REPORT ON THE VLF-EM SURVEY CONDUCTED ON THE SOUTH CLAIM GROUP IN BOSTON TOWNSHIP FOR MARSHALL BOSTON IRON MINES LIMITED

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BY

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Report No. 423
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Toronto, Ontario

1.0 INTRODUCTION

Marshall Boston Iron Mines Limited holds a group of contiguous patented and staked claims in their south claim group for precious metals. This report is for assessment work on the four staked claims. A. C. A. Howe International conducted an electromagnetic survey over the claim block to locate shear and fracture zones which may contain mineralized quartz veins.

The property is located in Boston Township directly ten miles south-southeast of the town of Kirkland Lake. Easy access is obtained along the Adams Mine Spur Line.

Previous work on the property has delineated two gold bearing veins. The electromagnetometer survey was employed to locate additional zones.

The VLF-EM survey delineated four first priority anomalies and three second priority anomalies which warrant further investigation.

This report is based on work performed from October 20 to November 27, 1980.

2.0 PROPERTY

Marshall Boston Iron Mines Limited holds a group of twelve patented claims held under option and four staked claims in Boston Township, Larder Lake Mining Division, Ontario. Although Marshall Boston possess a number of properties in Boston Township, it was the south claim group over which the geophysical survey was conducted. A block of nine patented claims adjoins this group on the north. Assessment work is being filed for the four staked claims. The claims may be more particularly described as follows:

STAKED CLAIMS	DATE RECORDED
L550004	January 31, 1980
L550005	January 22, 1980
L548998	January 22, 1980
L548999	January 22, 1980

PATENTED CLAIMS	PATENTED CLAIMS
L26690	L26555
L26691	L26556
L26692	L26557
L26552	L5340
L26553	L5341
L26554	L5378

3.0 LOCATION AND ACCESS

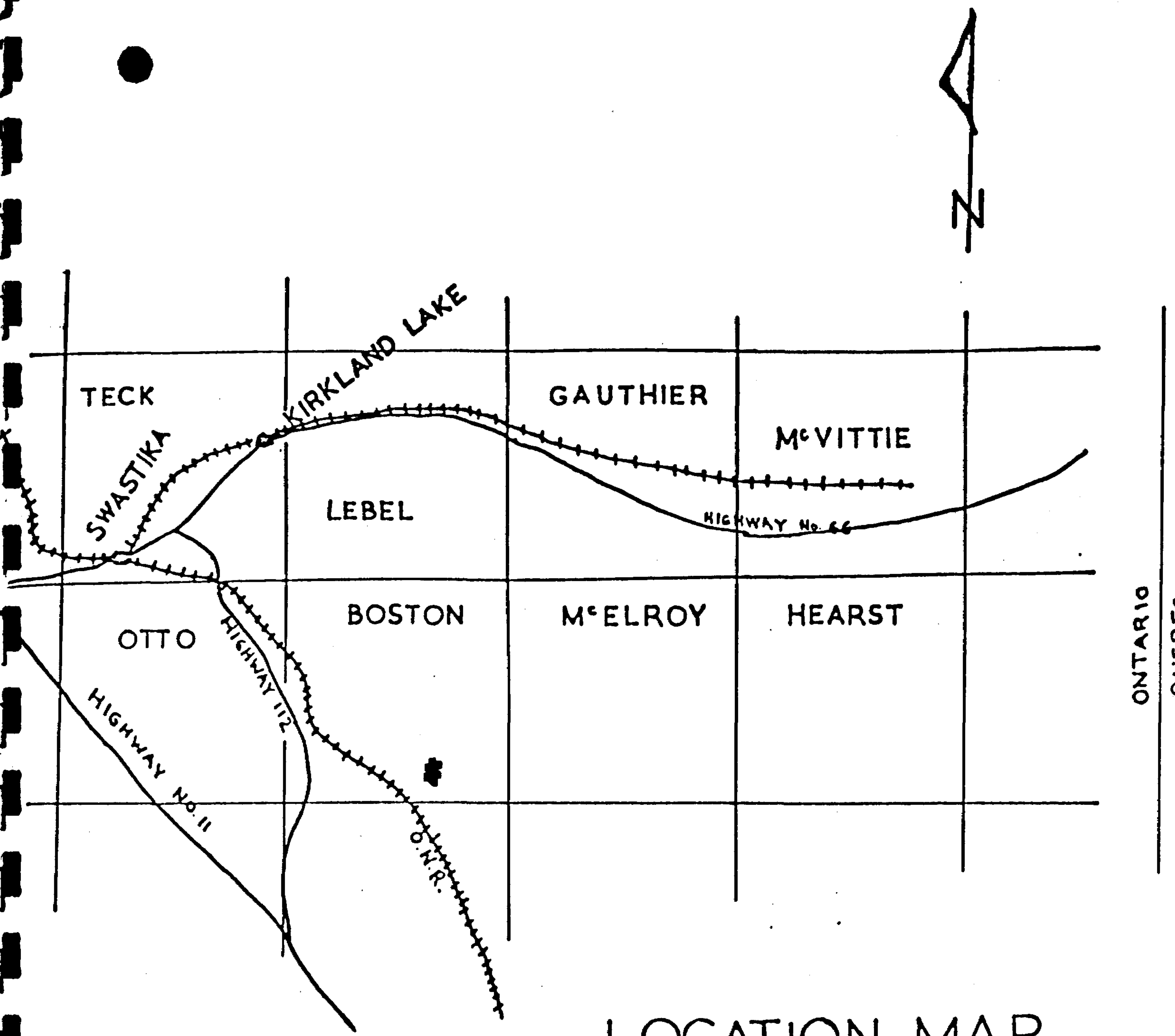
The south claim group is directly ten miles south-southeast of the town of Kirkland Lake in the township of Boston. The claims are bisected by the Adams Spur line.

