



GEOLOGICAL, GEOPHYSICAL, GEOCHEMICAL REPORT

on the

ORK 1 - 44 MINERAL CLAIMS

YA46061-084; YA46182-193; YA68511-518

NTS 105C/9

in the

WATSON LAKE MINING DIVISION

Latitude 60°38'N

Longitude 132°22'W

by

R. Campbell

J.C. Stephen



Dated September 10, 1982

Work Done: June 10 - July 8; July 23 - 29, 1982

by: J.C. Stephen Explorations Ltd.

Funded by: D.C. Syndicate

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of \$ 6,000 —

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Regional Manager, Exploration and  
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### SUMMARY AND CONCLUSIONS

Copper, silver bearing mineralization has been located in the eastern portion of the ORK claim group as a result of finding float fragments in 1981. In addition a relatively strong magnetic anomaly has been outlined which may be due to a magnetite skarn. Newmont Exploration of Canada Limited have obtained significant tin mineralization associated with magnetite skarn on the MINDY claims to the east.

These indications of mineralization, together with other anomalous zones on the property, warrant further geological and geophysical investigation and diamond drilling is recommended to test the presently indicated zones.

## INTRODUCTION

Preliminary geological mapping and geochemical sampling was done on the ORK 1 - 36 mineral claims during 1980 and 1981. This work outlined the general geological setting and showed geochemical indications of tin and tungsten. Previous silt sampling in 1976 had shown anomalous results for copper and zinc. In 1981 massive sulphide float was found on open ground between the ORK and MINDY claim groups.

These early indications lead to the decision to have an adequate base map prepared from air photos and to conduct more detailed work during 1982 in an effort to outline definite zones of mineralization.

The claim group was enlarged to 44 claims early in the summer of 1982. A crew, which varied from two to five persons, conducted geological mapping, geophysical surveys and geochemical sampling during parts of June and July 1982 with total expenditure of \$20,689.00.

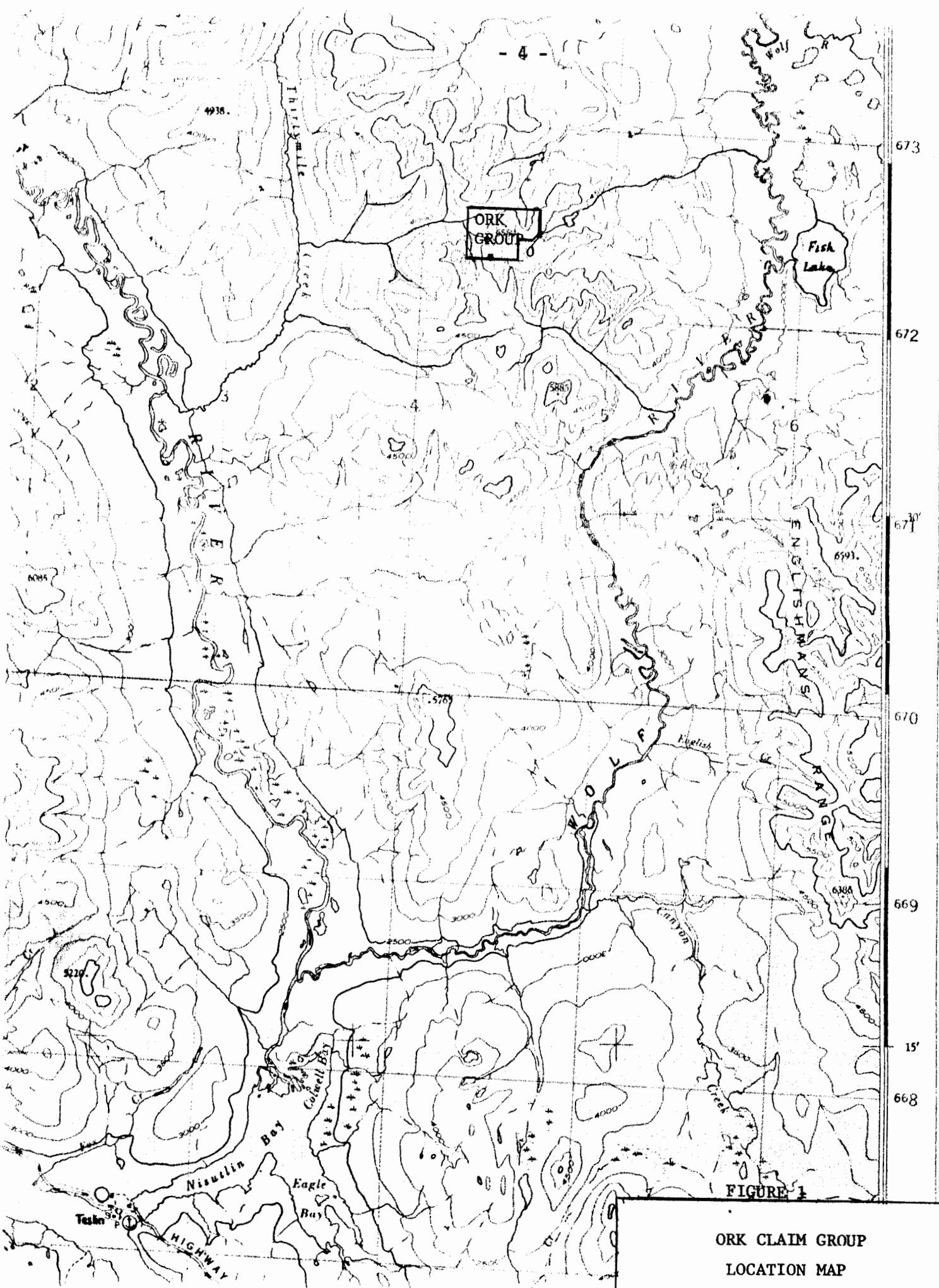
LOCATION AND ACCESS

See Figure 1 Location Map

The ORK claim group lies at the height of land between the Wolf and Nisutlin Rivers approximately 35 miles (56 kilometres) north east of Teslin on the Alaska Highway. Fish Lake, suitable for fixed wing aircraft, lies 10 miles (16 km) east of the property and a tractor road on the south side of the Wolf River lies 8 miles (13 km) south east.

All access to the property has been by helicopter generally through Teslin. Mobilization of equipment could be done by helicopter off the South Canal road 22 miles (35 km) west of the property.

Tree line on the property lies at about the 4500 foot elevation (1372 metres) and nearly all areas of interest are located above this elevation. Portions of the broad valleys in the east and west parts of the property are covered by deep till and moraine with only very limited outcrop. Small tarn lakes supply adequate water throughout the summer.



ORK  
GROUP

FIGURE 1

ORK CLAIM GROUP  
LOCATION MAP



PHOTO 1

ORK WATERFALL AREA  
FACING SOUTH

REGISTER OF CLAIMS

See Figure 2 Claim Map

<u>Group</u>	<u>Claim</u>	<u>Record No.</u>	<u>Record Date</u>
ORK	ORK 1 - 16	YA 46061 - 076	September 20, 1979
	ORK 17 - 24	YA 46182 - 189	October 3, 1979
	ORK 25 - 32	YA 46077 - 084	September 20, 1979
	ORK 33 - 36	YA 46190 - 193	October 3, 1979
	ORK 37 - 44	YA 68511 - 518	June 18, 1982

ORK 1 - 36 were transferred from individual status to J.C. Stephen August 12, 1980.



GEOLOGY

REGIONAL GEOLOGY

The ORK group covers a portion of Mulligan's Unit 3 (G.S.C. Memoir 326) "typically of unmetamorphosed, dark weathering sedimentary rocks which are locally hornfelsed and include limestone and skarn."

This rock series extends to the south east and to the north west. To the south east Unit 3 rocks include porphyritic volcanics and tuffs and have developed strong skarn zones with significant tin, tungsten, copper and other mineralization.

No volcanic rocks have been identified thus far on the ORK group.

PROPERTY GEOLOGY MAP I

TABLE OF FORMATIONS

8	Leuco Granite 8(a) Pegmatite
7	Chert 7(a) Chert Pebble Conglomerate
6	Argillite 6(a) Siliceous Argillite
5	Grey-Green Quartzite 5(a) Chert
4	Argillaceous Quartzite
3	Limestone 3(a) Calc Silicate
2	Skarn
1	Argillaceous Quartzite

## Rock Descriptions

1. Argillaceous Quartzite Dark rusty fine grained impure quartzitic rocks occur below the skarn-limestone horizon. Exposures are limited to the waterfall area in the east portion of the claim group, limited outcrops below the limestone around the north end of the main central ridge and to the south west of the property boundary.

These rocks are generally hornfelsed to some extent with development of biotite and a somewhat purplish color on fresh fracture. Pyrrhotite occurs as disseminated grains or small blebs. The biotite and pyrrhotite result in a dark rusty weathered surface.

Within the quartzite sequence at the waterfalls on ORK 42 two thin horizons of massive pyrrhotite chalcopyrite mineralization occur. These are apparently about 30 cm thick and conformable with the quartzites. Their rusty surface appearance is very similar to that of the host quartzites.

Minor argillite, sandstone? and greywacke is interbedded with the more siliceous quartzite.

2. Skarn Thin beds of skarn have been located along the upper and lower contacts of the main limestone horizon. Exposures are limited in extent and may represent thin, intermittent beds. Garnet skarns are most common with some development of dark green (hedenbergite?) skarn. Massive arsenopyrite, some pyrite, pyrrhotite, chalcopyrite, molybdenite, fluorite and axinite have been observed.

A strong magnetic anomaly occurs on ORK 39 at about the projected location of the limestone horizon and a piece of massive magnetite skarn float was found in this locality. It is thought the magnetic anomaly is due to magnetite skarn.

3. Limestone A prominent horizon of limestone, generally recrystallized to marble, outcrops around the north slopes of the main central ridge, south of the tarn lake in the west central portion of the claim group and to the south west of the property. Exposures of similar limestone occur north of the main west flowing creek. These exposures are considered to be parts of a single limestone horizon.

Additional limestone occurs to the north east of the property and may be part of this horizon.

Limestone also occurs near the top of the ridge near the south east corner of the ORK property. There is some doubt that this is part of the main limestone horizon.

The limestones are generally white to grey in color and vary in grain size due to differing effects of recrystallization.

Calc-silicate horizons (3a) occur in the upper portion of the limestone horizon west of the claim group. There are fine grained, siliceous, pale green rocks.

4. Argillaceous Quartzite Fine grained, variable composition, quartzitic sediments form a thick sequence above the main limestone horizon. These sediments have been termed greywacke, meta sandstone and quartzite. No distinct marker horizon has been recognized and variation of composition along and across strike causes confusion in mapping.

In general the rocks are dark grey to brown in color with varying argillaceous content and with varying development of biotite and other micas.

5. Grey Green Quartzite This rock is interbedded with unit 4 and is merely a relatively quartz sand rich variation of the same sequence.

Chert (5a) occurs as lenses, thin interbeds and more massive fine grained cherty quartzite as variations of the quartzitic horizons.

These appear to be zones of possible chemical sedimentation.

6. Argillite This is a black fine grained siltstone to black sheared graphitic shale. The rock is generally fairly soft, sometimes pyritic and usually rusty weathering.

Siliceous Argillite (6a) is a harder variety of unit 6 which may be transitional to units 4 and 5.

7. Chert 7a Chert Pebble Conglomerate An isolated hump consisting of chert pebble and quartz conglomerate which appears highly sheared with elongated pebbles occurs at north end of the main ridge. During earlier work on the property this had been assumed to be the lower most horizon exposed. During this summers work, however, the rock mass was suspected to be either a fault block or a large landslide mass.

Chert (7) with chert pebble conglomerate (7a) beds and interbedded argillite occurs at the south end of the main central ridge and the current interpretation is that this formation overlies the exposed sedimentary sequence and that the hump at the north end of the ridge is a downfaulted portion.

8. Leuco Granite White to grey, fine to medium grained, aplitic granite occurs in several small outcrop areas in the west portion of the claim group. The rock is composed largely of quartz, white feldspar and varying amounts of mica, mainly muscovite.

Pegmatite dykes (8a) are associated with this granite and have a similar composition. No rare earth minerals have been identified although fluorite occurs within and adjacent to intrusive outcrop areas and an unidentified green fluorescence has been observed on some specimens.

### Structure

The property is occupied by a thick sequence of sediments which exhibit moderate to gentle south easterly dips in the north eastern part of the claim group and gentle south westerly dips in the western part of the group.

On the high ridge in the south central portion of the claim, gentle ( $5^{\circ}$  -  $15^{\circ}$ ) dips appear to outline a local syncline or basin of small dimension.

The sedimentary sequence is intruded, apparently rather passively, by a leucogranite with related pegmatite and aplite. There may be a slight doming affect from this intrusion and this may be part of the cause of the apparent anticlinal structure through the property.

Two sets of faults are indicated by air photo linears and by moderate offset of sedimentary beds. These are indicated on Map I Geology and trend  $N25^{\circ}E$  and  $N60^{\circ}E$ .

The  $N25^{\circ}E$  fault set may be comprised of many more fractures than have been documented and the abrupt termination of the main magnetic anomaly on ORK 39 may be due to this type of faulting.

### Mineralization

Disseminated pyrrhotite with rare chalcopyrite is common within the argillaceous quartzite formations on the property and is considered an integral part of those rock types.

Fluorite and axinite have been found within intrusives and limestone in the western portion of the property in association with geochemical indications of tin and tungsten although no zones of mineralization have yet been identified.

Massive arsenopyrite, some pyrite, pyrrhotite and molybdenite mineralization occurs with small skarn zones on the north east slopes of the main central ridge. No economic mineralization has been located here.

During 1981 massive sulphide float was located near the waterfall on ORK 42. A sample of this rock assayed 5.18% copper and 3.36 oz silver. During 1982 two narrow, apparently conformable beds of similar pyrrhotite, chalcopyrite mineralization were located in the outcrop area at the waterfalls. The following assay results were obtained.

<u>Sample No.</u>	<u>Description</u>	<u>Cu%</u>	<u>Zn%</u>	<u>Sn%</u>	<u>Ag oz</u>	<u>Au oz</u>
25678C	Massive sulphide stringer in quartzite Cpy py pyrr	2.52	0.11	0.01	1.70	
25679C	Chip sample over 6' of cpy py pyrr mineralization	2.80	0.12	<0.01	1.96	
25680C	Float, cpy pyrr + magnetite	3.48	0.22	<0.01	2.68	0.010
25681C	Massive sulphide stringer in quartzite	0.57	0.04	<0.01	0.20	

Upstream from the waterfalls a piece of magnetite garnet skarn was found in the stream bed near the main magnetic anomaly. A sample of this float assayed 0.01% Cu, 0.13% Sn.

## GEOPHYSICS

Three separate geophysical surveys were conducted as part of the 1982 program. Work was concentrated primarily on the ORK 37 - 44 claims staked earlier in the season but two small grids in the south west portion of the property were covered by magnetometer survey as well.

All surveys were done by tape and compass for soil and talus sampling purposes. These grids are not as accurately established as they should be for geophysical purposes.

### Magnetometer Survey Map II

#### Procedure

A Scintrex MP-2 proton magnetometer was rented for use on the ORK claim group. Technical data on this magnetometer type is provided in Appendix I Geophysical Instruments.

Stations were read at 100 foot intervals on lines nominally 200 feet apart. A base station was established at the camp and check readings were taken to correct daily survey results. During certain periods readings were apparently affected by magnetic storms and the survey was delayed until base readings were stable.

Near the end of the program an attempt was made to extend the survey north east of the waterfalls area. The instrument, although it gave readings, seemed to be unreliable and those readings on lines 107E to 113E should be disregarded.

A standard value of 58,000 gammas was subtracted from all total field readings before plotting.

### Results

Magnetometer results are shown on Map II. These results have been contoured and several anomalous areas are indicated.

On lines 75E to about 81E values range generally above 200 gammas to a high of about 400 gammas which is assumed to be a general background level due to disseminated pyrrhotite in the quartzitic sediments. To the east of this area values are somewhat lower ranging from about 50 to 200 gammas which is thought to represent a general lower background over varying depths of glacial till and moraine in the valley bottom.

