Lithogeochemistry and Petrography of Volcanic and Sedimentary Rocks from Carscallen and Whitesides Townships, Timmins Region, Ontario: Phase I

for:
The Carscallen and Whitesides Syndicates

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Introduction

This report presents preliminary lithogeochemical data and interpretations for several sets of surface and drill-core samples of volcanic and volcaniclastic rocks, and iron-formations from Carscallen and Whitesides townships in the Timmins district, Ontario. The lithogeochemical data sets for Carscallen township include:

1) 15 samples from 6 holes drilled by Carscor Porcupine in 1946 near the eastern margin of the township;

2) 8 samples from 2 holes drilled by Alwyn Porcupine in 1946 near the eastern margin of the township (immediately west-northwest of the Carscor holes);

3) 20 samples from 2 holes drilled by Falconbridge in 1990 about one km northeast of Bigmarsh Lake;

4) 109 samples from 10 holes drilled by Cleyo Resources in 1993 near the eastern margin of the township (immediately west of the Carscor holes);

5) 40 samples from hole 93-BMD-001 drilled by BHP Minerals Canada in 1993 in the eastern portion of the township, to the east of Bigmarsh Lake (32 of the analyses are from the company report by Lomas (1993); the other 8 are part of the present study); and

6) 32 outcrop samples from the Barnes claim block situated midway between Carscallen and Bigmarsh lakes in the western portion of the township; this area was mapped by BHP in 1992 (the analyses are from information filed at the Timmins Mining Lands Branch).

In addition, 14 samples from the Cleyo-Carscor-Alwyn drill holes near the eastern margin of the township were studied petrographically and photographed. Finally, complete drill logs were examined for the following drill holes: Carscor Porcupine #1 to #15 (1946), Alwyn Porcupine #1 to #6 (1946), Hollinger Consolidated Gold Mines #1 to #15 (1959-60), INCO Canada #22671 and #22674 (1965), Mespi Mines W-1 to W-7 (1967), Cleyo Resources BM-1 to BM-10 (1983), Carscallen Hawk CH-1 to CH-4 (1986), Noranda Exploration C-90-1 to C-90-3 (1990), Noranda Exploration CLK-90-1 and CLK-90-2 (1990), Falconbridge Limited CS45-01 and CS45-02 (1990), and BHP Minerals 93-BMD-001 (1993). Drill hole locations are shown on the drilling compilation map included with this report. Conwest Exploration drilled a hole in the northeastern part of the township in 1977, but the log is not available at present. In 1985, Asarco drilled 17 overburden holes (BML series) along two groups of conductors in the eastern portion of the township.

The lithogeochemical data for Whitesides township include the following sample sets. In addition, detailed logs for holes 92-2 and FM87-1 were examined.

1) 5 samples from 2 holes drilled by Consolidated Rowan;

2) 3 samples from 3 holes drilled by Broken Reef;

3) 2 samples from hole 92-1 and 18 samples from hole 92-2;

4) 22 samples from hole FM87-1 drilled by the Whitesides Syndicate (1995);

5) 13 outcrop samples from the Dea property (6 analyzed by Granges Inc. in 1991 and 7 by Noranda in 1993).

Lithogeochemistry and Logs - Carscallen Township

Southeastern Carscallen Township Lithogeochemistry

Carscor Porcupine, Alwyn Porcupine and Cleyo Resources

In this section, lithogeochemical data are examined for samples from drilling programs by Carscor Porcupine, Alwyn Porcupine and Cleyo Resources, which focused on an area some 1.5 to 3 km southeast of Bigmarsh Lake, where iron formation and volcanic rocks outcrop. The area is crossed by a belt of WNW-trending airborne EM conductors (referred to here as the eastern-south conductors). Logs were also examined for 14 holes drilled by Consolidated Hollinger, mostly to the south of the Cleyo-Carscor-Alwyn drilling, but including two holes (C5 and C6) near the south end of Bigmarsh Lake, and 4 closely spaced holes, CH-1 to CH-4, drilled about 2 kilometres south of Bigmarsh Lake by Carscallen Hawk.

In Figures 1 and 2, whole-rock data for the area of Cleyo-Carscor-Alwyn drilling are shown as binary plots of the immobile elements Al, Ti, Zr and V. The samples include a variety of lithologies, mainly volcaniclastic beds and iron-formation. The ratio of one immobile element to another can be used to identify rock types. For a given rock type of uniform precursor composition, the absolute contents of a immobile element reflect the degree to which mobile components have been added to, or removed from the rock during hydrothermal alteration. In a rather different sense, mobile elements (e.g. iron and silica) can be deposited as chemical precipitates on the seafloor to form various types of iron formation (sulfide, oxide and silicate facies with various degrees of interbanding).

CARSCALLEN TOWNSHIP drillholes volcanics, volcaniclastics and iron-formation

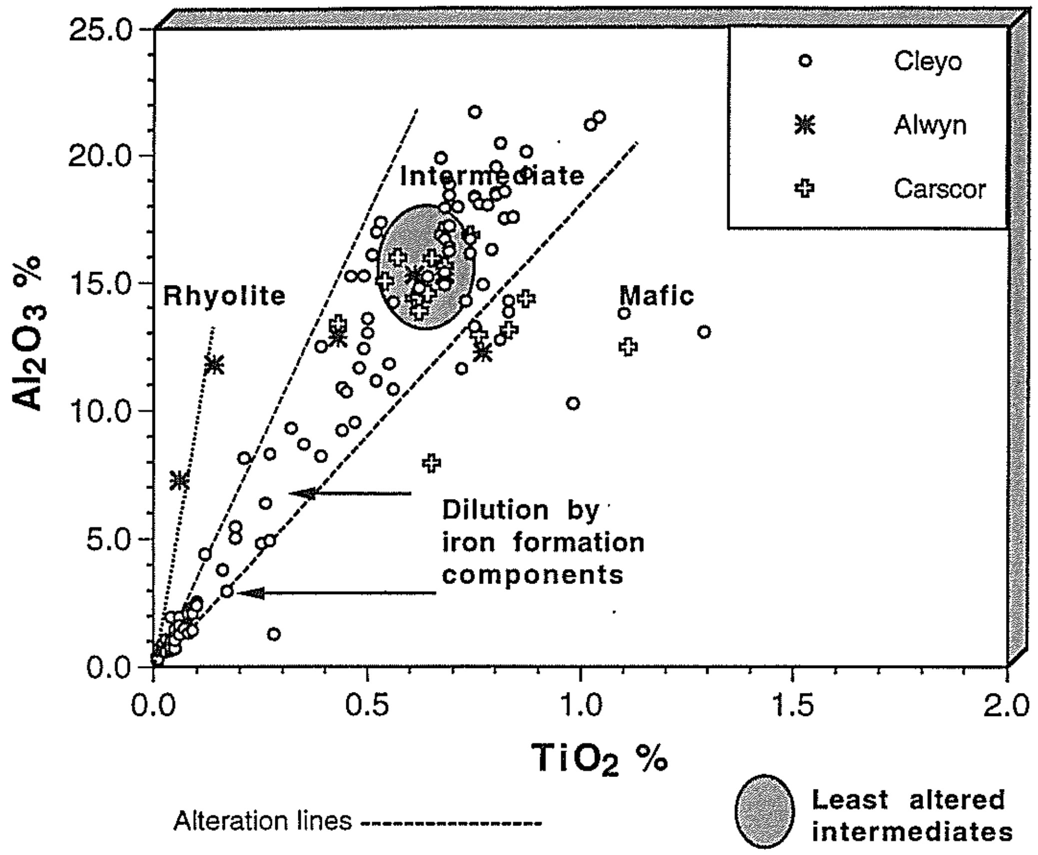


Fig. 1a

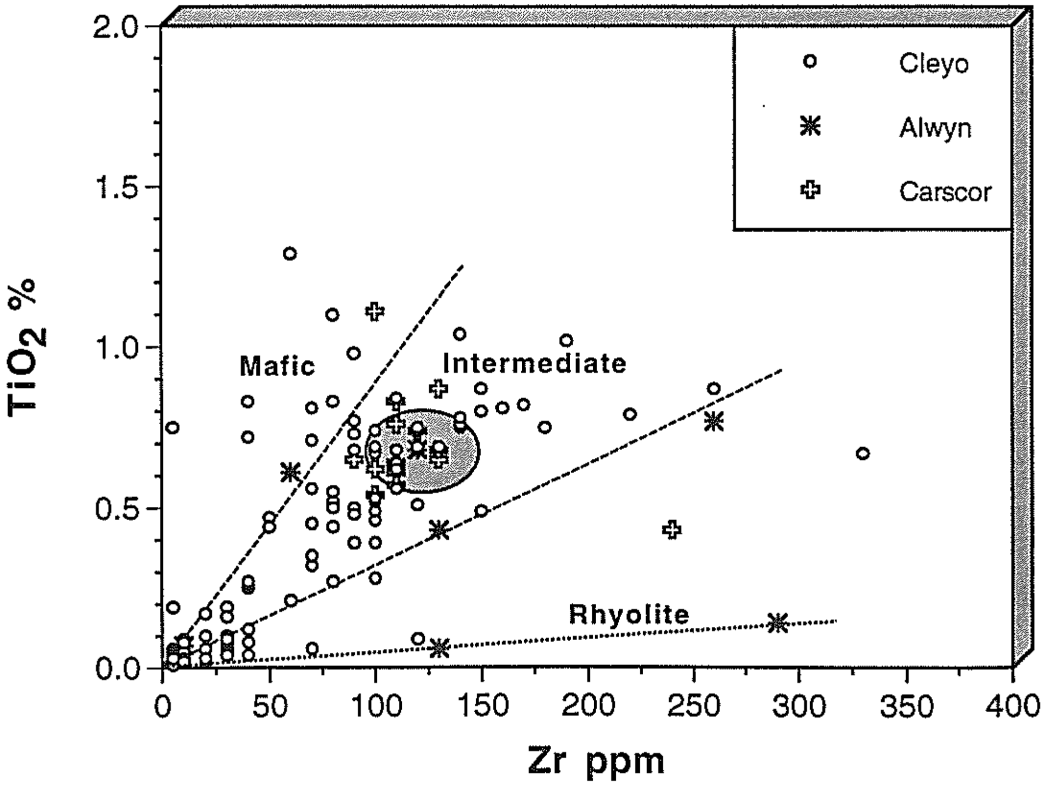
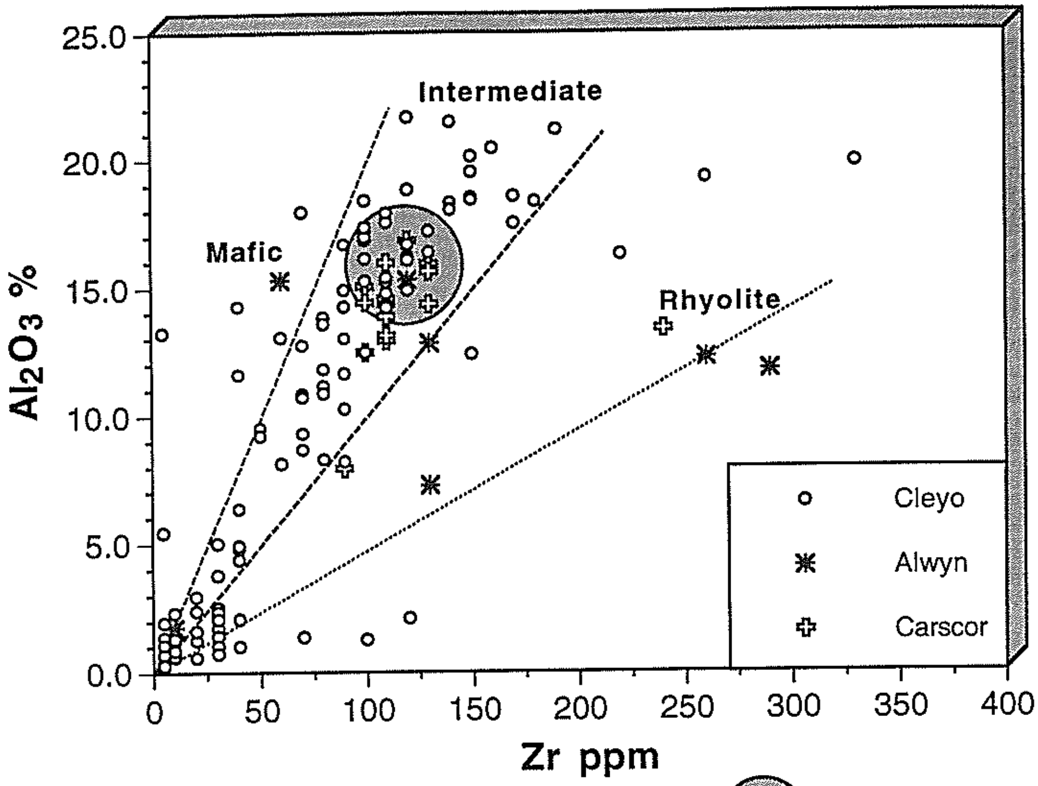


Fig. 1b

CARSCALLEN TOWNSHIP drillholes volcanics, volcaniclastics and iron-formation

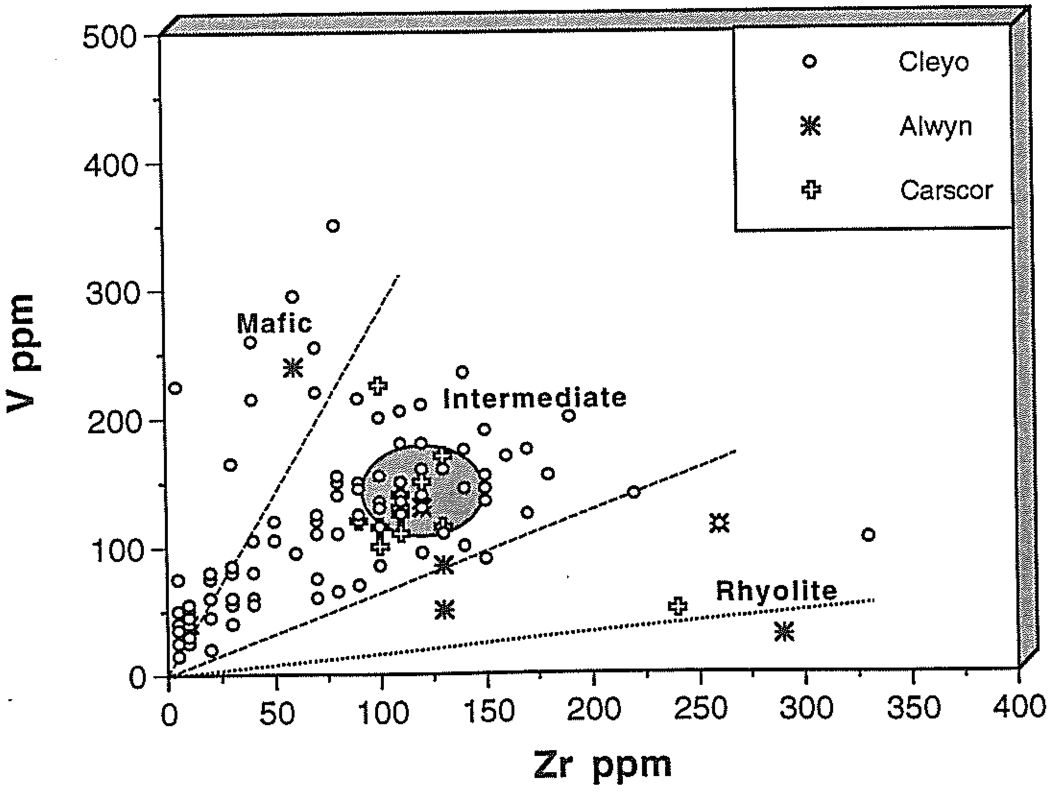
Fig. 2a



Alteration lines ----------------

▨ **Least altered intermediates**

Fig. 2b



As shown in Figures 1 and 2, most of the rocks in the Cleyo-Carscor-Alwyn area are of broadly intermediate composition, i.e. andesitic, although a few mafic and felsic compositions are also present. Based on the drill logs, at least half of the intermediate lithologies are shaly or tuffaceous or reworked volcaniclastic units. The intermediate whole-rock compositions conceivably could reflect mechanical mixing of volcanic material derived from more than one source. This is likely to be the case for the shales, which represent slowly accumulating sediment that should provide an 'average' of the detrital material which enters a marine basin. On the other hand, the shales do have compositions (major and trace element) which consistently are in the range of typical andesitic rocks. Thus, an alternative explanation is that the shales contain a major component of fine-grained andesitic tuff or volcaniclastic sediment. In some of the drill logs, likely volcanic units, including possible flows, were noted -- sampling has indicated that these are mainly of andesitic composition, with a few mafic units. Only a few samples in the Cleyo-Carscor-Alwyn drill holes could be classified as rhyolites, two of which are from Alwyn drilling (hole 5).

Many of the drill holes in the Cleyo-Carscor-Alwyn area intersected at least one interval of iron formation, in addition to the intermediate volcanic rocks and shales. The iron formation consists of pyritic, graphitic shale, with cherty bands and locally magnetite-rich bands, and is often tectonically distorted or brecciated. Where the iron formation has been affected by near-surface waters (e.g. along fault zones), the sulfide and magnetite may be altered to goethite-limonite, and the chert recrystallized. The iron-formation intervals are up to several metres in thickess along the drill core, but true thickesses are difficult to gauge as bedding/core angles can rapidly even within one interval. The iron-formation locally contains mm-scale to cm-scale beds of fine-grained volcaniclastic sediment or tuff.

Iron-formations that originate solely through chemical precipitation from stagnant seafloor bottom water layers, or from low-temperature vent-derived hydrothermal fluids, should contain almost no detrital minerals. Pure chemical sediments therefore should have very low contents of those immobile elements which occur in detrital phases, such as Al, Ti, Zr and V. Most iron formations, however, contain variable proportions of thin clastic beds. Because these are difficult to separate from the chemical bands, analysed samples commonly contain variable proportions of clastic and chemical components. If the clastic material were initially of one composition, say an andesite tuff, the result in an immobile element plot will be a series of points along a mixing line extending from the andesite precursor towards the origin (similar to an alteration line formed by mass gain). Using such relations, the proportion of detrital material in an iron-formation sample accordingly can be estimated. This is an important step to make, because it allows one to subtract the detrital component from a whole-rock chemical analysis, in order to leave the chemical component of the sample. It is this chemical component that is of interest to models dealing with lateral variations in hydrothermal activity within a depositional basin, and their use in exploration. A recent example of the above-described procedure as applied to Archean clastic metasediments and iron formation in the Casa Berardi mining camp is given by La Flèche and Camiré (1996).

In Figures 1 and 2, the trend of many samples towards the origin indicates that the iron formation in the Cleyo-Carscor-Alwyn area contains varying proportions of fine-grained intermediate (probably andesitic) material which has been diluted by chemical components. These components include silica, iron, sulfur and locally some carbonate. Some of the iron-formation intervals in the area are nearly pure chemical precipitates, as indicated by their very low contents of detrital indicator elements such as Al_2O_3 (<2.5%), TiO_2 (<0.1%) and Zr (<40 ppm). Other occurrences of iron formation contain up to 50% volcaniclastic or shaly material (andesite in volcanic arcs normally would contain about 14-17 % Al_2O_3 and 0.6-0.9 % TiO_2).

Historically, most iron formations in the area of Cleyo-Carscor-Alwyn drilling were not assayed for base metals. Pyrite-quartz-rich (vein-like) zones were assayed for gold, but values were typically in the 'anomalous' 0.01-0.02 opt range (about 35-70 ppb) or less. However, important exceptions occur. For example, Nelson Hogg reported in a 1946 drill log for Carsor Porcupine that "the graphitic sections carry coarse grained to massive pyrite, in rough bands parallel to the shearing and bedding. Some of these zones of massive pyrite carried values in gold, up to 0.75 oz. over 2 ft. There is no visible distinction between the sections that carry values and the many feet of similar mineralization that (are) barren."

New analyses in this report indicate that the sulfide-bearing portions of the iron-formation intervals commonly contain anomalous Zn and Cu values which are well above andesitic or shale backgrounds, i.e. Zn contents of 500-1000 ppm and Cu contents of 200-300 ppm. Downhole plots of Cu and Zn for two Cleyo holes which were sampled in some detail are shown in Figure 3. Enrichments of Cu in several Canadian occurrences of iron-formation is discussed by Kirkham (1979), who notes that the Cu-bearing iron formations typically occur within mafic volcanic piles, and locally can contain a few hundred thousand tonnes at 1-2 % Cu.

Petrographic descriptions of 14 thin-sections from various lithologies in the Cleyo-Carscor-Alwyn area of drilling are given in a later section, together with some thin-section photographs.

Other Southeastern Carscallen Township Drilling

Noranda Exploration

In 1990, Noranda Exploration drilled holes C90-1 to C90-3 near the southeast end of the group of holes drilled by Alwyn Porcupine and Cleyo Resources. Hole C90-1 is at the eastern margin of the area drilled by Cleyo Resources, with C90-2 located about 300 m to the southwest of C90-1, and C90-3 about 500 m to the northwest. Hole 90-1 contains mainly felsic to intermediate lapilli tuffs (28-154 m, and 236-257 m), with a thick interval from 154-236 m of felsic to intermediate tuffs containing interbedded black, carbonaceous, argillaceous, banded sediments with common nodular pyrite and traces of sphalerite or hematite. The felsic tuff interval from 28 to 108 m contains abundant disseminated and locally massive (34-35 m) pyrite. Average pyrite contents in this interval, according to estimates in the log, are 10-15% from 34.0-51.5 m, 5-10 % from 51.5-90.8 m, and 3-5% from 90.8-108.0 m. Within the interbedded interval of black carbonaceous sediments and tuffs (154-236 m), up to 20% pyrite occurs in the carbonaceous sections. Hole C90-1 ends with massive felsic to intermediate volcanics from 257 to 272 m. Assays for this hole by Noranda Exploration indicate that Zn and Cu contents were <100 ppm, with Au values generally <50 ppb.

Hole C90-2 is mainly felsic to intermediate volcanics, grey to dark grey, with interbedded black carbonaceous sediments (locally tuffaceous). Quartz-carbonate±pyrite veins occur sporadically throughout the section. About 10 of these vein-bearing sections were assayed over lengths of 0.5-1.2 m, but none returned Au values of more than 17 ppb. Massive felsic to intermediate volcanics similar to those at the end of hole C90-1 are present at 25-28 m and 190-197 m. A thick interval of mainly fine-grained sediments (argillaceous to carbonaceous) with tuffaceous beds occurs from 197 to 252 m (EOH), with 2-4% nodular pyrite in the 213-252 m section. Foliation (bedding) is 30-40° to the core axis in much of the hole, but decreases to 25-30° in this last section.

Hole C90-3 contains intervals of felsic massive and foliated felsic tuffaceous rocks (e.g. 84-95 m, 122-167 m, and 174 to EOH at 200 m), and intervals of black argillaceous to pyrite-nodule-bearing carbonaceous sediments with fine-grained tuffaceous interbeds (e.g. 57-84 m, 95-122 m). Pyrite-rich sections occur at 56.6-58.1 m (25%) and 167.4 to 174.0 m (5-7%). Metal values are slightly anomalous in two assay intervals from 56.6 to 59.6 m (Au = 141 and 69 ppb; Cu = 149 and 365 ppm; Zn = 113 and 312 ppm), and in three assay intervals from 119.5 to 122.3 m (Au = 34, 55 and 31 ppb; Cu = 123, 187 and 128 ppm; Zn = 207, 310 and 106 ppm).

Consolidated Hollinger

Consolidated Hollinger holes C1 to C14 were drilled in 1959-60 over an area extending about 3 km in a northwest direction from Highway 101 West to the southern end of Bigmarsh Lake, to test the east-central and east-southern conductors. According to the drill logs, these holes mainly intersected felsic tuffs and felsic fragmentals, sericitic to graphitic schists and tuffs, rhyolites and dacites, and grey fine-grained amygdaloidal lavas. However, no lithogeochemical data or assay data were filed with the original core logs, and no core material appears to have been retained. Graphitic tuffs and schists with pyritic and siliceous bands form intervals 5' to 30' thick within the felsic tuffs and various lavas. Disseminated pyrite is common in and near such intervals, which locally contain pyrite nodules up to 1" across. Variably impure 'iron formation' intervals with abundant graphitic tuff and pyrite occur in C-1, C-2, C-3, and C-4, which were drilled in a small area several hundred metres south of the Alwyn Porcupine holes. A substantial proportion of C-4 was logged as rhyolite, rhyolite fragmental and sericite schsits (with quartz eyes), although thicknesses in this hole could be exaggerated if the hole, which is oriented WNW, were partly drilled subparallel to lithological strike. C-4 also contains thin bands of magnetite in addition to pyrite (344-357'). It ends in an 'andesite' from 455' to 507'.

Holes C-5 and C-6 were drilled at the south end of Carscallen Lake. Sericite-carbonate schists and graphitic tuff with disseminated pyrite were encountered in C-5, together with a few massive possibly mafic intervals. Hole C-6 contains chlorite-sericite schistose tuffs, sericite schists (altered felsic lava), and graphitic siliceous pyrite-rich tuff (similar to holes CH-1 to CH-3). In C-6, pyrite layers up to 0.4' thick are common in the 169-193' interval (one band is 1.4' thick). The remainder of C-6, from 199' to 440' (EOH) consists of sericitized felsic lavas, with numerous quartz-carbonate veins near the bottom of the hole ('some pyrite and minor chalcopyrite with these veins').

Holes C-7-B, C-8 and C-9 are located several hundred metres southeast of the C-1 to C-4 group of holes, and intersected mainly felsic (sericite-carbonate) schists and altered (sericite-carbonate) dacite-rhyolite lavas, with lesser dark graphitic tuffs containing disseminated and nodular pyrite and sericitic bands. In holes C-7-B, C-8 and C-9, the proportion of felsic schists and lavas relative to intervals of pyrite-bearing graphitic tuff is higher than in than holes C-1 to C-3. A single assay of 0.1% Cu is reported for the 135-140' interval in EXC9 (presumably C-9); in the log this interval is described as sericitized carbonatized rhyolite with some dissemninated rhyolite.

Holes C-10, C-12, C-13 and C-14 were drilled several hundred metres south of the C-1 to C-8 group of holes, apparently to test a separate series of conductors which may also strike to the northwest. Thinly bedded sericite schists are the main lithology in C-10, with quartz eyes in places and lapilli-sized fragments in others; massive rhyolite occurs at the end of the hole (392-406'). Hole C-11 is also mainly felsic tuffs, with darker carbonaceous tuffs from 128-166', and pyritic streaks in felsic tuff from 166-185'. Hole C-13 is mainly dacitic tuffs, sericite- and carbonate-altered, but contains a graphitic, pyritic interval from 235' to 255'. Parts of this interval contain 15% nodular pyrite over core lengths of 5'. The section from 252 to 255' consists of "massive fine-grained pyrite composed of nodules up to 1" in diameter, tighttly packed together and separated by quartz veinlets". Massive dacite occurs from 318 to 383' in hole C-13, and sericitic tuffs to the EOH at 400'. Hole C-14 intersected massive felsic lavas to felsic schists, with intervals of black graphitic tuff some of which contained pyrite nodules or disseminations (e.g. 49-56' and 310-315'). The felsic schists also contained disseminated pyrite.

Hole C-12 was located in a different area further north, several hundred metres southeast of (and on strike with) the drilling carried out by Cleyo Resources and Alwyn Porcupine. Hole C-12 intersected fragmental to tuffaceous rhyolite (61-194'), then an interval of graphitic tuff with pyrite nodules (199-217', including sections of lost core), massive rhyolite (252-389') and finally andesite (389-402').

Hawk Resources

In 1986, Hawk Resources drilled holes CH-1 to CH-4 in a small area located almost two kilometres south of the south end of Bigmarsh Lake (the Hawk Resources holes about two kilometres west of Hollinger holes C13 and C14). No lithogeochemical data are currently available for these holes. Hole CH-1 intersected only diabase to the end of the hole (60-201'). Hole CH-2, located 100' to the east, intersected diabase from 48-128', then andesite to the end of the hole (128-256'). Quartz veins (<1" across) occur sporadically through the andesite, with 1-3% pyrite in the veins, and in minor chloritic zones near the veins.

Holes CH-3 nd CH-4 were drilled from the same collar, at dips of -45° and -65°, respectively. CH-3 intersected intermediate volcanics throughout the hole (from 30 to 156'), with a chloritized pyritic zone (1-5% pyrite) from 106-112', and quartz veins (up to 0.5 inch) in the 106-112' interval. CH-4 intersected massive intermediate to mafic rocks from 20' to the EOH at 237', with zones of quartz-healed breccia which contained pyrite as thin veins or fracture infillings. Chloritic zones with minor pyrite occur locally (e.g. in the 68-76' interval). A set of gold assays was filed with the assessment report, but all samples returned nil values, except for one Au value of 310 ppb (270 duplicate) in hole CH-4, at 93-95'. According to the log, pyrite occurs from 91 to 95' as veins and disseminated veins within a quartz-rich zone.

Eastern Carscallen Township Lithogeochemistry

BHP Minerals Canada

In this section, lithogeochemical data are examined for BHP Minerals drillhole 93-BMD-001. Other holes drilled in this area, for which only the logs are available, include INCO holes 26671 and 26674, and Noranda hole C-70-4. The area is about 1.5 km east of Carscallen Lake, and is underlain by a variety of volcanic rocks and graphitic sediments. It is crossed by a belt of WNW-trending airborne EM conductors (referred to here as the eastern-central conductors). As shown in a later section, the stratigraphy in this part of Carscallen township, which is only about 1.5 km northwest of the Cleyo-Carscor-Alwyn drilling, contains a different volcanic assemblage than the latter area.

Immobile-element plots for whole-rock samples from BHP hole 93-001 are shown in Figures 3, 4 and 5. The data set consists of 32 samples from BHP's company report (Lomas, 1993), and 8 samples from the current study. Hole 93-01 intersected a bimodal suite of mafic and felsic volcanic rocks (Fig. 3), but no iron formation, although a few thin intervals of pyritic shale were encountered (<0.5 metres thick). The mafic rocks are mainly basaltic andesite (excluding andesitic tuff in the first few metres of the hole).

Two felsic groups are apparent in these plots, which are termed rhyolites I and II. The former represents the majority of rhyolites in the hole, whereas the latter, which occurs at the end of the hole (224-236 metres), is a chemically fractionated rhyolite which has a distinctive texture in core. According to Lomas (1993), the felsic volcanic rocks in BHP hole 93-001 include massive flows and volcaniclastic varieties; she noted that the massive flows are dacitic to rhyolitic, with minor quartz eyes and fine feldspar phenocrysts locally,

CARSCALLEN TOWNSHIP

BHP Canada: hole 93-BMD-001

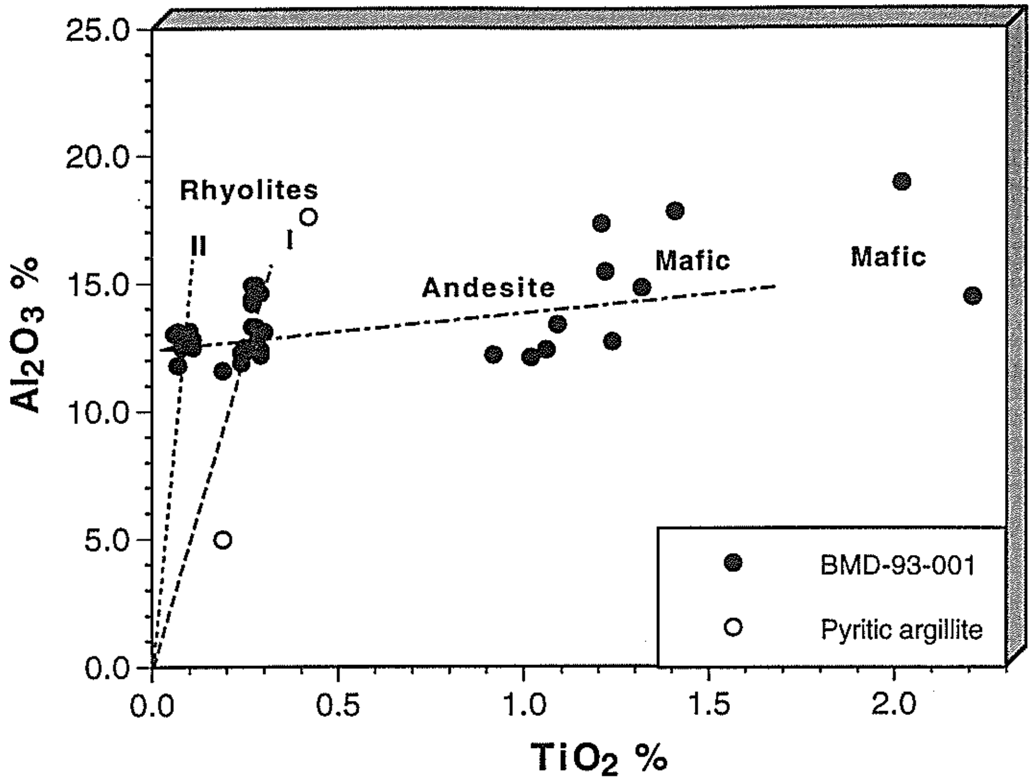


Fig. 3a

Alteration lines ------------------ Schematic fractionation trend ---·---·---►

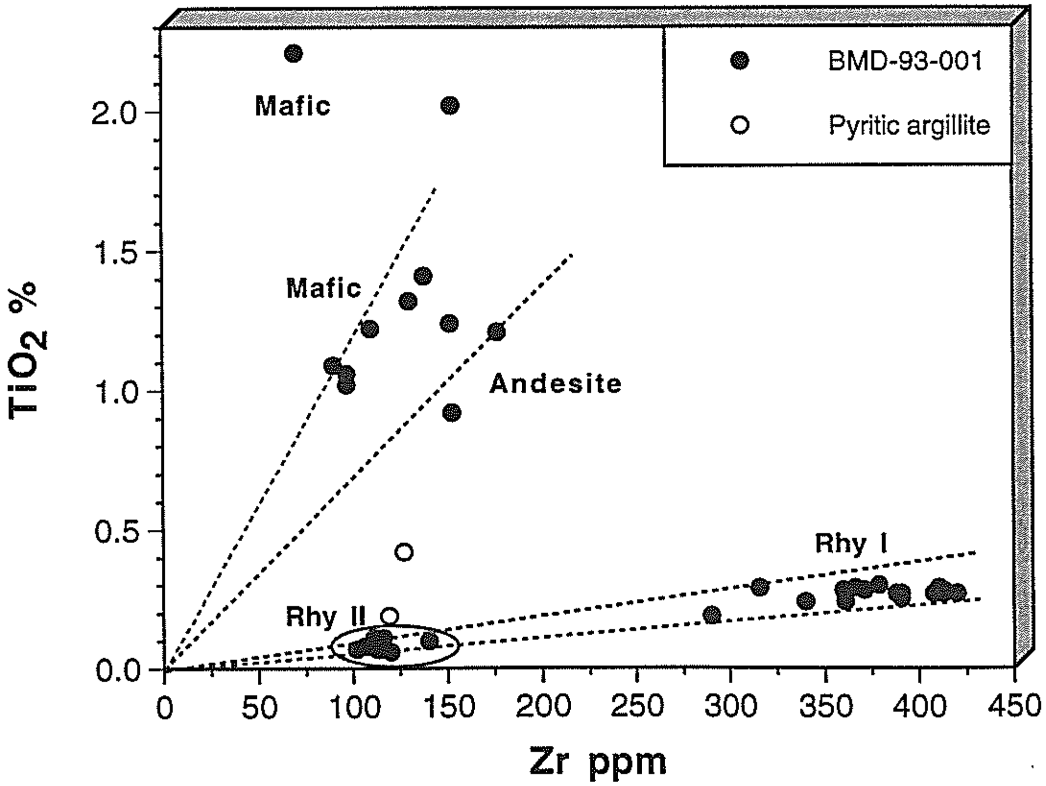
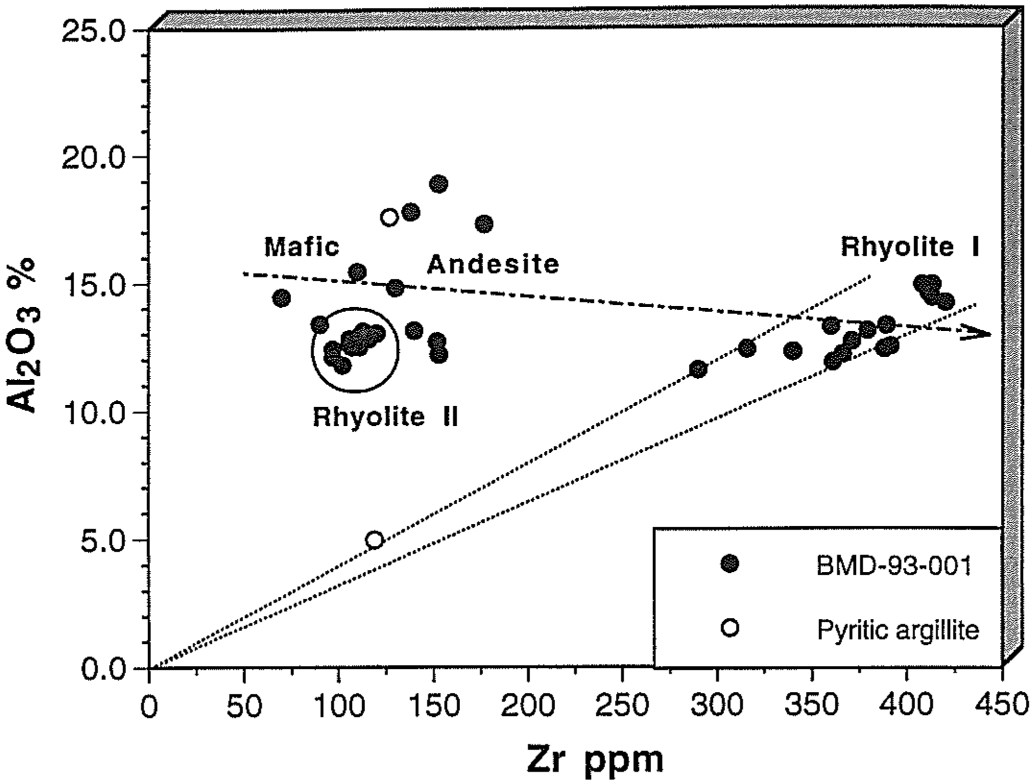