The south claim group can be readily reached from the village of Boston Creek. From Boston Creek a bush road leads northerly for approximately 1.5 miles where it intersects the Adams Mine Spur line. The spur line enters claim 26692 approximately 3/4 of a mile to the north. From this point a trail 100' long leads to the trenches on claim 26692.

4.0 HISTORY OF THE PROPERTY

1937 - Extensive work on the south group showed the presence of gold in two veins. An average assay value calculated from previous sampling data in company files showed 0.23 oz/Au per ton over 1.63' through a length of 440' on the No. 1 vein and an average value of 0.559 oz/Au per ton across 1.42 through a length of 188' on the No. 2 vein.

- Old reports also describe a strong shear lying 18' east and parallel to the No. 1 vein from which a value of 0.14 oz/Au was reported over 2.3'; additionally a vein is reported 150' west of the No. 2 vein on which some work was reportedly completed but for which no records are available.



LOCATION MAP

MARSHALL BOSTON IRON MINES LTD

A.C.A. HOWE INTERNATIONAL LTD.

Scale 1" = 4 miles

1972 - Marshall Boston Iron Mines Limited carried out limited surface sampling of the old trenches, followed by the drilling of two shallow holes.

- The trenches were check sampled (total of 22 samples) to test the reliability of previous sampling. An average assay based on previous sampling results of the No. 1 (easternmost) vein gave 0.23 oz. of gold over an average width of 1.63' through a length of 440'. Check sampling of this vein (four samples) yielded an average assay of 0.541 oz. gold across an average width of 1.32' through a length of 106'.
- An average assay of previous sampling on the No. 2 (westernmost) vein yielded 0.559 oz. of gold across an average width of 1.42', through a distance of 188'. A weighted assay based on check sampling (18 samples) of this vein yielded an average assay of 0.623 oz. gold across an average width of 0.80' through a distance of 131'.
- Following completion of the check sampling two diamond drill holes were spotted to test the underground continuation of the two auriferous veins. The first hole 72-G-1 was spotted 100' east of the No. 1 vein approximately 170' north of the south claim line (26692) inclined at -60° with an azimuth of 282°. This hole picked up the

two veins at vertical depths of 95' and 171' across true widths of 4.2' in each vein. The intersection on the No. 1 vein yielded an average assay of 0.070 oz. Au and 0.130 oz. of Ag across a core length of 5'1" from 104'4.5" to 109'5.5", the highest value in this section was across a core distance of 1' from 106' to 107' which assayed 0.22 oz. Au and 0.13 oz. Ag. The second intersection in the same hole (vein No. 2) yielded average assays of 0.011 oz. Au and 0.022 oz. Ag across a core length of 5'3" from 188'10" to 194'1".

- A second hole 72-G-2 was spotted 119' east of the No. 1 vein approximately 325' north of the south claim line (claim 26692) and 155' north of 72-G-1, inclined at -50° with an azimuth of 282°. The No. 1 vein appears to have been incorporated in a contact zone between a feldspar porphyry and mafic volcanic rock, however a siliceous section picked up at a vertical depth of 85' corresponds with the projected position of the No. 1 vein. The No. 2 vein was intersected at a vertical depth of 153' across a true width of 1.6'. Negligible values in gold and silver were returned upon assaying of this intersection.

