2

005555

93B019-07

INDUCED POLARIZATION
AND ELECTROMAGNETIC SURVEY
MT. RICHARDS AREA, VANCOUVER ISLAND
B.C.
FOR
CANADIAN PACIFIC MINERALS LTD.
BY
SPARTAN AERO LTD.,
PROJECT 71034

SPARTAN AERO LIMITED
INTERNATIONAL RESOURCES DEVELOPMENT

INDUCED POLARIZATION
AND ELECTROMAGNETIC SURVEY
MT. RICHARDS AREA, VANCOUVER ISLAND
B.C.

FOR

CANADIAN PACIFIC MINERALS LTD.

BY

SPARTAN AERO LTD.,

PROJECT 71034

26 February, 1971

John E. Mekarski, B.Sc.

SPARTAN AERO LIMITED

SUMMARY

Between 11 January 1971 and 15 February 1971 an induced polarization and electromagnetic survey was conducted upon Mt. Richards, B. C. on behalf of Canadian Pacific Minerals Ltd. by Spartan Aero Ltd.

Previous work on the property consisted of geological mapping, a geochemical survey which revealed several copper anomalies, and a ground magnetometer survey which yielded flat profiles within the area, with gabbro showing as magnetic ridges above non-responsive andesite tuff and related rocks.

Four zones of high I.P. response were outlined by this survey (Plan II).

To test these zones, the following diamond drill holes, in order of importance, are recommended:

Zone B - Line 68 + 00W, 2200N, -45°, N30°E, 750 ft.

Zone B - Line 68 + 00W, 3000N, -45°, N30°E, 500 ft.

Zone A - Line 84 + 00W, 4000N, -45°, N30°E, 500 ft.

Zone D - Line 32 + 00W, 1000S, -45°, S30°W, 350 ft.

Zone C - Line 52 + 00W, 450S, -45°, N30°E, 250 ft.

Several E. M. - 16 conductors were located but their correlation with I.P. data was inconclusive.

TABLE OF CONTENTS

ACCOMPANYING THIS REPORT:

PLAN Ia, Ib: APPARENT CHARGEABILITY AND RESISTIVITY PROFILE PRESENTATION, MT. RICHARDS, VANCOUVER ISLAND, B.C.

PLAN II: APPARENT CHARGEABILITY CONTOUR PLAN, MT. RICHARDS, VANCOUVER ISLAND, B.C.

PLAN III: ELECTROMAGNETIC PROFILE PRESENTATION, MT. RICHARDS, VANCOUVER ISLAND, B.C.

INDUCED POLARIZATION AND ELECTROMAGNETIC SURVEY

MT. RICHARDS AREA, VANCOUVER ISLAND, B.C.

FOR

CANADIAN PACIFIC MINERALS LTD.,

BY

SPARTAN AERO LTD.,

INTRODUCTION

Between 11 January 1971 and 15 February 1971 an induced polarization (I.P.) and electromagnetic (E.M.) survey was conducted upon Mt. Richards, within Somenos and Comiaken townships, Vancouver Island, B.C. * The survey was conducted on behalf of Canadian Pacific Minerals Ltd., by Spartan Aero Ltd.

The following persons were concerned with the project:

D.C. Douglas, Mining Engineer, Can. Pac. Minerals Rep.
P. Macfarlane, Geologist, Can. Pac. Minerals
J. Mekarski, Geophysicist, Spartan Aero Ltd.
E. Rockel, Geophysicist, Spartan Aero Ltd.
B. Hawkins, Field Assistant
T. Shearing, Field Assistant

The objective of the survey was to locate zones of disseminated sulfides, and outline areas of greatest sulfide concentration.

A description of instruments used and survey procedures is given in the appendix.

Fourteen and three tenths miles of reconnaissance I.P. (400 ft. electrode spacing, stations every 200 ft.) and three and two tenths miles of E.M. (stations every hundred ft.) were traversed. Additional I.P. work consisted of "detailing" several lines with 200 ft. electrode spacing, stations every 100 ft.

Previous work on the property by Can. Pac. Minerals consisted of geological mapping, geochemical sampling for copper and a ground magnetometer survey.

* Survey area inaccessible for about one week due to heavy snowfall.

GEOLOGY

The following publication pertains to the survey area: Geological Survey of Canada Memoir No. 13, Southern Vancouver Island, by Charles H. Clapp, 1912.

