Geochemistry and Petrography of Archean Volcanic Rocks from the Four Corners Area, southwestern Jessop Township, Timmins Region, Ontario

for:

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This report replaces any earlier versions

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-- Ore Systems Consulting --

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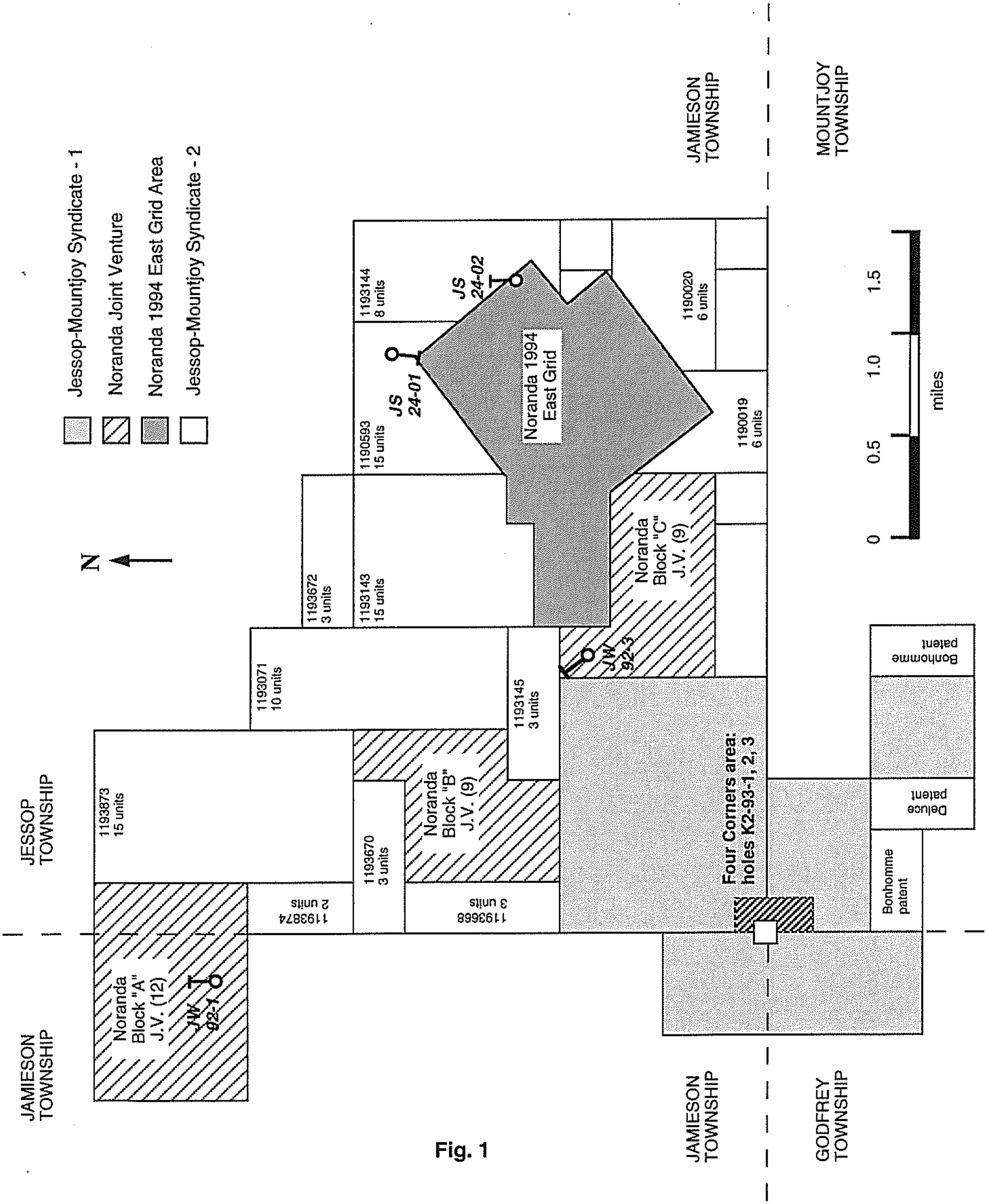
Introduction

The Bonhomme claims lie near the shared corner of the four townships of Jessop, Mountjoy, Godfrey, and Jamieson (Figure 1). Claim drilling to date has been carried out in Jessop and Mountjoy townships. The area is underlain by mafic and felsic volcanic rocks of the Archean Blake River Group. These rocks generally dip subvertically. Graded beds in K2-87-03 and K2-92-01 suggest that the sequence youngs to the north, although Jess 12-01 youngs to the south. The samples discussed in this study are from two areas in southern Jessop township: 1) The Four Corners area: claims 732132 and 723295; and 2) the east margin of Noranda's 1994 grid area, specifically claim blocks 1190593 and 1193144.

