SEIGEL ASSC
GEOPHYSICAL CONTR.

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CANADIAN SUPERIOR EXPLORATION LIMITED
REPORT ON GROUND INVESTIGATIONS
CONDUCTORS #71A and #72C
HEPBURN TOWNSHIP, ~~QUEBEC~~ - ADAIR ONTARIO

INTRODUCTION

The airborne survey of Hepburn Township showed the presence of a conductive zone on two flight lines, 71 and 72. The zone is called 71A and 72C.

A base line striking N60°W was cut, 600' long, and extended on the west by a second base line striking N80°W, for another 600'. Five cross lines were cut at 400' intervals for 500' on both sides of the base lines.

Plate 15-L, on the scale of 1" = 1/2 mile, shows the location of the grid with respect to the local topography.

DISCUSSION OF RESULTS

The electromagnetic survey revealed one conductive zone, curving in an arc, from a trend N60°W at line 0+00 to N60°E at line 16N (Plate 15-E). Electrical amplitudes are moderate and the conductive zone is open at both the east and west ends. The curve forms indicate steep dips.

As shown on Plate 15-M, on the scale of 1" = 200', this conductive zone has strong coincident magnetics on the west end (550 gammas) decreasing and disappearing toward the east at line 0+00. The correlation between the magnetics and the conductor is direct. Depths indicated by the magnetic curves vary from 60' in the west to 120' at line 8N.

CONCLUSIONS AND RECOMMENDATIONS

Detailed geological information was not available at the time of writing of this report and the following conclusions are based on the geophysical data only.

Conductors 71A and 72C probably represents a narrow mineralized zone containing varying amounts of pyrrhotite, which should account for the different magnetic profiles on lines 8N to 16N. To test this conductor, the following diamond drill hole is recommended:

Collar 200' north of base line on line 8N. Drill S10°W for 400' at 45° inclination.

Respectfully submitted,

Robbert A. Bosschart, Ph.D., P.Eng.

Toronto, Ontario.
April 18, 1966.

THE SE-200 PORTABLE ELECTROMAGNETIC UNIT

INTRODUCTION

The use of electromagnetic induction methods for the detection of subsurface conductors, including base metal sulphide ore bodies, is well established and accepted. The fundamental principal on which all these methods are based is as follows: when a conductor is placed in an audio frequency alternating magnetic field eddy currents are caused to flow within it. These eddy currents set up a secondary field which distorts the original magnetic field. All electromagnetic induction methods detect the presence of a subsurface conductor by measuring the distortion of the transmitted field.

Chief among subsurface geologic conductors are metallic sulphide bodies and graphite zones. The former include the majority of copper, lead, zinc and nickel ore bodies. Other conductors, generally of lesser strength, include electrolyte filled shears and faults, massive magnetite, serpentine and certain types of overburden.

The SE-200 consists of two portions, the transmitting unit and the receiving unit. The transmitting unit includes a transmitter coil, a transmitter oscillator to produce a 1250 c.p.s. sine wave alternating current in the transmitter coil, and a battery pack for power source. Two spirit levels at right angles permit the plane of the transmitting coil to be held vertical or horizontal, as desired.

The receiving unit consists of a receiving coil which can be tuned to resonate at the frequency of the transmitted signal, a high gain amplifier which boosts the signal output from the coil, a pair of earphones by which one may judge how the received signal is varying, and a clinometer by which the tilt of the plane of the coil may be measured.

All the field techniques which will be discussed below employ the SE-200 as a "null" measuring device. That is, the transmitter coil is held stationary with a selected orientation while the receiver coil is rotated about a selected axis until a minimum of signal is heard. The tilt of the receiver coil out of the plane it normally occupies at the null is recorded in terms of amplitude and direction, and is used to interpret the presence, location and other characteristics of subsurface conductors. Essentially, then, the unit measures the tilt or distortion in the direction of the electromagnetic field transmitted.

Field procedures employing three types of null configurations will be described below. These are designated A, B and C, and are shown on the accompanying sketches. In configuration A the transmitter coil is held with its plane vertical and pointing toward the receiver coil. The receiver coil is held with its plane horizontal and then tilted about the axis joining the two coils until the "null" or minimum signal tilt is observed. This is the configuration which is most recommended for reconnaissance and detail surveys, particularly in the Precambrian Shield, or elsewhere where the geologic conductors are expected to dip at angles of greater than about 30°. This configuration gives a minimum of response from truly flat lying conductors, such as overburden. It is also not effected by elevation differences between the coils, providing that the transmitter coil is properly aligned.

Configuration B has the plane of the transmitter coil vertical but perpendicular to the line joining the two coils. The plane of the receiver coil is rotated out of the horizontal about a horizontal axis perpendicular to the line joining the two coils. This configuration couples better with truly flat lying conductors than does configuration A. It also provides a greater effective range since it gives rise to twice the primary field at the same coil separation that A provides. However, it is susceptible to overburden effects and to differences in elevation between the two coils.

In configuration C the plane of the transmitter coil is held horizontal. The plane of the receiver coil is first held vertical and rotated about a vertical axis to obtain a null. The orientation of the coil axis at this null is recorded. The coil is then turned 90° and rotated out of the vertical about this axis to get a new null. This configuration thus gives rise to two angles, a "strike angle" and a "dip angle". Its advantage lies in the fact that it can be used by a single operator for reconnaissance of an area, without cut lines, providing the transmitter is placed horizontal on the ground, with the press button taped down so that it is continously transmitting. It is, however, susceptible to overburden effects and to effects due to elevation differences between the coils.

With any of these configurations under certain conditions a true sharp null cannot be heard. These conditions include: very low signal, i.e., when operating with a large coil separation; high background noise due to power lines, thunderstorms, etc.; or large out-of-phase components due to the effects of relatively poor conductors. Under these conditions, as the receiver coil is tilted, the true signal either drops below a steady noise background, remains steady or effectively disappears. The earphone sound remains the same for some further degrees of tilting, and then the signal eventually reappears for still further tilting. Instead of mentally estimating the null tilt it is usually better policy to record each of the tilt angles where the signal is just audibly stronger than the uniform low sound at the null. The difference between these angles, termed the "null width" provides useful information about the reliability of the reading and, in the case of the out-of-phase background, it gives an estimate of the phase angle of the secondary fields.

For all these configurations one simple convention of tilt direction applies. If one thinks of the plane of the receiving coil as that of a geologic bed, then the tilt at the null will be in the direction of dip of the corresponding bed. Generally on a survey with lines in one direction only, the tilts are indicated as North or South, and East or West, depending on the line direction.

It is often asked "what is the depth penetration of a particular electromagnetic method?" By "depth penetration" one usually implies the maximum depth of burial at which a measurable indication may be obtained from a subsurface conductor.

The response from a given body depends on the size, shape, attitude, conductivity and depth of burial of the body, plus the type of coil configuration, technique employed and frequencies used. Other things being equal, the larger the body the greater the depth at which it can be detected, providing that the coil separation can be simultaneously increased in proportion. Under few circumstances can a body be detected at a depth greater than its mean dimensions. Also, to obtain optimum response from a particular body the coil spacing should not be much larger than the strike length of the body. Under optimum conditions a highly conducting, long, steeply dipping tabular body will not be clearly detectible (i.e., will give rise to less than about 3° of tilt) at a depth greater than about 60% of the coil spacing. Thus the coil spacing to be employed should be at least twice the expected maximum depth of overburden and perferably even larger still. The upper limitation is imposed by the maximum coil spacing at which an adequate signal is detected, and also by the strike length of the target to be detected.

