Report No Bsg 84-358

Project 3816

F A L U N - T O M T E B O

1/1 - 30/4 1984

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APPENDICES

A. SUMMARY

The geological work during the winter months has mainly consisted of compilation of the field data. Outcrop maps over the surveyed area in different scales now exist. A provisional map in the scale 1:10.000 over the mapsheet 13F 5f has been constructed. An aeromagnetic Ebba image has initially been studied for regional structure interpretation.

A final report of the Questor Input Survey has been received and thoroughly discussed. All the significant anomalies have been checked in the field with reconnaissance profiles (SR 60 m:s coil separation or IP-VLF). Results from both the Input and SR airborne surveys have been compared. Preparations (about 10 km of peg.lines) for ground SR survey at Byngsbodarna (13F 5f) have commenced.

Most of the analysed elements both in the heavy mineral fraction and in the fine fraction of till are presented in column maps in different scales. The geochemically most interesting area, west of Grycksbo (Byngsbodarna) has been selected for deep till and bedrock sampling with a light drilling machine along forest roads.

The regional mapping activity is planned to continue towards NW, NE and E. More detailed mapping is restricted to the claimed areas and around the geochemical/geophysical anomalies from the regional surveys. A quaternary geological survey combined with a denser surface till sampling (10 samples/sq km) is planned for the area W of Grycksbo.

The high priority Input anomaly zones 1, 3 and 4 at Byngsbodarna are going to be checked with a ground SR survey (Apex multifrequence, 120 m coil separation) combined with a restricted IP test.

To follow up the interesting Input anomalies at Tomtebo area (priority zones of 1, 4, 5, 10 and 11) a deep till/bedrock sampling is planned.

B. INTRODUCTION

This report describes the exploration activity in the BP/LKAB joint venture project of Falun-Tomtebo during the first Tertiary of 1984.

The Tomtebo project (3818) is now included in the Falun project (3816) which now covers an 1800 sq km large area north of the Dala river between Leksand and Säter (App. B.1) in the eastern part of the Kopparberg County.

The interesting leptite belts are largely covered by preliminary claims for BP/LKAB but in order to reduce the costs (which are quite high due to the specific ownership of landed property in Bergslagen) the final claims were reduced after property boundaries were checked by the Consulting co. Viak. The claim permits (mutsedel) have not yet been issued by the Inspector of Mines.

The exploration activity during 1983 is described in the report Bsg 84-343.

C. AIM AND EXPECTATIONS

The results of the regional geological, geophysical and geochemical surveys have been used in order to determine interesting targets and to select areas for further detailed follow up exploration. An area W of Grycksbo, mapsheet 13F 5f - where a number of older workings on Zn-Pb-Au-Cu exist and where till geochemistry coincides with the Input anomalies - is expected to contain more mineralisations than those covered by Boliden's mining licenses. The planned geochemical sampling and geophysical ground survey is expected to produce interesting drilling targets to be checked during the winter.

D. GEOLOGY

D 1. Regional Geology

The magnetic airborne survey by LKAB can now be presented on a computer screen where the measured values can easily be extrapolated. Tectonic structures, which are not readily seen in the normal profile or isomaps, can be discerned. The magnetic and SR-surveys can be combined with the Landsat image and used as a first stage in a regional structural analysis. This work has just started, however, a very preliminary interpretation is presented here (App D 1).

A description of the most important mineral occurrences shown on the Mine Inventory maps (see report Bsg 84-343, app. D1-D3) is included here in app. D2.

D 2. Geology of the Byngsbodarna area

Clusters of Input anomalies together with anomalous Zn, Pb, Cu and W values (in the regional till samples) in an interesting leptite/metasedimentary environment has motivated the special interest, covering the economic mapsheet 13F 5f Byngsbodarna. A provisional geological map has been constructed based on the geological observations by Krüger (1982) and our reconnaissance mapping; where even airborne magnetics are used. It is presented in app. D 3 and shortly commented on as follows:

North of the synorogenic granite border, thin zones of gneiss, leptite gneiss, leptite and rhyolite occur. Mica schist often containing garnets lies surrounded by leptite gneiss. Gedrite and antophyllite have been grouped together though gedrite is mainly found in the leptite - ore quartzite and antophyllite in metasediments/mica schists.
Further north a belt of metasediments/mica schist gives an impression that this zone is rather homogenous. The metasediments certainly vary from being (a borderline classification) foliated leptite to a highly micaceous mica schist. These zones repeat themselves across the strike a number of times within a couple of hundred meters or so. At Sågtjärnen marble boulders occur, they lie close to a cluster of input anomalies. Sulphide mineralization is observed in the metasediments and in the non-differentiated leptite, a number of small iron ore lenses occur. A diorite massive occurs to the northeast being exposed by only a few outcrops.

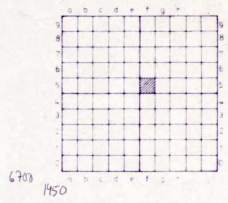
Northwest of the diorite a large fold structure is noticable from an airborne magnetic survey map. This is corroberated to a certain extent by a number of outcrop strike observations.

The outer zone of the fold consists of a garnet and cordierite bearing leptite. Smaller ore quartzite zones containing gold bearing sulphides are known. Inner zones along the eastern limb of the fold are also mineralized. On the western limb a "fragmental leptite rock" may be classified as a meta-pyroclastic rock.

Throughout the mapped area numerous amphibolite - swarms occur concordant along the strike, whereas the much younger dolerites often cut the strike and can be followed a number of kilometers.

Mapping is required; especially in areas where there is a scarcity of outcrop data.

The Boliden Company has carried out extensive exploration in the actual area culminating in the early seventies. They have used boulder tracing, ground geophysics, trenching and diamond drilling to localize the mineralizations. In the mapsheet 13F 5f they have drilled three prospects with relatively low contents of Zn, Pb and Cu which have been covered by mining licenses (valid to 1999). However, the gold content in the analysed drill cores is interesting.



LEGEND

- Mining Licence
- Drillhole
- Excavation

INPUT RESPONSE SYMBOLS

- 1 Channel (300 microseconds)
- 2 Channel (500 microseconds)
- 3 Channel (800 microseconds)
- 4 Channel (1200 microseconds)
- 5 Channel (1700 microseconds)
- 6 Channel (2300 microseconds)

061130
M409

EXPLORATION MAP

Uppr	Aktuell:	Skala 1: 10 000
LKAB PROSPEKTERING AB	Kartbl 13F 5f	App D5

The best value is 11.1 ppm in 2.05 m of drill-core (app. D 4). This together with the known concentration of arsenopyrite bearing boulders at Strömbo makes the area interesting for gold exploration. The Boliden owned mining licenses do not give any response in the airborne Input survey (app. D 5).

E. GEOPHYSICS

E 1. Airborne surveys

The final report of the Input survey has been received and thoroughly discussed by the project group. The high priority zones from 1 to 5 have been checked in the field with a few IP or SR reconnaissance traverses. The Input anomalies lie along the strike and are going to be measured in a grid system with SR (Apex. multifrequence 120 metres coil separation) and in the locations of zone 3 and 4 even with IP for reference.

E 2. Ground surveys

The Input anomalies which lie on lakes and open marshes have been tested with SR and IP during the winter months. Reason for anomaly at Tansen (mapsheet 5g), Årbosjön (6e) and Grycken (5g-h) was found to be a cabel in the lake bottom. The two reconnaissance traverses over Lake Gopen (6f) show a weak responce in VLF, IP and SR out of phase in connection with a magnetic anomaly. It is interpreted as a tectonized zone mainly due to the fact that SR in phase does not show any anomaly. However, the till samples taken south of the lake contain the highest copper values in the regional survey. The Input anomalies in the Lake Rogsjön (6h and 7b) were found to occur in connection of a NW trending dolerite dyke.

The cluster of Input anomalies south of Oxberget (mapsheet 5f, priority zone 1) were tested with SR (60 m coil separation). Good conductors (max, in phase -20 %) were located near the airborne anomalies. The zone is currently covered by a Boliden claim in quarantine, however, it is going to be included in the SR survey.

The ground surveys carried out during the 1st tertiary total as follows:

Method	/ line metres
SR 3.6/60 m	17.070
SR 3.6/100 m	2.550
VLF	6.880
IP	2.640
mag	16.650

F. GEOCHEMISTRY

F 1. Regional till geochemistry

The column maps covering the heavy mineral concentrate for Zn, Pb, Cu, W, Co and Ni and even the reference fine fraction till samples have been used in order to select the most promising areas for follow-up geochemistry. The results of the regional survey are shortly stated in appendix F.

F 2. Deep till and bedrock sampling

The NE striking leptite and metasedimentary zone to the west of Grycksbo (mapsheet 5f) gives an interesting response in till geochemistry and in geophysical airborne surveys. In order to find out which levels in the till are the most suitable for future sampling and to get a more detailed picture of the geology, a sampling programme has commenced along forest roads crossing the interesting zone. About 100 points are to be sampled by pneumatic drilling in three different levels: The bedrock, the basal till and the surface till. Near Input anomalies pyrite-pyrrhotite-chalcopyrite bearing amphibolites and mica schists have already been found.

G. PLANS AND RECOMMENDATIONS

G 1. Geology

The reconnaissance mapping is going to proceed towards NW (the mapsheets 13F 8b-c-d and 7b-c), NE (13F 7g-h-i and 6g-h-i) and E (13F 4i-j and 3i-j, see app. G1). The interpreted lineaments (spec. between Falun-Svärdsjö) are to be checked. Detailed boulder tracing and mapping are planned for a number of claimed areas and around about 40 geochemical and geophysical more restricted anomalies. The 1:10.000 mapsheets 5f and 6f are going to be mapped in detail. Excavations for quaternary geological reconnaissance survey in the area west of Grycksbo has started in order to assist planning for surface till sampling.

G 2. Geochemistry

The area selected for detailed follow up exploration west of Grycksbo is going to be covered by relatively dense (100 m sample separation along profiles 1000 m apart perpendicular to the drift direction) surface till sampling. Outside this area more restricted till sampling is planned for Lake Grycken area (sheet 5h), Varggården (around the so called "garbage dump" anomaly, sheet 4h) and for Bomsarvet near Borlänge (sheet 3g). The number of planned sample points totals 8-900.

The Österby claim in Tomtebo area (sheet 12F 9i) is going to be sampled after the harvest season with a light pneumatic drilling machine in order to test the Input anomalies (priority zones 1, 4, 5, 10 and 11). Geophysical ground surveys have indicated culture, mostly buried water pipes.

G 3. Geophysics

An airborne SR anomaly at Busmor (mapsheet 5e, see app. F2 in report Bsg 84-343) is currently been surveyed by ground magnetics and SR (3.6 kHz with 60 m coil separation). A slingram survey with a multifrequence Apex 120 m coil separation is planned to cover the Input priority zones 1, 3 and 4 at Byngsbodarna (sheet 5f) W of Grycksbo. The SR survey consisting of about 30 line km. It is going to be completed with an IP survey over a known weak chalcopyrite-sphalerite mineralization (without Input response) and over good Input anomalies as a reference. A thorough pegging of a grid system has already been carried out by a contractor.

H. ECONOMY

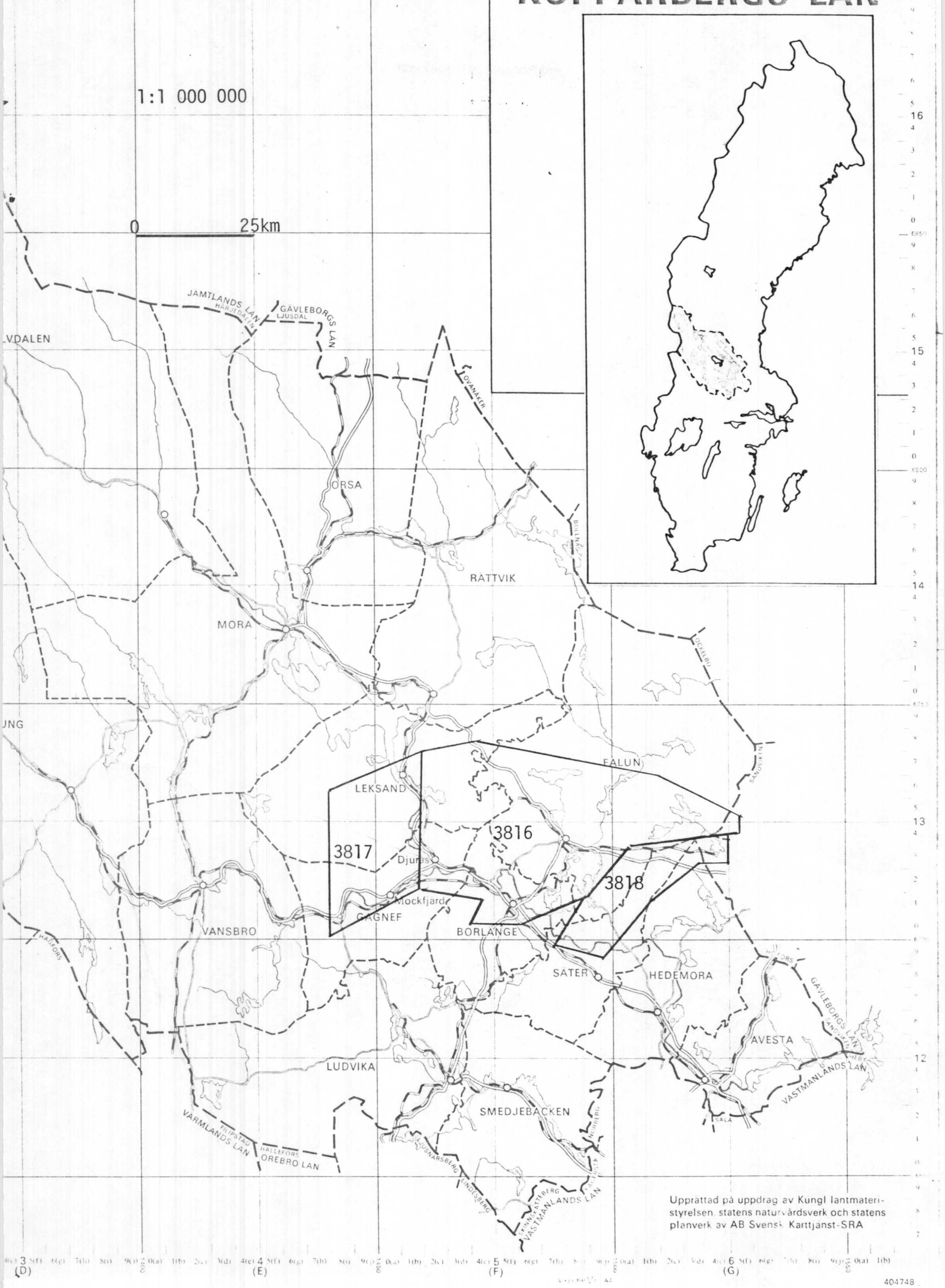
The main accounts for the four first months of the year are as follows:

		I tert. kkr	total 1984 kkr
Intern deb.	geology	244	716
-"-	geophysics	155	330
-"-	geochemistry	70	318
-"-	other	187	260
Total of intern deb.		656	1624
Extern costs			
	geology	80	300
	geophysics	12	85
	geochemistry	0	275
Total of extern costs		92	860
Grand total		748	2484

The planned exploration can probably be carried out without any substantial extra contributions to the budget.

Kartblankett Appendix B 1

KOPPARBERGS LAN



Upprättad på uppdrag av Kungl lantmäteristyrelsen, statens naturvårdsverk och statens planverk av AB Svensk Karttjänst-SRA

404748

EBBA - Regional Magnetics, Falun Project (Preliminary Comment by Chris Carlon)

1. Introduction

The following observations are based on a brief examination of the Falun-Grycksbo regional magnetic data using the grey scale images of the EBBA Image Analysis system.

A full EBBA Magnetics-Regional Topographic analysis is planned and this brief note is intended only as a preliminary comment.

A copy of the image and its preliminary assessment, at 1:250.000 accompanies this note.

2. Magnetic 'stratigraphy'

Several areas can be defined, picking out mapped geological features:

A. Corresponds to and is contained within the Falun leptite Belt. Area A is marked by a low magnetic response and magnetic gradients. It appears to define the bulk leptite composition and possibly also 'high Mg' rocks. A similar area is defined as E, within the larger leptite belt to the N. Area E lies to the SW of Grycksbo (see below).

B. An ovoid, well defined area centres on a 'Urgraniter' zone.

C. A belt of low magnetic relief corresponds mainly with a pegmatite zone

D. A belt of variable high magnetic relief lies over a leptite zone, in the SW corner of the image area, within younger granite

E. With a dark low magnetic 'core', and a rim of high magnetics, this zone defines an area noted in A. above. The high magnetic 'rim' cuts the mineralized zones at Floberget and continues SW and round to the SE though Rolandsgruvan. This could be a significant feature for mineralization defining a pyrite-pyrrhotite + (base metal? precious metal?) zone.

F. A belt of low magnetics corresponds to an 'Urgranite' belt N. of Falun

Areas B, C and D are defined to the east by a very clear curved zone which corresponds on mapped geology to the eastern limit of the pegmatite-Urgranite masses.

3. Linear features

The following brief comments can be made:

1. The EBBA image clearly defines two dominant fracture sets trending NE-SW and NW-SE. Minor sets trend N-S, E-W and at slight angles (of deflection?) to the main trends.

2. The NW-SE set is partly marked by a dyke suite producing lines of magnetic high response

3. A prominant E-W/ESE-WNW fracture set corresponds to the edge of an Urgranite massif in the NE part of the area

4. Fracture sets are seen to be orientated parallel to major fold axes directions.

5. A weakly defined fracture passes through the Falu gruva area, trending NE-SW, and runs towards Svärdsjö, across the strike of the leptite belts at a point where the Falun belt and the Svärdsjö belt suffer strike swings.

4. Circular features

While it is unclear what these may represent, or whether they are of economic significance, these are recognised in the area.

1. The eastern part of a larger circular area defined by a circular fracture in the west of the area of investigation (Areas B, C, D)

2. An area marked by low magnetic response of the SW end of the 'Grycksbo' zone (area E)

3. A circular structure lying over Urgraniter west of Falun

5. Conclusions

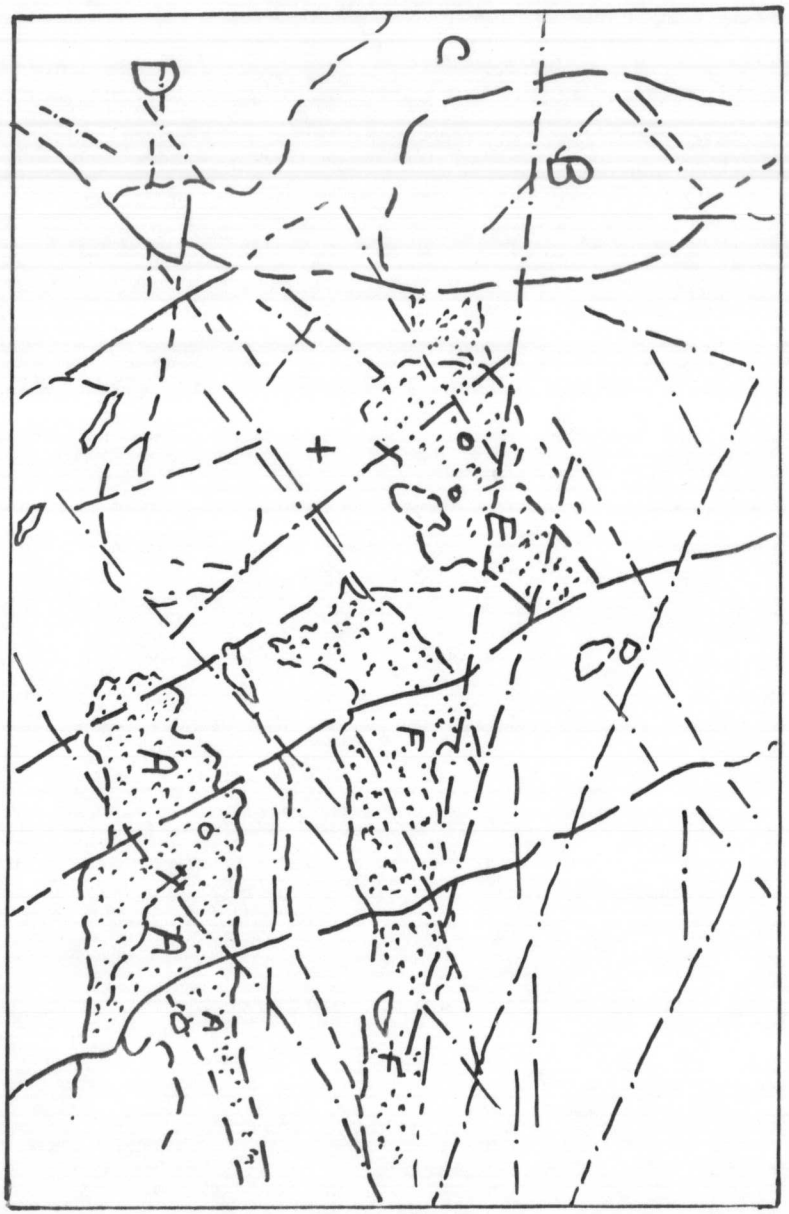
a) The fracture running through the Falun Mine area could be significant

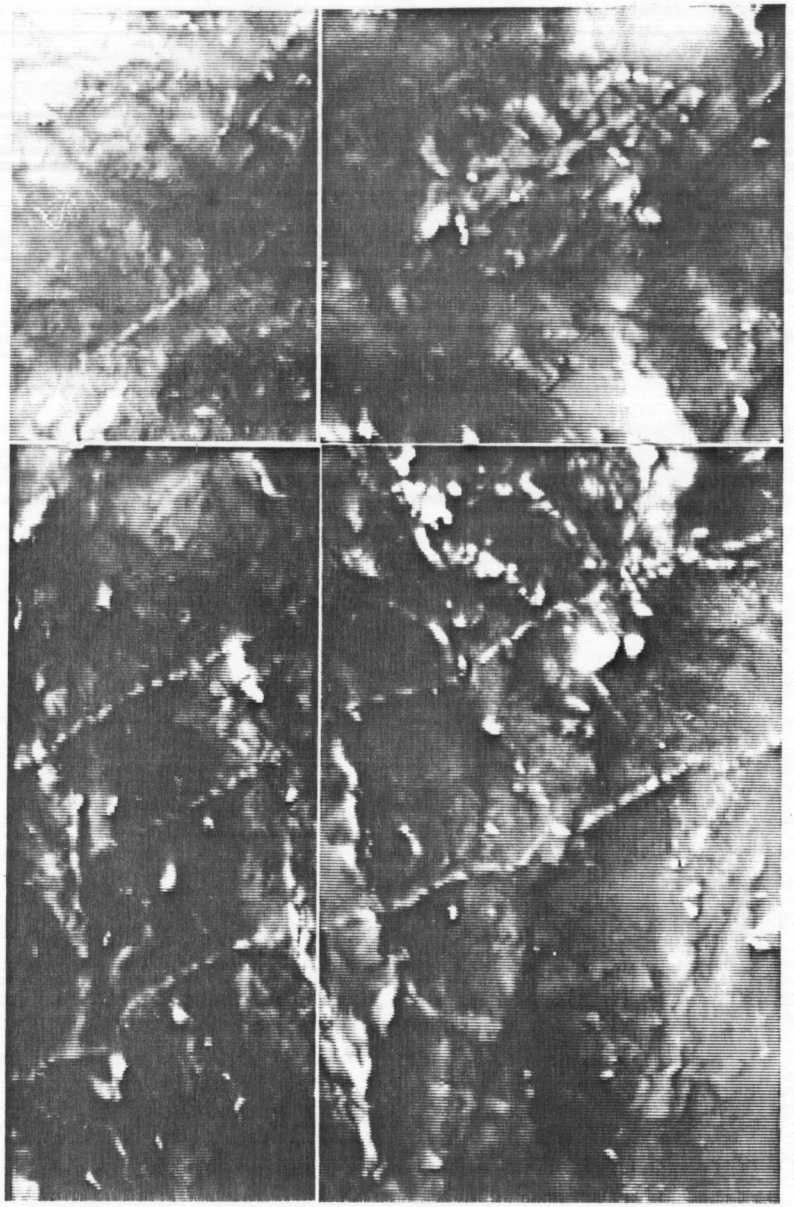
b) The Grycksbo and Falun Belts are clearly defined and need further study

c) The association of granite mass edges and fractures is clear

Scale 1: 250000

13 F FALUN





Appendix D 1 fig1

A short description covering a number of mineral occurrences in the Falun area (M. Bromley-Challenor)

Ärtsjön

Ärtsjön is situated 2 km NE of Floholm. The mineralisation has an irregular distribution over a 450 m length. It is considered to lie in approximately the some geological horizon as Floholm. The mineralisation which consists of sphalerite, galena and some chalcopyrite is known to a depth of 80 m and is associated to a chlorite-biotite skarn and partially to a sericitic leptite or sericitic quartzite. Ore reserves are approximatley 0,2 miljon tons.