Rocks encountered by the author on Mt. Richards were 1) Andesite tuffs and minor flows. The rocks locally vary through dacite to rhyolite. 2) Bands of gabbro which vary from diorite porphyry to diabase. Several zones of pyrite were encountered in the area. In general, the above rocks strike about N70W and dip steeply to the south.

GEOPHYSICAL RESULTS

The I.P. survey was carried out using a 400 ft. electrode spacing (sampling depth 300 ft.), with measurements taken every 200 ft. This spacing permits detection of large volumes of disseminated sulphides without missing fairly small concentrations.

Results of the reconnaissance I.P. survey and subsequent "detailing" with 200 ft. electrode spacing are presented on:

Plan I, Profile Presentation, which depicts apparent chargeability (Ma) in millivolt seconds per volt (milliseconds), linear scale, solid lines, apparent resistivity (ρa) in ohm-meters, logarithmic scale, dashed lines.

Plan II, Apparent Chargeability Contour Plan which shows I.P. results using 400 ft. electrode spacing contoured every 15 milliseconds.

From Plan I and II the following background I.P. response is obtained: 1) andesite tuff - about 300 milliseconds and 1500 ohm meters, 2) gabbro - about 20 milliseconds and 3000 ohm meters.

I.P. response of 45 milliseconds may be significant, and 60 milliseconds or higher, anomalous.

Background response of andesite tuff in comparison to other rock types is relatively high, because of an altered mineral assemblage (chlorite,etc.), and the presence of minor amounts of pyrite.

Four zones of interest were outlined by this survey, and are labellled A to D from north to south on Plan II.

Anomalies A and B attain I.P. peaks of over 120 milliseconds. They are underlain by andesite tuff and related rocks, and lie to the north and south of a band of gabbro, to which they may be genetically related. Anomaly A is open to the west, while B to both east and west.

Zones C and D are quite small in comparison with anomalies A and B, have I.P. response of only about 50 milliseconds, and may represent relatively small concentrations of sulfides.

To obtain additional information about each zone of interest and ascertain the nature of I.P. response at shallower depth (about 150 ft), portions of lines 84 + 00W, 68 + 00W and 32 + 00W were traversed using a 200 ft electrode spacing. This "detailing" confirmed the presence of each zone. Comparison of profiles over zones A, B and C (Plan I) show an offsetting to the north of the 150 ft. sampling horizon (200 ft spacing) with respect to the 300 ft. sampling horizon (400 ft. spacing). This indicates that regional dip of andesite tuffs is to the south. The 200 ft spacing response of zone D lies south of the 400 ft spacing response, indicating this zone dips northward.

To better delineate anomalous zone B, the most extensive one in the survey area, I.P. results of the 400 ft. electrode spacing along line 68 + 00W were interpreted in terms of a computer generated dike model (pages 4 and 5).

First, a profile of $B_2 = (Ma - M_1)/(M_2 - M_1)$ was plotted against d/a, where:

a = electrode spacing (400 ft)
d = distance from centre of array to centre of dike
Ma = apparent chargeability
M_1 = chargeability of host medium
M_2 = chargeability of dike

From model comparison, the probable width of the dike is 1000 ft., and dike centre at 300 ft. depth is at 3000 ft. N.

