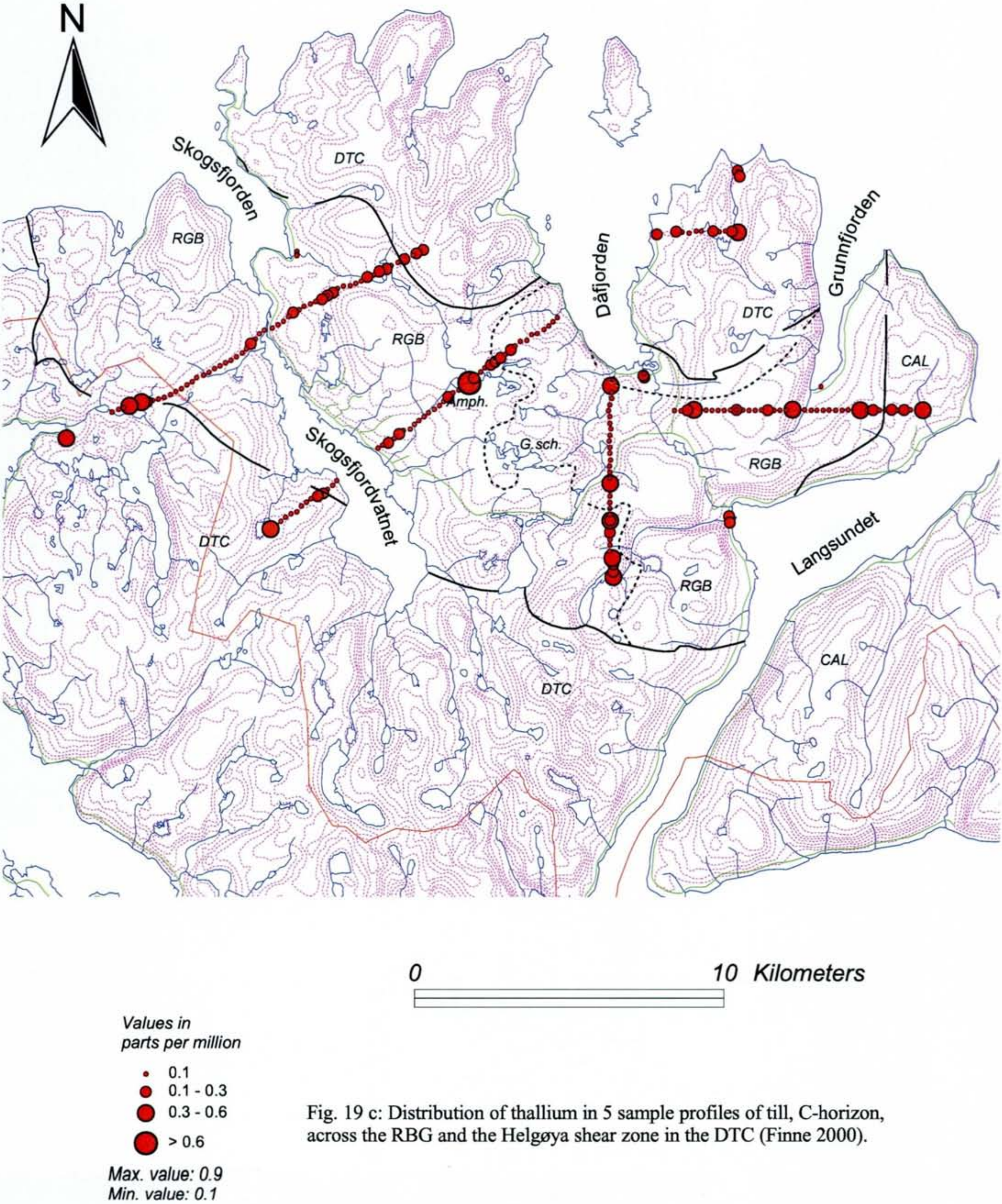


Fig. 19 c: Distribution of thallium in 5 sample profiles of till, C-horizon, across the RBG and the Helgøya shear zone in the DTC (Finne 2000).

Heavy minerals - Tungsten

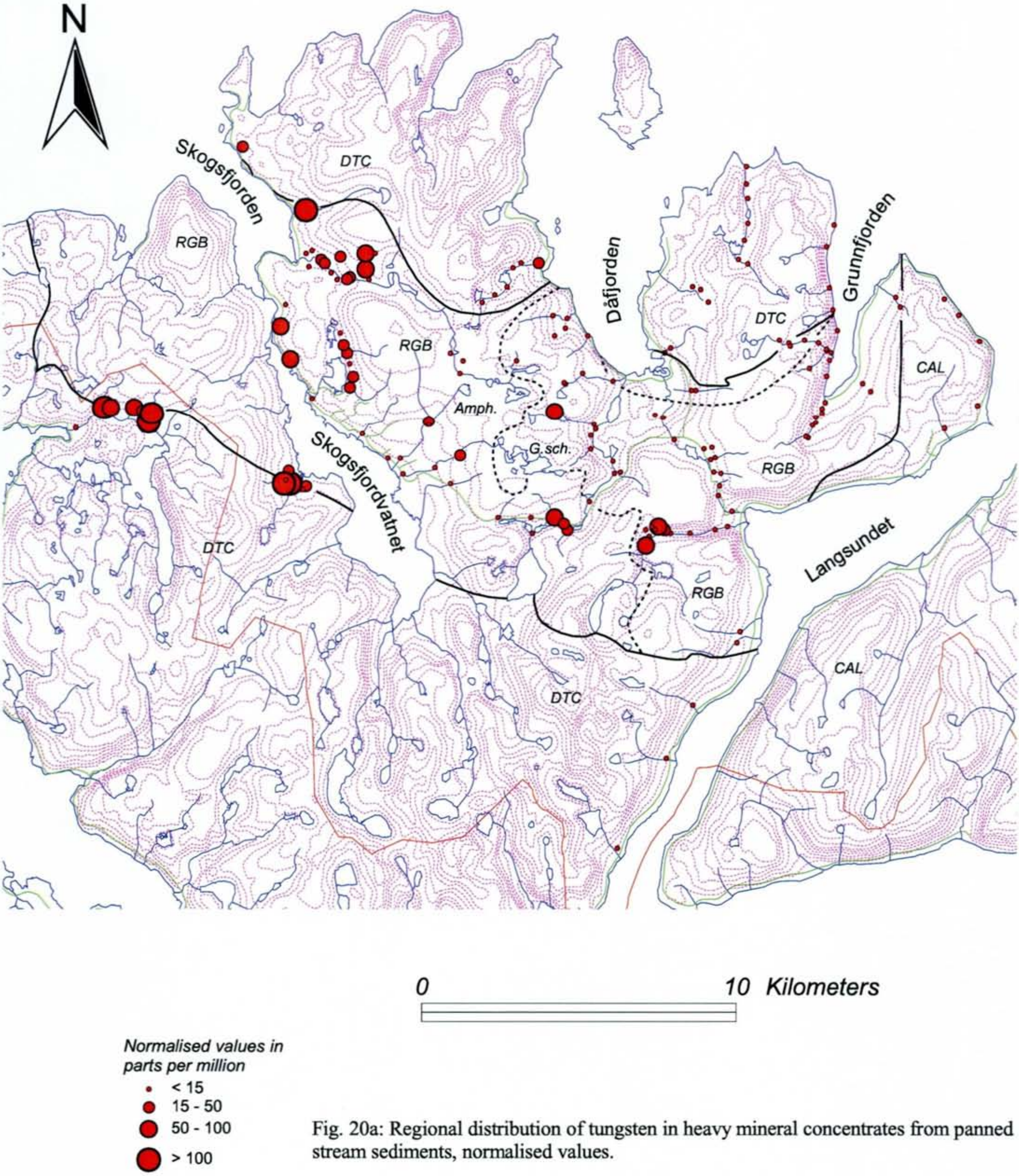


Fig. 20a: Regional distribution of tungsten in heavy mineral concentrates from panned stream sediments, normalised values.

Heavy minerals - Tungsten

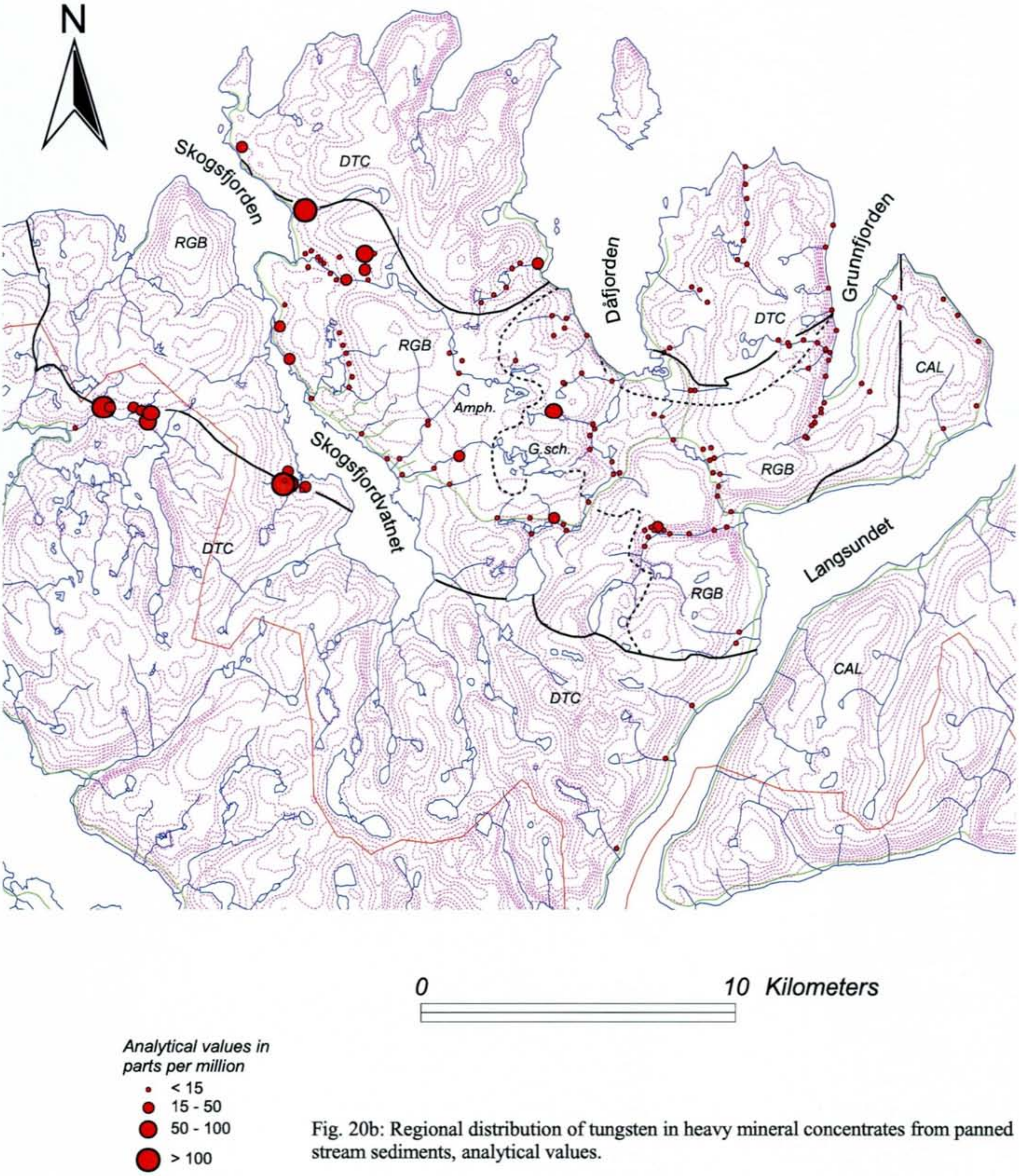


Fig. 20b: Regional distribution of tungsten in heavy mineral concentrates from panned stream sediments, analytical values.

Till - Tungsten

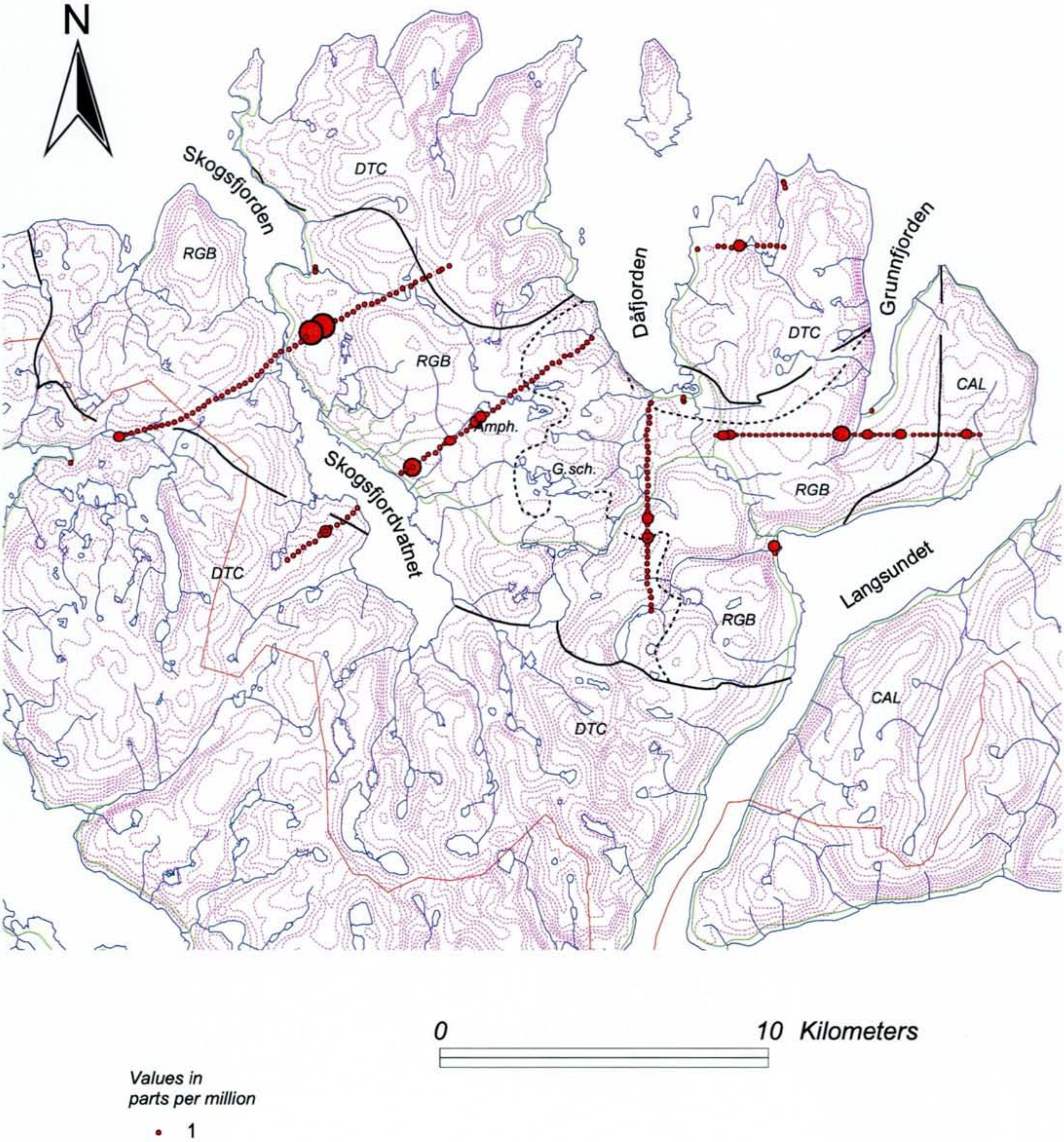


Fig. 20c: Distribution of tungsten in 5 sample profiles of till, C-horizon, across the RBG and the Helgøya shear zone in the DTC (Finne 2000).