Bergsätra

North of Bergsätra a small zinc lead mineralisation occurs. The small, but rich lenses occur in an sericitic quartzite and lie almost certainly in the same zone as the Harmsarvets silvermine.

In Bergsätra the quartzite contains a higher content of micaschist but the impregnation zone is thinner. The ore content is low but the silver ratio to lead is high.

Digertäckt mines

3 km NE of Falun.

Digertäckt mines lie 3 km N of Falun in a minor leptite belt paralell to Varpan-Svärdsjö. The mineralisation occurs in a thin leptite zone which strikes in an E-W direction and dips 55^{o} S. The leptite is on both sides surrounded by diorite which in turn is enveloped by granite. The western part of the area is traversed by an Asby dolerite. Digertäckts mine is 14 m deep., It is noticable from the dumpmaterial that the sphalerite occurs in a skarnic leptite.

The associated Urfjälls mine is 45 m deep and on the northern side of the pit a coarse grained tremolite skarn occurs and on the southern side a skarnic leptite.

A dump with high grade zinc ore lies close to the mine.

A substantial member of prospects occur in an westerly direction along the leptite strike. The total length of the mineralised horizon around Digertäkt mines is over 1 km.

Domän mine (even called Sveden)

Domän mine is situated immediately south of the road Falun Svärdsjö 4 km east of Falun. The mine contains pyrite which forms bands, strings and impregnations in a gneissic (vertical, 5-10 m thick) zone, in a plagioclase-leptite and ore quartzite. The skarn is a brownish grey cummingtonite which occurs in small quantaties, the same applies for pegmatite. Together with the pyrite; galena, chalcopyrite and pyrrhotite occurs.

Eriksbergsmine

Eriksbergsmine lies along the road south of Sågmyra. The mine dump contains an abundant amount of pyrrhotite and chalcopyrite in the form of inclusions and thin lenses in a dark skarn which even contains magnetite.

Floberg copper mine

Floberg copper mine is interesting from a mineralogical point of view. A complex sulphide ore with copper, pyrite, pyrrhotite, sphalerite and some galena. It lies in a skarn consisting of chlorite biotite, garnet, spinell and antophyllite. Even flourite and buckshot ore consisting of sphalerite and chlorite with some chalcopyrite and galena occurs. The wallrock is a staurolite bearing quartzite.

Floholm

Floholm lies 1 km east of Floberg. The rocks of the area consist of grey-quartz-phorphyritic and clacitic leptites interlayered with amphibolites and marbles. A marble layer occurs in the footwall of the ore horizon which is folded around an axcis that dips 60^{0} SSE. Adjacent to the ore; the leptites are altered to biotite quartzite and to skarn. Often the skarn and leptites have disseminated magnetite. Two ore types can be distinguished, even where they occur mixed together - rich pyrite ore with zinc and lead ore, with lower contents of pyrite. Chalcopyrite occurs in both types, generally as facture fillings. The zinc-lead ore occurs mainly in the more calcareous parts. The easterly oreshoot follows an isoclinal fold of marble whereas the westerly orebody forms a gentle curved sheet. The total area of the ore is about 360 m^2 with 0,2 Cu, 9 % Zn, 5 % Pb and 17 % S.

Grim-Moberg prospect

The dump material consists of a magnetite bearing amphibole skarn with disseminations and veins of chalcopyrite. Iron rich sphalerite also occurs. The nearby outcrops consist of dolerites and diorites surrounded by leptite.

Grönbo (also called the Aspan deposit)

Grönbo deposit is situated 8 km West of Falun it consists of 3 paralell ore zones which lie in the some leptite belt as Falun, Skytt and Näverbergs mine. The leptites are fine grained and banded with intercalations of marbles. The sericite alteration which envelopes the quartzite in the Falu mine can be followed more or less continuosly to Grönbo and 4 kilometers further west where it is terminated by a large fault zone. This fault zone can be followed over 250 kilometers SE down to the east at Trosa.

The ore deposit which lies in this zone with sericitic ore quartzite and marble, consists of a number of parallel orebodies, the largest being known to a depth of 130 m. The ore consists of sphalerite, chalcopyrite and some galena with a lesser content of pyrrhotite and pyrite. The ores plunge $\sim 70^{o}$ S and the total area with the copper and galena bearing zinc ore is in the region of 2000 m^2.

Harmsarvet silver mine. (owned by Boliden)

The mine is situated 13 km NW of Falun. The ore bearing rock consists of a microcline leptite and dark biotite rich leptite. A 1/2 m thick conglomeratic rock zone lies intercalated in the leptite.

The ore zone which is characterised by its silver content occurs as impregnations, fissure fillings and lenses. Sometimes associated to quarts lenses with or without flourite or sometimes associated to tectonic fissures. Along the hanging wall a thin zone of buckshot ore containing scheelite occurs.

Pyrite, sphalerite, galena and chalcopyrite are the dominent-ore minerals. The silver is mainly in the form of native silver, however, it also occurs as pyrargyrite, dyscracite etc. What is surprising is that the silvermineralisation occurs in fissures predominantly at right angles to the bedding and shistosity direction.

Kuså Nickelmine

Kuså Ni mine lies 12 km north of Borlänge. On the edge of a small gabbromassive which is of varying composition and is surrounded by a synorogenic granite. The ore consists of irregular bodies which plunge 30^{0} NNW. They consist of impregnations of nickel bearing pyrrhotite and chalcopyrite in the gabbro. The nickel content in the pyrrhotite is mainly derived from finely dissperced pentlandite. The ore also contains smaller contents of bravoite magnetite and sphalerite.

Kuså was worked between 1941-43 and gave 3 500 tons ore with 1,0 % Cu, 0.9 % Ni and 13 % S. (an ore reserve of approx..15 000 tons is thought to be realistic).

Långtjärns mine

The mine is situated 2 km NNW of the village of Harmsarvet. The ore occurs in a garnet pyroxene skarn which lies in a leptite. The ore is characterised by irregular lenses, aggregates and thin lenses. In the skarn, pyrrhotite, chalcopyrite and even some pyrite and magnetite occurs. 345 tons of ore containing 1 g/ton Au, 52 g/ton Ag and 4 % Cu has been mined.

Limbo mine

The dump surrounding the mine pit indicates that the main ore minerals consist of pyrite and chalcopyrite often disseminated in a siliceous leptite. Even amphibole skarn occurs.

Lustebo

At Lustebo just over 1 km SE of Floholm Boliden discovered a zinc-lead deposit which is very simular to the Floholm deposit but much smaller.

Skytt and Näverberg mine

Skytt and Näverberg mine, 5 km West of Falun contains copper, zinc and lead ores which like the sulphide ores of Falun, lie in antophyllite and cordierite ore-quartzites often with andalusite and almandine garnet.

In Skytt mine, Ca-Mg dolomitic marble lens is altered to ophicalcite which has partially been replaced by a tremolite, chondrodite skarn with sphalerite and to a lesser extent galena, chalcopyrite, pyrite and pyrrhotite; a little silver also occurs even in the form of native silver.

In Näverberg mine mainly chalcopyrite occurs in a cordierite antophyllite and gahnite bearing coarse cristalline ore quartzite. A slight content of gold also occurs.

Oxberg

Directly north of Oxberg lies a small sulphide impregnation in a siliceous leptite. It contains arsenopyrite; pyrrhotite, pyrite, chalcopyrite and galena. The ore even contains a somewhat higher gold content.

Rogsjön (even called Uvbergsviken)

The mineralisation in the Rogsjö area is associated to the discordant upper leptite gneissic arkose series where even isolated marble zones occur.

The mineralisation is drawn out in the shallow fold axels direction which is approx. N-S.

The occurence occurs in Uvbergsviken, almost in the middle of Rogsjön and exploration in the form of geophysical measurements resulting in diamond drilling has been carried out by Boliden. The ore is a zinc rich copper ore.

Sågmyra Coppermine

Ore minerals in the dump consist of some chalcopyrite and abundant pyrrhotite and even fine grained skarn iron ore. The leptite wall rock is siliceously altered.

Skommarbo mine

The prospect lies 100 m SW of Hälgsjön. One of the small dumps surrounding a pit contains molybdenite in a pegmatite. A number of small pits containing iron ore are also found in this area.

Skytt (see Näverberg)

Slättberg Nickelmine

Slättbergs mine lies 15 km ENE of Leksand. The ore is associated to a dyke consisting of basic amphibolite in a grey synorogenic granite. The vein strikes ENE with a near vertical dip. It is of 2-6 m thick and about 1,6 km in length. The nickel bearing pyrrhotite is mainly concentrated in quartzitic chlorite tectonic fissures and even as impregnations in the dyke. The pyrrhotite is fine grained, and its higher content has mainly been noticed in the central or hanging zone of the dyke. The sulphide zones width, is up to 6 m and with a known depth of 80 m. Internal reports concerning this area and the mineralisation exist Grb 63; 100; 199; 331.

Solarvet

About 1 kilometer W of Solarvet a row of small prospects occurs. In the dump certain samples are rich in zinc ore. The largest prospect has a mineralised zone of about 1 m in width. The zinc content is relatively high.

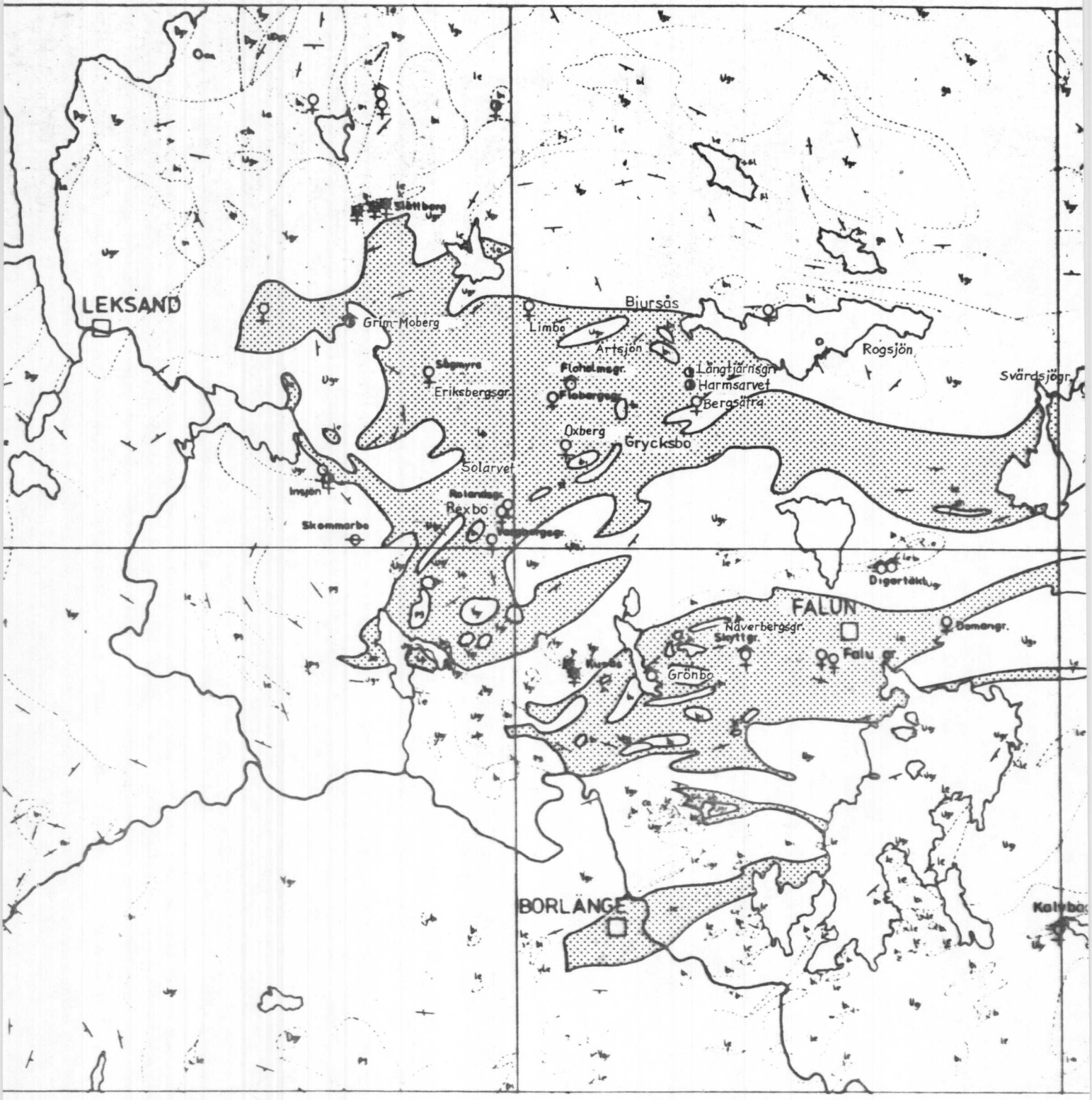
Svärdsjö mine (even called Svartviks mine)

Svärdsjö mine is situated 17 km NE of Falun. The ore consists of a silver rich complex zinc-lead-copperore, 0,6 % Cu, 6,1 % Zn, 2,7 % Pb and a substantial Ag content. The ore is associated together with a tremolite skarn in dolomite. The tremolite often being altered to talk. The leptite close to the ore bearing area is replaced by micaschists and ore quartzites containing almandine and cordierite.

Substantial tectonic deformation is evident. The separate lense shaped ore bodies are interrupted by large chlorite filled tectonic fissures and breccia-zones.

LKAB PROSPEKTERING AB
Håksberg

MINE - PROSPECT
13 F FALUN

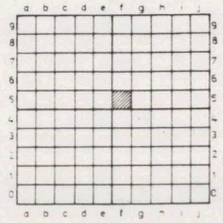


LEGEND

Leptite belts

Scale 1: 250 000

App D2 fig 1



LEGEND

- Dolerite, db
- Pegmatite, pg
- Serorogenic pegmatite-granite, gry
- Diorite, dt
- Amphibolite, af
- Synorogenic granite, gru
- "Ore Quartzite" (original silicified host rock), kv
- Mica schist, ms
- Meta-sediment, se
- Skarn, sk
- Marbles, Ca-Mg
- Granitoid gneiss, gn
- Tectonised fragmental leptitic rock
- Leptite, le
- Leptite gneiss (predominantley potassic), lg
- Meta-rhyolite, ry
- Andalusite/cordierite bearing
- Gedrite, antophyllite
- Garnet bearing

Texture

- Shistosity
- Porphyritic
- Quartz porphyritic
- Feldsparporphyritic
- Breccia
- Magnetit ore
- Sulphide ore

Michael Bromley-Challenor

Field observations by JK, SH and MB-C.

PROVISIONAL GEOLOGICAL MAP

BYNGSBODARNA

Uppr	Aktuell	Skala 1:20000
LKAB PROSPEKTERING AB	Kartbl 13F 5f	App D3

Drillcore analyses from Byngsbodarna area reported by Boliden Company to the Inspector of Mines (from 1974).

Oxberg 7

This zinc and copper mineralization was located with boulder tracing and trenching. The mineralization is associated to a garnet amphibole skarn with sphalerite and chalcopyrite as the main ore minerals.

Bore hole nr. 9

Section	Length (m)	Au (ppm)	Ag (ppm)	Cu (%)	Zn (%)
41,65-42,10	0,45	0,1	8	0,18	2,95
42,10-42,87	0,77	0,1	1	0,03	0,15
42,87-44,95	2,08	0,1	1	0,23	
56,80-58,30	1,50	0,1	6	0,05	0,38
60,05-60,85	0,80	0,2	4	0,02	0,38

Bore hole nr. 10

Section	Length (m)	Au (ppm)	Ag (ppm)	Cu (%)	Zn (%)
27,00-27,45	0,45	0,1	10	0,43	0,04
27,45-28,30	0,85	1,4	71	5,56	0,38
28,30-29,40	1,10	0,1	8	0,38	0,03
29,40-30,40	1,00	0,4	12	0,38	0,06
30,40-31,00	0,60	0,1	12	0,89	0,34
31,00-31,90	0,90	0,1	6	0,17	0,28

Bore hole nr. 11

Section	Length (m)	Au (ppm)	Ag (ppm)	Cu (%)	Zn (%)
34,95-36,15	1,20	0,1	6	0,37	0,13
36,15-36,90	0,75	0,1	2	0,04	0,43
36,90-38,15	1,25	0,1	4	0,06	2,91
38,15-39,00	0,85	0,1	4	0,03	0,44
39,00-39,55	0,55	0,1	3	0,04	0,08
39,55-40,35	0,80	0,1	5	0,19	0,82

Bore hole nr. 13

Section	Length (m)	Au (ppm)	Ag (ppm)	Cu (%)	Zn (%)	Pb (%)
29,90-31,05	1,15	0,1	2	0,05	0,68	
31,05-31,55	0,50	0,1	2	0,04	0,12	0,10
31,55-36,05	4,50	0,1	2	0,04	0,20	0,04
36,05-38,75	2,70	0,2	4	0,04	3,81	0,04
38,75-42,15	3,40	0,1	2	0,03	0,18	0,04
42,15-43,05	0,80	0,1	6	0,14	4,66	0,59

Bore hole nr. 14

Section	Length (m)	Au (ppm)	Ag (ppm)	Cu (%)	Zn (%)	Pb (%)
29,50-30,00	0,50	0,1	4	0,38	0,62	
30,00-30,45	0,45	0,1	4	0,09	0,06	
30,45-31,00	0,55	0,1	3	0,17	0,36	
34,00-35,00	1,00	0,1	6	0,74	0,15	
39,85-41,30	1,45	0,15	6	0,15	0,59	0,47

Bore hole nr 15 B

Section	Length (m)	Au (ppm)	Ag (ppm)	Cu (%)	Zn (%)	Pb (%)
72,60-73,30	0,70	0,2	36	0,07	0,22	
73,30-74,75	1,45	0,1	4	0,12	0.41	
74,75-76,60	1,85	0,1	2	0,06	1,66	
76,60-80,50	3,90	0,1	6	0,02	0,04	0,04
80,50-81,40	0,90	0,1	2	0,08	0,06	

Oxberg 64

The mineralization which contains arsenopyrite, pyrite and gold occurs in an "ore quartzitic"* altered leptite.
Boulder tracing, trenching and geophysical exploration methods have enabled the location of this mineralization

* (original silicified host rock)

Bore hole nr. 23

Section	Length (m)	Au (ppm)	Ag (ppm)	Cu (%)	Zn(%)	As (%)	S (%)
22,00-23,25	1,25	1,8	1	0,04	0,02	0,93	7,3
23,25-24,60	1,35	1,1	2	0,03	0,02	3,18	9,1
24,60-26,65	2.05	11,1	6	0,03	0,02	3,59	7,7
	4,60	5,9					

Bore hole nr. 25

Section	Length (m)	Au (ppm)	Ag (ppm)	Fe (%)
11,40-14,00	2,60	< 0,1	3	14,8

Bore hole nr. 26

Section	Length (m)	Au (ppm)	Ag (ppm)	Cu (%)	As (%)	S (%)
40,35-45,65	5,30	< 0,1	2	< 0,01	0,03	0,7
45,65-50,50	4,85	0,4	3	0,04	1,45	9,0
50,50-51,55	1,05	0,3	2	0,05	0,02	2,2

Floberget 143

The zinc-copper mineralization was located with the help of boulder tracing, trenching and geophysical exploration. The mineralization is associated to skarn and "ore quartzite"

Bore hole nr. 16

Section	Length (m)	Au (ppm)	Ag (ppm)	Cu (%)	Zn (%)	Pb (%)
54,70-55,75	1,05	0,3	3	0,04	0,13	0,04
55,75-56,80	1,05	0,1	6	0,17	0,49	0,06
56,80-57,50	0,70	0,2	2	0,38	0,21	0,04
57,50-60,35	2,85	0,1	2	0,01	0,03	0,04
60,35-60,85	0,50	0,1	2	0,04	0,09	0,04
60,85-62,25	1,40	0,1	14	0,85	2,00	1,33
62,25-63,40	1,15	0,2	14	0,82	11,15	1,56
63,40-64,15	0,75	0,2	2	0,31	1,02	0,45
64,15-67,20	3,05	0,1	1	0,02	0,32	0,06

Bore hole nr. 19

Section	Length (m)	Ag (ppm)	Cu (%)	Zn (%)	Pb (%)	S (%)
28,83-29,80	0,97	1		1,01	0,25	0,73
29,80-32,00	2,20	9		1,82	1,29	4,51
94,62-95,45	0,83	49		2,17	1,58	4,02
95,45-96,95	1,50	11		0,26	0,21	0,59
96,95-97,45	0,50	1		0,03	0,13	1,16
97,45-98,50	1,05	1		0,01	0,17	1,88
102,40-104,15	1,75	5	0,32			
104,15-104,95	0,80	16	0,66			

Bore hole nr. 20

Section	Length (m)	Au (ppm)	Ag (ppm)	Cu (%)	Zn (%)	Pb (%)
55,30-57,30	2,00	8,1	4	0,13		
75,90-76,45	0,55	0,1	6	0,04	1,20	0,37
78,00-80,42	2,42	0,1	5	0,14	0,05	0,10

F. REGIONAL TILL GEOCHEMISTRY

1. Sample collection, Preparation and Analysis

The survey area is approx. 575 km^2 and the average sample density is 0,9 sample/km^2. Duplicate samples were collected at almost every sample site: a large (3 kg) sample for heavy mineral concentration and a small (2 hg) to get the fine fraction. Totally 506 samples were concentrated by Goldhound equipment; for further preparation techniques see Report Bsg 84-343, p 15. Totally 493 samples were dried, sieved < 0,50 mm on nylon screens and ground in a Siebtechnik mill at 30 sec.

At the analytical laboratory of LKAB-PAB, Stockholm 1 g of a sample is heated with HNO_3+HF and boiled dry. The remainder is dissolved in 0,5 ml tartaric acid + 7,5 ml HCl and diluted to 50 ml. The solution is analysed for 26 elements: Al, B, Ba, Be, Ca, Cd, Ce, Co, Cu, Fe, K, La, Li, Mg, Mn, Mo, Na, Ni, P, Pb, Sr, Ti, V, W, Y and Zn by ICP-ES (Jarrell-Ash 9000). This is the standard methodology of till fine fraction survey.

The Goldhound concentrates were analysed for 26 elements by Analytica AB, Stockholm: Al, As, Ba, Ca, Co, Cr, Cu, Fe, K, Mg, Mo, Na, Nb, Ni, P, Pb, S, Si, Th, Ti, U, V, W and Zn by XRF and Ag, Sn by DC-ES.

The sampling pattern is semi-quadratic and covers the area well. Lakes and sediment cover are the main reason for some small while spots besides 15 fine fraction samples which disappeared somewhere in handling.

2. Analytical quality control

The analysis by ICP-ES is performed in sample sets of ≤ 39 geochemical samples and 1 laboratory reference sample. A sample set analysis begins and ends with the reference sample. The reference sample is a composite of till from the Bergslagen area.