Second, a profile of $\rho a/\rho_1$ was plotted against d/a, where

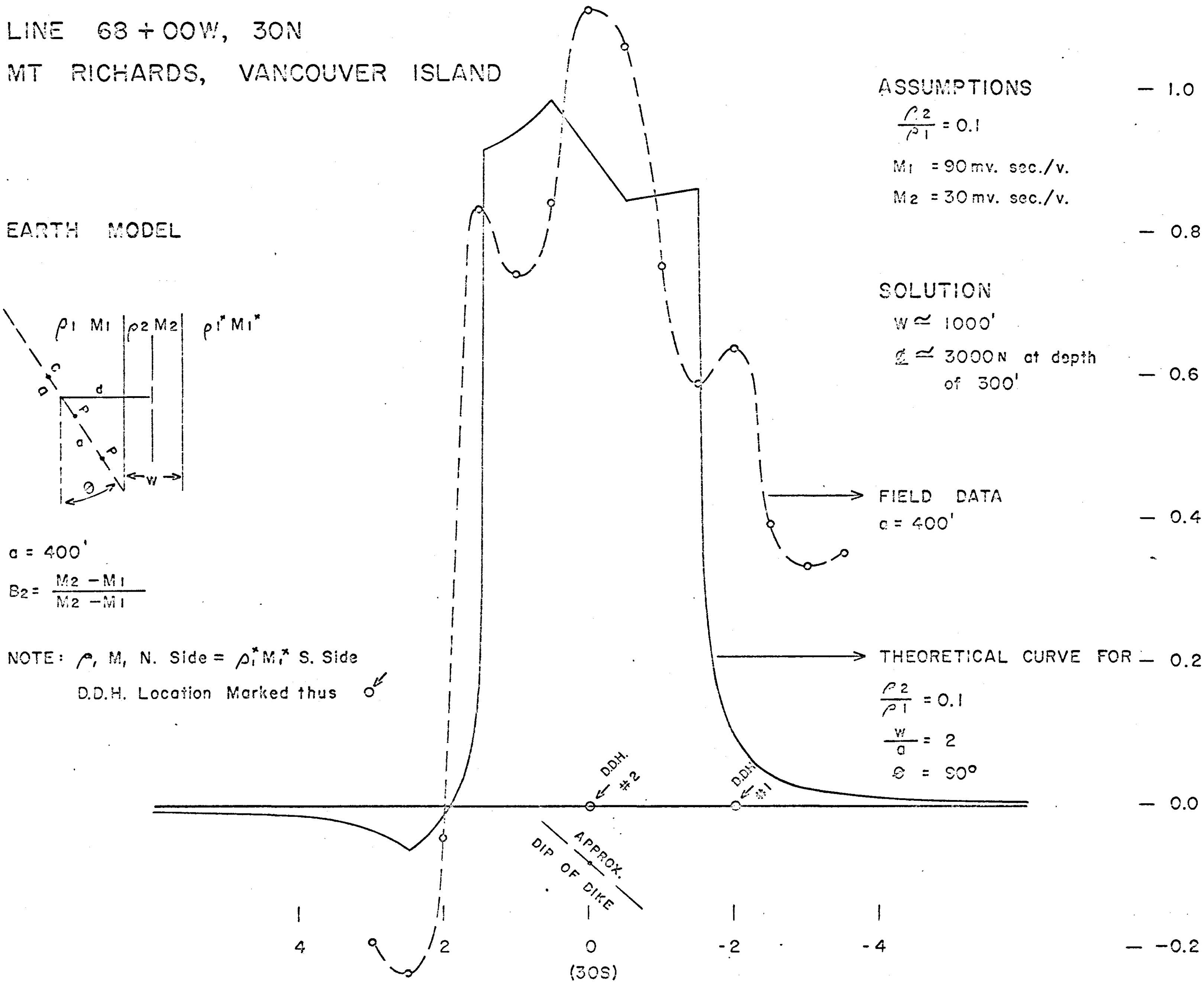
ρa = apparent (measured) chargeability
ρ_1 = chargeability of host medium
ρ_2 = chargeability of dike