Chip samples - Tungsten

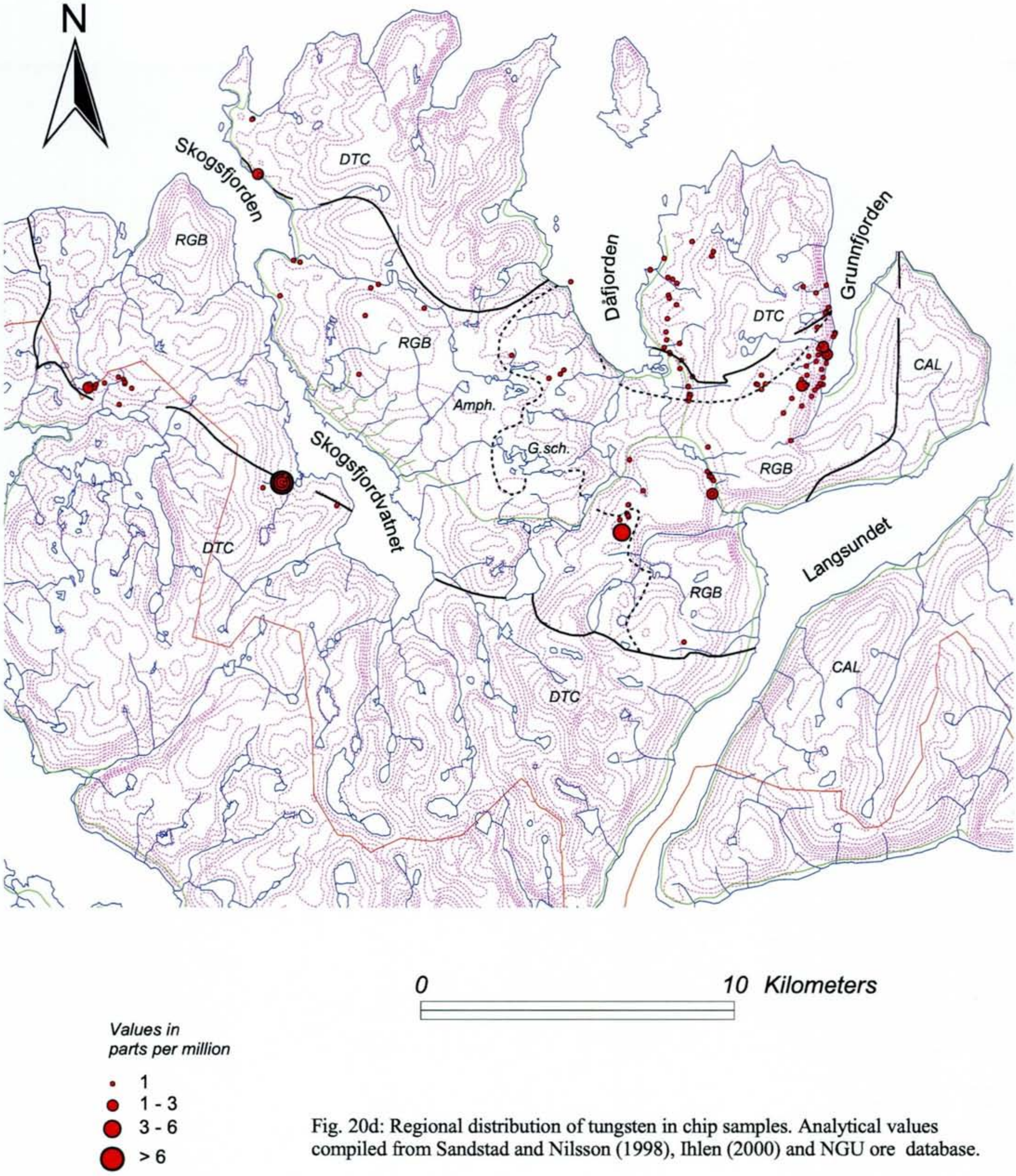


Fig. 20d: Regional distribution of tungsten in chip samples. Analytical values compiled from Sandstad and Nilsson (1998), Ihlen (2000) and NGU ore database.

Heavy minerals - Molybdenum

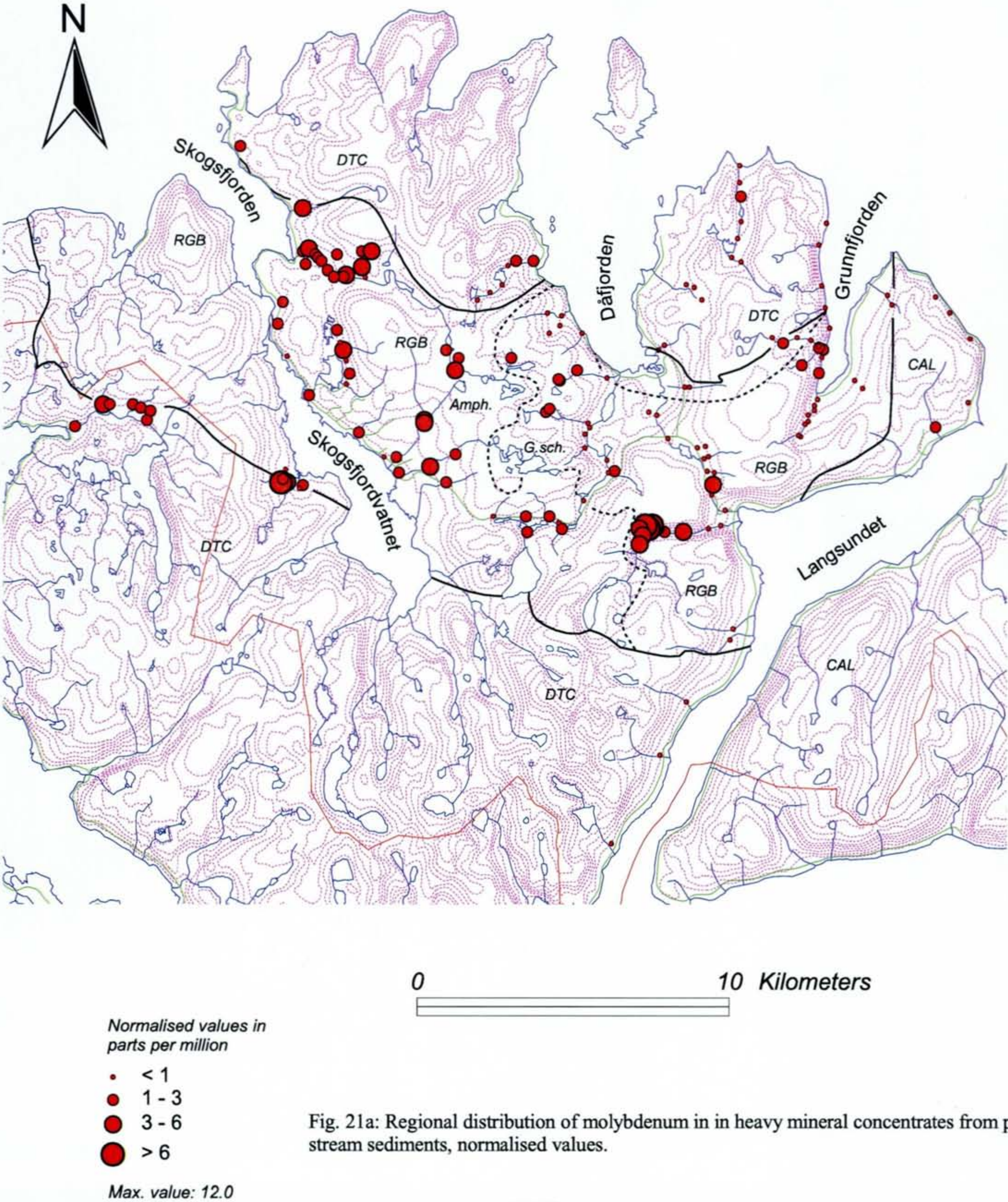


Fig. 21a: Regional distribution of molybdenum in in heavy mineral concentrates from panned stream sediments, normalised values.

Heavy minerals - Molybdenum

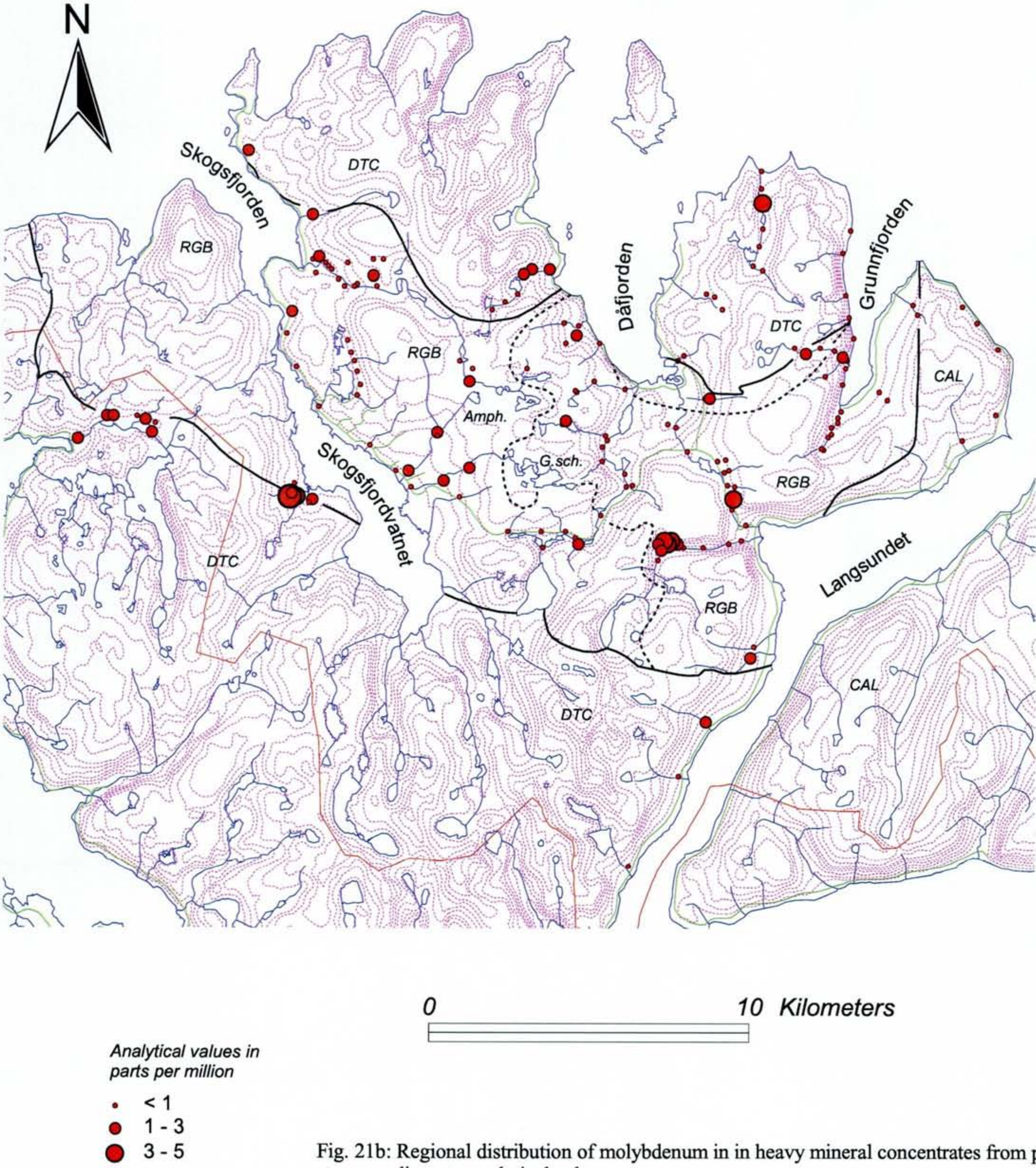


Fig. 21b: Regional distribution of molybdenum in in heavy mineral concentrates from panned stream sediments, analytical values.

Till - Molybdenum

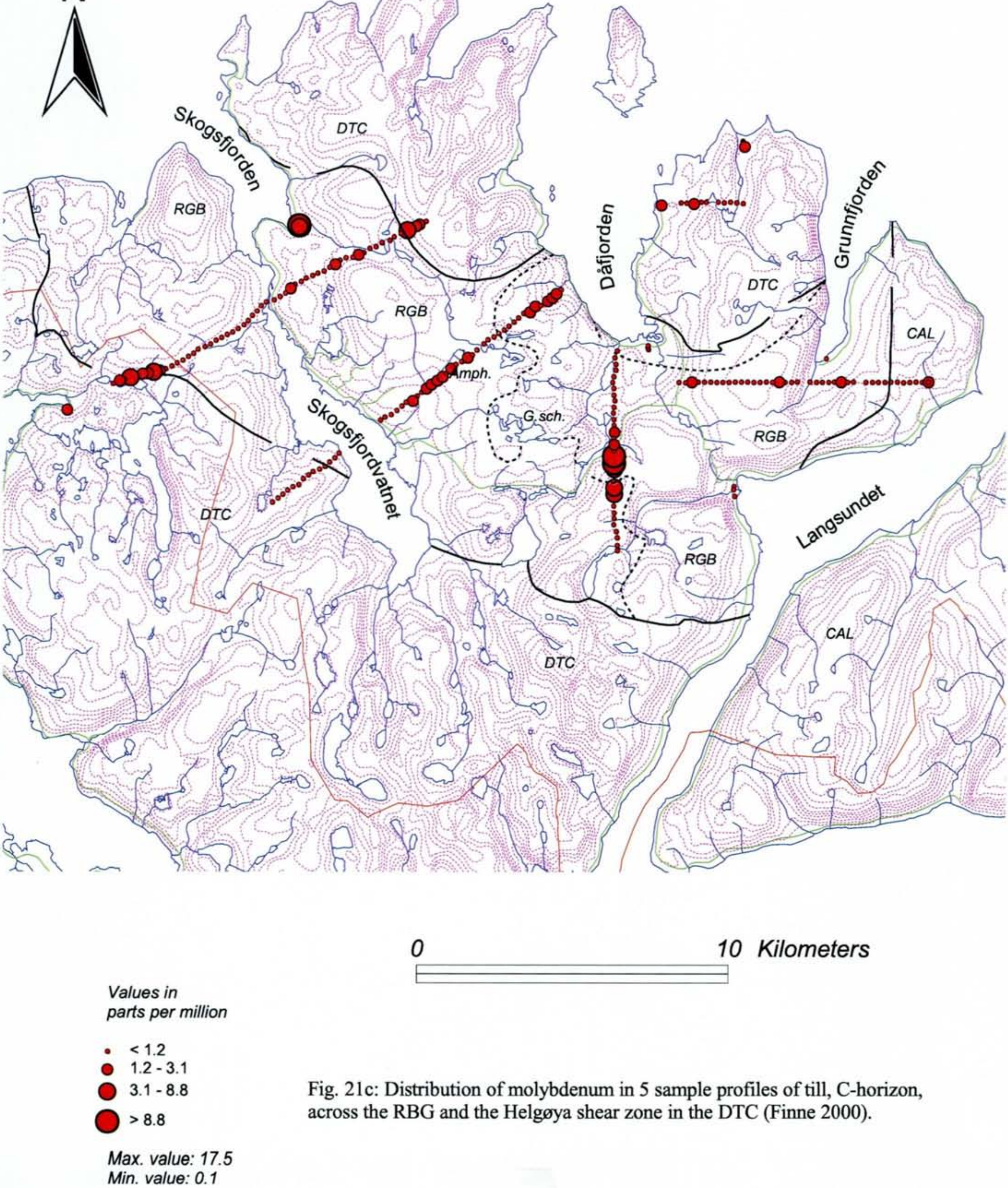


Fig. 21c: Distribution of molybdenum in 5 sample profiles of till, C-horizon, across the RBG and the Helgøya shear zone in the DTC (Finne 2000).