The study focuses on the lithogeochemistry and petrography of volcanic rocks intersected in diamond drill holes K2-93-1, K2-93-2 and K2-93-3, which were drilled in the Four Corners area (Fig. 2) by the Mountjoy-Jessop syndicate in 1993. Also discussed briefly are lithogeochemical data in Noranda's 1994 grid area, from holes JS 24-01 and JS 24-02, drilled by Kidd Creek in 1985 (data courtesy of Falconbridge Exploration).

A previous report on the Bonhomme claims (Van Hees, 1987) led to the drilling of holes K2-87-01, 87-02, and 87-03, which intersected important felsic volcanic lithologies that bear on the model outlined in the present report. Earth Resource Associates (Kirwan; 1991, 1992) later emphasized the results of geophysical surveys; to an extent their drilling recommendations were designed to test known EM and magnetic conductors. As a complementary approach, we have emphasized stratigraphy and lithogeochemistry as applied to evaluation of the property (Barrett and MacLean, 1993 a,b). Relevant geological data are recorded in the drill logs of Texas Gulf Sulphur (Jess 12-01), Noranda Exploration Ltd. (87-01, -02, -03, and 92-01, -02, -03) and Falconbridge Inc. (Jess 12-02).

Holes K2-93-1, K2-93-2 and K2-93-3 were drilled in the Four Corners area by the Mountjoy-Jessop syndicate to test both the geophysical anomalies discussed by Grant (1993). Also, the felsic volcanics that outcrop about 50-100 m east of the Four Corners may represent a continuation of the felsic volcanic stratigraphy intersected in holes 87-03 and 87-02. The goal was to locate the proximal part of the felsic volcanic pile, where hydrothermal activity would be expected to be most intense. Stratigraphic data (summarized in Barrett and MacLean, 1993 a,b) indicate that the fragmental felsic rocks are thickening and coarsening in a westward direction; in addition, they locally show notable sulfide mineralization and alteration.


