3099

GEOPHYSICAL - GEOCHEMICAL REPORT

ON

CLAIM GROUP -

Victoria, Elmore Fraction, Copper Canion, Victoria Fraction, Susan, Klondyke (known as the Copper Canion Group)

COPPER CANYON (L-22G) this rpt.

CLAIM RECORD NUMBERS -

21G, 91G, 22G, 90G, 23G, 68G

LOCATION -

About 20 miles by road N.W. of the City of Duncan, B.C., on the Chemainus River Road. Approximately 8 miles west of Highway No. 1, and approximately at Latitude 48^0 - 52'N., Longitude 123^o - 48'W., Victoria Mining District, B.C.

AUTHORS -

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under supervision of
F.C. Loring, P.Eng.,

HOLDERS OF CLAIMS -

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A.B.L. WHITTLES
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FIELD WORK DONE BETWEEN APRIL, 1971 and JUNE, 1971.

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ASSESSMENT REPORT SUMMARY

Pyrite - chalcopyrite mineralized schist zones along the Chemainus River at Copper Canyon, and the remains of an old adit have lead to the use of V.L.F. (Very Low Frequency)-EM, Crone J.E.M. (Electromagnetic) and magnetometer reconnaissance surveys.

These surveys located several zones which appear to have higher conductivity than the surrounding rock; over one of these zones a detailed grid was set up. Detailed V.L.F.-EM, magnetometer, geochemical, seismic and I.P. (Induced Polarization) measurements were obtained.

The conducting zone (Group B anomalies) over which the detailed work was carried out appears to be about 25 - 40 feet under the surface, 10 - 15 feet wide and at least 175' long. The western end of the anomaly has not yet been reached. The overburden appears to be about 20 - 25 feet deep and consists of till (based on the seismic results). The rock to the south of the large conducting body seems to be a high seismic velocity material such as diorite.

It is recommended that the largest zone of the Group B anomalies be drilled to further explore this zone.

The surveys were carried out during several days in April and May 1971 and the plotting and interpretation took place in May and June.

Field supervision and interpretation was carried out by Dr. A.B.L. Whittles, Ph.D., consulting geophysicist and Mr. F. Loring, P.Eng.

1. HISTORY

The first recorded mining interest in the Mount Sicker area occurred in the year 1897, following a forest fire which exposed gossans on what would later become the Lenora and Tyee south ore bodies of Mount Sicker Mines.

The claim area first appears in the Minister of Mines annual report for the year 1898, which reported on the Copper Canyon claim as follows:

> "On this claim a tunnel has been run 100 feet alongside a quartz reef highly mineralized with copper pyrites. The width of the reef is 18 inches."

The claim area again appears in the 1903 report, which mentions mineralized lenses occurring on the Victoria and Copper Canyon claims, and states that they are smaller size than previously noted, with the largest showing a width of only 6 or 7 feet, and the mineralization consisting of Quartz, with iron sulphides, or pyrrhotite, with a small quantity of chalcopyrite. They also state that the barites found on the upper part of the hill, i.e. the Mount Sicker orebody, are lacking. Again in the 1903 report, the claim area is reported on as being owned by the Mount Sicker and Brenton Mines, Ltd., who did extensive work on the Victoria and Copper Canyon claims. The report states that these claims are located along the strike of, and on the same band of schists as occurring on the Tyee and Lenora properties, and that this band can be traced from these properties through the Victoria and Copper Canyon claims. On the Victoria claim, there was reported 2 test pits, and a tunnel 150 feet in length, driven below the pits. Two short cross-cuts from this tunnel showed a mineralized zone in the schist to the north, and diorite to the south. On the steep bank of the river, outcrops of fairly solid iron sulphides were reported, and were tested by tunnels a few feet long, showing a small amount of copper, and low gold values.

Again in the 1903 report, work is reported on the west bank of the river, on the Copper Canyon claim. Here a tunnel was driven to the west following the strike of the schists for 310 feet. A quartz vein varying in width from one to 18 inches can be traced in the roof of this tunnel for 135 feet from the mouth, at which point it stops. From this tunnel 5 cross-cuts were driven, in north and south directions, obviously looking for an extension of this quartz vein, but without success. From the end of the tunnel, a raise was being driven up to surface. The only mineralization of any importance noted was in the quartz vein, which contained a considerable amount of iron sulphides and some small percentage of copper, with low gold values.

The claim area appears again in the 1928 report, as being owned by the Chemainus Valley Mining Company, Limited, a re-organization of the Mount Sicker and Brenton Mines, Limited. The report is as follows:

> "Considerable work was done on the property before the war, consisting of a 300 foot shaft, and drifts from it on one claim, a short tunnel and a great deal of surface work on another claim, all exposing, it is stated, some attractive copper showings. The company is contemplating resuming operations in the near future."

Mineral rights were acquired by the present owners in 1970. Progress to date is covered by the accompanying reports.

2. INSTRUMENTS USED

(i) V.L.F. - EM Units

The instruments used for this portion of the work were: the Ronka EM-16 and the Crone Radem. Both make use of the magnetic part of the electromagnetic waves emitted by the U. S. submarine radio stations. The station used in this survey was Jim Creek Washington (near Seattle) at 18.6 Kilocycles/sec.

The Ronka EM-16 measures the tilt angle (to $\pm \frac{1}{2}^{\circ}$) of the magnetic component of the V.L.F. - EM wave. Only the tilt angle measurement of this instrument was used.

The Crone RADEM is a similar instrument except that both the tilt angle (to ± 1° in most readings) and field strength (FS to ± 10%) were recorded and used.

The ground slope was also recorded in degrees so that the effect of topography could be estimated.

The first derivative of the tilt angle (the slope of the tilt angle plot, which is found by subtracting one station's tilt angle value from that of the next station and dividing by the distance between stations) was also used since it is less influenced by topography. The values of the first derivative are in degrees per foot (°/ft.).

Interpretation is based on methods discussed by Whittles (1969) and Frazer (1969).

(ii) E.M. Survey Unit

A Crone J.E.M. two frequency unit was used. Measurements precise to ± 1° in resulting tilt angle. Frequencies are 480 cps. and 1800 cps.

The unit consists of two coils each with a transmitter - receiver unit and battery. While one loop is transmitting from a vertical position (plane of coil vertical) the other is receiving. The coils are then reversed as receiver and transmitter. The dip angle for both 'chief' and 'helper' are recorded. In this survey two spacings between loops were used at different stations - 50' and 100'. The resulting dip angle (the addition of that obtained by 'helper' and 'chief') is plotted at the center station between the two loops.

(iii) Magnetometers

Two units were used - the McPhar M700 (precision ± 5 gammas) and the Sabre Mark II (precision ± 20 gammas) produced by Geotronics Instruments Ltd., Burnaby, B.C. All data was corrected to base station (00W, 00N) as -90 gammas. All surveys were looped into the base station and corrected for drift and magnetic variations.

(iv) Geochemistry Kit

A field kit made by Jens Morgenson Laboratories, Toronto) was used. All soil samples were taken by an auger from a depth of about 3 feet.

300 mg. of each sample was placed in a test tube and 5 ml. of the heavy metal buffer was added. The solution was shaken and then centrifuged. It was then decanted and 1 ml. of the indicator solution added. The color of the indicator gives a rough guide to the percentage of heavy metal present in the sample. (blue ‸ 50 ppm., purple ‸ 100 ppm., red ‸ 200 ppm.)

(v) Induced Polarization Unit

A Crone Condensor Discharge unit was used. Precision in determining chargeability was estimated to be ± 0.5 milliseconds. Both chargeability and resistivity were calculated. The Wenner array was used as electrode arrangements. Porous pots filled with saturated $CuSO_4$ solution were used for voltage electrodes. Current electrodes were copper stakes. All electrodes were wet with a salt solution before readings were taken.

(vi) Seismic Unit

A Soiltest Inc. Model 117C seismic timer was used. Reading precision to ± 10%, or better. The unit consists of a seismic timer, a hammer and hammer plate.

(vii) Line Surveying Equipment

Lines were surveyed and cut where necessary. Brunton compasses on tripods and 'poly chains' were used for most lines. Distances were corrected for slope, which was estimated with Suunto inclinometers.

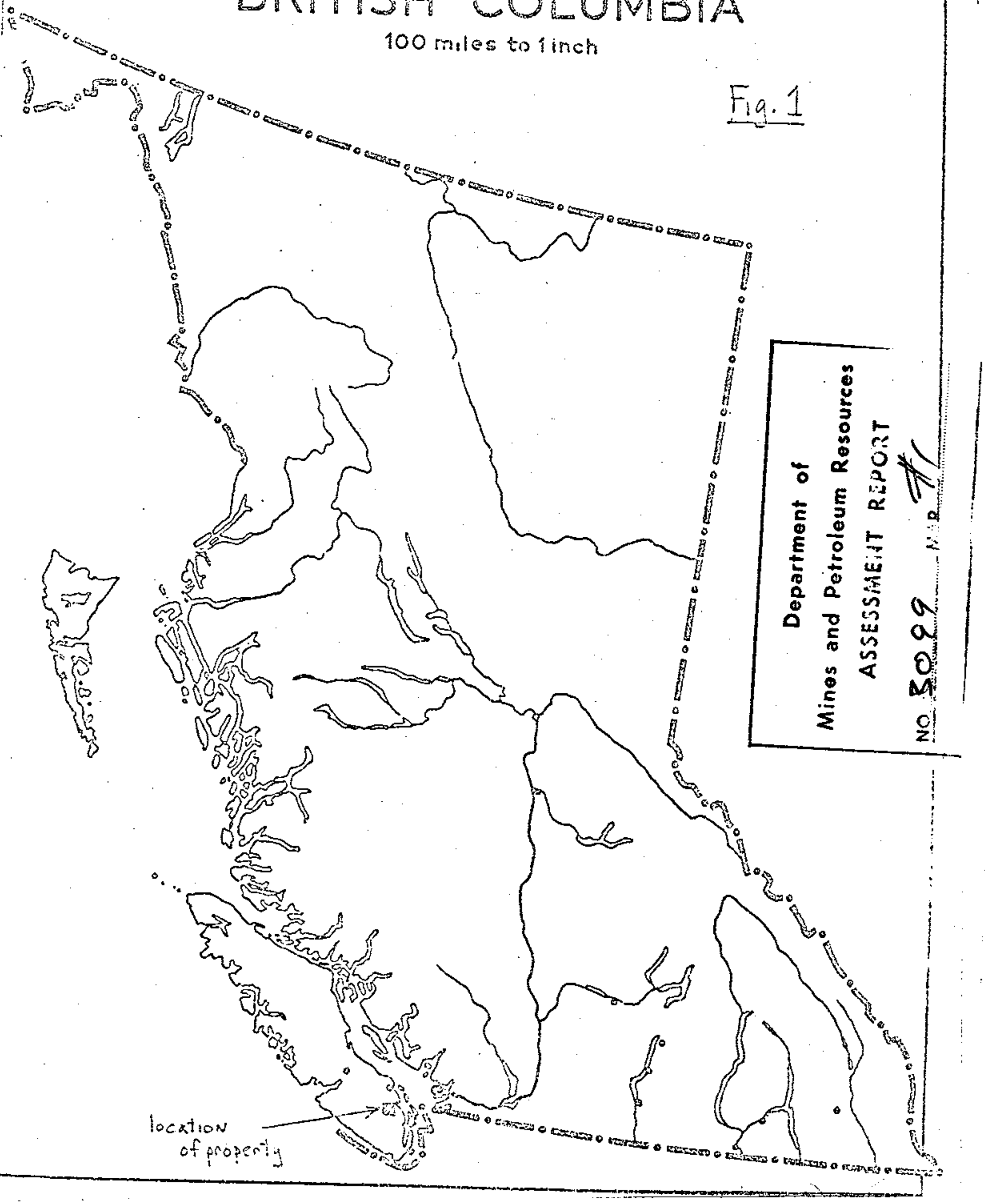
It is estimated that the 100' station locations are precise to about ± 10 feet while the station locations over the grid centered at 400W, 300S are precise to ± 2 feet.

6a

BRITISH COLUMBIA

100 miles to 1 inch

Fig. 1



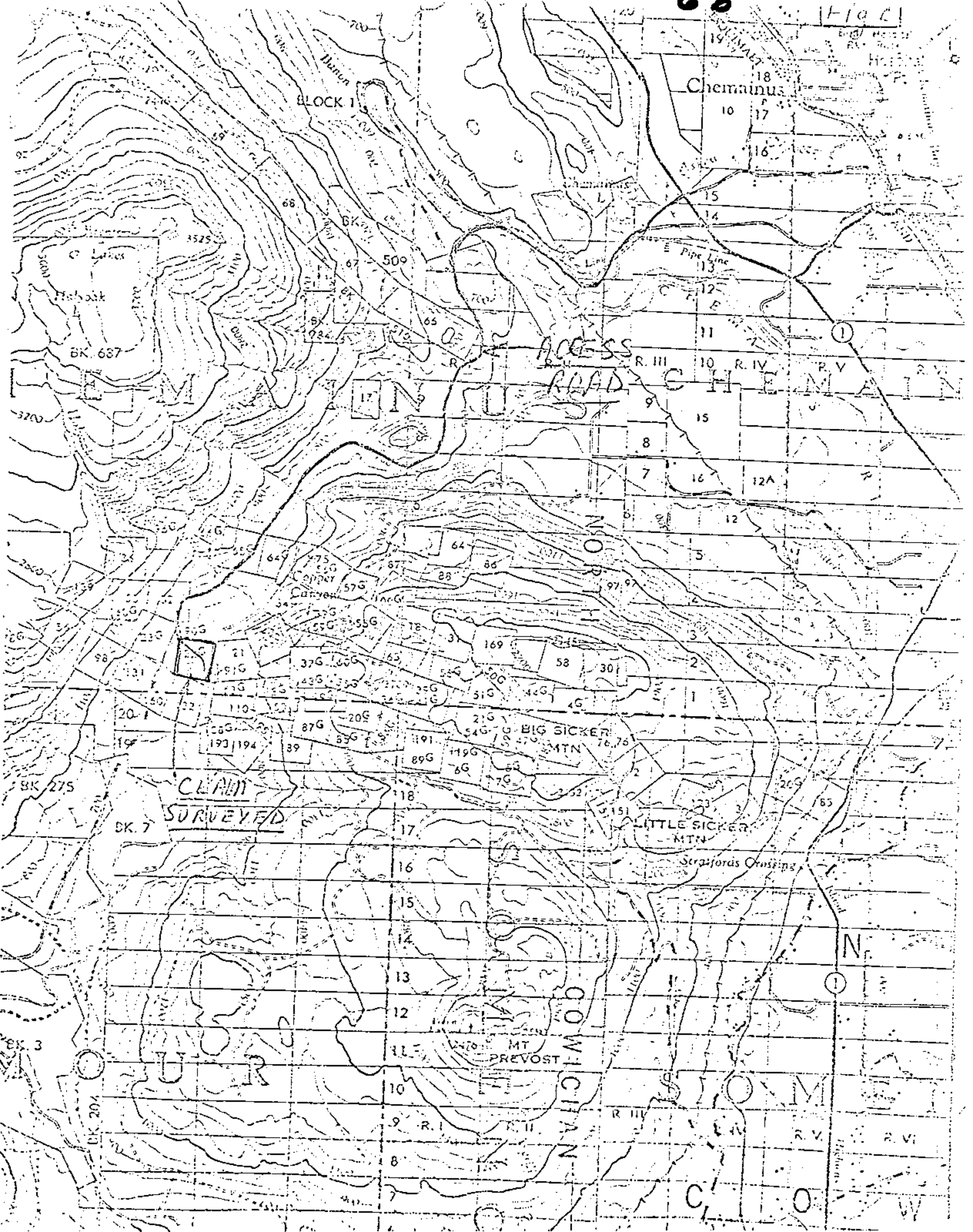


Fig C
Chemainus
BLOCK 1
ACCESS ROAD
Pipe Line
Holyoak L
BK. 687
R. III
R. IV
R. V
R. VI
Copper Canyon
BIG SICKER MTN
LITTLE SICKER MTN
Straffords Crossing
CLAIM SURVEYED
BK 275
BK. 7
MT PREVOST
R. I
R. II
BK. 3
BK 204

3. PROPERTY DESCRIPTION LOCATION AND ACCESS.

The property location is shown in Figures 1 and 2, near the town of Chemainus, on Vancouver Island, B.C., Canada. It is reached by use of the MacMillan-Bloedel logging road starting at the Island Highway just south of Chemainus cutoff. Some 8 miles along the logging road a small side road cuts off to the east and enters claim 22G. This claim access road proceeds right down to the Chemainus River as shown in Figure 3. Several old logging roads cut through the property as does the Chemainus River and a small stream. The property is fairly flat to the west, but steep near the river. An old mine adit on the River's edge is a short distance north of an old shaft. This mine shaft, close to 300S - OW is about 15 feet across and 30 feet deep. There are the remains of several old buildings and machinery in the area.

Most of the area is covered with overburden, and small and large trees with slight undergrowth.

The geological features will be described in Section 5. The observable structure - at the River's edge - showed a number of schistic formations, with minor mineralization, striking S 80°W and dipping about 70° to the south. Mineralization is mostly pyrite with some chalcopyrite.

4. OWNERSHIP

The Copper Canyon Group of claims is owned by Mr. G. Kinnard, Nanaimo, Mr. F. Loring, P.Eng., Coombs, and Dr. A. B. L. Whittles of Nanaimo.

These claims are:

NAME	RECORD NUMBER
Victoria	21G
Elmore Fraction	91G
Copper Canyon	22G
Victoria Fraction	90G
Susan	23G
Klondyke	68G

5. GEOLOGY

The area consists of diorite and schist formations running nearly east and west. The schist formation observed on Claim 22G is assumed to be the same formation which runs through the Mt. Sicker Mines Ltd. group of claims to the east. The Annual Report of the Minister of Mines (1928) notes that there are two mineralized zones on the claims to the east (on Mt. Sicker). These include one (at the southern edge of the schist zone that runs through the property) which has 'higher copper and lower zinc content than the north vein'. The north vein is located at, or close to, the northern edge of the schist zone.