Fluctuations in analytical performance consists of two components; random and systematic errors. These two components are reflected in the absolute differences $|X_{i1} - X_{i2}|$ between pairs of duplicate analysis of the reference sample and the average value $m_i = (X_{i1} + X_{i2})/2$ as an estimator of average concentration of the reference sample in a sample set. Some of the elements are plotted in a diagram of reference sample analysis fig. 1. In table 1 some calculations are made. Formulars used are:

$$m_L = \frac{\Sigma X_L}{n_L}$$

$$m = \frac{\Sigma X_i}{n} \qquad \Delta X_i = |X_{i1} - X_{i2}|$$

$$s_\Delta = \sqrt{\sum_{i=1}^{13} X_i^2 / 26}$$

$$s = \sqrt{\sum_{i=1}^{13} (m - \Delta X_i)^2 / 12}$$

$$R = \Delta X_{i_{max}} - \Delta X_{i_{min}}$$

m_L = long time mean of reference samples

X_L = element analysis of reference sample

n_L = 161 analysis of ref. samples

m_s = mean of survey reference sample

X_i = element analysis of survey ref. sample

n = 26 analysis of survey ref. sample

s_Δ = standard deviation of absolute differences of ref. sample analysis

s = standard deviation of duplicate analysis

R = range of duplicate analysis

s_Δ is an estimator of analytical precision and s is an estimator of total variation within the reference samples. If the values are normal distributed the relations are:

$s = \sqrt{s_d^2 + \frac{1}{2} s_\Delta^2}$ where s_d is the standard deviation of instrumental drift.

Since the reference sample analysis are a replicate analysis the total variation of analytical performance is under-estimated as different matrix occurs in the survey samples.

Table 1. Analytical performance of ICP-ES analysis of till fine fraction reference sample

	Cu ppm	Zn ppm	Pb ppm	Co ppm	Ni ppm	Mo ppm	W ppm	Li ppm	Mg %	Ca %
m_L	7	26	17	4	12	2	7	9	0,41	0,87
m	7,3	28	19	4,2	16	2,3	8,0	8,8	0,44	0,93
m_L-m	0	2	2	0	4	0	1	0	0,03	0,06
s	0,3	3	2,4	0,3	2,9	0,25	1,6	0,3	0,009	0,024
s_Δ	0,4	1,4	4	0,3	1,4	0,5	1,8	0,4	0,018	0,056
s_d	0,11	2,9	-	0,22	2,7	-	1,0	0,17	-	-
R	1	11,5	7,5	1	10,5	0,5	6	1	0,034	0,078

According to table 1 and fig. 1 instrumental drift is none or neglectible for Cu, Pb, Co, Mo, Li, Mg and Ca. A small drift occurs for W. Zn and Ni have instrumental drift as well as stepwise level changes. These changes are small in comparison to the regional variance. The analytical performance is satisfactory according to the reference sample analysis.

Although it should be observed that the ICP-ES analysis of Mo and W and to some content Pb are not totally sufficient for background determinations of till.

3. Results - fine fraction of till

Aritmetic mean (m), standard deviation (s), koefficient of variation (V), maximum and minimum for the elements are presented in table 2.

Table 2. Mean (m), standarddev. (s), koeff. of variation (V), maximum and minimum for elements in till < 0,50 mm (n=493)

ELEMENT	MEDELV	STD	VKOEFF	MAX	MIN
	m	s	V		
CU	Ø.ØØ18	Ø.ØØ15	Ø.8Ø21	Ø.Ø112	Ø.ØØØ2
NI	Ø.ØØ11	Ø.ØØØ8	Ø.79ØØ	Ø.Ø14Ø	Ø.ØØØ3
ZN	Ø.ØØ52	Ø.ØØ34	Ø.6483	Ø.Ø277	Ø.ØØ12
MO	Ø.ØØØ2	Ø.ØØØ1	Ø.3648	Ø.ØØØ6	Ø.ØØØ1
V	Ø.ØØ41	Ø.ØØ17	Ø.4Ø49	Ø.Ø188	Ø.ØØ17
FE	2.26Ø8	Ø.8271	Ø.3658	8.955Ø	Ø.9313
CA	Ø.9Ø64	Ø.3782	Ø.4173	3.359Ø	Ø.2491
MG	Ø.53Ø5	Ø.3348	Ø.6311	2.936Ø	Ø.Ø566
AL	5.4Ø97	Ø.8114	Ø.15ØØ	8.312Ø	Ø.557Ø
TI	Ø.2697	Ø.1124	Ø.4168	1.987Ø	Ø.Ø652
MN	Ø.Ø377	Ø.Ø129	Ø.3413	Ø.Ø969	Ø.Ø16Ø
W	Ø.ØØ1Ø	Ø.ØØØ4	Ø.3537	Ø.ØØ25	Ø.ØØØ1
PB	Ø.ØØ24	Ø.ØØ1Ø	Ø.4252	Ø.Ø12Ø	Ø.ØØØ5
CO	Ø.ØØØ7	Ø.ØØØ3	Ø.5235	Ø.ØØ3Ø	Ø.ØØØ3
CE	Ø.ØØ55	Ø.ØØ23	Ø.41Ø5	Ø.Ø31Ø	Ø.ØØ13
CD	Ø.ØØØØ	Ø.ØØØØ		Ø.ØØØ1	Ø.ØØØØ
LA	Ø.ØØ18	Ø.ØØØ5	Ø.2668	Ø.ØØ53	Ø.ØØØ1
BE	Ø.ØØØ1	Ø.ØØØ1	Ø.4399	Ø.ØØØ6	Ø.ØØØØ
SR	Ø.Ø111	Ø.ØØ24	Ø.2175	Ø.Ø432	Ø.ØØ17
Y	Ø.ØØ14	Ø.ØØØ4	Ø.2686	Ø.ØØ49	Ø.ØØØ1
BA	Ø.Ø458	Ø.ØØ68	Ø.1491	Ø.Ø722	Ø.ØØ37
LI	Ø.ØØ1Ø	Ø.ØØØ4	Ø.3533	Ø.ØØ3Ø	Ø.ØØØ3
B	Ø.ØØØ6	Ø.ØØØ2	Ø.382Ø	Ø.ØØ15	-Ø.ØØØ1
P	Ø.Ø34Ø	Ø.Ø193	Ø.5689	Ø.2475	Ø.Ø118
NA	1.6284	Ø.2877	Ø.1767	2.544Ø	Ø.Ø511
K	2.2758	Ø.4616	Ø.2Ø28	3.245Ø	Ø.1595

The koefficient of the variation can be regarded as a good estimator of geochemical contrast in this survey. High contrast (in order of decreasing V) is apparent for Cu, Ni, Zn, Mg, P and Co. These elements also have an obvious positively skewed distribution. On the other hand a very low contrast is apparent for (in order of increasing V): Ba, Al, Na, K and Sr. The range (max-min) is very low for Cd (1 ppm) and Mo (5 ppm).

Scatter diagrams are presented in Figs. 2-24. They exhibit a regional positive correlation between Cu, Zn, Co, Ni, Fe, Mg and Ca. Pb has only a weak correlation to this elements. Cumulative frequences of Cu, Zn, Pb, Co, Ni are plotted on logarithmic papers in fig. 27 and Fe, Mg, Ca, Mn, P in fig 28.The plottings indicates multipel populations of these elements. Cu, Zn, Fe and Mg display distribution similarities; in broad outline they appear as two straight lines with their intersection point at approx. 45 cumulative %. This shows that the distributions are log-normal and at least consist of two populations. Pb has an intersection point at 95 %, Ni at 70% and 95%, Co at 55%, 96% and 99,2%, Ca at 97%, Mn at 90% and P at 87% and 98%. Other intersection points for Fe is 97% and for Mg at 1,2% and 99,6%.

A key map of the relief and hydrography is presented in fig. 29.

Column maps of Zn-Cu, Pb-W, Co-Ni, Ca-Mg and P-Mn are presented in fig. 30-34. The regional background values - which are estimated by the rounded mode - are subtracted from the analytical raw values. They are: Zn 40 ppm, Cu 10 ppm, Pb 20 ppm, W 10 ppm, Co 5 ppm, Ni 8 ppm, Ca 0,8%, Mg 0,4%, P 300 ppm and Mn 300 ppm. Column maps of the residuals of Zn-Cu are presented in fig. 35. In scatter diagrams (figs. 9, 10 and 12), where Zn, Cu and Ni are plotted against Mg, a manual estimated line is plotted. This line is described of an equation $X = f(Mg) = k \cdot Mg + i$ where X = Cu, Zn or Ni; k = gradient; i = intercept. The residuals (r_x) are calculated from $r_x = X_a - F(Mg)$ where x_a = analytical raw value. The residuals form a normal distribution.

Small scale maps (1:250.000) of all elements are produced and available on request.

The element maps (appendices 30-34) show a similar regional dispersion of the elements: Cu, Zn, Pb, Ni, Co, Ca, Mg and Mn. The western parts have a low content and especially the eastern-central parts and the southern parts have an increase of this elements. This picture also appears from Fe and to some extent by B and Be. This means that the leptites probably are geochemical differentitated since this till geochemistry feature does not coincide with the extension of the leptite belts according to the geological map (appendix D1). The correlation between the till geochemistry results and the geology will be interpreted later when the geological mapping is finished.

The samples within the map sheets 13F 5-6 f-h have ben analysed for Au and Ag by AAS, Geological Survey of Finland, fig. 35. The detection limits are 3 ppb respectively 0,5 ppm. All analys is reported 0 ppb Au and 0 ppm Ag, except one sample (No 134) which were reported 5 ppb. This value is interpreted as an insignificant increase. The purpose of the analysis are to establish background values and it turned out to be very low; <3 ppb Au respectively $<0,5$ ppm Ag.

4. Results - heavy minerals of till

Arithmetic means (m), standard deviation (s), koefficient of variation (V_k), maximum and minimum for the analytical raw-values of the elements are presented in table 3.

Table 3. Mean (m), standard dev. (s), koeff. of variation (V_k), max, and min. for heavy minerals in till 1,0 mm (n=507).

ELEMENT	MEDELV	STD	VKOEFF	MAX	MIN
GL= weight	18.4872	6.6691	Ø.36Ø7	3Ø.ØØØØ	1.28ØØ
	m	s	V		
NA	1.7632	Ø.28Ø1	Ø.1571	3.1651	Ø.5132
MG	Ø.8152	Ø.6169	Ø.7567	7.Ø131	Ø.11Ø7
AL	5.8337	Ø.686Ø	Ø.1176	8.Ø177	2.ØØ78
SI	32.423Ø	3.1494	Ø.ØØ971	4Ø.5529	1Ø.5913
P	Ø.Ø283	Ø.Ø142	Ø.4999	Ø.1492	Ø.ØØ63
S	Ø.Ø164	Ø.Ø572	3.4964	Ø.7Ø66	Ø.ØØØ5
K	2.1559	Ø.4675	Ø.2169	3.1415	Ø.56Ø2
CA	1.7283	Ø.8ØØ7	Ø.4633	7.479Ø	Ø.2Ø74
TI	Ø.9582	Ø.9413	Ø.9823	15.5267	Ø.Ø645
V	Ø.Ø143	Ø.Ø12Ø	Ø.8398	Ø.1334	Ø.ØØ14
CR	Ø.Ø381	Ø.Ø166	Ø.435Ø	Ø.278Ø	Ø.Ø151
MN	Ø.1346	Ø.1171	Ø.8699	1.6729	Ø.Ø128
FE	6.2963	3.7716	Ø.599Ø	39.7918	Ø.84Ø6
CO	Ø.ØØ15	Ø.ØØ1Ø	Ø.6532	Ø.ØØ94	Ø.ØØØ4
NI	Ø.ØØ18	Ø.ØØ12	Ø.6692	Ø.Ø152	Ø.ØØØ1
CU	Ø.ØØ18	Ø.ØØ11	Ø.5878	Ø.Ø129	-Ø.ØØØ8
W	Ø.ØØ38	Ø.ØØ49	1.2848	Ø.Ø939	Ø.ØØØ2
ZN	Ø.ØØ77	Ø.ØØ47	Ø.6Ø89	Ø.Ø381	Ø.ØØ13
AS	-Ø.ØØØ1	Ø.ØØØ4	-6.6Ø52	Ø.ØØ2Ø	-Ø.ØØØ9
PB	Ø.ØØ29	Ø.ØØØ7	Ø.2234	Ø.ØØ81	Ø.ØØ1Ø
TH	Ø.ØØ11	Ø.ØØØ8	Ø.7519	Ø.ØØ75	-Ø.ØØØ2
U	Ø.ØØØ1	Ø.ØØØ3	2.3ØØ3	Ø.ØØ15	-Ø.ØØØ6
ZR	Ø.Ø472	Ø.Ø452	Ø.9579	Ø.67Ø6	Ø.ØØ52
NB	Ø.ØØ27	Ø.ØØ16	Ø.5862	Ø.Ø127	Ø.ØØØ4
MO	Ø.ØØ1Ø	Ø.ØØØ5	Ø.5Ø59	Ø.ØØ55	Ø.ØØØ3
BA	Ø.Ø448	Ø.ØØ85	Ø.1888	Ø.Ø9Ø7	Ø.Ø163

The analysis of As, and V are not accurate since many samples have negative contents figures. The zero level is to low. Most elements have a higher koeff. of variation than the fine fraction correspondence. Except from As and V which have a false high V_k, S and W have the highest V_k. and contrast. The contrast is very low for Al, K, Na, Si, B, Ba, Pb.

Column map of analytical raw values of P and S are presented in fig. 36. Column maps of W, Sn and Zn were presented in report Bsg 84-343, appendix G1-G3.

The results of Goldhound concentrated heavy mineral survey are partly the same as the fine fractions. One cause of this is that the enrichment is not so high. The difference in dispersion pattern are very small or small for Al, Ba, Ca, Co, K, Mg, Ni, and Zn. Larger differences occur for Pb, Ti, V and W.

In fig. 37 and 38 corrected values of W and Zn are presented as column maps. The correction is made for dilution of heavy minerals since the output weight of concentrate are poorly reproductive. Correction made is $x' = (x-b)m$ where x' = corrected value, x = analytical raw value, b = background value = constant, m = output weight.

Small scale maps (1:250.000) of all elements are produced and available on request.

Conclusions

Two major populations appear in the fine fraction survey as a simularity in spatial dispersion pattern and distribution type for many elements. The correlation between elements and the element composition makes the interpretation plausibel that we have one acidic population of low contents of Cu, Zn, Pb, Ni, Co, Fe, Ca, Mg, Mn and P. The other is an intermediate or basic population of high contents of the same elements. This is also apparent to some content in the heavy minerals, especially Mg.

Anomalies of Pb and residual anomalies of Cu and Zn occur in the fine fraction of till. Obvious heavy mineral anomalies of Zn and W are also present. These anomalies are interpreted as correlated to ore potential zones.

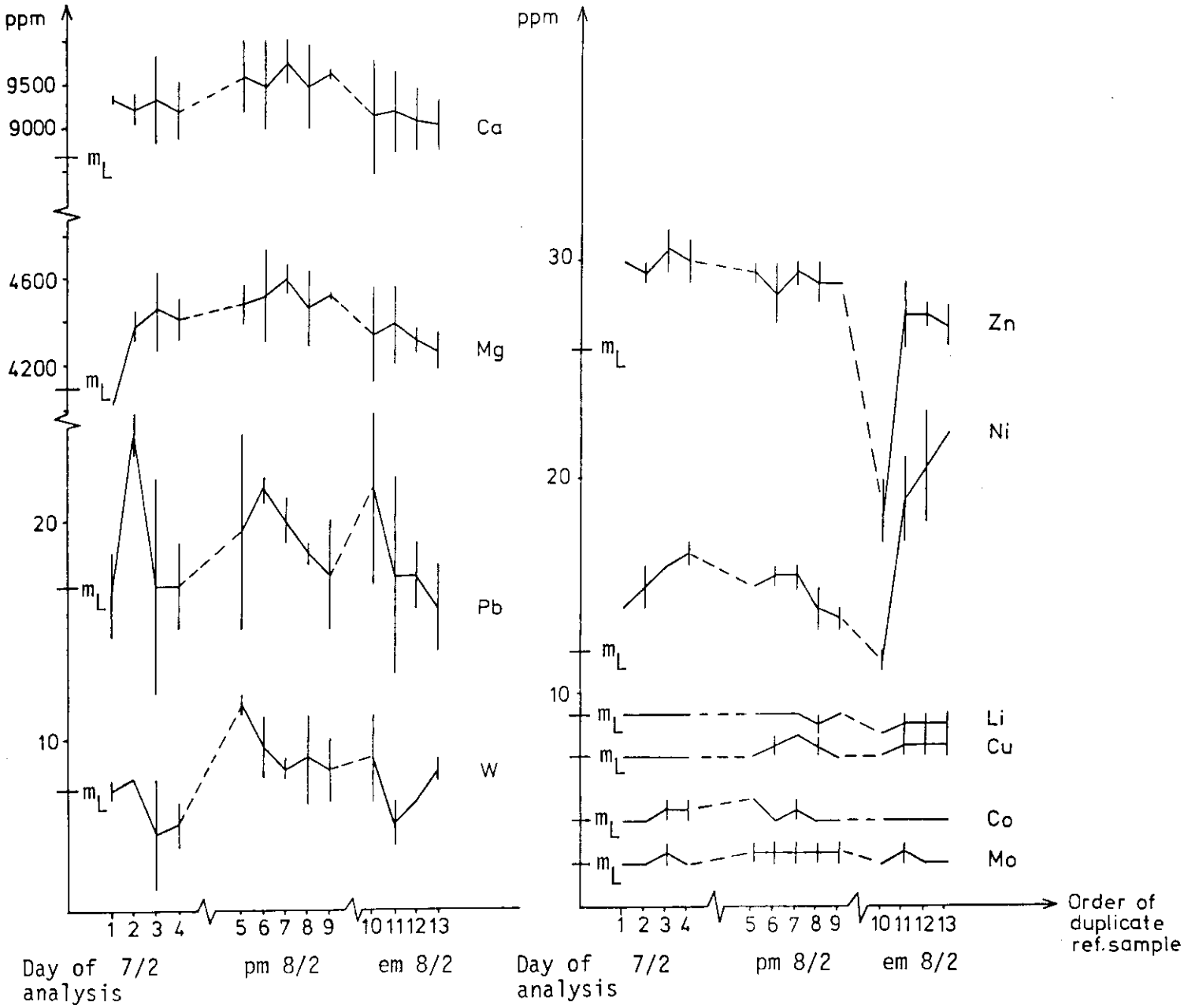
Three residual Ni-anomalies are probably caused by three small basic or ultra basic rocks, since they also are anomalies in Mg and Cr.

The most interesting anomalies occur in areas covered by map sheets of 13F 5-6 f-h. Geochemical surveys will be executed at chosen targets (page 5).