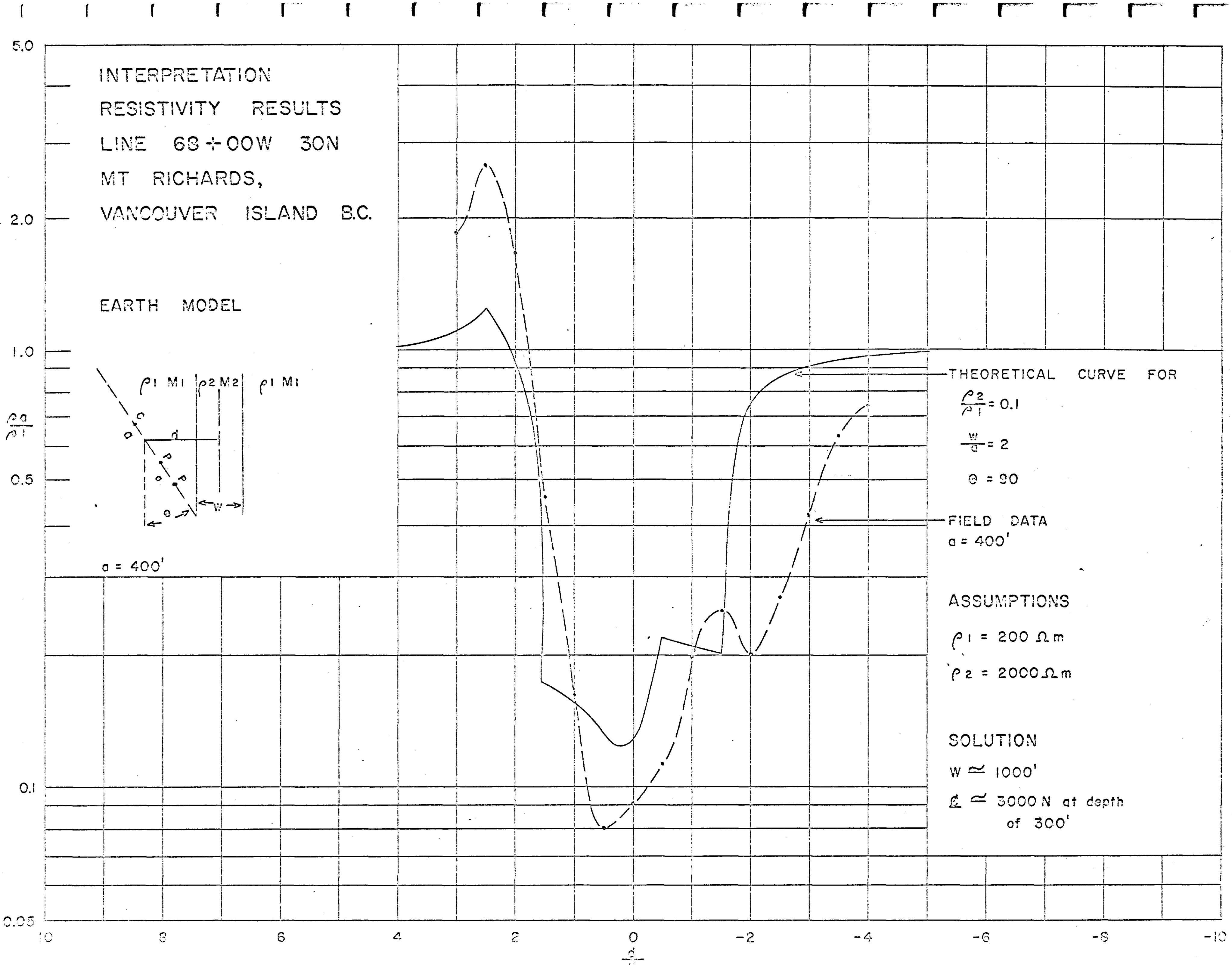
INTERPRETATION

INDUCED POLARIZATION RESULTS

LINE 68 + 00W, 30N

MT RICHARDS, VANCOUVER ISLAND




INTERPRETATION
RESISTIVITY RESULTS
LINE 68+00W 30N
MT RICHARDS,
VANCOUVER ISLAND B.C.
EARTH MODEL
ρ1 M1
ρ2 M2
ρ1 M1
a
c
d
p
a
p
w
θ
a = 400'
THEORETICAL CURVE FOR
ρ2/ρ1 = 0.1
w/a = 2
θ = 90
FIELD DATA
a = 400'
ASSUMPTIONS
ρ1 = 200 Ω m
ρ2 = 2000 Ω m
SOLUTION
w ≃ 1000'
℄ ≃ 3000 N at depth of 300'
ρa/ρ1
5.0
2.0
1.0
0.5
0.1
0.05
10
8
6
4
2
0
-2
-4
-6
-8
-10
d/a

Comparison with the best fitting theoretical curve shows a dike about 1000 ft. wide centered at about 3000 ft. N at a depth of 300 ft.

Because apparent dip obtained from chargeability profiles (plan I) for anomaly D is at variance with the regional trend, the chargeability data for 200 ft. and 400 ft. electrode spacing was interpreted in terms of a dike model (page 7).

Here, dike width is 200 ft or less, dike centre at 150 ft. depth is at 1500 ft. while at 300 ft. depth the centre is at 1300 ft. S. This indicates the anomaly dips north. Note that field data for a = 400 ft. failed to approximate the computer generated dike shape because the zone of interest is much narrower than the electrode spacing.