Lines 83E, 85E and 87E were extended north across the exposed skarn horizon and approximately over the assumed trend of the limestone horizon. Values range from 294 to 520 gammas, well above general background but not indicative of any distinct anomaly based on present knowledge.

On lines 93E and 95E at 36N to 38N a magnetic anomaly occurs which is entirely covered by overburden. This anomaly is open to the east. It may be related to the limestone-skarn horizon outcropping on the Newmont MINDY claims.

On line 89E at 49N a small positive anomaly occurs which is assumed to be related to the larger positive anomaly extending from about 92E to 96E and 48N to 53N. The main anomaly here is relatively intense reaching a peak of 6831 gammas.

North south profiles across this main anomaly are shown on Figures 5 and 6 together with the MaxMin EM profiles.

A magnetic body is indicated with a moderate south dip which is assumed to be a magnetite skarn horizon based on the finding of a piece of magnetite float in the vicinity plus the existence of magnetite skarn on the MINDY claims to the east.

On lines 99E to 105E from 58N to 62N a more linear positive magnetometer anomaly peaks at 727 gammas where pyrrhotite chalcopyrite mineralization of significant grade outcrops in the waterfall area. This anomaly appears to be cut off to the west while to the east magnetometer readings on lines 107E to 115E are considered unreliable.

A relative magnetic high occurs at 115E to 121E from 60N to 64N. This latter magnetic high together with a smaller one centered at 117E, 68N are beyond the east boundary of the present property in the vicinity of limestone and skarn outcrops. (See Map I)

#### Interpretation & Recommendations

The relative magnetic highs associated with limestone and small skarn zones centred at 85E, 68N and 115 E, 62N may be due to skarn development associated with the carbonate horizon. Additional magnetic surveying is required and should be done on a more carefully controlled grid. No precise target is defined at present.

The strong magnetic high at 95E, 52N is probably due to magnetite skarn. The rolling till surface in the area suggests possibly deep overburden but the sharp 6800 gamma peak and discovery of a piece of magnetite float indicate this anomaly may be locally close to surface. The anomaly appears to be terminated abruptly to east and west and this may be due to faulting at N25°E.

The smaller anomaly at 95E 37N is in the general vicinity of limestone mapped to the east on the MINDY claims. In the absence of other information and incomplete magnetometer coverage it is assumed this zone is related to a carbonate horizon.

The anomaly at 103E 61N occurs in the outcrop area at the waterfalls and is stratigraphically lower than the anomalies to the east and west associated with skarn and the carbonate horizon. Thin beds of pyrrhotite chalcopyrite mineralization are found in outcrop and this mineralization is presumed to be the cause of the anomaly. Additional magnetometer surveying to the east is recommended before drilling. The anomaly appears to be terminated to the west, probably by faulting.

#### Magnetometer Results on Small Grids

Two small grids were established, one at 2E, 00N and the other at 41E, 10N on which magnetometer readings were taken. Location of these grids is shown on Map I and results are shown on Figures 3 and 4.

On the 2E, 00N grid no anomalous magnetic readings were obtained.

On the 41E, 10N grid no distinct anomaly was located but a general north east trend to slightly higher than background values corresponds in a general way with moderately anomalous zinc values and spotty tin and tungsten values in soil samples.

12+00N	.	.	.	.
	.	.	.	.
10+00N	.172	.167	.140	.163
	.173	.167	.137	.179
8+00N	.169	.161	.143	.156
	.169	.163	.145	.147
6+00N	.160	.159	.152	.181
	.148	.154	.157	.158
4+00N	.162	.153	.156	.153
	.149	.163	.145	.164
2+00N	.148	.150	.159	.138
	.153	.174	.135	.134
0+00N	.139	.161	.163	.153
	2+00E	4+00E	6+00E	8+00E

FIGURE 3

ORK CLAIM GROUP  
2 EAST GRID  
MAGNETOMETER SURVEY

SCALE 1" = 200'

July 1982

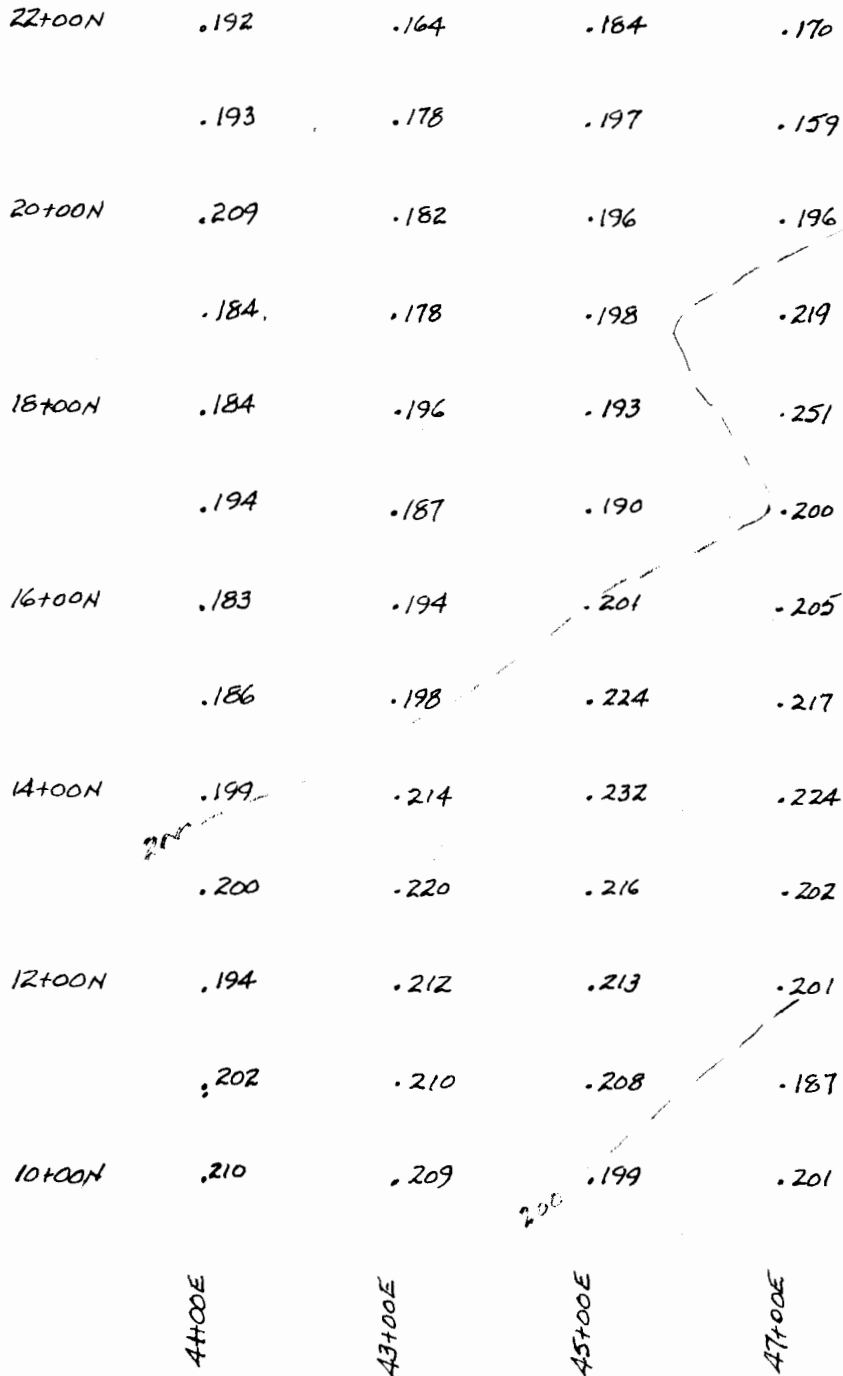


FIGURE 4

ORK CLAIM GROUP  
41 EAST GRID  
MAGNETOMETER SURVEY

SCALE 1" - 200'

July 1982

VLF - EM (EM-16) SURVEY MAP III

Method

A Ronka EM-16 was used to take dip angle and quadrature readings. The operating crew found that signals were relatively weak and difficult to read. They increased the station interval from 100 feet to 200 feet and, as a result, it is felt the survey results are not as precise as they should be. Some readings, as at 87E 54N, were not taken for the Maine station as signals were too weak and noisy.

Dip angle data for Seattle station have been treated using the "Fraser filter" and the positive results are contoured. Description of this filter method is included in Appendix I.

Results

The contoured EM-16 filtered results have a tendency to outline north east trends. Three of these, which pass through relative magnetic lows, are indicated by straight trend lines. The similar north east trend along the east edge of the data may be due to similar trends or may be an edge effect due to incomplete data to the east.

Several positive contour areas correspond with relative magnetic highs as listed below: -

- (a) at 85E, 68N the EM-16 40° contour corresponds to a local magnetic high. The overall trend of the 20° contour however trends north east in line with the trend line through 78E 50N.
- (b) at 115 E 68N the EM-16 20° contour corresponds generally with a small positive magnetic anomaly in the vicinity of limestone and small skarn outcrops. The EM-16 data does not extend south sufficiently to provide contours over the magnetic high at 115E 62N.

- (c) At 95E 52N the strong magnetic high does not appear to be conductive to the EM-16 frequencies. The magnetically anomalous area forms an EM-16 low surrounded by the 0° EM-16 contour and flanked to the west by two strong north east trends.
- (d) The small magnetic anomaly at 95E, 37N is reflected by a strong EM-16 anomaly with filter values to 71°. A general westward trend of EM-16 contours follows, and extends beyond, a similarly oriented weak magnetic trend. This correlation of magnetic and EM-16 values is more similar to correlation over sulphides in the waterfall area or to weaker correlations in the limestone-skarn areas in the extreme north east and north west areas of the survey, than to the strong magnetic, weak EM-16, effects at 95E 52N.
- (e) At 103E 61N the EM-16 filtered contour values correspond relatively well with the magnetic anomaly over the sulphide outcrop area.
- (f) At 85E, 53N an EM-16 filter anomaly corresponds to a weak magnetic trend and may be similar in relationship to the east west trends along 34N - 36N but may also be due to a possible north east trend through the contoured values at 81E 44N.

Interpretation

The EM-16 filter contours indicated by north east trend lines are presumed to be due to faulting associated with the N25°E fault set. It is likely the high values at 85E, 36N are part of one of these trends.

The EM-16 filter anomalies at 85E, 68N; 115E, 68N; 95E, 37N and possibly 85E 53N appear to be related to limestone-skarn horizons. The first two are modified by north east trending contours which may be related to north east faulting.

The moderate EM-16 anomaly at 103E 61N is probably due to sulphide mineralization. The anomaly is open to the east and further surveying should be done. To the west the high values on line 97E may be due to continuation of the northeast trend line thought to be due to faulting.

No EM-16 anomaly is indicated over the main strong magnetic anomaly which is presumed therefore to be due to non conductive material.

MAX MIN EM SURVEY    MAPS IV V VI VII

Procedure

The original massive sulphide float found on what is now ORK 42 was strongly conductive as well as being magnetic. A Max Min II instrument was rented for a short period and a survey was conducted along the grid lines previously established in the main valley bottom.

The initial survey was conducted with 50 metre spacing using 444 and 1777 Hz frequencies in an attempt to get as much detail as possible on the assumption that overburden was shallow.

Four lines were repeated at the same frequencies using 150 metre spacing when the initial survey failed to show the expected typical conductors.

Results

The readings collected at 50 and 150 metre cable spacings are plotted on Maps IV V VI and VII. No significant anomaly is indicated in the outcrop area at the waterfalls where sulphide mineralization is present.

The four lines at 150 metre spacing lie west of the waterfall sulphide zone and therefore do not test it. They do, however, cross the main strongly magnetic anomaly and two relatively short broad conductive areas are indicated. These lines are plotted as profiles in greater detail on Figures 5 and 6. The two conductive zones lie on the north and south flanks of the magnetic anomaly with only very weak conductive indications extending to lines 91E and 97E. The conductive zones trend nearly east west.

No significant conductive zone occurs over the small magnetic anomaly at 95E, 38N.

### Interpretation

Detailed plotting of the tilt angles measured by the field crew indicate a consistent over estimation of the topographic slopes when plotted against actual topographic contours. This would result in tilts applied to the MAX MIN transmitter and receiver too great for the actual topography. It is possible this has contributed, along with the moderate south dip of the formation, to failure to locate a conductor in the vicinity of mineralization at the waterfalls. It is also possible that the more massive sulphides do not extend over sufficient area to provide an adequate conductor. The magnetic and EM-16 results however indicate lateral extent sufficient for a conductor.

Testing by ohm-meter of a piece of the magnetite float thought to be from the main magnetic anomaly with flanking MAX MIN conductors indicates it to be moderately conductive. The EM conductors then do not necessarily indicate sulphide zones on the flanks of the magnetite although some sulphide mineralization may be present.

## GEOCHEMISTRY

Map VIII illustrates geochemical values obtained for copper, zinc, tin and tungsten over the grid area on ORK 37 - 44. Data sheets supplied by the field crew are included in this report as Appendix II.

### Procedure

Tape and compass lines were run to establish a north oriented grid. Samples were taken of available material at 200 foot station spacing. On lines 75E to 83E much of the material sampled was primarily talus fines with poorly developed soil. Over the remainder of the grid soil was collected primarily from a poorly developed 'B' horizon. Data sheets for these samples are included in this report as Appendix II. In some places samples were missed due to the coarse rocky nature of the material available.

### Results and Interpretation

In general only low values were obtained for the four elements analysed.

In the case of tungsten isolated values of 45, 68 and 175 ppm occur with scattered values from 10 to 22 ppm in several areas. No significantly anomalous zone occurs. The values obtained are in the limestone skarn area on the east boundary and to the south of the skarn mapped in the west central portion of the grid.

Tin values of 5 to 13 ppm occur near the east boundary limestone-skarn area but no other significant values occur.

Zinc and copper values are contoured at 100 ppm outlining nearly coincident zones in the talus areas on the west side of the grid. To the north in line 85E the few samples taken show similarly slightly anomalous values.

No indication is given in the soil results of the mineralization outcropping in the waterfalls area.

Zinc values, with a high of 480 ppm, are contoured at 100 ppm in the north east portion of the grid. Those values have no appreciable copper accompaniment and are quite widely dispersed with no definitely anomalous zone. Again this is in the limestone-skarn area.

Over most of the valley area, and covering the geophysical anomalies, no geochemical anomalies are found. It is assumed this is due to poor soil development overlying widespread, moderately deep glacial till and moraine.

#### Geochemical Results on Small Grids

Two small grids were established, one at 2E, 0N and the other at 41E, 10N. Soil sampling was done at 200 foot intervals on these grids and results are shown on Figures 7 and 8.

No anomalous values were obtained on the 2E, 0N grid.

On the 41E, 10N grid moderately anomalous (110 to 575 ppm) zinc values were obtained which trend north east in a zone generally coincident with the magnetic trend in this area. See Figures 4 and 8.

Associated with this zinc anomaly are scattered tungsten values ranging from 4 to 100 ppm and a few tin values ranging from 5 to 320 ppm. No zone of mineralization is known but fluorite occurs in limestone and granitic intrusives in the area.