Figures

FINE FRACTION OF TILL

HEAVY MINERAL (Goldhound) ANALYSIS OF TILL



max

m_i=(max-min)/2

min

m_L= long time mean

Fig.1
Reference sample analysis

Series: 83G6JO:1-521

GEOCHEMICAL DIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson

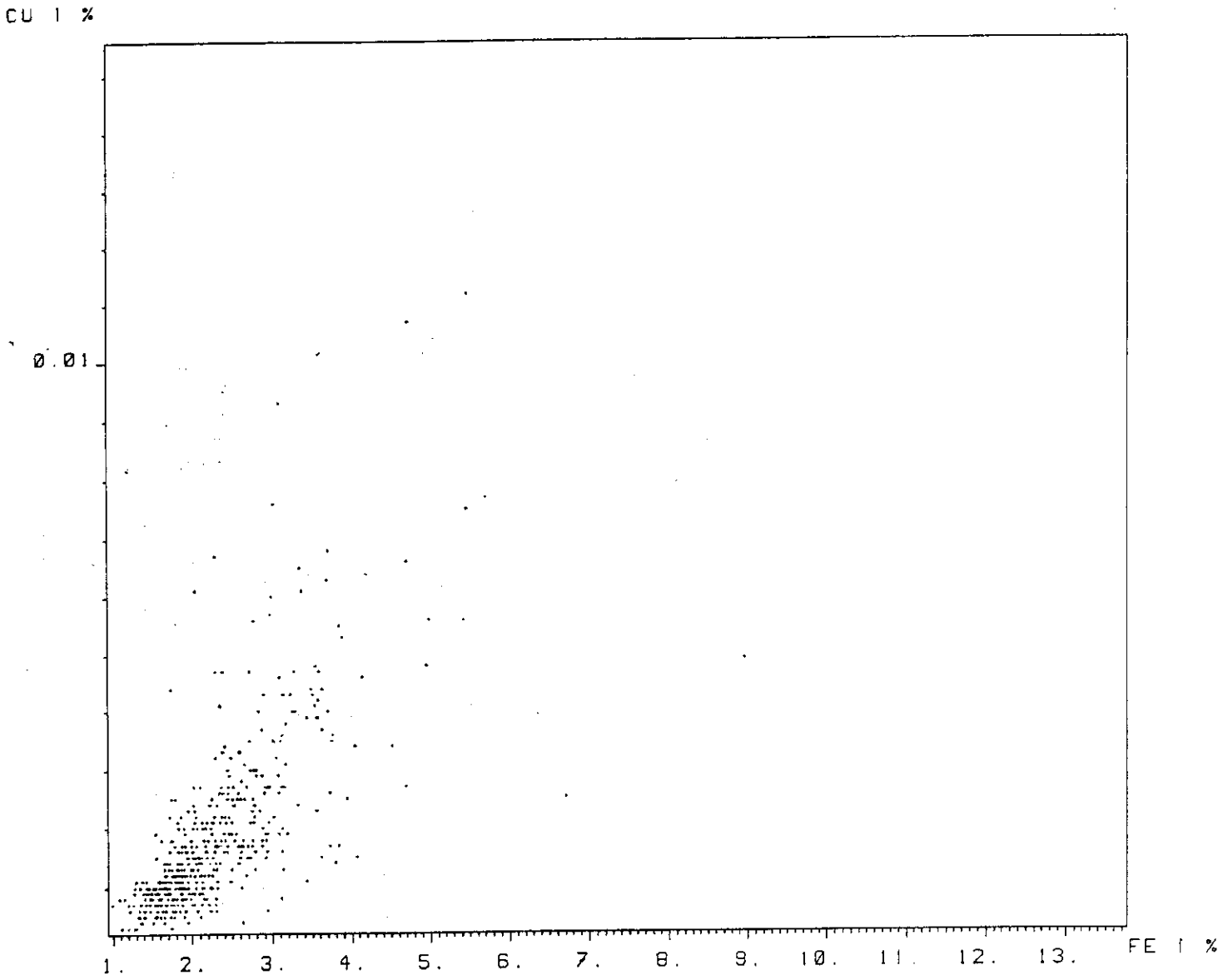


Fig. 2

Till fine fraction

Series: 83G6J0:1-521
n = 493

GEOCHEMICAL
SCATTERDIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson

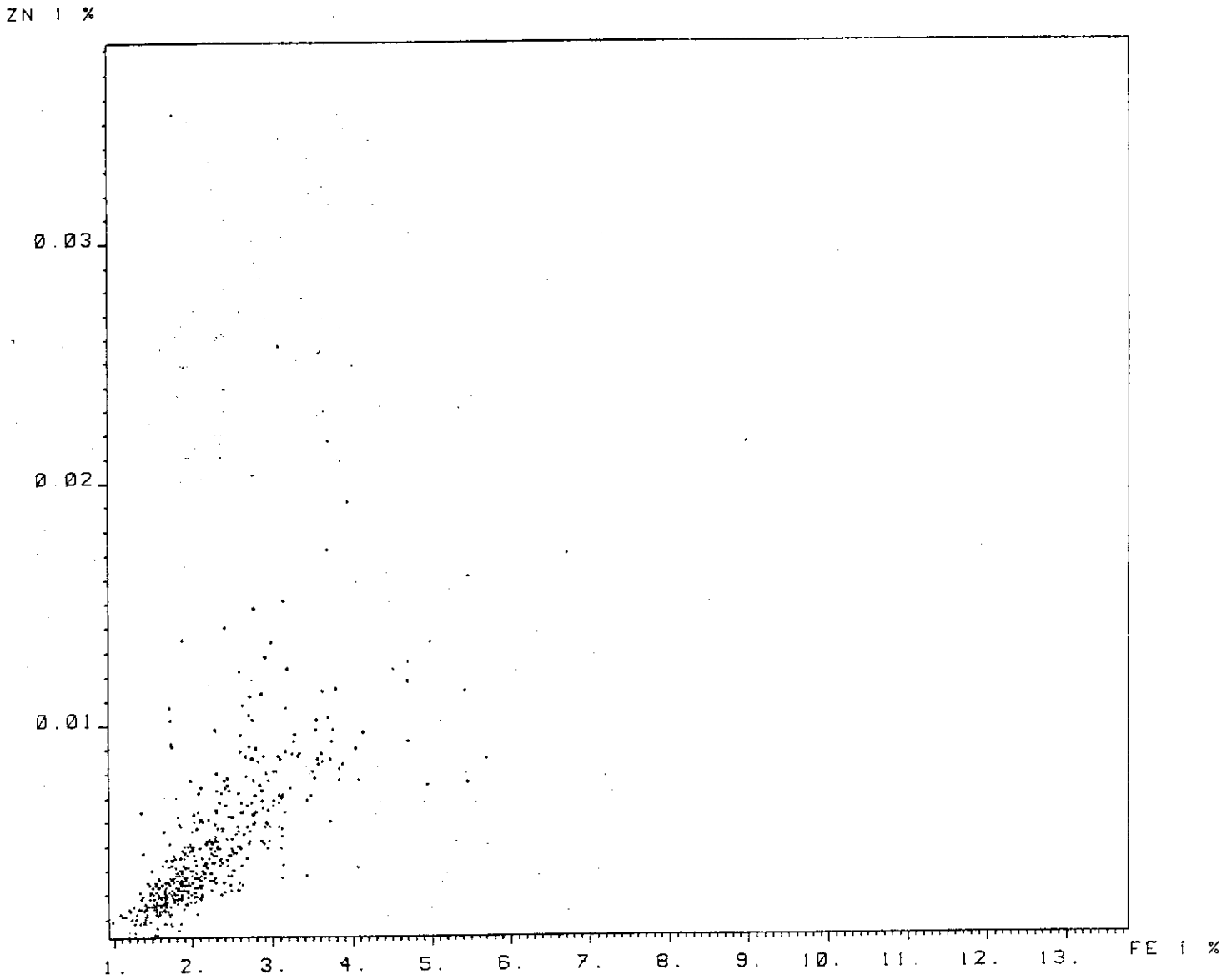


Fig.3

Till fine fraction

Series: 83G6J0:1-521
n = 493

GEOCHEMICAL
SCATTERDIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson

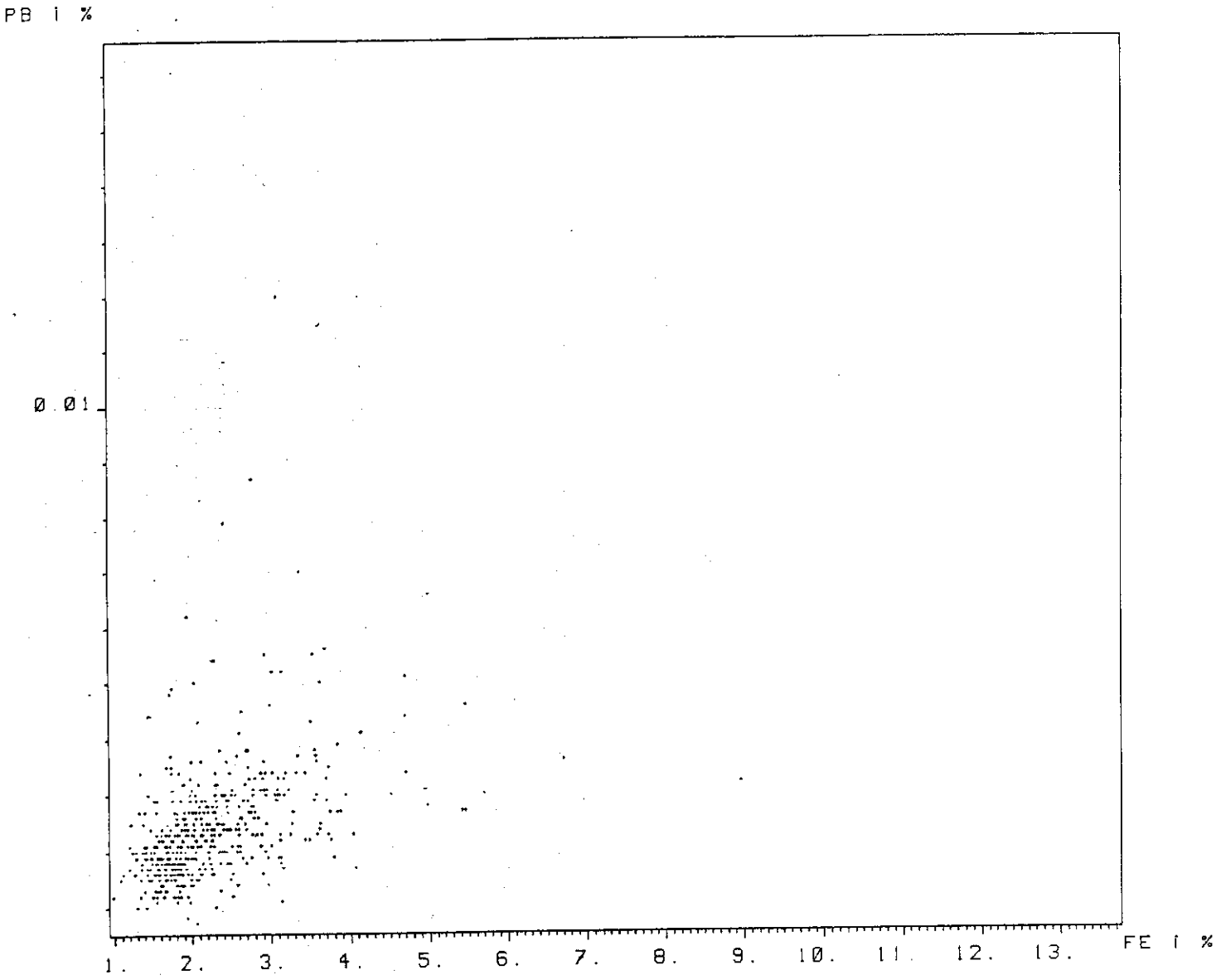


Fig. 4

Till fine fraction

Series: 83G6JO:1-521
n = 493

GEOCHEMICAL
SCATTERDIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson

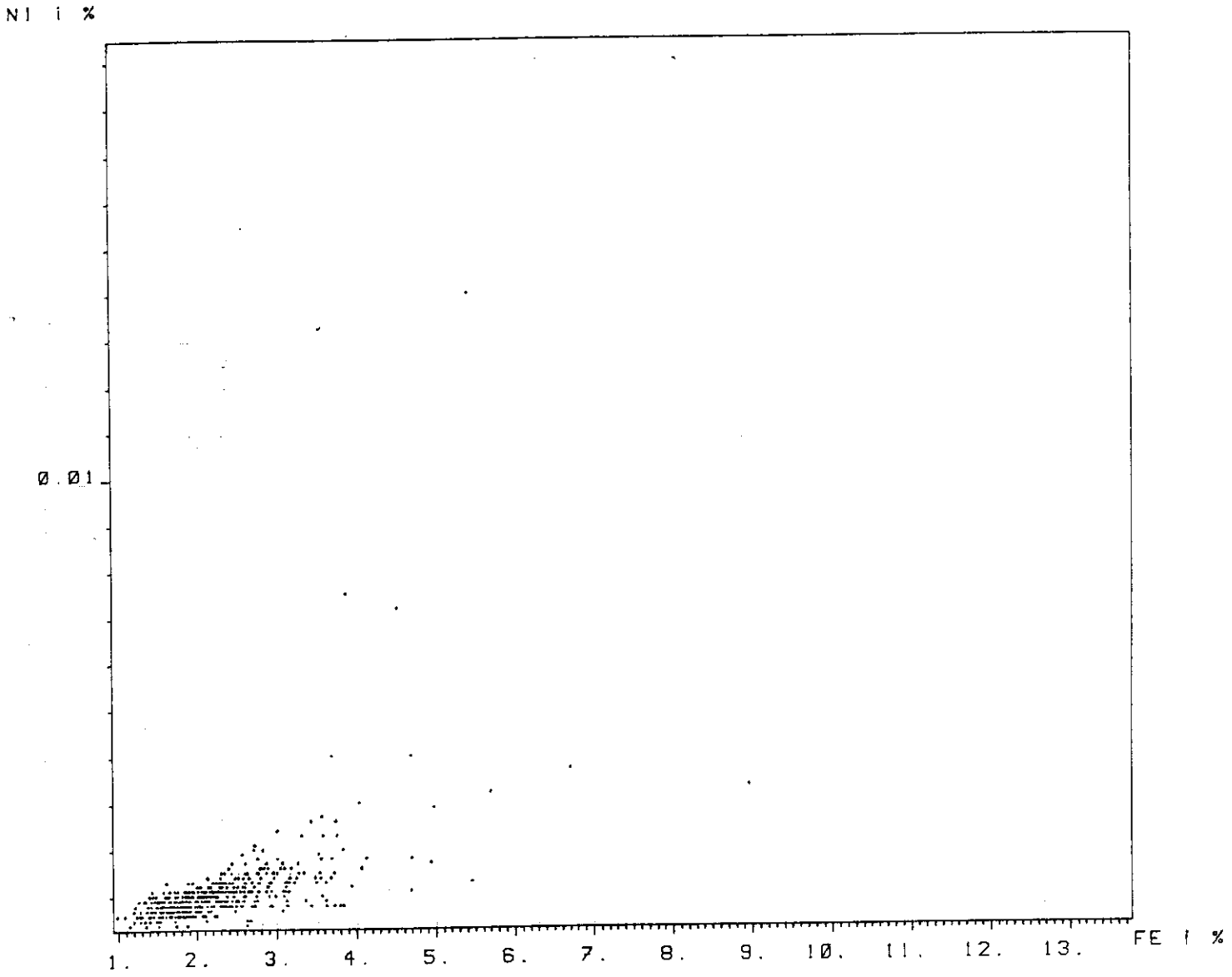


Fig.5

Till fine fraction

Series: 83G6J0:1-521
n = 493

GEOCHEMICAL
SCATTERDIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson

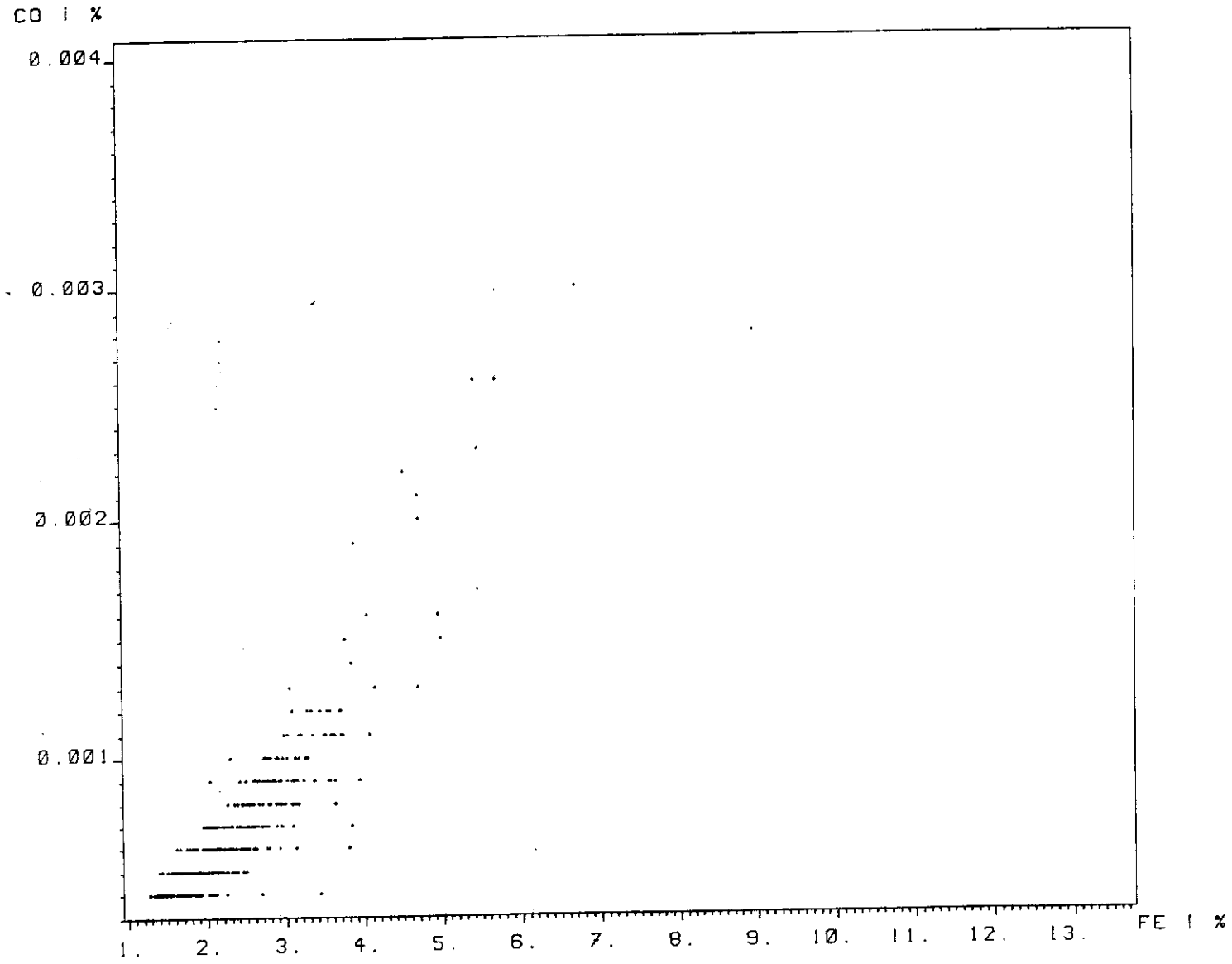


Fig.6

Till fine fraction

Series: 83G6J0:1-521
n = 493

GEOCHEMICAL
SCATTERDIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson

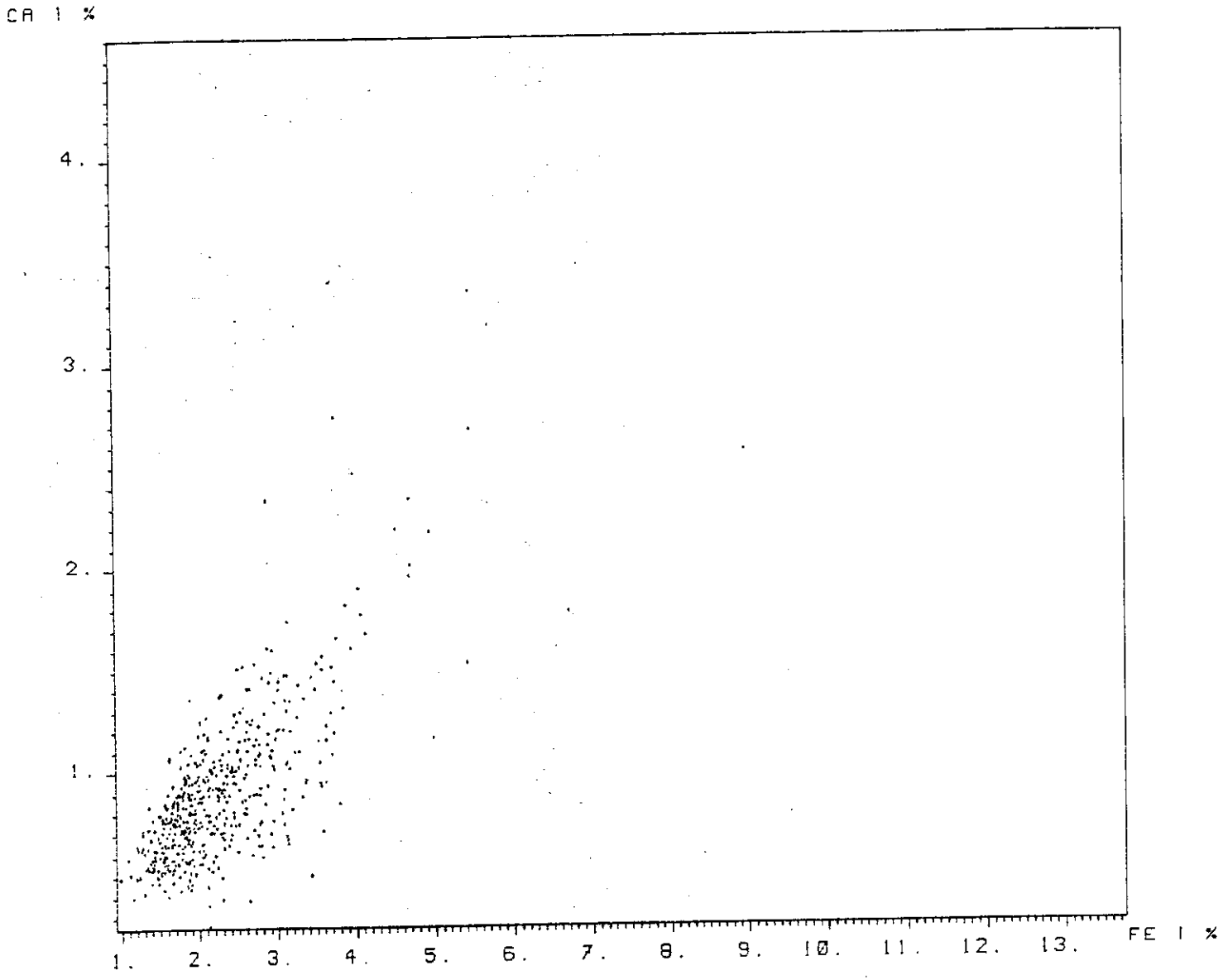


Fig.7

Till fine fraction

Series: 83G6J0:1-521
n = 493

GEOCHEMICAL
SCATTERDIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson

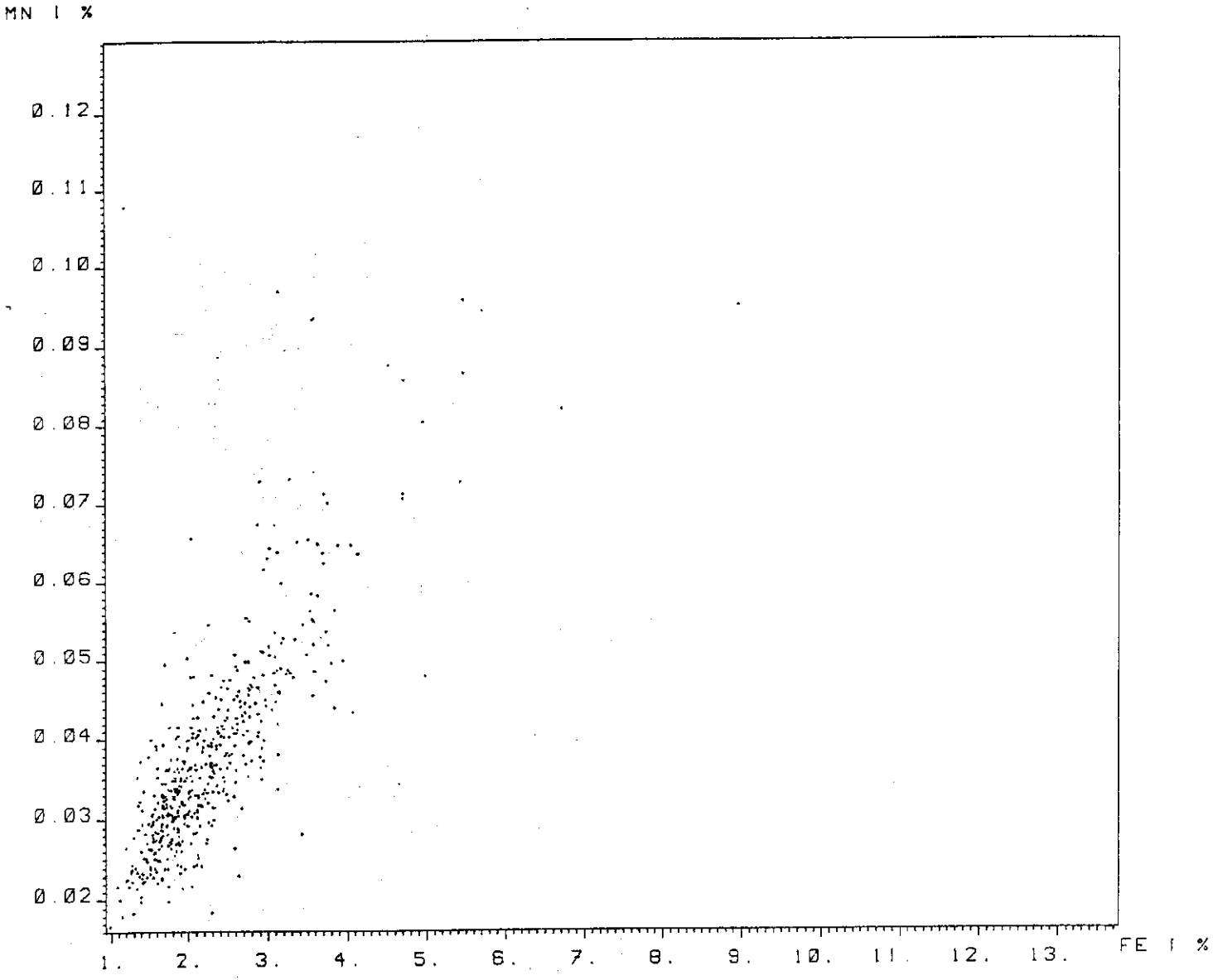


Fig. 8

Till fine fraction

Series: 83G6J0:1-521
n = 493

GEOCHEMICAL
SCATTERDIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson

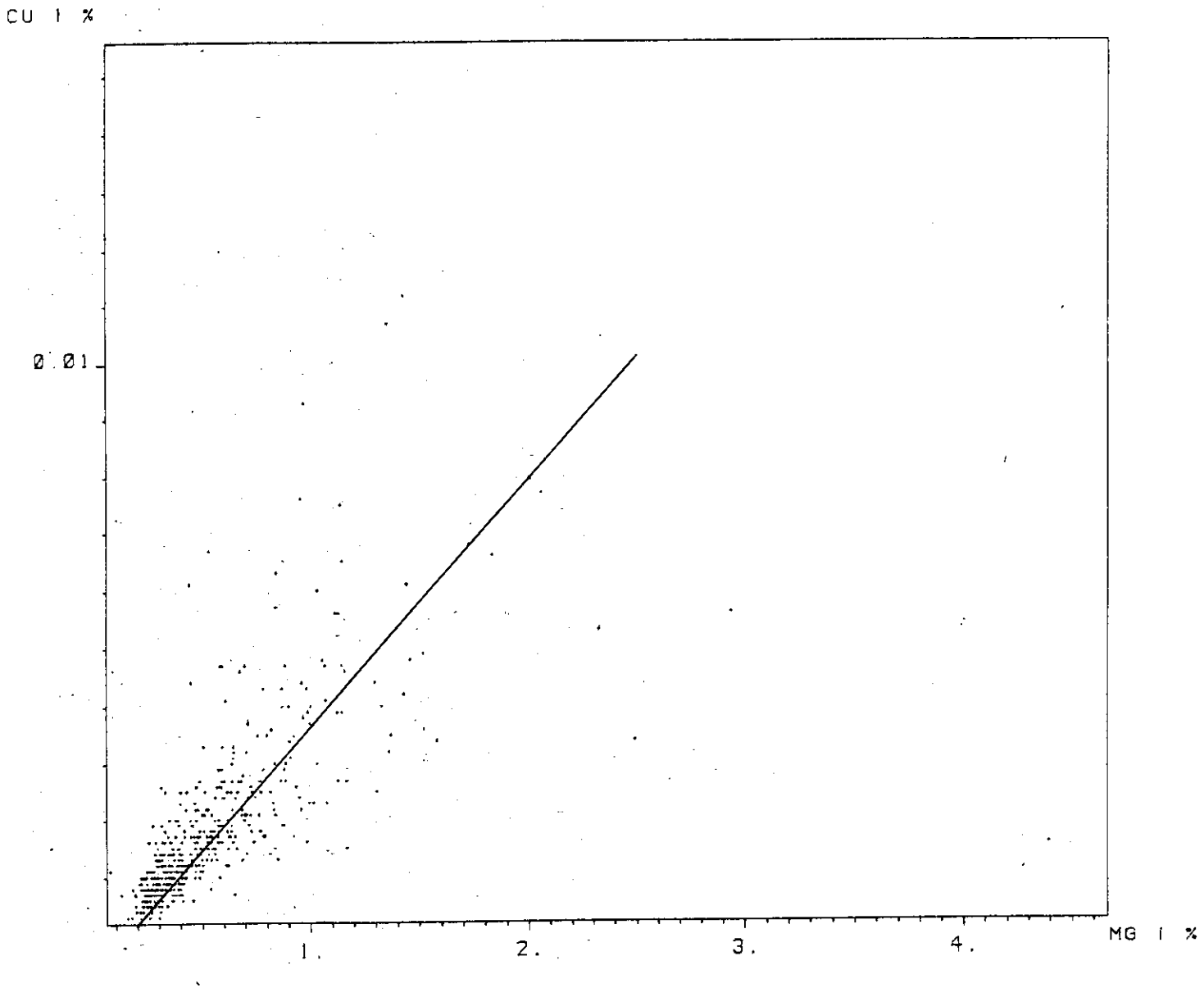


Fig. 9

Till fine fraction

Series: 83G6J0:1-521
n = 493

GEOCHEMICAL
SCATTERDIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson

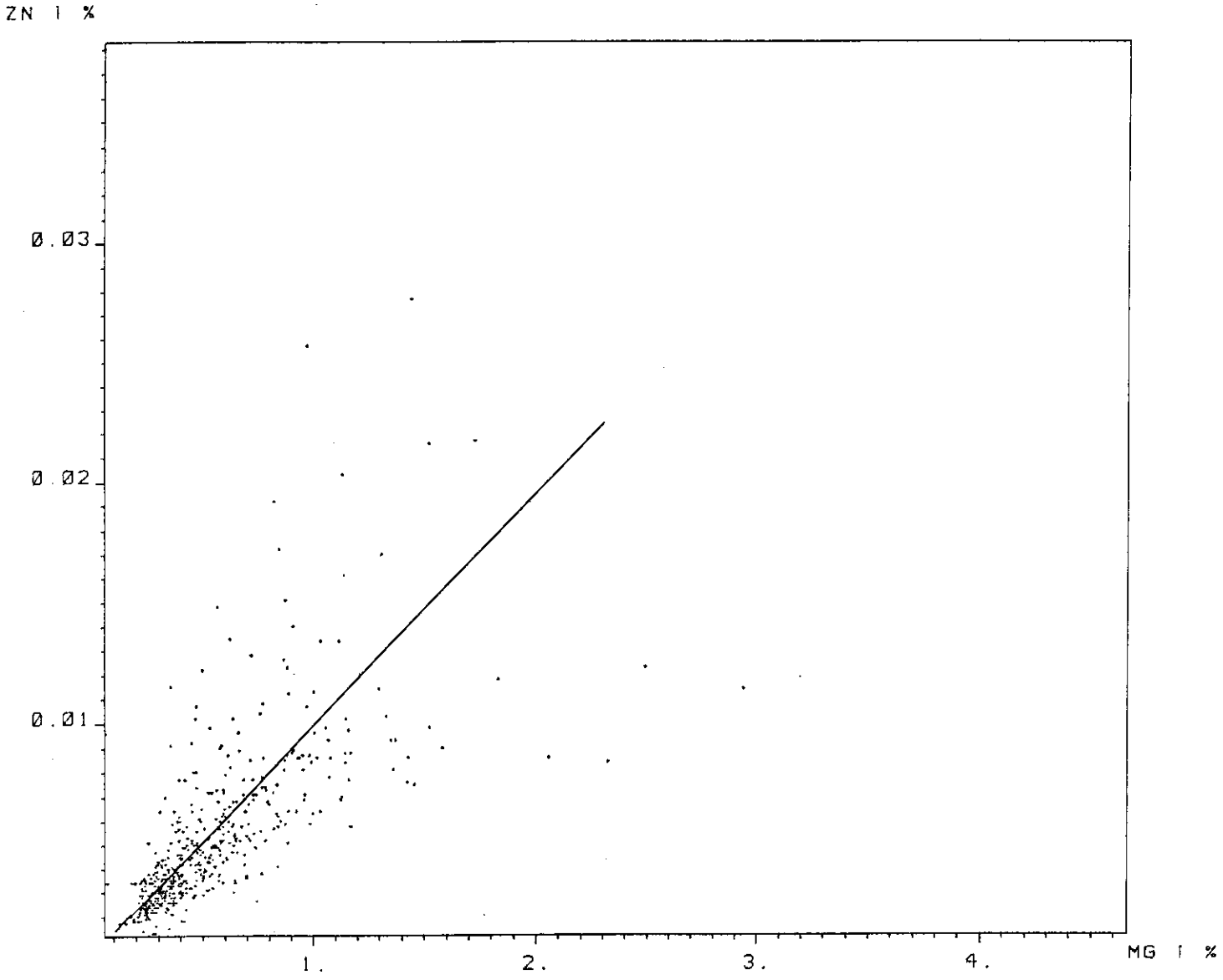


Fig.10

Till fine fraction

Series: 83G6J0:1-521
n = 493

GEOCHEMICAL
SCATTERDIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson

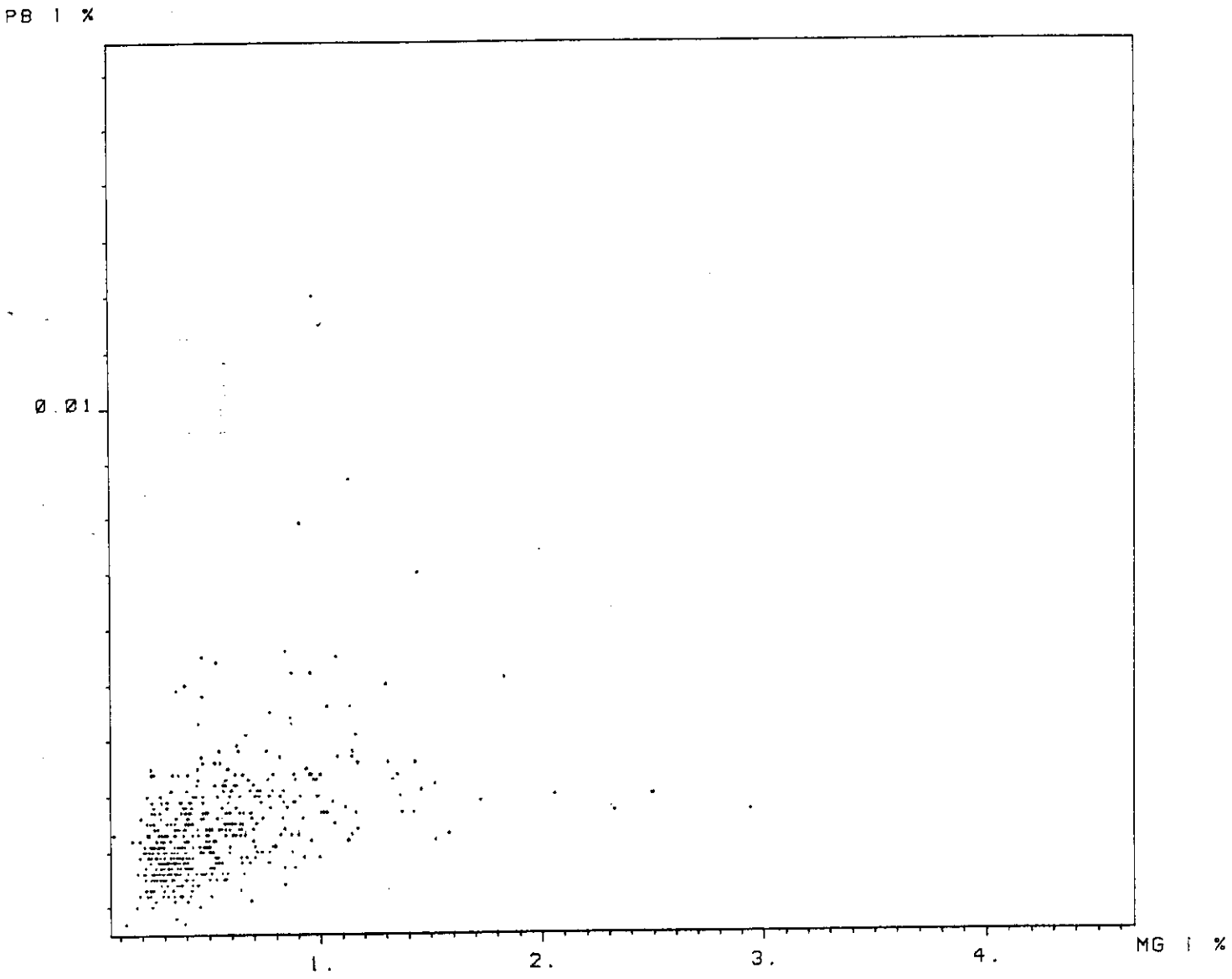


Fig. 11

Till fine fraction

Series: 83G6J0:1-521
n = 493

GEOCHEMICAL
SCATTERDIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson

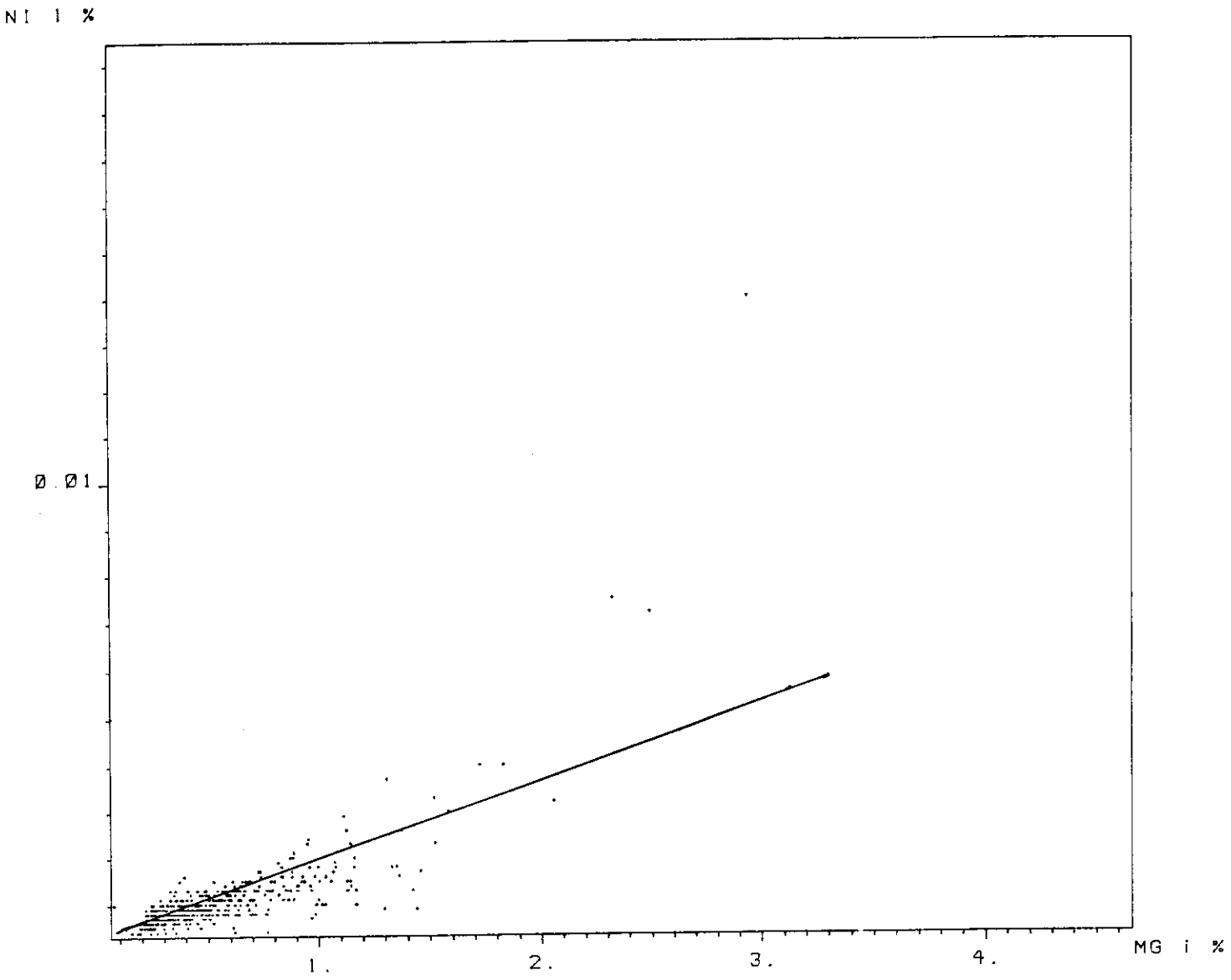


Fig.12

Till fine fraction

Series: 83G6J0:1-521
n = 493

GEOCHEMICAL
SCATTERDIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson

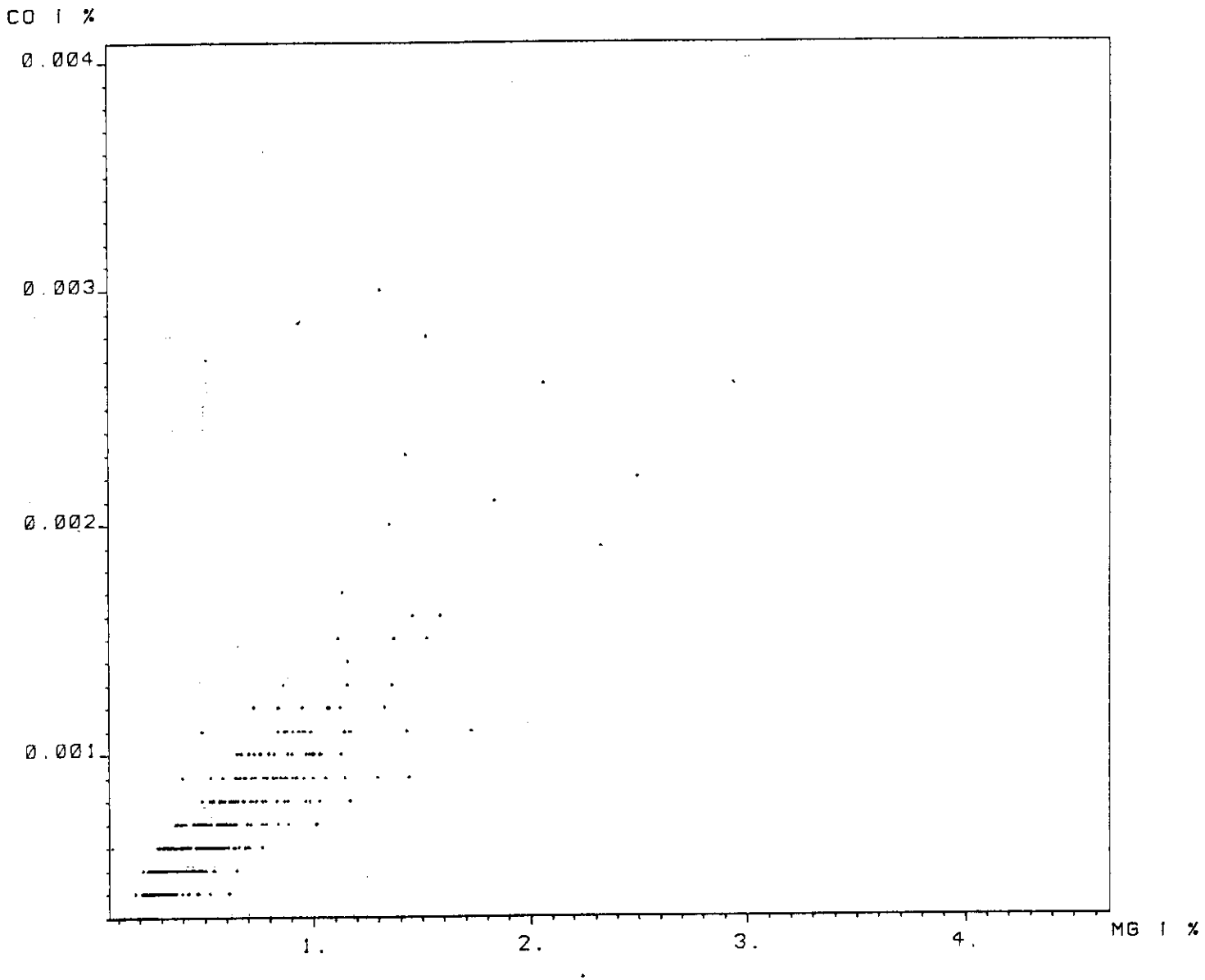


Fig.13

Till fine fraction

Series: 83G6JO:1-521
n = 493

GEOCHEMICAL
SCATTERDIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson

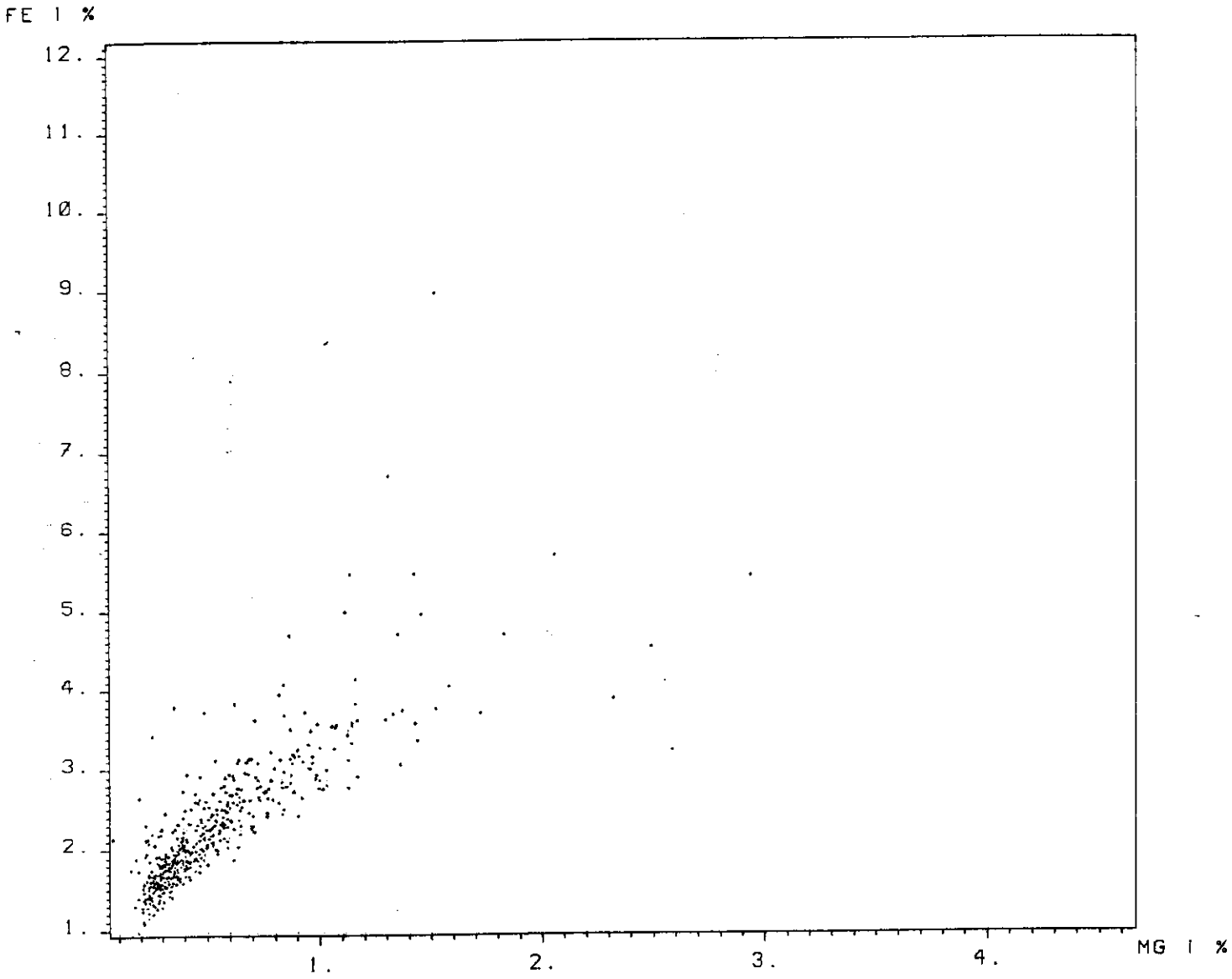


Fig.14

Till fine fraction

Series: 83G6J0:1-521
n = 493

GEOCHEMICAL
SCATTERDIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson

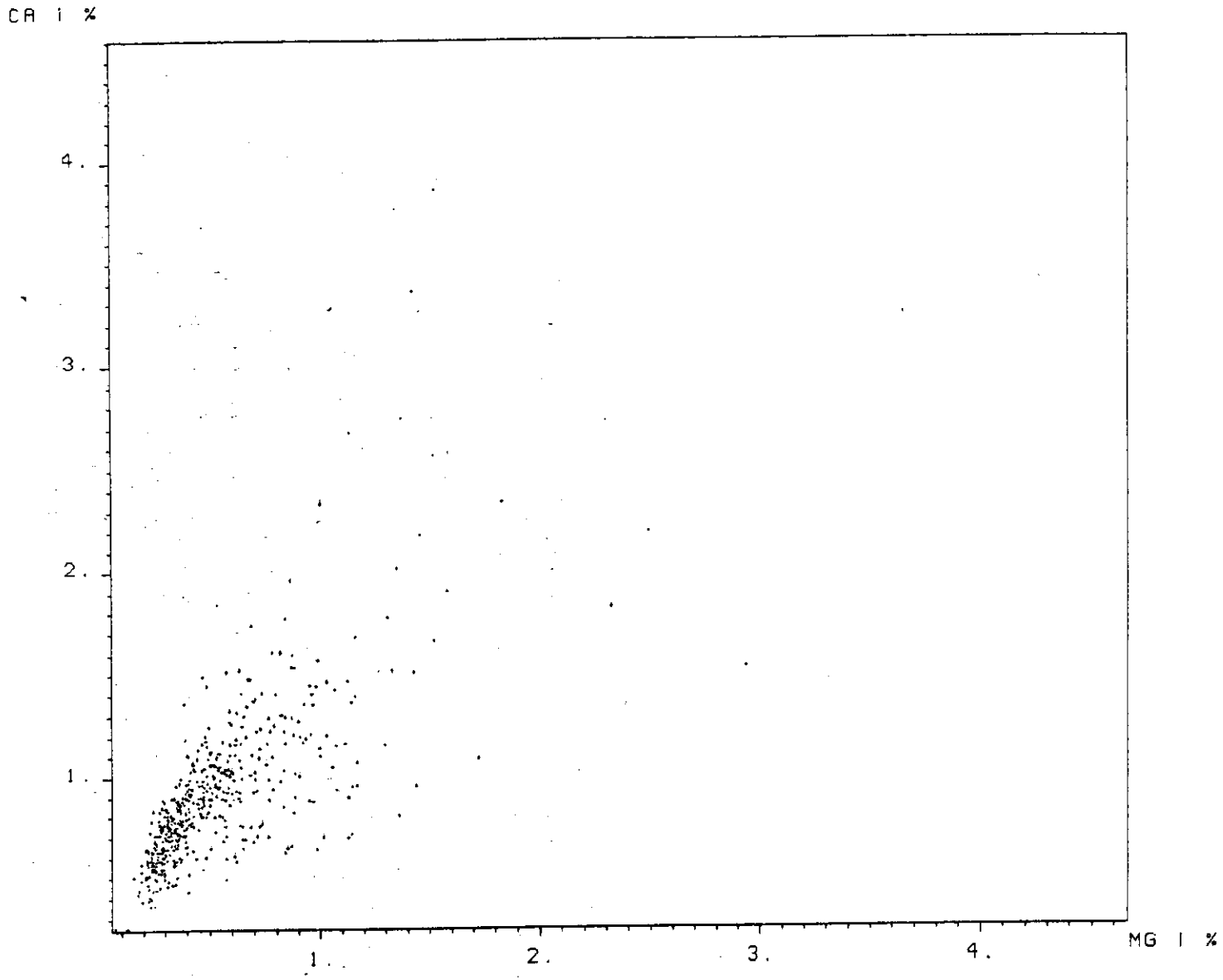