Five E.M. -16 traverses were obtained (Plan III), in order to check whether disseminated mineralization within the survey area had electrically continuous zones, and to evaluate usefulness of V.L.F. - E.M. in outlining a drilling target within an area of disseminated sulfides.

Line 32 + 00W - A definite conductor is indicated by a "crossover" at 250 S. Only background I.P. response is present here. Quartz eye dacite tuff within andesite tuffs was found in the vicinity. An inflection point of the in-phase curve at about 1100 S suggests the presence of a weak conductor at this location, which coincides with a geochemical anomaly of over 1000 ppm copper (background about 100 ppm) and the edge of I.P. anomaly D. Andesite tuff was found near 1100 S with gabbro to the south at 1400 S.

Line 52 + 00W - An inflection point at 1300 S indicates a weak conductor may be present at this point. Only background I.P. response, background geochemical values, and barren andesite tuffs were found here. An E.M. conductor is indicated by a crossover at 300 S. It coincides with a small I.P. peak (200 ft. spacing) small magnetic peak, and lies near a 1500 ppm copper anomaly at 100 S. As at 250 S, line 32 + 00W, quartz augen dacite tuff within andesite tuffs was found here. Some pyrite was also present.

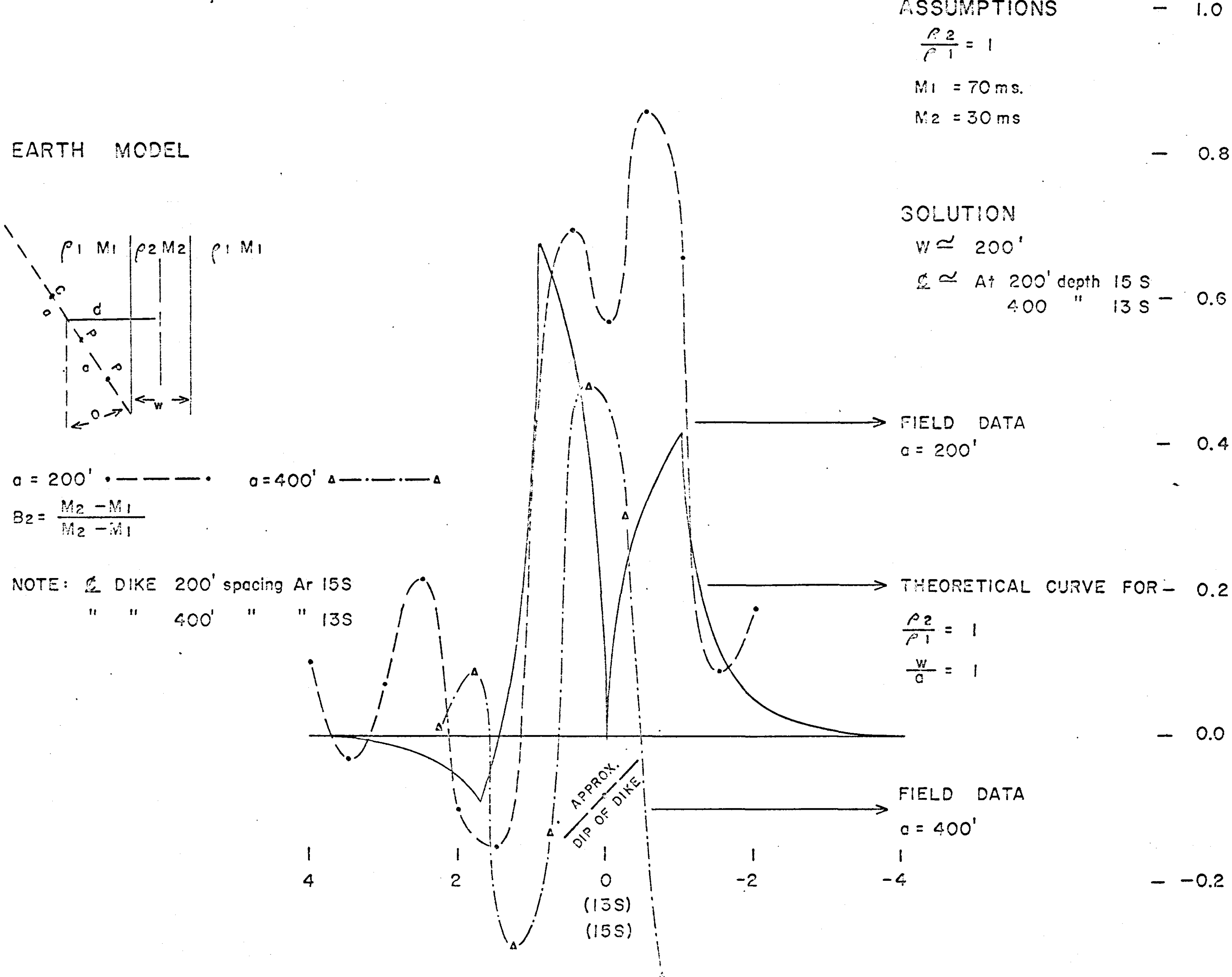
Because of the presence of I.P. anomalies at 1600 N and 2200 N and the geochemical anomaly of 500 ppm at 2200 N, the E.M. in-phase curve inflection points at about 1600 N and 2300 N may be significant. These would not normally be picked as "conductors" in a V.L.F. - E.M. survey.