On claim 22G the schist zones are apparent on the river bank, and strike about N. 80°E, dipping 70° to the south. The mineralization on claim 22G appears to be, in part, related to the schist zones, somewhat in the manner of the Mt. Sicker deposits. The schist zones on claim 22G are reported to be more silicious, more compact and less foliated than the Mt. Sicker deposits.

The old adit on claim 22G apparently was exploring the southern edge of a schist zone. According to the 1898 Annual Report the mineralized zone explored by this old adit was a 'quartz reef, highly mineralized with copper pyrites. The width of the reef is 18 inches'. Some mention is made of the magnetic mineral pyrrhotite in the 1903 Annual Report. The deposit appears to lack the large percentage of barite found in the Lenora-Tyee (on Mt. Sicker) deposits.

The mining report of 1903 discussed the underground work to some extent. The mineralization observed on the river bank disappeared 135 feet in, which corresponds to the V.L.F.-EM high observed at 100W, 200S (which appears quite localized). The adit continues for another 200 feet with cross-cuts off north and south. Most of the underground work beyond the 135 feet cut off appears to be in the schist zone.

Other quartz veins were observed to the south of the adit. One (at approximately 200W 800S - see Fig. 3) was opened by a short blast hole and a grab sample taken. This assayed at 10.2% copper. These small veins appear to strike in a different direction to the shear zones, about N 65°W.

6. GEOPHYSICAL SURVEYS

I. RECONNAISSANCE PROCEDURES

(a) General Field Procedures (Refer to Fig. 3)

The Copper Canyon claim was surveyed in 1897 and later Crown Granted. As a result of the age of the survey no location posts could be found, so the geophysical survey lines are located with respect to the old adit and shaft present on the property, as shown in the diagrams (see Fig. 3). The adit is shown on survey maps as being located about 100' south of the No. I post of Claim 22G which was located (70 years ago) on the west bank of the Chemainus River.

A base station was selected on the side of an old roadway, and is marked by a stump, 4" thick, 4' high and squared on 3 sides. A base line (OOON) was run to the west for 1000' using brunton compass (on tripod) and polychain, corrected for slope. This line was flagged every 50'.

Several reconnaissance lines were then run off north and south from the base line as shown in the diagrams, using compass and polychain for the most part.

Several anomalous readings were obtained along these lines; the strongest and largest was found initially at 400W, 300S. This was a V.L.F.-EM anomaly which was further explored over a 200 foot square with stations over a 25 foot grid.

This report now discusses the findings and interpretation of the reconnaissance lines and detailed surveys.

(b) Magnetometer Survey (Reconnaissance)

The possibility of pyrrhotite in the deposits and the likely magnetic contrast between the schist and diorite suggested that a magnetic survey might prove of some use. The results of the reconnaissance survey (Fig. 4) are inconclusive. The large highs and lows are apparently associated with metal objects lying on the surface (machinery, etc.) and there is no overall pattern clearly evident.

The detailed survey (discussed later in Section 6 II) did, however, show some correlation to the V.L.F.-EM results, and with the hypothesized location of the schist zone.

The McPhar M700 magnetometer was used for this part of the magnetic work. All work started at the base station (00W 00N) and a series of loops were taken. The base station value was set at -90 gammas.

(c) Crone EM Reconnaissance Survey

The instrument used was the Crone JEM discussed earlier in Section 2. The results of the survey are shown in Figures 5, 6, 7 and 8. The first two diagrams give all the readings obtained as profiles, while the last two simply emphasize the largest resulting tilt angles, and those that occur on both high and low frequencies. All values above +1° are noted on Figures 7 and 8, but the survey is precise only to about ± 1°. Very little weight can thus be given to anomalies of + 1°.

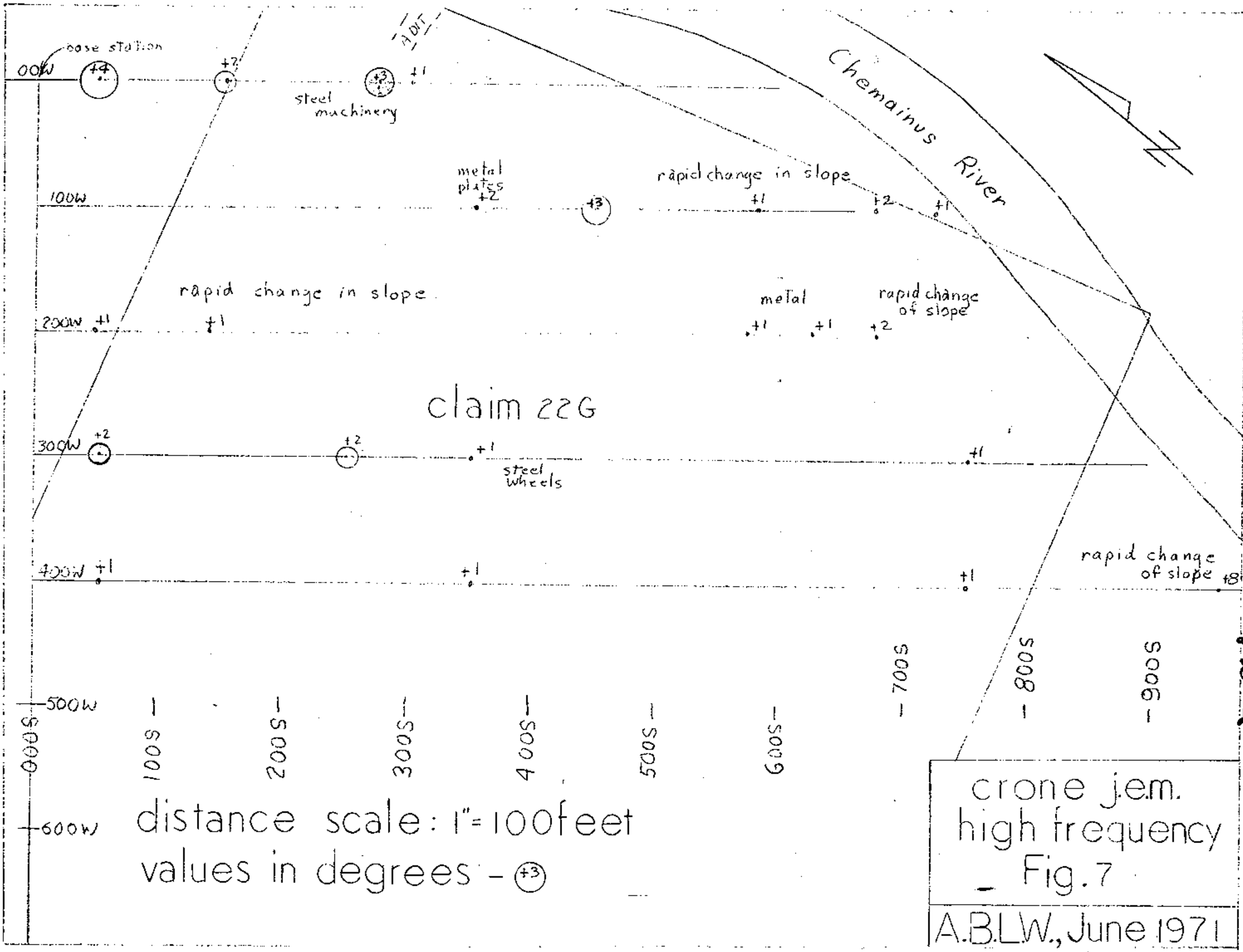
As already noted, these units employ two frequencies, and a lower frequency generally means a deeper penetration is achieved.

Spacing also affects the effective penetration. At 100 feet between units the effective penetration would be approximately 50 feet.

These types of units are generally not very effective with the disseminated type of deposit that we are apparently dealing with on this claim.

The Crone JEM unit generally eliminates regular topographical features but would appear to be influenced by large, rapid changes in topographical slope (for example where one of the units is at the top of a hill, the other part way down the slope). For this reason anomalies obtained in such regions cannot be given much weight in interpretation. The same is true for readings made in the region of metal sheets, machinery, etc.

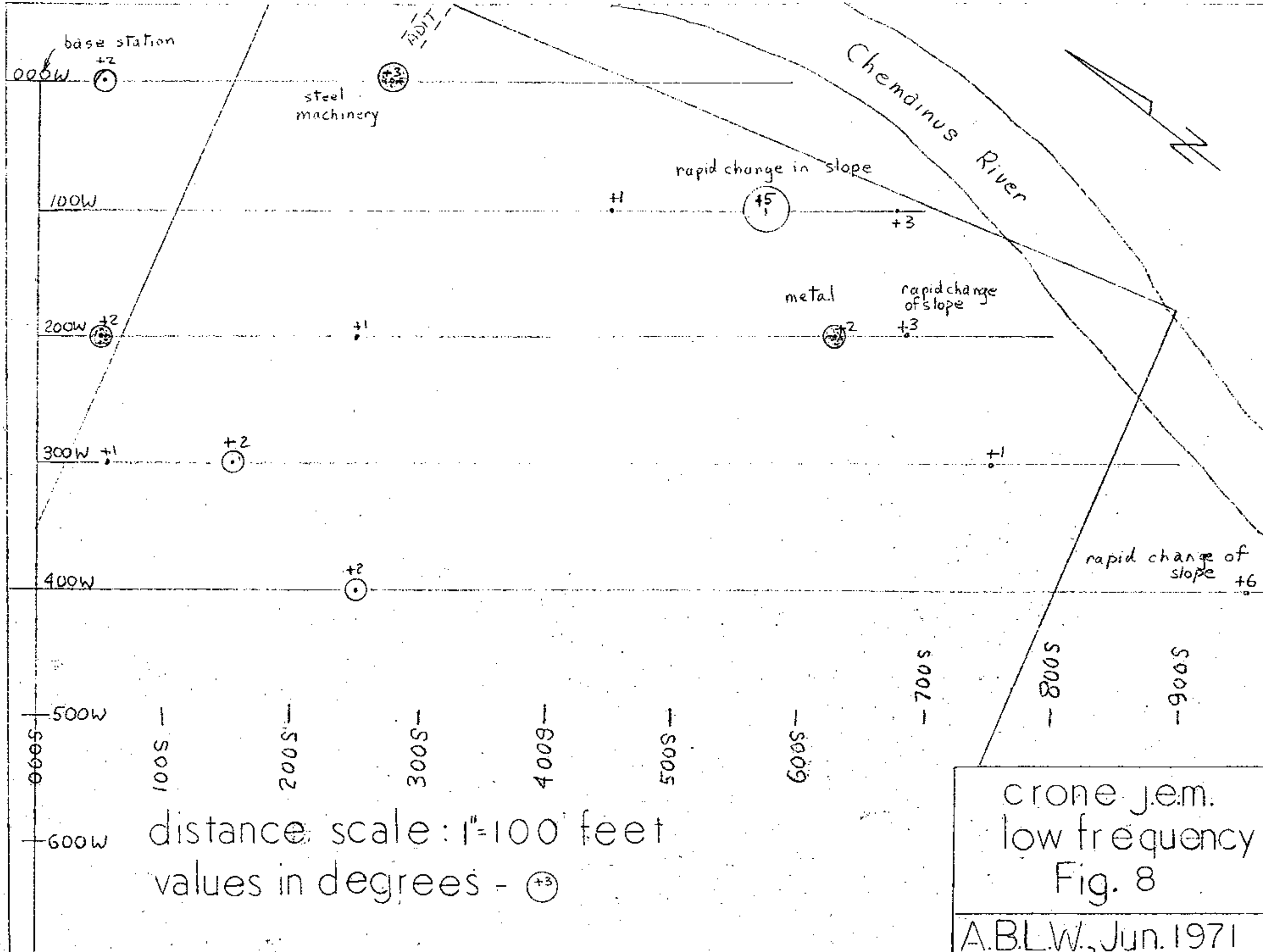
For a reading to be considered seriously one should observe a high on both low and high frequencies at about the same station. Furthermore, since



crone j.e.m.
high frequency
Fig. 7

A.B.L.W., June 1971

12a



crone j.e.m.
low frequency
Fig. 8

A.B.L.W., Jun. 1971

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higher frequencies correspond to less penetration (higher frequencies more readily induce counteracting surface currents in the soil), a value which is higher on the high frequency than on the low frequency would tend to indicate a more surface (overburden) effect.

If we eliminate those anomalous tilt angle readings that can be associated with topographical changes, surface (overburden) effects, metal, or which do not give highs on both high and low frequencies we have the following anomalies that can uniquely be associated with increases in conductivity at depth:

00W 275S (directly above the old adit)
200W 50S
200W 650S

All three are associated with the V.L.F.-EM anomalies discussed in the next section (6I(d)).

While the anomalies at 400W, 250S (Fig. 8, + 2°) and 400 W, 350S (Fig. 7, + 1°) do not occur at exactly the same location it is interesting to note that the station location of the instruments are right on the conducting zone indicated by the V.L.F.-EM readings. A stronger effect might have been obtained if the stations were shifted by 50 feet. This should be checked.

No strong relationships appear to exist between the Crone JEM and magnetic results. There is a slight suggestion of a magnetic low occurring at the Crone JEM high at 000W, 275S (Figures 4, 7 & 8) and again at 300W 150S (Figures 4 & 8).

(d) V.L.F.-EM Reconnaissance Survey

As noted earlier in Section 2, two instruments were used -- an EM-16 (Ronka) and a Crone RADEM. The results for each line are illustrated in Figures 11 to 21. The tilt angles in degrees (of the resultant magnetic component of the

