Bergvesenet

Postboks 3021, 7002 Trondheim

Rapportarkivet

Bergvesenet rapport nr	Intern Journal nr	Internt arkiv nr	Rapport lokalisering	Gradering
BV 3975	1720/93		Trondheim	**Fortrolig**
Kommer fra ..arkiv	Ekstern rapport nr	Oversendt fra	Fortrolig pga	Fortrolig fra dato:
		Egil Livgard	Muting	

Tittel

Report on Kells Creek Property, Oppdal, Norway

Forfatter	Dato	Bedrift
Egil Livgard	25.10 1993	Consolodated Logan Minees LTD Kjell Arve Isbrekken

Kommune	Fylke	Bergdistrikt	1: 50 000 kartblad	1: 250 000 kartblad
Oppdal	Sør-Trøndelag	Trondheimske	15194 15203	Røros

Fagområde	Dokument type	Forekomster
Geologi geofysikk geokjemi	Rapport	Gråurfjellet
Råstofftype	**Emneord**	
Malm/metall	Au	

Sammendrag

Konklusjon:

1) High grade gold mineralization has been located in gneiss blocks.
2) The property covers a window which exposes gneis from which, it appears, these mineralized blocks have been derived.
3) Similar mineralizations, but of lower grade, has ben located in several outcrops.
4) The source of the high grade blocks has not been located.
5) The high grade mineralization lies in quartz, K-feltspar gneiss which has undergone some deformation and been sligthly altered.
6) The area rock around Kells Lake has what appears to be the same rock type. It has ben folded, faulted and fractured (Kells Lake = Kjells Lake is the lake close to **dicovery site** of "Isbrekkitt" comments by Lieungh, Bergvesenet).
7) The Kells Lake area is spatially associated with the high grade blocks.
8) The Kells Lake area is the primary exploration target area.
9) Along the western boundary of the intrussive body to the east lies a zone of low resistivity. This area also should be explored further.

Report on the

KELLS CREEK PROPERTY

Oppdal, Norway

Prepared for:
CONSOLIDATED LOGAN MINES LTD.

Prepared by:
Egil Livgard, P.Eng.
LIVGARD CONSULTANTS

October 25, 1993

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SUMMARY

The Kells Creek property was staked by the prospector in early 1992 following the location of some very high grade gold gneiss blocks. Selected high grade assayed up to 200 g gold and 2,000 g silver per tonne. Consolidated Logan Mines optioned the property in early 1993 following an examination. Some more claims were acquired and the property then consisted of 111 claims, 300 x 1,000 m each, covering a total of over 30 square kilometres. The 1993 exploration consisted of prospecting, geological mapping and geophysical surveying on a square grid which extended over approximately five square kilometres and, based on preliminary prospecting, covered the most favourable area of the claims. The mapping outlined gneisses which generally showed a north-south strike and an easterly dip of 30-40°. It appeared that the gneisses had been tightly isoclinally folded. Foliation and cleavage appeared in most cases to be parallel to the fold axis. The main block of gneiss was called biotite gneiss as it was rather dark because of its variable content of biotite which averaged an estimated 10-15%. Other gneisses were generally lighter and one band was named white gneiss. It consisted of quartz and light pink K-feldspar with minor plagioclase and muscovite. This rock type appears similar to and may be the same as that which gave the very high grade values in the initial locations.

On top of the white gneiss lies a conglomerate which served as a useful marker horizon. The contact area is a zone of some change; around Kells Lake the contact has contorted schist to schistose gneiss and it may have been a zone of movement. The contact area has in some places been invaded by amphibolite mapped as separate lenses. The underlying gneiss has undergone some alteration in that K-feldspathization has occurred and pyrite has been concentrated to a small degree. The contact zone is a zone of weakness and may represent depositional hiatus. The conglomerate wedges out to the north and its place is taken by porphyritic gneiss.

To the east is found a large area with irregular outline of a homogenous non-foliated rock consisting of quartz, K-feldspar and muscovite with minor plagioclase. it has been termed intrusive.

Several faults have been mapped as well as a number of fractures.

The geophysical survey covered about 120 km on a box grid. The results corresponded very well with the mapped geology and aided in its interpretation. Low resistivity zones were outlined along the white gneiss and along the west boundary of the intrusive. The high grade blocks contains copper, gold, silver, zinc, lead, tellurium-selenium and opal - apparently low temperature deposition. The rock type is a quartz, K-feldspar gneiss which has undergone some deformation and minor alteration.

Mineralization consisting mainly of copper and values in gold and silver has been found in several places, particularly near or in the contact area of the white gneiss. The source of the very high grade gold mineralization has not been located. The area around Kells Lake appears as a likely source area of the high grade blocks. It has the right rock type, folding, faulting, and fracturing.

An aerial survey was flown over part of the property by NGU on behalf of the company in September, 1993. The results are not yet available.

A program consisting of some follow-up mapping, sampling and diamond drilling of 800 metres is recommended for 1994. It is estimated to cost $142,000. If the results are favourable, a second stage of drilling of 1,200 metres is recommended, at an estimated cost of $181,000.

CONCLUSIONS

1. High grade gold mineralization has been located in gneiss blocks.

2. The property covers a window which exposes gneiss from which, it appears, these mineralized blocks have been derived.

3. Similar mineralization, but of lower grade, has been located in several outcrops.

4. The source of the high grade blocks has not been located.

5. The high grade mineralization lies in quartz, K-feldspar gneiss which has undergone some deformation and been slightly altered.

6. The area around Kells Lake has what appears to be the same rock type. It has been folded, faulted and fractured.

7. The Kells Lake area is spatially associated with the high grade blocks.

8. The Kells Lake area is the primary exploration target area.

9. Along the western boundary of the intrusive body to the east lies a zone of low resistivity. This area also should be explored further.

INTRODUCTION

The writer spent two months from June 15th to August 15th, 1993 supervising exploration and mapping the geology on the Kells Creek property in Oppdal, Norway. This report summarizes the results of that work, presents some conclusions and suggests the thrust of future exploration.

The work consisted of geological mapping, geophysical surveying, and rock and silt sampling. The work was hindered to a degree by the worst weather the area has experienced in 40 years. The geophysical results corresponded to the mapped geology to a very satisfactory degree, but the geology proved to be more complex that anticipated. If exploration continues to generate positive results, much more effort must be put into geological mapping. It should be noted that all degrees in this report and on all maps are based on a 360° circle.

The writer was assisted by a very capable crew which varied between three and six men. Their efforts were very much appreciated. Local geologist Milosh Motys spent a short time with the writer on the property and his suggestions, thoughts and mapping were invaluable.

This report is based on the above work and references listed.

Norway's Geological Survey (N.G.U.) was commissioned by the company to do an aerial geophysical survey covering about 18 square kilometres. The survey had to be done in the fall when most of the snowdrifts were gone. It was flown on September 18, 1993. The results are not as yet available.

PROPERTY

The property consists of 111 "mutinger" (approximately equivalent to Canadian claims) which each cover an area 300 x 1,000 metres or 30 hectares for a total of 3,330 hectares or 33.7 square

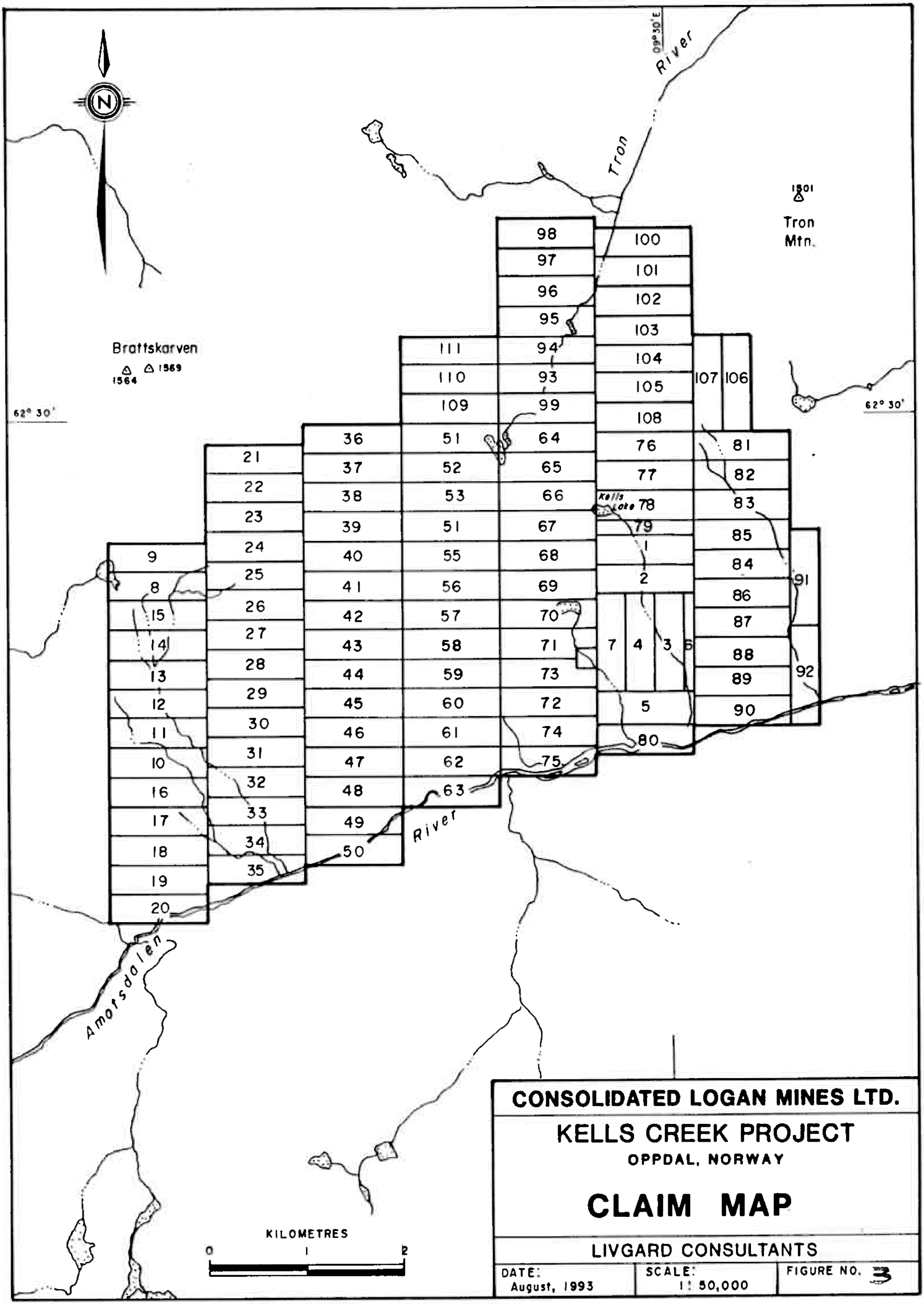
FIGURE 1
LOCATION MAP
SCALE: 1 : 800,000

FIGURE 2

Fig. 7. Avsmeltningsmorene og eskere øst for Orkelsjøen. Veien følger en av eskerne. Foto: A. J. Reite, 1987.

Fig. 9. Usammenhengende eller tynt morenedekke sør for Stuggusjøen, med enkelte arealer som består av bart fjell. Foto: A.J. Reite, 1987.

Typical terrain above treeline - much rock exposure and locally derived float. Thin intermittent glacial cover.


Tron River
09°30'E
1801
Tron Mtn.
Brattskarven
1564
1569
62° 30'
62° 30'
Kells Lake
River
Amotsdalen
KILOMETRES
0
1
2
CONSOLIDATED LOGAN MINES LTD.
KELLS CREEK PROJECT
OPPDAL, NORWAY
CLAIM MAP
LIVGARD CONSULTANTS
DATE: August, 1993
SCALE: 1: 50,000
FIGURE NO. 3

kilometres. The claims are in the name of Kjell Arve Isbrekken, and are in good standing until December 31, 1993 when a fee is payable.

LOCATION AND ACCESS

The claims are located in south-central Norway in the municipality of Oppdal. The main highway and the railway between Oslo and Trondheim pass through the centre of the municipality. Oppdal is a well-known winter sports centre, hosting a world cup downhill race in 1993. The main economic activity is farming.

The property lies in the mountains approximately 18 kilometres south southwest of the centre of the municipality. It lies on a peneplain about 1,200 metres above sea level, well above treeline. The peneplain extends north and west. To the south is the deeply incised Aamot Valley from which a walking trail 3-4 kilometres long extends onto the peneplain and the claim boundary.

Road access (4x4 drive) extends to within 3 kilometres of the west boundary of the claims. A number of hunting (reindeer) and fishing cabins at the termination of this road are the closest cultural activities.

Helicopters are stationed at Trondheim, 120 kilometres to the northeast. The city of Trondheim is the location of the head office and laboratories of the Norwegian Geologic Survey and also of Norway's main engineering university.

CLIMATE

The climate in Norway is moderated by the warm Gulfstream and, in spite of being located at the approximate latitude of 62°N, the weather is comparable to, although somewhat colder than, that of British Columbia. The property, which is at an elevation of 1,200-1,400 metres above sea level, has snow cover from October until June. The terrain is barren and relatively flat, and strong winds pile snow in "lee" areas and gullies and this drift snow does not melt until well into the summer season.

The summers usually have pleasant temperatures, and little rain and daylight almost around the clock.

HISTORY

In the fall of 1991, Mr. Kjell Arve Isbrekken, a prospector, located a large (50 x 60 x 20 cm) block of granitic gneiss which contained native gold, sulphides and copper staining. Pieces of this were examined at the Norwegian Geologic Survey (N.G.U.). The Geologic Survey found, among other things, a mineral which apparently has never previously been identified. It is a tellurium-selenium oxide(?), vitreous green-blue in colour.

Two selected pieces of the mineralized block were sent for analysis. The results yielded high gold values and the area was then staked.

No previous mineral exploration has taken place on or around the property and the only "mining" activity in the municipality is quarrying of "Helleskifer", thin plates of meta-sediments used for roof cover and other building stones.

The nearest mine lies 30 kilometres to the southwest. It was a producing mine (2,000 tons per day up until eight months ago) from a volcanogenic massive sulphide deposit.

A well-known copper mining district, Røros, lies 100 kilometres to the east. It operated for several hundred years but shut down a few years ago.

Consolidated Logan Mines Ltd. entered into an agreement with the prospector after examining the property in 1992. Additional claims were acquired. During the 1993 exploration season, geological mapping, sampling and geophysical surveying was carried out on a 120-km grid. Stream silt sediments were collected around the periphery of the property. Rock chip samples were collected from mineralized, oxidized and altered outcrops and minor soil sampling was also carried out. All samples were analyzed in Vancouver, B.C. That work is the subject of this report.

In September, 1993, a geophysical aerial survey was carried out for the company by Norway's Geological Survey (NGU) over most of the property.

WORK PROGRAM

The 1993 exploration program consisted first of regional prospecting and examination. Based on this the grid system was laid out. The grid system extended east-west over 2.5 kilometres - a few lines were from 1.0 km to 1.5 km. 27 lines were run 100 metres apart for a total of 58.8 kilometres. Lines were also run north-south 100 metres apart for a total of 54.0 kilometres. A few lines west added up to 8.5 kilometres. Stations were established every 25 metres.

All the grid lines added up to 121 kilometres. This grid was used for geological mapping and geophysical surveying using a Scintrex IGS-2 field unit. The results were processed and maps plotted in Vancouver.

Rock sampling was carried out where mineralization and/or alteration was noted. The sampling program was limited because of the inability to get quick turn-around on assays. A total of 46 stream silt samples were collected. The results were not good even downstream from known mineralization. It is believed that a heavy mineral survey might have been more useful.

The amount of time allotted to geology was limited, amounting to no more than 14 days due to supervisory duties and travelling, etc. Follow-up work must continue the geological mapping.

GEOLOGY

REGIONAL GEOLOGY

The property lies in an area of granitic gneiss of Middle Proterozoic age which forms the base of and is surrounded by a number of thrust faults. These faults have moved Proterozoic to Ordovician rocks over the basal gneisses. The thrusting took place in the Silurian-Ordovician age during the Caledonian mountain building. Erosion later exposed the Middle Proterozoic gneisses in a window bounded on the east by a pronounced northerly trending series of thrust faults and thrust sheets consisting of gneisses, schists, meta-arkose, quartzites, conglomerate and calcareous phyllite. To the south, the same rocks strike east northeast. More than a dozen thrust sheets have been identified.

The extensive thrust faulting has created very complex age relationships.

The oldest rock type in the area, the Graaurd Gneiss, is a basement rock of Middle Proterozoic age, consisting of:

> *"orthogneisses, mainly of granitic and granodiorite composition. The gneisses vary from homogeneous to compositionally layered and from weakly to strongly foliated. They are generally medium grained; small K-feldspar augen are present, but are only very rarely larger than a centimeter across. Younger mafic and felsic dikes and other small intrusive bodies are common. Generally these intrusions too are strongly deformed and are concordant with the surrounding gneissic foliation, but some of the intrusions cut earlier metamorphic foliations."*
> (NGU, Alan Krill, 1980)

There has been three periods of folding. The oldest consists of tight folds, occasionally isoclinal, with metamorphic minerals aligned with the fold axis indicating the main metamorphism took place during the first folding event, presumably in the Middle Proterozoic. Later folding was more open.

The last phase of the Caledonian mountain building was characterized by a partial regression of the overthrust rocks. Some zones or structures along this regression show a retrograde metamorphism. This retrograde metamorphism is often characterized, for various reasons, by a relatively high salt content (Trond Skyseth, Ph.D. Thesis, Buffalo, N.Y., 1993). This may be favourable for the type of mineralization on the property.

PROPERTY GEOLOGY

Mapping during the 1993 field season occupied no more than 12 to 14 days and only a rather general rocks classification was used.

Rock exposures are plentiful on the north facing slope into Tron River, poor on the south facing slope north of the river, moderate on the south facing slope toward Kells Lake west of the lake, while east of Kells Lake, exposure is almost non existent.

Rock Types

Biotite Gneiss: The main rock type on the property is a relatively dark gneiss which contains varying amounts of biotite - from 5 to 50% - but on the average about 10-12%.

It contains more plagioclase, less K-feldspar and perhaps less quartz than the other gneisses on the property. A large part of the biotite gneiss is coloured from light to dark brown by iron oxide from pyrite. The colouring is in north-south bands, generally following rock foliation. The strongest colour is associated with increased contortion in increasingly schistose gneiss. The main oxide colouring is on the west end of the grid near the main Tron Tjern (Lake). It decreases going east and south.

Several small intrusive bodies have been tentatively noted here. The biotite gneiss extends from west of the main Tron Tjern to almost 1.0 km east of the lake. Outcrops just west of the thrust fault on the east part of the property show another body of biotite gneiss with abundant epidote grains.

Conglomerate: The groundmass looks grey and consists of biotite, muscovite and quartz-feldspar. It is quite schistose. A relatively small amount (for a conglomerate) of well rounded quartz and feldspar fragments ranging up to about 20 cm in diameter is relatively evenly distributed. The rock exhibits tight internal folding, drag folding and ptygmatic folding. The rock type is well exposed west and south of Kells Lake and 1.0 km to the southeast at another small lake and also in some large outcrops on the west part of the property which has not been mapped.

This rock type is very useful as a marker horizon . The outcrops at the Kells Lake show a complexity which is not yet understood and this complexity can be projected to the other rocks and removes the deceptive idea that their relationship is simple.

White Gneiss (Sample 3): This rock type consists almost exclusively of quartz and light pink K-feldspar in about equal proportion. Characteristically it has a slight light brown colouring in patches. They may have been a felsitic volcanic or arkosic sandstone.

Porphyritic Gneiss (Sample 8): Plagioclase is the dominant feldspar in the rock type and it also has a relatively high biotite content. A petrographic study (of a sample of the rock type taken about 1.0 m above a conglomerate bed) estimates 42% plagioclase, 16% biotite and a surprising 10% epidote. A comment about the phenocrysts in the examined cut: "K-feldspar concentrates as occasional irregular porphyroblasts (or relict phenocrysts or clasts)". The origin of the rock type is uncertain. It is in one place closely associated with conglomerate (grid 950E - 200S).

Granitic Gneiss: This gneiss has the look and composition of granite with high K-feldspar content.

Light Gneiss: This rock type is blocky homogenous and has low amounts of biotite, very much quartz, minor plagioclase, and very little K-feldspar.

Intrusive (Sample 1): This rock type is light, homogenous, non-foliated and has a sugary feel to it. The studied cut was estimated to contain 50% quartz, 36% muscovite, and 10% K-feldspar. In rock outcrops which are almost continuous over several hundred metres the content of muscovite is considered to be quite a bit lower while the K-feldspar content is higher. The rock was thought to be an intrusive because of its homogenous look and lack of foliation. Fine grained hematite is disseminated evenly throughout the rock. Occasional small patches of limonite associated with a dark blue-black mineral (?) was noted. The petrographic study indicates that the hematite has higher concentration with the muscovite. The boundary of the rock type is covered where examined but stands out on aerial photos. At the northeast boundary, considerable fragments of keratophyre (?) were noted. The contact area is either an intrusive one or a thrust zone if the 500-metre wide exposure consists of a thin overthrust gneissic sheet. A small area of younger rocks - an overthrust remnant - lies south of and in contact with the above intrusive or gneiss (contact not examined).

Quartz - K-Feldspar - Hematite: This rock type is very coarse with crystals ranging up to several centimetres. It forms stubby lenses and short veins confirming to foliation. The hematite is grey metallic, harder than normal and has a dark brown, almost black, only very slight reddish streak yet spectrographic analysis has shown it to be hematite. The rock type is found in the biotite gneiss and possibly located in dilational fractures related to the broad secondary folding.

Amphibolite: It occurs as lenses and short streaks usually in the contact area between conglomerate and the underlying white gneiss.

Biotite-muscovite schist is noted in several places usually in narrow very contorted bands associated with zones of supposed movement.

Structure

Folds

The Proterozoic gneisses which underlie most of the property are isoclinally folded (pre-Cambrian) and show broad folds, striking 145° to 210° (Az) and dipping varyingly from 0° to 68° to the east. The majority of the rocks have, however, attitudes from 160° to 180° (Az) and dip 30° to 40° east.

Most of the measured strikes and dips are foliation (and cleavage) and only very seldom was a true bedding noted as being different to the foliation (an exception is of course the conglomerate marker - horizon). Sufficient change has taken place in the gneisses to obliterate most bedding features and only broad rock changes will indicate true strikes and dips. It appears that the bedding strike is in some cases slightly (10-20°) more easterly and the dip steeper than that in the foliation. In an ideal fold and cleavage relationship a bedding dipping steeper than the cleavage indicates that the bed is overturned. In this case the metamorphism and (probable) very tight isoclinal folding makes that assumption uncertain and the cleavage-foliation as defined by the preferred orientation of mica, and bedding may be parallel to each other and to the fold axis. Obliteration of fold axis may have taken place by discontinuous parallel to the plane of the fold limbs and further increasing the difficulty of understanding the structures.

Some folds have been indicated on the accompanying map, but these are highly speculative including the folds indicated in the conglomerates at Kells Lake. The relationship here could be due, at least in part, to thrust faulting between the conglomerate and the underlying white gneiss and normal faults west and south of the lake.

The area appears favourable for mineral deposition in or near the fault zones in the white gneiss.

Faults

A large number of faults, indicated or possible faults, probable fractures and other lineaments have been mapped and designated Fa to Fv (22). Each one will be briefly discussed.

Fa is a major fault with unknown displacement. It has been mapped as a trough 2-3 metres deep and 20-25 metres wide. It strikes east-west bending toward the north going east (4-5 km) and toward the south going west (6-7 km). The dip is steep possibly toward the south. Geological mapping did not with confidence correlate rocks north and south of the fault. The magnetic survey indicated a marked change in response on each side of the fault. The VLF-EM did note a strong response along the fault.

Fb is a structure parallel to Fa lying about 300 metres to the north. It is a trough about 2 metres deep and 5-10 metres wide. Geological mapping noted possible displacement and bending of some beds adjoining the structure . The geophysical ground surveys did not note the structure.

Fc is a probably fault which appears to strike about 130° Az and dip to the northeast. At its southeast end, it is the bed of Graaurd Creek. At its northwest end down to Tron River, it is a gully about 20 metres wide and 2 to 3 metres deep. It may connect to and indeed be the same of ***Fs***, lying in a similar gully, on the facing hillside across the Tron River. If they are the same, the change of strike on each hillside indicates a northeast dip of about 18° and thus a thrust fault. ***Fr*** and ***Fq*** may represent a parallel thrust fault to the east as may ***Fu***.

Fg strikes about north-south and dips 24 to 34° east. It is the contact between white quartzose gneiss to the west and conglomerate-porphyry-light gneiss to the east. The contact area contains occasional lenses and streaks of dark greenish amphibolite. Their maximum dimension is about

2 metres wide by 20 metres long, but most occurrences are smaller. The white gneiss is slightly pink due to K-feldspar and it takes on an increasing red colour as it approaches the contact. The colouring is thought to be caused by hematite staining, increasing silicification is indicated and pyrite, now partly oxidized, is concentrated near (at) the contact. A highly micaceous schistose layer with some white flecks (3-4 mm) of feldspar (?) was occasionally noted in or near the contact zone below the conglomerate.

This zone is believed to represent a hiatus in sedimentary deposition which has later been intruded by basic dykes. It may, before or during dyke emplacement, have served as (weak?) hydrothermal channelway and may also have been the location of thrust faulting.

To the north the zone appears to end against fault Fa. Alternatively it may have been shifted east by an apparent right-handed movement of about 150 metres. Structure ***Fe*** is located here and is similar in many respects. ***Fe*** structure may connect to or be the same of ***Fv*** on the north side of Tron River. Two other north-south striking features, ***Fd*** and ***Ff***, consist of very contorted micaceous schist bands lying in and near low topographic expressions. The schist is at times quite brown from oxidized pyrite. These features are later than the east-west fault Fa. They are though to represent zones of movement which appear to dip steeply.

Fh strikes about 25° east of north and dips 60 to 80° to the east. it is a silicified oxidized zone with contorted schist which has been caused by minor movement. To the south a fold has accommodated the movement in less competent rocks. Several other minor zones striking a little east or west of north consisting in part of contorted schist accompanied by oxide (pyrite) has been mapped. ***Fp*** which strikes parallel to ***Fh*** has perhaps caused unknown displacement of the marker horizon conglomerate beds at Kells Lake. The existence of ***Fp*** is somewhat speculative. ***Fo*** is another parallel very similar zone.

Fk strikes 75° Az. It consists of a well-defined depression about 1.5 metres deep and 5 to 10 metres wide. It appears that rocks on each side have been displaced, although at Kells Lake the displacement of the conglomerate is minor or non-existent.

Fm is a purely speculative zone noted down in an attempt to clarify the geology at Kells Lake. Several lineaments which may represent faults were noted on the aerial photos, i.e. ***Fi, Fj, Fl, Fn, Fw, Fy***. These lineaments correspond to low topography and, in most cases, no outcrops can be found.

Fx is exposed in the steep, south-facing hillside south of Kells Creek. It is 10-15 metres wide and appears to conform to foliation (and bedding?). It strikes northerly and dips 30-40° east. There has been movement in the zones as suggested by contorted schist lenses, very black biotite boundaries of the footwall and hanging wall, introduction (?) of quartz and copper mineralization with gold values. The significance and extent of this zone is unknown. It did not respond to the geophysical survey.

Lineaments ***Fs*** and ***Ft*** occupy gullies 4-6 metres deep and 10-20 metres wide. Fs may be an extension of thrust fault (?) Fe. Ft strikes parallel to minor fault ***Fh*** and may also be a zone of movement. Black (smoky) quartz is conspicuous in these gullies.

Alteration

Alteration which may be due to hydrothermal action has been noted as K-feldspathization at he contact between the white gneiss and the overlying conglomerate. This zone also contains some pyrite, some basic lenses, probably dykes, and one outcrop (on the southwest corner of Kells Lake) which shows contorted biotite-muscovite schist with talc, indicating possible movement.