5.0 GENERAL GEOLOGY

The geology of Boston Township and part of Pacaud Township has been described in a report by K. D. Lawton, Ontario Department of Mines Vol LXVI, Part V, 1957. The following is an abstract from this report:

"The consolidated rocks of the area are Pre-Cambrian in age, consisting mainly of Archean volcanics, sediments and intrusives. Late diabase dykes intrude the Archean rocks and are the sole representatives of the Proterozoic era in the area.

"Members of the Keewatin series of early Pre-Cambrian rocks are the dominant formations outcropping in Boston Township. They consist of lava flows, volcanic fragmented rocks and sedimentary rock. A small area of Timiskaming clastic sedimentary rocks outcrops in the northeast corner of Boston Township. Here the Keewatin and Timiskaming series are in faulted contact. Field relationships in nearby townships, however, indicate that the rocks of Timiskaming age stratigraphically overlie the Keewatin series. In the Kirkland Lake area Thomson[1] has shown that a great structural unconformity separates the Timiskaming series from the underlying Keewatin rocks.

"There are two groups of basic intrusives of post-Keewatin age. The older of the two is composed of diorite and metadiorite, whereas the younger includes serpentinite, hornblendite, diorite and minor diorite porphyry.

"The Keewatin, Timiskaming and post-Keewatin rocks are folded and faulted, and intruded by a variety of igneous rocks classified as Algoman in age. The Algoman series includes rocks of the following composition: granite, syenite, porphyries, diorite and lamprophyre.

"Much of the bedrock is covered by a mantle of unconsolidated clay, sand and gravel, laid down during the period of Pleistocene glaciation that affected this area.

"The rock classification used in this report conforms generally but with some revision to that adopted by Abraham[2] for McElroy Township and the eastern part of Boston Township. In the following table of formations, the members range from oldest at the bottom of the list to youngest at the top, though the rocks within a given group are not necessarily arranged in chronological order."

[1] J. E. Thomson - "The Keewatin Timiskaming Unconformity in the Kirkland District", Transaction, Royal Soc. Can., Section IV, Third Series Vol. XL 1946, pp. 113-122.

[2] E. M. Abraham - "Geology of McElroy and Part of Boston Townships", Ontario Department of Mines, Vol. LIX 1950, Part 6, p. 8.

6.0 TABLE OF FORMATIONS

CENOZOIC	
RECENT AND PLEISTOCENE:	Clay, sand, gravel and boulders.
	Great Unconformity
PRECAMBRIAN	
KEWEENAWAN OR MATACHEWAN:	Diabase.
	Intrusive Contact
ALGOMAN:	Basic syenite; syenite and porphyritic syenite; syenite porphyry; quartz porphyry; granite (dykes and small stocks); lamprophyre; diorite and metadiorite; quartz-feldspar porphyry; felsite. Batholithic granite (Round Lake batholith).
	Intrusive Contact
HAILEYBURIAN: (?)	Diorite; gabbro; hornblendite; serpentinite; diorite porphyry.
	Intrusive Contact
TIMISKAMING:	Fine-grained sedimentary rocks; greywacke; arkose; quartzite; slate. Conglomerate; conglomerate with some inter-bedded arkose, slate, and greywacke.
	Great Unconformity
POST-KEEWATIN: (?)	Diorite and metadiorite
	Intrusive Contact
KEEWATIN:	Basic and Intermediate Volcanics: Greenstone; brecciated and carbonate-veined greenstone; andesite, basalt, and pillow lava; dioritic, diabasic, and gabbroic lava; amphibolite; sheared basic lava; fragmental lava; basic lava containing horizons of tuff; injection gneisses, and metamorphosed basic lava and tuff adjacent to the Lebel and Otto syenite stocks; variolitic lava.

KEEWATIN:

Intermediate and Acid Volcanics:
Fragmental volcanics, generally porphyritic; porphyritic andesite, dacite, and rhyolite, containing horizons of acid and cherty tuff; dacite, andesite, occasionally fragmental.

Iron formation, including banded silica rock ("lean iron formation").

Acid volcanics, Tuff, Quartzite, etc.:
Rhyolite; acid tuff and cherty tuff; agglomerate conglomerate; tuffs, and sediments interbedded with volcanic rocks; tuff and iron formation; tuff, tuffaceous sediments, and their altered equivalents; cherty quartzite.

7.0 GEOLOGY OF THE PROPERTY

The property is predominantly underlain by Keewatin volcanics of Precambrian time. The rocks consist of basic and intermediate volcanics consisting of andesitic, basaltic, pillow, dioritic, gabbroic, and diabasic lavas. Also present on the property are intermediate to siliceous rocks consisting of porphyritic andesite, dacite, and rhyolitic lavas containing horizons of acid and cherty tuffs.

