6308

ELECTROMAGNETIC SURVEY

NAPIER LAKE PROPERTY

KAMLOOPS MINING DIVISION

92-I-8

BY

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FOR

NEWCONEX CANADIAN EXPLORATION LTD.

JUNE 16, 1977

P.W. Richardson.

TABLE OF CONTENTS

Map #1

I INTRODUCTION

The NAP Claim Group was staked in 1973 to cover a stain zone on the east side of Napier Lake. The stain zone was found to be caused by a sheared siliceous rock containing 1 to 10% disseminated pyrite. Copper and zinc geochemical anomalies occur in the area of pyrite mineralization. No base metal sulphides were observed with the pyrite, but overburden obscures most of the zone (Rebagliati; July 31, 1973).

In 1973, a program of percussion drilling was undertaken to explore for copper-zinc mineralization within the known pyritic zone and to determine the extent of the zone. The drilling located an area of low-grade copper mineralization (Rebagliati; November 30, 1973).

The widely spaced, short percussion holes demonstrated that extensive areas of commercial mineralization do not occur associated with the pyritic zone. However, the possibility exists that narrower zones of economic grade mineralization could occur parallel to the east-west schistosity, and this possibility was not thoroughly investigated by the widely spaced holes of the 1973 program. Such mineralization could be detected by an electromagnetometer. An EM survey was done in the period from June 6 to June 11 and this report was prepared June 14 to June 16, 1977.

II LOCATION

The NAP Claim Group is 21 miles south of Kamloops in the Kamloops Mining Division. The property is on N.T.S. Sheet 92-I-8 at latitude 50°25'N, longitude 120°17'W.

III ACCESS

Highway #5 lies just west of the western edge of the property. A gravel road branches from Highway #5 at the north end of Napier Lake, and extends to the northeast corner of the present claim group.

IV CLAIMS

The NAP Claim Group consists of Claims NAP 3-8 inclusive with Record Numbers 125864G-69G inclusive.

V TOPOGRAPHY AND VEGETATION

Napier Lake is at an elevation of 2,371 feet in a fairly steep-sided valley about 300 feet deep. East of the valley, the country rises in gently rolling terraces which are covered by grass and a few firs, pines and poplars. The trees are confined to small,moist depressions and narrow water courses, all of which are dry at surface in the summer.

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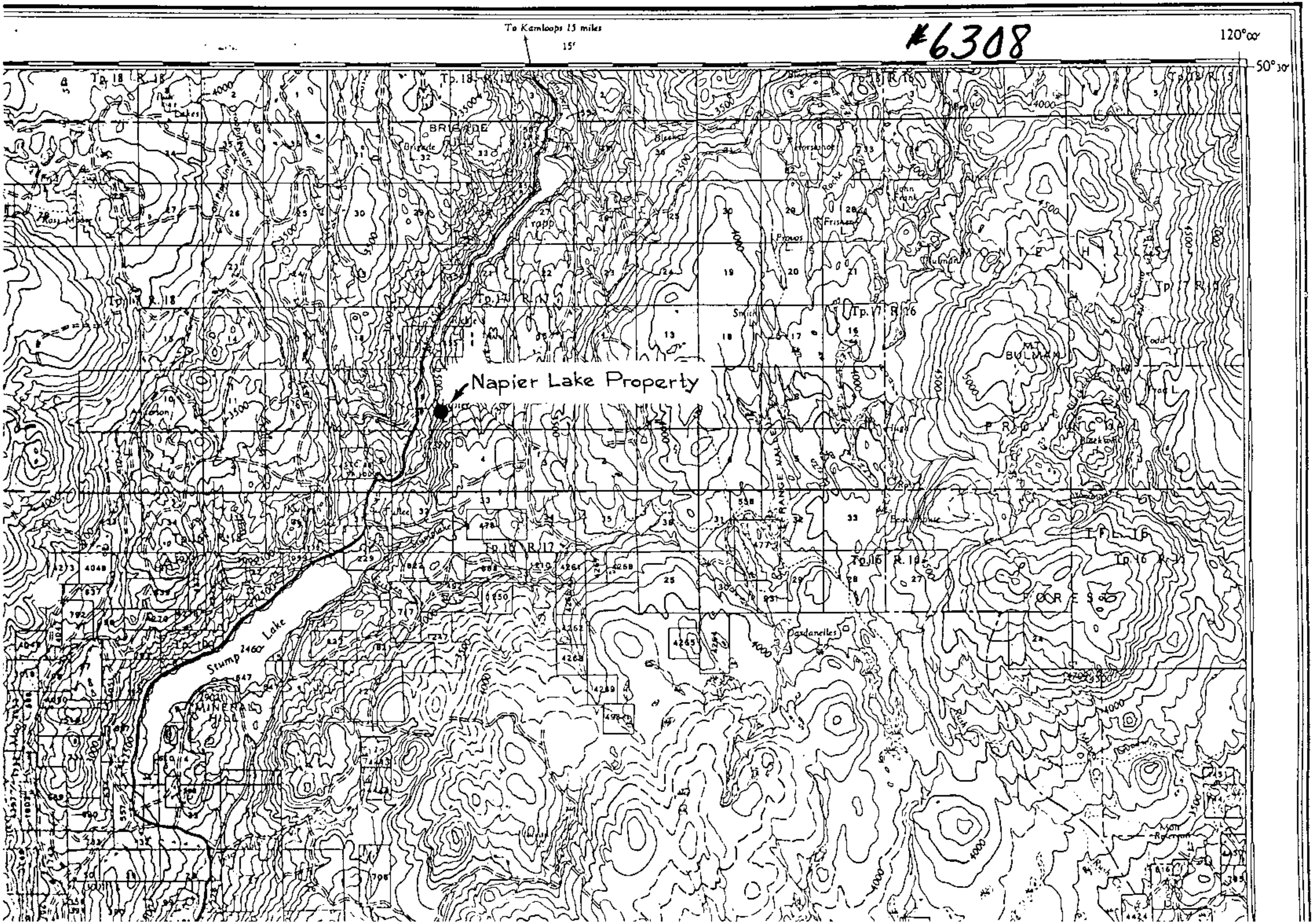
CTOR OF SURVEYS AND MAPPING

SECOND STATUS EDITION September 1st, 1961

SHEET 92 I/SE



VI ELECTROMAGNETIC SURVEY

The picket lines established in 1973 were re-established at the beginning of the survey. In the area of the disseminated pyrite, all the pickets had been knocked down over the years. The area of the claim group which is underlain by the pyrite zone was tested by using a Sharpe SE 200 electromagnetometer. The SE 200 was used in the configuration of a vertical loop transmitter and a horizontal loop receiver (see Appendix). In areas of good visibility, a central transmitter station was used, and the receiver was moved for each reading. In other areas, in-line traversing was done with both the transmitter and receiver moving along the same line 200 feet apart. The easternmost line, Line 59E, was read by transmitting from Line 57E and moving both transmitter and receiver for each reading.

VII RESULTS OF SURVEY

The results are plotted on 1" = 400' scale in order to be compatible with data collected during 1973.

It was found that there are no areas of high conductivity within the disseminated pyrite zone (see map in pocket). One area of weak conductivity was found in the area north of the zone, but this area coincided with marshy ground and is judged to be of no interest.

VIII CONCLUSIONS

The electromagnetometer did not reveal the presence of conductive bodies within the disseminated pyrite zone. If it is decided to investigate further the low-grade copper mineralization revealed by the percussion drilling program, it would be necessary to carry out an induced polarization survey on several lines which cross the disseminated pyrite zone.

IX RECOMMENDATIONS

It is recommended that the results of the electromagnetometer survey be applied as assessment work to hold the ground until a decision is made about further work on the property.

