

NEAB's WORK IN HARDANGER, YEAR 2013



Tjosås, "Roadcut", sample 563432. Chlorite schist with folded and faulted layer of iron rich sphalerite. The specimen's lowermost centimeter is strongly weathered.

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Appended map showing Ølve-Varaldsøy's geology and mineralisation

Appended table (table 2.0.1) with all ore and rock samples from Storhidleren 1 & 2, Hatlesteinsvatnet and Tjosås

Appended table (table 4.1.1) with all Ion Leach samples from Tjosås

Appended CD with the files necessary for printing this report.

1.0 SUMMARY AND INTRODUCTION

This report summarizes the work carried out at Storhidleren, Hatlesteinsvatnet and Tjosås (figure 1.0.A) in the Hardanger area by NEAB in 2013.

A 650 m long hole was drilled southeast of the Storhidleren mine on Varaldsøy. The objective was to test if gold mineralisation was associated with a deep-lying magnetic anomaly thought to be caused by the same chert horizon in which high-grade gold mineralisation occur in the old Storhidleren mine. The chert was intersected but there was no gold.

Some rust zones at Hatlesteinsvatnet on Ølve were investigated. One of the rust zones is associated with semimassive pyrite with minor gold.

The Tjosås Au-Ag-Cu-Pb-Zn occurrence at Øystese was subjected to Ion Leach soil sampling. High values of the aforementioned metals and other elements were found at or close to the old workings but also farther away. New outcrops were found east and west of the old workings and the strikelength of the mineralised stratigraphic level now exceeds 1400 m.

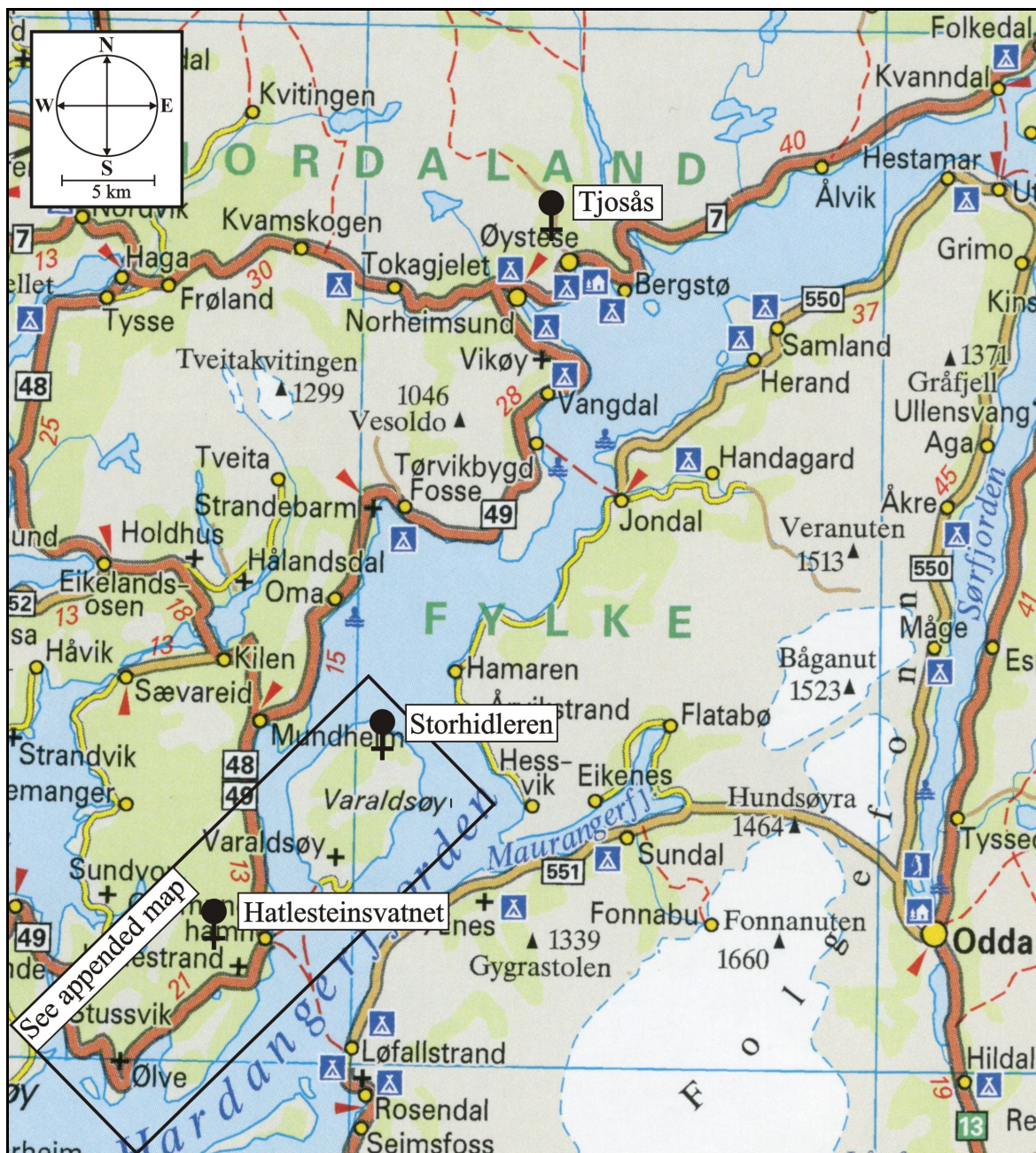


Figure 1.0.A: The three areas in the Hardanger area where NEAB worked in 2013.

2.0 STORHIDLEREN 1 & 2

LOCATION

There are old workings at two places: a small mine at Storhidleren 1 and a test pit at Storhidleren 2 (figure 2.0.E). The coordinates of a point c. twelve meters outside the main entrance to the mine are UTM E333500, N6673284. The coordinates of the test pit are UTM E333745, N6673396.

HISTORY

Ellefsen (1870) wrote: “An English has for a year continued a pyrite mining operation which seems little promising. In a steep hillside one sees two oxidized layers. The lower of these was the first one to be investigated. It shows 18-24 inches of pyrite. An adit has been started to investigate this at greater depth but needs to be continued for 6-8 m more. Next to this adit is another right under a quartzite layer. Thickness here varies from a couple of inches up to 12 inches. The whole endeavour seems to be of little worth.” In 1915 Norsk Bergverksdrift wrote: “Within 14 days the Storhidler mine has been emptied from water. There is 1 m thick pyrite, probably devoid of copper, in the winze. 5 m³ were mined and resulted in 5 tons of pyrite”. In 1916 Norsk Bergverksdrift wrote: “600 tons of ore containing waste rock was taken from the mine. Hand sorting resulted in 280 tons of pyrite grading 41% S”. In 1917 Norsk Bergverksdrift wrote: “330 tons of ore containing waste rock was taken from the mine. Handsorting resulted in 225 tons of pyrite grading 41% S and 0.3% Cu, 25 tons of pyrite grading 30% S, and 80 tons of waste rock”. In 1918 Norsk Bergverksdrift wrote: “33 tons of ore containing waste rock was taken from the mine. Handsorting of these 33 tons and material from the dump resulted in 45 tons of pyrite grading 40% S and 0.3% Cu, and 30 tons of pyrite concentrate grading 25% S”. In 1919 Norsk Bergverksdrift wrote: “191 tons of ore containing waste rock was taken from the mine. Handsorting resulted in 59 tons of pyrite grading 40% S, and 132 tons of waste rock”. Münster (1924) wrote: “this occurrence does not belong to the same stratigraphical level as the other (Valaheien, Nygruven etc.). Here occurs Cu-poor pyrite at a large quartzite lens hosted in phyllitic schists”. Later it is said that during the war 5-600 tons of pyrite at 41-42% S were produced and exported. Foslie (1944) wrote: “Die Storhidler Grube bei Båtvik am Nordende von Varaldsøy hat eine isolierte lage ohne andere schürfe in der Nähe. Es steht in verbindung mit ein mächtiges lager der geöhnlichen blauquarze, welches an der grenze von zahlreichen Adern kupferarmer Schwefelkies begleitet ist. Die gewonnenen Roherze sind daher ziemlich arm. Wegen der Art des Auftretens konnte aber durch einfache Handscheidung ein Ziemlich reiches Exporterz gewonnen werden”. Stadheim (1946) drew some sketches which differ from what Norrbotten Exploration AB (NEAB) have seen. Wulff (1996) took three samples all of which returned gold (up to 10.3 ppm), and in some detail described the mineralogy and textures of two polished samples. In 2009 NEAB carried out detailed sampling inside the mine and found gold contents up to 130 ppm (table 2.0.1). Later that year an airborne geophysical survey covering Varaldsøy and most of Ølve was carried out. In 2010 NEAB drilled four holes at Storhidleren, and in 2013 a 650 m long hole was drilled.

GEOLOGY

The main entrance to the mine (figures 2.0.A & 2.0.B) is at the foot of a km-long, steep hillside. The country rock is basalt while chert is host rock. Establishing the exact stratigraphy of the mineralisation (20°/ 30° E) inside the mine is difficult as everything is covered by grime. However, chip-sampling shows that there in the lower drift is a main ore zone with two layers of massive pyrite with chert, carbonate and chlorite schist in between. In total there is 90-120 cm of massive pyrite in the main ore zone. The massive pyrite is fine- to medium-grained with subordinate magnetite. The main ore zone is enveloped by chert and chloritized basalt both of which are more or less pyrite mineralised. Inside the mine are traces of malachite which originates from traces of chalcopyrite in cm-thick quartz veins which are perpendicular to the massive pyrite layer and occur both in the FW and HW of it. Inside the lower adit (i.e. in the footwall and below the main ore zone (figure 2.0.B)) occur 3 pyrite layers with schist-partings, chert and carbonate gangue. Their true thicknesses are 35 cm, 13 cm and 25 cm, respectively. They are hosted in chert and basalt and are rather weathered. There are also a number of semi-continuous pyrite lenses in

between the 3 pyrite layers. On top of the chert layer above the mine is an inaccessible rust zone called the hanging wall mineralisation. It has been intersected by three of NEAB's five drill holes (figure 2.0.K).

Country rocks

Basalt is the country rock. It is generally very chloritized, very calcite veined (figure 2.0.L) and often somewhat epidotized, i.e. calc-silicate altered. Most of the basalt is probably tuff but minor parts may be flows or in some cases dolerite dikes. The same can be said about basalt from elsewhere on Varaldsøy and Ølve. Weak dissemination of fine-grained magnetite occurs locally and slightly raises the susceptibility of the otherwise non-magnetic basalt. Insignificant pyrite mineralisation is not uncommon in the 5 drillholes but 100 m down in drillhole St5 occurs 5.05 m of disseminated to semi-massive pyrite (figure 2.0.I). This intersection was analyzed in its entirety but proved to be barren. Besides basalt, or *greenstone*, the volcanic pile also includes rhyolite (especially in drill hole St5) which is sometimes quartz porphyritic. Some parts of the drill holes St1 and St 4 are logged as "intermediary" which may be dacite but whole rock analysis has not been carried out to confirm this interpretation. At 73 m downhole in drillhole St4 occurs a few meters of laminated silt. Some other, minor parts of the cores may be arenite.

Host rock

The mineralisation at Storhidleren is intimately associated with chert. Mæland (1996) wrote "an eye-catching, small chert bed occurs in a steep slope at Båtviki on Varaldsøy's north coast. The layer is 7-8 m thick and outcrops over a length of 35-40 m. Its hematite content, which gives the chert its pink color, has been test mined in the Storhidler mine". He also wrote "a white and c. 5 m thick chert bed occurs on the spit east of Båtviki" (NEAB took two samples one of which has 0.16% Cu but no gold). On Varaldsøy's west coast, just south of the contact to the Mundheim group, Mæland (1996) mentions a c. 50 m thick zone where lamellar chert frequently occurs. He wrote that the chert beds mostly occur along the N – NW coast of Varaldsøy and concludes that "as the chert can contain pyrite which no doubt was deposited by hydrothermal solutions, then the chert must also have been deposited by hydrothermal fluids". All NEAB's five holes at Storhidleren 1 & 2 intersect chert. The color of the large chert layer associated with the mineralisation varies from grey to bordeaux. Mm-cm thick layers of magnetite and/or hematite are common. The chert layer reaches its maximum thickness above the mine but from there it wedges out down-dip (figure 2.0.J). The 2010 drill contractor (Northern Scandinavian Drilling) had significant troubles drilling through the chert while the 2013 drill contractor (SMOY/Drillcon) easily got through. Core samples of chert was in 2010 impossible to cut on NGU's diamond saw in Løkken Verk so nothing is left of the sampled parts of the chert. Similar samples of chert from drill hole St5 were in 2013 successfully cut on Elin Sagvold's (NGU employee) heavy-duty diamond saw so half of the core samples could be returned to the core trays.

Susceptibility

NEAB procured a magnetic susceptibilimeter meter (the model KT-10 from Czech company Georadis) as soon as it was realized that the mineralisation is intimately associated with a magnetic chert. Subsequently, the susceptibility (largely a measure of magnetite content) was measured systematically inside the mine and on all drill cores. The susceptibility of the main ore zone and of unmineralised basalt in the footwall is generally less than 1×10^{-3} SI units. The susceptibility of the footwall mineralisation reaches a maximum of 815×10^{-3} SI units. For a comparison, the susceptibility of massive magnetite from Rauneli on Ølve is $>1500 \times 10^{-3}$ SI units. So, the footwall mineralisation is magnetic while the main ore zone and the basaltic country rock are not. The felsic and intermediary rocks in the drill cores also have low susceptibility, typically below 1×10^{-3} SI units. Susceptibility measurements on the five drill holes confirmed that the magnetic anomaly from the airborne geophysical survey is caused by the chert layer.

