ASSESSMENT OF GEOLOGICAL INVESTIGATIONS ON WHOPPER PROPERTY, BURNTBUSH-DETOUR LAKES AREA, NTS 32E13/32L4
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QUALIFICATIONS OF THE WRITER

EDUCATION:

Hon. B.Sc., Lakehead University, Thunder Bay, 1971
M. Sc., Ph. D., University of Toronto, 1978

EXPERIENCE:

Assistant Professor of Geology, Lakehead University, 1977 to 1981
Summers 1971-1980: mapping for Geological Survey of
Canada, Dept. of Indian and Northern Affairs, Noranda
Exploration, New Inco Mines, Ontario Geological Survey
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PROFESSIONAL AFFILIATIONS:

Canadian Institute of Mining and Metallurgy, Geological
Association of Canada.

R. J. Shegelski, Ph. D.
LOCATION AND ACCESS

A contiguous 216 claim block staked by Newmont Exploration is located in the northern Abitibi greenstone belt approximately 200 km northeast of Timmins, Ontario in the West of Sunday Lake-Hopper Lake area. The property is situated north and northeast of Hopper Lake and lies in the northwest corner of Map 2453 (Johns, 1982).

The area is accessible in winter by ski equipped, fixed wing aircraft or by winter road which passes through the southwest corner of the property. Summer access is limited to helicopter and float equipped aircraft on the larger, deeper lakes. Much of the area is string bog and open marsh which are not easily traversed in the summer. A new all-weather gravel road to Detour Mine is presently being constructed and will be completed in the near future.
PROPERTY DESCRIPTION

A contiguous 216 claim block, herein referred to as Whopper property (Figure 1), was staked between June 6, 1981 and January 28, 1982 for Newmont Exploration. A list of the claims submitted for assessment credit are provided in Table I.

Ground cover on the northeast third of the property (Map G-1) consists of 15% string bog, 20% open marsh, 20% scattered spruce and 45% thick spruce forest. A large area of open swamp and string bog runs north-south 2,000 feet west of Hopper Creek and separates the northeast third of the property from that to the southwest. Heavy spruce forest generally increases in density to the southwest (from Map G-2 to Map G-3) and forms 80% of the ground cover along north-south trending ridges and flats in the southwestern third of the property (Map G-3). The open swamps are typically fringed by scattered spruce trees which grade outward into heavy spruce forest.

Vegetation covers Pleistocene to Recent alluvium which generally consists of sand, gravel and minor till. Thick layers of peat have begun to accumulate in the large open marshes and string bogs. The thickest overburden encountered in drilling was 120'. There is only about 2% outcrop on the property and local relief does not exceed 30 feet. Geological investigations in the form of helicopter reconnaissance surveys and diamond drilling were necessary to obtain additional information because of such poor exposure.
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PREVIOUS WORK

The Whopper project area is reasonably remote and was only mapped on reconnaissance scale in 1967 by G. Bennett et. al. This survey was followed by 1:15,840 scale mapping under supervision of G.W. Johns in 1978. The Whopper area is indicated as having almost no outcrop on Johns' map and there is certainly less than 3% rock exposure in the field. A table of lithologic units has therefore been constructed based upon general geology throughout the broader area (Johns, 1982) but has been modified based upon drilling results in the Whopper area (Table II).

Previous diamond drill programmes combined with the present drilling have allowed geological interpretation over most of the Whopper area. In 1971, three diamond drill holes were filed by INCO for assessment and were spotted on the basis of previously defined coincident magnetic anomalies and EM conductors. Hole 43297 intersected amphibolite metavolcanics and metasediments. The conductor was 5.3 feet of graphitic, sulfidic mudrock from 257.5 to 262.8 feet. Hole 43296 intersected amphibolite metavolcanics with sulfide rich flow tops from 180 to 190 feet and from 219.8 to 236.9 feet. Hole 43295 intersected more amphibolite metavolcanics with a distinct sulfide concentration (30-70%) from 231.0 to 238.6 feet. All drilling was conducted in the west of Sunday Lake Area and is located on Map G-1.
TABLE II

LITHOLOGIC UNITS, BURNTBUSH-DETOUR LAKES AREA *

PHANEROZOIC

CENOZOIC

QUATERNARY

Recent swamp, stream and lacustrine deposits
Pleistocene till, gravel, sand and clay

Unconformity

PRECAMBRIAN

PROTEROZOIC

Quartz Diabase Dikes

Intrusive Contact

ARCHEAN

Diorite Intrusions and Felsic to Intermediate Intrusions (quartz monzonite, granodiorite, granite, quartz diorite, feldspar porphyry, quartz-feldspar porphyry, gneiss, pegmatite, felsite, trondjhemite)

Intrusive Contact

Mafic and Ultramafic Intrusions (gabbro, amphibolite, porphyritic gabbro, hornblendeite, ultramafic rocks)

Intrusive Contact

Metasediments (chemical chert and iron formation; clastic wacke, arenite, arkose, calc-silicate rocks, grit, graphitic mudrock, tuff as schists)

Metavolcanics

Felsic to Intermediate (flows, porphyritic flows and pyroclastic or volcaniclastic rocks)

Mafic to Intermediate (massive, pillowed and porphyritic flows with flow top breccias and minor fragmentals of equivalent composition, as amphibolites)

* (modified from Johns, 1982)
In 1976, Patino Mines drilled three holes in the property after conducting a ground EM Survey. Hole No. 1 intersected both metavolcanic and metasedimentary layers. A graphitic sulfidic (24-30%) mudrock from 200 to 201.5 feet was apparently the conductor being drilled for. Hole No. 2 intersected three amphibolite basalt flows and a thin metasediment layer from 125.5 to 166 feet. The conductor was a 3.5' width of 20% pyrrhotite near the top of a flow 240 feet down the hole. None of these sulfide rich zones returned good assays in Cu, Ag, Au and Zn.
PRESENT STUDY