Fig. 3b

CARSCALLEN TOWNSHIP

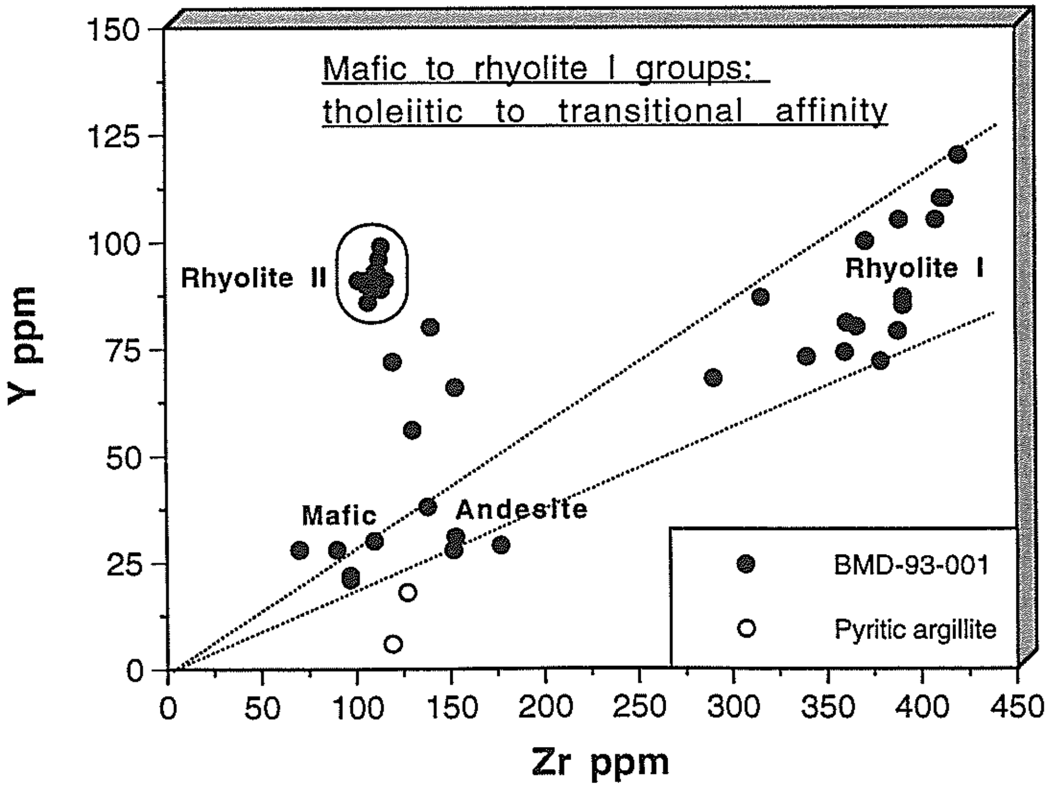
BHP Canada: hole 93-BMD-001

Fig. 4a



Alteration lines ----------------- Schematic fractionation trend -·-·-·-·-·-·-·→

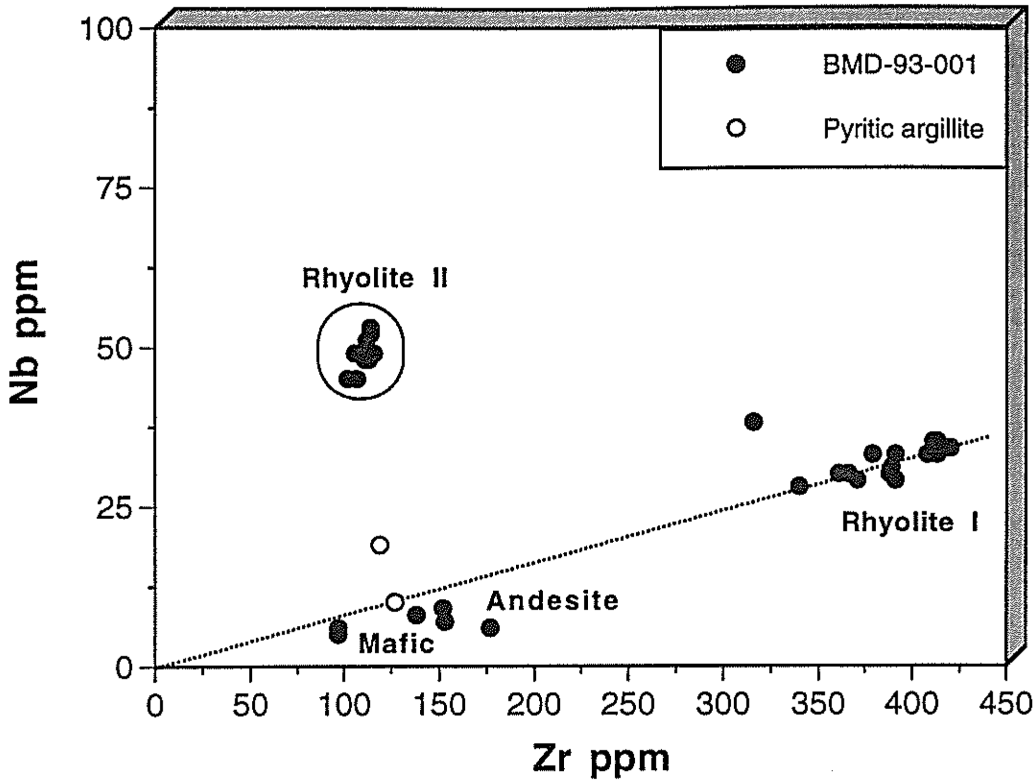
Fig. 4b



CARSCALLEN TOWNSHIP

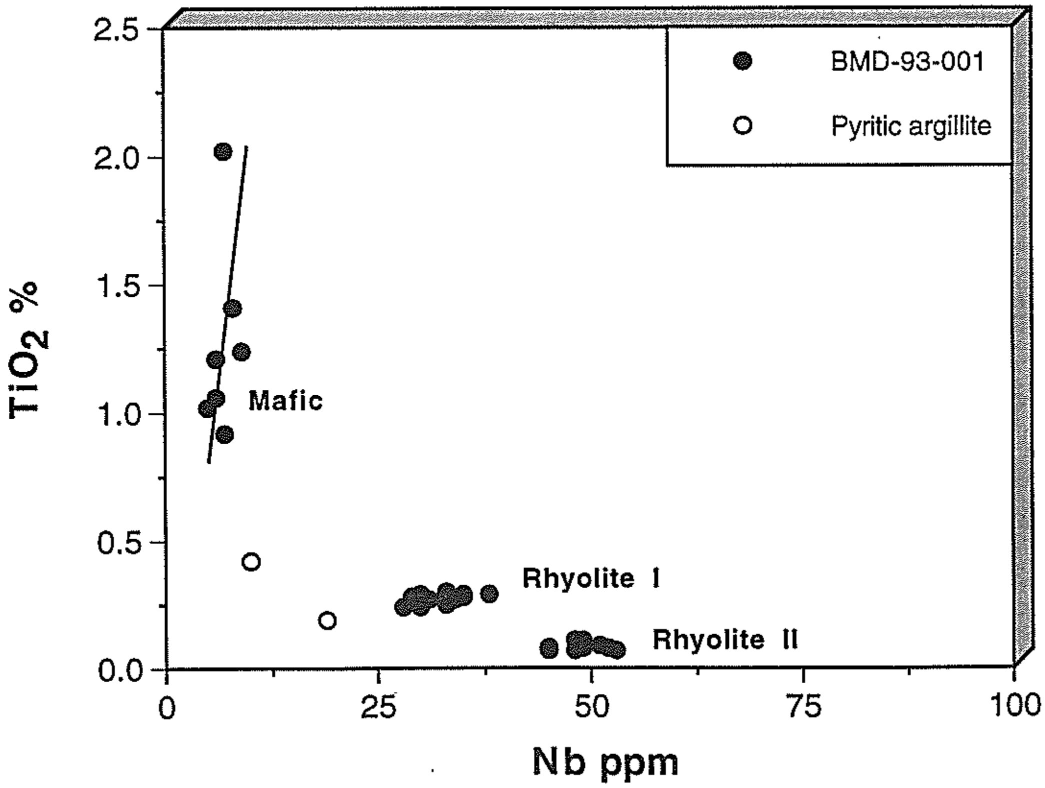
BHP Canada: hole 93-BMD-001

Fig. 5a



Alteration lines ----------------- Schematic fractionation trend --·--·--·--·→

Fig. 5b



whereas the volcaniclastic rocks are rhyolitic to andesitic lapilli tuff and ash tuff. A major rhyolite flow (chemically rhyolite I in the present study) occurs from 151 to 202 metres.

Based on the Jensen cation classification, Lomas (1993) identified the felsic flow rocks as tholeiitic rhyolite to tholeiitic dacite, and the volcaniclastic rocks (which were in general more susceptible to sericite and carbonate alteration) as calc-alkaline rhyolites. It is possible, however, that the volcaniclastic rocks fall in the calc-alkaline field of the Jensen plot is because they are sericitically altered, which produces a higher proportion of Al to Fe (a residual increase in Al commonly accompanies sericitization).

Plots of Y versus Zr (Fig. 4b) and Nb versus Zr (Fig. 5a) suggest that most of the volcanic rocks in hole 93-001 (excluding rhyolite II) are in fact of tholeiitic to transitional affinity, and are probably related by a common process such as fractionation. However, to confirm the affinity of the felsic volcanic rocks, rare-earth element data should be obtained for a representative suite of samples.

Rhyolite II, described by Lomas (1993) as rhyolite lapilli tuff to agglomerate, is a chemically unusual rock. It occurs from 224 to 236 m (end of hole), and is of essentially uniform composition over this interval despite its fragmental appearance. Rhyolite II has very low contents of TiO_2 (0.07-0.11%) and Zr (102-116 ppm) relative to rhyolite I (0.24-0.29% and 360-420 ppm Zr). The values for rhyolite II are typical of highly fractionated granitic magmas in continental margin settings.

The Y and Nb contents of rhyolite II are notably higher than those of rhyolite I (Fig. 5a). Such high Y-Nb contents are also typical of rhyolites formed in a continental crust setting. Rhyolite II also has high K_2O contents (4.4-5.0%) and relatively high Na_2O levels (2.1-3.6%), but appears to be little altered on the basis of its normal silica and Al contents. Assuming that rhyolite II is indeed part of the volcanic sequence (and not a later intrusive rock), its chemistry indicates that it is derived from a different source than rhyolite I and the other volcanic rocks.

In particular, the very high K, Nb and Y contents of rhyolite II suggests that it is an alkalic rhyolite formed in a rifted continental margin setting. By contrast, rhyolite I is a subalkalic rhyolite. The Nb-Zr plot (Fig. 5a) suggests that rhyolite I was formed as a result of fractionation of mafic magma. A plot of Ti versus Nb (Fig. 5b) is an effective way of showing the two rhyolite types, and also the bimodal nature of the volcanic rocks in BHP hole 93-001.

A plot of SiO_2 versus depth (Fig. 6a) for this hole can outline downhole lithological changes, provided that the rocks are little altered. However, it is more reliable to use an immobile element ratio such as Al_2O_3/TiO_2 (Fig. 6b) which is not affected by alteration. The latter plot clearly shows the difference between rhyolite I, which has Al_2O_3/TiO_2 ratios of about 45-60, and rhyolite II, which has ratios exceeding 100. The Zr/TiO_2 ratio (not shown) is not as effective way of separating the rhyolites, as rhyolite II is lower in both Zr and TiO_2, which results in little change in the Zr/TiO_2 ratio.

Assay data appended to the BHP log for hole 93-001 (Lomas, 1993) indicate that anomalous metal values occur in the main pyritic graphitic interval, which is 2.1 metres thick, with 773 ppm Cu and 2372 ppm Zn from 140.5 to 141.5 m, and 409 ppm Cu and 872 ppm Zn from 141.5 to 142.6 m. A 5 cm-thick interval of graphitic tuff at 61.4 m (true width unknown due to grinding) contained 445 ppb Au and 737 ppm Cu.

Other Eastern Carscallen Township Drilling

Inco Exploration

Holes 26671 and 26674 were drilled in 1965 about one kilometre east of Bigmarsh lake. Only summary logs were available for these two holes. The main lithologies in hole 26671 included undifferentiated volcanic breccia, graphitic tuff, and rhyolite. An interval of graphitic tuff with rhyolite (presumably tuff) occurs from 371 to 382', and a major interval of rhyolite from 382' to the EOH at 552. Volcanic breccia and graphitic tuff are also present in hole 26674, with undifferentiated tuffs from 268-460', and rhyolite from 460' to the EOH at 532'. It is possible that the rhyolite intersected in the lower parts of holes 26671 and 26674 is equivalent to the rhyolites encountered in BHP 93-001, a few hundred metres to the east.

Noranda Exploration

Hole C-70-4 was drilled in 1970 by Noranda, a few hundred metres northeast of the Inco holes. Most of the bedrock (214-544') is rhyolite breccia and dacite breccia, excluding a graphitic interval with nodular pyrite inclusions from 253-258', sericite schist from 323-334', porphyritic rhyolite and dacite from 392-425', and a graphitic from from 434-437'. Many of the felsic breccias have a graphitic or siliceous matrix which may contain pyritic nodules, and also disseminated pyrite and traces of chalcopyrite, e.g. 258-293'. Pyrite and sericite are present in variable amounts in the felsic volcanics, where the pyrite occurs as stringers, blebs and disseminations.

CARSCALLEN TOWNSHIP

BHP hole 93-BMD-001: Downhole lithological variations

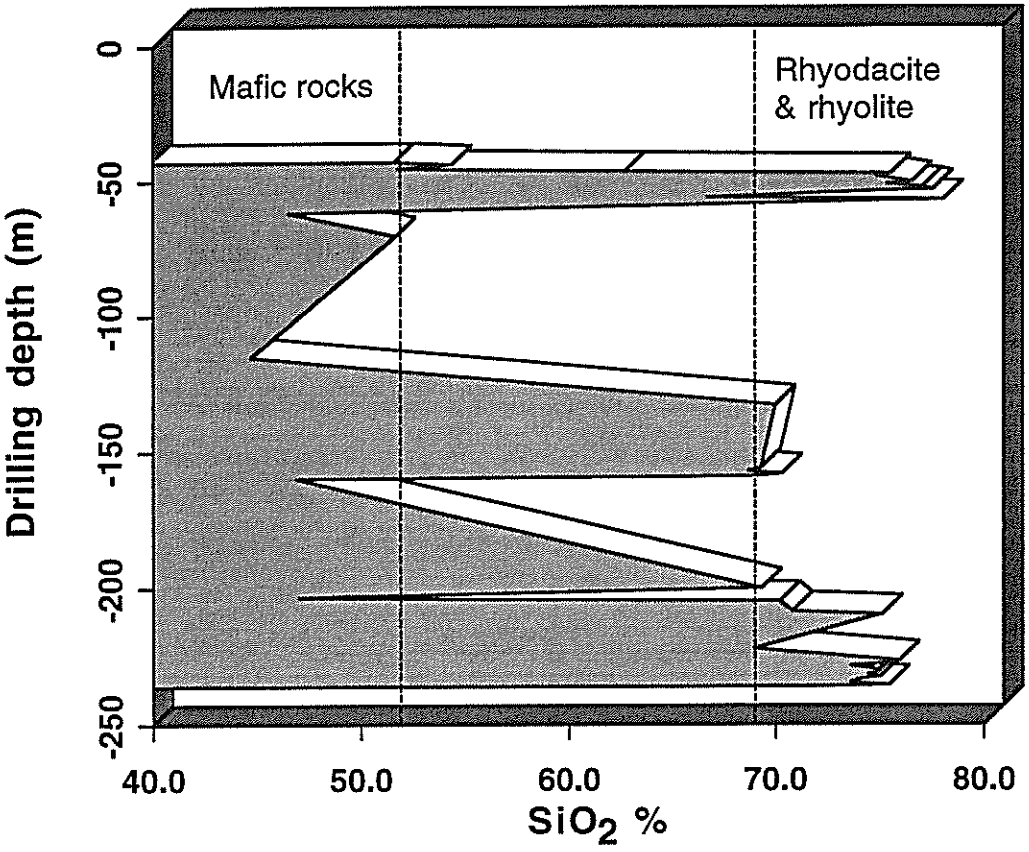


Fig. 6a

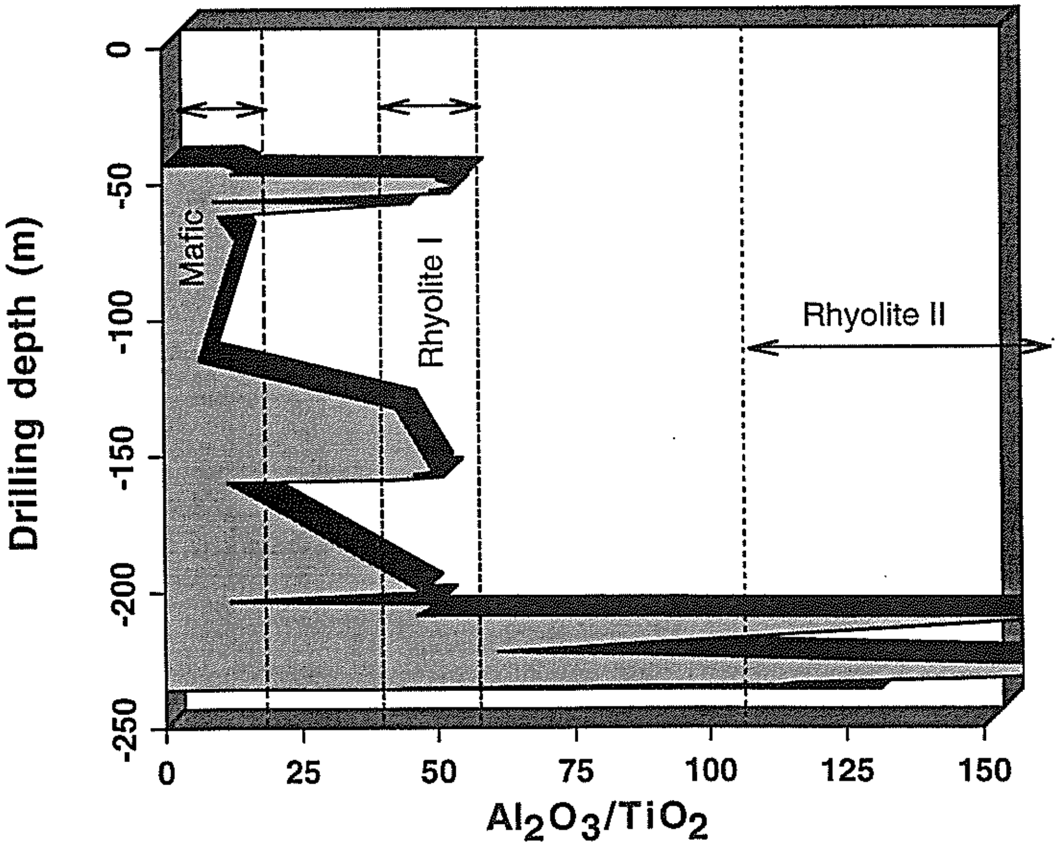


Fig. 6b

Rhyolite breccia from 308-322' is very sericitized, with trace sphalerite in the 313.8-315.2' and 316.5-317.5' intervals, and trace chalcopyrite at 319.8-322.0' (each of these sections contains 2-5% pyrite). Felsic breccia from 488' to 544' (EOH) is very sericitized, with 1-5% pyrite at 529.8-530.5' and 535.2-544.0'. The graphitic matrix to the breccia at 540.0-544.0' carries trace chalcopyrite.

Northeastern Carscallen Township Lithogeochemistry

Falconbridge Exploration

In this section, lithogeochemical data are examined from Falconbridge drill holes CS45-01 and CS45-02, located close to overburden holes BML-5 and BML-6. A log is also available for Noranda hole C-72-11, drilled a few hundred metres north of the Falconbridge holes. This area, which is about two kilometres northeast of Carscallen Lake, is underlain by volcanic rocks, with lesser sedimentary rocks and iron formation. Several airborne EM conductors are present (referred to here as the eastern-north conductors). Holes CS45-01 and CS45-02 were both drilled to the north at -50°, with CS45-02 located 200 m north of CS45-01.

In CS45-01, felsic volcanic (or fine-grained intrusive) intervals occur at 40-87m, 152-163m, 183-192m, 228-236m, and 245-290m (EOH). These alternate with mafic units of vesicular pillow lava up to 40 m thick. The only important sedimentary interval, from 100 to 110m, comprises weathered, brecciated sulfide iron formation with clasts of wacke, chert and pyrite. The section from 101-104m assayed 262 ppm Cu, 171 ppm Zn, 741 ppb Au, 15 ppm Au and 237 ppm Pb (2m of core missing). Two other assays in the 105-110m interval yielded 630 and 742 ppm Zn (1.5 m each).

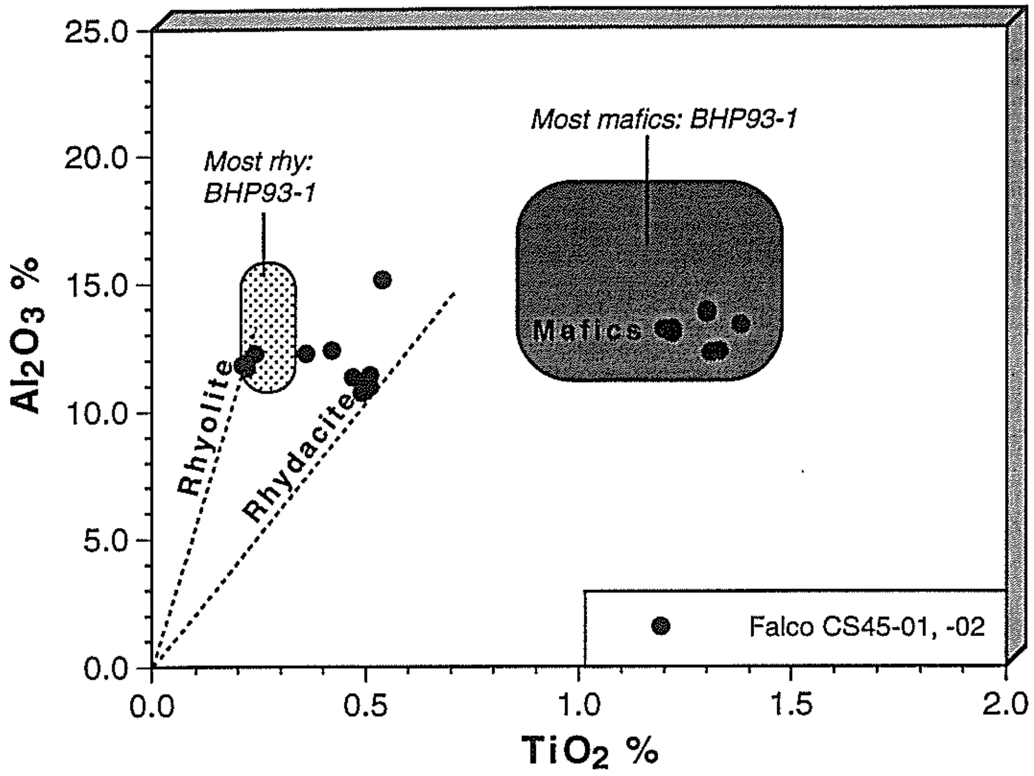
In CS45-02, the volcanic units alternate with sedimentary packages up to 25 metres thick which contain interbedded graphitic argillites, greywackes, thinly laminated pyrite and cherty material. Sedimentary rocks and iron formation are much more abundant than in CS-45-01. A mafic volcanic interval occurs in CS45-02 from 83-109m, with felsic volcanic rocks from 109-131m, and quartz-feldspar porhyritic rhyolite from 160 to 200m (EOH).

The main volcanic rock compositions in holes CS45-01 and CS45-02 are shown in plots of Al_2O_3-TiO_2 and TiO_2-Zr (Figs. 7a and 7b). All but four samples are from CS45-01. Both plots indicate that the volcanic rocks are a bimodal sequence of mafic lavas on the one hand, and rhyodacite and rhyolite compositions on the other. The mafic volcanic rocks

CARSCALLEN TOWNSHIP:

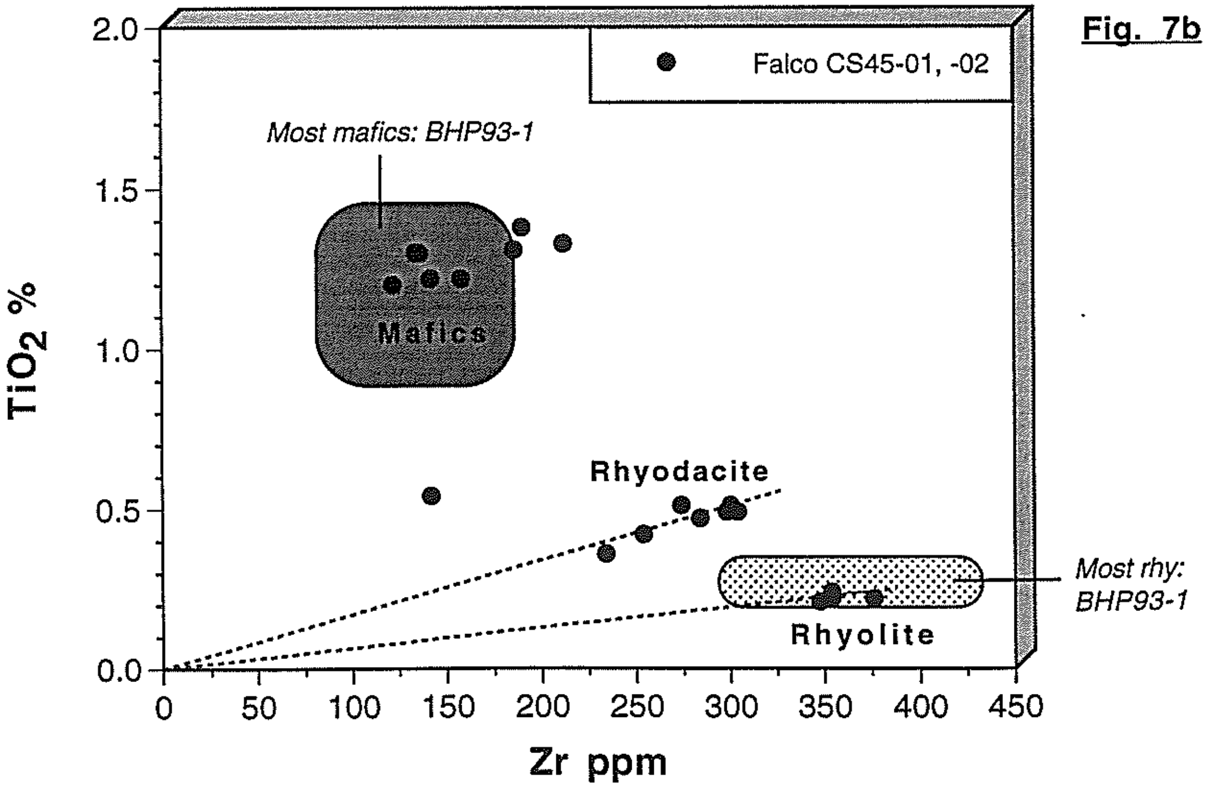
Falconbridge holes CS45-01 and CS45-02

Fig. 7a



Shaded fields are data for BHP 93-1, ≈1.5 km to south

Fig. 7b



are basaltic flows of near-uniform composition. The rhyolite compositions correspond to the quartz-feldspar porhyritic rhyolite which represents the deepest unit intersected in each hole. A dacite occurs at the top of hole CS45-01.

Volcanic rock compositions in holes CS45-01 and CS45-02 show an apparent continuum in plots of Al_2O_3-Zr and Y-Zr (Figs. 8a and 8b). On first inspection, this may suggests that intermediate (andesitic) compositions are present. However, the continuum is due largely to Zr variation in the rhyodacite group, and partly to Zr variation in the basaltic group (150-210 ppm Zr). Major element compositions indicate a clear bimodality. The basalts have fairly consistent Zr/Y ratios of about 6, that is, they are of transitional affinity. The basalts have normal contents of Fe, Ti and P, and thus are not of the 'evolved ferrobasalt' type found elsewhere in the Timmins area. The affinity of the felsic rocks in CS45-01 and CS45-02 is about 4.5-5.0, that is, close to the transitional-tholeiite boundary.

As shown in Figs. 7 and 8, the felsic and mafic volcanic rocks in Falconbridge holes CS45-01 and CS45-02 are generally similar in terms of composition and affinity to those in BHP hole 93-001, about 1.5 km to the south. However, the Falconbridge holes contain a lower-Zr rhyodacite, whereas BHP 93-001 contains an unusual felsic rock (rhyolite II) which is very low in Zr and high in K. The felsic volcanic rocks in the Falconbridge holes are very similar to those on the Barnes property about 5 km to the west, as discussed in the next section.

Assay results for Cu and Au in the sedimentary and iron formation intervals of CS45-02 are shown in Fig. 9 (the symbols give the mid-point of each 1.5m assay length). Two main zones of metal enrichment are present, one in the 75-85m interval, the other in the 135-145m interval. Cu systematically increases downhole within each interval from background levels of <50 ppm to 100-160 ppm, with peaks of 630 and 400 ppm. Within these two intervals, Au contents are commonly anomalous, i.e. in the 30-70 ppb range. Zn and Pb (not shown) are also enriched, with Zn peaks in the upper and lower intervals of 1250 and 1050 ppm, respectively, and Pb peaks of 102 and 78 ppm, respectively.

Noranda Exploration. Hole C-72-11, drilled by Noranda in 1972, is located a few hundred metres north of Falconbridge hole CS45-02. The entire bedrock intersection from 106' to 456' was logged as rhyolite tuff (grey to buff and sericitic). Some sections displayed 'argillic alteration', and others contained stringers of smokey quartz with some pyrite; numerous shear zones with up to 1% disseminated pyrite (and limonite oxidation) were also present. No lithogeochemical data are currently available for this hole.

CARSCALLEN TOWNSHIP:

Falconbridge holes CS45-01 and CS45-02

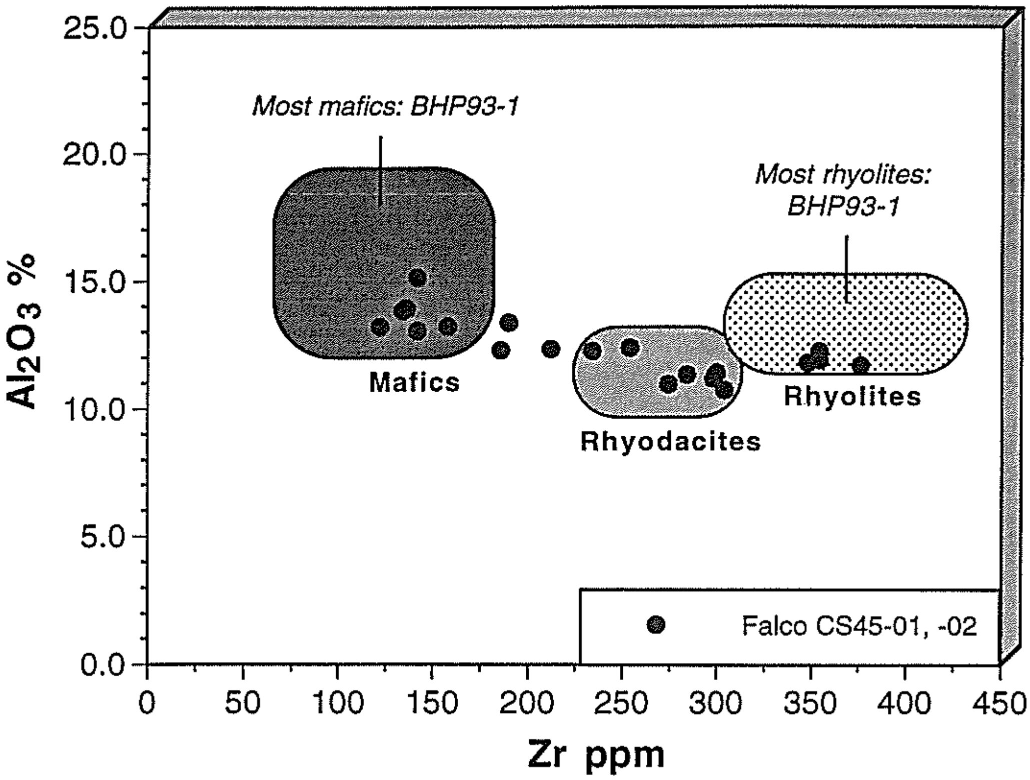


Fig. 8a

Shaded fields are data for BHP 93-1, ≈1.5 km to south

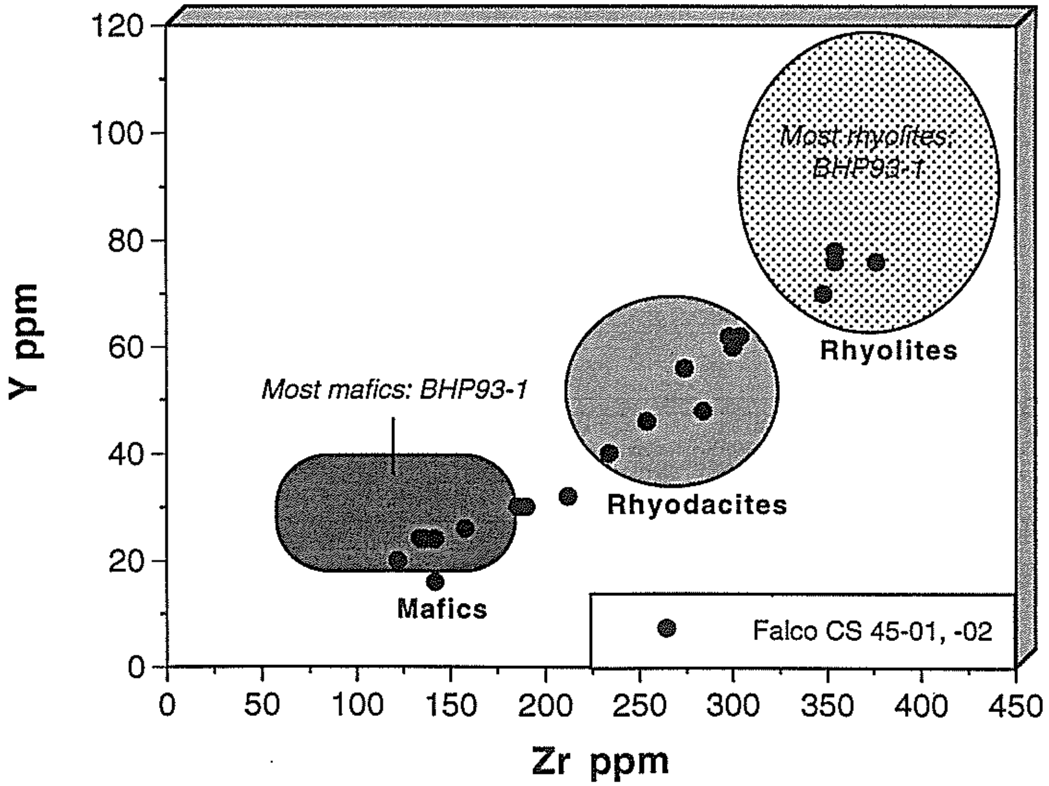


Fig. 8b

Carscallen: Falconbridge hole CS45-02

Downhole Metal Variations

Fig. 9a

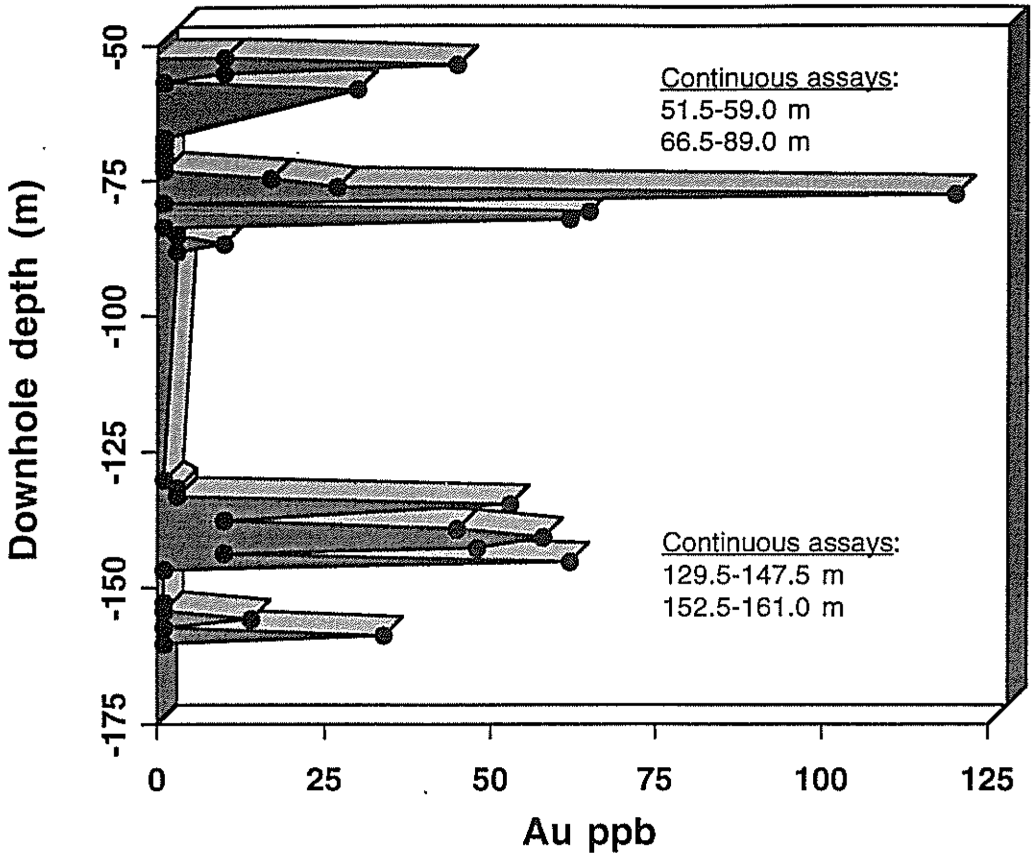
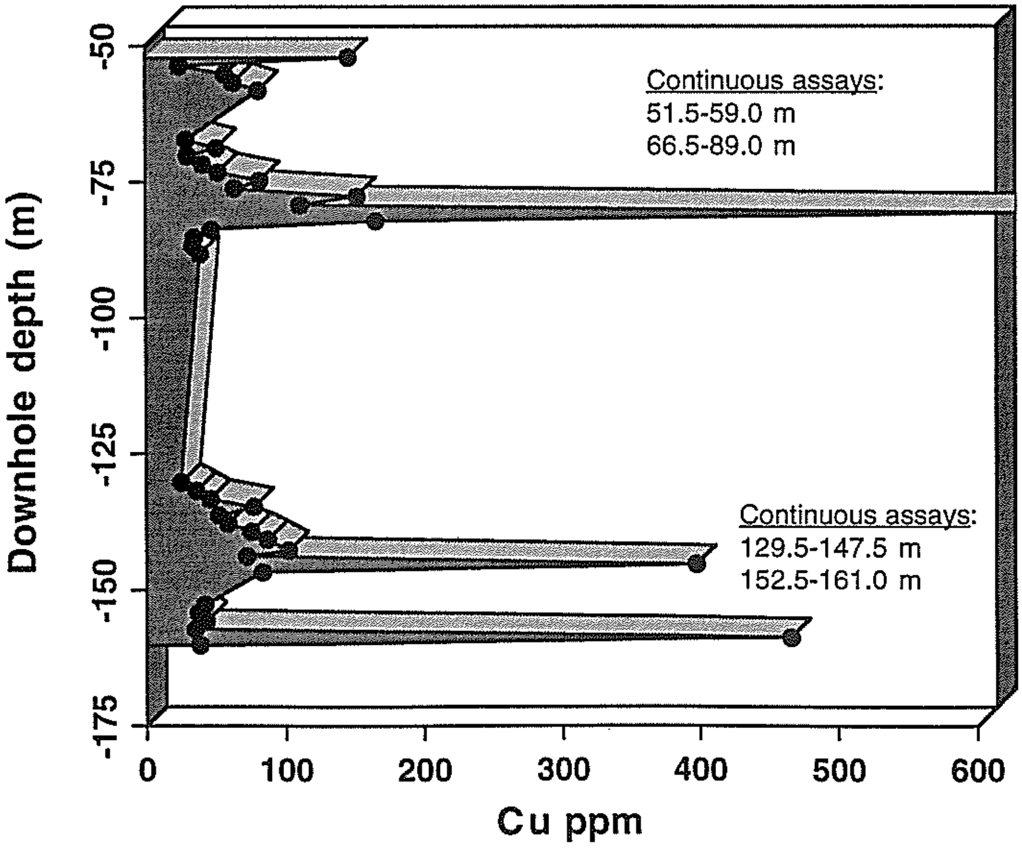


Fig. 9b



Central Carscallen Township

Noranda Exploration

In 1970, Noranda drilled holes C-70-5 and C-70-6 about one kilometre WSW of the southern end of Bigmarsh Lake. According to the logs, hole C-70-5 intersected mainly rhyolite breccia and tuffaceous rhyolite, with thin intervals of andesite tuff at 84-94', 145-150' and 508-530' (the EOH was 560'). Although no assays are available, modal estimates of mineralization were made in the logs. The original descriptions are given in quotations here because of some uncertainties due to the phrasings used. 'Minor disseminated pyrite and chalcopyrite' occur in rhyolite at 151.0-152.0, while from 189.5-191.5 there is 'tuffaceous rhyolite with up to 90% pyrite, pyrrhotite and chalcopyrite, trace sphalerite'. Within a major interval of tuffaceous rhyolite from 194.5-403.0, sections with up to '2% disseminated pyrite, trace pyrrhotite, chalcopyrite' occur at 375.8-377.8 and 396.0-399.8. The rhyolite breccias contain clasts up to 1.5 inches across, in a siliceous matrix which commonly contains 2-5% pyrite and pyrrhotite. Traces of chalcopyrite also occur in the breccia matrix at 403.5-410.8 and 419.8-428.8'.