10+00N	21.52 1 1	65.101 1 1	35.91 6 1	.
8+00N	21.69 1 1	82.160 1 1	29.76 8 1	.
6+00N	16.54 1 1	30.64 1 1	22.130 1 1	.
4+00N	34.73 1 1	19.104 1 1	31.69 1 1	.
2+00N	18.71 1 1	22.72 1 1	33.94 1 1	.
0+00N	.	.	.	.
	2+00E	4+00E	6+00E	8+00E

KEY  
Cu, Zn ppm.  
W Sr

FIGURE 7

ORK CLAIM GROUP  
2 EAST GRID  
GEOCHEMISTRY

SCALE 1" = 200'

July 1982

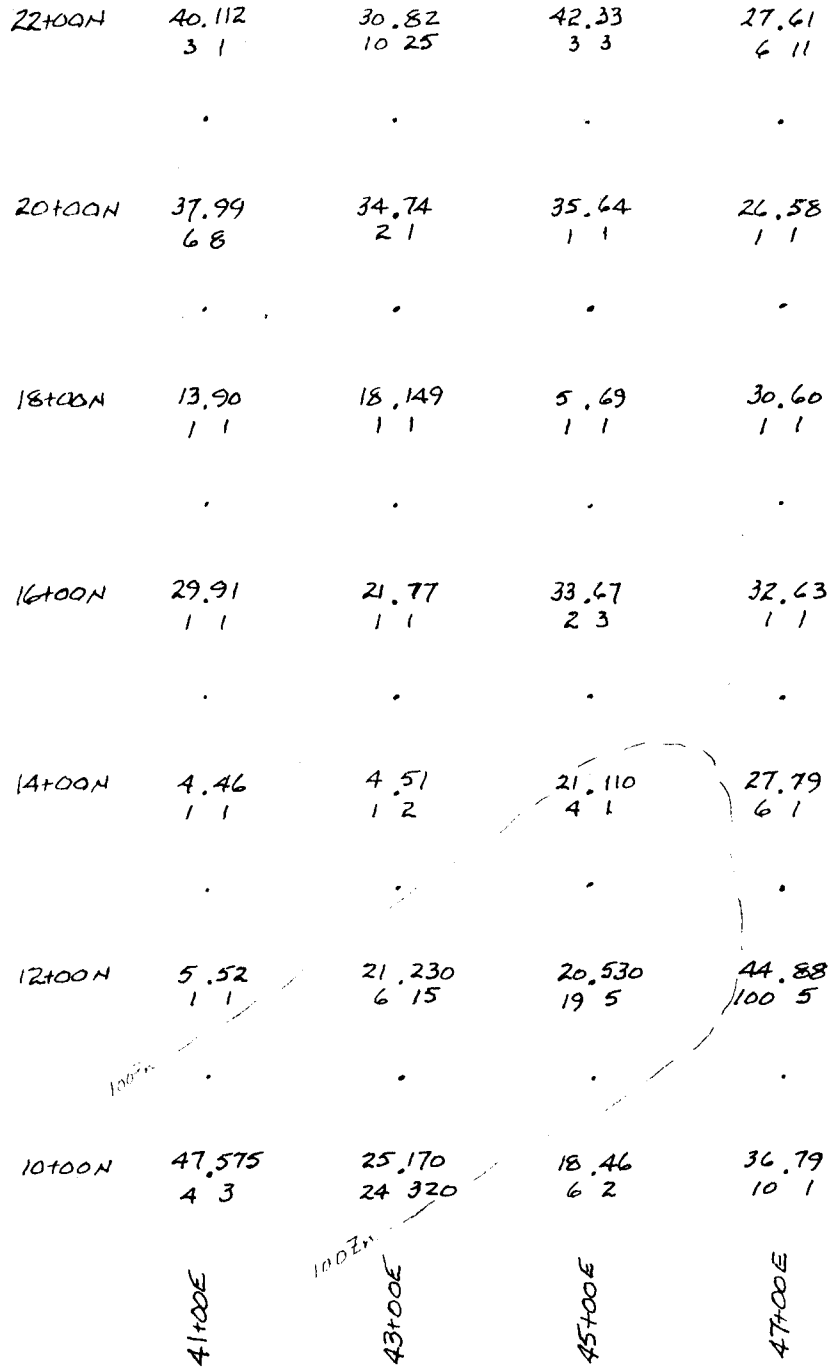


FIGURE 8

ORK CLAIM GROUP  
41 EAST GRID  
GEOCHEMISTRY

SCALE 1" - 200"

July 1982

### RECOMMENDATIONS

Indications of mineralization occur principally in the eastern portion of the property which is largely overburden covered. The following recommendations are made to investigate these indications further: -

- (1) the soil sample-magnetometer grid should be extended north and north west to the north boundary of the claims;
- (2) if open ground exists to the east between the existing ORK and MINDY claims this ground should be staked and the magnetometer and soil surveys extended to cover that ground;
- (3) detailed geological mapping of outcrops should be done at 1:2500 scale or better in the grid area with location of float mineralization to be recorded;
- (4) three 65 metre drill holes should be drilled within the magnetic anomaly at the waterfalls massive sulphide location to test the eastward and down dip extension of the sulphide occurrences;
- (5) two (or more) 120 metre drill holes should be drilled within the main magnetic anomaly to test the magnetic anomaly itself and the apparently related conductive zones. To the east, on the MINDY claims, Newmont have encountered substantial tin mineralization as tin borates in magnetite skarn.
- (6) One 100 metre? drill hole should test the magnetic anomaly north east of the tarn lake at the south end of the grid.

It is recommended this drilling be done using a hydra-wink drill with BQ core to reduce mobilization and moving costs. Total overall cost of this recommended program is expected to be: -

6 holes totalling 535 metres of drilling at \$245/metre = \$131,000

Respectfully submitted

J.C. Stephen Explorations Ltd.

J.C. Stephen

JCS/ms

ORK CLAIM GROUP  
STATEMENT OF EXPENDITURES

SALARIES

<u>Name</u>	<u>Position</u>	<u>Dates</u>	<u>Rate</u>	<u>Amount</u>
R. Campbell	Geologist	June 10-July 8 July 23-July 29	\$1800+15%	\$2484.
M. Webster	Sr. Asst.	June 10-July 8	1800+15%	2001.
N. Silins	Assistant	June 21-July 8	1400+15%	966.
A. Candy	Assistant	June 21-July 8	1200+15%	828.
B. Lawson	Geoph. Oper.	July 23-July 29	1750+15%	469.
S. Kay	Assistant	July 23-July 29	1750+15%	469.
J.C. Stephen		July 2, 28	150/day	<u>300.</u>
				\$7,517.00

MAGNETOMETER RENTAL MP-2 SCINTREX

20 days @ \$14. 280.00

PREPARATION OF BASE MAP (McELHANEY SURVEYS) 2,500.00

GEOCHEMISTRY

350 Soils for Sn W Cu Zn @ \$10.15 \$3552.  
26 Rock for Cu Sn @ \$5.65 147.  
20 Rock for SN Cu Ag Au @ \$11.40 228.  
3,927.00

MAX MIN EM RENTAL LG WHITE & ASSOCIATES

6 days @ \$110. 660.00

FOOD AND CAMP SUPPLIES

117 Man Days @ \$15.00 1,755.00

HELICOPTER      KEYSTONE HELICOPTERS, ATLIN  
Airbill no.      Date      Hours prorated  
003239      June 10      2.5  
003721      June 21      1.4  
003682      July 9      1.4  
003769      July 23      1.4  
003884      July 29      1.4  
8.1 hrs @ \$500.

\$ 4,050.00

\$20,689.00

A P P E N D I X I

G E O P H Y S I C A L I N S T R U M E N T S

## II. MAGNETOMETERS

### Instrument Use

The common types of portable magnetometers in use today are fluxgate, proton precession, Schmidt field balance, dip needle and other special purpose instruments. Field balances and dip needles are mechanical devices comprised of pivoted magnets measuring vertical or horizontal intensity or field direction, and are not much used today being replaced by the more sensitive and less cumbersome fluxgate and proton magnetometers. Portable fluxgate magnetometers employ a saturable core sensor held in a vertical direction to measure vertical intensity with an effective sensitivity on the order of several gammas. Fluxgate magnetometers, too, are slowly being replaced by the proton magnetometer which has greater sensitivity (1 gamma or better), absolute accuracy, no moving parts, and measures total field intensity with freedom from orientation errors. For reasons of its increasing utilization and because many applications require these features, the proton magnetometer will be the principal instrument under discussion in the Manual. Much of the Manual from Chapters III through IX nevertheless applies to vertical component flux gate magnetometers as well. Anomaly signatures at high latitudes (magnetic dip  $70^\circ$  or greater) are practically identical for the two instruments; at other latitudes they differ significantly.

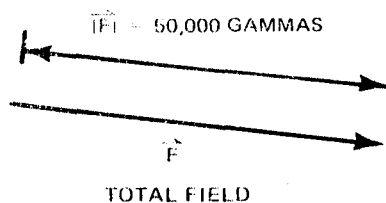
### Proton Magnetometer

The proton precession magnetometer is so named because it utilizes the precession of spinning protons or nuclei of the hydrogen atom in a sample of hydrocarbon fluid to measure the total magnetic intensity. The spinning protons in a sample of water, kerosene, alcohol, etc., behave as small, spinning magnetic dipoles. These magnets are temporarily aligned or polarized by application of a uniform magnetic field generated by a current in a coil of wire. When the current is removed, the spin of the protons causes them to precess about the direction of the ambient or earth's magnetic field, much as a spinning top precesses about the gravity field. The precessing protons then generate a small signal in the same coil used to polarize them, a signal whose frequency is

precisely proportional to the total magnetic field intensity and independent of the orientation of the coil, i.e., sensor of the magnetometer. The proportionality constant which relates frequency to field intensity is a well known atomic constant: the gyromagnetic ratio of the proton. The precession frequency, typically 2000 Hz, is measured by modern digital counters as the absolute value of the total magnetic field intensity with an accuracy of 1 gamma, and in special cases 0.1 gamma, in the earth's field of approximately 50,000 gammas.

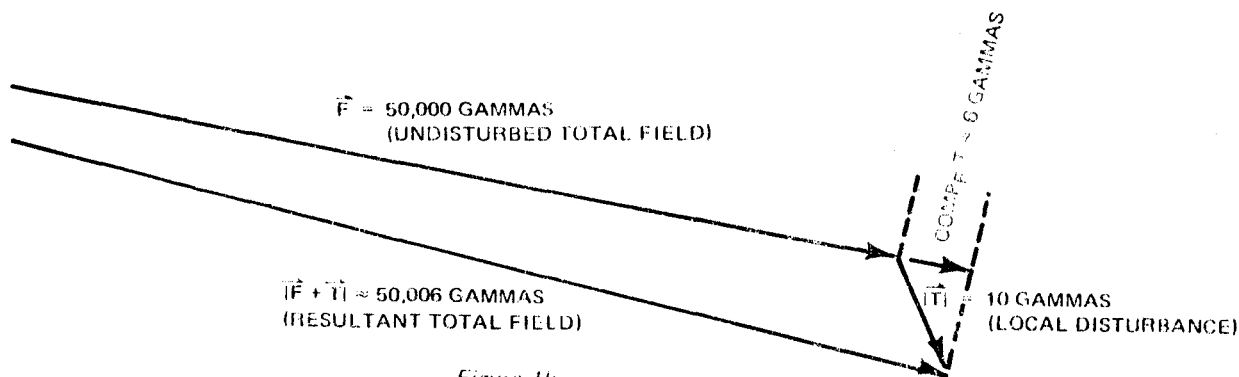
### Total Field Measurement

The total magnetic field intensity, as measured by a proton magnetometer, is a scalar measurement, or simply the magnitude of the earth's field vector independent of its direction. The measurement can be expressed as in *Figure 1a* as simply the length of the earth's field vector,  $F$ , shown here to be 50,000 gammas. A local perturba-



*Figure 1a.*

tion,  $T$ , of 10 gammas, as might be measured in any of the applications discussed herein, is shown in *Figure 1b* as a vector of arbitrary direction. This disturbance vector adds to the undisturbed field in the usual manner of vector addition as shown in *Figure 1b*, paying special notice to how the figure would actually appear if both the 50,000 and 10 gamma vectors were drawn to scale. It is clear from the figure, then, that since the proton magnetometer measures only the *magnitude* of the resultant vector whose direction is almost exactly parallel



*Figure 1b.*

to the undisturbed total field vector, that which is measured is very nearly the component of the disturbance vector in the direction of the original undisturbed total field, or where

$$|F + T| \approx F + \text{comp}_F T$$

where  $|F| \gg |T|$ .

Such conditions are almost always valid except in the near field of large steel objects or in the vicinity of iron ore deposits or certain ultrabasic rocks which produce anomalies larger than 10,000 gammas. Thus, the change in total field,  $\Delta F = \text{comp}_F T$ , i.e., the component of the anomalous field,  $T$ , in the direction of  $F$ . (Except where noted,  $\text{comp}_F T$  will be referred to simply as the anomaly  $T$ .) The proton precession magnetometer, for small perturbations, can therefore be considered to be an *earth's-field-determined component magnetometer*.

This property of measuring this scalar magnitude of the field, otherwise called total field intensity, is very significant with respect to the asymmetric signatures of anomalies, interpretation of anomalies, and in various special applications. Furthermore, the fact that what is measured is independent of the orientation of the sensor, allows the magnetometer to be operated without attention to orientation or leveling such as would be the case with

a fluxgate magnetometer on the mobile platform of a person, vehicle, or aircraft. The only limitation of such a scalar measurement, albeit a minor one, is the fact that the component of the anomalous field which is measured is not normally under the control of the observer, but rather at the whim of the local direction of the earth's magnetic field.

#### Limitations of a Proton Magnetometer

The proton magnetometer has no moving parts, produces an absolute and relatively high resolution measurement of the field and usually displays the measurement in the form of an unambiguous digital lighted readout. Several operational restrictions exist, however, which may be of concern under special field conditions. First, the proton precession signal is sharply degraded in the presence of a large magnetic field gradient greater than 200 gammas per foot (approximately 600 gammas per meter). Also, the signal amplitude from the sensor is on the order of microvolts and must be measured to an accuracy of 0.04 Hz of the precession frequency of several thousand Hz. This small signal can be rendered immeasurable by the effects of nearby alternating current electrical power sources. For these two reasons, a *proton magnetometer cannot usually be operated within the confines of a typical building*. Developments and procedures are presented which minimize these effects for the applications to be described in the Manual.

#### MP-2 Portable Proton Precession Magnetometer

The MP-2 is a repeatable one-gamma proton precession magnetometer for field survey or base station use. The optimized design of sensor and circuitry using the latest GaAs MOS components, has resulted in a very light weight, low power consumption, rugged and reliable magnetometer.

#### Features

When the MP-2 features are compared point-for-point with competing magnetometers, the Scintrex product is hard to beat.

1 gamma sensitivity and accuracy over range of 20,000 to 100,000 gammas.

Operates in very high gradients, to 5000 gammas per meter.

Weighs only 3.7 kg.

Up to 25,000 readings from only 8 D cells.

Battery pack isolated from electronics for corrosion protection.

Battery pack easily extended for winter use.

Light emitting diode digital display, with complete test feature.

Reads out in only 3.7 seconds.

Unique no-glare polarized reflector permits easy reading in bright sunlight.

Indicator light warning of excessive gradient, ambient noise or electronic failure.

Digital readout of battery voltage.

Rugged all metal housing for rough field use at all temperatures.

Automatic recycling or external trigger features permit ready conversion to base station use in the MBS-2 model.



# VLF-EM Data Processing

D. C. FRASER, Chief Geophysicist,  
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Toronto, Ontario

## ABSTRACT

Geophysical Engineering and Surveys Limited of the Keevil Mining Group have routinely conducted ground surveys with VLF-EM receivers for the past two years. Both Crone's Radem and Ronka's EM16 have been used.

VLF-EM dip-angle data often yield complex patterns which require considerable study for a proper interpretation. A method was developed which allows field operators to transform the noncontourable dip angles into contourable data, producing conductor patterns which are immediately apparent to exploration personnel untrained in VLF-EM interpretation.

VLF-EM contoured data generally peak very close to the top of a conductor, thereby allowing drill holes to be spotted accurately. However, the data generally should not be used alone to select drill targets because structures may be sufficiently conductive to yield strong anomalies. Thus, magnetic and/or vertical-loop EM correlations may be considered as necessary criteria for drilling.

VLF-EM surveys can replace IP surveys in certain environments. For example, the Restigouche orebody in the Bathurst camp of New Brunswick yielded a VLF-EM anomaly as distinct as that obtained by IP, although the body did not respond to vertical- or horizontal-loop EM. However, the cupriferous breccia pipes of the Tribag mine near Batchawana, Ontario yield strong IP anomalies but not VLF-EM anomalies, illustrating that disseminated ore targets should be sought with IP rather than with VLF-EM.

