83-#695 - 12251

APPENDIX III

GEOLOGY OF THE WEST GRID AREA

STEWART MOLY PROJECT

GEOLOGY REPORT

STEWART WEST GRID

PROJECT 10138

E. Hickling
August 1983

TABLE OF CONTENTS

INTRODUCTION

The West Grid is located on the Stewart Property about 28 km south of Nelson, BC. The area is host to two intrusions, a quartz monzonite porphyry and a biotite-augite monzonite, which lie within the Elise Volcanics and Hall Sediments. From previous mapping it has been shown that the quartz monzonite porphyry is host to stockwork molybdenum mineralization. The preliminary exploration carried out by Selco Inc. during the 1982 field season consisted of an airborne EM and magnetometer survey, geological mapping and chip sampling for rock geochemistry.

LOCATION

The Stewart claims are located about 28 km south of Nelson, immediately west of the town of Ymir. The property lies about 32 km due east of Castlegar at latitude 49°17'N, and longitude 117°15'W.

ACCESS

Property access is via old logging and mine access roads from Highway 3 and 6.

From Castlegar take Highway #3 to Salmo. Then turn left along Erie Creek road 5 km before Salmo, taking the Stewart Creek mine road just south of Craigtown. The Erie Creek road is of two-wheel drive standard, and the Stewart Creek mine road is of four-wheel drive standard. From Nelson take Highway #6 to Ymir, turning right along Stewart Creek mine road 5 km before Ymir.

Driving from Castlegar to the West Grid is at least one hour and from Nelson about forty five minutes. Due to the convenience of the major centres in the area, the exploration crew was accommodated in the Lakeside Motel, Nelson.

PROPERTY AND OWNERSHIP

The Stewart property is owned by Mr. Eric Denny and Mr. Jack Denny of Nelson, BC who have optioned the property to Selco Inc. through Harp Explorco Ltd. The property consists of a total 212 claims and claim units. The West Grid work was done on the claims outlined below:

Name	Recording Date	Record No.	No.of Units	No.of Acres	Current Exp. Year
Stewart 1	April 28/78	596	20	1235.60	1987
Stewart 7	Nov.28/78	890	12	741.36	1988
Stewart 8	Nov.28/78	891	20	1235.60	1984

The majority of the grid is located on Stewart 1.

PHYSIOGRAPHY

The relief of the area is mountainous and is part of the Bonnington Range of the southern Selkirk Mountains. In the immediate property area the terrain is rugged, but it lacks the precipitous cliffs common to the east and north. The West Grid is situated close to Stewart Peak, elevation 1954 metres (6410 feet), thus, part of the grid lies above tree line. The edges of the grid lie below tree level, and consequently have heavy forest growth.

Tributaries of Erie Creek, Boulder Mill Creek and Stewart Creek form the drainage system for Stewart Peak. These exhibit relatively steep gradients.

Glaciation in this part of southern B.C. is estimated to have affected elevations to about 2070 metres which implies that the Stewart area was under the ice cap during the last glacial event. This would explain the rounded, relatively smooth topography of the area in relation to adjacent mountain systems.

The climate is moderate and the temperatures are not extreme. Average annual precipitation is in the order of 28", snowfall is about 20", and mean temperature is about 45^{O}F, with the average maximum and minimum temperatures being about 97^{O}F and -4^{O}F respectively. Prevailing winds are westerly.

PREVIOUS EXPLORATION ACTIVITIES

In 1978 and 1979, Eric and Jack Denny of Nelson, BC carried out prospecting surveys of the area and acquired mineral rights to what is now the Stewart property. In 1979 they optioned the property to Shell Canada Resources Ltd. On the West Grid a program of line cutting and geological mapping was carried out.

Due to economic factors, Shell dropped out of the mineral exploration scene in early 1982, and returned the property to the Denny's.

1983 SURVEY OBJECTIVES

The objective of this program was to determine in detail the geology of the West Grid area, and to obtain sufficient geological and rock geochemical data to effectively identify the economic potential of the area.

EXPLORATION ACTIVITY

During the summer of 1983 a geological map on a scale of 1:2 500 of the Stewart West Grid was completed, comprising an area of approximately 1.56 km^2. The grid comprised twelve 1 km length lines set at a spacing of 120 m.

Three of these lines, 2+40S, 0+00, 1+20N were extended 600 m to the east by a geophysical crew. They carried out an EM and magnetics survey to test conductors detected by the 1982 airborne survey.

A geochemical rock chip sampling program was carried out over the grid to determine alteration and mineralization patterns. A total of 124 samples were collected.

The geological mapping required 20 days.

RESULTS

A) GEOLOGY

A1) Regional Geology

The Stewart property and surrounding area is host to sequences of the Elise (Rossland) Volcanic Formation, Hall Formation sediments and localized intrusives of Nelson, Coryell and post-Coryell Formations. The volcanic and sedimentary formations form conformable north-south linear trends and occupy a regional synclinal trough, the axis of which disects the Hall Formation sediments and has a shallow plunging axis (Grant, 1982).

A2) Detailed Geology

On the West Grid two distinct intrusives have been observed intruding the Elise Volcanics and Hall Sediments. The largest intrusive is a quartz monzonite porphyry which forms an oval shaped stock elongated north-south in the northern half of the grid area. This intrusion has an area of approximately 12500 m^2. A few smaller outcrops, about 750 m^2 in area, occur to the west of the main intrusive. The second intrusive is a biotite-augite-monzonite part of which is covered by the easterly corner of the grid. The country rock is dominated by the Elise Volcanics which form a series of flows trending roughly north-south. The Hall Sediments occur only on the easterly edge of the grid. They appear to be conformable with the Elise Volcanics. Some basic dykes cut across the Elise Volcanics, trending about 160° to 170°.

The age relationship between the quartz monzonite porphyry and the biotite-augite-monzonite was not evident. The biotite-augite-monzonite is thought to be one of the Nelson intrusives. The quartz monzonite porphyry has a distinctly different facies from other known Nelson intrusives and Mulligan (1952) has suggested that it might be older in age. Evidence from the biotite-augite-monzonite on the East Grid also seems to confirm this age relationship.

a) Quartz Monzonite Porphyry (QMP)

It is a coarse grained rock with matrix material to 1 mm, with a porphyritic texture. The minerals visible in hand specimen are white feldspar (60%), quartz (35%) and hornblende (5%). The feldspar and hornblende form phenocrysts within a light coloured quartzofeldspathic matrix. The feldspar phenocrysts vary from 0.5 cm to 5 cm in size with an average of 1 cm. The hornblende forms needle shaped phenocrysts from 1 to 6 mm in length, generally with a greenish alteration colour. Their proportion in the rock can vary from one to seven percent. Occasional quartz phenocrysts occur up to 8 mm in diameter.

Aplite veining occurs at various locations within the QMP, up to 10 cm wide. Often it contains up to 5% mafics, and may just be a finer grained variety of the QMP.

b) Biotite-Augite-Monzonite (BAM)

The BAM is a medium grained rock with matrix material to 0.5 mm, with a porphyritic texture. It has a medium grey mottled appearance with the dominant minerals being biotite (10-15%), augite (15-20%) and feldspar (70%). The biotite and augite form phenocrysts within a feldspathic matrix. Biotite books form up to 1.5 cm wide which give the rock a distinctive faceted looking appearance which resembles spinifex texture seen in ultramafic flows. Mulligan, 1952, suggests that these biotite lamellae mark a complex system of line shrinkage cracks. The augite phenocrysts vary from 1 to 7 mm in diameter and often show a well developed pyroxene shape. The proportions of biotite and augite vary locally within one outcrop and so the spinifex texture is not always well developed. The rock is not well hematized and has a grey weathered surface, with onion skin weathering. The rock has a massive texture with fractures more than 1 m apart. Occasionally manganese oxide staining is seen on the fractures.

c) <u>Felsite</u>

The felsite is a non-porphyritic version of the BAM. It is a fine to medium grained equigranular rock with component material to 0.25 - 0.5 mm. It has a pinkish-grey colour and is leucocratic. The minerals visible in hand specimen are pink and white feldspar-95%, and chlorite-5%. The chlorite is not a primary mineral, but the alteration product of some mafic mineral. There are occasional biotite books 3 mm. Like the BAM it is not hematized and has a grey weathered surface. In places it has been weathered to a white rock which is friable. It occurs within the BAM.

d) <u>Hall Sediments</u>

Within the mapped area, only one type of sediment was found, an argillite. It is a very fine grained (mid size), equigranular black rock with a dull lustre. It has a well developed fissibility, approximately 007/90. The rock is well hematized along its fracture surfaces.

e) <u>Elise (Rossland) Volcanics</u>

The oldest rocks in the area, the Elise Volcanics, comprise a series of flow units with a composition varying from basalt to andesite with occasional rhyolite. The texture varies from fine grained to gabbroic, and on the map, have been divided into units based on their texture.

i) A fine grained medium to dark grey hornfelsic rock. It often has a greenish tinge and tends to be siliceous. It sometimes has the appearance of mud cracks which may be just due to surface weathering. Occasionally it shows millimetres thick colour banding of lighter and darker units. It is generally well hematized along fractures. Fractures tend to be well developed with centimetre spacing. Up to 1% pyrite is often disseminated through the rock, or along fractures. The rocks weather to a buff colour, often with intense iron staining.

ii) A coarse stained rock with a medium to dark grey colour and mottled appearance (a gabbroic texture in places). Mafic and felsic phenocrysts are often visible and vary from 0.25 mm to 4 mm in length. The proportions of these phenocrysts vary with either just mafic, felsic or both phenocrysts visible. Within a flow unit the proportions and size of these phenocrysts will also vary. There is often leaching of the rock, 1 mm on either side of fractures. Pyrite (up to 1%) may be present, either disseminated or along fractures. At 6+00S, 5+75W a 0.5 mm epidote vein cuts the rock; these are occasionally seen at other locations. In places the rock is very well hematized and elsewhere it weathers to a grey colour. Fracturing varies from a few centimetres to tens of centimetres.

At the outcrop centred on the point 9+60S, 3+19W, this gabbroic rock has a distinctive appearance. It contains 10 to 15% of xenoliths. These xenoliths are angular to rounded and between 0.5 and 20 cm in diameter. They are composed mainly of a dark grey fine grained rock which shows white millimetre scale banding. The rock itself also tends to be slightly coarser grained than the surrounding rock with hornblende laths up to 4 mm and feldspar phenocrysts up to 5 mm. This rock is not hematized and has a grey weathered surface. This high proportion of xenoliths is only found in this one outcrop. About 1% xenoliths are found in some gabbroic rocks up to 100 m away. It might represent the vent of the volcano from which the flows originated. This unit was originally mapped as a breccia, but it does not appear to be a breccia pipe distinct from the volcanics as originally thought.

Interbedded with both the hornfelsic and gabbroic rock is a third type of volcanic. It is a felsic unit which is never more than 30 m thick. It has a very pale cream colour with a greenish tinge and often shows flow banding. It is not hematized and weathers to a buff colour.

Close to the QMP intrusion these rocks are cut by 1 mm wide quartz veining, from 1-5 per m^2. There is also some aplite veining, 2-10 cm wide, averaging one per m^2.

A3) Structure

No small scale structures such as faults and folds are visible within the area. A large 30 cm thick pyrite bearing quartz vein found at location 4+80S, 0+20E may represent a shear zone as it is much larger than other quartz veining in the area. This vein has an attitude of 019/30E.

Mulligan (1952) has observed that two moderately open major folds traverse this region, with the west grid lying on the western limb of what he describes as the Hall Creek syncline. The evidence seen on the West Grid does not contradict this.

The map of the fractures does not clearly show a dominant fracture direction. There seem to be two general trends of NE-SW and NW-SE fractures with the dip usually lying within 20^{o} of the vertical. A less well developed pattern of E-W trending fractures also seems to be visible. There is no apparent difference between the fractures present in the intrusives and those in the country rock, but fracture spacing between the rock types does vary:

QMP	4-20 / metre
BAM	1 / metre
Hall Sediments	millimetre spacing
Elise Volcanics	1-100 / metre

A4) <u>Alteration</u>

Within the QMP two alteration patterns were seen.

i) Greenish alteration of hornblende
ii) Silicification

Quartz stockworking occurs throughout the intrusion, forming veins of white to clear quartz, usually less than 5 mm wide. May have a random orientation and vary in density over the outcrop from 5-20 per metre^2. This stockwork becomes more intense on the western side of the intrusion on lines 3+60S and 4+80S with up to 30 veins/m^2, many of which are a few cm wide. At location 5+60S, 0+70W the stockwork forms up to 30% of the rock. At location 4+80S, 0+20E there is a white quartz vein 30 cm wide. It is very vuggy and contains crystals of quartz and pyrite.

This quartz stockworking extends up to 50 metres into the country rock.

No k-feldspar alteration is evident as in the eastern QMP.

B) GEOCHEMISTRY

One hundred and twenty four rock chip samples were collected for geochemical analysis. Multi-element analyses will be carried out on these samples, together with analysis for tungsten, tin and molybdenum.

Samples were collected along each grid line at 50 metre intervals, outcrop permitting. Chips were usually collected within a 3 m radius depending on the size of the outcrop. Where possible they were taken from below the weathered surface.

C) ECONOMIC GEOLOGY

Three sulphide minerals were found: pyrite, pyrrhotite and molybdenite.

Pyrite and pyrrhotite were found in the Elise Volcanics, Hall Sediments and QMP. In the Elise Volcanics and Hall Sediments they were either finely disseminated through the rock, or they were found along fractures. Their distribution was very patchy and varied between each outcrop. In the QMP the pyrite was confined to the quartz veins, usually as fine disseminations in the vein. Only at location 4+80S, 0+20E were 2 mm cubes of pyrite found.

Molybdenite in the QMP is associated with the quartz stockwork zone. For exact locations refer to the accompanying map.

No testing was done for scheelite (tungsten).

CONCLUSIONS AND RECOMMENDATIONS

1. The West Grid is host to a quartz monzonite porphyry intrusive which is similar in many respects to the large QMP intrusive found on the east grid area to the east.

2. Molybdenite mineralization, as on the east grid, is associated with quartz stockworking within the QMP.

3. This stock does not appear to have the alteration patterns as found on the main grid. The QMP on the West Grid has only been partially unroofed, it is about 1000' above the QMP of the eastern grid area. Consequently we may only be seeing the central core of the intrusion. It is possible that weathering has not yet reached the alteration patterns which may surround the QMP.

4. During the geophysical surveying a number of conductors were found in the NE corner of the grid which are associated with the BAM. On the SE corner of the east grid the BAM has associated fault controlled silver-lead-zinc mineralization. Consequently this area of BAM on the West Grid may be a target for similar type mineralization.

5. Further work depends on the results of the whole rock geochemical analysis, whether there is any evidence of alteration patterns. This work would involve diamond drilling, used to determine the amount of molybdenum mineralization.

REFERENCES

GRANT, B. (1982); Stewart-Moly Project (10138). A Report on Activities and Results.

MULLIGAN, R. (1952); Bonnington Map Area, British Columbia. Geological Survey of Canada, Paper 52-13, Department of Mines and Technical Survey.

LITTLE, M.W. (1960); Nelson Map Area, West Half, British Columbia. Geological Survey of Canada, Memoir 308.

APPENDIX I

HAND SPECIMENS DESCRIPTION

LINE 1+20N

10+00E	BAM. Coarse grained grey mottled rock, greenish type. Biotite books up to 1.5 cm, abundant. Augite phenocrysts 3 mm.
9+40E	Felsite. Medium to coarse grained, pink spotted rock. Equigranular. 95% plagioclase and alkali feldspar, 5% mafics.
8+75E	Weathered felsite. White altered feldspar, with orange spots of hematite. 0.25 mm crystals of sericite.
7+65E	BAM. Coarse grained, grey mottled rock with a greenish tinge. Biotite books 7 mm, augite 1 mm.
6+50E	BAM. Finer grained, grey mottled rock. Occasional biotite books 5 mm. Occasional augite 0.25 mm.
6+00E	BAM. Fine grained, grey mottled rock. Occasional biotite 6 mm.
1+45N 5+50E	Andesite. Fine grained, medium grey with a greenish tinge. Occasional fleck of pyrite.

LINE 1+20N (continued)

4+35E	Basalt. Fine grained, dark grey. Mafic phenocrysts visible under hand lens. Disseminated pyrite.
2+00E	Basalt (argillite?). Very fine grained. Dark grey with a dull lustre. Quartz vein 1 mm wide with associated pyrite. 1 cm of quartz veining, with some calcite.
1+10N 1+00E	Andesite. Fine grained, mottled rock, greenish tinge. Needle shaped mafic phenocrysts up to 1 mm. Hematized quartz vein, 1 mm wide, with pyrite.
0+92E	Andesite. Medium grained, grey mottled rock. Mafic phenocrysts up to 11 mm long. Feldspar phenocrysts up to 1 mm. Quartz vein 1 mm wide.

LINE 0+00

9+75E	BAM. Medium grained, grey mottled rock. Abundant biotite books up to 8 mm. Sparse augite phenocrysts, 2 mm.
7+75E	BAM. Medium grained grey mottled rock. Biotite books up to 5 mm, not so abundant as above. Augite, 3 mm, more abundant than above.
0+10S 6+50E	BAM. Medium grained, grey mottled rock with greenish tinge. Biotite books, 5 mm. Augite, 3 mm, scarce.
5+85E	BAM. Slightly finer grained matrix with greenish tinge. Biotite books abundant 8 mm. Augite, 2 mm, scarce.
3+75E	Andesite. Grey mottled rock. Hornblende phenos up to 0.5 mm showing chlorite alteration.
1+75E	Basalt. Dark grey, fine grained and slightly mottled. Hornblende 1 mm.
1+40E	Rhyolite. Pale white-green, medium-fine grained felsic rock. Highly siliceous. Weathers to a buff-white colour.
1+25E	Hornfels. Very fine grained grey rock, patches of white. Disseminated pyrite.

LINE 0+00 (continued)

0+75E Basalt. Medium grained, dark grey mottled rock. Hematized along fractures.

0+75W Hornfels. Very fine grained grey rock. Slightly siliceous.

2+50W Porphyry andesite. Grey medium grained rock. Feldspar 2 mm. Greenish tinge in places. Leaching along fractures.

LINE 1+20S

4+10E Argillite. Very fine grained, black. Dull lustre. Well developed fissibility.

3+00E Basalt. Dark grey, fine grained. Mafic phenocrysts visible under hand lens. Disseminated pyrite. Hematized along fractures.

1+75E Basalt. Dark grey, fine to medium grained. Mafic phenocrysts visible under hand lens.

1+30E Rhyolite. Very light buff-cream colour with a greenish tinge. Fine grained. Quartz vein 1 mm wide.

0+85E Two rock types.

a) QMP. Feldspar phenocrysts up to 2 cm, hornblende up to 2 mm (3%). Quartz phenocrysts 1 mm. Coarse grained. Pervasively hematized. Quartz vein 0.25 mm wide.

b) Basalt. Dark grey, fine to medium grained. Mafic phenocrysts visible under hand lens. Some calcite, 1-2 mm. Rock has a greenish tinge in places.

0+80E Andesite. Grey, medium grained mottled rock. Leaching along fractures.

LINE 1+20S (continued)

0+50E Andesite. Grey, fine-medium grained, mottled rock. Hornblende phenocrysts 1 mm.

0+00 QMP. Coarse grained. Feldspar less than 1 cm; hornblende 1 mm (2%); quartz 3 mm. Hornblende shows chlorite alteration. Quartz vein 0.25 mm wide.

0+80W Two rock types:

a) QMP. Feldspar up to 1 cm; hornblende 1-4 mm; quartz eyes 5 mm. Some biotite. Quartz vein 0.5 mm wide.

b) Porphyry andesite. Medium grained, grey. Feldspar up to 4 mm; hornblende up to 1 mm. Leaching along fractures.

1+50W Basalt. Grey, fine grained with a greenish tinge. Mafic phenocrysts up to 0.5 mm.

2+35W Two rock types:

a) Andesite. Grey, medium grained with a green tinge.

b) Rhyolite. Fine grained, light greenish-grey rock. Shows wavey colour banding. Cut by a 0.5 mm quartz vein.

LINE 2+40S

7+40E Basalt. Very fine grained, black rock, dull lustre. Mafic phenocrysts visible under hand lens. Hematization along fractures.

6+50E Andesite. Fine grained, medium grey, mottled rock. Flecks of pyrite.