Ore microscopy

Sample of massive pyrite (Wulff, 1996): pyrite occurs as up to 10 mm big aggregates. The individual grains are an- to euhedral and often exhibit caries texture. Gold occurs as inclusions and occasionally fracture filling in pyrite and is often intergrown with tennantite, galena and chalcopyrite. Most gold grains (the sample contains about 8 ppm Au) are 1-5 μm big but a few reaches 30 μm . Galena, chalcopyrite and tennantite occurs as up to 100 μm large

inclusions in pyrite. Tennantite and tetrahedrite is optically almost indistinguishable but the geochemistry of the sample suggests it is tennantite (there is much more arsenic than antimony). Arsenopyrite is rare and was only seen intergrown with tennantite. Molybdenite is widespread and occurs as 50 µm thick and ½ mm long “veinlets”. Occasionally molybdenite overgrows/encloses pyrite. Molybdenite occurs mostly in the matrix (50/50 chlorite and quartz) while the other ore minerals occur almost exclusively in pyrite.

Sample of massive magnetite (Wulff, 1996): magnetite occurs as up to 2 mm big, sub- to euhedral grains. Magnetite contains inclusions of all the other ore minerals. Some magnetite grains have inclusions of anhedral pyrite grains which are relicts after magnetite replacing pyrite. Pyrite is generally anhedral, often cataclastic and up to 1 mm big. Some pyrite grains contain plenty inclusions of chalcopyrite – which only occur this way. One inclusion in pyrite may be bornite. Molybdenite is widespread and occurs as up to 100µ large grains. Hematite occurs sporadically in the gangue. The sample contains 0.34 ppm Au but gold was not seen.

In 2010 NEAB had GTK carry out metallurgical test work on 30 kilo (23.9 g/t gold and 41.1 g/t silver) of more or less pyrite rich specimens from Storhidleren. Among other things it was shown that the gold's fineness averages only 663 per mill which suggest a low-temperature origin. The presence of minerals like *arsenopolybasite** and native silver was also established.

*In its report GTK does not state the exact composition of the *arsenopolybasite* (an old name for pearceite) but the mineral is an end-member of the polybasite ($\text{Ag}_{16}\text{Sb}_2\text{S}_{11}$) - pearceite ($\text{Ag}_{16}\text{As}_2\text{S}_{11}$) solid solution series. A more general formula is $[(\text{Ag}, \text{Cu})_6(\text{As}, \text{Sb})_2\text{S}_7][\text{Ag}_9\text{CuS}_4]$. Pearceite is not very common and mainly occurs in low- to medium-temperature mineralisation. Arsenopolybasite is probably more common in vein type mineralisation than in VHMS mineralisation.

Samples

Forty-three samples (table 2.0.1) have been taken from the mine or the dump. Twentyone of them are grab-samples while the rest is chip-samples. The samples are visually heterogenous (figures 2.0.C & 2.0.D) as is also reflected in their geochemistry – there are only few and weak correlations between the elements. Basically, the mineralisation is enriched in iron, sulphur, gold, silver, arsenic, antimony, molybdenum and phosphor. The samples' content of base metals is with one exception insignificant – much unlike any of the other auriferous VHMS occurrences in the area, or in Scandinavia for that matter.

Gold occurs in almost all the samples, also in those which at the time of sampling didn't look the least auriferous. The average of the grab-samples and the chip-samples are 12 and 14 ppm, respectively (these numbers include samples of barren waste rock).

Silver is the only other metal of value in Storhidleren and on average there's 31 and 17 ppm of it in the grab- and chip-samples, respectively.

It appears that the presence of gold requires the presence of at least *some* pyrite, but the gold content can get very high as soon as a low threshold content of pyrite has been passed. High gold content is sometimes associated with high contents of silver, arsenic and molybdenum but the correlation is weak. It should be noticed that the most gold rich (130 ppm) sample is low in everything except iron and hence sulphur (it's massive pyrite), but then it is from a pyrite layer in the footwall and not from the main ore zone as almost all the other samples are. Two sub-samples were taken from each of the chip-samples from the main ore zone. The results show that the gold is rather evenly distributed, i.e. no pronounced nugget effect.

The thickness of the gold mineralisation inside the mine is in excess of 7.5 m (figure 2.0.B), i.e. one of the thickest occurrences in the Ølve-Varaldsøy area. A chip-sampled section including the Main Ore Zone and part of the footwall averages 8.7 ppm over 1.95 m (table 2.0.2) A larger chip-sampled section including 10 sub-samples and

covering the whole mineralised zone averages 8.09 ppm Au over 8.44 m. The true thickness of each sub-sample is not very accurately measured, though. The 8.44 m grading 8.1 ppm include 2.5 m which is almost barren.

Profile 1, sample #	Thickness	Gold (ppm)	Thickness*gold (ppm)
563105 A+B	0.90	10.43	9.4
563106 A+B	0.45	5.75	2.6
563107 A+B	0.60	8.20	4.9
Sum	1.95		16.9
Total: 1.95 m @ 8.7 ppm			

Profile 2, sample #	Thickness	Gold (ppm)	Thickness*gold (ppm)
563108 A+B	0.50	11.30	5.7
563109 A+B	0.50	3.64	1.8
563110 A+B	0.70	31.90	22.3
563111 A+B	1.00	5.02	5.0
563145	1.50	5.53	8.3
563120+563144	0.09	13.07	1.1
563143	2.50	0.31	0.8
563121+563142	0.15	79.30	11.9
563141	1.15	7.20	8.3
563122+563140	0.35	8.89	3.1
Sum	8.44		68.3
Total: 8.44 m @ 8.1 ppm			

Table 2.0.2: Chip-samples across the gold mineralised zone.

Chip-sample 563107 is the only one with Zn content (0.46%) far above the detection limit, and consequently also the only one with notably Cd content (52 ppm). This sample is also the one richest in lead, molybdenum (0.21% & 0.15%, respectively) and in phosphor, 0.59%. There's 8.2 ppm Au in the sample.

A sample (HO.0027.01) taken in 1994 consists of massive magnetite. Similar large lumps of magnetite were not found in 2009. Only few, cm-sized bits and pieces were found.

Storhidleren differs in certain ways from Ølve-Varaldsøy's other VHMS deposits. The massive pyrite (figure 2.0.C) is similar to massive pyrite from the area's other VHMS occurrences (especially Dyråsen on Ølve) but other parts of it look distinctly epigenetic (figure 2.0.D). Having a VHMS with high gold content and low base metal content is uncommon and other relatively gold rich VHMS deposits in Norway have significant contents of base metals.

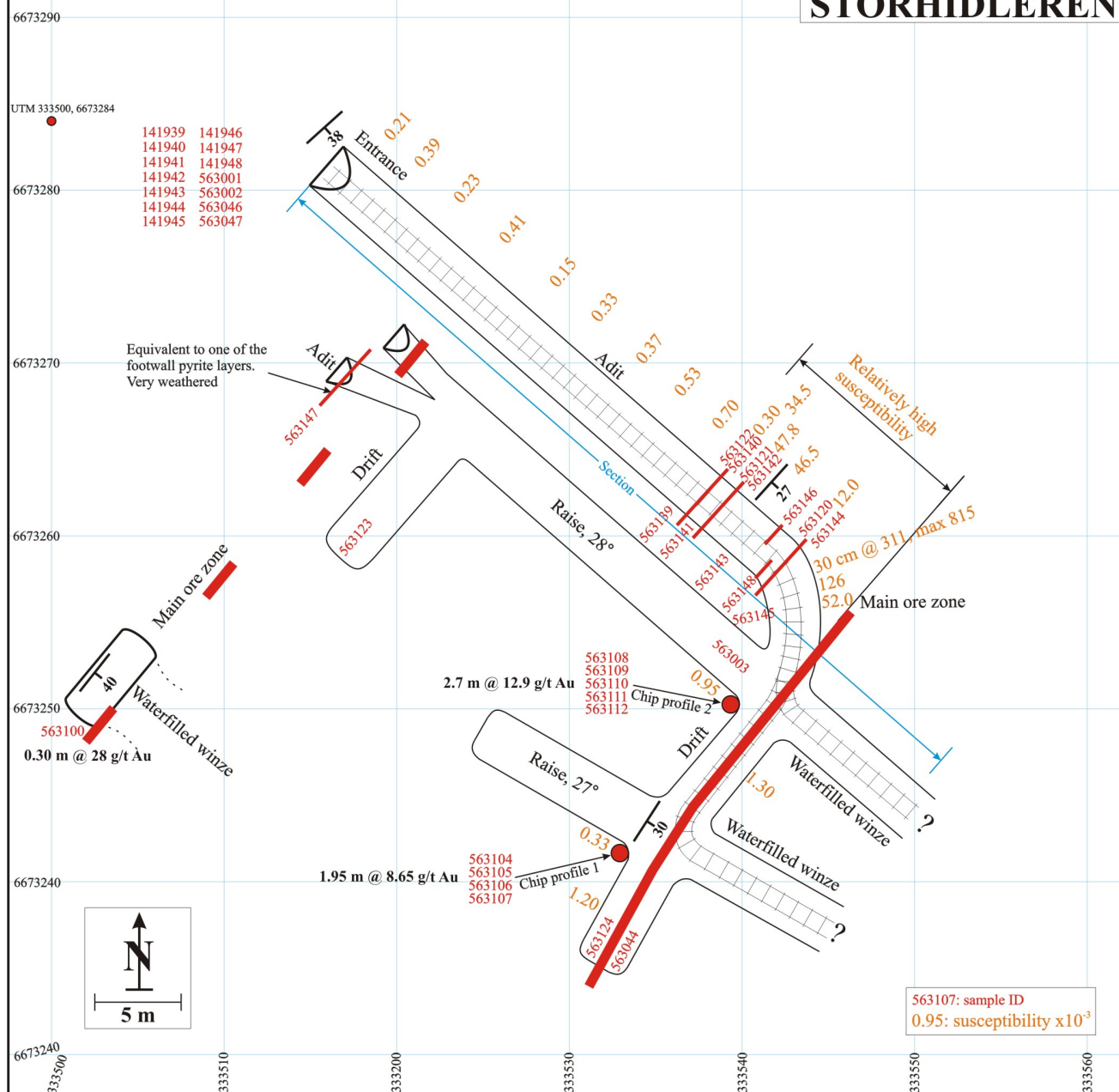


Figure 2.0.A: Map showing the Storhidleren mine.

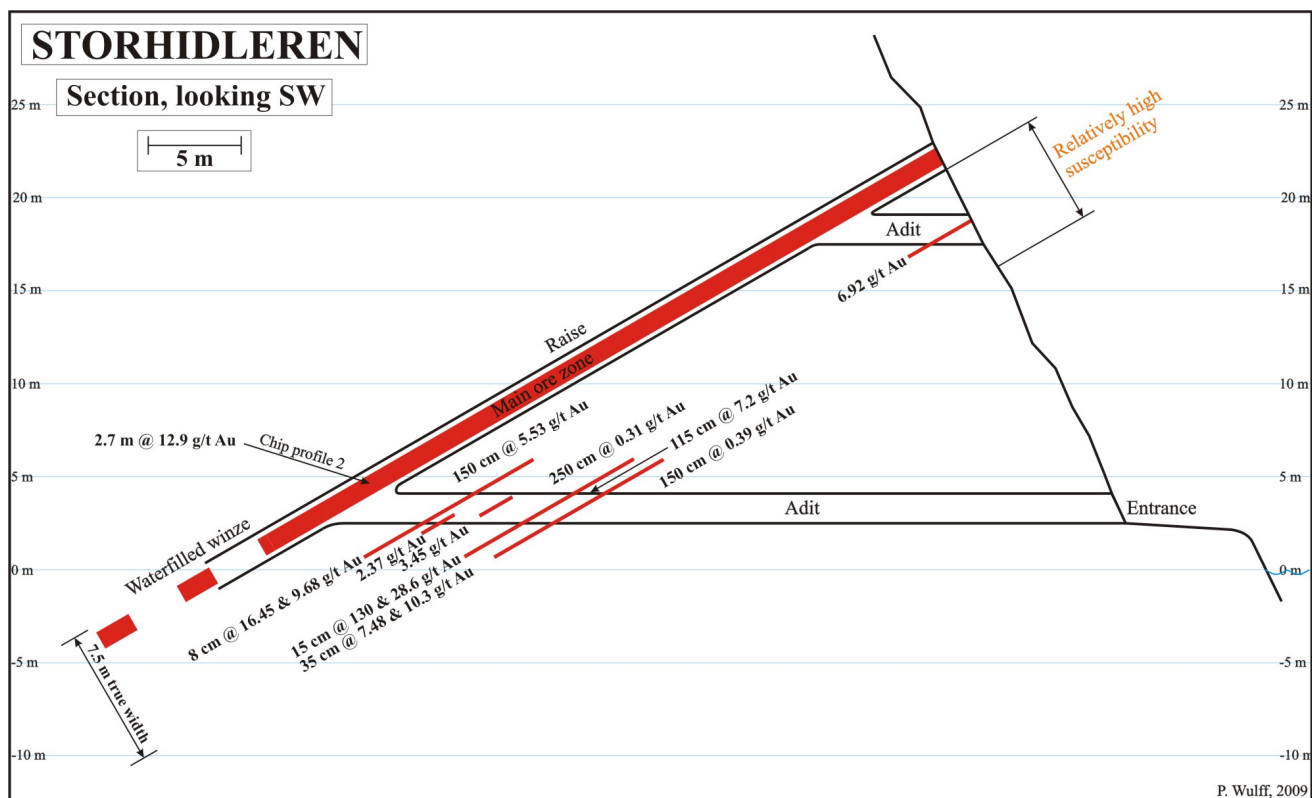


Figure 2.0.B: Section of the Storhidleren mine.