In early September, 1981, Newmont Exploration conducted a three day helicopter geological reconnaissance survey in the area and collected rock samples from more than a dozen sites. Five typical lithologies were selected for thin sectioning and petrographic descriptions of these are presented in Appendix I. Newmont Exploration staked 216 claims between June 6, 1981 and January 28, 1982. An airborne magnetometer and EM survey was flown over 210 line miles of ground on August 18, 1981 by Renting Earth Sciences Ltd., Ottawa. Line-cutting (170.76 miles) commenced by Ingamar Explorations, Connaught on September 12, 1981 and was completed December 17, 1981. Lines were both summer and winter cut, base lines contained 25 metre pickets, cross lines were spaced 100 metres apart with pickets on cross lines at 25 metre intervals. The extension grid between the northeast area (Map G-1) and the area to the southwest (Maps G-2, G-3) was the only exception where cross lines were spaced at 200 metre intervals instead of 100 metre intervals. Tie lines were cut parallel to each baseline and run along the boundaries of the property. Ground geophysical surveys were conducted by Rayan Exploration, North Bay, using MP-2 magnetometer and MAX MIN II and were conducted soon after and in conjunction with the linecutting. Ground geophysical surveys terminated December 21, 1981.

These surveys were augmented by geological examination
of all available outcrops on the property using airphotos to locate outcrops and cut lines for ground control. In addition, a ten hole diamond drill programme was conducted by Norex Drilling, Timmins and MSW Drilling, Earlton, from February 22, 1982 to March 4, 1982. The 4,049 feet of core obtained were logged in detail and a large number of sulfide rich intervals were split and assayed. Detailed cross sections were then constructed and geochemical data analysed during the remainder of March, 1982. Twelve representative samples were selected from drill core and analysed for whole rock abundances (see Table III) in order to better characterize lithologies on the property.

Geology of the Whopper Area - Results from Drilling

a) General Geology and the Character of Mineralization

Details of location, depth, inclination and character of each major conductor are included in Table IV. Supra-crustal rocks drilled include submarine basalt flows, greywack-arenite-siltstone sequences, minor graphitic sulfidic mudrock, minor mafic tuff and rare felsic tuffs which are probably reworked. No felsic volcanic flow rocks or fragmentals were observed and their absence suggests that the environment investigated is that of a submarine basalt shield complex.

A series of lithologic cross sections corresponding to the appropriate drill holes (W 82-1 is SECTION 1, etc...)

- 10 -
Table III
Whole Rock Geochemistry of Lithologies from Diamond Drill Core, Whopper Area

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7016 - hornblendite intrusion; 7013 - hornblendite dyke; 7009 - fine grained chill base, basalt flow; 7001, 7004, 7017, 7006 and 7007 - fine grained dark green amphibolites (metabasalt); 7010 - silicified flow base (metabasalt); 7002 - silicified, sulfidized amphibolite (metabasalt); 7005 - garnet porphyritic amphibolite, Fe metasomatized basalt; 7011 - quartz, feldspar, biotite schist (metasediment).
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**TABLE IV**

Conductor Remarks

WIDE ZONE OF SULFIDE AT AND NEAR BASAL HT CONTACTS: 395.5 to 426' avg. 5%; 437 to 453' avg. 30%; MS 451 to 453'; 465 to 502' avg. 5%; 529 to 584' avg. 10%

SULFIDES IN BASALT: 183 to 190.3' avg. 8%; 213 to 345' avg. 16%

SULFIDES AT AND NEAR BASALT FLOW CONTACTS: 184 to 225' avg. 15%; 225 to 296' avg. 4%; 308 to 318.4' avg. 10%

SULFIDES AT FLOW CONTACTS AND WITHIN SILICIFIED MAFIC FLOWS AND TUFFS: 79.2 to 94.6' avg. 7%; 100.1 to 105.6' avg. 10%; 112.7 to 133.4' avg. 17%; 207.5 to 211' avg. 11%

SULFIDES IN VOLCANICS AND GRAPHITIC SHALES: 113 to 122.3' avg. 6%; 156 to 175.4' avg. 5%; between 192.5 and 206--10' of core avg. 9%; 201.5 to 226' avg. 6%

SULFIDES IN BASALT FLOW TOPS: 196 to 203.5' avg. 6.5%; 234 to 244' avg. 6.5%

SULFIDES AT VOLCANIC-SEDIMENT CONTACTS AND IN GRAPHITIC SHALES: 108 to 113' avg. 5%; 135 to 170' avg. 5%; 179 to 192.5' avg. 5% in black shale.

SULFIDES IN INTERFLOW SEDIMENTS: 95 to 100' avg. 12%; 293.5 to 298.7' avg. 6%; 320 to 340' avg. 6%; selected splits between 342 and 354' avg. 9% over 5.4'; 412.25 to 417' avg. 6% in silicified flow top.