Trenching on claim 26692 has exposed two narrow irregular parallel auriferous quartz veins in basic volcanics striking N 005 E and dipping 63^{o} to the east. The veins are separated by approximately 80' which widens to 93' at the northern extremities. At the north end of the No. 1 vein (easternmost) a feldspar porphyry dyke cuts across the vein. This dyke appears to strike 330^{o} and exhibits an apparent dip of 75^{o} - 85^{o} to the east.

8.0 STRUCTURAL GEOLOGY

Aside from late Precambrian diabase dykes, Archean bedrock underlies the Boston Township map area. These rocks have been affected by various orogenic episodes which have left them tilted at steep angles, folded, faulted and cut by magmatic intrusion.

The most salient structural feature on the Marshall Boston Iron Mines Limited property is the Boston Fault. Beyond the property boundary to the northeast of Hildas Lake the Boston Fault has an average strike of S45^{o}W. Southwest of Hildas Lake the Boston Fault splits into two branches which cross the property in a southwesterly direction. Shearing adjacent to the fault dips vertically or at steep angles.

Many of the formations in the area are quite massive. However, a regional schistosity, which strikes northwest, about parallel to the rock formations is recognized. Wherever recognized the schistosity dips at steep angles.

Locally schistosity is developed in Keewatin country rocks adjacent to large Algoman intrusive masses. In these cases the schistosity is nearly vertical in attitude and strikes parallel to the contact of the intrusive.

Intermediate to acid volcanics may be quite schistose noticeably in the area west of Hildas Lake, and are traversed by a number of narrow shear zones. Extensive fracturing also characterizes these rocks in this area. Schistosity is locally developed in all rock types where they are traversed by or lie adjacent to faults and sheared zones.

9.0 MINERALIZATION

Gold mineralization was reported on the Kenzie vein during 1914. A. G. Burrows and P. E. Hopkins[1] who mapped the area classified the gold as occuring as native gold occasionally associated with tellurium, in quartz and veinlets in the Keewatin greenstones and later intrusions of granite and porphyry.

The quartz veins are also well mineralized with pyrite, chalcopyrite and molybdenum.

Within quartz veins gold mineralization frequently occurs with the sulphides and with chlorite streaks.

Certain areas of country rock consisting of greenstones and porphyry have been brecciated and partly replaced by quartz and carbonates forming replacement veins.

10.0 VLF-EM GEOPHYSICAL SURVEY

The reported nature of the targets indicates that little conductivity contrast between the veins and country rock could be expected, so the veins could only be sought indirectly by more conductive structures such as shear zones or water-bearing fractures which could host the veins. A Radem VLF-EM receiver was used to perform the survey utilizing the station, Annapolis Maryland. Dip angles and field strength in percent were recorded at

[1] A. G. Burrows and P. E. Hopkins, Boston-Skead Gold Area, Ontario Department of Mines Vol. XXX 1921, Part 6, pp.9-10.

each station. A north-south baseline was established with east-west lines every 400'. The stations were flagged every 100' by compass and pace. 11.2 miles of line were laid over the staked and patented claims. Line 12S was moved to 13S to avoid an extensive beaver dam and line 30S was included for fill-in.

Contouring of data is of necessity subjective, but bias due to survey layout was possibly avoided by comparison of Karous-Hjelt[1] filtered profiles to ensure that only those anomalies whose profiles can be correlated on adjacent lines are contoured together. Application of the Karous-Hjelt filtering method was used to indicate cause of anomaly and if a shear or fracture zone the depth and dip direction. Two areas require fill-in traverses to clarify the structure:

1. <u>Lines 4N, 00, 4S</u>

On 4N, elevated field strength values occur accross the western part of the line. Possibly an area of swamp or conductive ground might explain these values. The zone of +ve Fraser Filter extending between 4S - 4N could also consist of a series of NNE trending features which terminate against a continuation of the strong NW trending feature which is seen on the eastern part of the three lines.

The NW trending feature could be a sinistral wrench fault which terminates the NNE structures; the weak NNE structure

[1] Karous, M. and Hjelt, S. - "Determination of Apparent Current Density from VLF Measurements" Dept. of Geophysics, University of Oulu, Contribution No. 89,1977.

which extends along the base line north from 12N could possibly then be a continuation of the veins trenched on 4S and 8S immediately east of the railway, moved to the west by such a wrench fault. Fill-in check traverses would help to clarify the structure.