X REFERENCES

(1) Cockfield, W.E. (1961) "Geology and Mineral Deposits of Nicola Map-Area, British Columbia" GSC Memoir 249

(2) Rebagliati, C.M.
July 31, 1973 "Geology, Geochemistry & Geophysics, Napier Lake Property"

(3) Rebagliati, C.M
November 30, 1973 "Napier Lake Percussion Drilling Project"

XI STATEMENT OF COSTS

P.W. Richardson, P.Eng.	8 days @ $113.75	$ 910.00
Walter Lanz	6 days @ 35.00	210.00
Mrs. T. London	2 days @ 37.00	74.00
Room & Board		313.00
Electromagnetometer	4 days @ 10.00	40.00
Automobile	6 days @ 20.00	120.00
Field Supplies		27.00
	TOTAL	$1,694.00

XII STATEMENT OF QUALIFICATIONS

P.W. Richardson	- P.Eng. (B.C.)
	B.A.Sc. (1949) UBC - Geological Engineering
	M.A.Sc. (1950) UBC - Geology
	Ph.D. (1955) MIT - Economic Geology & Geochemistry
W. Lanz	- Undergraduate UBC

APPENDIX FIELD OPERATION

INTRODUCTION

Electromagnetic prospecting for highly conductive mineralization has long been recognized as a fast, efficient, counterpart of magnetic prospecting. Numerous conductive mineral deposits are relatively non-magnetic and will be overlooked by a magnetic survey. Other electric prospecting methods require probes in contact with the ground or long strands of electrical cable to be dragged or laid out in the surveyed area. As no wires connect the transmitter to the receiver and the distance between operators is non-critical the SE-200 electromagnetic method is ideal for reconnaissance search through rough country.

The ultra light weight transistorized SE-200 has made possible a new dimension of freedom in electromagnetic prospecting. In the past 25,000 to 50,000 c.p.s. signals were used in order to make transmitters portable. These low radio frequency signals were not effective to depths greater than 25 feet. To explore to depths of a few hundred feet low audio frequencies were employed. However, the transmitters required weighed almost one hundred pounds and were not portable during operation. The SE-200 transmitter is the ultimate answer to both these problems. The weight of the SE-200 transmitter is ten pounds and the frequency of 1,200 c.p.s. is chosen as the most effective for sulphide exploration to depths of 200 feet.

The SE-200 is equipped to perform both horizontal transmitter loop and vertical transmitter loop electromagnetic surveys. The use of a combination survey of the horizontal and vertical transmitter loop method affords twice the information normally obtainable for determining the attitude of conducting bodies (i.e. flat-lying, vertical, dipping 60° west, etc.). In Canadian exploration this will assist greatly in discriminating flat-lying conductive clay deposits from deeper and usually vertical bodies of sulphide mineralization.

Further, the use of the horizontal transmitter loop method is advantageous in determining the width of conductive zones while the use of the vertical transmitter loop method has been widely used for locating the central axis of vertical conductive bodies.

Rapid exploration methods with greater resolution than previously practical are made possible with the light weight SE-200 transmitter unit. These new methods and their application are described in detail on Pages 16 to 18.

Accurate depth to top of conductor determination has relied in the past upon empirical interpretation of idealized electromagnetic profile traverses. On Page 19 a direct approach to this problem made practical by the development of the SE-200 is outlined.

Another of the many new applications of the SE-200 is the practical operation of both the transmitter and receiver from light watercraft, even canoes. In the past electromagnetic exploration over lake covered areas had to be performed in winter months when the geologist was greatly hampered. Now it is practical to perform a simultaneous geological and geophysical reconnaissance of lake covered areas with a great saving in time and cost.

We are certain the mining industry will appreciate the new possibilities made practical with the development of the SE-200 and undoubtedly many new applications will be realized by its users. In this respect we will be pleased to receive comments from our customers so that new knowledge and suggestions may be made available to the advantage of the whole mining industry.

PRINCIPLES OF ELECTROMAGNETIC PROSPECTING

Any variable magnetic field will induce electrical eddy-currents in the medium through which it passes. The intensity of these eddy currents is proportional to the electrical conductivity of the medium multiplied by the rate of change of the magnetic field intensity. If a source (transmitter) of an alternating magnetic field is located near a metal deposit, then anomalously strong eddy currents will be induced in the deposit due to the metal's high electrical conductivity. Since all electrical currents will produce magnetic fields proportional to their intensity of current flow, therefore, anomalous transient magnetic fields will be found in the vicinity of this strong concentration of eddy currents.

If the transmitter coil broadcasts a nearly pure signal of only one frequency, then these induced eddy currents will also rebroadcast signals of the same frequency but not necessarily the same phase. A receiver coil tuned to the chosen transmitter signal frequency will then pick up simultaneously both the directly transmitted signal and the eddy current signal. These signals are then compared in amplitude and phase in order to determine the location of the anomalous eddy currents.

After plotting the results on a plan map or in profile the axis (centre line) and strike length of the anomalous conductive body is easily determined by inspection. However, reliable interpretation as to the depth to which the conductor is buried beneath the surface and to the width and dip of the conductor requires the assistance of a geophysicist.

In the null tilt method of the SE-200 system the relative strength of anomalous eddy current signals compared to the signals received directly from the transmitter is determined by the amount of tilt in degrees the combined signal has from the vertical or horizontal. (i.e. if the transmitter coil be horizontal in the first instance or vertical in the second instance). The magnitude of these eddy currents will of course be indicative of the amount or degree of anomalous electrical conductivity which is present.

The 'out of phase' signal (i.e. degree of signal polarization) is indicated by anomalously larger null widths of signal. (See Page 9, Paragraph 2, also Paragraph describing quadrature on Page 14).

The measure of 'out of phase' signal is indicative of the general specific conductivity of the anomalously conductive medium. This makes it possible to determine if the cause of the electromagnetic anomaly is a good conductor like massive sulphides as opposed to moderate conductors such as disseminated sulphide and clay deposits.

WHAT GEOLOGICAL FEATURES WILL ELECTROMAGNETIC SYSTEMS DETECT?

Electromagnetic systems detect all forms of anomalous electrical conductivity in the subsurface. Therefore, all anomalies are not necessarily metal deposits. A list in order of expected response of natural conductors is as follows:

- Graphite
- Graphitic shear zones
- Massive sulphides
- Specularite Hematite massive
- Continuous clay conductors traversed 1200 feet from transmitter
- Disseminated sulphides (10% mineralization or better) except SPHALERITE which is relatively poor conductor
- Serpentinized ultra basic rocks
- Saline water
- Continuous clay conductors traversed 400 feet from transmitter
- Anthraxalite
- Pyrolusite
- Magnetite or other strongly magnetic materials will give moderate reverse conductivity effects.

SE-200 RECEIVER MK. II

This receiver amplifier is of a modified design. It will be noted that with the SE-100 receiver, grounding contact was possible through the staff. As the SE-200 receiver has no staff, but also requires 'grounding' to avoid possible electrical instability, it has been necessary to supply a means of making electrical contact with the operator. If the wrist band supplied is worn in a similar manner to a watchband in contact with the wrist of the receiver operator, then sufficient grounding is attained. We would recommend that the grounding lead be worn inside the shirt sleeve and coat, in order to avoid tanglement in the bush. The free end of the grounding lead is to be plugged in the smaller jack receptacle on top of the amplifier. The larger jack receptacle is for the headphones.

Although there was initial success with our prototype instruments in the field, it has been found that both tuning and feedback adjustment are critical and dependent on the frequency output by the transmitter.

The early model had external adjustment for frequency tuning only. It has been noted that frequency output by the transmitter decreases slightly with a drop in battery voltage. Therefore, when a receiver is critically set for feedback at our lab during warm weather the frequency of the transmitter output may be slightly high compared to frequency of the transmitter output in cooler northern weather. The outcome is a possible instability whistle in the receiver amplifier.

To avoid this problem an exterior adjustment for feedback control has been added to the Mark II amplifier.

A broader range of tuning has also been made possible by provision of two tuning controls, one coarse and one fine. The variance of the transmitter output signal with battery voltage will be no more than ± 30 c.p.s. However, the tuning range of the coarse adjustment allows for tuning in a range of ± 150 c.p.s., so that this receiver will be suitable for work in conjunction with all available 1000 cycle transmitter equipment.

FINE TUNING PROCEDURE

If the receiver-transmitter spread is less than 400 feet, fine tuning will not be required in order to obtain a sufficiently loud signal. For transmitter-receiver spreads greater than 400 feet the following procedure is recommended once each morning and afternoon:

(a) Locate receiver between 400 and 500 feet from transmitter.

(b) Assemble receiver system

(i) Put on wristlet (preferably running wire up the inside of sleeve and through front of shirt or jacket).