The pyrite content (surface limonite) in the biotite gneiss, in view of its spacial distribution and its slightly elevated gold content, may either be hydrothermally introduced and related to nearby intrusions and/or the pyrite may perhaps be from original constituents and metamorphically remobilized and deposited preferentially in fractures and zones of movement striking north-south.

Red hematite staining may be a secondary alteration feature and a possible exploration guide.

Minor zeolite has been found in many places. If it is associated with hydrothermal action, which seems probable, it may not be particularly useful as an exploration guide due to its numerous locations. Minor biotite alteration to chlorite was occasionally noted (regressive metamorphism?).

Muscovite occurs frequently above (?) the main body of biotite gneiss. The white gneiss has minor muscovite - no biotite. The "intrusive" has muscovite in long thin streaks curving (folded?) and occasionally crossing (see metamorphism).

Metamorphism

The local metamorphism is a low grade green schist with development of epidote, chlorite and muscovite. Epidote is widespread and finely disseminated, particularly in the eastern biotite gneiss. The large area, designated as "intrusive" just to give it a name but subject to reclassification with future work, consisting of quartz, K-feldspar, muscovite and hematite has been pervasively changed with the formation of muscovite in very irregular streaks throughout, fracturing (?) and formation of hematite.

Gold is relatively mobile during metamorphism. Research confirms the possibility of the formation of gold deposits by the leaching of gold from various rocks by metamorphogenic hydrothermal solutions (Boyle, Chemistry of Gold).

Mineralization

Several large mineralized gneiss blocks up to an estimated 50 kg was located by the prospector in 1991-92 on the area now covered by the claims. Samples of selected high grade from these blocks have assayed up to 200 g/tonne gold and 2,000 g/tonne silver. These blocks were found on top of glacial outwash material or glacial till never in the glacial material. However, only limited excavation has been done to date. The material consists of highly rounded clasts, sand and clay. The blocks were angular, fractured and partly oxidized and therefore relatively weak. It is thought that they would not have survived long transport.

The mineralization is found in a quartz-feldspar gneiss. A very similar (same?) rock type has been mapped on the claim ground as white gneiss but the source of the high grade has not been located.

The mineralization occurs as interstitial patches, replacement patches in deformation breccia or fracturing, as replacement along fractures, and as open space filling.

The minerals are native gold seen with relict chalcopyrite, bornite, pyrite, chrysocolla, opal, and an unidentified mineral which may be the new tellurium-selenium oxide tentatively names ***Isbrekkenite*** after the prospector/locator. Chalcopyrite and bornite have been partly altered first to chalcocite-coverlite and later to hematite/limonite and malachite. The bornite contains ex-solution lenses of chalcopyrite. Galena was noted in one patch of pyrite. High tellurium values (3.9%) were obtained in one sample and it seems likely that gold-telluride minerals will occur. Zinc values (1.3%) were also obtained but sphalerite has probably oxidized as none was seen. Sphene which has been slightly altered to Ti-oxide and leucoxene was noted. One sample contained barite, which is frequently associated with gold.

Some of the mineralized samples were as follows:

No. 1	Quartz-feldspar gneiss block - selected high grade (ICP?) 190 g gold and 2,100 g silver per tonne 9.9% Cu, 1.3% Zn, 3.9% Te, 0.39% Pb, 0.15% Bi (prospector)
9528	Quartz-feldspar gneiss block - selected high grade 6.44 oz gold and 22.3 oz silver per ton (fire assay) 0.897 % Cu, 0.33% Pb (ICP) (company)
9529	White gneiss outcrop weakly spotted and streaked by limonite 0.679 g gold and 8.1 g silver per tonne (ICP)
9534	A highly quartzose (silicified?) copper stained block 0.22% Cu, 2.05 g gold and 8.8 g silver per tonne (ICP)
9536	Quartz-feldspar outcrop - gneiss slightly tectonically deformed - light K-feldspar alteration 0.383 g gold and 4 g silver per tonne (ICP)
9538	Quartz-feldspar gneiss block - selected by the writer for minimum mineralization 0.487 oz gold and 1.65 oz silver per ton (fire assay) 0.42% Cu
9662	Biotite gneiss outcrop - limonite 3ppb Au (ICP)

9663	Biotite gneiss outcrop - limonite 29ppb Au (ICP)
9664	Biotite gneiss outcrop - limonite with malachite and chrysocolla in fractures 4895ppm Cu, 882ppm Pb, 16.4ppm Ag, 68ppb Au (ICP)
9669	Biotite gneiss - Fx zone - partly contorted - quartz malachite and chrysocolla 9258ppm Cu, 30.4ppm Ag, 440ppb Au
9670	Quartz-feldspar gneiss block at Kells Lake 15,696ppm Cu, 253.4ppm Ag, 14,800ppb Au (ICP)
9672	Trench -biotite gneiss - quartz malachite 40,807ppm Cu, 224.2ppm Ag, 1850ppb Au
9681	Trench - white gneiss - biotite gneiss contact (800E-300S) 16,252ppm Cu, 108.6ppm Ag, 1820ppb Au (ICP)

Deposit

Copper-gold mineralization occurs widely scattered over the property in outcrops and in angular float blocks.

The exploration work has outlined or indicated three possible mineral deposition areas which deserve further attention.

1. A broad zone 100 metres by 1,200 metres (N-S) which consists of white lightly altered quartzose gneiss contains most of the copper-gold showings. It is bordered on the east

by an unconformity to an overlying conglomerate. The unconformity is marked by silicification and K-feldspar alteration, oxidation of pyrite in the gneiss and occasional lenses of amphibolite. On the west it borders a biotite rich gneiss. This gneiss lies immediately north of and uphill from several blocks of light gneiss - altered as above - which contained gold grading from 0.5 oz to 7.0 oz per ton. The mineralized blocks all showed indication of tectonic deformation/brecciation. Several (five or six) interpreted faults cross the gneiss band and these intersections may be the locations of mineralization.

The area around Kells Lake seems particularly favourable. The white gneiss band appears to be tightly folded creating deformation; cleavages, tension fractures, deformation faults, differential competence open spaces. A possible four faults, Fm, Fn, Fp, and Fk, have been indicated in the area and in addition a contorted talcose zone may lie in a thrust fault. A number of fractures have been mapped. An outcrop of broken, fractured, oxidized white gneiss (highly K-feldspathic flesh coloured) has been mapped. High grade mineralized blocks are spatially related to this Kells Lake area.

In the geophysical survey, the magnetic response tends to support the indicated faults while the VLF-EM shows lower resistivity in the area.

2. The "intrusive" on the east part of the claims has a well-defined but everywhere covered boundary area - a possible altered intrusive contact area. The "intrusive" body responds as a magnetic low area - metamorphism may have destroyed all magnetite. The west boundary of the body responds with lower resistivity. The low resistivity boundary should be further explored.

3. A high gold value in stream silt from the north part of the property must be followed up, preferably with heavy mineral sampling. The sample is from a creek which lies in the indicated location of a thrust fault.

Very little rock alteration accompanies the mineralization. Slight K-feldspathization was noted. Hematite staining may accompany some mineralization. The relative lack of alteration makes exploration more difficult.

Analysis for tellurium and selenium in the 1992 samples, some of which were from high grade rock (i.e. 6.44 oz Au), gave a maximum value of 1.61ppm Te and 1.75ppm Se. This is very surprising as the first set of analyses (prospector) gave very high tellurium values (3.9%) from a different but similar block.

Gold can be mobilized by metamorphogenic hydrothermal solutions and be deposited and concentrated in dilational zones. If this is how a gold deposit here was formed, then the following problems must be considered.

A. The metamorphism (largely) took place in the Proterozoic and the structural preparation - isoclinal-folding at the time of metamorphism, and faulting, fracturing and secondary folding probably during the Silurian-Ordovician-Caledonian orogeny.

B. Copper mineralization may originally have been sedimentary, while it seems likely that the relatively thin, not at all "clean" conglomerate seems unlikely to have been the source of the gold.

C. The tellurium-selenium source is unknown.

A hydrothermal (hot spring) type gold-tellurium-opal deposit seems more likely. The lack of an alteration halo is a concern.

Hydrothermal alteration at the enormous Round Mountain deposit in Nevada is virtually unnoticeable.

Silt Sampling

The creeks on the periphery and central part of the property were sampled by taking silt from the active part of the creek (screening). 46 samples were collected and analyzed by ICP. Only one sample was anomalous in gold (#36). It was taken from a creek draining the north part of the property north of Tron River. Samples taken 100 metres below known mineralization did not produce anomalous results.

It was noted that the creeks in the area move very large loads of fine sand in the spring run-off. Presumably the slightly sugary gneisses erode quickly. A heavy mineral survey with panning of perhaps two full pans at each sample site might give better results.

Soil Sampling

One short line of 21 soil samples was taken. The highest value obtained was 87ppm copper. Extensive glacial overburden in this area prevents getting reliable values in the soil.

AERIAL SURVEY

The aerial survey by Norway's Geological Survey commissioned by the company was flown on the weekend of September 18-19. 1993.

The survey covered about 60% of the property. The flight lines ran north-northwest and south-southeast, 100 metres apart. The instrument height was 30 metres above the surface. Readings were taken of magnetic responses, very low frequency (VLF) electro magnetic (EM) responses and radiometric responses.

The ground survey gave a very useful magnetic response - contoured at 2.5 gamma - in confirmation of the geological mapping, and the ground VLF-EM survey indicated some low resistivity zones - zones of possible alteration, mineralization, faulting or shearing. The same very useful information is expected from the aerial survey. In addition, the radiometric survey may indicate zones of K-feldspar alteration associated with mineralization and perhaps depletion or increase in uranium-thorium association with mineralization. Both effects are describes in the literature.

The results of the aerial survey will be available in final form early in 1994.

RECOMMENDATIONS

Depending on the results of the aerial survey, these recommendations may be altered and, in any case, refined.

RECOMMENDED EXPLORATION - STAGE I

1. A heavy mineral survey should be carried out in the drainage where a high gold value was obtained (Sample #36) in the silt survey. About four to six creeks from around Kells Lake and east to and including those around the intrusive body should be heavy mineral surveyed. The survey should be carried out as early as possible in the spring, but deep snowdrifts which take a long time to melt may be a problem.

2. All anomalous zones should be prospected and sampled. Analysis of all samples - heavy mineral and rock - should be expedited as much as possible. Last year's lack of results until the end of the season must be avoided and increased analysis cost should be expected.

3. Geological mapping of anomalous areas and of certain points which appeared significant when the geology was plotted should be carried out while awaiting analytical results.

4. Diamond drilling should follow completion of the above work. An 800-metre drill program consisting of 10 holes in five set-ups is recommended (subject to change). The core must, of course, be logged and sampled and an evaluation report produced.

RECOMMENDATIONS - STAGE II

1. Geological mapping should be continued.

2. Rock chip sampling (Appendix: Leakage Halos) should be carried out.

3. Diamond drilling totalling 1,200 metres is recommended.

4. Evaluation report.

ESTIMATED COSTS OF RECOMMENDATIONS - STAGE I

1.	Heavy mineral survey - 2 men, 1 week	$ 2,500
2.	Prospecting, sampling - 2 men, 2 weeks	5,000
3.	Geological mapping - 1 geologist, 3 weeks	5,000
4.	Diamond drilling - 800 metres @ $85	68,000
	Supervision, core logging - 3 weeks	5,000
	Support, helicopter	17,000
	Supplies, assaying	8,000
	Travel, freight and miscellaneous	15,000
	Evaluation report	4,000
	Subtotal	129,500
	Contingency @ 10%	12,500
	TOTAL ESTIMATED COSTS - STAGE I	**$ 142,000**

ESTIMATED COSTS OF RECOMMENDATIONS - STAGE II

1.	Geological mapping - 3 weeks	$ 5,000
2.	Rock chip sampling - 3 weeks	4,000
3.	Diamond drilling - 1,200 metres @ $85	102,000
	Supervision, core logging	7,500
	Support, helicopter	15,000
	Supplies assaying	12,000
	Travel, freight, and miscellaneous	15,000
	Evaluation report	4,000
	Subtotal	164,500
	Contingency @ 10%	16,500
	TOTAL ESTIMATED COSTS - STAGE II	**$ 181,000**

Respectfully submitted,

LIVGARD CONSULTANTS

Egil Livgard, B.Sc., P.Eng.

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- Røros og Sveg - 1:250,000 Geology (1989)
- Røros og Sveg - 1:250,000 Mineral Occurrences (1987)
- Sørtrøndelag - 1:250,000 Quaternary Geology (1990)
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- Southern Norway - 1:800,000 Road Map
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  #1475 J4, J5

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CERTIFICATE

I, **EGIL LIVGARD**, of 1990 King Albert Avenue, Coquitlam, B.C., do hereby certify:

1. I am a Consulting Geological Engineer, practising from #436 - 470 Granville Street, Vancouver, B.C.

2. I am a graduate of the University of British Columbia, with a B.Sc., 1960 in Geological Sciences.

3. I am a registered member in good standing of the Association of Professional Engineers of the Province of British Columbia (Reg. No. 7236).

4. I have practised my profession for over 25 years.

5. This report dated October 25th, 1993 is based on the references as listed and on the writer's work on the property on from June 20th to August 15th, 1993.

6. I do not have a direct or indirect interest in, nor do I beneficially own, directly or indirectly, any securities of Consolidated Logan Mines Ltd. or any associate or affiliate of Consolidated Logan Mines Ltd. My wife owns 208,000 common shares of Consolidated Logan Mines Ltd.

Dated at Vancouver, British Columbia this 25th of October, 1993.

Egil Livgard, B.Sc., P. Eng.

APPENDICES

Appendix A

Abstract from Ph.D. Thesis by Trond Skyseth, Buffalo, N.Y.:

"Geology, Geochemistry and Genesis of Gautelisfjell Carbonate-Hosted Gold Deposit"

GEOLOGY, GEOCHEMISTRY AND GENESIS OF THE GAUTELISFJELL CARBONATE-HOSTED GOLD DEPOSIT, ROMBAK WINDOW, NORTHERN NORWAY AND ITS RELATION TO CALEDONIAN METAMORPHISM

SKYSETH, Trond, University at Buffalo, Dept. of Geology, 415 Fronczak, Buffalo, NY 14260.

The Gautelisfjell gold deposit is situated in the Proterozoic Rombak Window within the Caledonides, Northern Norway. Most of the Au is finely disseminated in dolomitic impure dark carbonates overlain by a thicker sequence of turbiditic graywacke with tuffite and conglomerate layers. The supracrustal unit rests on a presumably Archean tonalite complex with a basal conglomerate at the contact. The Rombak Window consists mainly of granites, with a Rb-Sr age around 1.7 Ga, which crosscut the supracrustal unit. The region has undergone metamorphism up to lower amphibolite facies and later greenschist facies retrogression.

The deposit has generally a low sulfide content along with varying degree of silification and hydrothermal breccias. The grade varies between 0.1-20 ppm Au with anomalies over 300 ppm in thin zones. The trace element chemistry is characterized by a high Au/Ag-ratio with associated elements As, Bi, Te, Se, Sb, (+/- Cu, Pb, Mo). Barium and tungsten are concentrated and spatially associated peripheral to the gold mineralization. Observed gold grains range in size from 2-60 μm, and are associated with chlorite, calcite, magnetite, chalcopyrite, talc, pyrite, quartz, arsenopyrite and a Bi-Te phase. Three main styles of mineralization have been outlined with different mineralogy and associated trace elements; an As-dominated, a Cu-dominated and the dominant disseminated Au mineralization.

First, Au mineralizations accompany epidote-amphibole parageneses associated with early Caledonian NNE reverse faults and shear zones. Then, retrogression, characterized by biotite-chlorite and highly saline fluids associated with the main phase of Au mineralization, follows the early structures as well as later crosscutting NNW faults. In the carbonate, retrogression was accompanied by breakdown of calc-silicates and formation of crosscutting chlorite veins with magnetite, chalcopyrite and Au. Chlorite geothermometry indicates temperatures of formation around 300-350°C for the main gold phase. Still later E-W trending open-space hydrothermal breccias are also anomalous in Au. All together, these events indicate an extended period of Au metallogenesis related to the lower P-T conditions. Pb and Sr isotope data display a mixing array indicating the addition of radiogenic Caledonian lead and strontium into the Proterozoic rocks, further supporting the suggestion of introduction or at least remobilization of Au during the Caledonian orogeny.

The NNE structures are perpendicular to the direction of the emplacement of the Caledonian thrust sheets associated with prograde metamorphism. The NNW structures are possibly produced by an extensional event related to the collapse of the thickened crust with associated uplift and retrogression. Thus, it is proposed that Caledonian metamorphism mobilized Au-bearing hydrothermal fluids that deposited the Au at its present site. The recently proposed allochthonous character of the Rombak window (Bax, 1989) is also consistent with this model.

Appendix B

Summary of:

"Petrographics - Mineralogy of Samples from Oppdal Property"

John Payne, Ph.D. - February 1993
J.F. Harris, Ph.D. - October 1993

Vancouver Petrographics Ltd.

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Report for: Egil Livgard,
Consolidated Logan Mines,
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Job 930558

October 8th, 1993

SAMPLES:

5 rock samples of PreCambrian metamorphics from Norway, numbered 1, 3, 6, 8 and 14, were submitted for sectioning and petrographic examination.

Sample 1 was prepared as a standard thin section. The other four samples were prepared as polished thin sections.

SUMMARY:

All 5 samples are rather fine-grained, equigranular, very weakly to moderately foliated metamorphic rocks.

Samples 3, 6 and 14 are of similar composition, consisting predominantly of even mosaics of intergrown quartz and K-feldspar (microcline in part), with 5-10% accessory micas (mainly muscovite). The latter forms discrete schlieren in Sample 6. Sample 3 is essentially non-foliated, and Sample 14 shows a very weak, irregular foliation. The matrix in the case of the latter two samples includes sparsely scattered grains of coarser K-spar which may represent relict phenocrysts or clasts. These rocks are thought to be metamorphically recrystallized, felsic, igneous rocks or arkosic sediments.

Sample 1 is of closely similar type to the previous group, but has a higher content of muscovite and relatively less K-feldspar. The orientation of the muscovite defines a sinuous foliation, with microstructrually controlled segregations of mica in drag folds.

Sample 8 differs from the others in that plagioclase is the dominant feldspar, and quartz is relatively minor. The rather abundant mafic constituents are biotite and epidote; some muscovite is also present. Accessory K-feldspar occurs as clumps and lenticular segregations. The presence of well-crystallizied epidote defines the metamorphic facies as lower amphibolite. This rock may be a meta-greywacke of dacite-andesite affinities.

Mineralization was noted in only one sample - #14. This contains a few discrete pockets of intergrown bornite and chalcocite, partly replaced by covellite and partly altered to malachite. The textural relationships of the sulfides and the metamorphic silicates suggest that the sulfides are primary (recrystallized along with the host) or of remobilized, syn-metamorphic origin.

The rocks of this suite (including the mineralized one) are strikingly fresh and free of evidence of retrograde metamorphism or post-metamorphic alteration. One exception is Sample 6 in which the K-spar shows very mild argillic turbidity, and there is substantial development of what appears to be zeolite, as small pockets and areas of intergranular replacement/cementation of the quartz-feldspar matrix. This is presumably a specialized form of alteration of feldspar.

Individual petrographic descriptions, and photomicrographs illustrating some of the critical features, are attached.

J.F. Harris Ph.D.

(929-5867)

SAMPLE 1 QUARTZ MUSCOVITE SCHIST

Estimated mode

Quartz	50
Plagioclase	2
K-feldspar	10
Muscovite	36
Monazite	trace
Zircon	trace
Sphene	trace
Opaques	2

This is a metamorphic rock of simple composition, consisting essentially of an intergrowth of quartz and muscovite, with accessory K-feldspar.

The muscovite occurs as well-formed flakes, 0.1 - 1.0mm in length. These show a preferred orientation which defines a rather sinuous foliation. The muscovite flakes partly coalesce as discontinuous schlieren, one or two flakes thick, but there is no well-developed schistosity. Local thicker concentrations of muscovite are probably microstructurally controlled (in the axes of a small scale crumpling).

The matrix in which the muscovite is developed is a granoblastic aggregate of quartz and accessory K-feldspar, as a polygonal mosaic, predominantly of grain size 50 - 200 microns. A very minor component of intergrown plagioclase is also present.

Scattered coarser grains of quartz and K-spar, 0.5 - 1.0mm in size, are seen - especially at one end of the sectioned area.

These are sometimes clumped, and have the appearance of relict phenocrysts in a felsic igneous protolith, or gritty clasts in an original sediment.

An opaque mineral (not positively identifiable in the absence of a polished surface, but probably an Fe-Ti oxide) occurs in close association with the muscovite concentrations. It forms irregular to elongate grains, 0.1 - 0.6mm in size, often showing elongation parallel to that of the mica flakes. It is clearly a granoblastic (recrystallized primary) component.

Traces of dark brown sphene are seen, mainly in association with the muscovite and oxides, as tiny individual granules and concordant strings thereof.

The rock appears totally fresh and devoid of post-metamorphic modification.

SAMPLE 3 FINE-GRAINED QUARTZO-FELDSPATHIC METAMORPHIC

Estimated mode

Quartz	40
K-feldspar	50
Plagioclase	5
Muscovite	1
Biotite	4
Chlorite	trace
Hematite	trace
Magnetite	trace
Pyrite) Limonite)	trace

This is an evenly microgranular, non-foliated rock composed of an intergrowth of quartz, K-feldspar and minor plagioclase (see stained off-cut).

Thin section study shows that it consists of a polygonal mosaic of quartz and feldspars, predominantly of grain size 50 - 300 microns.

A few coarser, blocky/prismatic grains of K-feldspar (microcline) 0.5 - 2.0mm in size, occur scattered through this quartzite-like matrix; there is also a single, somewhat irregular, laminar zone of quartz of similar grain size. The former have the appearance of relict phenocrysts or clasts, and the latter of an original veinlet.

Accessories consist of minor biotite and muscovite, as sparsely scattered, individual, randomly oriented flakes, 0.2 - 1.0mm in size, occasionally aggregated as small elongate clumps.

The micas concentrate as marginal selvedges to the veniform quartz zone, and are sometimes associated with the coarser feldspar individuals.

Some biotite flakes show partial alteration to chlorite. The feldspars throughout the rock are totally fresh.

Opaques are notably rare. They consist of disseminated grains of hematite and magnetite, 20 - 200 microns in size. The hematite occurs mainly as flecks intergrown with biotite flakes. Extremely rare tiny grains of partially limonitized pyrite are also seen.

This rock is probably derived from a felsitic tuff or volcanic, or an arkosic sandstone.

SAMPLE 6 QUARTZO-FELDSPATHIC SCHIST

Estimated mode

Quartz	25
K-feldspar	54
Plagioclase	2
Muscovite	10
Phlogopite	!
Mineral X	7
Mineral Y	trace
Rutile	trace
Ilmenite	0.5

This is another fine-grained quartzo-feldspathic metamorphic rock in which K-feldspar is the dominant component.

In this respect it resembles Sample 3; however, there are two distinct differences. One is the relative abundance of accessory muscovite, which shows distinct preferred orientation and a strongly segregated mode of occurrence as thin schlieren - defining a rather irregular (sinuous) foliation. Individual mica flakes range from 0.2 - 1.5mm in length. A minor component of pale-coloured (phlogopitic) biotite is locally associated with the muscovite.

The other distinctive feature is the presence of mineral X - a colourless mineral of low R.I. ($<$quartz and K-spar) and low birefringence (similar to K-spar) which occurs sporadically throughout the rock as networks and patches of intimate cementation (intergranular replacement?) of the quartz/feldspar mosaic, sometimes grading to homogenous elongate/sub-concordant pockets up to 2mm or more in size. It is recognizable in the off-cut block by its strong white-etched appearance.

This mineral shows a well-developed cleavage and a bladed/fibrous habit. It sometimes has parallel and sometimes inclined extinction. Its interference figure also appears inconsistent, sometimes appearing unixial and other times biaxial with high 2V. SEM microanalysis yielded peaks of Ca, Al and Si plus minor K.

This mineral resembles a zeolite in general appearance and optical properties. Most zeolites do not contain K, but the compositional data could fit the variety <u>phillipsite</u>. Zeolite cannot exist as an equilibrium component in a metamorphically recrystallized assemblage such as this; however it could represent a specialized form of (post-metamorphic) localized alteration of feldspar. Its mode of occurrence (see photo) is consistent with this possibility.

The K-feldspar shows patchy development of mild pervasive alteration in the form of diffuse turbidity (incipient argillization?).

Opaques consist of sparsely disseminated Fe-Ti oxides (mainly ilmenite), as irregular grains 0.05 - 0.5mm in size. A little rutile is sometimes intergrown.

Sample 6 cont.

Mineral Y occurs in traces as a few patches of intergranular networks in the quartz-feldspar matrix. It is a mottled brownish material of low to moderate birefringence, somewhat resembling a form of secondary biotite. Its mode of occurrence is comparable with that of Mineral X in its more dispersed form. It is apparently another secondary phase.

The matrix of this rock is a varigranular mosaic of grain size 0.1 - 1.0mm. Obvious coarser grains of relict phenocrystic or clastic nature are not seen. The rock could have originated from a felsic igneous rock or an arkosic sediment.

SAMPLE 8 BIOTITE EPIDOTE SCHIST

Estimated mode

Quartz	18
K-feldspar	6
Plagioclase	42
Muscovite	8
Biotite	16
Epidote	10
Sphene	trace
Apatite	trace
Hematite) Ilmenite)	trace

This is another rock of evenly granulitic texture. It differs from the preceding samples in having plagioclase as the dominant feldspar, and in containing a considerably higher proportion of accessory silicates - including granular epidote and prominent flakes of biotite.

The matrix consists predominantly of a polygonal mosaic of plagioclase and quartz, of grain size 0.1 - 0.3mm. A few segregations of relatively coarser quartz occur as concordant strings. K-feldspar concentrates as occasional irregular porphyroblasts (or relict phenocrysts or clasts?), to 2.0mm in size, as clumps of smaller grains, and as elongate lenticles (see distribution of yellow cobaltinitrite stain on the off-cut)..

The accessory micas and epidote concentrate in parallel, laminar zones. The biotite (olive green in colour) and associated muscovite occur as well-oriented flakes up to 2.0mm in length, partly coalescing as semi-continuous schlieren. The epidote forms discrete, stumpy prismatic, subhedral grains, 0.1 - 0.5mm in size, concentrating as clusters closely associated with the micas.

Traces of Fe and Fe-Ti oxides and sphene occur intergrown with the micas.

The presence of epidote (which has every appearance of a prograde metamorphic constituent, co-genetic with the micas and the granular matrix) indicates a somewhat lower facies of metamorphism than the totally fresh, sharply-defined, granular fabric and the laminar mineralogical differentiation might suggest.

The protolith is debatable. The abundance of quartz and biotite suggest that it may be a meta-greywacke - the epidote being derived from a calcareous component.

SAMPLE 14 QUARTZO-FELDSPATHIC SCHIST

Estimated mode

Quartz	35
K-feldspar	47
Plagioclase	9
Muscovite	8
Sphene) Rutile)	trace
Ilmenite	0.2
Limonite	trace
Malachite	0.2
Bornite	0.3
Chalcocite	0.1
Covellite	0.1
Chalcopyrite	trace

This is a rock of similar composition to Samples 3 and 6, consisting essentially of a granular intergrowth of quartz and K-feldspar with accessory plagioclase and muscovite.

The matrix is an interlocking/polygonal mosaic of equant grains of quartz and feldspars, predominantly in the size range 0.1 - 0.5mm. Occasional coarser grains (mainly of K-spar), in the 0.5 - 1.5mm range, are also present.

Muscovite forms scattered flakes 0.1 - 1.0mm in size, rather poorly oriented and occasionally coalescing as thin, discontinuous, irregular schlieren. The only other metamorphic accessories are disseminated traces of fine-grained ilmenite and sphene.

The rock is a quartzo-feldspathic schist of uncertain (meta-felsic igneous or meta-arkosic) origin.