5+75E Coarse grained, mottled, light grey rock with greenish tinge. Similar to matrix of BAM, but no biotite books.

1+90E Hornfels. Very fine grained, greenish-grey. Quartz vein 0.25 mm. Hematization along fractures.

1+20E QMP. Feldspar up to 1 cm. Hornblende 1-2 mm (5%) showing chlorite alteration. Coarse grained. Rock is pervasively hematized.

0+54E QMP. Feldspars up to 1 cm; hornblende up to 3 mm showing chlorite alteration; quartz eyes 5 mm. Quartz veins 0.5 mm wide.

0+10E QMP. Feldspar up to 1 cm; hornblende up to 1 mm (3%), showing chlorite alteration; quartz eyes 2 mm.

LINE 2+40S (continued)

2+50S 0+35W	QMP. Coarse grained. Feldspar up to 1 cm; hornblende 2 to 3 mm (5%); quartz eyes 5 mm. Rock is well hematized.
1+75W	Andesite. Grey, medium grained; mottled with a greenish tinge. 1 mm hornblende phenocrysts.
2+25W	QMP. Feldspar up to 2 cm; hornblende 1 mm showing chlorite alteration; quartz eyes up to 8 mm. Rock is pervasively hematized.

LINE 3+60S

2+40E Hornfels. Very fine grained, grey rock with white patches. Siliceous. Epidote alteration along fractures.

1+75E Andesite. Medium grained, grey mottled rock. Greenish colour in places. Quartz veins, 0.5-2 mm wide.

3+70S
1+00E QMP. Coarse grained. Feldspar phenocrysts up to 1 cm. Hornblende 1 mm (3%), altering to chlorite. Quartz eyes 3 mm. Quartz veining 0.5 mm wide. Some flecks of molybdenite along the quartz vein.

4+00S
0+85E QMP. Coarse grained. Feldspar up to 1 cm; hornblende up to 4 mm showing chlorite alteration. Quartz eyes 4 mm. Hematization along fractures.

0+80E Contact between QMP and andesite:
QMP:- feldspars less than 1 cm, hornblende 1 mm, quartz 1 mm.
Andesite:- grey mottled rock with 1 mm phenocrysts of hornblende being altered to chlorite. Leaching along fractures.

0+50E QMP. Coarse grained. Feldspar phenocrysts up to 1 cm. Hornblende 1 mm (3%) with chlorite alteration. Quartz eyes up to 7 mm.

LINE 3+60S (continued)

0+00 QMP. Coarse grained. Feldspar up to 1 cm. Hornblende up to 5 mm with chlorite alteration. Quartz eyes 3 mm. Quartz veining 0.25 mm wide.

0+50W QMP. Coarse grained. Feldspar phenocrysts up to 2 cm. Hornblende up to 2 mm (7%). Quartz eyes 3 mm. Quartz vein 0.25 mm wide.

4+04S
1+00W QMP. Coarse grained. Feldspar up to 1 cm. Hornblende 3 mm, (7%) showing chlorite alteration. Quartz eyes 3 mm.

1+00W Andesite. Mottled grey, medium grained, occasional greenish colour. Leaching along fractures. Quartz vein 0.5 mm wide.

1+45W Hornfels. Very fine grained, greenish-grey rock with lighter patches. Disseminated pyrite.

2+10W Two rock types:

a) QMP. Feldspar phenocrysts less than 1 cm. Hornblende 3 mm (5%). Quartz eyes 3 mm. Maybe some biotite.

b) Rhyolite. Very fine grained, light coloured greenish rock.

LINE 3+60S (continued)

3+90W	Basalt. Fine grained, dark grey rock. Mafic phenocrysts visible under hand lens. Disseminated pyrite. Epidotization along veins, together with pyrite.
3+10S 5+50W	Andesite. Medium grained, grey mottled rock with a green tinge. Hornblende phenocrysts up to 2 mm. Pyrite along fractures.
3+10S 6+50W	Basalt. Dark grey, fine grained rock, with a greenish tinge. Mafic phenocrysts up to 3 mm.

LINE 4+80S

2+75E	Andesite. Grey, medium grained mottled rock. Mafic phenocrysts visible under hand lens. Greenish alteration along fractures.
5+00S 2+10E	Two rock types: a) QMP. Coarse grained. Feldspar phenocrysts up to 1 cm; hornblende 2 mm (3%); quartz eyes 3 mm. b) Hornfels. Fine grained, greyish colour. Siliceous in places. Clear quartz vein 1 mm wide.
4+45S 0+50E	QMP. Coarse grained. Feldspar phenocrysts up to 1 cm; hornblende 2 mm (5%), quartz eyes 5 mm.
4+90S 2+20E	QMP. Coarse grained. Feldspar phenocrysts up to 1 cm; hornblende 3 mm (4%). Clear quartz vein 1 mm wide.
0+25W	QMP. Coarse grained. Feldspar phenocrysts up to 1 cm. Hornblende 1-2 mm (3%). Quartz eyes 4 mm. Quartz vein 1 mm wide.
4+92S 0+63W	QMP. Coarse grained. Feldspar phenocrysts up to 1 cm. Hornblende 2 mm (5%). Quartz eyes 5 mm. Quartz veins 0.25 mm wide.

LINE 4+80S (continued)

1+25W Hornfels. Very fine grained grey rock with patches of white. Disseminated pyrite. Clear quartz vein 0.25-1 mm wide.

2+00W Andesite. Fine grained, light grey rock with a mottled appearance. Hornblende phenocrysts 1-2 mm. Leaching along fractures.

2+45W QMP. Coarse grained. Feldspars up to 1 cm. Lacks hornblende phenocrysts.

3+10W QMP. Coarse grained. Feldspar phenocrysts up to 1 cm. Hornblende 2 mm (3%); quartz eyes 3 mm. Quartz veins 0.5 mm wide.

3+50W Basalt. Dark grey, fine grained, slightly mottled. Mafic phenocrysts visible under hand lens.

4+15W Basalt. Same as 3+50W.

5+50W Basalt. Fine to medium grained, grey mottled rock. One biotite crystal, 1 mm diameter.

LINE 6+00S

6+30S 1+88E	Hornfels. Fine grained, dark grey rock with 3 mm wide bands of a lighter greenish-grey material. Slightly siliceous.
5+85S 1+40E	QMP. Coarse grained. Feldspar phenocrysts up to 1 cm. Hornblende 1 mm (3%). Quartz eyes 5 mm.
5+40S 1+30E	QMP. Coarse grained. Feldspar phenocrysts up to 1 cm. Hornblende 1 mm (4%), altering to chlorite. Quartz eyes 3 mm.
0+50E	Andesite. Medium grained, grey mottled rock. Green colour in places. Occasional phenocrysts of hornblende 1-2 mm. Leaching along fractures.
0+25W	Andesite. Grey, mottled, medium grained. Hornblende phenocrysts up to 1 mm. Quartz vein 1 mm wide.
5+60S 0+70W	QMP. Coarse grained. Feldspar phenocrysts up to 1 cm. Hornblende 2-4 mm (7%), altering to chlorite. Quartz eyes 2 mm.
1+50W	Rhyolite. Light coloured, greenish-white rock. Fine grained, with a slight colour banding. Siliceous.

LINE 6+00S (continued)

2+05W Hornfels. Very fine grained grey rock with patches of white disseminated pyrite. Greenish alteration along fractures.

2+65W Andesite. Fine to medium grained grey mottled rock. Greenish alteration in places. Hornblende phenocrysts 0.5-1 mm. (Biotite?).

3+45W Basalt. Fine to medium grained, dark grey, with a greenish tinge. Hornblende phenocrysts 1 mm. Leaching up to 3 mm on either side of fractures.

6+45S 3+62W Andesite. Fine to medium grained grey rock, mottled with a greenish tinge. Hornblende phenocrysts up to 1 mm.

3+90W Andesite. Dark grey, fine grained rock varying to a medium grained, mottled lighter grey rock. Occasional mafic phenocrysts up to 0.5 mm. 0.5 mm biotite books in the medium grained rock. Leaching along fractures.

5+50W Andesite. Medium grained, grey mottled rock. Some greenish alteration within the rock, and epidotization along a fracture surface. Occasional biotite books 0.5 mm.

LINE 6+00S (continued)

5+75W Basalt. Fine grained, dark grey mottled rock. A 0.5 mm epidote vein cuts the rock, with some leaching on either side of the vein. Also patches (0.5 mm) of epidote alteration within the rock.

LINE 7+20S

4+00E Andesite. Fine to medium grained, grey mottled rock. Greenish alteration in places. Biotite books less than 1 mm.

3+50E Andesite. Medium grained, grey mottled rock. Greenish alteration in places. Biotite up to 2 mm.

3+00E Basalt. Medium grained, dark grey rock. Mafic phenocrysts visible under hand lens. Moderately well hematized.

0+75W Hornfels. Fine grained grey rock with patches of white. Occasional greenish tinge, well hematized.

7+06S
1+65W Andesite. Coarse to medium grained dark grey rock. White feldspar phenocrysts less than 1 mm; hornblende 1 mm. Some leaching along fractures.

2+14W Hornfels. Fine grained, medium to dark grey rock with patches of white. Greenish alteration along fractures.

2+50W Basalt. Gabbroic texture. Grey mottled rock. Mafic phenos up to 1 mm, feldspar up to 2 mm.

LINE 7+20S (continued)

7+30S 2+85W — Andesite. Medium grained, mottled grey rock. Mafic phenocrysts visible under hand lens.

3+40W — Two rock types:

a) Andesite. Medium to coarse grained grey rock with a mottled appearance. 1 mm hornblende phenocrysts.

b) Rhyolite. Whitish-green felsic unit. Fine grained, siliceous.

3+80W — Basalt. Dark grey, fine grained rock with a greenish tinge. Occasional hornblende phenos 0.5 mm.

7+22S 4+22W — Basalt. Fine grained, dark grey rock. Hornblende phenocrysts visible under hand lens. Calcite infilling vesicles, less than 1 mm diameter.

7+00S 4+82W — Basalt. Dark grey mottled rock with greenish tinge. Occasional feldspar and biotite phenocrysts up to 0.5 mm. Leaching along fractures.

5+25W — Andesite. Medium grained, mottled, grey. Mafic phenocrysts visible under hand lens.

LINE 7+20S (continued)

7+50S 5+75W	Andesite. Coarse grained grey mottled rock with a greenish tinge. Hornblende phenocrysts up to 1 mm.

LINE 8+40S

3+90E Slate. Very fine grained black rock, dull lustre. Well developed fissibility.

3+00E Argillite. Very fine grained, black, dull rock.

1+15W Basalt. Medium grained, dark grey mottled rock. Feldspar phenocrysts 0.25 mm. Leaching along fractures. Disseminated pyrite.

8+10S
1+92W Basalt. Same as above.

2+50W Andesite. Fine to medium grained grey mottled rock. Hornblende phenocrysts up to 1 mm.

8+47S
3+00W Basalt. Dark grey, fine grained rock with a mottled appearance. Hornblende phenocrysts up to 2 mm. Disseminated pyrite. Leaching along fractures.

8+43S
3+50W Basalt. Dark grey, mottled, fine to medium grained. Hornblende phenocrysts up to 6 mm long. Disseminated pyrite.

3+80W Basalt. Medium grained, grey mottled rock. Disseminated pyrite.

LINE 8+40S (continued)

4+15W Basalt. Fine grained dark grey rock. Leaching along fractures. Has a 1 cm wide interbedded felsic unit.

4+59W Rhyolite. Light grey rock with a greenish tinge. Fine grained and siliceous.

5+25W Basalt. Fine to medium grained, grey mottled rock.

LINE 9+60S

3+75E Basalt. Fine grained dark grey rock with a greenish tinge in places. Disseminated pyrite. Hornblende phenocrysts up to 4 mm.

2+55E Slate. Very fine grained black rock (sand texture). Dull lustre. Very fissile.

3+19W Porphyritic Andesite. Grey, medium grained mottled rock. Feldspar phenos 3 mm, hornblende 2 mm. Leaching along fractures.

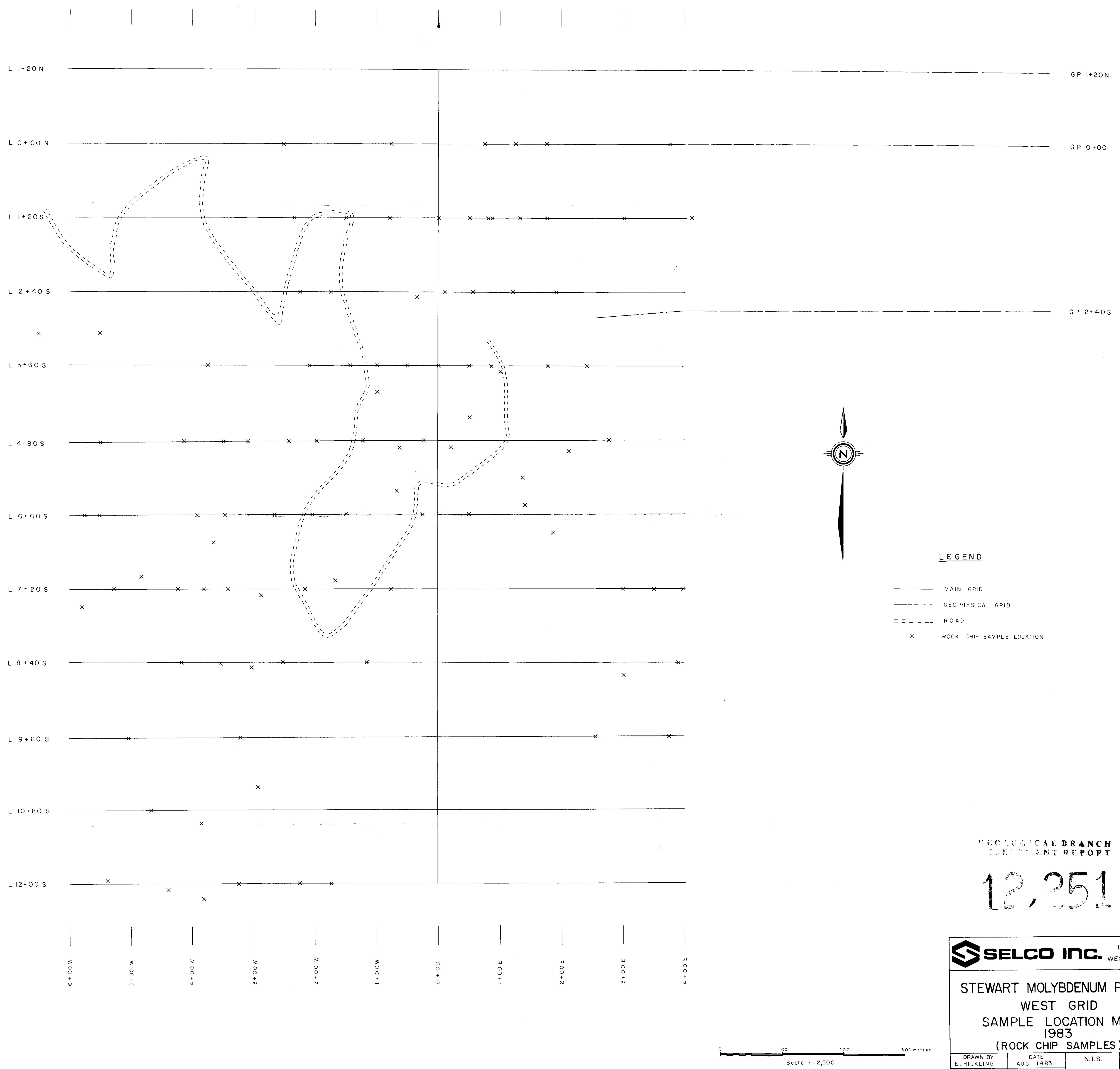
5+00W Basalt. Fine grained, dark grey rock with flecks of biotite.

LINE 10+80S

10+40S 2+90W	Andesite. Medium grained, grey mottled rock. Mafic phenocrysts visible under hand lens. Calcite infilling vesicles, 1-2 mm.
11+00S 3+85W	Basalt. Fine grained, dark grey rock with some greenish alteration. Mafic phenocrysts 0.5-1 mm long.
4+65W	Andesite. Medium grained mottled grey rock.

LINE 12+00S

1+75W	Andesite. Medium grained, grey mottled rock, greenish alteration. Calcite infilling vesicles.
2+25W	Andesite. Fine grained, grey, mottled.. Hornblende phenocrysts 1 mm. Flecks of biotite. Hematized in places.
3+25W	Andesite. Medium to fine grained, grey, mottled. Greenish alteration.
12+25S 3+80W	Basalt. Dark grey, mottled, fine to medium grained. Greenish tinge. Disseminated pyrite. Hematized along fractures.
12+10S 4+38W	Hornfels. Grey, fine grained rock with a greenish tinge. Disseminated pyrite.
11+95S 5+36W	Porphyritic Andesite. Grey mottled rock. Feldspar phenocrysts 2-3 mm, hornblende 2 mm. Fine grained matrix.



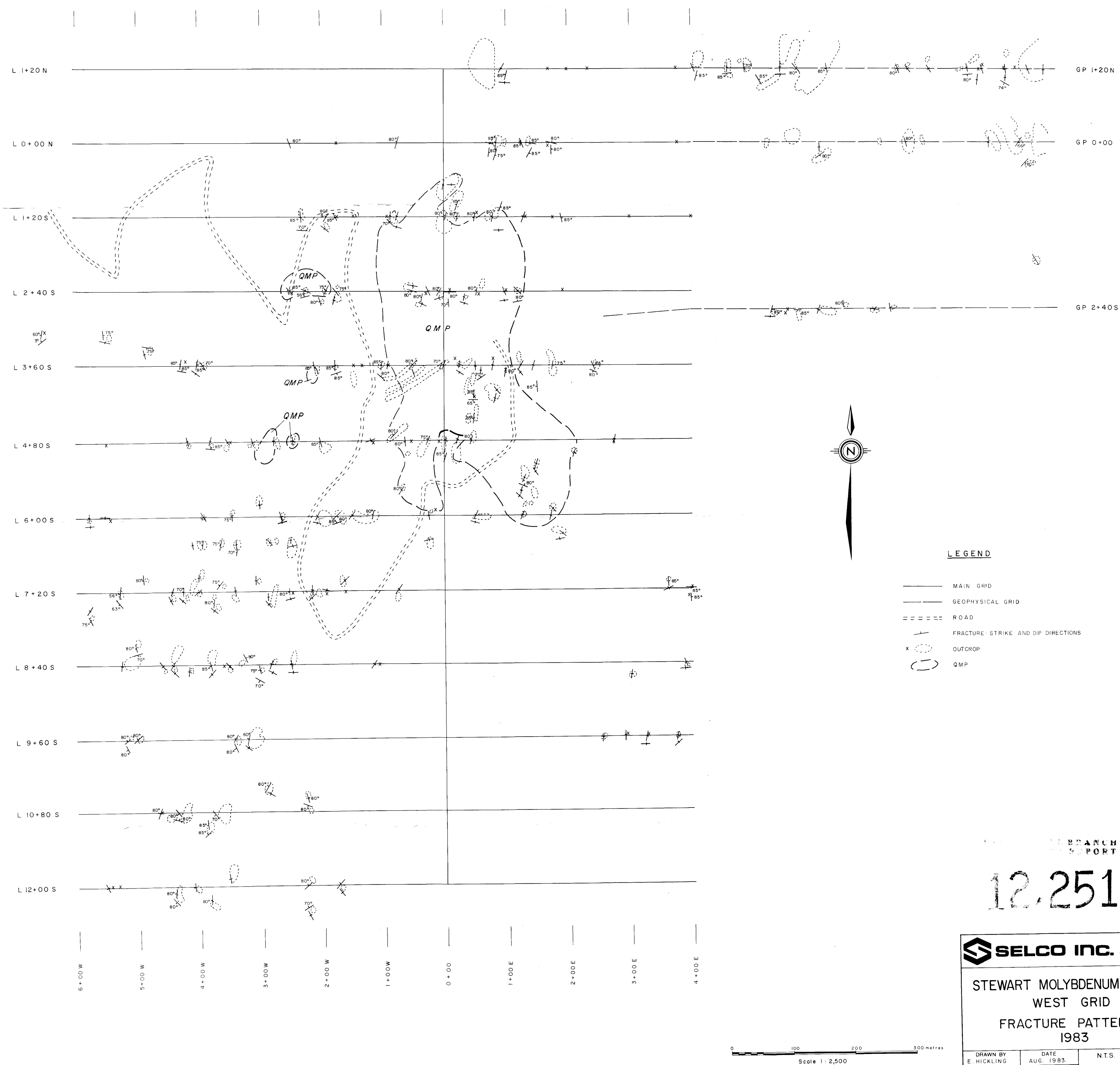
GEOLOGICAL BRANCH
ASSESSMENT REPORT

12,251

part 2 of 2

SELCO INC.	EXPLORATION WESTERN CANADA		
STEWART MOLYBDENUM PROJECT WEST GRID SAMPLE LOCATION MAP 1983 (ROCK CHIP SAMPLES)			
DRAWN BY E. HICKLING	DATE AUG. 1983.	N.T.S. 82 F	PLAN
TRACED BY J. S.	DATE SEPT. 1983.		