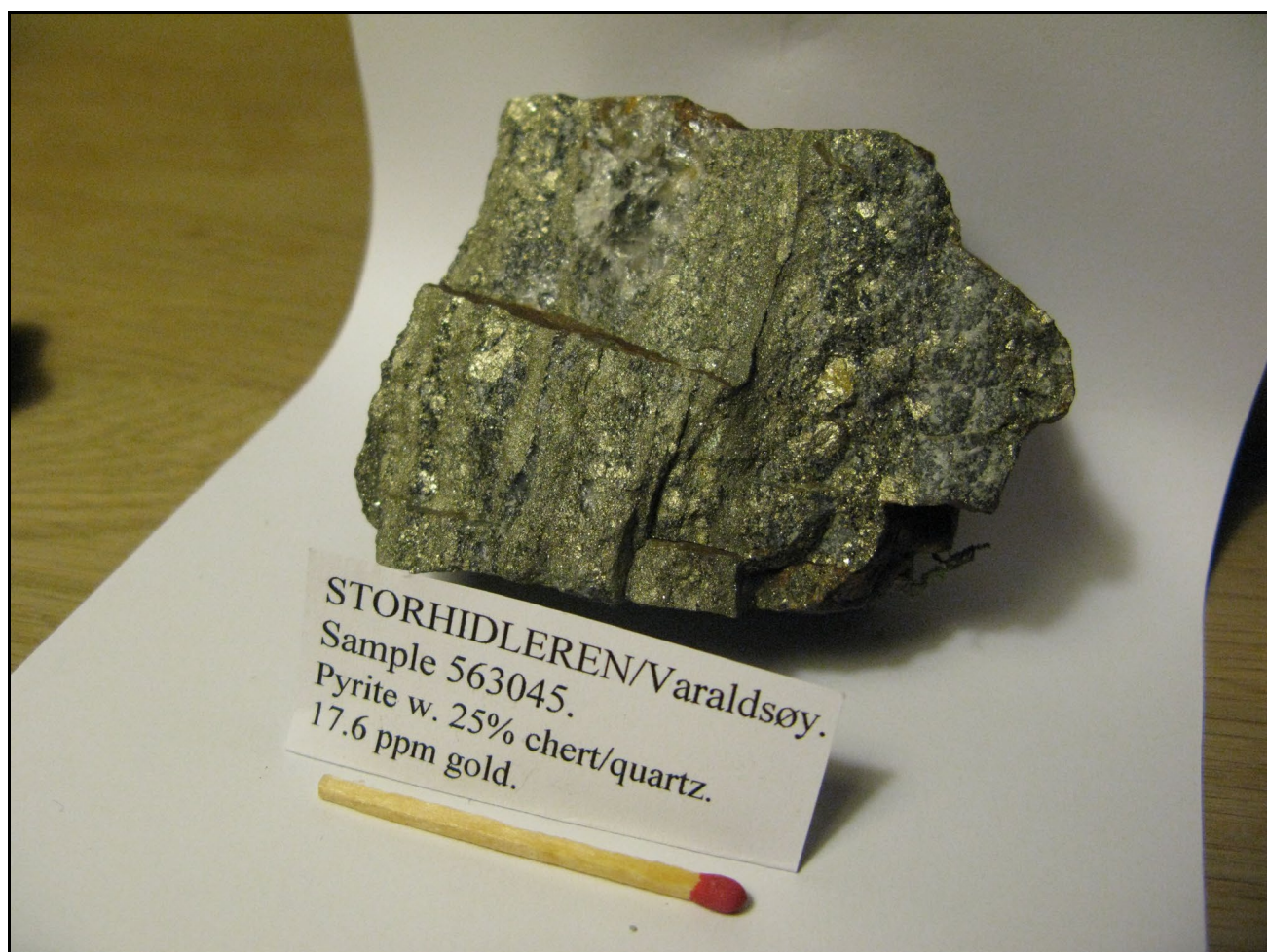


Figure 2.0.C: Typical ore from Storhidleren.



Figure 2.0.D: This specimen is sheared and looks epigenetic.

DRILLING

NEAB drilled four holes in 2010 and one hole in 2013. The drilling totals 1535 meters (table 2.0.3).

Hole ID	UTM E	UTM N	Azi	Dip	Length
St1	333631	6673190	298	55	230.39
St2	333631	6673190	298	80	205.43
St3	333631	6673190	335	45	199.69
St4	333775	6673230	330	45	250.00
St5	334114	6672819	311	63	650.00

Table 2.0.3: Basic data about NEAB's five holes at Storhidleren.

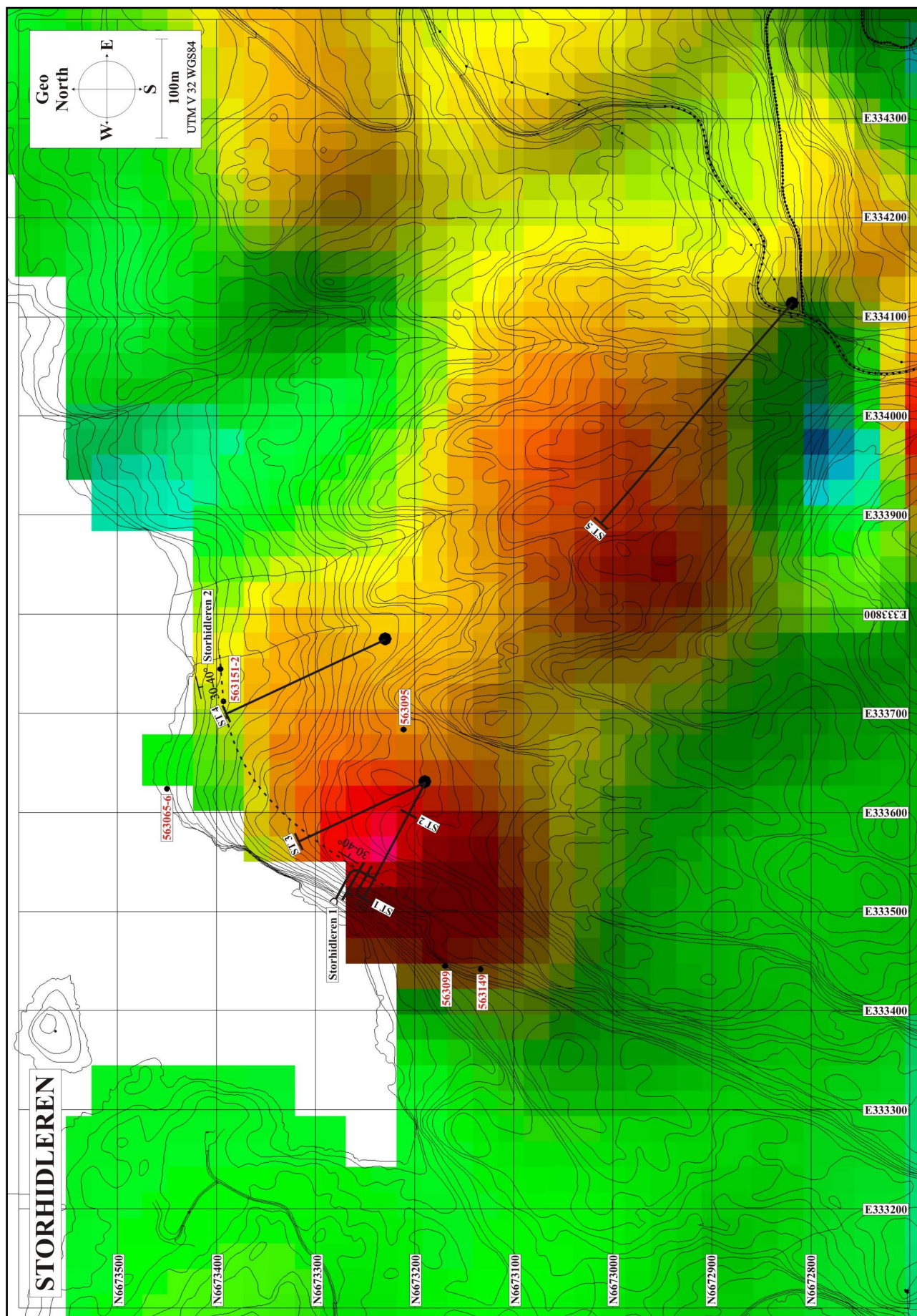


Figure 2.0.E: Map showing NEAB's five drill holes and the high-magnetic chert (yellow-red-pink). Green is un-magnetic basalt and minor rhyolite. Notice that the high-magnetic chert continues eastwards.

Figure 2.0.L shows in detail the intersections of mineralisation and associated chert.

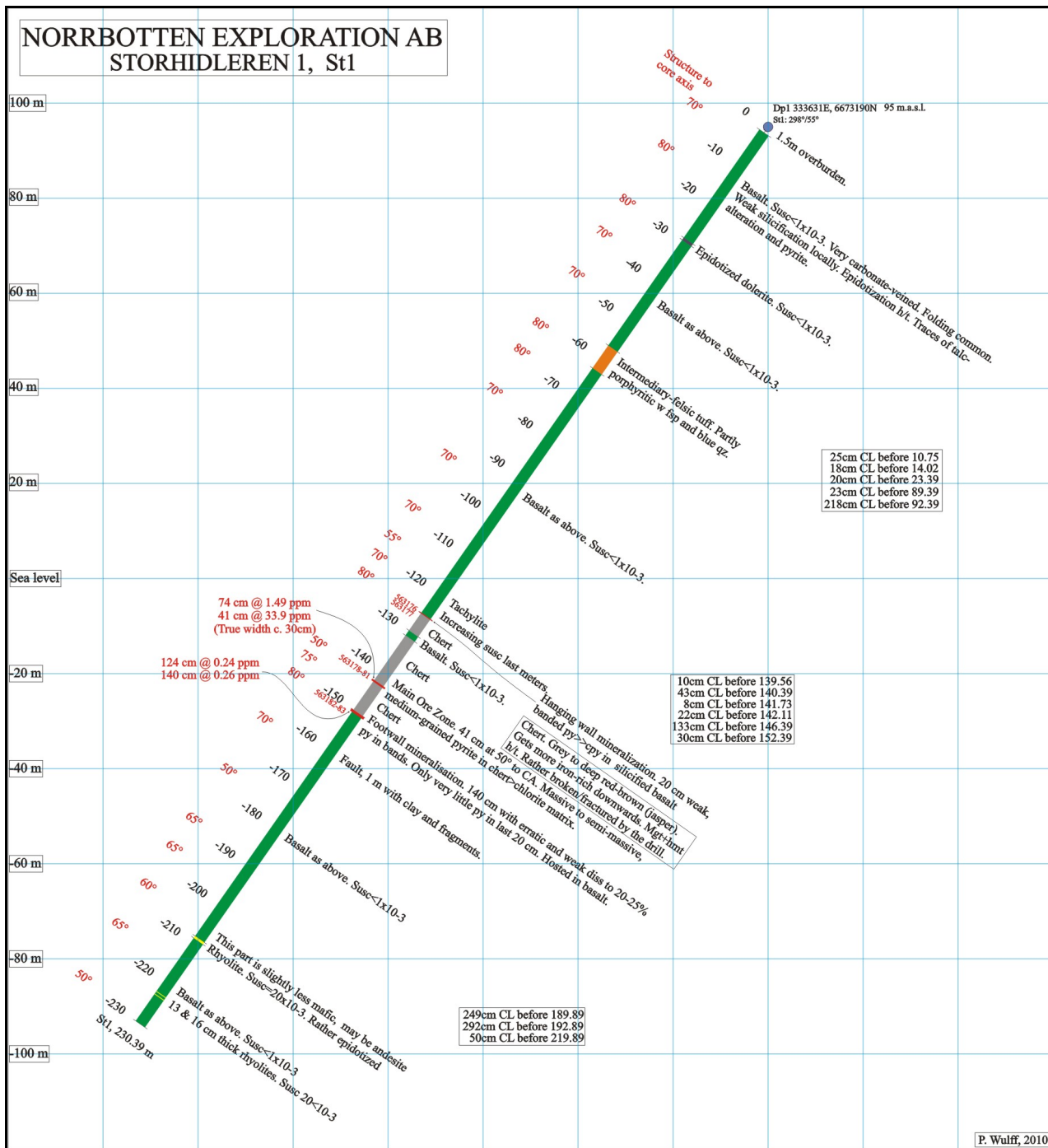


Figure 2.0.F: Graphic log. This hole was the only one to intersect the massive pyrite layer – 41cm@33.9 ppm Au. Also the foot- and hanging wall mineralisations were intersected.