Chip samples - Molybdenum

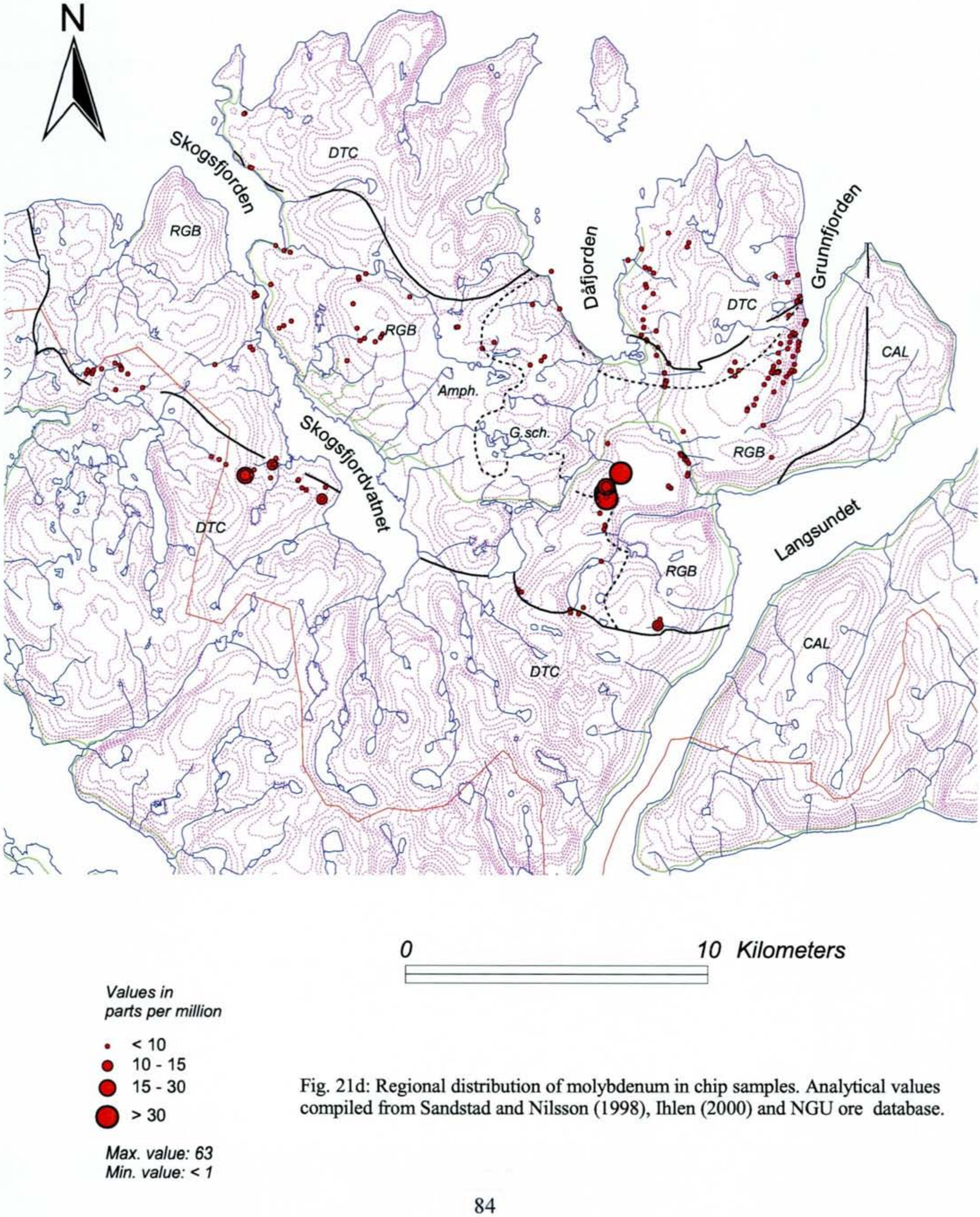


Fig. 21d: Regional distribution of molybdenum in chip samples. Analytical values compiled from Sandstad and Nilsson (1998), Ihlen (2000) and NGU ore database.

evenly distributed on a regional scale with clustering of samples containing enhanced Mo in the Nonsdagsdalselva and the Sørdalselva rivers which appear to reflect possible molybdenite-bearing sulphide mineralisation at Langryggen (max. 25 ppm) and at Sørdalshøgda ridge (max. 60 ppm Mo). The till samples contain normally less 3 ppm Mo with a maximum of 17.5 ppm above the auriferous tonalite intrusives at Sørdalshøgda ridge (Fig. 21c). Other clusters of anomalous till samples are found in the lower part of Bogadalen valley and at Nordkjosvatna lakes.

6.15. Uranium, U, and thorium, Th

Most igneous rocks in the crust contains less than 10 ppm U and 60 ppm Th with highly variable contents in the rock-forming minerals. The maximum contents of the heavy-mineral concentrates are 30 ppm and 21 ppm for U and Th, respectively, which indicate that most of the analytical data represent normal background values. The highest values for both elements are encountered in the greenschist facies domain in addition to some localities in the DTC. None of the known Au occurrences and adjacent sample localities show any enrichment of either U or Th. However, enhanced background levels of both elements are found associated with some of the epigenetic sulphide and Fe-oxide mineralisation at the eastern side of Hårskoltan
montain where up to 14 ppm U and 14 ppm Th occur. The till samples contain maxima of 79 ppm U and 25 ppm Th, which are rather evenly distributed on a regional scale.

7. INTER-ELEMENT CORRELATIONS

Summaries of the inter-element correlation are given in Table 1, whereas scatter diagrams for the element concentrations in heavy-mineral concentrates and chip samples are shown in Fig. 22-24 and Fig. 25-27, respectively. Extreme analytical values have been excluded from the data files used to construct the computer-assisted scatter diagrams. In addition, analytical values below detection limit are nominally set to half of the detection values, i.e. <2 ppm W is set to 1 ppm W.

Heavy-mineral concentrates sampled inside the RGB show a good correlation between S and Se (r=0.93), indicating that Se can be used as a monitor of sulphur contents in the concentrates. In the greenschist facies domain, Co, Ni, Cu, and Ag show good correlation with S and partly with Se (Fig. 22), indicating that these metals occur associated with sulphides in the concentrates. This is less distinct in the amphibolite facies domain (Fig. 23), where Co is the only element which correlates well with S and Se, as well as with Ni. Samples from the DTC show only good correlation between Co and Se (Fig. 24).

A characteristic feature for all the heavy-mineral concentrates is the apparent absence of any correlation between Au and other elements. This is even the case for the till samples (Finne 2000) and chip samples (Fig. 25-27) which suggest that gold appear in a number of different settings and element associations. The element associations typical for the Au mineralisations surveyed by Sandstad and Nilsson (1998) at Sørdalshøgda, i.e. Au-Ag-Cu and Au-As-Zn is not confirmed by the scatter-diagrams for chip samples from the epigenetic deposits (Fig. 26).

Table 1. Summary of inter-element correlations.

Sample type	Greenschist facies domain in RGB (r)	Amphibolite facies domain in RGB (r)	Dåfjord Tonalite Complex (r)
Heavy-mineral concentrates:	None with Au. S-Se (0.93), Co-S (0.87), Co-Se (0.86) Ni-S (0.83), Ag-S (0.83), Cu-S (0.80), Cu-Se (0.64)	None with Au. S-Se (0.93), Co-Se (0.91), Co-S (0.83), Co-Ni (0.77)	None with Au. Co-Se (0.78)
Chip samples:			
Stratabound sulphide deposits	No apparent inter-element correlation	No apparent inter-element correlation.	No deposits
Epigenetic deposits	No apparent inter-element correlations.	None with Au. Cu-Ag (weak)	Only one deposit.
Unmineralised bedrocks and tectonites	None with Au. Co-Ni, weak correlation.	None with Au. Co-Ni and Co-Zn, weak correlations.	No apparent inter-element correlation.
Till samples:	No apparent inter-element correlation, except for weak correlation between Zn-Co and Zn-Hg (Finne, unpubl.).		

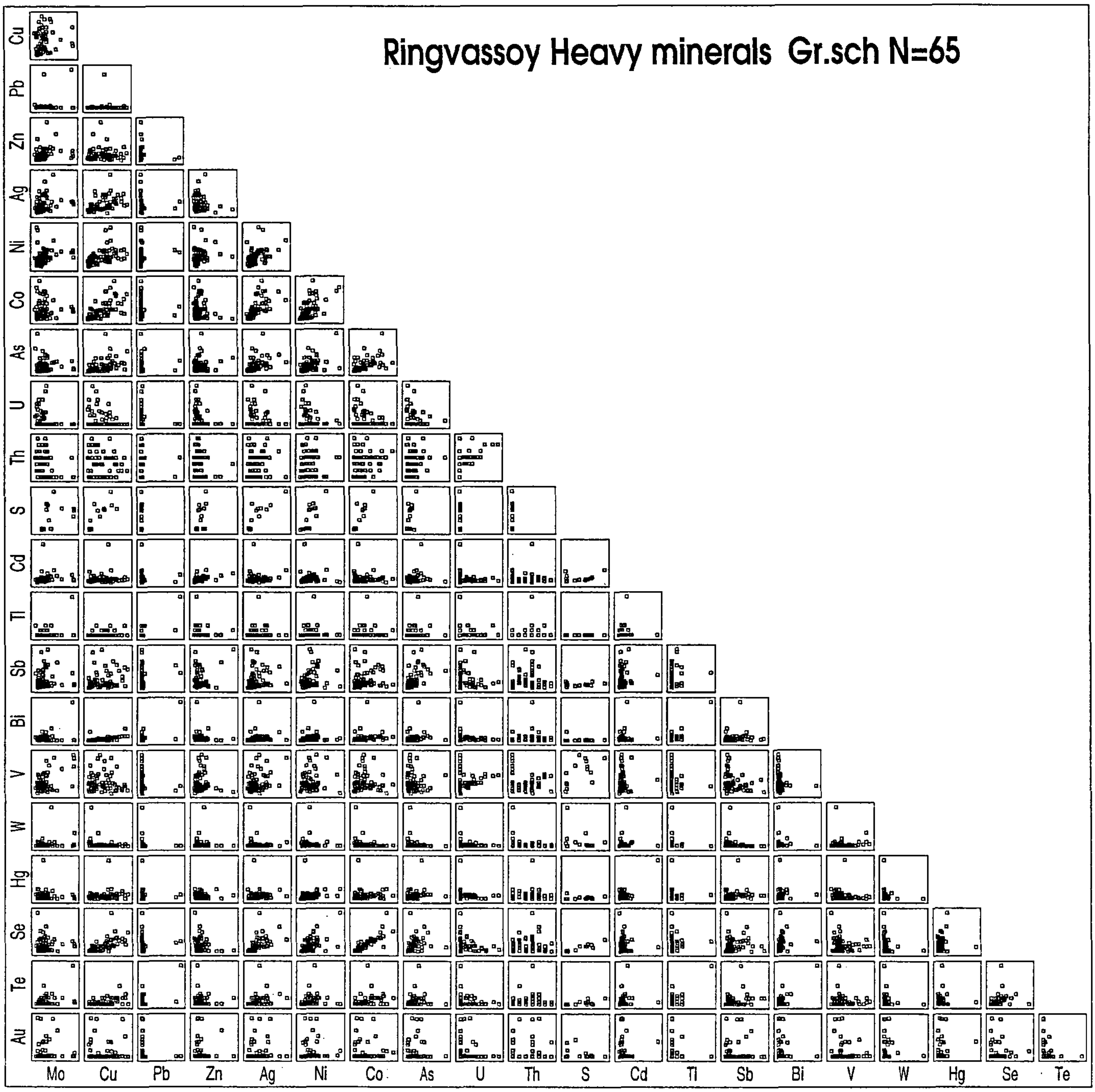


Fig. 22. Inter-element scatter-diagrams for Au, Ag, As, Sb, Bi, S, Se, Te Cu, Ni, Co, Zn, Pb, Cd, Hg, Tl, W, Mo, U, Th and V in heavy-mineral concentrates from the greenschist facies domain of the RGB.

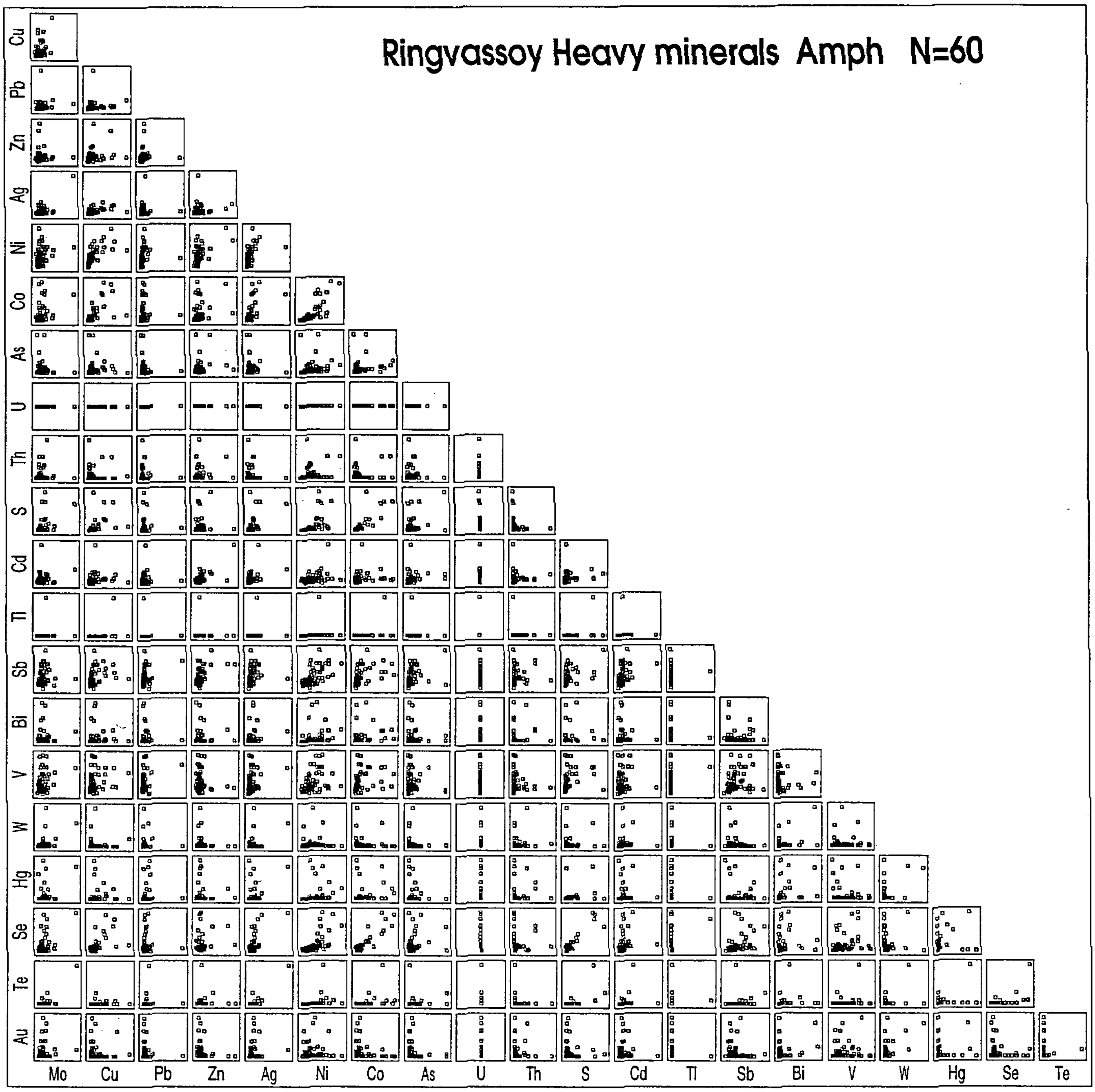


Fig. 23. Inter-element scatter-diagrams for Au, Ag, As, Sb, Bi, S, Se, Te, Cu, Ni, Co, Zn, Pb, Cd, Hg, Tl, W, Mo, U, Th and V in heavy-mineral concentrates from the amphibolite facies domain of the RGB.

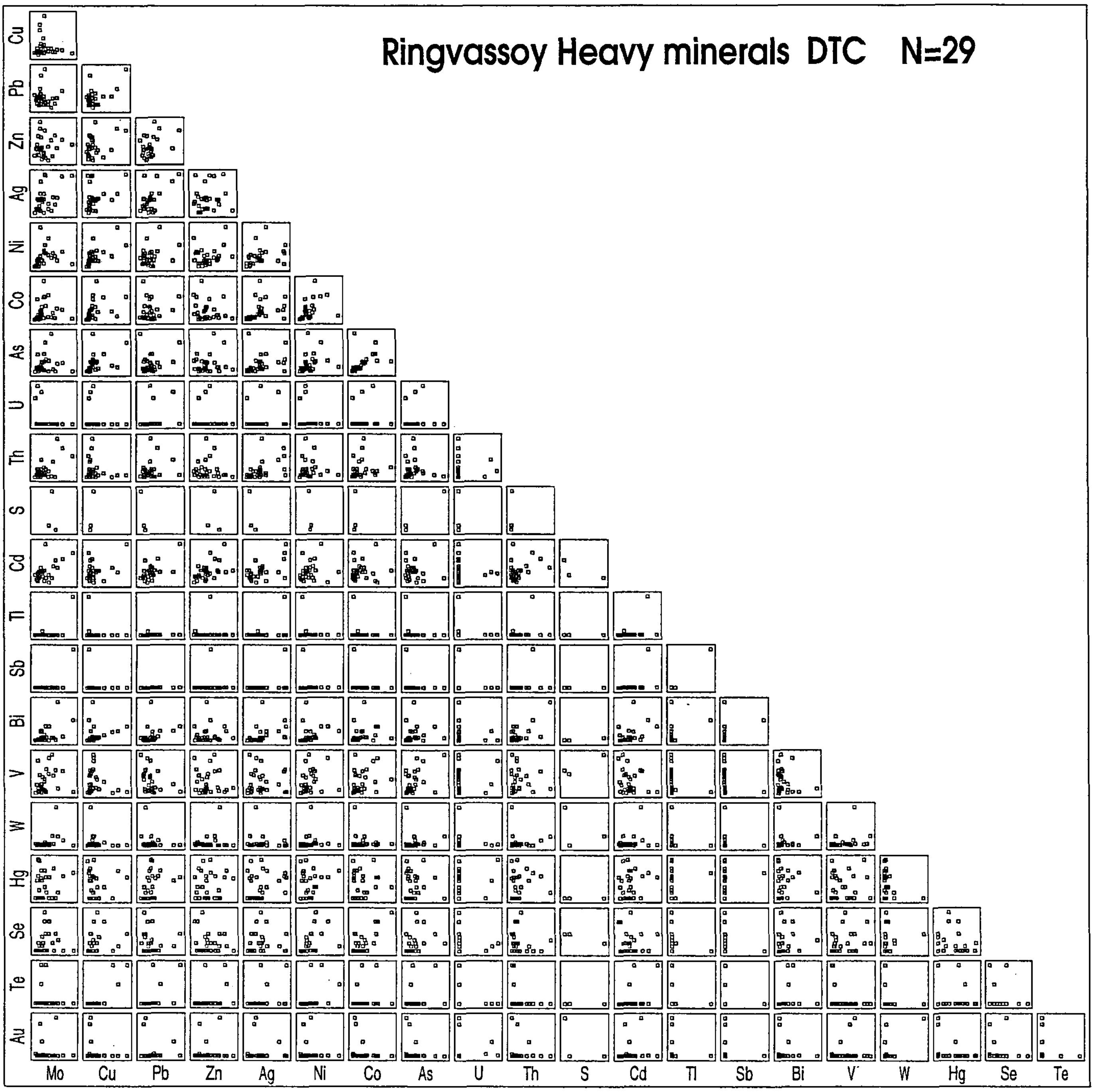


Fig. 24. Inter-element scatter-diagrams for Au, Ag, As, Sb, Bi, S, Se, Te, Cu, Ni, Co, Zn, Pb, Cd, Hg, Tl, W, Mo, U, Th and V in heavy-mineral concentrates from the DTC.