Its most distinctive feature is the presence of minor Cu mineralization, in the form of a localized string or cluster of discrete pockets, 0.2 - 2.0mm in size, of bornite with intergrown chalcocite and covellite. These are sharply bounded and/or penetrated by the silicates of the matrix - especially by well-formed flakes of muscovite (see photo). This relationship suggests that they are original primary constituents recrystallized along with the matrix, or formed as part of the metamorphic event.

The bornite/chalcocite intergrowths are of a simple mutual boundaries type, and may be primary. The covellite is developed along chalcocite/bornite contacts, and is most likely a supergene modification.

Additional evidence of surface effects is the presence of rims of malachite around some of the sulfide specks, and of adjacent pockets composed totally of malachite, or of limonite - sometimes with tiny included remnants of chalcopyrite.

Sample 14 cont.

This association of bornite/chalcopyrite as the principal sulfide species, plus associated high Ag (assay data supplied), is suggestive of the quartzite or arkose-hosted type of primary/ syngenetic Cu mineralization.

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Report for: **E. Livgard,**
Donegal Development, Ltd.,
1022 - 470 Granville Street
VANCOUVER, B.C.,

Job 920179
February 1993

Samples: 9528, 9529, 9532, 9534, 9536, 9537, 9538

Project: **Oppdal**

Summary:

Most of the are of slightly to strongly porphyroblastic gneisses dominated by feldspars and quartz with minor muscovite and/or biotite. The relative abundances of plagioclase, quartz, and K-feldspar vary widely between samples. Sample 9537 is a folded quartz-muscovite-plagioclase gneiss.

The samples contain replacement patches of a few types.

One major type of replacement patch consists of coarse intergrowths of bornite and chalcopyrite. In these, bornite also contains exsolution lenses of chalcopyrite. The sulfides were altered slightly to completely, mainly to limonite and malachite. Adjacent to limonite-malachite patches in some samples are interstitial patches of an unknown secondary mineral, probably an oxide.

Some replacement patches are dominated of hematite. Sample 9536 was brecciated moderately and replaced, mainly in the brecciated zones, by hematite, chlorite, and minor sphene and hornblende. Native gold probably is associated with the replacement patches.

A few samples contain replacement patches of opal. It occurs alone or intergrown with or surrounding patches of hematite or malachite.

Native gold occurs as free grains, in intimate intergrowths with opal, and bordering some limonite- or hematite-rich patches. The intergrowths with opal would pose metallurgical problems.

Two samples contain disseminated pyrite; in one of these pyrite contains minor inclusions of galena and chalcopyrite-(pyrrhotite).

Comparison with ICP data indicate the following:

1) Native gold was seen in the samples with Au >10 ppm,and was not seen in any of the other samples.

2) The samples with high Cu-values contain enough patches of bornite-chalcopyrite and/or malachite to explain these values.

3) No silver- or lead-bearing minerals were identified in samples with high gold assays, despite the relatively high values of silver and lead in the ICP analyses. It is probable that both these elements are present in secondary minerals, which probably would be extremely fine grained and impossible to identify in thin section.

4) The sample with a high Ba-content (2158 ppm) contains sufficient barite grains to account for this number.

Sample 9528 **Porphyroblastic Plagioclase-Quartz Gneiss; Interstitial Patches of Hematite-Limonite-Malachite-(Opal) after Chalcopyrite; Mineral Y, Opal, and Native Gold**

Porphyroblasts of plagioclase are set in a very fine grained groundmass of plagioclase and quartz. Interstitial patches contain one or more of secondary hematite and limonite, relic chalcopyrite, malachite, Mineral Y (oxide?), opal, and native gold.

porphyroblasts			
plagioclase	25-30		
groundmass			
plagioclase	40-45	biotite	minor
quartz	20-25	muscovite	minor
hematite/limonite	3- 4	chalcopyrite	minor
malachite	2- 3	native gold	minor
opal	0.3	cavities	2- 3
Mineral Y	1- 2		
K-feldspar (?)	0.1		
Mineral X	trace		

Plagioclase forms equant megacrysts up to 5 mm in size. Many show slightly warped and/or broken twins, indicating that the rock underwent slight cataclastic deformation. Muscovite forms disseminated flakes averaging 0.07-0.1 mm long in plagioclase megacrysts.

The groundmass is dominated by equant, submosaic plagioclase and quartz grains averaging 0.1-0.3 mm in size. Biotite forms a few disseminated flakes up to 0.5 mm long. Pleochroism is from nearly colorless to medium brown. Alteration is slight to moderate along cleavage planes to pale green chlorite.

A patch 2.5 mm across is dominated by limonite (partly removed from the section, with ribs of hematite, and a few relic patches averaging 0.05-0.1 mm in size of chalcopyrite, rimmed by opaque hematite. The patch has a complex rim, with an inner zone 0.01 mm wide of opal, outside of which is a zone averaging 0.2-0.8 mm wide of extremely fine grained, prismatic malachite, which in turn is rimmed by a second band of opal 0.01 mm wide. A few other patches of malachite are up to 0.7 mm in size. Many of these are are rimmed by opal as in the patch described above. One small patch of malachite contains a leaf of gold 0.04 mm long and less than 0.005 mm wide. A veinlet 0.01 mm wide is of malachite.

Chalcopyrite (and pyrite?) forms interstitial patches averaging 0.1-0.3 mm in size. Alteration is complete to aggregates of opaque hematite surrounded by orange-brown limonite.

A few patches averaging 0.1-0.6 mm across are dominated by opal showing delicate textures. In the core of the largest patch are a few anhedral patches 0.07 mm across and abundant spheroidal patches averaging 0.015 mm in size of a light yellowish green, isotropic mineral (Mineral Y).

Several interstitial patches up to 1 mm in size are of cryptocrystalline, medium to dark brown Mineral Y, possibly an oxide.

(continued)

Interstitial patches up to 1 mm in size are dominated by cryptocrystalline to extremely fine grained limonite and malachite. Some of these contain minor cores up to 0.02 mm in size of chalcopyrite or opaque hematite (probably after chalcopyrite). Commonly they are zoned, with malachite concentrated to wards the margins and limonite towards the cores.

Malachite forms interstitial patches up to 1 mm across of prismatic grains averaging 0.02-0.05 mm in length, and locally up to 0.15 mm long. A few large patches of malachite contain a few very irregular patches up to 0.2 mm in size of opal.

One replacement patch 1.7 mm long contains several ragged cores of hematite and minor Ti-oxide averaging 0.05-0.1 mm in size surrounded by extremely fine textured opal. At one side of the patch are two zones from 0.02-0.08 mm in size containing abundant native gold intergrown intimately with opal. Native gold grains average 0.003-0.008 mm in size. Adjacent to the opal-gold intergrowths in the margin of a plagioclase grain is a slightly elongate grain of native gold 0.09 mm long.

Opal also is concentrated in wispy seams averaging 0.02-0.03 mm wide and in interstitial patches averaging 0.3-0.5 mm in size. It ranges in color from colorless to light yellow.

Hematite also forms disseminated clusters of platy grains averaging 0.07-0.1 mm long.

Mineral Y forms interstitial patches up to 0.5 mm long. It is dark brown to opaque in color and appears to be cryptocrystalline in texture. It has low relief and is moderately soft (Hardness = 2). Patches of Mineral Y are adjacent to those of malachite-limonite, but Mineral Y is not intergrown with either of these minerals.

Sample 9538 **Porphyroblastic Plagioclase-K-feldspar Rock; Replacement Patches of Malachite-Limonite, Hematite-Opal-(Native Gold) and Mineral Y**

Porphyroblasts of K-feldspar-plagioclase intergrowths, less abundant ones of plagioclase, and minor ones of K-feldspar are set in a groundmass dominated by submosaic plagioclase with scattered concentrations of biotite. Some replacement patches are dominated by hematite and opal with minor native gold. Others are dominated by limonite-malachite with minor relic cores of opaque hematite, probably after after chalcopyrite/bornite(?). Others interstitial patches are of Mineral Y (as in Sample 9528).

porphyroblasts	
K-feldspar/plagioclase	20-25%
plagioclase	4- 5
K-feldspar	1
groundmass	
plagioclase	55-60
K-feldspar	3- 4
biotite	3- 4
interstitial patches	
malachite	2- 3
limonite	1- 2
hematite	0.5
opal	0.5
Mineral Y	0.5
native gold	trace
Ti-oxide	trace

Anhedral porphyroblasts up to 2.5 mm across consist of irregular, patchy intergrowths of about equal amounts of K-feldspar and plagioclase; textures suggest replacement of plagioclase by K-feldspar.

Plagioclase forms anhedral, equant porphyroblasts averaging 1-1.5 mm in size.

K-feldspar forms irregular porphyroblasts averaging 1-1.7 mm across.

The groundmass is dominated by equant, submosaic plagioclase grains averaging 0.15-0.3 mm in grain size and much less abundant grains from 0.3-0.5 mm in size. K-feldspar forms scattered grains averaging 0.1-0.15 mm in size.

Biotite forms disseminated flakes averaging 0.15-0.3 mm in size and a few up to 1 mm long. It is concentrated in a few patches from 2-3 mm across as flakes up to 1.5 mm in size. Several fresh flakes have pleochroism from pale to medium brown. Alteration commonly is towards muscovite; these grains have a white to yellow interference color and are pleochroic from pale to light greenish brown. Some grains are altered slightly to moderately to chlorite in lenses parallel to cleavage planes. In the large patches, alteration commonly is to pseudomorphic, very pale green chlorite containing minor to moderately abundant clusters of subhedral rutile grains averaging 0.03-0.07 mm long.

(continued)

Sample 9537 **Drag-Folded Quartz-Muscovite-Plagioclase-(K-feldspar) Gneiss; Limonite Veinlets**

The sample is a medium to coarse grained gneiss dominated by quartz and muscovite, with less abundant plagioclase, commonly as patches of much finer grains, and minor K-feldspar and pyrite. It was drag-folded on the scale of 1-2 cm. A prominent lineation was seen in the hand sample; it probably is parallel to the fold axis.

quartz	50-55%	galena	trace
muscovite	20-25	chalcopyrite	trace
plagioclase	15-17	pyrrhotite	*
K-feldspar	4- 5		
pyrite	2- 3		
Ti-oxide	trace		
veinlets			
limonite	0.2		

Quartz forms anhedral grains averaging 0.5-1 mm in size.

Plagioclase is concentrated in lensy patches parallel to foliation as equant, anhedral grains averaging 0.1-0.3 mm in size, and a few patches averaging 0.05-0.07 mm in size. A few patches and disseminated grains average 0.5-0.8 mm in size. It commonly is altered slightly along grain borders and wispy fractures to limonite.

Muscovite is concentrated in seams parallel to foliation as subhedral, equant to elongate flakes averaging 0.5-1 mm in length,and locally up to 2 mm long.

K-feldspar forms anhedral, in part interstitial grains averaging 0.5-1 mm in size and a few up to 1.7 mm across. One grain 2 mm across contains abundant subparallel flakes of muscovite averaging 0.2-0.6 mm in size. Another grain contain several anhedral inclusions of plagioclase and a few equant flakes of muscovite.

Pyrite forms disseminated, subhedral grains averaging 0.1-0.5 mm in size, and a few elongate grains up to 0.8 mm long. One pyrite patch 1.5 mm across contains a few blebby to lensy inclusions of galena averaging 0.02-0.04 mm in size. One other pyrite grain contains a blebby inclusion 0.02 mm across of chalcopyrite with an exsolution plate of pyrrhotite. Many grains are replaced slightly along their margins to locally strongly or completely to orange-brown limonite.

Ti-oxide forms disseminated grains and clusters of a few grains averaging 0.02 mm in size.

Limonite forms a few veinlets averaging 0.01-0.02 mm wide.

Ti-oxide forms minor disseminated grains averaging 0.03-0.08 mm in size.

The rock was deformed cataclastically in a few braided zones up to 1.7 mm wide. These contain one to several braided breccia seams which commonly average 0.1-0.15 mm wide, but which coalesce in places to broader breccia zones up to 1 mm wide. In these seams, groundmass minerals were granulated to aggregates averaging 0.005-0.01 mm in size.

Seams of cataclastic deformation were loci of replacement. The main replacement zone is up to 2 mm wide and contains abundant, disseminated, anhedral to subhedral grains of hematite averaging 0.03-0.05 mm in size, with a moderate number of grains from 0.1-0.4 mm long and a few from 0.5-0.8 mm long.

In this zone, one large replacement patch 2 mm long contains an irregular patch 1.2 mm across of fine grained sphene, altered slightly to Ti-oxide and leucoxene. Adjacent to this is an unusual patch up to 0.8 mm across in which sphene in intergrown intimately with equant books of chlorite averaging 0.02-0.03 mm in size. This patch also contains several subhedral prismatic grains of hornblende averaging 0.2-0.4 mm long, with unusual pleochroism from light green to deep reddish brown.

Chlorite forms patches up to 1.7 mm long of aggregates of books of equant flakes averaging 0.02-0.03 mm in size. Several lenses up to 2 mm long and 0.3 mm wide parallel to foliation are of slightly to moderately coarser grained chlorite with a similar texture; these lenses commonly extend outwards from the breccia zone. Chlorite is pleochroic from pale to light green. It is altered slightly to moderately to sericite on borders of some books and along selvages between flakes within books.

Although no native gold was seen, it is suspected that it would be associated with the replacement patches of hematite in the brecciated zones.

Sample 9536 **K-feldspar-Plagioclase-Quartz-Muscovite Gneiss; Brecciation and Mild Cataclastic Deformation; Replacement by Hematite, Chlorite, Sphene, Hornblende**

Minor porphyroblasts of plagioclase and K-feldspar are set in a well foliated groundmass dominated by quartz with less abundant K-feldspar and plagioclase and minor muscovite. Foliation is defined by orientation of minerals and metamorphic segregation of minerals into narrow layers parallel to foliation. The rock was deformed moderately by cataclastic deformation along a few braided seams. Replacement, concentrated in these seams, is to hematite, sphene, chlorite, and minor hornblende with unusual reddish pleochroism.

porphyroblasts	
plagioclase	2- 3%
K-feldspar	2- 3
groundmass	
quartz	35-40
K-feldspar	20-25
plagioclase	12-15
muscovite	1- 2
biotite	0.2
sphene	0.2
zircon	minor
Ti-oxide	trace
brecciated zones	10-12
replacement (mainly in brecciated zones)	
hematite	3- 4
chlorite	3- 4
sphene	0.7
hornblende	0.1

Plagioclase forms equant megacrysts averaging 1-2 mm in size. These contain minor to moderately abundant, disseminated flakes of muscovite averaging 0.05-0.08 mm in size.

K-feldspar forms a few anhedral megacrysts averaging 1-1.7 mm in size. Abundant dusty hematite inclusions give the grains a light brown color.

The groundmass contains moderately abundant, grains of K-feldspar and quartz averaging 0.5-0.7 mm long, elongated moderately to strongly parallel to foliation. These are set in a finer gained aggregate of quartz, K-feldspar, and much less abundant plagioclase averaging 0.07-0.3 mm in size. A few narrow seams of quartz parallel to foliation average 0.3-0.5 mm in grain size. K-feldspar commonly contains minor to moderately abundant dusty hematite inclusions, giving it a pale brown color.

Muscovite forms flakes averaging 0.2-0.3 mm in length and locally up to 0.6 mm long oriented parallel to foliation, and concentrated moderately in thin seams.

Biotite forms scattered flakes averaging 0.1-0.3 mm in size, and locally up to 0.5 mm long. It is altered completely to pseudomorphic to very fine grained chlorite and minor Ti-oxide.

Sphene is concentrated in a few patches up to 0.8 mm in size of anhedral grains averaging 0.05-0.12 mm in size associated with muscovite.

Zircon forms subhedral to euhedral grains averaging 0.02-0.07 mm in size.

(continued)

Patches averaging 0.1-0.3 mm in size and locally from 0.5-1.7 mm across are of bornite and chalcopyrite. Some larger patches are skeletal in outline. Bornite commonly contains moderately abundant exsolution lenses of chalcopyrite averaging 1-2 microns thick, oriented in up to three hexagonal crystallographic orientations of bornite. In a few large patches, chalcopyrite lenses are concentrated strongly near the margin of the bornite grain. Bornite is rimmed by a zone up to 0.02 mm wide of chalcocite or less commonly covellite, which in turn is rimmed by a zone up to 0.05 mm wide of orange-brown limonite and/or pale green malachite. Chalcocite also forms along a few fractures cutting bornite-(chalcopyrite) grains.

Chalcopyrite forms discrete grains averaging 0.2-0.5 mm in size, and one elongate patch 2 mm long (largely removed at edge of section). Many of these patches are altered along their margins to extremely fine grained, aggregates of limonite and malachite in zones from 0.02-0.07 mm wide.

K-feldspar forms minor grains bordering patches of sulfides; it was not identified in thin section, but its presence and distribution were interpreted from the stained offcut block.

Malachite also forms disseminated patches up to 0.1 mm in size of extremely fine grained aggregates,; these are most common in one plagioclase megacryst, and are the cause of the pale green color of the megacryst.

Sample 9534 **Porphyroblastic Plagioclase-Quartz Gneiss; Patches of Bornite-Chalcopyrite**

Porphyroblasts of plagioclase are set in a moderately foliated groundmass dominated by plagioclase and quartz with minor biotite. Quartz is concentrated in coarser grained lenses and patches, which commonly are elongated parallel to foliation. Replacement patches consist of bornite and chalcopyrite. They are altered moderately along grain borders and fractures. Early alteration was to chalcocite-covellite. Later, and more abundant alteration is to hematite/limonite and malachite. The light green color of some plagioclase megacrysts and patches in the groundmass is from disseminated patches of malachite.

porphyroblasts			
plagioclase	15-17%		
quartz	12-15		
groundmass			
plagioclase	30-35	bornite	1%
quartz	25-30	chalcopyrite	0.7
biotite	3- 4	chalcocite	minor
muscovite	minor	covellite	trace
K-feldspar	minor	hematite/limonite	0.3
epidote	trace	malachite	0.1
zircon	trace		

Plagioclase forms anhedral porphyroblasts averaging 1-2 mm in size, and a few up to 5 mm across. Some contain irregular patches and lenses of quartz averaging 0.05-0.15 mm in size. It contains irregular patches with moderately abundant dusty hematite, and scattered flakes of muscovite.

Quartz is concentrated in lenses averaging 1-2 mm wide and a few to several mm long. Grain average 0.5-1 mm in size, with a few up to 2 mm in size.

In the groundmass, plagioclase forms anhedral grains averaging 0.1-0.25 mm in size. Alteration is as in the megacrysts. Quartz form equant grains averaging 0.05-0.2 mm in size.

Biotite forms disseminated flakes averaging 0.3-0.7 mm in size, and a few from 0.8-1.3 mm long. Pleochroism is from pale to medium brown. Towards one end of the thin section, most grains are fresh. Towards the other end, most grains are altered moderately to completely to pseudomorphic chlorite with minor patches of Ti-oxide and commonly moderately abundant lenses of epidote. Chlorite is pleochroic from pale to light green. A few grains contain about equal amounts of muscovite intergrown along cleavage planes with chlorite. In the polished block, biotite is concentrated strongly in a seam 1-2 mm wide parallel to foliation; in this seam it forms flakes averaging 0.7-1 mm in size.

Muscovite forms disseminated, equant flakes averaging 0.1 mm in size.

One equant grain 0.4 mm across may be epidote. It has a medium yellow color and high relief. It is simply twinned, with twins having an extinction angle of 16 degree. Epidote forms a few anhedral grains up to 0.15 mm in size bordering sulfide patches.

Ti-oxide forms a few equant to elongate grains up to 0.1 mm long.

Zircon forms a euhedral grain with a square cross section 0.05 mm across and a subhedral, prismatic grain 0.07 mm long.

Sample 9532 **Quartz-Plagioclase-K-feldspar-Muscovite Gneiss**

Scattered porphyroblasts of K-feldspar and smaller ones of quartz and plagioclase occur in a slightly to moderately finer grained groundmass dominated by quartz, with much less plagioclase and K-feldspar, and minor muscovite. K-feldspar is concentrated strongly at one side of the section (see stained offcut block). Muscovite is concentrated moderately in seams which define a weak to moderate foliation. Barite is concentrated moderately in one diffuse band parallel to foliation.

porphyroblasts	
K-feldspar	3- 4%
quartz	4- 5
plagioclase	2- 3
groundmass	
quartz	50-55
K-feldspar	12-15
plagioclase	12-15
muscovite	3- 4
barite	0.3
hematite	0.3
chlorite	0.1
zircon	minor

K-feldspar forms equant, anhedral porphyroblasts averaging 0.6-0.8 mm in size, and a few up to 1.3 mm across. Some contain minor to moderately abundant perthitic lenses of plagioclase.

Quartz forms scattered porphyroblasts averaging 0.5-0.7 mm in size. It is concentrated slightly in a few lenses up to 1 mm wide of grains averaging 0.4-0.6 mm in size.

Plagioclase forms anhedral porphyroblasts averaging 0.4-0.5 mm in size; they commonly contain moderately abundant tiny inclusions of muscovite.

The groundmass contains scattered grains averaging 0.3-0.5 mm in size, mainly of quartz intergrown with submosaic aggregates of quartz, K-feldspar, and plagioclase averaging 0.05-0.2 mm in size. Some K-feldspar grains contain patches with moderately abundant dusty hematite inclusions.

Muscovite forms subhedral flakes averaging 0.1-0.3 mm in size. It is concentrated moderately in seams parallel to foliation averaging 0.05-0.1 mm wide and locally up to 0.4 mm wide. In the larger and more prominent seams, grains average 0.2-0.5 mm long.

Barite forms anhedral, disseminated, equant grains averaging 0.2-0.5 mm in size and a few up to 0.8 mm long.

Hematite forms disseminated tabular to equant grains averaging 0.1-0.15 mm long and a few up to 0.5 mm long. A few equant hematite grains contain a few inclusions of Ti-oxide up to 0.07 mm in size.

Chlorite forms a few ragged flakes up to 0.3 mm long containing minor inclusions of Ti-oxide. It probably is secondary after biotite.

Zircon forms a few anhedral grains up to 0.13 mm in size.

Sample 9529 **Quartz-Plagioclase-Microcline-Muscovite Gneiss; Minor Pyrite; Patchy Limonite Weathering and Veinlets**

Scattered porphyroblasts of plagioclase, K-feldspar and quartz are set in a fine grained, weakly foliated groundmass dominated by quartz with less abundant plagioclase and K-feldspar. Muscovite and minor biotite and Ti-oxide are concentrated in seams parallel to foliation. Pyrite forms disseminated grains surrounded by limonite. A few late veinlets and replacement patches are of limonite.

porphyroblasts			
plagioclase	3- 4%		
K-feldspar	3- 4		
quartz	2- 3		
groundmass			
quartz	50-55	Ti-oxide	0.3%
plagioclase	15-17	pyrite	0.1
K-feldspar	15-17	chalcopyrite	trace
muscovite	3- 4	zircon	trace
biotite	0.3		
veinlets and replacement patches			
limonite	0.5		

Plagioclase and K-feldspar form equant porphyroblasts averaging 0.8-1.5 mm in size. Some K-feldspar porphyroblasts contain exsolution lenses of plagioclase and others contain scattered irregular inclusions of plagioclase in optical continuity, suggesting that they too are of exsolution origin.

Quartz is concentrated slightly in a few lenses up to 2 mm long parallel to foliation, in which grains are up to 1.2 mm long.

The groundmass consists of anhedral grains of quartz and lesser plagioclase and K-feldspar averaging 0.1-0.3 mm in size, with moderately abundant disseminated grains from 0.3-0.5 mm in size.

Muscovite forms subhedral flakes averaging 0.3-0.8 mm in length and a few up to 1 mm long; they are concentrated moderately to strongly in a few seams parallel to foliation.

Biotite forms a few flakes up to 0.8 mm in size associated with muscovite. Pleochroism is from pale to light brown. Many biotite grains are altered moderately to strongly lenses of limonite/hematite parallel to cleavage.

Ti-oxide forms disseminated grains averaging 0.05-0.1 mm in size, and a few irregular patches up to 0.3 mm across. Some coarser grains contain abundant blebby inclusions averaging 0.01-0.2 mm in size of silicates. Ti-oxide is concentrated moderately in muscovite-rich seams.

Pyrite forms anhedral grains averaging 0.2-0.45 mm in size. These occur in cores of patches of cryptocrystalline limonite, which are up to 1 mm across.

Chalcopyrite forms two proximal grain 0.03 mm in size.

Zircon forms equant, anhedral grains averaging 0.03-0.05 mm in size. They are concentrated moderately in a few clusters with Ti-oxide.

A few tension filling, in part braided veinlets averaging 0.03-0.07 mm wide are of cryptocrystalline limonite. These are concentrated in and near muscovite-rich seams.

K-feldspar is concentrated in or near interstitial patches as very fine grains or aggregates. It was not identified in the section, but its presence and distribution is shown by the distribution of yellow color in the stained offcut block.

Native gold forms a few clusters of grains averaging 0.03-0.1 mm in size, in part associated with limonite (after chalcopyrite) and in part alone or associated with wispy veinlets of opal. One grain 0.02 mm across is in the core of a plagioclase grain.

Cavities up to 1.5 mm in size probably represent patches of limonite which were leached from the section.

Appendix C

Assay Certificates

C

Hydro Aluminium 24/11/91 Side 1

Ref. JOB.