INTERPRETATION

I.P. RESULTS

LINE 32 + OOW, 14 S

MT RICHARDS, VANCOUVER ISLAND



Line 52 + 00W - An inflection point at 1300 S indicates a weak conductor may be present at this point. Only background I.P. response, background geochemical values, and barren andesite tuffs were found here. An E.M. conductor indicated by the crossover at about 300 S coincides with a small I.P. peak (200 ft. spacing) and a small magnetic expression. It lies near a 1500 p p m copper anomaly. As at 250 S line 32 + 00W, quartz augen dacite tuff within andesite tuff was found here. Some pyrite was also found near this location. Very weak conductors may be indicated by inflection points at about 1600 N. (I.P. anomaly and change in rock type), and at 2300 N. (I.P. anomaly, rhyolite tuff with pyrite, geochemical anomaly of 500 p p m). These two "conductors" would not normally be picked without supporting I.P. and geochemical data.

Line 68 + 00W - Many inflection points exist along this line e.g. 700N, 2100 N, 2500 N, 3500 N. Some of these lie within barren andesite, while others lie near the edges of or within areas of anomalous I.P. response, and high geochemical values. These are not "genuine" conductors, but probably represent shear zones within andesite tuff. A strong E.M. conductor is indicated at 4900 N. Although no geochemical anomalies are present, this conductor coincides with the edge of an I.P. anomaly (200 ft. spacing).

Line 72 + 00W - This E.M. profile is similar to the one along 68 + 00W, and indicates the presence of a conductor at 4700 N. This coincides with the north edge of an I.P. anomaly which in turn coincides with a zone of dacite tuff containing pyrite.

Line 100 + 00W - Two E.M. conductors are present 1) A weak one about 500 N (background I.P. response in an area of andesite tuff). 2) A strong conductor at 2500 N which coincides with an I.P. anomaly in an area of dacite tuff with gabbro to the north of this area.

CONCLUSIONS AND RECOMMENDATIONS

Four zones of high I.P. response were outlined by this survey (Plan II).

The largest - zone B - should be tested by: 1) Collaring a diamond drill hole (D.D.H.) at 2200 N along line 68 + 00W and drilling northward along this line at -45^{o} to a depth of 750 ft. The proposed hole lies on the south edge of anomaly B and is located so as to intersect a 3000 p p m geochemical copper anomaly. 2) Collaring a D.D.H. at 3000 N, line 68 + 00W W and drilling northward along the line at -45^{o} to a depth of about 500 ft. in order to test the remainder of zone B.

Zone A to the north of zone B should be tested by collaring a D.D.H. at 4000N line 84 + 00W and drilling at -45^{0} northward along this line for a distance of 500 ft.

Zone D may be tested by collaring a D.D.H.at 1000 S, line 32 + 00W and drilling southward at -45^{0} along 32 + 00W for a distance of about 350 ft. This hole is so located as to test the I.P. anomaly and a geochemical anomaly to the north of it.

Although Zone C is narrow and does not attain an I.P. response of over 60 milliseconds (twice background), it does coincide with a definite E.M. conductor and lies near a geochemical anaolay. It is therefore recommended the zone be tested by collaring a D.D.H. at 450S, line 52 + 00W and drilling northward along this line at -45^{0} for a distance of about 250 ft.