## INTRODUCTION

A METHOD HAS BEEN DESCRIBED (Fraser, 1969) which enables somewhat noisy, noncontourable dip-angle data to be transformed into less noisy, contourable data. This data processing is performed routinely by

field personnel, and simply involves additions and subtractions.

Both magnetic and VLF-EM data can be collected by a single individual as part of a ground evaluation program. The VLF-EM method can provide contour maps which may be as useful to exploration geologists as magnetic maps. The key to the usefulness, however, lies in the data processing, because raw dip-angle data frequently are more confusing than elucidating. This point is illustrated in *Figure 1*, which presents dip-angle data from the Temagami mine in Ontario. Clearly, the complex pattern requires some thought for proper interpretation. Conversely, *Figure 2* provides a conductor pattern which is immediately apparent even to those untrained in VLF-EM interpretation. It is obtained from the data of *Figure 1*, using the method described in the Appendix. The contoured units are expressed in degrees. Only the positive quantities are contoured.

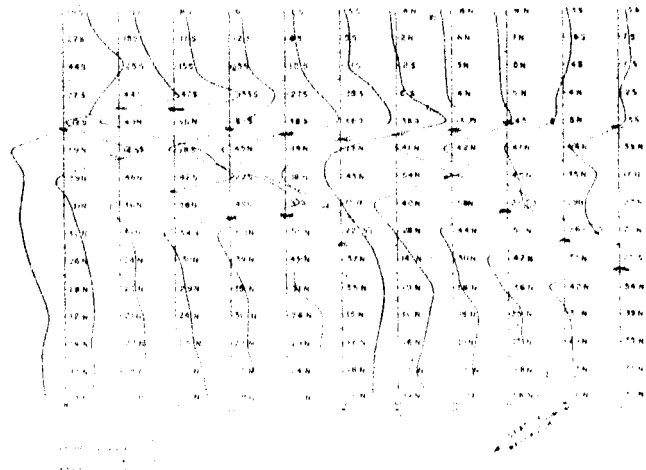


FIGURE 1—Dip-angle VLF-EM data in the vicinity of the Temagami mine. The arrow defines the primary field direction from the transmitter at Seattle, Washington (after Fraser, 1969).

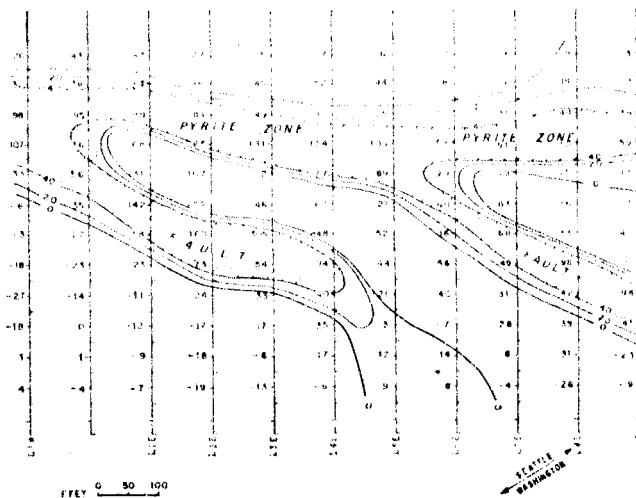


FIGURE 2 — Contoured VLF-EM data, in degrees, as calculated from the map of Figure 1 (after Fraser, 1969).



D. C. FRASER obtained a Bachelor's and a Master's degree in geology at the University of New Brunswick and, in 1966, a Ph.D. degree in geophysics at the University of California at Berkeley. He has performed research on induced polarization, resistivity, magnetics, gravity and electromagnetics, including the design of new interpretation methods employing, in part, digital filtering and correlation techniques. Recently, he has been involved to a considerable

extent in mapping conductivity inhomogeneities, first with ground equipment as a thesis problem, and then with airborne equipment in collaboration with Barringer Research Limited.

Dr. Fraser has worked for several petroleum and mining companies and currently is chief geophysicist of Geophysical Engineering & Surveys Limited, a member of the Society of Exploration Geophysicists and of the CIM, and a past president of the Canadian Exploration Geophysical Society.

PAPER PRESENTED: at the 72nd Annual General Meeting of the CIM, Toronto, April, 1970.

KEYWORDS: Geophysical exploration, Data processing, Electromagnetic surveys, Dip angles, VLF-EM surveys, Filter theory, Contouring.

CIM TRANSACTIONS: Vol. LXXIV, pp. 11-13, 1971.

## FIELD EXAMPLES

The following field examples were chosen to illustrate the three primary uses to which VLF-EM has been applied by Geophysical Engineering and Surveys Limited.

### General Prospecting

General prospecting or ground evaluation provides the most common use for VLF-EM. Ground often is obtained which requires only a general approach to exploration, as when there is insufficient geological information regarding the specific target sought. In such cases, magnetic and VLF-EM surveys are routinely performed without the guidance of a geophysicist. VLF-EM conductors are tested by short traverses with vertical-loop EM. The anomaly patterns generally are sufficiently clear so that mapping, trenching, drilling or abandonment will be decided without consulting a geophysicist. Exceptions can occur when patterns become complex.

Figure 3 illustrates a survey in which two strong VLF-EM conductors were obtained. The southern anomaly has vertical-loop EM correlation and the northern one does not. The VLF-EM anomaly with vertical-

loop correlation also coincides with a magnetic anomaly, and probably is due to magnetic sulphides. It will be drilled shortly. The other equally strong VLF-EM anomaly without vertical-loop correlation does not parallel the magnetic patterns, and probably is due to a fault.

### In Place of IP

There are certain environments where VLF-EM can be used as an alternate to IP. These are the environments characterized by massive or heavily disseminated sulphides which occur within 300 feet of surface and yet do not respond to conventional EM. IP was considered to be the most suitable geophysical method for the detection of such bodies (Hallov, 1967). However, it is well worth testing VLF-EM in these environments because of the very substantial cost savings that result if the method is responsive. As an example, Figure 4 illustrates a VLF-EM survey over the Restigouche orebody in the Bathurst area of New Brunswick. Figure 5, showing IP chargeability contours, allows a comparison to be made of the relative merits of IP and VLF-EM for this type of mineralization. The Restigouche body did not respond to vertical- or horizontal-loop EM because of the high spha-

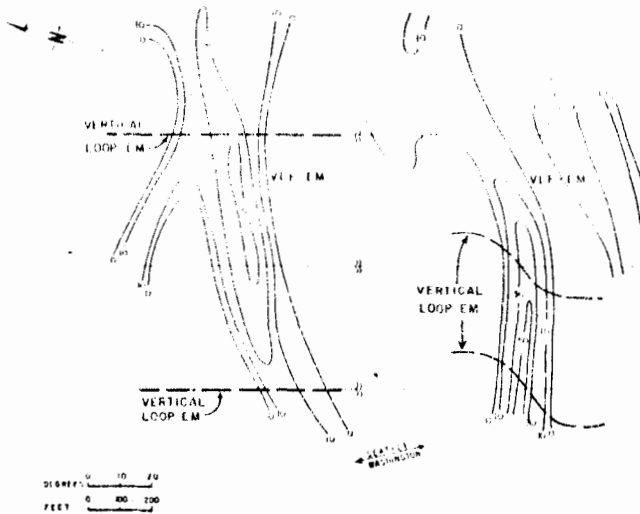


FIGURE 3 — Contoured VLF-EM in degrees and vertical-loop EM profiles (1,200 hz) from a property evaluation survey in the Uchi Lake area.

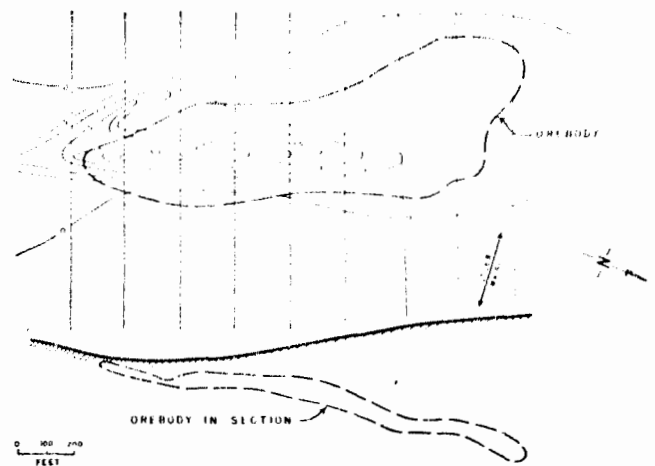


FIGURE 4 — Contoured VLF-EM in degrees from the Restigouche orebody, illustrating that the method is a viable alternate to IP in this environment (cf. Figure 5).

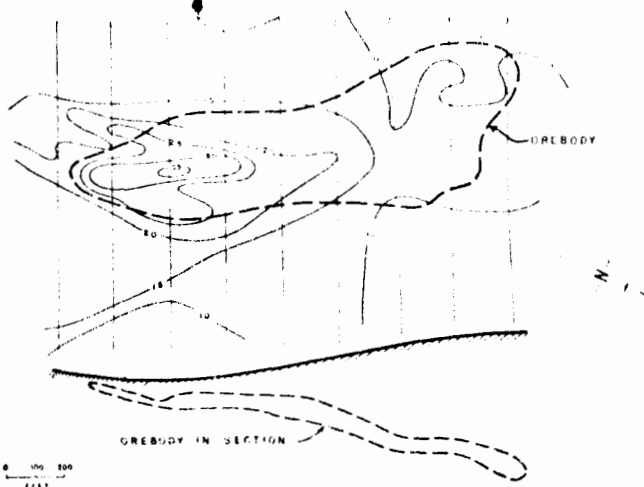


FIGURE 5 — Gradient-array IP chargeability in milliseconds over the Restigouche orebody, for comparison with the VLF-EM data of Figure 4.

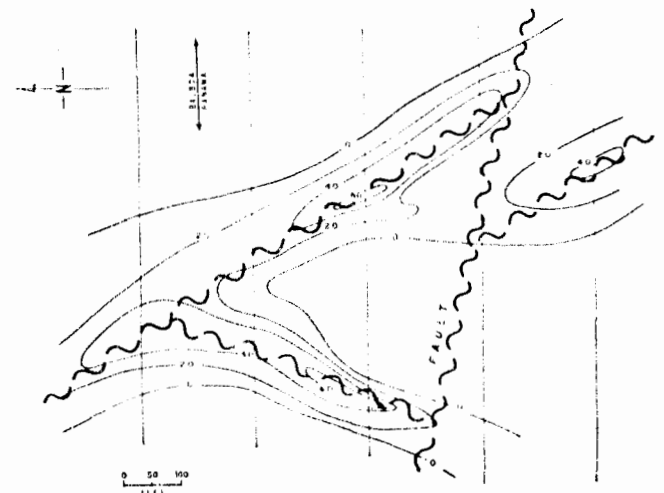


FIGURE 6 — Contoured VLF-EM in degrees from a fault-mapping survey in the Cobalt area.

Other environments described in Hallof (1967) would not be as amenable to the use of VLF-EM in place of IP. A truly disseminated copper deposit will not provide a VLF-EM anomaly but will yield a large IP effect, as was found to be the case for the breccia pipes of the Tribag mine near Batchawana, Ontario.

### Structural Interpretation

Inasmuch as VLF-EM responds well to structures, the method has been applied to the mapping of faults. An example is shown in *Figure 6*, which depicts a portion of a survey in the Cobalt area of Ontario. The property was a silver prospect where the veins were postulated to be associated with faults. VLF-EM appeared to be the most reasonable geophysical method available to aid in tracing these faults. Considerable drilling has been done on this property, and the fault interpretation was verified.

*Figure 2* illustrates that faults can be as conductive to VLF-EM as massive pyrite. In this Temagami example, the faults contain a brecciated matrix with some hematite cementing. They yield a strong IP anomaly, but are non-conductive to conventional EM.

### DEPTH OF EXPLORATION

The relatively high transmitted frequency of approximately 20,000 hz severely limits the depth of exploration in areas of conductive overburden. As an example, penetration of the 100 to 200 feet of clay in the Timmins area often is not achieved.

In regions where the overburden has a less exceptional conductivity, such as the Bathurst area, depth of exploration generally is limited to about 300 feet. This depth was predicted from model curves in Fraser (1969), and appears to be true in practice, as over the Restigouche deposit (*Figure 4*).

### CONCLUDING REMARKS

VLF-EM surveys are exceptionally easy to perform, but the dip-angle data may be exceedingly difficult to interpret correctly. This latter point has produced unfavourable comments regarding the utility of VLF-EM as a prospecting tool. The data-processing method used to transform somewhat noisy, noncontourable dip angles into less noisy, contourable data greatly increases the value of VLF-EM surveys.

The efficiency of data flow is significantly increased in the case of an active mining company performing such surveys in large quantities. This is because the contoured maps may be used directly by geologists in charge of their various projects, rather than requiring a geophysicist to study each dip-angle map.

Contoured VLF-EM maps form a useful complement to magnetic maps. The survey and data-processing cost is similar to that for a hand-held fluxgate magnetometer.

For general exploration in the Shield, VLF-EM conductors generally should be tested with vertical-loop EM to separate massive sulphides (and graphite) from conductive structures. As such structures can be mapped with VLF-EM, this provides another use for the method. Further, some massive and heavily disseminated sulphides, which do not respond to conventional EM, will yield VLF-EM anomalies as distinct

as those obtained by IP. These three uses of VLF-EM, i.e., for general prospecting, mapping of structures and as a judicious alternate to IP, form our primary applications of VLF-EM to property evaluation.

## APPENDIX

### The Data-Processing Technique

THE DATA-PROCESSING TECHNIQUE is described in detail by Fraser (1969), where it is also discussed in terms of filter theory\*. The method is very simple to apply, as is shown by the example of *Figure 7*. This figure illustrates that the contourable quantity is the sum of the values at two adjacent stations minus the sum at the next two adjacent stations. The above-referenced paper presents a tabulation method suited to the processing of this dip-angle data. The calculations are performed in the field by the instrument operators.

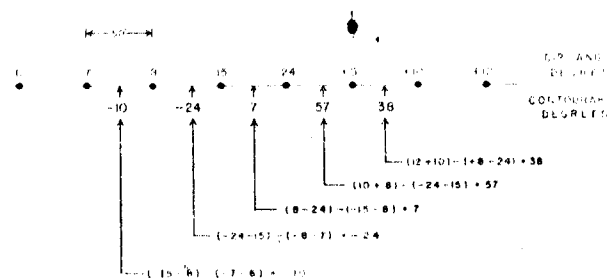


FIGURE 7—Example of the data processing calculations, illustrating that the contoured quantities are obtained simply from additions and subtractions performed on the dip angles.

A 50-foot station interval is recommended to avoid the problem of near-surface conductors appearing as deeper conductors, as could occur if the station spacing was larger. In actual practice, data are collected at 100-foot intervals, with 50-foot readings being taken where anomalies occur. Later, 50-foot artificial data are interpolated in non-anomalous areas prior to performing the calculations. This procedure avoids some confusion in the contour patterns which would result from near-surface 'geological noise'.

Normally, only the positive values are contoured, because the negative quantities generally represent anomaly flanks. Consequently, the inclusion of negative contours would serve only to confuse the conductor patterns. However, if a backward crossover was produced by a geological source, an erroneous interpretation of the contour map and the dip-angle profiles would result. To date, such a crossover has not been recognized on the predominantly in-phase dip-angle data.

### REFERENCES

- Fraser, D. C., (1969), Contouring of VLF-EM Data; *Geophysics*, Vol. 34, pp. 958-967.  
 Hallof, P. G., (1967), The Use of Induced Polarization Measurements to Locate Massive Sulphide Mineralization in Environments in which EM Methods Fail; paper presented at Canadian Centennial Conference on Mining and Groundwater Geophysics, Niagara, Ontario.

\*The technique is analogous to passing the dip-angle data through a bandpass filter which (1) completely removes DC bias and greatly attenuates long wave lengths, (2) completely removes Nyquist frequency noise, (3) phase-shifts all frequencies by 90 degrees and (4) has the bandpass centered at a wave length of five times the station spacing.