Plug in wristlet jack receptacle.

(ii) Plug in amplifier to coil.

(iii) Plug in headphones to phone jack receptacle on amplifier unit.

(c) Turn volume control on to full (maximum clockwise).

Turn feedback control to minimum (maximum counter clockwise). (Feedback control is dial directly under and on same shaft as volume control).

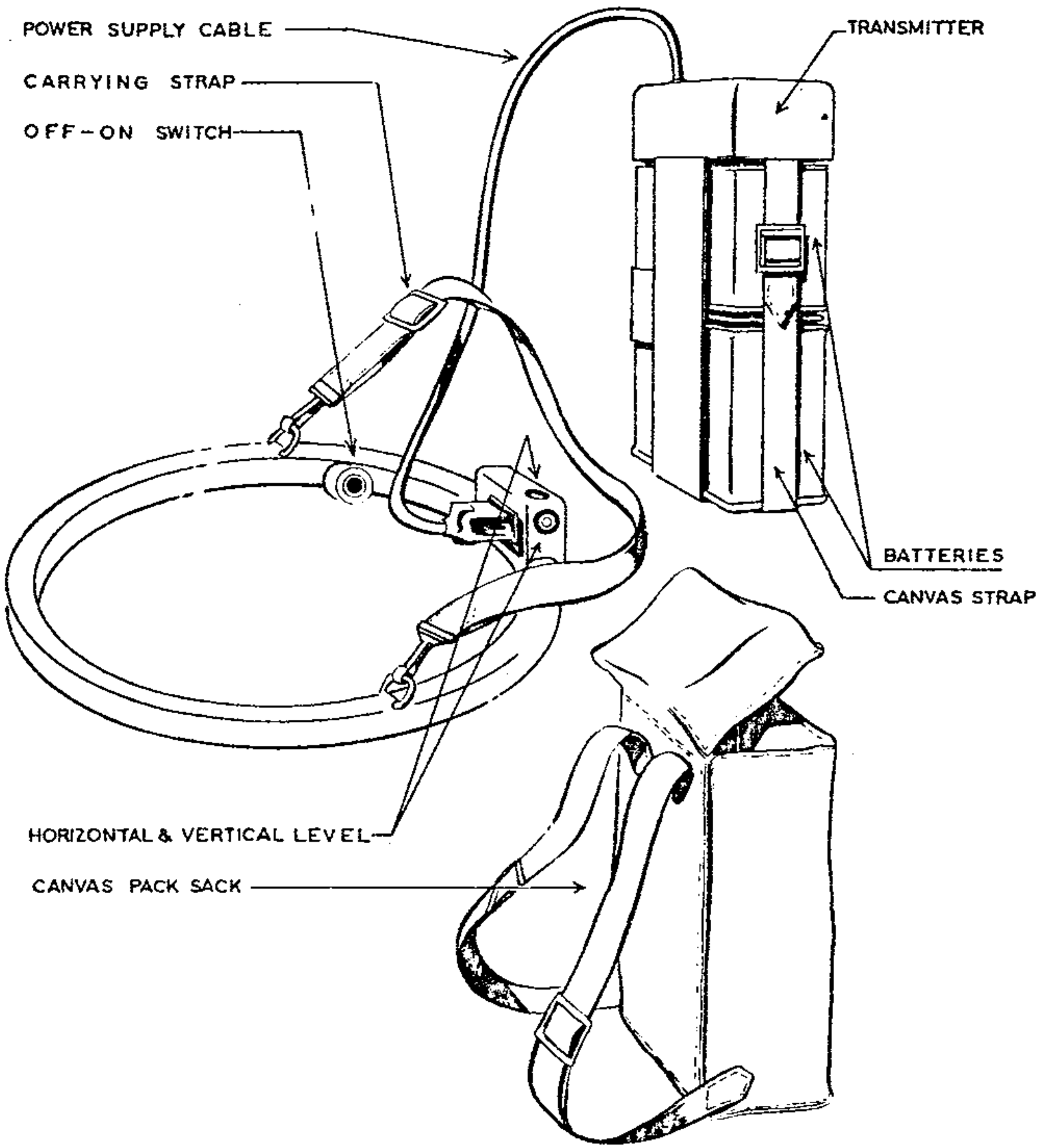
(d) When signal operator starts transmitting tilt receiver until signal is just audible.

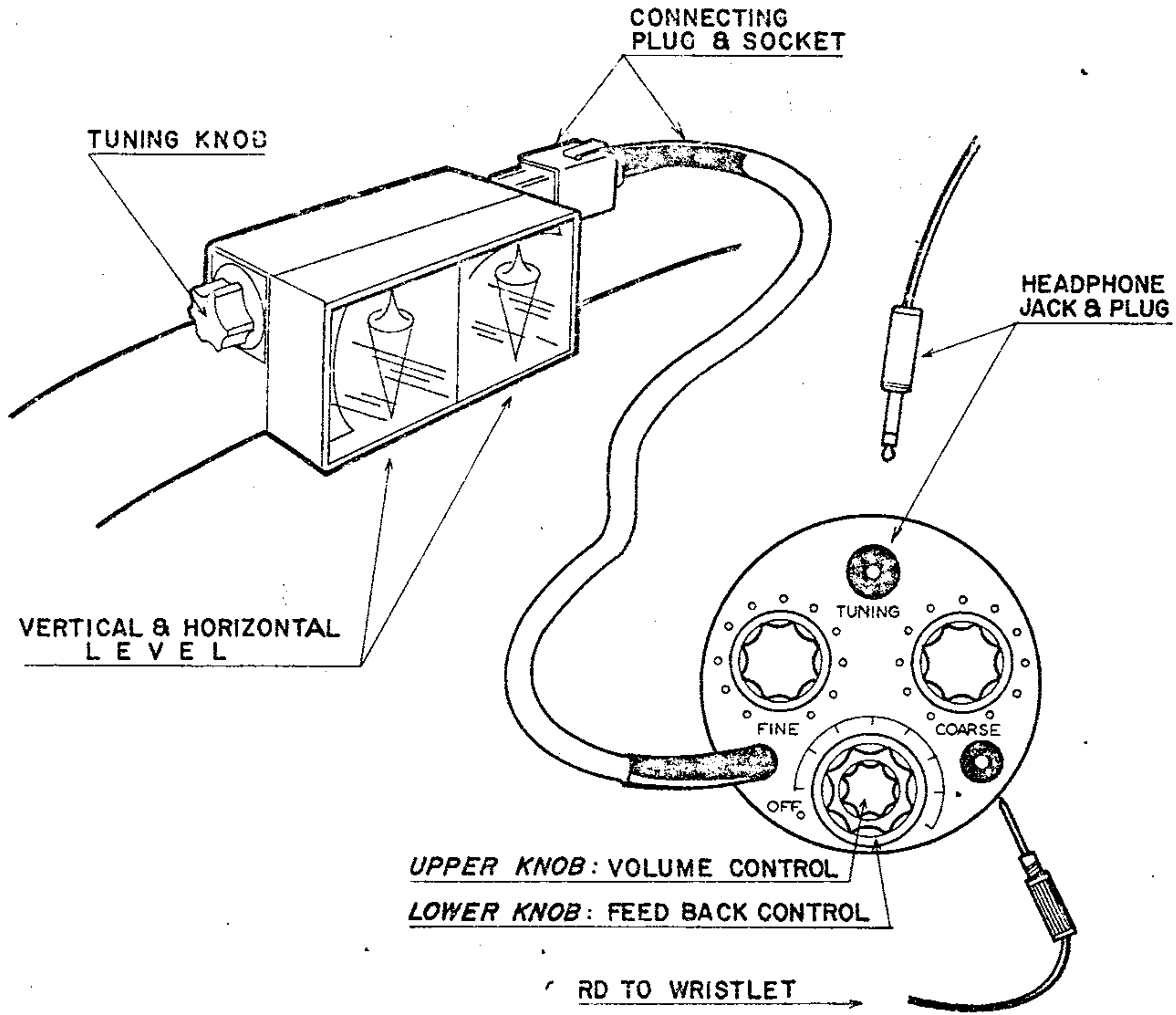
(e) Maintaining position (d) turn coil tuning control until maximum loudness of signal is heard.