Several electromagnetic conductors were located by the E.M.-16, however, correlation with I.P. data is inconclusive, as sulfide particles within the zones must be electrically continuous, or be concentrated (about 20%) before they respond as an E.M. conductor. Since elctrolyte filled shear zones may also respond, it is felt that the V.L.F.-E.M. is not a good prospecting tool in this area.

Respectfully submitted,

J. E. Mekarski

J. E. Mekarski, Geophysicist
March 3rd, 1971.

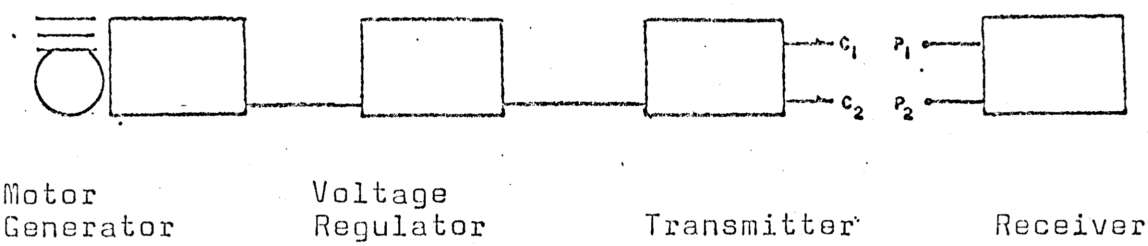
PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
R. W. STEMP

Expiry Date: August 5, 1971

R. W. Stemp

APPENDIX

INSTRUMENTATION



The above block diagram shows the I.P. apparatus employed on this project.

A conventional A.C. motor generator in conjunction with a voltage regulator is used as a current source for a modified Sharpe Instruments transmitter. The transmitter, capable of delivering 2.5 K.V., incorporates an electronic timing device designed by Canadian Aero Service Limited.

The I.P. receiver is the high sensitivity "Newmont" unit, manufactured by Data Control System of Danbury, Connecticut.

This I.P. receiver is equipped with direct chargeability read-out, automatic S.P. buck-out, and a device to obtain information on the slope of the decay transient.

The electromagnetic unit was a Ronka E.M.-16 receiver, which measures the vertical field in-phase and quadrature components of the horizontal electromagnetic field transmitted by V.L.F. communication stations. The instrument has a range of $\pm$ 150% or 90° in-phase, and $\pm$ 40% quadrature. Its accuracy of resolution is $\pm$ 1%.

SURVEY PROCEDURES (I.P.)

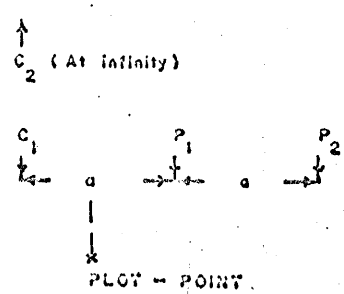
Induced polarization and resistivity measurements were made in the time domain mode of operation. The time cycle of measurement used in this survey consisted of alternate 2.0 seconds "On" and 2.0 seconds "Off" periods with consecutive "On" periods being of reverse polarity. Secondary voltage was measured by integration during the period from .45 seconds to 1.10 seconds after cessation of the transmitter current "On" period.

Measurement of the secondary voltage was delayed 0.45 seconds after cessation of the transmitter "On" period to avoid coupling and transient effects.

To conform to standard presentation, the integrator time constant was adjusted to give induced polarization readings equivalent to those obtained with a transmitter cycle of 3.0 seconds "On" and 3.0 seconds "Off" with integration of the secondary voltage decay during the first second of the "Off" period.

Values obtained are plotted at the midpoint between the current and potential electrodes as shown below:

THREE ARRAY



The induced polarization method is best suited to the detection of disseminated metallic sulfides. Graphite, oxides like magnetite and pyrolusite, as well as clay minerals of the montmorillomite group also produce inducted polarization effects.

The induced polarization responseis related to the percent by volume, as well as to particle size of the chargeable material. Since polarization is essentially a surface phenomenon, the induced polarization effect from a given volume percentage of chargeable material will increase as the particle size decreases.

SURVEY PROCEDURES (E.M.)