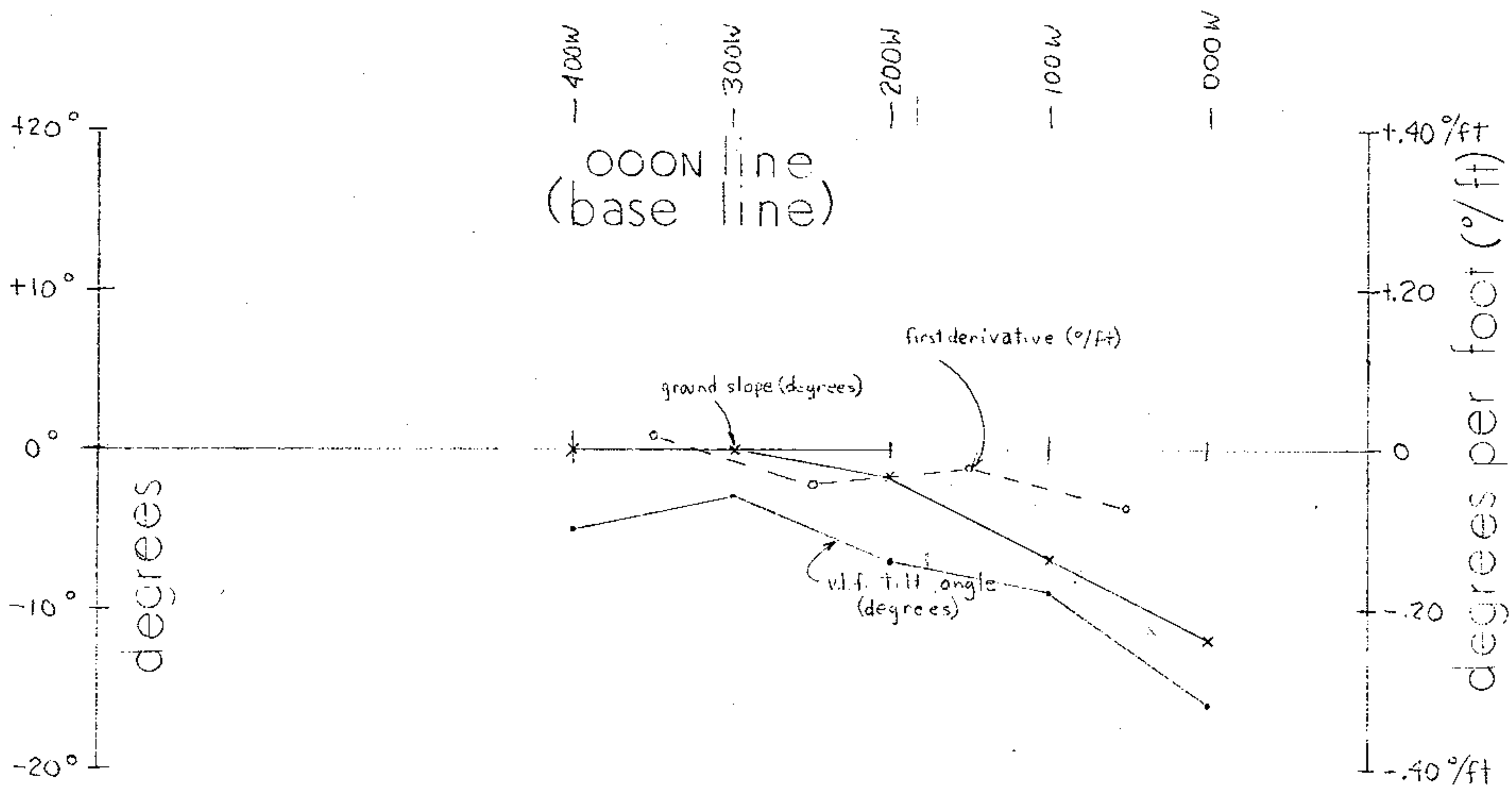

Fig. 11
VLF EM
Profiles

A.B.L.W., June 1971

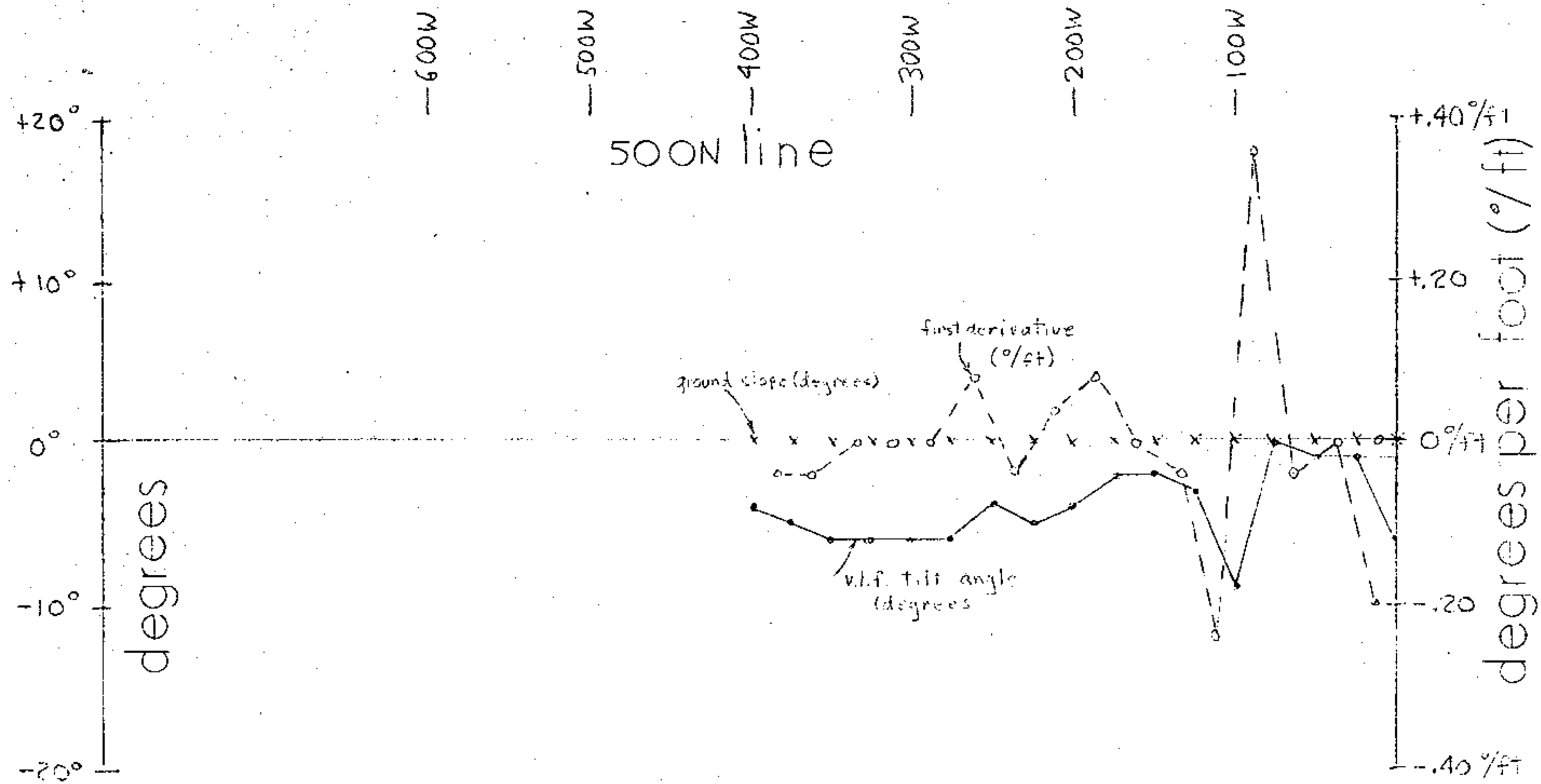

Fig.12
VLF-EM
Profiles
A.B.L.W., June 1971

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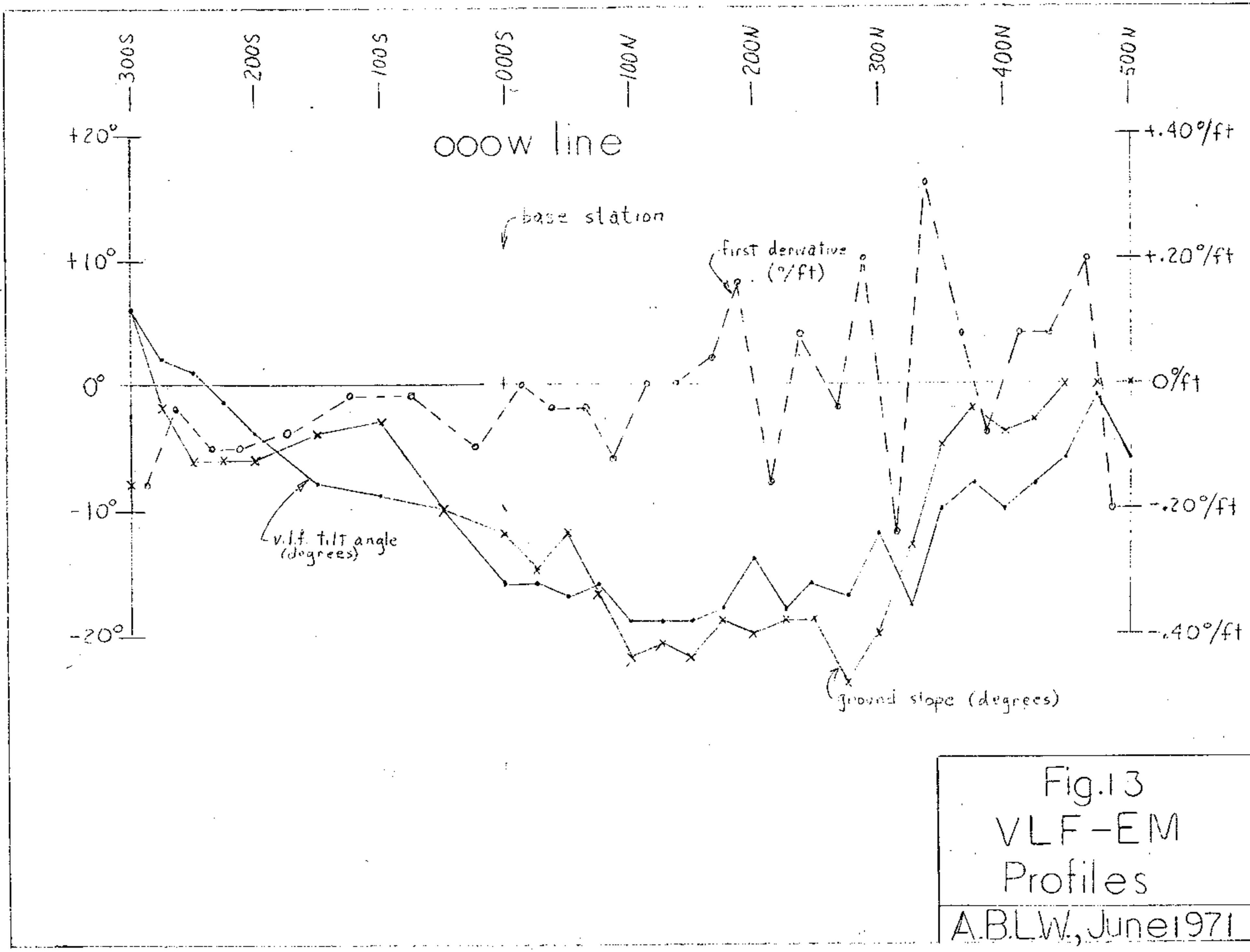

Fig. 13
VLF-EM
Profiles
A.B.L.W., June 1971

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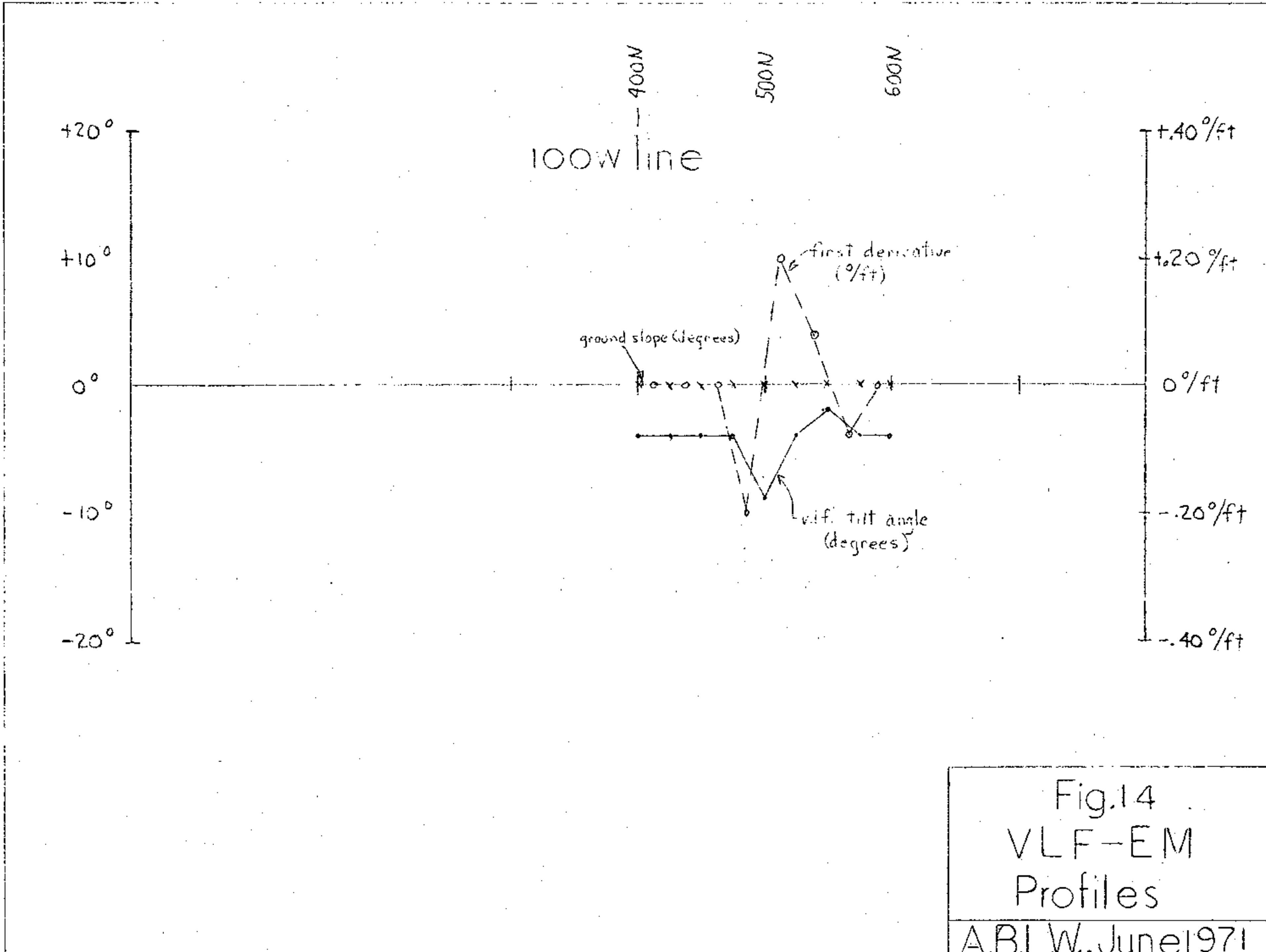

Fig.14
VLF-EM
Profiles

A.B.L.W., June 1971

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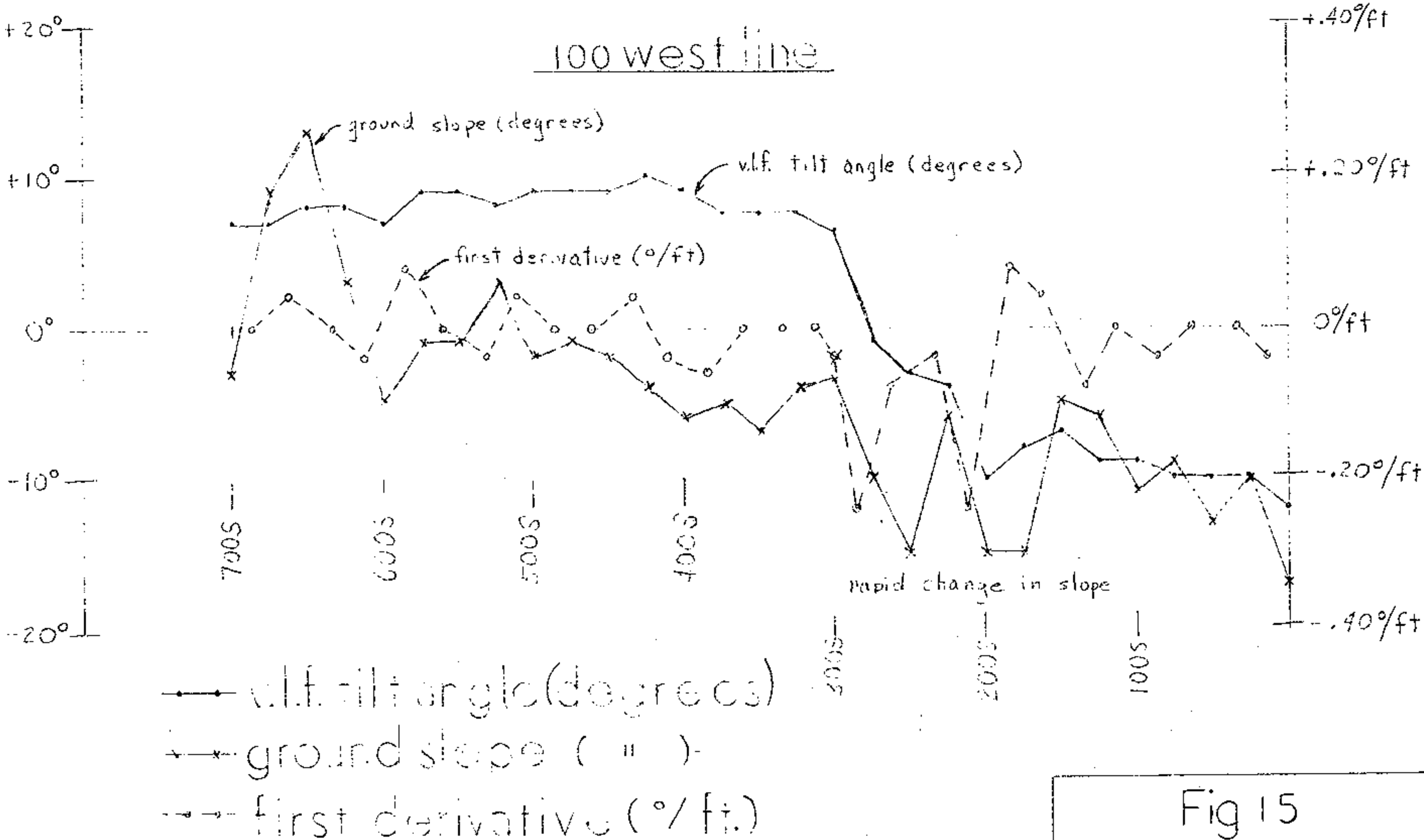