A P P E N D I X II

GEOCHEM & ASSAY DATA SHEETS

SAMPLER R Campbell

PROJECT DC Syndicate ORK

DATE June /82

LINE

AIR PHOTO NO.

SAMPLE NO.	LOCATION	Depth in.	Horiz	DESCRIPTION				SLOPE	VEG.	ADDITIONAL OBSERVATIONS OR REMARKS	ASSAYS			
				Colour	Part Size	% ORG.	Ph				Ca	Zn	W <sub>3</sub>	Sn
DCDT	75E32N							light		Talus of Black Argillite Shale	155	263	1	1
"	75E34N							"		"	200	249	1	1
DCDT	75E36N							"		"	53	88	1	1
DCD	75E38N	6"	B	Rusty Brown	med fine	20		"	Grass		31	97	1	1
DCD	75E40N	8	"	"	"	"		"	"		52	74	1	1
DCD	42N	8	"	Brown	fine	"		"	"	Sil Arg talus Around	122	72	2	1
DCD	44N	6	"	"	"	"		"	"	"	83	100	1	2
DCD	46N	10	"	"	"	40		"	"	"	62	82	1	1
DCDT	48N							"	"	Sil Arg talus with Leached Soil	57	91	2	1
DCD	50N	8	B	Rusty Brown	fine	25		"	"	Sil Arg Around	36	66	1	1
DCDT	52N							Slight	"	Sil Arg talus with Dark Brown Soil	55	97	2	1
DCD	54N	6	B	Brown	Silty fine	50		"	"	Sil Arg Around	126	215	1	1
DCDT	56N							mod high	"	Rusty Silty Arg + Sil Arg	101	124	1	1
DCDT	58N							"	"	"	210	176	1	1
DCDT	60N							"	"	"	175	115	2	1
DCDT	77E59N							"	"	"	150	123	2	1
DCDT	57N							"	"	Sil Arg talus some Rusty leached Soil in Sample	138	150	2	2
DCD	55N	8	B	Slight Rusty Brown	Fine	20		"	"	Arg Rubble Around	72	124	1	1
DCDT	53N							"	"	Arg talus	135	150	4	2
DCDT	51N							"	"	Arg talus w/lot dark Soil in Sample	124	139	1	2

SAMPLER RCampbell

DATE June 82

PROJECT D.C. Syndicate ORK

LINE

AIR PHOTO NO.

SAMPLE NO.	LOCATION	Depth (ft)	Horiz	DESCRIPTION				SLOPE	VEG.	ADDITIONAL OBSERVATIONS OR REMARKS	ASSAYS			
				Colour	Part Size	% ORG.	Ph				Cu	Zn	K	Sn
DCD	77E49N	8	B	Dark Brown	fine	20		high	Grass	Arg. Rubble	53	85	1	1
DCD	17N	6	B	med Brown	"	"		Mod	"	Wet Channel way for melting snow Arg Rubble	90	123	1	1
DCD	45N	"	"	Brown	"	"		"	"	Sil Arg Rubble	70	79	2	1
DCD	43N	8	"	"	"	"		"	"	Arg + Meta SS Rubble	79	86	1	1
DCD	41N	8	"	med Brown	med	"		"	"	Arg + Meta SS Rubble	58	69	2	1
DCD	39N	10	"	"	fine	50		"	"	Meta SS + Chert Rubble	45	73	1	1
DCD	37N	6	"	Red Brown	"	20		"	"	Chert to Cherty Arg around	95	98	1	2
DCD	35N	"	"	"	"	"		"	"	"	54	78	1	1
DCD	33N	8	"	Brown	"	"		"	"	Sil Arg Rock Fragments	56	83	1	1
DCD	31N	6	"	Brown	"	"		"	"	"	86	99	2	2
DCD	79E30N	8	"	Rusty Brown	Silty fine	"		High	"	Meta SS talus	22	56	1	1
DCD	32N	10	"	Brown	fine	"		"	"	" + Sil Arg	43	58	1	1
DCD	34N	10	"	"	"	"		"	"	"	58	82	2	1
DCD	36N	"	"	"	"	"		"	"	"	48	74	1	2
DCD	38N	"	"	"	"	10		"	"	"	50	75	1	2
DCD	40N	6	"	"	"	20		"	"	"	73	90	1	2
DCD	42N	6	"	Rusty Brown	"	20		mod	"	Sil Arg. talus	52	65	1	1
DCD	44N	8	"	Brown	"	20		mod-high	"	Meta SS + Sil Arg talus	50	62	1	1
DCD	46N	"	"	Brown	"	10		"	"	"	98	90	1	1
DCD	48N	"	"	"	Silty-Fine	20		high	"	Rusty Arg in hole	64	77	1	2

SAMPLER R Campbell

PROJECT OC Syndicate ORK

LINE

DATE June 82

AIR PHOTO NO.

SAMPLE NO.	LOCATION	Depth	Horiz	DESCRIPTION				SLOPE	VEG.	ADDITIONAL OBSERVATIONS OR REMARKS	ASSAYS			
				Colour	Part Size	% ORG.	Ph				Cu	Zn	W	Sn
22 DCD	79E50N									Over Dirty Chert OC with arg bands Some Rusty talus around	137	115	3	1
DCD	52N	8	B	Brown	Fine	40		mod	Grass	"	82	76	2	1
DCDT	56N									Arg. white talus some rusty	140	208	1	1
DCDT	58N									"	160	110	1	1
DCDT	81E57N									Arg + meta SS talus	116	90	1	2
DCD	55N	6	B	Brown	Fine	20		mod high	Grass	Arg + meta SS talus	125	105	1	2
DCD	53N	6	B	Rusty Brown	Fine	20		Med	Grass	Taken Below S.1 Arg with meta SS lenses OC	29	48	1	1
DCDT	47N									Base of meta SS OC some Rusty Talus	174	77	15	2
DCD	43N	8	B	Dark Brown	Silty fine	40		Mod	Grass	Talus of All Rock Types	32	50	2	3
DCD	41N	"	"	"	"	60		"	"	"	38	56	1	1
DCD	38N	6	"	Rusty Brown	Fine	30		Mod	Grass	Beside Rock Slide	52	82	2	3
DCD	37N	4	"	Rusty Brown	"	40		"	"	only pod of soil in side near station				
DCD	31N	6	"	Brown	"	40		"	"	In Rock Slide	43	80	1	1
DCD	29E32N	8	"	Rusty Brown	"	60		"	"		33	63	1	2
DCD	36N	6	"	Med Brown	"	50		"	"	lots of Slide material Around	16	56	1	1
DCD	40N	8	"	Rusty Brown	silty fines	30		"	"	Still in Slide Area	9	40	1	1
DCD	44N	18	"	Med Brown	Silty	60		"	"	lots of Gravel in Rubble Slide Area	98	73	7	1
DCD	46N	12	"	"	"	"		"	"	"	118	71	10	1
DCD	48N	6	"	Med Brown	"	"		"	"	Below MSS OC	80	100	2	2
DCDT	50N									Coarse sample meta SS + Arg Talus	103	105	1	2



SAMPLER Susan Kay/Ben Lawson

DATE July 28/82

PROJECT D.C. - Syndicate - ORK

NTS

LINE

AIR PHOTO NO.

SAMPLE NO. DC-ORK-D	LOCATION	Depth (cm)	Horiz	DESCRIPTION				SLOPE	VEG.	ADDITIONAL OBSERVATIONS OR REMARKS	ASSAYS			
				Colour	Part Size	% ORG.	Ph				Co	Zn	W	Sn
85E	32+00N	12	AB	med to lt. br.	loamy silt	high		mod.	grass moss		46	75	1	3
	34+00N	10	A	med to dk br	silty loam	high		mod	"		29	65	1	1
	36+00N	5	AB	lt. br.	f. silty sand	high		mod	"		13	49	2	1
	38+00N	15		brown		mod		"	rocky		17	48	1	1
	40+00N	7	AB	lt yell br.	silty clay	low		mod	grass moss		39	54	5	2
	42+00N	18		brown		mod. high		"	"		44	58	14	4
	44+00N	3	B	lt bi	silty sand	high		mod	grass moss		91	60	4	3
	46+00N	25		brown		mod		"	"		62	68	68	2
	48+00N	10	AB	lt or br.	f. silty sand	mod to high		flat	grass moss		144	78	14	3
	50+00N	20		brown		"		"	"		37	68	1	1
	52+00N	10	AB	med br.	f. silty sand	high		gentle	grass moss		89	120	1	2
	54+00N	15		brown		mod high		"	"		32	62	1	1
	56+00N	10	AB	lt br to gray	loamy silt	high		gentle	grass moss	30 ft S of picket	41	113	3	2
	58+00N	30		black		"		"	"		57	62	3	1

SAMPLER Susan Kay

DATE July 28/1982

PROJECT DC Syndicate - ORK

NTS

LINE

AIR PHOTO NO.

SAMPLE NO. DC-ORK-D	LOCATION	Depth (cm)	Horiz	DESCRIPTION				SLOPE	VEG.	ADDITIONAL OBSERVATIONS OR REMARKS	ASSAYS			
				Colour	Part Size	% ORG.	Ph				Cu	Zn	W	Sn
89E	62+00N	15	AB	dk gray bl.	loamy silt	high		mod	grass moss	talus slope	171	153	8	3
	60+00N	10	AB	lt. gray br.	f. silt + humus	v high		mod	"	talus slope	117	120	7	2
	58+00N	5	AB	med br.	loamy silt	high		gentle	"		124	110	1	1
	56+00N	10	AB	med br.	loamy silt	"		flat	"		32	61	1	2
	54+00N	10	AB	lt. br.	f. pebbly sand	mod		flat	"		27	63	1	1
	52+00N	5	AB	lt or br.	f. silty sand	high		"	"		22	50	1	1
	50+00N	7	B	med or br.	med. silty sand	low		"	"		24	52	1	1
	48+00N	2	B	med yell br.	clay (pebbly)	"		"	"		54	70	3	1
	46+00N	2	B	med yell br.	pebbly clay	"		"	"		35	62	1	1
	44+00N	2	B	dk br.	sandy clay	"		"	"		31	60	1	2
	42+00N	3	B	med yell br.	"	"		"	"	flagged as 40N on grid	32	67	1	1
	40+00N	7	AB	lt or br.	f. silty sand	mod.		"	"	flagged as 38N on grid	19	58	1	1
	38+00N	7	AB	med br.	loamy silty sand	high		gentle	"	flagged as 36N on grid	17	62	1	1
	36+00N	3	B	lt. yell br.	v pebbly silt	low		"	"	flagged as 36N on grid	41	70	1	2
	34+00N	3	B	med br.	pebbly clay	low		flat	"		65	103	1	1
	32+00N	5	B	"	f. silty sand	mod		"	"		55	98	4	5
	30+00N	5	B	lt. yell br.	clayey silt	low to mod		"	"		46	98	6	7



SAMPLER Ben Lawson  
DATE July 27/82

PROJECT ORK (DC Syndicate)

NTS

LINE

AIR PHOTO NO.

SAMPLE NO.	LOCATION	Depth	Horiz	DESCRIPTION				SLOPE	VEG.	ADDITIONAL OBSERVATIONS OR REMARKS	ASSAYS			
				Colour	Part Size	% ORG.	Ph				Cu	Zn	W	Sr
82 DC	95 E 62N	6'		brn		10-15		mod.	grassy		20	58	1	1
	60N	7'		"		15-20		"	"		31	108	1	1
	52N	7'		blk		40-45		"	"		87	83	1	1
	56N	7'		brn		15-20		"	"		53	67	1	1
	54N	4'		gr/brn		5-10		"	"	frost boil	33	53	3	1
	52N	13'		brn		30-35		"	"		40	51	3	1
	50N	12'		blk		"		"	"		25	68	1	1
	48N	4'		lt. brn		0-5		"	"		21	44	4	2
	46N	6"		brn		10-15		liquid	"		11	42	1	1
	44N	3"		lt. brn		0-5		"	"	frost boil	26	52	1	1
	42N	6"		brn		10-15		"	"		26	58	1	1
	40N	6"		"		"		"	"		17	60	1	1
	38N	5"		"		"		mod	"		18	63	1	1
	36N	7'		"		"		"	"		17	56	1	1
	34N	6"		"		"		"	"		23	62	1	1
	32N	5'		brn		5-10		moderate	grassy	New Line	32	82	10	8
	30N	7'		"		10-15		"	"		20	60	1	1
	34	4'		"		6-5		level	"		36	158	1	3
	36	3"		"		"		"	"	pcbbly				
	38	6"		"		5-10		"	"		24	57	1	2

SAMPLER Susan Kay

DATE July 28/1982

PROJECT DC Syndicate - ORK

NTS

LINE

AIR PHOTO NO.

SAMPLE NO. DC ORK-D	LOCATION	Depth (cm)	Horiz	DESCRIPTION				SLOPE	VEG.	ADDITIONAL OBSERVATIONS OR REMARKS	ASSAYS			
				Colour	Part Size	% ORG.	Ph				Cu	Zn	K	Sn
93E	30+00N	12	AB	med br	pebbly sand	mod		gentle	grass moss					
	32+00N	5	B	lt br.	f. pebbly silt	mod		"	"					
	34+00N	5	B	lt. br.	pebbly silt	low		"	"	25 ft N of flag.				
	36+00N	10	AB	med br.	f. sandy silt	high		"	"	pebbly				
	38+00N	7	B	med br.	pebbly silt	low		flat	"					
	40+00N	7	B	lt yell bl.	pebbly clay	low		flat	"					
	42+00N	5	B	"	"	"		"	"					
	44+00N	3	B	dk br.	"	low		"	"					
	46+00N	3	B	med br	pebbly silt	"		"	"					
	48+00N	7	B	"	f. pebbly silt	"		"	"					
	50+00N	5	B	lt. br.	"	"		"	"					
	52+00N	15	B	med br.	f. silty sand	high		gentle	"	pebbly				
	54+00N	10	B	"	"	low		"	none	edge of talus slope; 25' N of picket				
	56+00N	2	B	med br.	f. clayey silt	"		flat	"	edge of boulder field				
	58+00N	10	A	gray to blackish brown	loamy sand	v high		"	"					
	60+00N	7	AB	lt. br.	f. pebbly silt	mod		gentle	"					
	62+00N	15	AB	dk br.	f. silty sand	high		"	"					

SAMPLER Susan Kay

PROJECT DC Syndicate - Ont.

LINE

DATE July 27/1982

AIR PHOTO NO.