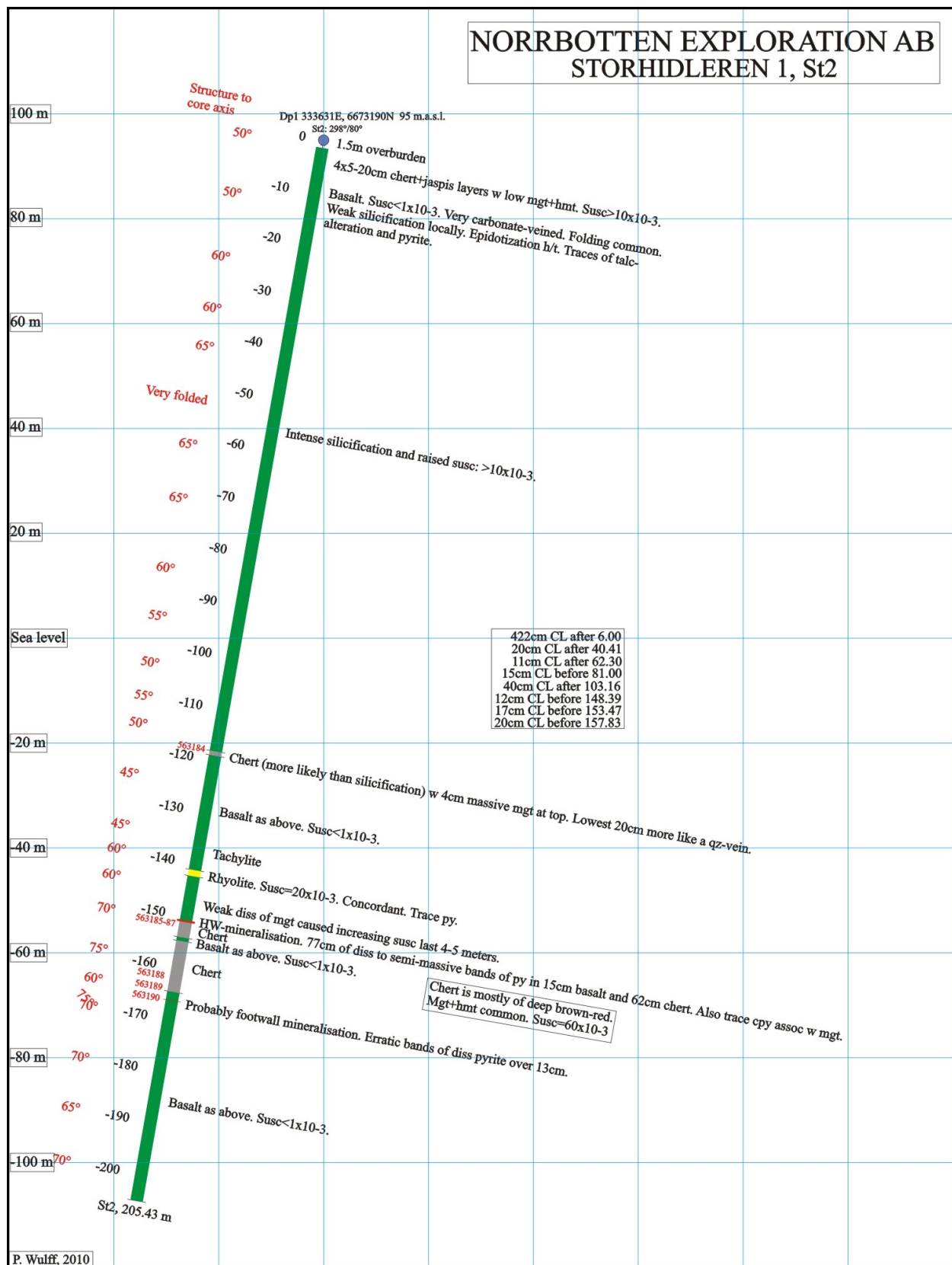


Figure 2.0.G: Both the foot- and hanging wall mineralisations were intersected in this hole.

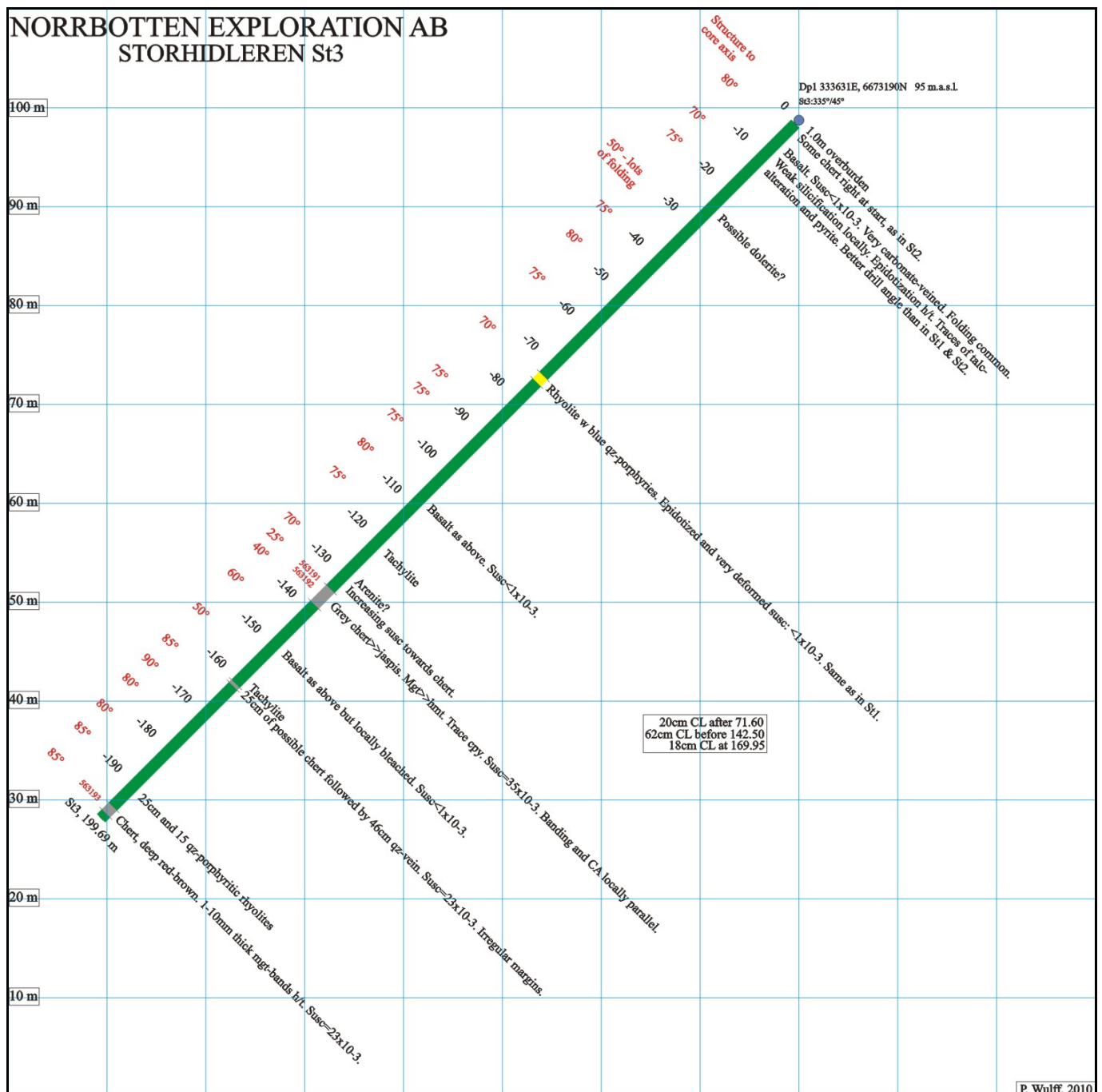


Figure 2.0.H: The principal chert layer is the one intersected between 130 and 140 m.

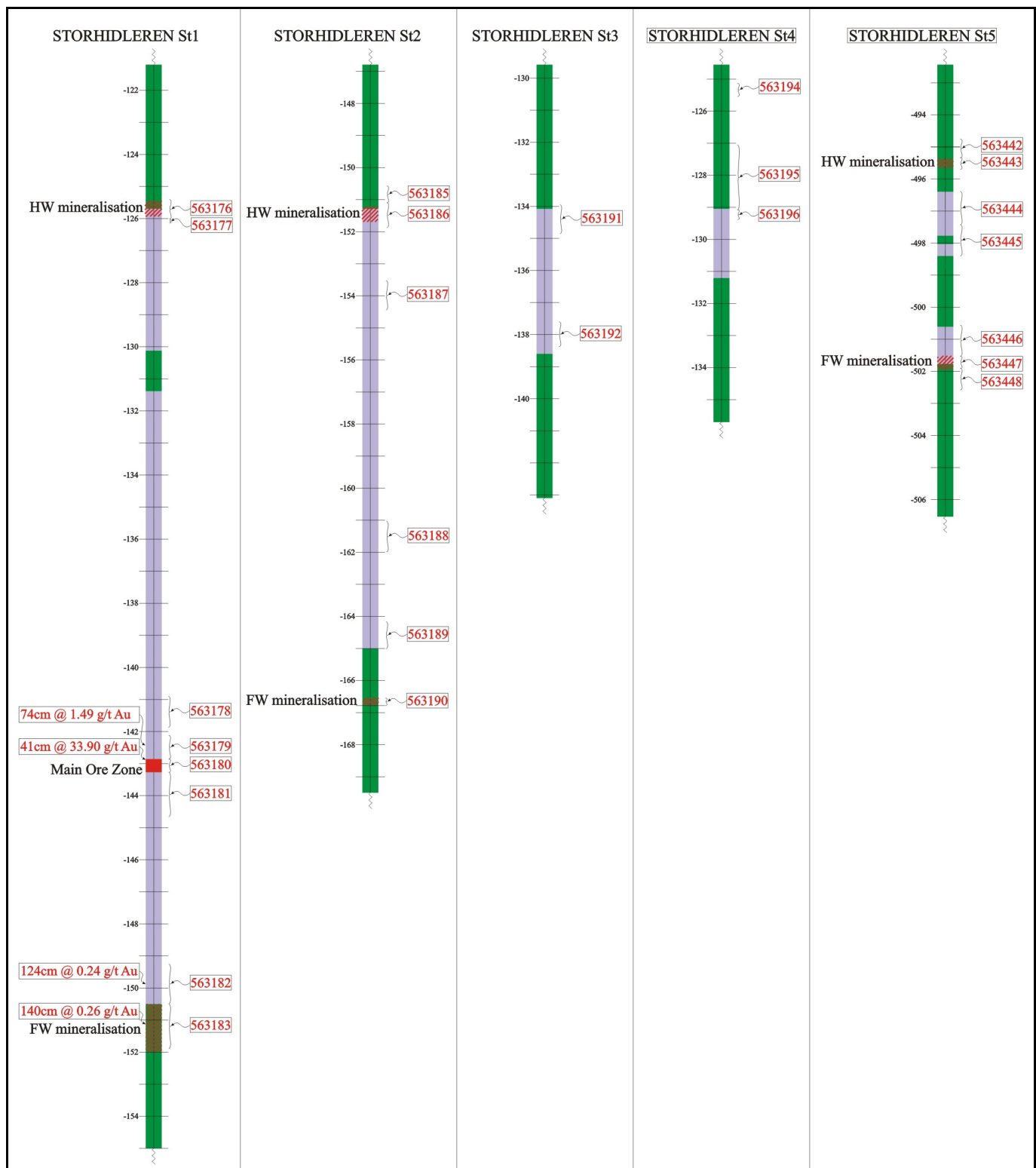


Figure 2.0.K: The chert intersections in the five drill holes at storhidleren. The Main Ore Zone was intersected in only one hole while the foot- and hanging wall mineralisations were intersected in three holes.

Storhidleren 2

In 2010 a hitherto unknown test pit, Storhidleren 2, was found at a creek about 270 m East of the Storhidleren mine. It is not clear if Storhidleren 2 is on the same stratigraphic level as Storhidleren 1 - as is indicated on figure 2.0.E, but it probably is. The mineralisation (70-80°/38°S) is in many ways similar to the one in the Storhidleren mine – basaltic country rock, massive to semi-massive pyrite+magnetite in cherty and/or chloritic matrix, and several meters of chert which includes layers of basalt (figure 2.0.M). The two sulfide layers are banded and can be

followed across the creek. Their thicknesses range from 12 to 45 cm but chert/quartz makes up 50% of the 45 cm thick sulfide-layer. Fourteen samples were taken: 563067-9 and 563083-93. Much contrary to expectations none of the auriferously looking samples (figure 2.0.N) had anything of interest.