Fig 15
VLF-EM
Profiles

A.B.L.W., June 1971

13e

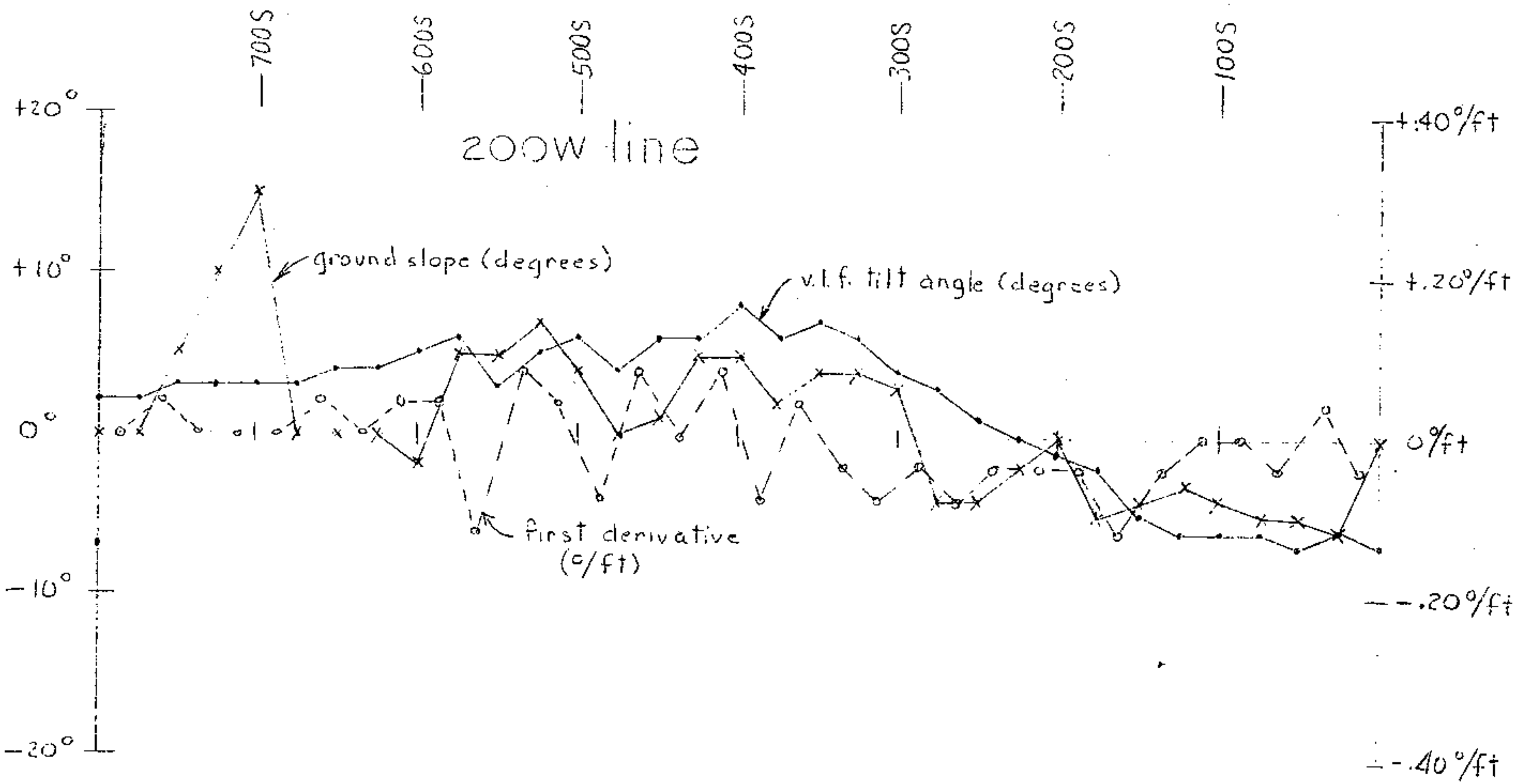

Fig.16
VLF-EM
Profiles
A.B.L.W., June 1971

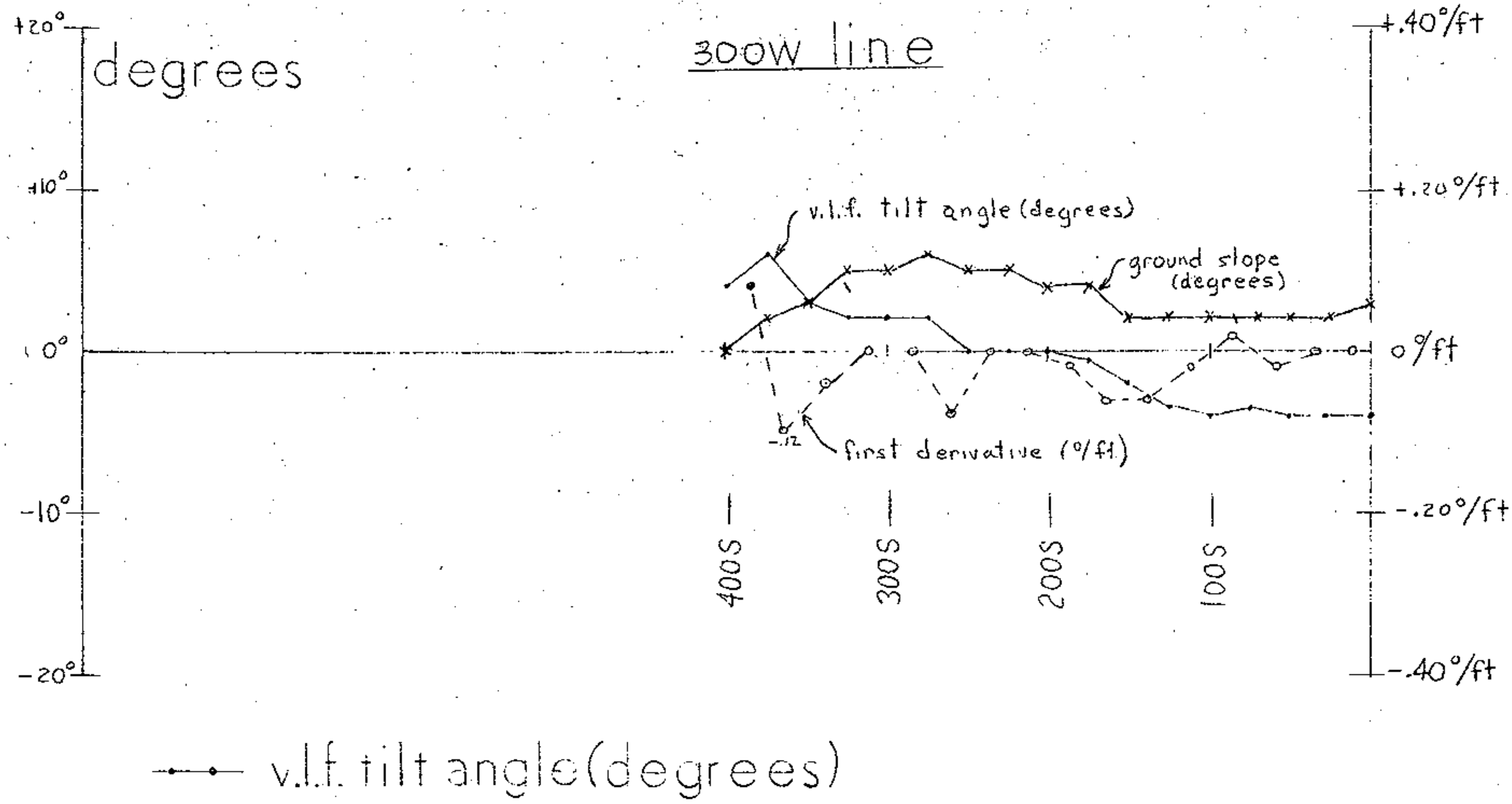

Fig. 17
VLF-EM
Profiles

A.B.L.W., June 1971

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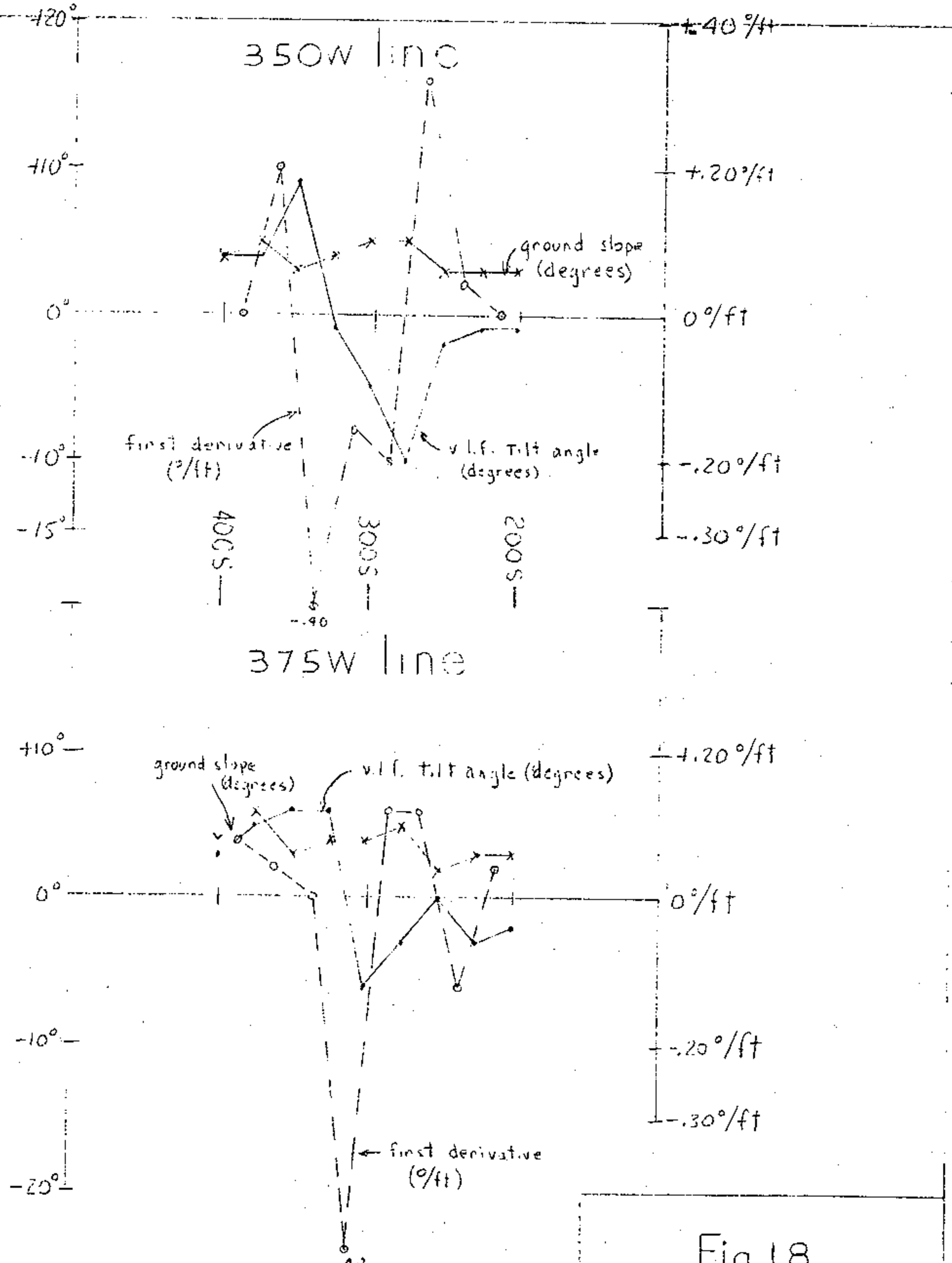

Fig. 18
VLF-EM
Profiles

A.B.L.W., June 1971

13 4

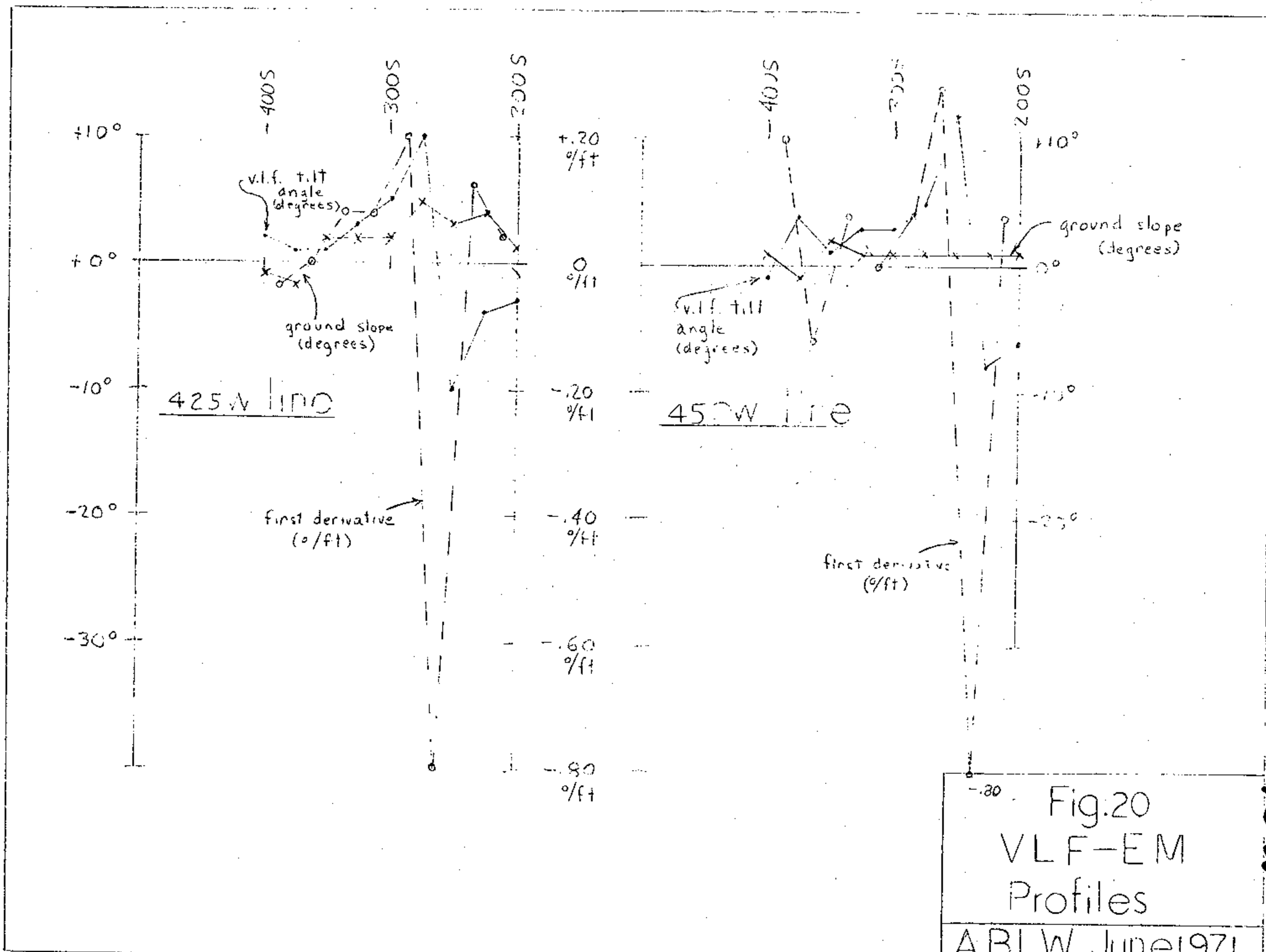

Fig.20
VLF-EM
Profiles

A.B.L.W., June 1971

13a.

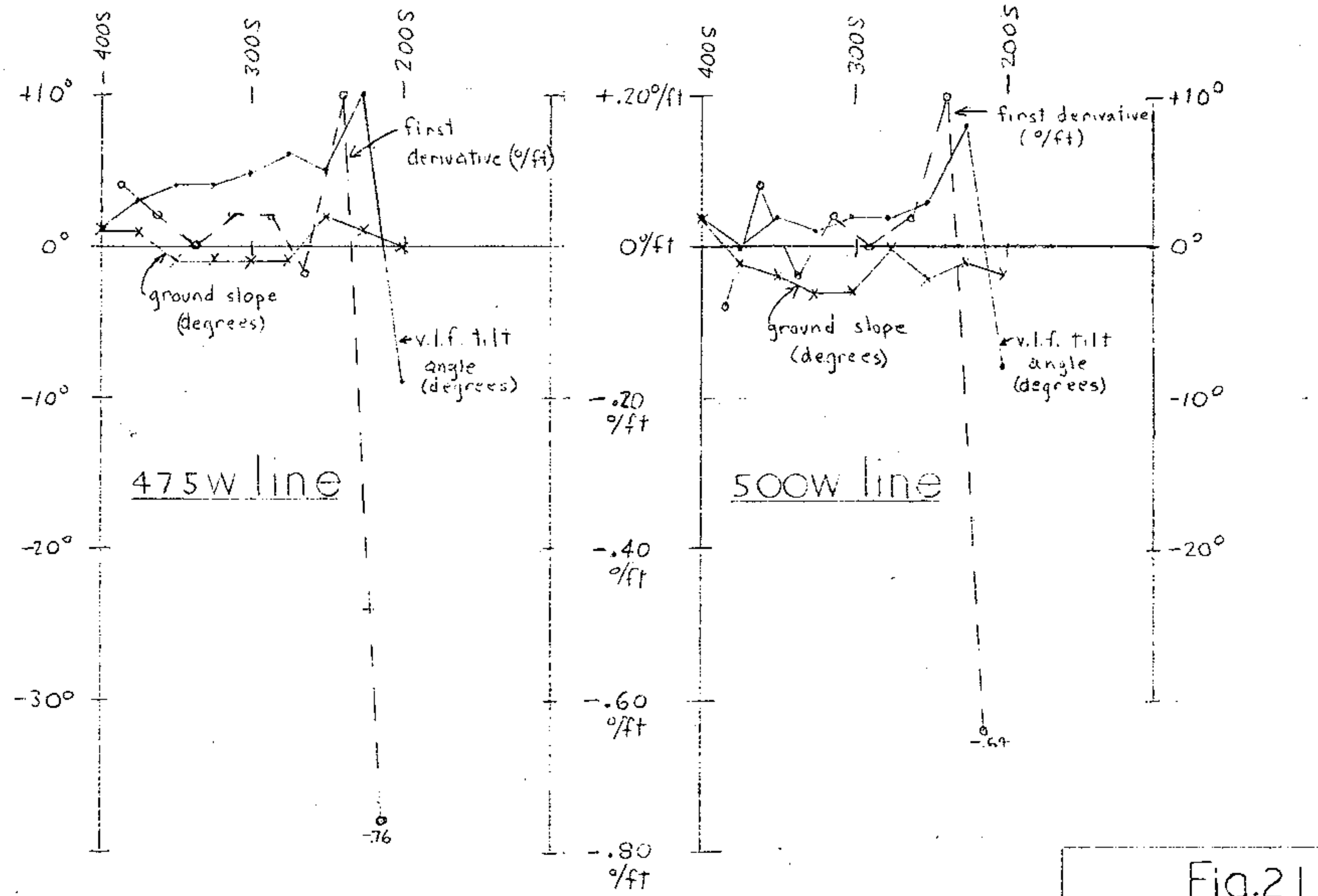

Fig.21
VLF-EM
Profiles

A.B.L.W., June 1971

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V.L.F.-EM field), the slope of the ground (in degrees), and the first derivative of the tilt angle are recorded on these profiles (see Section 2(i) for a discussion of how the first derivatives are obtained).

All the first derivative values are in turn plotted on Fig. 3, the diagram showing the physical features of the claim. The method by which the first derivatives are obtained (e.g. the slopes of the tilt angle profiles) means that the negative values are alone significant.

The contour maps, Figures 9 and 22, were made from the first derivative values. Figure 23 represents a contour map of the field strength readings taken over the small grid centered at 300S, 400W. These detailed diagrams (Fig. 22 & 23) will be discussed later in greater detail (See Section 6 II(g)).

In making Figure 9, all anomalies associated with rapid topographical changes were not considered since they cannot be uniquely assigned as conductivity changes. The topographical changes apparently can cause changes of -.10°/ft in the tilt angle of the V.L.F. field in this area, and under the moisture conditions of the time (fairly damp). This should be less as the ground dries out during the summer. Hence values greater than this (-.10°/ft) were considered to reflect true conductivity changes. This leaves several anomalies to be discussed.

One anomaly follows the strike of the schist zones from the old adit, and terminates about 300 ft. in from river bank at 200W, 160S. A second one is highly localized at 100W, 280S. Note that the contours of both of these seem to bend slightly to the south. A small (third) one is evident at 00W, 225S. These zones are apparently associated with the mineralized zone the old workings were exploring. The two larger ones terminate about the same distance in from the river bank as did the old underground working. These three anomalies will be called Group A for the rest of this report.

The largest, strongest and most interesting anomaly lies directly west of the anomalies associated with the old workings (Group A). This large anomaly and the two smaller ones are called Group B. This group reflects a good change in conductivity. The strike is similar to that of Group A.