Funnsted:
Kartblad: Snohetta 1519/4
Koordinat: X= 52500-52600 Y= 692800-592900

Analyse: Åmotsdalen Nr. 1 : Overflate

Nr.	Grunnstoff		Egenvekt	Kg/Tonn	PPM (Gr/Tonn)
1.	H	Hydrogen	0.071		
2.	He	Helium	0.126		
3.	Li	Litium	0.53		
4.	Be	Beryllium	1.85		
5.	B	Bor	2.34		
6.	C	Karbon	2.26		
7.	N	Nitrogen	0.81		
8.	O	Oksygen	1.14		
9.	F	Fluor	1.505		
10.	Ne	Neon	1.20		
11.	Na	Natrium	0.97	42.0	42000.0
12.	Mg	Magnesium	1.74	6.3	6300.0
13.	Al	Aluminium	2.70	145.0	145000.0
14.	Si	Silisium	2.33	486.0	486000.0
15.	P	Fosfor	1.82	4.5	4500.0
16.	S	Svovel	2.07	15.0	15000.0
17.	Cl	Klor	1.56	11.0	11000.0
18.	Ar	Argon	1.4		
19.	K	Kalium	0.86	42.0	42000.0
20.	Ca	Kalsium	1.55	9.2	9200.0
21.	Sc	Scandium	3.0		
22.	Ti	Titan	4.51	2.0	2000.0
23.	V	Vanadium	6.1	0.24	240.0
24.	Cr	Krom	7.19		
25.	Mn	Mangan	7.43	0.16	160.0
26.	Fe	Jern	7.86	19.0	19000.0
27.	Co	Kobolt	8.9		
28.	Ni	Nikkel	8.9	0.3	300.0
×29.	Cu	Kopper	8.96	99.0	99000.0
30.	Zn	Sink	7.14	13.0	13000.0
31.	Ga	Gallium	5.91	0.15	150.0
32.	Ge	Germanium	5.32		
×33.	As	Arsen	5.72		
34.	Se	Selen	4.79	1.1	1100.0
35.	Br	Brom	3.12		
36.	Kr	Krypton	2.6		
37.	Rb	Rubidium	1.53	0.4	400.0
38.	Sr	Strontium	2.6	1.1	1100.0
39.	Y	Yttrium	4.47		
40.	Zr	Zirkonium	6.49		

NB! ikke påvist

Nr.		Grunnstoff	Egenvekt	Kg/Tonn		Gr/Tonn
41.	Nb	Niob	8.4	0.33		330.0
42.	Mo	Molybden	10.2	0.28		280.0
43.	Tc	Technetium	11.5			
44.	Ru	Ruthenium	12.2			
45.	Rh	Rhodium	12.4			
46.	Pd	Palladium	12.0			
✓ × 47.	Ag	Sølv	10.5	2.1	.21%	2100.0
48.	Cd	Kadmium	8.65			
49.	In	Indium	7.31	0.11		110.0
50.	Sn	Tinn	3.3	0.1		100.0
51.	Sb	Antimon	6.62	0.34		340.0
✓ × 52.	Te	Tellur	6.24	39.0	3.9%	39000.0
53.	I	Jod	4.94			
54.	Xe	Xenon	3.06			
55.	Cs	Cesium	1.9			
56.	Ba	Barium	3.5			
57.	La	Lantan	6.17			
× 58.	Ce	Cerium	6.67	0.78		780.0
× 59.	Pr	Praseodym	6.77	0.89		890.0
× 60.	Nd	Neodym	7.0	0.53		530.0
61.	Pm	Prometium	-			
62.	Sm	Samarium	7.64			
63.	Eu	Europium	5.26			
64.	Gd	Gadolinium	7.89			
65.	Tb	Terbium	8.27			
66.	Dy	Dysprosium	8.54			
67.	Ho	Holmium	8.8			
68.	Er	Erbium	9.05			
69.	Tm	Thulium	9.33			
70.	Yb	Ytterbium	6.98			
71.	Lu	Lutetium	9.84			
72.	Hf	Hafnium	13.1			
73.	Ta	Tantal	16.6			
74.	W	Wolfram	19.3			
75.	Re	Rhenium	21.0			
76.	Os	Osmium	22.6			
77.	Ir	Iridium	22.5			
78.	Pt	Platina	21.4			
✓ × 79.	Au	Gull	19.3	0.19		190.0
80.	Hg	Kvikksølv	13.6			
81.	Tl	Thallium	11.85	0.13		130.0
82.	Pb	Bly	11.4	3.9		3900.0
✓ × 83.	Bi	Vismut	9.8	1.5		1500.0
84.	Po	Polonium	9.2			
85.	At	Astat	-			
86.	Rn	Radon	-			
87.	Fr	Francium	-			
88.	Ra	Radium	5.0			
89.	Ac	Actinium	-			
90.	Th	Thorium	11.7			

Nr.		Grunnstoff	Egenvekt	Kg/Tonn	Gr/Tonn
91.	Pa	Protactinium	15.4	påvist i den andre proven	
92.	U	Uran	19.07		
93.	Np	Neptunium	19.5		
94.	Pu	Plutonium	-		
95.	Am	Americium	-		
96.	Cm	Curium	-		
97.	Bk	Berkelium	-		
98.	Cf	Californium	-		
99.	Es	Einsteinium	-		
100.	Fm	Fermium	-		
101.	Md	Mendelevium	-		
102.	No	Nobelium	-		
103.	Lr	Lawrencium	-		

Sum 34 Grunnstoff utgjor 947.63 Kg/Tonn

Hydro Aluminium 27/11/91

Ref. JOB.43
18000.00 Mg / 4.522 Cm2 = 3.981 g/Cm2

Analyse: Åmotsdalen Nr.2 : Knust

Nr.	Grunnstoff		Kg/Tonn	Gr/Tonn
11.	Na		90.585	90585.0
12.	Mg		1.799	1799.0
13.	Al		101.211	101211.0
14.	Si		302.677	302677.0
16.	S		1.347	1347.0
19.	K		2.859	2859.0
20.	Ca		1.683	1683.0
22.	Ti		0.242	242.0
23.	V		0.019	19.0
24.	Cr		0.238	238.0
25.	Mn		0.078	78.0
26.	Fe		3.229	3229.0
28.	Ni		1.340	1340.0
29.	Cu		12.029	12029.0
30.	Zn		0.002	2.0
31.	Ga		0.009	9.0
34.	Se		0.328	328.0
37.	Rb		0.010	10.0
38.	Sr		0.108	108.0
39.	Y		0.010	10.0
47.	Ag		1.994	1994.0
49.	In		0.007	7.0
50.	Sn		0.094	94.0
51.	Sb		0.086	86.0
52.	Te		11.753	11753.0
58.	Ce	Cerium	0.177	177.0
59.	Pr	Praseodym	0.032	32.0
79.	Au		0.209	209.0
80.	Hg		0.004	4.0
82.	Pb		0.276	276.0
83.	Bi		0.752	752.0
92.	U		0.428	428.0

Sum 32 Grunnstoff utgjør 535.620 Kg/Tonn

COMP: LIVGARD CONSULTANTS
PROJ:
ATTN: EGIL LIVGARD

MIN-EN LABS — ICP REPORT

705 WEST 15TH ST., NORTH VANCOUVER, B.C. V7M 1T2
(604)980-5814 OR (604)988-4524

FILE NO: 2V-0666-RJ1
DATE: 92/07/24
* ROCK * (ACT:F31)

SAMPLE NUMBER	AG PPM	AS PPM	BA PPM	CU PPM	K PPM	LI PPM	MO PPM	NA PPM	NI PPM	PB PPM	SB PPM	ZN PPM	AU-FIRE PPB
9523	.8	14	76	12	2720	5	2	310	2	8	1	12	21
9524	1.3	11	123	10	3040	3	3	300	2	6	1	15	1
9525	1.2	15	14	4	220	1	4	30	6	3	1	1	4
9526	2.1	2	325	41	5670	8	4	230	13	4	1	43	4
9527	1.0	13	36	4	770	1	3	230	3	4	1	5	17
9528	>200.0	17	22	8973	470	1	3	670	3	334	11	7	>10000
9529	8.1	1	262	92	3040	4	3	280	2	11	1	20	679
9530	3.6	6	77	24	1470	1	14	250	4	7	1	1	273
9531	2.4	12	157	19	2230	1	3	120	7	9	1	8	84
9532	2.3	13	2178	15	930	1	3	160	4	9	1	1	36
9533	1.4	15	16	9	150	1	3	30	7	4	2	1	20
9534	8.8	8	405	2158	1670	2	2	580	3	11	3	10	2050
9535	2.1	14	100	17	1360	1	2	90	4	6	1	1	14
9536	4.0	20	41	44	1010	1	3	380	2	12	1	9	383
9537	1.0	10	331	6	1530	1	3	160	2	5	1	1	5
9538	56.6	10	51	4192	1390	2	2	860	4	103	6	16	>10000

GEOCHEMICAL ANALYSIS CERTIFICATE

Consolidated Logan Mines Ltd. File # 93-1638 Page 1
1022 - 470 Granville St., Vancouver BC V6C 1V5 Submitted by: Seamus Young

SAMPLE#	Mo ppm	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Ni ppm	Co ppm	Mn ppm	Fe %	As ppm	U ppm	Au ppm	Th ppm	Sr ppm	Cd ppm	Sb ppm	Bi ppm	V ppm	Ca %	P %	La ppm	Cr ppm	Mg %	Ba ppm	Ti %	B ppm	Al %	Na %	K %	W ppm	Au* ppb
9658 Snow Ck	3	296	8	6	7.9	4	1	154	5.32	2	<5	<2	10	11	<.2	3	<2	23	.02	.007	3	24	.11	43	.07	4	.37	.03	.32	1	52
9659 "	2	30	38	4	.6	5	1	63	.47	3	5	<2	14	4	<.2	2	<2	4	.03	.005	5	7	.05	13	.03	<2	.18	.07	.14	1	5
STILL BIZ 9660 Cu	2	14902	4	94	19.6	18	8	722	2.08	<2	<5	<2	8	85	1.2	<2	3	35	.56	.077	32	39	1.63	146	.18	2	1.89	.06	1.46	<1	490 Cu
9661 Scu	213	2286	10	23	1.8	17	24	258	5.71	<2	<5	<2	10	71	.3	2	<2	37	.20	.012	18	3	.38	135	.11	5	.89	.03	.54	1	7 w Mo
RE 9661	214	2248	12	23	1.8	17	24	263	5.80	<2	<5	<2	10	71	.2	<2	<2	38	.20	.012	18	2	.39	137	.11	4	.90	.03	.55	<1	6 w Mo
OX 9662 DRK SCH	4	97	3	20	.2	7	1	182	1.53	<2	<5	<2	4	9	<.2	<2	4	13	.05	.008	4	39	.32	47	.09	2	.53	.06	.33	<1	3
2.5m 9663 "	8	289	9	41	1.0	7	1	321	2.72	<2	<5	<2	15	12	.2	<2	3	20	.07	.026	5	29	.69	83	.18	2	.89	.06	.75	<1	29
9664 "	4	4895	882	104	16.4	5	3	670	2.53	<2	<5	<2	12	103	.9	<2	8	28	.28	.035	23	6	.74	110	.22	2	1.22	.09	.84	<1	68
OX 9665 Qtz Py	6	250	5	3	.4	13	3	58	1.71	<2	<5	<2	<2	4	<.2	2	<2	4	.10	.030	<2	52	.07	21	.02	<2	.13	.01	.05	<1	2
OX 9666 LIGHT GN	6	151	50	9	1.4	3	1	66	1.45	<2	45	<2	23	6	<.2	<2	<2	10	.03	.009	11	5	.07	52	.05	<2	.28	.03	.15	1	1
9667 KFELD,Si	4	147	23	10	1.0	5	1	125	1.17	<2	23	<2	16	7	<.2	<2	2	8	.03	.006	33	30	.09	55	.04	<2	.27	.04	.13	<1	2
Black 9669 Cu	2	9258	3	94	30.0	44	14	882	3.14	<2	6	<2	4	32	.8	<2	6	58	.31	.073	20	145	2.25	484	.30	<2	2.06	.07	2.28	<1	440
9670 KELLSTARN	1	15696	150	24	253.4	3	1	86	.91	<2	225	15	6	2	2.1	4	187	6	.01	.012	6	5	.08	16	.01	<2	.24	.15	.05	1	14800
Black 9671 Cu	2	31806	3	50	120.5	8	3	306	1.01	<2	5	<2	7	138	2.8	<2	2	18	.24	.063	39	26	.48	725	.10	<2	.68	.11	.52	<1	1780 .05 oz
STANDARD C/AU-R	18	61	34	129	7.4	71	32	1021	3.96	41	12	7	36	52	19.6	15	17	57	.53	.087	41	59	.94	185	.09	30	1.88	.08	.16	11	500

ICP - .500 GRAM SAMPLE IS DIGESTED WITH 3ML 3-1-2 HCL-HNO3-H2O AT 95 DEG. C FOR ONE HOUR AND IS DILUTED TO 10 ML WITH WATER.
THIS LEACH IS PARTIAL FOR MN FE SR CA P LA CR MG BA TI B W AND LIMITED FOR NA K AND AL.
ASSAY RECOMMENDED FOR ROCK AND CORE SAMPLES IF CU PB ZN AS > 1%, AG > 30 PPM & AU > 1000 PPB
- SAMPLE TYPE: P1 ROCK P2 SOIL AU* ANALYSIS BY ACID LEACH/AA FROM 10 GM SAMPLE.
Samples beginning 'RE' are duplicate samples.

DATE RECEIVED: JUL 23 1993 **DATE REPORT MAILED:** July 30/93 **SIGNED BY** .... D.TOYE, C.LEONG, J.WANG; CERTIFIED B.C. ASSAYERS

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TO: SEAMUS YOUNG	FROM: ROSEMARY
CO.:	CO.:
DEPT.:	PHONE #: 253-3158
FAX #: 689-0288	FAX #: 253-1716

MINERAL
• ENVIRONMENTS
LABORATORIES
(DIVISION OF ASSAYERS CORP.)

SPECIALISTS IN MINERAL ENVIRONMENTS
CHEMISTS • ASSAYERS • ANALYSTS • GEOCHEMISTS

VANCOUVER OFFICE:
705 WEST 15TH STREET
NORTH VANCOUVER, B.C. CANADA V7M 1T2
TELEPHONE (604) 980-5814 OR (604) 988-4524
FAX (604) 980-9621

SMITHERS LAB.:
3176 TATLOW ROAD
SMITHERS, B.C. CANADA V0J 2N0
TELEPHONE (604) 847-3004
FAX (604) 847-3005

Assay Certificate

2V-0666-RA1

Company: **EGIL LIVGARD**
Project:
Attn: EGIL LIVGARD

Date: AUG-05-92
Copy 1. EGIL LIVGARD, VANCOUVER, B.C.

Oppdal - Norway

We hereby certify the following Assay of 3 CUT ROCK samples submitted JUL-16-92 by EGIL LIVGARD.

Sample Number	AU-FIRE g/tonne	AU-FIRE oz/ton	AG g/tonne	AG oz/ton
9528	220.80	6.440	766.0	22.34
9538	16.70	.487		
9539	2.59	.076		

Certified by ____________________

MIN-EN LABORATORIES

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(DIVISION OF ASSAYERS CORP.)

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SMITHERS LAB.:
3176 TATLOW ROAD
SMITHERS, B.C. CANADA V0J 2N0
TELEPHONE (604) 847-3004
FAX (604) 847-3005

Geochemical Analysis Certificate

2V-0666-RG1

Company: LIVGARD CONSULTANTS
Project:
Attn: EGIL LIVGARD

Date: JUL-24-92
Copy 1. LIVGARD CONSULTANTS, VANCOUVER, B.C.

We hereby certify the following Geochemical Analysis of 16 CUT ROCK samples submitted JUL-16-92 by EGIL LIVGARD.

Sample Number	TE PPM	SE PPM
9523	.03	.07
9524	.07	.04
9525	.01	.01
9526	.27	.16
9527	.08	.31
9528	.44	.68
9529	.65	1.75
9530	.48	.47
9531	.19	.11
9532	.10	.02
9533	.08	.05
9534	.17	.19
9535	.12	.01
9536	1.61	1.02
9537	.10	.56
9538	.48	.97

Certified by ____________

MIN-EN LABORATORIES

ACME [redacted] LABORATORIES LTD. [redacted] E. HASTINGS ST. VANCOUVER B.C. [redacted] PHONE([redacted])253-3158 FAX(60[redacted])253-1716

GEOCHEMICAL ANALYSIS CERTIFICATE

Consolidated Logan Mines Ltd. File # 93-1741 Page 1

1022 - 470 Granville St., Vancouver BC V6C 1V5 Submitted by: Seamus Young

SAMPLE#	Mo ppm	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Ni ppm	Co ppm	Mn ppm	Fe %	As ppm	U ppm	Au ppm	Th ppm	Sr ppm	Cd ppm	Sb ppm	Bi ppm	V ppm	Ca %	P %	La ppm	Cr ppm	Mg %	Ba ppm	Ti %	B ppm	Al %	Na %	K %	W ppm	Au* ppb
9668	3	20	3	47	.1	5	1	271	2.25	15	<5	<2	17	9	<.2	<2	<2	27	.15	.039	5	7	.49	53	.16	3	.77	.08	.53	1	5
9672 TRENCH	2	40807	25	100	224.2	8	8	346	3.59	10	75	2	15	167	3.7	4	319	24	.23	.084	311	12	.43	994	.15	4	1.36	.05	.77	<1	1850
9673	5	226	8	4	1.8	6	2	42	1.32	8	<5	<2	13	9	<.2	<2	<2	3	.02	.010	8	8	.06	64	.03	3	.23	.05	.20	1	10
RE 9673	5	222	6	5	1.6	5	1	39	1.34	7	<5	<2	12	9	<.2	<2	<2	3	.02	.010	7	7	.06	65	.03	3	.23	.05	.20	1	7

ICP - .500 GRAM SAMPLE IS DIGESTED WITH 3ML 3-1-2 HCL-HNO3-H2O AT 95 DEG. C FOR ONE HOUR AND IS DILUTED TO 10 ML WITH WATER.
THIS LEACH IS PARTIAL FOR MN FE SR CA P LA CR MG BA TI B W AND LIMITED FOR NA K AND AL.
ASSAY RECOMMENDED FOR ROCK AND CORE SAMPLES IF CU PB ZN AS > 1%, AG > 30 PPM & AU > 1000 PPB
- SAMPLE TYPE: P1 ROCK P2 TO P3 SOIL AU* ANALYSIS BY ACID LEACH/AA FROM 10 GM SAMPLE.
Samples beginning 'RE' are duplicate samples.

DATE RECEIVED: JUL 30 1993 **DATE REPORT MAILED:** Aug 5/93. **SIGNED BY**.......... D.TOYE, C.LEONG, J.WANG; CERTIFIED B.C. ASSAYERS

[redacted] E. [redacted] ST. [redacted] [redacted] [redacted] [redacted] [redacted] [redacted]

GEOCHEMICAL ANALYSIS CERTIFICATE

Consolidated Logan Mines Ltd. PROJECT NORWAY File # 93-2083 Hi-TeA

1022 - 470 Granville St., Vancouver BC V6C 1V5

SAMPLE#	Mo ppm	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Ni ppm	Co ppm	Mn ppm	Fe %	As ppm	U ppm	Au ppm	Th ppm	Sr ppm	Cd ppm	Sb ppm	Bi ppm	V ppm	Ca %	P %	La ppm	Cr ppm	Mg %	Ba ppm	Ti %	B ppm	Al %	Na %	K %	W ppm	Au* ppb
9682	2	141	4	35	.3	37	34	357	4.08	4	<5	<2	<2	84	<.2	2	<2	76	2.25	.082	4	38	.96	14	.30	5	1.24	.09	.08	1	4
9683	1	2635	20	97	2.1	7	4	208	2.66	<2	<5	<2	2	26	.5	2	4	6	.70	.049	7	9	.26	20	.03	4	.72	.07	.17	<1	6
9684	2	49	760	1734	1.4	17	11	420	2.62	265	<5	<2	4	43	13.6	5	<2	15	1.11	.064	11	19	.62	19	.01	5	.79	.03	.20	<1	4
9685	<1	1365	16231	27257	225.5	7	2	2244	6.90	116	11	<2	20	320	298.7	1036	<2	6	10.89	.023	4	<1	1.63	15	<.01	2	.11	.01	.07	2	210
RE 9685	<1	1425	17105	26042	235.9	9	2	2323	7.23	125	16	<2	17	329	318.2	1100	<2	6	11.59	.024	3	<1	1.69	16	<.01	<2	.12	.01	.08	1	300

ICP - .500 GRAM SAMPLE IS DIGESTED WITH 3ML 3-1-2 HCL-HNO3-H2O AT 95 DEG. C FOR ONE HOUR AND IS DILUTED TO 10 ML WITH WATER.
THIS LEACH IS PARTIAL FOR MN FE SR CA P LA CR MG BA TI B W AND LIMITED FOR NA K AND AL.
ASSAY RECOMMENDED FOR ROCK AND CORE SAMPLES IF CU PB ZN AS > 1%, AG > 30 PPM & AU > 1000 PPB
- SAMPLE TYPE: ROCK AU* ANALYSIS BY ACID LEACH/AA FROM 10 GM SAMPLE. Samples beginning 'RE' are duplicate samples.

DATE RECEIVED: AUG 23 1993 **DATE REPORT MAILED:** Aug 31/93. **SIGNED BY**..........D.TOYE, C.LEONG, J.WANG; CERTIFIED B.C. ASSAYERS

[redacted]ACM[redacted]ALY[redacted]L L[redacted]RATC[redacted]S LT[redacted] E.[redacted]TIN[redacted]T. [redacted]COUV[redacted]B.C[redacted]6A [redacted]NE([redacted]253[redacted]58 [redacted](60[redacted]3-1[redacted]

GEOCHEMICAL ANALYSIS CERTIFICATE

Consolidated Logan Mines Ltd. File # 93-2359 RE ANALYSIS

1022 - 470 Granville St., Vancouver BC V6C 1V5

SAMPLE#	Mo ppm	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Ni ppm	Co ppm	Mn ppm	Fe %	As ppm	U ppm	Au ppm	Th ppm	Sr ppm	Cd ppm	Sb ppm	Bi ppm	V ppm	Ca %	P %	La ppm	Cr ppm	Mg %	Ba ppm	Ti %	B ppm	Al %	Na %	K %	W ppm
9526	2	30	2	55	.8	20	5	503	1.70	<2	<5	<2	8	20	<.2	<2	<2	23	.17	.033	30	26	.72	158	.15	4	.95	.05	.73	2
9528	3	2744	167	18	166.9	10	2	193	.80	<2	105	23	4	13	.7	<2	228	12	.33	.104	14	11	.21	34	.02	2	.42	.22	.15	1
9529	4	15	5	26	1.3	6	1	258	1.69	<2	<5	<2	10	10	<.2	<2	<2	12	.09	.023	4	28	.34	122	.11	4	.56	.06	.44	<1
9534	2	1860	6	11	5.5	5	1	173	.79	2	<5	<2	7	15	.2	<2	3	10	.09	.005	12	8	.25	111	.04	2	.41	.11	.16	1
RE 9534	2	1931	6	12	5.2	5	1	167	.75	3	<5	<2	7	15	.2	<2	3	10	.08	.005	11	7	.24	112	.04	2	.40	.11	.15	1
9536	2	28	7	6	1.0	6	1	72	1.12	<2	<5	<2	14	4	<.2	<2	<2	12	.06	.006	23	7	.13	14	.08	<2	.22	.06	.08	1
9537	4	7	4	1	.3	5	1	22	1.31	<2	<5	<2	11	20	<.2	<2	<2	<2	.04	.037	17	25	.01	134	.01	5	.24	.02	.17	<1
9538	2	5362	146	13	47.3	6	1	93	.51	<2	165	6	4	4	.9	<2	69	6	.05	.019	8	7	.10	12	.01	<2	.28	.18	.06	<1
STANDARD C	17	57	38	125	6.7	70	29	1025	3.96	38	17	6	36	51	17.9	14	18	55	.50	.086	38	57	.90	183	.09	34	1.88	.09	.15	10

ICP - .500 GRAM SAMPLE IS DIGESTED WITH 3ML 3-1-2 HCL-HNO3-H2O AT 95 DEG. C FOR ONE HOUR AND IS DILUTED TO 10 ML WITH WATER.
THIS LEACH IS PARTIAL FOR MN FE SR CA P LA CR MG BA TI B W AND LIMITED FOR NA K AND AL.
ASSAY RECOMMENDED FOR ROCK AND CORE SAMPLES IF CU PB ZN AS > 1%, AG > 30 PPM & AU > 1000 PPB
- SAMPLE TYPE: ROCK   Samples beginning 'RE' are duplicate samples.

DATE RECEIVED: SEP 9 1993 **DATE REPORT MAILED:** Sept 14/93 **SIGNED BY**..........D.TOYE, C.LEONG, J.WANG; CERTIFIED B.C. ASSAYERS

Consolidated Logan Mines Ltd. FILE # 93-1638 SOIL

SAMPLE#	Mo ppm	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Ni ppm	Co ppm	Mn ppm	Fe %	As ppm	U ppm	Au ppm	Th ppm	Sr ppm	Cd ppm	Sb ppm	Bi ppm	V ppm	Ca %	P %	La ppm	Cr ppm	Mg %	Ba ppm	Ti %	B ppm	Al %	Na %	K %	W ppm	Au* ppb
800S 1000E	<1	15	3	35	<.1	7	4	291	1.61	<2	<5	<2	<2	13	<.2	<2	<2	25	.13	.035	6	13	.56	44	.15	2	.88	.01	.24	<1	2
800S 1025E	<1	14	4	35	.1	9	5	301	1.70	<2	<5	<2	2	17	.2	<2	<2	24	.16	.043	10	17	.68	68	.14	2	1.06	.01	.27	<1	1
800S 1050E	2	20	3	33	.1	3	1	274	1.86	<2	<5	<2	5	6	<.2	<2	<2	36	.03	.040	16	8	.45	97	.15	2	1.01	.01	.25	<1	1
800S 1075E	<1	40	4	50	.4	12	5	343	1.61	<2	<5	<2	5	15	<.2	<2	<2	22	.10	.047	41	27	.96	140	.14	2	1.56	.01	.42	<1	2
800S 1100E	1	64	10	55	.9	15	6	352	2.25	<2	<5	<2	5	10	.2	<2	<2	32	.05	.102	45	47	.97	135	.13	3	2.37	.01	.38	<1	2
RE 800S 1100E	1	66	12	55	.9	15	6	357	2.31	<2	<5	<2	5	10	<.2	<2	<2	33	.05	.104	46	48	.96	137	.13	4	2.41	.01	.39	<1	3
800S 1125E	<1	15	4	12	<.1	2	1	61	.50	<2	<5	<2	<2	7	<.2	<2	<2	9	.05	.018	5	5	.07	23	.09	2	.28	<.01	.04	<1	<1
800S 1150E	<1	5	5	36	<.1	5	4	406	1.49	<2	<5	<2	<2	11	<.2	<2	<2	25	.06	.030	5	9	.69	73	.11	2	.98	.01	.39	<1	<1
800S 1175E	<1	32	5	20	.4	5	1	61	.28	<2	<5	<2	<2	8	<.2	<2	<2	8	.05	.069	44	20	.10	45	.04	2	1.02	.01	.04	<1	3
800S 1200E	<1	14	4	43	<.1	14	5	368	1.65	<2	<5	<2	3	12	<.2	<2	<2	22	.08	.014	14	29	1.03	76	.17	<2	1.32	.01	.44	<1	3
800S 1225E	<1	9	5	37	<.1	22	6	361	1.36	<2	<5	<2	2	11	<.2	<2	<2	19	.06	.011	7	55	1.14	74	.15	<2	1.13	.01	.54	<1	1
800S 1250E	<1	9	8	18	.2	4	1	102	.64	<2	<5	<2	<2	11	<.2	<2	<2	9	.08	.051	10	31	.13	69	.08	2	.45	.01	.11	<1	1
800S 1275E	<1	87 ✓	5	18	.8	5	1	38	.37	<2	<5	<2	<2	13	<.2	<2	<2	9	.08	.103	46	49	.06	64	.04	2	1.22	.01	.05	<1	4
800S 1300E	<1	5	7	11	.1	3	1	77	.54	<2	<5	<2	2	10	<.2	<2	<2	10	.07	.018	10	12	.10	28	.11	2	.41	.01	.09	<1	<1
800S 1325E	<1	11	3	43	<.1	20	7	447	2.29	<2	<5	<2	2	17	<.2	<2	<2	42	.16	.037	8	40	1.15	64	.21	2	1.45	.01	.45	<1	1
800S 1350E	<1	8	5	34	<.1	12	5	324	1.53	<2	<5	<2	2	12	<.2	<2	<2	27	.08	.013	6	25	.79	55	.19	2	1.03	.01	.40	<1	1
800S 1375E	<1	10	3	31	<.1	13	4	276	1.17	<2	<5	<2	<2	10	<.2	<2	<2	18	.06	.013	4	32	.69	45	.15	3	.87	.01	.32	<1	2
800S 1400E	<1	4	7	14	<.1	3	1	128	.90	<2	<5	<2	2	7	<.2	<2	<2	20	.06	.010	6	8	.15	21	.16	<2	.49	.01	.11	<1	1
800S 1425E	<1	58	13	15	.4	5	1	25	.29	<2	<5	<2	<2	8	<.2	<2	<2	6	.05	.090	53	22	.04	53	.04	<2	.96	.01	.03	<1	3
800S 1450E	<1	10	8	19	<.1	6	3	172	1.10	<2	<5	<2	2	10	<.2	<2	<2	29	.07	.017	9	19	.37	48	.17	2	.76	.01	.19	<1	1
800S 1475E	<1	12	8	25	.1	8	3	185	1.22	<2	<5	<2	2	11	<.2	<2	<2	22	.08	.029	14	23	.43	63	.15	2	.99	.01	.20	<1	1
800S 1500E	<1	9	2	32	<.1	14	5	328	1.36	<2	<5	<2	4	8	<.2	<2	<2	17	.07	.012	13	28	.76	58	.16	2	1.01	.01	.36	<1	2
STANDARD C/AU-S	17	60	37	124	6.8	67	30	1111	3.96	40	18	6	34	55	16.2	14	16	52	.52	.086	36	55	.92	193	.08	33	1.88	.06	.13	10	47

Sample type: SOIL. Samples beginning 'RE' are duplicate samples.