(f) Repeat procedure (d) and (e) with coarse and fine tuning controls on amplifier.

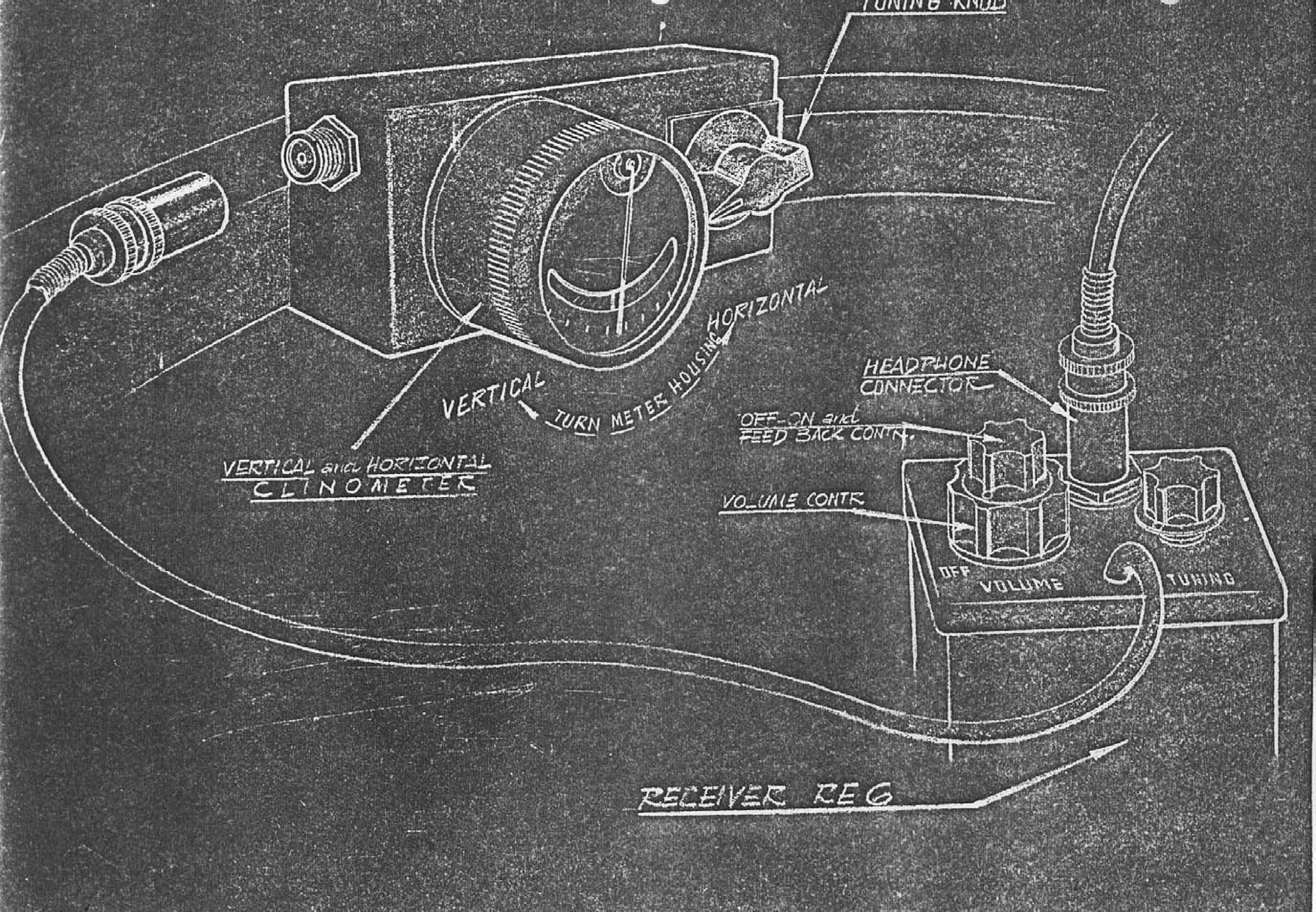
(g) Move feedback control clockwise until signal strength is sufficient. However, limiting signal loudness is controlled by instability if feedback control is set too far clockwise. (A steady whistle instead of interrupted signal will indicate instability).

(h) Signal strength is most accurately judged by reading dip angles noting tilt angles in degrees to either side of null position where the signal may be discerned. If no conductors are present optimum performance is $\pm 2^{\circ}$ on either side of null with a transmitter to receiver separation of 400 feet or $\pm 4^{\circ}$ with a 500 foot separation. If a good conductor is present the null widths will be sharper. If a moderate conductor such as clay or disseminated sulphides is present the null widths will be broader.


POWER SUPPLY CABLE
CARRYING STRAP
OFF-ON SWITCH
TRANSMITTER
BATTERIES
CANVAS STRAP
HORIZONTAL & VERTICAL LEVEL
CANVAS PACK SACK



CONNECTING
PLUG & SOCKET
TUNING KNOB
HEADPHONE
JACK & PLUG
VERTICAL & HORIZONTAL
LEVEL
TUNING
FINE
COARSE
OFF
UPPER KNOB: VOLUME CONTROL
LOWER KNOB: FEED BACK CONTROL
RD TO WRISTLET



TUNING KNOB
HORIZONTAL
VERTICAL
TURN METER HOUSING
HEADPHONE CONNECTOR
OFF-ON and FEED BACK CONTR.
VERTICAL and HORIZONTAL CLINOMETER
VOLUME CONTR
OFF
VOLUME
TUNING
RECEIVER RE 6

FIELD PROCEDURES

The SE-200 lends itself to four basic transmitter-receiver configurations and four field survey methods. These permit a choice of sixteen possible field procedures.

Configuration	'A'	Method	I	II	III	IV
"	'B'	"	"	"	"	"
"	'C'	"	"	"	"	"
"	'D'	"	"	"	"	"

Of these procedures Configuration 'A' method I has been widely used in Canadian mining.

The other methods have only become practical with the development of the SE-200. Methods II and III are twice as rapid as the conventional method and explore the surveyed area more thoroughly. Method IV is rapid in detecting conductors of short strike length and has unique 'depth to conductor' determination potentialities.

Although method II and III are rapid and thorough they still require conventional checking of interesting conductors by Configuration 'A' method I with the transmitter set on the apparent conductor axis. This enables the interpreter to take advantage of the empirical quantitative interpretive data accumulated over many years of experience in electromagnetic prospecting. As the back-log of experience grows with method II, III and IV this latter step in the program may be circumvented.

To those who are relatively inexperienced in electromagnetic prospecting we would recommend the use of Configuration 'A' method II for reconnaissance followed by checkwork using Configuration 'A' method I in which the transmitter is located on the conductor axis.

METHOD I CONFIGURATION 'A'

This is the conventional procedure using Configuration 'A'. It is relatively selective in that it gives a strong response only to the conductors in the immediate vicinity of the transmitter.

Using Configuration 'A' (see diagram Page 10) the transmitter operator remains stationary while the receiver operator takes a reading at each station on parallel lines in the vicinity of the transmitter. For each reading the transmitter operator must orient the direction of his coil in a previously calculated direction so that the plane of his coil is aimed through the receiver station. The receiver operator at each station will hold his receiver coil horizontal and rotate the coil about an axis passing through the transmitter coil location until a null signal position is noted. It is customary to record the dip angle reading of the receiver clinometer at two points of equal signal intensity and on opposite sides of the null signal position. The average of these two angles is then computed as the null-tilt angle. Their difference is computed as the null width. This same procedure is used by the receiver operator for obtaining null-tilt angles for all methods using Configuration 'A'.

On either side of a conductor the null-tilt angles will be of opposite sign, such that the plane of the receiver coil faces downward toward the conductor axis. The station where the computed null-tilt angles change sign (pass through zero angle) is called the crossover or conductor axis. It is to be noted that if the plane of the receiver coil when nulled, points downward away from the crossover then the crossover is termed a reverse crossover and is not a conductive axis. Transmitter set-up stations are usually chosen within 1000 feet of each other for reconnaissance work or on a suspected conductor axis for detail work. The computed null-tilt angle is plotted at the receiver station location on the plan map or profile. However, with this plot the corresponding transmitter location should be identified. Different values will of course be obtained for the same station if a different transmitter location is used.