For base metal bodies in the Precambrian Shield, an average strike length of about 1000' of heavy sulphide mineralization may be expected, under 100' or less of overburden. A coil spacing of 400' is satisfactory for reconnaissance surveys under these conditions.

For first quality surveys an accuracy of 1° of tilt is desirable. In the absence of external noise and conductive (out-of-phase) effects this implies that a maximum of about 10° in null width is permissible. Actual field tests on the SE-200 indicate a conservative range of 500' within the 10° null width limitation, Thus, the maxiumum depth of penetration of the SE-200 is about 300' for very large conductors.

Conductors may be classed as to both strength and quality. Strength is an indefinite factor, as it is based on the magnitude of the observed distortion in the tilt angles. This magnitude is a function of the depth of burial, the size, shape, conductivity and attitude of the body, the coil spacing and configuration, and the location and direction of the traverse. Under optimum conditions, with bodies whose depth of burial is much smaller than the coil spacing (e.g. up to 50' depth with a 400' coil spacing) peak individual tilt angles may be classed as follows: weak, 0° - 5°; moderate, 5° - 10°; strong, 10° - 20°; and very strong, over 20°.

The quality of a conductor relates to how highly conductive it is. This is reflected in how much the null width is increased over what it would normally be at that separation of the transmitter and receiver coils.. Usually this is noted at the peak tilt angle distortion and is measured in relation to the amplitude of the tilt angle itself. A poor conductor is one whose null width increase is greater than the corresponding tilt angle. An intermediate conductor would have a null width increase of 50% - 100% of the tilt angle. A good conductor would have less than 50% of the tilt angle as null increase. In some ways the quality is a better criterion than the strength, because the latter is effected by depth of burial, and coil spacing etc.

The "typical" base metal sulphide body described above would generally show up as a good and strong anomaly. Barren sulphide zones of the same dimensions and continuous heavy graphite zones would also have the same electrical characteristics. Shear zones with the same sulphides or graphite often cause indications of intermediate quality and moderate strength. Clay filled valleys almost always give rise to conductors of poor quality and weak-to-moderate strength. Aside from these generalities it is dangerous to be dogmatic about the nature of the source of an observed set of tilt angles.

RECONNAISSANCE TECHNIQUES

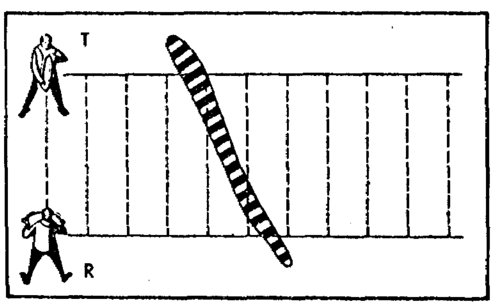
The purpose of reconnaissance coverage of an area is to detect the presence of all conductors of sufficient size and proximity to the ground surface, with a minimum of time and expense. In all such techniques both coils move progressively from station to station. Tilt angles are plotted against the appropriate receiver location and there is always some indication of where the corresponding transmitter coil is located.

Traverse lines may be properly cut and picketed, as on a property to be systematically covered, or may be blazed only, using pace and compass control. Stations should be preferably at 100' intervals and not more than 200' intervals since reconnaissance type anomalies tend to be rather sharply peaked.

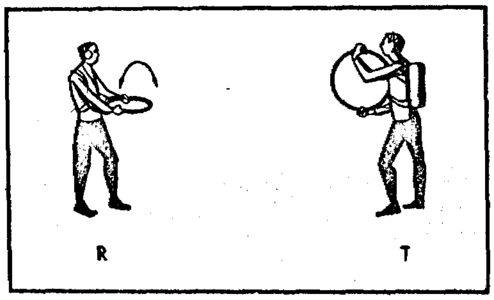
1. Broadside Method (otherwise called the Parallel Line Method)

In this method the traverse lines are inclined at approximately 90° to the expected strike, although the direction is not critical. The two coils move progressively up two parallel lines separated by about 400', with both coils being at the same "latitude" relative to the grid. At the proper station interval each coil stops and Configuration A is used (Fig. Ia).

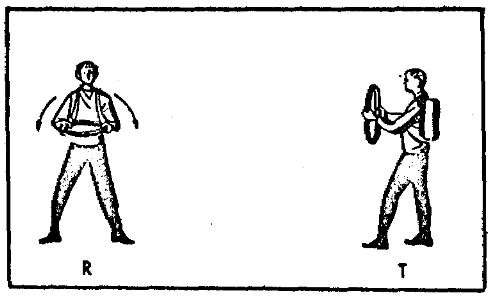
FIG.I a



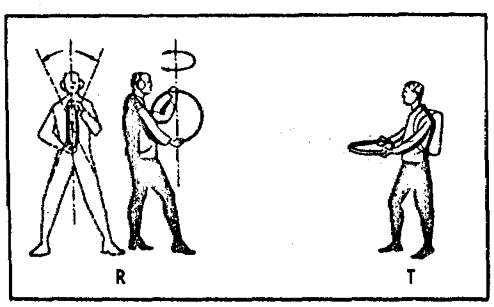
CONFIGURATION A



CONFIGURATION B



CONFIGURATION C



BROADSIDE TECHNIQUE TYPICAL SURVEY RESULTS

SINGLE FREQUENCY

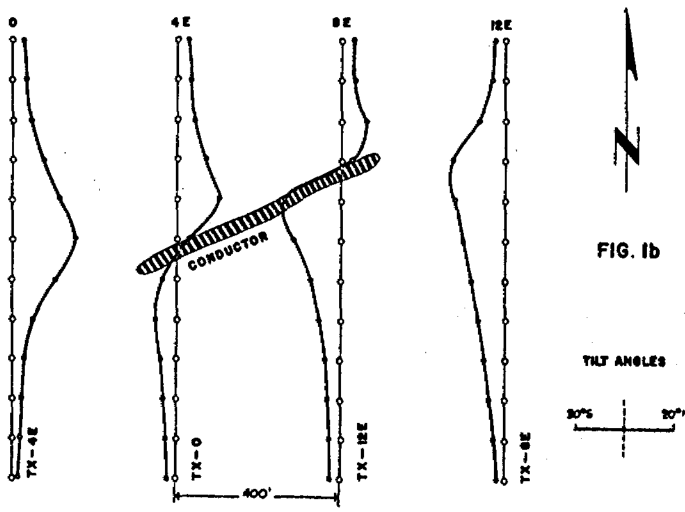


FIG. Ib

Figure Ib shows the type of tilt angle curves which might be encountered near a conductor in a typical survey.

Note how the transmitter line is indicated for each receiver line.