ACME ANALYTICAL

Consolidated Logan Mines Ltd. FILE # 93-1741 SILT

ACME ANALYTICAL

SAMPLE#	Mo ppm	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Ni ppm	Co ppm	Mn ppm	Fe %	As ppm	U ppm	Au ppm	Th ppm	Sr ppm	Cd ppm	Sb ppm	Bi ppm	V ppm	Ca %	P %	La ppm	Cr ppm	Mg %	Ba ppm	Ti %	B ppm	Al %	Na %	K %	W ppm	Au* ppb
1	1	3	6	30	<.1	9	4	330	1.20	2	<5	<2	2	19	<.2	<2	<2	15	.28	.057	15	15	.76	86	.09	3	.78	.02	.30	<1	<1
2	<1	9	3	17	<.1	6	1	205	.93	<2	<5	<2	2	54	<.2	<2	<2	11	.35	.082	13	9	.43	46	.08	2	.53	.01	.15	<1	<1
3	<1	<1	4	8	<.1	3	1	74	.97	2	<5	<2	3	6	.5	<2	<2	6	.05	.012	15	6	.09	50	.05	4	.17	<.01	.03	1	1
4	<1	<1	3	8	<.1	4	1	77	.59	<2	<5	<2	2	6	<.2	<2	<2	6	.06	.014	11	5	.14	22	.05	<2	.24	<.01	.05	<1	1
5	<1	7	4	32	<.1	8	4	277	1.55	4	<5	<2	7	27	.3	<2	<2	13	.48	.144	16	7	.49	102	.09	2	.49	.01	.24	1	1
6	<1	4	7	28	<.1	6	2	286	.96	<2	<5	<2	5	32	<.2	<2	<2	9	.43	.116	18	7	.41	60	.07	2	.42	.01	.22	<1	<1
7	<1	5	6	22	<.1	7	4	275	1.04	<2	<5	<2	2	22	<.2	<2	<2	12	.24	.044	10	9	.38	64	.09	<2	.56	.01	.17	1	<1
8	<1	4	4	16	<.1	7	2	154	.62	<2	<5	<2	2	17	.3	<2	<2	8	.22	.044	8	10	.31	41	.07	2	.42	.01	.15	<1	<1
9	<1	6	5	17	<.1	5	2	139	.84	2	<5	<2	2	17	.3	<2	<2	10	.26	.043	12	10	.27	44	.08	2	.45	.01	.10	1	1
10	<1	1	3	14	<.1	7	3	128	.90	<2	<5	<2	2	17	<.2	<2	<2	10	.23	.047	11	8	.23	32	.08	2	.35	.01	.10	<1	2
11	<1	8	5	12	<.1	6	2	135	.66	<2	<5	<2	<2	20	.2	<2	<2	10	.25	.056	9	10	.25	38	.08	2	.43	.01	.14	1	1
12	<1	15	4	19	.1	6	4	286	1.21	3	<5	<2	2	26	<.2	<2	<2	15	.46	.123	12	14	.39	57	.08	<2	.65	.01	.21	1	1
13	<1	4	3	10	<.1	4	<1	116	.46	<2	<5	<2	2	9	<.2	<2	2	6	.13	.031	7	5	.20	29	.06	3	.31	.01	.09	<1	<1
14	<1	1	3	10	<.1	4	1	96	.38	<2	<5	<2	2	12	.2	<2	<2	5	.14	.033	6	6	.19	39	.05	<2	.29	.01	.11	<1	1
15	<1	6	4	11	<.1	4	1	72	.43	<2	<5	<2	<2	9	.2	<2	<2	6	.09	.015	9	8	.13	12	.05	<2	.23	<.01	.05	<1	<1
RE 15	<1	6	7	10	<.1	3	1	71	.43	<2	<5	<2	<2	9	.2	<2	<2	6	.09	.015	7	8	.13	14	.05	<2	.23	<.01	.04	<1	1
16	1	23	3	29	<.1	7	4	282	1.03	<2	<5	<2	3	16	<.2	<2	<2	12	.20	.050	18	10	.40	55	.08	<2	.57	.01	.20	1	<1
17	1	11	7	23	<.1	2	2	149	.70	5	<5	<2	<2	16	.2	<2	<2	8	.20	.043	16	8	.26	32	.07	<2	.44	.01	.11	<1	<1
18	1	12	5	16	<.1	3	1	109	.76	<2	<5	<2	<2	14	<.2	<2	<2	9	.20	.043	17	11	.24	22	.06	2	.43	.01	.09	1	5
19	1	30	5	22	.1	7	2	149	.92	<2	<5	<2	2	19	.2	<2	<2	13	.40	.104	24	10	.29	33	.07	<2	.54	.01	.13	<1	2
20	1	15	2	21	.1	7	2	134	.70	<2	<5	<2	3	15	<.2	<2	<2	9	.26	.069	22	17	.26	30	.06	<2	.47	.01	.12	<1	1
21	<1	27	5	30	.1	10	3	220	1.09	3	<5	<2	2	17	<.2	<2	<2	15	.33	.078	21	18	.41	42	.09	<2	.75	.01	.18	1	1
22	<1	15	3	21	.1	6	2	185	.79	<2	<5	<2	<2	21	.3	<2	<2	11	.37	.098	18	13	.27	28	.06	<2	.53	.01	.13	1	1
23	<1	12	7	25	<.1	7	3	233	.87	2	<5	<2	2	19	<.2	<2	<2	14	.32	.074	10	14	.37	39	.08	<2	.55	.01	.16	<1	<1
24	<1	14	5	19	<.1	6	2	179	.82	<2	<5	<2	<2	25	.2	<2	<2	11	.49	.128	11	15	.29	34	.07	<2	.46	.01	.14	1	<1
25	<1	16	4	27	<.1	6	3	278	.97	<2	<5	<2	<2	22	<.2	<2	<2	15	.21	.044	13	17	.39	52	.08	<2	.65	.01	.15	<1	<1
26	<1	19	7	44	.1	12	4	299	1.24	3	<5	<2	3	46	<.2	<2	<2	19	.52	.101	19	26	.66	92	.11	3	1.02	.01	.36	1	<1
27	2	34	7	42	.2	14	7	507	1.44	3	5	<2	4	18	.4	<2	<2	18	.28	.078	46	26	.52	59	.10	<2	1.03	.01	.25	1	2
28	<1	7	<2	22	<.1	9	2	186	.74	<2	<5	<2	2	18	<.2	<2	<2	11	.38	.107	17	14	.42	59	.08	<2	.53	.01	.20	<1	1
29	<1	3	3	13	<.1	3	<1	84	.38	<2	<5	<2	2	12	<.2	<2	<2	5	.26	.068	8	6	.15	21	.04	<2	.23	<.01	.08	<1	1
30	<1	11	4	22	<.1	4	3	234	1.46	<2	<5	<2	5	20	.6	<2	<2	12	.42	.128	30	7	.33	35	.07	2	.35	.01	.17	1	<1
31	<1	4	2	18	<.1	5	2	128	.57	<2	<5	<2	<2	25	<.2	<2	<2	7	.32	.079	12	7	.23	26	.05	<2	.33	.01	.09	<1	<1
32	<1	6	6	24	<.1	5	3	226	1.72	2	<5	<2	3	22	<.2	<2	<2	14	.31	.087	17	8	.30	32	.09	<2	.35	.01	.17	1	1
33	<1	7	4	26	<.1	7	3	170	.81	<2	<5	<2	<2	26	.2	<2	<2	14	.32	.074	7	8	.46	53	.08	<2	.55	.01	.21	<1	<1
34	<1	12	4	29	.1	7	2	169	1.00	2	<5	<2	3	34	<.2	<2	<2	13	.49	.128	13	12	.35	41	.08	<2	.51	.01	.18	1	1
35	<1	12	6	19	<.1	6	1	135	.82	<2	<5	<2	3	20	.2	<2	<2	8	.27	.067	20	8	.25	37	.06	<2	.35	.01	.11	<1	<1
36	<1	5	6	16	<.1	2	1	110	1.16	3	<5	<2	4	28	.3	<2	<2	11	.65	.181	14	8	.19	19	.08	<2	.29	.01	.10	<1	340
STANDARD C/AU-S	16	58	34	122	6.8	67	28	1104	3.96	37	19	7	35	54	16.8	14	17	51	.51	.086	37	56	.90	190	.09	33	1.88	.06	.14	11	48

Sample type: SOIL. Samples beginning 'RE' are duplicate samples.

SAMPLE#	Mo ppm	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Ni ppm	Co ppm	Mn ppm	Fe %	As ppm	U ppm	Au ppm	Th ppm	Sr ppm	Cd ppm	Sb ppm	Bi ppm	V ppm	Ca %	P %	La ppm	Cr ppm	Mg %	Ba ppm	Ti %	B ppm	Al %	Na %	K %	W ppm	Au* ppb
37	<1	10	2	18	<.1	5	1	131	.89	<2	<5	<2	2	19	<.2	<2	<2	9	.45	.110	14	10	.26	26	.06	<2	.38	.01	.12	<1	2
38	<1	6	<2	17	<.1	3	1	149	.81	<2	<5	<2	3	15	<.2	<2	<2	8	.36	.107	16	5	.27	26	.05	2	.27	<.01	.14	<1	2
39	<1	3	3	13	<.1	8	1	60	.46	<2	<5	<2	<2	9	<.2	<2	<2	6	.10	.015	4	17	.16	14	.05	<2	.23	<.01	.06	<1	2
40	<1	6	4	13	<.1	5	2	86	.57	<2	<5	<2	<2	9	<.2	<2	<2	8	.10	.018	7	11	.18	22	.06	2	.29	.01	.07	<1	1
41	<1	17	<2	20	<.1	16	4	200	1.19	<2	<5	<2	4	15	.2	<2	<2	13	.31	.066	16	38	.44	32	.08	<2	.57	.01	.18	<1	1
RE 41	<1	16	<2	21	<.1	17	4	204	1.20	<2	<5	<2	3	15	<.2	<2	<2	14	.31	.066	16	40	.45	33	.09	<2	.58	.01	.18	<1	1
42	<1	8	3	14	<.1	13	3	225	.85	<2	<5	<2	2	10	<.2	<2	<2	11	.15	.029	8	30	.32	26	.07	3	.41	<.01	.12	<1	<1
43	<1	12	4	11	<.1	4	1	72	.51	<2	<5	<2	<2	12	<.2	<2	<2	7	.16	.036	13	7	.14	15	.05	2	.29	.01	.05	<1	1
STANDARD C/AU-S	16	57	37	120	6.5	67	27	1099	3.96	47	18	7	34	54	16.9	14	18	50	.51	.085	37	53	.90	190	.09	32	1.88	.06	.14	11	46

Sample type: SOIL. Samples beginning 'RE' are duplicate samples.

ACME ANALYTICAL LABORATORIES LTD. 852 E. HASTINGS ST. VANCOUVER B.C. V6A 1R6 PHONE(604)253-3158 FAX(604)253-1716

GEOCHEMICAL ANALYSIS CERTIFICATE

Consolidated Logan Mines Ltd. File # 93-2086 SILT

1022 - 470 Granville St., Vancouver BC V6C 1V5

SAMPLE#	Mo ppm	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Ni ppm	Co ppm	Mn ppm	Fe %	As ppm	U ppm	Au ppm	Th ppm	Sr ppm	Cd ppm	Sb ppm	Bi ppm	V ppm	Ca %	P %	La ppm	Cr ppm	Mg %	Ba ppm	Ti %	B ppm	Al %	Na %	K %	W ppm	Au* ppb
44	<1	2	3	9	<.1	4	1	63	.81	<2	<5	<2	2	7	<.2	2	<2	5	.13	.026	9	6	.07	8	.05	3	.17	<.01	.02	<1	3
45	1	7	4	24	<.1	12	3	147	1.10	<2	<5	<2	2	13	<.2	<2	<2	13	.19	.027	11	16	.35	34	.10	5	.58	.01	.12	<1	2
46	<1	14	4	36	<.1	9	5	342	1.41	<2	<5	<2	3	47	<.2	<2	<2	18	.36	.056	14	14	.41	47	.11	2	.75	.01	.17	<1	2
RE 46	<1	16	4	38	<.1	11	5	361	1.49	<2	<5	<2	3	49	<.2	<2	<2	19	.38	.059	15	15	.43	47	.11	<2	.78	.01	.19	<1	2

ICP - .500 GRAM SAMPLE IS DIGESTED WITH 3ML 3-1-2 HCL-HNO3-H2O AT 95 DEG. C FOR ONE HOUR AND IS DILUTED TO 10 ML WITH WATER.
THIS LEACH IS PARTIAL FOR MN FE SR CA P LA CR MG BA TI B W AND LIMITED FOR NA K AND AL.
- SAMPLE TYPE: SILT AU* ANALYSIS BY ACID LEACH/AA FROM 10 GM SAMPLE. Samples beginning 'RE' are duplicate samples.

DATE RECEIVED: AUG 23 1993 **DATE REPORT MAILED:** Aug 31/93. **SIGNED BY** C. Leong ...D.TOYE, C.LEONG, J.WANG; CERTIFIED B.C. ASSAYERS

Appendix D

Geochemistry of Gold

Appendix D

Geochemistry of Gold

"The use of analyses of the materials of leakage halos and of pervasive alteration zones cannot be over-emphasized in prospecting for covered and deeply buried, blind gold-bearing orebodies. When carrying out a lithogeochemical survey based on leakage halos or pervasive mineralization effects using either rock samples or drill cores the following points should be kept in mind. In addition to analyzing the rock and core samples, all shear zones, fractures, contorted zones and altered zones should, likewise, be sampled and analyzed for gold and its indicator elements (As, Sb, Te, Bi, B, F, Hg). A detailed geological map showing all these features as well as any small veins, no matter what size, should be plotted and the gold and indicator element values entered at the appropriate sites. Where drilling is done, sections with all of this detail should also be prepared. Only in this way is it possible to observe patterns in the primary gold dispersion in the rocks and from these patterns to predict the locus of large deposits. It should be constantly borne in mind that most large deposits have a halo of smaller satellites developed in subsidiary or parallel fractures or in favourable sites in porous, permeable and chemically replaceable rocks. Trace-element work on small shear zones, fractures, etc. increases out ability to differentiate smaller and smaller satellites. It may well be that the data when plotted will show an increase in the gold or indicator element content of alteration zones in a certain direction or that the number of gold-bearing fractures, etc. increases toward a certain valley or draw beneath which lies a major shear or fault zone containing deposits. It is also advisable to contour the results since this method often brings out zones that should be trenched or drilled."

Prospecting for Gold Deposits
Boyle, GSC 1979

Appendix E

Photomicrographs

PHOTOMICROGRAPHS

All photos are at scale of 1cm = 0.17mm

SAMPLE 6

Neg. 304-22: Cross-polarized transmitted light. Shows the probable zeolite (light grey) as a discrete pocket (left; showing bladed/ fibrous texture) and as an area (centre to right) of intergranular replacement/cementation of the host rock quartz/K-spar mosaic (various greys to near black - the latter representing grains in the extinction or near extinction position). Elongate grains in colours (yellow-green-red) are flakes of muscovite.

SAMPLE 8

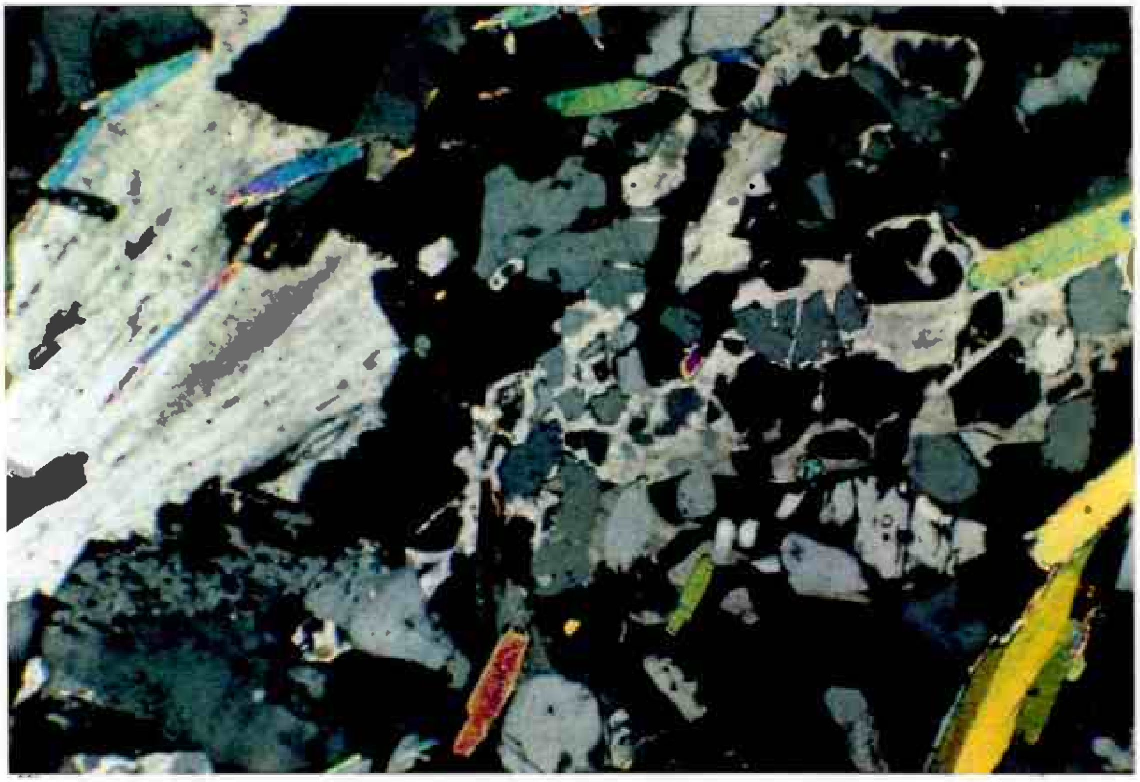
Neg. 304-23: Cross-polarized transmitted light. Shows even-grained, mosaic-textured matrix of quartz and plagioclase (white-greys), with intergrown oriented flakes of biotite (elongate; reddish, green) and stumpy prismatic grains of epidote (yellow, pink, violet, green).

SAMPLE 14

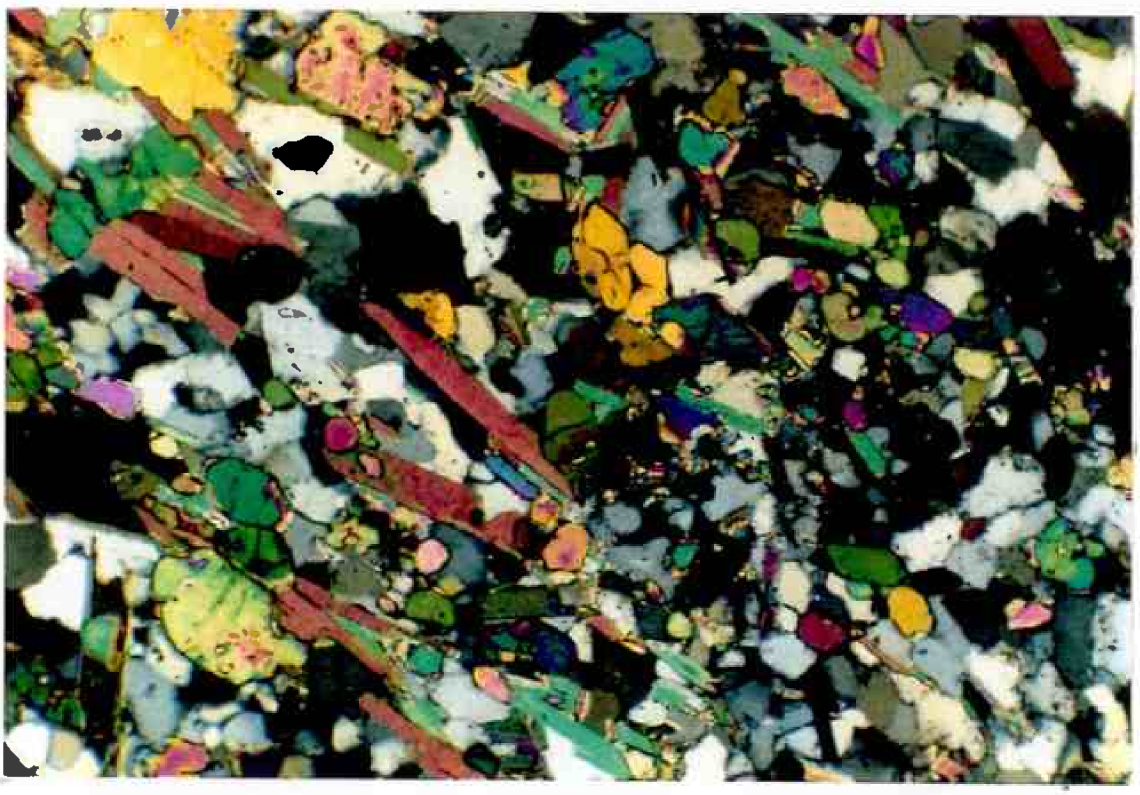
Neg. 304-24: Reflected light. Shows pocket of bornite (pinkish brown) and intergrown chalcocite (light blue-grey) in silicate matrix (peripheral dark-rimmed grey areas). Note covellite (speckled dark blue) developed along chalcocite grain boundaries and cleavages. Note penetration of matrix silicates into the bornite segregations (bottom left).

Neg. 204-25: Cross-polarized transmitted light. Black (opaque) is a bornite pocket, bounded by granoblastic mosaic intergrowth of quartz and K-spar (white-greys). Note euhedral crystals of muscovite (violet, blue, brown) penetrating into the sulfides. The sulfide pocket is partially rimmed by a thin selvedge of malachite (yellowish green; upper centre).

PHOTOMICROGRAPHS

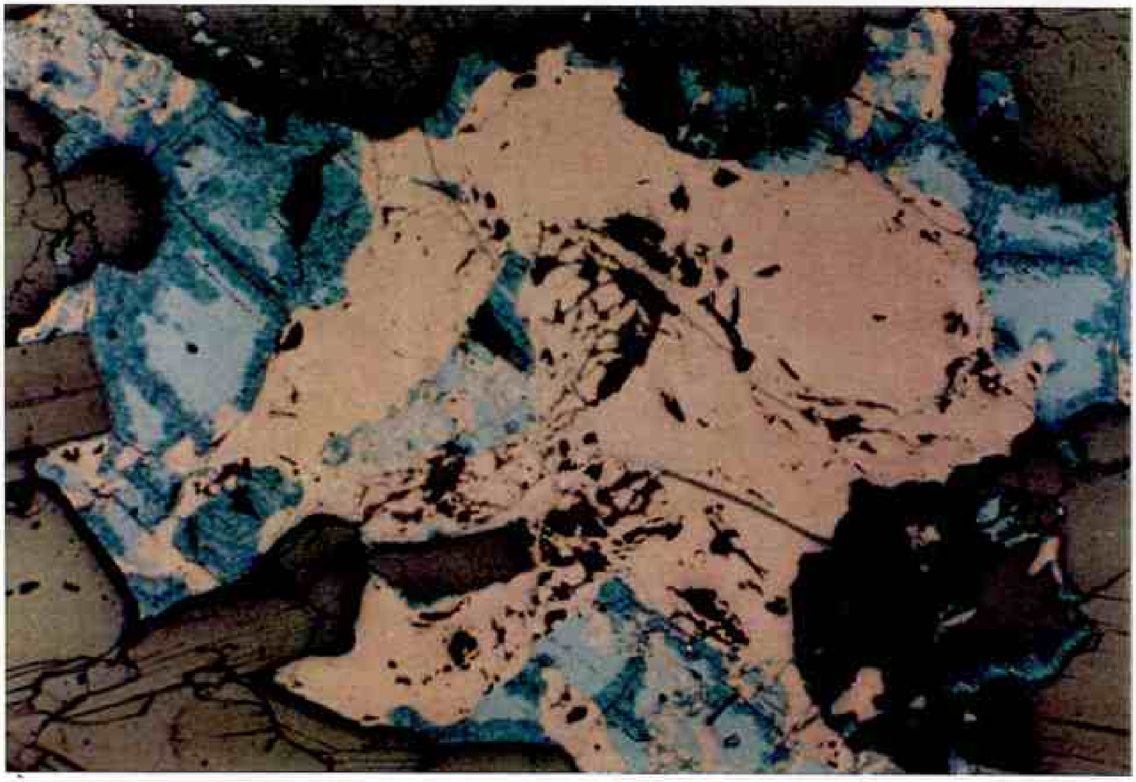


304-22

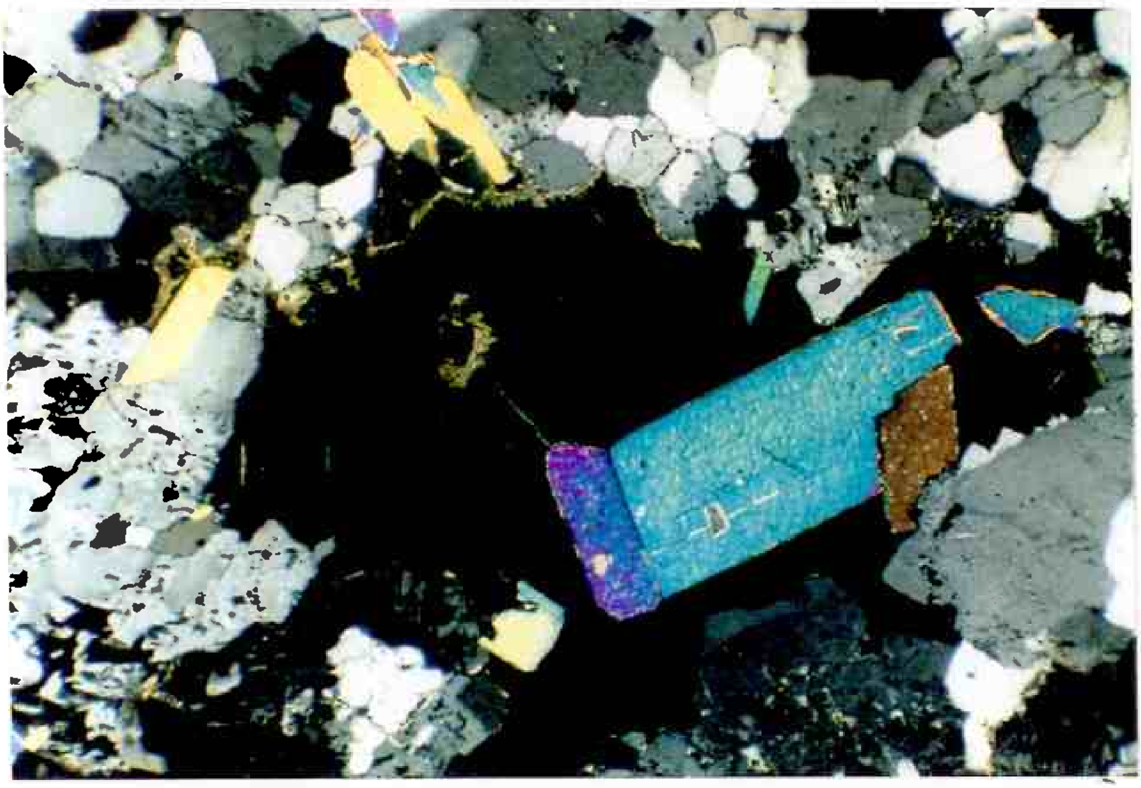


304-23

PHOTOMICROGRAPHS



304-24



304-25

Appendix F

Geophysical Survey Report on the Oppdal Property prepared by F.J.R. Syberg, August, 1993

REPORT

on

GEOPHYSICAL SURVEYS

OPPDAL, NORWAY

for

CONSOLIDATED LOGAN MINES LTD.

VANCOUVER, B.C.

by

F.J.R. Syberg

August, 1993.

TABLE OF CONTENTS

SUMMARY

Geophysical surveys consisting of total field magnetics, VLF-EM Cutler, MD, and VLF-EM Rugby, UK, were carried out in Oppdal, Norway, for Consolidated Logan Mines Ltd. during July and August, 1993.