2. Lines 13S, -16S, -24S

The feature at 1400E, line 13S, which has been contoured with an anomaly at 800E on 16S and has biased the contouring to produce the very unlikely cross-shaped feature on 16S-24S may be related to an area of swamp. It coincides exactly in position with an embayment of swampy ground. It is possible however that the anomalies on 16S and 13S represent a fracture zone which terminates against a NW trending feature running from 1200E on 32S to 200E on 16S. The ENE direction of the anomaly is almost perpendicular to the direction of the VLF transmitter at Annapolis, so a minimum coupling situation with concomitent weakening and broadening of the anomaly would occur. Fill-in check traverses would help delineate this structure.

A general rise in background from west to east is evident on most lines; this suggests one of four situations namely;

(i) a zone of strong surficial conductivity occurs to the east of the survey area, e.g. marshland

(ii) an upper conductive rock layer is thickening to the east

(iii) an upper resistive rock layer is thinning to the east

(iv) a topographic effect due to gradually changing elevation

Most of the in-phase profiles are relatively smooth suggesting good data. The dominant feature is the anomaly due to the railway. The very strong anomalies over the railway line are often asymmetric due to a constant station spacing being maintained over the anomaly and true maximum and/or minimum not being measured. Anomalies are recommended for stripping or trenching, however, prior to this it is advisable that anomalies be accurately located by actual measurement of the VLF response on a much closer spacing of say, 10'; also, closely-spaced parallel short traverses would give a more accurate strike direction. The known veins are reported as having 80-90' separation; so if it was hoped to follow these as individual structures, a station spacing of much less than the vein separation would be necessary.

11.0 DISCUSSION OF RECOMMENDED ANOMALIES

The Fraser Filter technique of filtering the dip angles requires four adjacent data points to generate one point so two extra readings are necessary at the end of each line. The Karous-Hjelt filter however requires seven adjacent data points to generate one point on the first level, 13 for the second level etc., therefore anomalies at the ends of traverse lines are not well interpreted and the Fraser Filter results provide more information.

The following anomalies for further investigation are recommended due to the Fraser Filter, Field Strength contour maps and comparison with the Karous-Hjelt profiles:

1. The anomaly occurring around the baseline from line 12N to 28N.

The anomaly is delineated by both Fraser Filter and Field Strength contours. The Karous-Hjelt filter indicates two easterly dipping conductors with a near surface separation of 200' which converge at depth. This relatively shallow feature may represent surface drainage dictated by fracturing. This anomaly could possibly be a continuation of veins 1 and 2 which have been moved to the west by a wrench fault discussed earlier on lines 4N,00 and 4S.

2. The anomalies occurring immediately east of the railway from 13S + 7W to 24S + 10W.

Appearing south along strike with the above anomaly is a near surface east dipping single linear feature.

3. Amonaly on the western end of lines 4N to 20N.

A moderate conductor is indicated by both Fraser Filter and Field Strength contours. Little information is gleaned from the Karous-Hjelt filter on the characteristics of the conductor due to insufficient data points on the western end of the lines.

4. Anomaly on the western end of lines 4S to 13S.

As above, the anomaly at the western end of the line is seen in the Fraser Filter and Field Strength contours, however no dip information extracted from the Karous-Hjelt filter profiles.

In addition, three second priority anomalies are present. One strong anomaly occurs at the eastern end of lines 20N to 28N and also another strong relatively shallow feature at 16N + 18E occurs with a westerly dip. Thirdly, at 13S + 13E a broad relatively strong conductor is not clearly defined due to lack of data to the east. This has a likely cause in a swamp. If the contouring of the Fraser Filter data is correct, the slight asymmetry is probably due to the obliquity of the intersection with the traverse line. The equivalent feature on 16S is much weaker and shallower. A number of northwest trending conductors are also noted from the contoured data.

12.0 DISCUSSION AND RECOMMENDATIONS

It is postulated that two dominant fracture directions intersect in the area, namely one set with a NNE to NE trend and one with a NW to NNW trend. A possible sinistral wrench fault is suggested with a NW trend from line 00 to line 12N; this could move the mineralization west. The shallow features delineated by the Karous-Hjelt filter on lines 20N and 16N which appear to contain two easterly dipping conductors which converge at depth may represent the northern continuation of the mineralization on claim 26692. To remove ambiguity, intermediate traverses ought to be measured. It would be worth conducting a very closely spaced traverse across the trenched area of known mineralization to see if any response occurs.

The VLF survey has outlined a number of possible linear features warranting further investigation. Four first priority and three second priority conductors have been picked which are worth surface stripping, if not diamond drilling.