66



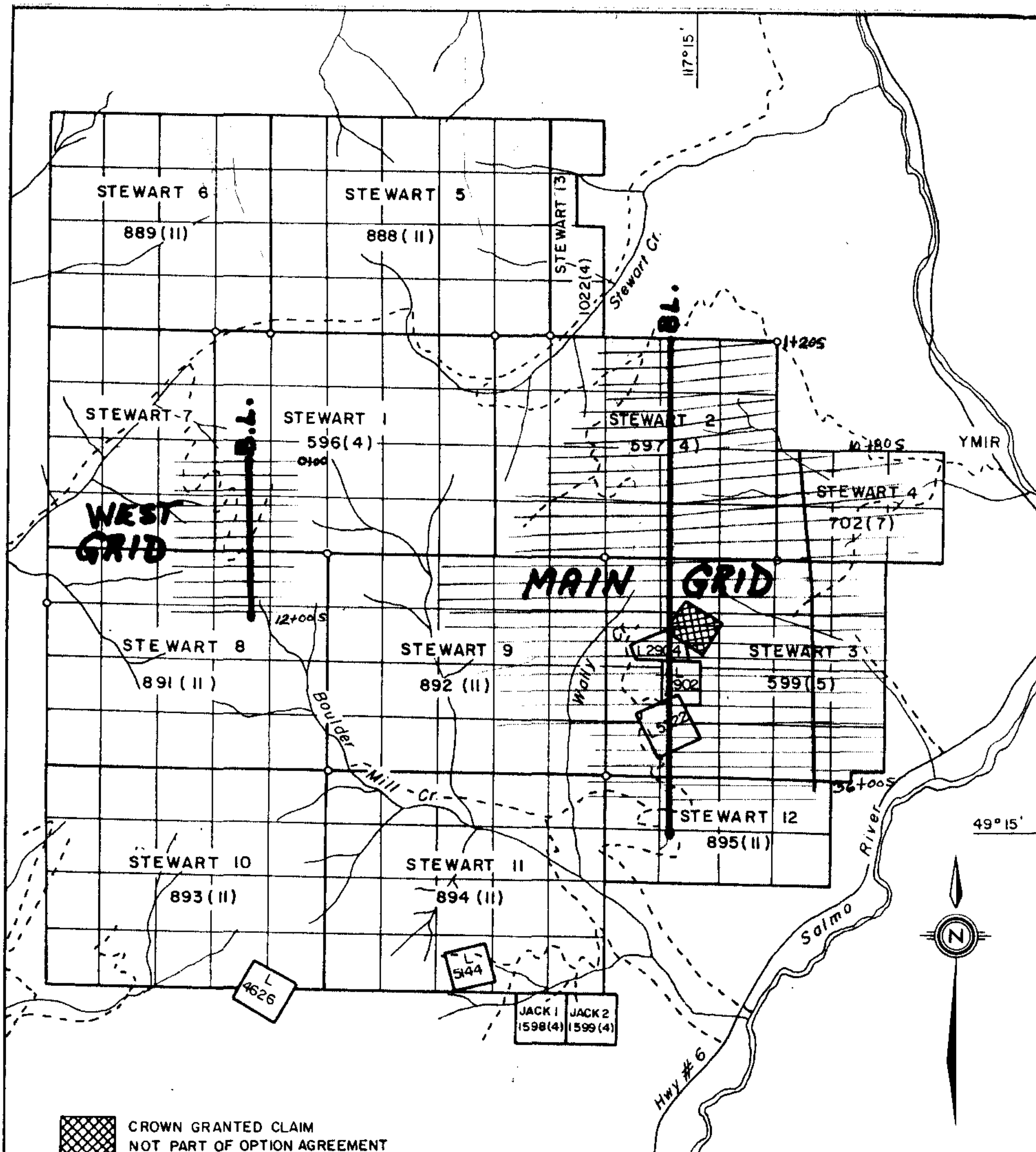
BRANCH REPORT

12.251 part 2 of 2

SELCO INC. EXPLORATION WESTERN CANADA

STEWART MOLYBDENUM PROJECT
WEST GRID
FRACTURE PATTERNS
1983

DRAWN BY	DATE	N.T.S.	PLAN
E. HICKLING	AUG. 1983	82 F	
TRACED BY J.S.	DATE SEPT 1983		



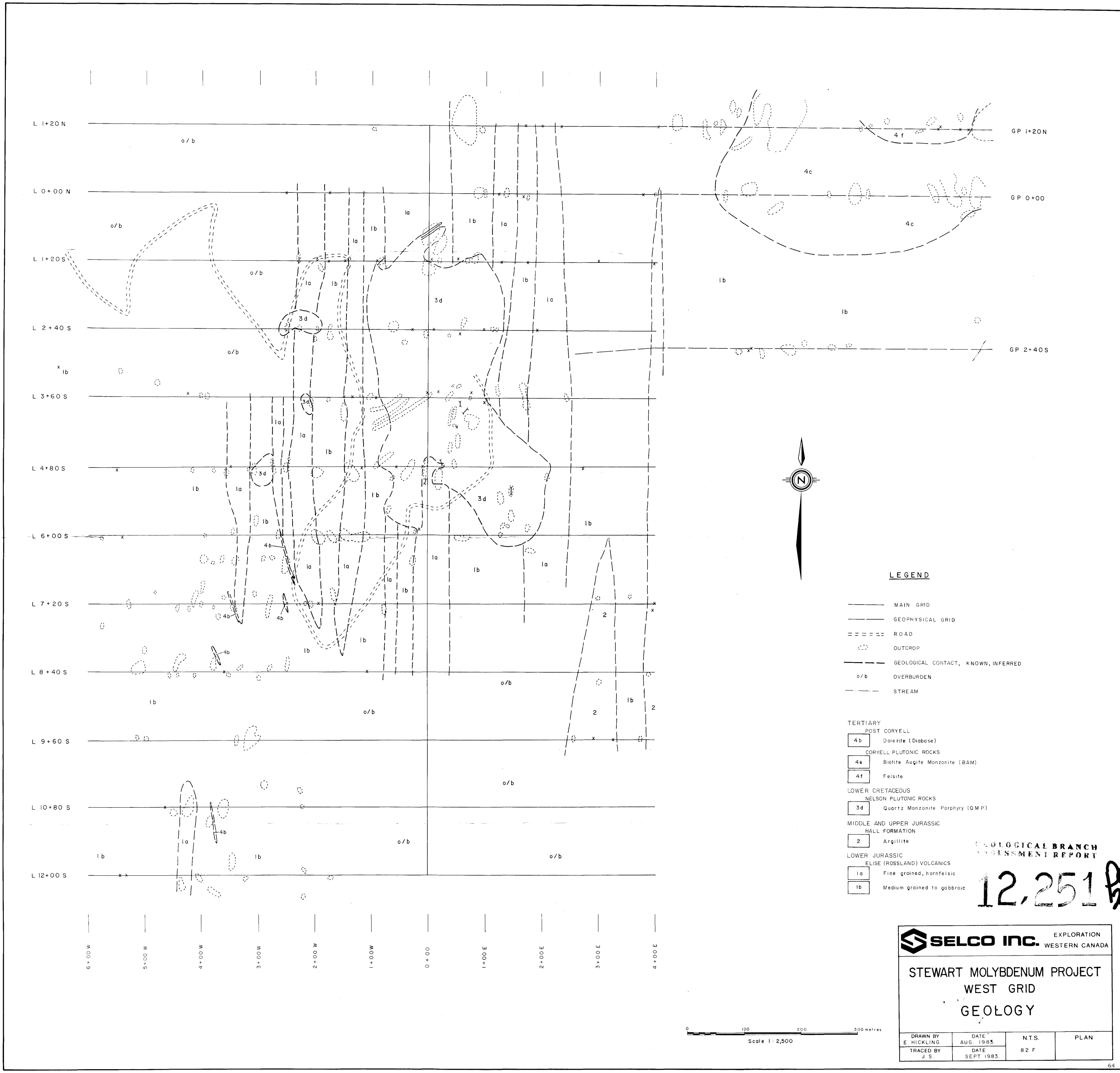
SELCO INC. EXPLORATION WESTERN CANADA

CLAIM LOCATION MAP
& GRID LOCATION MAP

Scale 1:50,000

0 1 2 km

DRAWN BY B. G.	DATE JUNE, 1983.	N.T.S.	PLAN
TRACED BY J. S.	DATE JUNE, 1983.	82F	FIG. III



L 1+20N
L 0+00N
L 1+20S
L 2+40S
L 3+60S
L 4+80S
L 6+00S
L 7+20S
L 8+40S
L 9+60S
L 10+80S
L 12+00S
GP 1+20N
GP 0+00
GP 2+40S
6+00W
5+00W
4+00W
3+00W
2+00W
1+00W
0+00
1+00E
2+00E
3+00E
4+00E
N
LEGEND
MAIN GRID
GEOPHYSICAL GRID
ROAD
OUTCROP
GEOLOGICAL CONTACT, KNOWN, INFERRED
o/b OVERBURDEN
STREAM
TERTIARY
POST CORYELL
4b Dolerite (Diabase)
CORYELL PLUTONIC ROCKS
4e Biotite Augite Monzonite (BAM)
4f Felsite
LOWER CRETACEOUS
NELSON PLUTONIC ROCKS
3d Quartz Monzonite Porphyry (QMP)
MIDDLE AND UPPER JURASSIC
HALL FORMATION
2 Argillite
LOWER JURASSIC
ELISE (ROSSLAND) VOLCANICS
1a Fine grained, hornfelsic
1b Medium grained to gabbroic
GEOLOGICAL BRANCH
ASSESSMENT REPORT
12,251
Part 2 of 2
0
100
200
300 metres
Scale 1:2,500
SELCO INC.
EXPLORATION
WESTERN CANADA
STEWART MOLYBDENUM PROJECT
WEST GRID
GEOLOGY
DRAWN BY
E. HICKLING
DATE
AUG. 1983
TRACED BY
J.S.
DATE
SEPT 1983
N.T.S.
82 F
PLAN
64

APPENDIX IV

GEOCHEMICAL ANALYTICAL TECHNIQUES

An Overview of Neutron Activation Analysis in Geochemistry

L.A. Haskin

Department of Earth and Planetary Sciences and McDonnell
Center for the Space Sciences
Washington University
St. Louis, Missouri 63130

INTRODUCTION

Neutrons were discovered in 1932 and within four years the principles for neutron activation analysis (NAA) had been set forth (von Hevesy and Levi, 1936). High intensities of neutrons were needed, however, to make the technique useful for trace-element analysis. These intensities did not become available until research nuclear reactors were fairly abundant at universities and government laboratories in the late 1940's and in the 1950's. Development of NAA became rapid, initially in the context of exploring the capabilities and merits of a new analytical technique. By the 1960's this type of research had diminished, as the principles and possibilities of the technique had been tried and proven. Most advances since that time have been based on major improvements in technology and most were made by researchers developing better methods to obtain data needed for their research, as opposed merely to demonstrating a new capability.

Geochemists were involved in NAA early in the development period (e.g., analysis of Pd and Ga, Brown and Goldberg, 1949).

Among the earlier indications of the prowess of NAA was the demonstration of very low concentrations of U in stony and iron meteorites (Reed and Turkevich, 1955; Hamaguchi et al., 1957). NAA was the method was used to get modern rare-earth element (REE) geochemistry underway (Schmitt et al., 1960; Haskin and Gehl, 1962; Coryell et al., 1962). It is the preferred technique for several groups of trace elements (e.g., siderophiles and 'volatiles', Crocket et al., 1967; Ganapathy et al., 1970). Along with mass spectrometric isotope dilution (MSID) and, to a lesser extent, spark-source mass spectrometry (SSMS), it is the standard technique for modern multi-element geochemical analysis (i.e., measurement of many trace elements in a single aliquot of sample).

HOW NAA WORKS

The sample to be analyzed is sealed into a polyethylene or a fused silica tube and suspended in the core of a nuclear reactor where it is bathed in a sea of neutrons. Most of the nuetrons have very low kinetic energies ('thermal' neutrons'). For more specialized applications, slightly more energetic ('epithermal') neutrons from a reactor, or still more energetic neutrons produced by bombardment of a target with deuterons may be used (Brunfelt and Steinnes, 1969; Ehmann and Morgan, 1970; Schmitt et al., 1970); these cases are not considered here.

Usually, only a small fraction of each kind of atom (each kind of isotope) in the sample will react with neutrons. The most common reaction is absorption by an atom of a single neutron to produce a new isotope of the parent atom; this is called an (n, y) reaction. Many of the isotopes thus produced are radioactive. Each radioisotope decays with its own characteristic energies and half-life to a stable form.

The sample is removed from the reactor and taken to the laboratory for radioassay (detection of the decaying nucleus). The radioisotopes present are identified by some combination of pre-assay chemical purification, half-life measurement, or gamma-ray spectrometry. From the identities of the radioisotopes, the identities of the parent elements in the sample can be determined. This information is of little interest, as virtually all natural materials seem to contain a little bit of every chemical element. What is important is the quantity of the parent element in the sample, and that is related to the number of decays observed for the daughter radioisotope.

The sensitivity of determination for a particular element depends on how many of its atoms must be present in the sample to provide enough detectable and identifiable decays of the daughter isotope. This depends on several factors. The first is neutron flux, or bombardment intensity. The second is cross-section, or probability for the parent isotope to absorb a neutron. The third is duration of the neutron irradiation, which cannot be usefully continued beyond a few half-lives of the element of interest before a steady-state concentration of the daughter isotope is reached. The fourth is efficiency of the radiation detector. The fifth is nature of the radiations accompanying decay of the daughter isotopes, i.e., whether they are easily detected. The sixth is half-life of the daughter isotope; it must not be too short, or the isotope will be gone before the sample reaches the detector and it must not be too long or too little of the daughter isotope will decay during a reasonable amount of time in the detector.

A good example is the element Mn. ^{55}Mn readily absorbs a neutron (thermal nuetron cross section 13 barns; there are (10^{-24} cm^2 per barn) by the reaction ^{55}Mn (n,y)^{56}Mn. ^{56}Mn decays to stable ^{56}Fe with a half-life of 2.58 hours. Each decaying nucleus emits a beta particle (electron) and most emit one or more gamma rays (photons). By using a detector with a efficiency of 50 percent or more, irradiating the sample at a neutron flux of 10^{14} n/cm^2/s for 10 hours, and separating the Mn for counting within 2.6 hours after irradiation, as few as 10^8 atoms of Mn in the sample can be detected and measured. That amounts to merely 10^{-16} gram, a much lower quantity of Mn than is expected in most natural materials and an amount well below our capability to prepare and handle most samples and to keep packaging materials free from Mn!

Rather than measure independently the six factors mentioned above, which is not easy to do, it is common practice to include along with the sample a standard with known concentrations of the elements of interest. Then all of the conditions of irradiation and detection cancel, and a simple proportionality results between the amounts the elements in the sample and standard and the number of counts observed for each per unit time on the detector.

Details of how NAA works are given in other sections of this handbook and in the monograph of DeSoete, Gijbels, and Hoste (1972). Many examples of application to geochemistry are given in the conference volume edited by Brunfelt and Steinnes (1971). A more detailed discussion of principles and problems than the present one, and which includes the calculations for Mn mentioned here, has been prepared by Haskin and Ziege (1971).

ADVANTAGES OF NAA

The very high sensitivity for Mn is a very favorable case, but high sensitivity can be attained for most chemical elements. NAA has other advantages as well.

Most rocks and minerals are chemically complex and most elements are present in very small amounts (10 ppm). Many chemical methods for analysis at low concentrations require some combination of sample dissolution and addition of reagents, or chemical separation, or both. These steps provide abundant opportunity to contaiminate the sample with detectably significant amounts of the elements being determined, either as impurities in the reagents or through particulate matter in the laboratory. To avoid this may require use of especially purified reagents and a clean room atmosphere, plus regular determination of reagent blanks (i.e., analyses with no sample added). That such procedures can be successfully carried out is clear from the analytical results of good laboratories using MSID. However, such control is painstaking and expensive.

In NAA, the sample can be irradiated with neutrons prior to any chemical processing. Then, accidental contamination during processing does not affect the analysis because the contaminants, having not been made radioactive, cannot register in the detector. Thus, there is no reagent blank, and less stringent controls are required. Of course, a sample contaminated prior to irradiation is just as ruined for NAA as for other techniques, so care in early sample preparation is necessary.

Even better, much modern NAA is done without any chemical separation ('Instrumental' NAA, or INAA). We routinely analyze for 16 elements in mafic rocks and lunar samples.

The concentration range for most of these is 0.01 to 50 ppm, and we routinely analyze for these in samples as large as 100 mg aliquots of powder or as small as 1 mg fragments from lunar soils, all with high precision. INAA greatly reduces sample handling time. Furthermore, unpowdered chips of rock can be analyzed by INAA, then thin sections can be made for petrographic study of the very same sample.

For elements yielding relatively small amounts of radiation against intense backgrounds of other radiation in the same energy region, chemical processing remains necessary. However, unlike many other chemical techniques, separation and purification of the element need not be quantitative. Once the sample has been irradiated, it can be deliberately 'contaminated' with a weighed amount of the element being determined (as 'carrier'). The carrier is carefully mixed with the corresponding radioisotope of the sample. Separation then involves working with a macroscopic, rather than a microscopic amount of the element. After radioassay, the fraction of carrier that survived the chemical separation is determined. This enables correction for the amount of radioisotope also lost.

NAA is an excellent technique for multi-element analysis on a single aliquot of sample. Analysis for many elements in a sample is important in establishing correlations in behavior among different trace elements. Finally, the total work required is reduced if a sample need be prepared and handled only once or twice as opposed to requiring a variety of techniques and procedures for its characterization.

Because so much multielement work can be done by INAA, another advantage of NAA is the capacity to analyze many samples. Fifty to 100 samples can now be analyzed accurately and efficiently for a single project. Experience is showing that satisfactory characterization of many rock suites requires analysis of large numbers of samples. At present, the only other technique providing relatively rapid multielement analysis of competitive quality and with little effort for sample preparation and standardization appears to be X-ray fluorescence spectrometry (XRF) (e.g., Norrish and Hutton, 1969), but only a few trace elements can be rapidly determined by XRF with good precision. Spark-source mass spectrometry (SSM) provides data for many more elements than INAA but requires much more time and effort and is of lower precision, yielding unimpressive results except in the most capable hands (e.g., Taylor and Gorton, 1977). Atomic absorption spectrophotometry (AAS) requires extensive sample and standard preparation and mutliple passes through the instrument for different elements. Emission spectroscopy (ES) is rapid, but only semiquantitative unless exceptional effort is made, and that is time-consuming. Plasma spectroscopy has been inadequately tested so far.

THE PRESENT 'NICHE' FOR NAA IN GEOCHEMISTRY

NAA is now a well established method for trace element analysis in geochemistry. It is competitive with or superior to most other methods when precise, accurate data are needed when many samples need to be analyzed, or both. Modern NAA requires sophisticated equipment. Extensive computer data reduction is common, but consistent precision and accuracy can be obtained only be careful analysts who are familiar with the principles and pitfalls of the method.

REFERENCES

Allen, R.O., Haskin, L.A., Anderson, M.R. and Muller, O. (1970): Neutron activation analysis for 39 elements, small or precious geologic samples. J. Radioanal. Chem. 6, 115-137.

Brown, H. and Goldberg, E. (1949): The neutron pile as a tool in quantitative analysis: The Ga and Pd content of iron meteorites. Science 109, 347.