SAMPLE NO.	LOCATION	Depth (cm)	Horiz	DESCRIPTION				SLOPE	VEG.	ADDITIONAL OBSERVATIONS OR REMARKS	ASSAYS			
				Colour	Part Size	% ORG.	Ph				Cu	Zn	Kl	Sn
101E	68+00N	10	A	med or br to br	f. silty sand	high		flat	scrub grass moss	pebbly	58	65	3	1
	66+00N	15	AB	lt or br.	med silty sand	mod		gentle	"		15	45	1	1
	64+00N	10	AB	"	f. silty sand	high		"	"		12	48	2	4
	62+00N									no sample; 15cm humus - talus below				
	60+00N									no sample - TALUS				
	58+00N									no sample - TALUS				
	56+00N	15	A	gray br.	f. silty sand	high		gentle	grass moss		17	59	7	1
	54+00N	10	A	"	pebbly clay	r. high		flat	grass moss	boulders with thin layer of OM	35	108	3	1
	52+00N	20	A	med br.	pebbly silt	"		"	"		18	65	5	1
	50+00N	10	B	lt or br.	f. silty sand	mod		(flat)	"		11	55	1	1
	48+00N	20	B	lt br.	coarse pebbly sand	mod to low		"	"		15	45	1	1
	46+00N	10	B	lt or br.	f. silty sand	low		"	"		31	53	1	1
99E	48+00N	5	B	lt gray br.	clayey sand	low		flat	"	no sample; 4 cm humus, 2cm Ae, rocks	24	55	1	3
	50+00N	15	AB	dk gray br.	clay	high		"	"	beside small stream	18	58	1	2
	52+00N	15	AB	dk or br.	pebbly silt	"		"	"		11	53	1	1
	54+00N	20	B	"	f. pebbly sand	mod		"	"		10	53	1	1
	56+00N	10	B	"	coarse pebbly sand	low		gentle	"		9	50	1	1
	58+00N	15	AB	"	pebbly f. sand	mod		flat	"		12	54	1	2
	60+00N									no sample - talus	-	-	-	-
	62+00N	20	A	f. silty sand	black br.	r. high		gentle	"		15	58	1	2

SAMPLER Susan Kay  
 DATE July 27/1982

PROJECT DC Syndicate - Ork

NTS \_\_\_\_\_

LINE \_\_\_\_\_

AIR PHOTO NO. \_\_\_\_\_

SAMPLE NO. DC-ORK-0	LOCATION	Depth (cm)	Horiz	DESCRIPTION				SLOPE	VEG.	ADDITIONAL OBSERVATIONS OR REMARKS	ASSAYS			
				Colour	Part Size	% ORG.	Ph				Ca	Zn	W	Sw
99E	64+00N	15	A	lt or br.	f silty sand	v. high		gentle	grass moss		36	76	1	2
	66+00N	15	AB	dk or br.	"	"		"	"		37	68	1	1
	68+00N	10	B	lt or br.	"	low			scrub grass moss		36	68	1	3
97E	66+00N	3	B	lt yell bl.	clay	low		flat	none		112	85	1	3
	64+00N	5	B	lt or br.	f silty sand	mod		gentle	grass moss		9	53	1	1
	62+00N	10	B	dk br.	med pebbly sand	mod		gentle	"		15	60	3	1
	60+00N	5	B	lt br.	pebbly clay	low		flat	none	talus slope	27	68	1	1
	58+00N	10	AB	med br.	f silty sand	high		gentle	grass moss		10	40	1	1
	56+00N	10	AB	med br.	pebbly sand	high mod		flat	grass moss		13	43	1	1
	54+00N	10	B	lt br.	med pebbly sand	mod		gentle	"		13	53	1	1
	52+00N	10	B	lt br.	f pebb sand	low		flat	"	10 feet west of line	20	48	1	1
	50+00N	7	B	lt br.	pebbly clay	low		flat	"	flagged as 48+00N	25	55	1	2
	48+00N	7	B	lt yell bl.	f clayey silt	low		"	"	pebbly	16	45	1	1
	46+00N	7	B	med br.	med silty sand	mod to high		"	"		13	58	1	1
	44+00N	10	B	lt br.	pebbly clay	low		"	"		21	52	1	1
	42+00N	5	A	med br to black	f silt and humus	v. high		"	"		18	60	1	1
	40+00N	12	B	lt br.	coarse pebbly clay	mod		"	"		37	95	1	2
	38+00N	7	B	med br.	med silty sand	mod		gentle	none	on talus slope.	31	55	1	1



SAMPLER Susan Kay

PROJECT DC Syndicate-Ork

LINE

DATE July 27, 1982

AIR PHOTO NO.

SAMPLE NO.	LOCATION	Depth (cm)	Horiz	DESCRIPTION				SLOPE	VEG.	ADDITIONAL OBSERVATIONS OR REMARKS	ASSAYS			
				Colour	Part Size	% ORG.	Ph				Cu	Zn	W	Sw
105E	64+00N	10	AB	med br.	silty sand	high		gentle	grass moss		10	55	1	2
	62+00N	15	AB	med br.	fine "	"		"	grass moss spruce		8	40	1	2
	60+00N	20	AB	lt. br.	fine "	"		"	grass moss		12	40	1	1
	58+00N	25	AB	"	"	"		"	"		39	52	7	3
	56+00N	-	-	( <del>med</del> ) br.	-	-	-	-	-	no sample; talus sample; snow				
	54+00N	25	AB	med br.	"	"		flat	grass moss	pebbly	12	51	1	1
	52+00N	30	AB	"	pebbly sand	mod		"	"		11	50	1	1
	50+00N	15	AB	lt. or br.	"	"		"	"		10	43	1	1
	48+00N	15	AB	med br.	"	high		"	"		16	62	1	1
103E	48+00N	40	AB	gray br.	coarse pebbly sand	mod.		"	"	very rocky	18	46	2	1
	50+00N	20	AB	med br.	med pebb sand	mod		"	"		12	53	1	1
	52+00N	10	AB	lt or br.	f. silty sand	mod		"	"	pebbly	10	53	1	1
	54+00N	20	AB	dk br.	pebbly sand	mod to high		"	"		12	48	1	1
	56+00N	25	B	dk br.	"	low		gentle	"	boulders	20	60	1	1
	58+00N	-	-	-	-	-	-	-	-	no sample; talus slope	-	-	-	-
	60+00N	20	B	lt or br.	silty sand	mod		gentle	grass moss		12	52	1	1
	62+00N	20	B	"	"	"		"	"	pebbly	10	43	12	1
	64+00N	20	B	med br.	"	"		"	grass moss buckwheat	pebbly	11	43	1	1
	66+00N	20	AB	"	"	mod to high		"	grass moss	pebbly	18	58	1	1
	68+00N	10	B	lt or br.	fine silty sand	low		flat	"	pebbly	8	42	1	1



SAMPLER Susan Kay  
DATE July 29/1982

PROJECT D.C. Syndicate - ORK

NTS

LINE

AIR PHOTO NO.

SAMPLE NO.	LOCATION	Depth (cm)	Horiz	DESCRIPTION				SLOPE	VEG.	ADDITIONAL OBSERVATIONS OR REMARKS	ASSAYS			
				Colour	Part Size	% ORG.	Ph				Cu	Zn	K	Su
109E	48+00N	3	B	lt yell br.	pebbly clay	low		gentle	grass moss	25' west of line	52	109	19	20
	50+00N	10	B	med br.	pebb silty sand	mod		"	"		22	54	2	2
	52+00N	3	A,B	lt or. br.	f clay silt	high		flat	"		48	98	2	1
	54+00N	5	B	med br.	pebbly clay	low		flat	moss		31	63	3	1
	56+00N	25	B	med br.	pebbly sand	high		gentle	grass moss		20	69	1	1
	58+00N	7	B	lt br.	coarse pebbly sand	mod		flat	"		23	65	1	2
	60+00N	10	A	black	loam	r. high		"	"		41	139	1	1
	62+00N	7	B	lt yell br.	pebbly silt	high		"	grass moss willow		21	63	6	1
	64+00N	7	B	lt or. br.	f pebbly silty sand	mod		"	"		12	55	1	1
	66+00N	20	A	black	loam	r. high		"	"		28	77	1	1
	68+00N	10	B	med br.	pebbly clay/silt	low		gentle	"		22	112	1	3
	70+00N	10	B	med br.	fine clayey silt	mod		mod	willow		73	169	22	13
	72+00N	10	A,B	dk br to black	loamy silt	high		mod	willow meadow		42	129	9	11
	74+00N	10	A	"	silty loam	r. high		flat	grass moss willow		35	120	1	3

SAMPLER BEN LAWSON  
DATE Jul, 27/82

PROJECT ORK (D/C Syndicate)

NTS \_\_\_\_\_  
LINE \_\_\_\_\_  
AIR PHOTO NO. \_\_\_\_\_

SAMPLE NO.	LOCATION	Depth	Horiz	DESCRIPTION				SLOPE	VEG.	ADDITIONAL OBSERVATIONS OR REMARKS	ASSAYS			
				Colour	Part Size	% ORG.	Ph				Ca	Zn	K	Sm
ORK-1)	87E 94N	8'		brn		15-20		mod	grassy		58	60	4	1
	92N	6'		"		10-15		"	"		72	86	1	2
	40N	8'		"		"		"	"		32	60	2	1
	38N	9'		"		"		"	"		15	58	1	2
	36N	6'		"		"		level	"		18	46	1	1
	34N	9'		"		"		"	"		59	95	1	2
	32N	7'		"		"		"	"		30	83	1	1
	30N	6'		"		"		"	"		16	68	1	2
	111E 50N	6'		brn		5-10		mod	rocky	possibly New Line	17	49	3	1
	52N	5'		"		10-15		level	grassy		53	92	10	7
	54N	8'		"		15-20		"	"		23	53	2	3
	56N	7'		dk brn		"		"	"		14	52	1	1
	58N	11'		"		"		"	"		22	70	13	5
	60N	5'		"		20-25		mod	"		52	215	7	11
	62N	6'		"		"		"	"		71	395	10	8
	64N	5'		brn		10-15		"	"		36	210	6	6
	66N	6'		"		"		"	"		35	150	5	6
	68N	10'		dk brn		"		"	"		28	116	7	8
	70N	8'		brn		10-15		"	"		56	125	12	5
	72N	6'		"		"		"	"		34	84	12	4
	74N	8'		"		15-20		"	"		34	92	10	1

SAMPLER A. Candy, N. Silins

DATE July 1, 1982

PROJECT - ORK claims  
D.C. syndicate

NTS

LINE 117

AIR PHOTO NO.

SAMPLE NO.	LOCATION	Depth	Horiz	DESCRIPTION				SLOPE	VEG.	ADDITIONAL OBSERVATIONS OR REMARKS	ASSAYS			
				Colour	Part Size	% ORG.	Ph				Cu	Zn	W	Sn
82DCDORL TUTE62N		8"	B	creamy brown	fine	low		moderate	grasses mosses	creamy brown colour perhaps limestone	7	80	1	2
64N		5"	B	fine brown		low		slight	gr.	lots of pebbles	13	83	1	1
66N		6"	B	light grey	fine	<del>low</del>		moderate	grasses		15	80	5	4
68N		4"	B	light brown	fine	0%		sl.	moss	frost bail	33	480	45	7
70N		4"-6"	B	dark brown	fine	<del>low</del>		moderate	grasses		19	94	10	3
72N		5"	B	br.		low		slight			14	78	6	2
74N		4"	B	light brown	fine pebbles	med		moderate	grasses lichen		12	78	2	5
76N		5"	B	grey		high		slight			38	100	5	3
78N		12"	B	black		high		none	grasses		20	146	1	1
80N		6"	B	br		high		slight	mosses		17	90	1	1
82N		12"	B	black		high		none	grasses		14	88	1	1

SAMPLERS N. Silins, A. Candy

DATE July 1, 1952

PROJECT ORK claims  
D.C. syndicate

NTS

LINE 119

AIR PHOTO NO.

SAMPLE NO.	LOCATION	Depth	Horiz	DESCRIPTION				SLOPE	VEG.	ADDITIONAL OBSERVATIONS OR REMARKS	ASSAYS			
				Colour	Part Size	% ORG.	Ph				Cu	Zn	W	Sn
82 DCD ORK T 119E B2N		5"	B	bl.		med		slight	gr.		14	26	1	1
80N		6"	"	bl		high		slight	gr		13	93	2	1
78N		10"	"	bl.		high		slight	gr.		19	93	1	2
76N		4"6"	"	black		low		slight	grasses masses		21	70	3	1
74N		5"	"	dk br.		med		slight	gr.	by limestone rubble	12	153	12	2
72N		6"	"	gr. br		med		moder	grasses moss	near limestone rubble	13	88	2	2
70N		10"	"	gr. br.		low		slight	gr.		18	115	1	2
68N		6"	"	grey brown		med		mod	grasses + flowers		20	87	5	5
66N		4"	"	light br.		low		slight	gr.	frost boil - lots of pebbles	38	105	16	23
64N		4"	"	dark tan brown		low		mod	none	frost level	10	41	175	1
62N		3"	"	tan		0%		slight	gr.	con. fragments of limestone.	2	56	1	1

**J.C. STEPHEN**  
EXPLORATIONS LTD.

## GEOCHEMICAL DATA SHEET - SOIL SAMPLING

SAMPLER N. Silins / A. CandyDATE July 6<sup>th</sup> / 82PROJECT ORK

NTS

LINE

AIR PHOTO NO.

SAMPLE NO.	LOCATION	Depth	Horiz	DESCRIPTION				SLOPE	VEG.	ADDITIONAL OBSERVATIONS OR REMARKS	ASSAYS			
				Colour	Part Size	% ORG.	Ph				Cu	Zn	W	Sn
82 DCD 6L10N		5"		w	sandy	low		steep	gr.		35	91	6	1
8N		6"		bl.		high		steep	mossy		29	76	8	1
6N		3'		bl.		high		steep	mossy	15m past last sample - rocky slope	22	130	1	1
4N		5"		br/gr		low		"	"	frost boil	31	69	1	1
2N		4"		br.		low		steep	"		33	94	1	1
82 DCD 4E 2N		3'		br.		high		steep	bb rocky		22	72	1	1
4N		5"		br		high		steep	bl/gr		19	104	1	1
6N		4"		br		med		steep	gr.		30	64	1	1
8N		7"		bl/br.	fine	low		steep	gr.		82	160	1	1
10N		3' 8"		br		low		steep steep	gr. rocky	frost boil	65	101	1	1
82 DCD 10N 2E		8"		br.		low		steep	rocky		21	52	1	1
8N		6"		dk br.		med high		steep	mossy		21	69	1	1
6N		8"		dk br.		high		steep	mossy		16	54	1	1
4N		14"		br.		high		steep	bb mossy		39	73	1	1
2N		10'		dk br.		high		steep	mossy bb		18	71	1	1





SAMPLER N. Silins / A. CandyDATE July 6<sup>th</sup>PROJECT GRK

NTS \_\_\_\_\_

LINE \_\_\_\_\_

AIR PHOTO NO. \_\_\_\_\_

SAMPLE NO.	LOCATION	Depth	Horiz	DESCRIPTION				SLOPE	VEG.	ADDITIONAL OBSERVATIONS OR REMARKS	ASSAYS			
				Colour	Part Size	% ORG.	Ph				Cu	Zn	W	Sn
82 DC DT 101		3"		lt br.	fine	med		mod.	rocky		67	160	5	1
102		3"		br.		low		mod.	rocky		44	255	1	1
103		2"		br.	fine	0%		mod.	rocky		30	140	1	1
82 DC DT 2										Coarse grains of marble at Gravit Contact	2	14	1	1
3										Rusty Cherty Quartz talus.	169	61	21	1
										These samples 200-207 sent for Rock Geochem / To coarse for talus Snd.				
82 DC DT ORK 200										Arg Rusty Silicious				
201										Black Arg Cherty Rusty				
202										Black Arg Yellow oxide				
203										Black Arg Yellow oxide				
204										" " less oxide				
205										S.1 Grey Arg Rusty				
206										Black Arg				
207										" "				





SAMPLER MORRIS & MINDY

PROJECT CRK - DELTA CAMP

NTS 105 C

LINE MAP SHEET 105 C

DATE JUNE 15/82

AIR PHOTO No. A 11474 B

SAMPLE NUMBER	LOCATION	ROCK TYPE	ALTERATION	MINERALIZATION	STRIKE / DIP	ADDITIONAL REMARKS	APPARENT WIDTH	TRUE WIDTH	ASSAYS			
									Au.	Ag	Sr	Cu
80705 B	SEC MAP	META SS	RUSTY	Py, Chalco		ROCK GEOCHEM.			110	0.2	↓	107
80706 B		META SS	"	"		FLOAT ROCK GEOCHEM			20	1.9	↓	112
80707 B		QUARTZITE	"	"		ROCK GEOCHEM			10	0.2	↓	57
80708 B		QTZ IN META SS	"	Py		CHLDR. MICA R. GEOCHEM			40	0.1	↓	21
80709 B		QUARTZITE	"	Py, Chalco		ROCK GEOCHEM			110	0.9	↓	720
80710 B	ASSAY	QUARTZITE	"	Py, Arsenic, Pyrite, Chalco		NEWMONT CIRQUE ASSAY			0.003g	0.01	0.01	0.01
80711 B	ASSAY	QUARTZITE	"	Py, Pyrite, Chalco		CLIMHO ASSAY			0.005g	0.01	0.04	0.04
80712 B		QUARTZITE	"	Pods of Arsenic		FLOAT R. GEOCHEM			110	0.2	↓	85
80713 B		QUARTZITE	"	Py, Chalco		LENS OF QTZ R. GEOCHEM			110	0.2	↓	19
80714 B		SUCCESSIVE ARSENITE	"	Py, Chalco		RIDGE TOP R. GEOCHEM			20	0.4	↓	175
80715 B		QUARTZITE	"	Py, Chalco, Pyrite		FORCED HEAVE R. GEOCHEM			110	0.5	↓	108
80716 B		QUARTZITE	"	Py, Arsenic		FLOAT R. GEOCHEM			110	0.3	↓	25
82DCDTRK 1		META SS	"	—		TALUS SANDS GEOCHEM			19	0.1	↓	57
96716 B		QUARTZITE	"	Py, Chalco, Pyrite		OUTCROP R. GEOCHEM			10	0.1	↓	61
96717 B		QUARTZITE	"	Py, Chalco		OC undulates LS. R. GEOCHEM			10	0.1	↓	130
96718 B		QUARTZITE	YELLOW	Py, Chalco, Pyrite		OC Yellow GELISSA R. GEOCHEM			110	0.8	3	370
96719 B		LS & SKARN	GREY WEATHER.	GREEN GARNETS		VERY NARROW SKARN R. GEOCHEM					21	
96720 B		QUARTZITE	RUSTY	Py		MUCH QUARTZ R. GEOCHEM			20	0.2	4	225
96721 B		QUARTZITE	RUSTY YELLOW	Py, Chalco, Pyrite		MINERAL VEINS R. GEOCHEM			10	0.3	5	128
96722 B		QUARTZITE	RUSTY	Py		OUTCROP R. GEOCHEM			110	0.1	↓	9



SAMPLER R Campbell / M Webster

PROJECT DC Syndicate ORK

LINE

DATE June July / 82

AIR PHOTO No.