Dips obtained from the IGH filter process, while not accurate in absolute terms could suggest drill placings. It must be stressed that considerable ambiguity exists with regard to the strike directions of features described. Intermediate check traverses with closely spaced stations must be carried out to define their locations and directions accurately before the recommended surface stripping and/or diamond drilling is carried out.

dlh

CERTIFICATE

I, Terence P. MacMichael, of 19-1975 Memory Lane, Pickering, Ontario, hereby certify that:

1. I am and have been employed since 1979 as a geologist by A. C. A. Howe International Ltd. Mining and Geological Consultants with offices at Suite 826, 159 Bay Street, Toronto, Ontario M5J 1J7.

2. I am a graduate of Dalhousie University, Halifax, Nova Scotia with a Bachelor of Science (1975) Honours degree in geology.

3. I have practiced my profession in excess of five years.

4. I have no interest in Marshall Boston Iron Mines Limited or in the property discussed in this report, nor do I anticipate such interest.

5. This report is based on a property examination I conducted during October 20 to November 27, 1980.

T. P. MacMichael

T. P. MacMichael, B.Sc.

Ontario

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GEOPHYSICAL – GEOLO
TECHNICAL DA

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TO BE ATTACHED AS AN APPENDIX TO TECHNICAL REPORT
FACTS SHOWN HERE NEED NOT BE REPEATED IN REPORT
TECHNICAL REPORT MUST CONTAIN INTERPRETATION, CONCLUSIONS ETC.

Type of Survey(s) Radem VLF-EM

Township or Area Boston Township

Claim Holder(s) Marshall Boston Iron Mines Ltd.

Survey Company A. C. A. Howe International Ltd.

Author of Report T. P. MacMichael

Address of Author Suite 826, 159 Bay St. Toronto, Ont M5J 1J7

Covering Dates of Survey October 20 - December 2, 1980
(linecutting to office)

Total Miles of Line Cut

SPECIAL PROVISIONS CREDITS REQUESTED

ENTER 40 days (includes line cutting) for first survey.

ENTER 20 days for each additional survey using same grid.

	DAYS per claim
Geophysical	
–Electromagnetic	40
–Magnetometer	
–Radiometric	
–Other	
Geological	
Geochemical	

AIRBORNE CREDITS (Special provision credits do not apply to airborne surveys)

Magnetometer ______ Electromagnetic ______ Radiometric ______
(enter days per claim)

DATE: March 9/81 SIGNATURE: T. P. MacMichael
Author of Report or Agent

Res. Geol. ______ Qualifications on this file

Previous Surveys

File No.	Type	Date	Claim Holder
			L.D.

MINING CLAIMS TRAVERSED
List numerically

(prefix)	(number)
L	548998 ✓✓
L	548999 ✓✓
L	550004 ✓✓
L	550005 ✓✓

If space insufficient, attach list

TOTAL CLAIMS 4

GEOPHYSICAL TECHNICAL DATA

GROUND SURVEYS – If more than one survey, specify data for each type of survey

Number of Stations 200 Number of Readings 400

Station interval 100 feet Line spacing 400 feet

Profile scale

Contour interval Fraser Filter dip angle values - interval of 20.
Field Strength interval every 20% above 100%.

MAGNETIC

Instrument

Accuracy – Scale constant

Diurnal correction method

Base Station check-in interval (hours)

Base Station location and value

ELECTROMAGNETIC

Instrument Radem VLF-EM Receiver

Coil configuration

Coil separation

Accuracy

Method: ☐ Fixed transmitter ☐ Shoot back ☐ In line ☐ Parallel line

Frequency Annapolis, Maryland
(specify V.L.F. station)