Hole C-70-6 also intersected almost entirely rhyolite breccias and tuffs, with a lamprophyre dyke at 42-47' (the EOH was at 379'). Rhyolite breccia occurs from 47-118', with a highly sericitized zone at 48-51'. Within the rhyolite breccia interval which extends from 182-208', mineralization occurs as follows: 192.4-194.5: 'minor to 5% pyrite, chalcopyrite, trace pyrrhotite, sphalerite in matrix as patches, blebs and disseminations'; 196.0-198.0: 5-15% pyrite, chalcopyrite, pyrrhotite, trace sphalerite in matrix'; 205.0-207.5: 1-5% pyrite, pyrrhotite, chalcopyrite, minor - 1% - sphalerite in matrix'. Similar mineralization occurs in the matrix of rhyolite breccia at 245.5-248.0' and at 311.8-316.2'. The holes ends in highly sericitized rhyolite tuff (316-379') with trace disseminated pyrite.

Placer Dome Exploration

Holes 354-01 to 354-03 were drilled in 1989 by Placer Dome about one kilometre west of Bigmarsh Lake. The distance between 354-01 in the north and 354-03 in the south was about a kilometre. The main lithologies intersected in hole 354-01 were: 19-50m: andesite; 50-55m: chert; 55-92m:basalt; 92-110m: chert with carbonated basalt matrix; 110-115m: andesite. Best assays were in the interval between 89 and 101 m, as follows: 0.21 ppm over 0.66 m (at ≈89 m); 0.32 ppm over 0.82 m (at ≈91 m); 0.79 ppm over 1.18 m (at ≈98 m); and 0.35 ppm over 1.00 m (at ≈101 m).

Hole 354-02 intersected the following lithologies: 19-66m: amygdaloidal basalt; 66-70m: carbonitized rhyolite tuff; 70-73m: graphitic chert; 73-79m: carbonitized rhyolite tuff; 79-116m: carbonatized andesite. Best assays were in the interval between 66 and 73 m, as follows: 1.02 ppm over 0.34 m (at ≈66 m); 0.47 ppm over 0.99 m (at ≈69 m); and 0.16 ppm over 1.22 m (at ≈73 m).

The main lithologies intersected in hole 354-03 were: 17-59m: carbonatized, sericitic, dacitic ash tuff; 59-64m: carbonatized basalt; 64-70m: graphitic chert and basalt: 70-87m: carbonatized andesite tuff; 87-99: carbonatized basalt. Only one anomalous Au value of 0.03 ppm was reported.

Western Carscallen Township Lithogeochemistry

In this section, lithogeochemical data are interpreted for samples from an outcrop mapping program on the Barnes claims by BPH Minerals in 1992. The claim block, which flanks the Malette Road, lies 2-3 km northeast of Carscallen Lake. Drill logs were also examined for Mespi Mines W-1 to W-7, located in the southern part of the Barnes block and up to several hundred metres west of it. Lithologies within the Barnes block include felsic and mafic volcanic rocks, and iron formation. Several airborne EM conductors are present in the area covered by the outcrop mapping and the Mespi Mines drilling.

Drill logs were also examined for Noranda Exploration drillhole CLK-90-1, located between the Barnes block and Carscallen Lake to the west, and hole CLK-90-2, situated at the southeastern tip of Carscallen Lake. In the area between the Barnes block and Carscallen Lake, numerous airborne EM anomalies are present (referred to as the western conductors), but only a few holes (CLK-90-1 and westernmost Mespi holes W-1 to W-3) have tested this large area of anomalies.

BPH Minerals Canada

Lithogeochemical data for 32 samples from an outcrop mapping program on the Barnes claims were made available by BPH, as well as a sketch map of the outcrop area with assigned rock types based on the Jensen classification diagram. The samples were analyed for major elements and a suite of metals, but no trace immobile elements. Thus, the only immobile element plot that can be used to examine this data set is Al_2O_3 versus TiO_2 (Fig. 10a). The felsic volcanic rocks (and their altered equivalents) clearly fall into two groups, here referred to as rhyolite and rhyodacite.

CARSCALLEN TOWNSHIP:
Outcrops on Barnes claims

Fig. 10a

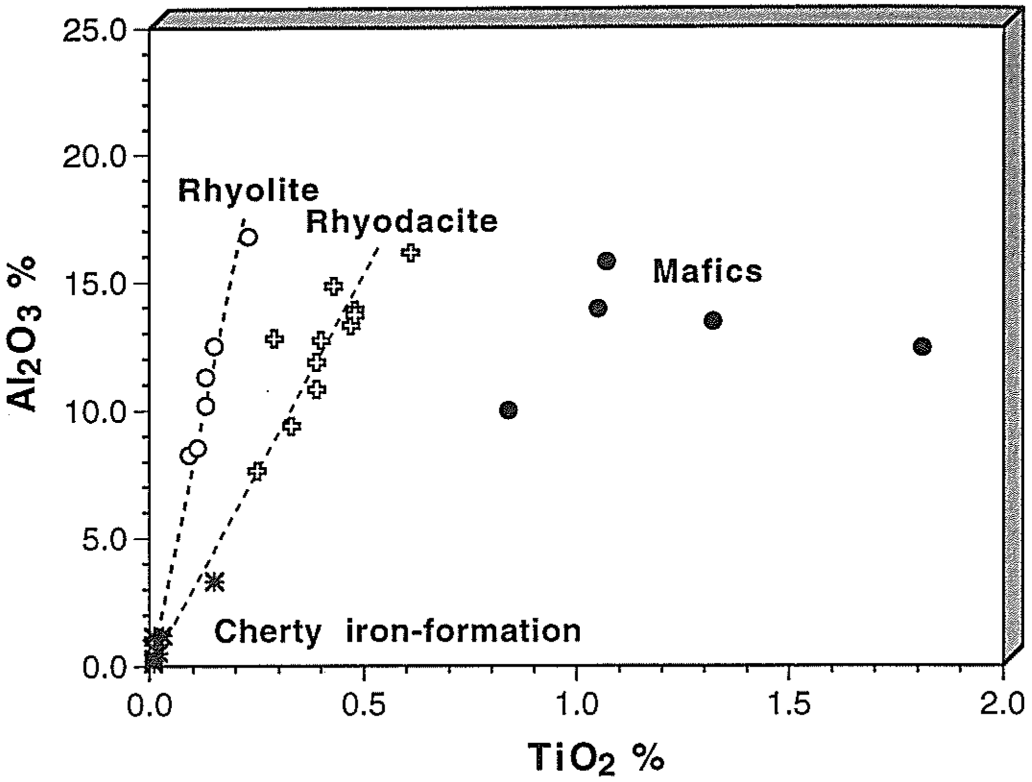
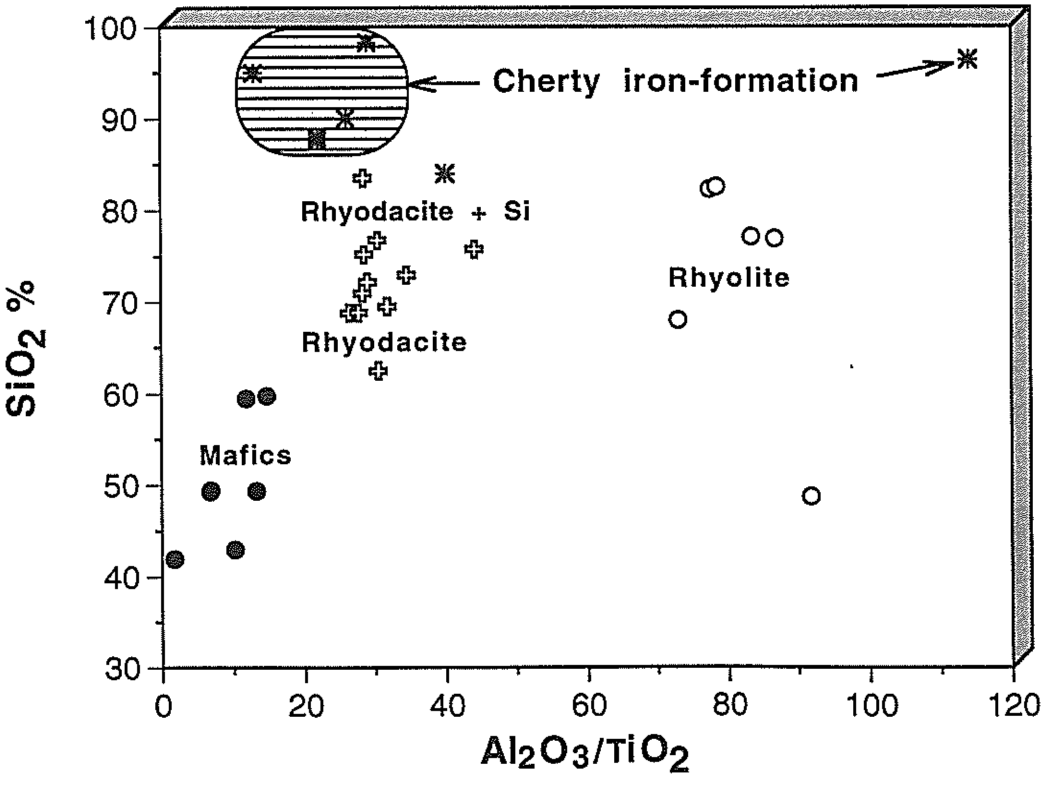


Fig. 10b



Some of the felsic volcanic rocks show the diluting effects of mass gain, which shifts samples along alteration lines towards the origin, whereas a few show mass loss, which shifts samples away from the origin. The form effect is primarily due to addition of silica, whereas the latter is mainly the result of sericitization. Also present on the Barnes claims is a smaller group of mafic volcanic rocks, which do not appear to be very altered. Iron-formation samples plot close to the origin, generally with Al_2O_3 values <2%, and TiO_2 <0.05%. Although the iron-formation samples consists mainly of silica and iron oxides, they appear to contain a small component of felsic material, given that they lie at the extreme ends of the 'dilution trends' that would be expected for rhyolite and rhyodacite.

The effects of variations in components such as silica or iron can be examined by plotting them against the Al_2O_3/TiO_2 ratio, given that this ratio reflects different lithologies on the Barnes claims. Variations of silica are shown in Fig. 10b, which suggests (more clearly than Fig.10a) that many iron-formation samples contain a rhyodacitic component. It should be noted that errors in the measurement of TiO_2 in particular, at the low levels found in iron formation, could cause shifts in the Al_2O_3/TiO_2 ratio. For example, a rounding error due to reporting, for example, 0.016 % TiO_2 as 0.02% TiO_2 would cause the Al_2O_3/TiO_2 ratio to be incorrectly lowered by 25%, for eample, from 40 to 30. Such an effect may in fact explain the shift seen in Fig. 10b for the iron-formation samples relative to rhyodacite. Addition of silica has occurred not only in the iron formation, but also in two of the rhyolites, and possibly two of the mafic rocks as well.

The outcrop distribution of samples classified using the Al_2O_3/TiO_2 ratio is shown in Figure 11. The dashed line roughly separates rhyolite and rhyodacite, although the demarcation is not a simple one as mafic rocks occur on either side of the suggested line. Iron-formation is present mainly in outcrops located in the southeast corner of the Barnes block, with a minor occurrence in the northwest corner (Fig. 11).

Outcrop samples with alkali alteration or minor mineralization effects are outlined in Figure 12. Samples simultaneously having <3% K_2O and less than 2% Na_2O are inferred to have experienced alkali exchange during sericitization. Such samples are all rhyodacites, excluding one mafic rock in the northwest corner, and one rhyolite in the southeast corner. Anomalous metal values are present in some outcrops, as indicated by the concentration data and locations listed below Figure 12. One iron-formation outcrop contains anomalous values of Cu and Pb, whereas a second contains elevated contents of Zn and MnO, and a third contains anomalous MnO. Two rhyolite outcrops also contain anomalous Zn values.

Fig. 11

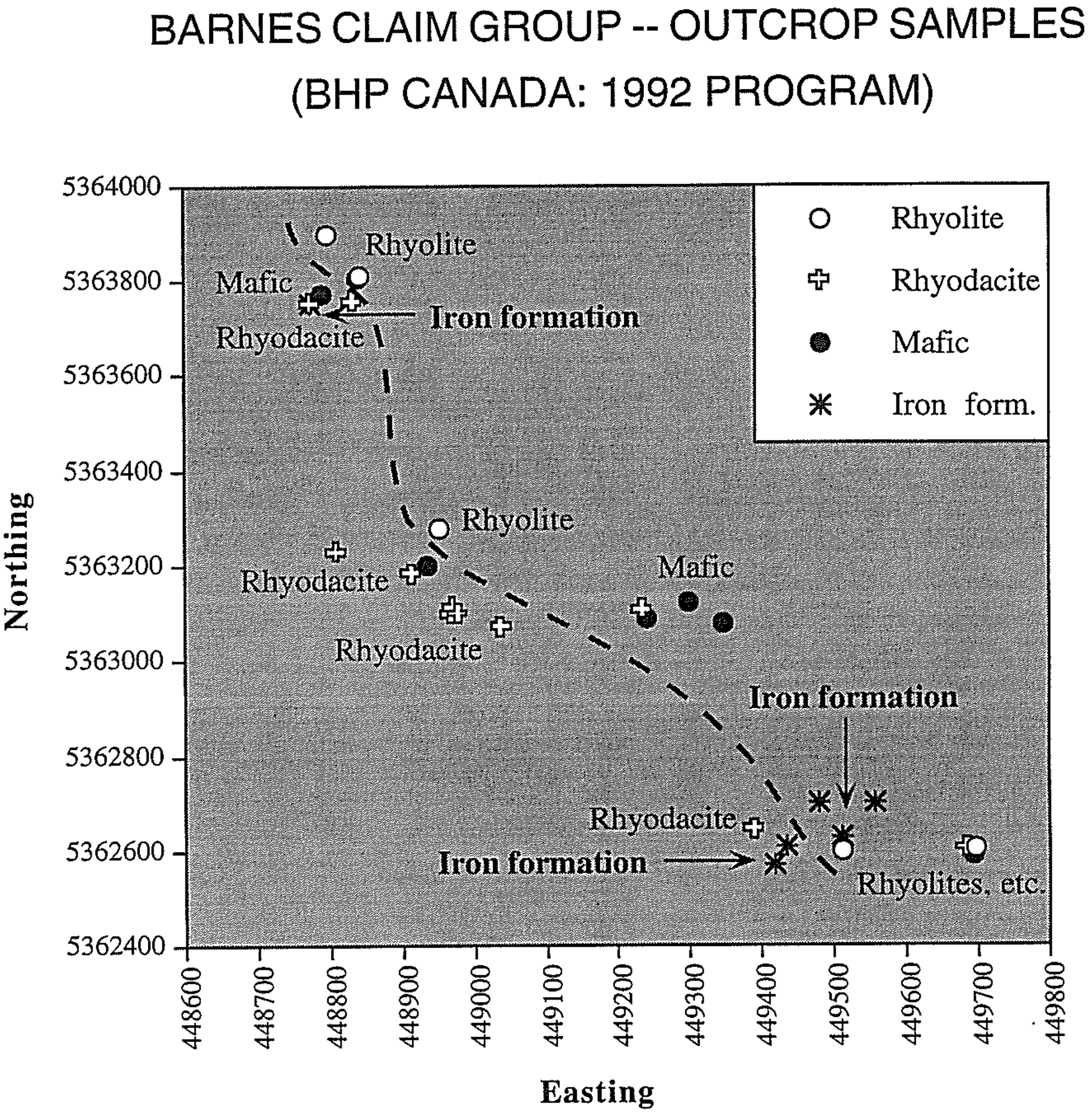

BARNES CLAIM GROUP -- OUTCROP SAMPLES
(BHP CANADA: 1992 PROGRAM)
Northing
5364000
5363800
5363600
5363400
5363200
5363000
5362800
5362600
5362400
Easting
448600
448700
448800
448900
449000
449100
449200
449300
449400
449500
449600
449700
449800
○ Rhyolite
✚ Rhyodacite
● Mafic
✳ Iron form.
Rhyolite
Mafic
Iron formation
Rhyodacite
Rhyolite
Rhyodacite
Mafic
Rhyodacite
Iron formation
Rhyodacite
Iron formation
Rhyolites, etc.

Fig. 11

BARNES CLAIM GROUP -- OUTCROP SAMPLES
(BHP CANADA: 1992 PROGRAM)

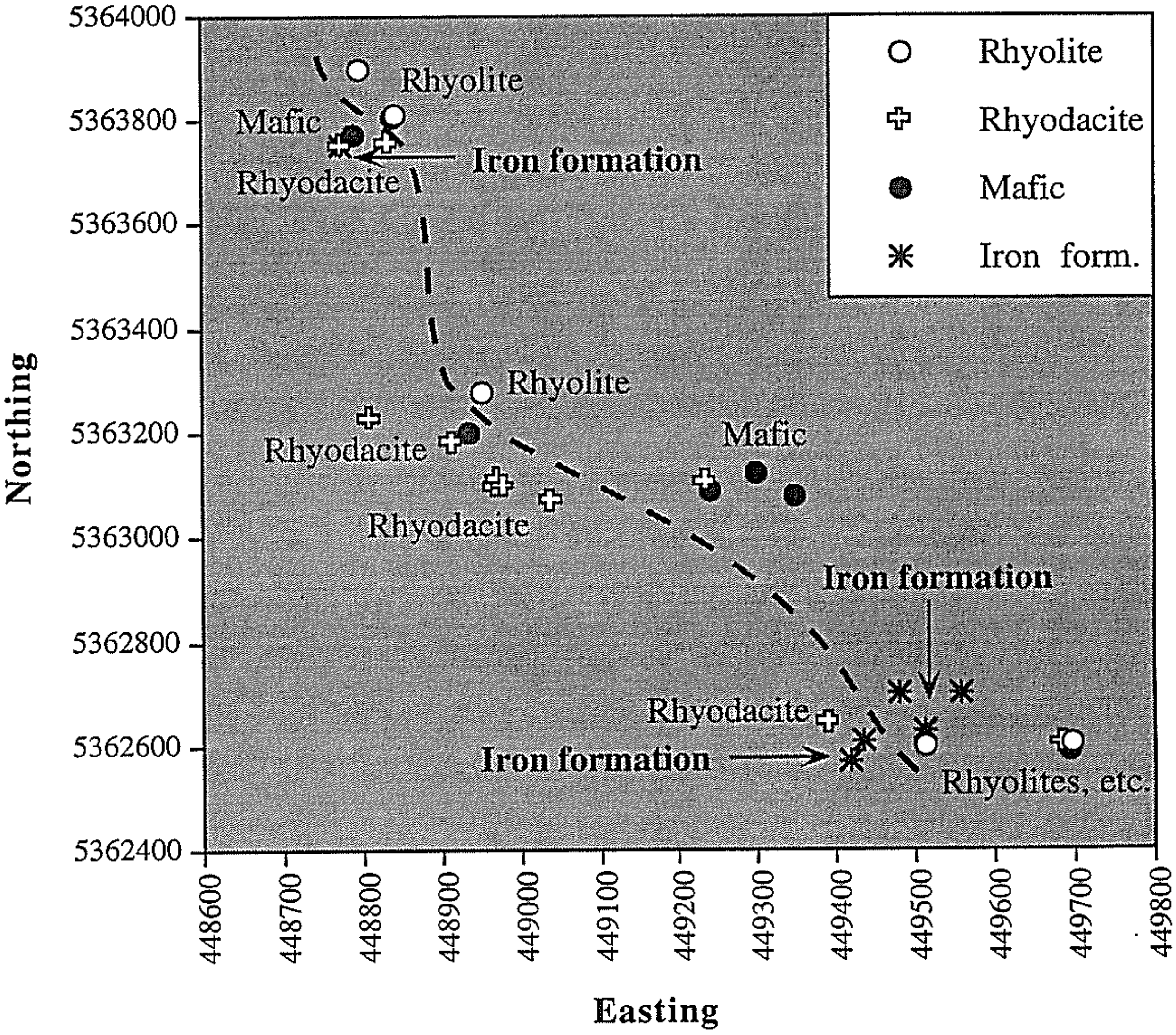
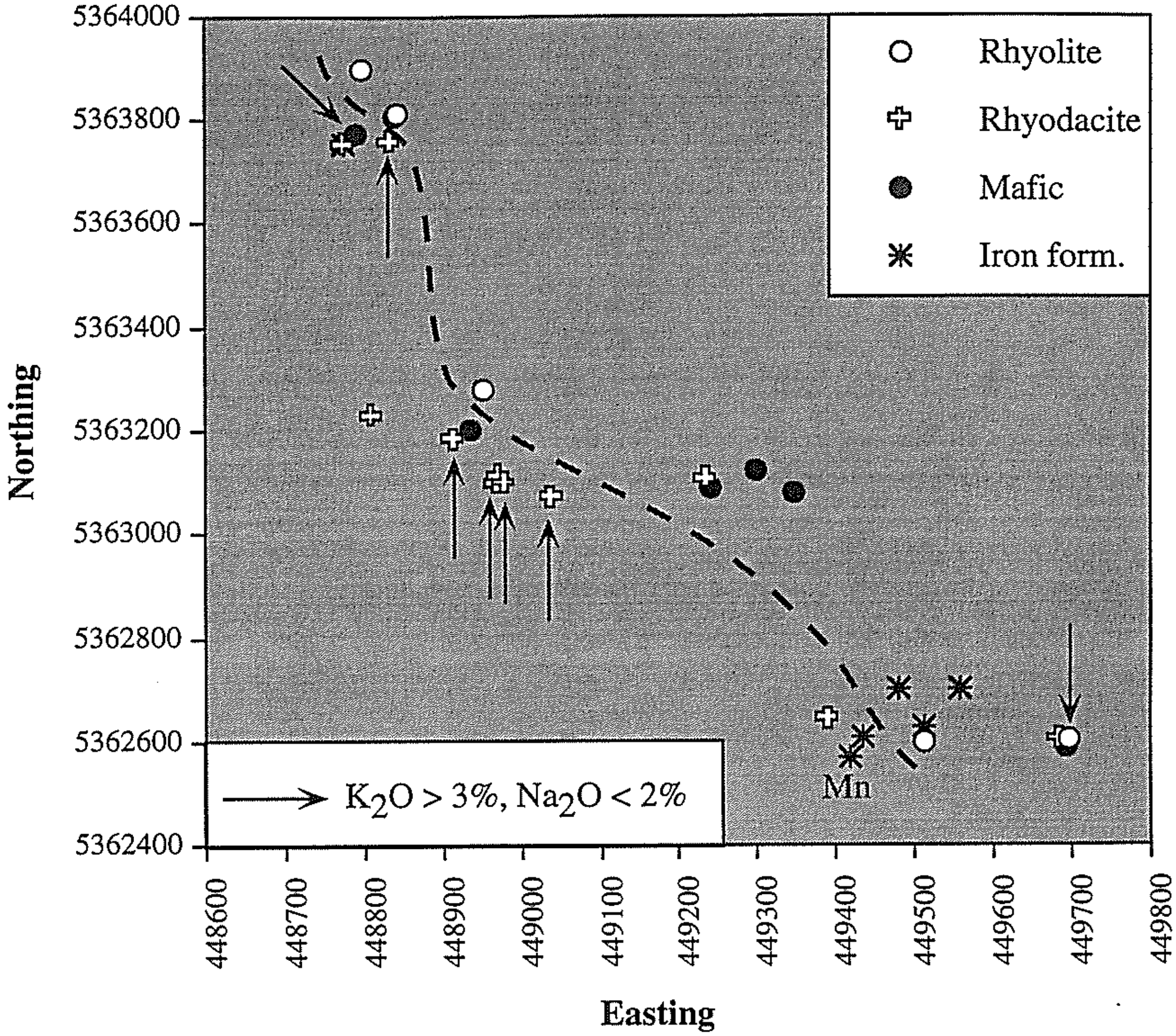


Fig. 12

BARNES CLAIM GROUP -- OUTCROP SAMPLES
(BHP CANADA: 1992 PROGRAM)



Iron-formation sample at 449512, 5362629: 484 ppm Cu & 1340 ppm Pb

Iron-formation sample at 449559, 5362704: 366 ppm Zn & 0.21% MnO

Iron-formation samples (2) at 449417, 5362574: 0.16% & 0.29% MnO

Rhyolite sample at 448798, 5363896: 252 ppm Zn

Rhyolite? sample at 448839, 5363808: 320 ppm Zn

Mespi Mines

Holes W-1 to W-7 were drilled in 1967 by Mespi Mines, with holes W-1 to W-3 located just west of the Barnes block, and holes W-4, W-5, W-7 and W-8 in the block. Hole W-6 has not been located, and the log has not been found. Small speciments of core from all holes are archived in the Timmins core library. These core specimens, which were taken every 25', have been examined in conjunction with the logs. Lithogeochemical analyses in progress will be reported in a later study of Carscellen and other townships. However, six available analyses of iron-formation are discussed in this section. These analyses were filed in the Timmins office as a data sheet with a laboratory report date of December 1988.

According to the drill logs, Mespi hole WC-1 intersected rhyodacite tuffs intruded by diorite from 32' to 136', then rhyodacite tuff from 136' to 266', then diorite to the end of the hole at 399'. The central rhyodacite tuff contains chloritic partings, local silicified zones, and 'irregular splashes' of pyrite and pyrrhotite. The 170-192' interval contains 30% pyrite and pyrrhotite (massive over 3-6 inches) with traces of chalcopyrite.

Hole WC-2 intersected rhyolite tuffs from 8-185', rhyolite porphyry from 185-230', rhyolite tuffs from 230-240', rhyolite porphyry from 240-248', then a 'contact zone' from 248-262' in which the rhyolite is intruded by chilled mafic material, then rhyolite tuffs and silicified rhyolite from 262-357', diorite from 336-357', and finally rhyolite to the EOH at 405' Within the upper rhyolite tuffs is an interval from 150-157' of 30% pyrite and pyrrhotite with traces of chalcopyrite. Assays for this interval indicated almost no base metals (0.01% Cu, 0.02% Ni, nil Zn). Assays for the 251-273' interval, which included the contect zone (average of 20% sulfides) and for the first 10' of rhyolite tuffs downhole from this, indicated 0.02-0.04% Cu, with nil Zn and only traces of Au (apart from the 256-261' section, which contained 0.025 opt Au).

Hole WC-3 intersected rhyodacite at 48-74', 187-213', and 327-348'. Fine-grained and somewhat brecciated diorite (variably feldpar phyric) occurred at 25-48', 74-154', 312-327', and from 348 to the end of the hole at 359'. Basalt? of similar description to some of the diorite was recorded at 154-179. Minor (2-5%) pyrite and pyrrhotite with trace chalcopyrite occurred in the diorite unit from 48-74' in disseminated and stringer form.

Hole WC-4 contained major intervals of what was logged as 'meta-andesite' from 35-265' (also 12-17'). However, inspection of remaining core fragments and 3 whole-rock analyses from 1988 (at 200, 225 and 250') indicate that portions of the 'meta-andesite' interval consist of sedimentary and sulfide-iron-formation rocks. Quartz-feldspar porphyry was logged from 17-35', rhyolitic tuff from 265-304', greywacke from 304-319' and rhyolite tuffs from 319' to the end of the hole at 410'. The section from 175-200' contained 25% pyrite and pyrrhotite with trace chalcopyite, while the section from 200-242' contained 40-70% pyrite and pyrrhotite with trace chalcopyrite, with 40-70% pyrite and pyrrhotite with trace chalcopyite at 253-265. The entire interval from 200-250' was assayed, generally in 5' sections. Cu and Ni values throughout were in the 0.01-0.02% range, Zn was nil, Ag was ≤0.05 opt, and Au was ≤0.005 opt.

Hole WC-5 was logged as 'rhyodacite' from 30-300', rusty and carbonatized intemediate tuffs from 300-323', carbonatized diorite from 323-363', and conglomerate? or intermediate breccia from 363' to the end of the hole at 445. Within the main 'rhyodacite' interval, 7% pyrite plus pyrrhotite occurred from 127-145', and 15% pyrite plus pyrrhotite from 145-150'. The interval from 127-250' contained coarser clasts up to 1" across; the presence of graded bedding suggested that tops were uphole. The section from 192-250' was logged as 'quartz pebble conglomerate', while the section from 250-300' contained 'well bedded carbonatized rhyolitic quartz porphyry tuffs'. It may be that portions of the 'rhyodacite' interval (30-300') actually represent a heterogeneous sequence of sedimentary bedded rocks including some sulfide iron formation (analogous to hole WC-4).

Hole WC-7a intersected weathered, soft, hematite-stained tuffs from 90-130', fine-grained felsic tuffs from 130 to 195', where the casing broke and the hole was abandoned. Hole WC-7b was drilled from almost the same location, and in the same direction as 7a. According to the logs, this hole intersected bedded, colour banded, intermediate sediments from 144-224', andesite? From 224-371', rhyolite tuffs from 371-377', andesite? And andetuff from 377-444', rhyolite tuff from 444-563', fine-grained intermedaite rock from 563-616', andesite from 616-656', coarse lithic tuffs from 656-659', and rhyolite tuffs from 659 to the end of the hole at 708'. Within the first sedimentary interval (144-224), minor pyrite and pyrrhotite and trace chalcopyrite were noted, while the deepest rhyolite tuffs contained 20% pyrite and pyrrhotite from 677-679', and minor pyrite and pyrrhotite from 679 to 708' (EOH).

Iron-Formation and Rare-Earth Elements

Six samples of iron formation from Mespi holes WC-1, WC-4 and WC-6 were analyzed in December 1988 (by Nuclear Activation Services Limited) for major and trace elements, including the rare-earth elements (REE). The analyses are given in Table 5. All six samples contain 70 to 95% combined SiO_2 + Fe_2O_3. Three samples with 0.06-1.43% Al_2O_3 are almost pure iron-formation, whereas three with 4.6-6.3% Al_2O_3 contain clastic or volcaniclastic components (probably as detrital laminations in the iron-formation samples). For the latter three samples, Al-Ti-Zr relations (not plotted) suggest that the clastic component is of intermediate composition, and constitutes some 30-40% of the rock. In terms of metal enrichments, MnO = 0.21-0.29% in the 3 samples from WC-4, and 0.56% in the W-6 sample. The highest Au values can be described as anomalous, with 31 ppb in WC-4-200', and 97 ppb in WC-4-250'. The sample at WC-4-200' also has the highest contents of the following elements: B = 90 ppm, Ba = 260 ppm, Co = 71 ppm and Ni = 60 ppm. Sample WC-1-173' has 70 ppm Cu and 190 ppm Zn (slightly higher than Cu-Zn values in WC-4-200').

Chondrite-normalized plots of the REE distributions of the six samples of Mespi iron formation are shown in Figure 13. The 3 samples from hole WC-4 (at 200, 225 and 250') have similar patterns showing enrichment in the light REE (Fig. 13a). These patterns differ mainly in their absolute contents of REE, due to variable amounts of dilution of the clastic component by SiO_2 + Fe_2O_3 (the chemical component). The highest REE contents correspond to the sample with the largest clastic component (Al_2O_3 = 6.3%), whereas the lowest REE contents correspond to the largest chemical component (Al_2O_3 = 0.06%). Two samples from WC-1 have no Eu anomaly (Fig. 13b), whereas a sample from WC-6 has a positive Eu anomaly (again, this is a nearly pure iron formation sample with very low overall REE contents). In Figure 13, two samples of rhyolite from outcrops in westernmost Carscallen township are plotted for comparison. The REE patterns of the Mespi iron-formation samples range from near-parallel to steeper than the rhyolite patterns. Thus, in some cases the iron formation may contain a component of rhyolitic material, but in others it probably contains a component of some other lithology (with a steeper REE pattern, e.g. calc-alkaline andesite).

The REE content of the chemical component of iron formations is typically very low (Barrett et al., 1988). Thus, in order to investigate the possibility of anomalous REE patterns related to nearby hydrothermal activity, one must analyse either pure samples of iron formation, or else attempt to subtract out the contaminating effect of clastic material. In many samples of impure iron formation, the compositional features of the chemical component are masked by the detrital component. Methods for determining the REE patterns by subtracting the clastic component are outlined by La Flèche and Camiré (1996).