For the E.M. -16 survey, a transmitting station was selected at about 90° to the traverse line. Readings were taken every 100 feet along traverses by first tilting the instrument till the audio signal was minimal to obtain the in-phase component of the secondary field, then further minimizing the signal by rotating the quadrature knob to obtain the quadrature component of the secondary field. All readings were taken with the instrument facing in a constant direction.

NAME:	MEKARSKI, John Edward
DATE OF BIRTH:	19th. February, 1935
PLACE OF BIRTH:	Warsaw, Poland
CITIZENSHIP:	Canadian - CC55-20558 (Card No. 192810)
PASSPORT NUMBER:	CA284017
PLACE OF ISSUE:	Ottawa, Ontario
DATE OF ISSUE:	July 7, 1970
DATE OF EXPIRY:	July 7, 1975
ADDRESS:	36 College Street, Elmira, Ontario.
EDUCATION:	Carleton University, Geology Major University of Alberta (Computing Science 310 Course)
DEGREE:	B.Sc., 1965
LANGUAGES SPOKEN:	English, Polish, some Spanish, and French.
	Holds Commercial Pilot Licence - YZC-10273.

EXPERIENCE:

Miscellaneous:	Summer jobs, etc: Laboratory Technician at Nangatuk Chemicals and at General Foods, quality control clerk at Dominion Rubber, draftsman (also instrument man) at Bert J. Roe, Ontario Land Surveyor).

1963 -

GEOLOGICAL SURVEY OF CANADA, Timagami, Ontario.

Detailed geological mapping of iron formation.

1964 -

CONSOLIDATED MINING & SMELTING CO. LTD., Montreal, P.Q.

Geochemical surveys for minerals in the vicinity of Springdale, Newfoundland.

1965 - 67

SHELL OIL COMPANY Edmonton, Alberta.

Subsurface geological mapping and geological environment interpretation. Well logging, core studies, correlation work and well site geology.

1967 - 68

CANADIAN AERO SERVICE LTD.

(1) Induced Polarization survey, Hanns Peak Area, near Steamboat Spring, Colorado.

(2) Induced Polarization and resistivity surveys for porphry copper at Camp Verde, Arizona. (Dipole-Dipole Arrays).

(3) Magnetic investigations at Deming, New Mexico.

(4) Induced Polarization investigation in diamond drill holes, Battle Mountain, Nevada.
Work included: Point potential survey, Pole-Pole and Pole Dipole Arrays, as well as Directional I.P.

1968 - 69	(5) Supervision and interpretation of airborne geophysical survey for mining exploration near Miquelon north-western Quebec.
	(6) Induced Polarization survey at Coppermine River, Arctic. Work included three Electrode Array, and expander Array.
	(7) Geological evaluation of uranium property, Mont-Laurier area, P.Q.
	(8) Induced Polarization survey Quilchena Creek area, B.C. (Three Electrode Array).
1969 - 70	(9) Induced Polarization and magnetic surveys Rosita and Riscos de Oro areas, Nicaragua, C.A. (Three Electrode and Dipole-Dipole Arrays).
	(10) Supervision and interpretation of airborne E.M. magnetometer, and scintillometer surveys, Stony Rapids, Saskatchewan.
	(11) Ground follow-up exploration in the vicinity of Grove Lake, Sask. consisting of: geology, geochemical sampling, ground E.M. (EM-16 and SE-300), ground magnetometer and scintillometer.
1970 -	
SPARTAN AERO LIMITED	(12) Airborne geophysical data interpretation of properties in: Goodall Township, Earngey Twp., Shabumeni Twp., Swain Lake, Okanse Lake, Johnson Island and Sundown Lake, Ontario.

<u>1970 - con't.</u>

(13) Airborne geophysical data interpretation, Atikokan Project, Sabawi Lake area, Ontario.

(14) Airborne geophysical data interpretation, Muskrat Dam Lakes area, Ontario.

(15) Induced Polarization survey, Bourlamaque Twp., Val d'Or area, Que.

(16) Ground Magnetometer survey, East Barriere Lake area, British Columbia.

(17) Airborne Geophysical survey, Povungnituk River area, Labrador, Que.

(18) Airborne Geophysical survey, Lac Laurac area, W. of Schefferville, Que.

(19) Ground E.M. magnetometer and geology, Dryden - Sioux Lookout area, Ontario.