Report of Work
for
Royal Oak Mines Inc

Magnesite Project
Deloro Township, Northeast ON
Line Cutting, TFM, and VLF-EM Surveys

R J Daigle August 1997
1.0 Summary

Royal Oak Mines Ltd., explored their Magnesite Property in August, 1997 with line cutting, TFM, and VLF-EM surveys. The property comprises nineteen contiguous claims approximately 400 m north along the south boundary of Deloro Township. The work was completed by Geoserve Canada Inc., of South Porcupine, ON. This report will summarize the 1997 survey results. The author recommends a geological survey to help classify the EM anomalies delineated on the recently cut grid.

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2.0 Introduction

**Nineteen claims** in Deloro Township received exploration in **mid August 1997**. The nine contiguous claims are referred to as the **Magnesite Property**, and are situated just north of the south boundary of Deloro Township. The property is roughly 12 km south of Timmins, ON, and is accessible by the Pine South road. **Royal Oak Mines Ltd**, initiated the work which was comprised of line cutting, total field magnetics, and VLF-EM surveys. The contract was awarded to Geoserve Canada Inc., of South Porcupine ON. The work started on August 25, 97 and was completed on August 30, 97. The objective of this program is primarily the detection of structures favourable for gold occurrences. However, since the property lies within the Eldorado Assemblage, and mineralization within this assemblage includes komatiite-associated, nickel-copper sulfide mineralization associated with ultramafic flows (Pyke 1982, Green and MacEachern 1990) makes this property a good prospect for sulfide mineralization. The Magnesite Property is structurally located approximately 11 km south of the Destor Porcupine Fault and north of the Adams Granodiorite. The underlying geology is believed to be primarily mafic metavolcanics, and ultramafic rocks. Geological Compilation Map 2205 shows a north of east trending olivine dike, and a north-south fault (McKay Fault) bisecting the property. There’s been an abundance of surface work dating back to the turn of the century. The main rush of work was in the decades of the 40’s, and 50’s. The mantle of Quaternary deposits have an average thickness ranging from 1 to 12 m. This information was taken from **past exploration** (diamond drilling) on the property, as seen on Preliminary Map 2079 (Sangster, P.J., and Maharaj Deosaran, 1981). This report will summarize the results of the 1997 work done by Royal Oak Mines Ltd.

**past exploration**; The drill holes which are plotted on Figure 1 were taken from P Map 2079, and were drilled by Porcupine Southgate Mines Ltd in 1944, 45, and 46. Other holes were also drilled in 1953, and 1963. Several other more recent assessment files (T3525,T3062,T2544) are available at the Resident Geologist Office, Timmins, ON.
3.0 1997 Exploration

3.1 Line Cutting

Line cutters started work on August 25, 1997 and completed the grid on August 30, 1997. A baseline origin was established on claim 1207799 along the north-south power line. The baseline was then cut easterly (N90°T Azimuth) for 2400m. Cutters then turned lines 90° to the baseline at a 100 m interval, and cut lines to the north and south claim boundaries. Cutters completed lines westerly and completed lines on claim 1207799 last since it was only recorded on August 28, 1997. Lines on this claim were cut on August 29, 1997. The entire 31.2 km grid was chained and picketed at a 25 m interval.
3.2 TFM Survey Procedure

Five (5) operators were involved reading the surveys due to the short period of time to complete this grid. Operators included, Denis Crowley, Don Caron, Dave Clement, Glen O'Keef, and Normand Collin, who all read surveys intermittently from August 26, 97 to August 30th, 1997. crews used the TerraPlus GSM-19, Overhauser magnetometers to read the total field magnetics on the property. A GSM-19 was also used as base station to monitor the diurnal drifts. The grid was read at 25 m and 12.5 m intervals. A total of 1651 stations were read with the total field ranging from 55662 nt to 62304 nt. The property has an average intensity of 58143 nt. Plan 2 (pocket) labels the readings with a 58000 nt base removed. The data was then contoured at a 50 nt interval. The maps were done using Geosoft.