Some interpretive points to note are as follows: Conductors may be indicated by a crossover (i.e. the coil tilts away from the conductor on both sides, forming an "anticlinal" pattern if one used the dipping bed analogy) when crossed by a receiver coil (Lines 4E and 8E). True crossovers occur most often when the conductor strikes truly at right angles to the line direction. When the conductor strikes at a shallower angle to the picket lines it is usually reflected by unidirectional tilt angles which peak when the transmitter coil is closest to the conductor (Lines O and 12E). For this reason one must keep track of the locations of both coils, although the tilt angle is plotted against the receiver coil location. In the case of unidirectional tilts, the tilt direction is away from the conductor, which gives an indication of strike direction of the conductor.

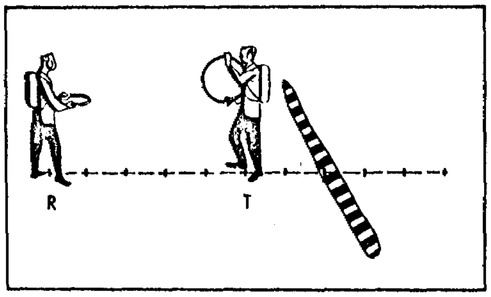
Since we would generally get an indication of a conductor if it underlies either the transmitter line or receiver line, we can consider that the single broadside traverse in effect covers both lines in a reconnaissance fashion. It is preferable, however, to have a receiver coil move up each line separately to remove any ambiguity of whether a tilt angle is due to a conductor near the receiver or transmitter location.

2. <u>In-Line Methods</u>

In special circumstances it may be desirable to only traverse a single line. Usually this line is predetermined, i.e. an existing road or trail. Configurations A or B may be employed, with both coils moving in unison along the line with a coil separation of 400' (Fig. 2a).

Configuration A is generally recommended over Configuration B for steeply dipping conductors and for reasons mentioned above. It suffers by comparison with the latter, however, in that the single line traverse should not be at right angles to the probable conductor strike and preferably should be about 30°-45° to the probable strike direction.

IN LINE METHOD FIG.2a



TYPICAL SURVEY RESULTS
IN LINE METHOD

CONFIGURATION A

FIG.2b

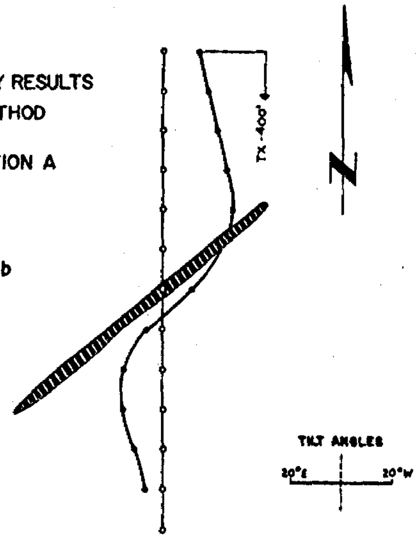


Figure 2b shows an example of profile results crossing a conductor, using a 400' coil spacing.

As with the Broadside Method, conductors may be indicated by crossovers or largely unidirectional tilt angles. The latter are more likely than the former because of the small angle between the traverse line and the conductor strike.

Because of the preference for small angles between the regional strike and the line direction with this method the areal coverage is not as effective as with the Broadside Method.

Configuration B may be employed as an In-Line Method where one or more of the following conditions exist: flat lying conductors are expected; the overburden is not expected to be conductive, and topographic variations are not severe. The traverse line is preferably nearly at right angles to the expected conductor strike.

The coil separation will be 400'. Figure 3 shows a typical tilt angle curve over a flatly dipping conductor.

IN LINE METHOD
CONFIGURATION B

TYPICAL SURVEY RESULT

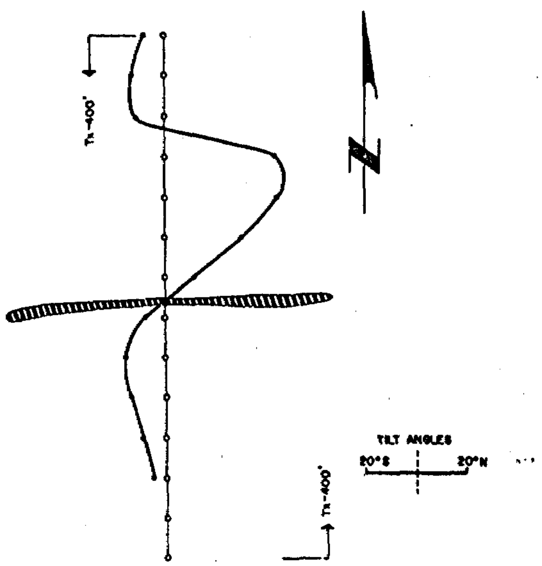


FIG. 3

Note how the location of the transmitter is indicated relative to the receiver coil position. It is seen that very asymmetrical, double crossover curves are generally obtained, one crossover being a normal "anticlinal" sequence and the other a reversed crossover or "syncline". These curves are accordingly somewhat more difficult to intepret than with methods I or 2 above.

Elevational effects must be watched closely with this configuration, since an effective tilt angle will be observed which is about 1.5 times the vertical angle between the coils. Elevational tilts will be of equal amplitude and opposite direction when the coils are reversed, so that some corroboration of their presence is possible, particularly in the absence of subsurface conduction.

3. One Man Search Pattern

The above reconnaissance methods all assume that two operators are available, one to carry each coil. When both coils move systematically through the search area the optimum and most effective reconnaissance coverage is achieved. On rare occasions there may be only a single operator available. A technique suitable for such occasions would be as follows: Configuration C is employed. The transmitter is laid horizontal on the ground with the "on" switch taped down so that it is continously transmitting. The receiver only is moved to any point within range of the transmitter coil. As indicated in the Introduction, both strike angles and dip angles may be recorded.

TYPICAL SURVEY RESULTS
CONFIGURATION C
SINGLE FREQENCY

Fig.4

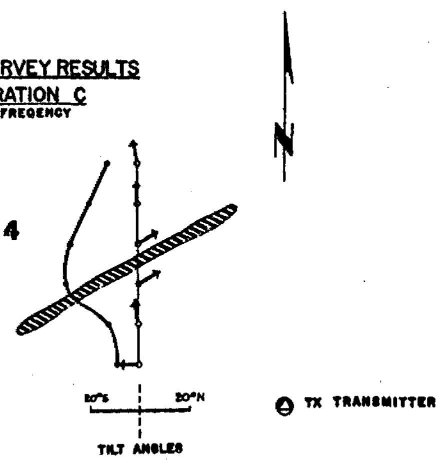


Figure 4 shows the results of a typical traverse across a conductor in the vicinity of the configuration C transmitter.

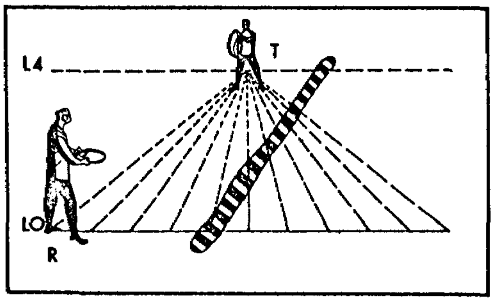
The arrows indicate the direction of the strike angle. Note that the angles are measured relative to the vertical plane as reference. The conductor axis is marked by a maximum of tilt angle, not by a crossover.