The two smaller anomalies bear a similar relationship to the large one of Group B, as do the two smaller ones in Group A to the largest one of Group A.

It is important to note that the end of Group B is still not in sight although it extends over 175 feet and is approximately 50 feet wide.

It is also worth noting that the most easterly contour appears to be bent slightly to the north - in the opposite direction to the anomalies associated with the old adit.

If the large anomaly of Group B is due to mineralization then it is likely to be disseminated since it does not strongly affect the Crone JEM unit. The V.L.F. unit is more sensitive to disseminated mineralization.

One must point out that one can only infer a change in conductivity -- the effect may be due to graphite, clay, a water filled fracture, and not necessarily mineralization. The large anomaly of Group B does not appear to be simply a change from one rock type to another since the tilt angle swings about equal positive and negative over the conductive zone.

One other isolated anomaly appears in the area to the south of the base line (located at 200W, 560S). This is associated with the Crone JEM results of Figures 7 and 8, and does not appear to be related to topography changes. This one might be associated with the small pyrite bearing schist zone noted on the river bank near the end of line 100W. This anomaly should be rechecked (since it is near the road it might have been influenced by the presence of a car). If the V.L.F. results for line 300W are completed a further check would be available. The anomaly does, at the present time, seem to be of minor importance.

Three other groups of anomalies appear to be significant. The large negative First Derivative values obtained near 00W, 500N, and 100W, 500N (Group E) need to be detailed further before any explanation can be offered. These anomalies may, however, be related to another schist zone. There is a slight depression in the ground near 00W, 500N.

The other two groups of anomalies may be related since they are quite similar in character. These are located as follows:

Group C -- -.24°/ft at 00W, 300N.
-.16°/ft at 00W, 200N.

Group D -- -.16°/ft at 400W, 212N.
-.12°/ft at 400W, 140N.

Group D anomalies are located on flat ground and therefore are likely to be significant. Both the anomalies in Group C and Group D are separated by approximately 100 feet.

The ratio of 1st derivative values for both Groups are:

Group C -- $\frac{0.16}{0.24} = 0.67$

Group D -- $\frac{0.12}{0.16} = 0.69$

so they are quite similar in character. The JEM Crone high (+ 2°) obtained at 200W, 50S could well reflect a continuation of the 400W, 140N anomaly. This could be checked out in further surveys.

Taken in total the reconnaissance work leads to the formulation of a hypothesis which can guide, and be checked by further work. This is given in the following section.

(e) Interpretation

A working hypothesis has been constructed in Figure 10. It is suggested as a possible explanation of the geophysical anomalies and the knowledge of the area as outlined in the various Annual Reports to the Minister of Mines. It is here suggested that the Group A and Group B anomalies are the same zone since their characters (one strong V.L.F. high flanked by two smaller ones) are similar. The strike of both are similar and correlated to the suggested strike and location. (Annual Report 1903) of the schist zone.

It is further suggested that these two groups of anomalies originally lay along the southern boundary of the schist zone, but that the eastern portion containing the adit and Group A anomalies faulted off and was displaced north and downward with respect to the western part of Claim 22G. The adit is shown in the 1903 Annual Report as probably being located close to the southern boundary of the schist zone that continues down Mt. Sicker from the Lenore and Tyee claims.

This hypothesis correlates well with the results obtained to the north of the base line. Hence Group C and Group D anomalies would represent the northern boundary of the schist zone. Groups C and D are quite similar in character, as noted in the previous section, and do not appear to continue unbroken along their strikes. The best correlation with the present data suggests that they were originally part of the same zone but were displaced (~270') when the east block fractured off and moved down and to the north.

Hence one can infer a fault running almost north-south, and dipping to the east. The upper (western) edge of this fault line would run along the edge of the steep bank that strikes from about 400W, 600S to 000W, 400N. There is thus some physical evidence to support this hypothesis.

The distortion of the Group A and B anomalies along this hypothesized fault line also checks.

There is other reported evidence for north - south faulting. In the 1903 Annual Report there is the following statement: "It is claimed, and with some evidence to back the supposition, that the mineralized zone at the elevation of the Key City Claim (#37G) has been deflected to the south or into the XL claim (#19G) ground". The "Geophysical Report on Mt. Sicker Mines Ltd. (N.P.L.)" of

Nov. 30, 1968, also (in the Summary, page 7) indicates the possibility of "flectures toward the north and south" which the authors of the 1968 Report interpreted as folding.

The rock type to the south of the Group B anomalies has the seismic characteristic of a rock such as granite (diarite?) (See section 7 II(h)). Diorite boulders were observed in this region. It is noted in the 1903 Annual Report that underground working on the Victoria Claim (#21G - across the river from 22G) intersected diorite to the south. "Some 80 feet vertically below these pits a tunnel has been driven 150 feet in a S 80°E direction, apparently with the intention of cutting these exposures at that depth. From the inner end of the tunnel a cross cut has been run south for 25' and into diorite". Diorite was also reported on 200W, 700S by one of the field crews of the present survey. It has not, however, been confirmed.

The magnetic reconnaissance results (Fig. 4) can be re-interpreted in the light of the above hypothesis. If the black schist reported observed in the adit is more magnetic than the green schist and diorite, this would account for the high trends along base line from 100W to 300 W, and along line 300W from 00N to 300S.

II. DETAILED SURVEYS

(f) Magnetometer

Magnetometer readings were taken over a 200 foot X 200 foot grid centered at 400W, 300N. Station readings were spaced at 25 feet on 25 feet lines. All data was time corrected and tied into the base station (00W, 00N as -90 gammas). The results are contoured in Fig. 24. The main features are a series of 3 highs trending in an east west line, flanked on either side by negative values. The strike and location of the high zones is the same as the zone outlined in the V.L.F. survey. This will be discussed in the following section (g).

The depth to these magnetic highs was estimated using profiles and type curves. The depth estimates ranged from 25 to 40 feet below the surface.

(g) V.L.F. - Radem Detailed Survey

Two types of contour maps were prepared from the V.L.F.-EM survey - a first derivative contour map (Fig. 22) from the profiles from this region (Fig. 18, 19, 20 & 21); and a field strength (F.S.) contour map (Fig. 23). Both were obtained for the 200 foot by 200 foot grid centered at 400W, 300S, the same area as was discussed in the preceding section (f).

One major anomaly is obvious in both maps (Fig. 22 & 23) and occur at the same points in both. This zone definitely reflects an increase in conductivity. Correlated with the magnetic highs in this region it strongly suggests that mineralization is the cause, since one would expect a magnetic low, if the zone were weathered clay and leached out, or if it were graphite. This would tend to discount the zone being due to graphite or clay.

The depth and radius of this zone was roughly estimated, assuming the body is a cylinder, and using the formulas outlined in the Ronka Em-16 instrument manual. These yielded about 25 - 35 feet depth below the surface and a radius of 10 - 15 feet. The length is over 175 feet.