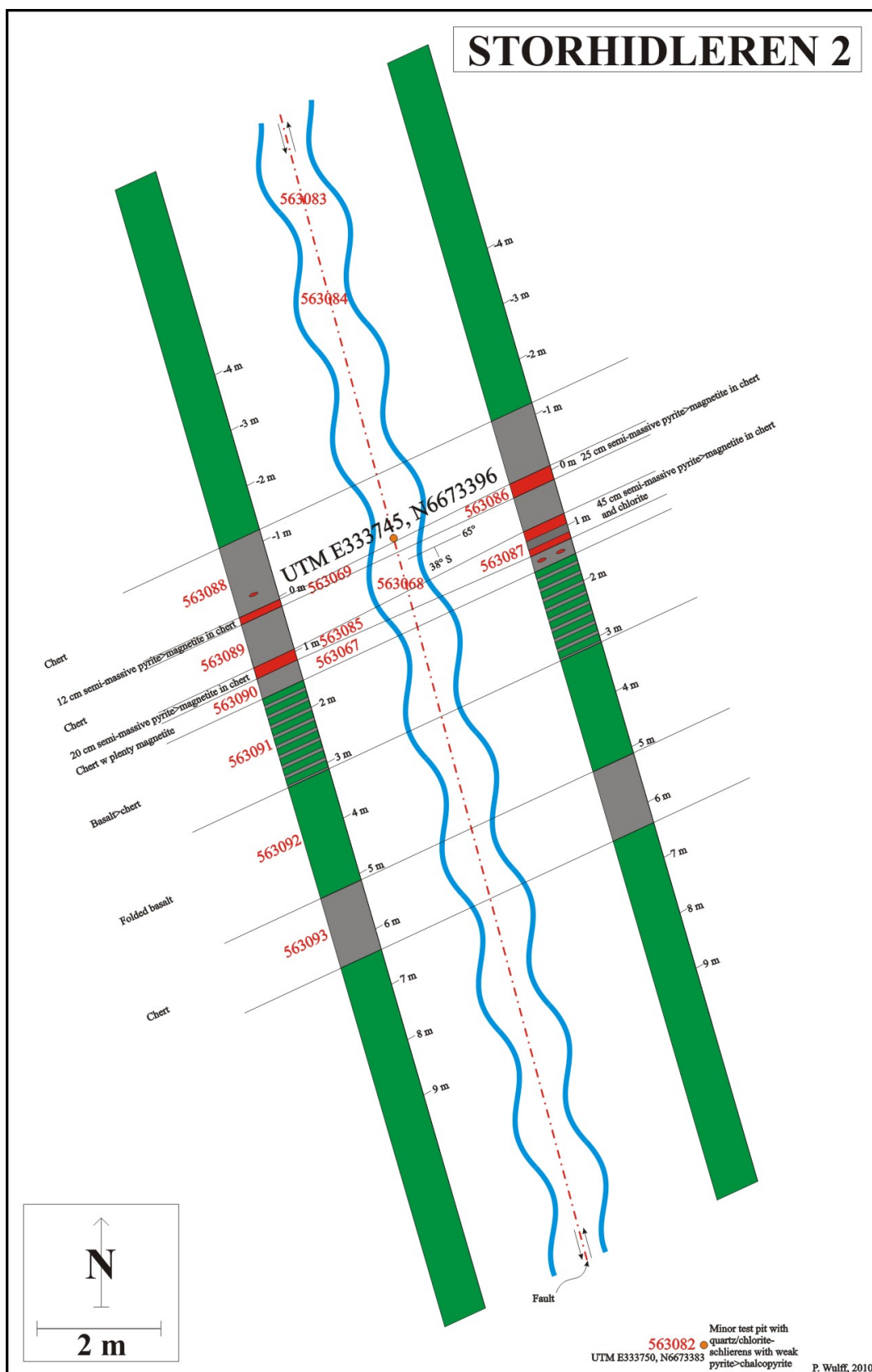


Figure 2.0.M: Storhidleren 2.



Figure 2.0.N: Barren sample from Storhideren 2. A similar sample from Storhideren 1 would have had plenty of gold.

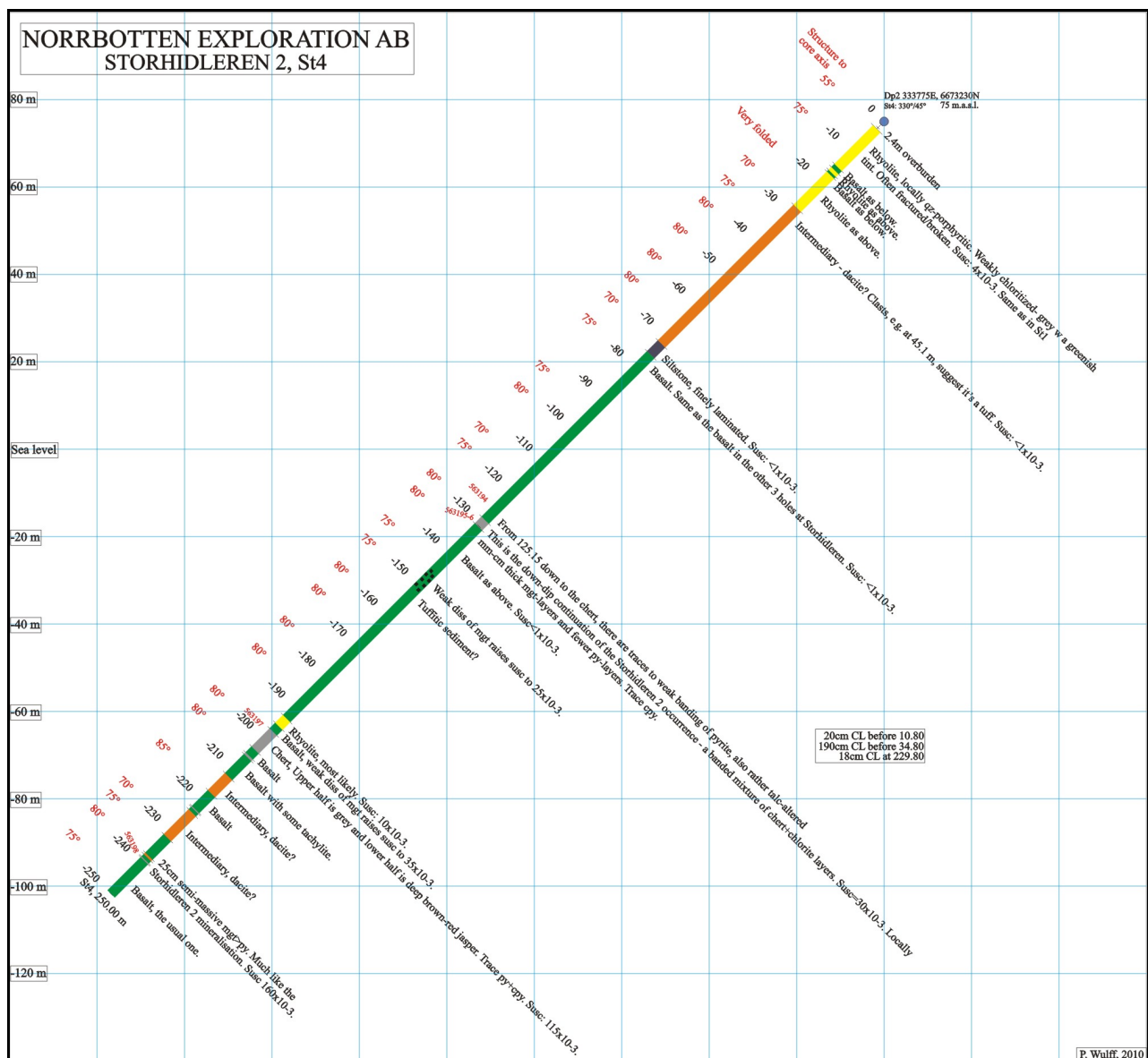


Figure 2.0.O: This hole was drilled in order to test the stratigraphy around Storhidleren 2. The down dip continuation of Storhidleren 2 was intersected at 130 m, and another similar but smaller mineralisation was intersected at 238 m down hole. None of them had any gold. A chert layer with only traces of mineralisation was intersected round 200 m. This chert layer could be the down dip continuation of the two chert lenses occurring on the coast between the Storhidleren mine and Storhidleren 2.

3.0 HATLESTEINSVATNET

Test pits in sulphidic mineralisation are on Steinar Foslie's (1955) map (see appended map) symbolized with ♀ (figure 3.0.A) and two such symbols are marked at Hatlesteinsvatnet. One of the symbols is the Blånuten showing which was visited in 2009. The other symbol is nameless and located on the SE shore of Hatlesteinsvatnet. Accompanied by Ole Skjelnes (store owner on Varaldsøy) I visited Hatlesteinsvatnet on two occasions. First time was to find the unnamed test pit which was the last unvisited test pit on Foslie's map. There is no test pit however, only a rust zone on a skerry 10 m from the shore. One sample (563425), the most sulphide rich available, was taken but it is barren (table 2.0.1). While walking along the rugged shore, 2-3 rust zones were noticed on the opposite side of Hatlesteinsvatnet. These rust zones were visited some days later, using a boat belonging to a hunter* from Gjermundshamn. One of the rust zones (at sample 563427) is in sericitized rhyolite and has an 8-10 cm thick layer (figures 3.0.B & 3.0.C) of almost massive pyrite (0.2 ppm gold and 25% sulphur, table 2.0.1) while the other rust zones are insignificant and not worth sampling. Foslie has marked a rust zone in Hatlesteinsvatnet's southern part from which one, and as it turned out (table 2.0.1), barren sample (563426) was taken.

*This hunter knew both Møller's test pit and the test pits at Hytteheiane. Some years ago he had also seen a test pit 1-1.5 km S or SE of the test pits at Hytteheiane. Unfortunately he was uncertain whether he could relocate the test pit so we did not search for it. It's an unknown test pit, if it exists.

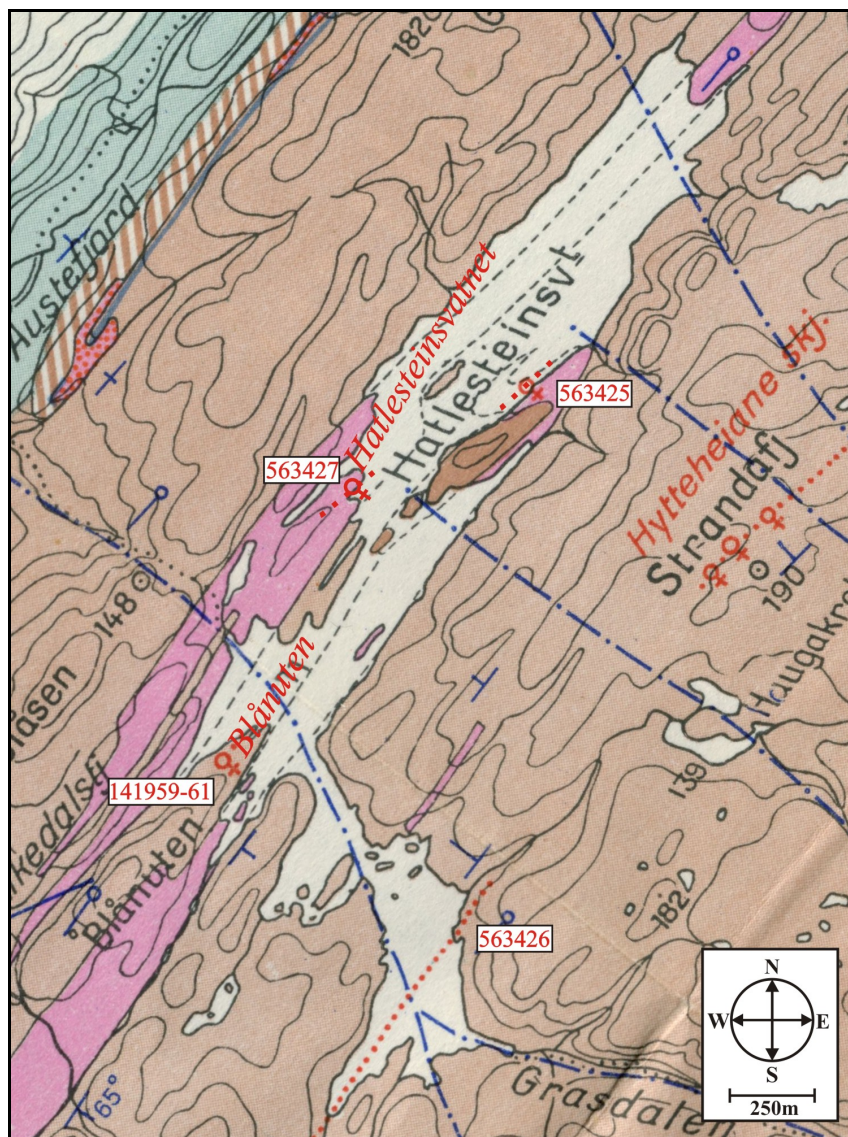


Figure 3.0.A: Hatlesteinsvatnet, slightly modified part of Steinar Foslie's (1955) map of Ølve-Varaldsøy's geology. Pink is rhyolite, brown is basalt and darkbrown is gabbro.



Fig 3.0.B: Photo showing the rust zone at sample 563427.



Figure 3.0.C: Photo showing a slice of almost massive pyrite (sample 563427).

4.0 TJOSÅS

Tjosås is one of the Hardanger district's few VHMS occurrences with potentially economic contents of base metals, especially zink. It is also one of Norway's most gold rich VHMS deposits, with grades up to 36.9 ppm in grab-samples. Since 2009 NEAB has each year spent about one day at Tjosås and has slowly progressed the project but in 2013 NEAB spent seven days and carried out its largest Ion Leach sampling programme.