Carscallen Township iron-formation

Mespi drill holes: in and west of Barnes block

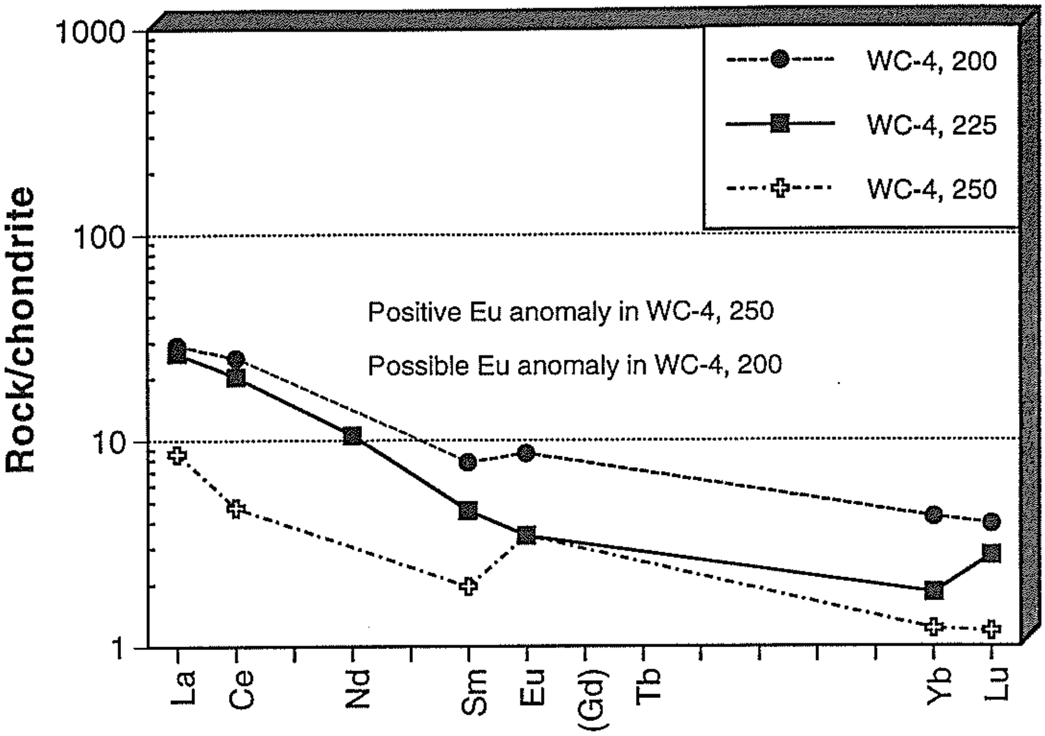


Fig. 13a

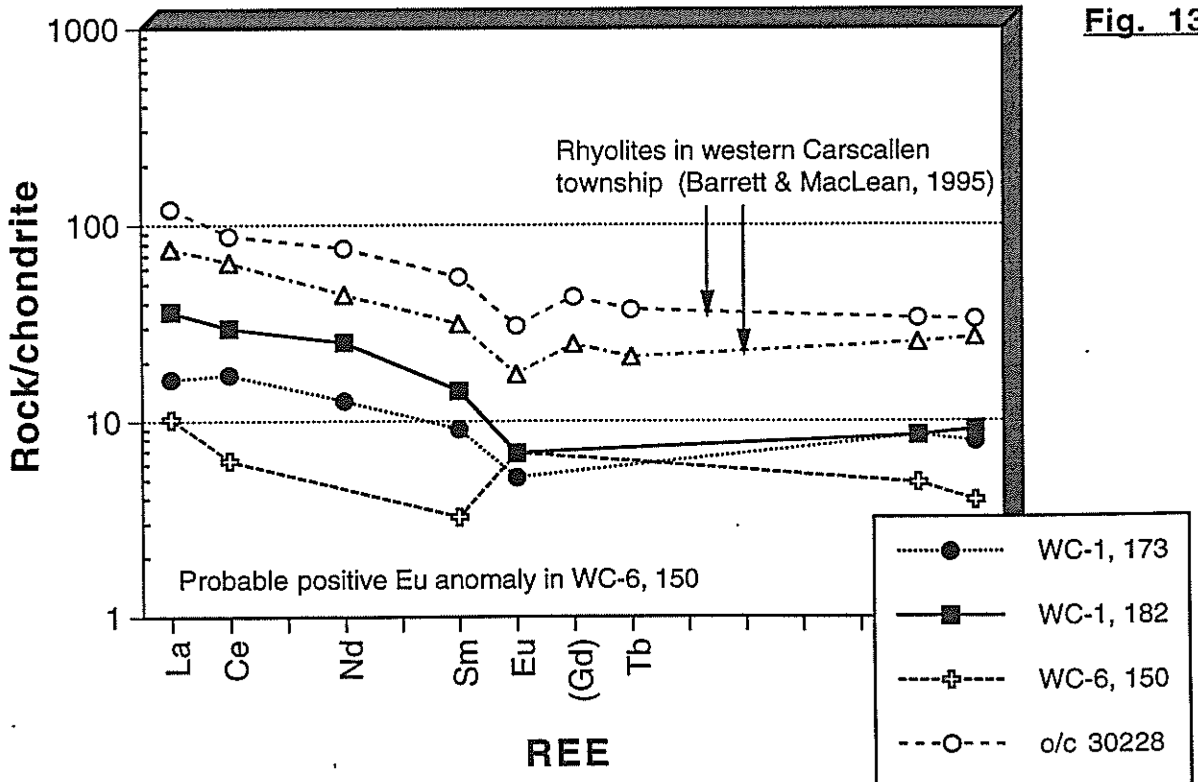


Fig. 13b

Although there are not as yet enough data available on Carscellen iron formations to make this correction rigorously, it can seen from Figure 13 that the two samples with the lowest REE contents (which have the largest chemical component) also have positive Eu anomalies. The question then arises as to the interpretation of these anomalies in terms of proximity to hydrothermal vents on the seafloor. In modern oceans, positive Eu anomalies occur in chemical deposits spatially close to hydrothermal vents (Barrett et al., 1990); in some samples, negative Ce anomalies are also present. Positive Eu anomalies result as dissolved Eu^{+2} in hot reduced hydrothermal fluids is precipitated upon discharge of these fluids into oxidizing seawater. Negative Ce anomalies result if a component of seawater is present in a 'mixed' fluid; such REE patterns could reflect a more vent-distal location.

Using this approach, it is possible in theory to recognize vent-proximal areas on a paleo-seafloor by the presence of a chemical precipitates with a strongly positive Eu anomaly (i.e. hydrothermal fluid-dominated), coupled with the lack of a Ce anomaly (i.e. no normal seawater was intermixed with the hydrothermal fluid). This type of approach has been applied to iron formations in sedimentary basins where VMS deposits are also known to occur, for example in the Bathurst camp (Graf, 1977; Peter and Goodfellow, 1996).

In the Archean, however, the situation becomes more complex, as deeper parts of the world ocean may have been in a generally more reduced state than at present, due to greater net hydrothermal input into oceans during the Archean. If so, then it becomes more problematic to recognize a vent hydrothermal signal, because the background 'normal' seawater already may have had a positive Eu anomaly (and possibly lacked a negative Ce anomaly as well). Nonetheless, the concept is worth applying even in the Archean, as Eu is one of the few elements which is sensitive to oxidation state of the fluid, and variations in Eu anomalies do in fact exist in Archean iron formations (Barrett et al., 1988; Derry and Jacobsen (1990), and also in certain modern metalliferous deposits. for example the reduced brine pools in the Red Sea (Cocherie et al., 1994; Barrett and Jarvis, unpublished data). Further aspects of the chemistry of Precambrian iron formations and the interpretation of Eu anomalies are discussed in Derry and Jacobsen (1990), Danielson et al. (1992), and Bau and Möller (1993).

Noranda Exploration

Holes CLK90-1 and CLK90-2 were drilled in 1990 by Noranda. The former hole is situated about 1 km east of Carscallen Lake, in the middle of a group of three airborne conductors, while the latter hole is located at the southeastern tip of Carscallen Lake.

Hole CLK90-1 mainly intersected mafic volcanic flows from the first bedrock at 28m to the EOH at 215m. The mafic flows locally contain minor to trace disseminated pyrite. Felsic cherty tuff beds are interstratified within the mafic sequence, with the main ones at 129-130m, 154-157m, and 188-194m. The felsic cherty tuff beds are notably more sulfide-mineralized than the mafic units. The upper cherty tuff section (129-130m) contains 5-7% pyrite + pyrrhotite and minor sphalerite, chalcopyrite and magnetite, while the middle section (154-157m) has 5-10% pyrite + pyrrhotite and minor chalcopyrite, and the lower section (188-194m) contains only trace pyrite.

Hole CLK90-2 also intersected mainly mafic volcanic flows from the first bedrock at 9m to the EOH at 170m. The mafic flows locally contain trace to 1% disseminated pyrite + pyrrhotite. Two main intervals of cherty tuff with sulfide mineralization are interstratified within the mafic sequence: one at 91.7-92.6m, which carries 5-10% pyrite + pyrrhotite, the other at 100.3-101.7m, which contains 7-10% pyrrhotite + pyrite and trace sphalerite?

Lithogeochemistry and Logs - Whitesides Township

Eastern Whitesides Township Lithogeochemistry

Most of the data discussed in this section are for samples from the Dea Property in eastern Whitesides Township (holes WD92-1 and 92-2, and outcrops), and the Whitesides Syndicate claims (hole FM87-1), which are located to the west of the Dea Property. Lithogeochemical data for holes FM87-1 and WD92-2 are given in Table 6, together with data obtained by Granges and Noranda for outcrops on the Dea Property.

Holes drilled in the Bean Lake area include Consolidated Rowan holes W-1 to W-4, drilled in 1958, Broulan Reef holes 1-56, 2-56 and 3-56, drilled in 1956, and Hollinger Consolidated Gold winkie drillholes W-1 to W-7, drilled in 1957. Claw Lake Moly Mines drilled hole W-1 a few hundred metres west of Prisson Lake, and holes 1-5 in the area of WD92-2, immediately north of Cathy Lake. Lithogeochemical data for some of these holes are given in Table 7.

Drillhole FM-87-1

This long drill hole (1203') intersected a sequence of alternating mafic and felsic units, some apparently flows, others dykes or shallow intrusive porphyries. The main felsic units are from 124-213', 266-275', 377-386', 393-403', 452-473', 481-491', 545-588', 593-613', 660-668', 670-730', and 825-1202'. The felsic units range texturally from quartz eye-rhyolites to albitic dykes to felsic porphyries to felsic pegmatitic zones. Interesting intervals of greenish chloritic schistose rocks with interstratified cherty beds occur from 213-245' and from 275-377'. The cherty bands in the latter interval contain 10-30% pyrrhotite with traces of chalcopyrite or sphalerite. Garnets are present in some of the greenish schistose rocks, as are quartz-calcite veinlets and ankerite alteration.

The compositional range of rocks in hole FM87-1 is shown in terms of immobile element ratios in Figure 14a. The main lithological groups are basalt, andesite and rhyolite. Three samples which plot towards the origin contain chemical precipitates and a component of probably andesitic volcaniclastic material. The volcanic component has been diluted by the addition of variable proportions of Ca, Mg, Fe and Si, representing calcite-ankerite-pyrrhotite-quartz material in veins and as apparently primary precipitates in mixed exhalite-volcaniclastic beds. With regard to the affinity of the volcanic rocks in hole FM87-1, the rhyolites and andesites are of tholeiitic affinity, whereas some of the mafic are tholeiitic but others are transitional to mildly calc-alkaline (Fig. 14b).

Assays for the 22 samples from hole FM87-1 (Table 6) yielded maximum Zn values of 721 ppm at 499-501' (cherty quartz-eye rhyolite with sphalerite in fractures, and minor disseminated pyrrhotite) and 353 ppm at 443.5-446' (quartz-eye rhyolite with trace mineralization). Gold values are anomalous in parts of the upper portion of the hole: 62 ppb at 161-163' (sericitic rhyolite), 55 ppb at 186.7-187.7' (calcite-quartz breccia-shear zone), 79 ppb at 276.5-281.5' (chert with 10-20% pyrrhotite bands), 51 ppb at 443.6-446' (quartz-eye rhyolite), and 27 ppb at 446-450' (mafic volcanic with 2-5% pyrrhotite). All other Au assays were below 7 ppb. The highest Cu values were 272 ppm at 1068-1072' (albitic dyke), 142 ppm at 276.5-281.5' (chert with 10-20% pyrrhotite bands), and 134 ppm at 446-450' (mafic volcanic with 2-5% pyrrhotite). All other Cu values in hole FM87-1 were below 122 ppm.

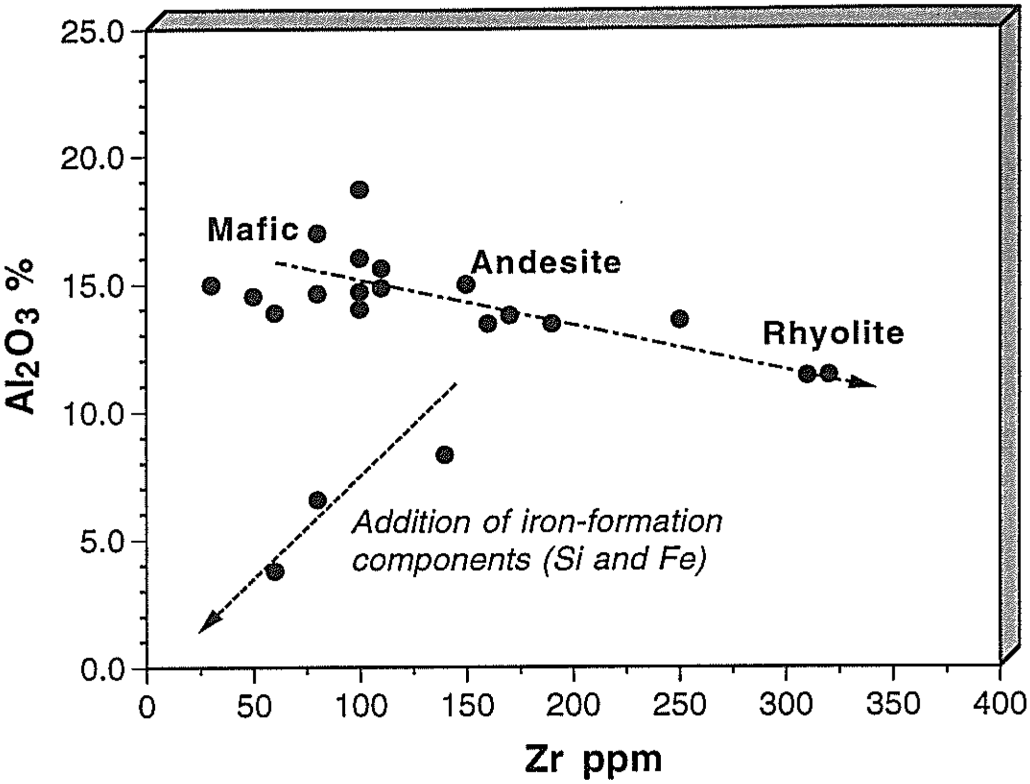
Drillhole WD92-2

Hole WD92-2, located immediately north of Cathy Lake, intersected mainly mafic and felsic volcanic rocks and dykes or shallow intrusives (porphyritic). The main felsic units occur at 89-99' (felsic porphyry?), 107-129' ('sandy' felsic material, with some iron formation), 154-225' (massive flow-banded rhyolite with some 'sandy' volcaniclastic intervals), and 232-243' (ditto). The massive rhyolite units contain scattered, euhedral, faintly bluish quartz eyes. Fine-grained non-porphyritic mafic dykes (or sills) occur at 129-141', 156-161', 225-232', and 285-290'. An unusual dark chloritic lithology with breccia

WHITESIDES TOWNSHIP

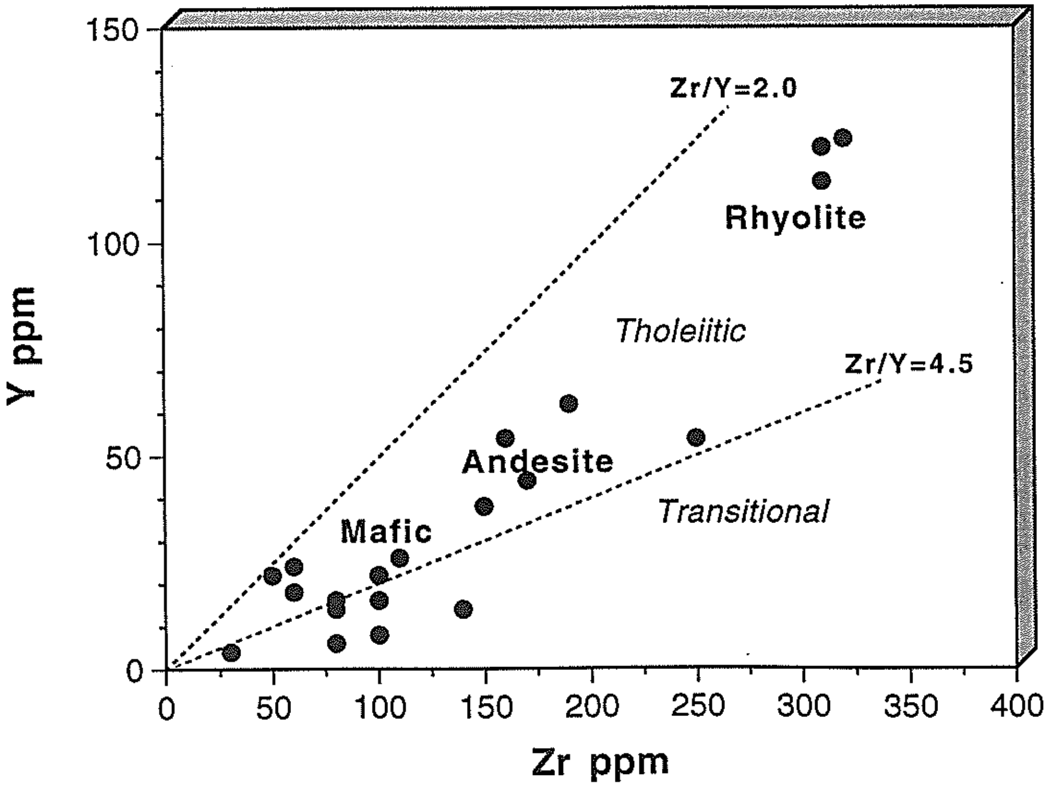
Whitesides Syndicate: hole FM87-1

Fig. 14a



Schematic fractionation trend ---·---·---►

Fig. 14b



fragments and containing iron sulfides and garnet occurs from 99-107' and from 142-154'. This dark lithology may represent impure, chloritic iron formation. Finally, massive plagioclase-porphyritic mafic rock occurs from 243-285', 290-328' and 328-382', with the plagioclase crystals almost glomeroporphritic in the last interval. Two final boxes of core exist below 382', but were not examined.

The compositional range of the rocks in WD92-2 is shown in terms of immobile element ratios in Figure 15a. This and other plots (including the three further samples in Table 7) indicate that four main groups of rocks are present in WD92-2: 1) basalts, which correspond to the dark, fine-grained, non-porphyritic sills and dykes; 2) basaltic andesite at the top of the hole (53-87'); 3) rhyolites, which occurs as flow-banded intervals and 'sandy' volcaniclastic material (of identical composition); 4) andesites, which correspond to the massive feldspar-porphyritic units that are abundant in the lower part (243-285') of the hole; and 5) two 'sedimentary' rocks which are a mixture of volcanic and iron-formation components. These mixed rocks have been affected by variable additions of Ca, Mg and Fe, now in the form of calcite-ankerite-garnet and iron sulfides which occur between breccia fragments and as primary precipitates. The garnet is metamorphic, as indicated by the presence in some of the mafic rocks of 'spongy' porphyroblasts up to 1 cm across.

The rhyolites in WD92-2 are of tholeiitic affinity, as are some of the mafic rocks (Fig. 15b). In this regard, the rhyolites and mafic rocks are essentially the same as those intersected in hole FM87-1. The andesites in WD92-2 are generally transitional to mildly calc-alkaline.

Dea Property Outcrops

Outcrops on the Dea property comprise dominantly mafic and lesser felsic volcanic rocks and local iron formation. Good exposures occur about one kilometre southeast of Cathy Lake, where the lithological units strike southeast. Hole WD92-1 was drilled in this area, where iron formation outcrops. Extrapolation of the iron formation trend to the southeast would come close to hole CLK-90-1, drilled by Noranda about a kilometre east of Carscallen Lake in western Carscallen township. Iron formation -- probably a different interval relative to the Cathy Lake occurrence, unless large-scale folding has occurred -- also outcrops at the southeast tip of Carscallen Lake, where Noranda drillhole CLK-90-2 was located. Hole WD92-1 is not discussed in any detail in this report, as only two analyses were available.

WHITESIDES TOWNSHIP

Whitesides Syndicate: hole WD92-2 and Dea Property outcrops

Fig. 15a

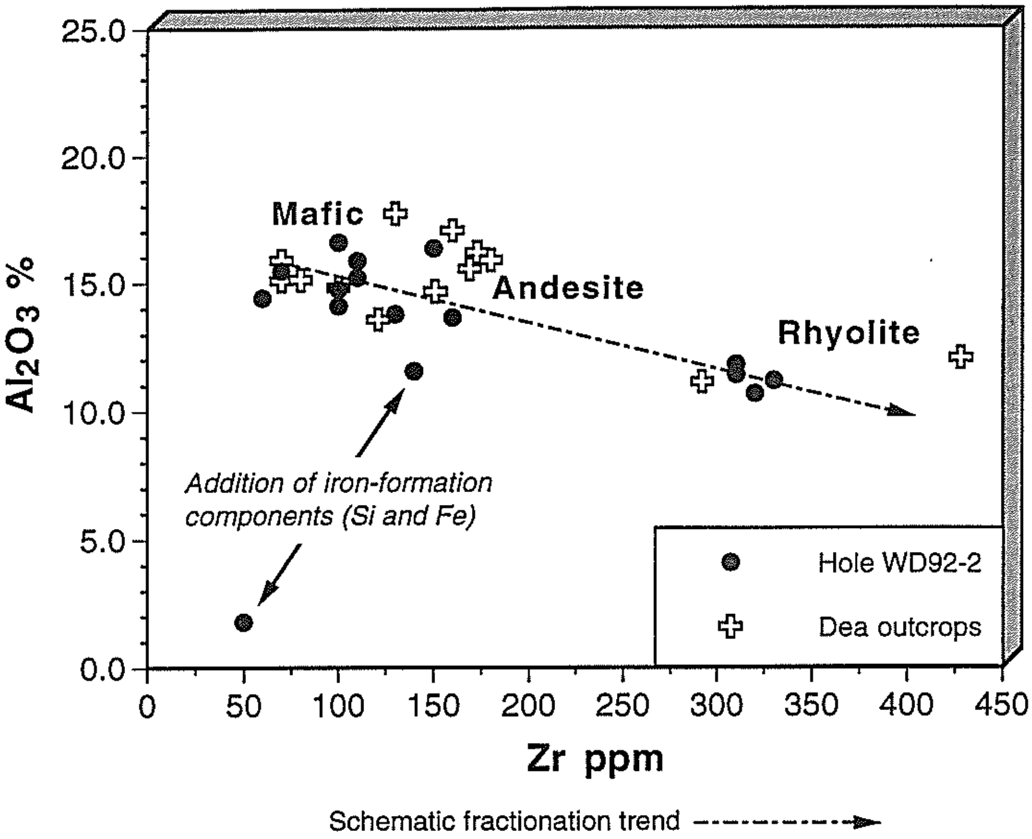
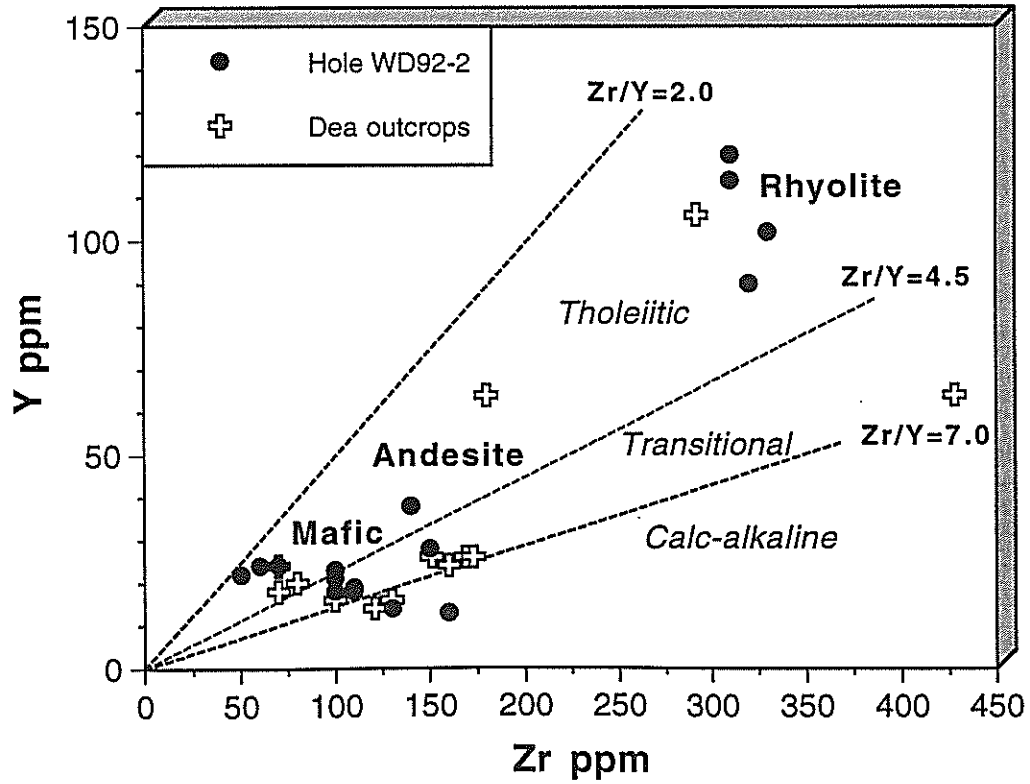


Fig. 15b



The data set for the Dea property outcrops includes 6 Noranda and 7 Granges samples. Immobile element relations are shown in Figure 15a (together with the data for WD92-2). The Noranda samples range from basalt to andesite (mafic sample 81965 was originally mapped by T. Barrie as rhyolite). The Granges samples include two rhyolites, three andesites, one dacite, and one basalt. The maximum Zn content of the Noranda and Granges outcrop volcanic rocks was 150 ppm, and the maximum Cu content was 85 ppm. These data sets did not include samples of iron formation.

Central Whitesides Township Lithogeochemistry

Lithogeochemical data for the holes discussed in this section are from the McGill University laboratory (Table 7). This data set included a total of five samples from two Consolidated Rowan holes, one sample from each of three Broulan Reef holes, two from WD92-1, and three further samples from WD92-2 (discussed above). Results are plotted in Figure 16. The three WD92-2 samples are plotted in this figure (rather than Fig. 15) in order to treat all of the McGill data together.

Hole WD92-1 was drilled by the Whitesides Syndicate almost a kilometre southeast of Cathy Lake. The two whole-rock analyses currently available are from the shallower southern part of the hole (55 and 151'). Their compositions lie near the boundary between basaltic andesite and andesite (Fig. 16a). These two samples are similar in composition and affinity (Fig. 16b) to the three additional samples from hole WD92-2.

The holes drilled in central Whitesides township by Consolidated Rowan and Broulan Reef intersected mainly mafic intrusive rocks of the southern margin of the Kamiskotia Gabbroic Gomplex, possibly including enclaves of mafic volcanic rocks. Two samples with interemediate silica contents (Table 7) are present, one in hole 5 (133'), the other in hole 7 (222'). These may correspond to later-stage differentiates of the Kamiskotia Gabbroic Gomplex. One of these two samples has low contents of Zr and K and may be a quartz diorite, whereas the other is notably higher in these elements and may be more akin to a granodiorite. The Fe-rich sample in Consolidated Rowan hole 7 (254') is probably a cumulate layer. All rocks in the Consolidated Rowan and Broulan Reef drill holes are of tholeiitic affinity (Fig. 16b). By contrast, andesitic composition rocks which occur in parts of the Dea property outcrops and hole WD92-2 are of transitional to calc-alkaline affinity, which suggests that they may be derived from a different source (or area).

WHITESIDES TOWNSHIP

Whitesides Syndicate: McGill data for KGC intrusive rocks & nearby mafic rocks

Fig. 16a

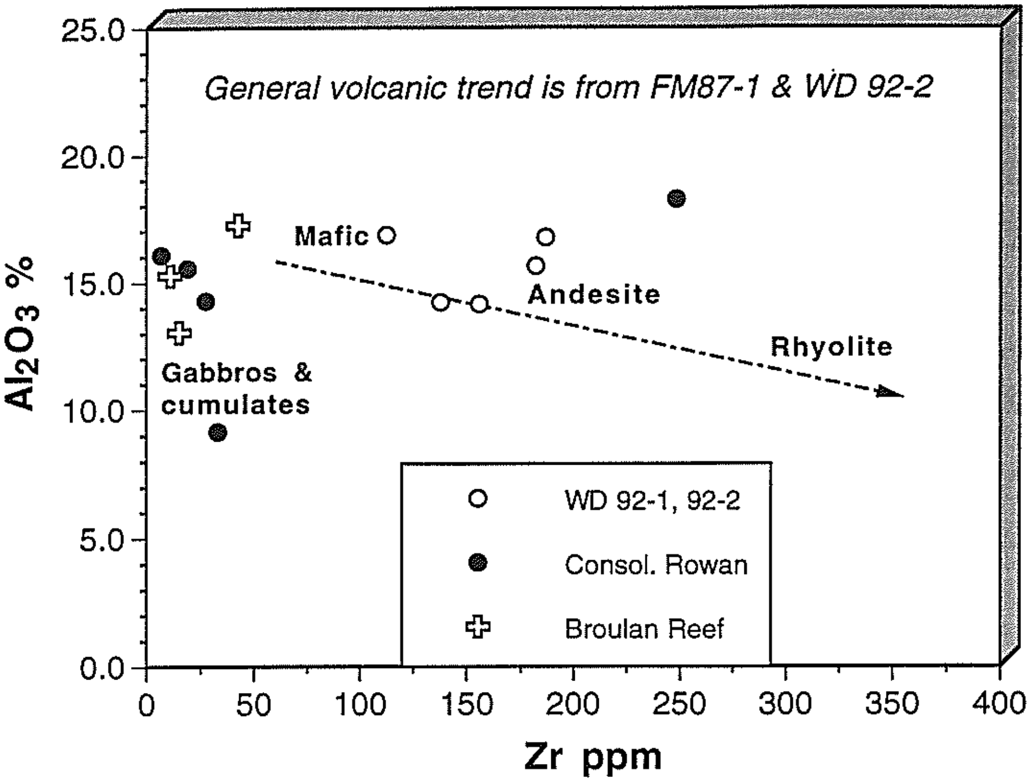
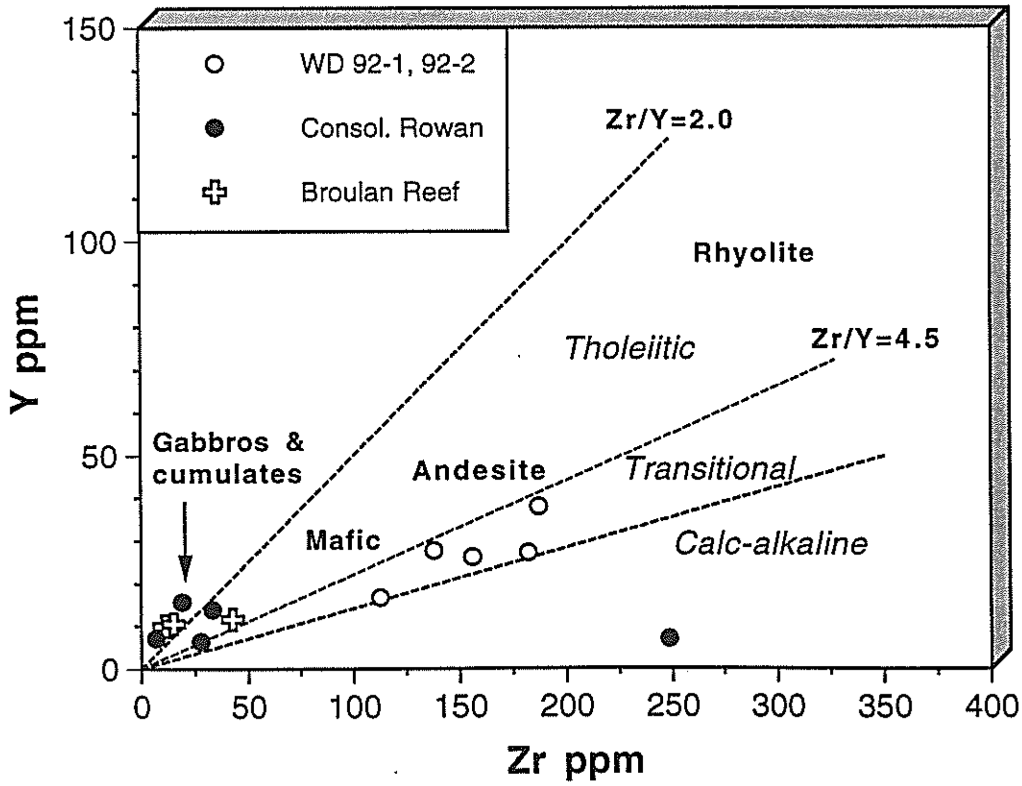


Fig. 16b



Petrography of Samples from Eastern Carscallen Township

Samples Examined:

16833* (Cleyo Resources)
16837 (Cleyo Resources)
16838 (Cleyo Resources)
16840* (Cleyo Resources)
26733 (Alwyn Porcupine)
26744 (Carscor Porcupine)
26746 (Carscor Porcupine)
26749 (Carscor Porcupine)
26750 (Carscor Porcupine)
59601 (Cleyo Resources)
59625 (Cleyo Resources)
59641* (Cleyo Resources)
59672 (BHP Canada)
* = polished-thin section.

General Observations

All of the samples are very rich in carbonates, with contents ranging up to ≈60 %. Carbonate is in the matrix of all the rocks, and is also common as cross-cutting veins, amygdule fillings and irregular masses. It is almost always coarse-grained, more so than the silicate components. This very intense carbonitization has often obliterated primary textures, so that the original identities of many samples are not petrographically obvious.

Rock Types. The majority of the samples appear to be sedimentary rocks or reworked tuffs - mainly felsic in nature. There are at least a couple of mafic lavas in the group, whose identity relies largely on the presence of substantial (1 to 3 %) leucoxene, lack of quartz phenocrysts and quartz matrix, and, in one sample, the presence of "ghost" plagioclase phenocrysts. In addition to carbonate, the felsic samples have a matrix of fine-grained quartz and abundant sericite. Berlin Blue chlorite is abundant in a few samples, and minor epidote is present in a few others.

Shearing. Most, if not all, samples are sheared, some very strongly. Sericite is prominent along all shears, which cut all carbonate textures except some large carbonate veins. The carbonitization was active early, and continued to some extent after shearing.

Amygdules. All samples contain amygdules which are round to oval shaped grains of polygranular quartz±carbonate, excluding one sample in which amygdules are filled with Berlin Blue chlorite. In many samples, the quartz-rich ovoids clearly represent amygdules within volcanic rocks or rock fragments, but in a few they appear to constitute detrital grains in sandstones (this would require that they were weathered out of their parental rocks without losing shape). Some amygdules are in definitely basaltic rocks, while others in felsic rocks. Quartz phenocrysts were recognized in only one sample (a sandstone or reworked felsic crystal tuff).

Mineralization and Alteration. Three polished thin-sections were made in order to examine ore minerals. In sample #16840 there is ≈25% sphalerite, 10% pyrite, and traces of chalcopyrite and pyrrhotite. Sphalerite was also identified in sample #16833, and small grains of chalcopyrite in pyrite in #59672. In a couple of samples, Berlin Blue chlorite is abundant -- this type of chlorite is commonly associated with base metal sulfide mineralization. Sericite and carbonate are too widespread to associate them directly with mineralization; however, considerable sericite was formed prior to the shearing.

Conclusions. A few samples are basalts, and the remainder are felsic volcanic-derived sediments. All samples have been heavily carbonatized. They are moderately to strongly sheared and are heavily sericitized. A few samples are chloritized and mineralized, which provides evidence that a metal-generating hydrothermal system was active in the vicinity of these rocks.

Descriptions of Samples and Photographs: see following section

Magnifications listed are for the photographic prints.

Plate 1. Cleyo Resources, drillhole BM-1

BM-1, 95' (#16840). Mineralized Siliciclastic Sediment or Reworked Tuff

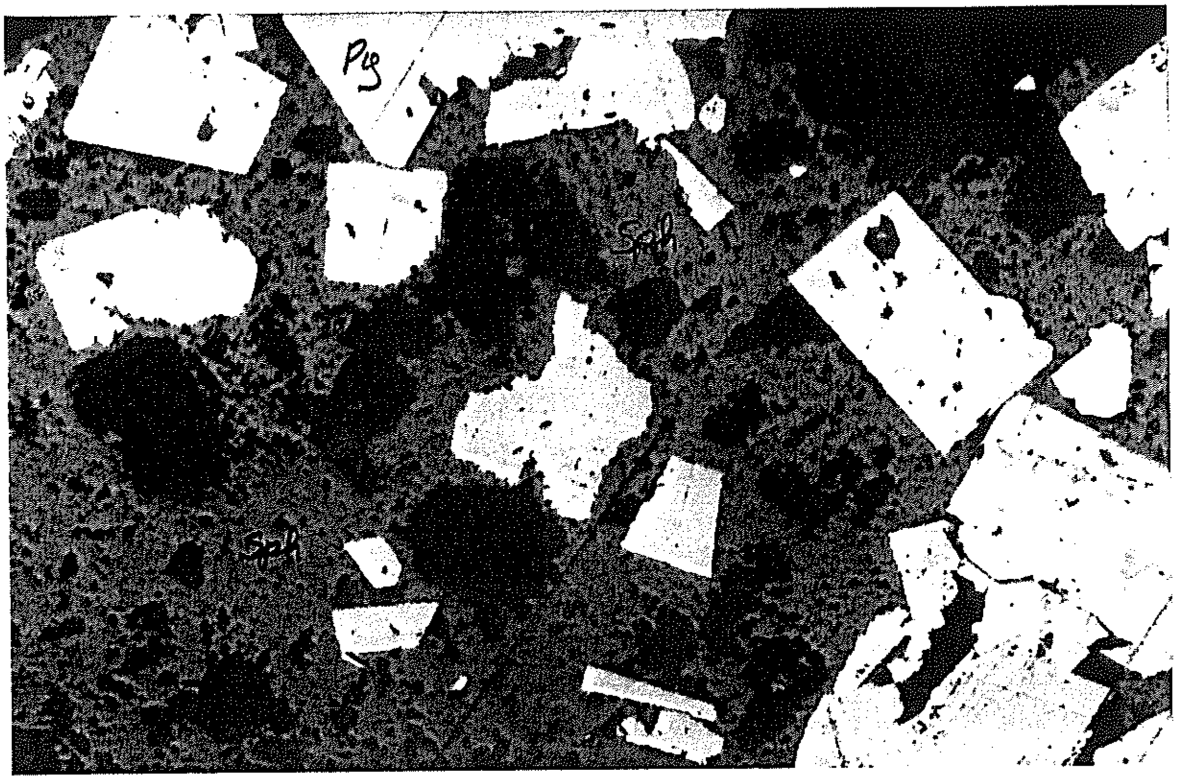
- Sample contains ≈25% sphalerite, 10% pyrite, and 65% siliceous matrix, with traces of chalcopyrite and pyrrhotite.
- The matrix is fine-grained quartz and minor sericite, chlorite, epidote, carbonate.