SAMPLE NUMBER	LOCATION	ROCK TYPE	ALTERATION	MINERALIZATION	STRIKE / DIP	ADDITIONAL REMARKS	APPARENT WIDTH	ASSAYS				
								Cu	Ag	Au	W	Sn
80732B	See Map	Sil Arg Grey Granite	Calc Silicate Veins	Chalco Pyrrho		At contact of P.S. 1 Arg and Calc Silicate	54					1
80733B	"	Qtzite		Pyrrho		Rusty exterior						
80734B	"	leucogranite		Qtz Plag musc. Amph.		Orange fluorescence						37
80735B	"	limy Arg with Marble				Possible yellow fluorescence along bed surface maybe moss						1
80736B	"	Silicious Calc Silicate		Axenite								1
80737B	"	Calc Silicate		Axenite		From a Block Possibly OC						1
80738B	"	med-coarse Granite		Qtz Plag Musc								10
80739B	"	Coarse Pegmatite		Qtz Green Plag Musc. Fbrite?	Pyke	Yellow + Green fluorescence Cuts Marble in Creek				98		9
96731B	"	Cherty Arg		Py Fine + Diss			109		10			90
96732B	"	High Cherty	Shear zone?			Small fragments of Chert intermixed with Arg.	230	0.6	20			15
96733B	"	Sulphide Flint	Rusty weathering	Py massive vein		Found a large boulder Chert Arg.	375	1.1	60			4
96734B	"	Arg	Rusty stain	Py Fine Diss								
96735B	"	Cherty Arg		Py Fine Diss		Occurring in Aggregated clouds	51		20			2
96736B	"	Cherty		Py Fine Diss minor Chalco			310		410			7
96737B	"	Peg Granite Marble Contact		Qtz Musc. Plag		Yellow Fluorescence						37



A P P E N D I X   I I I  
S T A T E M E N T S   O F   Q U A L I F I C A T I O N S

STATEMENT OF QUALIFICATIONS

I, Robert W. Campbell, am a student in the Honors Bachelor of Science Program at Laurentian University, Sudbury, Ontario.

I have the following employment experience: -

May - Sept. 1981 Geological Assistant with J.C. Stephen Explorations Ltd., employed on a tin skarn project in the Swift River, Yukon area.

June - Sept. 1982 Party chief with J.C. Stephen Explorations Ltd., employed on a skarn exploration and property development program in the Swift River - Teslin Yukon area.

September 1982

R.W. Campbell

STATEMENT OF QUALIFICATIONS

J.C. STEPHEN

Academic

1950 Associate Member British Institute Engineering Technology  
1950-1951 One year Geology University of Alberta

Experience Summary

1947-1955 Development and production experience in engineering and geology at Central Patricia Gold Mines, Eldorado Mining and Refining, Madsen Gold Mines, Hasaga Gold Mines, Pickle Crow Gold Mines as Surveyor, Assistant to the Engineer, Geologist.

1955-1959 Regional exploration experience with Pickle Crow Gold Mines, Combined Developments Ltd., R.G. Crosby and Associates, Jay-Kay Syndicate as Field Geologist.

1959-1961 Municipal construction including monolithic concrete tunnels as Senior Inspector.

1962-1968 Regional exploration with Mastodon Highland Bell Mines as field geologist.

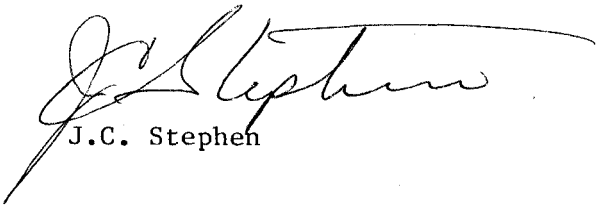
1968-1976 Regional exploration with Bacon and Crowhurst Ltd., as supervisor of exploration syndicates.

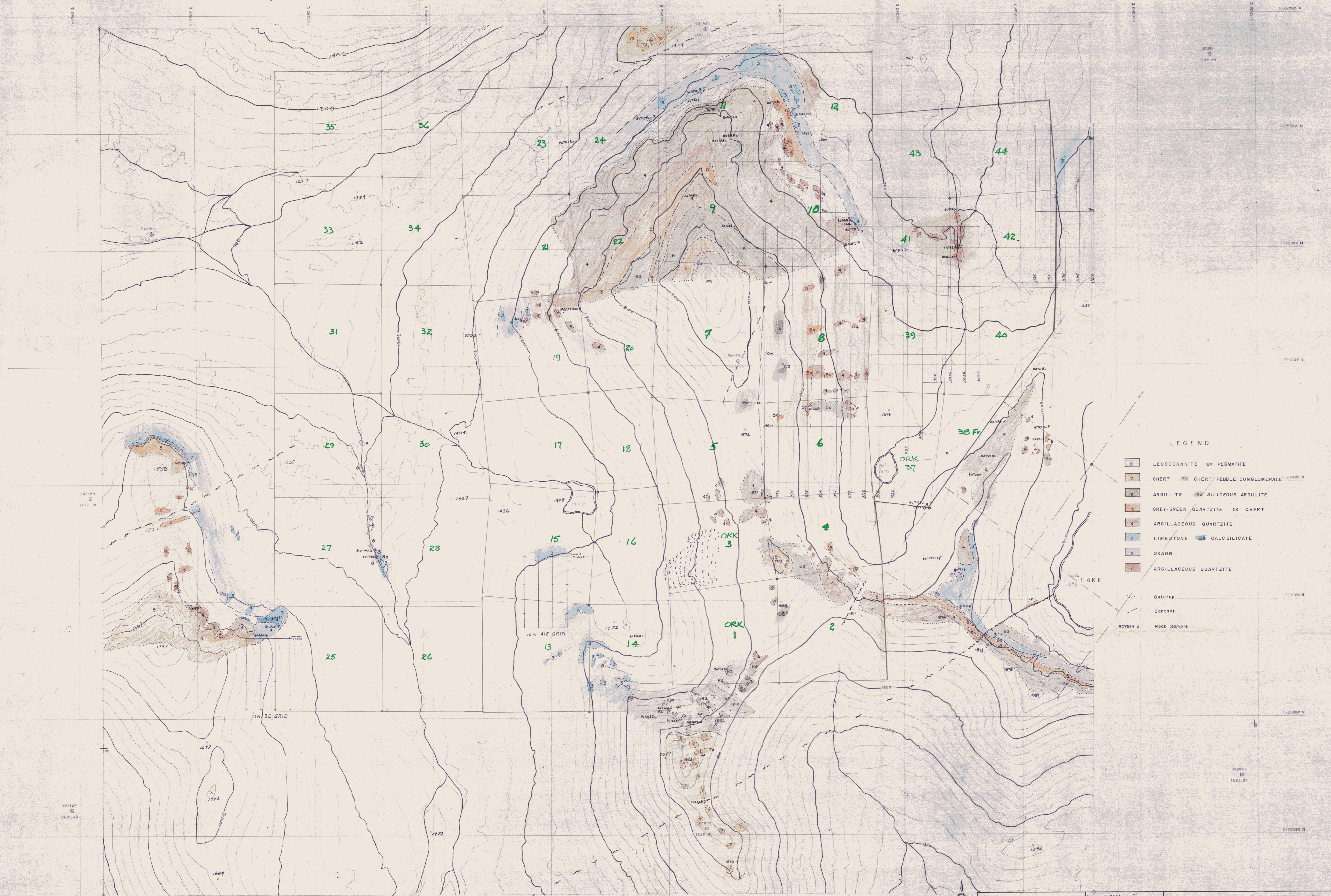
1977-Present President J.C. Stephen Explorations Ltd.

Manager	D.C. Syndicate	(Dome, Cominco)
Manager	Target Project	(Dome Exploration)
Manager	B.C. Gold Syndicate	(Newmont, McIntyre, Canada Tungsten)
Manager	Newex Syndicate	(Newmont, Lornex)

During June and July 1982 I was responsible for supervision of the field crew on ORK 1 - 44 and prepared this report from the data collected.

September 10, 1982

  
J.C. Stephen



LEGEND

- 8 LEUCOGRANITE 8a PEGMATITE
- 7 CHERT 7a CHERT PEBBLE CONGLOMERATE
- 6 ARGILLITE 6a SILICEOUS ARGILLITE
- 5 GREY-GREEN QUARTZITE 5a CHERT
- 4 ARGILLACEOUS QUARTZITE
- 3 LIMESTONE 3a CALCILICATE
- 2 SKARN
- 1 ARGILLACEOUS QUARTZITE

- Outcrop
- Contact
- 80708 x Rock Sample



Scale - 1:5000  
 Contour - 20 Metres  
 Date - May 1992  
 Job No. - 05844-0  
 Sheet No. 1 of 1

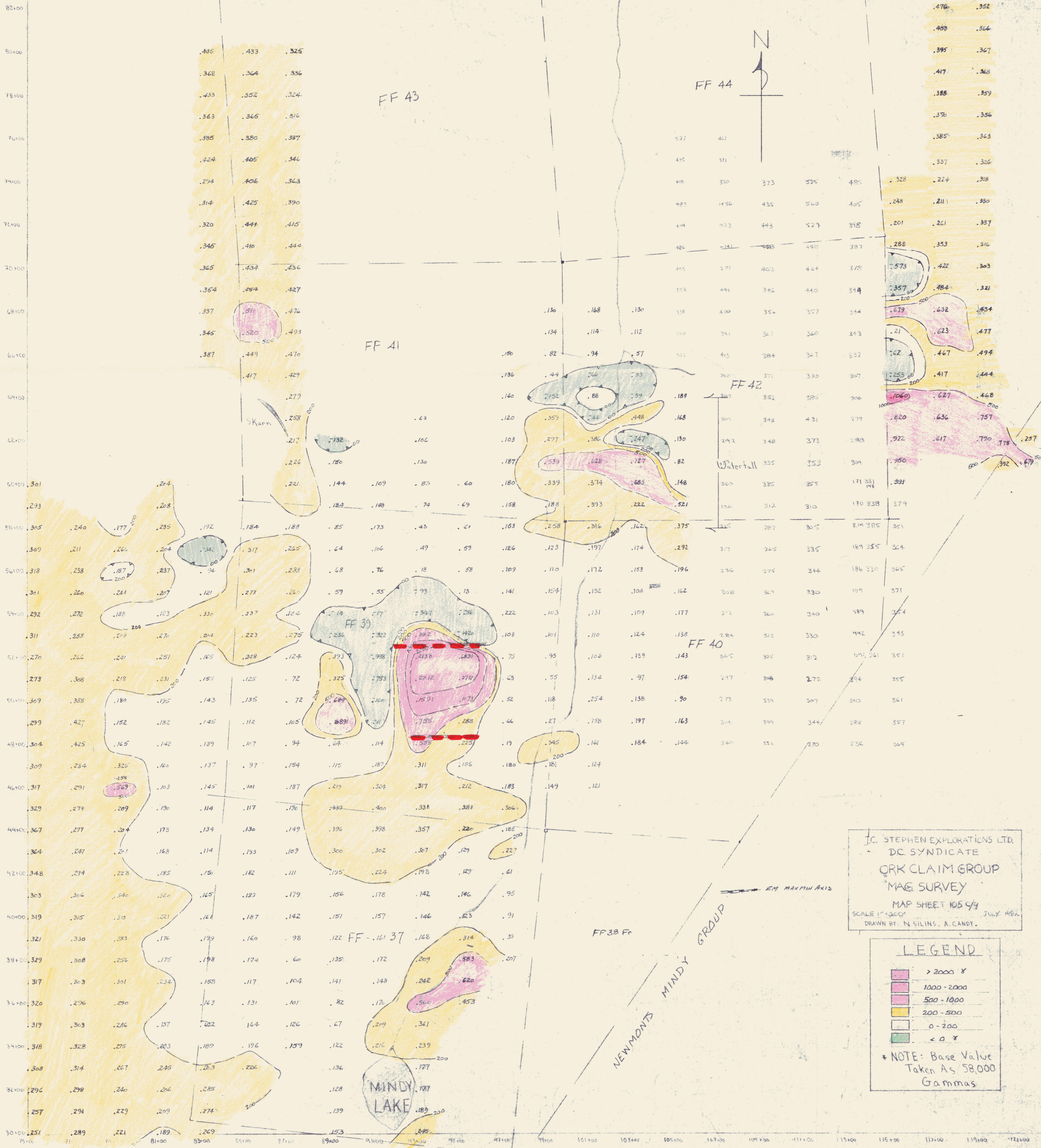
J.C. STEPHEN EXPLORATION LTD.