SULFIDES IN SILICIFIED TUFFS AT VOLCANIC-SEDIMENT CONTACTS: 85 to 88' avg. 3% po and cpy; 134 to 143' background 1.1%; 149 to 155.75' avg. 7%; 170.75 to 176' avg. 8% po and cpy; 180 to 182.5' avg. 20% po and cpy in milky quartz; 294.3 to 298.2' avg. 5%

SULFIDES IN SILICIFIED BASALT AT VOLCANIC-SEDIMENT CONTACTS: 123 to 131' avg. 12%; 164 to 193' avg. 5% with 90% sulfide from 169 to 173.3'; 205 to 212' avg. 11%; 223 to 248' avg. 5%
included in a back pocket for reference. Examination of sections reveals that the two common lithologies in the area are submarine basalt flows now present as amphibolites and deep marine sediments represented by biotite-feldspar-quartz schists. These two major lithologies are interlayered to varying degrees with a generally observed trend of thicker basalt flows and heavier pyrrhotite mineralization in the northeast portion of the property. SECTIONS 1, 2, 4 and 12 in particular all contain horizons of massive pyrrhotite in a milky quartz matrix which are presently interpreted as inhalative sulfide deposits (i.e. syngenetic mineralization which occurs within porous rock media after the rock is deposited and prior to compaction). None of the other sections have encountered this specific type of massive sulfide deposit but hole W82-3 contains up to 70% sulfides in altered mafic volcanics and most closely approaches this type of deposit.

The holes to the southwest generally consist of interlayered sediments and volcanics except for W-82-3 which is transitional with the set described above and W82-9 which drilled through basalts into a small pluton with a hornblendite margin. These remaining holes (W82-5, 6, 7 and 8) contain conductors in the form of graphitic, sulfidic (5-12%) mudrock with some possible magnetite component: or highly silicified flow contacts with up to 9% sulfide. The graphitic sulfidic mudrock is interpreted as a synsedimentary biogenic accumulation in felsic volcanic tuff whereas the sulfidization along basalt contacts is interpreted
to be late deuteric to early diagenetic metasomatism which occurred during cooling of the volcanic pile. This metasomatism affects both the underlying and overlying flow and thus appears to be related to natural inhalative processes generated by deposition of volcanic flows. No anomalous gold values were found in these metasomatized contacts nor should any be expected because this sulfidization lacks the extraordinary processes required for ore formation. The graphitic sulfidic mudrock does not contain anomalous gold values either and the absence is explained by the fact that these biochemical sediments are non-exhalative. In short, the conductors in the southeast portion of the property are caused by natural depositional processes and do not appear to warrant further exploration. The conductor associated with hole W82-3 is the exception because it consists of an abnormally thick sequence of silicified, sulfidized basalt suggesting prolonged hydrothermal activity and a split containing quartz veining in this zone ran 208 ppb gold.

Holes W82-1, 2, 4 and 12 to the northeast do not contain anomalous gold values in spite of an abundance of pyrrhotite (some pyrite) and the local occurrence of trace chalcopyrite. The sulfides are massive and penetrate as disseminations into both underlying and overlying strata. They are preferentially located within porous host rocks which they variably replace and unfortunately they are barren of gold and base metals. I interpret these sulfide concentrations as inhalative sulfide iron formations (i.e. epigenetic massive sulfides formed by
lateral migration of metal-rich fluids along porous horizons within the rock rather than at the rock – sea water interface.

Although this inhalative mineralization is barren, the process is unusual and indicates active mobilization of iron, sulfur and silica. Gold is not concentrated in the exhalites but could potentially be redistributed laterally or, underlying stratigraphic sequences might be more favourable for gold mineralization. With regard to this last alternative it is worth while to examine the plan view geology, structure and stratigraphy to determine whether any stratigraphic sequences remain to be tested.

b) Stratigraphy and Structure

Younging has been determined from graded bedding in greywackes and to a greater degree from morphology of basalt flows. Gradational transitions from a chilled base through massive to pillowed flow to flow top breccia provide very reliable younging (Dimiroth et al., 1978). Younging directions, including those deduced from Patino and Inco holes suggest that the Supracrustals are isoclinally folded (Map G-4). In particular hole W82-8 contains opposing younging directions which are separated by an axial planar mylonite zone thereby defining a fold closure (SECTION 8). In the northeast all strata dip 60–80° south-southeast but holes W82-1 young south whereas W82-4, W82-12 and all Inco holes young north and are overturned. The trace of an axial surface therefore lies
between these two sets of holes.

The sequence of interlayered mafic volcanics and sedimentary rocks to the southwest represented by Patino holes 1 to 3 plus holes W82-3, 5, 6, 7, 8 and 9 outline an extremely complex structural picture in which bedding dips steeply both north and south and younging directions change both within holes and between adjacent holes. Such structural complexity is typical of sediment-rich supracrustal sequences in Archean greenstones.

From the limited geological information available from drilling and outcrops there are a number of potential interpretations for stratigraphic superposition but the general trend from predominantly mafic strata in holes W82-1, 2, 4, 12 and Inco holes suggests that these strata underly the basalt-sediment sequence outlined to the southwest. The predominantly mafic strata lie northwest of the Patino holes and holes W82-6 to W82-9 and contain a high magnetic signature. Furthermore, the magnetic field rapidly increases near the northwest boundary of the property and here there are local conductors along magnetic highs which may represent a separate, underlying stratigraphic sequence which probably contains basalts with oxide iron formations and/or ultramafic horizons. In view of the geology of Detour Lake Mine (see Figure 7 of Johns, 1982), it would appear necessary to locate a basalt-ultramafic contact in order to increase chances of finding gold ore.
c) Correlation of Geology and Geophysics