Geophysical signatures coincide with two major structures and numerous moderate to weakly responding structures. In addition, the geophysical surveys indicate alteration zones with which there are associated several shear zones. the interpreted shear zones are all within areas thought to be alteration zones.

The geophysical signatures due to the Cutler VLF-EM transmitter indicate easterly trending cross faulting.

The presently known gold, copper and copper-gold showings coincide with one northerly trending alteration zone.

INTRODUCTION

During the period of July 17 to August 15, 1993, Donegal Developments, Vancouver, B.C., conducted geophysical surveys on behalf of joint venture partners Consolidated Logan Mines Ltd., Vancouver, B.C., and Calais Resources Ltd., Vancouver, B.C., in Oppdal, Norway. The field operation was carried out by Mr. Mark Terry, B.Sc., under the supervision of Mr. Egil Livgard, P.Eng.

The surveys were conducted on mineral claims known as the Kells Creek Project. Reference in made to reports by Egil Livgard, P. Eng., with reference to the location of the claims, location of survey grid and geological details.

The geophysical surveys consisted of total magnetic field and two VLF-EM station measurements. The stations used throughout the survey period were Cutler, Maryland, and Rugby, England. The VLF-EM field measurements consisted of the horizontal field strength, the vertical secondary in-phase and out-phase magnetic fields.

The survey instrumentation consisted of a Scintrex IGS-2 field unit, containing microprocessing boards for magnetic and VLF-EM measurements, and a Scintrex MP-3 magnetic basestation recorder. Both units include sufficient random access memory (RAM) for the purpose of storing recorded measurements. At the end of each survey day the measurements were downloaded to a computer and saved on diskettes. The instrument accuracy was 0.1 nT for the magnetic measurements and plus-minus 0.5% for both of the secondary VLF-EM measurements leading to accuracies of 0.2° for the computed dip angle and 0.2% for the computed quadrature.

For the most part the survey consisted of a 100 by 100 meter box grid. This included 26 E-W lines and 22 N-S lines 100 meters apart and a station interval of 25 meters. The total distance surveyed was 114.6 line kilometers. The exact directions of the survey lines were N04°W and N86°E.

The purpose of the surveys was to record geophysical responses due to geological structures which would assist with the interpretation of geology and the potential of discovering economic copper-gold mineralization.

The N-S oriented survey lines were maximally coupled to the Cutler transmitter station, and the E-W lines reasonably coupled to the Rugby transmitter.

The manipulation, processing, presentation and interpretation of the survey results has been carried out by the author of this report.

DATA PREPARATION AND PROCESSING

All data files downloaded from the field instruments were edited and checked to suit subsequent computer applications. The magnetic measurements were corrected for diurnal variations using the basestation measurements. These had been recorded every 15 seconds. The base level of the recorded base data was set to 50650 nT. No attempt was made to adjust the magnetic survey to the regional geomagnetic field.

The VLF-EM dip angle and quadrature, in units of degrees and percent, respectively, were computed using the secondary vertical in-phase and out-phase measurements. The procedures for these calculations are detailed in the operations manual published by Scintrex Ltd.

A 12.5 by 12.5 meters grid was superimposed on the survey grid. A standard computer applications program was used to interpolate such a grid matrix for each geophysical survey item. The interpolation procedure consisted of the computation of weighted means using numerical weights calculated from a modified logistic function and using closest surrounding field measurements.

Each interpolated grid matrix of survey data was spectrally analyzed, two-dimensionally, for the purpose of assessing sporatic attributes in the field data and due to various causes, such as uncertainty of station location, geological noise, and line-station interval. Each grid matrix was then filtered, smoothed. The total magnetic field grid matrix was smoothed using a 25 meter upward continuation which essentially simulates having recorded the survey 25 meters above topography. The VLF-EM data was smoothed using a filter similar to a 10 meter upward continuation operator. All the above filter applications were applied using a digital two-dimensional Fourier transform.

A Fraser filter was applied to the VLF-EM dip angle matrices. The filter direction for Cutler was downward matrix columns and left to right along matrix rows for Rugby. The purpose of the Fraser filter is to phase shift cross-overs to relative positive peaks as well as suppress topographic biases.

In order to assist interpretational considerations Hilbert transforms together with a band-pass filter was applied to the quadrature measurements in a direction approximately perpendicular to the direction to the transmitter station. Final contour plans of relevant survey data were plotted and are attached to this report.

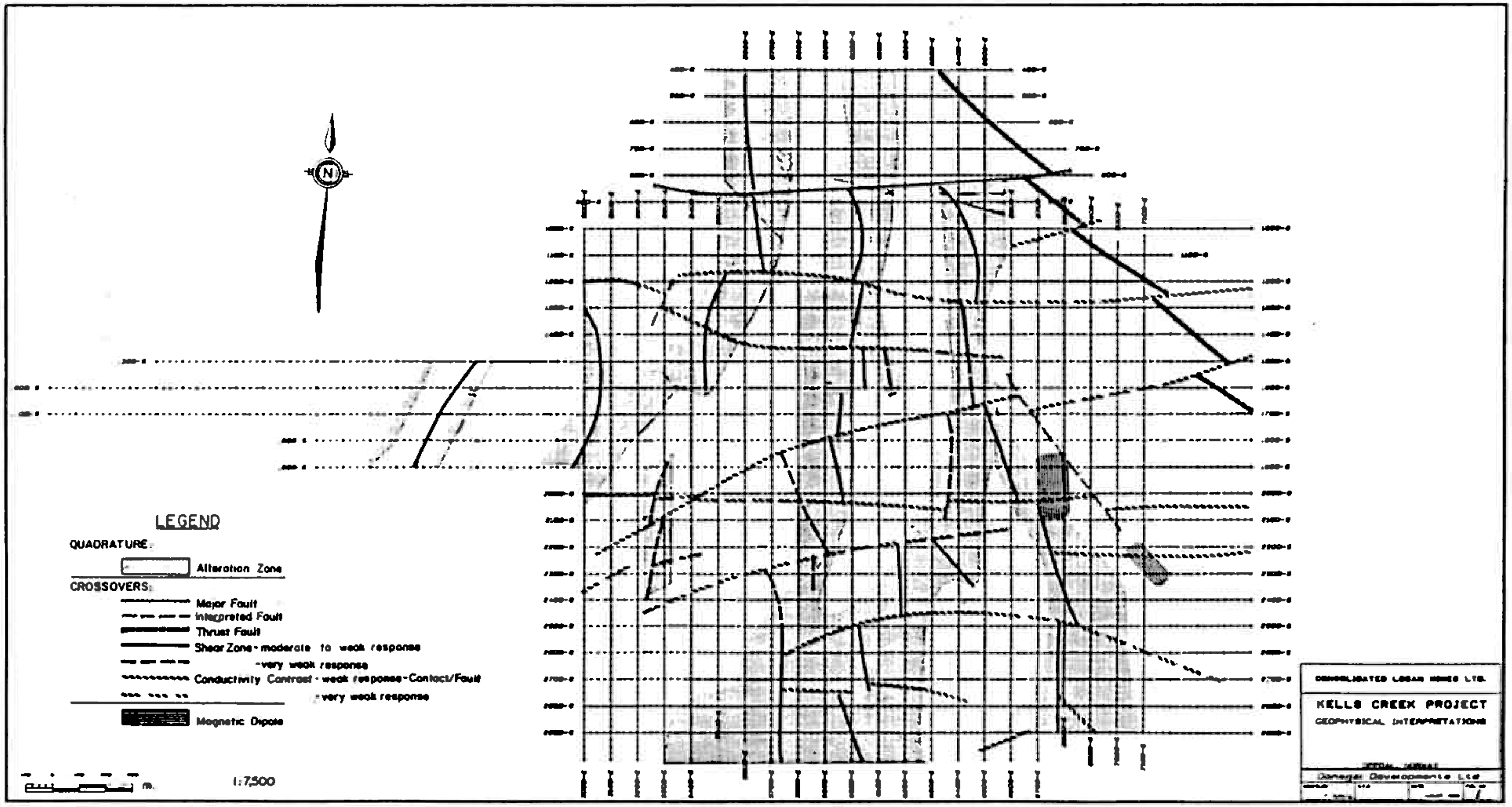
INTERPRETATIONS

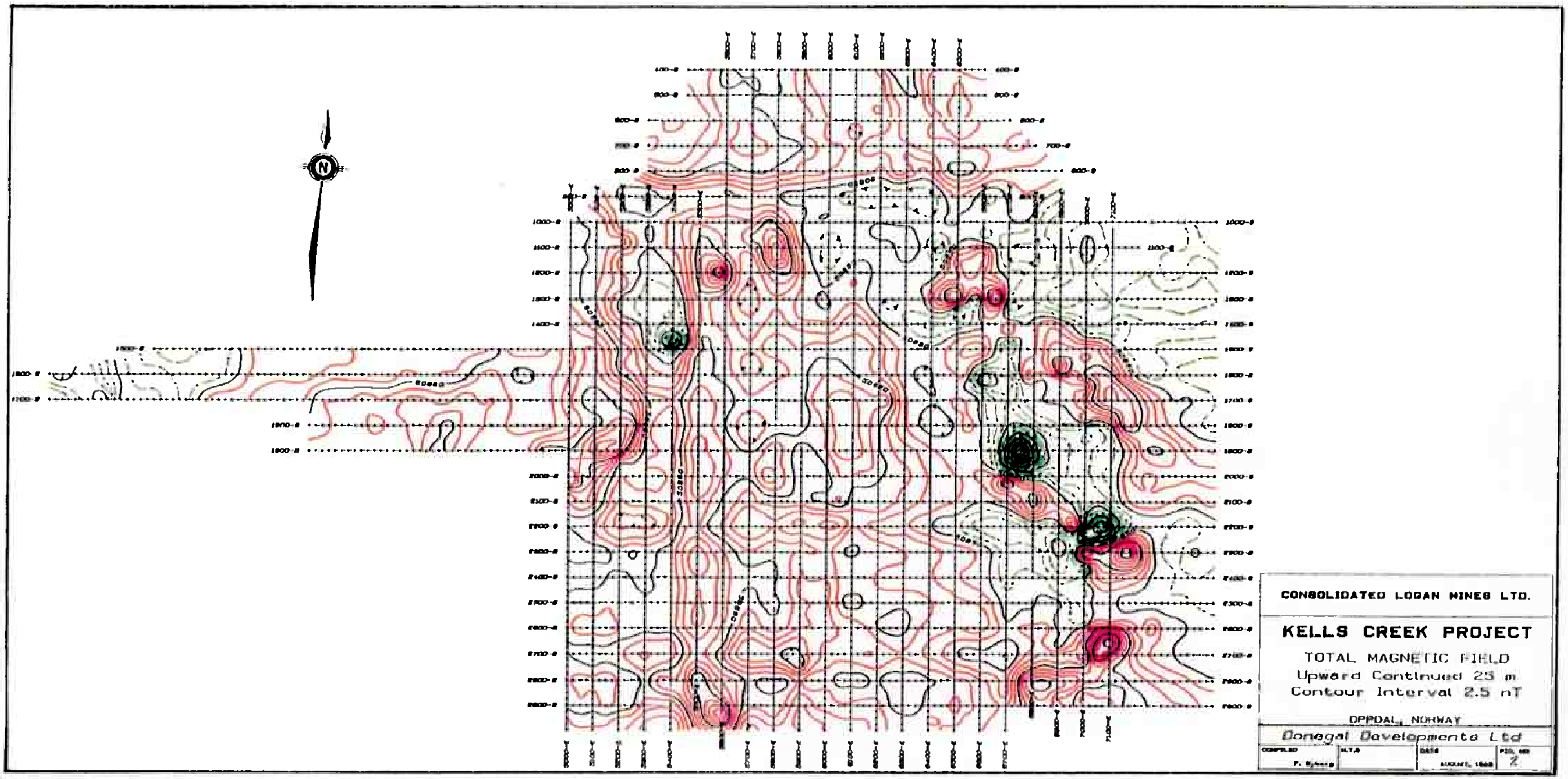
The total magnetic field in the survey area is uncommonly quiet. In order to reconcile with potential magnetic sources in the geological column it became necessary to use a contour interval of 2.5 nT. The lack of magnetic range may suggest an area overlying alteration where magnetite has been altered to hematite.

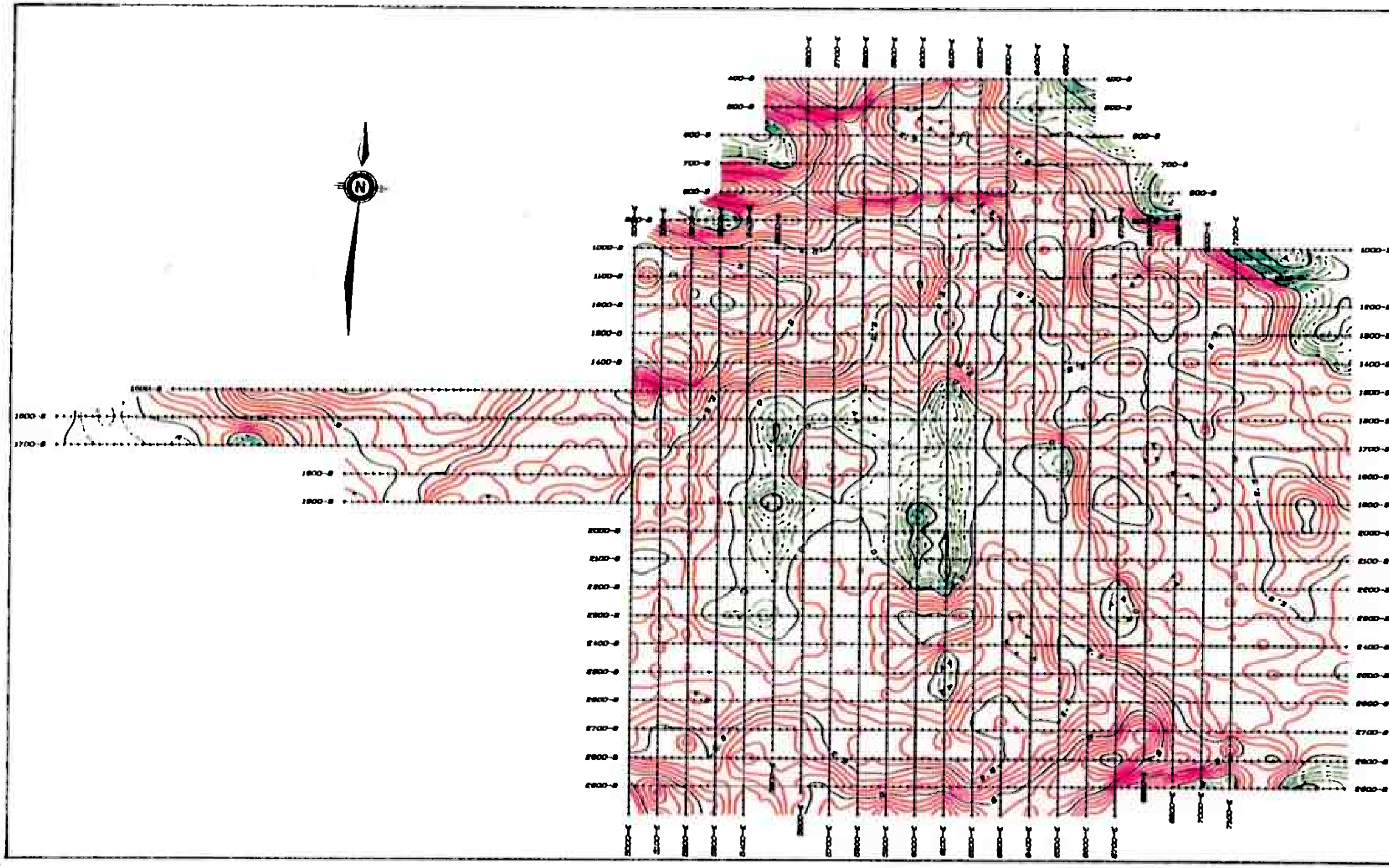
The dip angle cross-overs for both transmitter stations all indicate faults or contacts/faults/shear zones. In general they are all associated with very low conductivities. This may suggest that no significant sulphide concentrations are present in the near-surface geological column.

Similarly to the interpretation of the magnetic data this could suggest that alteration of sulfides has taken place.

The quadrature contour plans suggest a conductivity polarization in a northerly direction in that in the central part of the survey area the Rugby quadrature is predominantly negative, whereas Cutler is positive. Detailed analysis of


N
LEGEND
QUADRATURE:
Alteration Zone
CROSSOVERS:
Major Fault
Interpreted Fault
Thrust Fault
Shear Zone - moderate to weak response
-very weak response
Conductivity Contrast - weak response - Contact/Fault
-very weak response
Magnetic Dipole
m.
1:7,500
KELLS CREEK PROJECT
GEOPHYSICAL INTERPRETATIONS


CONSOLIDATED LOGAN MINES LTD.
KELLS CREEK PROJECT
TOTAL MAGNETIC FIELD
Upward Continued 25 m
Contour Interval 2.5 nT
OPPDAL, NORWAY
Donegal Developments Ltd
2



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KELLS CREEK PROJECT

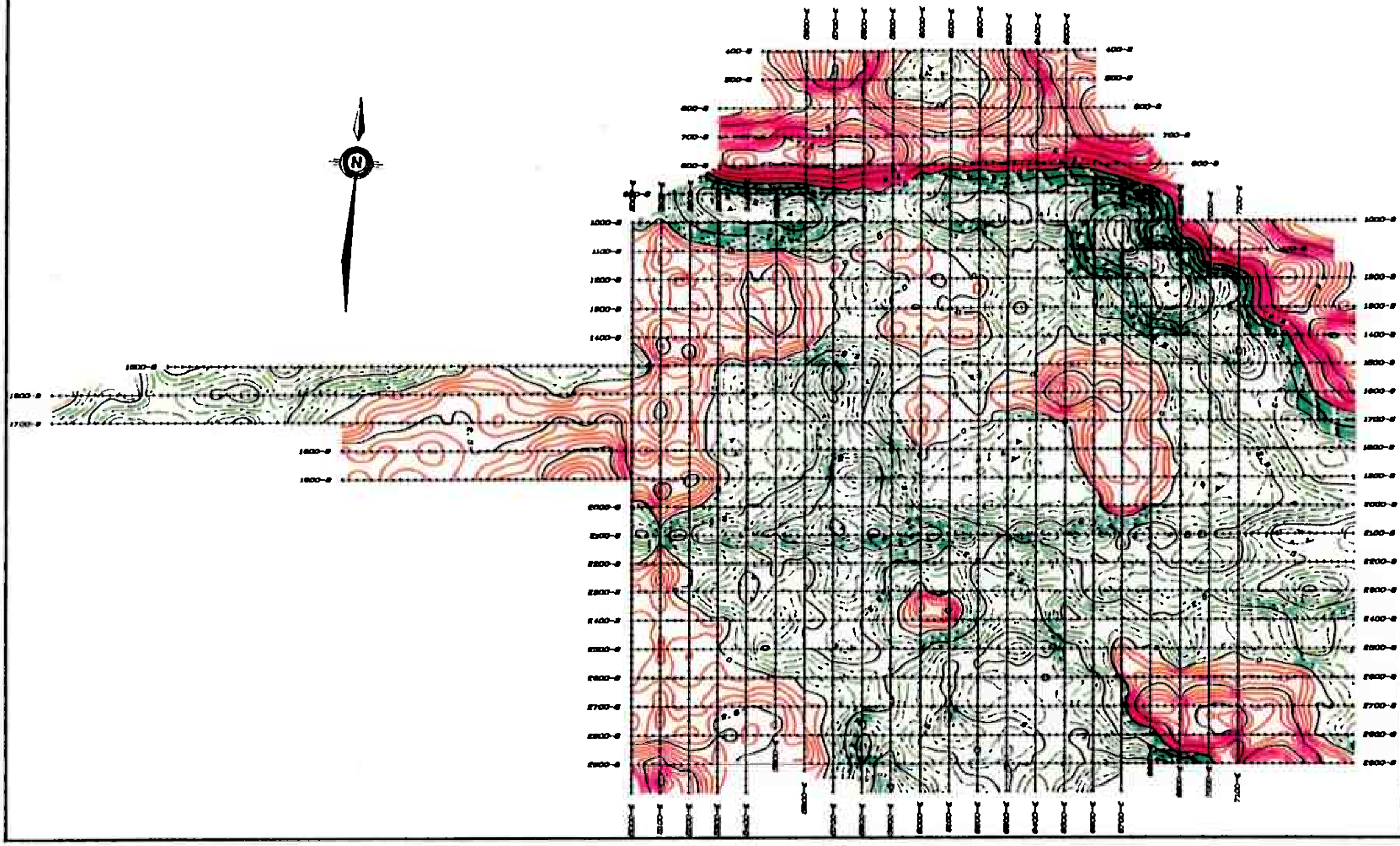
VLF-EM QUADRATURE

Contour Interval 0.5%

OPPDAL, NORWAY

Donegal Developments Ltd

COMPILED	N.T.S	DATE	FIG. NO
P. Syberg		AUGUST, 1988	3



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KELLS CREEK PROJECT

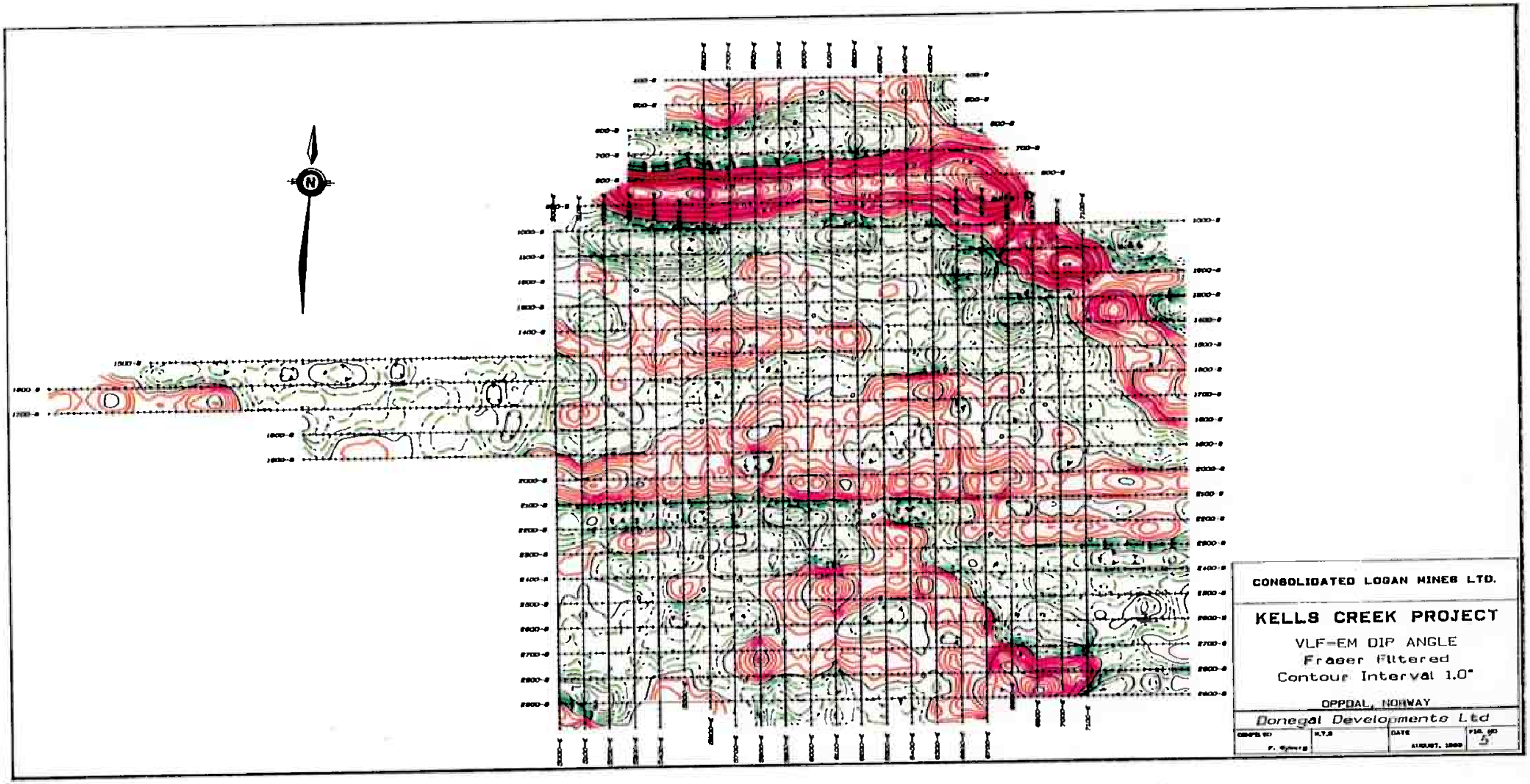
VLF-EM DIP ANGLE

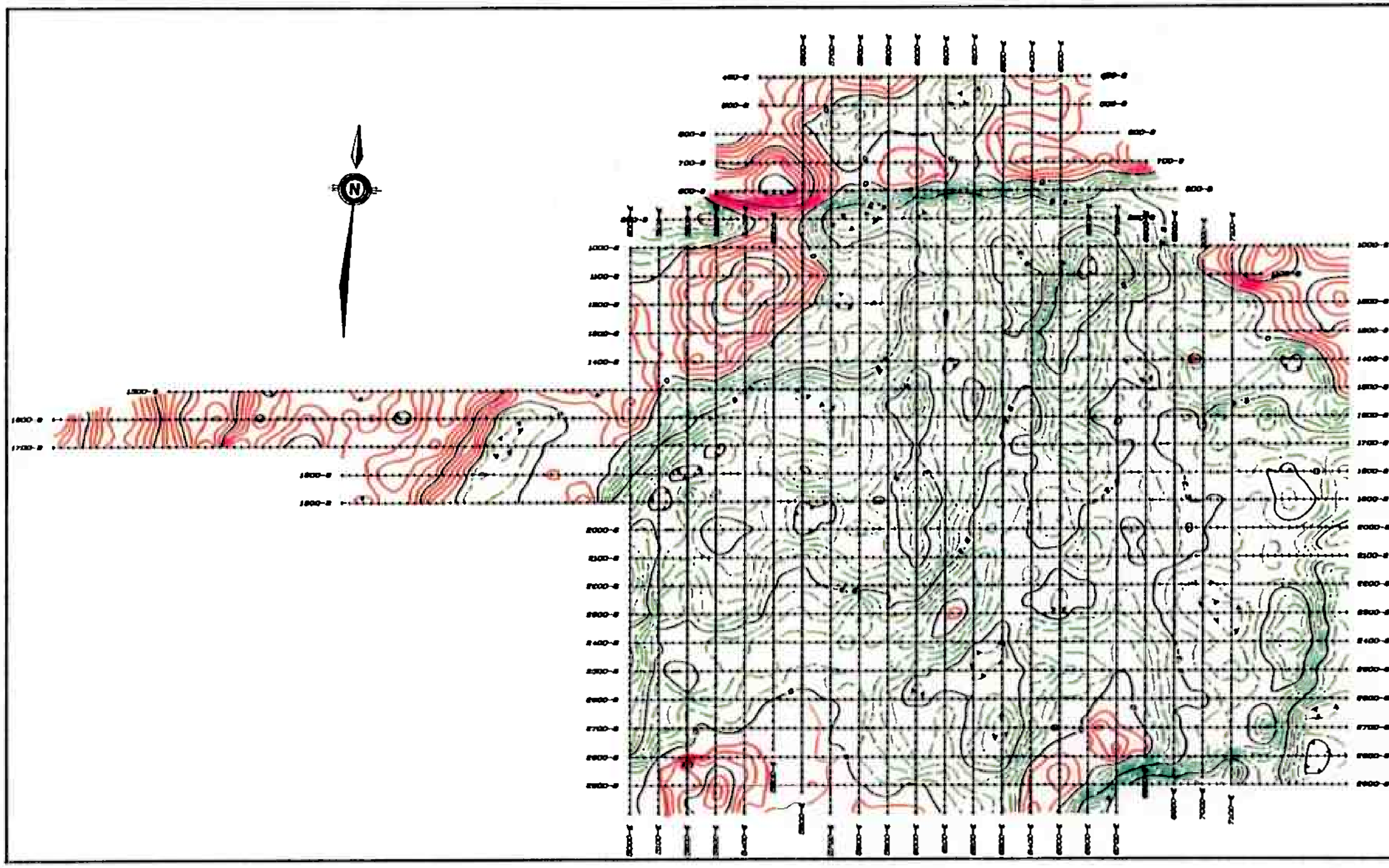
Contour Interval 0.5°

OPPDAL, NORWAY

Donegal Developments Ltd

COMPILED	N.T.S.	DATE	FIG. NO
[illegible]		AUGUST, [illegible]	[illegible]