This configuration is particularly sensitive to elevational differences between the two coils. The apparent tilt angle due to elevational effects is three times the vertical angle between the coils, for small angles.

DETAIL TECHNIQUE

As indicated above, the results of the reconnaissance survey may be interpreted to give some idea of the presence and location of all the detectible conductors in the survey area. The function of the detail survey is to confirm the conductor presence and pin-point its location with sufficient accuracy to permit drilling, trenching or other investigation. A recommended field technique employs a transmitter coil which is held at one point on the trace of each conductor (for a long conductor) or on strike of each conductor (for a short conductor). The coil configuration A is once again used (Fig. 5a). The receiver coil is moved from station to station on all lines within range of the transmitter, in the vicinity of the probable conductor position. At most 500' either side of the conductor axis need be covered. For all but very flatly dipping conductors a crossover will result marking the conductor location very accurately. On very flatly dipping conductors the crossover location will be shifted somewhat towards the hanging wall side.

DETAIL METHOD FIG.5 a



TYPICAL DETAIL SURVEY RESULTS
MASSIVE SULPHIDE BODY CONFIGURATION A

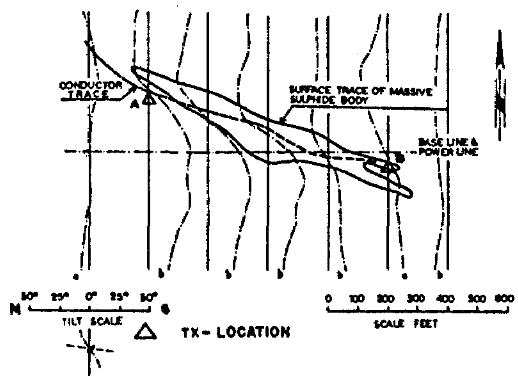
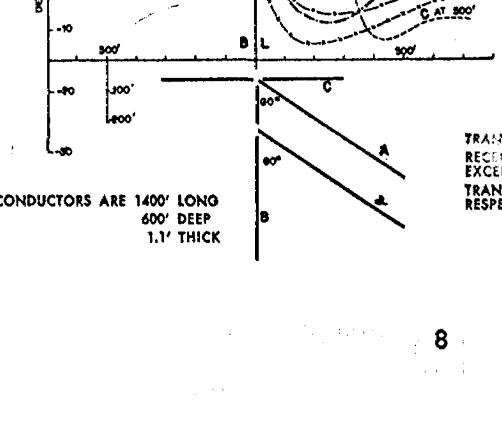


FIG.5 b

Figure 5b shows typical detail survey results over a rather strong conductor due to a massive sulphide body. Note how the transmitter location is indicated for each traverse.

EM TILTS – TYPE CURVES (MODEL STUDIES)

FIG.6



TRANSMITTER IS ON B.L.
RECEIVER TRAVERSE IS 800' FROM TRANSMITTER, EXCEPT FOR CONDUCTOR "C".
TRANSMITTER-RECEIVER SYSTEM IS CENTERED WITH RESPECT TO CONDUCTOR LENGTH.

Figure 6 shows detail type (fixed transmitter) tilt angle curves based on model studies for several conducting bodies of different depths and dip. These curves assist in the interpretation of dip angle profiles resulting from the detail surveys. Points to note include the following:

(a) The double crossover curve exhibited by the flat lying body, with the crossovers close to the body edges.

(b) The slight shift of the crossover towards the hanging wall side of a flatly dipping conductor.

(c) The asymmetry of the tilt angle curve caused by a flatly dipping conductor, with the larger tilt angles on the footwall side of the crossover.

SPECIFICATIONS

FREQUENCY:	1250 c.p.s.
SIGNAL TYPE:	intermittent, 2 to 3 c.p.s.
SEPARATION:	up to 500 feet ± 2° (null)
EXPLORATION DEPTH:	approximately ½ of separation
OPERATION:	all weather
BATTERIES:	2 x 6 volt #731 Eveready (transmitter), 1 x 9 volt #216 Eveready (receiver)
BATTERY LIFE:	in excess of 1000 stations
COIL DIAMETER:	18 inches (46 cm)
TOTAL WEIGHT:	20 lbs. (9¾ Kg)
SHIPPING WEIGHT:	approximately 40 lbs. (18 Kg)

EQUIPMENT OPERATING INSTRUCTIONS

1. Connect #7 Transmitter cable to receptacle #8.
2. Connect #12 Headphones to #11 Amplifier.
3. Connect #10 connector to Receiver coil, Fig. D.
4. Separate the coils at least 20 feet before activating Transmitter by depressing the push-button switch #9 otherwise serious damage may occur.
5. Turn button #1 clockwise until click is heard, this switches the power "on" on receiver and adjust volume knob #2, to comfortable level.
6. Depress button switch #9, this will activate the Transmitter and beep-beep signal should be heard from receiver unit.
7. The timing is a very important sequence of this operation and should be done as follows:

    a) Take the instruments in the field and separate them 400-500 feet. Hold coils steady, switch on both receiver and transmitter. Adjust volume control #2 until the signal is just present.

    b) Turn knob #14 until maximum signal is heard.

    c) Turn the tuning knob #5 on Amplifier for maximum signal, reduce volume if necessary.

    d) Repeat steps (b) and (c) for best results.

    e) Turn #1 knob clockwise until the Amplifier breaks into oscillation. This control is then reduced until the system is just stable.

8. When transmitter stops oscillating or goes on steady pulse, the following applies:

    a) Remove transmitter cover.

    b) Adjust controls for suitable (steady or pulse) signal.

    NOTE: A change in temperature may also necessitate a slight adjustment.

9. Cables may break from usage causing units to become inoperative. These can be readily repaired in the field. A simple continuity test while moving the cable will reveal the faulty section. By pulling loose the faulty wire, the exact spot of breakage will be known.

    A geophysical repair kit furnished with suitable tools to facilitate repairs most efficiently can be purchased from Sharpe Instruments.