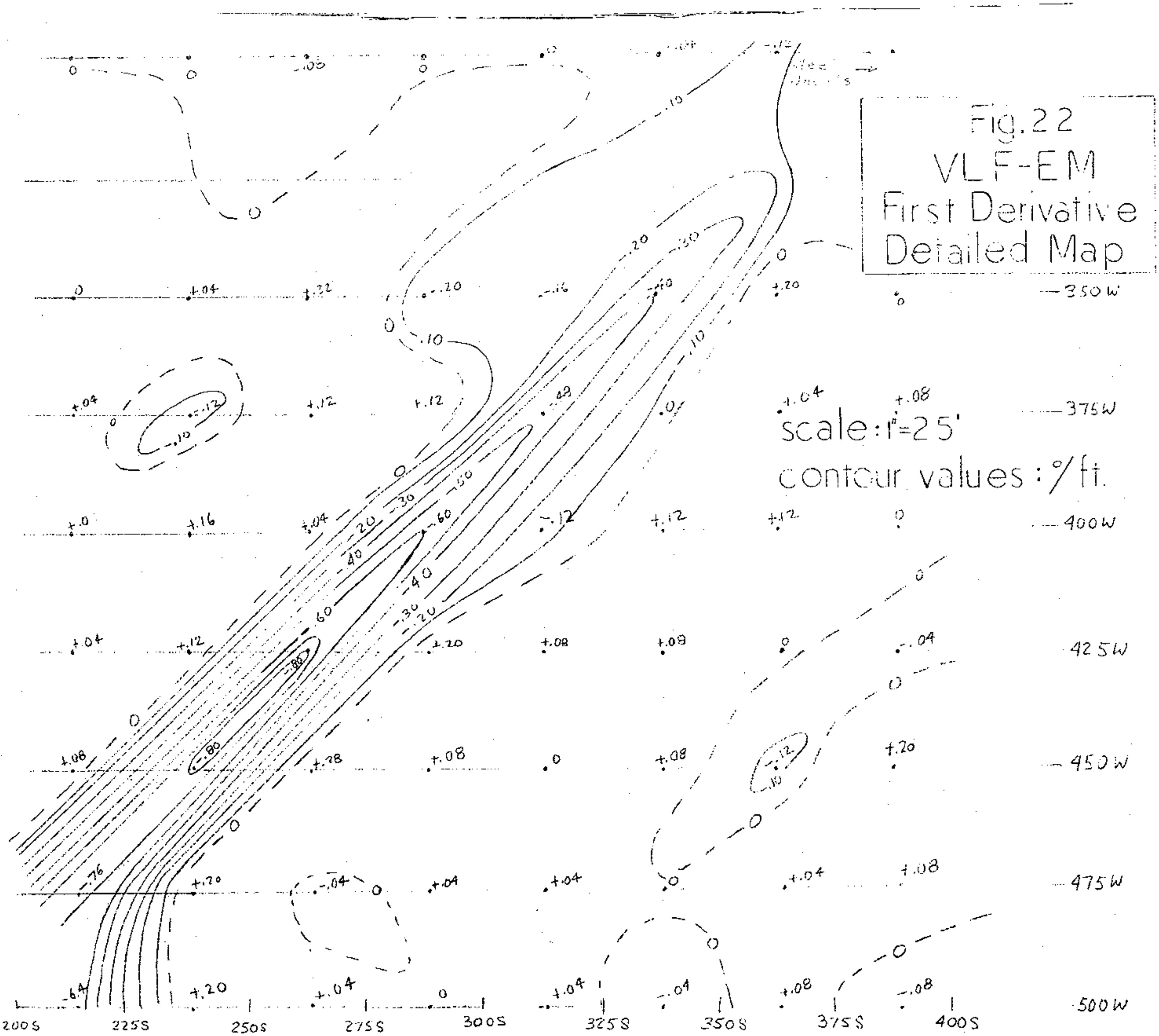


Fig. 22
VLF-EM
First Derivative
Detailed Map

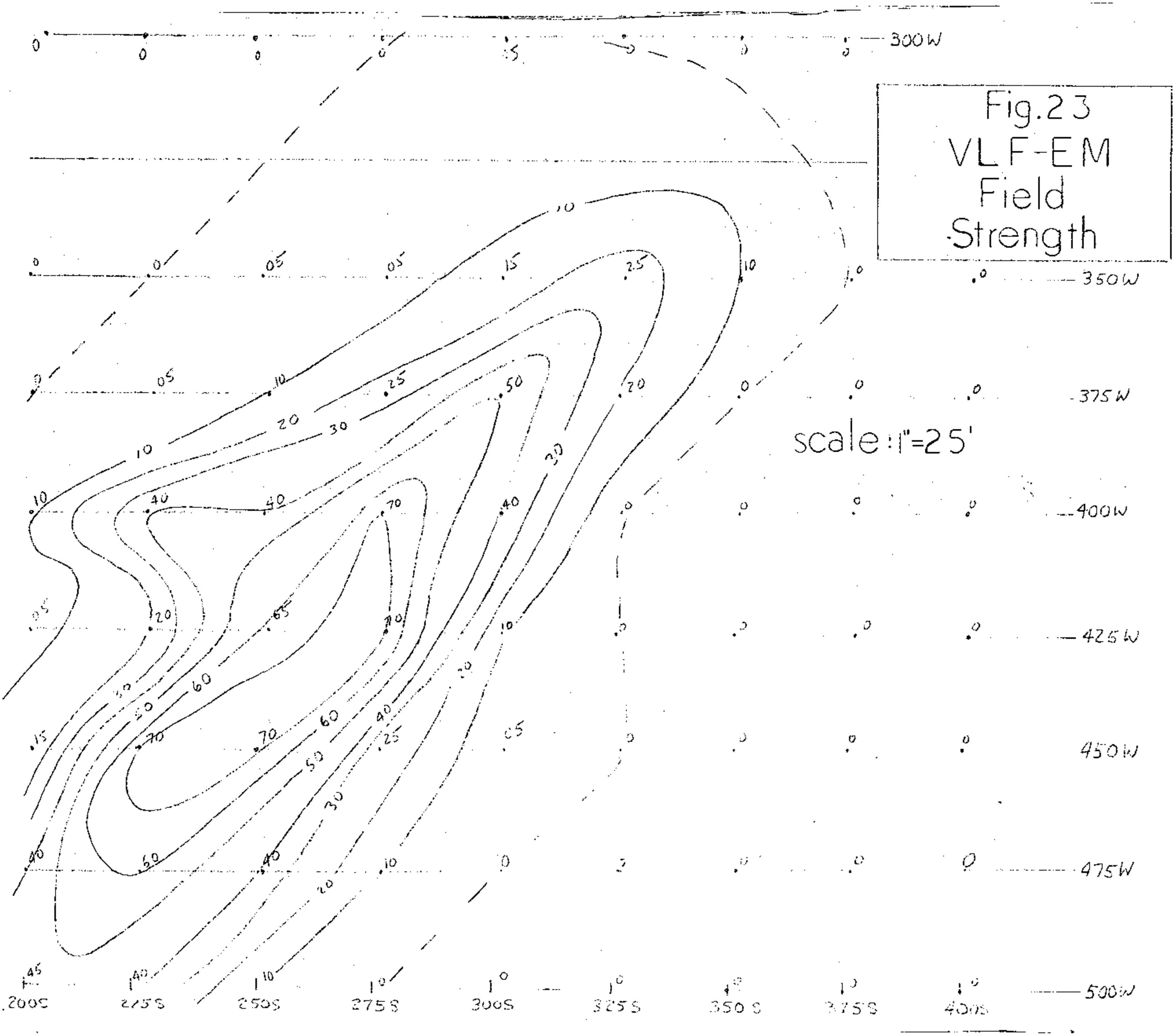


Fig.23
VLF-EM
Field
Strength

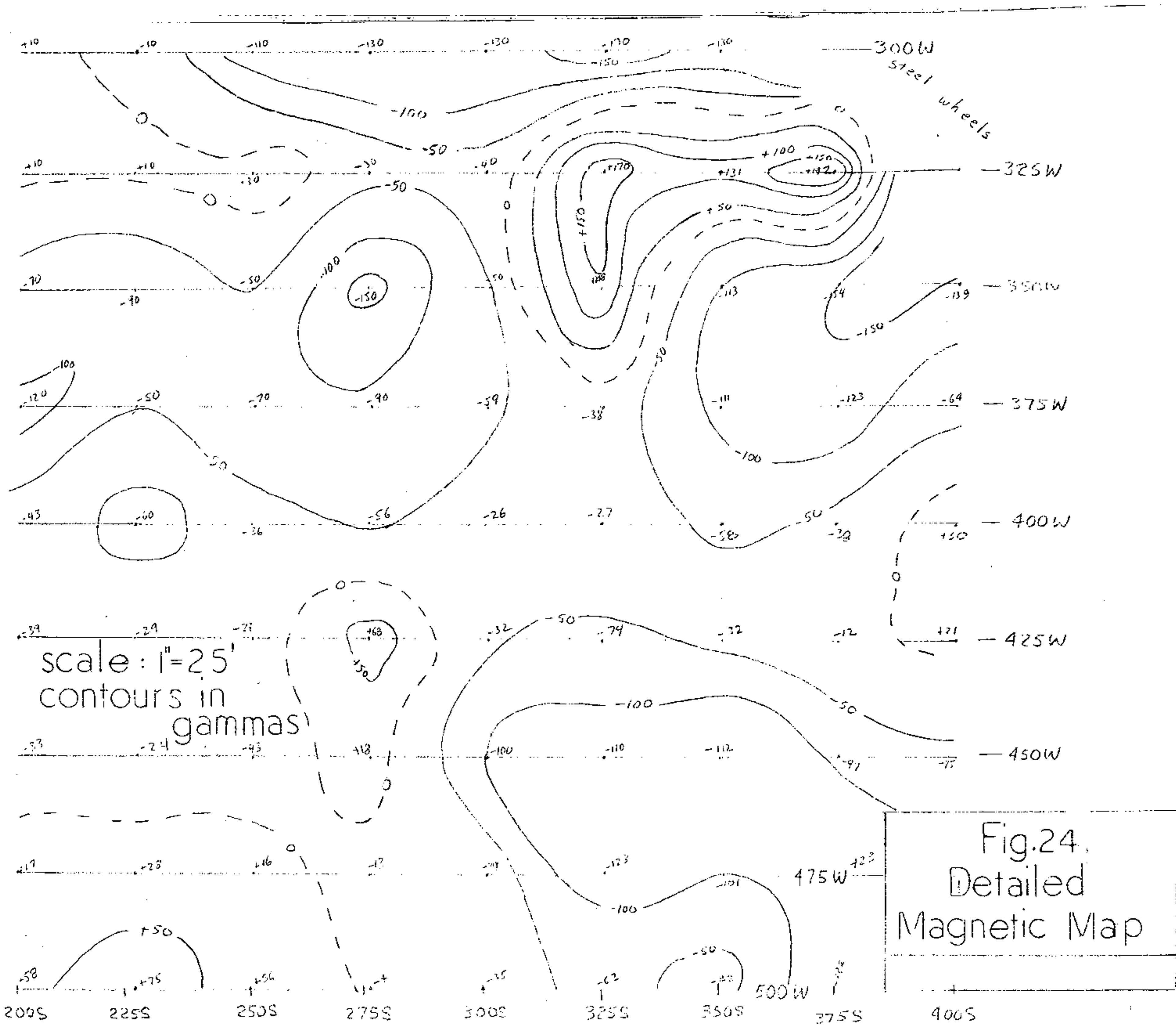
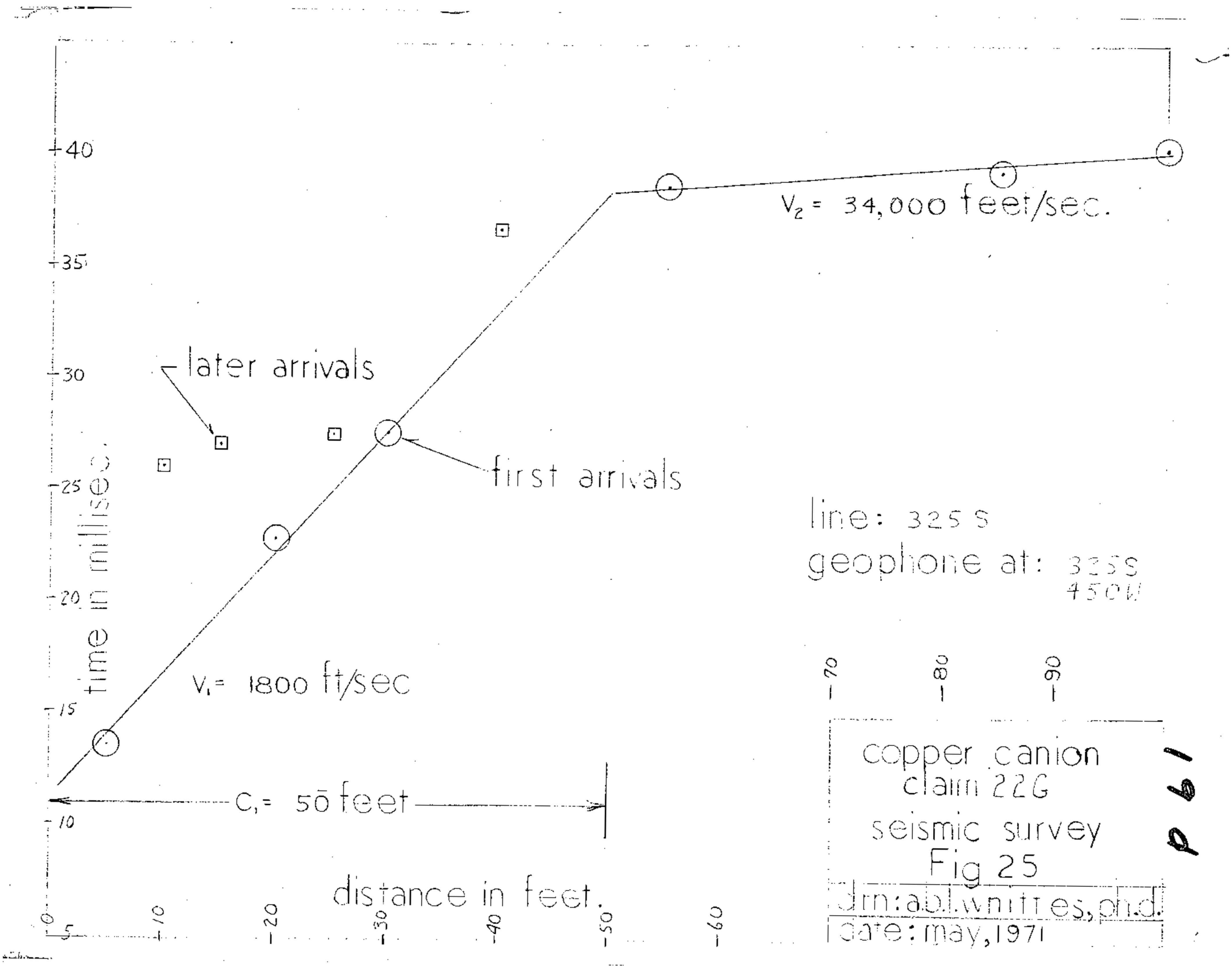


Fig.24. Detailed Magnetic Map



time in millisec.
+40
+35
+30
25
20
15
10
later arrivals
first arrivals
V_2 = 34,000 feet/sec.
V_1 = 1800 ft/sec
C_1 = 50 feet
line: 325 S
geophone at: 325S 450W
distance in feet.
0
5
10
20
30
40
50
60
70
80
90
copper canion
claim 22G
seismic survey
Fig 25
drn: a.b.l. whittes, ph.d.
date: may, 1971

The two smaller anomalies are possibly pockets of mineralization, although nothing definite can be stated with the present evidence.

It is important to note that the largest anomaly is over 175' long, and indeed still open to the west.

(h) Seismic Survey

A single line (325S) was run for about 100 feet, with the geophone (receiver) positioned at 325S, 450W, for the purpose of determining layer characteristics, geochemistry characteristics, and drilling or trenching possibilities. The geophone was kept stationary and the hammer was moved eastward along the line 325S. The results are shown in Fig. 25. Considerable difficulty was experienced in getting consistant first arrivals, due probably to the light soil covering (the hammer plate was hammered over a foot into the earth), and the presence of boulders in this soil.

The results indicate two layers with distinctly different seismic velocities. The first layer (V_1 = 1800 ft/sec) appears to be about 20 - 25 feet deep, based on the usual calculations, using the 'critical' distance C_1 = 50 feet. The velocity (V_1) of this layer corresponds to that of clay or glacial till.

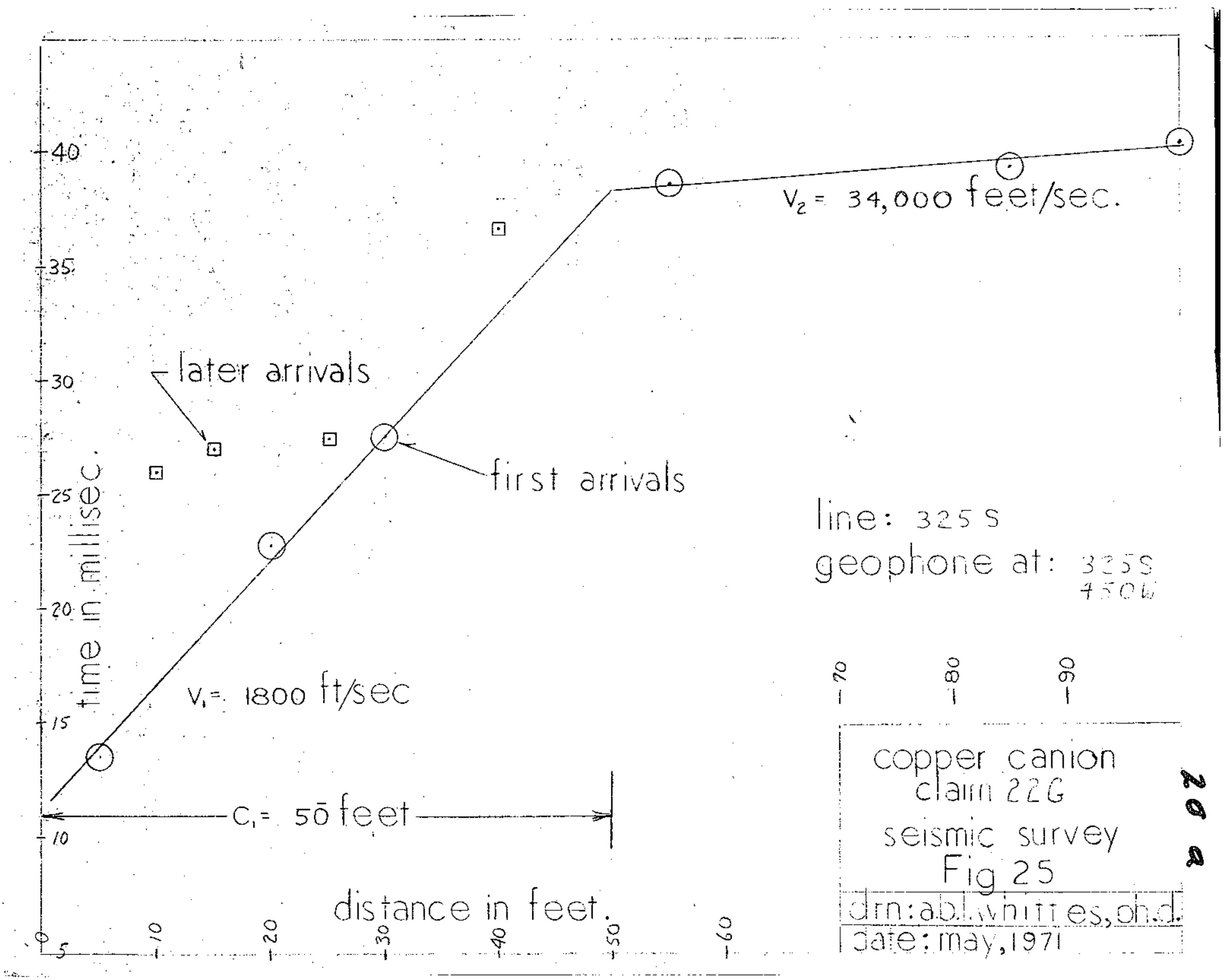
The second layer is an extremely high velocity one (V_2 = 34,000 ft/sec). Such velocities are usually only found with fine grained, dense, igneous rocks such as granites. It could be interpreted as diorite.

The seismic results suggest that geochemical soil analysis might not be too effective in this area since the soil cover is deep (20 - 25').

The results also suggest that trenching is not the best method to use -- probably drilling will be required to explore this zone.

(i) Geochemical Survey

A number of soil samples were taken as well as a number of rock samples. The soil samples were taken at 25 foot intervals from 200S to 400S on the 400W line (through group B anomalies) and at 000S, 100S, 475S, 550S, 725S, 800S, 850S, 950S all on the 400W line, at 250S, 300S, 350S over the old adit. All soil samples


40
35
30
25
20
15
10
time in millisec.
later arrivals
first arrivals
V₂ = 34,000 feet/sec.
V₁ = 1800 ft/sec
C₁ = 50 feet
line: 325 S
geophone at: 325S 450W
distance in feet.
0
5
10
20
30
40
50
60
70
80
90
copper canion
claim 22G
seismic survey
Fig 25
drn: a.b.l. whittles, ph.d.
date: may, 1971

were taken at a depth of 3 feet.

The rock samples were taken at intervals along the river bank.

All the soil sample results were negative indicating little or no heavy metal content, even those that were taken near the adit and shaft.

Most of the rock samples along the river bank indicated very low copper readings, although one assayed as 2% copper and another (a grab sample from a quartz vein that was blasted open) assayed 10.2% copper. These occurrances did, however, seem very localized.

The results may be interpreted in at least three ways:

(a) If the conductive zone (Group B) is mineralized, it may well consist mainly of pyrite, as did the zone explored by the old adit; in this case no heavy metal values would be present.

(b) The zone may be non-metallic -- e.g. consist of graphitic schists or clay.

(c) The depth of the overburden, wet climate, and slope of the ground may prevent the migration of heavy metal ions to near the surface from which the soil samples were taken.

(j) IP - Resistivity Survey

A Crone condensor discharge IP unit was used over this zone to test its applicability to this type of deposit, and its further application in surveying these claims. The results are shown in Figures 26 & 27. Spacing was 50 feet for most of the survey, using a Wenner Array for the electrodes, so depth penetration is about 25 feet.

The contour maps indicate three conductive zones running roughly parallel to one another (I, II, III).

The values of chargeability are not very large partly due, perhaps, to the small spacing (50 feet) which would mean an effective penetration of only about 25 feet (e.g. the top of the zone indicated by the V.L.F.-EM and magnetometer results).

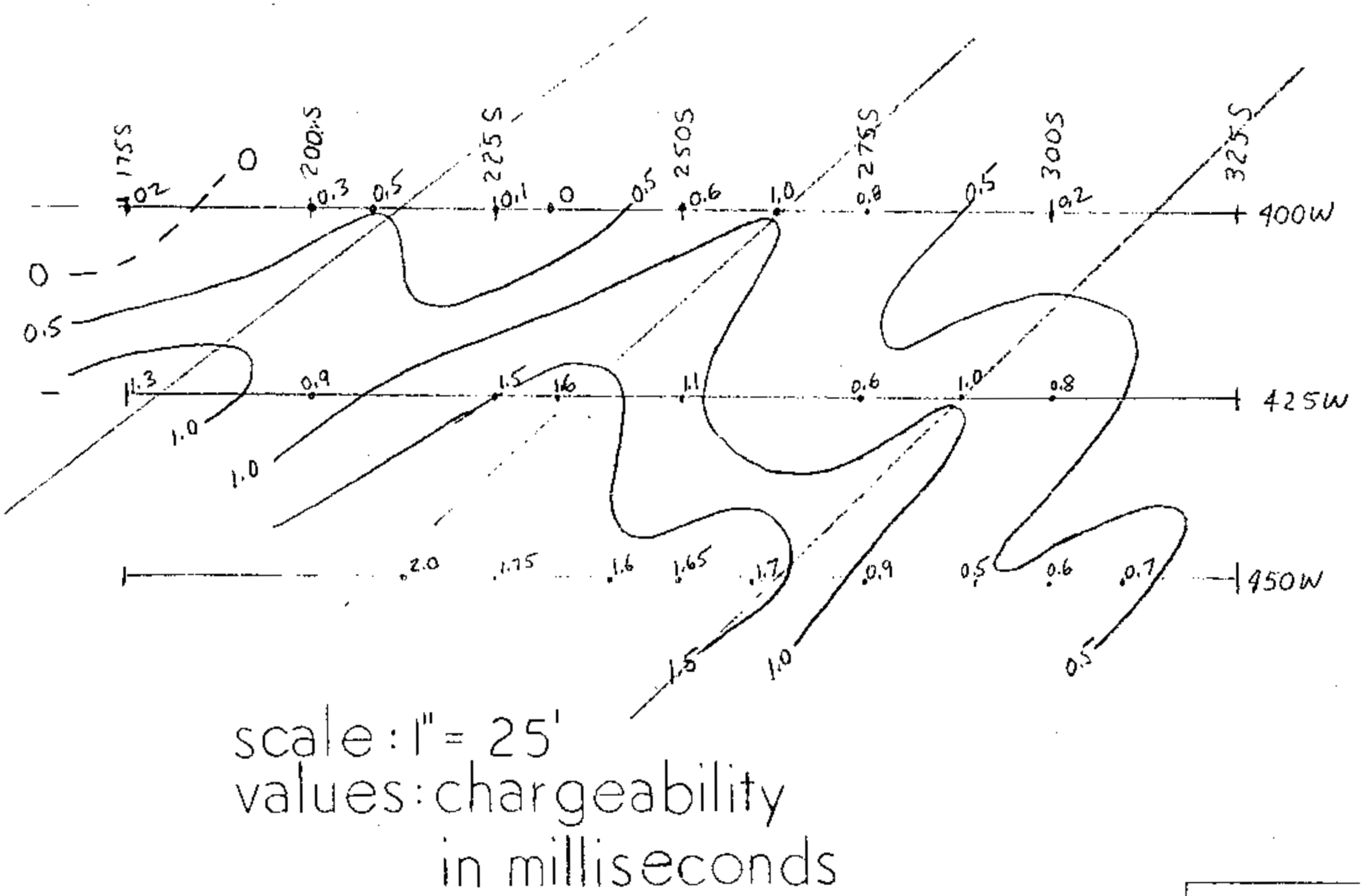
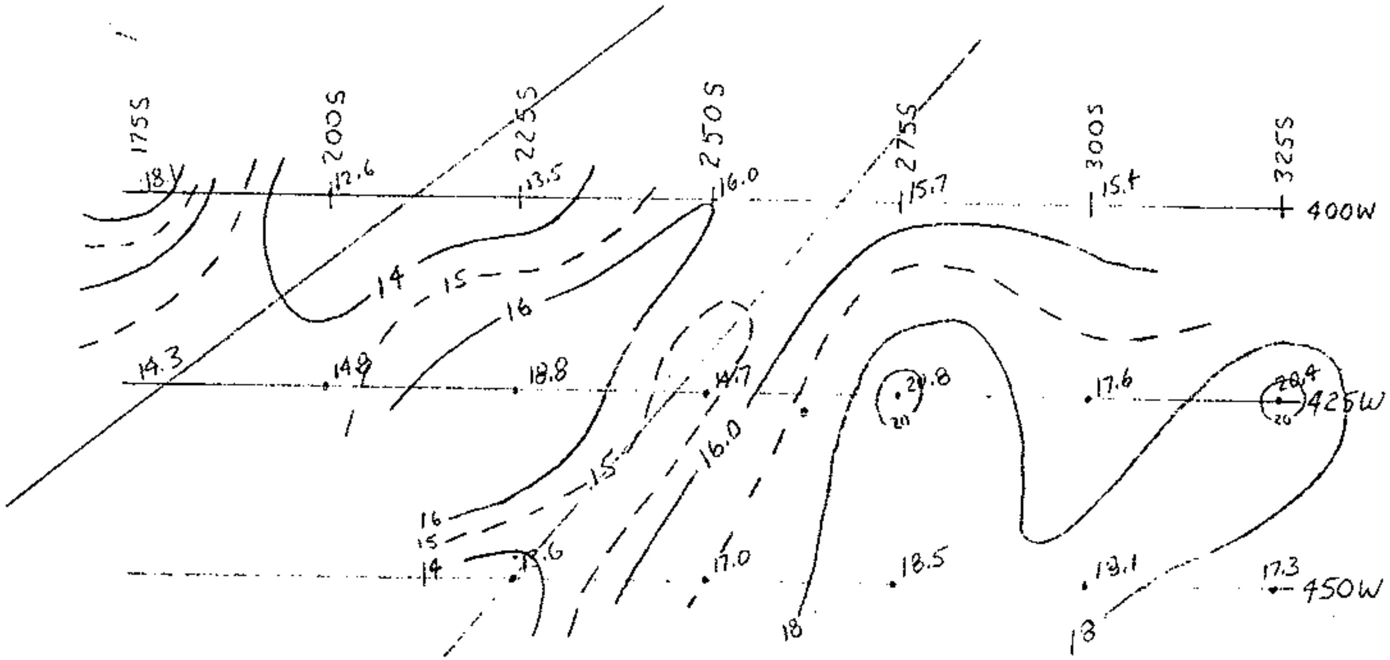


Fig. 26
I.P. Contour
Map

21a



scale 1"=25'
values: 17 × 10³ ohm-feet

Fig. 27
Resistivity
Contours

(k) Interpretation of Detailed Grid Area (Group B Anomalies)

All the detailed surveys correlate well. The V.L.F.-EM I.P. and Resistivity results indicate a higher conductivity as shown, and the magnetic map suggests slight magnetic mineralization (alteration). This gives support for the idea that the zone is mineralized and the process of mineralization has altered the surrounding rock.