INTERPRETATION

Configuration 'A' Method I

Plan View

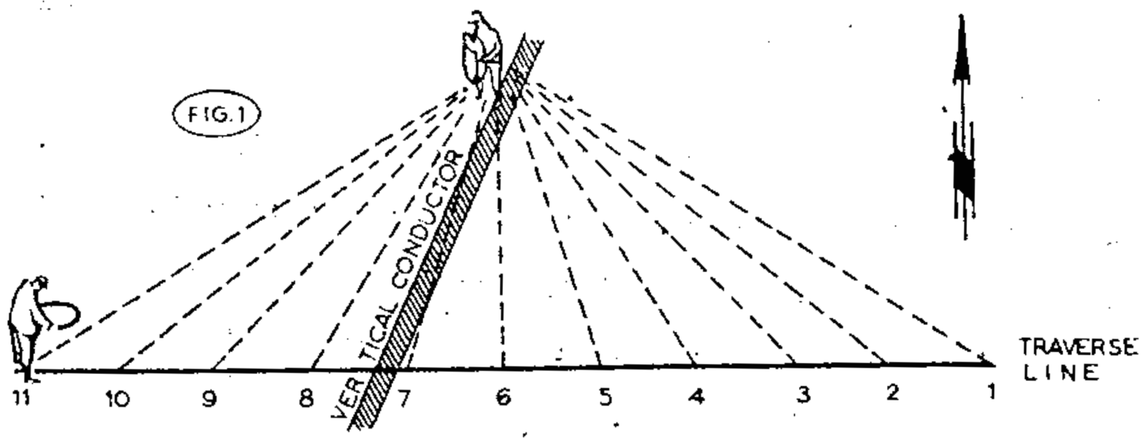


FIG.1

Readings are taken at 100 foot intervals along traverse line crossing conductor. Note that transmitter operator aims transmitter coil at receiver operator, also receiver operator faces transmitter opperator for each null tilt dip angle determination. (i.e. receiver coil is rotated about an axis passing through transmitter location).

VERTICAL VIEW FACING NORTH
SHOWING NULL TILT COIL POSITIONS

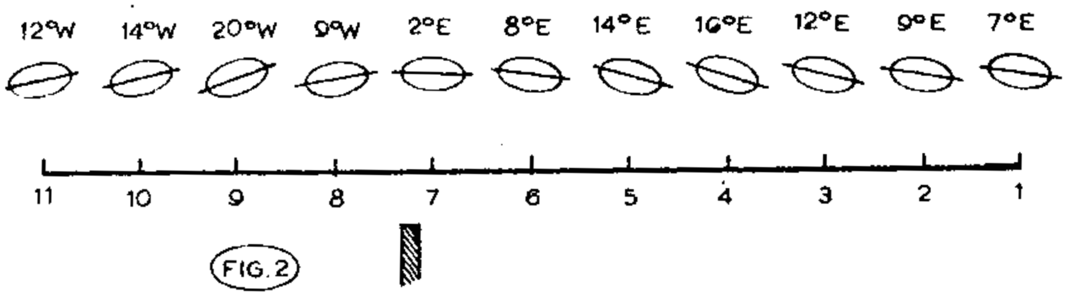
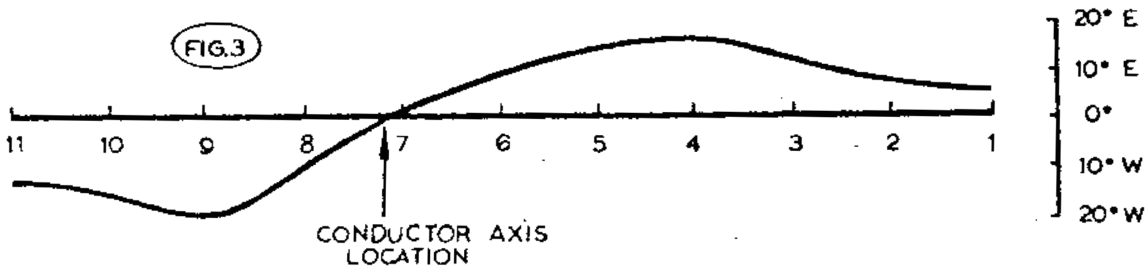


FIG.2

Profile Result
(Curve showing null tilt angles in degrees)

FIG.3



The following performance characteristics of the vertical loop E.M. system have been compiled from field experience and model studies. They are designed to show what the equipment can do, how it will perform under various conditions, and what the significant measurements are. Its limitations are also specified.

Figure 1 shows the response from a massive sulphide body, buried by 20 - 30 feet of overburden. Note that transmitter is identified for each dip angle profile, also that conductive axis follows the steepest slope of profile and not necessarily the exact points of crossover from positive to negative dip angles.