Plate 1: upper. Sphalerite + pyrite + silicates. Reflected light. 275X.

Plate 1: lower. Sphalerite + silicates. The yellow-orange translucent mineral is sphalerite. Transmitted light. 274X.

Plate 1. Cleyo Resources, drillhole BM-1

Upper: Drillhole BM-1, 95'. Reflected light, x275 (lab sample 16840).



Lower: Drillhole BM-1, 95'. Transmitted light, x275 (lab sample 16840).

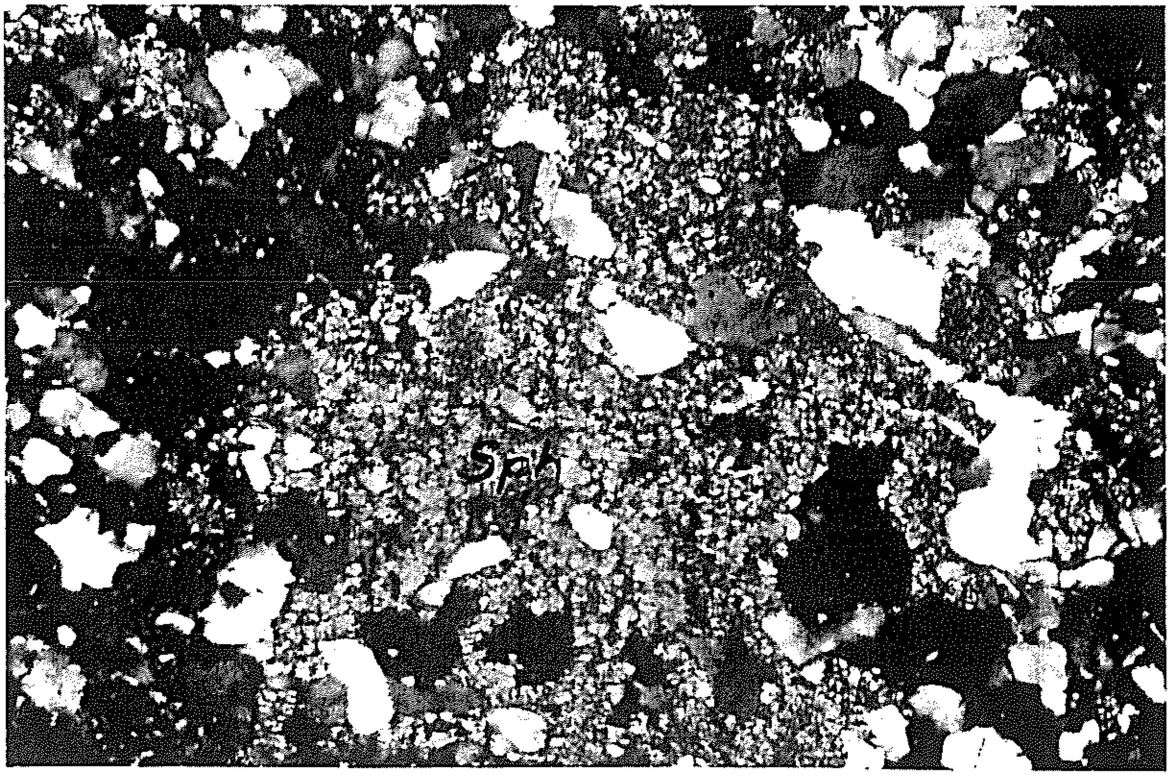


Plate 2. Cleyo Resources, drillholes BM-3 and BM-5

BM-3, 90' (#59601).
Reworked Felsic Volcanic - Sedimentary Rock (Carbonated)

- The rock has a detrital texture. Matrix of quartz-sericite, with abundant carbonate.
- Round and oval shaped quartz amygdule grains are present which appear unrelated to the matrix. The amygdules may have remained intact following disintegration of a felsic volcanic precursor.

Plate 2: upper. Rock consisting of fine-grained sericite + quartz + carbonate, with oval shaped grain of what appears to be a quartz amygdule. Probably a felsic volcaniclastic sediment. 40X.

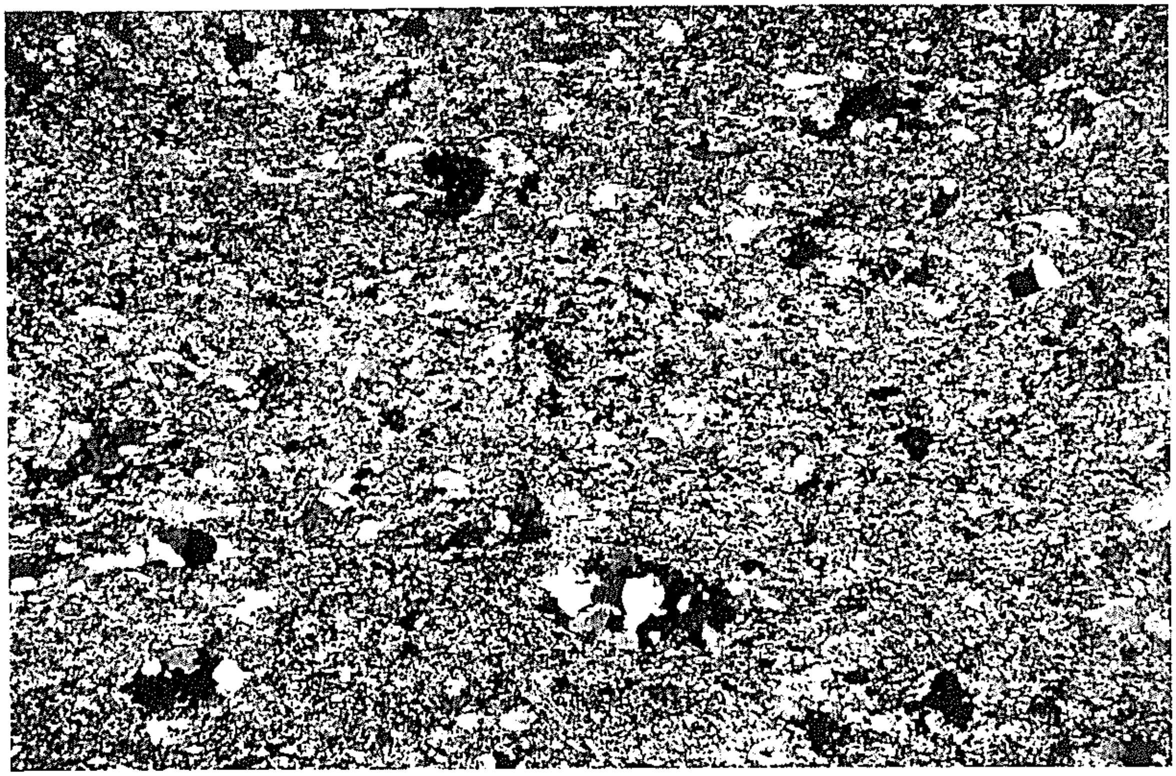
BM-5, 109' (#16833).
Very Carbonitized Rock with Sphalerite and Pyrite

- 50% carbonate, with zones very rich in sericite and containing some chlorite and ≈5% fine-grained quartz. There is no evidence of phenocrysts, and no feldspar, but there are numerous round amygdules of Berlin Blue chlorite; this chlorite is also in the matrix.
- The carbonate matrix and the chlorite amygdules are cut by many shears lined with sericite.
- The matrix contains ≈3% fine-grained sphalerite and ≈5% pyrite grains.
- The lack of leucoxene suggests a felsic volcanic source.

Plate 2: lower. Amygdules of Berlin Blue chlorite in a matrix of carbonate and some sericite; shows late shearing, with concentration of sericitic along shear planes. X40.

Plate 2. Cleyo Resources, drillholes BM-3 and BM-5

Upper: Drillhole BM-3, 90'. Crossed polars, x40 (lab sample 59601).



Lower: Drillhole BM-5, 109'. Crossed polars, x40 (lab sample 16833).

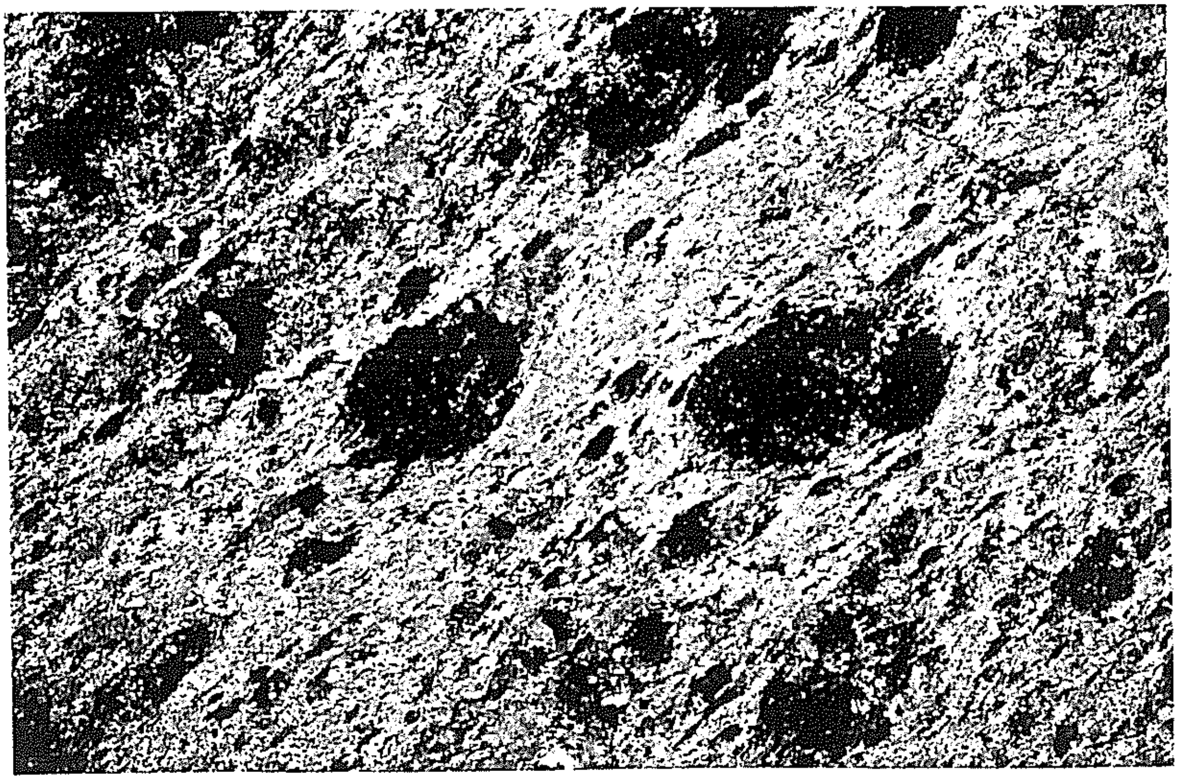


Plate 3. Cleyo Resources, drillhole BM-6

BM-6, 157' (#18637)
Very Carbonitized, Probably Basic Rock

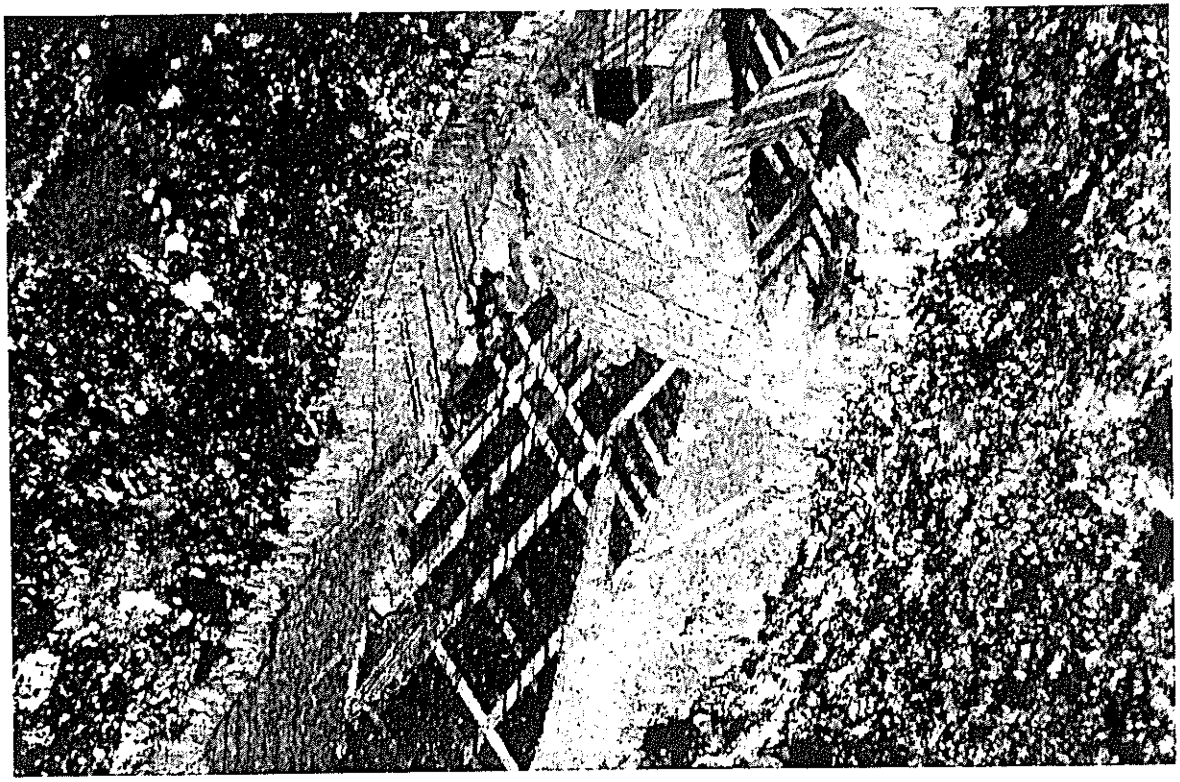
- 70% carbonate as matrix and prominent veins, and ≈30% silicates.
- The silicate portion is composed of fine-grained quartz and albite, and 3-4% leucoxene, the latter suggesting that the rock was basaltic.
- An early set of quartz-rich veins contain abundant albite.
- Sericite is abundant along the many shears.

Plate 3: upper. Vein of Carb with intrically twinned carbonate grains. 40X.

Plate 3: lower. Chlorite and carbonate cut by sericitic shears. 40X.

Plate 3. Cleyo Resources, drillhole BM-6

Upper: Drillhole BM-6, 157' Crossed polars, x40 (lab sample 18637).



Lower: Drillhole BM-6, 157'. Crossed polars, x40 (lab sample 18637).

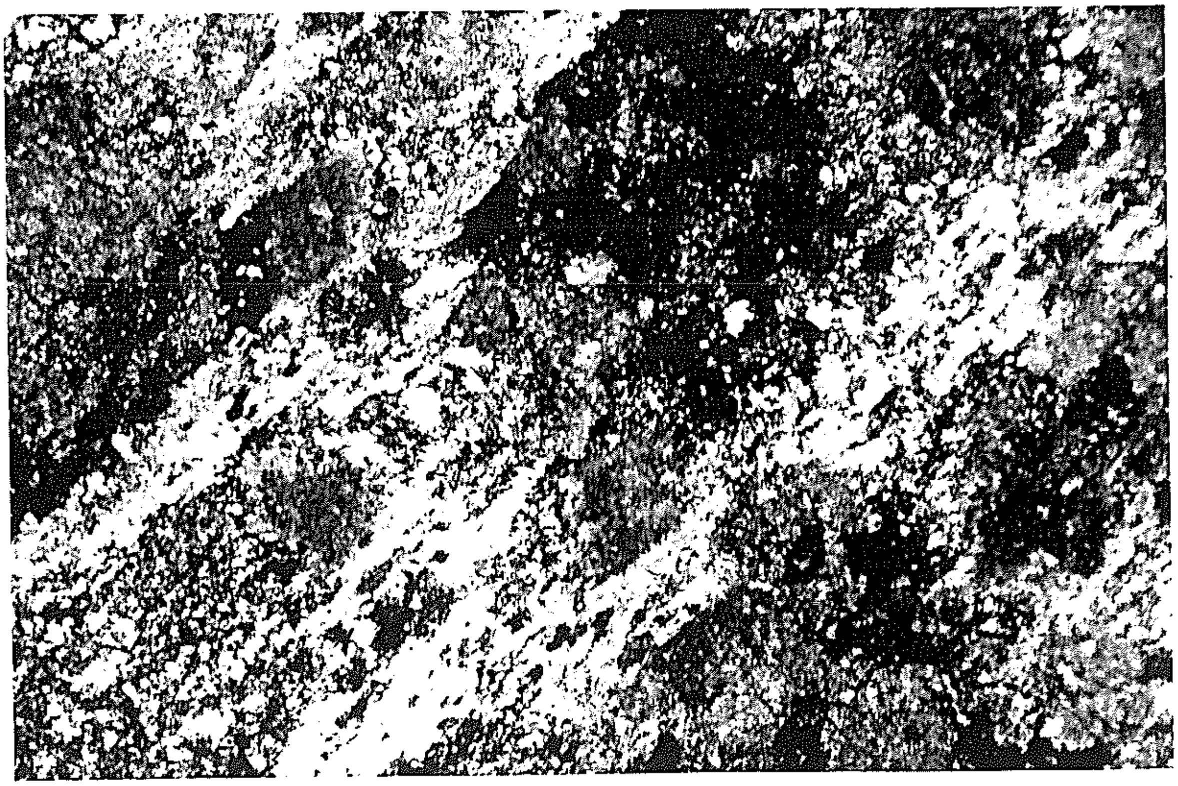


Plate 4. Cleyo Resources, drillhole BM-6

BM-6, 177' (#16838)
Very Altered Silicic Rock

A very fine-grained quartz-rich rock, with many patches of Berlin Blue chlorite, sericite and carbonate. It is much less carbonated than the above samples. There is no evidence of shearing in this sample.

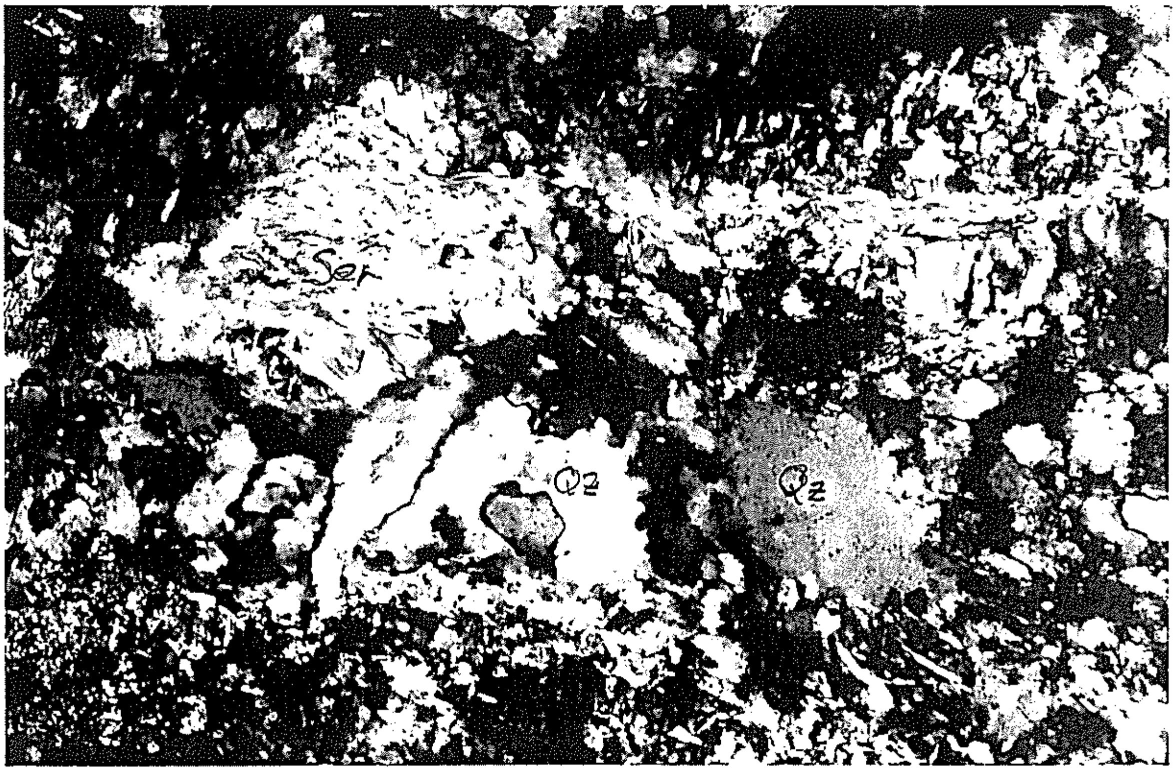
- Quartz ≈ 65%, carbonate ≈ 15%, sericite and chlorite ≈10% each.
- Sample is a quartzose sediment or reworked felsic tuff.

Plate 4: upper. Large sericite grain in quartzose matrix. 175X.

Plate 4: lower. Berlin Blue chlorite and carbonate in quartzose matrix. 40X.

Plate 4. Cleyo Resources, drillhole BM-6

Upper: Drillhole BM-6, 177'. Crossed polars, x40 (lab sample 16838).



Lower: Drillhole BM-6, 177'. Crossed polars, x40 (lab sample 16838).

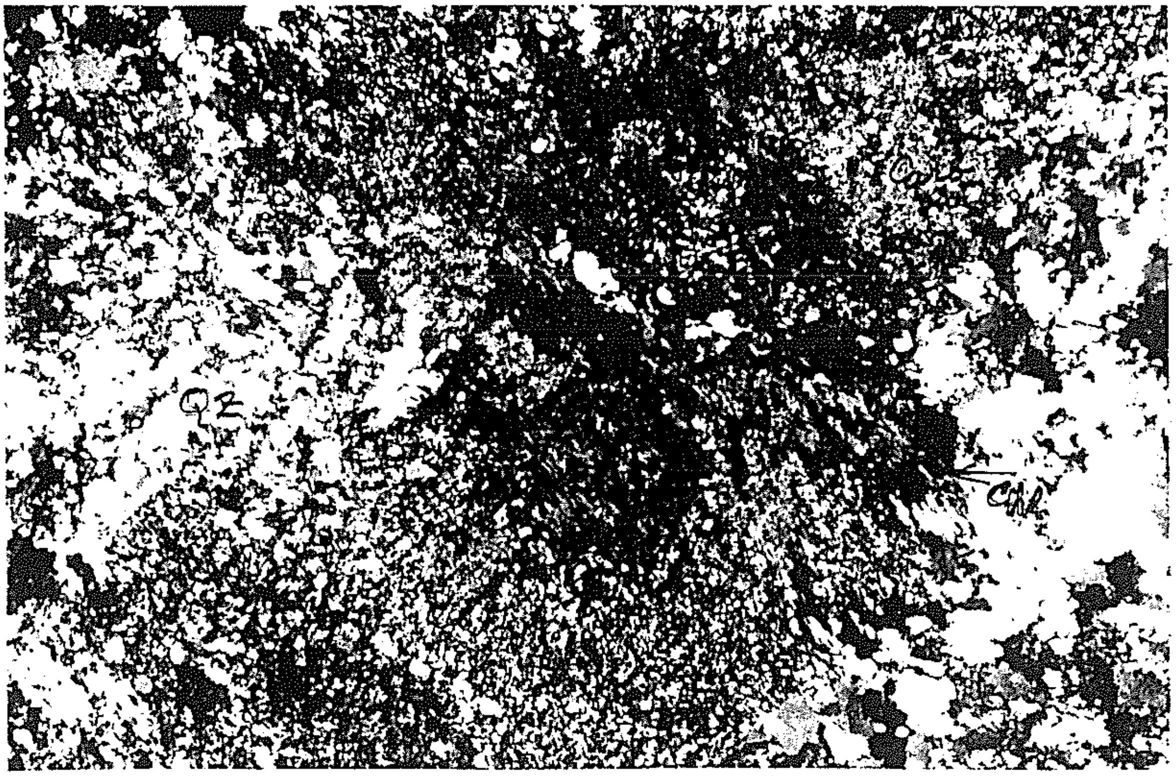


Plate 5. Cleyo Resources, drillholes BM-7 and BM-8

BM-7, 92' (#59625)
Carbonate-Rich Sedimentary Rock

- Rock contains ≈60% carbonate as coarse grains in matrix and as cross-cutting veins.
- The remainder is 25% sericite and 15% quartz.
- The rock is sheared, with sericite concentrated close to the shear planes.
- The sample contains a layer or large 'pebble' of fine grained quartzite.

Plate 5: upper. Carbonate matrix of rock cut by shears along which sericite and quartz are concentrated. 40X.

BM-8, 109' (#59641)
Carbonate-Rich Rock with Sharp Colour Change

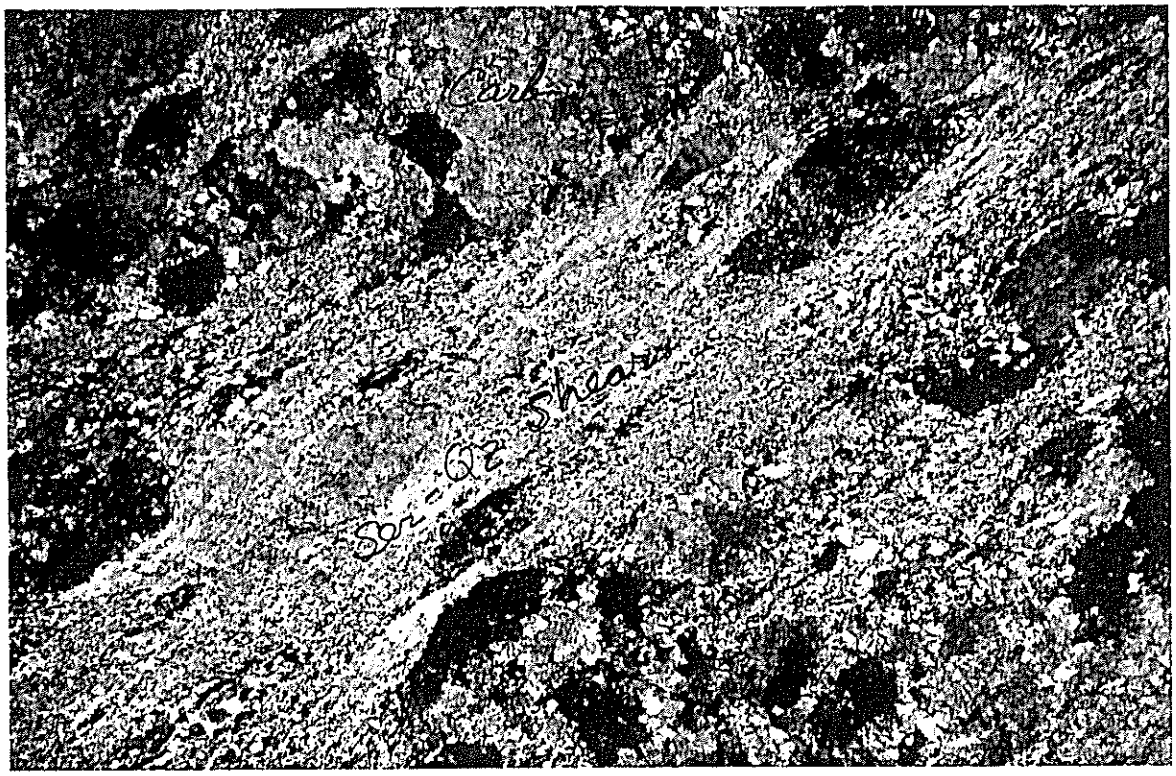
Polished thin-section. The core is divided sharply into a dark and a light zone.

- The light zone is a heavily carbonated rock cut by shears and zones of quartz-sericite. This part of the sample also contains pyrite grains with small inclusions of chalcopyrite. The carbonate is much coarser-grained than the silicate part of the rock.
- The dark zone is characterized by altered carbonate grains containing a common fine-grained opaque, which in reflected light is identified as iron oxide (hematite or goethite). An oxidation process apparently altered and degraded Fe-bearing carbonate and pyrite of the light zone rock to this dark and porous material. The alteration boundary, which is very sharp, could be due to weathering or circulation of oxygenated water. It is not likely to have any relation to the mineralization.

Plate 5: lower. Boundary between the carbonated light zone and the oxidized hematite-bearing dark zone. Note that the sericite in the shears becomes rust-stained in the dark zone. 40X.

Plate 5. Cleyo Resources, drillholes BM-7 and BM-8

Upper: Drillhole BM-7, 92'. Crossed polars, x40 (lab sample 59625).



Lower: Drillhole BM-8, 109'. Crossed polars, x40 (lab sample 59641).

Plate 6. Cleyo Resources, drillhole BM-8

BM-8, 109' (#59641)

Carbonate-Rich Rock with Sharp Colour Change

Polished thin-section. The core is divided sharply into a dark and a light zone.

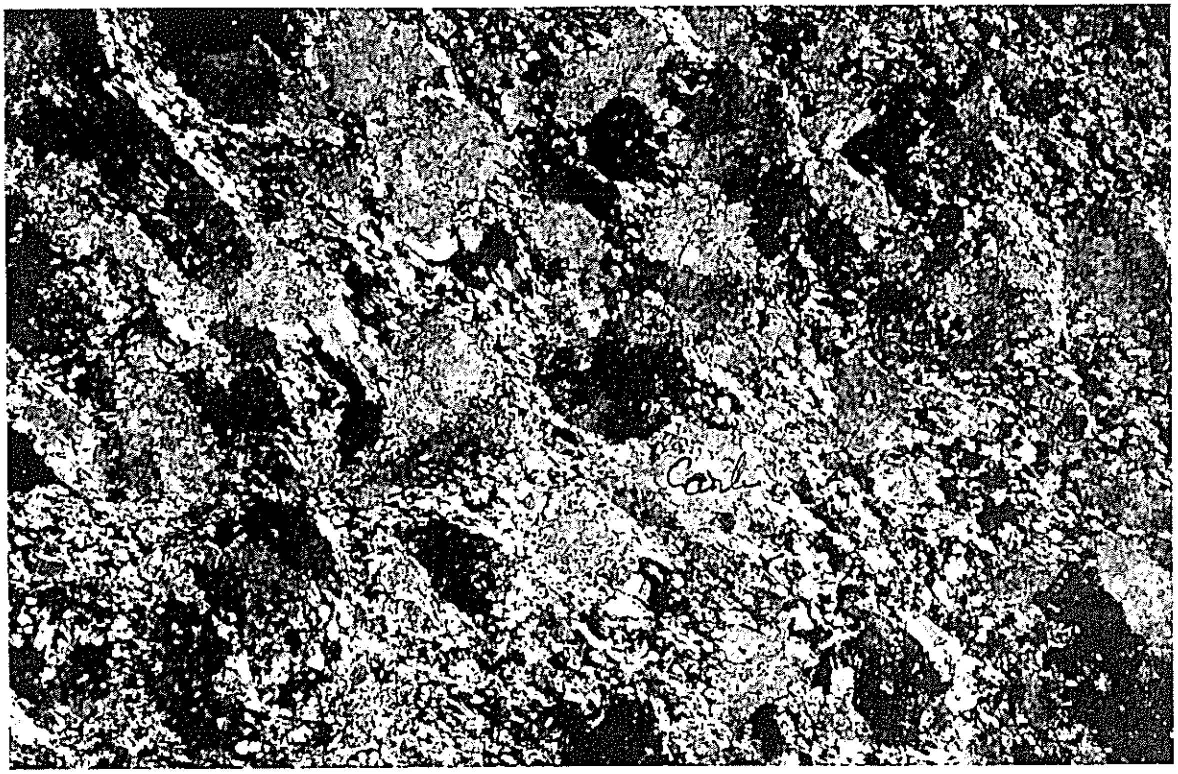
- The light zone is a heavily carbonated rock cut by shears and zones of quartz-sericite. This part of the sample also contains pyrite grains with small inclusions of chalcopyrite. The carbonate is much coarser grained than the silicate part of the rock.

Plate 6: upper. Light zone: shears with sericite and quartz cutting coarse carbonate. Crossed polars, 40X.

Plate 6: lower. Light zone: pyrite grains containing inclusions of chalcopyrite. Polished thin-section: reflected light, 63X.

Plate 6. Cleyo Resources, drillhole BM-8

Upper: Drillhole BM-8, 109'. Crossed polars, x40 (lab sample 59641).



Lower: Drillhole BM-8, 109'. Reflected light, x63 (lab sample 59641).

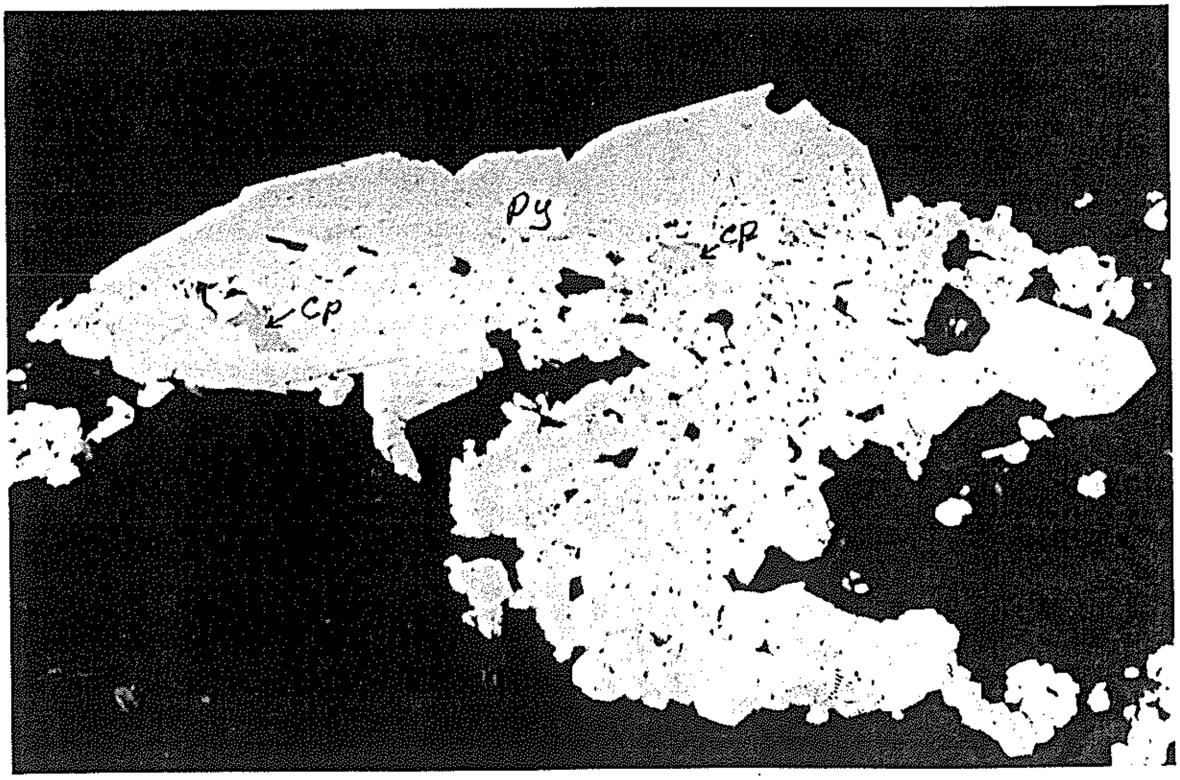


Plate 7. Alwyn Porcupine, drillhole #6

Hole #6, 480' (#26733)
Carbonated Quartz-Sericite Rock

- Carbonate ≈ 35%, quartz ≈ 30%, sericite ≈ 30%, others ≈ 5%. Minor pyrite and leucoxene.

Plate 7: upper. General view of wide sericitic-quartz zones, cut by narrow irregular veins of brown carbonate. 40X.

Plate 7: lower. Details of coarse carbonate and fine-grained sericite-quartz zones in above photo. 175X.

Plate 7. Alwyn Porcupine, drillhole #6

Upper: Drillhole #6, 480'. Crossed polars, x40 (lab sample 26733).

Lower: Drillhole #6, 480'. Crossed polars, x40 (lab sample 26733).