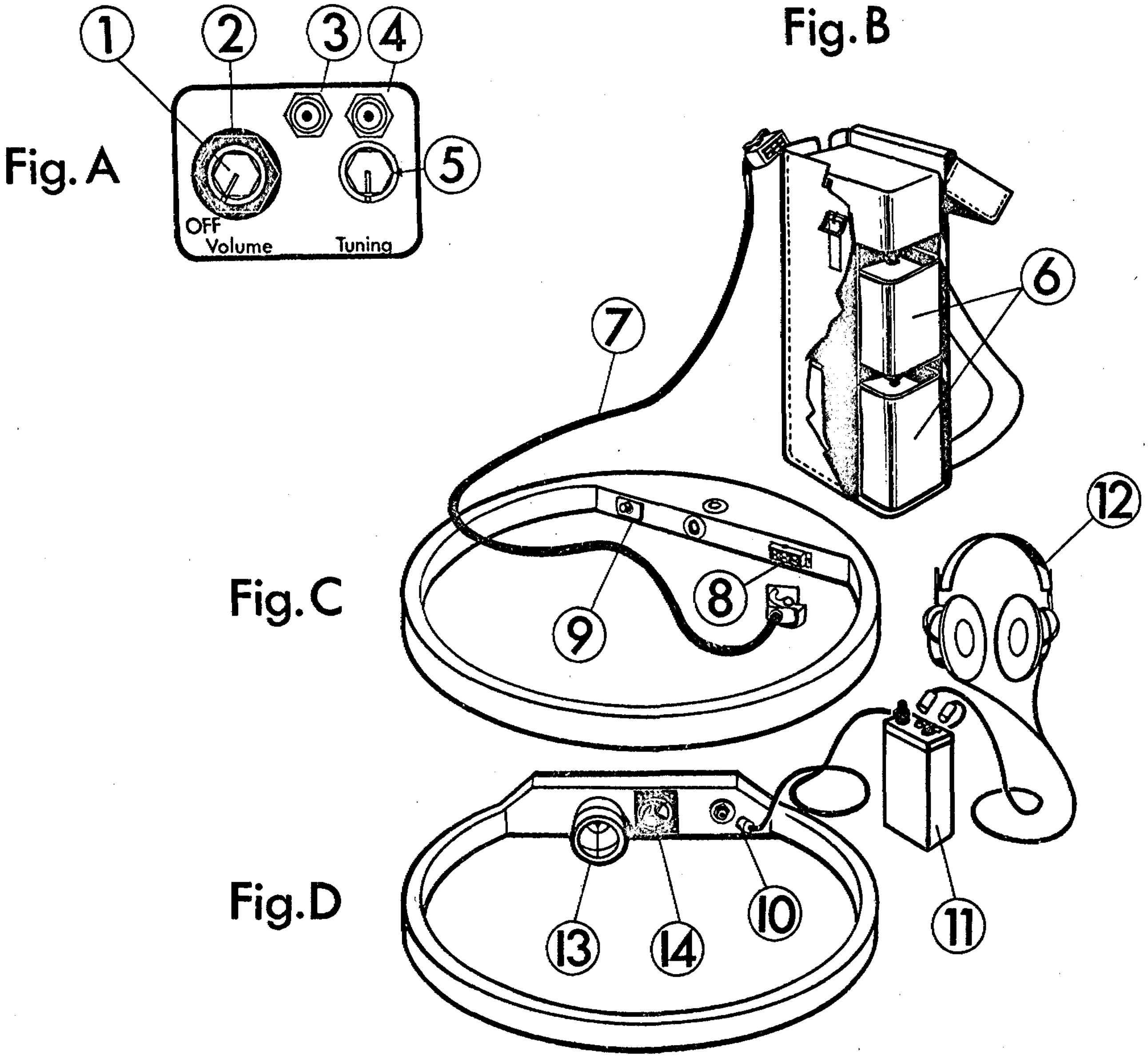


Fig. A — TOP VIEW OF RE-6A AMPLIFIER

1 Switch and Feedback Control (Upper Knob)
2 Volume Control (Lower Knob)
3 Phone Receptacle
4 Coil Receptacle
5 Tuning Knob

Fig. B — TRANSMITTER AND POWER PACK

6 Batteries
7 Transmitter Cable

Fig. C — TRANSMITTER COIL

8 Receptacle
9 Push Button Switch

Fig. D — RECEIVER

10 Connector To Amplifier
11 Amplifier Model RE6A
12 Headphones Model HC-6C
13 Clinometer
14 Receiver Coil Tuning Knob

DESCRIPTION OF THE ELECTROMAGNETIC SURVEY UNIT MODEL SE-200

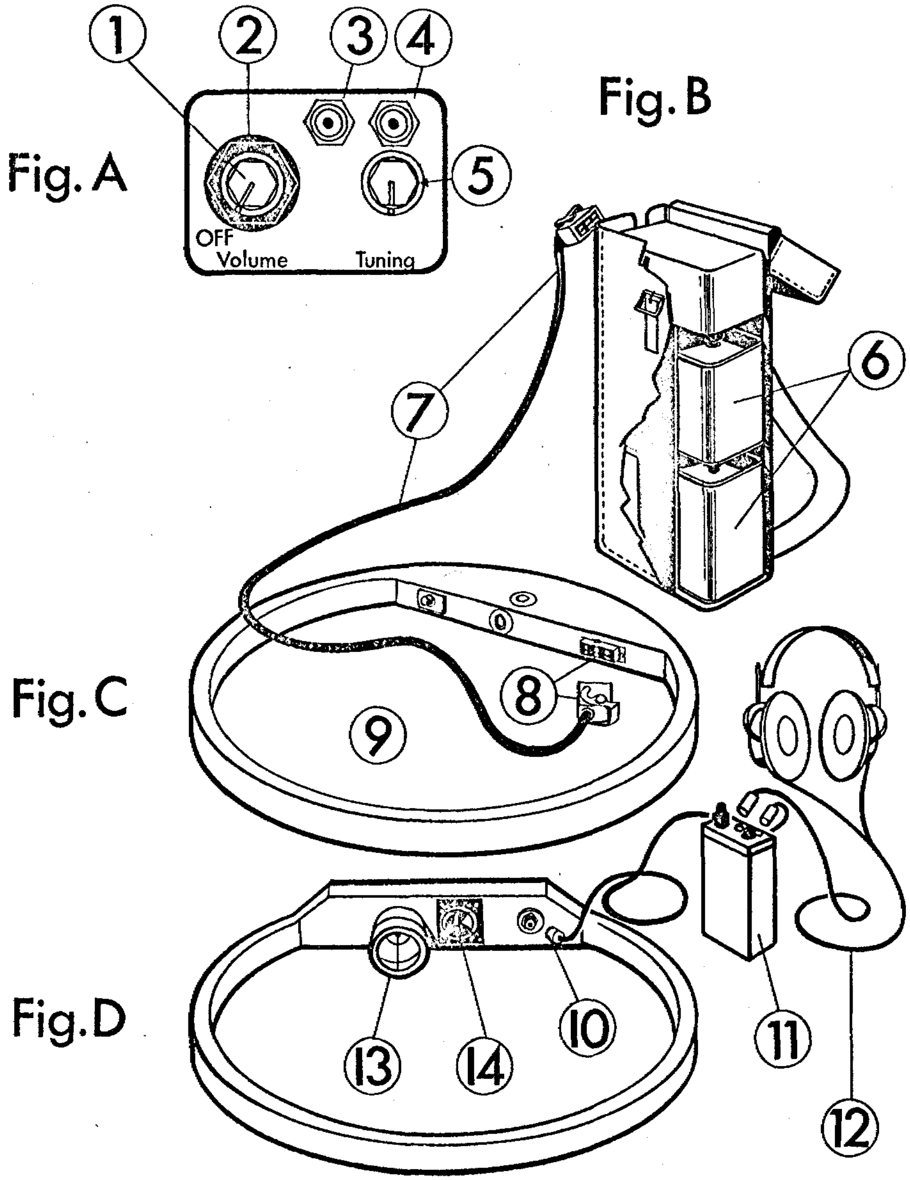


Fig. A — TOP VIEW OF RE-6 AMPLIFIER

1 SWITCH AND FEEDBACK CONTROL (UPPER KNOB)
2 VOLUME CONTROL (LOWER KNOB)
3 PHONE RECEPTACLE
4 COIL RECEPTACLE
5 TUNING KNOB