Fig.15

Till fine fraction

Series: 83G6J0:1-521
n = 493

GEOCHEMICAL
SCATTERDIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson

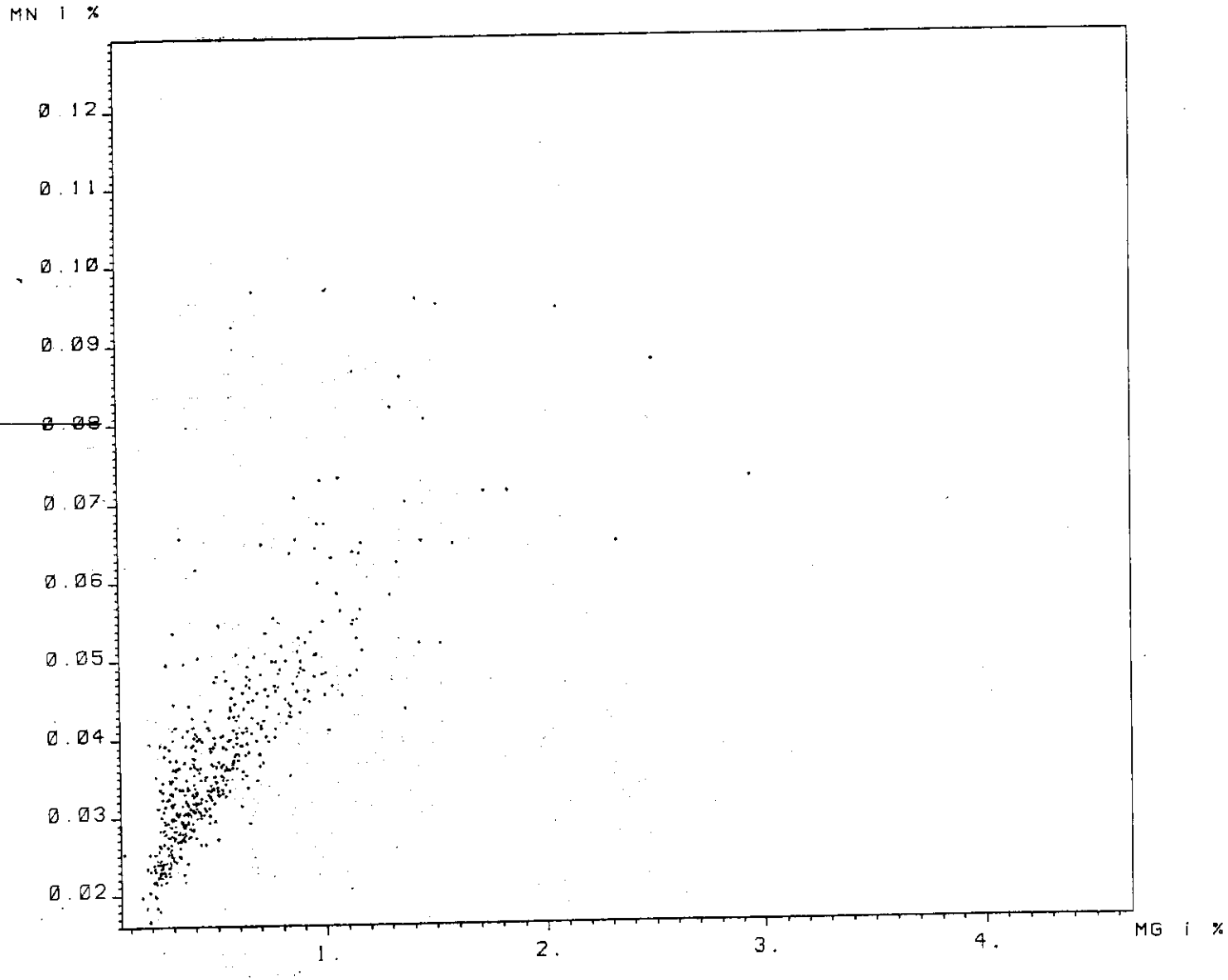


Fig.16

Till fine fraction

Series: 83G6J0:1-521
n = 493

GEOCHEMICAL
SCATTERDIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson

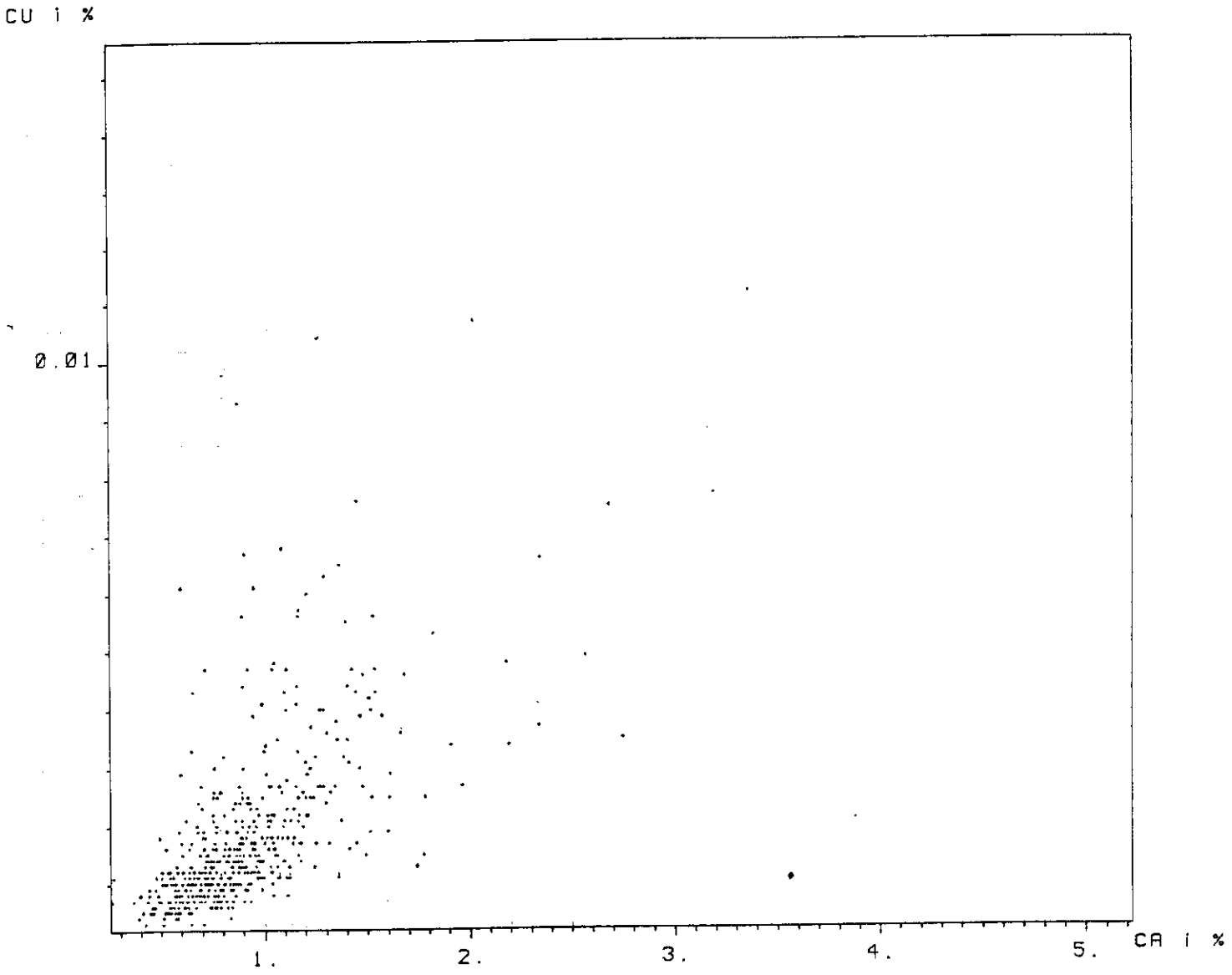


Fig.17

Till fine fraction

Series: 83G6J0:1-521
n = 493

GEOCHEMICAL
SCATTERDIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson

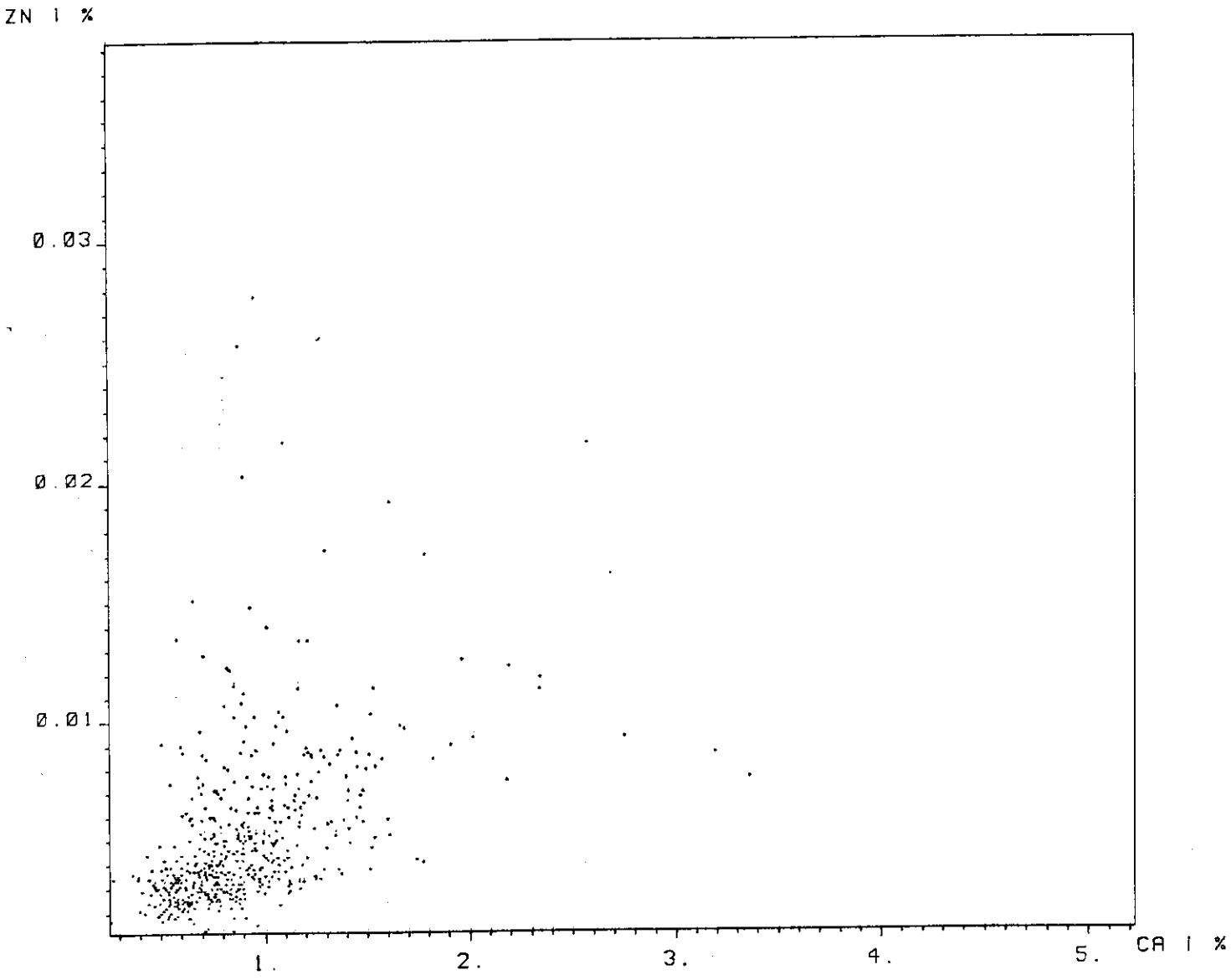


Fig. 18

Till fine fraction

Series: 83G6J0:1-521
n = 493

GEOCHEMICAL
SCATTERDIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson

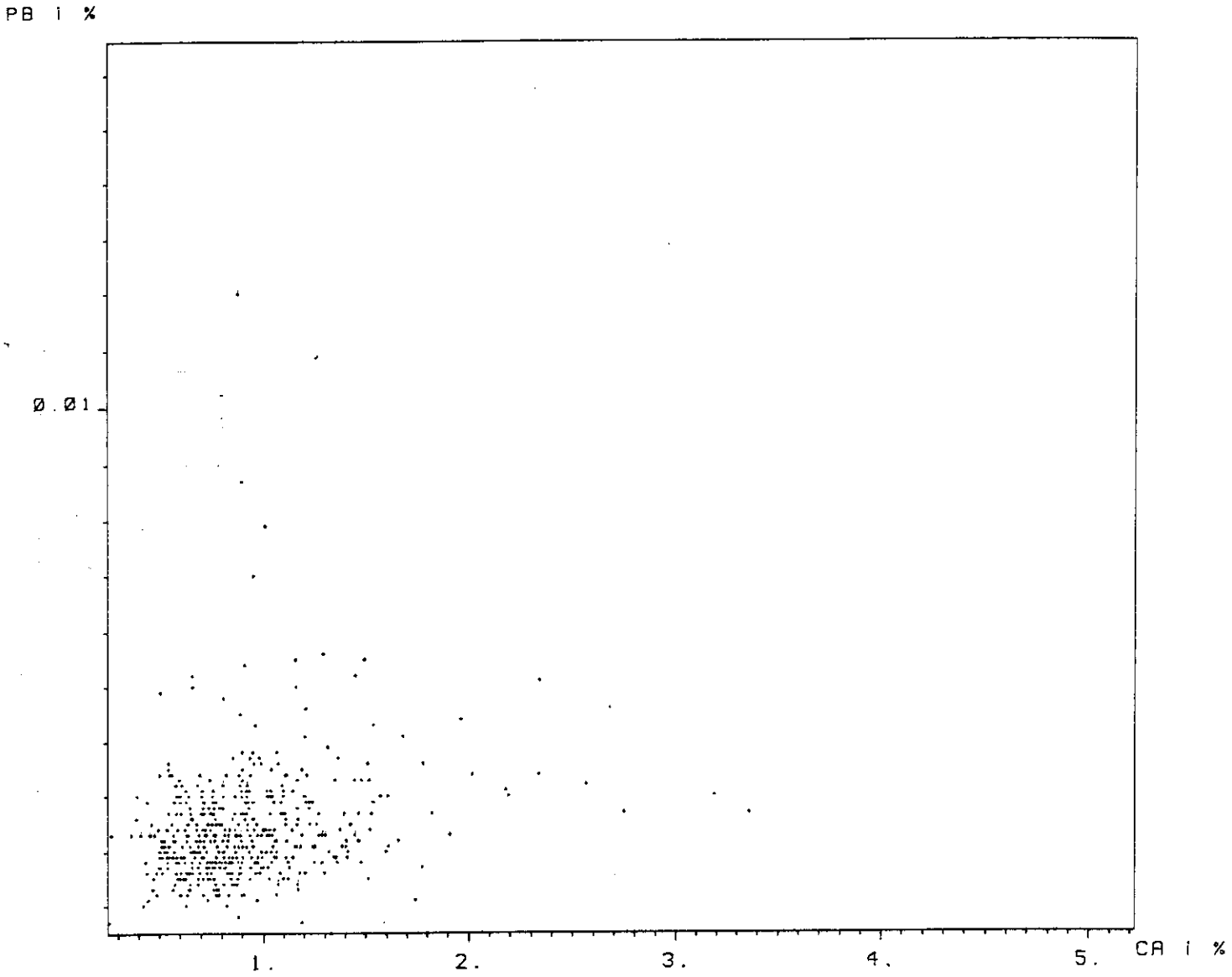


Fig.19

Till fine fraction

Series: 83G6J0:1-521
n = 493

GEOCHEMICAL
SCATTERDIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson

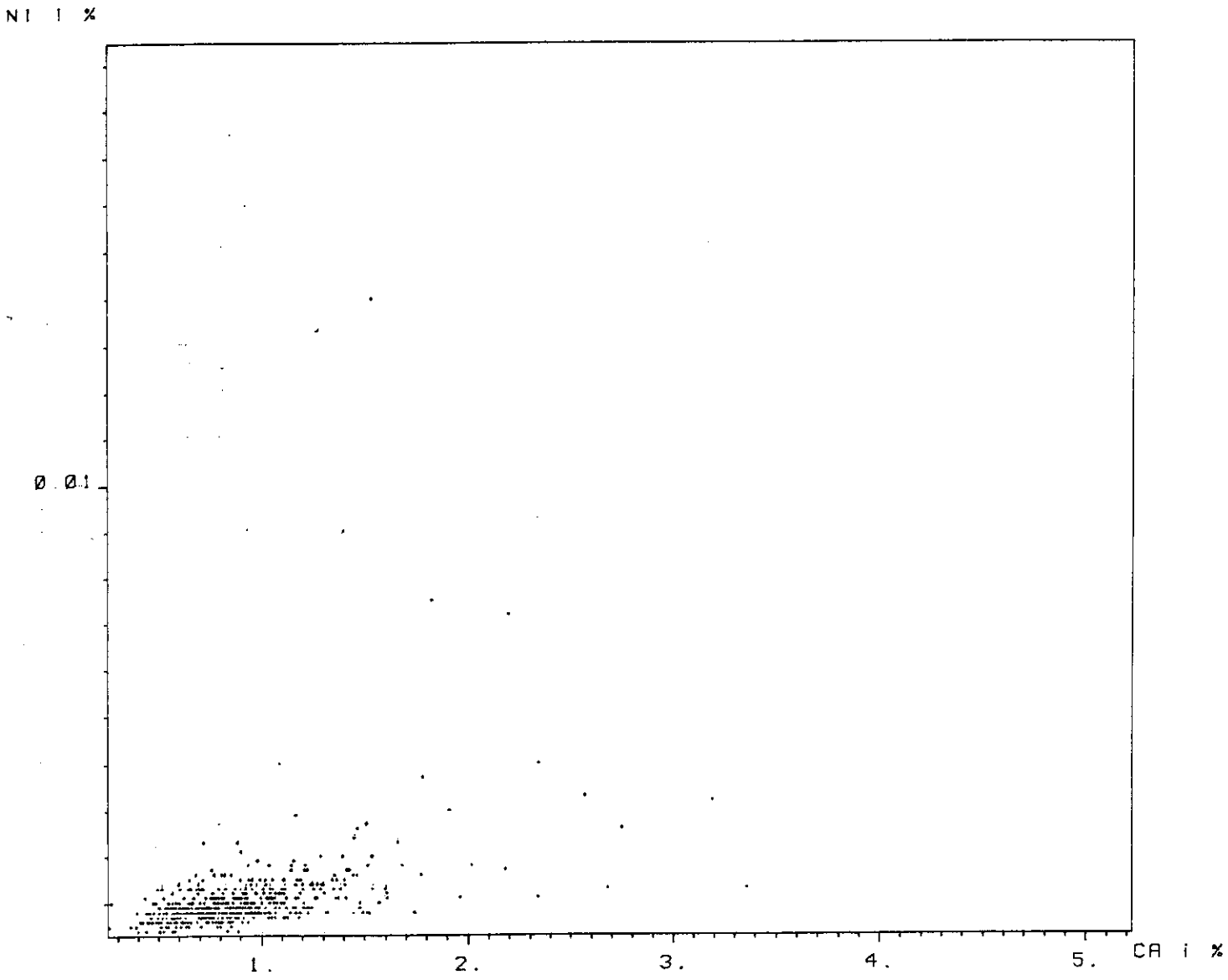


Fig. 20

Till fine fraction

Series: 83G6J0:1-521
n = 493

GEOCHEMICAL
SCATTERDIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson

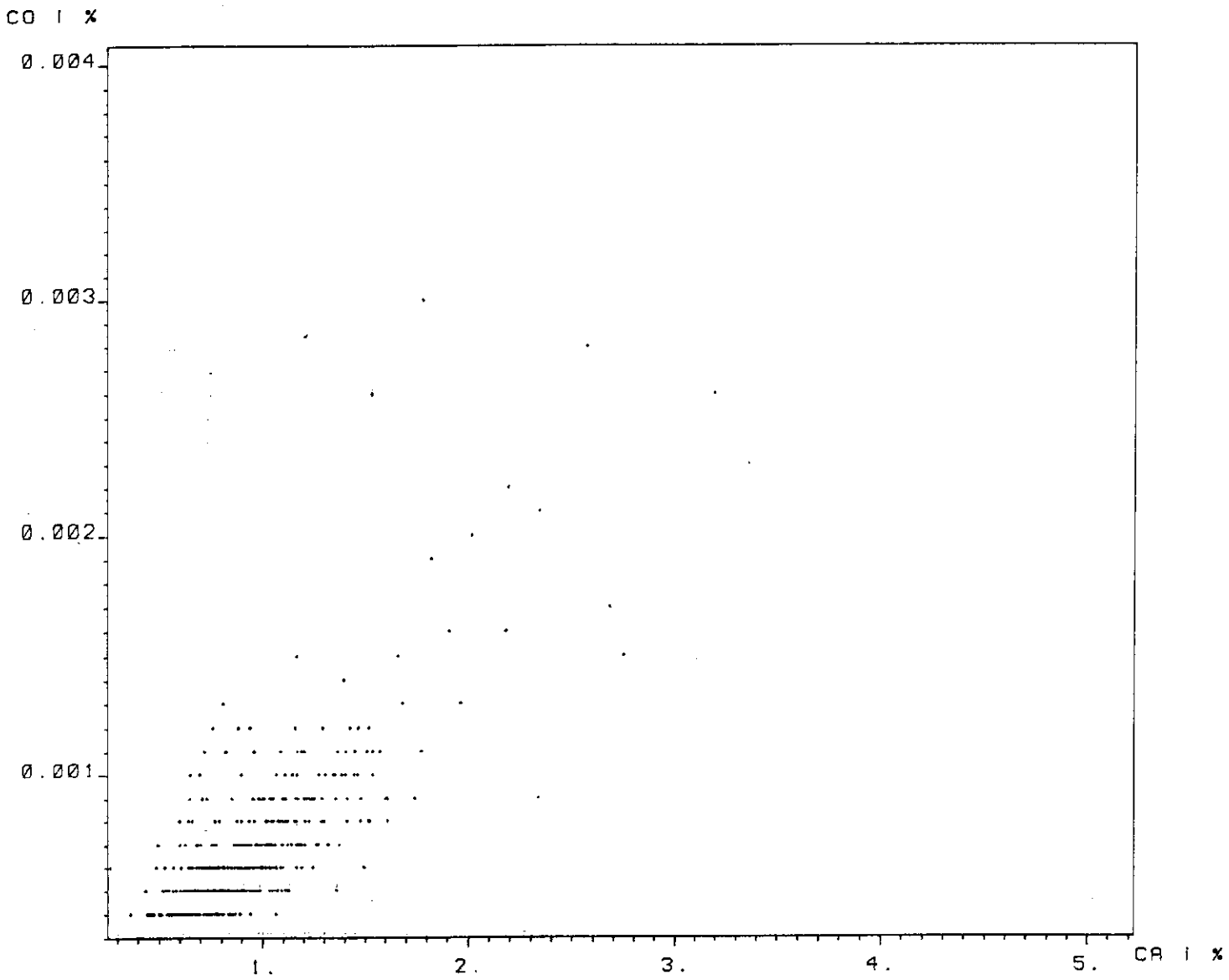


Fig. 21

Till fine fraction

Series: 83G6J0:1-521
n = 493

GEOCHEMICAL
SCATTERDIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson

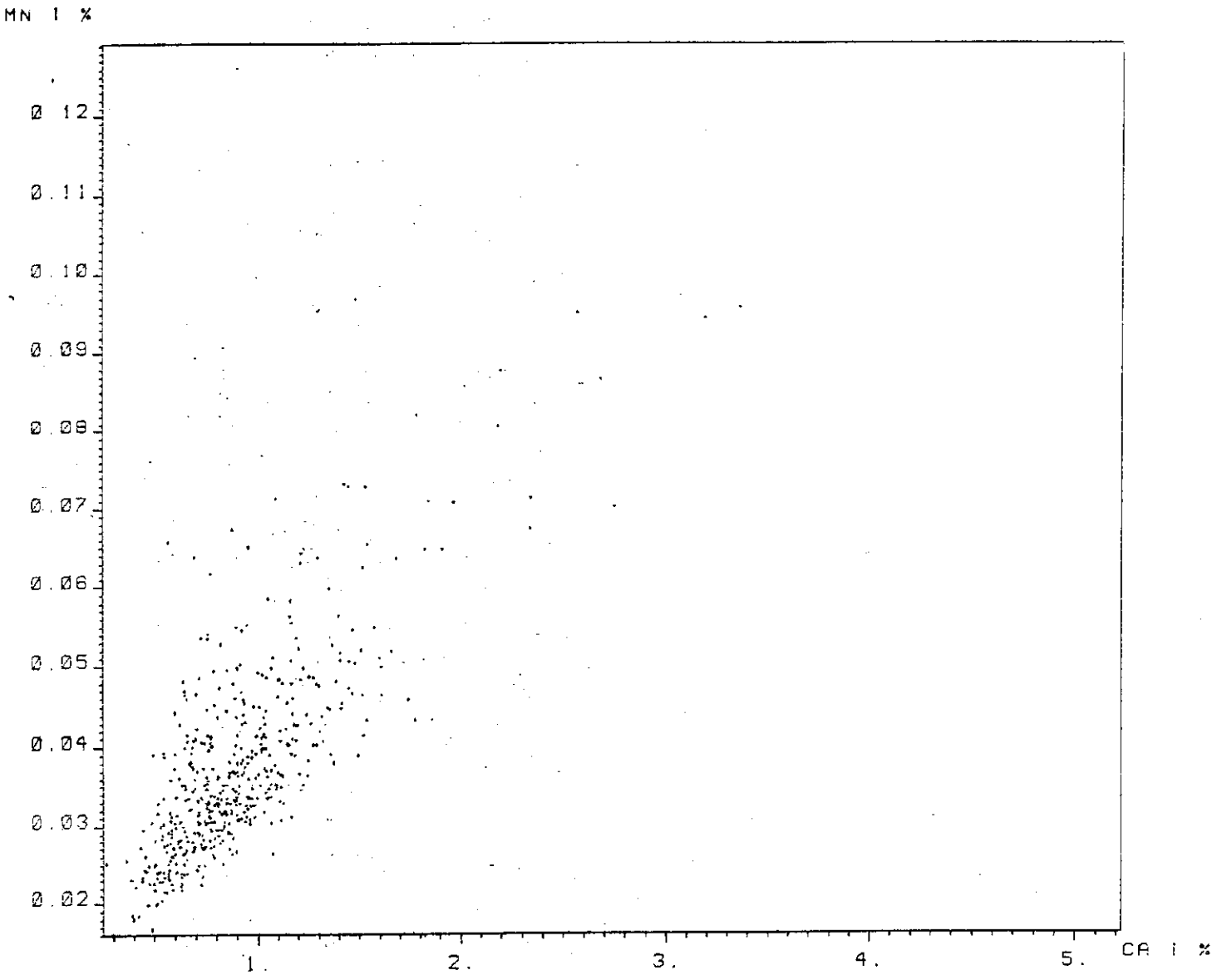


Fig. 22

Till fine fraction

Series: 83G6J0:1-521
n = 493

GEOCHEMICAL
SCATTERDIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson

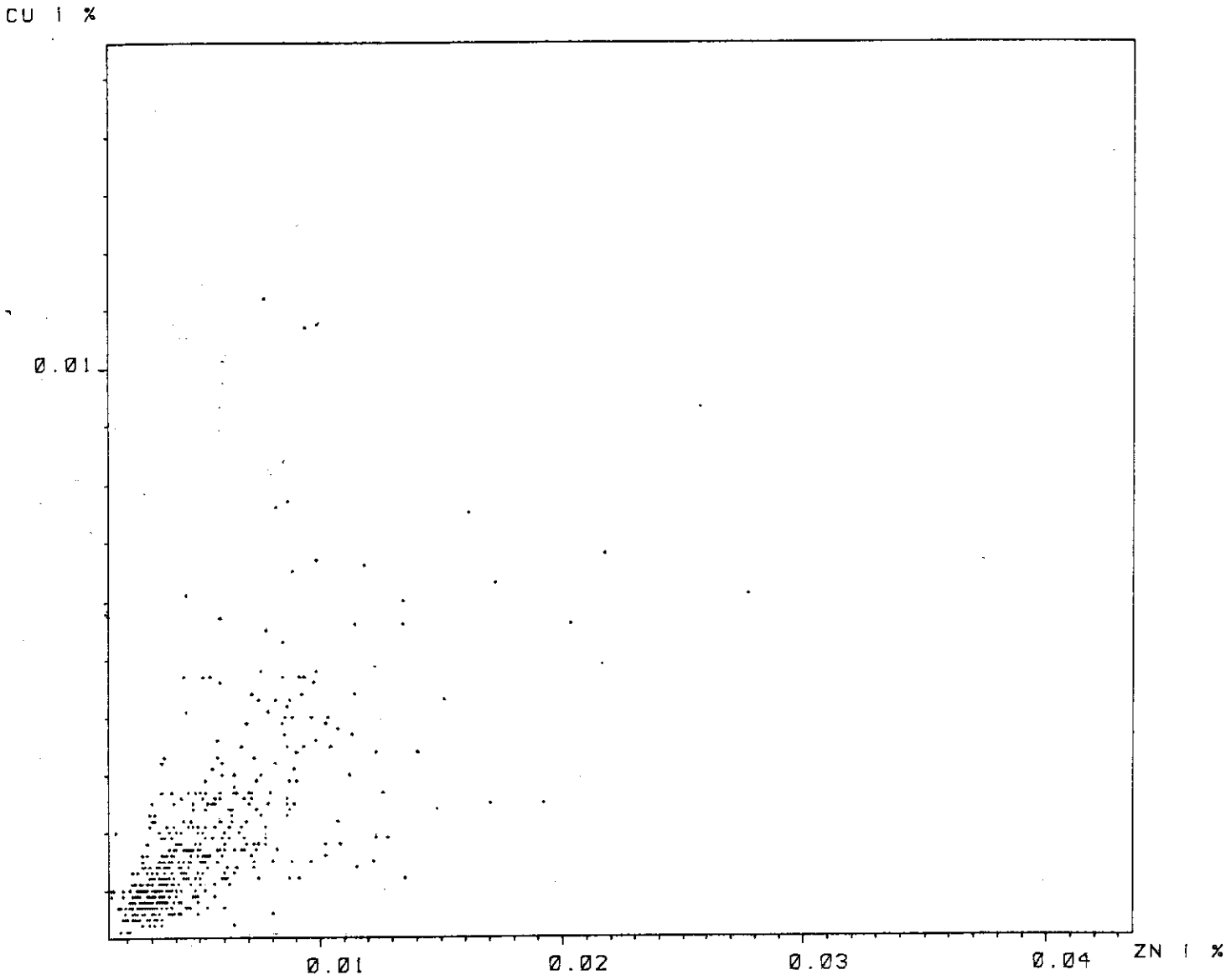


Fig.23

Till fine fraction

Series: 83G6J0:1-521
n = 493

GEOCHEMICAL
SCATTERDIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson

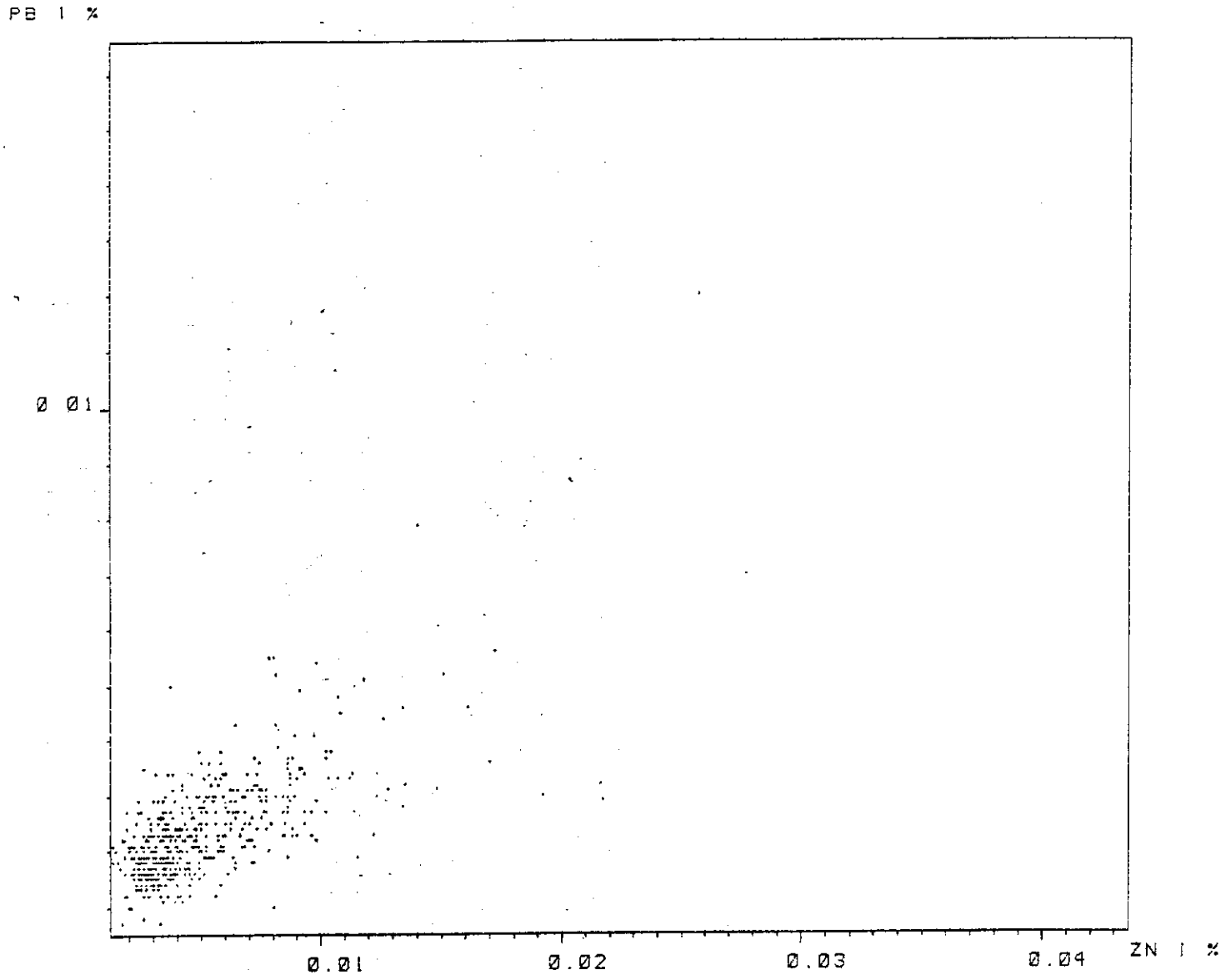


Fig.24

Till fine fraction

Series: 83G6J0:1-521
n = 493

GEOCHEMICAL
SCATTERDIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson

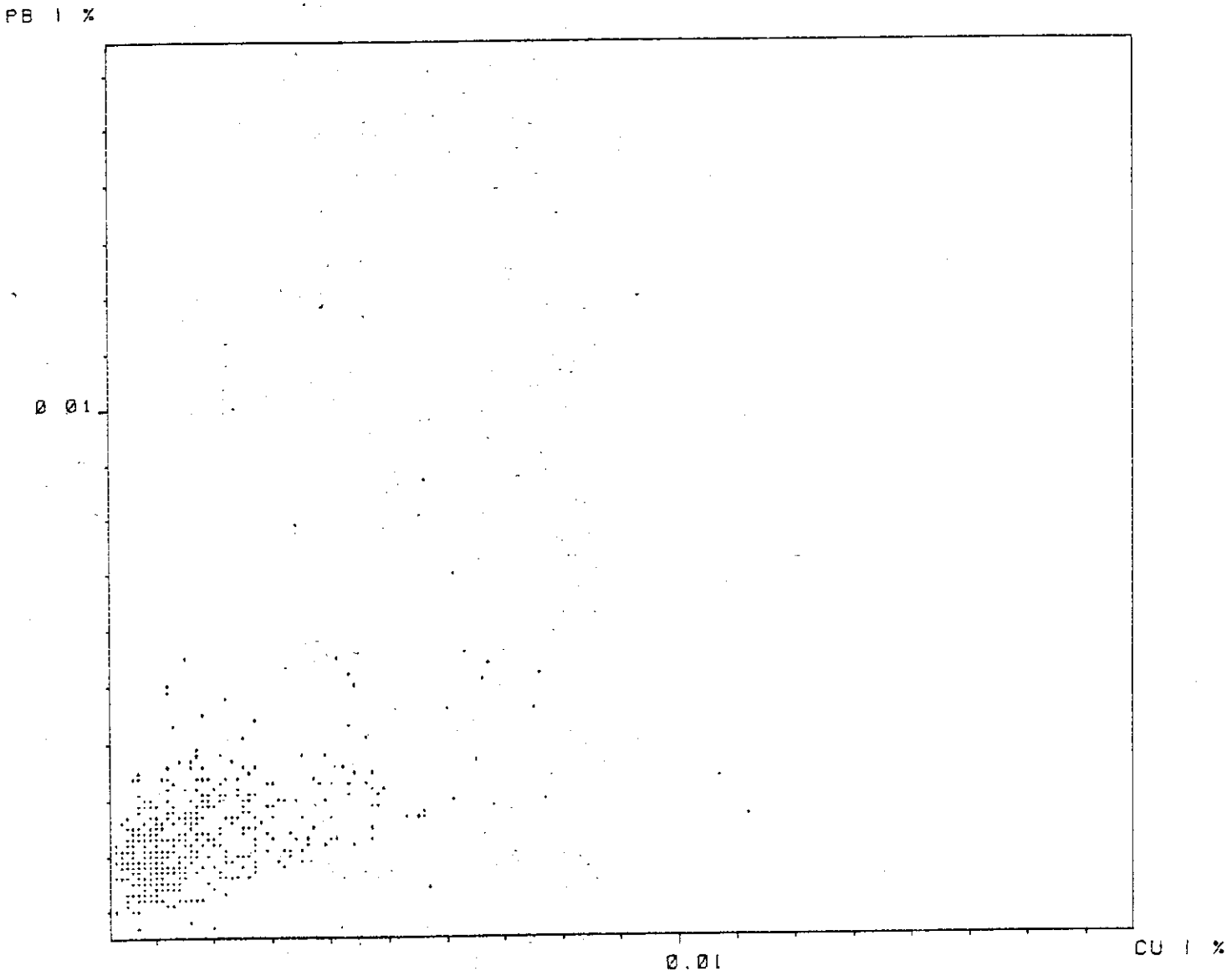


Fig.2

Till fine fraction

Series: 83G6JU:1-521
n = 493

GEOCHEMICAL
SCATTERDIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson

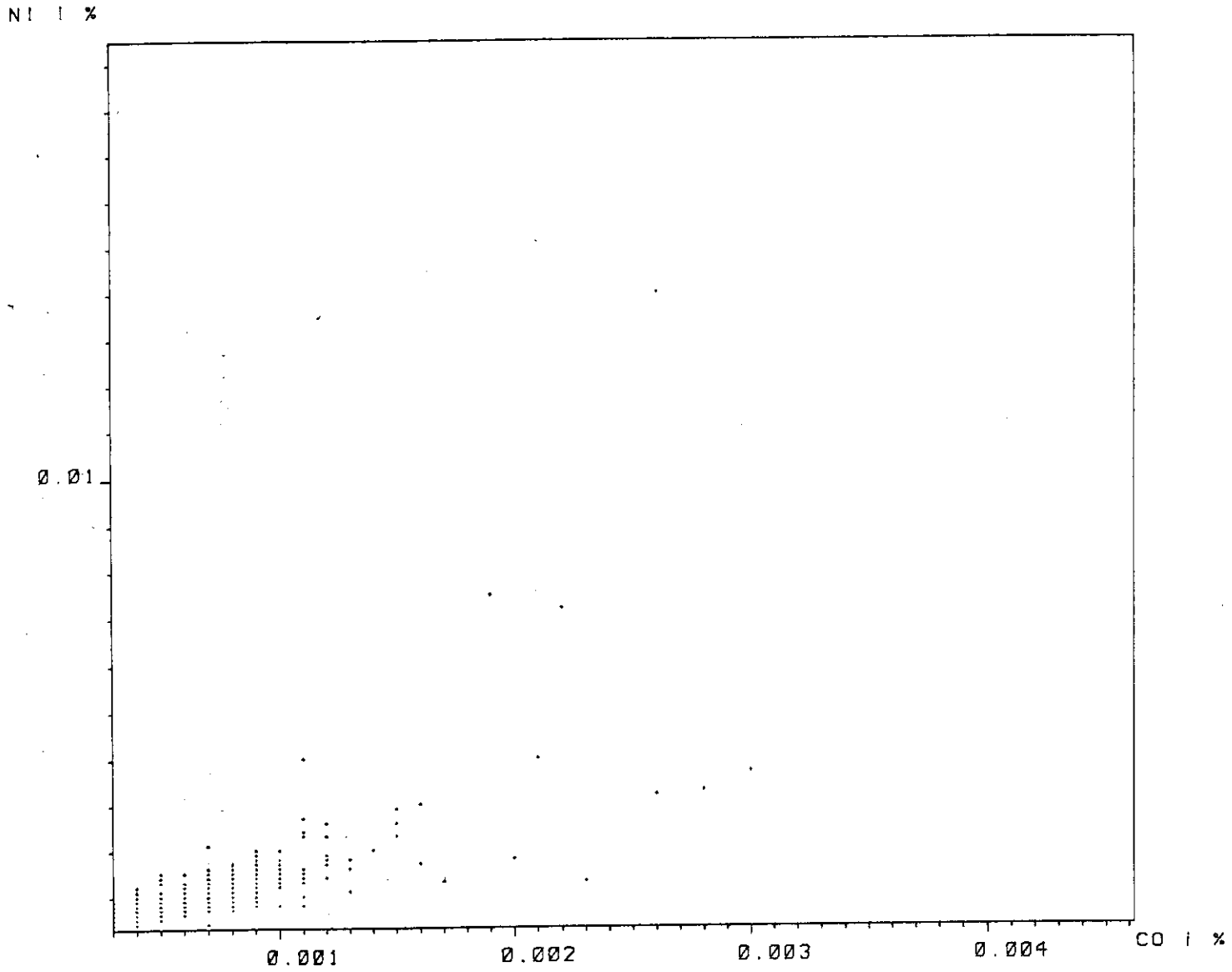


Fig. 26

Till fine fraction

Series: 83G6J0:1-521
n = 493

GEOCHEMICAL
SCATTERDIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson

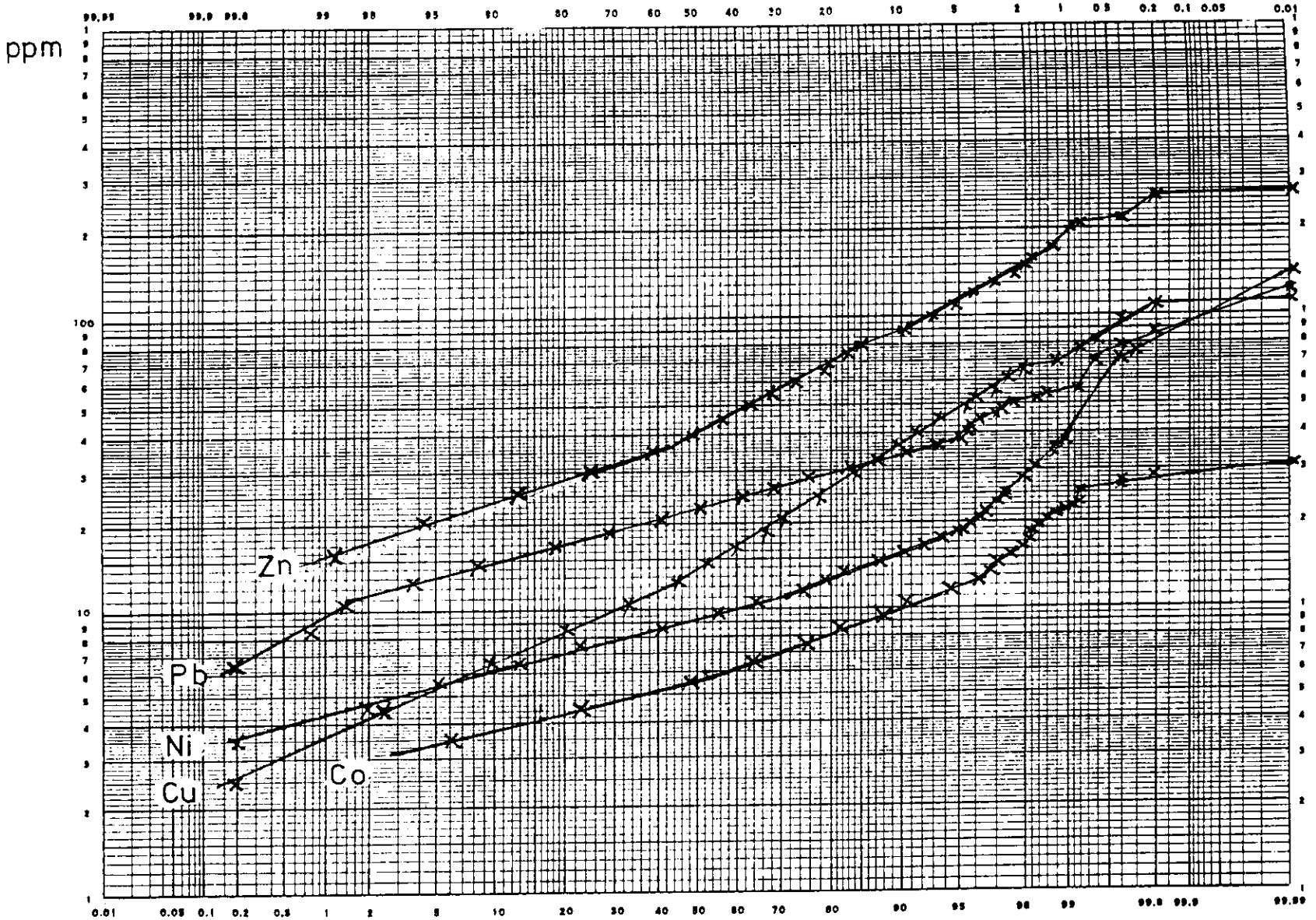


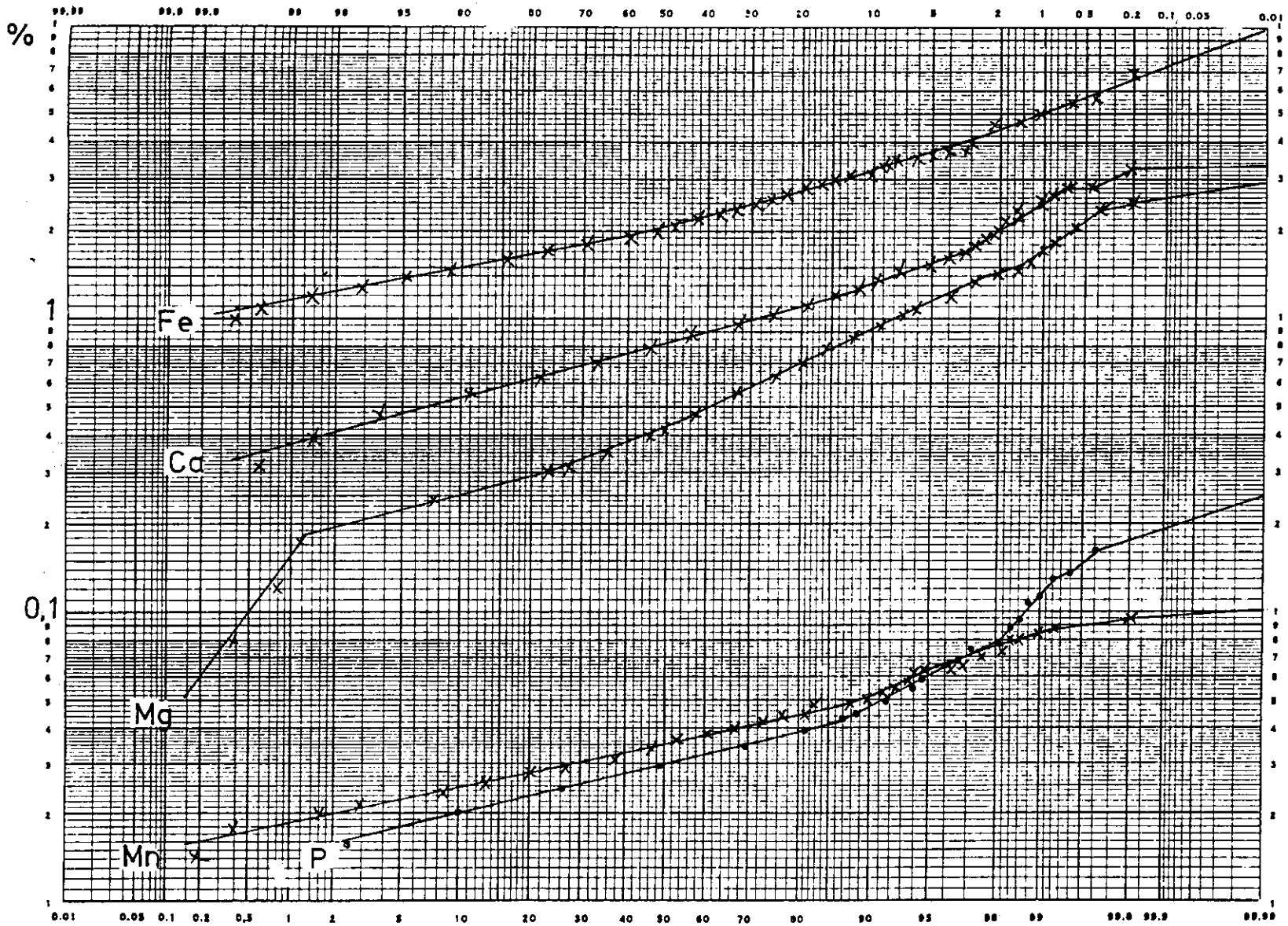
Fig. 27

Till fine fraction
Series: 83G6JO:1-521
n = 493

Cumulative frequencies
for Cu, Zn, Pb, Ni, Co

PROBABILITY DIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson



GEOCHEMISTRY

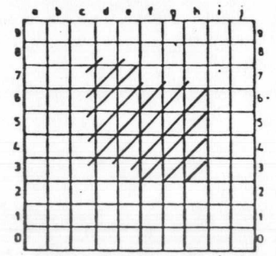
Fig. 28

Till fine fraction
Series: 83G6JO:1-521
n = 493

Cumulative frequencies
for Fe, Mg, Ca, Mn, P

PROBABILITY DIAGRAM
Project: 3816
Projectarea: FALUN

Christer Mattsson



FALUN 13F