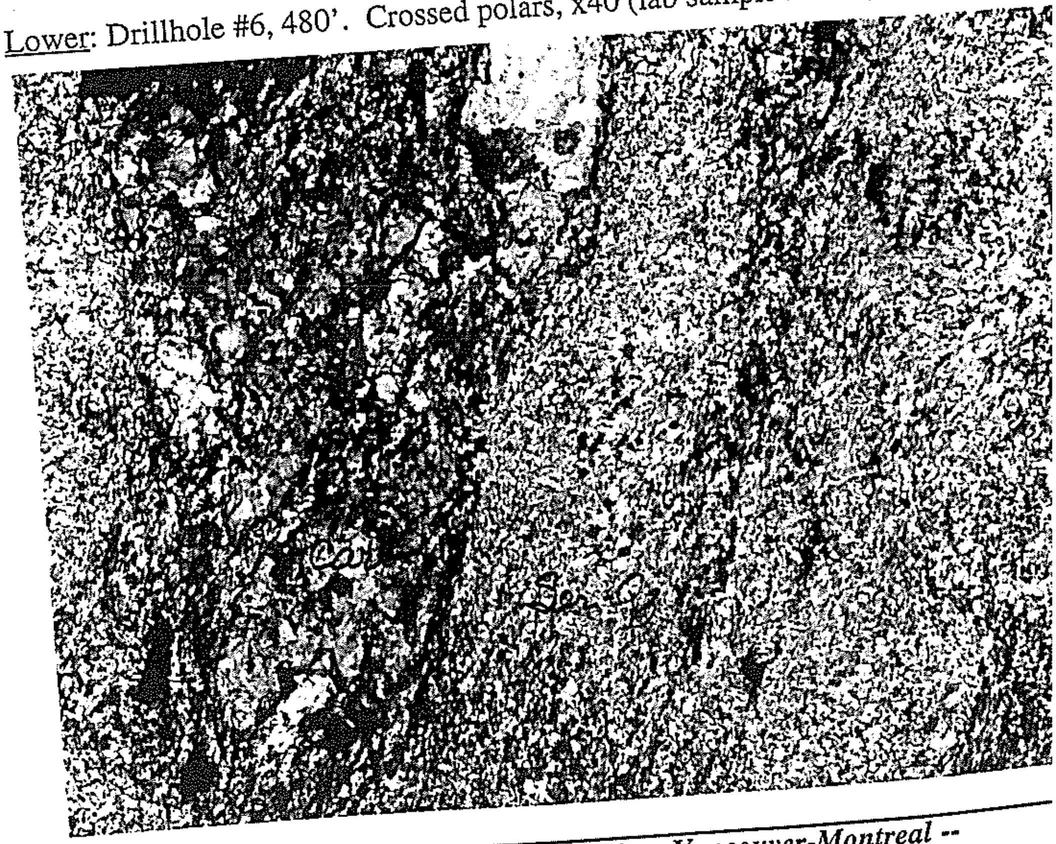


Plate 8. Carscor Porcupine, drillholes #1 and #4

Hole #1, 430' (#26746)
Altered Basic to Intermediate Rock

- Fine-grained matrix enclosing "ghost" plagioclase phenocrysts.
- Matrix is ≈60% quartz, 20% carbonate, 10% sericite, 5% Berlin Blue chlorite, and 3% leucoxene.
- The plagioclase phenocrysts and relatively abundant leucoxene indicate at least an intermediate rock.

Plate 8: upper. Ghost plagioclase phenocrysts in fine-grained matrix. 40X.

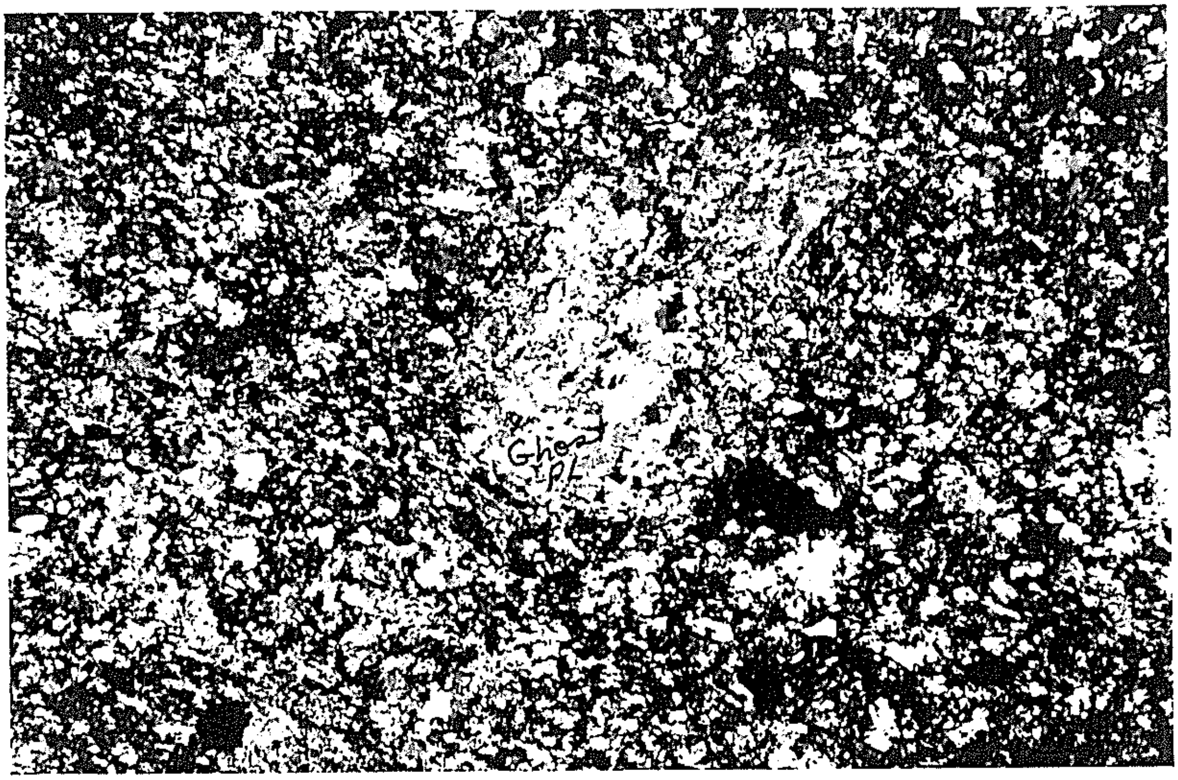
Hole #4, 608' (#26744)
Very Carbonated Rock (Volcanic?) with Quartz Amygdules

- 40% carbonate, 30% sericite, 25% quartz, 5% Berlin Blue chlorite.
- Numerous quartz amygdules, indicating a volcanic rock precursor.
- The sericitization appears to be late and associated with the shearing.

Plate 8: lower. Sericitic shears cutting coarse brown carbonate and quartz matrix. 40X.

Plate 8. Carscor Porcupine, drillholes #1 and #4

Upper: Drillhole #1, 430'. Crossed polars, x40 (lab sample 26746).



Lower: Drillhole #4, 608'. Crossed polars, x40 (lab sample 26744).

Plate 9. Carscor Porcupine, drillholes #4 and #8

Hole #4, 608' (#26744)
Very Carbonated Rock (Volcanic?) with Quartz Amygdules

- 40% carbonate, 30% sericite, 25% quartz, 5% Berlin Blue chlorite.
- Numerous quartz amygdules, indicating a volcanic rock precursor.
- The sericitization appears to be late and associated with the shearing.

Plate 9: upper. Quartz amygdule in carbonate-quartz-sericite matrix. 40X.

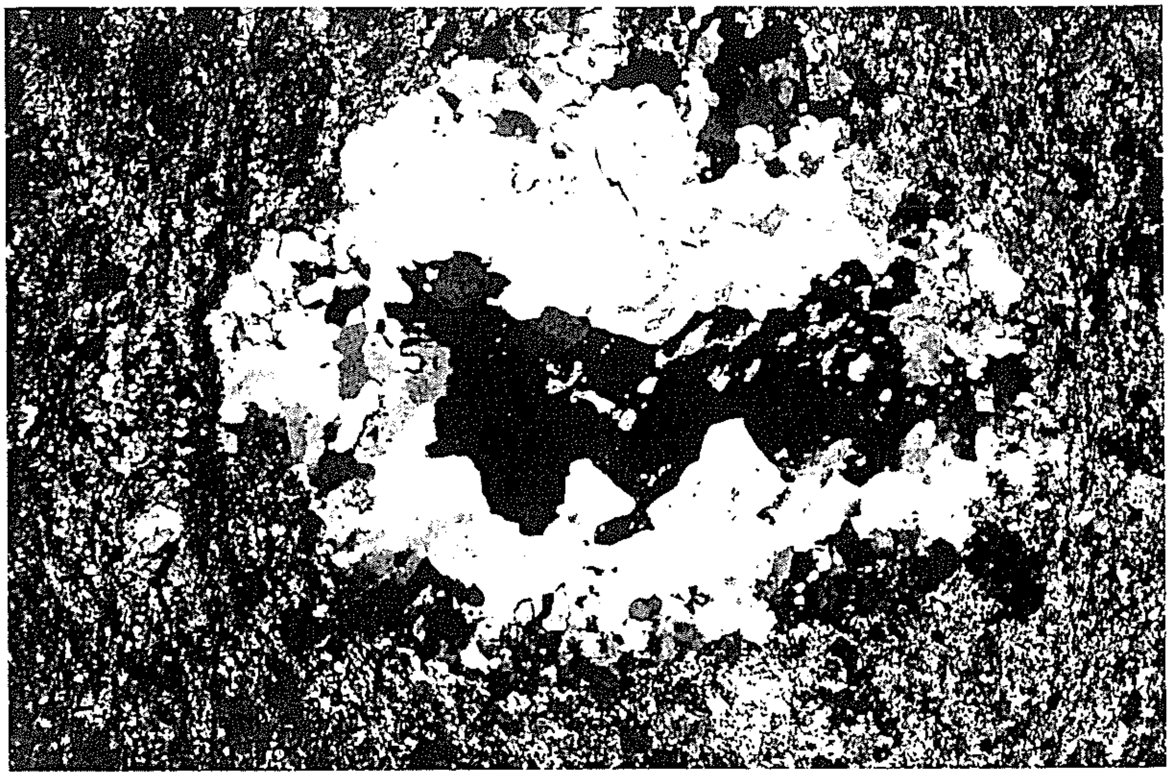
Hole #8, 82' (#26749)
Reworked Felsic Volcanic - Sedimentary Rock

- There are grains of single-crystal quartz (5-8%) that are probably phenocryst fragments.
- The matrix is medium grained and consists of ≈40% quartz, 35% carbonate, 20% sericite, and 5% others.
- Sample appears to be a reworked felsic tuff.

Plate 9: lower. Single-crystal quartz grains which appear to be fragments of quartz phenocrysts, in a quartz-carbonate-sericite matrix. 40X.

Plate 9. Carscor Porcupine, drillholes #4 and #8

Upper: Drillhole #4, 608'. Crossed polars, x40 (lab sample 26744).



Lower: Drillhole #8, 82'. Crossed polars, x40 (lab sample 26749).

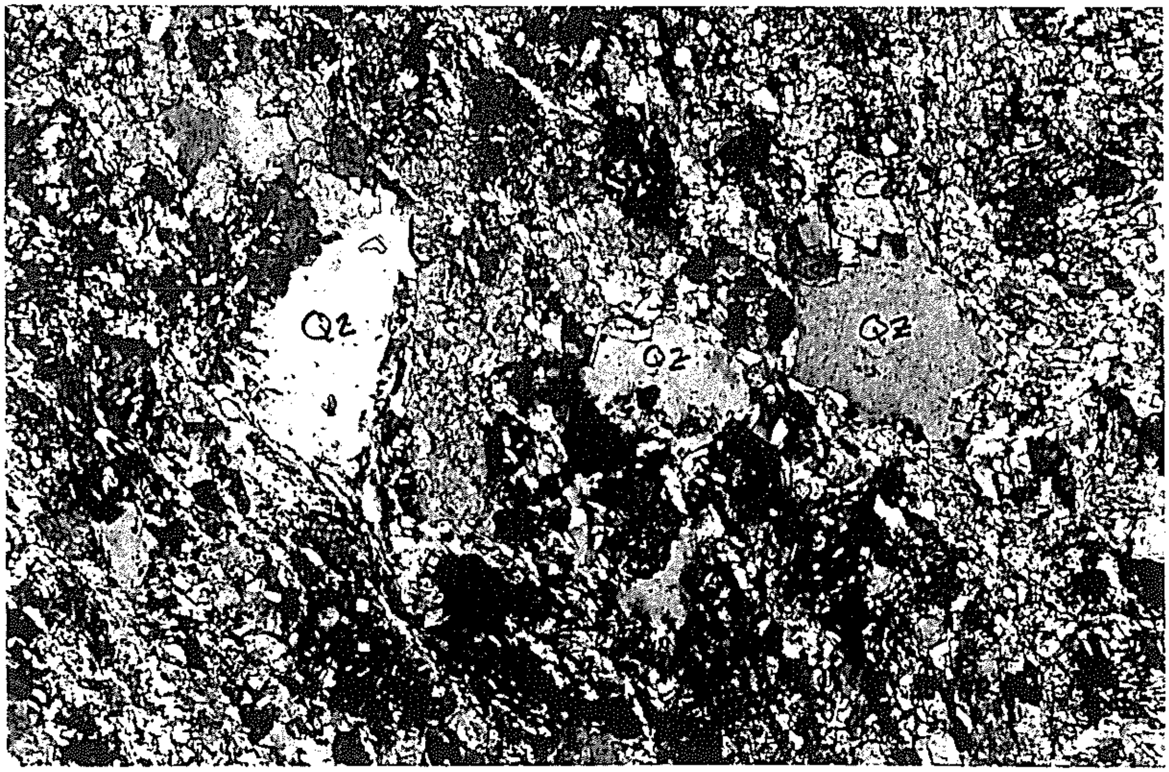


Plate 10. Carscor Porcupine, drillhole #8

Hole #8, 562' (#26750)
Reworked Felsic Volcanic - Sedimentary Rock (Carbonated)

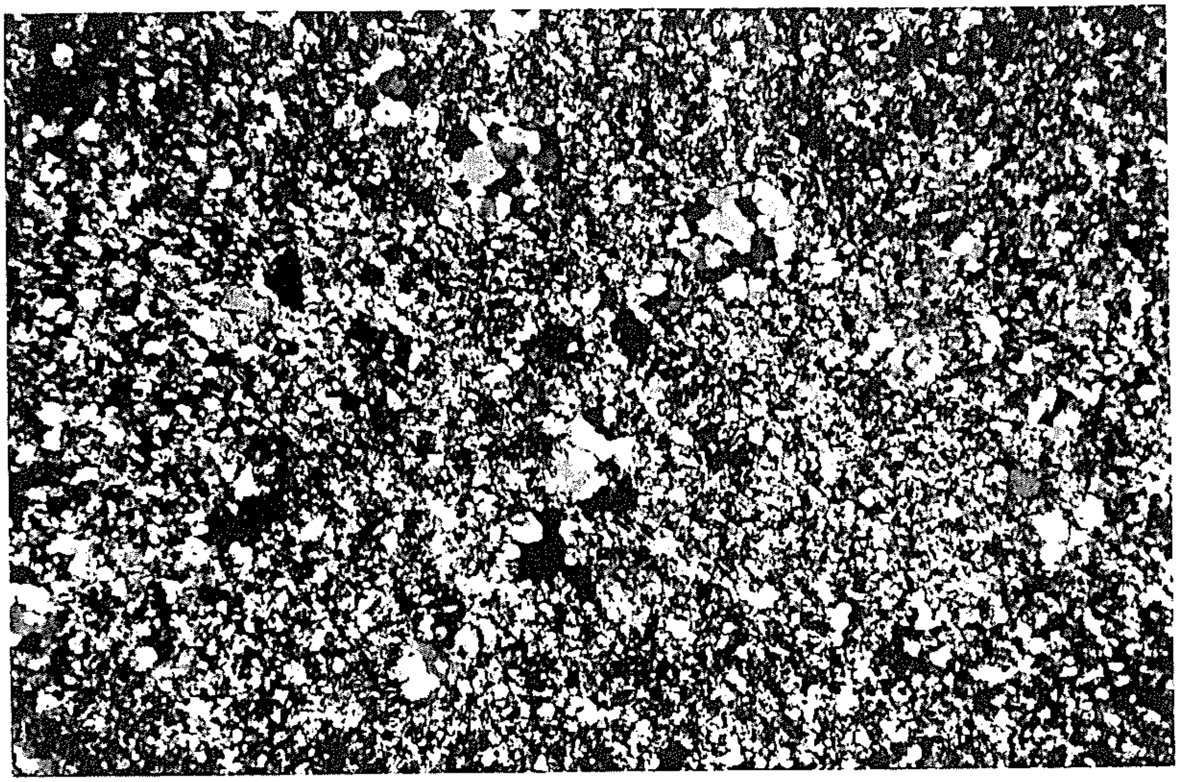
- Sample comprises ≈50% carbonate as veins and matrix, and 50% silicate rock.
- The silicate portion of the sample is massive with a fine-grained equigranular texture of quartz, sericite and carbonate. It also contains well formed quartz amygdules, and on this basis, it appears to be a rhyolite.
- There are no phenocrysts, and no feldspar was seen.

Plate 10: upper. Small quartz amygdules in fine-grained quartz-rich groundmass containing sericite and carbonate. 40X.

Plate 10: lower. Enlargement of groundmass of above photo: Qz+Carb+Ser. 175X.

Plate 10. Carscor Porcupine, drillholes #4 and #8

Upper: Drillhole #8, 562'. Crossed polars, x40 (lab sample 26750).



Lower: Drillhole #8, 562'. Crossed polars, x175 (lab sample 26750).

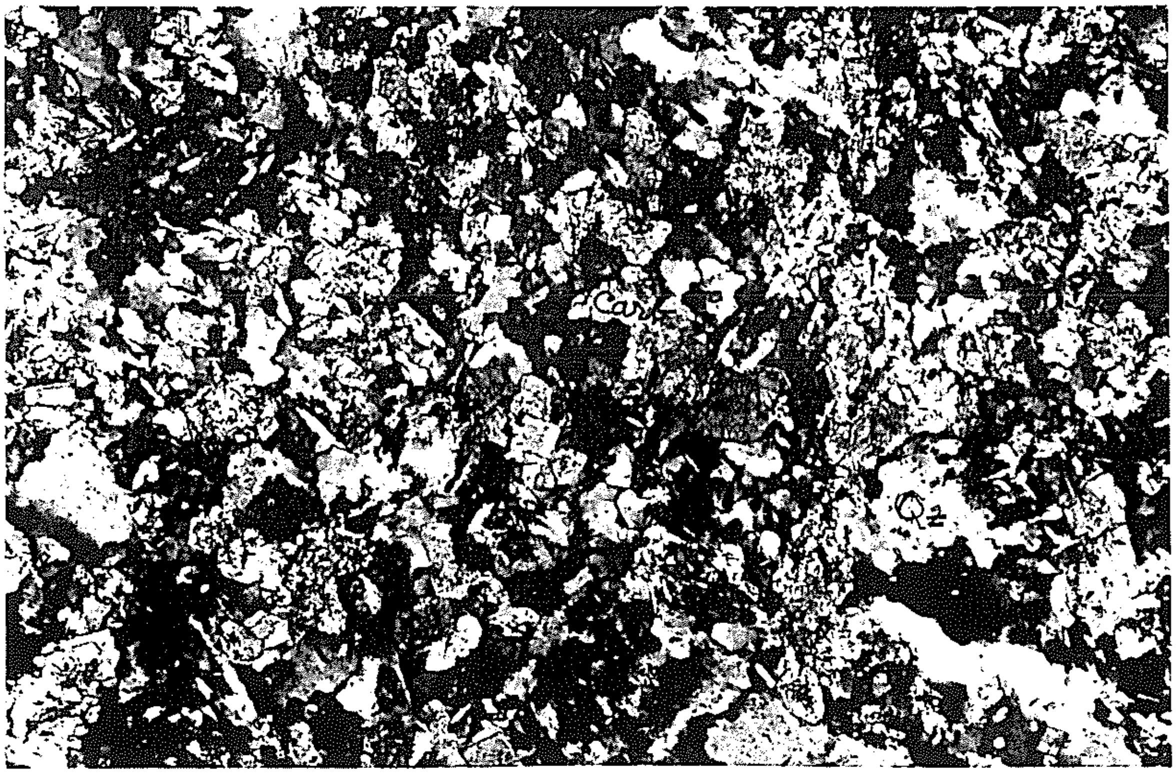


Plate 11. BHP Minerals Canada, drillhole 93-BMD-001

Hole 93-BMD-001 (#59672)
Amygdaloidal Basalt

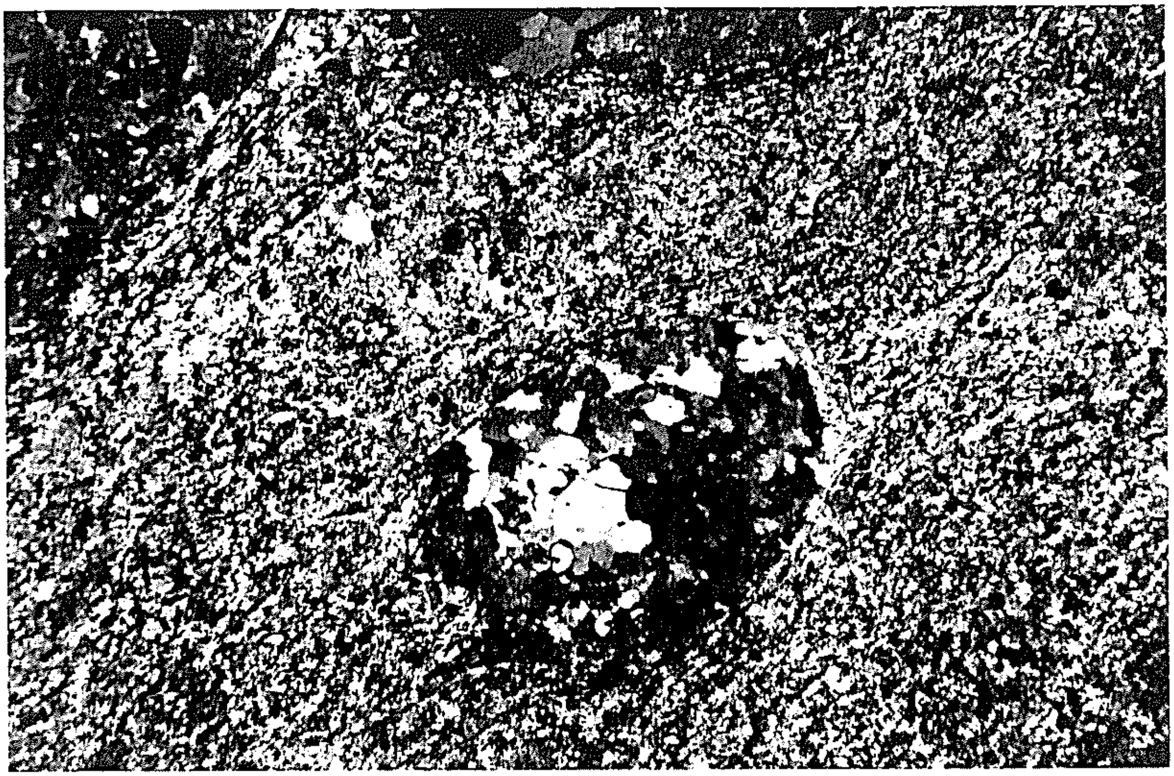
- Fine grained basaltic rock containing numerous carbonate-quartz amygdules in a carbonated and sericitic matrix.
- There is ≈2% leucoxene and ≈25% carbonate in the rock.
- Shears are accentuated with sericite, which forms ≈10% of rock.

Plate 11: upper. Broken carbonate-quartz amygdule in carbonated and sericitized groundmass of basaltic rock. 40X.

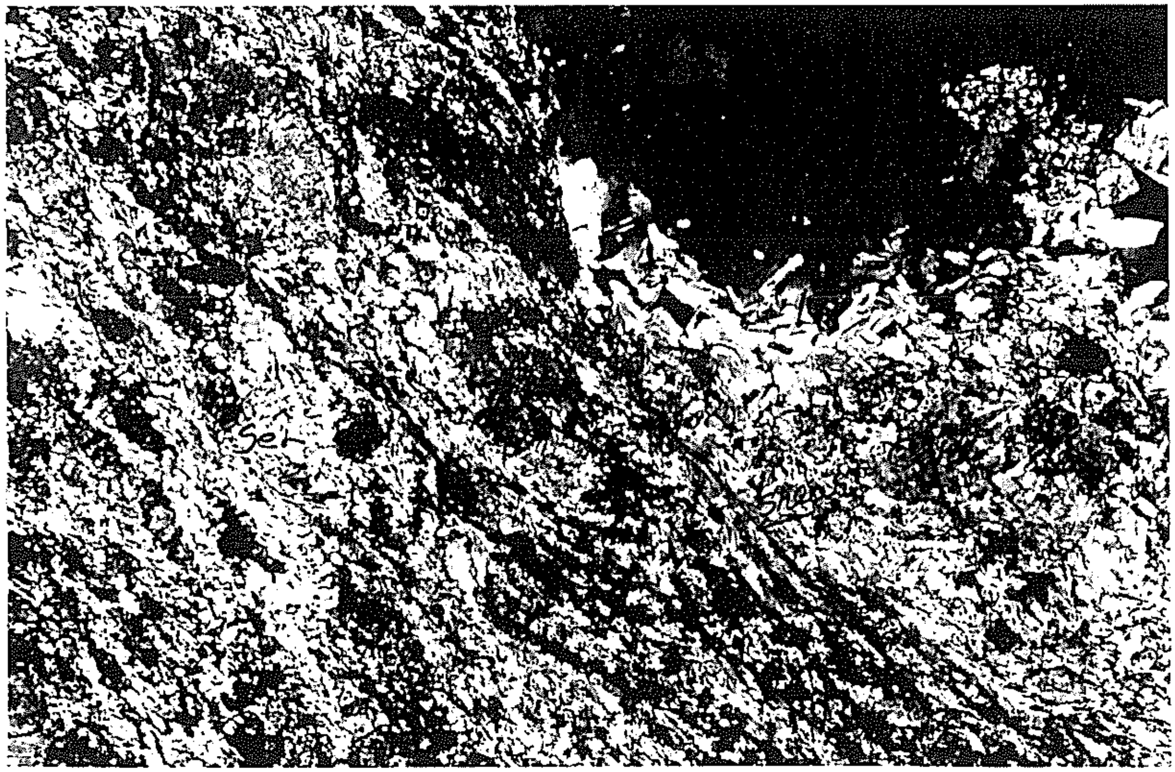
Plate 11: lower. Detail of above photo, illustrating shears and intensity of sericitization in the basalt. 175X.

Plate 11. BHP Minerals Canada, drillhole 93-BMD-001

Upper: Drillhole 93-BMD-001, 115m. Crossed polars, x40 (lab sample 59672).



Lower: Drillhole 93-BMD-001, 115m. Crossed polars, x175 (lab sample 59672).



Carscor hole #13, 665' (#21116)

-- Petrography courtesy of C.H.B.Leitch --

Massive Pyrite-Hematite:
with inclusions/matrix of quartz and Fe-rich carbonate and chlorite

Massive pyrite with a reddish cast probably due to hematite. The modal mineralogy in polished thin section is approximately:

Pyrite	80%
Quartz	10%
Carbonate	5%
Hematite	3%
Chlorite	2%

Pyrite forms coarse subhedral crystals up to 4 mm in diameter as well as fine, sub- to euhedral cubic crystals of less than 0.3 mm size intergrown with quartz and minor hematite. Quartz is commonly fine-grained, anhedral and interlocking in the matrix (10-30 microns), but also forms fibrous crystals to 0.25 mm long around pyrite (pressure shadows). Carbonate forms sub- to anhedral crystals that are also larger in and near pressure shadows (to 0.2 mm); high relief and Fe stain suggests they could be ankerite or siderite. The carbonate crystals are commonly associated with tiny flakes of earthy to specular hematite up to 20 microns in diameter, and with subhedral flakes up to 0.1 mm diameter of Fe-rich chlorite (bright green, high relief, anomalous birefringence, length-slow). This sample consists of a very iron-rich assemblage of pyrite, with minor hematite and Fe-rich chlorite, but it does not appear to contain any base-metal sulfides.

This sample assayed 466/497 ppb Au, 4.5 ppm Ag, 79 ppm Zn and 148 ppm Cu.

Western Carscallen Township: Outcrop Petrography

Outcrop sample 30228:
Quartz Porphyritic Rhyolite

- Small quartz phenocrysts are overgown by lacey quench quartz in optical continuity.
- Variable textures in the section:
    - (a) Quartz porphyritic with fine grained moderately altered (sericitic) groundmass;
    - (b) Coarse grained - mainly quartz (these represent areas of silicification).

Western Carscallen Township: Outcrop

Outcrop sample 30227:
Sericitized Rhyolite Tuff

- Ranges from quartz-sericite-altered rock to sericitite. Fine-grained matrix.
- A few quartz phenocrysts (?) and minor quartz veining are present.

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Appendix

Comments on Stratigraphic Dilemmas and the Use of Lithogeochemistry

It is worth noting, in regard to lithogeochemical studies, that a significant number of the lithological units identified visually by numerous core loggers over the last 50 years have been seriously in error. There are many examples of rocks described as felsic (some even termed rhyolite) which chemically are andesites or basaltic andesites. There are cases of rocks identified as Fe-tholeiitic basalts which are dacites, and of quartzites which are andesite. Rocks which have been identified visually as calc-alkaline can be tholeiitic in chemistry, and vice versa.

Although identifying fine-grained and sometimes altered rocks is by no means an easy task, the fact remains that it is impossible to use drill logs to correlate lithological units from one drill hole to another, let alone from one exploration project to another, without corroborative lithogeochemical data. Worse, the misidentifications get perpetuated in compilation programs in later years. When logs are 'simplified' because of the large scale of many compilations, they problems can become exacerbated to the point that the stratigraphic sequence that appears on a 'new' map can bear little resemblance to the true sequence. Obviously, this is more likely to happen in areas where drilled rocks or outcrops are fine-grained and neither obviously mafic nor felsic, and neither obviously volcanic or sedimentary. Such ambiguous sequences can occur over surprisingly large areas.

Where these sequences are hydrothermally altered, there is no scientific basis to visually based identifications, only guesswork which stands as good a chance at being wrong as right. The irony is that it is some of these very rocks which are considerable interest to the explorationist. The question then becomes: how can one follow a particular lithological zone in an exploration program, if the zone cannot be identified or lacks visually diagnostic features in the first place?

Secondly, without knowledge of the original composition of a lithological unit, it is impossible to determine the degree to which it is hydrothermally altered. For example, altered dacites can turn out to be basalts which are chemically unaltered apart from addition of CO_2 (which then combined with the abundant primary CaO to form carbonate and lighten the rock colour). Thus, the second question that arises is: how can one follow an alteration zone if one cannot tell how altered the rock is?

This is a serious problem, because many rocks that have been regional metamorphosed to greenshist or amphibolite facies have developed a new suite of minerals which are commonly incorrectly attributed to hydrothermal alteration, yet in reality represent little more than isochemical volatile addition to a rock that is otherwise 'dead' from the point of view of a hydrothermal mineralizing system.

As a result of decades of such haphazard identifications of rock types and of unconstrained statements regarding alteration, the stratigraphic framework and alteration features in many areas of exploration interest are very poorly known, despite the fact that numerous holes have been drilled. The problem is heightened by the fact that most of the core from older drilling programs has been discarded or lost, and therefore re-evaluations are not possible. Thus, an unfortunate situation exists in many areas, even those which have ostensibly been explored for at least half a centruy -- namely, that no-one really knows what the rocks are or where they are going. On this basis alone, a case can be made for a certain proportion of stratigraphic drilling in any new exploration program.

Table 1. Chemical Composition of Volcanic Rocks and Iron Formation in Carscallen Township, Ontario

Lab No.	Hole	Depth: ft	SiO2	Al2O3	TiO2	Fe2O3	MnO	MgO	CaO	Na2O	K2O	P2O5	LOI	TOTAL
Cleyo Resources (1983)														
16803	BM-1	87	37.65	13.79	1.10	20.30	0.11	5.96	4.85	1.84	1.46	0.08	10.40	97.53
16839	BM-1	76	71.64	2.21	0.08	18.92	0.04	0.11	0.47	0.35	0.30	0.06	3.67	97.85
16841	BM-1	95	69.46	1.73	0.06	20.37	0.14	0.23	0.22	0.17	0.18	0.12	5.61	98.27
16842	BM-1	98	52.57	12.39	0.49	8.87	0.10	3.63	6.06	0.20	2.92	0.10	11.40	98.74
16843	BM-1	117	53.59	20.45	0.81	11.61	0.03	0.74	0.68	0.41	5.46	0.24	5.29	99.31
16844	BM-1	133	49.64	13.01	0.50	6.82	0.20	3.38	7.82	0.27	3.58	0.28	12.25	97.75
16845	BM-1	150.5	52.65	18.36	0.75	10.14	0.07	3.50	3.71	0.30	3.82	0.14	7.14	100.60
16846	BM-1	179.5	58.00	19.88	0.67	10.04	0.02	2.61	0.58	0.26	4.26	0.08	4.24	100.64
16847	BM-1	190	56.00	14.22	0.56	11.64	0.05	2.10	2.63	0.25	3.42	0.20	6.92	97.98
16811	BM-2	71	93.56	0.64	0.04	2.33	0.01	0.31	0.21	0.13	0.10	0.01	0.38	97.73
16812	BM-2	100	84.21	0.40	0.01	13.45	0.01	0.11	0.08	0.05	0.08	0.04	1.84	100.27
16813	BM-2	107	93.25	0.25	0.01	6.19	0.02	0.08	0.01	0.01	0.06	0.02	0.97	100.87
16814	BM-2	127	59.85	1.96	0.06	21.84	0.18	1.52	0.21	0.01	0.01	0.06	12.06	97.75
16815	BM-2	132	60.95	2.33	0.09	19.15	0.20	2.36	2.16	0.01	0.01	0.06	10.25	97.54
16816	BM-2	140	82.00	0.43	0.01	8.40	0.18	1.47	2.96	0.02	0.04	0.12	3.89	99.50
16817	BM-2	148	20.98	4.80	0.25	40.58	0.30	6.22	0.50	0.01	0.01	0.14	24.27	98.06
16818	BM-2	160	62.97	12.46	0.39	8.27	0.04	2.31	2.89	0.35	2.92	0.20	5.41	98.21
16821	BM-2	165	51.32	14.89	0.68	5.98	0.07	3.00	6.93	0.31	4.38	0.22	10.21	97.98
16820	BM-2	188	66.45	0.30	0.01	10.94	0.11	2.88	6.43	0.01	0.04	0.01	10.67	97.83
16819	BM-2	192	70.75	1.39	0.06	11.28	0.10	2.40	4.07	0.01	0.14	0.02	7.45	97.69
16848	BM-3	67	59.39	16.29	0.79	6.47	0.09	1.38	4.65	2.37	2.70	0.26	6.28	100.68
16849	BM-3	71	56.10	1.50	0.07	14.83	0.27	2.53	10.15	0.21	0.22	0.14	14.70	100.72
16804	BM-3	71	65.02	0.72	0.05	10.13	0.21	1.81	8.29	0.13	0.10	0.02	11.55	98.05
16850	BM-3	81.5	66.61	0.61	0.02	13.74	0.32	1.66	4.22	0.08	0.04	0.04	10.21	97.56
59602	BM-3	90	59.38	16.38	0.69	4.73	0.09	1.09	4.14	2.74	3.32	0.22	6.81	99.58
59603	BM-3	95	47.36	10.82	0.56	15.26	0.22	2.48	8.74	0.52	1.60	0.12	13.22	100.89
59604	BM-3	101	61.10	16.70	0.74	5.63	0.13	0.57	3.95	2.17	3.60	0.20	5.88	100.69
59605	BM-3	104	59.16	14.91	0.77	5.48	0.10	1.31	4.19	1.37	3.60	0.24	7.47	98.60
59606	BM-3	120.5	41.48	17.17	0.68	3.97	0.17	0.32	15.43	3.45	3.26	0.20	14.67	100.81

Table 1. Chemical Composition of Volcanic Rocks and Iron Formation in Carscallen Township, Ontario

Lab No.	Hole	Depth: ft	Cr ppm	V ppm	Sc ppm	Co ppm	Ni ppm	Cu ppm	Zn ppm	Pb ppm	Ba ppm	Sr ppm	Rb ppm	Nb ppm	Y ppm	Zr ppm
Cleyo Resources (1983)																
16803	BM-1	87	975	350	43	40	195	190	750		250	140	< .05	< 30	14	80
16839	BM-1	76	260	80	2	5	35	15	235		60		< .05	< 30	10	30
16841	BM-1	95	210	85	2	15	10	100	475		30		< .05	< 30	12	30
16842	BM-1	98	220	90	11	20	30	105	555		310		< .05	< 30	16	150
16843	BM-1	117	260	170	18	60	40	210	1850		610		< .05	< 30	28	160
16844	BM-1	133	215	120	11	30	70	110	685		350		< .05	< 30	18	90
16845	BM-1	150.5	200	155	17	35	65	60	295		460		< .05	< 30	16	180
16846	BM-1	179.5	115	105	16	15	20	50	500		520		< .05	< 30	28	330
16847	BM-1	190	300	125	13	65	70	390	3030		440		< .05	< 30	26	110
16811	BM-2	71	555	35	1	5	15	65	35		5	5	< .05	< 30	1	5
16812	BM-2	100	260	35	1	10	35	205	550		30	5	< .05	< 30	8	5
16813	BM-2	107	1310	35	1	15	65	30	440		5	5	< .05	< 30	1	5
16814	BM-2	127	410	40	3	3	70	210	190		20	5	< .05	< 30	8	5
16815	BM-2	132	280	50	2	10	25	150	60		40	30	< .05	< 30	8	10
16816	BM-2	140	785	50	1	15	45	115	1080		20	50	< .05	< 30	6	5
16817	BM-2	148	230	55	6	5	90	220	230		40	5	< .05	< 30	14	40
16818	BM-2	160	545	85	10	65	90	490	6645		390	70	< .05	< 30	18	100
16821	BM-2	165	155	95	10	10	45	40	610		580	130	< .05	< 30	22	120
16820	BM-2	188	315	15	1	10	3	3	175		20	80	< .05	< 30	1	5
16819	BM-2	192	340	25	2	10	3	35	340		40	50	< .05	< 30	4	5
16848	BM-3	67	320	140	15	20	30	90	270		400		< .05	< 30	22	220
16849	BM-3	71	120	45	2	30	105	50	80		50		< .05	< 30	4	10
16804	BM-3	71	320	40	2	20	65	40	265		20	60	< .05	< 30	4	5
16850	BM-3	81.5	385	40	1	10	30	15	120		10		< .05	< 30	1	10
59602	BM-3	90	345	160	17	20	80	30	95		510		< .05	< 30	20	130
59603	BM-3	95	300	120	15	25	85	85	165		280		< .05	< 30	14	70
59604	BM-3	101	475	130	18	15	25	15	105		530		< .05	< 30	20	120
59605	BM-3	104	350	145	20	10	10	35	60		550		< .05	< 30	28	90
59606	BM-3	120.5	155	155	20	10	55	30	110		500		< .05	< 30	20	100