Detailed examination of the ground magnetometer survey outlines five separate ranges of magnetic intensity which appear to generally characterize lithological associations in the Whopper area. Lithologies inferred from magnetic intensities and drilling appear in Map G-4. Intensities of less than 59,400 gammas are attributed to greywackes with low pyrrhotite and low magnetite. Intensities between 59,400 and 59,500 gammas probably represent sedimentary rocks with minor mafic volcanic flows and/or minor interlayers of sedimentary pyrrhotite and magnetite. Magnetic intensities between 59,500 and 59,800 are likely to be intermediate to mafic volcanics with minor disseminated pyrrhotite and/or magnetite. Intensities between 59,600 and 60,000 gammas have been the main drill targets where they have corresponding short, intense conductors. These zones are generally narrow and are surrounded by rocks with lower magnetic intensities. These conductors are graphitic sulfidic mudrock, interflow diagenetic pyrrhotite or sulfide inhalite deposits. The background magnetic intensity increases towards the northwest edge of the property and passes into a broad high mag terrane (above 59,600 gammas) at both the southwest and northeast ends of the northwest edge of the property. Within this high mag terrane there are linear zones with magnetic intensities greater than 59,800 gammas. It is this terrane which is interpreted to be underlying strata.
Part of it is undoubtedly gneissic particularly further to the northwest but the narrower more magnetic area could represent basalts with oxide iron formation and/or ultramafic rocks.

d) Geochemistry of Sulfide-rich Strata

Sludges, sulfide-rich samples and milky quartz concentrations were analysed for Au, Ag, Ni, and Cu in an attempt to delineate any anomalous gold. Although abundant pyrrhotite-quartz mineralization was found in several holes, anomalous gold was found only in W82-3 from 63.93 to 65.52 metres (208 ppb) and in selected milky quartz veins in W82-7 from 7.77 to 8.22 metres (137 ppb). The Detour Lake Mine contains anomalous copper and copper was analysed as a tracer at Whopper to detect any gold-copper association which might be present. A plot of gold (ppb) versus copper (ppm) is presented in Figure 2 and suggests that there is no gold-copper association in the sulfide-rich mineralization. The only exceptions are in some samples from hole W82-2 and more obviously from hole W82-8 (circled in Figure 2). Sample distribution instead suggests an antipathetic relationship of high gold-low copper and visa versa. A plot of nickel (ppm) versus copper (ppm) is presented in Figure 3 for those holes containing concentrated inhalative sulfides. This plot demonstrates an excellent correlation between copper and nickel in the sulfides and argues for simultaneous inhalative leaching of both copper and nickel from the basalts. The process of pure dilution
through high volume replacement would thereby account for the low abundances of gold in these inhalites. In general, those samples with higher sulfide content are also those which contain higher copper and nickel contents but no such association is observed with gold. This observation further supports an inhalative leaching process. It is obvious, therefore, that gold is not directly associated with copper or with sulfides in the inhalite horizons where they have presently been drilled.

Twelve samples of "fresh" rock were selected from core drilled this past field season and were submitted to X-Ray Laboratories for trace Au, Ni, Cu, Zn, As and for whole rock analysis. Background gold values are all ≤ 3 ppb whereas sulfide rich samples average out to approximately 15 ppb. It is questionable whether this difference is significant and represents an enrichment in the latter lithology.

e) Dimensions of Inhalative Sulfide Mineralization

A review of the average % sulfide and aggregate widths from diamond drilling and lengths of conductors as projected from geophysical surveys provides the following information which is summarized in Table V.

Inhalative sulfide mineralization collects in two separate environments, flow top breccias in basalts and porous arenaceous sections of turbidite metasediments. Sulfide mineralization in basalts is predominantly pyrrhotite forming aggregate widths of up to 137 feet of 13% sulfide. Within
Table V

Characteristics of Conductors, Detailed Projections

<table>
<thead>
<tr>
<th>Drill Holes on Zone</th>
<th>Average % Sulfide</th>
<th>Aggregate Width (ft.)</th>
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<tr>
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<tr>
<td>INCO 43296, W82-4</td>
<td>11</td>
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<td>W82-1, W82-2</td>
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<td>AND</td>
<td>2</td>
<td>50</td>
<td></td>
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</tbody>
</table>

| Predominantly Sedimentary Host |
| W82-6                      | 6.5               | 17.5                  | 2,625                  |
| W82-7                      | 5                 | 53.5                  | 2,625                  |
| W82-8                      | 8                 | 39                    | 2,625                  |
| Patino #1                 | 25                | 1.5                   | 2,625                  |
| AND                       | 3.5               | 29                    |                        |
| Patino #3                 | 20                | 3.5                   | 2,625                  |
| AND                       | 2                 | 50                    | 2,625                  |
this aggregate thickness, there are local massive sulfide layers. These volcanic hosted, inhalative sulfide iron formations are laterally continuous for up to 11,000 feet but massive sulfide zones are less continuous whereas disseminated sulfides are for more widespread. Inhalite horizons are characterized by long zones of relatively strong conductivity coincident with long linear magnetic highs.

The second type of inhalite is hosted in arenite but there are also occurrences of syngeneic sulfides in graphitic mudrock which have been encountered in drilling. Sulfides in the former host generally consist of pyrite and pyrrhotite scattered throughout the sediment with local thin layers of 20-25% sulfides. Pyrite is the predominant sulfide in the graphitic mudrocks. The lengths of sulfide rich zones hosted in metasediments is shorter than those in basalts but this may be due in part to tectonism because younging indicators in the sedimentary-rich strata indicate complex isoclinal folding.