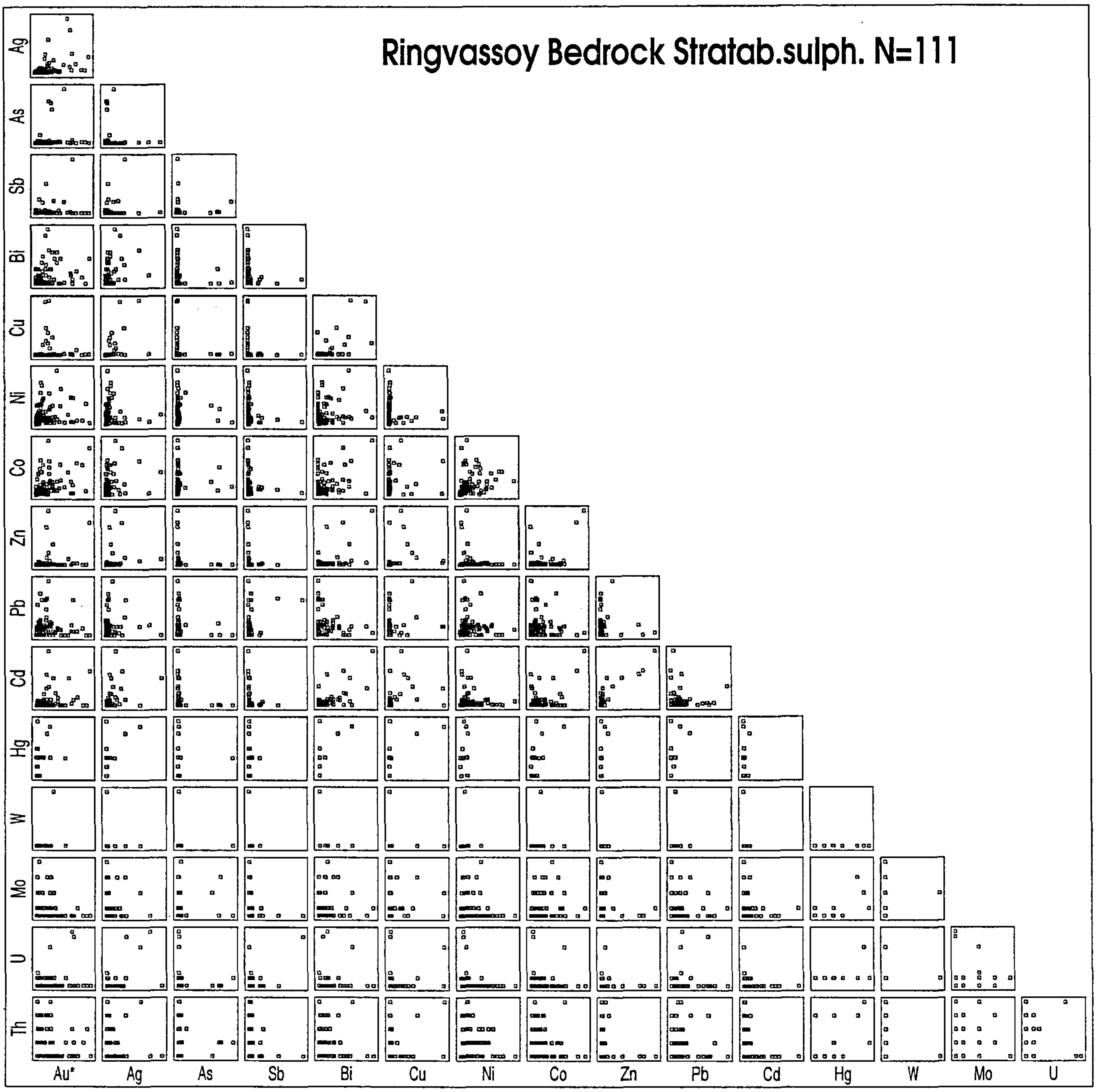


Fig. 25. Inter-element scatter-diagrams for Au, Ag, As, Sb, Bi, Cu, Ni, Co, Zn, Pb, Cd, Hg, W, Mo, U and Th in chip samples of stratabound sulphides and magnetite in the RGB. Analytical values compiled from Sandstad and Nilsson (1998), Ihlen (2000) and NGU ore database.

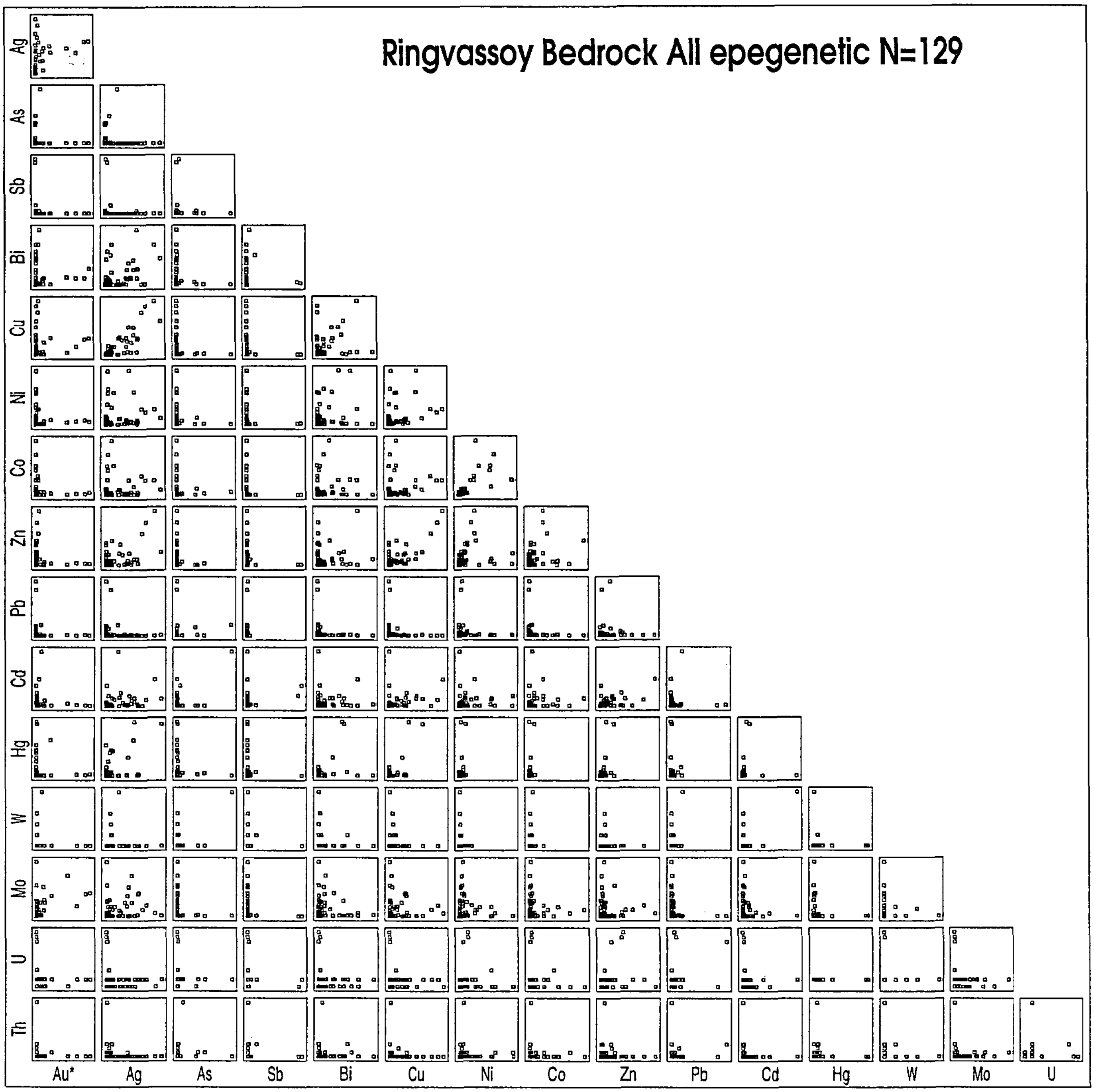


Fig. 26. Inter-element scatter-diagrams for Au, Ag, As, Sb, Bi, Cu, Ni, Co, Zn, Pb, Cd, Hg, W, Mo, U and Th in chip samples of gold and sulphide mineralisation in quartz veins and shear zones (epigenetic) in the RGB and DTC. Analytical values compiled from Sandstad and Nilsson (1998), Ihlen (2000) and NGU ore database.

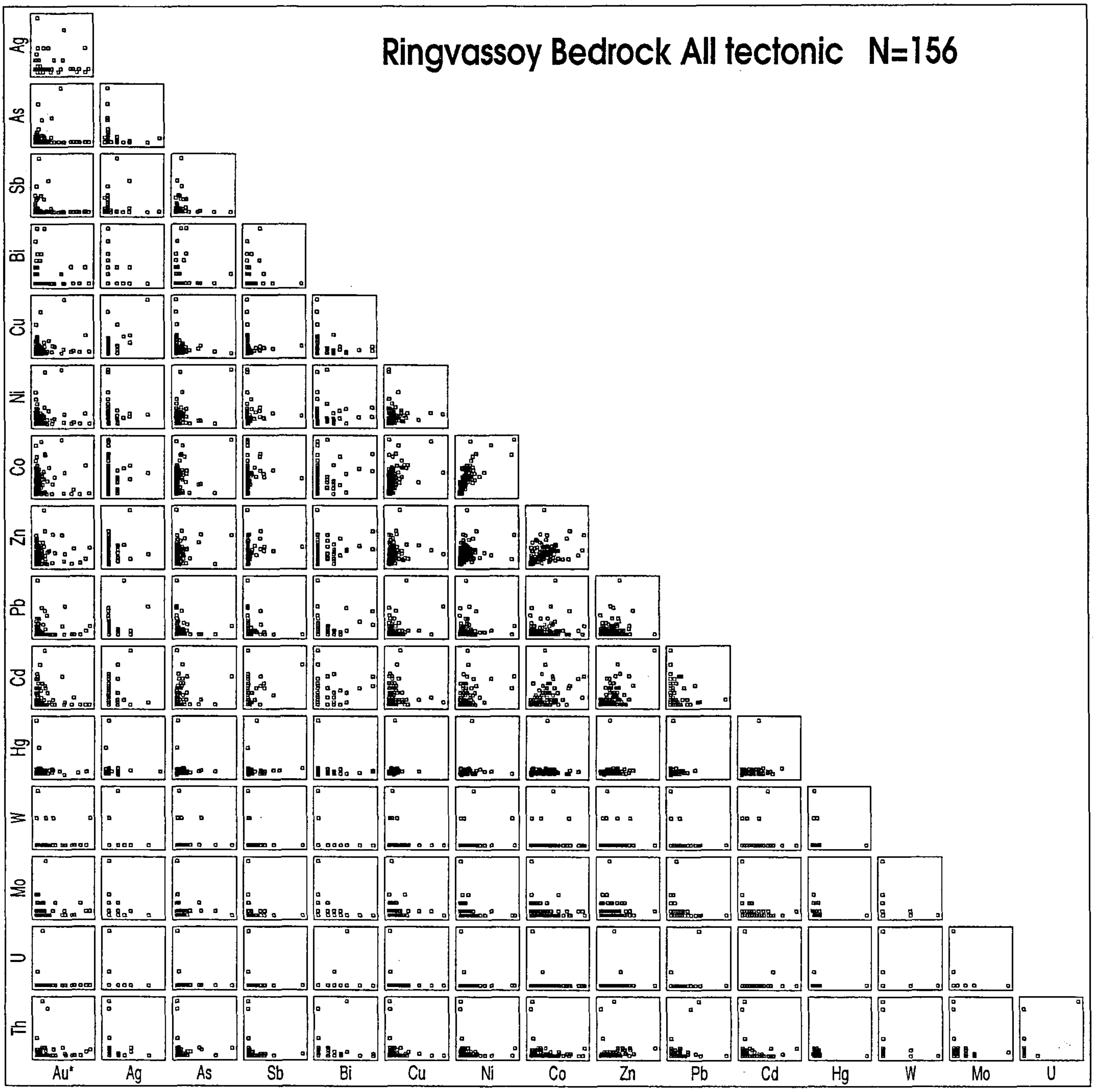


Fig. 27. Inter-element scatter-diagrams for Au, Ag, As, Sb, Bi, Cu, Ni, Co, Zn, Pb, Cd, Hg, W, Mo, U and Th in chip samples of unmineralised bedrocks and tectonites in the RGB and DTC. Analytical values from Ihlen (2000).

8. INTERPRETATIONS OF POSSIBLE GOLD SOURCES

When comparing the regional distribution of gold in different sample media (Fig. 9a-e), it becomes apparent that the strongest gold anomalies of the heavy-mineral concentrates and tills are found in the amphibolite facies domain. On a global scale, the vast majority of epigenetic gold deposits are located in greenschist facies rocks and frequently at the transition towards amphibolite facies. On Ringvassøy this trend is less apparent with known gold mineralisations occurring in both metamorphic domains. These deposits give, in addition, only moderate to weak geochemical anomalies.

The source of the gold enrichment in the western part of the RGB is rather enigmatic. None of the known stratabound sulphide deposits in this area contains more than 212 ppb Au. Since similar sulphide deposits in the greenschist facies domain also are low in gold and with no associated geochemical gold anomalies, such deposits seem an unlikely source for the gold in the heavy-mineral concentrates. The only type of deposit which is high in gold, is the shear-associated sulphide-quartz veins in Leirbogdalen and Nonsdagsdalen valleys. The geochemical signature of the Nonsdagsdalen deposit is a moderate gold and a strong sulphur anomaly in the panned heavy minerals. This stands in contrast to the strong gold anomalies elsewhere which carry associated small (Nordkjosvatn and Midtgårdselva) to moderate (Tennvatn and Leirbogdalen) concentrations of sulphur. The absence of visible gold in the concentrates would suggest that the gold in the source area is fine-grained. In the heavy-mineral concentrates, the most likely carrier of gold is Fe-oxides and/or sulphides which may either have their origin in a low-sulphide shear mineralisation and/or low-sulphide Fe-oxide mineralisation, i.e. banded iron formation.

9. CONCLUSIONS

The presently known occurrences of gold are mainly hosted by quartz veins intersecting greenstones and tonalitic sills of the Skogsfjordvatn Group in the RGB. The vein-type mineralisation is estimated to have a low economic potential. The stratabound Au-As-Zn mineralisation at Sørdalshøgda-South was found to be uneconomic after being tested by core-drilling by industry. Nevertheless, this type of gold mineralisation is the only one that, under favourable conditions, may reach necessary dimensions and grades for a viable mining operation. The geochemistry of the heavy-mineral concentrates indicates that this type may be more widespread in the steep east-facing cliffs in the upper part of the Sørdalen valley, than previously considered.

The geochemistry of the heavy-mineral concentrates shows that the metal enrichment is mainly confined to rivers inside the RGB, whereas those in the DTC and the Caledonides carry normal back-ground levels. The following distribution patterns can be recognised:

- Se, As, Bi, Te, U and Th appear to be enriched in the greenschist facies domain.
- Au is the only element which shows a clear enrichment in the amphibolite facies domain.
- Ag, Sb, Cu, Co, Ni, Zn, Pb, Hg, Tl, W and Mo show no clear enrichment trends between the two metamorphic domains.
- The till geochemistry confirms the enrichment of gold in the western part of the RGB.