Brunfelt, A.O. and Steinnes, E. (1969): Instrumental activation analysis of silicate rocks with epithermal neutrons. Anal. Chim. Acta 48, 13-24.

Brunfelt, A.O. and Steinnes, E., (Eds.) (1971): Activation Analysis in Geochemistry and Cosmochemistry, Proc. of the NATO Advanced Study Institute, Kjeller, Norway, Sept. 1970, Universitetsforlaget, Oslo.

Coryell, C.D., Chase, J.W. and Winchester, J.W. (1962): A procedure for geochemical interpretations of terrestrial rare-earth abundance patterns. J. Geophys. Res. 68, 559-566.

Crocket, J.H., Keays, R.R. and Hsieh, S. (1967): Precious metal abundances in some carbonaceous and enstatite chondrites. Geochim. Cosmochim. Acta 31, 1615-1623.

Denechaud, E.B., Helmke, P.A. and Haskin, L.A. (1970): Analysis for the rare-earth elements by neutron activation and Ge(LI) spectrometry. J. Radioanal. Chem. 6, 97-113.

DeSoete, D., Gijbels, R. and Hoste, J. (1972): Neutron Activation Analysis. Wiley-Interscience, London.

Ehmann, W.D. and Morgan, J.W. (1970): Oxygen, silicon and aluminum in lunar samples by 14 MeV neutron activation. Science 167, 528-530.

Ganapathy, R., Keays, R.R., Laui, J.C. and Anders, E. (1970): Trace elements in Apollo 11 lunar rocks: implications for meteorite influx and origin of moon. Proc. Apollo 11 Lunar Sci. Conf., 1117-1142.

Gordon, G.E., Randle, K., Goles, G.G., Corliss, J.B., Beeson, M.H. and Oxley, S.S. (1968): Instrumental activation analysis of standard rocks with high resolution gamma-ray detectors. Geochim. Cosmochim. Acta 32,369-396.

Hamaguchi, H., Reed, G.W. and Turkevich, A. (1957): Uranium and barium in stone meteorites. Geochim. Cosmochim. Acta 12, 337-347.

APPENDIX V

X-RAY ASSAY LABS

MULTI-ELEMENT ANALYSIS RESULTS

WEST GRID SAMPLING PROGRAM

X-RAY ASSAY LABORATORIES LIMITED

DATE: 21-NOV-83 REPORT: REF.FILE: 14944 PAGE: 61

S A M P L E N U M B E R S

ELEMENT & UNITS	**WG 1+45N-5** +50E	**WG 1+20N-0** +92E
U PPM	<5	<5
TH PPM	2	2
NA PPM	22000	24000
SC PPM	39	25
CR PPM	190	50
FE %	5.5	5.7
CO PPM	24	23
NI PPM	<500	<500
ZN PPM	180	220
AS PPM	<10	<10
SE PPM	<10	<10
BR PPM	<5	<5
MO PPM	<5	5
SB PPM	1	1
CS PPM	<2	2
BA PPM	<2000	<2000
LA PPM	9	14
HF PPM	<2	3
TA PPM	<2	<2
W PPM	<10	<10
AU PPB	<100	<100
CE PPM	22	29
ND PPM	<20	<20
SM PPM	3.1	3.7
EU PPM	1.1	1.1
YB PPM	2	2
LU PPM	0.3	0.3
SR PPM	<1000	1000
RB PPM	<100	<100

X-RAY ASSAY LABORATORIES LIMITED

DATE: 21-NOV-83 REPORT: REF.FILE: 14944

SAMPLE NUMBERS

ELEMENT & UNITS	!WG 1+20N-2** !+00E	WG 1+20N-4** **+35E	WG 1+20N-6** **+00E	WG 1+20N-6** **+50E	WG 1+20N-7** **+65E	WG 1+20N-8** **+75E
U PPM	<5	<5	<5	5	<5	5
TH PPM	7	3	9	16	16	22
NA PPM	33000	20000	17000	18000	20000	24000
SC PPM	10	26	19	13	3.3	3.2
CR PPM	70	160	100	310	80	80
FE %	1.7	5.0	4.7	3.5	1.0	1.2
CO PPM	5	21	25	23	<5	<5
NI PPM	<500	<500	<500	<500	<500	<500
ZN PPM	50	250	60	70	90	60
AS PPM	<10	<10	<10	<10	<10	<10
SE PPM	<10	<10	<10	<10	<10	<10
BR PPM	<5	<5	<5	<5	<5	<5
MO PPM	19	<5	6	12	5	5
SB PPM	<1	<1	<1	<1	<1	<1
CS PPM	<2	3	7	6	4	2
BA PPM	<2000	<2000	<2000	<2000	<2000	<2000
LA PPM	17	15	33	42	45	44
HF PPM	4	2	5	6	4	5
TA PPM	<2	<2	<2	<2	<2	2
W PPM	<10	<10	<10	<10	<10	<10
AU PPB	<100	<100	<100	<100	<100	<100
CE PPM	32	28	75	80	75	69
ND PPM	<20	<20	30	30	20	20
SM PPM	3.2	3.6	7.4	6.9	4.6	5.4
EU PPM	1.0	1.4	1.8	1.6	0.7	<0.5
YB PPM	2	2	<2	<2	<2	<2
LU PPM	0.3	0.3	<0.2	<0.2	<0.2	<0.2
SR PPM	1000	1000	1000	1000	<1000	<1000
RB PPM	<100	100	200	300	100	200

SAMPLE NUMBERS

ELEMENT & UNITS	WG 1+20N-9 +40E	WG 1+20N-1 0+00E	WG 1+10N-1 +00E	WG 0+00S-2 +50W	WG 0+00S-0 +75W	WG 0+00S-0 +75E
U PPM	<5	<5	<5	<5	<5	<5
TH PPM	11	3	2	3	4	2
NA PPM	17000		31000	25000	14000	26000
SC PPM	20	16	17	12	14	22
CR PPM	480	40	40	30	170	60
FE %	4.7	4.9	5.0	3.1	4.0	5.7
CO PPM	33	9	7	14	10	15
NI PPM	<500	<500	<500	<500	<500	<500
ZN PPM	90	140	140	50	290	170
AS PPM	<10	<10	<10	<10	<10	PENDING
SE PPM	<10	<10	<10	<10	<10	<10
BR PPM	<5	<5	<5	<5	<5	<5
MO PPM	8	<5	<5	<5	15	6
SB PPM	<1	<1	<1	<1	<1	<1
CS PPM	8	3	2	<2	<2	2
BA PPM	<2000	<2000	<2000	<2000	<2000	<2000
LA PPM	36	14	14	16	36	14
HF PPM	6	4	4	2	3	2
TA PPM	<2	<2	<2	<2	<2	<2
W PPM	<10	<10	<10	<10	<10	<10
AU PPB	<100	<100	PENDING	<100	<100	<100
CE PPM	75	29	29	29	52	23
ND PPM	20	<20	<20	<20	30	<20
SM PPM	7.4	3.7	3.9	2.5	6.3	3.3
EU PPM	2.0	1.1	1.6	<0.5	1.8	1.9
YB PPM	<2	3	2	2	3	2
LU PPM	<0.2	0.4	0.4	0.2	0.5	0.4
SR PPM	1000	1000	1000	<1000	<1000	1000
RB PPM	200	<100	<100	<100	<100	<100

X-RAY ASSAY LABORATORIES LIMITED

DATE: 21-NOV-83 REPORT: REF.FILE: 14944

SAMPLE NUMBERS

ELEMENT & UNITS	WG 0+00S-1 +25E	WG 0+00S-1 +75E	WG 0+00S-3 +75E	WG 0+00S-5 +85E	WG 0+00S-7 +75E	WG 0+00S-9 +75E
U PPM	5	PENDING	<5	<5	<5	<5
TH PPM	5	PENDING	2	8	15	9
NA PPM	21000	PENDING	10000	17000	17000	16000
SC PPM	18	PENDING	48	18	16	18
CR PPM	220	PENDING	250	100	370	250
FE %	4.3	PENDING	4.5	4.5	4.1	4.4
CO PPM	16	PENDING	19	25	27	28
NI PPM	<500	PENDING	<500	<500	<500	<500
ZN PPM	480	PENDING	<50	70	120	110
AS PPM	<10	PENDING	<10	<10	<10	<10
SE PPM	10	PENDING	<10	<10	<10	<10
BR PPM	<5	PENDING	<5	<5	<5	<5
MO PPM	27	PENDING	<5	<5	9	6
SB PPM	1	PENDING	1	<1	<1	<1
CS PPM	<2	PENDING	<2	4	6	5
BA PPM	2000	PENDING	<2000	<2000	<2000	<2000
LA PPM	36	PENDING	9	30	39	31
HF PPM	4	PENDING	2	6	5	5
TA PPM	<2	PENDING	<2	<2	<2	<2
W PPM	<10	PENDING	<10	<10	<10	<10
AU PPB	<100	PENDING	<100	<100	<100	<100
CE PPM	54	PENDING	16	57	77	59
ND PPM	30	PENDING	<20	20	20	20
SM PPM	6.8	PENDING	3.0	6.8	7.0	6.5
EU PPM	1.7	PENDING	1.0	2.1	1.2	1.6
YB PPM	4	PENDING	2	2	<2	2
LU PPM	0.6	PENDING	0.3	<0.2	<0.2	<0.2
SR PPM	1000	PENDING	<1000	1000	1000	1000
RB PPM	<100	PENDING	<100	200	200	200

X-RAY ASSAY LABORATORIES LIMITED

DATE: 21-NOV-83 REPORT: REF.FILE: 14944

SAMPLE NUMBERS

ELEMENT & UNITS	WG 0+10S-6 1+50E	WG 1+20S-2 +35W(A)	WG 1+20S-2 +35W(B)	WG 1+20S-1 +50W	WG 1+20S-0 +80W(A)	WG 1+20S-0 +80W(B)
U PPM	<5	<5	<5	<5	<5	<5
TH PPM	13	2	<1	3	4	2
NA PPM	16000	25000	700	16000	27000	29000
SC PPM	18	14	1.3	15	3.6	23
CR PPM	430	130	20	190	110	100
FE %	4.5	3.1	0.3	3.9	1.6	5.5
CO PPM	32	5	<5	13	<5	16
NI PPM	<500	<500	<500	<500	<500	<500
ZN PPM	120	130	130	560	<50	<50
AS PPM	<10	<10	<10	<10	<10	<10
SE PPM	<10	<10	<10	<10	<10	<10
BR PPM	<5	<5	<5	<5	<5	<5
MO PPM	7	38	<5	29	15	12
SB PPM	<1	<1	<1	1	<1	<1
CS PPM	5	2	<2	<2	<2	<2
BA PPM	<2000	<2000	<2000	<2000	<2000	<2000
LA PPM	39	15	2	30	14	13
HF PPM	6	3	<2	3	4	3
TA PPM	<2	<2	<2	<2	<2	<2
W PPM	<10	<10	<10	<10	<10	<10
AU PPB	<100	<100	<100	<100	<100	<100
CE PPM	76	23	<5	43	27	25
ND PPM	30	<20	<20	20	<20	<20
SM PPM	7.3	3.3	0.4	5.2	2.6	3.6
EU PPM	1.9	0.7	<0.5	0.6	0.8	1.3
YB PPM	<2	2	<2	3	<2	2
LU PPM	<0.2	0.4	<0.2	0.5	<0.2	0.3
SR PPM	1000	1000	<1000	1000	1000	1000
RB PPM	200	<100	<100	<100	<100	<100

S A M P L E   N U M B E R S

ELEMENT & UNITS	WG 1+20S-0+00	WG 1+20S-0+50E	WG 1+20S-0+80E	WG 1+20S-0+85E(A)	WG 1+20S-0+85E(B)	WG 1+20S-1+30E
U PPM	<5	PENDING	<5	<5	<5	<5
TH PPM	3	PENDING	2	5	14	3
NA PPM	23000	PENDING	29000	25000	19000	27000
SC PPM	9.6	PENDING	12	2.0	26	14
CR PPM	120	PENDING	90	160	140	100
FE %	2.3	PENDING	3.6	1.6	5.6	2.1
CO PPM	<5	PENDING	5	<5	33	8
NI PPM	<500	PENDING	<500	<500	<500	<500
ZN PPM	120	PENDING	60	<50	80	100
AS PPM	<10	PENDING	<10	<10	<10	<10
SE PPM	<10	PENDING	<10	<10	<10	<10
BR PPM	<5	PENDING	<5	<5	<5	<5
MO PPM	16	PENDING	16	77	<5	10
SB PPM	<1	PENDING	<1	<1	<1	<1
CS PPM	<2	PENDING	<2	<2	4	<2
BA PPM	<2000	PENDING	<2000	<2000	<2000	2000
LA PPM	15	PENDING	14	19	92	16
HF PPM	2	PENDING	3	4	3	3
TA PPM	<2	PENDING	<2	<2	3	<2
W PPM	<10	PENDING	<10	<10	30	<10
AU PPB	<100	PENDING	<100	<100	<100	<100
CE PPM	24	PENDING	30	31	140	34
ND PPM	<20	PENDING	<20	<20	50	<20
SM PPM	2.4	PENDING	3.5	2.5	7.4	3.4
EU PPM	1.3	PENDING	1.2	<0.5	2.5	1.3
YB PPM	2	PENDING	2	<2	2	2
LU PPM	0.3	PENDING	0.4	<0.2	0.3	0.3
SR PPM	1000	PENDING	1000	<1000	1000	1000
RB PPM	<100	PENDING	100	<100	<100	<100

X-RAY ASSAY LABORATORIES LIMITED

DATE: 21-NOV-83 REPORT: REF.FILE: 14944

S A M P L E   N U M B E R S

ELEMENT & UNITS	WG 1+20S-1 +75E	WG 1+20S-3 +00E	WG 1+20S-4 +10E	WG 2+40S-2 +25W	WG 2+40S-1 +75W	WG 2+40S-0 +10E
U PPM	<5	PENDING	<5	<5	<5	<5
TH PPM	2	PENDING	4	5	2	6
NA PPM	25000	PENDING	15000	25000	28000	23000
SC PPM	26	PENDING	15	1.9	24	3.6
CR PPM	60	PENDING	210	110	90	110
FE %	5.9	PENDING	1.7	1.0	5.3	1.2
CO PPM	15	PENDING	5	<5	16	<5
NI PPM	<500	PENDING	<500	<500	<500	<500
ZN PPM	160	PENDING	190	<50	240	<50
AS PPM	<10	PENDING	<10	<10	<10	<10
SE PPM	<10	PENDING	10	<10	<10	<10
BR PPM	<5	PENDING	<5	<5	<5	<5
MO PPM	<5	PENDING	23	11	11	58
SB PPM	1	PENDING	1	<1	<1	<1
CS PPM	2	PENDING	<2	<2	<2	<2
BA PPM	<2000	PENDING	<2000	<2000	<2000	<2000
LA PPM	14	PENDING	27	20	13	22
HF PPM	3	PENDING	3	4	3	4
TA PPM	2	PENDING	<2	<2	<2	<2
W PPM	10	PENDING	<10	<10	<10	<10
AU PPB	<100	PENDING	<100	<100	<100	<100
CE PPM	27	PENDING	42	38	25	37
ND PPM	<20	PENDING	20	<20	<20	<20
SM PPM	4.1	PENDING	5.5	2.6	3.6	3.2
EU PPM	1.5	PENDING	1.3	1.3	1.7	1.1
YB PPM	3	PENDING	3	<2	2	2
LU PPM	0.4	PENDING	0.5	0.3	0.4	0.3
SR PPM	<1000	PENDING	<1000	1000	1000	1000
RB PPM	<100	PENDING	<100	<100	<100	100

X-RAY ASSAY LABORATORIES LIMITED

S A M P L E   N U M B E R S

ELEMENT & UNITS	WG 2+40S-0 +54E	WG 2+40S-1 +20E	WG 2+40S-1 +90E	WG 2+40S-5 +75E	WG 2+40S-6 +50E	WG 2+40S-7 +40E
U PPM	<5	<5	<5	<5	<5	<5
TH PPM	5	7	5	3	4	3
NA PPM	27000	29000	19000	17000	25000	29000
SC PPM	2.7	3.0	17	41	24	28
CR PPM	150	130	190	240	170	140
FE %	1.4	1.8	4.6	5.0	4.3	4.5
CO PPM	<5	<5	10	16	21	11
NI PPM	<500	<500	<500	<500	<500	<500
ZN PPM	60	70	250	<50	280	150
AS PPM	<10	<10	<10	<10	<10	<10
SE PPM	<10	<10	<10	<10	<10	<10
BR PPM	<5	<5	<5	<5	<5	<5
MO PPM	29	45	34	<5	5	6
SB PPM	<1	<1	<1	1	1	<1
CS PPM	<2	<2	<2	3	4	2
BA PPM	<2000	<2000	<2000	<2000	<2000	<2000
LA PPM	20	24	27	14	17	15
HF PPM	4	5	4	2	2	2
TA PPM	<2	<2	<2	<2	<2	<2
W PPM	<10	<10	<10	<10	<10	<10
AU PPB	<100	<100	<100	<100	<100	<100
CE PPM	32	34	40	32	28	25
ND PPM	<20	<20	20	<20	<20	<20
SM PPM	3.1	2.5	5.4	3.5	3.7	3.6
EU PPM	1.0	0.9	1.2	1.1	1.1	1.0
YB PPM	<2	<2	3	2	2	2
LU PPM	0.3	0.2	0.5	0.3	0.3	0.3
SR PPM	1000	1000	1000	<1000	1000	<1000
RB PPM	<100	<100	<100	<100	<100	<100

X-RAY ASSAY LABORATORIES LIMITED

DATE: 21-NOV-83 REPORT: REF.FILE: 14944

SAMPLE NUMBERS

ELEMENT & UNITS	WG 2+50S-0 +35W	WG 3+10S-6 +50W	WG 3+10S-5 +50W	WG 3+60S-3 +90W	WG 3+60S-2 +10W(A)	WG 3+60S-2 +10W(B)
U PPM	<5	<5	<5	<5	<5	<5
TH PPM	5	2	2	3	5	3
NA PPM	21000	20000	26000	22000	29000	14000
SC PPM	2.5	35	22	20	2.4	15
CR PPM	130	70	120	70	120	130
FE %	1.3	7.4	5.2	4.8	1.6	6.0
CO PPM	<5	31	20	21	<5	14
NI PPM	<500	<500	<500	<500	<500	<500
ZN PPM	50	100	200	80	50	420
AS PPM	<10	<10	<10	<10	<10	<10
SE PPM	<10	<10	<10	<10	<10	<10
BR PPM	<5	<5	<5	<5	<5	<5
MO PPM	54	<5	7	10	6	12
SB PPM	<1	1	1	<1	<1	<1
CS PPM	<2	2	<2	<2	<2	<2
BA PPM	<2000	<2000	<2000	<2000	<2000	<2000
LA PPM	17	14	13	11	22	12
HF PPM	3	2	3	2	4	2
TA PPM	<2	<2	<2	<2	<2	<2
W PPM	<10	<10	<10	<10	<10	<10
AU PPB	<100	<100	<100	<100	<100	<100
CE PPM	29	26	31	27	33	23
ND PPM	<20	<20	<20	<20	<20	<20
SM PPM	2.9	4.3	3.3	2.8	2.9	2.7
EU PPM	0.8	1.4	1.6	1.3	0.8	<0.5
YB PPM	2	2	2	2	<2	2
LU PPM	0.3	0.4	0.3	0.3	<0.2	0.3
SR PPM	1000	1000	1000	1000	1000	1000
RB PPM	100	<100	<100	<100	<100	<100