Fig. B — TRANSMITTER AND POWER PACK

6 BATTERIES
7 TRANSMITTER CABLE

Fig. C — TRANSMITTER COIL

8 RECEPTACLE
9 PUSH BUTTON SWITCH

Fig. D — RECEIVER

10 CONNECTOR TO AMPLIFIER
11 AMPLIFIER MODEL RE6A
12 HEADPHONES MODEL HC-6C
13 CLINOMETER
14 RECEIVER COIL TUNING KNOB

SHARPE INSTRUMENTS OF CANADA L[illegible]D
79 Martin Ross Avenue — Downsview, Ontario

SE-200

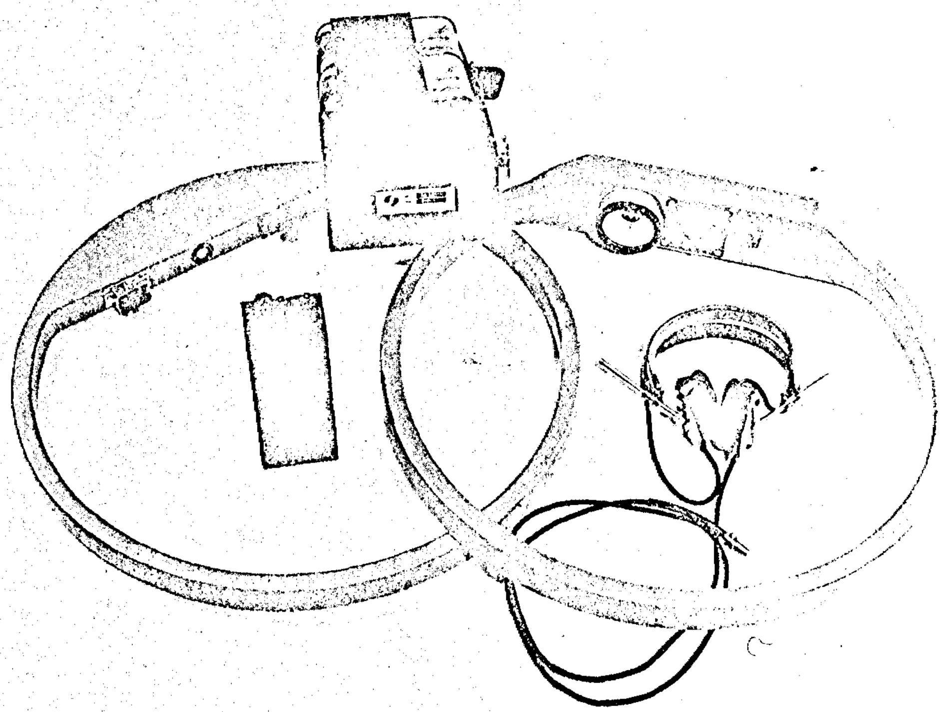
ELECTROMAGNETIC UNIT

In the search for base metals in the form of massive sulphide deposits, the Model SE-200 Electromagnetic Unit finds its application in reconnaissance and detail survey operation.

This inexpensive instrument is fully transistorized, extremely light in weight and a dependable accurate tool with many configurations possible to suit different attitudes of ore bodies.

The SE-200 consists of two portions, the transmitting unit and the receiving unit. Operators can move completely free from each other since inter-connecting cables are not needed.

For easy distinction in the presence of powerline noise the primary signal is modulated. Insensitive to weather and climatic conditions, the Model SE-200 is used in survey operations on all continents.



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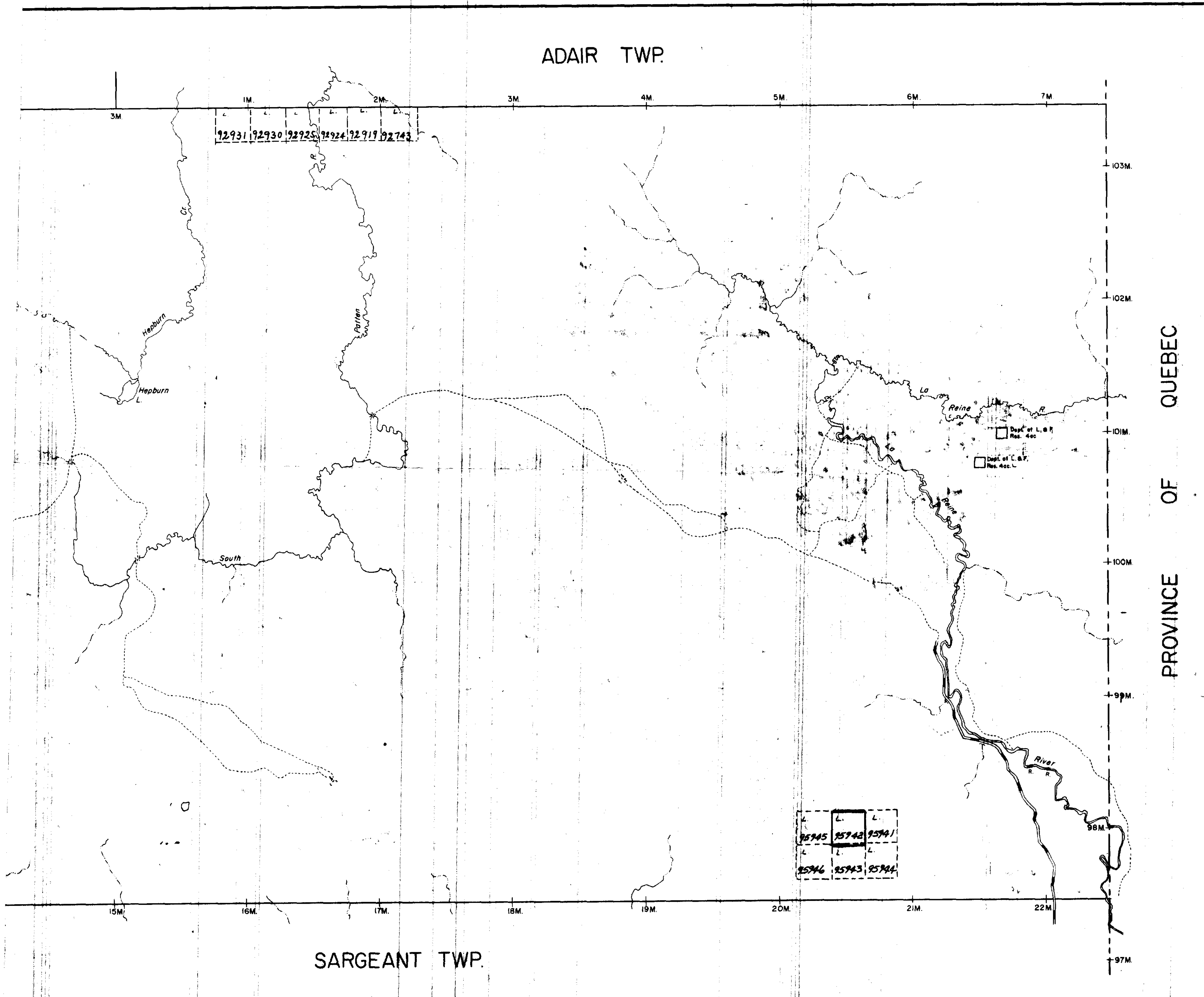

M.500

THE TOWNSHIP OF

HEPBURN

DISTRICT OF COCHRANE

LARDER LAKE MINING DIVISION

SCALE: 1 INCH=40 CHAINS

LEGEND

PATENTED LAND	Ⓟ
CROWN LAND SALE	C.S.
LEASES	Ⓛ
LOCATED LAND	Loc.
LICENSE OF OCCUPATION	L.O.
MINING RIGHTS ONLY	M.R.O.
SURFACE RIGHTS ONLY	S.R.O.
ROADS	
IMPROVED ROADS	
KING'S HIGHWAYS	
RAILWAYS	
POWER LINES	
MARSH OR MUSKEG	
MINES	
CANCELLED	

NOTES

400' Surface rights reservation around all lakes and rivers.