ELECTROMAGNETIC TILT ANGLES MOBRUN ORE BODY

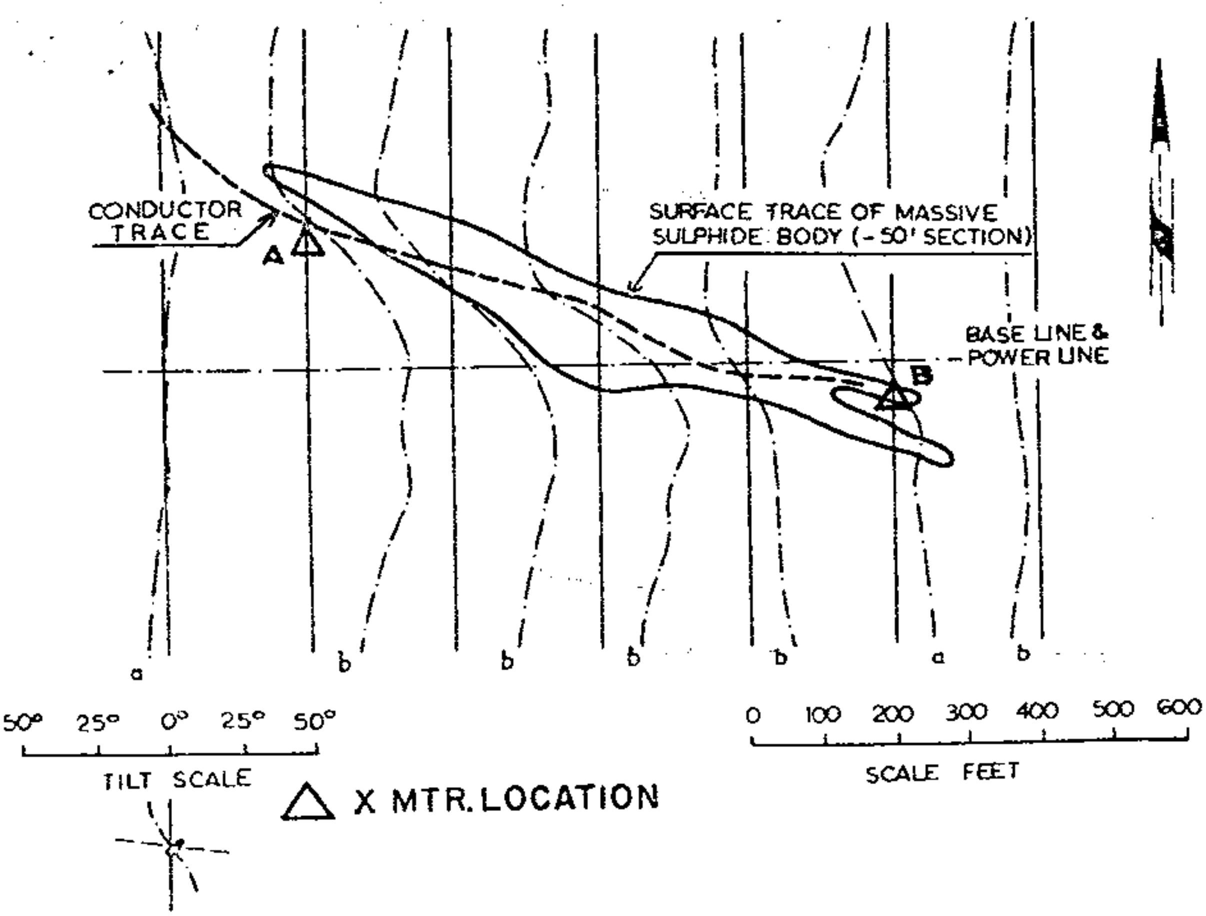
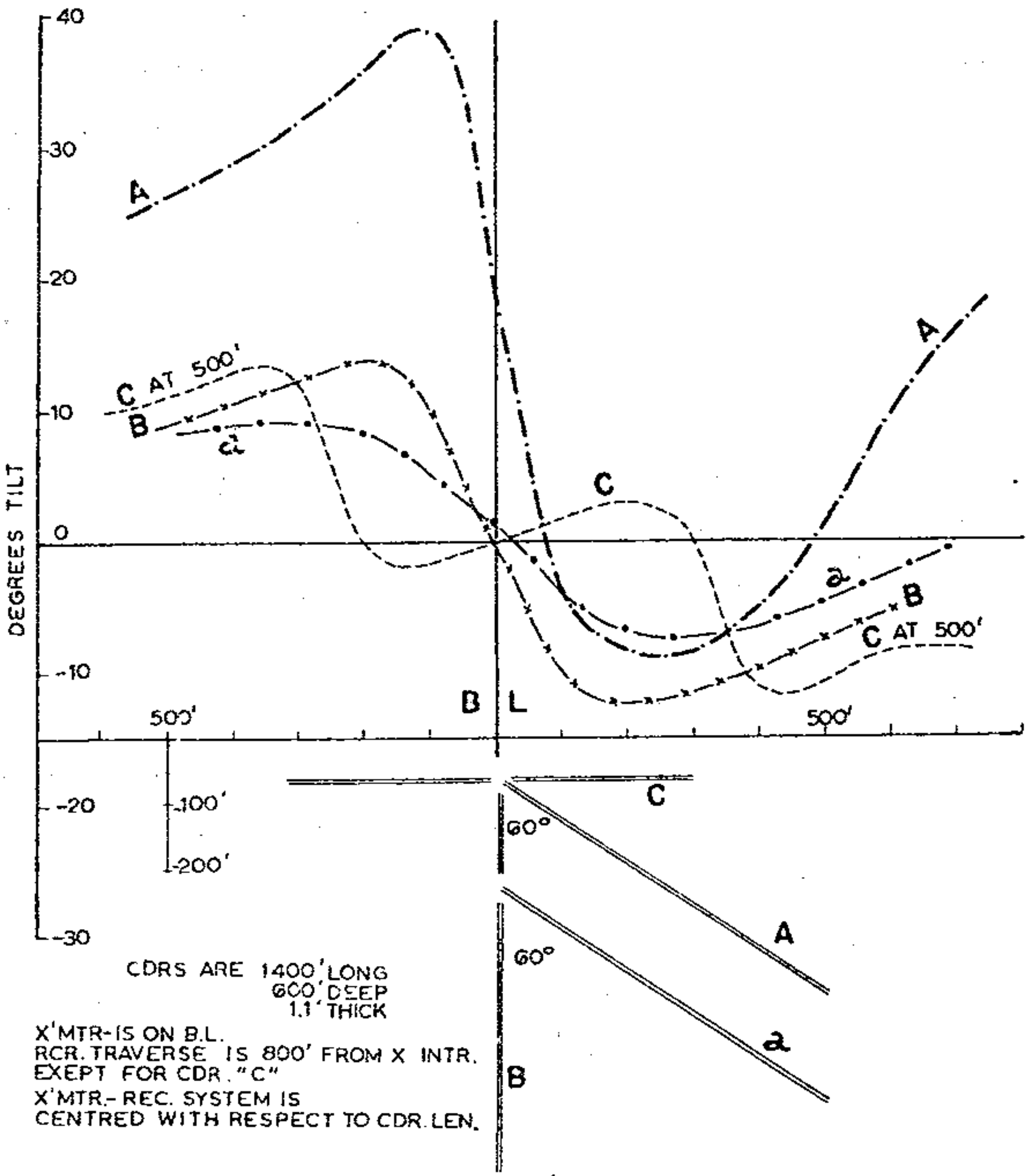


Figure 2 shows the response of long thin sheet conductors in various attitudes and at various apex depths. The cross-over displacement for the dipping conductors is noteworthy, as well as the curve slopes and magnitudes. Tilt magnitudes are almost optimum since the geometric location of the coil with respect to the conductor is very favourable.

EM TILTS — TYPE CURVES (MODEL STUDIES)



THE IMPORTANT GEOMETRIC FACTORS ARE AS FOLLOWS:

COUPLING: Depends on the angle at which the transmitted signal penetrates the face or plane of the conductor. If penetration is at right angles (90^{o}) the eddy currents produced will be maximum and therefore the eddy current fields and magnitude of response will also be maximum. The degree of coupling is usually termed as 100% x cosine of the angle between the strike of the conductor axis and the orientation of the plane of the transmitter coil. Coupling is inefficient when this angle exceeds 60^{o}. (i.e. when penetration is at an angle less than 30^{o}).

DIP OF CONDUCTOR: Has small effect on magnitude of response until dip is less than 30^{o} from horizontal. Flat-lying conductors produce cross-overs at each edge, and if these are extensive conductors like clay layers, they may shield the effects from deeper conductors. In the latter case, effective penetration depth may be reduced by as much as 50%.

END EFFECTS: Attenuation of anomalous signals over the end of conductors is appreciable. (See Figure 1). Reverse cross-overs are possible if the geometry is suitable. (e.g. if the transmitter lies between the conductor and receiver traverse).

MULTIPLE CONDUCTORS: Multiple conductors react as a single conductor when closely spaced and will produce multiple peaks when separated by 100 feet or more. Multiple cross-overs occur if separation is large. Dip angles of one conductor will dominate if transmitter is nearest to it. Sometimes no actual cross-over occurs at second conductor but only a strong positive slope in profile.

DEPTH OF CONDUCTOR: Qualitative depths can be estimated from magnitudes, slope, reverse slope, and breadth of anomaly. These estimates rely largely on empirical results. Large conductors can be detected at 250 - 400 feet depth, depending on the electrical properties of the country rocks. Conductor size and degree of conductivity become increasingly important with depth.

However, at surface a massive sheetlike sulphide vein one inch thick and strike length several hundred feet can give a strong response, sometimes as great as ± 20 degrees. At 200 feet depth of top below surface a massive sheetlike sulphide vein will have to have a thickness of 20 or more feet to give a similar response. A disseminated sulphide sheet may require 200 feet thickness at depth or 50 feet thickness at surface to obtain the same magnitude of response estimated for the above massive sulphide veins.

SIGNIFICANT PROFILE CURVE PARAMETERS ARE AS FOLLOWS:

MAGNITUDE: Maximum peak to peak change in dip angles caused by conductor. In the above example (Figure 2, Page 10) the magnitude is 20° + 16° = 36°.

SLOPE: The slope, measured in degrees per hundred feet of profile, of the plotted anomaly both from the cross-over point (centre of positive slope) and past the peak values (reverse slope). Both slopes are usually steeper on the footwall side of near surface conductors. The conductor axis usually underlies the centre of the steepest positive slope.

ASSYMMETRY: Departure of dip angle profile from approximating identical slopes on either side of the conductor axis. Assymmetry indicates the dip of the conductor when transmitter is located on conductive axis. However, when the transmitter is located a few hundred feet or more off the conductive axis the assymmetry will be large even for a vertical conductor.

QUADRATURE: The 'out of phase' component indicated by the width of the null (see Page 9, Paragraph 2). Nulls broaden on both sides of the cross-over over good conductors (e.g. massive sulphides), but are broadest directly over moderate conductors (e.g. disseminated sulphides). Sharpe nulls or a minimum of quadrature are found directly over good conductors.

As the strength of the signal broadcast by the transmitter weakens rapidly with distance, it will be noted that null widths normally increase in width proportionally to the cube of the distance of the receiver from the transmitter provided no anomalously conductive material is present. If the transmitter and receiver remain on the axis of a long conductive zone, the null widths will be found to increase approximately as the square of the distance of the transmitter from receiver. Therefore, good signal strength (small null widths) may be obtained 2000 feet from the transmitter along the strike of a continuous conductor.