- Most of the known ore mineralisations containing high concentrations of Au, Ag, As, Sb, and Cu are detected by the panning method; the main exception includes some of the Zn-rich deposits at Hårskoltan.
- Strongly anomalous concentrations of Pb, Sb and Tl in Gamvikdalen valley within the Helgøya shear zone suggest the presence of these elements in a vein mineralisation. The shear zone appear with the exception of some weakly anomalous samples of gold to be barren.
- Gold in heavy-mineral concentrates, tills and chip samples shows no covariance with any of the other elements which suggests that gold occurs in a number of different geological settings and mineral parageneses.
- Se shows a good correlation with sulphur and thus represents an alternative to monitor the presence of sulphides in the heavy-mineral concentrates.

A short follow-up campaign is proposed for gold in the anomalous areas in the western part of the RGB (see below).

10. RECOMMENDATIONS

Although known gold mineralisations on Ringvassøy are too small to represent any major economic potential, the gold anomalies in the western part of the island suggest the presence of possible new and undiscovered types of gold mineralisation. This is the only reason for making some recommendations for a small follow-up campaign.

Further prospecting on Ringvassøy should be focused on low-sulphide shear-zone mineralisation and Fe-oxide mineralisation in the western amphibolite facies domain. Renewed panning of the rivers in the anomalous areas and the rivers further west should be carried out together with a mineralogical study of the heavy-mineral concentrates. This would facilitate the definition of possible minerals intergrown with gold in the source rocks. Since the gold most probably is derived from tills along the rivers, it becomes evident that the transport direction and distance of the tills are key factors in the search for source rocks. Thus, knowledge of the total Quatenary geology is a necessity for success.

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Appendix 1: Analytical results, raw data and sample weights (grams). Au, Ag and Hg are given in ppb, S in % and the rest of the elements in ppm. All analyses are done at ACME anal. Lab., Canada.
Detection limits: Mo: 01 ppm. Se, Cu, Ni, V, Co and Zn: 1 ppm. As and W: 2 ppm. Bi and Pb: 3 ppm. U: 5 ppm. Th: 2 ppm. Cd: 0.01 ppm. Sb, Bi, Tl and Te: 0.2 ppm. Hg: 10ppb.S: 0.01 %. Ag: 30 ppb. Au: 2 ppb.

Samples	Mo	Cu	Pb	Zn	Ag	Ni	Co	As	U	Th	Cd	Sb	Bi	V	W	Tl	Hg	Se	Te	Au	S	Sample wt.
1-98	0.3	62.1	11	42.8	300	25	260	50.5	15	4	0.08	0.3	< 0.2	351	4	< 0.2	40	0.4	< 0.2	26		1.70
2-98	0.5	26.2	4.2	25.2	151	16	43	10.5	< 5	4	0.06	0.5	0.2	203	4	< 0.2	< 10	< 0.3	< 0.2	1541		5.40
3-98	< 0.1	25.7	14	24.9	< 30	7	11	1.3	11	< 2	0.07	< 0.2	< 0.2	20	5	< 0.2	< 10	< 0.3	< 0.2	102		0.90
4-98	0.7	37.5	32.7	36.2	659	25	127	28.5	13	10	0.09	0.5	1.3	109	< 2	< 0.2	21	0.3	< 0.2	683		3.90
5-98	0.4	41.4	8.3	57	274	31	68	14.4	< 5	3	0.09	0.3	0.2	40	< 2	< 0.2	12	0.3	< 0.2	9		5.10
6-98	4.3	21.2	10389.2	43.3	780	15	24	< 5.5	< 5	12	0.22	484.9	2.7	31	< 2	< 2.2	28	< 3.3	< 2.2	24		2.50
7-98	0.4	9	12.3	31	81	7	12	2.7	< 5	< 2	0.05	0.2	< 0.2	25	< 2	< 0.2	39	< 0.3	< 0.2	6		2.70
8-98	0.2	27.1	9.5	36.4	89	11	22	12	< 5	2	0.04	0.2	< 0.2	102	< 2	< 0.2	21	< 0.3	< 0.2	10		3.40
9-98	0.3	30.2	12.6	35.6	95	17	25	7.9	< 5	5	0.08	0.5	0.2	63	< 2	< 0.2	25	< 0.3	< 0.2	10		2.80
10-98	0.7	58.2	14.9	55	279	27	68	13.4	< 5	5	0.1	0.6	0.3	74	< 2	< 0.2	< 10	< 0.3	< 0.2	11		3.20
11-98	2.5	52.5	11.4	37.1	325	26	148	23.8	< 5	21	0.12	0.3	5	64	24	< 0.2	10	0.5	< 0.2	3		6.70
12-98	3.1	48.8	18.1	51	767	55	132	26.7	< 5	16	0.18	0.8	0.6	243	14	< 0.2	25	< 0.3	< 0.2	11		2.70
13-98	2	31.2	10.9	23.8	334	50	94	8.2	< 5	9	0.13	0.7	0.4	197	5	< 0.2	32	< 0.3	< 0.2	9		3.20
14-98	1.2	57.5	6.2	20.6	787	49	179	36	< 5	5	0.05	0.7	0.5	262	5	< 0.2	10	< 0.3	< 0.2	17		3.60
15-98	1	22.7	9.7	27.5	< 30	17	30	5.3	< 5	2	0.1	< 0.2	< 0.2	46	5	< 0.2	30	< 0.3	< 0.2	4		3.10
16-98	1	91.5	4.8	29.8	292	58	478	30.3	< 5	6	0.1	0.2	0.4	160	5	< 0.2	15	1.4	< 0.2	7		7.00
17-98	0.8	81.5	10.6	38	270	26	166	26.5	< 5	3	0.09	0.5	0.5	181	3	< 0.2	< 10	0.4	< 0.2	44		4.10
18-98	0.7	102.8	5.2	33.9	309	25	109	11	< 5	2	0.1	0.6	0.5	60	2	< 0.2	< 10	0.6	< 0.2	4		6.80
19-98	1.1	120.2	7.3	53.3	275	57	59	89.9	< 5	3	0.16	1.3	0.6	205	2	< 0.2	16	0.4	0.2	9		4.80
20-98	0.4	76.3	14.4	42.3	116	44	36	60.3	< 5	7	0.09	0.7	0.4	76	< 2	< 0.2	< 10	< 0.3	< 0.2	7		6.60
21-98	1.4	211.1	9.2	222.6	216	52	39	615.1	< 5	3	0.39	15.5	0.9	54	< 2	0.2	23	0.6	0.4	21		4.00
22-98	2.4	104.6	10.5	157.5	398	63	90	449.8	< 5	< 2	0.29	10.3	< 0.2	98	< 2	< 0.2	< 10	< 0.3	< 0.2	2303		2.00
23-98	0.6	394	6.4	41.4	881	67	2136	378.8	< 5	5	0.16	1.4	1.9	283	2	0.2	22	12.6	0.4	376		10.80
24-98	1.1	283.6	7.1	47.7	1076	54	1576	281.2	7	4	0.22	1.9	1.3	264	< 2	< 0.2	< 10	9.5	0.5	535		9.60
25-98	1	421.5	5.2	42.2	573	56	1391	193.4	7	3	0.16	1	1.9	206	< 2	< 0.2	< 10	8.8	0.4	15		5.90
26-98	0.7	83.1	3.6	20.1	538	57	567	262.7	12	4	0.07	14.4	0.5	431	< 2	0.2	24	3.5	0.4	16		12.30
27-98	1	367	4.9	20.7	300	89	560	475	6	4	0.07	10.8	1.6	327	< 2	< 0.2	28	3.5	0.4	14		4.90
28-98	1.4	418.6	6.4	40.1	884	83	1306	701.3	< 5	4	0.12	9.3	1.9	116	< 2	< 0.2	33	8.5	0.4	72		7.80
29-98	1.3	87.8	34.5	29.3	278	37	218	34.1	30	6	0.08	2.4	0.5	563	< 2	< 0.2	22	1.1	< 0.2	22		3.20
30-98	1.1	340.5	38.8	66.5	806	76	290	84.8	< 5	2	0.28	2.6	1.9	30	2	< 0.2	24	0.7	0.3	8		4.30
31-98	0.6	218.3	12.8	34.1	283	40	114	18.9	< 5	< 2	0.12	1.1	1.2	21	< 2	< 0.2	< 10	< 0.3	0.3	4		4.90
32-98	0.6	264.3	20.1	69.6	409	134	56	14.1	< 5	2	0.09	2	1.3	50	< 2	< 0.2	30	0.3	0.2	6		5.50
33-98	0.3	31.3	5.7	35.1	102	18	40	7.1	< 5	2	0.03	0.4	< 0.2	37	< 2	< 0.2	< 10	< 0.3	< 0.2	3		3.40
34-98	0.4	295.9	29.8	130.8	< 30	116	297	51.7	< 5	< 2	0.11	< 0.2	0.2	166	< 2	< 0.2	56	< 0.3	< 0.2	31		2.20
35-98	1.3	78.4	12.2	48.4	< 30	35	25	5.5	< 5	< 2	0.04	< 0.2	0.3	37	< 2	< 0.2	62	< 0.3	< 0.2	5		1.50
36-98	0.4	80	13.2	46	128	49	78	8.8	< 5	< 2	0.08	0.4	0.3	59	< 2	< 0.2	42	< 0.3	< 0.2	5		2.10
37-98	0.6	81	15.6	80.9	56	38	23	6.9	< 5	< 2	0.1	0.6	0.4	72	< 2	< 0.2	23	< 0.3	< 0.2	3		3.60
38-98	2.2	137.4	12.1	66.3	158	61	123	43.3	< 5	< 2	0.19	1.6	0.7	66	2	< 0.2	19	1	< 0.2	18		3.70
39-98	1.2	330.1	6.7	35.4	1198	81	715	725.6	11	7	0.12	1.9	1.5	541	3	< 0.2	26	5.3	0.2	1300		7.90
40-98	1.2	531.3	6.4	30.1	1162	85	1139	357	< 5	4	0.13	8.3	2.3	287	< 2	0.3	25	7.1	0.4	1800		6.10
41-98	1.9	495.5	10.8	51.2	698	80	377	391	< 5	2	0.14	4.7	2.3	118	< 2	< 0.2	48	6.1	< 0.2	3360		3.10
42-98	0.3	285.1	5.2	75	339	44	695	269.3	< 5	4	0.16	2.2	1.2	255	< 2	< 0.2	< 10	5.7	< 0.2	23		4.00
43-98	0.8	139.7	9.8	32.9	253	39	171	151.9	< 5	3	0.11	5.4	0.8	155	< 2	< 0.2	31	1.6	< 0.2	17		3.60

Samples	Mo	Cu	Pb	Zn	Ag	Ni	Co	As	U	Th	Cd	Sb	Bi	V	W	Tl	Hg	Se	Te	Au	S	Sample wt.
44-98	4.1	4266.5	938.3	28.7	684	71	704	476.9	< 5	4	0.33	6.1	19.1	233	< 2	< 1.8	27	6.4	2	30		6.00
45-98	< 0.3	334	78.4	47.3	308	47	554	1033.1	8	4	0.13	5.9	1.6	177	< 2	< 0.6	28	3.5	< 0.6	10		3.60
46-98	0.9	575.2	6.9	55	525	66	1410	918.3	< 5	2	0.16	7.5	2.4	110	< 2	< 0.2	29	11.8	< 0.2	14		3.60
47-98	1.2	1035.5	5.6	43.5	1892	82	1540	754.4	< 5	5	0.22	8.6	4.3	250	< 2	< 0.2	55	15.5	0.6	31		6.00
48-98	0.6	497.9	2.5	15.5	913	41	878	411.4	< 5	3	0.11	3.1	2.2	165	< 2	< 0.2	33	8.1	0.4	55		10.20
49-98	0.6	133.3	7.2	28.5	1316	54	1021	597.8	5	4	0.1	6.3	0.8	243	3	< 0.2	25	6.2	< 0.2	3360		5.60
50-98	0.4	276.3	4	56.5	964	170	1563	1716.2	5	4	0.06	7	0.4	571	< 2	< 0.2	19	2.8	< 0.2	78		2.00
51-98	0.9	409.4	7.3	220	540	117	673	91.3	< 5	3	0.1	1.6	1.2	240	2	< 0.2	20	4.5	< 0.2	28		2.30
52-98	1.5	243.5	6.2	36	642	84	513	77.7	< 5	3	0.13	1.8	1.1	171	< 2	< 0.2	29	3.7	< 0.2	21		4.80
53-98	0.4	22.2	4.9	27	206	34	22	2.7	13	4	0.09	< 0.2	< 0.2	299	6	< 0.2	16	< 0.3	< 0.2	1065		4.10
54-98	0.9	160.6	3.6	39.3	423	22	224	32.4	20	6	0.15	0.4	1.3	596	< 2	< 0.2	< 10	1	< 0.2	10		8.70
55-98	0.7	182.6	5.2	86.9	243	37	59	9.9	12	4	0.23	0.4	0.8	289	< 2	< 0.2	13	0.3	< 0.2	13		5.40
56-98	0.5	33	3	27.9	65	23	57	7	20	6	0.07	0.2	0.2	512	< 2	< 0.2	< 10	< 0.3	< 0.2	11		6.30
57-98	0.5	147.3	5	47.6	288	50	384	139.1	17	5	0.12	3.2	0.7	476	< 2	< 0.2	< 10	1.8	0.2	2		6.30
58-98	1.1	293.4	6.7	77.4	629	64	572	182.2	< 5	4	0.15	1	1.3	174	< 2	< 0.2	20	2.4	< 0.2	19		3.00
59-98	0.7	404	6.3	51.7	651	68	1448	377.8	< 5	3	0.17	1	1.8	92	< 2	< 0.2	11	8.2	0.3	18		6.70
60-98	1.4	243.5	6.6	71.2	974	74	895	282.8	< 5	5	0.24	1.2	1.1	212	< 2	< 0.2	30	4.4	< 0.2	13		3.40
61-98	0.3	51.9	3.5	32.2	221	30	137	186.8	9	5	0.09	0.4	0.2	328	8	< 0.2	14	0.8	< 0.2	3420		5.40
62-98	0.3	311.5	4	26.4	475	37	376	166.4	17	4	0.08	1.1	1.4	332	2	< 0.2	< 10	2.4	< 0.2	21		5.30
63-98	0.8	222.9	46.1	47.2	301	41	208	39.9	6	3	0.11	1.9	1	232	3	< 0.2	19	1.3	< 0.2	15		5.60
64-98	0.3	38.7	3.1	23	194	17	109	37.2	15	4	0.07	1.5	0.3	338	< 2	< 0.2	< 10	0.5	< 0.2	2		6.20
65-98	0.3	107.7	2.8	26.4	77	20	189	115.2	< 5	3	0.08	2.8	0.5	172	2	< 0.2	20	1.1	< 0.2	11		8.00
66-98	0.3	65.2	5.1	21	530	23	310	104	< 5	2	0.13	2.2	0.3	283	< 2	< 0.2	31	2.7	< 0.2	11		8.10
67-98	0.4	25.9	3.4	24.4	199	16	95	38.3	< 5	2	0.09	4.1	0.2	123	8	< 0.2	13	0.5	0.2	2		6.10
68-98	0.8	114.1	3.7	26.2	407	30	462	148.3	9	3	0.1	3.5	0.4	296	< 2	< 0.2	22	3.4	0.2	10		5.60
69-98	0.9	450.5	5	29.3	1115	47	909	296.3	< 5	2	0.1	7	2	193	4	< 0.2	30	7	1	24		5.00
70-98	0.8	63	3.8	23.9	310	17	624	106	< 5	2	0.05	2	0.2	186	3	< 0.2	16	3.8	0.2	3		5.30
71-98	0.5	329	2.8	21.9	528	31	909	340.4	< 5	2	0.1	2.7	1.3	251	< 2	< 0.2	34	7.2	0.3	5		13.30
72-98	0.9	302.8	4.7	533.8	371	31	218	615.6	< 5	4	1.57	5.2	1	420	< 2	< 0.2	223	2.9	0.2	1329		7.00
73-98	0.9	218.9	4.3	21.7	242	38	500	332.6	11	3	0.05	3.4	0.8	347	< 2	< 0.2	10	3.5	< 0.2	17		5.40
74-98	1.1	258.7	822.6	18.3	275	81	222	50.9	< 5	< 2	0.04	9	0.7	95	< 2	0.2	12	5.4	0.2	14		2.10
75-98	0.3	341	10.6	17	693	182	1766	132	< 5	4	0.02	0.6	1.1	19	< 2	< 0.2	58	23.9	< 0.2	486		3.10
76-98	0.1	14.4	5.8	18.1	46	50	16	25.1	< 5	< 2	0.03	< 0.2	< 0.2	49	< 2	< 0.2	16	< 0.3	< 0.2	14		2.10
77-98	0.5	12.2	5.1	11.8	102	11	4	13.9	< 5	4	0.06	0.3	< 0.2	21	< 2	< 0.2	16	< 0.3	< 0.2	7		3.30
78-98	< 0.1	35.3	6.4	15.4	176	11	9	3.2	< 5	< 2	0.03	0.6	< 0.2	7	< 2	< 0.2	< 10	< 0.3	< 0.2	7		2.70
79-98	0.5	9.2	209	12.2	51	7	9	1	< 5	3	0.04	3.1	0.2	30	< 2	0.2	< 10	< 0.3	< 0.2	4		5.50
80-98	1.4	98.9	111.2	82.5	887	156	124	371.3	< 5	7	0.4	18.5	0.8	11	< 2	0.2	53	15.8	< 0.2	5		6.90
81-98	0.8	26	8.6	18.6	238	26	76	8.6	< 5	2	0.06	0.2	< 0.2	51	< 2	0.2	< 10	0.4	< 0.2	5		3.90
82-98	1	149.7	12.7	21.9	408	53	284	51.9	< 5	3	0.03	0.3	0.8	135	9	< 0.2	15	1.1	< 0.2	12		3.40
83-98	1.5	62.9	8.1	17	201	98	309	32.2	< 5	4	0.02	0.2	1.9	380	5	< 0.2	24	1.1	< 0.2	18		3.20
84-98	1.8	536.9	45.9	88.1	457	46	326	105	< 5	4	0.24	0.9	6.1	235	4	0.3	< 10	4.5	0.6	9		3.80
85-98	1.3	298.8	7.1	37.1	443	48	230	110.8	< 5	4	0.08	0.7	2.2	164	< 2	0.2	< 10	2.4	< 0.2	17		3.10
86-98	1	274.1	5.8	32.2	1111	35	936	260.4	10	4	0.15	1.5	1.2	348	< 2	0.2	17	6.5	0.5	16		5.30
87-98	1.2	139.4	5.2	23.3	1065	27	501	308.1	26	6	0.2	1.8	0.5	539	2	0.3	22	3.3	0.2	44		5.70
1-99	0.81	42.72	3.51	30	87	41.9	35.4	9.2	< 5	<2	0.09	1.39	0.16	295	< 2	< 0.02	< 5	0.5	< 0.02	564	0.14	12.95
2-99	1.75	56.98	4.43	64.5	136	50.2	77.1	103.9	< 5	<2	0.28	1.98	0.12	156	64.7	0.02	< 5	0.8	0.02	72	0.12	6.89
3-99	1.03	65.28	6.35	71.9	145	31.8	112.7	29	< 5	<2	0.16	1.14	0.09	631	< 2	0.04	< 5	0.7	0.02	9	0.09	11.95