ONT. DEPT. OF MINES MINING LANDS BR.
THIS MAP FOR CHECKING PURPOSES ONLY – MUST NOT BE SOLD.

DATE OF ISSUE
MAR 3 1967
ONTARIO DEPT. OF MINES

PLAN NO. M.500

DEPARTMENT OF MINES
— ONTARIO —

32013NE0009 63.2099 HEPBURN

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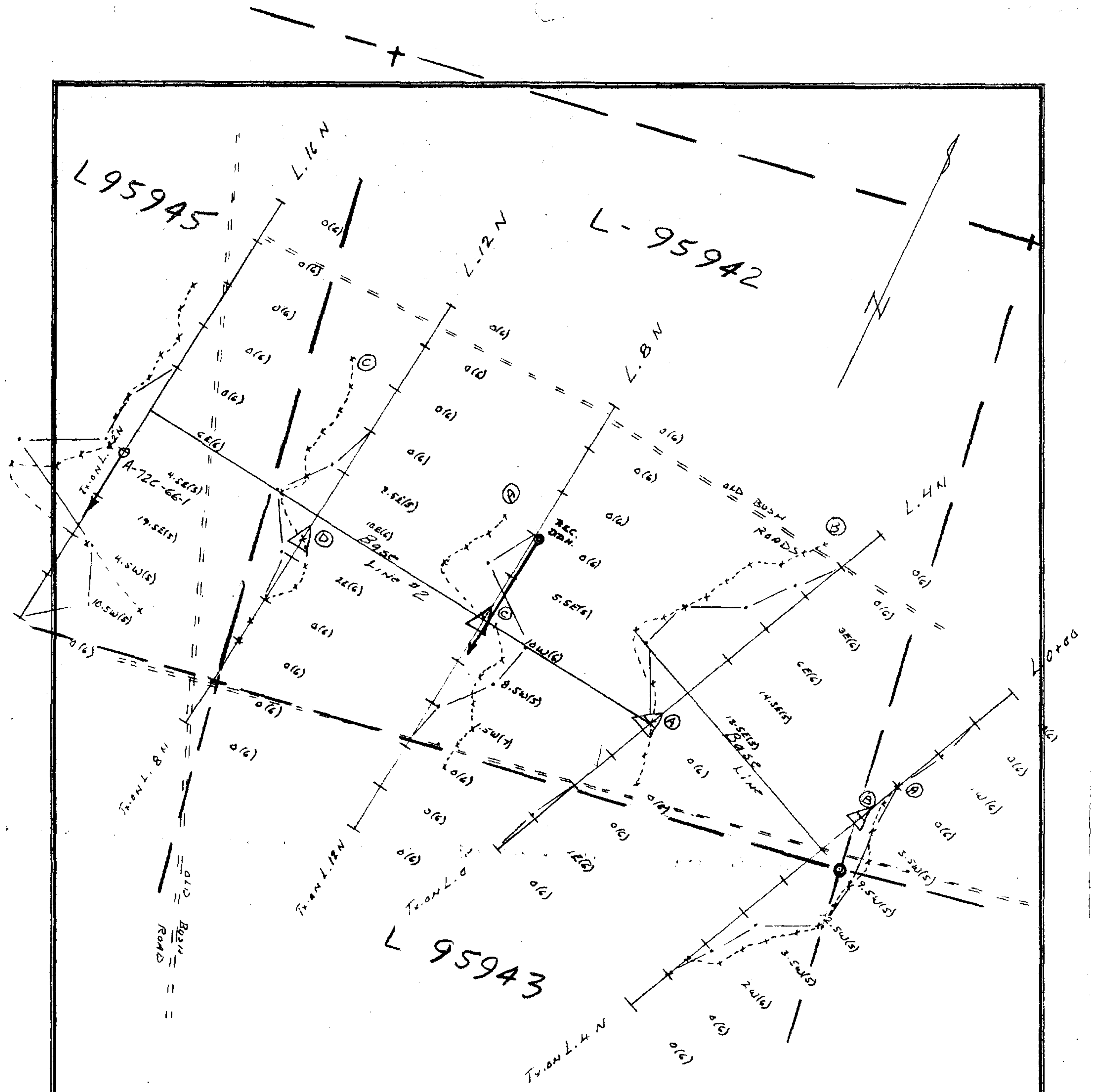


CANADIAN SUPERIOR EXPL.

HEPBURN TOWNSHIP

AREA: CONDUCTORS 72[c] & 71[a]