Jessop-Mountjoy Syndicate - 1
Noranda Joint Venture
Noranda 1994 East Grid Area
Jessop-Mountjoy Syndicate - 2
N
JAMIESON TOWNSHIP
MOUNTJOY TOWNSHIP
JESSOP TOWNSHIP
GODFREY TOWNSHIP
1193144 8 units
JS 24-02
JS 24-01
Noranda 1994 East Grid
1190020 6 units
1190593 15 units
1190019 6 units
1193672 3 units
1193143 15 units
Noranda Block "C" J.V. (9)
1193071 10 units
1193145 3 units
JW 92-3
Bonhomme patent
1193873 15 units
Noranda Block "B" J.V. (9)
Four Corners area: holes K2-93-1, 2, 3
Deluce patent
1193670 3 units
1193874 2 units
1193668 3 units
Bonhomme patent
Noranda Block "A" J.V. (12)
JW 92-1
0
0.5
1.0
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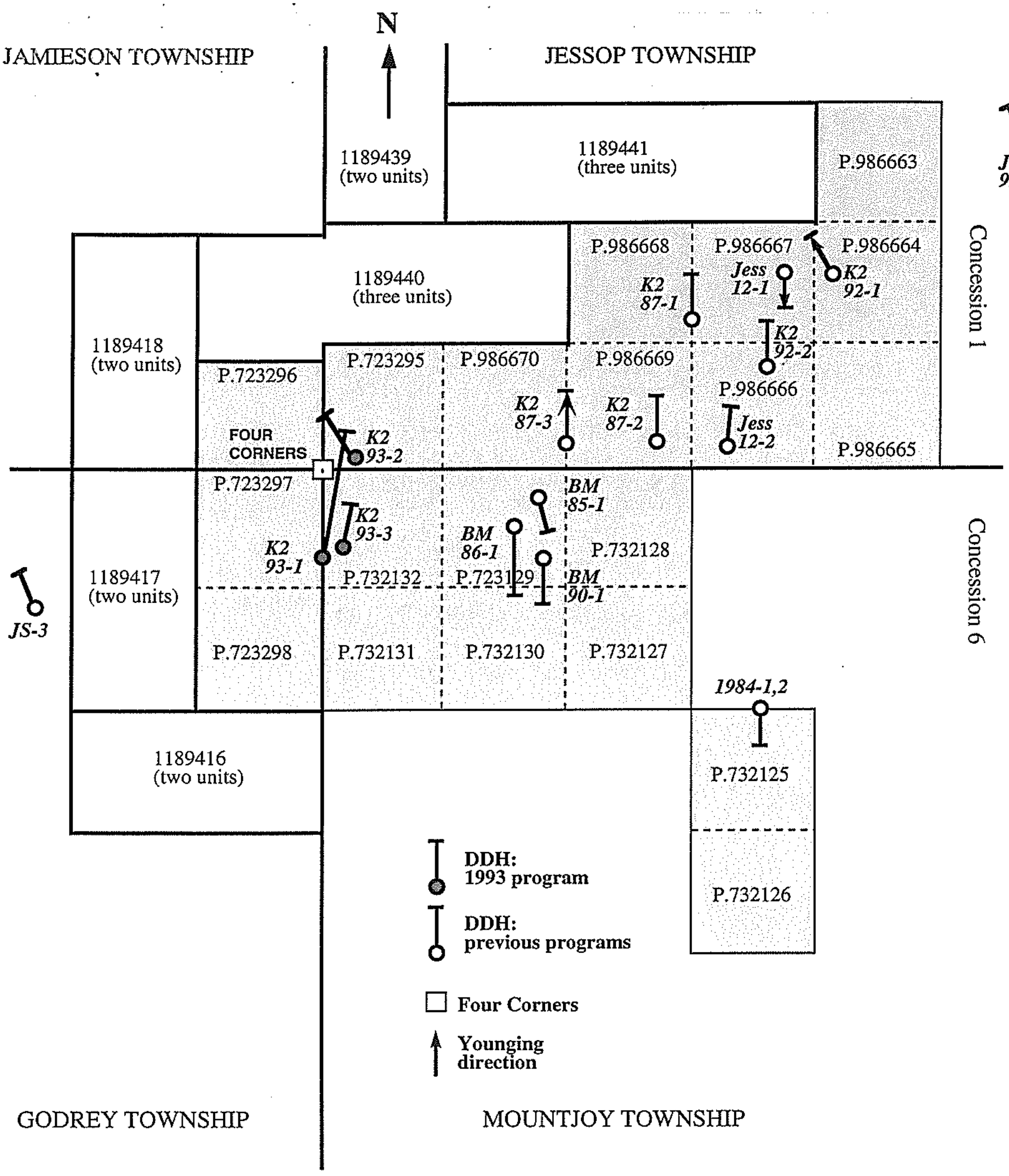
miles

Fig. 1



Location of initial Bonhomme 20-claim block (grey), new claims (white), and known diamond drillholes (from J.L. Kirwan report dated April 27, 1992)

Fig. 2

Purpose and Scope of Study

The purposes of this study are: 1) to characterize chemically the main volcanic rock types in drillholes K93-1, K93-2 and K93-3 located immediately east of the Four Corner area on the Bonhomme claims; 2) to petrographically describe some of these volcanic rocks; 3) to assess the original volcanic environments from variations in stratigraphic sequence and volcanic facies; 4) to compare the chemistry of the volcanic rocks with those hosting massive sulfide deposits in the Timmins area and elsewhere in the Abitibi greenstone belt; and 5) to make recommendations for further work on the property.