The average basalt-hosted inhalite is predominantly composed of pyrrhotite with minor pyrite and trace chalcopyrite. It contains 8% sulfide over a 70' aggregate width and a 5,200' projected length. In contrast, the average sediment-hosted inhalite is composed of pyrrhotite and/or pyrite with rare chalcopyrite and averages 4-5% sulfide over a 5' aggregate width and a 2,600' projected length.
f) Interpretation of Whole Rock Geochemistry

The samples analysed from Whopper property for background trace elements and whole rock geochemistry are compared with samples collected from Detour Lake Mine on a Jensen Cation plot. (Figure 4). In general, the Detour rocks consist of an extrusive trimodal association (i.e. ultramafic, basaltic and rhyolitic or dacitic rocks all in close proximity). The Detour basalts show a distinct calc alkaline trend on AFM plot as well as on Jensen Cation plot (Figure 4). Whole rock geochemistry of basalts at Detour indicate carbonate and silica alteration and petrographic examination of Detour ore suggests that gold, pyrite, chalcopyrite and silica have preferentially replaced the rhyolitic felsic tuffs.

The Whopper area contains ultramafic rock but where drilled, it occurs as intrusive hornblendite. The most felsic rock identified to date on the property is metasediment, the composition of which appears to be a result of mixing of mafic and felsic debris (see Table III, Figure 4). No felsic volcanic rocks have been identified to date. The basalts of Whopper are, however, calc alkaline like those at Detour and this similarity reinforces our regional geophysical interpretation that both areas are stratigraphically equivalent, and that Whopper property has good potential for Detour-type gold mineralization.
Figure 4
Whole Rock Comparison - Detour Lake and Whopper
SUMMARY AND INTERPRETATION

Whopper area is a submarine basalt shield complex containing a lower stratigraphic sequence with high magnetic response which is tentatively interpreted to be flood basalts containing oxide iron formation and/or serpentinized ultramafic rocks. This lower sequence is overlain by a thick sequence of basaltic flows with minor interflow sediments and contains inhalative sulfide mineralization which is commonly localized at flow contacts as intersected in holes W82-1, 2, 4 and 12. The inhalative deposits in these basalts were likely derived by simultaneous leaching of Cu and Ni from the flows with massive addition of Fe and sulfur from infiltrating hydrothermal fluids. Resulting deposits are pyrrhotite and form long relatively wide conductors with corresponding linear magnetic highs. Less intense inhalative sulfides in basalts are likely caused by late deuteric or diagenetic metasomatism and may be a result of natural submarine weathering. A more diverse volcanic-sedimentary sequence overlies the basalt flows and contains inhalative sulfide mineralization (pyrite-pyrrhotite) in both basalts and arenaceous metasediments as well as synsedimentary graphitic pyritic mudrocks. Conductors in these strata are narrower, contain less pyrrhotite and have shorter strike lengths but this latter feature may be a result of tectonic dislocation.
RECOMMENDATIONS

Mineralization at Detour Lake Mine is concentrated within a relatively narrow zone (maximum 670 feet) of strata with a trimodal rock association which immediately underlies a thick sequence of calc alkaline basalt flows. The similarity in whole rock geochemistry between Detour Mine and Whopper property is encouraging and there is a distinct possibility that the highly magnetic terrane at Whopper contains a trimodal zone. The presence of abnormal quantities of sulfide mineralization formed by contemporaneous leaching of elements from basaltic host rock indicate active processes on Whopper property which, in a gold enriched protore, could produce an ore deposit. I would therefore maintain that the key processes necessary for ore formation have been indicated by drilling.

I recommend that a terrane with a trimodal association be sought on the property and if found be intensively explored. In this regard, the highly magnetic terrane at the northwest edge of the property appears to have the best potential. Two conductors at or near the southern contact of this terrane remain as yet untested and could be explored by our second priority holes W82-10 and W82-11 which were not drilled last season. Long holes should be drilled through the conductors and at least one more drill hole should be designed to identify the lithology which solely contains high magnetism. Drilling should be oriented to provide a complete stratigraphic
cross section of the highly magnetic terrane and thereby establish the presence or absence of a trimodal association.

There are several other conductors on the property which could also be tested, particularly in areas of low magnetic background. Here, gold deposits associated with disseminated sulfides and hosted in felsic volcanic rocks might be found. I would recommend detailed IP surveys over these conductors prior to drilling in order to establish priorities. This is necessary due to our limited geological information and lack of lithogeochemical data because of widespread overburden.

[Signature]
REFERENCES

Operation Kapuskasing; Ontario Dept. Mines, Misc. Paper 10,
98 pp.

Structure and Organization of Archean Subaueous Basalt
Flows, Rouyn-Noranda Area, Quebec, Canada; Can. Journ. of
Earth Sci., Vol. 15, No. 6, P902-918.

Johns, G.W., 1982
Geology of the Burntbush-Detour Lakes Area, District of
SAMPLE 7018 DIORITE

LOCATION: North end of Hopper Lake

TEXTURE: Coarse equigranular with intergrowths and sutured contacts, local hornblende coronas on fine-grained, complex cores suggest prograde metamorphism, interlocking hornblende and biotite suggest simultaneous crystallization, rare myrmekitic quartz-feldspar intergrowths.

ESTIMATED MODE

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<tr>
<td>Hornblende</td>
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<td>Quartz</td>
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* For field locations see Map G-4
SAMPLE 7019  PEGMATITE IN MIGMATITE

LOCATION:  Gneiss terrane northwest of Whopper grid

TEXTURE:  Pegmatite - coarse grained igneous intergrowths of K-feldspar, quartz, biotite and trace apatite and epidote.  

Migmatite - gneissic layers of muscovite-biotite alternating with quartz-feldspathic ones, relict fragmental texture suggests that the rock was originally either a clastic or pyroclastic felsic rock.

ESTIMATED MODE

Pegmatite

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Migmatite

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<tr>
<td>Biotite</td>
<td>5%</td>
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</table>
SAMPLE 7020 PEGMATITE

LOCATION: Exposure on shore of Small lake south of Whopper property

TEXTURE: Coarse grained igneous

Pegmatite contains plagioclase, microcline, muscovite and minor hornblende. Presence of two feldspars indicates that the parent rock is probably a monzonite.