SURVEY: ELECTOMAGNETIC

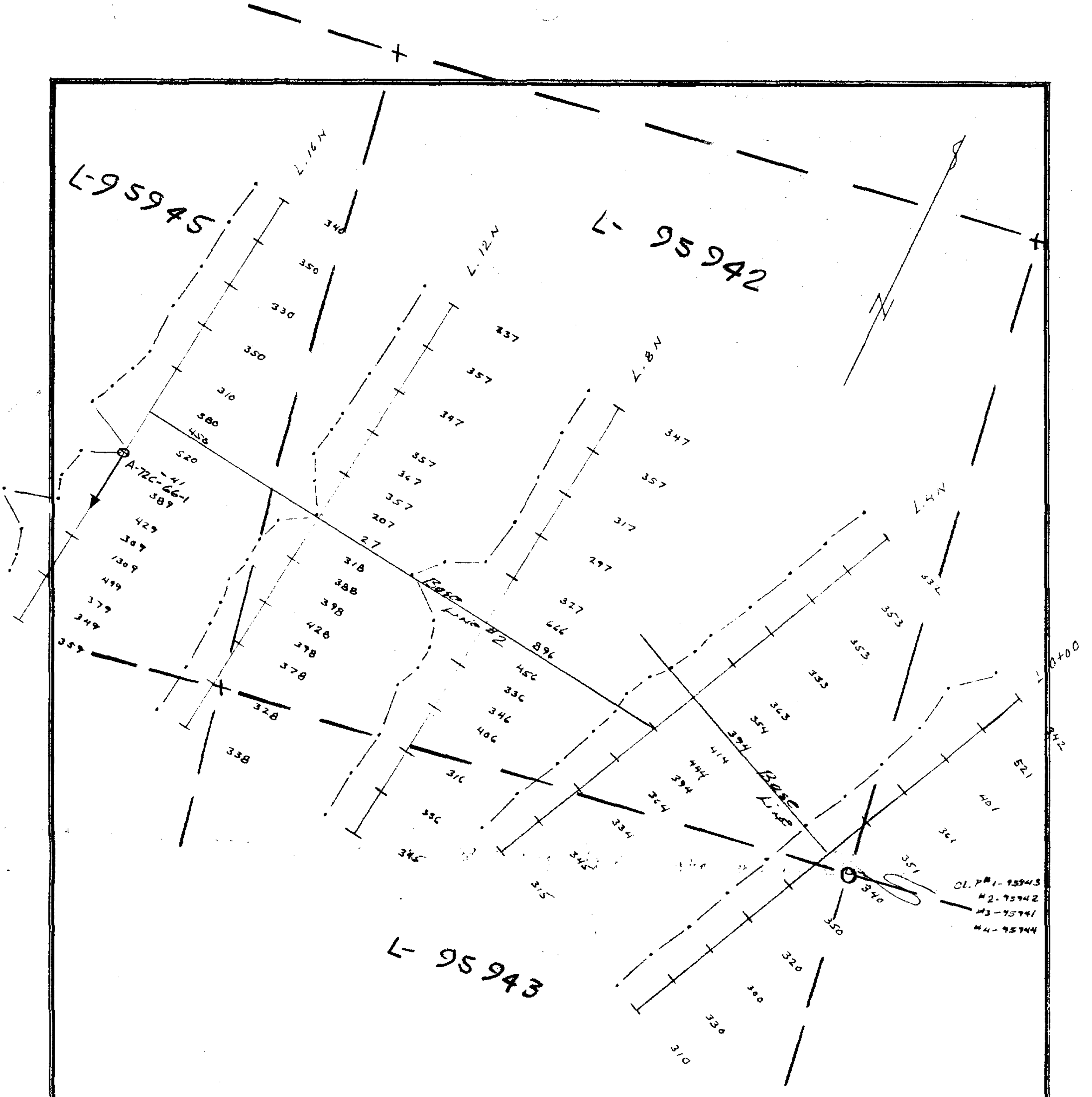
SCALES:	LEGEND:	
1" = 200'	Parallel Line	.—.
1" = 20° electromagnetic	Fx. Tx.	x— x
	Fx. Tx. Location	△
	Convention: East Tilts on North Side of Lines	

Survey by Harold O. Seigel & Associates, Limited.

WORK BY: G. T.	PLOT BY: G. T.	DATE: 3-4-66

E 15-E

32D13NE0009 63.2099 HEPBURN



CANADIAN SUPERIOR EXPL.

HEPBURN TOWNSHIP

AREA: CONDUCTORS 72^{c} & 71^{a}

SURVEY: MAGNETIC

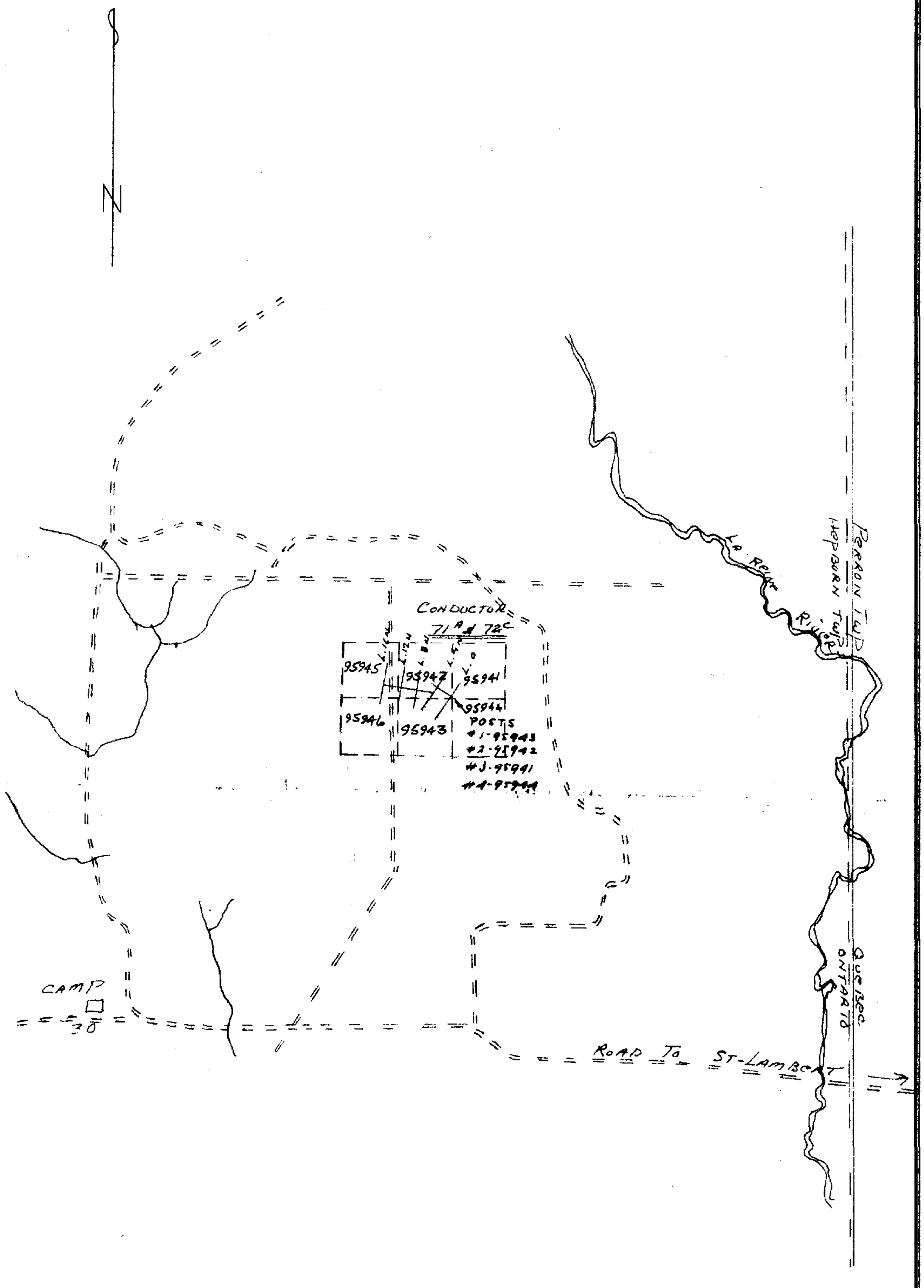
SCALES:	LEGEND:
1" = 200	
1" = 1000 GAMMAS	

Survey by Harold O. Seigel & Associates, Limited.

WORK BY: G. T.	PLOT BY: G. T.	DATE: 3-4-66

: 15 – M

32D13NE0009 63.2099 HEPBURN



CANADIAN SUPERIOR EXPL.

HEPBURN TOWNSHIP

AREA: CONDUCTORS 71^A & 72^C

SURVEY:

SCALES: 1" = 2640'

LEGEND:

Survey by Harold O. Seigel & Associates, Limited.

WORK BY: G. T.	PLOT BY: G. T.	DATE: 3-4-66

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