X-RAY ASSAY LABORATORIES LIMITED

DATE: 21-NOV-83 REPORT: REF.FILE: 14944

S A M P L E N U M B E R S

ELEMENT & UNITS	WG 3+60S-1+45W	WG 3+60S-1+00W	WG 3+60S-0+50W	WG 3+60S-0+00	WG 3+60S-0+50E	WG 3+60S-1+75E
U PPM	<5	<5	<5	<5	<5	<5
TH PPM	4	2	5	5	5	4
NA PPM	17000	28000	29000	27000	25000	26000
SC PPM	15	22	2.6	2.3	2.1	12
CR PPM	220	110	110	100	100	120
FE %	3.7	4.3	1.6	1.3	1.0	2.8
CO PPM	5	9	<5	<5	<5	<5
NI PPM	<500	<500	<500	<500	<500	<500
ZN PPM	160	180	<50	<50	<50	80
AS PPM	<10	<10	<10	<10	<10	<10
SE PPM	<10	<10	<10	<10	<10	<10
BR PPM	<5	<5	<5	<5	<5	<5
MO PPM	22	69	12	22	12	28
SB PPM	<1	<1	<1	<1	<1	<1
CS PPM	<2	<2	2	<2	2	<2
BA PPM	<2000	<2000	<2000	<2000	<2000	<2000
LA PPM	40	12	21	20	13	21
HF PPM	2	2	4	3	4	3
TA PPM	<2	<2	<2	<2	<2	<2
W PPM	<10	<10	<10	<10	<10	<10
AU PPB	<100	<100	<100	<100	<100	<100
CE PPM	60	24	43	31	22	37
ND PPM	20	<20	<20	<20	<20	20
SM PPM	5.7	3.3	3.1	2.7	2.2	4.2
EU PPM	1.2	1.3	0.8	1.1	0.7	1.1
YB PPM	3	2	2	<2	<2	2
LU PPM	0.5	0.3	<0.2	<0.2	<0.2	0.4
SR PPM	<1000	1000	2000	1000	1000	1000
RB PPM	<100	100	<100	<100	<100	<100

SAMPLE NUMBERS

ELEMENT & UNITS	WG 3+60S-2 +40E	WG 3+70S-1 +00E	WG 4+00S-0 +85E	WG 4+04S-1 +00W	WG 4+45S-0 +50E	WG 4+80S-5 +50W
U PPM	<5	<5	<5	<5	<5	<5
TH PPM	4	5	6	7	6	3
NA PPM	18000	26000	28000	31000	28000	27000
SC PPM	19	2.1	2.3	2.4	2.4	24
CR PPM	220	170	130	150	120	160
FE %	3.3	1.3	1.1	1.6	1.3	6.7
CO PPM	6	<5	<5	<5	<5	20
NI PPM	<500	<500	<500	<500	<500	<500
ZN PPM	310	<50	<50	<50	<50	<50
AS PPM	<10	<10	<10	<10	<10	<10
SE PPM	<10	<10	<10	<10	<10	<10
BR PPM	<5	<5	<5	<5	<5	<5
MO PPM	27	5	11	8	9	5
SB PPM	1	<1	<1	<1	<1	1
CS PPM	2	<2	<2	2	<2	<2
BA PPM	2000	2000	<2000	2000	<2000	<2000
LA PPM	26	16	19	22	22	13
HF PPM	4	4	5	5	4	3
TA PPM	<2	<2	<2	<2	2	<2
W PPM	<10	<10	<10	<10	<10	<10
AU PPB	<100	<100	<100	<100	<100	<100
CE PPM	38	33	32	42	37	29
ND PPM	20	<20	<20	<20	<20	<20
SM PPM	5.4	2.6	3.1	3.6	3.3	3.7
EU PPM	1.5	1.2	0.9	1.2	1.0	1.3
YB PPM	3	<2	<2	2	<2	2
LU PPM	0.4	<0.2	0.3	0.3	0.3	0.3
SR PPM	<1000	<1000	<1000	1000	1000	<1000
RB PPM	100	<100	100	100	<100	<100

X-RAY ASSAY LABORATORIES LIMITED

DATE: 21-NOV-83 REPORT: REF.FILE: 14944

SAMPLE NUMBERS

ELEMENT & UNITS	WG 4+80S-4 +15W	WG 4+80S-3 +50W	WG 4+80S-3 +10W	WG 4+80S-2 +45W	WG 4+80S-2 +00W	WG 4+80S-1 +25W
U PPM	<5	<5	<5	<5	<5	6
TH PPM	3	3	7	6	2	5
NA PPM	16000	28000	31000	30000	28000	17000
SC PPM	25	25	2.2	2.5	29	16
CR PPM	100	80	160	120	90	270
FE %	6.6	5.1	1.4	0.7	6.0	2.8
CO PPM	27	14	<5	<5	20	10
NI PPM	<500	<500	<500	<500	<500	<500
ZN PPM	<50	160	<50	<50	<50	200
AS PPM	<10	<10	<10	<10	<10	<10
SE PPM	<10	<10	<10	<10	<10	<10
BR PPM	<5	<5	<5	<5	<5	<5
MO PPM	16	28	27	9	69	230
SB PPM	<1	1	1	<1	<1	<1
CS PPM	2	2	<2	3	<2	<2
BA PPM	<2000	<2000	<2000	2000	<2000	4000
LA PPM	10	12	26	25	10	34
HF PPM	3	3	4	5	3	4
TA PPM	<2	<2	2	<2	<2	<2
W PPM	<10	<10	<10	<10	<10	<10
AU PPB	<100	<100	<100	<100	<100	<100
CE PPM	27	25	44	43	22	53
ND PPM	<20	<20	<20	<20	20	20
SM PPM	3.2	3.6	3.3	3.7	3.9	6.7
EU PPM	1.4	1.6	0.7	1.1	1.6	1.8
YB PPM	2	2	2	2	2	4
LU PPM	0.3	0.4	<0.2	0.3	0.4	0.5
SR PPM	<1000	<1000	<1000	1000	1000	<1000
RB PPM	100	<100	<100	100	100	<100

X-RAY ASSAY LABORATORIES LIMITED

DATE: 21-NOV-83 REPORT: REF.FILE: 14944

SAMPLE NUMBERS

ELEMENT & UNITS	WG 4+80S-0 +25W	WG 4+80S-2 +75E	WG 4+90S-0 +20E	WG-4+92S-0 +63W	WG 5+00S-2 +10E(A)	WG 5+00S-2 +10E(B)
U PPM	<5	<5	<5	<5	<5	<5
TH PPM	6	3	6	5	6	5
NA PPM	26000	37000	25000	27000	27000	24000
SC PPM	2.0	11	2.0	2.9	2.9	16
CR PPM	200	110	160	140	180	200
FE %	1.3	2.2	1.4	1.8	1.5	3.0
CO PPM	<5	5	<5	<5	10	7
NI PPM	<500	<500	<500	<500	<500	<500
ZN PPM	50	60	<50	<50	<50	130
AS PPM	<10	<10	<10	<10	<10	<10
SE PPM	<10	<10	<10	<10	<10	<10
BR PPM	<5	<5	<5	<5	<5	<5
MO PPM	6	29	16	<5	7	91
SB PPM	<1	<1	<1	<1	<1	<1
CS PPM	<2	<2	<2	<2	2	<2
BA PPM	<2000	2000	<2000	2000	2000	2000
LA PPM	19	14	19	23	22	21
HF PPM	4	4	4	5	4	5
TA PPM	<2	<2	<2	<2	<2	<2
W PPM	<10	<10	<10	<10	<10	<10
AU PPB	<100	<100	<100	<100	<100	<100
CE PPM	34	31	34	44	42	33
ND PPM	<20	<20	<20	20	20	20
SM PPM	2.6	3.4	3.1	4.0	3.8	4.8
EU PPM	0.9	<0.5	<0.5	1.7	0.9	0.9
YB PPM	<2	2	<2	2	2	3
LU PPM	<0.2	0.4	0.3	0.3	0.3	0.4
SR PPM	1000	1000	<1000	1000	1000	<1000
RB PPM	100	100	<100	<100	100	<100

X-RAY ASSAY LABORATORIES LIMITED

DATE: 21-NOV-83 REPORT: REF.FILE: 14944

SAMPLE NUMBERS

ELEMENT & UNITS	WG 5+40S-1+30E	WG 5+60S-0+70W	WG 5+85S-1+40E	WG 6+00S-5+75W	WG 6+00S-5+50W	WG 6+00S-3+90W
U PPM	<5	<5	<5	<5	<5	<5
TH PPM	6	6	7	3	3	2
NA PPM	28000	32000	34000	23000	21000	31000
SC PPM	2.7	3.3	2.6	20	13	19
CR PPM	150	140	80	60	60	30
FE %	1.2	1.3	1.3	6.1	5.5	6.7
CO PPM	<5	<5	<5	21	13	23
NI PPM	<500	<500	<500	<500	<500	<500
ZN PPM	<50	<50	<50	120	80	120
AS PPM	<10	<10	<10	<10	<10	<10
SE PPM	<10	<10	<10	<10	<10	<10
BR PPM	<5	<5	<5	<5	<5	<5
MO PPM	11	10	7	<5	5	6
SB PPM	1	<1	<1	1	2	<1
CS PPM	<2	<2	<2	3	2	2
BA PPM	2000	2000	2000	<2000	<2000	<2000
LA PPM	25	24	26	13	11	12
HF PPM	5	5	5	4	3	3
TA PPM	<2	<2	<2	<2	<2	<2
W PPM	<10	<10	<10	<10	<10	<10
AU PPB	<100	<100	<100	<100	<100	<100
CE PPM	42	47	50	26	25	25
ND PPM	20	<20	<20	<20	<20	<20
SM PPM	3.2	4.3	3.8	3.2	2.8	3.2
EU PPM	0.9	1.1	1.2	1.2	1.0	0.8
YB PPM	2	2	2	2	2	2
LU PPM	0.3	0.3	0.3	0.3	0.3	0.3
SR PPM	<1000	1000	1000	1000	1000	1000
RB PPM	100	100	100	100	<100	<100

X-RAY ASSAY LABORATORIES LIMITED

DATE: 21-NOV-83 REPORT: REF.FILE: 14944

SAMPLE NUMBERS

ELEMENT & UNITS	WG 6+00S-3 +75W	WG 6+00S-2 +65W	WG 6+00S-2 +05W	WG 6+00S-1 +50W	WG 6+00S-0 +25W	WG 6+00S-0 +50E
U PPM	<5	<5	<5	<5	<5	<5
TH PPM	2	2	3	5	3	3
NA PPM	36000	31000	26000	12000	25000	30000
SC PPM	26	27	24	17	22	30
CR PPM	30	50	90	170	60	70
FE %	6.4	6.0	4.3	6.4	4.5	6.3
CO PPM	18	10	17	25	6	16
NI PPM	<500	<500	<500	<500	<500	<500
ZN PPM	<50	<50	90	320	120	<50
AS PPM	<10	<10	<10	<10	<10	<10
SE PPM	<10	<10	<10	10	<10	<10
BR PPM	<5	<5	<5	<5	<5	<5
MO PPM	5	17	30	130	14	26
SB PPM	<1	<1	<1	<1	<1	<1
CS PPM	<2	<2	<2	2	2	<2
BA PPM	<2000	<2000	3000	2000	<2000	<2000
LA PPM	12	13	20	37	13	15
HF PPM	5	3	4	4	4	5
TA PPM	<2	<2	<2	<2	<2	<2
W PPM	<10	<10	10	10	<10	10
AU PPB	<100	<100	<100	<100	<100	<100
CE PPM	27	28	41	54	30	31
ND PPM	<20	<20	20	30	20	<20
SM PPM	4.0	3.9	5.4	6.8	3.8	4.4
EU PPM	1.7	1.5	1.4	1.3	1.5	1.1
YB PPM	3	3	3	4	2	2
LU PPM	0.4	0.4	0.5	0.6	0.4	0.4
SR PPM	1000	1000	<1000	<1000	<1000	<1000
RB PPM	<100	<100	100	100	<100	100

X-RAY ASSAY LABORATORIES LIMITED

DATE: 21-NOV-83 REPORT: REF.FILE: 14944 PAGE: 76

SAMPLE NUMBERS

ELEMENT & UNITS	WG 6+30S-1+88E	WG 6+45S-3**+62W	WG 7+00S-4**+82W	WG 7+06S-1**+65W	WG 7+20S-5**+25W	WG 7+20S-3**+80W
U PPM	<5	<5	<5	<5	<5	<5
TH PPM	3	2	2	2	3	3
NA PPM	25000	35000	35000	32000	31000	27000
SC PPM	37	28	17	23	14	34
CR PPM	180	30	30	80	40	60
FE %	5.3	7.4	6.2	5.0	4.3	5.7
CO PPM	18	29	20	12	11	22
NI PPM	<500	<500	<500	<500	<500	<500
ZN PPM	260	<50	90	90	50	160
AS PPM	<10	<10	<10	10	<10	<10
SE PPM	<10	<10	<10	<10	<10	<10
BR PPM	<5	<5	<5	<5	<5	<5
MO PPM	31	7	<5	14	6	<5
SB PPM	<1	1	1	1	1	<1
CS PPM	<2	<2	<2	<2	<2	<2
BA PPM	<2000	<2000	<2000	<2000	<2000	<2000
LA PPM	17	13	13	15	12	15
HF PPM	2	3	2	3	3	3
TA PPM	<2	<2	<2	<2	<2	<2
W PPM	<10	<10	<10	<10	<10	<10
AU PPB	<100	<100	<100	<100	<100	<100
CE PPM	39	25	29	40	26	28
ND PPM	<20	<20	<20	<20	<20	<20
SM PPM	4.5	4.3	3.4	3.9	2.7	4.5
EU PPM	1.1	0.8	1.0	1.3	<0.5	2.3
YB PPM	2	3	3	3	2	3
LU PPM	0.4	0.5	0.4	0.4	0.4	0.4
SR PPM	1000	1000	2000	2000	1000	<1000
RB PPM	<100	<100	<100	<100	<100	<100

X-RAY ASSAY LABORATORIES LIMITED

DATE: 21-NOV-83 REPORT: REF.FILE: 14944

SAMPLE NUMBERS

ELEMENT & UNITS	WG 7+20S-3 +40W	WG 7+20S-2 +14W	WG 7+20S-0 +75W	WG 7+20S-3 +00E	WG 7+20S-3 +50E	WG 7+20S-4 +00E
U PPM	<5	<5	<5	<5	<5	<5
TH PPM	2	4	4	3	3	2
NA PPM	34000	20000	24000	34000	19000	20000
SC PPM	24	25	23	21	38	48
CR PPM	50	170	130	100	220	230
FE %	5.6	4.5	4.6	2.6	5.2	4.6
CO PPM	20	26	17	14	25	25
NI PPM	<500	<500	<500	<500	<500	<500
ZN PPM	170	360	310	60	<50	<50
AS PPM	10	<10	<10	<10	10	<10
SE PPM	<10	<10	<10	<10	<10	<10
BR PPM	<5	<5	<5	<5	<5	<5
MO PPM	7	16	50	<5	9	6
SB PPM	<1	<1	<1	<1	1	1
CS PPM	<2	<2	<2	2	3	<2
BA PPM	<2000	3000	2000	2000	2000	<2000
LA PPM	14	32	32	17	19	14
HF PPM	2	2	4	4	3	2
TA PPM	<2	<2	<2	<2	<2	<2
W PPM	<10	<10	<10	<10	<10	<10
AU PPB	<100	<100	<100	<100	<100	<100
CE PPM	28	53	52	37	32	30
ND PPM	<20	30	20	<20	<20	<20
SM PPM	4.0	6.3	6.5	4.1	4.4	4.1
EU PPM	1.5	1.6	2.1	1.2	1.4	0.7
YB PPM	3	4	4	2	3	2
LU PPM	0.5	0.6	0.6	0.4	0.4	0.4
SR PPM	1000	1000	<1000	<1000	<1000	<1000
RB PPM	<100	100	<100	<100	<100	<100

X-RAY ASSAY LABORATORIES LIMITED

DATE: 21-NOV-83 REPORT: REF.FILE: 14944 PAGE: 78

S A M P L E N U M B E R S

ELEMENT & UNITS	WG 7+22S-4 +22W	WG 7+30S-2 +85W	WG 7+50S-5 +75W	WG 8+40S-5 +25W	WG 8+40S-4 +59W	WG 8+40S-4 +15W
U PPM	<5	<5	<5	<5	<5	<5
TH PPM	2	3	3	3	3	3
NA PPM	24000	29000	31000	25000	23000	28000
SC PPM	15	26	23	19	17	17
CR PPM	30	100	70	40	20	10
FE %	5.5	5.1	5.5	5.3	5.7	6.3
CO PPM	15	21	18	15	19	16
NI PPM	<500	<500	<500	<500	<500	<500
ZN PPM	150	<50	170	100	100	350
AS PPM	<10	<10	10	<10	<10	60
SE PPM	<10	<10	<10	<10	<10	<10
BR PPM	<5	<5	<5	<5	<5	<5
MO PPM	5	30	<5	<5	<5	<5
SB PPM	<1	<1	1	1	1	1
CS PPM	2	<2	<2	<2	2	<2
BA PPM	<2000	<2000	<2000	<2000	<2000	<2000
LA PPM	12	14	14	13	14	13
HF PPM	2	2	3	2	2	2
TA PPM	<2	<2	<2	<2	<2	<2
W PPM	<10	<10	<10	<10	<10	<10
AU PPB	<100	<100	<100	<100	<100	<100
CE PPM	32	36	30	26	32	29
ND PPM	20	<20	<20	<20	<20	<20
SM PPM	3.2	3.9	3.5	3.5	3.5	3.5
EU PPM	<0.5	1.2	<0.5	1.4	<0.5	<0.5
YB PPM	2	3	3	2	2	3
LU PPM	0.4	0.5	0.4	0.3	0.4	0.4
SR PPM	<1000	1000	<1000	<1000	1000	1000
RB PPM	<100	<100	<100	<100	<100	100

X-RAY ASSAY LABORATORIES LIMITED

DATE: 21-NOV-83 REPORT: REF.FILE: 14944 PAGE: 79

SAMPLE NUMBERS

ELEMENT & UNITS	WG 8+40S-2 +50W	WG 8+40S-1 +15W	WG 8+40S-3 +90E	WG 8+43S-3 +50W	WG 8+47S-3 +00W	WG 8+60S-3 +00E
U PPM	<5	PENDING	<5	<5	<5	<5
TH PPM	2	PENDING	2	3	2	5
NA PPM	26000	PENDING	26000	24000	26000	21000
SC PPM	26	PENDING	32	31	30	19
CR PPM	60	PENDING	50	50	90	130
FE %	6.3	PENDING	6.1	7.2	7.4	2.1
CO PPM	23	PENDING	34	28	32	5
NI PPM	<500	PENDING	<500	<500	<500	<500
ZN PPM	110	PENDING	230	<50	<50	70
AS PPM	10	PENDING	<10	<10	<10	<10
SE PPM	<10	PENDING	<10	<10	<10	<10
BR PPM	<5	PENDING	<5	<5	<5	<5
MO PPM	6	PENDING	<5	<5	5	11
SB PPM	<1	PENDING	<1	<1	1	1
CS PPM	<2	PENDING	<2	3	<2	3
BA PPM	<2000	PENDING	<2000	<2000	<2000	2000
LA PPM	14	PENDING	15	13	12	24
HF PPM	3	PENDING	2	3	2	4
TA PPM	<2	PENDING	<2	<2	<2	<2
W PPM	<10	PENDING	<10	<10	<10	<10
AU PPB	<100	PENDING	<100	<100	<100	<100
CE PPM	31	PENDING	35	33	26	41
ND PPM	20	PENDING	20	<20	<20	<20
SM PPM	4.1	PENDING	4.2	3.9	3.9	5.4
EU PPM	1.0	PENDING	1.5	0.9	1.4	1.6
YB PPM	3	PENDING	3	3	3	4
LU PPM	0.5	PENDING	0.4	0.4	0.4	0.5
SR PPM	2000	PENDING	1000	1000	<1000	<1000
RB PPM	<100	PENDING	<100	<100	<100	<100

DATE: 21-NOV-83 REPORT: REF.FILE: 14944 PAGE: 80

SAMPLE NUMBERS.