3.3 TFM Survey Results

East of Shaw Creek magnetic contours represent high magnetic intensities ranging from 200 nt to near 3000 nt above background. This area is believed to be underlain by ultramafic rocks, which are the source of these said high intensities. A narrow gathering of near east-west trending contours which run coarsely along the baseline are believed to be caused by an underlying olivine dike. The magnetite content of an olivine would well be represented by these intensities. The inferred olivine is seen at the west limit north of the baseline and at its postulated east limit on line 1400 E/ 100N. The lower intensities bisecting the said ultramafic rocks are likely the eastern extension of the olivine dike. The trend is now near northeast and becomes obscured near line 1900E/ 300N. An ellipsoidal gathering of contours from line 500E to 800E, north of the baseline has intensities reaching highs conformable to the ultramafic rocks at the east limit. Sinuous dipole effects flank north producing low intensities perhaps due to the dip of the underlying body. This would also imply a short strike length. The erratic gathering of contours south of the baseline from line 200E to 900E are problematical. Several sources can be postulated (narrow olivine dike, fingers or sills of ultramafic rocks).
3.4 VLF-EM Survey Procedure

All of the said crews involved with the magnetics survey also took part in the VLF-EM survey, during the same period. Crews used the Geonics EM-16 unit, and read the electromagnetic survey with Cutler Maine, 24.0 KHz as the broadcasting station. The readings were taken facing north producing positive amplitudes when approaching underlying bedrock electromagnetic conductors (and other anomalies). The results of this survey are plotted on Plan 3 (pocket) posting and profiling both In-Phase and Out-of-Phase elements. This map was also produced using Geosoft. A Fraser Filter map (Plan 5) is also included with this report.

3.5 VLF-EM Survey Results

Plan 4 does not show anomaly axis allowing future interpretations. The anomalies are delineated on the compilation map (Plan 4). The author has classified four prominent zones (A to D) trending coarsely east-west. The strong amplitudes of these zones are justified by targets being near surface. The labyrinth of anomaly axis are problematical at this time. Plan 5, which shows contoured Fraser Filter products simplifies interpretations. The prominent anomaly centrally located seen north of the baseline, occurs north of the magnetically inferred trend of an olivine dike. The anomaly is postulated to be influenced by a bedrock high effect. The sinuous trend of contours (on Plan 5) from lines 800E to 1500E (south of the baseline) postulates that there may be a nearby intrusion causing a folding of the underlying geology, in this vicinity. Westerly this zone takes a more linear coarse and extends beyond the surveyed area.
4.0 Conclusion

All gathered information infers that the property is bisected north-south by two faults. The McKay fault occurs near the power line, and a second fault occurs near and along Shaw Creek. Both magnetic and electromagnetic surveys infers that stratigraphy trends near east-west. The author recommends a geological survey at this time to help classify the electromagnetic conductors delineated by the recent 1997 VLF-EM survey. If the induced polarization method is recommended the author suggests that a dipole of 25 m be used to isolate the mineralized zones. The Pole Dipole Array is favoured to help eliminate contact problems over outcrop areas located on this property.

Respectfully submitted for approval,

Richard J Daigle
Geoserve Canada Inc

DATE: Sept 15th, 97.
5.0 Certification

I, Richard J Daigle residing at 40 Crawford Street, South Porcupine, ON, certify that:

1.0 This is my 19th year of practice in mining exploration.

2.0 I am registered with the Ontario Association of Certified Technologist.

3.0 I am presently owner operator of Geoserve Canada Inc.

4.0 I was employed by MC Exploration Services Inc., of Timmins, ON, as geophysical evaluator from 1992 to 1997.

5.0 Accomplished geophysical contracts (IP, HLEM, TFM, SP) and property assessments in Eastern Canada, 1987 to 1992.

6.0 Accomplished geophysical contracts in northeastern ON, 1985-87.

7.0 Geophysicist Assistant/ Senior Technician for Kidd Creek Mines under the supervision of Mr D Londry, 1981-85.

8.0 Experienced Max-Min (HLEM) surveys/ interpretations under the supervision of MR J Betz, 1979-81.

9.0 Received Electronic Technologist Certificate in 1979.

10.0 I have no direct interest in the property reported on.

Date: Sept 15, 97.

Timmins, ON.