MISORIENTATION: If the transmitter is not accurately oriented in the direction of the receiver coil spurious null tilt dip angles will occur if receiver operator is either uphill or downhill from the transmitter. For moderate error in orientation the null tilt dip angle error can be calculated from the following formula:

$$\text{Error of null tilt angle in degrees} = \frac{\text{Transmitter Misorientation in degrees} \times \text{Angle in degrees Operator is above or below transmitter}}{\text{(Divided by 20)}}$$

FURTHER NOTES: Xmtr must be kept 500 feet or more from power or telephone lines which will act as Xmtrs by induction and will cause spurious cross-overs if receiver traverses parallel the wire direction.

Model studies generally have employed tabular or sheet conductors. Spheres and cylinders will produce essentially the same results but over a shorter strike length. E.M. tilts are not diagnostic of conductor shape. Cross-overs occur on the side of the conductor nearest the Xmtr location. They are displaced downdip a small distance (slightly more down dip when the Xmtr-Rcr geometry is askew) and up-dip when conductor is very deep.

METHOD II CONFIGURATION 'A'

Method II is used for traverse lines that are more or less perpendicular to the regional geological strike.

In the second method the transmitter operator moves simultaneously with the receiver operator for each station reading. It is desirable for the receiver operator to be directly opposite the transmitter operator on a line 400 feet away and parallel to the transmitter operator's line. The transmitter operator then need only orient his coil perpendicular to the traverse line for each reading without being concerned about changing orientation angles. This method is twice as rapid as method I and is superior for reconnaissance survey purposes, in that, if no conductor is present it is rapidly determined and proven more conclusively. (Situations have occurred where a fairly short conductor lay between two transmitter set-ups in method I and thereby was not detected. Method II is not prone to this error). However, if a conductor is present it will always be detected by method II, but the shape of the profile form may show considerable distortion when the results are plotted, i.e. if the conductor is not perpendicular to the traverse lines the calculated null-tilt angles will be larger on one side of the crossover than on the other side. Therefore, for quantitative interpretation purposes it is always better after completing method II, if the transmitter be 'set-up' on crossovers determined by method II so that they may be detailed by method I. If the strike of the conductor is more than 30 degrees off perpendicular to the traverse lines then a maximum tilt angle will be observed when the transmitter is located on the conductor axis.

METHOD III CONFIGURATION 'A'

Method III is used for traverse lines that are singular such as roads or trails or when traverse lines are more or less parallel the regional geological strike.

In the third method the transmitter operator and receiver operator move simultaneously along the same traverse line. It should be noted however, that the results will depend on the direction in which the configuration is moving. 'One way crossovers' may be expected as the dip angles recorded will be very large on one side of the conductor axis and quite small on the other side. The maximum dip angle will be observed when the transmitter is located on the conductor axis. This means that the side of the conductor axis on which the largest dip angles are observed will depend on whether the receiver operator is ahead or behind the transmitter operator. In the instance that the conductor axis is perpendicular to the traverse line no null-tilt angle will be observed with Configuration 'A'. Therefore, it is suggested that both Configuration 'A' and Configuration 'C' be read simultaneously in Method III. This is possible when the first fifteen seconds of transmission are used for Configuration 'A' at any one location. The receiver operator may then record this reading while the transmitter operator is preparing for transmission of Configuration 'C' some several seconds later. Then, upon transmission and recording of both Configurations the transmitter and receiver operators move simultaneously onto their next stations. SE-200 field crews have averaged one minute per 100 foot station reading two Configurations when using method II and III.

METHOD IV CONFIGURATION 'A'

In method IV the conventional role of the transmitter and receiver is reversed in that the receiver operator remains stationary while the transmitter operator explores.

Conductors 200 feet in strike length or less are very difficult to discover with normal 1000 cycle EM equipment unless the transmitter happens to be located very close to the conductor. Although, conventional airborne EM equipment will detect these shorter conductors they are often missed by ground checkwork since the extremely high density of transmitter set-up locations required normally is time consuming and tedious. Now with the ultra-light SE-200 unit it is possible for the transmitter operator to move through the bush with the same freedom and independence to which the receiver operator was accustomed. Continuous or at least a very high density of transmitter set-up locations is at last practical since transmitter set-up time is less than five seconds for each Configuration. For method IV observed null-tilt angles will increase to a maximum until transmitter is directly over the conductor. Once a significant or maximum dip angle is noted by the receiver operator he will signal the transmitter operator to remain stationary while the conductor axis is determined by conventional traverses. However, in the case of very short conductors of high conductivity (massive mineralization) large dip angles may be obtained by method IV and yet no crossover is obtainable when the receiver operator carries out conventional traverses. In this instance the transmitter has coupled with the conductor immediately beside it or below it and effectively the primary signal is being broadcast from the combination of the conductor and transmitter.

DEPTH TO CONDUCTOR DETERMINATION

A second use of method IV is a fairly direct approach to determination of depth to the top of a conductor below surface. Many model curves have been worked out for depth determination using method I Configuration 'A'. However, these generally prove satisfactory only under the most ideal of conditions.

A more direct approach to depth determination is to fix the location of the receiver 200 feet off the conductor axis and 400 feet along strike from the transmitter traverse. Null-tilt readings are then recorded for the transmitter moving at 50 foot intervals along a traverse running 200 feet either side of the conductor axis. If the conductor is within 50 feet of the surface then null-tilt angles corresponding to transmitter locations on or within 50 feet of conductor axis will be considerably larger than null-tilt angles corresponding to transmitter locations 200 feet off the conductor axis. Similarly a small change in observed angles on or off the conductor indicate depth of 200 feet or more. As empirical results of such depth determinations become available Sharpe Instruments Ltd. expects that this method will prove to be extremely reliable.

CONFIGURATION 'B'

Field information obtained by use of Configuration 'B' is at present scarce. The following comments may require revision when model studies are completed.

For Configuration 'B' operation, the transmitter is held horizontally and therefore requires no orientation. This means that one man operation of the SE-200 is possible for Method I if the transmitter is taped (electric tape) with the transmitting button depressed and the coil left in a horizontal position. The receiver operator takes dip angle readings from the vertical with the receiver coil axis of rotation passing through the transmitter coil location. The results will show considerable similarity to Configuration 'A' profile results. However, the following distinctive characteristics will be present:

Magnitude of null tilt angles will be greatly accentuated at conductor edges especially for flat lying conductors.

"Slope" and "magnitude" of dip angle profile will be greatest for transmitter located on down dip side of conductor axis.

Magnitudes will be approximately 50% larger for flat lying conductors and approximately 30% smaller for vertical conductors when transmitter located near conductor axis. (As compared to Method 'A').

For Configuration 'B' coupling and hence magnitude will be very poor for thin vertical conductors when transmitter is located directly on top of conductive axis. However, coupling will improve greatly as transmitter is moved 50 or 100 feet to either side of the conductor axis. For thick vertical conductors improvement in magnitude will be moderate and should not be expected until transmitter is 50 or 100 feet outside the edges of the conductor. Therefore, successive transmitter setups across the conductor axis using Configuration 'B' may be used to indicate the width or narrowness of vertical conductive zones.

Coupling antenuates very quickly when the transmitter is removed more than a few hundred feet from conductor axis. Therefore, Configuration 'B' will discriminate advantageously against a second conductor a few hundred feet away. (Twice as effectively as Configuration 'A').

Configuration 'B' is not dependent upon accurate orientation of transmitter coil as is Configuration 'A'. Also, it is relatively free of topographical errors due to elevation of receiver above or below transmitter. However, in the latter case the receiver operator will be required to judge carefully the direction in which the transmitter lies and should tilt the axis of rotation of the receiver coil uphill or downhill so that it passes through the transmitter coil location.

CONFIGURATION 'C'

In Configuration 'C' the axis of the transmitter coil instead of the plane of the transmitter coil is aimed at the receiver operator. The receiver coil measures null tilt angles from the horizontal about an axis perpendicular to the line joining transmitter and receiver. (i.e. tilt angles are taken to and from the transmitter direction). If a conductor lies between transmitter and receiver the null tilt angles will be away from the transmitter such that the plane of the receiver coil when nulled slopes downward away from the transmitter coil. If the conductor is on the far s[illegible] of the receiver operator the null tilt angles will tilt towards the transmitter.