ORK 091364

PRELIMINARY RECONNAISSANCE TYPE MAPPING

McElkenny Surveying & Engineering Ltd.  
 200-1186 Atsani Street, Vancouver, B.C., Canada

Scale of photography 1:30000 From 1948

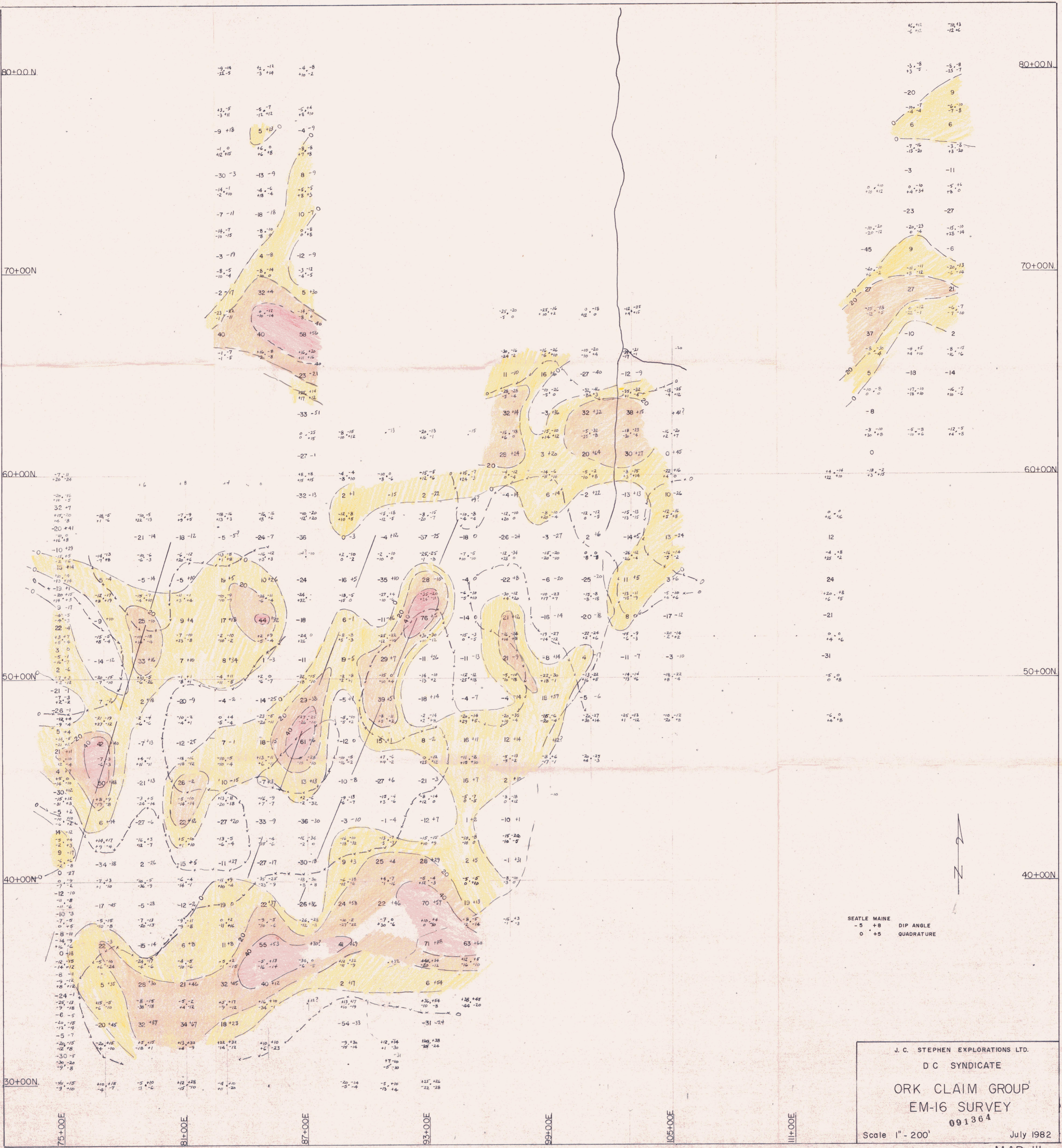


J.C. STEPHEN EXPLORATIONS LTD.  
 DC SYNDICATE  
 ORK CLAIM GROUP  
 MAE SURVEY  
 MAP SHEET 105 4/9  
 SCALE 1" = 200' JULY 1962  
 DRAWN BY: N. SILINS, A. CANDY.

**LEGEND**

- > 2000 γ
- 1000 - 2000
- 500 - 1000
- 200 - 500
- 0 - 200
- < 0 γ

\* NOTE: Base Value Taken As 58,000 Gammas



80+00.N

70+00N

60+00N

50+00N

40+00N

30+00N

80+00.N

70+00N

60+00N

50+00N

40+00N

75+00E

81+00E

87+00E

93+00E

99+00E

105+00E

111+00E

SEATTLE MAINE  
-5 +8  
0 +5  
DIP ANGLE  
QUADRATURE

J. C. STEPHEN EXPLORATIONS LTD.  
D C SYNDICATE  
ORK CLAIM GROUP  
EM-16 SURVEY  
091364  
Scale 1" = 200'  
July 1982

MAP III

80+00N

80+00N

70+00N

70+00N

60+00N

60+00N

50+00N

50+00N

40+00N

40+00N

30+00N

75+00E

81+00E

87+00E

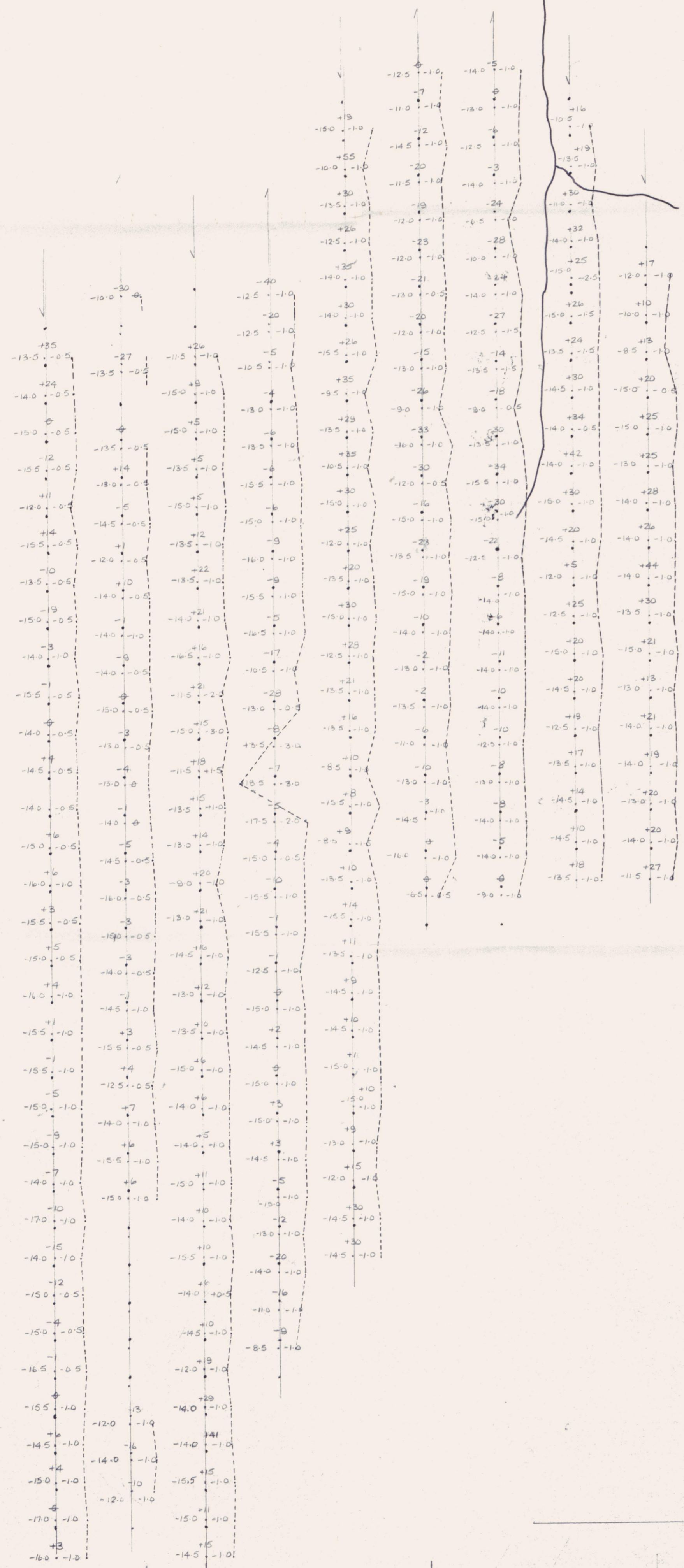
93+00E

99+00E

105+00E

111+00E

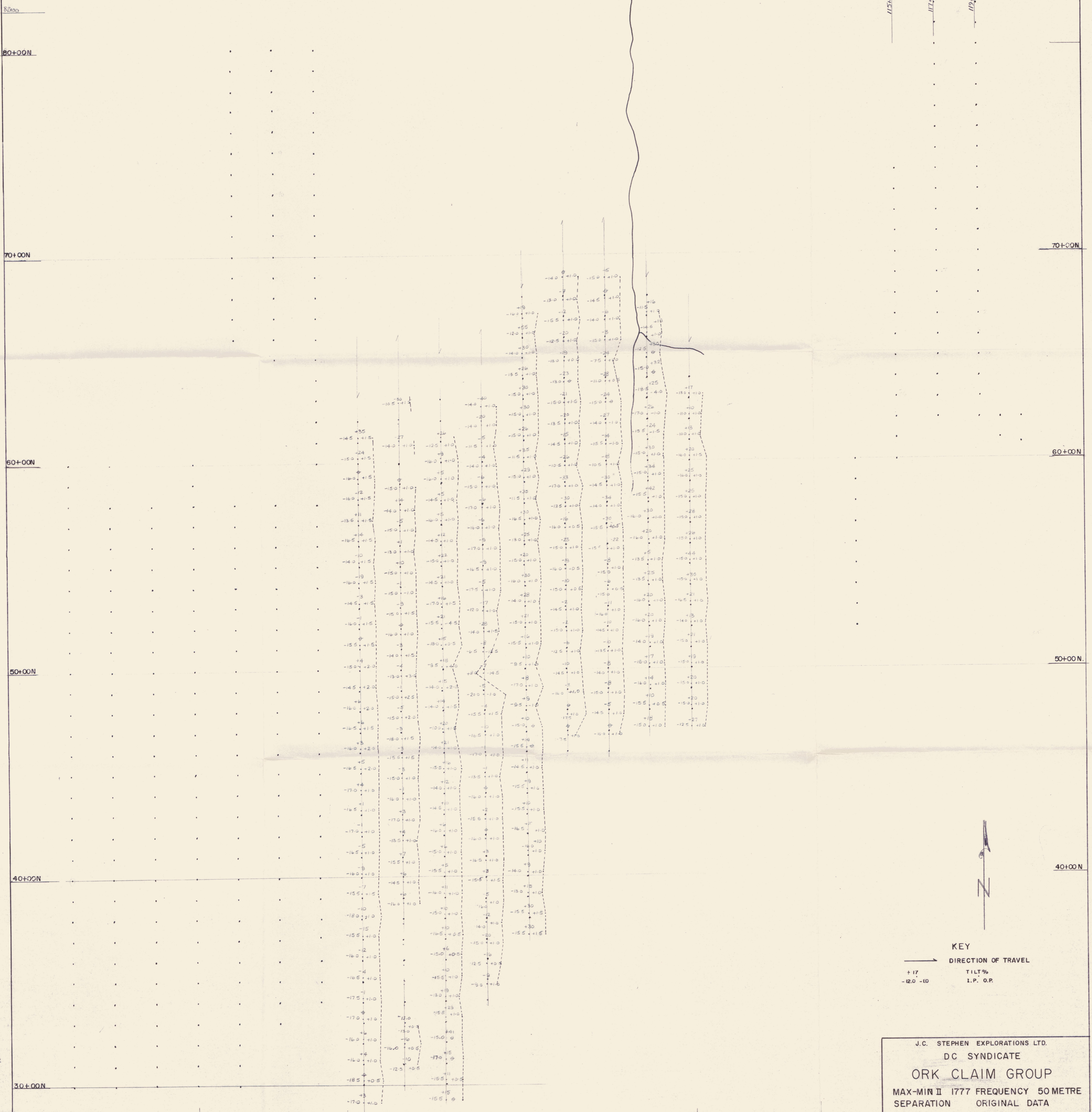
117+00E



KEY  
 → DIRECTION OF TRAVEL  
 +17 TILT %  
 -12.0 -10 I.P. O.P.

J.C. STEPHEN EXPLORATIONS LTD.  
 D.C. SYNDICATE  
**ORK CLAIM GROUP**  
 MAX-MIN II 444 FREQUENCY 50METRE  
 SEPARATION ORIGINAL DATA  
 Scale 1"=200' 091364 July 1982

MAP IV



KEY  
 → DIRECTION OF TRAVEL  
 +17 TILT%  
 -12.0 -10 I.P. O.P.

J.C. STEPHEN EXPLORATIONS LTD.  
 DC SYNDICATE  
**ORK CLAIM GROUP**  
 MAX-MIN II 1777 FREQUENCY 50 METRE  
 SEPARATION ORIGINAL DATA  
 Scale 1" = 200' 091364, July 1982



KEY  
 ———→ DIRECTION OF TRAVEL  
 +17 TILT %  
 -120 -1.0 I.P. O.P.

J.C. STEPHEN EXPLORATIONS LTD  
 DC SYNDICATE  
**ORK CLAIM GROUP**  
 MAX-MIN II 444 FREQUENCY 150 METRE  
 SEPARATION ORIGINAL DATA  
 Scale 1" = 200' 091364 July 1982

80+00N  
80+00N

70+00N  
70+00N

60+00N  
60+00N

50+00N  
50+00N

40+00N  
40+00N

30+00N  
30+00N

80+00N  
80+00N

70+00N  
70+00N

60+00N  
60+00N

50+00N  
50+00N

40+00N  
40+00N

30+00N  
30+00N

75+00E

81+00E

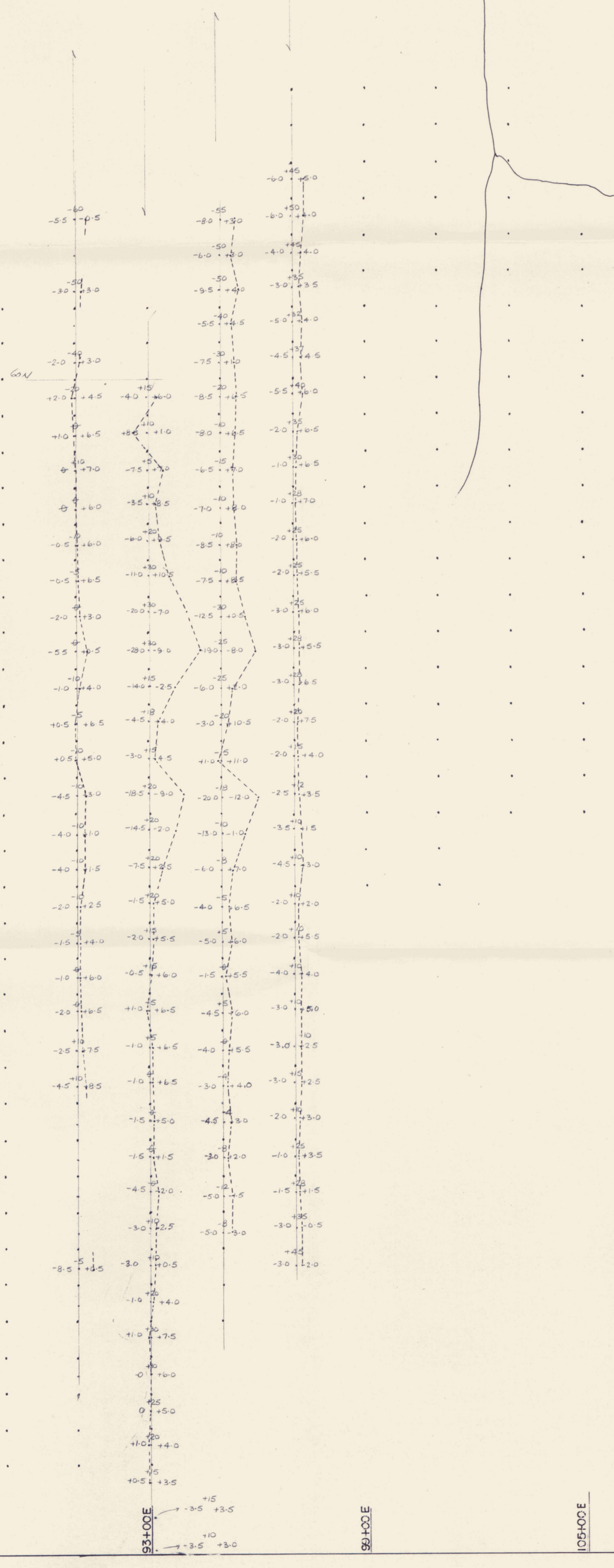
87+00E

93+00E

99+00E

105+00E

111+00E



KEY  
 → DIRECTION OF TRAVEL  
 +17 TILT %  
 -12.0 -1.0 I.P. O.P.

J.C. STEPHEN EXPLORATIONS LTD.  
 DC SYNDICATE  
 ORK CLAIM GROUP  
 MAX-MIN II 1777 FREQUENCY 150METRE  
 SEPARATION ORIGINAL DATA  
 Scale 1"=200' July 1982

091364 MAP VII