ESTIMATED MODE

not possible because of coarse grain
SAMPLE 7021  AMPHIBOLITE (METABASALT)

LOCATION:  Centre of main grid, Whopper property

TEXTURE:  intergrowths of plagioclase hornblende, chlorite, biotite and rare epidote and pyroxene; epidote filled fractures cut across the amphibolite; sample is cut by a feldspar rich (40%) amphibolite.

ESTIMATED MODE

Hornblende  65%
Plagioclase  25%
Chlorite      5%
Epidote-Pyroxene  4%
Biotite       1%
TEST FOR Ni-Cu ASSOCIATION holes W82-1,2,4 and 12

- = 1 to 8% sulfide
+ = 9 to 14% sulfide
Δ = 14 to 95% sulfide

Figure 3
Ni - Cu Association
TEST FOR Au-Cu ASSOCIATION all holes

Figure 2

Au - Cu Association
Ontario Ministry of Natural Resources

Report of Work (Geophysical, Geological, Geochemical and Expenditures)

**Type of Survey(s)**

- Line Cutting and Geology

**Claim Holder(s)**

NEWMONT EXPLORATION OF CANADA LTD.

**Address**

Box 1430 TIMMINS, ONTARIO P4N 7N2

**Survey Company**

INGOMAR EXPLORATIONS LTD.

**Prospector's Licence No.**

A37767

**Date of Survey (from & to)**

12/08/81 to 12/09/81

**Total Miles of Line Cut**

2.5194

**Name and Address of Author (of Geo-Technical report)**

R. J. Shogalski

Box 1430

TIMMINS, ONTARIO P4N 7N2

**Credits Requested per Each Claim in Columns at right**

- Mining Claims Traversed (List in numerical sequence)

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**Expenditures**

Type of Work Performed: Geophysical Survey

**Performing the Claim(s):**

- Electromagnetic
- Magnetometer
- Radiometric
- Other

**Total Days Credits**

148

**For Office Use Only**

**Received**

OCT 1 1982

**Recorded**

SEP 24 1982

**Receipt No.**

RECEIVED

**MINING LANDS SECTION**

**Certification Verifying Report of Work**

I hereby certify that I have a personal and intimate knowledge of the facts set forth in the Report of Work annexed hereto, having performed the work or witnessed same during and/or after its completion and the annexed report is true.

Name and Postal Address of Person Certifying

R. J. Shogalski

Box 1430

TIMMINS, ONTARIO P4N 7N2

Date Certified:

Oct 23, 1982

Certified by (Signature):

R. J. Shogalski
Submitted for 20 days credit linecutting and 20 days credit geology.

WEST OF SUNDAY LAKE - HOPPER LAKE AREA

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Type of Survey(s): GEOLOGICAL
Township or Area: West of Sunday Lake - Hopper Lake
Claim Holder(s): NEWMONT EXPLORATION OF CANADA LTD.
Survey Company: NEWMONT EXPLORATION OF CANADA LTD.
Author of Report: Dr. R. J. Shegelski
Address of Author: Box 1430, Timmins, Ontario P4N 7N2
Covering Dates of Survey: Sept. 12, 1981 to Nov. 10, 1982
Total Miles of Line Cut: 170.76

SPECIAL PROVISIONS CREDITS REQUESTED
Geophysical
Electromagnetic
Magnetometer
Radiometric
Other

Geological
Geochemical

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

DATE: 10-10-82 SIGNATURE: R. J. Shegelski

Res. Geol. Qualifications: 2. 508

Previous Surveys
File No. Type Date Claim Holder

MINING CLAIMS TRAVERSED
List numerically

TOTAL CLAIMS
GEOPHYSICAL TECHNICAL DATA

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

<table>
<thead>
<tr>
<th>Number of Stations</th>
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<tr>
<td>Station interval</td>
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<td>Instrument</td>
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MAGNETIC

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<tr>
<th>Accuracy – Scale constant</th>
<th>Diurnal correction method</th>
<th>Base Station check-in interval (hours)</th>
<th>Base Station location and value</th>
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ELECTROMAGNETIC

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<tr>
<th>Instrument</th>
<th>Coil configuration</th>
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GRAVITY

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<th>Base station value and location</th>
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INDUCED POLARIZATION

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<th>Parameters – On time</th>
<th>Frequency</th>
<th>Parameters – Off time</th>
<th>Range</th>
<th>Parameters – Delay time</th>
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RESISTIVITY

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### SELF POTENTIAL
- **Instrument**: ______________
- **Survey Method**: ______________
- **Range**: ______________
- **Corrections made**: ______________

### RADIOMETRIC
- **Instrument**: ______________
- **Values measured**: ______________
- **Energy windows (levels)**: ______________
- **Height of instrument**: ______________
- **Background Count**: ______________
- **Size of detector**: ______________
- **Overburden**: ______________
  - (type, depth – include outcrop map)

### OTHERS (SEISMIC, DRILL WELL LOGGING ETC.)
- **Type of survey**: ______________
- **Instrument**: ______________
- **Accuracy**: ______________
- **Parameters measured**: ______________
- **Additional information (for understanding results)**: ______________

### AIRBORNE SURVEYS
- **Type of survey(s)**: ______________
- **Instrument(s)**: ______________
  - (specify for each type of survey)
- **Accuracy**: ______________
  - (specify for each type of survey)
- **Aircraft used**: ______________
- **Sensor altitude**: ______________
- **Navigation and flight path recovery method**: ______________
- **Aircraft altitude**: ______________
- **Line Spacing**: ______________
- **Miles flown over total area**: ______________
- **Over claims only**: ______________
GEOCHEMICAL SURVEY – PROCEDURE RECORD

Numbers of claims from which samples taken.