WARNING: Since the receiver operator will be on an angle uphill or downhill from the transmitter this angle will be added to the anomalous null tilt angle. Therefore, it will be of the utmost importance that the receiver operator record whether he is moving uphill or downhill. It will then be possible to eliminate the more obvious topographical effects during interpretation of the results.

Configuration 'C' couples best with vertical conductors striking perpendicular to the line joining transmitter and receiver or short conductors of uncertain strike length lying between or in the vicinity of the transmitter operator and receiver operator. These conductors probably would remain undetected by a survey using Configuration 'A' only.

In the case of a broad conductor underlying both the transmitter and receiver the tilt angles will likewise dip towards the transmitter due to the rapid antenuation of the transmitted signal in a strongly conductive medium.

Under ideal conditions this dip angle may be diagnostic of the specific conductivity of a broad near surface conductor.

It should be noted that a maximum dip angle and not a cross-over occurs opposite or over a conductor.

CONFIGURATION 'D'

In Configuration 'D' the transmitter is held horizontally as in 'B'. However, null tilt dip angles are read in degrees from vertical about an axis perpendicular to the line joining transmitter and receiver (i.e. tilt angles are read with the receiver coil rotating such that the top and bottom are moving towards and away from the transmitter). Again, as in Configuration 'C' the null tilt angles will include the angular displacement uphill or downhill of the receiver operator with respect to the transmitter. Therefore, the receiver operator should record notations of his approximate elevation for each reading or at least whether he is moving uphill or downhill on his traverse.

Maximum coupling will be obtained for horizontal conductors lying under the transmitter. For large sheetlike flatlying conductors effective depth of exploration may be 50% greater than the spread between transmitter and receiver.

However, a maximum of effective depth of exploration is reached when the transmitter - receiver separation approaches 400 feet. For Configuration 'A' the maximum effective depth of exploration is obtained over vertical sheetlike deposits with a transmitter - receiver separation of approximately 600 feet. In the latter case limiting depth of exploration is considered to be 400 to 500 feet for ideal 'orebodies' and a minimum of conductive overcover.

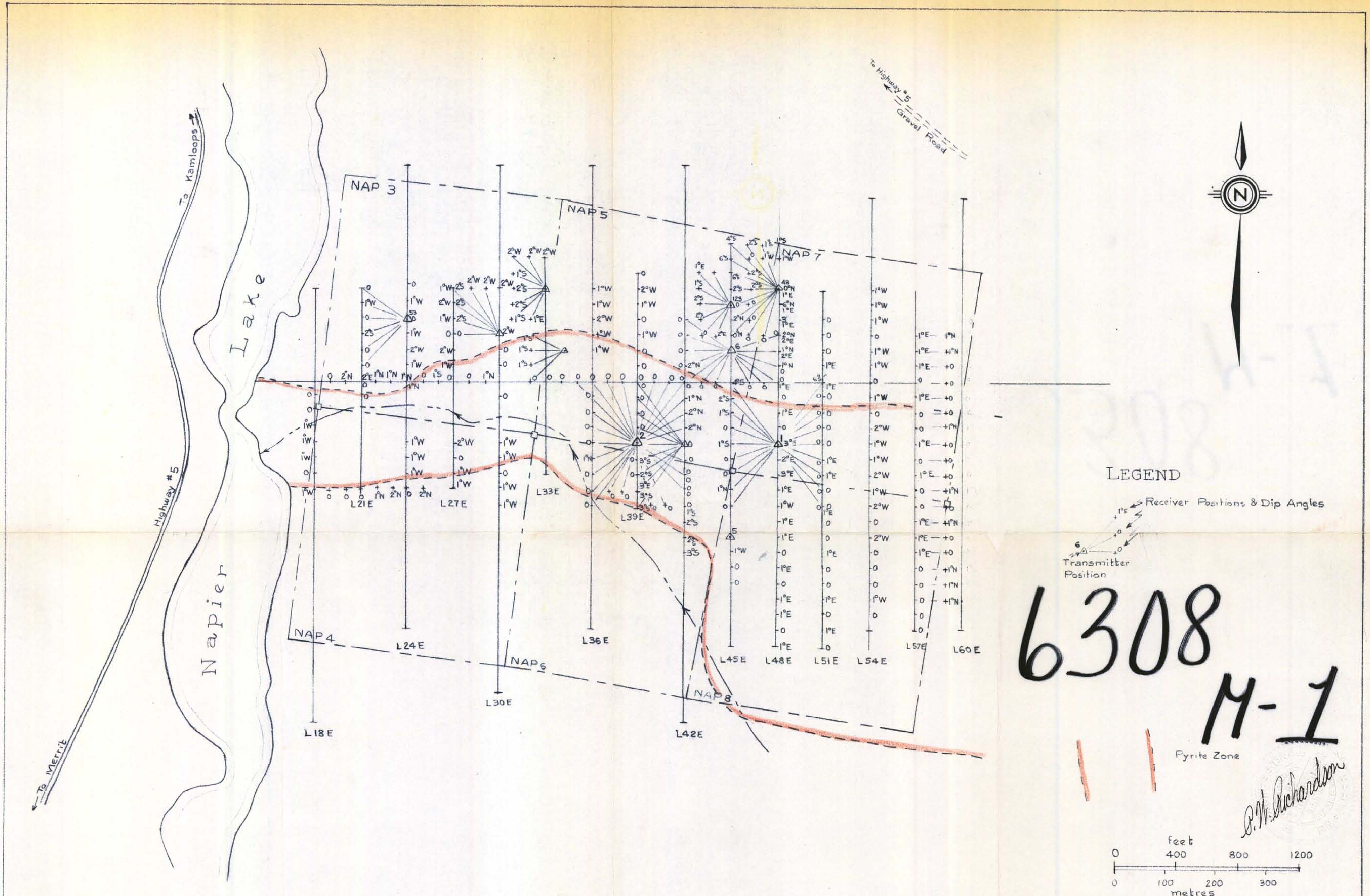
For Configuration 'D' and in the case of flatlying or shallow dipping conductors when the transmitter is directly over the conductor null tilt angles will be small and slightly negative (top of receiver coil away from the transmitter) as long as receiver also remains over the conductor. Once the receiver is outside the 'conductive area' the null tilt angles will change to positive angles (top of receiver coil towards transmitter) and will build up to a maximum positive angle within a few hundred feet outside the conductor edge. For the more deeply buried conductors this maximum positive null tilt angle will be found to be considerably farther outside the conductive boundary.

For flat lying or shallow dipping conductors which the transmitter does not overlie, the null tilt angles will be negative for the receiver located between the transmitter and conductor. Positive null tilt angles will be obtained for the receiver located on the far side of the flat lying conductor from the transmitter. With the receiver located over the flat lying conductive sheet small positive null tilt angles may be predominate over the most of the 'conductive area'.

For steeply dipping sheetlike conductors the negative null tilt dip angles will in general predominate in the vicinity of the conductive axis. The predominance of the negative null tilt dip angles will be increased over sheetlike conductors dipping steeply away from the transmitter.

The positive null tilt dip angles will be accentuated by sheetlike deposits dipping steeply towards the transmitter. However, for all types of conductors the null tilt dip angles will in general change from negative (top of receiver coil away from the transmitter) to positive (top of receiver coil towards the transmitter) as conductor is traversed in a direction travelling away from the transmitter. Therefore, if negative or strong positive null tilt angles are encountered in the normal course of a survey using Configuration 'D' then for detailing purposes radial traverse lines should be run from the transmitter through the location where the high null tilt dip angles were read. In this way the attitude and location of the conductor may be more precisely determined.

CAUTION: Never operate receiver closer than 50 feet from the transmitter to avoid overloading and possibly damaging the transistors in the receiver amplifier.



To Accompany Report:
"Electromagnetic Survey,
Napier Lake Property"
by P.W. Richardson, P. Eng.

NEWCONEX CANADIAN EXPLORATION LTD

NAP CLAIMS

ELECTROMAGNETIC SURVEY

KAMLOOPS MINING DIVISION

92-I-8

1" = 400' 1:4800

June 16, 1977 P.W.R.