Richard J Daigle
6.0 Equipment Specifications

6.1 GEM Systems Advanced Magnetometers

GSM-19 V 4.0

GEM Systems Inc
52 West Beaver Creek Road, Unit 14
Richmond Hill, Ontario
Canada, L4B-1L9

Phone: (905) 764-8008
Fax: (905) 764-9329

1.0 Instrument Description

- The sensor is a dual coil type designed to reduce noise and improve gradient tolerance. The coils are electrostatically shielded and contain a proton rich liquid in a pyrex bottle, which also acts as an RF resonator.
- The sensor cable is coaxial, typically RG-58/U, up to 100m long.
- The staff is made of strong aluminum tubing sections. This construction allows for a selection of sensor elevations above the ground during surveys. For best precision the full staff length should be used.
- Recommended sensor separation in gradiometer mode is one staff section, although two or three section separations are sometimes used for maximum sensitivity.
- The console contains all the electronic circuitry. It has a sixteen key keyboard, a 4x20 character alphanumeric display, and sensor and power input/output connectors. The keyboard also serves as an ON-OFF switch.
- The power input/output connector also serves as a RS232 input/output and optionally as analog output and contact closure triggering input.
- The keyboard front panel, and connectors are sealed (can operate under rainy conditions)
- The charger has two levels of charging, full and trickle, switching automatically from one to another.

1.1 Instrument Specifications

Resolution 0.01 nT, magnetic field and gradient
Accuracy 0.20 nT over operating range
Range 20,000 to 120,000 nT automatic tuning, requiring initial setup
Gradient Tolerance over 10,000 nT/m
Operating Interval 3 seconds minimum, faster optional. Reading initiated from keyboard, external trigger, or carriage return via RS-232
Input/Output 6 pin weatherproof connectors
Power Requirements 12V, 200mA peak, 30mA standby, 300mA peak with Gradiometer
Power Source Internal 12V, 1.9Ah sealed lead-acid battery standard, external source optional.
Battery Charger Input; 110/220VAC, 50/60Hz and/or 12VDC Output; 12V dual level charging
Operating Ranges Temperatures; -40°C to +60°C
Battery Voltages; 10.0 V min to 15.0V max
Humidity; up to 90% relative, non condensing
Storage Temperature -50°C to +65°C
Dimensions Console; 223 X 69 X 240 cm
Sensor Staff; 4 x 450mm sections
Sensor; 170 x 71 mm diameter
Weight; Console 2.1Kg Staff 0.9Kg Sensors; 1.1Kg
6.2 VLF, Geonics EM-16

Geonics Limited
2 Thorncliffe Park Drive
Toronto, ON, Canada
M4H-1H2 (416) 425-1821

Specifications
Source Of primary Field VLF transmitting stations eg. NAA 24.0 KHz
read by plug-in frequency crystals
Parameters measured (1) The vertical in-phase component (tangent of the
tilt angle of the polarization ellipsoid). (2) The vertical out-phase (quadrature) component (the short
axis of the polarization ellipsoid compared to the long axis).
Method of reading In-Phase from mechanical inclinometer and quadrature from a calibrated dial.
Nulling by audio tone.
Scale range In-Phase +/- 150%, quadrature +/- 40%.
Readability +/- 1%
Reading time 10-40 seconds, depending on signal strength
Operating temperature -40 to +50°C.
Operating controls On-Off switch, push-button battery test, station selector, volume control,
quadrature dial, inclinometer dial.
Power supply six (6) AA alkaline cells, life about 200 hrs.
Dimensions 42 x 14 x 9 cm
Weight 1.6 kg
7.0 Survey Theory

7.1 VLF-EM Survey

Since the beginning of 1965 a large number of mining companies have found the EM 16 system to meet the need for a simple, light and effective exploration tool for mining geophysics. The VLF-EM method uses the military and time standard VLF transmissions as primary field. Only a receiver is then used to measure the secondary fields radiating from the local conductive targets. This allows a very light, one-man instrument to do the survey. Because of the almost uniform primary field, good response from deeper targets is obtained. The EM 16 provides In-Phase & Quadrature components of the secondary field with the polarities indicated. Interpretation technique has been highly developed particularly to differentiate deeper targets from the many surface indications. The VLF transmitting stations have vertical antennas. The magnetic signal component is then horizontal and concentric around the transmitter locations.