Total Number of Samples

Type of Sample
(Nature of Material)

Average Sample Weight

Method of Collection

Soil Horizon Sampled

Horizon Development

Sample Depth

Terrain

Drainage Development

Estimated Range of Overburden Thickness

ANALYTICAL METHODS

Values expressed in:  per cent □
p. p. m. □
p. p. b. □

Cu, Pb, Zn, Ni, Co, Ag, Mo, As,-(circle)

Others

Field Analysis (________ tests)
Extraction Method
Analytical Method
Reagents Used

Field Laboratory Analysis
No. (________ tests)
Extraction Method
Analytical Method
Reagents Used

Commercial Laboratory (________ tests)
Name of Laboratory
Extraction Method
Analytical Method
Reagents Used

General

SAMPLE PREPARATION
(Includes drying, screening, crushing, ashing)

Mesh size of fraction used for analysis

General

...
To: Geophysics

Comments

☐ Approved  ☐ Wish to see again with corrections  Date  Signature

☐ To: Geology - Expenditures

Comments

☐ Approved  ☐ Wish to see again with corrections  Date  Signature

To: Geochemistry

Comments

☐ Approved  ☐ Wish to see again with corrections  Date  Signature

To: Mining Lands Section, Room 6462, Whitney Block. (Tel: 5-1380)
Dear Sirs:

We have received reports and maps for a Geological Survey submitted under Special Provisions (credit for Performance and Coverage) on Mining Claims P 393793 et al in the area West of Sunday Lake - Hopper Lake.

This material will be examined and assessed and a statement of assessment work credits will be issued.

Yours very truly,

E.F. Anderson
Director
Land Management Branch

Whitney Block, Room 6450
Queen's Park
Toronto, Ontario
M7A 1W3
Phone: 416/965-1380

cc: Hewmont Exploration Limited
    Timmins, Ontario
    Attn: R.J. Shagalski.
November 15, 1982

Mr. Fred Matthews  
Ministry of Natural Resources  
Lands Administration Branch  
Mining Lands Sections  
Room 1617, Whitney Block  
Queen's Park  
TORONTO, Ontario  
M7A 1W3

Dear Mr. Matthews,

Enclosed are two (2) copies of an assessment of geological investigations on the Whopper property, Burntbush-Detour Lakes Area. The geological data sheets are at the end of the reports as required.

Thank you for your service.

Sincerely yours,

R.J. Shegelski,  
Project Geologist

RJS/sd
Encl.
LEGEND

1. DIABASE DIKE
   intrusive contact

2. GRANITE, GRANODIORITE
   intrusive contact

3. HORNBLENDE D I T E
   intrusive contact

4. QUARTZ-FELDSPAR-BIOTITE
   SCHIST (METASEDIMENT)

5. INTERLAYERED METASEDMENTS
   AND AMPHIBOLITES

6. PREDOMINANTLY AMPHIBOLITES,
   MINOR INTERLAYERED
   METASEDMENTS

7. AMPHIBOLITES (METABASALTS),
   LOCAL SULFIDIC CONTACTS

8. POSSIBLY SERPENTINIZED ULTRAMA
   FIC, OXIDE IRON FORMATION

9. QUARTZ-FELDSPATHIC
   GNEISSIC TERRANE
**LEGEND**

- Diabase Dike
- Intrusive contact
- Granite, Granodiorite
- Intrusive contact
- Hornblende
- Intrusive contact
- Quartz-Feldspar-Biotite Schist (Metasediment)
- Interlayered Metasediments and Amphibolites
- Predominantly Amphibolites, Minor Interlayered Metasediments
- Amphibolites (Metabasalts), Local Sulphidic Contacts
- Possibly Serpentized Ultra Mafic Oxide Iron Formation
- Quartz-Feldspathic Gneissic Terrane

**SYMBOLS**

- Drill Holes
- Amphibolite
- Quartz-Biotite Schist (Metasediment)
- Volcanoclastic Sulphide-Rich Zone Brecia
- Hornblende
- Graphitic Mudrock Contacts (Internal, Lithologic)
- Dip-Slip (Top Upright, Unknown, Overturned)
- Outcrops
  - Basalt
  - Metasediment
  - Gr-Granite
  - Gr-Hornblende
- Lithologic Boundary
- Fault (assumed)
- Geophysical EM Conductors (Weak, Strong, Width)
- Axis of Magnetic Anomaly (Weak, >18(000), Strong <9(000))
- Topographic String Bog
  - Open Marsh (Muskeg)
  - Scattered Spruce Trees
  - Thick Spruce Forest Boundaries

**SCALE**

- 0 metres
- 1000 metres

**LOCALITY**

- 32E13NWC018 HOPPER LAKE
LEGEND

FELSIC TUFF

GRAPHITIC PYRITIC MUDROCK

SILTSTONE

ARENITE

GREYWACKE

INTERMEDIATE TO MAFIC TUFF

PILLOW BRECCIA, VOLCANIC BRECCIA

FLOW TOP BRECCIA

MASSIVE BASALT FLOW

PILLOW BASALT

CHILLED FLOW BASE

HEAVY SULFIDES, INHALATIVE SULFIDE IRON FORMATION

HORNBLENDITE

FINE, COARSE

YOUNGING DIRECTION (TOPS UP)