Samples	Mo	Cu	Pb	Zn	Ag	Ni	Co	As	U	Th	Cd	Sb	Bi	V	W	Tl	Hg	Se	Te	Au	S	Sample wt.
4-99	1.28	107.59	10.2	77.9	274	67	172	46.6	< 5	<2	0.22	2.67	0.17	353	< 2	0.05	< 5	2.6	0.09	21	2.06	8.94
5-99	0.78	39.76	2.78	31.1	152	12.1	14.8	303.5	< 5	<2	0.47	2.63	0.08	75	5.8	0.02	< 5	0.4	0.07	14	0.03	12.18
6-99	1.01	46.12	3.74	65.9	120	42.8	38.9	22.6	< 5	<2	0.12	1.31	0.05	172	< 2	0.03	< 5	0.7	< 0.02	145	0.11	9.70
7-99	0.91	66.56	4.39	115.7	153	34.7	50.8	104.2	< 5	<2	0.29	1.55	0.06	168	3.1	0.06	< 5	0.9	0.04	10	0.15	11.73
8-99	2	77.38	4.03	63.4	252	52.1	94.6	30.5	< 5	<2	0.14	1.61	0.11	1092	< 2	0.06	8	0.6	0.02	6	0.95	9.86
9-99	2.46	169.51	3.85	38.6	486	67.5	189.7	33.2	< 5	<2	0.14	1.27	0.56	588	10.6	0.1	8	1.7	0.16	8	1.18	9.70
10-99	1.17	106.32	2.96	27.2	449	53.7	208.7	16.4	< 5	<2	0.1	0.36	3.81	602	2.8	0.05	7	1.9	0.05	2476	1.86	23.37
11-99	0.62	180.2	2.02	42.8	221	32.3	63.4	6.2	< 5	<2	0.08	0.56	0.18	241	3.8	0.03	5	0.8	0.03	738	0.3	16.52
12-99	1.66	287.35	3.6	45.8	570	67.5	271.9	42.6	< 5	<2	0.15	1.35	0.22	780	< 2	0.05	10	2.5	0.1	44	1.79	9.26
13-99	0.95	81.24	6.22	74.5	845	75.8	338.6	40.9	< 5	<2	0.09	1.6	2.11	255	< 2	0.09	< 5	0.9	0.23	234	0.76	3.34
14-99	1.13	116.15	7.37	264	1005	84	144.1	37.3	< 5	<2	0.9	1.57	0.15	196	< 2	< 0.02	6	1.2	0.03	5	0.24	6.48
15-99	0.79	101.77	5.3	77.9	325	61.2	114.9	25.4	< 5	<2	0.3	1.04	0.14	1086	16.3	0.04	< 5	0.9	0.03	102	0.4	16.78
16-99	1.62	31.68	2.74	44.4	73	35.1	31	4.1	< 5	<2	0.06	0.68	0.15	538	10	0.02	< 5	0.5	< 0.02	2	0.04	10.40
17-99	0.75	32.62	4.56	70.9	169	37.2	30.3	7.6	< 5	2	0.13	1.08	0.05	224	13.4	< 0.02	< 5	0.4	< 0.02	374	0.01	6.80
18-99	1.13	44.43	13.53	79.2	56	48.9	58	14	< 5	<2	0.12	0.67	0.11	265	2.2	< 0.02	< 5	0.9	< 0.02	14	0.07	9.31
19-99	1.4	282.23	4.45	46.4	1240	94.2	709.7	147.3	< 5	<2	0.13	0.91	0.33	593	< 2	0.03	13	6.5	0.18	34	4.84	11.78
20-99	1.01	34.4	1.8	29.1	166	24.8	33.9	33.1	< 5	<2	0.06	0.54	0.06	201	3.4	< 0.02	< 5	0.5	< 0.02	1245	0.2	13.88
21-99	1.55	17.39	1.43	43.2	48	22.2	31.4	22.7	< 5	<2	0.08	0.65	0.11	216	2.9	0.02	< 5	0.5	0.02	86	0.04	16.50
22-99	0.76	8.79	1.15	49.2	19	14.1	23.6	2.9	< 5	<2	0.1	0.47	0.07	161	< 2	0.02	< 5	0.3	< 0.02	3	0.01	16.38
23-99	1.16	12.36	1.59	33.6	86	23.1	21.1	7.9	< 5	<2	0.08	0.67	0.05	191	10.6	< 0.02	< 5	0.7	< 0.02	1041	0.03	9.43
24-99	1.25	33.3	1.61	38.4	538	32.6	97.2	34.4	< 5	<2	0.09	0.7	0.05	582	9.4	< 0.02	< 5	0.8	< 0.02	2028	0.29	11.00
25-99	0.64	29.33	1.81	32.5	91	25	49.3	23.3	< 5	<2	0.05	0.4	0.26	380	5.5	0.02	< 5	0.6	0.02	1110	0.18	18.85
26-99	1.25	31.11	2.26	40.6	216	32.7	67.8	72.7	< 5	<2	0.16	0.67	0.1	445	6.3	0.05	8	0.9	0.02	914	0.49	14.39
27-99	1.19	31.23	2.4	36.9	420	47.1	78.5	36.1	< 5	<2	0.09	0.97	0.03	856	29.4	< 0.02	< 5	0.5	< 0.02	10234	0.33	6.69
28-99	0.9	13.47	1.01	43.4	25	25.3	24.2	4.4	< 5	<2	0.04	0.42	0.04	183	< 2	< 0.02	< 5	0.8	< 0.02	57	0.03	11.58
29-99	0.57	40.98	1.7	42.6	64	29.6	35	91	< 5	<2	0.12	0.5	0.25	179	3.6	0.04	< 5	0.7	0.03	22	0.17	17.49
30-99	1.13	40.54	2.13	36.8	119	39.3	39.6	78.2	< 5	<2	0.05	0.86	0.07	218	4.3	0.02	< 5	0.7	< 0.02	22	0.1	9.13
31-99	0.87	72.9	2.89	60.8	130	44.7	80.3	127.2	< 5	<2	0.21	1.17	0.1	406	9.5	0.07	< 5	1.1	0.04	20	0.34	8.04
32-99	2.31	22.01	3.02	52.8	83	31.3	39.1	23.1	0.6	4.6	0.23	0.56	0.09	205	32.1	0.08	< 5	0.9	0.03	6	0.25	13.51
33-99	1.14	21.02	3.17	51.3	40	33.8	28.4	7.8	< 5	<2	0.14	0.78	0.07	174	53.2	0.02	< 5	0.8	< 0.02	9	0.02	6.43
34-99	0.8	26.44	3.04	51.2	46	38.9	43.8	25.2	< 5	2.3	0.11	0.58	0.17	145	< 2	0.05	< 5	0.4	0.04	< 2	0.15	22.82
35-99	1.75	94.09	1.88	47.9	443	41.5	35.2	48.1	0.5	2.2	0.12	0.36	3.55	303	454.2	0.04	50	0.2	0.1	8777	0.12	16.87
36-99	1.83	61.15	1.98	50.1	59	34.6	40.2	111.6	< 5	<2	0.05	1.04	0.43	415	24.8	< 0.02	< 5	0.4	0.03	< 2	0.92	6.39
37-99	1.96	100.28	5.54	122.9	289	62.3	238.9	471.7	< 5	<2	0.25	2.45	0.17	152	7.9	0.1	< 5	4.4	0.36	632	6.43	4.19
38-99	0.93	26.17	1.19	52.6	68	24.8	15.2	5.1	< 5	<2	0.12	0.31	0.02	111	31.3	0.02	< 5	0.1	< 0.02	154	0.02	14.35
39-99	0.52	14.71	1.64	46.5	102	20.1	13	8.2	< 5	<2	0.1	0.31	0.02	127	19.9	0.02	< 5	0.6	< 0.02	1211	0.02	13.02
40-99	0.98	462.78	5.94	70.3	960	82.5	78	11.9	< 5	<2	0.24	0.78	0.06	234	< 2	0.05	< 5	1	0.07	6622	0.52	11.34
41-99	0.81	63.43	1.68	60.6	82	33.5	36.4	9	< 5	<2	0.08	0.52	0.62	167	10.3	0.03	5	0.5	0.08	8	0.04	7.38
42-99	0.76	53.5	1.47	48	187	27.1	61.9	36.2	< 5	<2	0.11	0.35	0.05	495	8.6	0.02	< 5	0.4	0.02	4004	0.15	17.86
43-99	1.48	38.26	4.81	39.6	95	43.4	44.6	1.6	< 5	<2	0.07	0.34	0.11	216	< 2	0.04	< 5	0.7	0.03	3	0.16	9.49
44-99	1.68	16.31	1.27	36.7	432	17.3	16.2	3.3	0.6	<2	0.13	0.43	0.08	104	242.7	0.02	< 5	0.6	< 0.02	6860	0.04	11.01
45-99	1.64	18.72	2.88	43.1	492	30.6	18.4	0.8	1	2	0.11	0.44	0.08	177	36.5	< 0.02	< 5	0.4	< 0.02	4077	0.03	7.15
46-99	2.27	33.97	5.94	58.3	184	39.9	31.6	2.3	0.6	<2	0.17	1.05	0.16	253	98.2	< 0.02	< 5	0.7	< 0.02	1841	0.06	6.85
47-99	0.61	29.02	1.87	36.9	30	16.6	16.9	473	< 5	<2	0.15	0.33	0.65	106	18.5	0.07	< 5	0.3	0.09	95	0.02	18.06
48-99	1.52	25.77	3	47.7	25	25.8	16	9	< 5	<2	0.14	0.4	0.11	100	18.9	0.05	5	0.6	0.03	18	< .01	10.59
49-99	1.21	15.7	1.87	41.2	245	16.4	12.1	4.3	< 5	<2	0.13	0.26	0.11	92	93.4	0.03	< 5	0.5	0.02	3924	0.01	13.89
50-99	2.24	57.61	6.14	52	67	32.9	40.4	1.5	< 5	<2	0.05	0.63	0.08	466	16.7	< 0.02	< 5	0.3	< 0.02	24	0.07	7.22

Samples	Mo	Cu	Pb	Zn	Ag	Ni	Co	As	U	Th	Cd	Sb	Bi	V	W	Tl	Hg	Se	Te	Au	S	Sample wt.
51-99	1.36	50.05	7.27	40.6	88	68.8	58.7	2.6	< 5	<2	0.04	0.51	0.05	1117	< 2	< 0.02	5	0.4	< 0.02	20	0.06	3.96
52-99	3.6	680.14	16.45	53.9	281	59.6	113.8	5.3	< 5	<2	0.07	0.72	0.14	639	93.6	0.06	< 5	1.2	0.04	591	0.73	7.13
53-99	1.28	34.04	4.22	54.5	90	32.9	34.1	1.9	< 5	<2	0.05	0.34	2.31	173	40.2	< 0.02	< 5	0.5	< 0.02	742	0.07	5.50
54-99	7.6	9867.86	10.1	53.4	3898	67.4	486.2	6.5	< 5	<2	0.35	0.7	1.06	770	278.4	0.12	53	6.8	1.02	1805	4.5	7.03
55-99	3.41	67.54	4.23	42.4	174	44.5	60.2	2.8	< 5	<2	0.05	0.3	0.15	290	8.9	< 0.02	< 5	0.6	0.03	1823	0.1	5.03
56-99	1.4	351.41	4.43	41.6	1368	52.2	585.5	199.6	< 5	<2	0.18	1.09	0.21	652	< 2	0.02	11	4.3	0.13	111	1.96	21.66
57-99	1.26	251.16	4.33	43.3	1139	53.6	457.8	125.9	< 5	<2	0.14	1.32	0.52	990	3	0.02	8	3.4	0.09	26	1.61	11.30
58-99	1.54	49.53	3.25	48.8	239	38.7	293.8	45	< 5	<2	0.1	0.85	0.1	853	7.5	< 0.02	5	1.1	< 0.02	1510	0.76	11.00
59-99	4.3	156.4	2.63	38.5	534	50.1	441.7	103.3	< 5	<2	0.11	1.57	0.26	1072	22.5	0.03	< 5	3.4	0.17	334	1.54	13.47
60-99	4.24	188.85	2.98	53.5	701	80.3	517.6	123.2	< 5	<2	0.13	1.13	0.33	1171	3.7	< 0.02	14	3.5	0.22	47	1.08	8.35
61-99	4.25	421.03	3.31	66.9	619	72.4	573.3	149.8	< 5	<2	0.15	1.36	0.42	827	2.5	0.02	10	4.8	0.23	39	1.68	9.86
62-99	2.94	243.04	3.33	67.6	802	76.4	566.7	224.1	< 5	<2	0.15	1.25	0.27	752	< 2	< 0.02	14	4.6	0.4	26	1.7	9.08
63-99	2.08	345.39	4.83	79	2325	123.8	1068.1	413.5	0.5	<2	0.52	1.86	0.34	1081	7.5	0.02	19	7.5	0.4	32	3.02	8.41
64-99	0.8	44.3	2.59	26.1	184	20.1	49.7	11.7	< 5	<2	0.05	0.44	4.48	324	13.2	0.02	36	0.1	0.02	1244	0.1	22.77
65-99	0.57	39.09	1.62	50.3	105	31.6	56.3	8.4	< 5	<2	0.05	0.69	0.2	349	3.4	0.02	< 5	0.7	< 0.02	2329	0.14	8.82
66-99	0.96	166.15	3.71	61.9	296	55.8	245	251.5	< 5	<2	0.26	0.53	0.09	777	12.5	0.02	< 5	1.7	0.07	484	0.91	19.48
67-99	0.93	23.32	4.47	25.4	38	15.9	20	10.7	< 5	<2	0.11	0.59	0.04	265	10.3	< 0.02	< 5	0.6	< 0.02	233	0.04	7.58
68-99	0.96	74.71	4.58	54.8	129	31.3	51.3	63.4	< 5	<2	0.12	0.66	0.25	287	4.3	< 0.02	< 5	0.6	0.03	5	0.22	14.98
69-99	0.53	39.19	2.39	48.1	156	36	54.2	4.3	< 5	<2	0.09	0.57	0.14	308	< 2	< 0.02	< 5	0.4	< 0.02	13	0.07	10.66
70-99	1.29	104.09	66.25	47.5	247	36.9	110.6	20.1	< 5	<2	0.09	1.79	0.16	848	< 2	< 0.02	< 5	0.6	< 0.02	7	0.38	11.90
71-99	2.02	432.34	4.09	51.7	881	61.6	553.4	52.3	< 5	<2	0.15	1.09	0.35	778	< 2	0.11	< 5	5.7	0.17	11	4.8	13.87
72-99	1.92	263.82	4.15	63.1	499	55	486.4	70.5	< 5	<2	0.14	1.09	0.11	371	22.7	0.02	< 5	3.1	0.04	7	2.03	7.44

Appendix 2: Normalised values according to a sample weight of 5 grams.