Principal of Operation

The VLF transmitting stations operating from communications with submarines have concentric horizontal magnetic fields around them. When the fields meet conductive bodies in the ground, there will be secondary fields radiating from these bodies. The EM 16 measures the vertical components of these secondary fields. The instrument is simply a sensitive receiver covering the frequency band of the selected station with means of measuring the vertical field components. The receiver has two inputs, with two receiving coils built into the instrument. One coil has normally vertical axis and the other is horizontal. The vertical coils signal is first minimized by tilting the instrument. The tilt-angle is calibrated in percentage. The remaining signal in this coil is finally balanced out by a measure of percentage of the signal from the other coil, after being shifted 90° (normally parallel to the primary field). Thus, if the secondary signals are small compared to the primary horizontal field, the mechanical tilt-angle is an accurate measurement of the vertical real-component (In-Phase), and the compensation signal from the horizontal coil is a measure of the vertical signal (Quadrature).

Selection Of The Station

The magnetic field lines from the station are at right angles to the direction of the station. Always select a station which gives the field approximate at right angles to the main strike of the ore bodies or geological structure of the area being surveyed. The strike of the geology should point to the transmitter, a variation of +/- 45° is tolerable in practice. Following is a list of some of the available stations:

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<th>Station</th>
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<td>Cutler, Maine</td>
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<tr>
<td>NLK</td>
<td>Seattle, Washington</td>
<td>24.8 KHz</td>
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<tr>
<td>NSS</td>
<td>Annapolis, Maryland</td>
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</table>
Taking A Reading
The direction of the survey lines should be selected approximately along the lines of the primary magnetic field, at right angles to the direction to the station being used. Before starting the survey, the instrument can be used to orient oneself in that respect. By turning the instrument sideways, the signal is minimum when the instrument is pointing towards the station, thus indicating that the magnetic field is at right angles to the receiving coils inside the handles. To take a reading, first orient the reference coil (lower end of the handle) along the magnetic lines. Swing the instrument back and forth for minimum sound intensity. Use the volume for comfortable listening. Then use the left hand to adjust the quadrature component dial to further minimize the sound. When the minimum sound level is achieved read the inclinometer by looking into the lens, then take note of both readings. The dials inside the inclinometer are calibrated in positive and negative percentages. If the instrument is facing 180° from the original direction of travel, the polarities of the readings will be reversed. Therefore always face the same direction (station being at right angle of the nulled direction).

Fraser Filter
VLF-EM data often yields complex patterns which require considerable study for a proper interpretation. A method, Fraser Filter was developed which allows field operators to transform the noncontourable dip angles into contourable data, producing conductor (anomaly) patterns which are immediately apparent to exploration personnel. The contoured data peaks very close to the top of the conductive axis, thereby allowing drill holes to be spotted accurately. The contoured data is expressed in degrees and only the positive quantities are contoured. This is dependant on the direction the filter was applied, usually a south to north or west to east filter is used and produces positive peaks where maximum deflection is seen on the In-Phase profile. The filter should only be applied to evenly spaced readings (eg. 25 m reading interval along the entire line read).

Formula \((i_{1}+i_{2})-(i_{3}+i_{4})\)

The formula is the sum of station 1 & station 2 minus the sum of station 3 and 4. The plot point is in the middle of the stations calculated. This method is extremely useful in reducing noise and eliminating regional effects.
7.2 TFM Survey

Theory:

The magnetic method is based on measuring alteration in the shape and magnitude of the earth's naturally occurring magnetic field caused by changes in the magnetization of the rocks in the earth. These changes in magnetization are due mainly to the presence of the magnetic minerals, of which the most common is magnetite, and to a lesser extent ilmenite, pyrrhotite, and some less common minerals. Magnetic anomalies in the earth's field are caused by changes in two types of magnetization; (1) Induced, caused by the magnetic field being altered and enhanced by increases in the magnetic susceptibility of the rocks, which is a function of the concentration of the magnetic minerals. (2) Remanent magnetism is independent of the earth's magnetic field, and is the permanent magnetization of the magnetic particles (magnetite, etc.) in the rocks. This is created when these particles orient themselves parallel to the ambient field when cooling. This magnetization may not be in the same direction as the present earth's field, due to changes in the orientation of the rock or the field. The unit of measurement (variations in intensity) is commonly known as the Gamma which is equivalent to the nanotesla (nT).