SCALE

0 75

METRES

SECTION 1

HOLE W82-1

LOOKING EAST

METRES
HOLE W82-3
LOOKING NORTHEAST

LEGEND

FELSIC TUFF

GRAPHITIC PYRITIC MUDROCK

SILTSTONE

ARENITE

GREYWACKE

INTERMEDIATE TO MAFIC TUFF

PILLOW BRECCIA,

VOLCANIC BRECCIA

FLOW TOP BRECCIA

MASSIVE BASALT FLOW

PILLOW BASALT

CHILLED FLOW BASE

HEAVY SULFIDES, INHALATIVE

SULFIDE IRON FORMATION

HORNBLENDITE

FINE, COARSE

YOUNGING DIRECTION
(TOPS UP)

SCALE 75 METRES
SECTION 4

HOLE W 82-4

LOOKING NORTHEAST

LEGEND

FELSIC TUFF

GRAPHITIC PYRITIC MUDROCK

SILTSTONE

ARENITE

GREYWACKE

INTERMEDIATE TO MAFIC TUFF

PILLOW BRECCIA,

VOLCANIC BRECCIA

FLOW TOP BRECCIA

MASSIVE BASALT FLOW

PILLOW BASALT

CHILLED FLOW BASE

HEAVY SULFIDES, INHALATIVE SULFIDE IRON FORMATION

HORNBLENDITE

FINE, COARSE

YOUNGING DIRECTION (TOPS UP)

0 SCALE 75 METRES
HOLE W 82-5

LOOKING EAST

LEGEND

FELSIC TUFF  x-x-x-x-x-x-x

GRAPHITIC PYRITIC MUDROCK

SILTSTONE

ARENITE

GREYWACKE

INTERMEDIATE TO MAFIC TUFF

PILLOW BRECCIA, VOLCANIC BRECCIA

FLOW TOP BRECCIA

MASSIVE BASALT FLOW

PILLOW BASALT

CHILLED FLOW BASE

HEAVY SULFIDES, INHALATIVE SULFIDE IRON FORMATION

HORNBLENDE

FINE, COARSE

YOUNGING DIRECTION (TOPS UP)

0 SCALE 75

METERS
SECTION G

HOLE W 82-6
LOOKING NORTHEAST

LEGEND

FELSIC TUFF  x-x-x-x-x-x-x-x
GRAPHITIC PYRITIC MUDROCK ————
SILTSTONE ————
ARENITE ————
GREYWACKE ————
INTERMEDIATE TO MAFIC TUFF ————
PILLOW BRECCIA, VOLCANIC BRECCIA △△△△△△△△△△△△
FLOW TOP BRECCIA △△△△△△△△△△△△
MASSIVE BASALT FLOW VVVVVVVV
PILLOW BASALT 888888888
CHILLED FLOW BASE ————
HEAVY SULFIDES, INHALATIVE SULFIDE IRON FORMATION ———
HORNBLENDITE + + + + + + + + + +
FINE, COARSE
YOUNGING DIRECTION (TOPS UP)

S C A L E  75 METRES
**Section 7**

**HOLE W 82 - 7**

**LOOKING NORTH EAST**

**LEGEND**

- FELSIC TUFF
- GRAPHITIC PYRITIC MUDROCK
- SILTSTONE
- ARENITE
- GREYWACKE
- INTERMEDIATE TO MAFIC TUFF
- PILLOW BRECCIA, VOLCANIC BRECCIA
- FLOW TOP BRECCIA
- MASSIVE BASALT FLOW
- PILLOW BASALT
- CHILLED FLOW BASE
- HEAVY SULFIDES, INHALATIVE SULFIDE IRON FORMATION
- HORNBLENDITE
- FINE, COARSE
- YOUNGING DIRECTION (TOPS UP)

**SCALE 75 METRES**

**CONDUCTOR AXIS**

**LEGEND:**

- POLYCHROME TUFF
- GRAPHITIC PYRITIC MUDROCK
- SILTSTONE
- ARENITE
- GREYWACKE
- INTERMEDIATE TO MAFIC TUFF
- PILLOW BRECCIA, VOLCANIC BRECCIA
- FLOW TOP BRECCIA
- MASSIVE BASALT FLOW
- PILLOW BASALT
- CHILLED FLOW BASE
- HEAVY SULFIDES, INHALATIVE SULFIDE IRON FORMATION
- HORNBLENDITE
- FINE, COARSE
- YOUNGING DIRECTION (TOPS UP)
SECTION 9

HOLE W 82 - 9
LOOKING NORTHEAST

LEGEND

FELSIC TUFF

INTRUSIVE GRAPHITIC PYRITIC MUDROCK

SILTSTONE

ARENITE

GREYWACKE

INTERMEDIATE TO MAFIC TUFF

PILLOW BRECCIA, VOLCANIC BRECCIA

FLOW TOP BRECCIA

MASSIVE BASALT FLOW

PILLOW BASALT

CHILLED FLOW BASE

HEAVY SULFIDES, INHALATIVE SULFIDE IRON FORMATION

HORNBLENDITE

FINE, COARSE

YOUNGING DIRECTION (TOPS UP)

0 SCALE 75 METRES
HOLE W 82 - 12
LOOKING NORTHEAST

LEGEND

FELSIC TUFF

GRAPHITIC PYRITIC MUDROCK

SILTSTONE

ARENITE

GREYWACKE

INTERMEDIATE TO

MAFIC TUFF

PILLOW BRECCIA, VOLCANIC BRECCIA

FLOW TOP BRECCIA

MASSIVE BASALT FLOW

PILLOW BASALT

CHILLED FLOW BASE

HEAVY SULFIDES, INHALATIVE

SULFIDE IRON FORMATION

HORNBLENDITE

FINE, COARSE

YOUNGING DIRECTION (TOPS UP)

0 SCALE 75 METRES