Figure 4.0.A: Typical terrain at Tjosås. The two peaks in the background, towards SSW, are the Tørviknuten-Vesoldo mountains where NEAB in earlier years has worked on a VHMS mineralisation.

Location

The main occurrence (Tjo1-5) is at UTM E343077, N6699537, and at UTM E342196, N6699421 is a small test pit called Tjo6. In 2013 a mineralised roadcut was found at UTM E343412, N6699542, together with a rustzone (Tjo7) outcropping in a creek at UTM E341957, N6699370 (figures 4.0.B & 4.1.A).

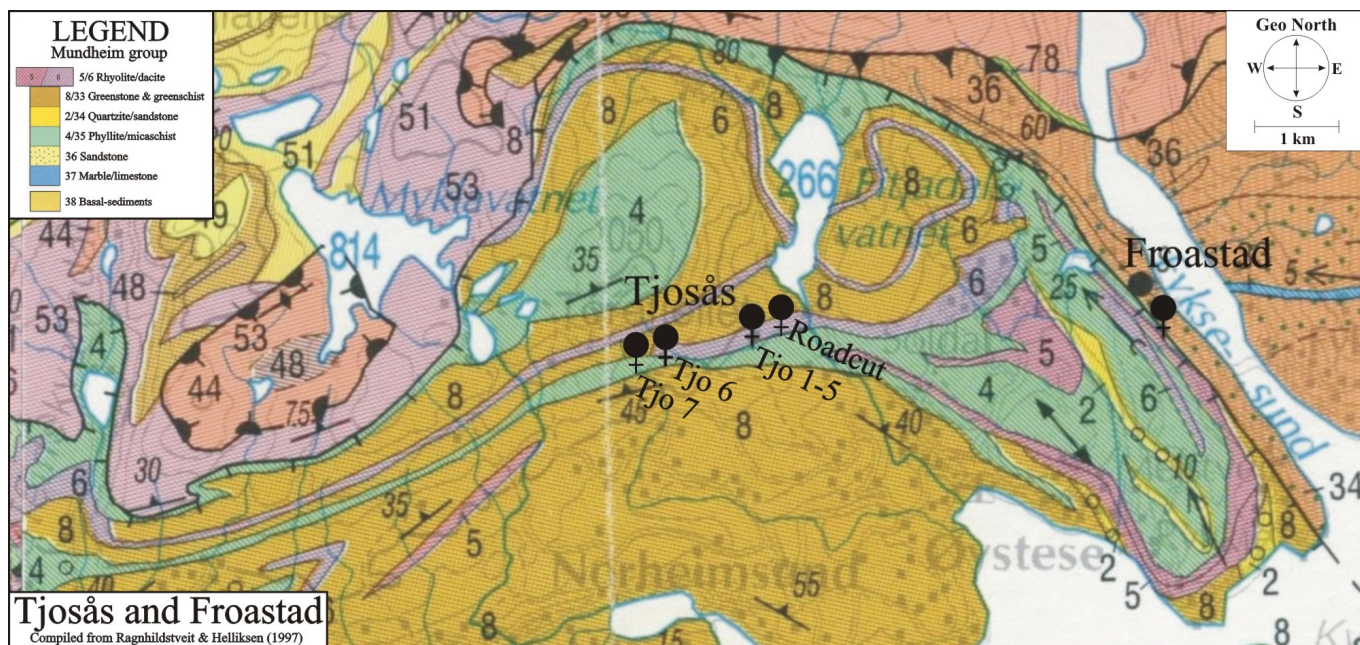


Figure 4.0.B: Geological map showing the Norrheimsund-Øystese area and the Tjosås occurrence. There is supposed to be a sulphide mineralisation at Froastad but I failed locating it in 2009.

History

In 1883 Norges Bergverksdrift wrote that “last year, on land belonging to the farms Tjosaas and Stues, some occurrences with cupriferous pyrite and galena in quartz were test mined by English Robert Milburn. In an undated report (Hagen), Tjosås is said to be too poor to warrant further investigation. Geologists from NGU passed the occurrence in 1977 and took two samples returning 0.28% & 1.2% Cu, 0.37% & 0.52% Pb and 5.7% & 1.4% Zn, respectively. NGU concluded that Tjosås was of some interest because of its relatively high Zn content but did not analyze the two samples for gold. During 2009-12 NEAB took some grab-samples from the old workings and found high contents of zink and gold (up to 13% and 36,9 ppm respectively). In 2013 NEAB took 134 Ion Leach samples some of which have very high contents of gold, copper, lead and zink. Oddly, some of the Ion Leach samples with high zink content are also enriched in uranium. A mineralised roadcut and a rust zone were also found and have extended the length of the mineralised level to +1400 m.

Ore and rock samples

NEAB has now gathered 25 ore and rock samples at Tjosås. With regards to metal value, these samples are in the Hordaland region seconded only by samples from Storhidleren. Including NGU’s two relatively poor samples, the ore samples average 5.2 ppm Au, 27 ppm Ag, 8.4 % Zn and 1.5% Cu+Pb (table 2.0.1).

Tjo1-5

The richest part of the occurrence can be followed for about 75 m along strike at Tjo1-5. Figure 4.0.C shows the old workings – it appears the eastern test pit and adit are too far south to hit the massive part of the mineralisation but there is the same chlorite-sericite alteration as in the other old workings. The mineralisation is best seen at Tjo2 and Tjo5. At Tjo2 are two 10-15 cm thick layers of massive and fine-grained sulfide (mostly sphalerite) whereas I at Tjo5 only noticed one 5 cm thick layer – but judging from 30 cm thick (across banding) specimens in the dump, there is/was much more than seen in outcrop. The sulfide layers are pyritic and pyrrhotitic and have more sphalerite than any other VHMS in the district. Chalcopyrite and galena are also common but there is much less of them than of sphalerite. The alteration is the typical – sericitization, chloritisation, silicification and pyritization. In addition there is carbonatization. Host rock is phyllite, probably originally an intermediary volcanic rock.

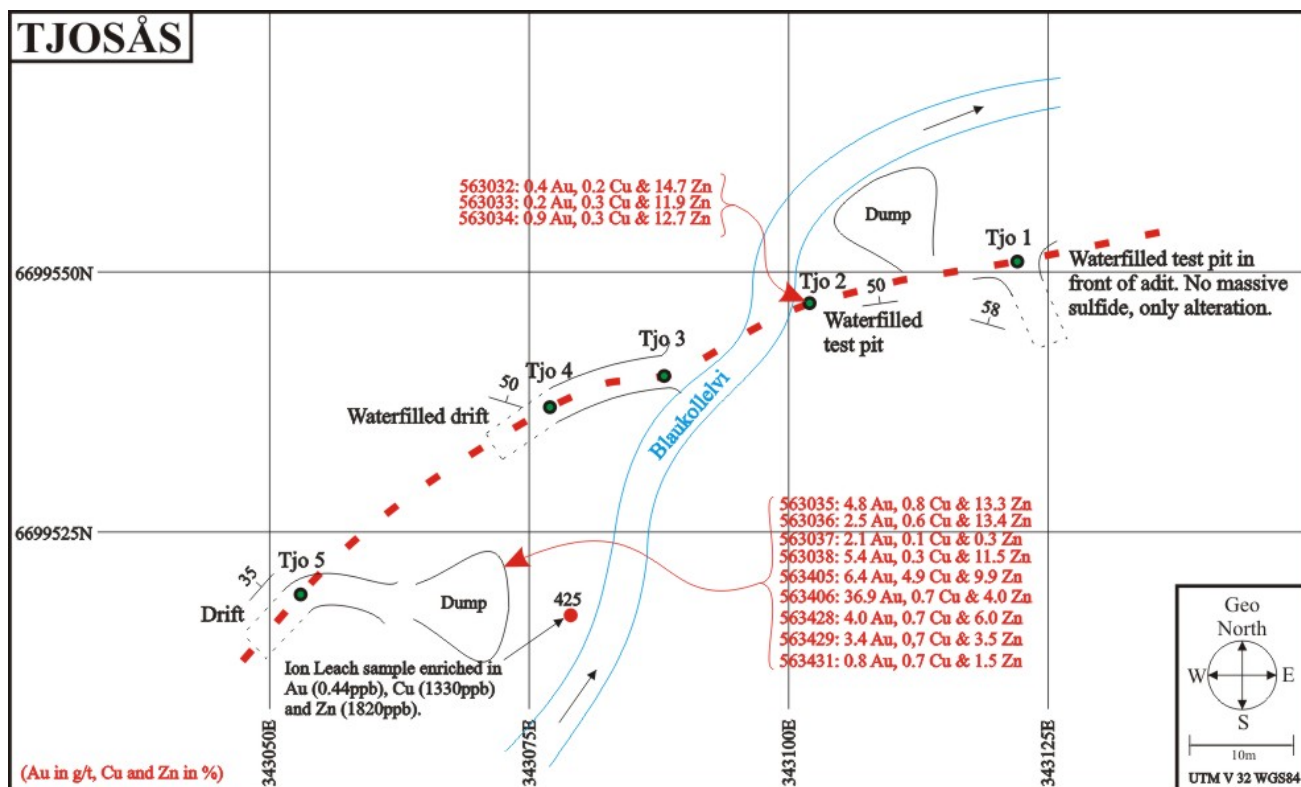


Figure 4.0.C: Map showing the old workings at Tjo1-5 and the ore samples' contents of gold, copper and zink. An Ion Leach sample enriched in gold, copper and zink was taken downhill from the dump outside Tjo5.



Figure 4.0.D: Some of the old workings at Tjosås. There is about 75 meters from Tjo1 to Tjo5. Tjo3 and Tjo4 are behind vegetation. The creek Blaukollelvi crosses the mineralisation.

Tjo6

At UTM E342196, N6699421, c. 900 meters WSW (figure 4.1.A) of the above old workings and approximately in the strike direction, is a 2m³ test pit. There's 40-50 cm of almost massive pyrite hosted in a rusty sericite schist resembling the one in the other old workings. Strike/dip is 57°/60°W. The test pit appears to be in the same stratigraphic level as the other old workings. An at least 60 m long and >5 m thick rust zone occurs in erratic outcrops at the site. This test pit was shown to me by Dagfinn Kjosås (figure 4.0.E) who is a local farmer and part owner of the land. Three ore samples have been taken: 563115-16 & 563130. They have the same elements as the samples from the main occurrence (Tjo1-5) but there are less of the valuable ones despite the samples having higher sulphide content (table 2.0.1). One of them has almost 1.5% Zn and 1 ppm gold, however, so they are not completely barren. Some of NEAB's richest Ion Leach samples (with regard to gold, zink, uranium and arsenic) come from the immediate surroundings of this test pit – one of them (437) was taken a few meter behind Dagfinn Tjosås, i.e. in the hanging wall.



Figure 4.0.E: The test pit at Tjo6 and part owner of the area farmer Dagfinn Kjosås standing on weathered ore.

Roadcut

The roadcut is at UTM E343412, N6699542, i.e. on the gravel road leading up to Nystøl and in the strike direction from the old workings at Tjo1-5 and Tjo6. There is about 2 meters of sericite-quartz schist with disseminated pyrite and pyrrhotite. A sample of the roadcut (563420) has 0.16 ppm gold but else nothing. Embedded in the gravel road less than 4 m from the roadcut were two ore specimens. The larger weighed 4-5 kilos and contained a folded layer of almost massive and very iron rich sphalerite (see photo on front page). The specimen was crushed and the high-grade fragments together with another walnut-sized fragment of massive, iron rich sphalerite went into sample 563432 which returned 15.9% Zn and 0.7% Cu but no gold. In theory, the two ore specimens can come from somewhere else but I searched in vain for similar ones elsewhere in and along the gravelroad. So the ore specimens are assumed to come from the roadcut or very close to it.



Figure 4.0.F: The roadcut with its slightly rusty outcrop of sericite-quartz with disseminated pyrite.



Figure 4.0.G: The largest of the two ore specimens found embedded in the gravel road at the roadcut. The lower fragment was cut and polished and is also shown on the front page of this report.

Tjo7

Tjo7 is a rusty alteration zone (figure 4.0.H) outcropping in a creek at UTM E341957, N6699370 (figure 4.0.I). An Ionic Leach sample taken approximately 17 m SE of the top of the rusty part of the outcrop is NEAB's richest in copper, silver and lead. I saw no massive sulphide, only disseminated pyrite in a sericitized felsic, volcanic rock. At the time of passing the site I did not realize that the outcrop very possibly is the western continuation of the stratigraphic level hosting massive sulphide mineralisation to the East but there is little doubt that it is. The rust zone can probably also be found in a creek about 150 m farther to the west (figure 4.1.A).



Figure 4.0.H: The rust zone at Tjo7. NEAB's richest Ion Leach sample was taken below the rust zone approximately where I stood when taking this photo.



Figure 4.0.I: A close-up of the rust zone at Tjo7. Sericitic alteration with weak dissemination of fine-grained pyrite. At the GPS's antenna is a slightly more weathered zone that could very well be 1-2 cm of massive sulphide.

4.1 Ion Leach sampling

NEAB has during 2012-13 taken 905 Ion Leach samples from 29 targets in Northern Sweden. In 2013 Ion Leach sampling was also carried out at Tjosås where 134 samples were taken (figure 4.1.A & table 4.1.1). The first 39 samples were taken in mid-July and in late September another 96 samples were taken. 20 of the 96 samples were taken within 10-20 m from 8 of the richest of the first 34 samples in order to test if these samples' high contents of gold, copper, lead and zink could be reproduced – several could.