CONSOLIDATED LOGAN MINES LTD.
KELLS CREEK PROJECT
VLF-EM DIP ANGLE
Fraser Filtered
Contour Interval 1.0°
OPPDAL, NORWAY
Donegal Developments Ltd
DATE
FIG. NO
5



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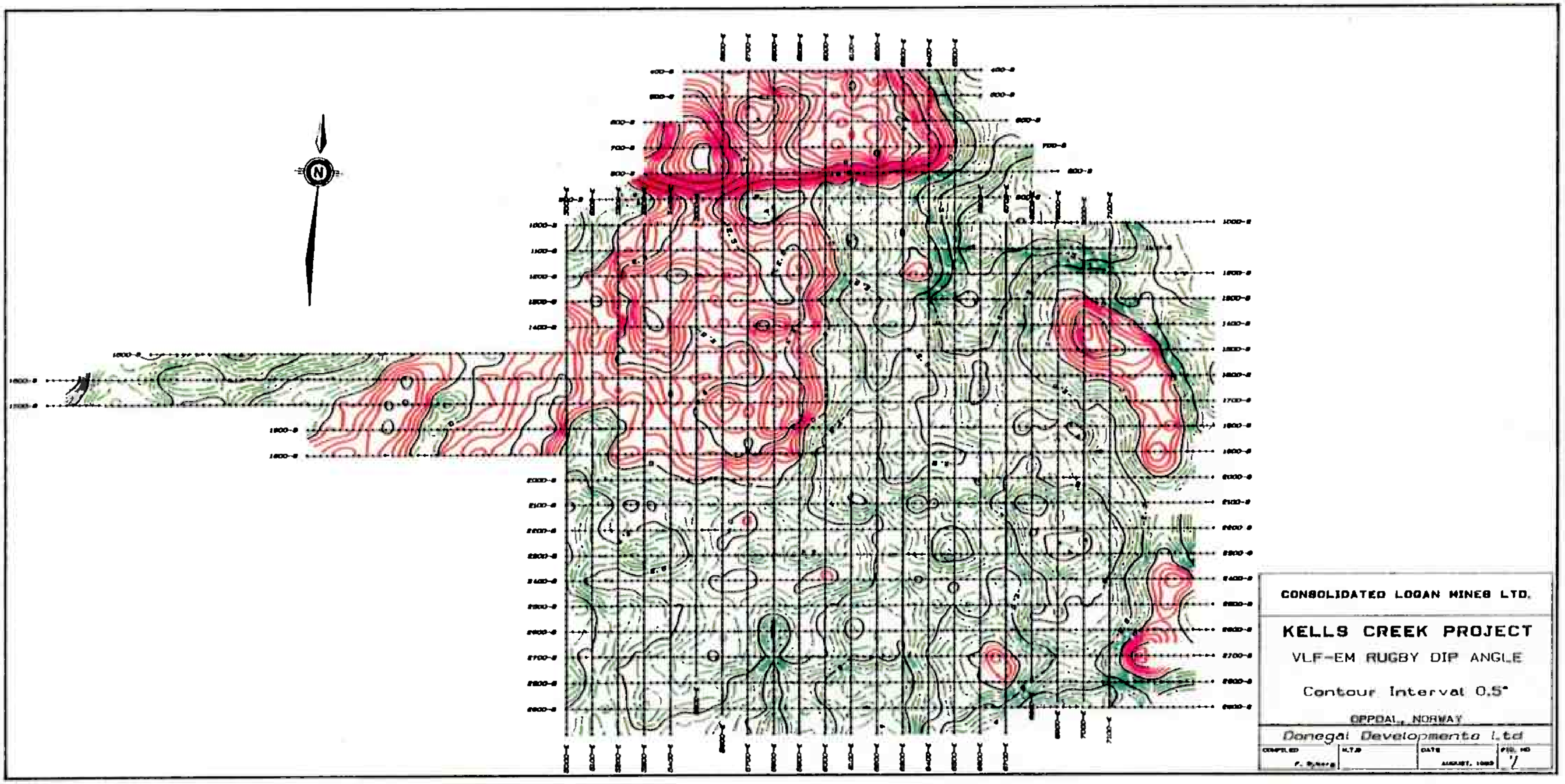
KELLS CREEK PROJECT

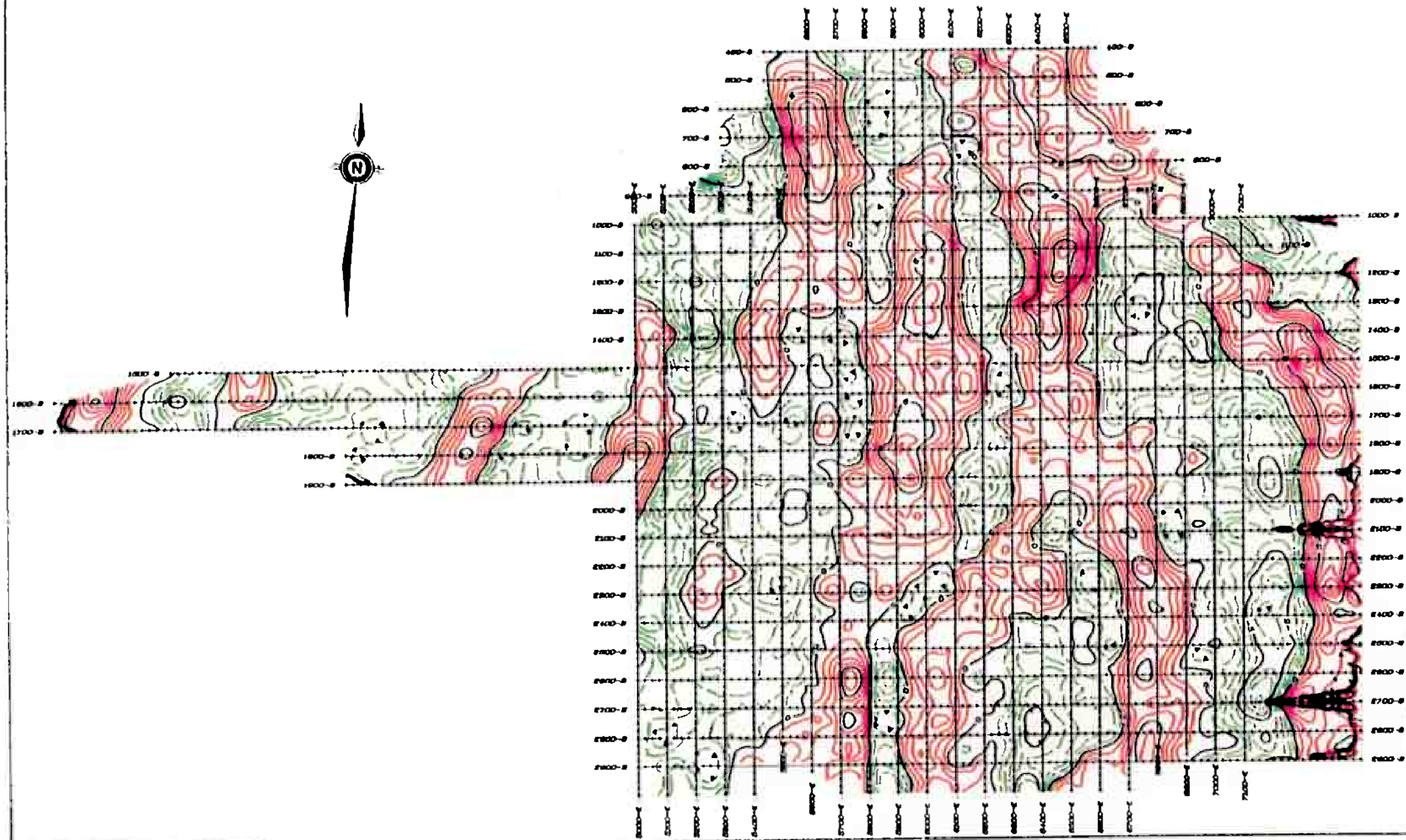
VLF-EM RUGBY QUADRATURE

Contour Interval 0.5%

Donegal Developments Ltd

COMPILED		DATE	FIG. NO
		AUGUST	6


CONSOLIDATED LOGAN MINES LTD.
KELLS CREEK PROJECT
VLF-EM RUGBY DIP ANGLE
Contour Interval 0.5°
OPPDAL, NORWAY
Donegal Developments Ltd
COMPILED
N.T.S
DATE
FIG. NO



CONSOLIDATED LOGAN MINES LTD.

KELLS CREEK PROJECT

VLF-EM RUGBY DIP ANGLE

Fraser Filtered

Contour Interval 1.0°

OPPDAL, NORWAY

Donegal Developments Ltd

COMPILED	N.T.S	DATE	FIG. NO
F. Nyberg		AUGUST, 1988	8

the Rugby quadrature suggest alteration zones noted in Figure 1, Geophysical Interpretations. It is noted that all Rugby dip angle cross-overs, thought to coincide with shear zones, are within the boundaries of the interpreted alteration zones.

The interpretation of a major fault coincides with the geological mapping of such a structure.

The interpretation of a thrust fault is due to dip angle cross-overs with respect to Cutler. They correlate with the mapping of a thrust fault. En echelon off-sets seen in geophysical data probably renders this structure a relatively older event.

CONCLUSIONS

The geophysical surveys have detected geological structures and alteration zones. In this respect it is thought that the survey results will assist geological mapping objectives. That is, the interpreted alteration zones delineate a broader view of the near-surface geological column whereas the interpreted shear zones could indicate the conduits for alterations.

Respectfully submitted,

F.J.R. Syberg

F.J.R. Syberg, B.Sc.

CERTIFICATE OF QUALIFICATION

I, F.J.R. Syberg, 2228 Franklin Street, Vancouver, B.C., hereby certify that:

1) I graduated from the University of British Columbia in 1967 having obtained a B.Sc. degree majoring in geophysics and geology.

2) I have been engaged in mining exploration and production since 1956.

3) I am responsible for all computer programs used to process the field data.

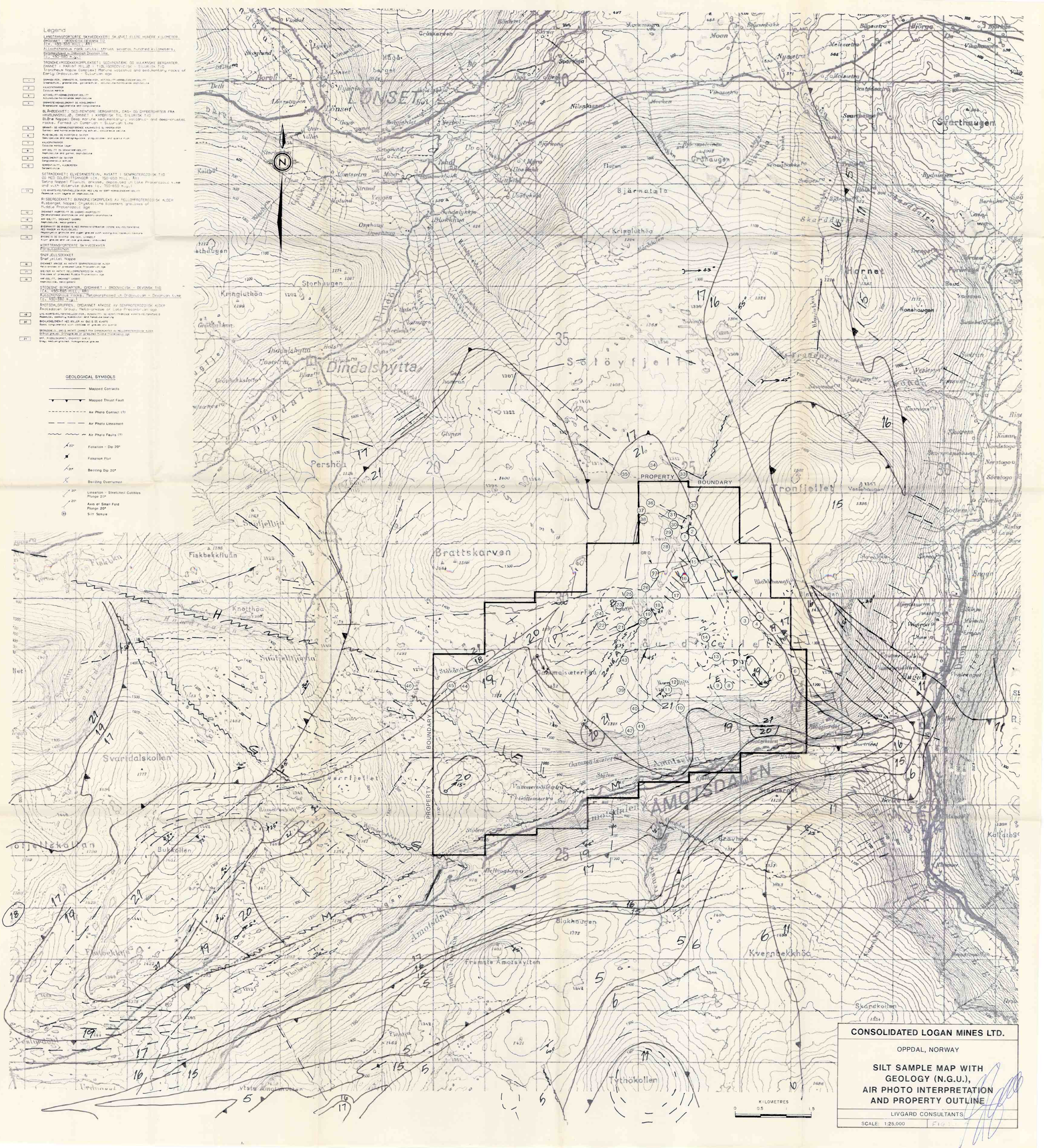
4) I have no interest whatsoever in the property described herein or the securities of Consolidated Logan Mines Ltd.

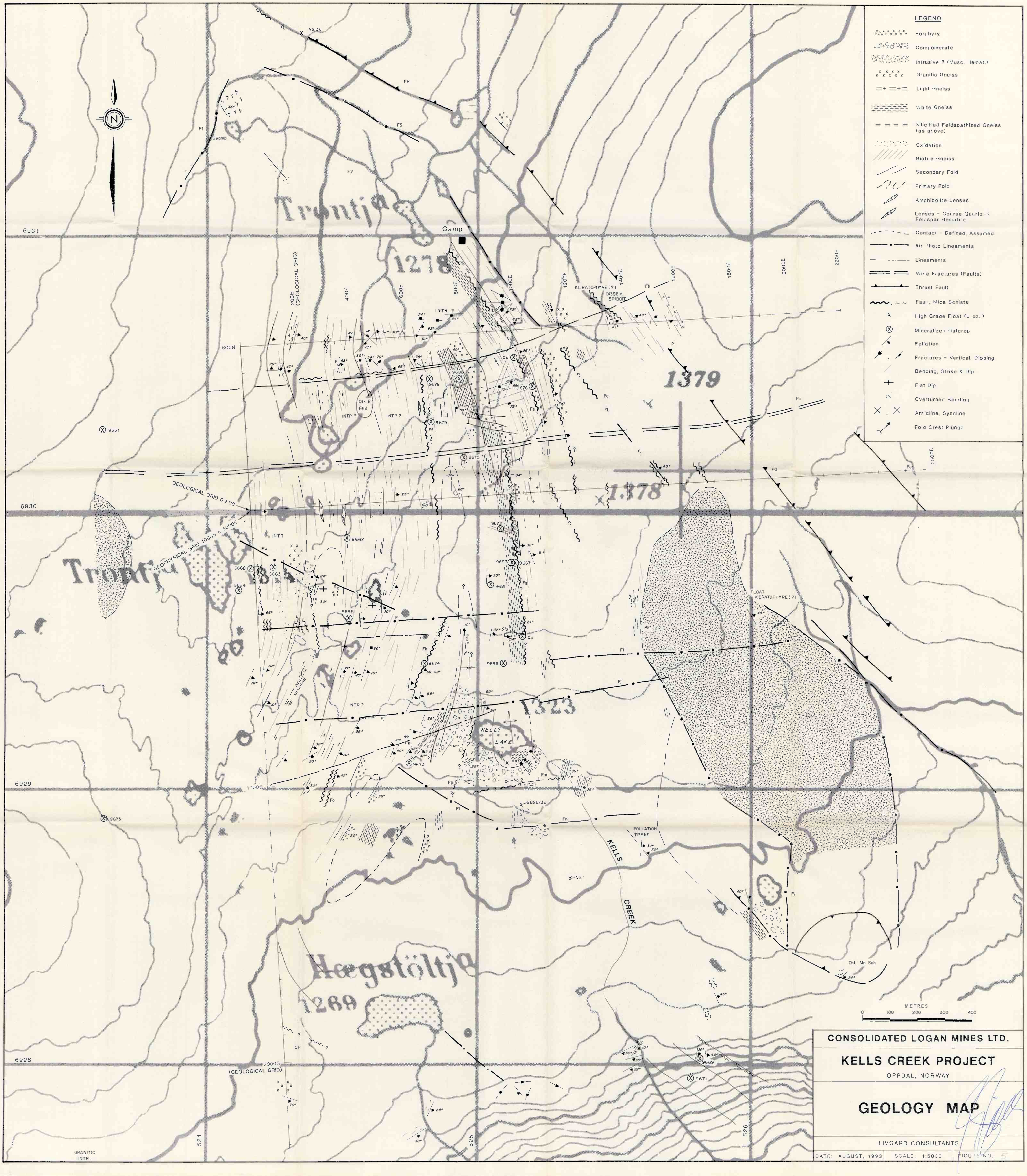
6) I grant Consolidated Logan Mines Ltd. permission to use all data and information contained in this report as the company may see fit.

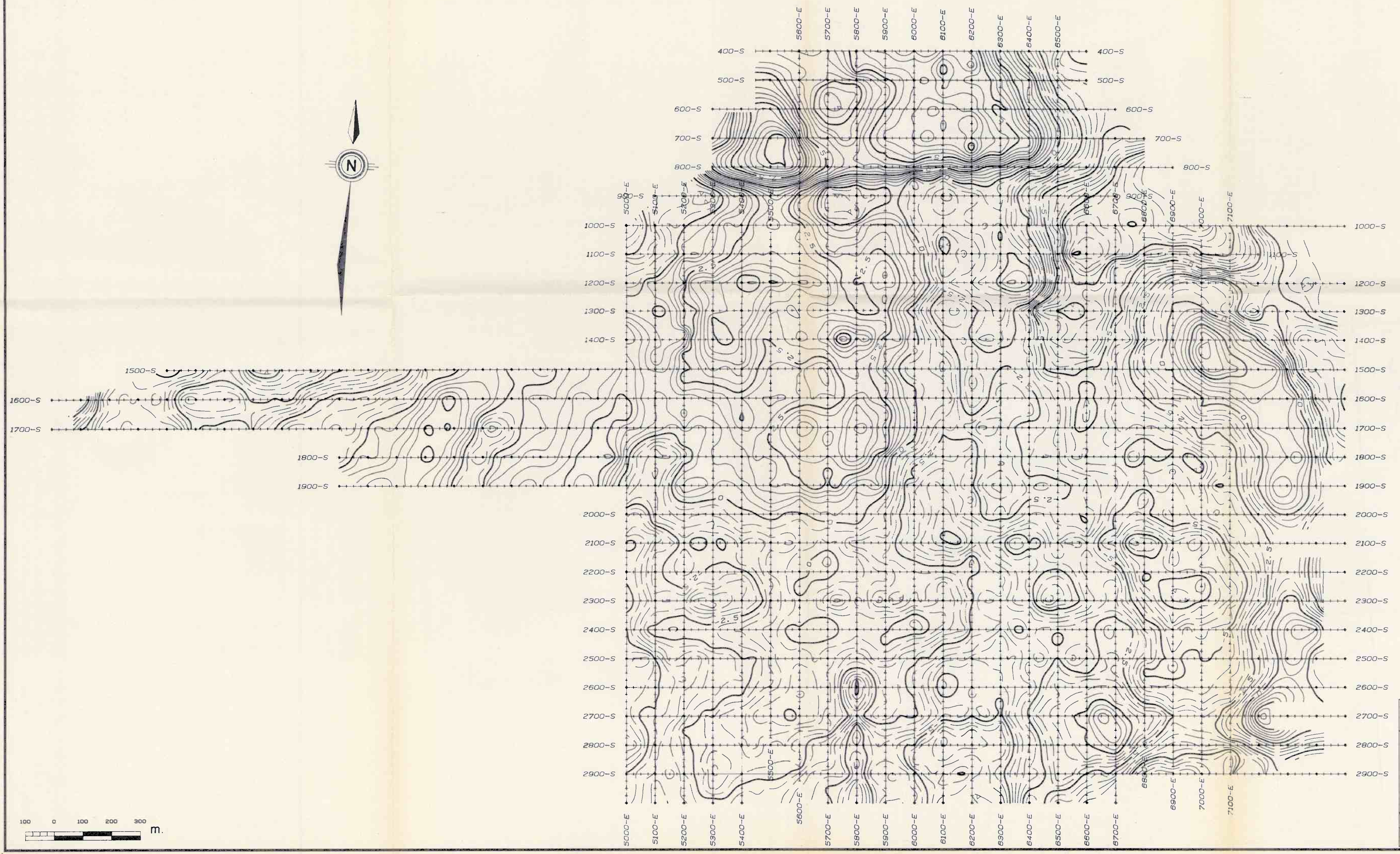
Dated at Vancouver, B.C. this 30 day of August, 1992.

F.J.R. Syberg

Fred J.R. Syberg, Geophysicist


GEOLOGICAL SYMBOLS
Mapped Contacts
Mapped Thrust Fault
Air Photo Contact (?)
Air Photo Lineament
Air Photo Faults (?)
Foliation - Dip 20°
Foliation Flat
Bedding Dip 20°
Bedding Overturned
Lineation - Stretched Cobbles Plunge 20°
Axis of Small Fold Plunge 20°
Silt Sample
LØNSET
Dindalshytta
Brattskarven
Sólöyfjellet
Tronfjellet
Hornet
Svarthaugen
ÅMOTSDALEN
Svartdalskollen
Blokhaugen
Kvernbekkhöa
Skardkollen
Tythökollen
PROPERTY BOUNDARY
KILOMETRES
CONSOLIDATED LOGAN MINES LTD.
OPPDAL, NORWAY
SILT SAMPLE MAP WITH GEOLOGY (N.G.U.), AIR PHOTO INTERPRETATION AND PROPERTY OUTLINE
LIVGARD CONSULTANTS
SCALE: 1:25,000


LEGEND
Porphyry
Conglomerate
Intrusive ? (Musc. Hemat.)
Granitic Gneiss
Light Gneiss
White Gneiss
Silicified Feldspathized Gneiss (as above)
Oxidation
Biotite Gneiss
Secondary Fold
Primary Fold
Amphibolite Lenses
Lenses - Coarse Quartz-K Feldspar Hematite
Contact - Defined, Assumed
Air Photo Lineaments
Lineaments
Wide Fractures (Faults)
Thrust Fault
Fault, Mica Schists
High Grade Float (5 oz.)
Mineralized Outcrop
Foliation
Fractures - Vertical, Dipping
Bedding, Strike & Dip
Flat Dip
Overturned Bedding
Anticline, Syncline
Fold Crest Plunge
METRES
0 100 200 300 400
CONSOLIDATED LOGAN MINES LTD.
KELLS CREEK PROJECT
OPPDAL, NORWAY
GEOLOGY MAP
LIVGARD CONSULTANTS
DATE: AUGUST, 1993
SCALE: 1:5000
FIGURE NO. 5
Trontjø
Camp
1278
1379
1378
1323
1269
Hægstöltjø
KELLS LAKE
KELLS CREEK
GEOLOGICAL GRID 0+00
GEOPHYSICAL GRID 1000S & 5000E
KERATOPHYRE (?)
DISSEM. EPIDOTE
FLOAT KERATOPHYRE (?)
FOLIATION TREND
Chl. Mn Sch
GRANITIC INTR
2000S (GEOLOGICAL GRID)
200E (GEOLOGICAL GRID)
400E
600E
800E
1000E
1200E
1400E
1600E
1800E
2000E
2200E
2500E
600N
1000S
6931
6930
6929
6928
524
525
526