Method:

The magnetometer, GSM-19 with an Overhauser sensor measures the Total Magnetic Field (TFM) perpendicular to the earth's field (horizontal position in the polar region). The unit has no moving parts, produces an absolute and relatively high resolution measurement of the field and displays the measurement on a digital lighted display and is recorded (to memory). Initially, the tuning of the instrument should agree with the nominal value of the magnetic field for each particular area. The Overhauser procession magnetometer collected the data with a 0.2 nanoTesla accuracy. The operator read each and every line at a 12.5 m interval with the sensor attached to the top of three (56cm) aluminum tubing sections. The readings were corrected for changes in the earth's magnetic field (diurnal drift) with a similar GSM-19 magnetometer, >> base station << which automatically read and stored the readings at every 30 seconds. The data from both units was then downloaded to PC and base corrected values were computed.
Declaration of Assessment Work Performed on Mining Land

Ministry of Northern Development and Mines

Mining Act, Subsection 65(2) and 66(3), R.S.O. 1990

Instructions: For work performed on Crown Lands before recording a claim, use form 0240.
- Please type or print in ink.

1. Recorded holder(s) (Attach a list if necessary)
   - Name: ROYAL OAK MINES INC.
   - Address: P.O. Bag 2010
   - City: TIMMINS
   - Province: ONT
   - Telephone Number: 705-360-1141
   - Fax Number: 705-360-1532

2. Type of work performed: Check (✓) and report on only ONE of the following groups for this declaration.
   - Geotechnical: prospecting, surveys, assays and work under section 18 (regs)
   - Physical: drilling, stripping, trenching and associated assays
   - Rehabilitation

   Work Type: Linecutting, Total Field Mag, VLF-EM

   Dates Work Performed: From 25 08 1997 To 30 08 1997

   Global Positioning System Data (if available): Deloro
   - M or G-Plan Number: G-3193

   Please remember to:
   - Obtain a work permit from the Ministry of Natural Resources as required;
   - Provide proper notice to surface rights holders before starting work;
   - Complete and attach a Statement of Costs, form 0212;
   - Provide a map showing contiguous mining lands that are linked for assigning work;
   - Include two copies of your technical report.

3. Person or companies who prepared the technical report (Attach a list if necessary)
   - Name: Richard Daigne, Geoserve Canada Inc.
   - Address: P.O. Box 1525 South Porcupine, ONT
   - Telephone Number: 705-235-8661
   - Fax Number: 705-235-8038

4. Certification by Recorded Holder or Agent
   - Peter Harvey, do hereby certify that I have personal knowledge of the facts set forth in this Declaration of Assessment Work having caused the work to be performed or witnessed the same during or after its completion and, to the best of my knowledge, the annexed report is true.

   Signature of Recorded Holder of Agent: Peter Harvey
   - Date: Sept 3 97
   - Agent's Address: ROYAL OAK MINES INC.
   - Telephone Number: 360-1141
   - Fax Number: 360-1532
   - December 2, 1997
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Column Totals: 16,640 12,800 783 3,840
Ontario Ministry of Northern Development and Mines

Statement of Costs for Assessment Credit

Transaction Number (office use) 29700.00386

Personal Information collected on this form is obtained under the authority of subsection 6(1) of the Assessment Work Regulation 0/W. Under section 8 of the Mining Act, the information is a public record. This information will be used to review the assessment work and correspond with the mining land holder. Questions about this collection should be directed to the Chief Mining Recorder, Ministry of Northern Development and Mines, 6th Floor, 933 Ramsey Lake Road, Sudbury, Ontario, P3E 6B5.

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<th>Cost Per Unit</th>
<th>Total Cost</th>
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<td>31.7 Km of grid and surveys</td>
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Associated Costs (e.g. supplies, mobilization and demobilization).