RELIEF AND HYDROGRAPHY MAP

Project: 3816

Projectarea: FALUN

Christer Mattsson	Date 840604	Scale 1:100000
LKAB PROSPEKTERING AB	FALUN 13F	Report Bsg 84-358 Fig. F 29

1465 1470 1475 1480 1485

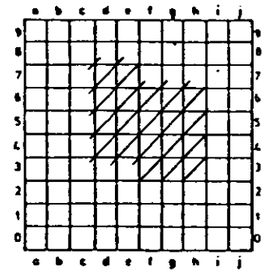
6740 6735 6730 6725 6720 6715

Direction of
Glacial movement

N

6740
6735
6730
6725
6720
6715

1465
1470
1475
1480
1485



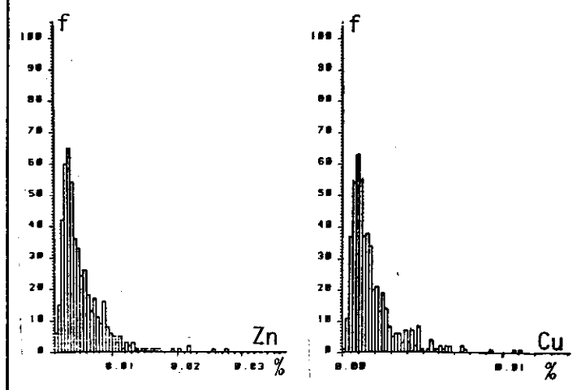
FALUN 13F

LEGEND

Analytical rawvalues -40 ppm Zn
-10 ppm Cu

	Zn 20 ppm	Zn 20 ppm/mm	Cu 10 ppm	Cu 10 ppm/mm
	≤ 40	—	10	—
m	52		18	
m + 2s	120		48	
m + 4s	188		78	

sampling site —



METHODICAL DESCRIPTION

Till fine fraction.
Spade, approx 0,8 m depth.
Podsolic C-horizon.
30 g sieved dry < 0,50 mm.
Dried 105°C. Grinded < 2 µm.
1 g in HNO_3 + HF, tartaric acid + HCL + H_2O to 50 ml.
ICP-ES by LKAB-PAB, Stockholm.
Series: 83G6J0:001-521

GEOCHEMICAL MAP

Project: 3816

Projectarea: FALUN

Zn and Cu in till

Christer Mattsson	Date 840604	Scale 1:100000
LKAB PROSPEKTERING AB	FALUN 13F	Report Bsg 84-358 Fig. F 30

C

Direction
of Glacial movement

N

6740

6735

6730

6725

6720

6715

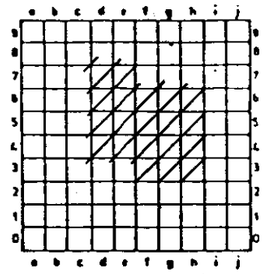
1465

1470

1475

1480

1485



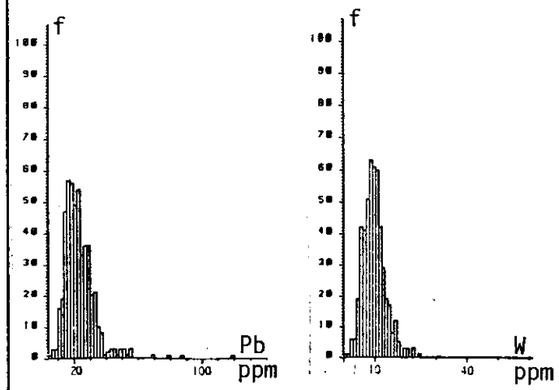
FALUN 13F

LEGEND

Analytical rawvalues -20 ppm Pb
-10 ppm W

	Pb 10 ppm	Pb 10 ppm/mm	W 4 ppm	W 4 ppm/mm
	≤ 20	—	10	—
m	24	▁	10	—
m + 2s	44	▙	18	▀
m + 4s	64	▌	26	▀

sampling site —



METHODICAL DESCRIPTION

Till fine fraction.
Spade, approx 0,8 m depth.
Podsolic C-horizon.
30 g sieved dry < 0,50 mm.
Dried 105°C. Grinded < 2 µm.
1 g in HNO_3 + HF, tartaric acid + HCL + H_2O to 50 ml.
ICP-ES by LKAB-PAB, Stockholm.
Series: 83G6J0:001-521

GEOCHEMICAL MAP

Project: 3816

Projectarea: FALUN

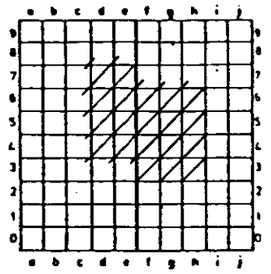
Pb and W in till

Christer Mattsson	Date 840604	Scale 1:100000
LKAB PROSPEKTERING AB	FALUN 13F	Report Bsg 84-358 Fig. F 31

Direction of
Glacial movement

6740
6735
6730
6725
6720
6715

1465
1470
1475
1480
1485

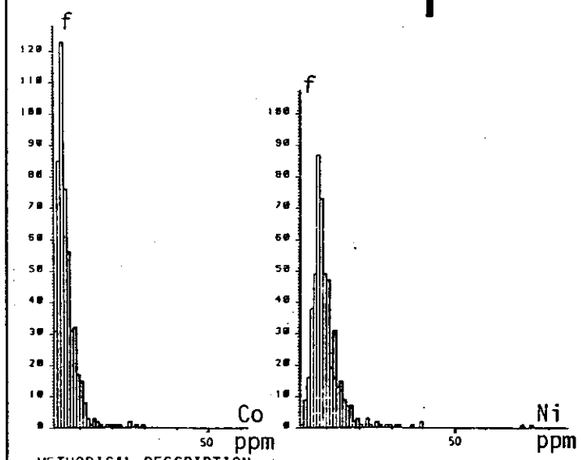


FALUN 13F

LEGEND

Analytical rawvalues -5 ppm Co
-8 ppm Ni

	Co 2 ppm	Co 2 ppm/mm	Ni 4 ppm	Ni 4 ppm/mm
	⩽ 5	—	8	—
m	7	—	11	—
m + 2s	13		27	
m + 4s	19		43	
m + 8s			75	



METHODICAL DESCRIPTION

Till fine fraction.
Spade, approx 0,8 m depth.
Podsolic C-horizon.
30 g sieved dry < 0,50 mm.
Dried 105°C. Grinded < 2 µm.
1 g in HNO_3 + HF, tartaric acid + HCL + H_2O to 50 ml.
ICP-ES by LKAB-PAB, Stockholm.
Series: 83G6JO:001-521

GEOCHEMICAL MAP

Project: 3816

Projectarea: FALUN

Co and Ni in till

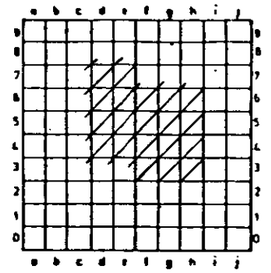
Christer Mattsson	Date 840604	Scale 1:100000
	FALUN 13F	
LKAB PROSPEKTERING AB	Report Bsg 84-358 Fig. F 32	