ELEMENT & UNITS	WG 9+60S-5 +00W	WG 9+60S-3 +19W	WG 9+60S-2 +55E	WG 9+60S-3 +75E	WG 10+40S- 2+90W	WG 10+80S- 4+65W
U PPM	<5	<5	<5	<5	<5	<5
TH PPM	3	1	5	2	2	3
NA PPM	31000	27000	19000	28000	27000	27000
SC PPM	20	34	18	33	28	18
CR PPM	30	80	180	70	70	50
FE %	5.6	7.0	2.4	7.4	6.9	4.9
CO PPM	19	27	7	33	30	15
NI PPM	<500	<500	<500	<500	<500	<500

ZN PPM	100	<50	110	<50	130	80
AS PPM	<10	<10	<10	260	20	<10
SE PPM	<10	<10	<10	<10	<10	<10
BR PPM	<5	<5	<5	<5	<5	<5
MO PPM	<5	<5	14	<5	<5	<5
SB PPM	<1	1	2	1	1	1
CS PPM	<2	<2	2	8	<2	<2
BA PPM	<2000	<2000	2000	<2000	<2000	2000
LA PPM	13	13	31	12	12	13
HF PPM	2	4	4	2	2	3
TA PPM	<2	<2	<2	<2	<2	<2
W PPM	<10	<10	<10	<10	<10	<10
AU PPB	<100	<100	<100	<100	<100	<100
CE PPM	26	28	47	24	25	27
ND PPM	<20	<20	20	<20	<20	<20
SM PPM	3.6	3.9	6.5	3.9	3.5	3.8
EU PPM	1.5	<0.5	1.6	<0.5	<0.5	1.3
YB PPM	3	3	4	2	2	3
LU PPM	0.4	0.4	0.6	0.4	0.4	0.4
SR PPM	<1000	<1000	<1000	1000	1000	2000
RB PPM	<100	<100	<100	<100	<100	<100

X-RAY ASSAY LABORATORIES LIMITED

DATE: 21-NOV-83 REPORT: REF.FILE: 14944

SAMPLE NUMBERS

ELEMENT & UNITS	!WG 11+00S-** !3+85W	WG 11+95S-** **5+36W	WG 12+00S-** **3+25W	WG 12+00S-** **2+25W	WG 12+00S-** **1+75W	WG 12+10S-** **4+38W
U PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
TH PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
NA PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
SC PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
CR PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
FE %	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
CO PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
NI PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
ZN PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
AS PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
SE PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
BR PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
MO PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
SB PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
CS PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
BA PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
LA PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
HF PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
TA PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
W PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
AU PPB	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
CE PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
ND PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
SM PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
EU PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
YB PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
LU PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
SR PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING
RB PPM	PENDING	PENDING	PENDING	PENDING	PENDING	PENDING

X-RAY ASSAY LABORATORIES LIMITED

DATE: 21-NOV-83 REPORT: REF.FILE: 14944

SAMPLE NUMBERS

ELEMENT & UNITS	WG 12+25S-13+80W **
U PPM	PENDING
TH PPM	PENDING
NA PPM	PENDING
SC PPM	PENDING
CR PPM	PENDING
FE %	PENDING
CO PPM	PENDING
NI PPM	PENDING
ZN PPM	PENDING
AS PPM	PENDING
SE PPM	PENDING
BR PPM	PENDING
MO PPM	PENDING
SB PPM	PENDING
CS PPM	PENDING
BA PPM	PENDING
LA PPM	PENDING
HF PPM	PENDING
TA PPM	PENDING
W PPM	PENDING
AU PPB	PENDING
CE PPM	PENDING
ND PPM	PENDING
SM PPM	PENDING
EU PPM	PENDING
YB PPM	PENDING
LU PPM	PENDING
SR PPM	PENDING
RB PPM	PENDING

EXPLANATION OF CODES

PENDING - RESULTS TO BE REPORTED

PARTIAL REPORT ONLY

APPENDIX VI

REPORT ON GROUND GEOPHYSICS 1983

BY ALAN WYNNE

REPORT INCLUDES GEOPHYSICAL CROSS

SECTIONS AND INSTRUMENT DESCRIPTIONS

During the period July 25th to August 8th inclusive, a program of Genie electromagnetics and proton precession magnetics was conducted over portions of the Stewart Project area.

The purpose of the survey was to locate on the ground and briefly evaluate fourteen conductors which were picked from the H.E.M. survey flown by Questor.

One line of EM and magnetic was run over each of the anomalies.

The anomaly responses are described here in order of location from north to south (see Airborne Anomaly Location Map).

#4 This anomaly, located at 1+85E, (H.E.M. 10360W W) exhibits a very weak EM response and a magnetic response indicative of a 2-D ribbon dipping steeply to the east. The EM likely indicates a weak vertical conductor at about 30 m depth.

#5,6 Anomaly #5 (H.E.M. 10380W J) is located at 4+00W, has a width of 50 metres, is vertical and very shallow, and exhibits a very strong conductivity-thickness of 90 seimens. A positive magnetic anomaly of 4000 gammes correlates to this zone.

Anomaly #6 (H.E.M. 10380W H) is located at 1+00W; has a width of 10 metres, is vertical and very shallow, and has a conductivity-thickness of 10 seimens. A positive magnetic anomaly of 800 gammes correlates to this zone also.

In addition, a unit 100 metres wide centred at 9+50W exhibits a conductivty of 180 seimens and a magnetic correlation of 4000 gammes. This unit is shallow and vertical, and likely corresponds to H.E.M. 10380 W L.

#9 This anomaly (H.E.M. 10290E B), located at 3+00W, exhibits a width of 50 m, is vertical, shallow and highly conductive. The magnetic profile exhibits highs along the edges of the unit and a low in the centre.

In addition, two thin conductors are located at 1-85W (H.E.M. 10290E D) and 0+00W (H.E.M. 10290E E). These are vertical, highly conductive and exhibit the magnetic response of 2-D ribbon structures steeply dipping to the east.

#14 This anomaly (H.E.M. 10280 W L), located at 5+25W, shows a dip of 60^{o} W, depth of 8 m, conductivity-thickness of 12 seimens and thickness of 20 metres. The magnetic profile indicates a steeply dipping 2-D ribbon, however, the dip appears easterly.

#1,13, 8, 2 Four anomalies do appear on the ground geophysics.

However, it appears that anomaly #2 correlates to line 3+60S, 7+00E (H.E.M. 10220 W J), anomaly 13 correlates to line 1+220N, (H.E.M. 10237W K), anomaly 8 correlates to line 1+20N, 4+60E (H.E.M. 10240E F) anomaly #1 was not located on the eastern extension of line 1+20N, and a fourth anomaly was located at L 3+60S, 13+20E (H.E.M. 10200W B).

The anomaly at L 1+20N, 3+20N, 3+40E exhibits a depth of 20 m, conductivity-thickness of 9 seimens and a magnetic low. Dip is not determinable due to interference with the next conductor. The anomaly at L 1+20W, 4+60E shows a depth of 25 metres, conductivity-thickness of 9 seimens and a magnetic low. Dip is not determinable due to interference with the next conductor. The anomaly at L 1+20W, 4+60E shows a depth of 25 metres, conductivity-thickness of 4 seimens and non-determinable dip. A magnetic low correlates to the anomaly.

The conductor at L 3+60S/7+00E exhibits a steep easterly dip, depth of 30 m, conductivity-thickness of 8 seimens and weak magnetic correlation. The conductor at L 3+60S/13+20E exhibits vertical dip, depth of 30 metres, conductivity-thickness of 4 seimens and a good 2-D ribbon model magnetic profile.

#3 The conductor (H.E.M. 10237W E) is located at 3+25W by a very weak EM response and a poorly shaped, but high amplitude magnetic vertical ribbon. No interpretation can be made on either method.

#7,12, 11 Anomaly #7 (H.E.M. 10101E B) exhibits very weak EM response but is located by a magnetic 2-D ribbon profile at line 0/8+00W. Anomaly #11 (H.E.M. 10091W T) appears to be 50 metres wide, is vertical, shallow, and has a conductivity-thickness of 35 seimens. It is located on line 0/4+25W and has a modest magnetic signature.

Anomaly #12 (H.E.M. 10080E A) located at L in 0/2+10W is narrow, vertical, shallow and has a conductivity-thickness of 30 seimens. Magnetic correlation is poor.

#10 Anomaly #10 (H.E.M. 10020E N) located at 0+80W, is shallow, vertical, has a conductivity-thickness of 50 seimens and corresponds to a magnetic high.

Conclusion

From the work to date, it is possible to separate the anomalies located into three groups on the basis of electromagnetic response and magnetic response. The groups are as follows:

Strong EM, positive magnetics - 2,5,6,9,11,12,14,
10200W B, 10290E D, 10290E E, 10380W L.

Strong EM, negative magnetics - 13, 8

Weak EM, positive magnetics - 3,4,7

No further separation can be made without geological appraisal and further electromagnetics.

Technical Description of the SE-88 GENIE Portable Electromagnetic System

Transmitter

Transmitting Element
Iron-cored coil for each of two selected frequencies.

Transmitting Frequency Pairs
Five pairs. 112.5 Hz reference with one of 337.5, 1012.5 or 3037.5 Hz; or 337.5 Hz reference with one of 1012.5 or 3037.5 Hz.

Transmitting Moments
150 Am at 112.5 Hz, 100 Am at 337.5 Hz, 50 Am at 1012.5 Hz, 25 Am at 3037.5 Hz.

Relative Amplitude Stability
Better than 0.1%

Power Supply
Rechargeable nickel-cadmium batteries; 2 options available, Light and Heavy Duty Battery Packs. Each pack contains 20 cells at 1.25 V Nominal with a total output of ± 12.5 V nominal. The Heavy Duty Pack has 7 A hour capacity while the Light Duty Pack has 4 A hour capacity.

Power Supply Endurance
Light duty pack: 3 hours continuous at 20°C
Heavy duty pack: 5 hours continuous at 20°C

Operating Temperature Range
-30°C to +50°C

Storage Temperature Range
-40°C to +50°C

Total Weight
With light duty battery; 16.1 kg. With heavy duty battery; 17.8 kg

Dimensions
Height: 820 mm
Width: 370 mm
Depth: 155 mm

Receiver

Receiving Element
Iron-cored coil

Receiving Frequency Pairs
Same as transmitter plus 37.5 Hz reference with one of 112.5, 337.5, 1012.5 and 3037.5 for a future transmitter.

Separation Selections for Distance Monitor
Primary selector: 6.35 m, 12.5 m, 25 m, 50 m, 100 m, 200 m plus
Multiplier: x 1, x 1.25, x 1.5, x 1.75. For example, 100 m x 1.5 = 150 m.

Maximum Transmitter-Receiver Separation
200 m under most conditions. Greater separations may be possible depending on atmospheric and power line noise.

Power Line Filtering
Internally switch selectable at 60 or 50 Hz and 3rd harmonic.

Signal Averaging time
Switch selectable at 2, 4, 8 or 16 seconds

Resolution of Ratio Display
0.1%

Power Supply
Rechargeable nickel-cadmium batteries

Power Supply Endurance
20 hours continuous at 20°C

Operating Temperature Range
-30°C to +50°C

Storage Temperature Range
-40°C to +50°C

Total Weight
5.7 kg

Console Dimensions
Length: 300 mm
Height: 230 mm
Depth: 160 mm

Coil Dimensions
Length: 500 mm
Diameter: 45 mm

Battery Charger

Power Requirement
115 V or 230 V, 50 Hz or 60 Hz, 50 VA

Charging Time
7 hours for completely discharged batteries, subsequent automatic trickle charging. Transmitter and receiver batteries can be charged simultaneously.

Weight
4.5 kg

Dimensions
Length: 290 mm
Height: 150 mm
Depth: 130 mm

SCINTREX

222 Snidercroft Road
Concord Ontario Canada
L4K 1B5

Telephone: (416) 669-2280
Cable: Geoscint Toronto
Telex: 06-964570

Geophysical and Geochemical Instrumentation and Services

Specifications

Dynamic Range	18,000 to 103,000 gammas
Capture Range	±25% relative to ambient field strength of last stored value
Tuning Method	Tuning value is calculated accurately utilizing a specially developed tuning algorithm.
Display Resolution	0.1 gamma
Processing Sensitivity	±0.02 gamma
Mathematical Truncation Error	±0.02 gamma
Statistical Error Resolution	0.01 gamma
Absolute Accuracy	±15 ppm at 23°C, 50 ppm over the operating temperature range
Memory Capacity	1140 readings standard, upgradeable to 2140 readings
Display	Custom-designed, ruggedized liquid crystal display with an operating temperature range from -40°C to +55°C. The display contains six numeric digits, decimal point, battery status monitor, signal decay rate and signal amplitude monitor and function descriptors. Upon exceeding 100,000 gammas, the display rolls over eliminating first significant digit.
Gradient Tolerance	5,000 gammas per meter (typical)
Test Mode	A) Diagnostic testing data and programmable memory B) Self test (hardware)
Sensors	Optimized miniature design. Magnetic cleanliness is consistent with the specified absolute accuracy.
Sensor Separation	1 meter standard. Sensors balanced to an accuracy of 0.5%
Environmental Range	-40°C to +55°C; 0-100% relative humidity; weatherproof
Power Supply	Non-magnetic rechargeable sealed lead-acid battery cartridge.
Battery Cartridge Life	2,000 to 5,000 readings, depending upon ambient temperature and rate of readings.
Weight and Dimensions	
Instrument Console	4.5kg, 41 x 11 x 15cm
Lead-Acid Battery,	2.0kg, 9.5 x 11 x 13.5cm
Sensor	2.5kg, 5.6cm diameter x 230cm
System Complement	Instrument console; sensor, backpole, power supply and charger, harness assembly, operations manual.

```
PPM500 #230025 B=69
03/03 12:04:26
OP    #1
12:04:18 57387.4 .14      -100    50   88
            17.4
12:04:49 57389.7 .13      -100     0   88
            17.9
12:04:57 57399.5 .16      -100   -50   88
            18.1
12:05:05 57393.1 .19      -100  -100   88
            18.1
12:05:13 57387.3 .23      -100  -150   88
            18.2
12:05:33 57387.9 .14      -200  -175   88
            16.2
12:05:42 57391.6 .13      -200  -150   88
            16.6
12:05:49 57389.4 .14      -200  -100   88
            16.3
12:06:02 57392.1 .15      -200   -50   88
            16.7
12:06:10 57386.6 .16      -200    -0   88
            17.0
```

PPM-500 DATA BLOCK contains:

time of reading, total field reading, gradient measurement (directly beneath total field reading), statistical error, line & station number, normalized decay rate and amplitude of sensor signal.

E D A Instruments Inc
1 Thorncliffe Park Drive
Toronto, Ontario
Canada M4H 1G9
Telex 06 23222 EDA TOR
Cable. Instruments Toronto
(416) 425-7800

In U.S.A.
E D A Instruments Inc
5151 Ward Road
Wheat Ridge, Colorado
U.S.A. 80033
Telex 00 450681 DVR
(303) 422 9112

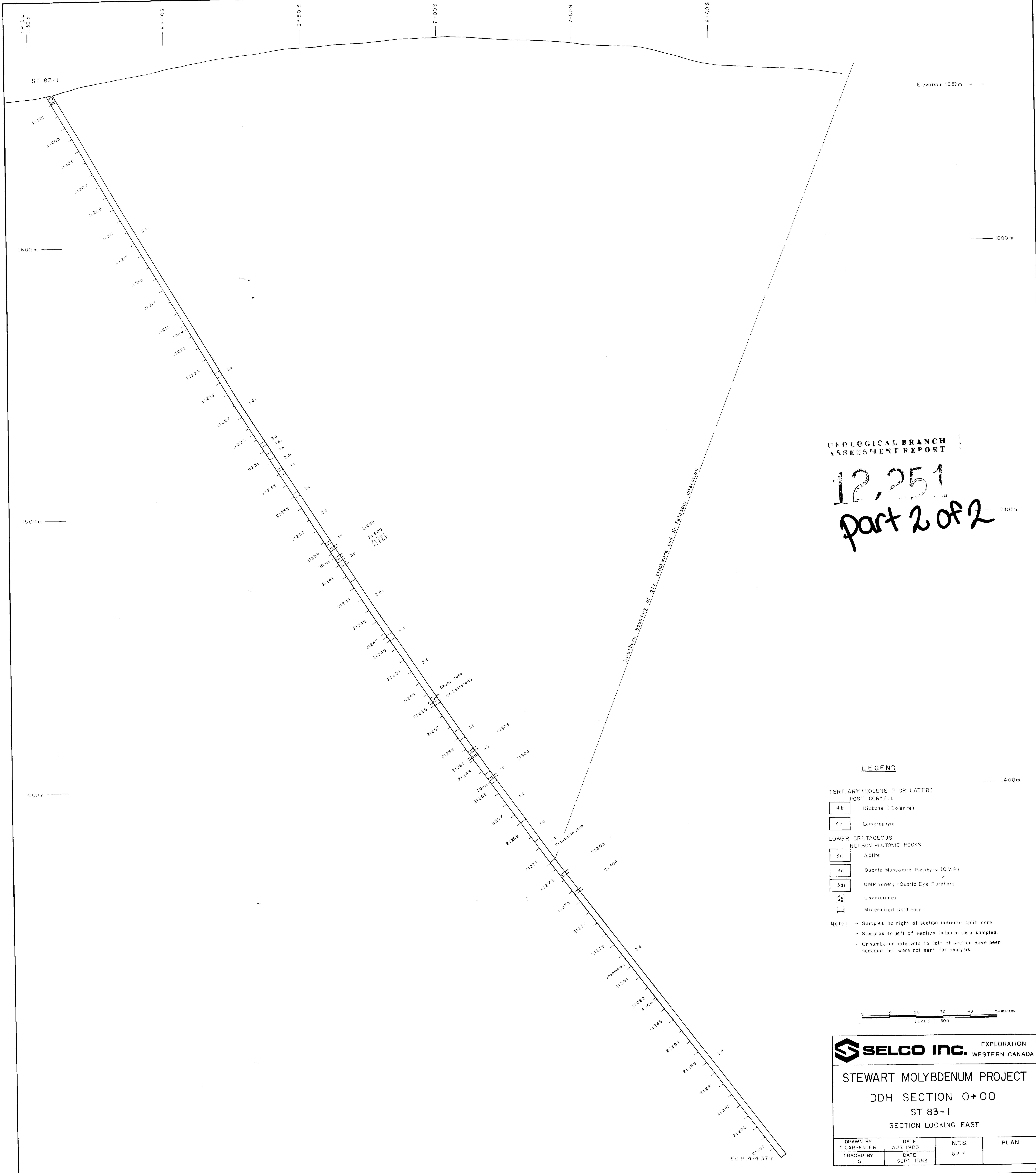
SELCO INC. EXPLORATION WESTERN CANADA

STEWART MOLYBDENUM PROJECT

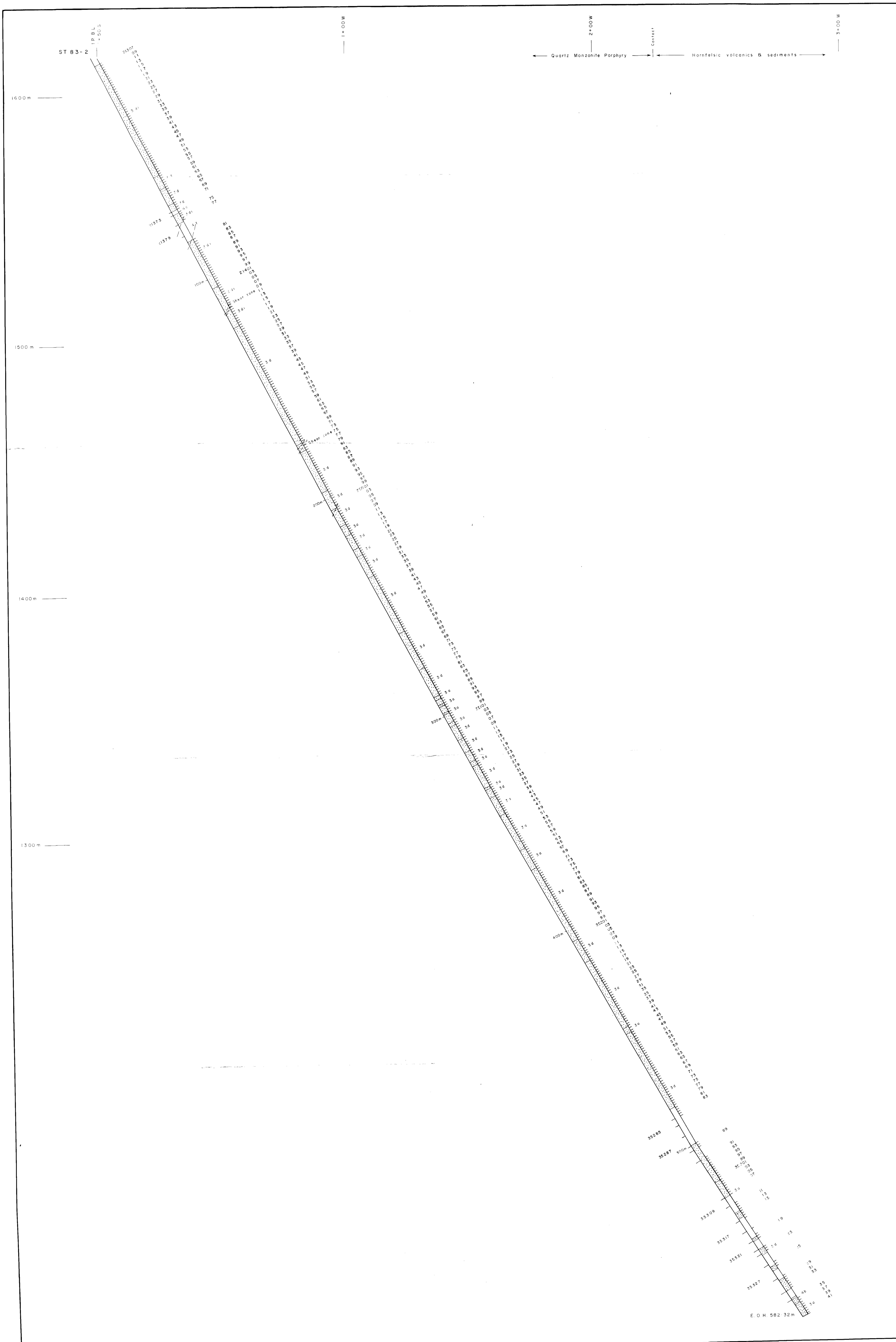
ANOMALIES 1, 2, 8, 13

ELECTROMAGNETICS (GENIE) & MAGNETICS

DRAWN BY	DATE	N.T.S.	PLAN
A. WYNNE	AUG 1983	82 F	
TRACED BY	DATE		
J.S.	SEPT. 1983		58



IP BL 1+50S
6+00S
6+50S
7+00S
7+50S
8+00S
ST 83-1
Elevation 1657m
1600m
1500m
1400m
100m
200m
300m
400m
Shear zone
4c (altered)
Transition zone
Southern boundary of qtz stockwork and K-feldspar alteration
unsampled
E.O.H. 474.57m
GEOLOGICAL BRANCH
ASSESSMENT REPORT
12,251
part 2 of 2
LEGEND
TERTIARY (EOCENE ? OR LATER)
POST CORYELL
4b Diabase (Dolerite)
4c Lamprophyre
LOWER CRETACEOUS
NELSON PLUTONIC ROCKS
3a Aplite
3d Quartz Monzonite Porphyry (QMP)
3d1 QMP variety - Quartz Eye Porphyry
Overburden
Mineralized split core
Note: - Samples to right of section indicate split core.
- Samples to left of section indicate chip samples.
- Unnumbered intervals to left of section have been sampled but were not sent for analysis.
0 10 20 30 40 50 metres
SCALE 1:500
SELCO INC.
EXPLORATION
WESTERN CANADA
STEWART MOLYBDENUM PROJECT
DDH SECTION 0+00
ST 83-1
SECTION LOOKING EAST
DRAWN BY T. CARPENTER
DATE AUG 1983
TRACED BY J.S.
DATE SEPT 1983
N.T.S. 82 F
PLAN
67