Samples	Mo	Cu	Pb	Zn	Ag	Ni	Co	As	U	Th	Cd	Sb	Bi	V	W	Tl	Hg	Se	Te	Au	S	Sample wt.
1-98	0.1	21.1	3.7	14.6	102	9	88	17.2	5	< 2	0.03	< 0.2	< 0.2	119	< 2	< 0.2	14	< 0.3	< 0.2	9		1.70
2-98	0.5	28.3	4.5	27.2	163	17	46	11.3	< 5	4	0.06	0.5	0.2	219	4.3	< 0.2	< 10	< 0.3	< 0.2	1664		5.40
3-98	< 0.1	4.6	2.5	4.5	< 30	1	2	0.2	<5	< 2	0.01	< 0.2	< 0.2	4	< 2	< 0.2	< 10	< 0.3	< 0.2	18		0.90
4-98	0.5	29.3	25.5	28.2	514	20	99	22.2	10	8	0.07	0.4	1.0	85	< 2	< 0.2	16	< 0.3	< 0.2	533		3.90
5-98	0.4	42.2	8.5	58.1	279	32	69	14.7	< 5	3	0.09	0.3	0.2	41	< 2	< 0.2	12	0.3	< 0.2	9		5.10
6-98	2.2	10.6	5194.6	21.7	390	8	12	<5.5	< 5	6	0.11	242.5	1.4	16	< 2	< 0.2	14	< 3.3	< 0.2	12		2.50
7-98	0.2	4.9	6.6	16.7	44	4	6	1.5	< 5	< 2	0.03	< 0.2	< 0.2	14	< 2	< 0.2	21	< 0.3	< 0.2	3		2.70
8-98	0.1	18.4	6.5	24.8	61	7	15	8.2	< 5	< 2	0.03	< 0.2	< 0.2	69	< 2	< 0.2	14	< 0.3	< 0.2	7		3.40
9-98	0.2	16.9	7.1	19.9	53	10	14	4.4	< 5	3	0.04	0.3	< 0.2	35	< 2	< 0.2	14	< 0.3	< 0.2	6		2.80
10-98	0.4	37.2	9.5	35.2	179	17	44	8.6	< 5	3	0.06	0.4	< 0.2	47	< 2	< 0.2	< 10	< 0.3	< 0.2	7		3.20
11-98	3.4	70.4	15.3	49.7	436	35	198	31.9	< 5	28	0.16	0.4	6.7	86	32.2	< 0.2	13	0.7	< 0.2	4		6.70
12-98	1.7	26.4	9.8	27.5	414	30	71	14.4	< 5	9	0.10	0.4	0.3	131	7.6	< 0.2	14	< 0.3	< 0.2	6		2.70
13-98	1.3	20.0	7.0	15.2	214	32	60	5.3	< 5	6	0.08	0.4	0.3	126	3.2	< 0.2	20	< 0.3	< 0.2	6		3.20
14-98	0.9	41.4	4.5	14.8	567	35	129	25.9	< 5	4	0.04	0.5	0.4	189	3.6	< 0.2	< 10	< 0.3	< 0.2	12		3.60
15-98	0.6	14.1	6.0	17.1	< 30	11	19	3.3	< 5	< 2	0.06	< 0.2	< 0.2	29	3.1	< 0.2	19	< 0.3	< 0.2	2		3.10
16-98	1.4	128.1	6.7	41.7	409	81	669	42.4	< 5	8	0.14	0.3	0.6	224	7.0	< 0.2	21	2.0	< 0.2	10		7.00
17-98	0.7	66.8	8.7	31.2	221	21	136	21.7	< 5	2	0.07	0.4	0.4	148	2.5	< 0.2	< 10	0.3	< 0.2	36		4.10
18-98	1.0	139.8	7.1	46.1	420	34	148	15	< 5	3	0.14	0.8	0.7	82	2.7	< 0.2	< 10	0.8	< 0.2	5		6.80
19-98	1.1	115.4	7.0	51.2	264	55	57	86.3	< 5	3	0.15	1.2	0.6	197	1.9	< 0.2	15	0.4	< 0.2	9		4.80
20-98	0.5	100.7	19.0	55.8	153	58	48	79.6	< 5	9	0.12	0.9	0.5	100	< 2	< 0.2	< 10	< 0.3	< 0.2	9		6.60
21-98	1.1	168.9	7.4	178.1	173	42	31	492.1	< 5	2	0.31	12.4	0.7	43	< 2	< 0.2	18	0.5	0.32	17		4.00
22-98	1.0	41.8	4.2	63	159	25	36	179.9	< 5	< 2	0.12	4.1	< 0.2	39	< 2	< 0.2	< 10	< 0.3	< 0.2	921		2.00
23-98	1.3	851.0	13.8	89.4	1903	145	4614	818.2	< 5	11	0.35	3.0	4.1	611	4.3	0.4	48	27.2	0.864	812		10.80
24-98	2.1	544.5	13.6	91.6	2066	104	3026	539.9	13	8	0.42	3.6	2.5	507	< 2	< 0.2	< 10	18.2	0.96	1027		9.60
25-98	1.2	497.4	6.1	49.8	676	66	1641	228.2	8	4	0.19	1.2	2.2	243	< 2	< 0.2	< 10	10.4	0.472	18		5.90
26-98	1.7	204.4	8.9	49.5	1323	140	1395	646.2	30	10	0.17	35.4	1.2	1060	< 2	0.5	59	8.6	0.984	39		12.30
27-98	1.0	359.7	4.8	20.3	294	87	549	465.5	6	4	0.07	10.6	1.6	320	< 2	< 0.2	27	3.4	0.392	14		4.90
28-98	2.2	653.0	10.0	62.6	1379	129	2037	1094	< 5	6	0.19	14.5	3.0	181	< 2	< 0.2	51	13.3	0.624	112		7.80
29-98	0.8	56.2	22.1	18.8	178	24	140	21.8	19	4	0.05	1.5	0.3	360	< 2	< 0.2	14	0.7	< 0.2	14		3.20
30-98	0.9	292.8	33.4	57.2	693	65	249	72.9	< 5	2	0.24	2.2	1.6	26	1.7	< 0.2	21	0.6	0.258	7		4.30
31-98	0.6	213.9	12.5	33.4	277	39	112	18.5	< 5	< 2	0.12	1.1	1.2	21	< 2	< 0.2	< 10	< 0.3	0.294	4		4.90
32-98	0.7	290.7	22.1	76.6	450	147	62	15.5	< 5	2	0.10	2.2	1.4	55	< 2	< 0.2	33	0.3	0.22	7		5.50
33-98	0.2	21.3	3.9	23.9	69	12	27	4.8	< 5	< 2	0.02	0.3	< 0.2	25	< 2	< 0.2	< 10	< 0.3	< 0.2	2		3.40
34-98	0.2	130.2	13.1	57.6	< 30	51	131	22.8	< 5	< 2	0.05	< 0.2	< 0.2	73	< 2	< 0.2	25	< 0.3	< 0.2	14		2.20
35-98	0.4	23.5	3.7	14.5	< 30	11	8	1.7	< 5	< 2	0.01	< 0.2	< 0.2	11	< 2	< 0.2	19	< 0.3	< 0.2	2		1.50
36-98	0.2	33.6	5.5	19.3	54	21	33	3.7	< 5	< 2	0.03	0.2	< 0.2	25	< 2	< 0.2	18	< 0.3	< 0.2	2		2.10
37-98	0.4	58.3	11.2	58.3	40	27	17	5	< 5	< 2	0.07	0.4	0.3	52	< 2	< 0.2	17	< 0.3	< 0.2	2		3.60
38-98	1.6	101.7	9.0	49.1	117	45	91	32	< 5	< 2	0.14	1.2	0.5	49	< 2	< 0.2	14	0.7	< 0.2	13		3.70
39-98	1.9	521.6	10.6	55.9	1893	128	1130	1146.5	17	11	0.19	3.0	2.4	855	4.7	< 0.2	41	8.4	0.316	2054		7.90
40-98	1.5	648.2	7.8	36.7	1418	104	1390	435.5	< 5	5	0.16	10.1	2.8	350	< 2	0.4	31	8.7	0.488	2196		6.10
41-98	1.2	307.2	6.7	31.7	433	50	234	242.4	< 5	< 2	0.09	2.9	1.4	73	< 2	< 0.2	30	3.8	< 0.2	2083		3.10
42-98	0.2	228.1	4.2	60	271	35	556	215.4	< 5	3	0.13	1.8	1.0	204	< 2	< 0.2	< 10	4.6	< 0.2	18		4.00
43-98	0.6	100.6	7.1	23.7	182	28	123	109.4	< 5	2	0.08	3.9	0.6	112	< 2	< 0.2	22	1.2	< 0.2	12		3.60
44-98	4.9	5119.8	1126.0	34.4	821	85	845	572.3	< 5	5	0.40	7.3	22.9	280	< 2	< 0.2	32	7.7	2.4	36		6.00
45-98	< 0.1	240.5	56.5	34.1	222	34	399	743.8	6	3	0.09	4.2	1.2	127	< 2	< 0.2	20	2.5	< 0.2	7		3.60

Samples	Mo	Cu	Pb	Zn	Ag	Ni	Co	As	U	Th	Cd	Sb	Bi	V	W	Tl	Hg	Se	Te	Au	S	Sample wt.
46-98	0.6	414.1	5.0	39.6	378	48	1015	661.2	< 5	< 2	0.12	5.4	1.7	79	< 2	< 0.2	21	8.5	< 0.2	10		3.60
47-98	1.4	1242.6	6.7	52.2	2270	98	1848	905.3	< 5	6	0.26	10.3	5.2	300	< 2	< 0.2	66	18.6	0.72	37		6.00
48-98	1.2	1015.7	5.1	31.6	1863	84	1791	839.3	< 5	6	0.22	6.3	4.5	337	< 2	< 0.2	67	16.5	0.816	112		10.20
49-98	0.7	149.3	8.1	31.9	1474	60	1144	669.5	6	4	0.11	7.1	0.9	272	3.4	< 0.2	28	6.9	< 0.2	3763		5.60
50-98	0.2	110.5	1.6	22.6	386	68	625	686.5	< 5	2	0.02	2.8	< 0.2	228	< 2	< 0.2	< 10	1.1	< 0.2	31		2.00
51-98	0.4	188.3	3.4	101.2	248	54	310	42	< 5	< 2	0.05	0.7	0.6	110	0.9	< 0.2	< 10	2.1	< 0.2	13		2.30
52-98	1.4	233.8	6.0	34.6	616	81	492	74.6	< 5	3	0.12	1.7	1.1	164	< 2	< 0.2	28	3.6	< 0.2	20		4.80
53-98	0.3	18.2	4.0	22.1	169	28	18	2.2	11	3	0.07	< 0.2	< 0.2	245	4.9	< 0.2	13	< 0.3	< 0.2	873		4.10
54-98	1.6	279.4	6.3	68.4	736	38	390	56.4	35	10	0.26	0.7	2.3	1037	< 2	< 0.2	< 10	1.7	< 0.2	17		8.70
55-98	0.8	197.2	5.6	93.9	262	40	64	10.7	13	4	0.25	0.4	0.9	312	< 2	< 0.2	14	0.3	< 0.2	14		5.40
56-98	0.6	41.6	3.8	35.2	82	29	72	8.8	25	8	0.09	0.3	0.3	645	< 2	< 0.2	< 10	< 0.3	< 0.2	14		6.30
57-98	0.6	185.6	6.3	60	363	63	484	175.3	21	6	0.15	4.0	0.9	600	< 2	< 0.2	< 10	2.3	0.252	3		6.30
58-98	0.7	176.0	4.0	46.4	377	38	343	109.3	< 5	2	0.09	0.6	0.8	104	< 2	< 0.2	12	1.4	< 0.2	11		3.00
59-98	0.9	541.4	8.4	69.3	872	91	1940	506.3	< 5	4	0.23	1.3	2.4	123	< 2	< 0.2	15	11.0	0.402	24		6.70
60-98	1.0	165.6	4.5	48.4	662	50	609	192.3	< 5	3	0.16	0.8	0.7	144	< 2	< 0.2	20	3.0	< 0.2	9		3.40
61-98	0.3	56.1	3.8	34.8	239	32	148	201.7	10	5	0.10	0.4	0.2	354	8.6	< 0.2	15	0.9	< 0.2	3694		5.40
62-98	0.3	330.2	4.2	28	504	39	399	176.4	18	4	0.08	1.2	1.5	352	2.1	< 0.2	< 10	2.5	< 0.2	22		5.30
63-98	0.9	249.6	51.6	52.9	337	46	233	44.7	7	3	0.12	2.1	1.1	260	3.4	< 0.2	21	1.5	< 0.2	17		5.60
64-98	0.4	48.0	3.8	28.5	241	21	135	46.1	19	5	0.09	1.9	0.4	419	< 2	< 0.2	< 10	0.6	< 0.2	2		6.20
65-98	0.5	172.3	4.5	42.2	123	32	302	184.3	< 5	5	0.13	4.5	0.8	275	3.2	< 0.2	32	1.8	< 0.2	18		8.00
66-98	0.5	105.6	8.3	34	859	37	502	168.5	< 5	3	0.21	3.6	0.5	458	< 2	< 0.2	50	4.4	< 0.2	18		8.10
67-98	0.5	31.6	4.2	29.8	243	20	116	46.7	< 5	2	0.11	5.0	0.2	150	9.8	< 0.2	16	0.6	0.244	2		6.10
68-98	0.9	127.8	4.1	29.3	456	34	517	166.1	10	3	0.11	3.9	0.4	332	< 2	< 0.2	25	3.8	0.224	11		5.60
69-98	0.9	450.5	5.0	29.3	1115	47	909	296.3	< 5	2	0.10	7.0	2.0	193	4.0	< 0.2	30	7.0	1	24		5.00
70-98	0.8	66.8	4.0	25.3	329	18	661	112.4	< 5	2	0.05	2.1	0.2	197	3.2	< 0.2	17	4.0	0.212	3		5.30
71-98	1.3	875.1	7.5	58.3	1404	82	2418	905.5	< 5	5	0.27	7.2	3.5	668	< 2	< 0.2	90	19.2	0.798	13		13.30
72-98	1.3	423.9	6.6	747.3	519	43	305	861.8	< 5	6	2.20	7.3	1.4	588	< 2	< 0.2	312	4.1	0.28	1861		7.00
73-98	1.0	236.4	4.6	23.4	261	41	540	359.2	12	3	0.05	3.7	0.9	375	< 2	< 0.2	11	3.8	< 0.2	18		5.40
74-98	0.5	108.7	345.5	7.7	116	34	93	21.4	< 5	< 2	0.02	3.8	0.3	40	< 2	< 0.2	< 10	2.3	0.084	6		2.10
75-98	0.2	211.4	6.6	10.5	430	113	1095	81.8	< 5	2	0.01	0.4	0.7	12	< 2	< 0.2	36	14.8	< 0.2	301		3.10
76-98	0.0	6.0	2.4	7.6	19	21	7	10.5	< 5	< 2	0.01	< 0.2	< 0.2	21	< 2	< 0.2	< 10	< 0.3	< 0.2	6		2.10
77-98	0.3	8.1	3.4	7.8	67	7	3	9.2	< 5	3	0.04	< 0.2	< 0.2	14	< 2	< 0.2	11	< 0.3	< 0.2	5		3.30
78-98	< 0.1	19.1	3.5	8.3	95	6	5	1.7	< 5	< 2	0.02	0.3	< 0.2	4	< 2	< 0.2	< 10	< 0.3	< 0.2	4		2.70
79-98	0.6	10.1	229.9	13.4	56	8	10	1.1	< 5	3	0.04	3.4	0.2	33	< 2	0.2	< 10	< 0.3	< 0.2	4		5.50
80-98	1.9	136.5	153.5	113.9	1224	215	171	512.4	< 5	10	0.55	25.5	1.1	15	< 2	0.3	73	21.8	< 0.2	7		6.90
81-98	0.6	20.3	6.7	14.5	186	20	59	6.7	< 5	2	0.05	< 0.2	< 0.2	40	< 2	0.2	< 10	0.3	< 0.2	4		3.90
82-98	0.7	101.8	8.6	14.9	277	36	193	35.3	< 5	2	0.02	0.2	0.5	92	6.1	< 0.2	10	0.7	< 0.2	8		3.40
83-98	1.0	40.3	5.2	10.9	129	63	198	20.6	< 5	3	0.01	< 0.2	1.2	243	3.2	< 0.2	15	0.7	< 0.2	12		3.20
84-98	1.4	408.0	34.9	67	347	35	248	79.8	< 5	3	0.18	0.7	4.6	179	3.0	0.2	< 10	3.4	0.456	7		3.80
85-98	0.8	185.3	4.4	23	275	30	143	68.7	< 5	2	0.05	0.4	1.4	102	< 2	< 0.2	< 10	1.5	< 0.2	11		3.10
86-98	1.1	290.5	6.2	34.1	1178	37	992	276	11	4	0.16	1.6	1.3	369	< 2	0.2	18	6.9	0.53	17		5.30
87-98	1.4	158.9	5.9	26.6	1214	31	571	351.2	30	7	0.23	2.1	0.6	614	2.3	0.3	25	3.8	0.228	50		5.70
1-99	2.1	111.1	9.1	77.7	226	108.5	91.7	23.8	< 5	3	0.23	3.6	0.4	767	2.6	< 0.2	< 10	1.3	< 0.2	1466	0.36	13.00
2-99	2.4	78.6	6.1	88.9	188	69.2	106.2	143.2	< 5	< 2	0.39	2.7	< 0.2	215	89.3	< 0.2	< 10	1.1	< 0.2	99	0.17	6.90
3-99	2.5	156.7	15.2	171.8	348	76	269.4	69.3	< 5	2	0.38	2.7	0.2	1514	< 2	< 0.2	< 10	1.7	< 0.2	23	0.22	12.00
4-99	2.3	191.5	18.2	139.3	488	119.8	307.5	83.3	< 5	2	0.39	4.8	0.3	628	3.2	< 0.2	< 10	4.6	< 0.2	37	3.68	8.90
5-99	1.9	97.0	6.8	75.8	371	29.5	36.1	739.3	0	< 2	1.14	6.4	0.2	183	14.2	< 0.2	< 10	1.0	< 0.2	34	0.07	12.20
6-99	2.0	89.5	7.3	127.8	233	83	75.5	43.8	< 5	2	0.23	2.5	< 0.2	334	< 2	< 0.2	< 10	1.4	< 0.2	282	0.21	9.70