Direction of
Glacial movement

N

6740
6735
6730
6725
6720
6715

1465
1470
1475
1480
1485



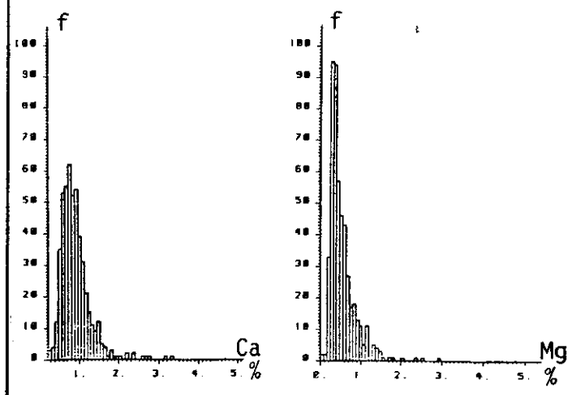
FALUN 13F

LEGEND

Analytical rawvalues -8000 ppm Ca
-4000 ppm Mg

	Ca ppm	2000 ppm/mm	Mg ppm	2000 ppm/mm
⩽	8000	—	4000	—
m	9064		5305	
m + 2s	16520		12001	
m + 4s	24192		18697	

sampling site —



METHODICAL DESCRIPTION

Till fine fraction.
Spade, approx 0,8 m depth.
Podsolic C-horizon.
30 g sieved dry < 0,50 mm.
Dried 105°C. Grinded < 2 µm.
1 g in HNO_3 + HF, tartaric acid + HCL + H_2O to 50 ml.
ICP-ES by LKAB-PAB, Stockholm.
Series: 83G6J0:001-521

GEOCHEMICAL MAP

Project: 3816

Projectarea: FALUN

Ca and Mg in till

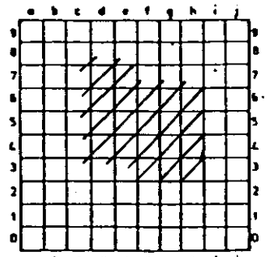
Christer Mattsson	Date 840604	Scale 1:100000
LKAB PROSPEKTERING AB	FALUN 13F	Report Bsg 84-358 Fig. F 33

Direction of
Glacial movement

N

6740
6735
6730
6725
6720
6715

1465
1470
1475
1480
1485

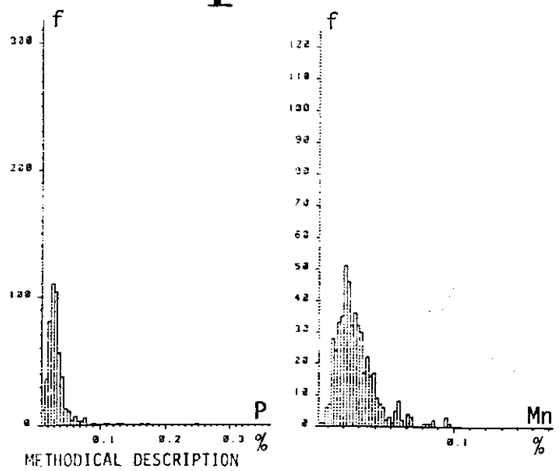


FALUN 13F

LEGEND

Analytical rawvalues

	P 100 ppm	P 100 ppm/mm	Mn 100 ppm	Mn 100 ppm/mm
	300		300	
m	340		377	
m + 2s	730		640	
m + 4s	1100		890	
m + 8s	1880		1400	
sampling site				



METHODICAL DESCRIPTION

Till fine fraction.
Spade, approx 0,8 m depth.
Podsolic C-horizon.
30 g sieved dry < 0,50 mm.
Dried 105°C. Ground < 2 µm.
1 g in HNO_3 + HF, tartaric acid + HCL + H_2O to 50 ml.
ICP-ES by LKAB-PAB, Stockholm.
Series: 83G6J0:001-521

GEOCHEMICAL MAP

Project: 3816

Projectarea: FALUN

P and Mn in till

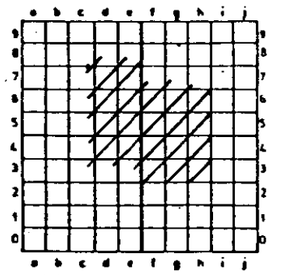
Christer Mattsson	Date 840604	Scale 1:100000
LKAB PROSPEKTERING AB	FALUN 13F	Report Bsg 84-358 Fig. F 34

Direction of
Glacial movement

N

6740
6735
6730
6725
6720
6715

1465
1470
1475
1480
1485



FALUN 13F

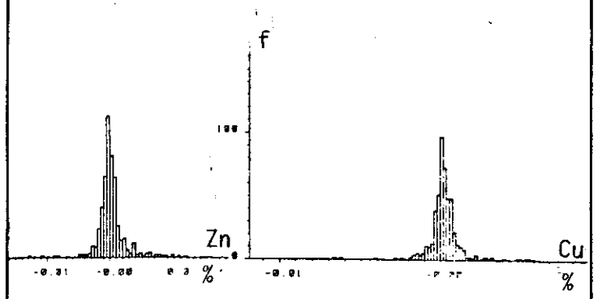
LEGEND

Residual values > 0 Zn and Cu

	Zn 10 ppm ppm/mm	Cu 5 ppm ppm/mm
m	3	2
m + 2s	53	22
m + 4s	103	42
m + 8s	203	82

sampling site —

Samples analyzed for Ag and Au
all < 0,5 ppm Ag
5 ppb Au others < 3 ppb Au



METHODICAL DESCRIPTION

Till fine fraction.
Spade, approx 0,8 m depth.
Podsolic C-horizon.
30 g sieved dry < 0,50 mm.
Dried 105°C. Ground < 2 µm.
1 g in HNO_3 + HF, tartaric acid + HCL + H_2O to 50 ml.
ICP-ES by LKAB-PAB, Stockholm.
Series: 83G6JO:001-521

GEOCHEMICAL MAP

Project: 3816

Projectarea: FALUN

Zn and Cu in till

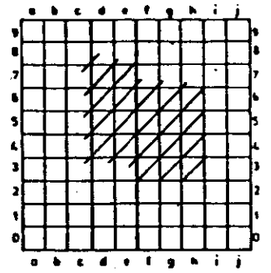
Christer Mattsson	Date 840604	Scale 1:100000
	FALUN 13F	
LKAB PROSPEKTERING AB	Report Bsg 84-358 Fig. F 35	

Direction of
Glacial movement

N

6740
6735
6730
6725
6720
6715

1465
1470
1475
1480
1485



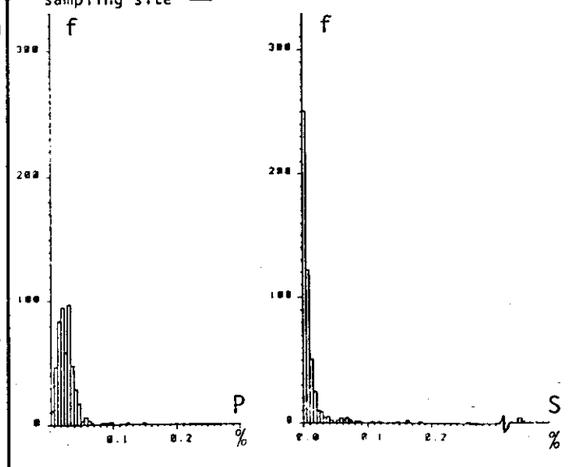
FALUN 13F

LEGEND