The lack of geochemical results would suggest that if mineralization is present it is mainly pyrite, although the overburden may be too deep for ions from this zone to reach the surface.

It would appear that the presence of pyrite itself may well be important. Muller & Carson (1969) state, in discussing deposits such as the one on Mt. Sicker (the old Twin J Mine),

> "Abundant disseminated pyrite is found on the fringes of the known deposits and could be a useful guide in exploration."

A tentative interpretation would suggest that the largest zone in Group B is a disseminated mineralized zone lying along the contact between diorite to the south and the schist to the north. This zone seems to have about 20 - 25 feet of overburden over it, extend for at least 175 feet in an east - west direction, and be 10 - 15 feet wide.

The large zone appears to continue on past the 500W line, and appears to be getting slightly larger at the western extremity (at 500W).

Small pods of mineralization perhaps exist at 375W, 237S & 237S, 362S.

This interpretation must be considered speculative until checked by drilling.

7. RECOMMENDATIONS

(1) There does not seem much point in using the magnetometer in a reconnaissance sense, although it might be used in detailed surveys to give further indication of mineralization.

(2) Soil samples should be taken over the largest zones in Groups A, B, C, D & E, and the samples sent in for analysis. A half dozen 'background' samples (away from these anomalous zones) should also be taken.

(3) The largest anomaly in Group B should be drilled to determine its composition.

(4) The V.L.F.-EM survey should be continued west of the 500W line to outline the limits of the Group B anomalies.

(5) The Crone JEM unit should be re-run over the Group B anomalies at 25 ft. stations with 100 ft. spacing between coils.

(4) It might prove worthwhile to survey and map the old underground workings. This would help to decide on the hypothesized geologic structure (Fig. 10), and future work on the claim.

(5) The 100W, 200W, 300W lines north of the base line should be completed using the V.L.F.-EM unit.

(6) The 300W line should be completed for the V.L.F.-EM unit.

(7) More detailed work (using V.L.F.-EM unit) needs to be done around the Group E anomalies.

(8) A study of stero-prints of air magnetic maps of the area would help decide on the hypothesized fault structure outline on Fig. 10.

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
F. C. LORING

F.C. Loring, P. Eng.

8. REFERENCES

(1) 1898 Report of the Minister of Mines of B.C.; page 1148.

(2) 1903 Report of the Minister of Mines of B.C.; pages II 239, 240, 252, 253.

(3) 1928 Report of the Minister of Mines of B.C.; page C365.

(4) 1968 (Nov. 30) "Geophysical Report on Mt. Sicker Mines Ltd. (NPL)" by E. P. Sheppard, P.Eng.

(5) 1969, "Prospecting with Radio Frequency EM-16 in Mountainous Regions"; Western Miner, Vol. 42, No. 2, March, 1969, by A. B. L. Whittles.

(6) 1969, "Geology & Mineral Possibilities of Vancouver Island" by J. E. Muller and D. J. T. Carson. Paper presented to the Annual Meeting of the Prospectors & Developers Association.

(7) 1969, "Contouring of V.L.F.-EM data"; Geophysics, Vol. 34, No. 6, Dec. 1969, by D. C. Fraser.

(8) 1970, EM-16 Operating Manual, Geonics Ltd., 2 Thorncliffe Park Drive, Toronto 17, Ontario.

9. APPENDICES

(a) Resumé of Technical and Field Work Experience of Dr. A. B. L. Whittles, Ph.D.

(1) University training at University of B.C. and University of Toronto with the completion of a Ph.D. in Physics (Geophysics section) in 1964, from U.B.C.

(2) Prior experience (2 summers) with geophysical section Imperial Oil Ltd., in Alberta.

(3) Surveying experience, Buttle Lake Power project.

(4) 4 years at the B.C. Institute of Technology teaching geophysical prospecting courses to day and evening students.

(5) Consulting experience during past 5 years with companies in Vancouver and Calgary, including field supervision and interpretation.

(6) Presently in charge of the Geological Technology, Malaspina College, Nanaimo, and including the teaching of courses on geophysical prospecting.

(7) An active member with the Canadian Society of Exploration Geophysicists, the Society of Exploration Geophysicists, and the B.C. Geophysical Society.

(b) Cost Analysis

(1) Time Used by Dr. A. B. L. Whittles:

(a) Field Supervision and instrument operation (April 30, May 7, 14 and 21) -	4 days	
(b) Plotting and interpretation of 24 man days of field work by the students of the Geological Technology, Malaspina College (May 6, 13, 20, 27, June 11, 14, 16, 18, 19, 20, 21, 28) -	12 days	
	16 days	

(2) Time Used by F. C. Loring, P.Eng.:

(a) Examination of property and field supervision of geophysical survey -	2 days	
(b) Checking over geophysical report & verifying facts against results (June 23, 24, 25) -	3 days	
	5 days	
TOTAL TIME OF DR. A. B. L. WHITTLES & F. C. LORING --	21 days	
21 days @ $150.00 per day --		$3,150.00

PHYSICAL WORK

D. Robinson Equipment Rentals	$10.50	
Purvis Ritchie Equipment Rentals	14.00	
Continental Explosives	53.41	
Crest Labs	47.40	
T.S.L. Labs	36.45	
Chemex Labs	24.00	
Drilling, Blasting & Line Cutting:	275.00	
	$460.76	460.76
		$3,610.76

C E R T I F I C A T E

I, Frank C. Loring, of Qualicum Beach, B.C., hereby certify that:

1. I am a Consulting Mining Engineer, residing at R.R.#2, Qualicum Beach, B.C.

2. I am a graduate of Michigan Technological University, Houghton, Michigan, U.S.A., with B.Sc. degrees in Mining Engineering and Mechanical Engineering.

3. I have been active in the mining industry for the past twenty five years, in the fields of exploration, production, and consulting.

4. The information for the accompanying report was obtained from records of previous work, plus the results of field work carried out in April, May and June, 1971, under the direction of Dr. A. B. L. Whittles, Ph.D., Geophysicist, supervised by myself.

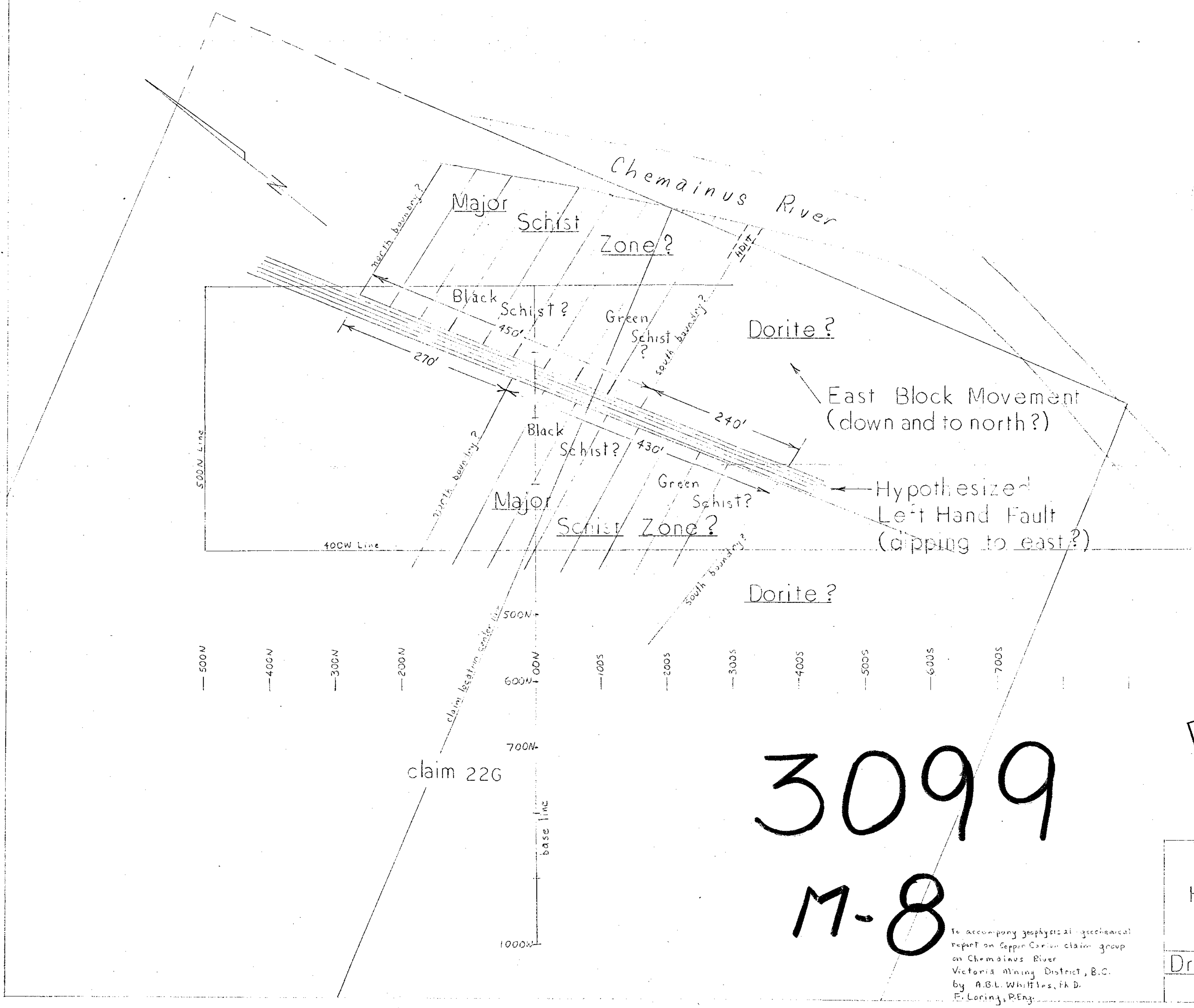
5. I am the owner of a 20% interest in the Copper Canyon claim group.

6. I am a member of the Professional Engineers Association of B. C., the Canadian Institute of Mining and Metallurgical Engineers, and the B.C. and Yukon Chamber of Mines.

DATED AT QUALICUM BEACH, B. C., THIS 2nd DAY OF JULY, 1971.

F. C. Loring, P. Eng.,
Consulting Engineer.

PROFESSIONAL PROVINCE OF F. C. LORING BRITISH COLUMBIA ENGINEER

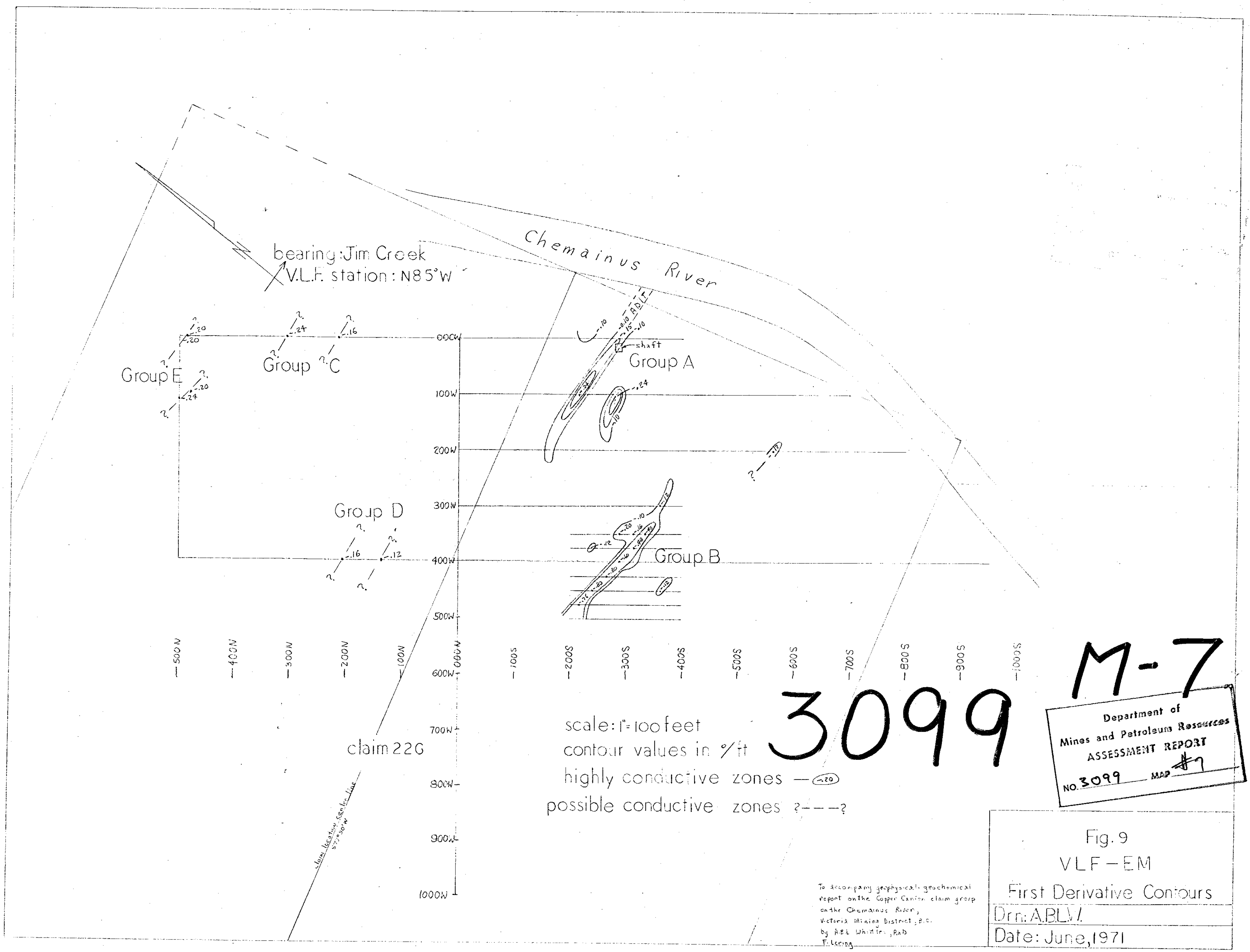


3099
M-8

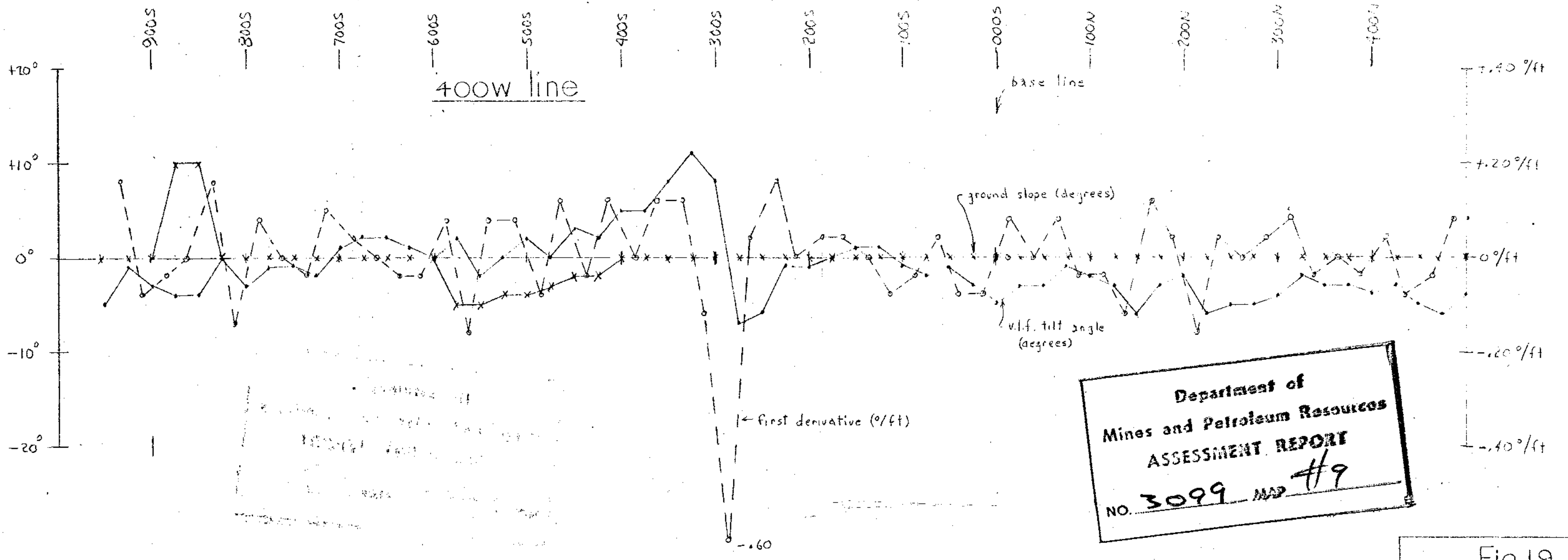
To accompany geophysical - geochemical report on Copper Canyon claim group on Chemainus River
Victoria Mining District, B.C.
by A.B.L. Whittles, Ph.D.
E. Loring, P.Eng.