Transportation Costs

Food and Lodging Costs

Total Value of Assessment Work $16,640

Calculations of Filing Discounts:

1. Work filed within two years of performance is claimed at 100% of the above Total Value of Assessment Work.
2. If work is filed after two years and up to five years after performance, it can only be claimed at 50% of the Total Value of Assessment Work. If this situation applies to your claims, use the calculation below:

\[
\text{Total Value of worked claimed} = \text{Total Value of Assessment Work} \times 0.50
\]

Note:
- Work older than 5 years is not eligible for credit.
- A recorded holder may be required to verify expenditures claimed in this statement of costs within 45 days of a request for verification and/or correction/clarification. If verification and/or correction/clarification is not made, the Minister may reject all or part of the assessment work submitted.

Certification verifying costs:

Peter Harvey, do hereby certify, that the amounts shown are reasonably be determined and the costs were incurred while conducting assessment work on the accompanying Declaration of Work form as Project Geologist (recorded holder, agent, or state company position with signing authority) I am authorized to make this certification:

Peter Harvey Date Sept 3 '97
December 2, 1997

Dear Sir or Madam:

Subject: Transaction Number(s): W9760.00338 Approval

We have reviewed your Assessment Work submission with the above noted Transaction Number(s). The attached summary page(s) indicate the results of the review. WE RECOMMEND YOU READ THIS SUMMARY FOR THE DETAILS PERTAINING TO YOUR ASSESSMENT WORK.

If the status for a transaction is a 45 Day Notice, the summary will outline the reasons for the notice, and any steps you can take to remedy deficiencies. The 90-day deemed approval provision, subsection 6(7) of the Assessment Work Regulation, will no longer be in effect for assessment work which has received a 45 Day Notice.

Please note any revisions must be submitted in DUPLICATE to the Geoscience Assessment Office, by the response date on the summary.

If you have any questions regarding this correspondence, please contact Lucille Jerome by e-mail at jeromel2@epo.gov.on.ca or by telephone at (705) 670-5858.

Yours sincerely,

Blair Kite
Supervisor, Geoscience Assessment Office
Mining Lands Section

Correspondence ID: 11615
Copy for: Assessment Library
## Work Report Assessment Results

**Submission Number:** 2.17865  
**Date Correspondence Sent:** December 02, 1997  
**Assessor:** Lucille Jerome  

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<td>DELORO</td>
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</tr>
</tbody>
</table>

**Section:**  
14 Geophysical MAG  
14 Geophysical VLF  

**Correspondence to:**  
Resident Geologist  
South Porcupine, ON  
Assessment Files Library  
Sudbury, ON

**Recorded Holder(s) and/or Agent(s):**  
Peter Harvey  
ROYAL OAK MINES INC.  
KIRKLAND, WASHINGTON
**Total Field Magnetic Plan**

58000 nT Base Removed

**Contours**

- Level 1: 50 nT from 55500 to 65500 nT
- Level 2: 100 nT from 55500 to 65500 nT
- Level 3: 200 nT from 55500 to 65500 nT

**Base Station Location:** Along Access Road

1651 Readings @ 12.5 m & 25.0 m

5662 nT to 62304 nT Range, 58143 nT Mean

**INSTRUMENTS**

TerraPlus GSM-19 Overhauser

**Royal Oak Mines Inc.**

Magnesite Project

Deloro Twp, Porcupine Mining Division

GSM 48005350 k

GEOSERVE CANADA INC Aug 30, 97
LEGEND

Magnetic Anomaly

- Mag High
- Mag Low

Metal & Mineral Abbreviations

IF Iron Formation
mg Magnetite
po Pyrrhotite
py Pyrite
cp Chalcopyrite

PAST EXPLORATION

Approximate DDH Location
with Bearing.

Taken From P. Map 2079, Deloro Twp., OGS,
Sangster, PJ and Maharaj, Deosaran, 1980.

APPROXIMATE LOCATION

DELORO TWP.

ADAMS TWP.

PLAN 4

Royal Oak Mines Inc.

Compilation Map
Magnesite Project

Scale: 1:20,000

October 30, 1997

TOPO

- Assumed Claim Post Location
- Drainage
- Bush Road

ZONE B

ZONE C

ZONE D

ZONE A

LEGEND

Mag High
Mag Low
Very Weak
Weak
Moderate
Good
Very Good

Assumed Claim Post Location

Drainage

Bush Road

ZONE B

ZONE C

ZONE D

ZONE A

LEGEND

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