Table 1. Chemical Composition of Volcanic Rocks and Iron Formation in Carscallen Township, Ontario

Lab No.	Hole	Depth: ft	SiO2	Al2O3	TiO2	Fe2O3	MnO	MgO	CaO	Na2O	K2O	P2O5	LOI	TOTAL
Cleyo Resources (cont.)														
59607	BM-3	151	58.54	21.48	1.04	3.81	0.01	0.96	1.14	0.58	6.06	0.28	4.04	97.95
59608	BM-3	175	51.12	19.27	0.87	10.53	0.03	2.60	1.51	0.29	4.78	0.14	6.40	97.52
59609	BM-3	187	56.81	16.14	0.74	9.75	0.03	2.67	1.86	0.24	3.74	0.14	5.51	97.63
59610	BM-3	205	50.17	17.56	0.84	7.70	0.04	2.89	4.96	0.28	4.66	0.24	9.39	98.73
59611	BM-3	214	80.72	1.47	0.05	7.87	0.07	1.25	1.74	0.26	0.28	0.02	4.66	98.39
16805	BM-4	160	43.91	1.38	0.06	48.71	0.05	2.08	2.57	0.06	0.04	0.18	< .01	98.09
59612	BM-4	82	57.70	1.26	0.06	20.64	0.59	1.81	5.13	0.01	0.02	0.06	12.58	99.88
59613	BM-4	93	58.24	15.23	0.64	4.79	0.12	0.89	5.71	3.17	2.96	0.20	7.56	99.51
59614	BM-4	102	71.60	6.36	0.26	12.11	0.10	1.52	3.12	0.20	0.28	0.08	5.04	100.67
59615	BM-4	104	59.70	19.52	0.80	3.73	0.07	0.85	2.96	1.95	4.78	0.22	5.84	100.41
59616	BM-4	110	53.65	21.68	0.75	3.26	0.05	0.98	3.03	2.69	5.24	0.12	6.22	97.67
59617	BM-4	118	57.08	8.21	0.39	24.56	0.08	1.72	0.35	0.15	0.34	0.16	5.45	98.47
59618	BM-4	132	67.77	2.54	0.10	23.10	0.10	0.51	0.16	0.03	0.06	0.10	3.59	98.06
59619	BM-4	158	49.57	18.56	0.82	7.36	0.06	2.36	5.61	0.41	5.20	0.14	10.19	100.27
59620	BM-4	180	50.42	18.33	0.75	7.03	0.04	2.52	3.82	0.38	5.40	0.20	9.01	97.89
59621	BM-4	187	84.31	1.96	0.04	3.67	0.04	1.33	3.46	0.09	0.38	0.04	4.36	99.67
59622	BM-4	196.5	48.51	11.14	0.52	26.08	0.07	4.54	1.72	0.04	0.12	0.14	7.70	100.61
16822	BM-5	66	49.52	17.21	0.69	6.91	0.09	3.91	6.75	7.15	0.28	0.18	7.16	99.83
16823	BM-5	86	50.17	18.08	0.76	7.24	0.08	3.82	5.91	7.55	0.12	0.18	5.21	99.13
16824	BM-5	106	40.42	18.51	0.80	10.32	0.15	4.16	9.64	1.22	3.00	0.22	9.86	98.30
16833	BM-5	109	42.79	18.04	0.78	15.99	0.13	5.06	5.53	1.78	2.58	0.18	7.48	100.35
16825	BM-5	112	36.96	4.92	0.27	24.18	0.40	4.51	20.90	0.75	0.22	0.14	5.64	98.89
16826	BM-5	122	43.84	5.44	0.19	33.02	0.24	4.73	7.80	0.37	0.38	0.10	1.95	98.03
16827	BM-5	137	45.34	2.96	0.17	40.12	0.15	4.43	5.94	0.23	0.28	0.08	0.49	100.21
16828	BM-5	145.5	57.36	1.42	0.09	27.18	0.22	3.14	7.65	0.22	0.38	0.24	1.01	98.89
16829	BM-5	150	88.35	1.09	0.03	6.48	0.03	0.64	0.92	0.01	0.04	0.04	1.39	99.01
16830	BM-5	155	45.32	9.52	0.47	28.09	0.10	6.62	2.97	0.04	0.04	0.18	4.83	98.18
16831	BM-5	160.5	90.93	0.64	0.03	4.52	0.02	0.70	0.59	0.05	0.06	0.02	0.36	97.92
16832	BM-5	167	50.28	5.02	0.19	28.46	0.19	6.59	7.94	0.10	0.04	0.04	2.03	100.89

Table 1. Chemical Composition of Volcanic Rocks and Iron Formation in Carscallen Township, Ontario

Lab No.	**Hole**	**Depth: ft**	**Cr** ppm	**V** ppm	**Sc** ppm	**Co** ppm	**Ni** ppm	**Cu** ppm	**Zn** ppm	**Pb** ppm	**Ba** ppm	**Sr** ppm	**Rb** ppm	**Nb** ppm	**Y** ppm	**Zr** ppm
Cleyo Resources (cont.)																
59607	BM-3	151	300	235	27	45	75	160	1420		720		< .05	< 30	22	140
59608	BM-3	175	215	115	23	25	40	185	2555		540		< .05	< 30	22	260
59609	BM-3	187	340	135	19	40	45	120	2995		520		< .05	< 30	20	100
59610	BM-3	205	245	205	25	50	10	175	2535		760		< .05	< 30	18	110
59611	BM-3	214	675	25	2	3	3	20	165		60		< .05	< 30	12	10
16805	BM-4	160	340	60	3	15	3	55	265		60	20	< .05	< 30	16	70
59612	BM-4	82	450	20	4	15	70	40	85		20		< .05	< 30	6	20
59613	BM-4	93	225	140	17	10	15	15	80		430		< .05	< 30	16	110
59614	BM-4	102	290	60	7	15	55	20	250		60		< .05	< 30	12	40
59615	BM-4	104	245	155	21	10	60	20	60		660		< .05	< 30	12	150
59616	BM-4	110	295	180	24	10	3	45	80		760		< .05	< 30	16	120
59617	BM-4	118	275	70	10	20	3	140	760		60		< .05	< 30	18	90
59618	BM-4	132	595	55	3	20	3	155	420		5		< .05	< 30	10	30
59619	BM-4	158	220	175	21	25	85	75	875		590		< .05	< 30	22	170
59620	BM-4	180	185	145	20	30	75	190	900		720		< .05	< 30	16	140
59621	BM-4	187	610	35	2	5	20	25	30		50		< .05	< 30	2	5
59622	BM-4	196.5	220	110	15	20	40	15	385		30		< .05	< 30	14	80
16822	BM-5	66	85	110	15	20	95	10	95		80	240	< .05	< 30	20	130
16823	BM-5	86	110	100	17	20	70	3	105		60	170	< .05	< 30	22	140
16824	BM-5	106	105	145	19	10	60	30	560		390	130	< .05	< 30	20	150
16833	BM-5	109	135	175	18	15	40	115	310		400	160	< .05	< 30	18	140
16825	BM-5	112	180	105	10	15	100	40	690		70	130	< .05	< 30	16	40
16826	BM-5	122	270	75	5	5	45	55	225		150	50	< .05	< 30	18	5
16827	BM-5	137	335	75	5	15	30	35	440		100	40	< .05	< 30	12	20
16828	BM-5	145.5	665	55	2	15	65	35	195		110	50	< .05	< 30	14	30
16829	BM-5	150	605	35	1	5	50	75	220		40	5	< .05	< 30	4	5
16830	BM-5	155	190	120	13	15	35	40	385		60	20	< .05	< 30	16	50
16831	BM-5	160.5	765	30	1	5	30	30	25		50	5	< .05	< 30	1	10
16832	BM-5	167	190	165	4	20	130	105	160		40	30	< .05	< 30	2	30

Table 1. Chemical Composition of Volcanic Rocks and Iron Formation in Carscallen Township, Ontario

Lab No.	Hole	Depth: ft	SiO_2	Al_2O_3	TiO_2	Fe_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	LOI	TOTAL
Cleyo Resources (cont.)														
16834	BM-6	67	49.27	18.43	0.80	8.72	0.09	4.93	4.75	6.96	0.20	0.18	5.11	99.43
16835	BM-6	101	49.85	17.51	0.82	8.50	0.10	4.53	5.77	6.98	0.08	0.18	6.41	100.73
16836	BM-6	136	58.32	15.39	0.68	6.95	0.10	3.74	4.18	5.43	0.66	0.16	4.62	100.24
16837	BM-6	157	43.03	21.18	1.02	10.20	0.09	5.59	5.45	3.32	2.90	0.22	7.82	100.80
16838	BM-6	177	59.84	11.80	0.55	10.46	0.08	4.98	2.50	1.22	0.98	0.14	5.86	98.40
59623	BM-7	73	38.91	9.20	0.44	11.11	0.42	3.73	15.62	0.96	0.56	0.08	19.48	100.51
59624	BM-7	89	59.76	16.70	0.68	10.67	0.39	0.59	2.23	2.22	1.32	0.14	5.30	100.01
59625	BM-7	92	41.28	10.70	0.45	6.80	0.25	3.94	14.98	1.74	0.92	0.10	19.58	100.73
59626	BM-7	111	56.36	10.86	0.44	6.63	0.29	0.31	10.79	1.60	0.96	0.12	10.01	98.36
59627	BM-7	120	60.31	16.22	0.69	5.45	0.09	1.40	4.78	2.30	1.62	0.16	7.61	100.63
59628	BM-7	126	59.37	16.86	0.67	6.22	0.12	0.22	5.29	2.95	1.64	0.14	6.89	100.37
59629	BM-7	138	28.01	9.29	0.32	3.73	0.23	0.77	29.74	1.54	0.86	0.10	26.31	100.90
59630	BM-7	154	78.95	4.39	0.12	9.00	0.04	1.09	1.67	0.16	0.04	0.06	2.53	98.05
59631	BM-7	173.5	66.56	16.08	0.51	5.41	0.04	2.06	0.25	1.18	2.80	0.12	2.99	98.00
59632	BM-7	184	61.80	10.26	0.98	14.37	0.08	5.27	0.50	0.51	0.20	0.10	4.35	98.43
59633	BM-7	195	49.79	13.04	1.29	14.20	0.13	6.71	4.16	1.23	0.48	0.18	8.82	100.00
59634	BM-8	51	46.51	14.25	0.73	10.40	0.14	3.85	7.33	1.11	1.80	0.08	11.76	97.98
59635	BM-8	56	54.95	3.79	0.16	15.12	0.32	2.93	9.03	0.08	0.14	0.12	11.07	97.70
59636	BM-8	69	54.53	13.82	0.83	7.23	0.12	2.26	6.48	1.26	1.74	0.42	8.94	97.64
59637	BM-8	79	44.62	17.97	0.71	6.36	0.16	0.29	11.92	2.43	1.78	0.22	11.59	98.05
59638	BM-8	85	57.60	8.67	0.35	23.40	0.20	1.60	0.97	0.33	0.14	0.08	4.90	98.24
59639	BM-8	96	62.58	18.42	0.69	8.92	0.16	0.88	0.52	2.37	1.64	0.16	3.94	100.28
59640	BM-8	114	61.45	17.93	0.68	8.32	0.22	0.28	0.58	2.79	1.42	0.16	4.04	97.87
59642	BM-8	126	52.37	13.58	0.50	10.01	0.22	2.57	6.00	1.54	0.84	0.10	9.82	97.55
59643	BM-8	139	55.95	11.64	0.48	9.92	0.14	2.39	7.42	1.52	0.58	0.10	10.25	100.39
59644	BM-8	152	56.59	18.84	0.69	4.96	0.08	1.26	4.20	2.34	1.92	0.16	6.72	97.75
59645	BM-8	157	56.65	2.41	0.10	16.81	0.65	2.20	9.67	0.19	0.10	0.01	9.01	97.80
59646	BM-8	172	53.02	15.24	0.46	6.83	0.15	1.41	8.36	2.44	1.62	0.12	9.05	98.72
59647	BM-8	182	58.55	15.25	0.49	5.87	0.11	1.56	6.26	1.48	1.54	0.12	6.66	97.89
59648	BM-8	187	65.95	16.99	0.52	3.34	0.05	0.81	2.28	1.81	1.98	0.14	3.75	97.61
59649	BM-8	195	65.15	17.36	0.53	3.83	0.05	0.88	2.57	1.44	2.46	0.12	3.79	98.20

Table 1. Chemical Composition of Volcanic Rocks and Iron Formation in Carscallen Township, Ontario

Lab No.	Hole	Depth: ft	Cr	V	Sc	Co	Ni	Cu	Zn	Pb	Ba	Sr	Rb	Nb	Y	Zr
Cleyo Resources (cont.)																
16834	BM-6	67	70	135	18	25	75	5	135		70	180	< .05	< 30	24	150
16835	BM-6	101	120	125	19	20	35	90	145		70	240	< .05	< 30	22	170
16836	BM-6	136	310	150	16	20	70	25	125		180	250	< .05	< 30	18	110
16837	BM-6	157	45	200	22	25	100	10	130		450	250	< .05	< 30	18	190
16838	BM-6	177	410	150	12	25	115	35	165		160	80	< .05	< 30	12	80
59623	BM-7	73	200	105	13	15	70	40	75		110		< .05	< 30	12	50
59624	BM-7	89	550	150	20	25	55	45	75		290		< .05	< 30	20	90
59625	BM-7	92	250	110	14	20	30	30	15		190		< .05	< 30	12	70
59626	BM-7	111	295	110	13	15	30	15	40		200		< .05	< 30	20	80
59627	BM-7	120	350	130	16	10	35	35	45		370		< .05	< 30	18	120
59628	BM-7	126	205	130	18	15	35	50	70		380		< .05	< 30	14	100
59629	BM-7	138	85	75	10	5	25	20	50		420		< .05	< 30	6	70
59630	BM-7	154	925	55	5	20	35	170	980		50		< .05	< 30	10	40
59631	BM-7	173.5	335	140	20	20	15	3	65		540		< .05	< 30	10	120
59632	BM-7	184	315	215	29	40	75	3	140		60		< .05	< 30	22	90
59633	BM-7	195	230	295	43	45	45	35	130		90		< .05	< 30	40	60
59634	BM-8	51	265	145	23	20	55	15	90		170		< .05	< 30	12	90
59635	BM-8	56	275	55	6	10	40	35	190		20		< .05	< 30	12	30
59636	BM-8	69	615	155	24	45	80	55	120		270		< .05	< 30	32	80
59637	BM-8	79	290	255	48	60	220	110	100		330		< .05	< 30	26	70
59638	BM-8	85	155	125	17	55	245	115	180		60		< .05	< 30	16	70
59639	BM-8	96	600	200	27	20	95	55	110		360		< .05	< 30	16	100
59640	BM-8	114	350	180	27	30	10	45	95		340		< .05	< 30	22	110
59642	BM-8	126	185	140	21	20	20	45	90		170		< .05	< 30	10	80
59643	BM-8	139	365	125	22	30	50	45	110		130		< .05	< 30	20	90
59644	BM-8	152	255	160	22	20	3	60	95		420		< .05	< 30	20	120
59645	BM-8	157	415	60	9	30	35	255	1230		40		< .05	< 30	6	20
59646	BM-8	172	180	135	19	15	15	50	170		250		< .05	< 30	12	100
59647	BM-8	182	100	115	21	20	3	110	315		260		< .05	< 30	10	100
59648	BM-8	187	345	130	18	15	40	290	1350		340		< .05	< 30	14	100
59649	BM-8	195	300	155	18	20	20	155	745		430		< .05	< 30	8	100

Table 1. Chemical Composition of Volcanic Rocks and Iron Formation in Carscallen Township, Ontario

Lab No.	Hole	Depth: ft	SiO2	Al2O3	TiO2	Fe2O3	MnO	MgO	CaO	Na2O	K2O	P2O5	LOI	TOTAL
Cleyo Resources (cont.)														
59650	BM-9	62?	55.35	2.08	0.08	23.80	0.35	2.28	0.87	0.14	0.14	0.04	12.47	97.59
59651	BM-9	86	40.15	11.60	0.72	10.83	0.18	8.12	9.82	1.10	0.36	0.08	17.02	99.97
59652	BM-9	101	77.88	2.37	0.09	12.15	0.06	0.68	0.62	0.25	0.22	0.06	3.61	98.00
59653	BM-9	109	39.61	13.24	0.75	10.65	0.14	6.91	8.80	1.51	0.26	0.10	15.54	97.52
59654	BM-9	118	41.65	14.26	0.83	11.67	0.21	4.19	10.88	1.57	0.24	0.10	11.96	97.56
59655	BM-9	137	68.79	1.32	0.08	22.23	0.21	0.50	1.04	0.12	0.02	0.04	4.26	98.61
59656	BM-9	138	72.17	1.63	0.06	20.08	0.08	0.43	0.16	0.02	0.02	0.04	3.75	98.44
16806	BM-9	139	70.54	0.87	0.02	23.04	0.12	0.33	0.23	0.04	0.02	0.04	3.65	98.90
59657	BM-9	146	61.35	8.12	0.21	19.57	0.05	1.85	0.19	0.04	0.01	0.10	7.26	98.73
59658	BM-9	151	67.06	1.05	0.05	24.28	0.10	0.48	0.20	0.02	0.01	0.10	4.85	98.20
59659	BM-9	160	78.95	0.61	0.02	14.30	0.08	0.44	0.31	0.02	0.06	0.06	3.70	98.54
59660	BM-9	174	62.55	14.78	0.62	4.69	0.13	1.36	3.26	1.63	2.92	0.24	5.62	97.79
59661	BM-9	177	47.54	8.29	0.27	16.07	0.08	1.40	2.00	0.34	1.46	0.08	20.53	98.06
59662	BM-9	181	45.83	20.12	0.87	6.01	0.17	2.44	6.03	1.92	4.28	0.20	10.22	98.10
59663	BM-9	196	58.39	1.28	0.28	21.60	0.40	2.24	2.07	0.12	0.28	0.20	11.78	98.64
59664	BM-10	59	55.95	2.10	0.09	24.78	0.51	1.60	0.57	0.03	0.02	0.10	11.78	97.53
59665	BM-10	84	61.26	0.60	0.03	18.20	0.23	2.33	3.87	0.02	0.04	0.02	11.64	98.24
59666	BM-10	100	66.54	1.02	0.04	14.77	0.25	2.64	3.86	0.02	0.08	0.06	8.37	97.64
59667	BM-10	114	40.93	12.73	0.81	11.56	0.24	6.84	9.01	0.44	1.84	0.10	16.17	100.67
59668	BM-10	122	76.95	2.08	0.09	11.08	0.21	1.32	1.71	0.08	0.10	0.04	3.85	97.51
59669	BM-10	136	71.45	0.74	0.04	19.06	0.13	0.69	0.83	0.05	0.04	0.01	4.94	97.96
Alwyn Porcupine (1946 holes)														
26734	#5	260	73.95	11.76	0.14	2.12	0.05	0.44	1.40	2.42	2.12	0.04	3.35	97.78
26735	#5	350	79.75	7.27	0.06	1.59	0.05	0.97	1.99	0.46	1.74	0.04	4.11	98.03
26736	#5	480	59.38	12.83	0.43	5.02	0.13	1.24	5.57	2.49	1.80	0.10	8.84	97.83
26730	#6	100	59.95	12.25	0.77	8.34	0.10	2.21	2.58	1.72	1.54	0.16	8.42	98.05
26731	#6	300	50.93	15.31	0.68	7.70	0.17	3.35	6.35	4.37	1.02	0.16	10.45	100.48
26732	#6	379	66.85	1.76	0.07	11.71	0.24	1.80	5.75	0.20	0.06	0.20	8.84	97.50
26733	#6	480	50.22	15.29	0.61	4.54	0.19	1.17	9.06	2.13	2.76	0.10	11.47	97.54

Table 1. Chemical Composition of Volcanic Rocks and Iron Formation in Carscallen Township, Ontario

Lab No.	Hole	Depth: ft	Cr ppm	V ppm	Sc ppm	Co ppm	Ni ppm	Cu ppm	Zn ppm	Pb ppm	Ba ppm	Sr ppm	Rb ppm	Nb ppm	Y ppm	Zr ppm
Cleyo Resources (cont.)																
59650	BM-9	62?	380	55	3	15	30	50	355		50		< .05	< 30	12	40
59651	BM-9	86	635	215	37	45	240	70	90		40		< .05	< 30	16	40
59652	BM-9	101	1070	60	5	20	25	85	915		40		< .05	< 30	14	30
59653	BM-9	109	270	225	38	40	170	85	125		40		< .05	< 30	20	5
59654	BM-9	118	280	260	42	50	160	90	95		40		< .05	< 30	18	40
59655	BM-9	137	360	55	4	10	40	15	80		20		< .05	< 30	14	10
59656	BM-9	138	780	80	4	15	70	40	240		20		< .05	< 30	10	20
16806	BM-9	139	420	45	1	10	5	25	270		20	5	< .05	< 30	8	10
59657	BM-9	146	1130	95	8	35	80	205	1255		10		< .05	< 30	10	60
59658	BM-9	151	560	40	4	10	3	40	300		20		< .05	< 30	14	30
59659	BM-9	160	510	45	1	10	30	35	135		20		< .05	< 30	12	20
59660	BM-9	174	470	135	20	10	10	30	195		330		< .05	< 30	18	110
59661	BM-9	177	525	65	10	60	100	260	620		160		< .05	< 30	10	80
59662	BM-9	181	300	190	30	15	75	35	80		490		< .05	< 30	24	150
59663	BM-9	196	460	3040	12	20	350	215	105		410		< .05	< 30	44	100
59664	BM-10	59	540	210	5	30	45	110	965		50		< .05	< 30	20	120
59665	BM-10	84	885	45	2	15	15	45	170		30		< .05	< 30	10	20
59666	BM-10	100	295	80	3	15	100	45	2090		10		< .05	< 30	16	40
59667	BM-10	114	940	220	35	45	255	65	350		230		< .05	< 30	12	70
59668	BM-10	122	455	55	5	5	20	60	230		30		< .05	< 30	10	30
59669	BM-10	136	805	60	2	20	3	45	475		20		< .05	< 30	10	30
Alwyn Porcupine (1946 holes)																
26734	#5	260	160	30	3	3	3	15	95		320	40	< .05	< 30	104	290
26735	#5	350	140	50	2	3	3	10	25		260	30	< .05	< 30	66	130
26736	#5	480	165	85	10	10	95	35	130		300	100	< .05	< 30	24	130
26730	#6	100	175	115	15	20	70	25	125		510	100	< .05	< 30	44	260
26731	#6	300	120	130	16	25	75	55	60		230	130	< .05	< 30	20	120
26732	#6	379	310	40	2	10	3	20	75		40	90	< .05	< 30	10	10
26733	#6	480	545	240	31	45	170	90	50		360	110	< .05	< 30	12	60

Table 1. Chemical Composition of Volcanic Rocks and Iron Formation in Carscallen Township, Ontario

Lab No.	Hole	Depth: ft	SiO_2	Al_2O_3	TiO_2	Fe_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	LOI	TOTAL
Carscor Porcupine (1946 holes)														
26745	#1	160	55.33	14.35	0.87	7.20	0.11	4.20	5.80	4.53	0.10	0.20	7.04	99.72
26746	#1	430	53.95	12.93	0.76	5.70	0.09	3.61	5.00	3.74	0.48	0.20	11.14	97.60
26741	#4	265	50.71	13.13	0.83	7.64	0.13	2.03	7.28	1.77	1.44	0.20	12.76	97.90
26742	#4	297	49.20	16.85	0.74	6.05	0.11	2.32	6.59	2.22	1.70	0.16	12.05	97.97
26743	#4	509	58.54	14.56	0.64	2.57	0.05	0.82	7.84	2.16	0.98	0.14	9.62	97.93
26744	#4	608	53.68	13.87	0.62	5.22	0.09	3.20	6.91	2.41	0.92	0.14	10.84	97.88
26737	#5	117	50.95	14.42	0.62	6.28	0.11	2.26	6.80	2.48	1.44	0.16	12.33	97.85
26738	#5	288	65.54	13.37	0.43	3.06	0.04	1.04	3.61	3.27	1.14	0.10	6.21	97.82
26739	#5	440	57.09	14.37	0.61	5.01	0.09	2.24	5.45	3.80	0.76	0.10	8.96	98.48
26740	#5	573	60.33	15.95	0.65	2.79	0.05	1.29	5.14	4.08	1.02	0.16	7.40	98.86
26747	#7	98	58.65	15.05	0.54	4.13	0.07	1.77	5.06	2.07	2.10	0.14	8.62	98.22
26748	#7	679	35.92	12.47	1.11	10.73	0.19	4.45	13.22	2.11	0.60	0.06	19.28	100.15
26749	#8	82	53.30	15.98	0.57	4.89	0.09	2.00	6.29	4.03	1.36	0.12	9.76	98.38
26750	#8	562	46.52	7.93	0.65	7.43	0.18	4.77	11.92	1.29	0.60	0.12	17.63	99.04
21116	#13	665												
26751	#13	677	48.47	15.63	0.68	8.33	0.11	1.93	6.48	1.89	1.76	0.14	12.49	97.91

Table 1. Chemical Composition of Volcanic Rocks and Iron Formation in Carscallen Township, Ontario

Lab No.	Hole	Depth: ft	Cr ppm	V ppm	Sc ppm	Co ppm	Ni ppm	Cu ppm	Zn ppm	Pb ppm	Ba ppm	Sr ppm	Rb ppm	Nb ppm	Y ppm	Zr ppm
Carscor Porcupine (1946 holes)																
26745	#1	160	120	170	17	20	95	50	115		50	110	< .05	< 30	20	130
26746	#1	430	235	125	15	20	75	70	70		140	100	< .05	< 30	18	110
26741	#4	265	140	140	16	25	35	30	145		240	150	< .05	< 30	18	110
26742	#4	297	200	150	17	3	25	3	65		280	160	< .05	< 30	14	120
26743	#4	509	95	110	11	5	25	25	50		200	160	< .05	< 30	12	110
26744	#4	608	175	125	14	15	35	30	90		210	130	< .05	< 30	16	110
26737	#5	117	105	115	13	15	20	40	45		290	140	< .05	< 30	12	100
26738	#5	288	195	50	17	15	20	40	60		270	90	< .05	< 30	44	240
26739	#5	440	105	130	14	15	15	25	50		260	130	< .05	< 30	14	110
26740	#5	573	205	115	13	10	55	30	95		260	150	< .05	< 30	20	130
26747	#7	98	140	100	12	10	10	25	35		270	110	< .05	< 30	10	100
26748	#7	679	150	225	29	25	20	25	65		130	130	< .05	< 30	24	100
26749	#8	82	285	125	15	15	30	3	25		280	130	< .05	< 30	10	110
26750	#8	562	165	120	11	10	50	20	70		120	110	< .05	< 30	14	90
21116	#13	665														
26751	#13	677	115	115	14	15	40	25	30		280	120	< .05	< 30	12	130

Table 2. Chemical Composition of Volcanic Rocks and Iron Formation in Carscallen Township, Ontario

Lab No.	Hole	Depth: m	SiO2	Al2O3	TiO2	Fe2O3	MnO	MgO	CaO	Na2O	K2O	P2O5	LOI	TOTAL
BHP Hole 93-BMD-001														
29501	93-001	45.0-46.0	51.8	17.3	1.21	14.80	0.08	5.54	0.14	0.29	0.26	0.06	7.80	99.29
29502	93-001	46.0-46.9	62.7	17.8	1.41	8.07	0.03	1.41	0.09	0.10	3.74	0.07	4.20	99.62
29504	93-001	46.9-48.0	75.5	14.9	0.27	0.84	0.02	0.21	0.02	2.80	1.92	0.04	3.05	99.58
29505	93-001	48.0-49.0	74.8	14.6	0.29	1.29	0.02	0.63	0.30	2.91	2.09	0.04	2.75	99.73
29506	93-001	50.0-51.0	76.5	14.4	0.27	0.93	0.02	0.21	0.02	3.26	2.03	0.05	2.40	100.10
29507	93-001	51.0-52.0	75.3	14.9	0.28	0.73	0.02	0.19	0.02	2.63	1.99	0.05	3.00	99.11
29508	93-001	52.0-53.0	77.0	13.3	0.27	0.66	0.02	0.17	0.03	3.48	1.95	0.04	1.85	98.78
29509	93-001	53.0-54.0	77.5	14.2	0.27	0.74	0.02	0.17	0.03	3.29	2.00	0.04	2.20	100.47
29510	93-001	56.0-56.6	66.7	18.9	2.02	1.65	0.02	0.31	0.28	0.31	4.47	0.33	4.55	99.55
29511	93-001	56.6-58.0	78.0	12.7	0.28	0.95	0.02	0.23	0.02	1.78	2.68	0.05	1.90	98.62
29512	93-001	61.2-61.4	33.0	4.97	0.19	43.40	0.03	0.19	0.22	0.74	0.93	0.09	17.00	100.77
29513	93-001	61.4-61.45	70.3	17.6	0.42	1.03	0.01	0.34	0.30	5.95	2.28	0.18	1.75	100.17
29520	93-001	61.45-62.2	46.5	12.7	1.24	10.90	0.23	3.18	7.45	0.09	3.85	0.19	7.10	93.44
29536	93-001	70.0-71.0	51.7	12.2	0.92	8.37	0.14	3.24	6.78	1.77	2.01	0.14	12.00	99.28
29547	93-001	132.2-133.0	70.0	12.4	0.29	3.48	0.06	0.88	2.66	3.22	2.24	0.04	4.15	99.43
29548	93-001	155.3-156.3	69.3	11.9	0.24	3.97	0.07	0.72	3.14	3.21	2.15	0.04	4.15	98.90
29549	93-001	156.3-157.3	68.7	12.4	0.27	4.19	0.08	0.68	2.82	3.71	2.08	0.05	3.40	98.39
29550	93-001	157.3-158.3	70.3	12.3	0.24	4.19	0.09	0.73	2.81	3.92	1.86	0.05	3.45	99.95
29551	93-001	158.3-159.3	69.2	12.2	0.29	3.98	0.08	0.83	2.36	4.00	1.92	0.05	3.40	98.32
29552	93-001	159.3-160.0	46.9	12.4	1.06	11.30	0.19	4.98	8.40	2.55	0.73	0.10	9.80	98.42
29553	93-001	203.0-204.0	47.0	12.1	1.02	11.10	0.19	4.86	8.79	2.61	0.74	0.10	10.30	98.82
29554	93-001	204.0-205.0	70.2	12.5	0.25	4.42	0.13	0.74	2.12	4.18	1.97	0.05	3.10	99.66
29555	93-001	208.0-209.0	70.8	12.5	0.27	3.89	0.07	0.60	2.23	4.32	2.08	0.04	3.25	100.05
29558	93-001	209.0-210.0	75.1	11.8	0.07	1.76	0.04	0.43	1.87	2.92	4.09	0.02	1.75	99.86
29559	93-001	226.3-227.0	75.9	12.5	0.08	1.51	0.03	0.38	0.56	2.74	4.75	0.02	1.00	99.48
29560	93-001	227.0-228.0	75.3	13.1	0.07	1.58	0.03	0.63	0.62	2.13	5.32	0.02	1.55	100.35
29561	93-001	228.0-229.0	73.6	12.8	0.08	1.54	0.04	0.39	1.74	2.79	4.95	0.02	1.80	99.76
29562	93-001	229.0-230.0	74.5	13.0	0.07	1.61	0.04	0.25	0.45	3.58	4.53	0.02	0.80	98.86
29563	93-001	230.0-231.0	74.9	12.7	0.08	1.58	0.03	0.35	0.90	2.63	4.64	0.02	1.50	99.34
29564	93-001	231.0-232.0	74.4	12.8	0.08	1.72	0.05	0.42	1.16	3.15	4.43	0.02	1.75	99.99
29565	93-001	232.0-233.0	75.0	13.0	0.09	1.66	0.04	0.32	0.85	2.47	4.80	0.02	1.30	99.55
29566	93-001	233.0-234.0	74.0	12.8	0.11	1.79	0.04	0.31	0.98	2.65	4.55	0.02	1.20	98.46

Table 2. Chemical Composition of Volcanic Rocks and Iron Formation in Carscallen Township, Ontario

Lab No.	Hole	Depth: m	Cr %	V ppm	Sc ppm	Co ppm	Ni ppm	Cu ppm	Zn ppm	Pb ppm	Ba ppm	Sr ppm	Rb ppm	Nb ppm	Y ppm	Zr ppm
<u>BHP Hole 93-BMD-001</u>																
29501	93-001	45.0-46.0	0.01								268	21	12	6	29	177
29502	93-001	46.0-46.9	0.01								2090	26	100	8	38	138
29504	93-001	46.9-48.0	0.01								584	37	62	33	105	408
29505	93-001	48.0-49.0	0.01								508	87	69	35	110	411
29506	93-001	50.0-51.0	0.01								500	57	69	33	165	413
29507	93-001	51.0-52.0	0.01								431	61	67	35	110	413
29508	93-001	52.0-53.0	0.01								379	87	65	31	105	389
29509	93-001	53.0-54.0	0.01								338	67	67	34	120	420
29510	93-001	56.0-56.6	0.01								673	123	138	7	66	153
29511	93-001	56.6-58.0	0.01								399	62	95	29	100	371
29512	93-001	61.2-61.4	0.01								305	41	38	19	6	119
29513	93-001	61.4-61.45	0.01								502	124	94	10	18	127
29520	93-001	61.45-62.2	0.01								465	120	120	9	28	152
29536	93-001	70.0-71.0	0.01								379	164	71	7	31	153
29547	93-001	132.2-133.0	0.01								371	181	75	38	87	316
29548	93-001	155.3-156.3	0.01								374	141	75	30	81	361
29549	93-001	156.3-157.3	0.01								375	154	70	30	79	388
29550	93-001	157.3-158.3	0.01								339	111	57	28	73	340
29551	93-001	158.3-159.3	0.01								363	178	66	30	80	366
29552	93-001	159.3-160.0	0.01								183	240	22	6	22	97
29553	93-001	203.0-204.0	0.01								168	238	25	5	21	97
29554	93-001	204.0-205.0	0.01								417	106	69	33	87	391
29555	93-001	208.0-209.0	0.01								444	139	77	29	85	391
29558	93-001	209.0-210.0	0.01								817	120	113	45	91	102
29559	93-001	226.3-227.0	0.01								901	67	129	45	86	107
29560	93-001	227.0-228.0	0.01								895	58	152	48	96	113
29561	93-001	228.0-229.0	0.01								902	104	134	49	90	106
29562	93-001	229.0-230.0	0.01								735	53	132	53	99	114
29563	93-001	230.0-231.0	0.01								675	73	151	49	91	106
29564	93-001	231.0-232.0	0.01								708	64	142	52	89	114
29565	93-001	232.0-233.0	0.01								699	63	156	51	93	112
29566	93-001	233.0-234.0	0.01								685	64	153	49	91	116

Table 2. Chemical Composition of Volcanic Rocks and Iron Formation in Carscallen Township, Ontario

Lab No.	Hole	Depth: m	SiO_2	Al_2O_3	TiO_2	Fe_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	LOI	TOTAL
BHP Hole 93-BMD-001 (cont.)														
29567	93-001	234.0-235.0	73.6	12.5	0.11	1.74	0.05	0.49	1.95	2.47	4.58	0.02	1.80	99.31
29503	93-001	235.0-236.0	75.4	13.1	0.30	2.62	0.02	0.33	0.16	3.37	1.63	0.02	2.45	99.41
Bonhomme samples: BHP 93-BMD-001														
59670	93-01	44	54.41	15.43	1.22	13.92	0.09	5.67	0.17	2.42	0.10	0.04	4.63	98.09
59671	93-01	43	51.62	14.79	1.32	15.67	0.10	4.51	0.63	1.45	0.12	0.20	8.75	99.16
59672	93-01	115	44.65	14.42	2.21	9.60	0.23	2.41	6.87	0.37	4.00	0.32	12.56	97.62
59674	93-01	200	69.32	13.26	0.28	4.55	0.08	0.96	2.50	3.54	2.46	0.06	3.86	100.87
59673	93-01	203	48.99	13.38	1.09	11.27	0.18	5.07	7.52	2.80	0.90	0.12	9.53	100.85
59677	93-01	222	68.98	11.60	0.19	3.46	0.06	0.55	3.58	3.49	2.36	0.06	4.49	98.81
59676	93-01	230	74.93	13.03	0.06	1.57	0.04	0.22	1.44	2.91	4.74	0.04	1.86	100.84
59675	93-01	236	71.85	13.12	0.10	1.91	0.04	0.53	1.67	2.55	4.72	0.04	2.47	98.99

Table 2. Chemical Composition of Volcanic Rocks and Iron Formation in Carscallen Township, Ontario

Lab No.	Hole	Depth: m	Cr %	V ppm	Sc ppm	Co ppm	Ni ppm	Cu ppm	Zn ppm	Pb ppm	Ba ppm	Sr ppm	Rb ppm	Nb ppm	Y ppm	Zr ppm
BHP Hole 93-BMD-001 (cont.)																
29567	93-001	234.0-235.0	0.01								642	105	145	48	93	111
29503	93-001	235.0-236.0	0.01								661	41	47	33	72	379
Bonhomme samples: BHP 93-BMD-001																
59670	93-01	44	235	305	42	40	130	95	140		80		< .05	< 30	30	110
59671	93-01	43	200	300	43	60	120	85	445		140		< .05	< 30	56	130
59672	93-01	115	290	315	21	55	170	40	465		310		< .05	< 30	28	70
59674	93-01	200	420	95	6	5	40	15	65		480		< .05	< 30	74	360
59673	93-01	203	190	270	31	40	40	40	125		160		< .05	< 30	28	90
59677	93-01	222	600	40	3	3	15	5	120		390		< .05	< 30	68	290
59676	93-01	230	655	15	1	3	25	5	70		760		< .05	< 30	72	120
59675	93-01	236	705	30	2	5	3	10	75		680		< .05	< 30	80	140