Fig. 10
Hypothesized Geologic Structure

Drn: A.B.L.W.
June, 1971



Chemainus River
bearing: Jim Creek
V.L.F. station: N85°W
Group E
Group C
Group A
Group D
Group B
shaft
ADIT
000W
100W
200W
300W
400W
500W
600W
700W
800W
900W
1000W
500N
400N
300N
200N
100N
000N
100S
200S
300S
400S
500S
600S
700S
800S
900S
1000S
claim 226
scale: 1"=100 feet
contour values in %/ft
highly conductive zones
possible conductive zones ?---?
3099
M-7
Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 3099 MAP #7
Fig. 9
VLF-EM
First Derivative Contours
Drn: A.B.L.W.
Date: June, 1971
To accompany geophysical-geochemical report on the Copper Canyon claim group on the Chemainus River, Victoria Mining District, B.C.
by A.B.L. Whittles, PhD
F. Lering



Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 3099 MAP #9

3099 M-9

To accompany geophysical-geochemical report on the Copper Canion claim group on the Chemainus River Victoria Mining District, B.C. by A.B.L. Whittles, Ph.D. F. Loring, P.Eng.

Fig.19
VLF-EM
Profiles
A.B.L.W., June 1971

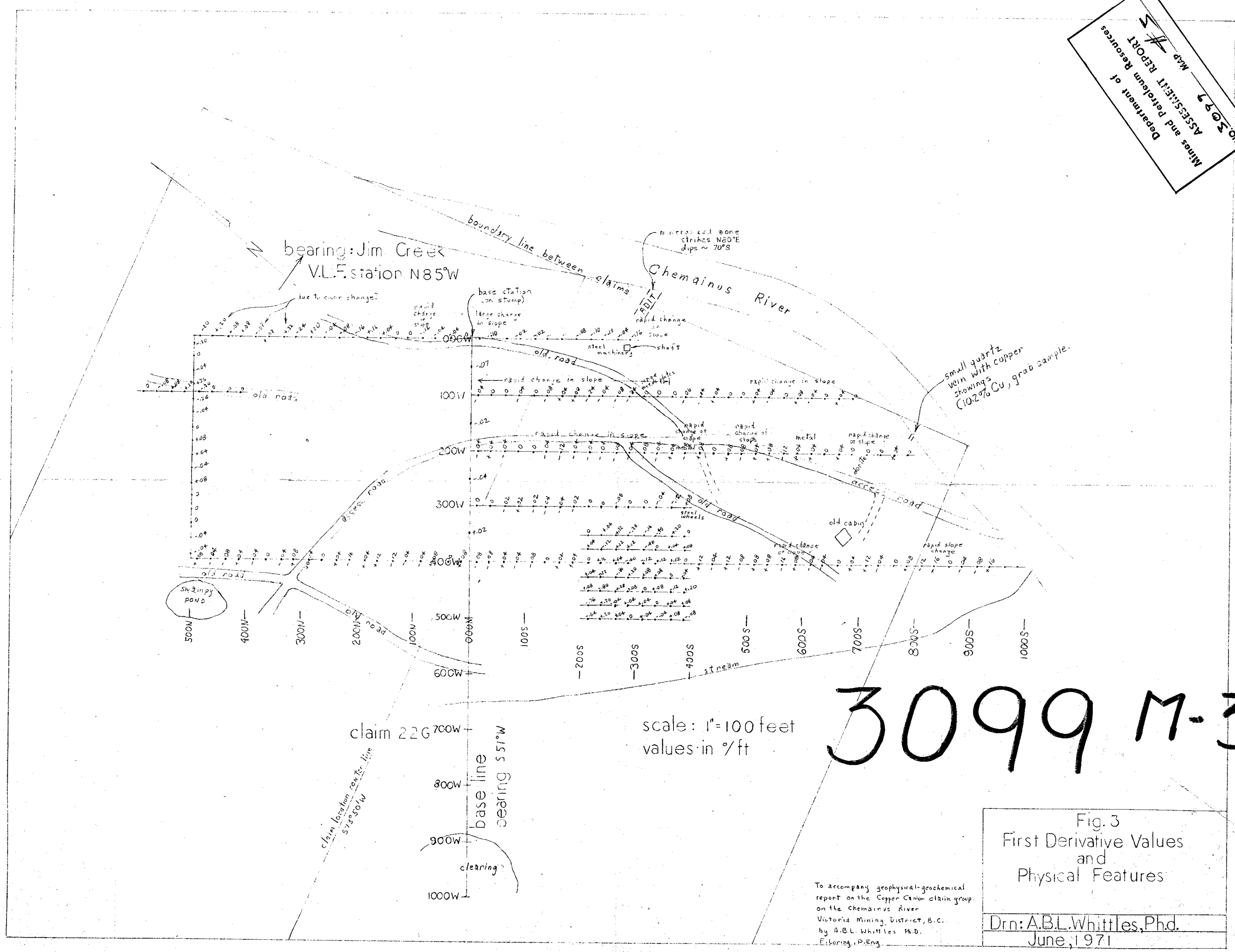
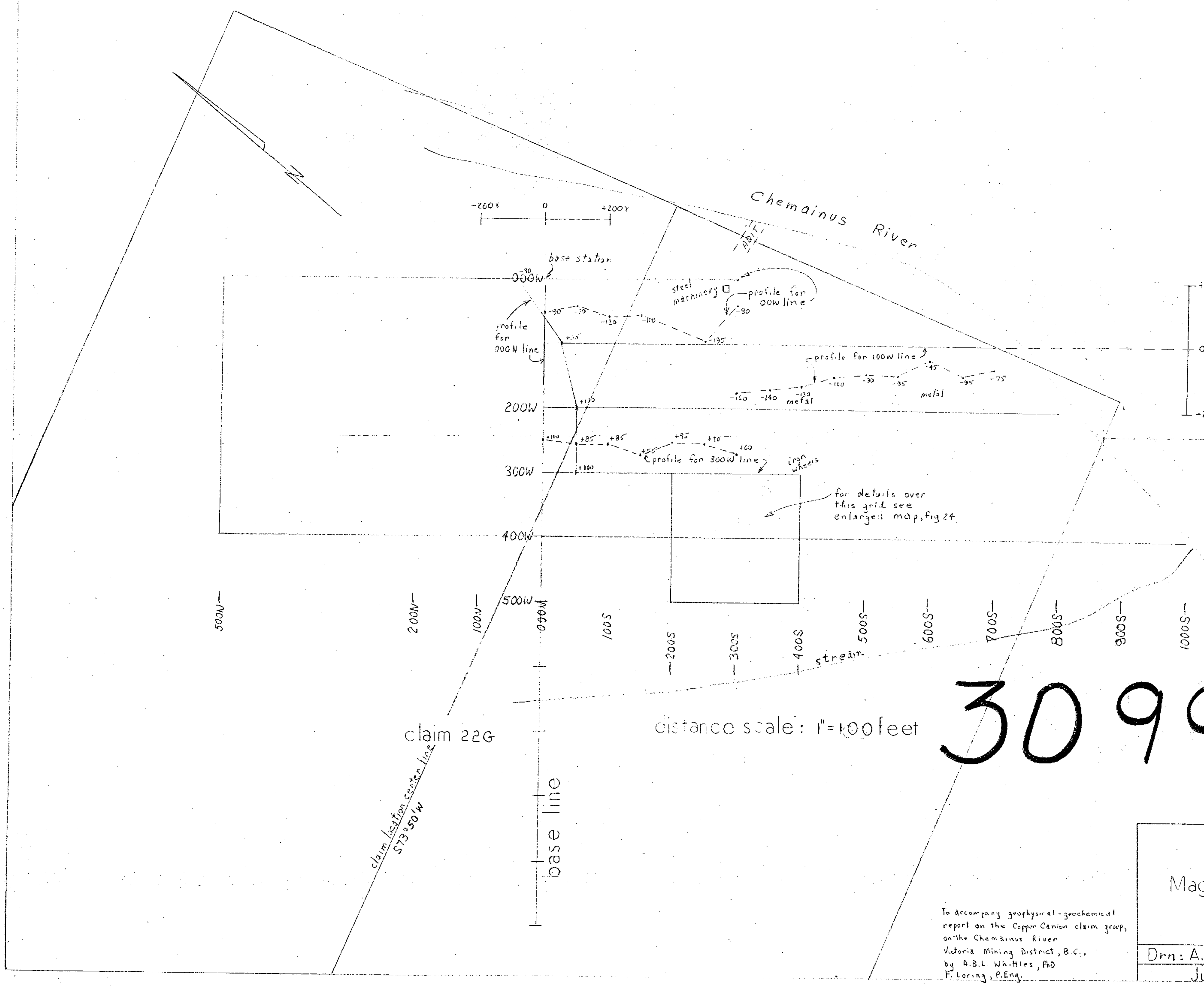


Fig. 3 First Derivative Values and Physical Features

Department of Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 3099 MAP #4

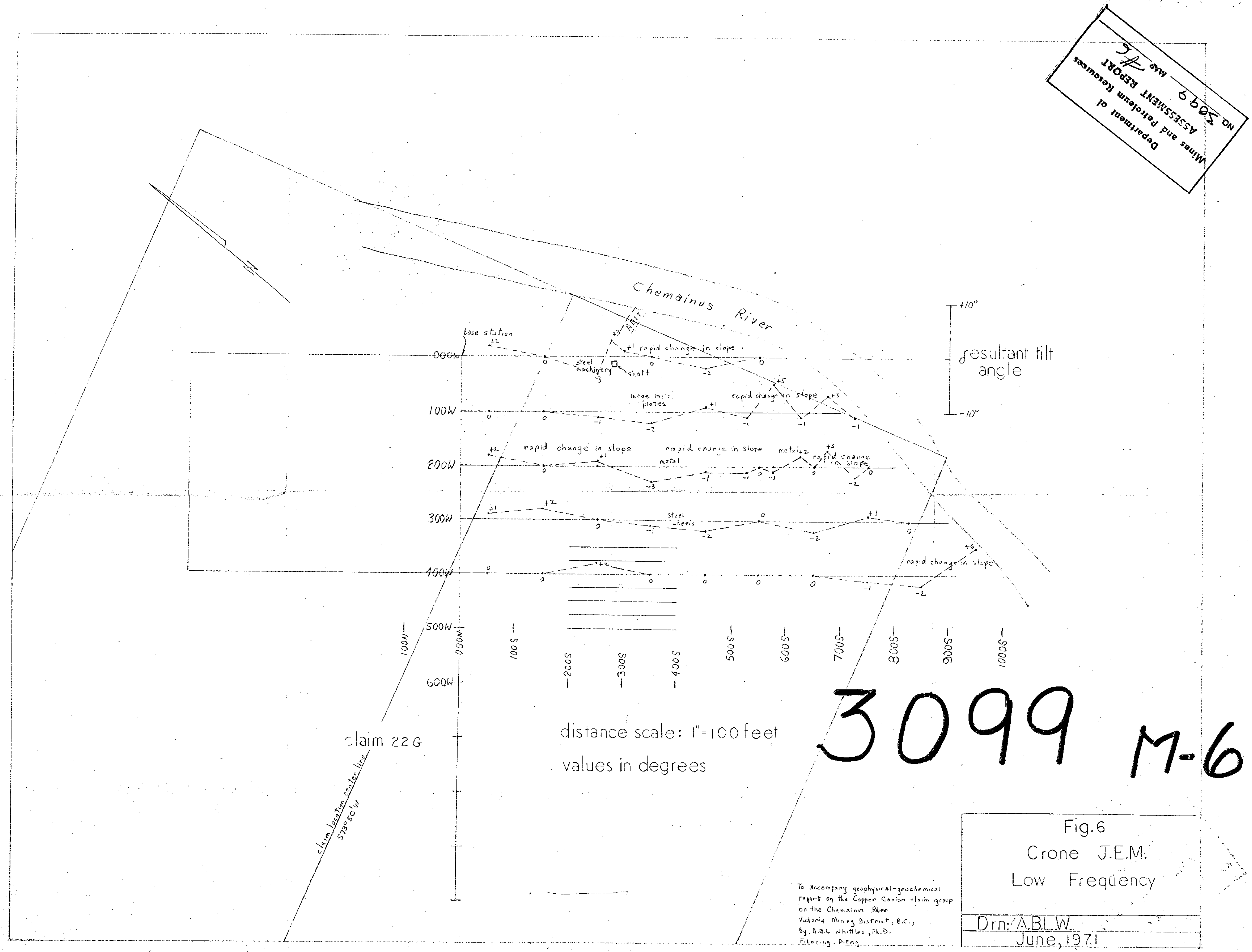


3099 M-4

Fig. 4
Magnetic Profiles

To accompany geophysical-geochemical report on the Copper Canion claim group, on the Chemainus River
Victoria Mining District, B.C.,
by A.B.L. Whittles, PhD
F. Loring, P.Eng.

Drn: A.B.L.W.
June, 1971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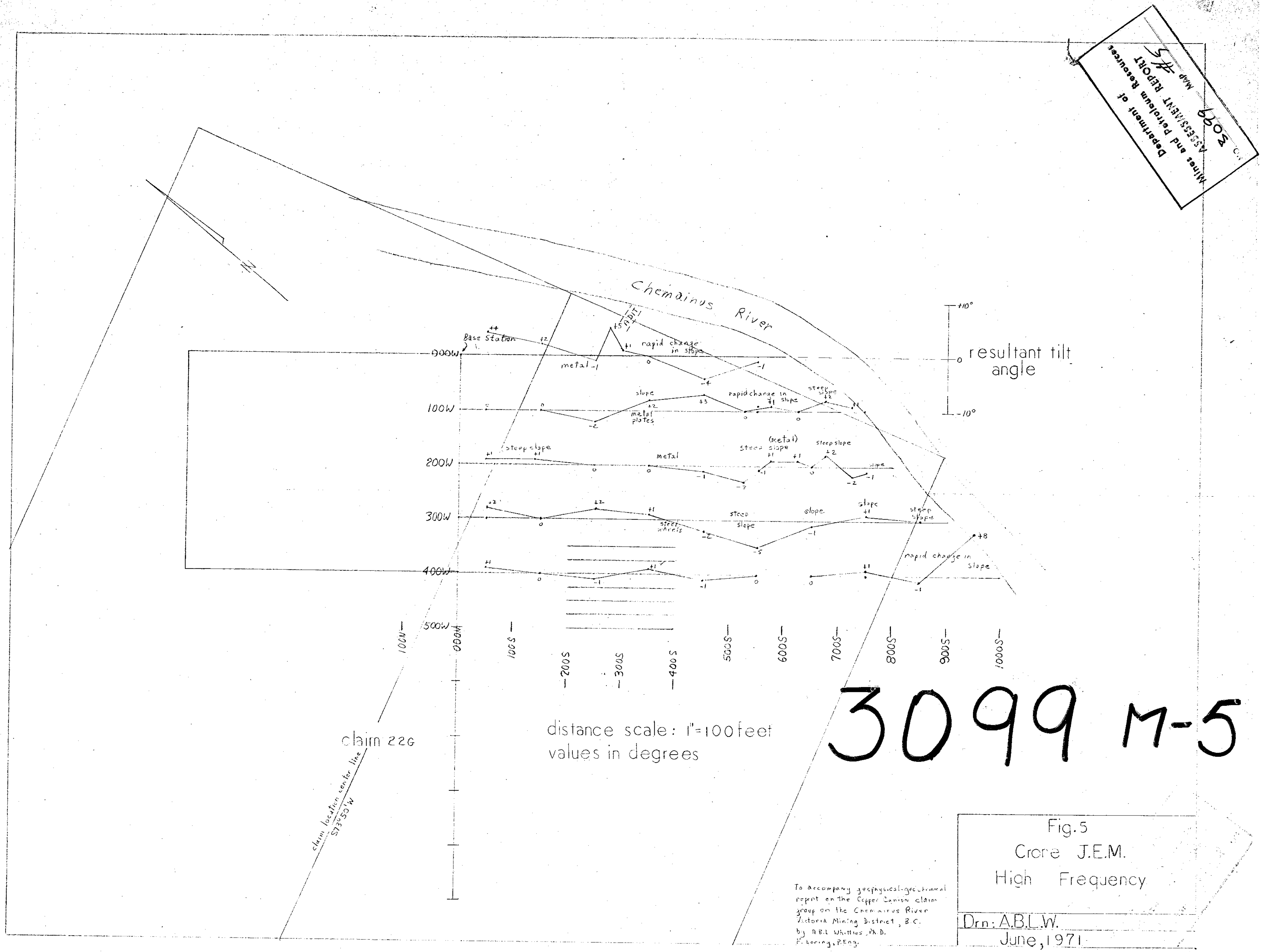
ASSESSMENT REPORT
NO. 3099 MAP #6
Chemainus River
base station
rapid change in slope
steel machinery
shaft
large insul. plates
metal
steel wheels
resultant tilt angle
+10°
-10°
000W
100W
200W
300W
400W
500W
600W
100N
000W
100S
200S
300S
400S
500S
600S
700S
800S
900S
1000S
claim 22G
claim location center line S73°50'W
distance scale: 1"=100 feet
values in degrees
3099 M-6
To accompany geophysical-geochemical report on the Copper Canion claim group on the Chemainus River Victoria Mining District, B.C., by A.B.L. Whittles, Ph.D. F. Loring, P.Eng.
Fig.6
Crone J.E.M.
Low Frequency
Drn: A.B.L.W.
June, 1971



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ASSESSMENT REPORT
3099
Map #5
Chemainus River
ADIT
Base Station
rapid change in slope
metal
slope
metal plates
rapid change in slope
steep slope
steep slope
metal
(metal)
steep slope
steep slope
steel wheels
steep slope
slope
slope
steep slope
rapid change in slope
resultant tilt angle
+10°
0
-10°
000W
100W
200W
300W
400W
500W
100N
000S
100S
200S
300S
400S
500S
600S
700S
800S
900S
1000S
claim 226
claim location center line S73°50'W
distance scale: 1"=100feet
values in degrees
3099 M-5
To accompany geophysical-geochemical report on the Copper Canyon claim group on the Chemainus River Victoria Mining District, B.C. by A.B.L. Whittles, Ph.D. F. Loring, P.Eng.
Fig. 5
Crone J.E.M.
High Frequency
Drn: A.B.L.W.
June, 1971