There are some important differences between the sample conditions and the soils from Northern Sweden and Tjosås, respectively:

- outcrops are very common at Tjosås so thickness of overburden rarely exceeds 2-3 meters and the average is probably only ½-1 meter. Indeed, some samples from Tjosås are partly weathered bedrock, i.e. saprolite. Thinner overburden should lead to higher contents of metal ions.
- Norrbotten is mostly rather flat and the altitude difference between the lower- and uppermost samples from each of the 29 targets is rarely larger than 20-30 m. Tjosås, however, is hilly and the altitude difference between the lower- and uppermost samples is in excess of 340 m. The altitude differences at Tjosås have led to differing vegetation and soil development which no doubt influences the soils' ability to retain metal ions – probably leading to larger variance.
- at Tjosås are many strike-parallel outcrop ridges which block the flow of groundwater and thus shield some areas from influx of metal ions from nearby weathering mineralisation. This probably leads to larger variance between the samples' contents of metal ions which in turn can lead to *apparently* more extreme values.
- average precipitation in Norrbotten is around 500 mm whereas it is around 2000 mm in the Bergen area. Groundwater flow is thus much higher at Tjosås than in Norrbotten and this probably leads to lower contents of metal ions at Tjosås, i.e more rapid dilution and removal of dissolved metal ions.
- earth worms are sometimes seen while digging holes at Tjosås, especially in the lower-lying and more vegetated areas in the SE part of the sampled area. The earth worms homogenize the soil and make it look like soil from a ploughed field. The action of earth worms probably lowers the content of metal ions in soil samples.
- soil from Tjosås is on average more fine grained and more micaceous than soil from Norrbotten. We know from target 84 in Norrbotten that fine-grained and clayey soils are capable of holding higher concentrations of metal ions.

Some of the above differences cancel out each other but I still think that a mineralisation will lead to considerably higher contents of metal ions in the soil at Tjosås than it would in a soil from Norrbotten.

Relative to the 905 Ion Leach samples from N-Sweden, the Tjosås samples have higher median contents (table 4.1.2) of gold, silver, copper, lead and arsenic but not in all cases zink despite the fact that the highest Zn content of all NEAB's Ion Leach samples comes from Tjosås.

Two of the 139 samples (425 & 437) were deliberately taken at sites where one would expect high contents of metal ions from adjacent mineralisation. Sample 425 is taken a few meters below the drift and the dump at Tjo5 (figure 4.0.C) where ion laden water coming from the richest part of the Tjosås mineralisation was assumed to pass through. Except for zink, sample 425 is not particularly enriched in the metals of interest, however. Sample 437 was taken a few meters from the test pit at Tjo6 where the soil is reddish because of high content of iron hydroxides. Sample 437 is enriched in Zn, As, Fe, Mo, U and Ba but not in Au, Ag, Cu or Pb.

The nine figures (4.1.B-4.1.J) show the contents of gold, silver, copper, lead, zink, uranium, iron, arsenic and molybdenum, respectively. The actual contents are written on the figures for samples with higher Au content than 1 ppb, higher Ag content than 25 ppb, higher Cu, Pb or Zn contents than 2000 ppb, higher Fe content than 400 ppb, higher As content than 300 ppm and higher Mo content than 25 ppb. It is seen that the richest samples generally are from the western part of the sampled area but that may have something to do with soil changes, topography and lower thickness of overburden. It is also seen that many of the samples with high contents are south of the mineralised stratigraphic level - probably because the groundwater on its way downhill mobilizes the metallic ions and redeposits them a little farther downhill.

The following 10 tables (tables 4.1.3-4.1.12) list the 10 samples that are richest in gold, silver, copper, lead, zink, uranium, iron, arsenic and molybdenum, respectively, and the ten samples that have the lowest pH. Red numbers are contents that are among the ten highest of the 134 samples. Some samples, e.g. 437, 552, 625, 638 are enriched in five of the nine elements whereas other samples are only enriched in one element. Relative to the host rock, the ore samples from Tjosås are more or less enriched in gold, copper, lead, zink, iron, arsenic, molybdenum and bismuth, i.e. metals that with the exception of bismuth are also more or less enriched in the Ion Leach samples. The uranium contents of ore samples are around or below the detection limit of 10 ppm. Uranium is mostly also low in Ion Leach samples from Tjosås but there is a clear association between high zink and uranium contents.

Gold

Sample no	Comments	Au ppb	Ag ppb	Cu ppb	Pb ppb	Zn ppb	U ppb	Fe ppm	As ppb	Mo ppb	pH
638	High in chlorite, grey.	3,61	33	464	1495	3580	114	56	28	8	7,8
430	Grey, high in muscovite.	2,81	7	955	1110	50	123	148	26	28	8,3
552	Grey, mgr sand. At rust zone.	1,44	29	22300	7670	1120	95	198	107	12	7,6
446	Grey, fgr sand.	1,09	10	378	392	90	87	93	98	8	7,7
614	Dark grey, fgr.	1,05	4	1130	302	80	12	8	9	15	6,0
436	Light brown, mgr sand.	1,04	17	1580	513	1200	98	130	40	10	7,9
462	Grey, fgr sand.	0,77	17	524	399	90	165	33	35	6	7,6
624	High in chlorite, red-brown.	0,73	15	438	790	120	18	300	42	10	7,3
562	Mostly fgr. Brownish.	0,68	9	1230	1410	180	38	368	89	11	7,0
553	Fgr, yellowish, clayey.	0,64	9	3450	755	420	95	913	745	31	8,0

Table 4.1.3: On average the samples with high gold contents have only slightly higher contents of the base metals. The sample with the highest gold also has the highest silver content. The 3.61 ppb sample is only surpassed by one other sample – one from Sjungerget in Norrbotten with 5.5 ppb. Sample 436 has 1.04 ppb gold but was taken 210 m uphill from the mineralised stratigraphic level.

Silver

Sample no	Comments	Au ppb	Ag ppb	Cu ppb	Pb ppb	Zn ppb	U ppb	Fe ppm	As ppb	Mo ppb	pH
638	High in chlorite, grey.	3,61	33	464	1495	3580	114	56	28	8	7,8
443	Reddish, fgr sand.	0,21	30	1110	590	640	43	162	209	17	8,0
566	Mgr, grey-brown.	0,40	29	917	419	910	78	143	61	17	7,9
552	Grey, mgr sand. At rust zone.	1,44	29	22300	7670	1120	95	198	107	12	7,6
580	Quite organic and high in chlorite.	0,09	28	808	224	80	25	64	5	3	6,6
631	Light brown, mgr.	0,10	19	1080	591	90	22	135	45	6	8,2
640	Grey, clayey.	0,12	18	497	579	11100	307	32	15	8	7,5
611	Brown, fgr, clayey.	0,41	18	942	62	80	21	132	7	5	7,5
591	Fgr, reddish.	0,04	18	258	257	70	4	52	<2	2	6,4
436	Light brown, mgr sand.	1,04	17	1580	513	1200	98	130	40	10	7,9

Table 4.1.4: The 10 highest Ag contents are only 3-6 times higher than the median so silver is only weakly enriched at Tjosås. There is a weak association between high silver and zink contents. Figure 4.1.C shows no clear association between the mineralised stratigraphic level and the highest silver contents.

Copper

Sample no	Comments	Au ppb	Ag ppb	Cu ppb	Pb ppb	Zn ppb	U ppb	Fe ppm	As ppb	Mo ppb	pH
552	Grey, mgr sand. At rust zone.	1,44	29	22300	7670	1120	95	198	107	12	7,6
625	High in chlorite, grey.	0,11	8	4680	1325	700	110	326	343	54	8,3
617	Brown, fgr.	0,25	10	4370	139	160	108	77	67	4	6,3
441	Grey, fgr sand.	0,23	3	3820	567	220	18	198	30	4	7,4
553	Fgr, yellowish, clayey.	0,64	9	3450	755	420	95	913	745	31	8,0
438	Dark brown, fgr sand. Quite organic.	0,07	3	2760	795	270	31	29	44	3	6,7
612	Grey, fgr.	0,11	8	2470	70	100	16	172	11	8	7,4
628	High in chlorite, mgr, grey.	0,45	13	2430	1470	270	143	298	152	35	8,1
431	Brown, fgr sand.	0,24	9	2210	743	720	37	31	9	1	6,9
570	Mgr, brownish.	0,28	4	2080	62	180	31	57	10	7	7,3

Table 4.1.5: The 22300 ppb value is extremely high, even surpassing the highest value from Keivitsa (table 4.1.2). The same sample also has the highest silver and lead contents, and one of the highest gold contents. The median content of copper is 503 ppb (40% higher than Keivitsa's), and it only drops to 454 ppb if the ten samples with >2000 ppb copper are excluded from the sample set. That is, the Tjosås samples generally have high median copper contents but the copper is still clearly enriched adjacent to the mineralised stratigraphic level (figure 4.1.2).

Lead

Sample no	Comments	Au ppb	Ag ppb	Cu ppb	Pb ppb	Zn ppb	U ppb	Fe ppm	As ppb	Mo ppb	pH
552	Grey, mgr sand. At rust zone.	1,44	29	22300	7670	1120	95	198	107	12	7,6
618	Grey, fgr.	0,27	10	565	6220	270	60	208	114	35	7,1
637	Dark grey, fgr.	0,07	2	501	3270	200	51	145	35	4	6,7
586	High in chlorite, greenish.	0,03	3	211	3080	720	30	224	22	21	5,4
584	High in chlorite, brownish.	0,10	2	1320	2990	600	10	98	16	4	6,8
587	Fgr, brownish.	0,02	2	436	2790	120	21	23	8	5	6,8
561	High in chlorite, greenish/brownish.	0,40	13	952	2320	380	83	465	1385	113	6,8
645	Reddish, mgr.	0,18	7	719	2270	530	23	189	12	12	6,7
585	Mgr, brownish.	0,12	7	507	1760	250	33	165	29	8	7,2
442	Grey, fgr sand.	<0.02	0	492	1640	370	11	153	22	4	6,5

Table 4.1.6: The samples with high lead content are with two exceptions not particularly enriched in other elements. The high lead values are concentrated along and just south of the mineralised stratigraphic level.

Zink

Sample no	Comments	Au ppb	Ag ppb	Cu ppb	Pb ppb	Zn ppb	U ppb	Fe ppm	As ppb	Mo ppb	pH
640	Grey, clayey.	0,12	18	497	579	11100	307	32	15	8	7,5
638	High in chlorite, grey.	3,61	33	464	1495	3580	114	56	28	8	7,8
437	Reddish, mgr sand.	0,10	9	227	75	2340	214	867	1450	50	7,7
623	Grey, fgr.	0,26	8	1610	972	2290	89	107	42	11	7,7
425	Grey, mgr sand.	0,44	11	1330	875	1820	38	83	17	6	7,8
463	Grey, mgr sand.	0,13	6	708	1510	1230	46	55	29	6	7,8
436	Light brown, mgr sand.	1,04	17	1580	513	1200	98	130	40	10	7,9
552	Grey, mgr sand. At rust zone.	1,44	29	22300	7670	1120	95	198	107	12	7,6
445	Grey, mgr sand.	0,33	7	1480	373	960	34	175	555	5	7,6
566	Mgr, grey-brown.	0,40	29	917	419	910	78	143	61	17	7,9

Table 4.1.7: There is far more zink than copper and lead in ore from Tjosås so one would expect that the zink content would be much higher than the copper and lead content in the Ion Leach samples. That is not the case, however, instead the median contents of copper and lead are 3-4 times higher than the median content of zink.. Samples rich in zink are also rich in uranium, especially at Tjo6 (figure 4.1.F) where the high zink contents are associated with the mineralised stratigraphic level.

Uranium

Sample no	Comments	Au ppb	Ag ppb	Cu ppb	Pb ppb	Zn ppb	U ppb	Fe ppm	As ppb	Mo ppb	pH
640	Grey, clayey.	0,12	18	497	579	11100	307	32	15	8	7,5
437	Reddish, mgr sand.	0,10	9	227	75	2340	214	867	1450	50	7,7
565	Fgr, grey.	0,26	6	1230	548	220	187	131	667	7	7,2
462	Grey, fgr sand.	0,77	17	524	399	90	165	33	35	6	7,6
628	High in chlorite, mgr, grey.	0,45	13	2430	1470	270	143	298	152	35	8,1
641	Grey, clayey.	0,21	5	632	1080	360	125	49	13	4	7,4
430	Grey, high in muscovite.	2,81	7	955	1110	50	123	148	26	28	8,3
638	High in chlorite, grey.	3,61	33	464	1495	3580	114	56	28	8	7,8
625	High in chlorite, grey.	0,11	8	4680	1325	700	110	326	343	54	8,3
617	Brown, fgr.	0,25	10	4370	139	160	108	77	67	4	6,3

Table 4.1.8: As said above, uranium is highest in samples that are also high in zink. Some samples taken at Tjo6 have high contents of both uranium and calcium. The median content (table 4.1.2) of uranium is 27 so the enrichment is only 11, i.e. not very large.