GEOLOGICAL BRANCH
ASSESSMENT REPORT

12,251
part 2 of 2

LEGEND

TERTIARY (EOCENE ? OR LATER)
POST CORYELL

4b	Diabase (Dolerite)
4c	Lamprophyre

CORYELL PLUTONIC ROCKS

4f	Gabbro

LOWER CRETACEOUS
NELSON PLUTONIC ROCKS

3a	Aplite
3d	Quartz Monzonite Porphyry (QMP)
3di	QMP variety - Quartz Eye Porphyry
	Mineralized split core

Note: - Split core plotted to right of section.
- Chip samples plotted to left of section.
- Only those samples sent for analysis are numbered. Alternating even numbered samples have been collected and are presently being stored.

0 10 20 30 40 50 metres
SCALE 1:500

SELCO INC. EXPLORATION WESTERN CANADA

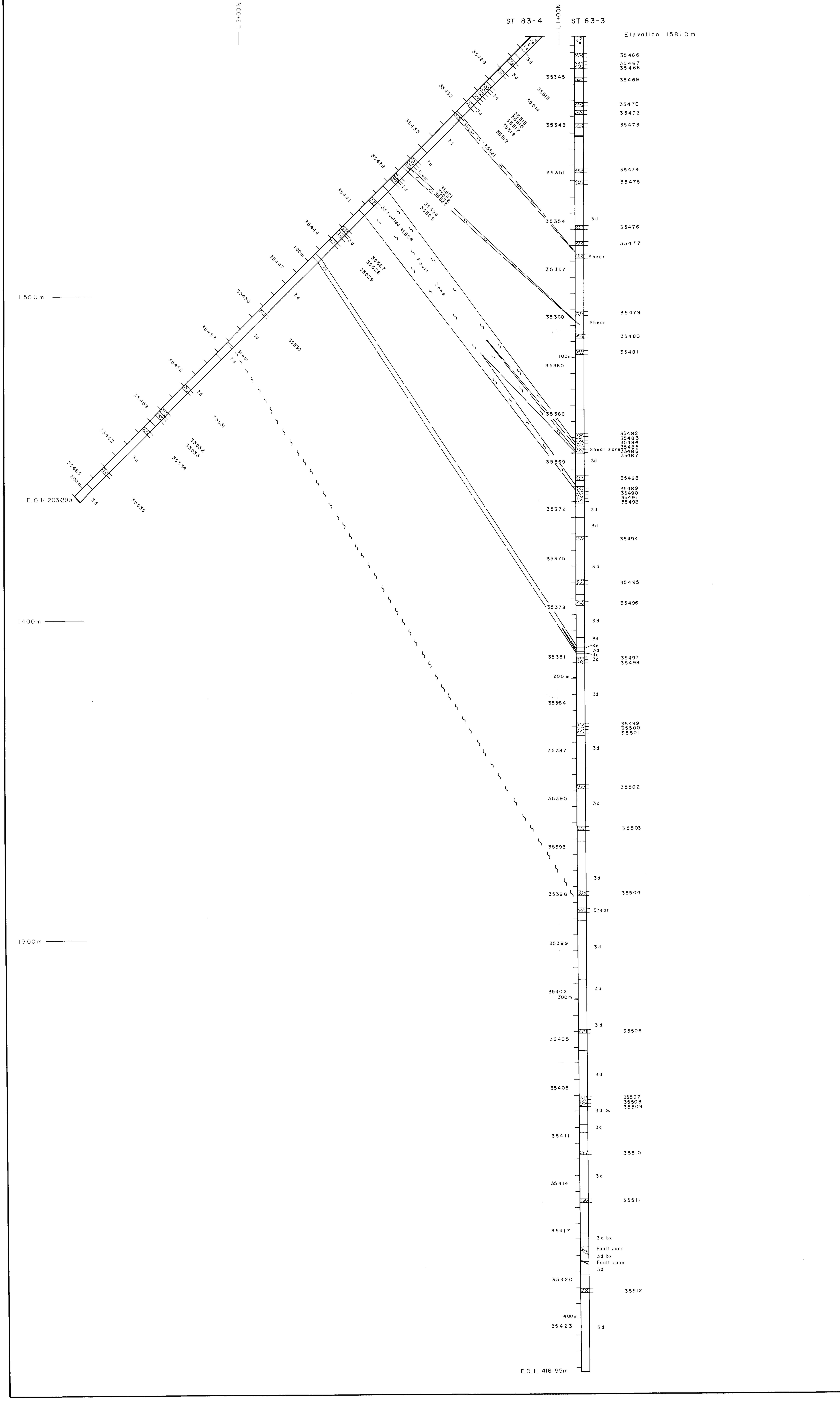
STEWART MOLYBDENUM PROJECT

DDH SECTION 1+50 S

ST 83-2

CORE SAMPLE LOCATIONS

DRAWN BY	DATE	N.T.S.	PLAN
T. CARPENTER	AUG 1983	82 F	
TRACED BY	DATE		
J.S.	SEPT 1983		



LEGEND

TERTIARY (EOCENE ? OR LATER)
POST CORYELL

4c	Lamprophyre

LOWER CRETACEOUS
NELSON PLUTONIC ROCKS

3a	Aplite
3d	Quartz Monzonite Porphyry (Q.M.P.)
	Overburden
	Mineralized split core
bx	Breccia

Note - Samples to right of section indicate split core
- Samples to left of section indicate chip samples
- Unnumbered intervals to left of section have been sampled but were not sent for analysis.