Parameters measured Dip Angle and Field Strength

GRAVITY

Instrument

Scale constant

Corrections made

Base station value and location

Elevation accuracy

INDUCED POLARIZATION RESISTIVITY

Instrument

Method ☐ Time Domain ☐ Frequency Domain

Parameters – On time

– Off time

– Delay time

– Integration time

Frequency

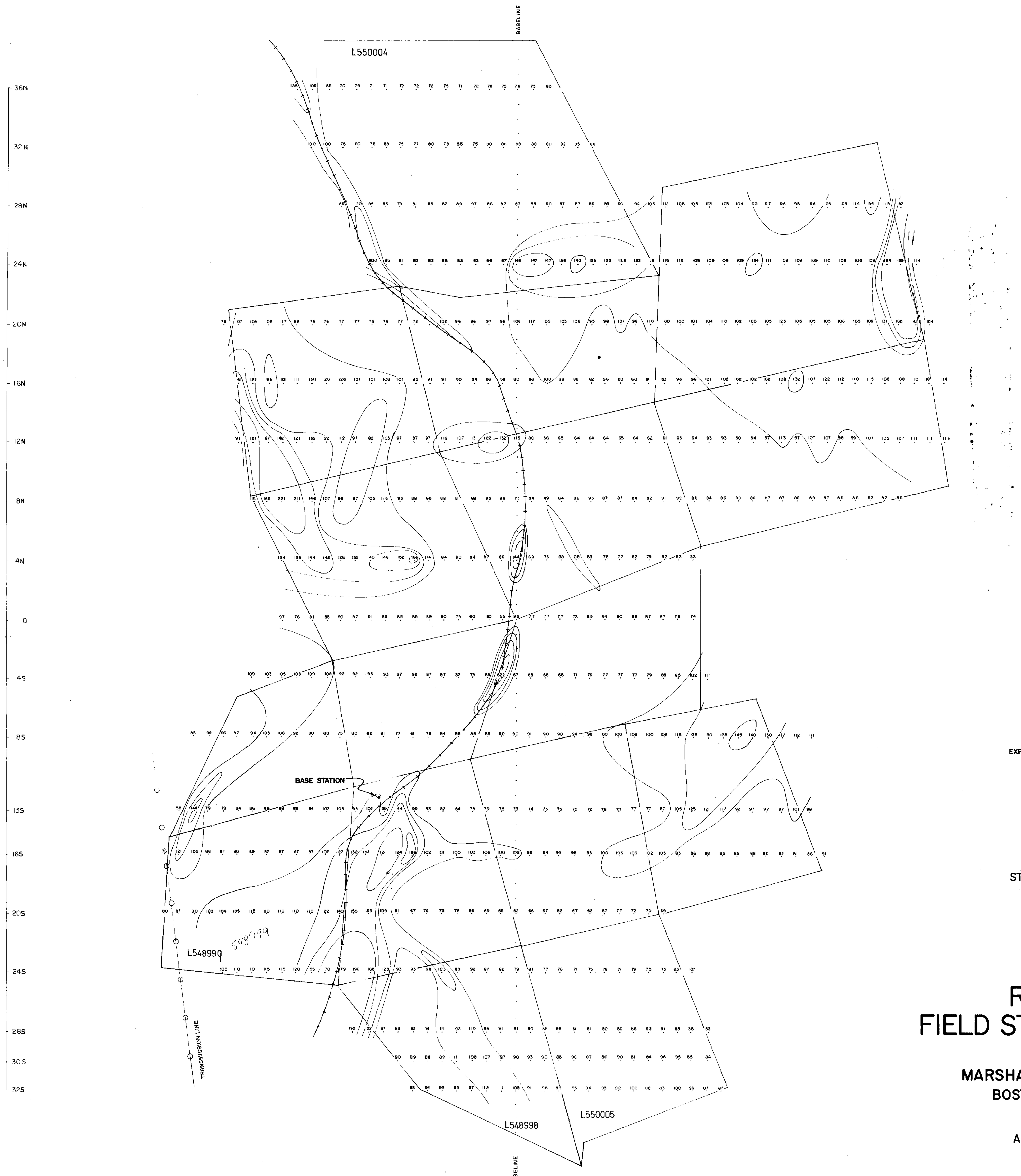
Range

Power

Electrode array

Electrode spacing

Type of electrode



EXPLANATION

FIELD STRENGTH VALUES IN PERCENT
CONTOUR INTERVAL 100 – 120
120 – 140
140 – 160
160 +

· STATION POINTS

STATION: ANNAPOLIS MARYLAND

RADEM VLF-EM FIELD STRENGTH SURVEY MAP

for

MARSHALL BOSTON IRON MINES LTD.

BOSTON TOWNSHIP – SOUTH GROUP

by

A.C.A. HOWE INTERNATIONAL LTD.