Table 3. Chemical Composition of Volcanic Rocks and Iron Formation in Carscallen Township, Ontario

Falconbridge holes (1990) northeast of Bigmarsh Lake

Lab No.	Hole	Depth: m	SiO2	Al2O3	TiO2	Fe2O3	MnO	MgO	CaO	Na2O	K2O	P2O5	LOI	TOTAL
4301	CS45-01	41.0-44.0	63.95	15.12	0.54	3.38	0.08	0.92	3.46	3.63	1.76	0.16	6.30	99.33
4302	CS45-01	71.0-74.0	71.96	12.39	0.42	3.60	0.07	1.59	2.14	0.63	2.72	0.12	5.16	100.80
4303	CS45-01	80.0-83.0	72.55	12.28	0.36	2.83	0.05	0.98	1.56	0.47	3.18	0.12	4.83	99.21
4304	CS45-01	89.0-92.0	47.74	13.23	1.22	8.63	0.15	3.46	6.96	1.54	2.72	0.22	14.19	100.09
4305	CS45-01	116.0-119.0	48.70	13.37	1.38	8.80	0.13	3.56	6.67	1.98	2.32	0.26	13.64	100.83
4306	CS45-01	146.0-149.0	49.18	12.30	1.31	8.99	0.14	3.69	6.94	2.16	1.82	0.26	14.13	100.94
4307	CS45-01	155.0-158.0	70.32	11.42	0.51	4.31	0.06	0.95	2.60	2.85	1.76	0.12	5.40	100.33
4308	CS45-01	159.5-162.5	67.85	11.33	0.47	4.28	0.06	1.15	2.75	1.51	2.26	0.14	6.42	98.23
4309	CS45-01	167.0-170.0	46.71	13.20	1.20	6.97	0.11	3.42	8.02	1.14	2.46	0.18	14.59	98.04
4310	CS45-01	185.0-188.0	69.48	10.95	0.51	4.72	0.07	1.04	3.05	2.26	2.04	0.12	6.12	100.39
4311	CS45-01	194.0-197.0	49.54	13.93	1.30	5.81	0.11	3.07	7.93	2.83	2.80	0.28	13.36	100.99
4312	CS45-01	224.0-227.0	49.53	13.82	1.30	7.69	0.12	3.90	7.18	2.56	1.48	0.20	12.46	100.27
4313	CS45-01	230.0-233.0	70.53	11.18	0.49	3.88	0.06	0.91	2.18	3.22	1.40	0.12	4.75	98.75
4314	CS45-01	239.0-242.0	48.16	13.05	1.22	7.60	0.12	3.40	6.93	1.96	1.84	0.22	13.77	98.30
4315	CS45-01	248.0-251.0	70.51	12.28	0.24	3.48	0.06	1.32	2.23	2.78	2.22	0.06	5.36	100.57
4316	CS45-01	278.0-281.0	71.77	11.81	0.21	3.58	0.07	0.61	2.05	3.87	1.76	0.06	4.47	100.29
4318	CS45-02	91.0-93.0	49.57	12.34	1.33	8.19	0.14	3.46	6.36	2.25	1.78	0.28	13.22	98.93
4319	CS45-02	110.0-113.0	69.25	10.73	0.49	4.63	0.07	1.15	1.71	3.12	1.56	0.12	5.29	98.14
4320	CS45-02	161.0-164.0	68.94	11.92	0.22	3.79	0.05	2.25	2.03	2.86	1.88	0.06	5.60	99.63
4321	CS45-02	191.0-194.0	70.64	11.72	0.22	3.68	0.05	0.83	2.55	3.20	2.10	0.06	5.31	100.39

Table 3. Chemical Composition of Volcanic Rocks and Iron Formation in Carscallen Township, Ontario

Lab No.	Hole	Depth: m	Cr	V	Sc	Co	Ni	Cu	Zn	Pb	Ba	Sr	Rb	Nb	Y	Zr
			%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Falconbridge holes (1990) northeast of Bigmarsh Lake																
4301	CS45-01	41.0-44.0	0.03	75	13	25	30	110	15						16	142
4302	CS45-01	71.0-74.0	0.00	20	11	<5	30	10	65						46	254
4303	CS45-01	80.0-83.0	0.00	3	8	<5	<5	5	45						40	234
4304	CS45-01	89.0-92.0	0.03	270	22	35	75	20	105						26	158
4305	CS45-01	116.0-119.0	0.02	270	19	30	55	15	120						30	190
4306	CS45-01	146.0-149.0	0.02	145	18	30	45	40	55						30	186
4307	CS45-01	155.0-158.0	0.03	90	10	5	5	10	35						60	300
4308	CS45-01	159.5-162.5	0.01	25	10	10	10	<5	45						48	284
4309	CS45-01	167.0-170.0	0.04	190	25	35	60	50	65						20	122
4310	CS45-01	185.0-188.0	0.03	25	11	5	10	10	50						56	274
4311	CS45-01	194.0-197.0	0.03	210	25	35	65	70	60						24	136
4312	CS45-01	224.0-227.0	0.03	195	26	40	105	35	55						24	134
4313	CS45-01	230.0-233.0	0.03	10	11	<5	25	5	70						62	298
4314	CS45-01	239.0-242.0	0.03	180	23	30	60	30	75						24	142
4315	CS45-01	248.0-251.0	0.03	3	5	<5	25	<5	75						76	354
4316	CS45-01	278.0-281.0	0.03	3	4	<5	30	10	35						70	348
4318	CS45-02	91.0-93.0	0.01	155	16	25	45	25	155						32	212
4319	CS45-02	110.0-113.0	0.02	3	9	<5	15	5	60						62	304
4320	CS45-02	161.0-164.0	0.03	3	5	<5	15	10	75						78	354
4321	CS45-02	191.0-194.0	0.03	3	4	<5	25	10	110						76	376

Table 4. Chemical Composition of Volcanic Rocks and Iron Formation in Carscallen Township, Ontario

Lab No.	Easting	Northing	SiO2	Al2O3	TiO2	Fe2O3	MnO	MgO	CaO	Na2O	K2O	P2O5	LOI	TOTAL
<u>BHP Minerals: Barnes Property - outcrops</u>														
92OR-007	449696	5362605	82.32	8.52	0.11	3.91	0.02	0.55	0.34	0.48	2.48	0.12	2.06	100.92
92OR-008	448952	5363276	77.09	12.50	0.15	2.72	0.04	0.20	0.29	2.34	3.84	0.12	1.42	100.72
92OR-009	448915	5363183	62.44	7.63	0.25	17.21	0.07	1.54	0.12	0.09	1.54	0.12	7.53	98.54
92OR-010	448810	5363227	72.13	13.91	0.48	3.69	0.11	0.52	1.42	3.96	2.25	0.20	2.12	100.81
92OR-011	448935	5363199	43.00	13.45	1.32	10.86	0.26	4.01	7.74	1.87	3.53	0.81	11.13	97.99
92OR-012	448959	5362994	41.94	4.30	2.60	23.03	0.31	11.28	10.44	0.18	0.05	0.14	1.83	96.10
92OR-013	448959	5363097	68.74	16.14	0.61	4.65	0.12	0.61	0.95	2.73	3.90	0.23	3.04	101.74
92OR-014	448970	5363071	75.17	13.70	0.48	2.83	0.08	0.68	1.11	0.16	4.32	0.20	2.60	101.37
92OR-015	449039	5363089	49.32	13.95	1.05	11.68	0.18	5.37	6.23	2.80	0.52	0.18	7.89	99.22
92OR-016	449240	5363107	76.72	11.87	0.39	2.68	0.08	0.50	1.38	3.95	1.39	0.19	1.89	101.08
92OR-017	449235	5363125	49.30	14.08	2.08	13.77	0.16	2.58	7.61	3.82	0.60	0.36	3.84	98.22
92OR-018	449298	5363080	49.40	12.43	1.81	16.78	0.25	4.85	8.20	2.39	0.66	0.26	1.36	98.39
92OR-019	449348	5363771	59.69	15.77	1.07	10.08	0.16	1.62	1.74	1.64	3.34	0.20	4.78	100.12
92OR-020	448790	5363754	75.73	12.79	0.29	4.28	0.06	0.50	1.28	0.35	3.07	0.15	2.89	101.39
92OR-021	448844	5363810	76.87	11.28	0.13	2.80	0.04	2.22	3.39	1.82	0.97	0.09	1.75	101.36
92OR-022	448839	5363803	48.70	8.26	0.09	12.47	0.15	12.89	10.66	0.26	0.10	0.07	4.11	97.76
92OR-033	449390	5362646	70.92	13.30	0.47	3.70	0.09	1.15	2.42	3.05	2.09	0.08	3.25	100.53
92OR-034	449417	5362574	87.97	0.22	0.01	10.30	0.29	0.90	0.11	0.02	0.05	0.02	0.66	100.56
92OR-035	449435	5362612	95.00	0.13	0.01	4.72	0.07	0.03	0.01	0.01	0.03	0.04	0.77	100.82
92OR-036	449417	5362574	95.00	0.13	0.01	4.26	0.16	0.44	0.34	0.01	0.04	0.04	0.60	101.03
92OR-037	449559	5362704	89.99	0.52	0.02	7.91	0.21	0.43	0.14	0.01	0.04	0.02	1.55	100.84
92OR-038	449693	5362589	59.44	9.98	0.84	9.86	0.17	3.67	5.55	0.73	1.42	0.05	6.39	98.12
92OR-039	449685	5362605	68.78	10.81	0.39	9.54	0.05	0.23	0.39	2.01	2.10	0.06	4.63	99.00
92OR-040	449512	5362629	96.38	1.14	0.01	1.57	0.01	0.08	0.38	0.59	0.02	0.05	0.21	100.44
92OR-041	449512	5362600	68.03	16.79	0.23	1.87	0.03	0.30	2.31	5.83	1.39	0.09	2.81	99.69
92OR-042	449481	5362703	98.27	0.29	0.01	1.25	0.01	0.03	0.07	0.11	0.01	0.05	0.01	100.11
92OR-043	448980	5363099	83.50	9.38	0.33	1.19	0.03	0.37	0.54	0.16	3.15	0.10	1.77	100.53
92OR-044	448972	5363111	72.91	14.83	0.43	0.92	0.01	0.17	0.09	1.43	8.81	0.09	0.78	100.48
92OR-045	448798	5363896	82.57	10.19	0.13	2.02	0.01	0.35	0.23	0.25	2.79	0.07	2.12	100.74
92OR-046	448775	5363749	83.96	1.20	0.03	3.22	0.10	1.71	4.09	0.09	0.27	0.03	5.95	100.66
92OR-047	448775	5363749	87.57	3.30	0.15	3.18	0.04	1.39	1.32	0.10	0.48	0.09	2.38	100.02
92OR-048	448775	5363749	69.45	12.71	0.40	4.93	0.08	1.14	2.43	2.93	1.87	0.11	4.23	100.29

Table 4. Chemical Composition of Volcanic Rocks and Iron Formation in Carscallen Township, Ontario

Lab No.	Easting	Northing	Cr2O3	V	Sc	Co	Ni	Cu	Zn	Pb	Ba	Sr	Rb	Nb	Y	Zr
			%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
BHP Minerals: Barnes Property - outcrops																
92OR-007	449696	5362605	0.01			3	9	17	76	2						
92OR-008	448952	5363276	0.01			1	3	13	60	2						
92OR-009	448915	5363183	0.00			37	23	28	92	12						
92OR-010	448810	5363227	0.02			4	4	7	28	2						
92OR-011	448935	5363199	0.01			37	23	53	60	4						
92OR-012	448959	5362994	0.00			42	100	123	50	20						
92OR-013	448959	5363097	0.02			8	9	13	76	20						
92OR-014	448970	5363071	0.04			2	6	4	62	26						
92OR-015	449039	5363089	0.05			39	79	56	124	2						
92OR-016	449240	5363107	0.04			3	6	8	20	1						
92OR-017	449235	5363125	0.02			51	63	73	102	6						
92OR-018	449298	5363080	0.00			22	23	103	58	2						
92OR-019	449348	5363771	0.03			47	83	47	30	2						
92OR-020	448790	5363754	0.00			3	5	6	58	1						
92OR-021	448844	5363810	0.00			2	3	12	142	18						
92OR-022	448839	5363803	0.00			1	2	267	320	28						
92OR-033	449390	5362646	0.01			3	5	4	84	2						
92OR-034	449417	5362574	0.01			1	16	7	18	4						
92OR-035	449435	5362612	0.01			1	15	14	10	2						
92OR-036	449417	5362574	0.01			1	8	1	14	1						
92OR-037	449559	5362704	0.01			2	29	11	366	6						
92OR-038	449693	5362589	0.02			23	40	12	76	2						
92OR-039	449685	5362605	0.01			10	21	15	72	6						
92OR-040	449512	5362629	0.01			1	27	484	34	1340						
92OR-041	449512	5362600	0.01			3	12	6	30	14						
92OR-042	449481	5362703	0.01			1	15	5	2	8						
92OR-043	448980	5363099	0.01			1	10	1	22	6						
92OR-044	448972	5363111	0.01			1	9	1	4	4						
92OR-045	448798	5363896	0.01			7	35	40	252	14						
92OR-046	448775	5363749	0.01			1	14	5	20	4						
92OR-047	448775	5363749	0.02			5	61	6	58	2						
92OR-048	448775	5363749	0.01			3	3	37	48	6						

Table 5. Chemical Composition of some Iron Formation Samples, Mespi Drillholes, Western Carscallen Township*

File No.	Hole	Depth: ft	SiO_2 %	Al_2O_3 %	TiO_2 %	Fe_2O_3 %	MnO %	MgO %	CaO %	Na_2O %	K_2O %	P_2O_5 %	LOI %	TOTAL %
Mespi Mines Drillholes														
TI-1107	WC-4	200.0	28.00	6.31	0.32	42.40	0.29	2.23	0.63	0.07	0.71	0.07	18.80	99.80
TI-1107	WC-4	225.0	81.60	4.59	0.12	7.41	0.21	1.17	1.89	1.25	0.19	0.03	1.90	100.00
TI-1107	WC-4	250.0	90.00	0.06	0.02	4.58	0.22	0.48	1.04	0.05	0.01	0.01	2.50	99.90
TI-1104	WC-1	173.0	42.60	5.49	0.44	37.60	0.16	2.65	1.98	0.02	0.04	0.05	9.50	100.20
TI-1104	WC-1	182.0	73.80	1.43	0.05	16.70	0.09	1.09	2.54	0.09	0.03	0.19	3.10	99.10
TI-1104	WC-6	150.0	68.90	0.55	0.03	19.70	0.56	1.25	1.85	0.05	0.20	0.02	6.00	99.10

* Data from Nuclear Activation Services Report (Dec. 1988) filed at Timmins Mine Recorders Office.

Table 5. Chemical Composition of some Iron Formation Samples, Mespi Drillholes, Western Carscallen Township*

File No.	**Hole**	**Depth: ft**	**Cr** ppm	**V** ppm	**Sc** ppm	**Co** ppm	**Ni** ppm	**Cu** ppm	**Zn** ppm	**Pb** ppm	**Ba** ppm	**Cd** ppm	**Sr** ppm	**Rb** ppm	**Nb** ppm	**Y** ppm	**Zr** ppm
Mespi Mines Drillholes																	
TI-1107	WC-4	200.0	120	58	10	71	60	65	140	16	260	2	<10	50	b.d.	b.d.	20
TI-1107	WC-4	225.0	27	20	2	5	20	8	62	<2	120	<1	10	20	b.d.	b.d.	30
TI-1107	WC-4	250.0	23	<2	<0.5	4	7	2	17	<2	40	<1	<10	20	b.d.	b.d.	<10
TI-1104	WC-1	173.0	99	88	19	45	49	70	190	<2	100	2	20	<10	b.d.	b.d.	<10
TI-1104	WC-1	182.0	24	18	3	11	18	43	61	<2	60	2	<10	<10	b.d.	b.d.	<10
TI-1104	WC-6	150.0	26	2	2	19	29	40	43	<2	120	<1	<10	30	b.d.	b.d.	<10

			Au ppb	**Ag** ppm	**As** ppm	**B** ppm	**Br** ppm	**Cs** ppm	**Sb** ppm	**La** ppm	**Ce** ppm	**Nd** ppm	**Sm** ppm	**Eu** ppm	**Tb** ppm	**Yb** ppm	**Lu** ppm
TI-1107	WC-4	200.0	31	1	130	90	10	1.4	1.6	7.1	16	<5	1.2	0.5	<0.5	0.7	0.10
TI-1107	WC-4	225.0	5	<0.5	3	20	8	<0.5	0.2	6.5	13	5	0.7	<0.3	<0.5	0.3	0.07
TI-1107	WC-4	250.0	97	<0.5	6	20	8	<0.5	0.3	2.1	3	<5	0.3	0.2	<0.5	0.2	<0.05
TI-1104	WC-1	173.0	5	<0.5	37	40	8	1.5	0.6	4.0	11	6	1.4	0.3	<0.5	1.4	0.20
TI-1104	WC-1	182.0	8	<0.5	20	30	7	<0.7	<0.2	8.9	19	12	2.2	0.4	<0.5	1.4	0.23
TI-1104	WC-6	150.0	<2	<0.5	22	20	7	2.2	<0.2	2.5	4	<5	0.5	0.4	<0.5	0.8	0.10

* Data from Nuclear Activation Services Report (Dec. 1988) filed at Timmins Mine Recorders Office.

Table 6. Chemical Composition of Volcanic and Associated Rocks in Whitesides Township, Ontario

Lab No.	Company	Hole	Depth: ft	SiO2 %	Al2O3 %	TiO2 %	Fe2O3 %	MnO %	MgO %	CaO %	Na2O %	K2O %	P2O5 %	LOI %	TOTAL
Whitesides Syndicate Property: 1995 drill hole FM87-1															
Sampled in summer 1995 by LB. Analysed at TSL/ASSAYERS Laboratories.															
26804	Whitesides Syn.	FM87-1	161-163	66.17	13.43	0.30	6.51	0.11	1.89	4.32	0.85	2.30	0.10	2.69	98.67
26808	Whitesides Syn.	FM87-1	186.7-187.7	46.17	14.95	0.39	4.92	0.11	2.57	22.28	0.05	0.14	0.08	9.00	100.66
26821	Whitesides Syn.	FM87-1	267-272	72.61	13.56	0.26	3.65	0.06	0.81	3.52	1.45	2.25	0.06	2.19	100.42
26823	Whitesides Syn.	FM87-1	276.5-281.5	72.55	3.75	0.09	10.63	0.21	2.91	4.99	0.39	0.22	0.06	2.65	98.45
26829	Whitesides Syn.	FM87-1	324.6-327	48.90	14.96	1.38	9.80	0.29	5.39	13.92	0.84	1.24	0.24	3.04	100.00
26836	Whitesides Syn.	FM87-1	362-367	52.57	14.83	1.14	12.42	0.36	4.38	8.38	1.13	1.74	0.18	2.50	99.63
26843	Whitesides Syn.	FM87-1	390.7-392.9	49.28	13.86	0.95	14.29	0.29	5.22	11.04	1.04	0.68	0.10	3.93	100.68
26845	Whitesides Syn.	FM87-1	398-403	74.83	11.39	0.16	2.70	0.05	0.37	1.76	4.07	1.00	0.04	1.19	97.56
26849	Whitesides Syn.	FM87-1	443.5-446	50.18	14.50	1.00	13.48	0.28	4.30	11.43	1.30	1.40	0.12	2.60	100.59
26850	Whitesides Syn.	FM87-1	446-450	70.75	6.54	0.45	8.64	0.19	2.63	5.38	0.65	0.56	0.06	1.86	97.71
26701	Whitesides Syn.	FM87-1	457-459	78.93	11.40	0.12	2.35	0.06	0.14	1.46	3.90	1.24	0.02	1.04	100.66
26703	Whitesides Syn.	FM87-1	487-489	78.97	11.42	0.10	2.19	0.04	0.45	0.93	4.45	1.00	0.04	1.13	100.72
26705	Whitesides Syn.	FM87-1	499-501	59.39	14.68	0.53	9.56	0.22	5.01	5.43	2.32	1.56	0.14	2.08	100.92
26706	Whitesides Syn.	FM87-1	581.1-583	57.35	15.59	0.61	10.86	0.21	3.71	5.36	1.91	1.94	0.14	3.28	100.96
26707	Whitesides Syn.	FM87-1	988.3-989.3	51.63	18.70	0.87	6.49	0.13	3.63	10.95	3.33	0.90	0.16	4.14	100.93
26710	Whitesides Syn.	FM87-1	1068-1072	71.10	13.99	0.36	3.73	0.08	1.18	3.72	4.70	0.62	0.10	1.30	100.88
26711	Whitesides Syn.	FM87-1	1080.2-1085.7	70.88	14.59	0.28	2.84	0.04	0.83	3.96	4.47	0.76	0.10	1.32	100.07
26715	Whitesides Syn.	FM87-1	1149.2-1152	33.82	8.29	1.96	8.15	0.20	13.38	16.14	1.58	3.08	0.66	14.45	101.71
26716	Whitesides Syn.	FM87-1	1189-1191	58.47	16.95	0.50	5.85	0.08	2.98	6.10	3.00	1.44	0.12	4.73	100.22
26717	Whitesides Syn.	FM87-1	1191-1194	60.63	15.97	0.47	6.02	0.08	2.73	5.71	2.74	1.62	0.10	4.39	100.46
26718	Whitesides Syn.	FM87-1	1194-1198.4	71.35	13.75	0.29	3.48	0.05	0.86	2.44	4.01	2.06	0.08	1.80	100.17
26719	Whitesides Syn.	FM87-1	1198.4-1202.5	68.93	13.41	0.36	3.89	0.08	1.05	2.73	3.72	2.42	0.10	2.00	98.69
Dea Property: hole WD92-2															
Sampled in summer 1995 by TJB and LB. Analysed at TSL/ASSAYERS Laboratories.															
92-2-84	Bonhomme Syn.	92-2	84	49.85	16.37	1.18	13.19	0.33	4.82	5.36	0.63	2.01	0.20	4.24	98.18
92-2-95	Bonhomme Syn.	92-2	95	64.01	13.78	0.60	8.30	0.22	3.30	6.68	0.26	1.08	0.20	2.55	100.98
92-2-101	Bonhomme Syn.	92-2	101	36.64	11.56	0.95	26.83	0.59	7.49	12.63	0.37	0.50	0.16	2.48	100.20

Table 6. Chemical Composition of Volcanic and Associated Rocks in Whitesides Township, Ontario

Hole	Depth: ft	Cr ppm	V ppm	Sc ppm	Co ppm	Ni ppm	Cu ppm	Zn ppm	Ba ppm	Sr ppm	Y ppm	Zr ppm	Pb ppm	Au ppb	Ag ppm	Cu ppm	Zn ppm
Whitesides Syndicate Property: 1995 drill hole FM87-1																	
Sampled in summer 1995 by LB. Analysed at TSL/ASSAYERS Laboratories.																	
FM87-1	161-163	510	55	2	5	20	60	330	340	190	62	190		62	0.8	56	310
FM87-1	186.7-187.7	450	110	<1	30	130	20	485	10	30	4	30		55	0.1	15	471
FM87-1	267-272	305	25	<1	<5	20	50	75	370	250	54	250		3	0.2	47	77
FM87-1	276.5-281.5	365	40	<1	5	20	150	210	40	60	18	60		79	1.2	142	195
FM87-1	324.6-327	315	140	19	25	35	10	300	310		38	150		0	0.1	19	240
FM87-1	362-367	455	195	30	35	85	15	195	330		26	110		3	0.3	32	151
FM87-1	390.7-392.9	525	280	44	40	60	70	395	300		24	60		0	0.6	100	293
FM87-1	398-403	695	25	5	5	15	20	60	150		122	310		0	0.2	30	58
FM87-1	443.5-446	425	295	41	25	55	40	455	360		22	50		51	0.6	122	353
FM87-1	446-450	560	150	21	20	25	34	170	130		16	80		27	0.5	134	88
FM87-1	457-459	615	15	3	10	15	25	220	260		114	310		7	0.1	29	136
FM87-1	487-489	705	15	2	<5	20	20	135	140		124	320		0	0.1	26	77
FM87-1	499-501	560	95	15	25	110	35	780	420		16	100		0	1.2	23	721
FM87-1	581.1-583	1125	130	18	25	125	50	155	530		26	110		0	0.1	42	135
FM87-1	988.3-989.3	435	160	23	25	100	95	165	220		16	100		0	0.1	99	67
FM87-1	1068-1072	480	60	9	15	30	235	65	120		8	100		3	0.2	272	60
FM87-1	1080.2-1085.7	670	40	5	10	25	15	35	280		6	80		0	0.1	16	36
FM87-1	1149.2-1152	935	195	19	50	365	65	60	1580		14	140		7	0.1	65	64
FM87-1	1189-1191	820	105	14	30	90	35	45	320		14	80		0	0.1	42	50
FM87-1	1191-1194	680	105	13	25	75	95	55	310		22	100		0	0.1	94	64
FM87-1	1194-1198.4	700	40	6	5	30	10	35	440		44	170		0	0.1	11	45
FM87-1	1198.4-1202.5	655	45	7	15	20	10	45	440		54	160		0	0.1	12	108
Dea Property: hole WD92-2																	
Sampled in summer 1995 by TJB and LB. Analysed at TSL/ASSAYERS Laboratories.																	
92-2	84	340	290	34	35	70	30	400	130	90	28	150					
92-2	95	860	110	16	30	45	15	175	160	120	14	130					
92-2	101	250	335	65	80	285	15	295	50	180	38	140					

Table 6. Chemical Composition of Volcanic and Associated Rocks in Whitesides Township, Ontario

Lab No.	Company	Hole	Depth: ft	SiO_2 %	Al_2O_3 %	TiO_2 %	Fe_2O_3 %	MnO %	MgO %	CaO %.	Na_2O %	K_2O %	P_2O_5 %	LOI %	TOTAL
Dea Property: hole WD92-2 (cont.)															
92-2-112	Bonhomme Syn.	92-2	112	76.78	11.19	0.15	3.51	0.06	0.86	1.53	0.29	3.22	0.06	1.52	99.17
92-2-125	Bonhomme Syn.	92-2	125	14.77	1.78	0.09	18.05	0.57	11.85	28.23	0.01	0.12	0.02	22.40	97.89
92-2-136	Bonhomme Syn.	92-2	136	45.46	15.45	1.10	17.68	0.34	6.20	9.13	1.10	1.02	0.12	2.60	100.20
92-2-161	Bonhomme Syn.	92-2	161	50.13	14.41	1.05	13.68	0.26	5.02	11.10	1.68	1.40	0.12	1.45	100.30
92-2-171	Bonhomme Syn.	92-2	171	76.39	11.42	0.15	2.96	0.05	0.65	2.03	4.01	1.12	0.06	0.94	99.78
92-2-193	Bonhomme Syn.	92-2	193	77.96	11.82	0.14	2.18	0.03	0.37	1.29	3.81	1.44	0.04	1.25	100.33
92-2-222	Bonhomme Syn.	92-2	222	76.29	10.70	0.13	2.85	0.05	0.24	1.43	4.01	0.88	0.04	0.99	97.61
92-2-245	Bonhomme Syn.	92-2	245	53.03	14.10	0.42	16.81	0.48	3.63	6.78	2.17	1.22	0.12	1.43	100.19
92-2-293	Bonhomme Syn.	92-2	293	59.13	15.87	0.63	9.15	0.17	2.74	6.53	3.60	1.02	0.18	1.50	100.52
92-2-316	Bonhomme Syn.	92-2	316	57.15	16.59	0.51	12.13	0.26	2.80	5.16	2.97	1.70	0.14	1.42	100.83
92-2-331	Bonhomme Syn.	92-2	331	57.60	15.21	0.87	10.04	0.17	3.02	7.69	3.48	0.76	0.18	0.96	99.98
92-2-376	Bonhomme Syn.	92-2	376	57.39	14.75	0.78	7.75	0.15	6.48	6.87	3.16	0.60	0.14	1.53	99.60
				Note: see also Table 7 for three McGill analyses from this hole, and two from WD92-1.											
Dea Property outcrops															
Sampled in 1993 by Tucker Barrie. Analysed at TSL/ASSAYERS Laboratories.															
81963	Noranda Explor.	outcrop		47.33	15.89	0.73	12.05	0.15	7.37	10.60	1.98	0.18	0.08	1.51	97.87
81964	Noranda Explor.	outcrop		57.85	17.06	0.83	6.50	0.12	2.27	5.98	4.52	1.26	0.16	1.35	97.90
81965	Noranda Explor.	outcrop		52.21	15.08	0.92	12.06	0.21	5.22	8.58	3.02	0.34	0.10	0.56	98.30
81966	Noranda Explor.	outcrop		54.90	15.12	0.99	11.06	0.17	3.20	8.14	2.71	0.54	0.14	0.81	97.78
81967	Noranda Explor.	outcrop		59.47	14.82	0.49	6.00	0.12	2.49	9.25	0.21	2.16	0.12	2.81	97.94
81968	Noranda Explor.	outcrop		49.47	15.90	1.10	15.67	0.23	2.34	8.45	2.59	0.90	0.36	1.13	98.14
Dea Property outcrops															
Sampled in 1991 by Warren Bates. Analysed at Swastika Laboratories.															
18051	Granges Inc.	outcrop		60.89	15.55	0.96	8.21	0.02	3.02	5.69	2.02	2.00	0.20	1.88	100.44
18052	Granges Inc.	outcrop		60.21	16.22	1.03	8.49	0.12	2.49	6.19	1.72	2.12	0.22	1.69	100.50
18053	Granges Inc.	outcrop		77.19	11.14	0.12	3.76	0.09	0.80	1.59	2.19	1.68	0.02	1.39	99.97
18054	Granges Inc.	outcrop		46.54	14.67	1.11	15.74	0.42	6.13	10.61	1.31	1.04	0.08	2.26	99.91
18055	Granges Inc.	outcrop		77.62	12.07	0.17	2.70	0.03	0.35	0.71	4.53	1.22	0.04	1.13	100.57
18056	Granges Inc.	outcrop		67.38	13.57	0.57	7.05	0.10	1.47	1.67	3.13	1.46	0.16	1.74	98.30
18057	Granges Inc.	outcrop		62.39	17.73	0.70	4.96	0.09	1.27	4.44	4.46	0.88	0.14	1.19	98.25

Table 6. Chemical Composition of Volcanic and Associated Rocks in Whitesides Township, Ontario

Hole	**Depth: ft**	**Cr** ppm	**V** ppm	**Sc** ppm	**Co** ppm	**Ni** ppm	**Cu** ppm	**Zn** ppm	**Ba** ppm	**Sr** ppm	**Y** ppm	**Zr** ppm	**Pb** ppm	**Au** ppb	**Ag** ppm	**Cu** ppm	**Zn** ppm
92-2	112	625	25	5	15	25	10	60	540	50	102	330					
92-2	125	55	135	33	30	115	15	710	40	90	22	50					
92-2	136	250	365	49	90	100	100	145	120	100	24	70					
92-2	161	470	305	44	45	105	105	150	390	140	24	60					
92-2	171	815	30	5	10	20	20	95	190	70	120	310					
92-2	193	410	35	3	10	20	20	45	160	40	114	310					
92-2	222	580	15	3	5	15	15	65	210	60	90	320					
92-2	245	360	110	18	30	20	20	85	380	150	18	100					
92-2	293	420	120	18	25	60	60	60	260	190	18	110					
92-2	316	440	130	21	35	70	70	120	400	240	21	100					
92-2	331	335	155	19	30	60	60	55	180	220	19	110					
92-2	376	535	165	23	30	45	45	95	200	210	23	100					
Dea Property outcrops																	
Sampled in 1993 by Tucker Barrie. Analysed at TSL/ASSAYERS Laboratories.																	
outcrop		695	220	34	45	165	85	65	60	110	18	70					
outcrop		1620	145	10	25	55	30	95	770	220	24	160					
outcrop		610	250	37	45	95	60	150	120	90	24	70					
outcrop		1030	190	30	40	130	80	105	410	120	20	80					
outcrop		870	95	10	10	95	35	35	290	200	16	100					
outcrop		505	290	26	25	290	70	105	400	190	64	180					
Dea Property outcrops																	
Sampled in 1991 by Warren Bates. Analysed at Swastika Laboratories.																	
outcrop				16			35	97	371	177	26	169	80		0.1		
outcrop				17			33	115	368	156	26	173	42		0.1		
outcrop				2			48	110	407	4	106	292	60		0.2		
outcrop				33			29	89	448	208	26	151	16				
outcrop				2			25	31	410	56	64	428	8				
outcrop				21			51	45	336	91	14	121	1				
outcrop				23			11	26	310	285	16	130	1				

Table 7. Chemical Composition of Some Volcanic and Intrusive Rocks in Whitesides Township, Ontario

McGill University Geochemical Laboratory: XRF data

Sample	Hole	Area	Depth ft.	SiO_2 %	Al_2O_3 %	TiO_2 %	Fe_2O_3 %	MnO %	MgO %	CaO %	Na_2O %	K_2O %	P_2O_5 %	LOI %	Total %
Dea Property															
BON 040	WD92-1	East Whitesides	55	56.51	16.79	1.100	8.84	0.14	3.88	8.28	0.89	2.49	0.200	1.22	100.45
BON 041	WD92-1	East Whitesides	151	53.82	14.24	1.214	13.00	0.18	1.96	5.77	3.84	0.32	0.223	6.09	100.72
BON 042	WD92-2	East Whitesides	53	54.92	15.65	1.367	11.95	0.20	3.07	7.26	3.60	0.73	0.224	0.99	100.05
BON 043	WD92-2	East Whitesides	71	47.88	14.16	0.952	11.92	0.33	6.33	14.41	0.25	0.70	0.176	2.57	99.81
BON 044	WD92-2	East Whitesides	348	57.35	16.87	0.843	6.46	0.13	4.74	6.76	4.38	1.07	0.118	1.74	100.57
Consolidated Rowan															
BON 037	Consol. Rowan 5	Central Whitesides	133	60.75	18.27	0.589	3.44	0.06	1.48	4.95	5.80	1.35	0.166	3.11	100.04
BON 038	Consol. Rowan 5	Central Whitesides	164	47.83	16.08	0.953	13.82	0.29	6.07	9.78	2.20	0.13	0.013	2.52	99.77
BON 039	Consol. Rowan 5	Central Whitesides	203	47.45	15.57	0.900	12.45	0.31	7.91	11.53	1.49	0.03	0.064	2.57	100.37
BON 035	Consol. Rowan 7	Central Whitesides	222	67.76	14.28	0.349	6.72	0.13	0.87	4.59	3.76	0.41	0.038	1.69	100.63
BON 036	Consol. Rowan 7	Central Whitesides	254	42.19	9.15	0.390	30.61	0.87	4.14	7.73	0.42	0.06	0.038	4.69	100.36
Broulan Reef															
BON 048	Broulan Reef W-1	Central Whitesides	802	47.49	15.28	0.865	16.46	0.30	6.54	9.35	2.12	0.15	0.091	1.85	100.62
BON 049	Broulan Reef W-2	Central Whitesides	442	42.50	13.05	0.538	22.55	0.19	6.86	9.09	1.48	0.05	0.020	3.82	100.35
BON 047	Broulan Reef W-3	Central Whitesides	84	53.98	17.25	0.731	8.89	0.25	6.31	6.50	3.96	0.24	0.110	2.21	100.56

Table 7. Chemical Composition of Some Volcanic and Intrusive Rocks in Whitesides Township, Ontario

McGill University Geochemical Laboratory: XRF data

Sample	Hole	Depth ft.	BaO ppm	Co ppm	Cr2O3 ppm	Cu ppm	Ni ppm	V ppm	Zn ppm	Ga ppm	Nb ppm	Pb ppm	Rb ppm	Sr ppm	Th ppm	U ppm	Y ppm	Zr ppm
BON 040	WD92-1	55	538	39	93	43	50	139	142	21.1	9.9	1.7	8.2	239.4	3.0	2.5	38.0	186.8
BON 041	WD92-1	151	288	47	<10	66	<5	48	132	18.5	9.8	<1	16.5	103.9	<1	1.4	27.6	138.1
BON 042	WD92-2	53	312	28	103	56	64	202	189	19.3	8.8	9.6	77.6	162.1	1.8	<1	27.2	182.2
BON 043	WD92-2	71	307	40	107	79	87	150	559	17.8	7.9	15.3	14.1	177.1	3.9	3.5	26.2	156.1
BON 044	WD92-2	348	298	38	307	86	160	159	110	18.0	7.3	<1	37.6	181.4	<1	<1	16.7	112.7
BON 037	Consol. Rowan 5	133	546	26	21	78	7	48	64	20.2	6.5	<1	28.5	139.1	<1	<1	7.0	248.3
BON 038	Consol. Rowan 5	164	135	57	85	65	38	229	138	18.9	3.1	<1	1.5	197.0	1.5	2.7	7.1	6.8
BON 039	Consol. Rowan 5	203	75	48	328	50	140	233	131	16.5	4.2	<1	<1	140.6	1.1	2.5	15.6	19.0
BON 035	Consol. Rowan 7	222	213	39	<10	64	<5	18	77	18.4	5.6	<1	4.5	74.3	<1	<1	6.4	27.6
BON 036	Consol. Rowan 7	254	78	46	193	117	93	101	136	12.4	2.6	6.9	1.3	74.6	10.1	11.0	13.8	33.0
BON 048	Broulan Reef W-1	802	123	81	233	201	187	172	183	19.3	3.4	<1	<1	139.8	2.3	3.9	10.0	11.0
BON 049	Broulan Reef W-2	442	70	164	441	363	513	208	147	13.8	3.6	3.3	<1	96.7	5.9	7.8	10.5	15.2
BON 047	Broulan Reef W-3	84	410	44	407	36	152	159	101	18.7	7.0	<1	2.0	160.6	<1	<1	11.6	42.7