Iron

Sample no	Comments	Au ppb	Ag ppb	Cu ppb	Pb ppb	Zn ppb	U ppb	Fe ppm	As ppb	Mo ppb	pH
553	Fgr, yellowish, clayey.	0,64	9	3450	755	420	95	913	745	31	8,0
437	Reddish, mgr sand.	0,10	9	227	75	2340	214	867	1450	50	7,7
561	High in chlorite, greenish/brownish.	0,40	13	952	2320	380	83	465	1385	113	6,8
634	Somewhat organic, high in chlorite.	0,15	2	126	129	120	24	429	52	8	5,8
459	Brown, mgr sand.	0,02	1	70	209	130	14	380	52	2	7,1
562	Mostly fgr. Brownish.	0,68	9	1230	1410	180	38	368	89	11	7,0
625	High in chlorite, grey.	0,11	8	4680	1325	700	110	326	343	54	8,3
559	Reddish mgr sand	0,16	3	362	140	100	29	326	70	10	7,0
583	Fgr, clayey, light-brown.	0,40	4	362	802	160	28	317	14	9	5,3
624	High in chlorite, red-brown.	0,73	15	438	790	120	18	300	42	10	7,3

Table 4.1.9: One would intuitively expect that samples with high contents of base metals would also be high in iron, but that is not really the case. Instead, the iron rich samples are clearly enriched in arsenic and molybdenum.

Arsenic

Sample no	Comments	Au ppb	Ag ppb	Cu ppb	Pb ppb	Zn ppb	U ppb	Fe ppm	As ppb	Mo ppb	pH
437	Reddish, mgr sand.	0,10	9	227	75	2340	214	867	1450	50	7,7
561	High in chlorite, greenish/brownish.	0,40	13	952	2320	380	83	465	1385	113	6,8
553	Fgr, yellowish, clayey.	0,64	9	3450	755	420	95	913	745	31	8,0
567	Fgr, brownish.	0,40	8	448	251	160	43	211	670	8	6,3
565	Fgr, grey.	0,26	6	1230	548	220	187	131	667	7	7,2
445	Grey, mgr sand.	0,33	7	1480	373	960	34	175	555	5	7,6
551	Mgr, reddish sand, regolith.	0,33	13	199	313	120	28	145	374	18	7,9
625	High in chlorite, grey.	0,11	8	4680	1325	700	110	326	343	54	8,3
443	Reddish, fgr sand.	0,21	30	1110	590	640	43	162	209	17	8,0
628	High in chlorite, mgr, grey.	0,45	13	2430	1470	270	143	298	152	35	8,1

Table 4.1.10: The maximum content of arsenic in all NEAB's Swedish samples is 80 ppb but the maximum content at Tjosås is a whopping 1450 ppb. Six of the highest As contents are also enriched in Mo. The highest As contents are in the western end of the sampled area - as is also the case with many other elements.

Molybdenum

Sample no	Comments	Au ppb	Ag ppb	Cu ppb	Pb ppb	Zn ppb	U ppb	Fe ppm	As ppb	Mo ppb	pH
561	High in chlorite, greenish/brownish.	0,40	13	952	2320	380	83	465	1385	113	6,8
625	High in chlorite, grey.	0,11	8	4680	1325	700	110	326	343	54	8,3
437	Reddish, mgr sand.	0,10	9	227	75	2340	214	867	1450	50	7,7
618	Grey, fgr.	0,27	10	565	6220	270	60	208	114	35	7,1
628	High in chlorite, mgr, grey.	0,45	13	2430	1470	270	143	298	152	35	8,1
553	Fgr, yellowish, clayey.	0,64	9	3450	755	420	95	913	745	31	8,0
430	Grey, high in muscovite.	2,81	7	955	1110	50	123	148	26	28	8,3
586	High in chlorite, greenish.	0,03	3	211	3080	720	30	224	22	21	5,4
551	Mgr, reddish sand, regolith.	0,33	13	199	313	120	28	145	374	18	7,9
566	Mgr, grey-brown.	0,40	29	917	419	910	78	143	61	17	7,9

Table 4.1.11: The majority of the ten most molybdenum enriched samples are also enriched in several other elements so molybdenum is clearly a part of the mineralisation. This is puzzling as no ore sample from Tjosås has more than 30 ppm molybdenum.

pH

Sample no	Comments	Au ppb	Ag ppb	Cu ppb	Pb ppb	Zn ppb	U ppb	Fe ppm	As ppb	Mo ppb	pH
578	Quite organic and high in chlorite.	<0,02	0	6	24	30	5	240	5	1	4,9
605	Quite organic, dark grey, fgr.	0,06	1	30	598	40	14	67	12	7	5,2
602	Very organic, fgr, dark-brown.	0,03	1	55	22	20	9	158	6	2	5,2
583	Fgr, clayey, light-brown.	0,40	4	362	802	160	28	317	14	9	5,3
586	High in chlorite, greenish.	0,03	3	211	3080	720	30	224	22	21	5,4
589	Fgr, brown-red.	0,02	2	10	24	120	12	108	7	2	5,5
582	Quite organic, fgr, dark-brown.	0,04	4	224	38	180	4	48	<2	1	5,5
632	Grey, fgr.	0,18	4	407	620	80	58	267	93	7	5,6
595	Somewhat organic, fgr, dark-brown.	0,18	3	317	487	170	45	154	33	16	5,8
634	Somewhat organic, high in chlorite.	0,15	2	126	129	120	24	429	52	8	5,8

Table 4.1.12: Oxidation of sulphide mineralisation can pollute the overburden with metal ions and lower its pH. However, at Tjosås there is almost no high metal contents among the samples with the lowest pH. This could e.g. be caused by the sub-cropping sulphide mineralisation is too small to lower pH, or that there is sufficient carbonate in the ore or host rock to neutralize the acid generated from the oxidation of sulphides, or that groundwater flushes out H^+ ions as soon as they are formed. The occurrence of the word “organic” in the description of six of the low-pH samples suggests that the soil’s pH at Tjosås has more to do with decomposing vegetation than with oxidation of sulphide mineralisation. The location of the 10 samples with the lowest pH is shown on figure 4.1.A. Some of these acidic samples are just south of the mineralised stratigraphic level but I wouldn’t put too much weight on that.

5.0 CONCLUSION AND FURTHER WORK

Storhidleren

The drilling of the 650 m long hole at Storhidleren confirmed that the chert horizon associated with high-grade gold mineralisation in the old mine continues down dip – as was also indicated by NEAB's airborne geophysical survey. The intersection of chert deep down-dip from the storhidleren mine increases the probability that the other magnetic highs east of Storhidleren are also caused by chert. Unfortunately, the chert horizon in the intersection in hole St5 is not associated with gold mineralisation.

Hatlesteinsvatnet

The showings at Hatlesteinsvatnet are of no further interest.

Tjosås

The Ion Leach sampling carried out at Tjosås does with some accuracy indicate the presence of mineralisation. Some of the 134 Ion Leach samples have very high contents of gold, copper, lead and zink that easily rival samples from all the Swedish targets and from Keivitsa. It is especially interesting that many of the Tjosås samples are enriched in 2-3-4 of the elements that also occur in the old workings. The strike length of the mineralised stratigraphic level at Tjosås was increased from 900 m to >1400 m. A strike length of >1400 m increases the chance of also finding mineralisation at depth.

The Tjosås project can be progressed by more Ion Leach sampling and/or ground geophysical surveying.

Ion Leach sampling

It is suggested to continue the Ion Leach sampling in the strike directions towards west and east (figure 5.0.A). About 130 samples will suffice and the program will cost around SEK 80,000, all included.

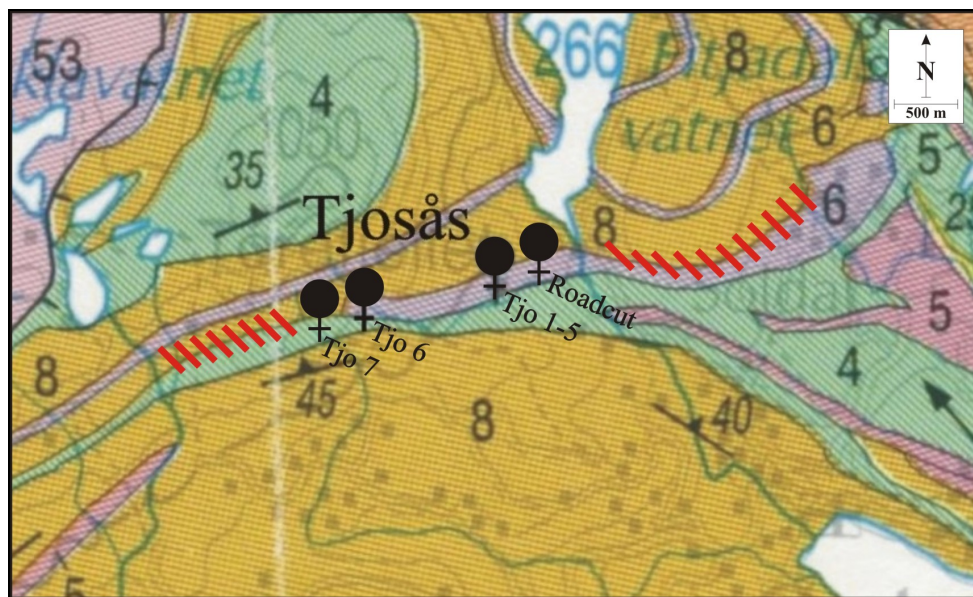


Figure 5.0.A: Further Ion Leach sampling is suggested in the red-striped areas in the strike directions of the known mineralisation.

Ground geophysical surveying

A geologist has suggested that NEAB try out a low-cost geophysical method called *MaxMin*. The method is a more sophisticated version of what in Sweden is known as *Slingram*. Two geophysicists (one of them independent) were asked if Slingram would be applicable to a place like Tjosås and both said that it would. Large areas can quickly be surveyed with the Slingram method and the method is straightforward; one worker carries a transmitter coil that via

a cable is connected to another worker who carries a receiver coil (figure 5.0.B). The transmitter coil generates a primary electromagnetic field that, if a conductor is present, generates a secondary electromagnetic field which is then detected by the receiver coil. The two coils are carried on traverses perpendicular to the assumed strike direction of the conductor and a reading is taken each, say, 20 m. In case a conductor is sensed, the workers will immediately know and more detailed surveys can be carried out in order to establish a fairly accurate location of the conductor. A newly erected power line (figure 4.1.A) crosses the mineralised stratigraphic level and will no doubt disturb geophysical surveying in its vicinity, say 100-150 m on both sides. Another problem is the presence of graphite schist which has been noticed in a gully and in a blasted outcrop under one of the power line towers. Both the mineralised stratigraphic level and the graphite schist are stratabound. The graphite schist has not been seen in the mineralised stratigraphic level so it may be possible to distinguish between a geophysical response from the mineralised stratigraphic level and one from a graphite schist. Hiring a Slingram from Swedish Malå Geoscience costs SEK600/day, i.e. same price as for a magnetometer. Seven days of surveying would cost around SEK75,000, all included.

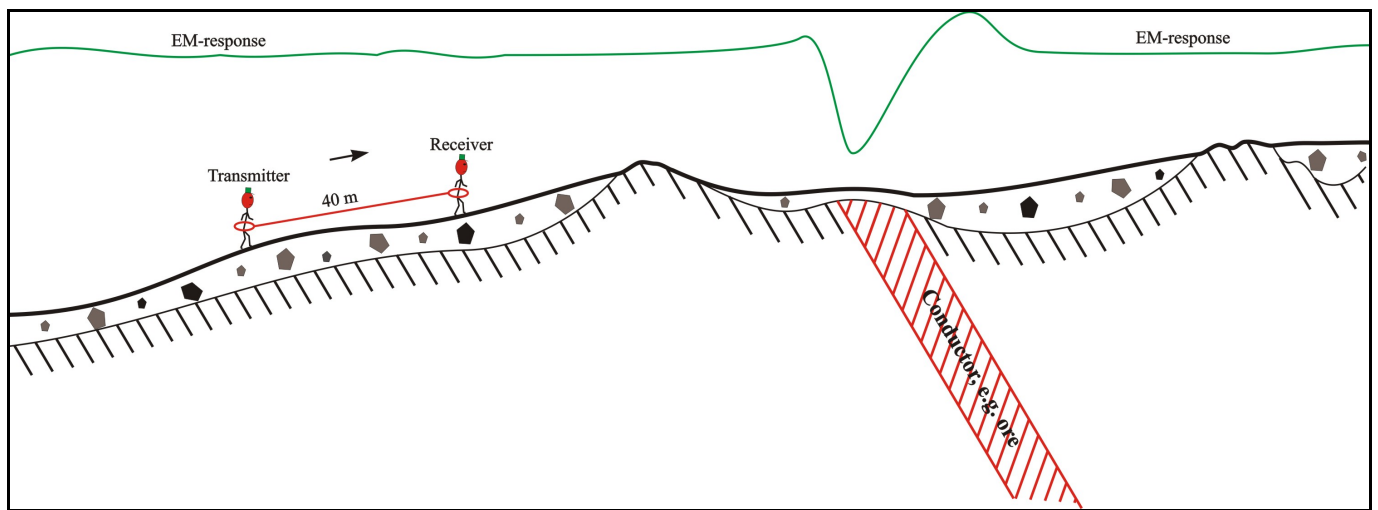


Figure 5.0.B: As a Slingram survey at Tjosås could look like.