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KELLS CREEK PROJECT

VLF-EM RUGBY DIP ANGLE

Contour Interval 0.5°

OPPDAL, NORWAY

Donegal Developments Ltd

COMPILED	N.T.S	DATE	FIG. NO
F. Syberg		AUGUST, 1998	7

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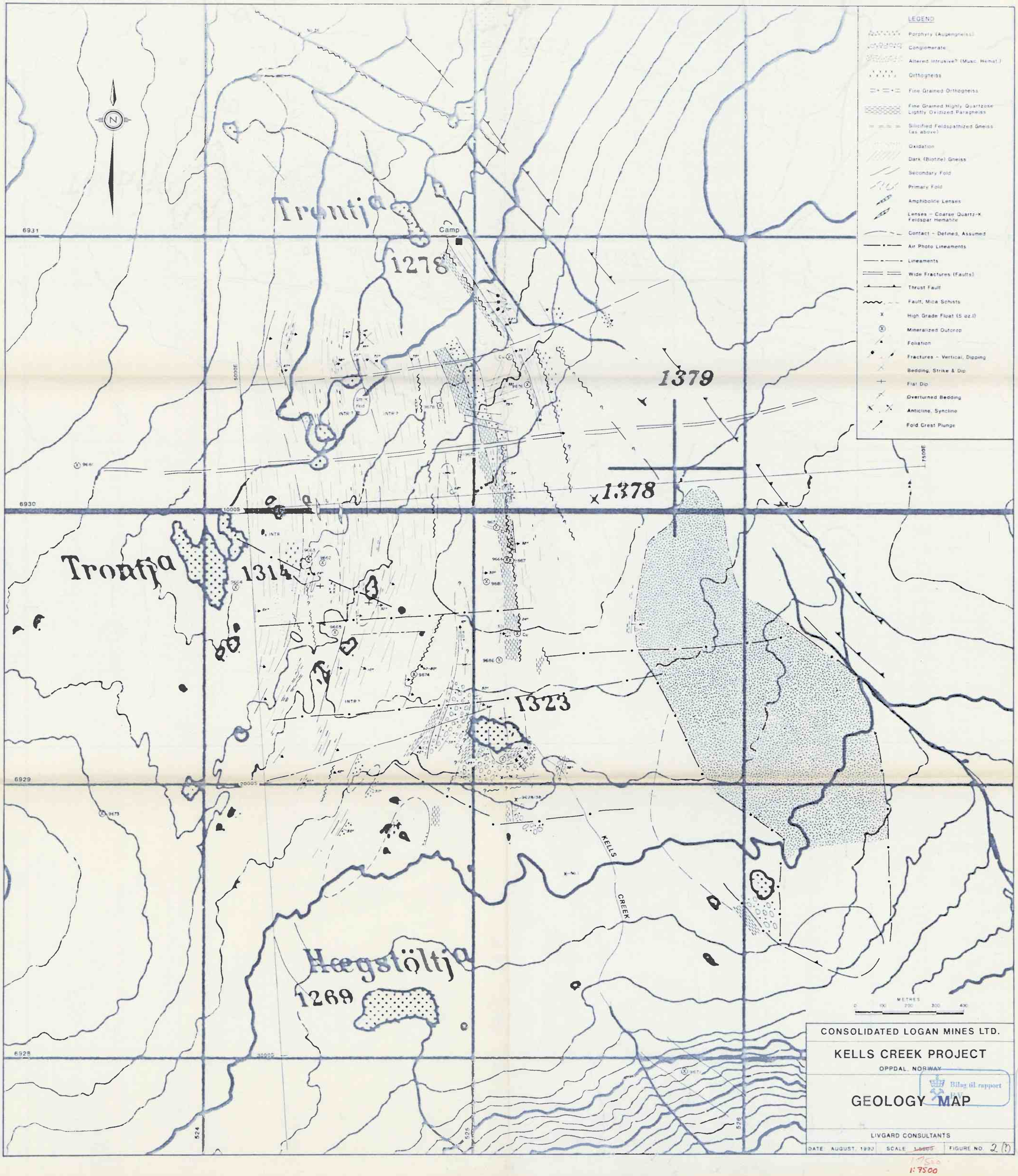
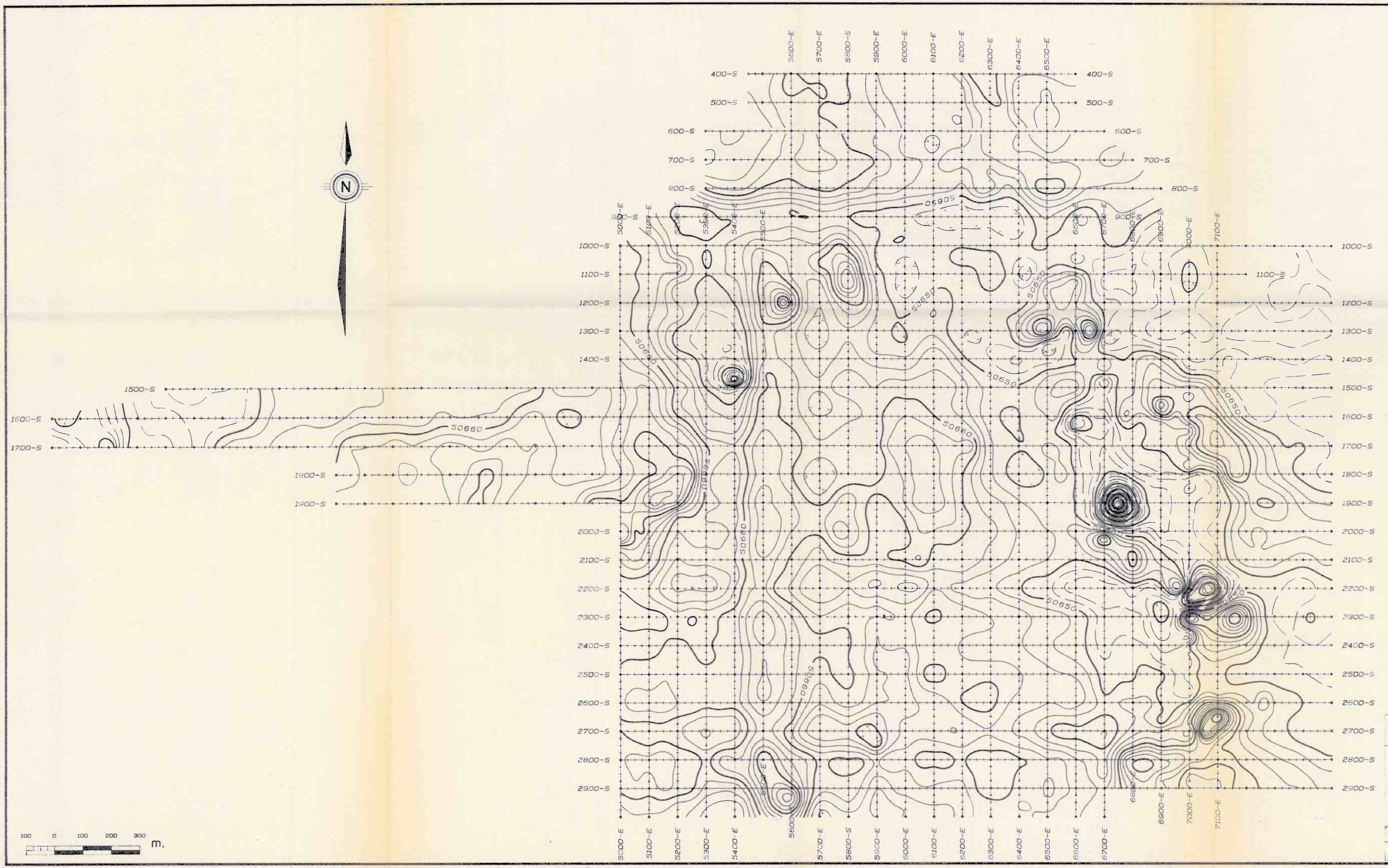


LEGEND
Porphyry (Augengneiss)
Conglomerate
Altered Intrusive? (Musc. Hemat.)
Orthogneiss
Fine Grained Orthogneiss
Fine Grained Highly Quartzose Lightly Oxidized Paragneiss
Silicified Feldspathized Gneiss (as above)
Oxidation
Dark (Biotite) Gneiss
Secondary Fold
Primary Fold
Amphibolite Lenses
Lenses – Coarse Quartz-K Feldspar Hematite
Contact – Defined, Assumed
Air Photo Lineaments
Lineaments
Wide Fractures (Faults)
Thrust Fault
Fault, Mica Schists
High Grade Float (5 oz.!)
Mineralized Outcrop
Foliation
Fractures – Vertical, Dipping
Bedding, Strike & Dip
Flat Dip
Overturned Bedding
Anticline, Syncline
Fold Crest Plunge
N
Trontja
Camp
1278
1379
1378
Trontja
1314
1323
Hægstöltja
1269
KELLS CREEK
6931
6930
6929
6928
524
525
526
5000E
7500E
1000S
2000S
3000S
INTR
METRES
0
100
200
300
400
CONSOLIDATED LOGAN MINES LTD.
KELLS CREEK PROJECT
OPPDAL, NORWAY
GEOLOGY MAP
LIVGARD CONSULTANTS
DATE AUGUST, 1983
SCALE ~~1:5000~~ 1:7500
FIGURE NO. 2 (?)

1:7500

N
400-S
500-S
600-S
700-S
800-S
900-S
1000-S
1100-S
1200-S
1300-S
1400-S
1500-S
1600-S
1700-S
1800-S
1900-S
2000-S
2100-S
2200-S
2300-S
2400-S
2500-S
2600-S
2700-S
2800-S
2900-S
5000-E
5100-E
5200-E
5300-E
5400-E
5500-E
5600-E
5700-E
5800-E
5900-E
6000-E
6100-E
6200-E
6300-E
6400-E
6500-E
6600-E
6700-E
6800-E
6900-E
7000-E
7100-E
LEGEND
QUADRATURE:
Alteration Zone
CROSSOVERS:
Major Fault
Interpreted Fault
Thrust Fault
Shear Zone - moderate to weak response
- very weak response
Conductivity Contrast - weak response - Contact/Fault
- very weak response
Magnetic Dipole
100 0 100 200 300 m.
1:7,500
Bilag til rapport
BV 3975
CONSOLIDATED LOGAN MINES LTD.
KELLS CREEK PROJECT
GEOPHYSICAL INTERPRETATIONS
OPPDAL, NORWAY
Donegal Developments Ltd
COMPILED F. Syberg
N.T.S
DATE AUGUST, 1993
FIG. NO 1



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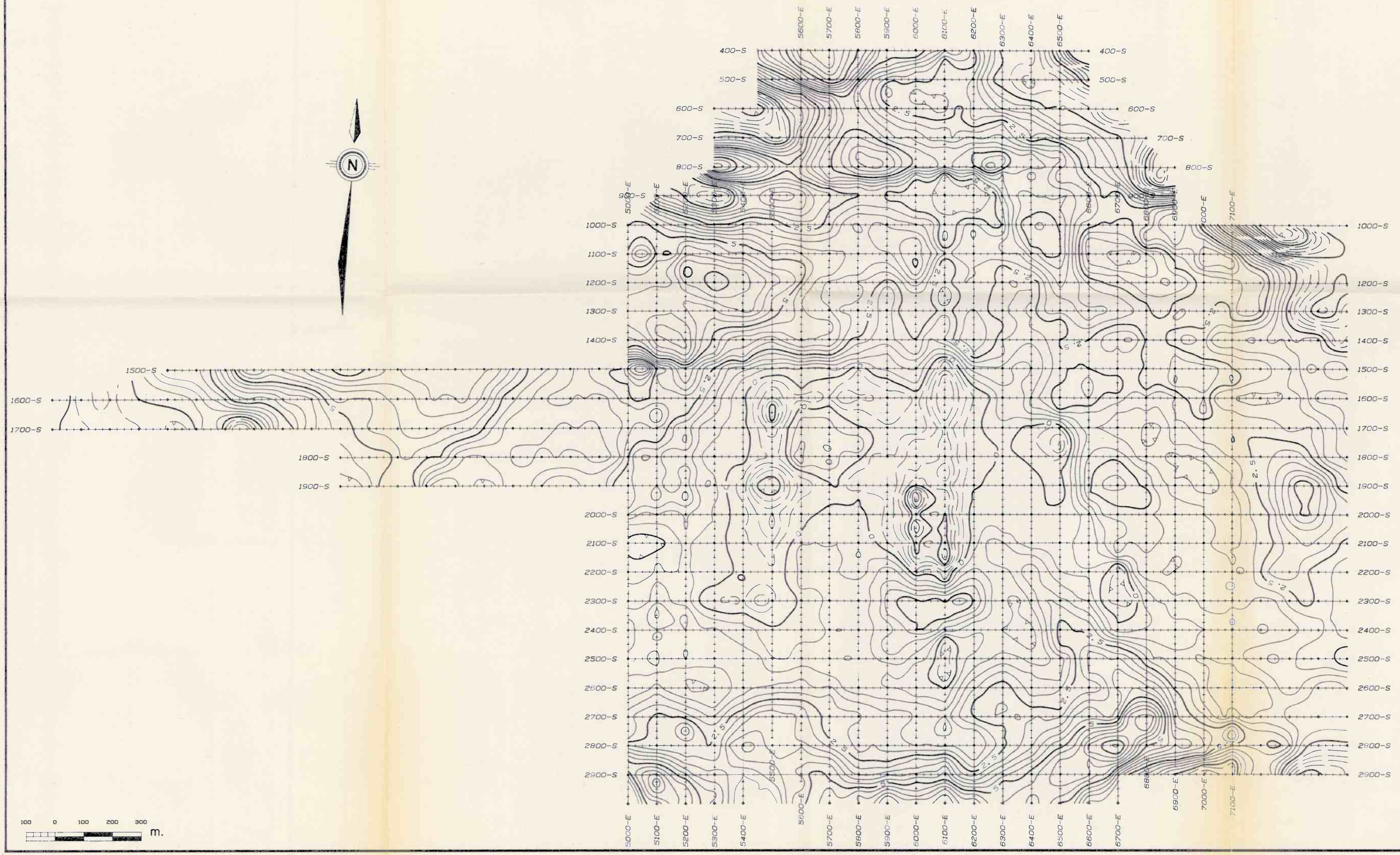
KELLS CREEK PROJECT

TOTAL MAGNETIC FIELD
Upward Continued 25 m
Contour Interval 2.5 nT

OPPDAL, NORWAY

Donegal Developments Ltd

COMPILED	N.T.S	DATE	FIG. NO
F. Syberg		AUGUST, 1993	2



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KELLS CREEK PROJECT

VLF-EM CUTLER QUADRATURE

Contour Interval 0.5%

OPPDAL, NORWAY

Donegal Developments Ltd

COMPILED	N.T.S	DATE	FIG. NO
F. Syberg		AUGUST, 1983	3

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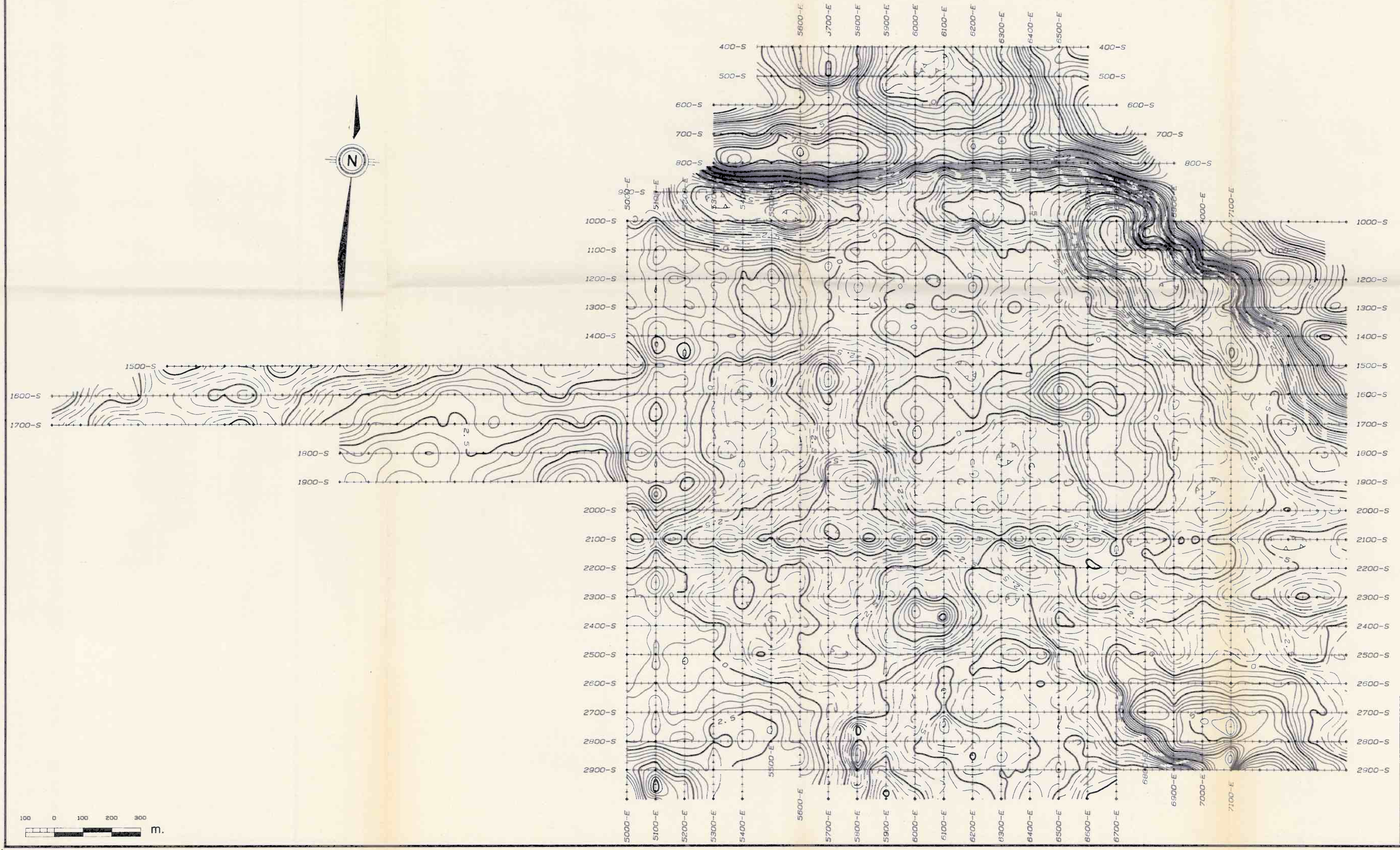

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KELLS CREEK PROJECT

VLF-EM CUTLER DIP ANGLE

Contour Interval 0.5°

OPPDAL, NORWAY

Donegal Developments Ltd

COMPILED	N.T.S	DATE	FIG. NO
F. Syberg		AUGUST, 1993	4

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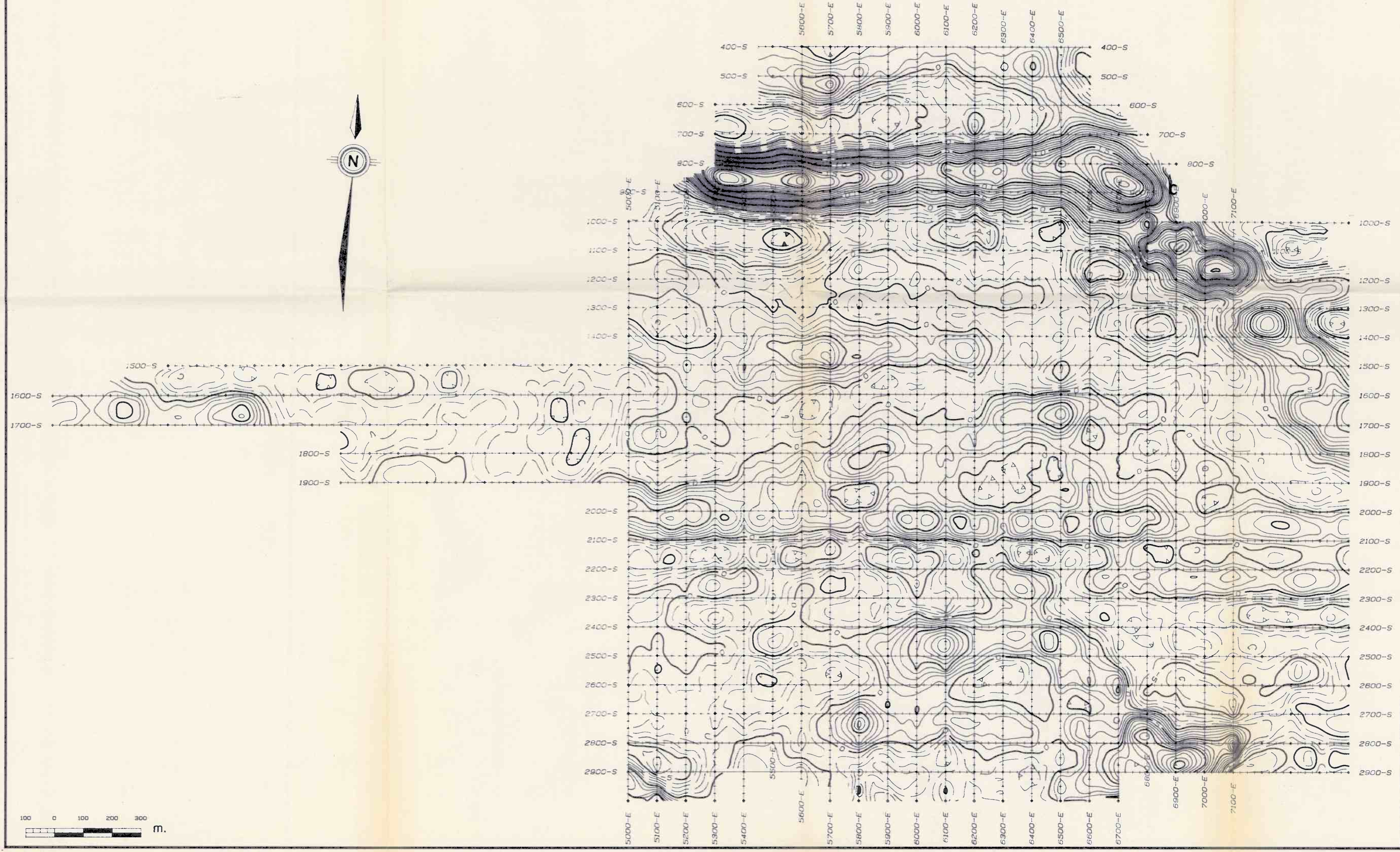

Bilag til rapport BV 3975

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KELLS CREEK PROJECT

VLF-EM CUTLER DIP ANGLE
Fraser Filtered
Contour Interval 1.0°

OPPDAL, NORWAY

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COMPILED	N.T.S	DATE	FIG. NO
F. Syberg		AUGUST, 1983	5

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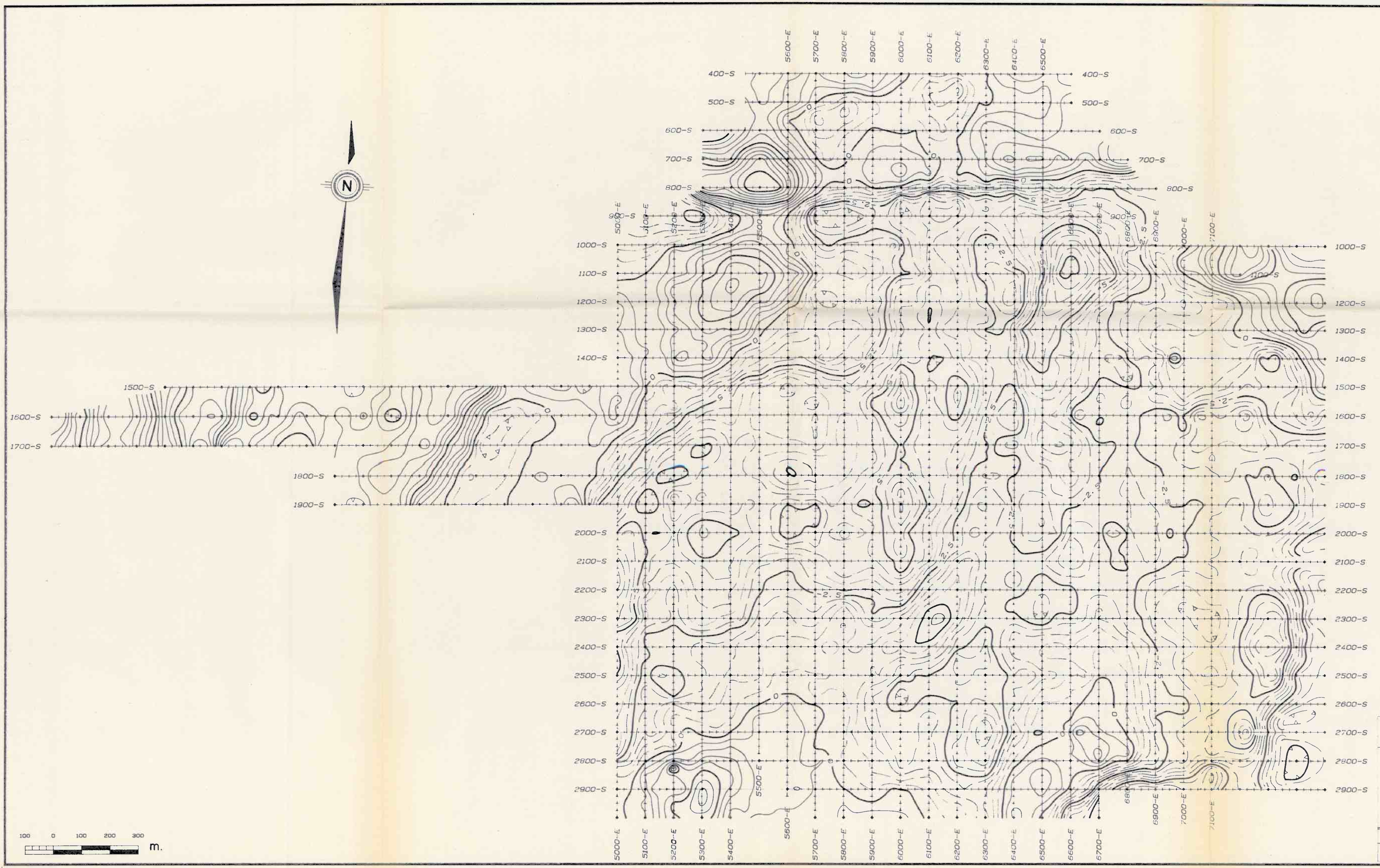

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KELLS CREEK PROJECT

VLF-EM RUGBY QUADRATURE

Contour Interval 0.5%

OPPDAL, NORWAY

Donegal Developments Ltd

COMPILED	N.T.S	DATE	FIG. NO
F. Syberg		AUGUST, 1993	6

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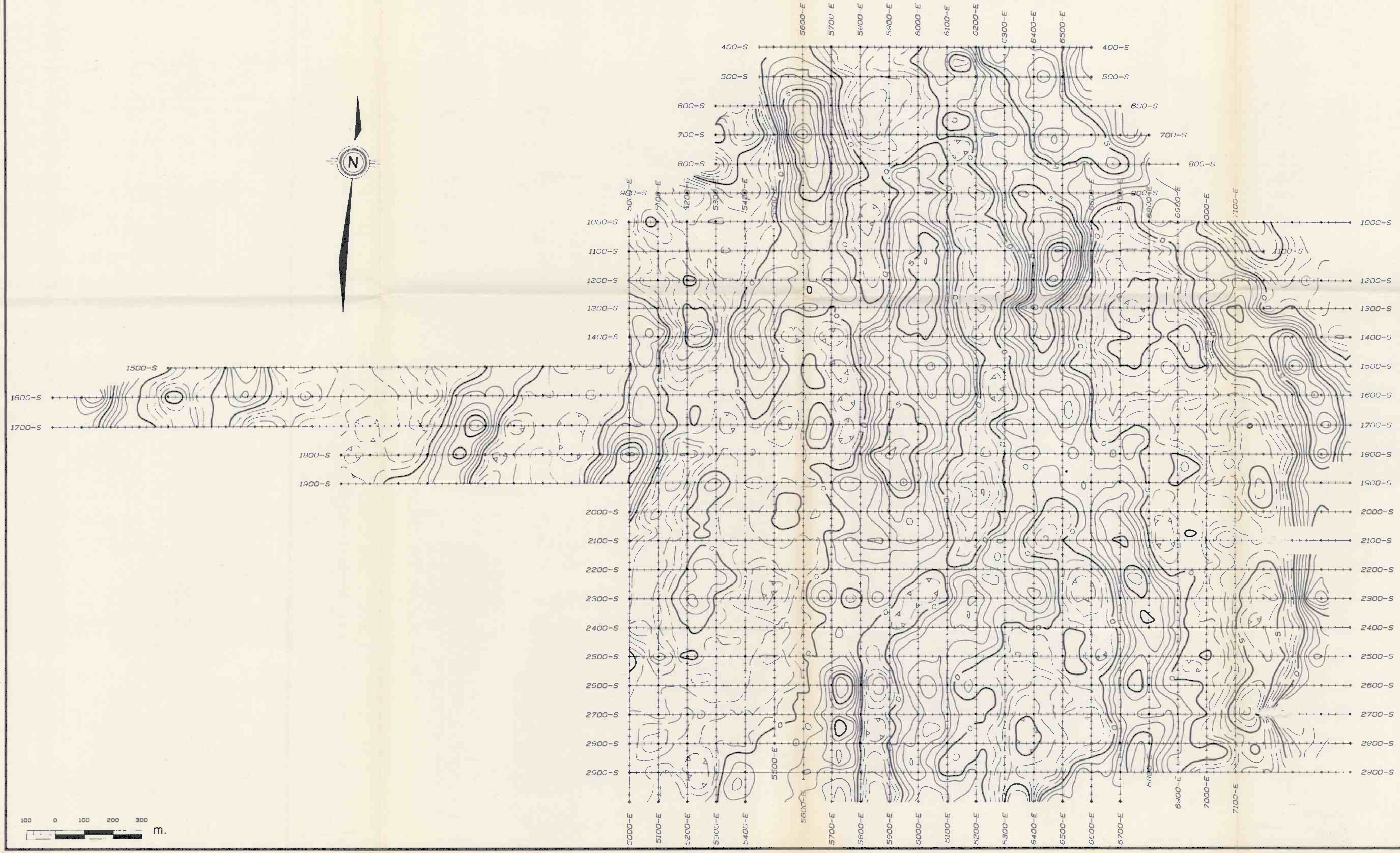

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KELLS CREEK PROJECT

VLF-EM RUGBY DIP ANGLE
Fraser Filtered
Contour Interval 1.0°

OPPDAL, NORWAY

Donegal Developments Ltd

COMPILED	N.T.S	DATE	FIG. NO
F. Syberg		AUGUST, 1993	8

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