0 10 20 30 40 50 metres
SCALE 1:500

SELCO INC. EXPLORATION WESTERN CANADA

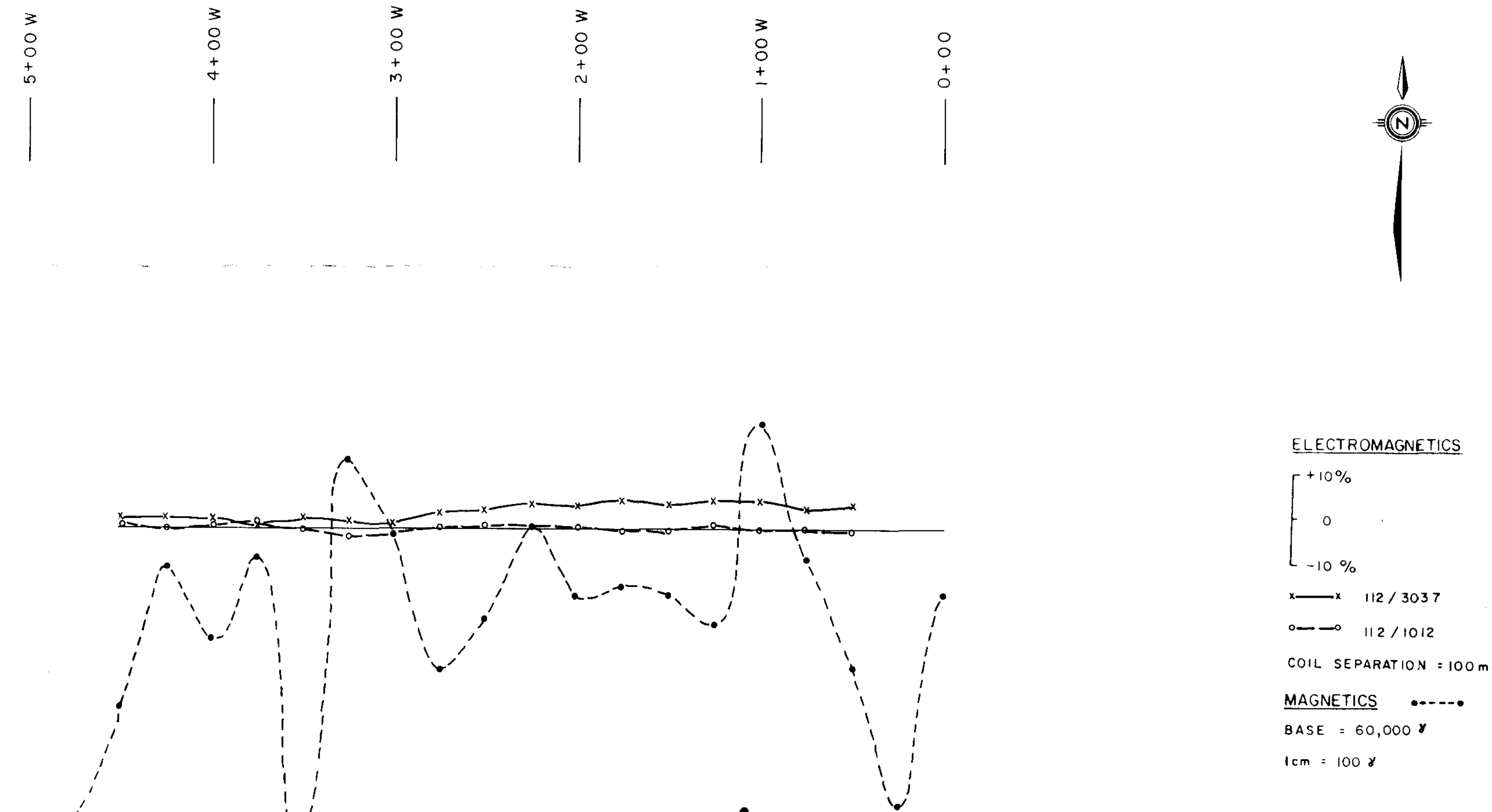
STEWART MOLYBDENUM PROJECT

DDH SECTION 4+19E

ST 83-3 AND ST 83-4

SECTION LOOKING EAST

DRAWN BY	DATE	N.T.S.	PLAN
T. CARPENTER	AUG 1983	82 F	
TRACED BY	DATE		
J.S.	SEPT 1983		



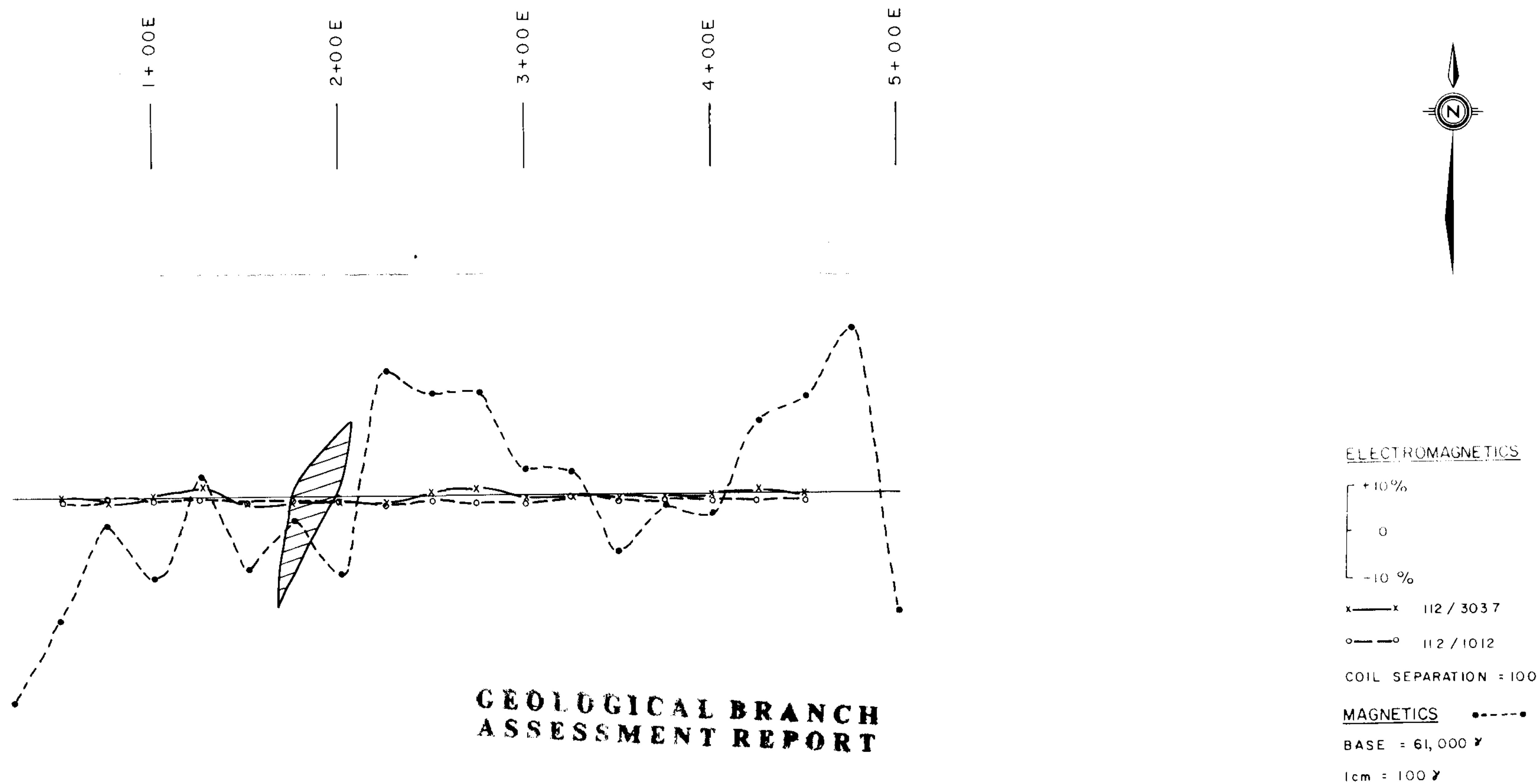
Part 2 of 2

0 100 200metres
Scale 1 : 2 500

SELCO INC. EXPLORATION WESTERN CANADA

STEWART MOLYBDENUM PROJECT
ANOMALY 3
ELECTROMAGNETICS (GENIE)
& MAGNETICS

DRAWN BY	DATE	N.T.S.	PLAN
A. WYNNE	AUG. 1983.		
TRACED BY	DATE	82 F	
J. S.	SEPT. 1983.		51



GEOLOGICAL BRANCH
ASSESSMENT REPORT

12,251

Part 2
Of 2

0 100 200 metres

Scale 1 : 2 500

SELCO INC. EXPLORATION WESTERN CANADA

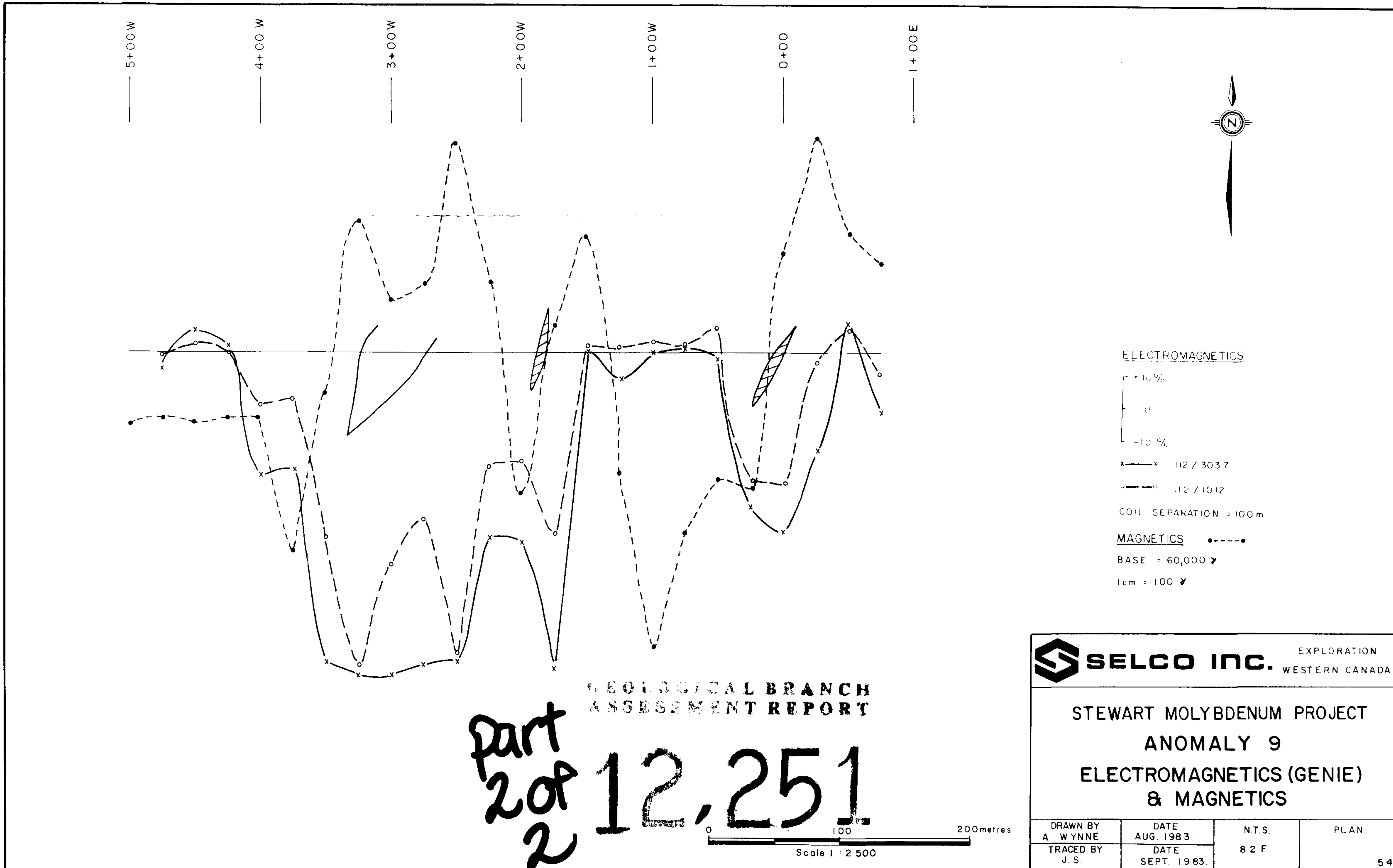
STEWART MOLYBDENUM PROJECT

ANOMALY 4

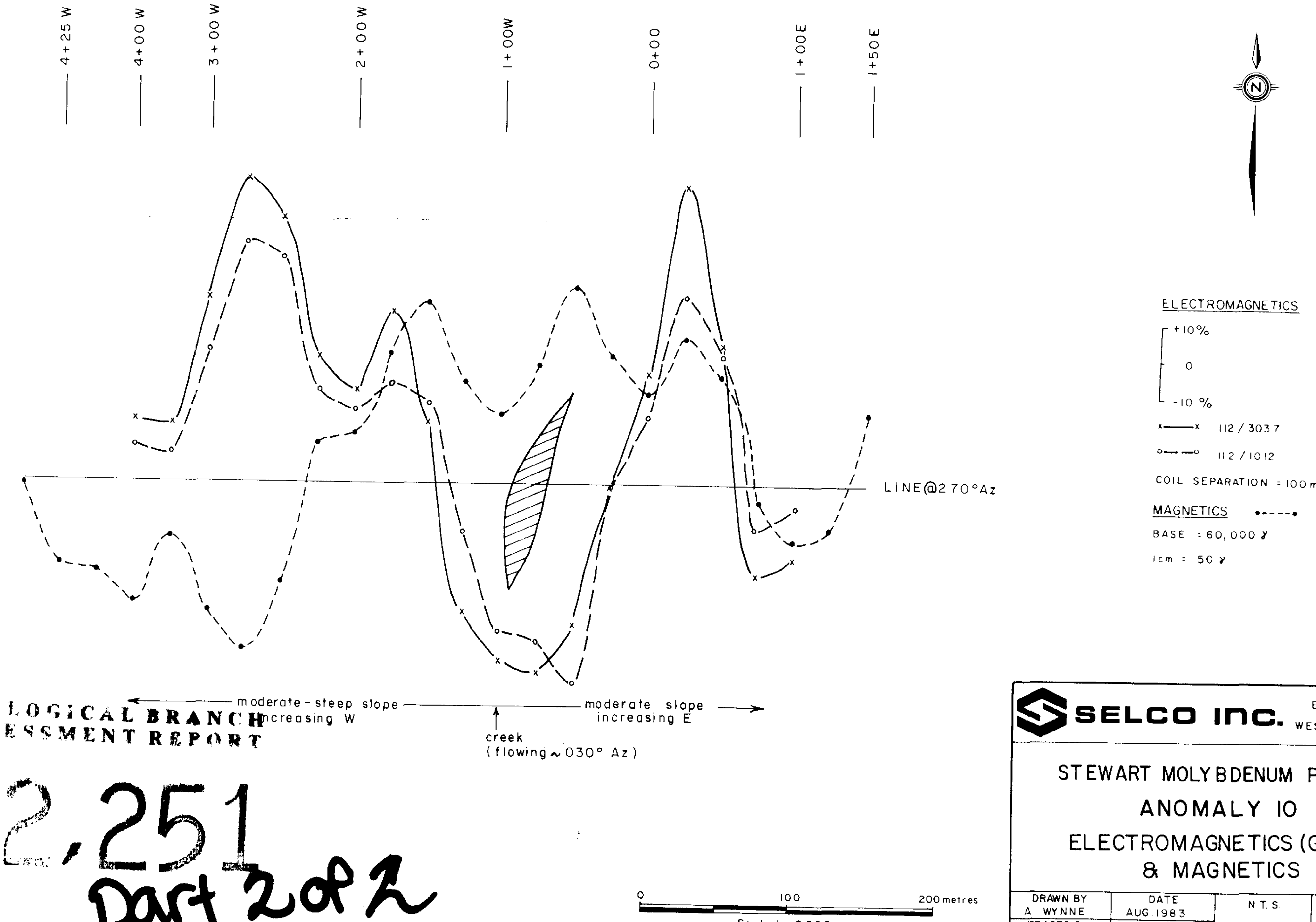
ELECTROMAGNETICS (GENIE)
& MAGNETICS

DRAWN BY A. WYNNE	DATE AUG. 1983	N. T. S.	PLAN
TRACED BY J.S.	DATE SEPT. 1983	82 F	52

GEOLOGICAL BRANCH
ASSESSMENT REPORT
12,251
part 2 of 2
64,371 γ
61,913 γ
63,718 γ
LINE @ 270° Az
ELECTROMAGNETICS
+10%
0
-10%
112 / 3037
112 / 1012
COIL SEPARATION = 100 m
MAGNETICS
BASE = 60,000 γ
1cm = 100 γ
0
100
200 metres
Scale 1:2500
SELCO INC.
EXPLORATION
WESTERN CANADA
STEWART MOLYBDENUM PROJECT
ANOMALIES 5 & 6
ELECTROMAGNETICS (GENIE)
& MAGNETICS
DRAWN BY
A. WYNNE
DATE
AUG. 1983
TRACED BY
J.S.
DATE
SEPT. 1983
N.T.S.
82 F
PLAN
53
19+00 W
18+00 W
17+00 W
16+00 W
15+00 W
14+00 W
13+00 W
12+00 W
11+00 W
10+00 W
9+00 W
8+00 W
7+00 W
6+00 W
5+00 W
4+00 W
3+00 W



5+00W
4+00W
3+00W
2+00W
1+00W
0+00
1+00E
N
ELECTROMAGNETICS
+10%
0
-10%
112 / 3037
112 / 1012
COIL SEPARATION = 100 m
MAGNETICS
BASE = 60,000 γ
1cm = 100 γ
GEOLOGICAL BRANCH
ASSESSMENT REPORT
Part 2 of 2
12,251
0
100
200metres
Scale 1 : 2 500
SELCO INC.
EXPLORATION
WESTERN CANADA
STEWART MOLYBDENUM PROJECT
ANOMALY 9
ELECTROMAGNETICS (GENIE)
& MAGNETICS
DRAWN BY
A. WYNNE
DATE
AUG. 1983.
TRACED BY
J. S.
DATE
SEPT. 1983.
N.T.S.
82 F
PLAN
54



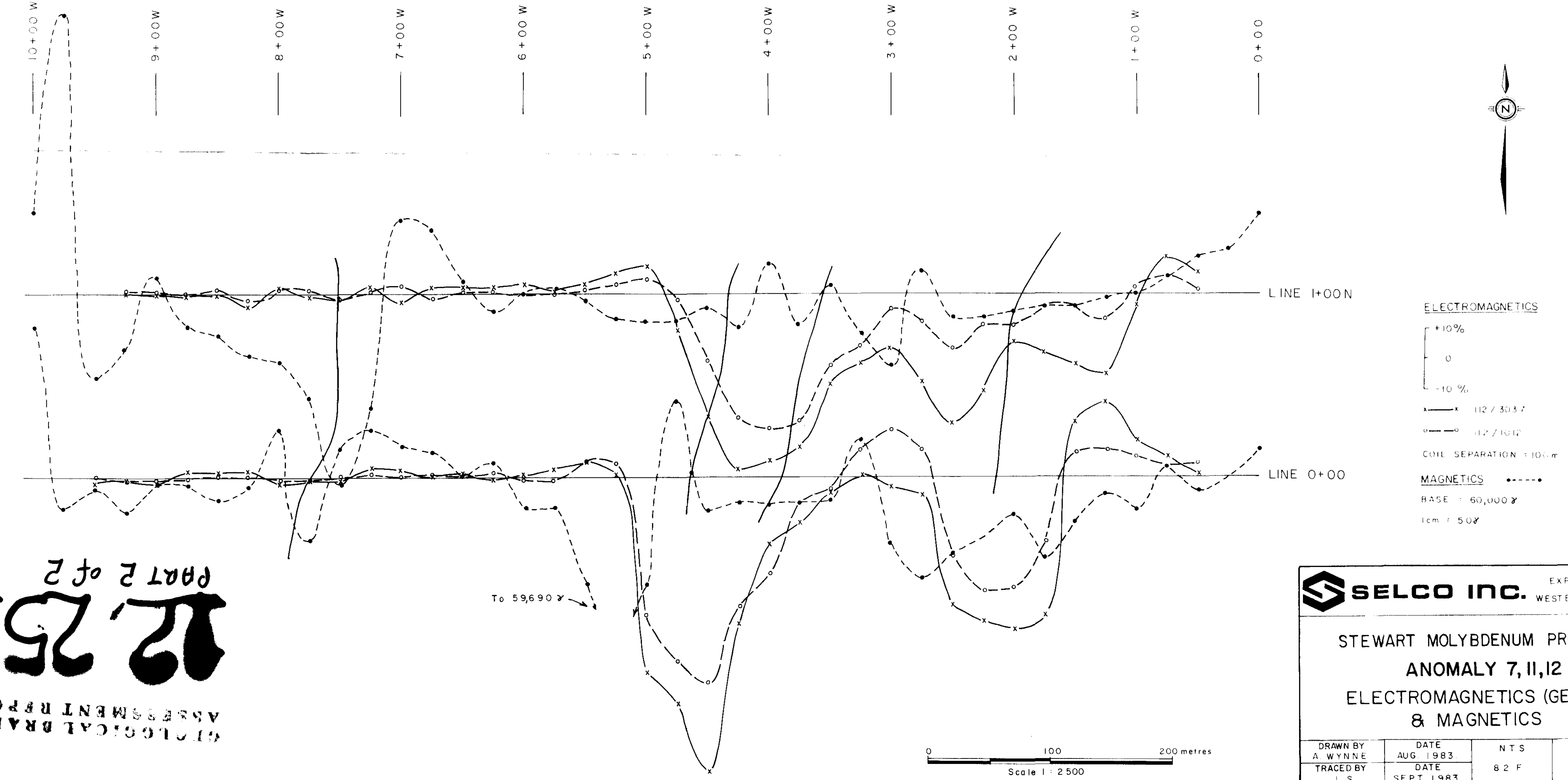
SELCO INC. EXPLORATION WESTERN CANADA

STEWART MOLYBDENUM PROJECT

ANOMALY 10

ELECTROMAGNETICS (GENIE) & MAGNETICS

DRAWN BY	DATE	N.T.S.	PLAN
A. WYNNE	AUG 1983	82 F	
TRACED BY	DATE		
J. S.	SEPT. 1983		55



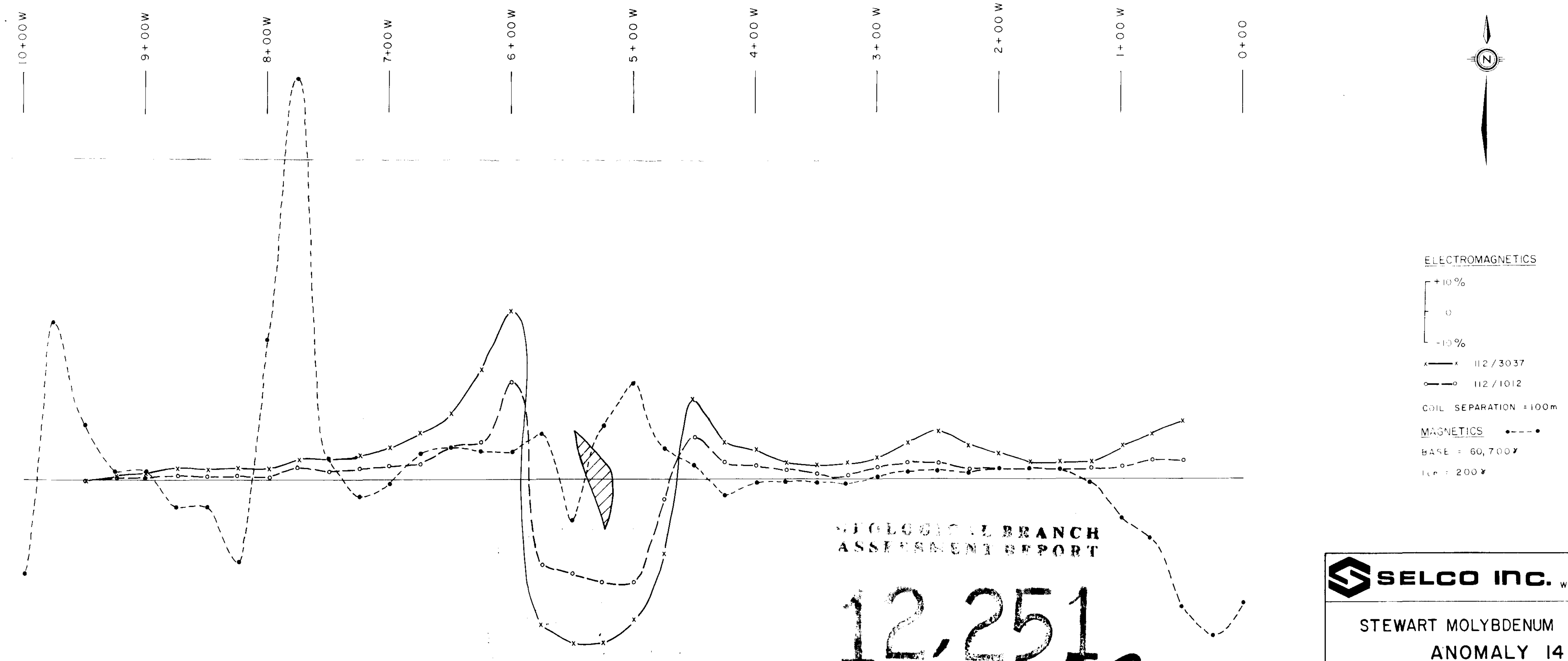
SELCO INC. EXPLORATION WESTERN CANADA

STEWART MOLYBDENUM PROJECT

ANOMALY 7, 11, 12

ELECTROMAGNETICS (GENIE) & MAGNETICS

DRAWN BY	DATE	NTS	PLAN
A. WYNNE	AUG. 1983	82 F	
TRACED BY	DATE		
J. S.	SEPT 1983		56



0 100 200 metres

Scale 1 : 2 500

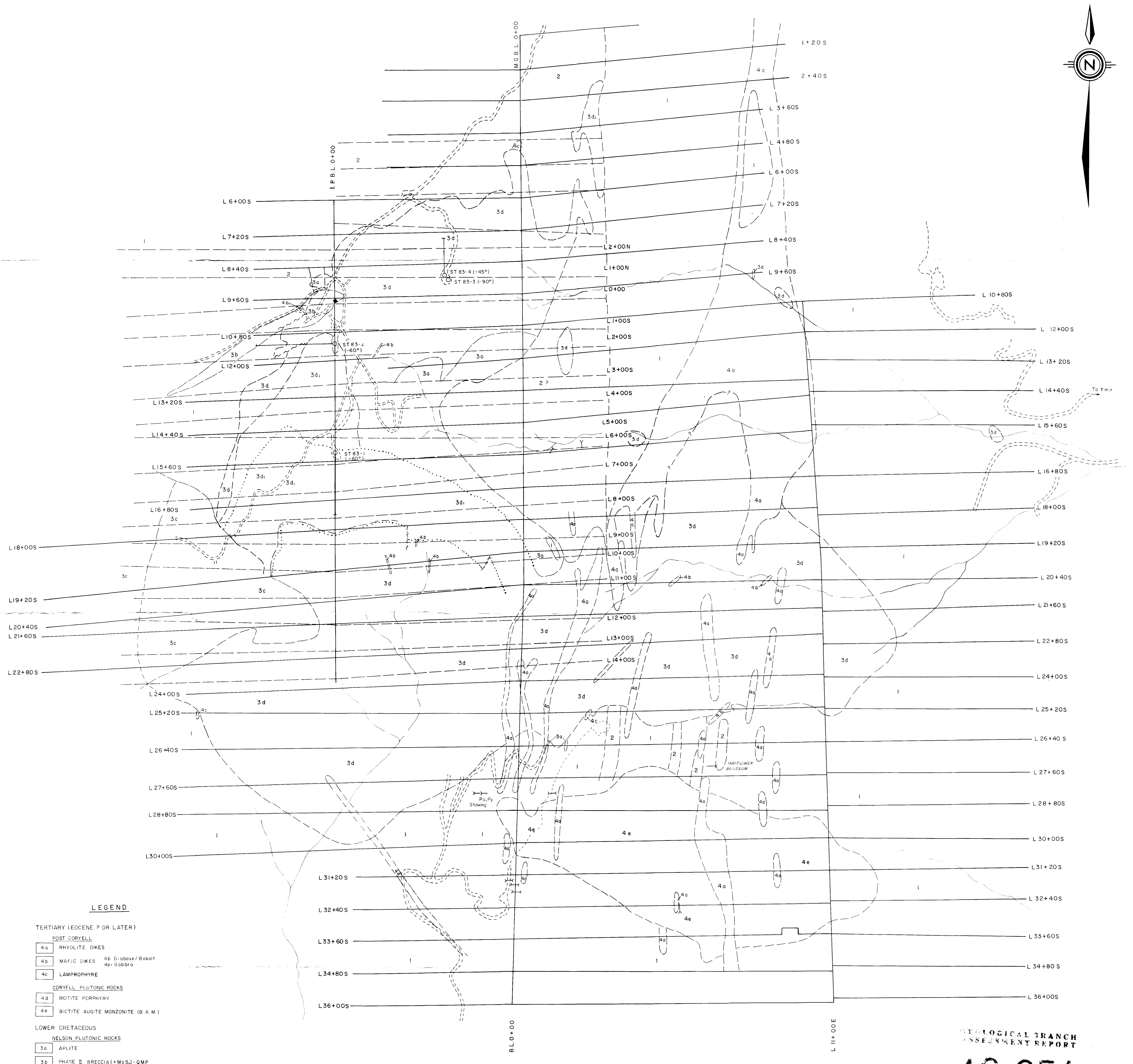
SELCO INC. EXPLORATION WESTERN CANADA

STEWART MOLYBDENUM PROJECT

ANOMALY 14

ELECTROMAGNETICS (GENIE)
& MAGNETICS

DRAWN BY	DATE	N.T.S.	PLAN
A. WYNNE	AUG 1983		
TRACED BY	DATE	82 F	
J. S.	SEPT 1983		57



LEGEND

TERTIARY (EOCENE ? OR LATER)

POST CORYELL

4a	RHYOLITE DIKES
4b	MAFIC DIKES — 4b Diabase/Basalt; 4b1 Gabbro
4c	LAMPROPHYRE

CORYELL PLUTONIC ROCKS

4d	BIOTITE PORPHYRY
4e	BIOTITE AUGITE MONZONITE (B.A.M.)

LOWER CRETACEOUS

NELSON PLUTONIC ROCKS

3a	APLITE
3b	PHASE II BRECCIA (+MoS_2) - QMP
3c	PHASE I BRECCIA (QMP + VOLCANIC FRAGMENTS
3d	QUARTZ MONZONITE PORPHYRY (QMP)
3d1	QUARTZ EYE PORPHYRY (QEP)

MIDDLE & UPPER JURASSIC

2	HALL FORMATION (UNDIFFERENTIATED ARGILLITES, SANDSTONES, CONGLOMERATES, LIMESTONES/DOLOMITES

LOWER JURASSIC

1	ELISE (ROSSLAND) VOLCANICS (UNDIFFERENTIATED ANDESITES, LATITES, BASALTS, AUGITE PORPHYRY, AGGLOMERATE, TUFF & MINOR SHALE)

LEGEND

- MAIN GRID
- I.P. GRID
- GEOLOGICAL BOUNDARY APPROX., ASSUMED, INTERPETED
- STREAM
- ROAD, TRAIL
- SHAFT
- ADIT
- TRENCH
- DIAMOND DRILL HOLE
- LIMITS OF QTZ STOCKWORK & POTASSIC ALTERATION ZONE

0 100 200 300 400 500 metres

Scale 1:5000

GEOLOGICAL BRANCH
ASSESSMENT REPORT

12,251
part 2 of 2

SELCO INC. EXPLORATION WESTERN CANADA

STEWART MOLYBDENUM PROJECT

DIAMOND DRILL HOLE LOCATIONS 1983 EXPLORATION PROGRAM

DRAWN BY T. CARPENTER	DATE SEPT. 1983.	N.T.S. 82 F/3,6	PLAN
TRACED BY J.S.	DATE OCT. 1983.		