400 0 400 800 1200 1600 2000

Scale 1" = 400' November 1980 T.P. MacMichael

T.P. MacMichael

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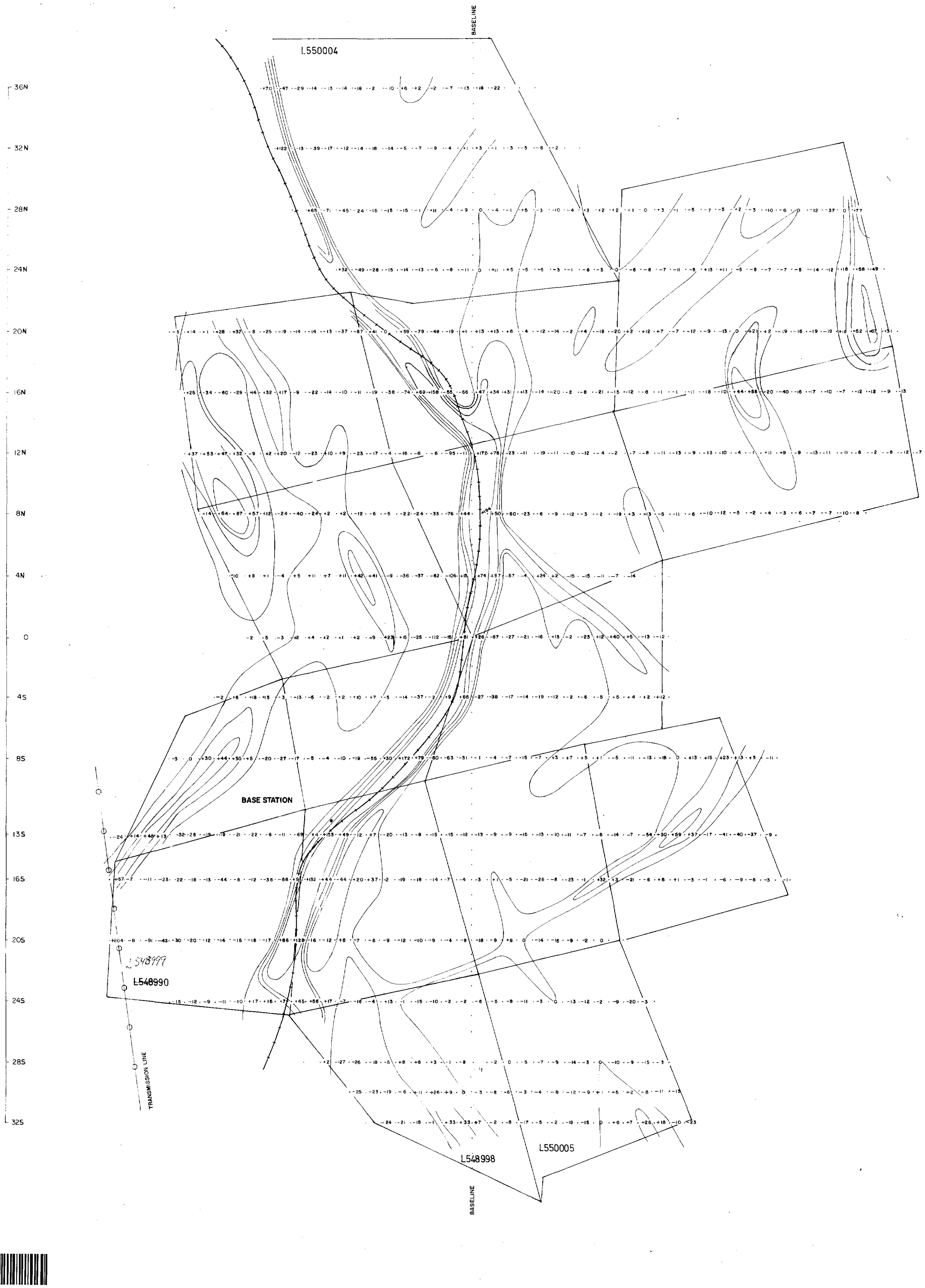
200



EXPLANATION

CONTOUR INTERVAL OF FRASER FILTER
DIP ANGLE VALUES 0 – 20
20 – 40
40 – 60
60 +

· STATION POINTS

STATION: ANNAPOLIS MARYLAND

RADEM VLF-EM FRASER FILTER CONTOUR MAP

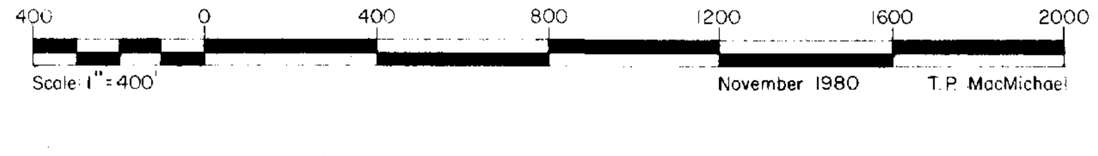
for

MARSHALL BOSTON IRON MINES LTD.

BOSTON TOWNSHIP – SOUTH GROUP

by

A.C.A. HOWE INTERNATIONAL LTD..



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B.K. MacMichael

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