Samples	Mo	Cu	Pb	Zn	Ag	Ni	Co	As	U	Th	Cd	Sb	Bi	V	W	Tl	Hg	Se	Te	Au	S	Sample wt.
7-99	2.1	155.8	10.3	271.4	358	81.4	119.2	244.5	< 5	3	0.68	3.6	< 0.2	393	7.3	< 0.2	< 10	2.1	< 0.2	23	0.35	11.70
8-99	4.0	153.2	7.9	125	499	102.7	186.6	60.1	< 5	2	0.28	3.2	0.2	2162	< 2	< 0.2	16	1.2	< 0.2	11	1.87	9.90
9-99	4.8	328.8	7.5	74.9	943	131	368	64.4	< 5	< 2	0.27	2.5	1.1	1141	20.6	< 0.2	16	3.3	0.3104	16	2.29	9.70
10-99	5.5	497.6	13.8	127.1	2101	251	975.5	76.7	< 5	< 2	0.47	1.7	17.8	2817	13.1	0.2	33	8.9	0.234	11585	8.69	23.40
11-99	2.0	594.7	6.7	141.4	729	106.7	209.5	20.5	< 5	3	0.26	1.8	0.6	795	12.5	< 0.2	17	2.6	< 0.2	2436	0.99	16.50
12-99	3.1	534.5	6.7	84.8	1060	125	503.6	78.9	< 5	< 2	0.28	2.5	0.4	1451	2.2	< 0.2	19	4.7	< 0.2	81	3.32	9.30
13-99	0.6	53.6	4.2	49.8	558	50.6	226.2	27.3	< 5	< 2	0.06	1.1	1.4	168	< 2	< 0.2	< 10	0.6	< 0.2	155	0.51	3.30
14-99	1.5	151.0	9.6	342.1	1307	108.9	186.8	48.3	< 5	< 2	1.17	2.0	0.2	255	< 2	< 0.2	< 10	1.6	< 0.2	7	0.31	6.50
15-99	2.7	341.9	17.8	261.4	1092	205.4	385.6	85.2	< 5	4	1.01	3.5	0.5	3649	54.8	< 0.2	< 10	3.0	< 0.2	342	1.34	16.80
16-99	3.4	65.9	5.7	92.4	152	73	64.5	8.5	< 5	2	0.12	1.4	0.3	1119	20.8	< 0.2	< 10	1.0	< 0.2	3	0.08	10.40
17-99	1.0	44.4	6.2	96.4	230	50.6	41.2	10.3	< 5	3	0.18	1.5	0.1	305	18.2	< 0.2	< 10	0.5	< 0.2	509	0.01	6.80
18-99	2.1	82.6	25.2	147.5	104	91.1	108	26.1	< 5	3	0.22	1.2	0.2	493	4.1	< 0.2	< 10	1.7	< 0.2	26	0.13	9.30
19-99	3.3	666.1	10.5	109.3	2926	221.9	1672.1	347	< 5	2	0.31	2.1	0.8	1399	< 2	< 0.2	31	15.3	0.4248	80	11.40	11.80
20-99	2.8	95.6	5.0	80.8	461	68.8	94.1	91.9	< 5	2	0.17	1.5	0.2	559	9.5	< 0.2	< 10	1.4	< 0.2	3462	0.56	13.90
21-99	5.1	57.4	4.7	142.6	158	73.3	103.6	74.9	< 5	2	0.26	2.1	0.4	713	9.6	< 0.2	< 10	1.7	< 0.2	284	0.13	16.50
22-99	2.5	28.8	3.8	161.2	62	46.2	77.3	9.5	< 5	2	0.33	1.5	0.2	528	3.0	< 0.2	< 10	1.0	< 0.2	10	0.03	16.40
23-99	2.2	23.2	3.0	63.4	162	43.6	39.8	14.9	< 5	< 2	0.15	1.3	0.1	359	19.9	< 0.2	< 10	1.3	< 0.2	1957	0.06	9.40
24-99	2.8	73.3	3.5	84.5	1184	71.7	213.8	75.7	< 5	3	0.20	1.5	< 0.2	1280	20.7	< 0.2	< 10	1.8	< 0.2	4462	0.64	11.00
25-99	2.4	110.9	6.8	122.5	344	94.3	185.9	87.8	< 5	4	0.19	1.5	1.0	1436	20.8	< 0.2	< 10	2.3	< 0.2	4195	0.68	18.90
26-99	3.6	89.6	6.5	116.8	622	94.1	195.1	209.2	< 5	5	0.46	1.9	0.3	1282	18.1	< 0.2	23	2.6	< 0.2	2633	1.41	14.40
27-99	1.6	41.8	3.2	49.4	563	63	105	48.3	< 5	< 2	0.12	1.3	< 0.2	1147	39.4	< 0.2	< 10	0.7	< 0.2	13713	0.44	6.70
28-99	2.1	31.3	< 3	100.5	58	58.6	56	10.2	< 5	2	0.09	1.0	0.1	425	1.9	< 0.2	< 10	1.9	< 0.2	131	0.07	11.60
29-99	2.0	143.4	5.9	149	224	103.5	122.4	318.3	< 5	3	0.42	1.8	0.9	627	12.6	< 0.2	< 10	2.5	< 0.2	76	0.59	17.50
30-99	2.1	73.8	3.9	67.2	217	71.8	72.3	142.8	< 5	2	0.09	1.6	0.1	397	7.8	< 0.2	< 10	1.3	< 0.2	39	0.18	9.10
31-99	1.4	116.6	4.6	97.8	208	71.9	129.1	204.5	< 5	2	0.34	1.9	< 0.2	650	15.2	< 0.2	< 10	1.8	< 0.2	32	0.55	8.00
32-99	6.2	59.4	8.2	142.7	224	84.6	105.6	62.4	< 5	12	0.62	1.5	0.2	554	86.7	0.2	< 10	2.4	< 0.2	16	0.68	13.50
33-99	1.5	26.9	4.1	66	51	43.5	36.5	10	< 5	2	0.18	1.0	< 0.2	223	68.1	0.0	< 10	1.0	< 0.2	12	0.03	6.40
34-99	3.6	120.6	13.9	233.7	210	177.5	199.9	115	< 5	10	0.50	2.6	0.8	661	< 2	0.2	< 10	1.8	< 0.2	< 0.2	0.68	22.80
35-99	5.9	318.0	6.3	161.6	1497	140	118.8	162.3	< 5	7	0.40	1.2	12.0	1024	1535.2	< 0.2	169	0.7	0.338	29665	0.40	16.90
36-99	2.3	78.3	< 3	64	76	44.2	51.4	142.6	< 5	2	0.06	1.3	0.6	531	31.7	< 0.2	< 10	0.5	< 0.2	< 0.2	1.18	6.40
37-99	1.6	84.2	4.6	103	243	52.2	200.2	395.3	< 5	< 2	0.21	2.1	< 0.2	128	6.6	< 0.2	< 10	3.7	0.3024	531	5.39	4.20
38-99	2.7	75.4	3.4	151	196	71.2	43.6	14.6	< 5	2	0.34	0.9	< 0.2	320	90.1	< 0.2	< 10	0.3	< 0.2	445	0.06	14.40
39-99	1.4	38.2	4.3	121.1	265	52.3	33.9	21.4	< 5	3	0.26	0.8	< 0.2	330	51.7	< 0.2	< 10	1.6	< 0.2	3148	0.05	13.00
40-99	2.2	1045.9	13.5	159.4	2170	187.1	176.9	27	< 5	2	0.54	1.8	< 0.2	529	< 2	< 0.2	< 10	2.3	< 0.2	14966	1.18	11.30
41-99	1.2	93.9	2.5	89.4	121	49.4	53.7	13.3	< 5	< 2	0.12	0.8	0.9	247	15.2	< 0.2	< 10	0.7	< 0.2	12	0.06	7.40
42-99	2.7	191.5	5.3	171.5	669	96.8	221.1	129.3	< 5	3	0.39	1.3	< 0.2	1772	30.8	< 0.2	< 10	1.4	< 0.2	14336	0.54	17.90
43-99	2.8	72.7	9.1	75.2	181	82.4	84.7	3	< 5	2	0.13	0.6	0.2	410	2.9	< 0.2	< 10	1.3	< 0.2	6	0.30	9.50
44-99	3.7	35.9	< 3	80.8	950	38.1	35.7	7.3	< 5	< 2	0.29	0.9	< 0.2	229	533.9	< 0.2	< 10	1.3	< 0.2	15092	0.09	11.00
45-99	2.4	27.0	4.1	61.6	708	43.8	26.3	1.1	< 5	3	0.16	0.6	< 0.2	255	52.6	< 0.2	< 10	0.6	< 0.2	5871	0.04	7.20
46-99	3.1	46.9	8.1	79.9	254	54.7	43.3	3.2	< 5	< 2	0.23	1.4	0.2	349	135.5	< 0.2	< 10	1.0	< 0.2	2540	0.08	6.90
47-99	2.2	105.1	6.8	133.3	109	60	61	1708.5	< 5	2	0.54	1.2	2.4	384	67.0	0.3	< 10	1.1	0.3258	345	0.07	18.10
48-99	3.2	54.6	6.4	101	53	54.6	33.9	19.1	< 5	2	0.30	0.8	0.2	212	40.1	< 0.2	11	1.3	< 0.2	38	< 0.01	10.60
49-99	3.4	43.6	5.2	114.5	681	45.6	33.6	11.9	< 5	< 2	0.36	0.7	0.3	256	259.7	< 0.2	< 10	1.4	< 0.2	10908	0.03	13.90
50-99	3.2	83.0	8.9	75.1	96	47.5	58.3	2.2	< 5	< 2	0.07	0.9	< 0.2	671	24.0	< 0.2	< 10	0.4	< 0.2	34	0.10	7.20
51-99	1.1	40.0	5.8	32.2	70	54.5	46.5	2.1	< 5	< 2	0.03	0.4	< 0.2	894	0.3	< 0.2	< 10	0.3	< 0.2	16	0.05	4.00
52-99	5.1	965.8	23.5	76.9	399	85	162.3	7.6	< 5	< 2	0.10	1.0	< 0.2	907	132.9	< 0.2	< 10	1.7	< 0.2	839	1.04	7.10
53-99	1.4	37.4	4.6	60	99	36.2	37.5	2.1	< 5	< 2	0.06	0.4	2.5	190	44.2	< 0.2	< 10	0.6	< 0.2	816	0.08	5.50
54-99	10.6	13815.0	14.2	75.1	5457	94.8	683.6	9.1	< 5	< 2	0.49	1.0	1.5	1078	389.8	< 0.2	74	9.5	1.428	2527	6.33	7.00

Samples	Mo	Cu	Pb	Zn	Ag	Ni	Co	As	U	Th	Cd	Sb	Bi	V	W	Tl	Hg	Se	Te	Au	S	Sample wt.
55-99	3.4	67.5	4.3	42.7	174	44.8	60.6	2.8	< 5	< 2	0.05	0.3	< 0.2	290	8.9	< 0.2	< 10	0.6	< 0.2	1823	0.10	5.00
56-99	6.1	1525.1	19.2	180.2	5937	226.1	2536.4	864.7	< 5	3	0.78	4.7	0.9	2830	7.8	< 0.2	48	18.7	0.5642	481	8.49	21.70
57-99	2.8	567.6	9.8	97.9	2574	121.1	1034.6	284.5	< 5	2	0.32	3.0	1.2	2237	6.8	< 0.2	18	7.7	0.2034	60	3.64	11.30
58-99	3.4	109.0	7.2	107.4	526	85.1	646.4	99	< 5	< 2	0.22	1.9	0.2	1877	16.5	< 0.2	11	2.4	< 0.2	3322	1.67	11.00
59-99	11.6	422.3	7.1	103.7	1442	135	1189.9	278.3	< 5	< 2	0.30	4.2	0.7	2894	60.8	< 0.2	< 10	9.2	0.459	902	4.15	13.50
60-99	7.1	317.3	5.0	89.3	1178	134.1	864.4	205.7	< 5	< 2	0.22	1.9	0.6	1967	6.2	< 0.2	24	5.9	0.3696	79	1.80	8.40
61-99	8.4	833.6	6.5	131.9	1226	142.8	1130.5	295.4	< 5	< 2	0.30	2.7	0.8	1637	5.0	< 0.2	20	9.5	0.4554	77	3.31	9.90
62-99	5.4	442.3	6.0	122.8	1460	138.7	1029.1	407	< 5	< 2	0.27	2.3	0.5	1369	< 2	< 0.2	25	8.4	0.728	47	3.09	9.10
63-99	3.5	580.3	8.1	132.9	3906	208.2	1796.5	695.5	< 5	< 2	0.87	3.1	0.6	1816	12.6	< 0.2	32	12.6	0.672	53	5.08	8.40
64-99	3.6	202.0	11.8	118.9	839	91.5	226.3	53.3	< 5	4	0.23	2.0	20.4	1477	60.2	< 0.2	164	0.5	0.0912	5671	0.46	22.80
65-99	1.0	68.8	2.9	88.7	185	55.7	99.3	14.8	< 5	< 2	0.09	1.2	0.4	614	6.0	< 0.2	< 10	1.2	< 0.2	4099	0.25	8.80
66-99	3.7	648.0	14.5	241.2	1154	217.4	954.5	979.8	< 5	< 2	1.01	2.1	0.4	3030	48.8	< 0.2	< 10	6.6	0.273	1887	3.55	19.50
67-99	1.4	35.4	6.8	38.5	58	24.1	30.3	16.2	< 5	< 2	0.17	0.9	< 0.2	403	15.7	< 0.2	< 10	0.9	< 0.2	354	0.06	7.60
68-99	2.9	224.1	13.7	164.2	387	93.8	153.7	189.9	< 5	3	0.36	2.0	0.8	861	12.9	< 0.2	< 10	1.8	< 0.2	16	0.66	15.00
69-99	1.1	83.9	5.1	102.5	334	76.8	115.6	9.2	< 5	2	0.19	1.2	0.3	659	< 2	< 0.2	< 10	0.9	< 0.2	28	0.15	10.70
70-99	3.1	247.7	157.7	113.1	588	87.8	263.2	47.8	< 5	< 2	0.21	4.3	0.4	2018	2.6	< 0.2	< 10	1.4	< 0.2	17	0.90	11.90
71-99	5.6	1201.9	11.3	143.4	2449	170.9	1535.1	145.1	< 5	< 2	0.42	3.0	1.0	2163	3.1	0.3	< 10	15.8	0.4726	32	13.32	13.90
72-99	2.8	390.5	6.2	93.9	739	81.8	723.8	104.9	< 5	< 2	0.21	1.6	< 0.2	549	33.6	< 0.2	< 10	4.6	< 0.2	10	3.02	7.40