Analytical rawvalues -350 ppm P
Heavy Mineral Concentrate (HMC) -50 ppm S

	P 100		S 200	
	ppm	ppm/mm	ppm	ppm/mm
	⩽ 350	—	50	—
m	283	—	164	—
m + 2s	570		1310	
m + 4s	850		2450	

sampling site —



METHODICAL DESCRIPTION
Goldhound concentrate from till
Podsolic C-horizon, 5-10 dm depth
3 kg sieved < 1,0 mm
Input 9 hg Output 1,3-30 g
Dried 105°C, Ground < 2 µm
Direct analysis of 2-3 g powder sample
XRF-Analysis by Analytica AB, Stockholm
Series 83G6GO:001-521

GEOCHEMICAL MAP

Project: 3816
Projectarea: FALUN

P and S in till (HMC)

Christer Mattsson	Date 840604	Scale 1:100000
LKAB PROSPEKTERING AB	FALUN 13F	Report Bsg 84-358 Fig. F 36

Direction of
Glacial movement

N

6740

6735

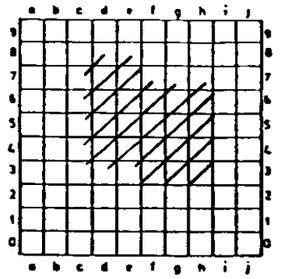
6730

6725

6720

1465

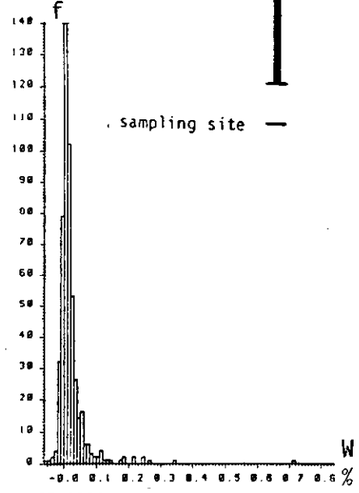
1470



LEGEND **13F Falun**

Values corrected for dilution
x' = (x-b)m
Heavy Mineral Concentrate (HMC)

	mg	400 mg/mm
b = 23 ppm	0	
m	0,236	
m + 2s	2,8	
m + 4s	4,3	
m + 8s	8,4	



. sampling site —

METHODICAL DESCRIPTION
Goldhound concentrate from till
Podsolic C-horizon, 5-10 dm depth
3 kg sieved < 1,0 mm
Input 9 hg Output 1,3-30 g
Dried 105°C, Ground < 2 µm
Direct analysis of 2-3 g powder sample
XRF-Analysis by Analytica AB, Stockholm
Series 83G6GO:001-521

GEOCHEMICAL MAP

Project: 3816

Projectarea: FALUN

W in till (HMC)

Christer Mattsson	date:84-02-09	Scale 1:100000
LKAB	FALUN 13F	
PROSPEKTERING AB	Report Bsg 84-358	
	Fig. F 37	

Direction of

Glacial movement

N

6740

6735

6730

6725

6720

6715

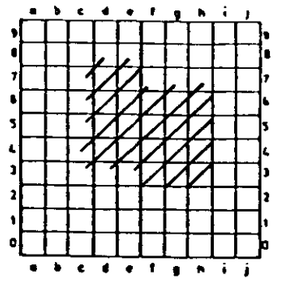
1465

1470

1475

1480

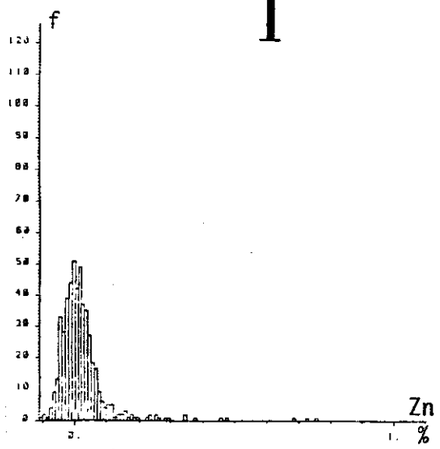
1485



LEGEND **13F Falun**

Values corrected for dilution
x' = (x-b)m
Heavy Mineral Concentrate (HMC)

	mg	400 mg/mm
b = 60 ppm	0	
m	0,216	
m + 2s	1,9	
m + 4s	3,7	
m + 8s	7,1	
sampling site	—	



METHODICAL DESCRIPTION
Goldhound concentrate from till
Podsolic C-horizon, 5-10 dm depth
3 kg sieved < 1,0 mm
Input 9 hg Output 1,3-30 g
Dried 105°C, Ground < 2 µm
Direct analysis of 2-3 g powder sample
XRF-Analysis by Analytica AB, Stockholm
Series 83G6G0:001-521

GEOCHEMICAL MAP

Project: 3816

Projectarea: FALUN

Zn in till (HMC)

Christer Mattsson	date:84-02-09	Scale 1:100000
LKAB PROSPEKTERING AB	FALUN 13F	Report Bsg 84-358 Fig. F 38

Appendix G 1

PLANNED REGIONAL EXPLORATION

Project 3816 and 3817

1984

ROSPEKTERING AB

SBERG

ÖVERSIKTSKARTA

E REGIONAL GEOLOGY and QUATERNARY GEOLOGY

F REGIONAL GEOLOGY and QUATERNARY GEOLOGY

LEGEND

field work carried out

outcrop map

provisional map compiled

5km

Siljan

Saxen

Rogsjön

FALUN

Runn

BORLÄNGE

Flosjön

Västerdalälven

3817

3816

84

(84)

Q84

13