Lithogeochemistry

Methods

The new sample set contains 35 samples from drillholes K93-1, K93-2 and K93-3, and 6 samples from outcrops within 50-150 m of the Four Corners (4 samples from a mafic unit in hole 86-1were also analyzed). Drillhole samples were generally about 25 cm in length, except where noted. Most samples were analyzed by X-ray fluorescence at the XRAL lab in Toronto using glass beads for major elements and pressed pellets for the trace elements Zr, Y, Nb, Ba, Rb and Sr to ensure accuracy and low detection limits. Three samples were analyzed by ICAP (lithium metaborate fusion). In addition, we list 22 XRF analyses provided by Falconbridge Limited from holes 24-01 and 24-02, located on the eastern margin of Noranda's 1994 east grid. These samples were taken over 3 ft. intervals.

Four Corners Area

Primary Geochemistry

Twenty five of the samples are from K93-1, with 8 samples from K93-2 and only 2 from the first part of K93-3. As shown by a plot of Al_2O_3 versus TiO_2, the volcanic stratigraphy is lithogochemically simply, comprising a mainly bimodal sequence of basaltic andesite and rhyolite, with five dacitic compositions (Fig. 3a). The basaltic andesites show a small range in compositions due to fractionation, whereas the rhyolite is essentially an end-member rhyolite with precursor immobile element values estimated at $Al_2O_3 = 11.6\%$, $TiO_2 = 0.17\%$ and Zr = 362 ppm. The five dacitic compositions, although fairly uniform in terms of Al_2O_3-TiO_2, could represent a mechanical mixture of polylithic lapilli fragments. However, the proportion of felsic to mafic fragments would have to be about the same (about 4:1) to produce the narrow range of 0.47-0.68% TiO_2 observed in the dacitic samples. One sample with an "andesitic" composition is an agglomerate intersected in hole K93-2, and certainly represents a mixture (about 1:1) of mafic and felsic clasts.

A plot of TiO_2 versus Zr (Fig. 3b) shows that the basaltic andesites can be divided in high-Zr and low-Zr groups. The high-Zr group is comprised of 3 samples from K93-1, at 543, 583 and 790 feet. These are from pillowed to massive lavas (locally present mafic hyaloclastic material was not sampled). The pillow lavas are variolitic near their margins (samples were from interiors). The high-Zr group is also high in P_2O_5 (0.41-0.45%). A similar group of high-Zr basaltic andesites was also noted by Barrett and MacLean (1993b) in hole K2-87-3 located about 0.5 miles to the east (Fig. 2).

The five dacitic compositions comprise one low-Zr and four high-Zr samples (Fig. 3b). They occupy a field very similar to that of "rhyolite B" observed in several holes 0.5-1.0 miles to the east (Barrett and MacLean (1993a). We use the term dacite here, because although the TiO_2 and Zr contents of the dacite are similar to those of rhyolite B, the Fe_2O_3 contents (8-20%) are much higher than any rhyolite, as are MnO values. Although some of the increased iron contents could reflect alteration, it is likely, given the other features of the analyses, that these are high-Zr, Fe-rich dacites similar to the "evolved ferrodacite" rock type to the east. The one low-Zr dacite is closer to rhyodacite in composition.

A plot of Al_2O_3 versus Zr (Fig. 4a) again shows the basaltic andesite group and the rhyolite alteration line. In this plot, the three high-Zr basaltic andesites and the four high-Zr dacites coincidentally plot close to the rhyolite alteration line. This emphasizes the need to examine all samples in each of the Al-Ti-Zr cross-plots to identify the rock types with certainty. Note that in each of these plots (Figs. 3a, 3b, and 4a), all rhyolites lie along or very close to single alteration lines, indicating that Al-Ti-Zr were essentially immobile during alteration. Mass changes resulting from alteration of this single precursor system therefore can be readily calculated, as discussed in a later section. A plot of SiO_2 versus Zr (Fig. 4b) illustrates the low-Zr and high-Zr basaltic andesite groups (the latter group contains one ferrodacite). This plot also shows that the addition or removal of silica has significantly affected the Zr content of the rhyolites (and similarly their Al-Ti contents). Although the precursor rhyolite is estimated below to have had $SiO_2 = 77\%$ and Zr = 362 ppm, rhyolites now have SiO_2 values of 63-83% and Zr values of 290-470 ppm (LOI-free basis). However, because mass changes in other mobile elements such as the alkalis and iron have also occurred, the silica variations cannot be read directly from the SiO_2 versus Zr plot, but must be calculated as shown later.

Composition of volcanic rocks in Four Corners area, southwest Jessop Township (holes K93-1, 2, 3)

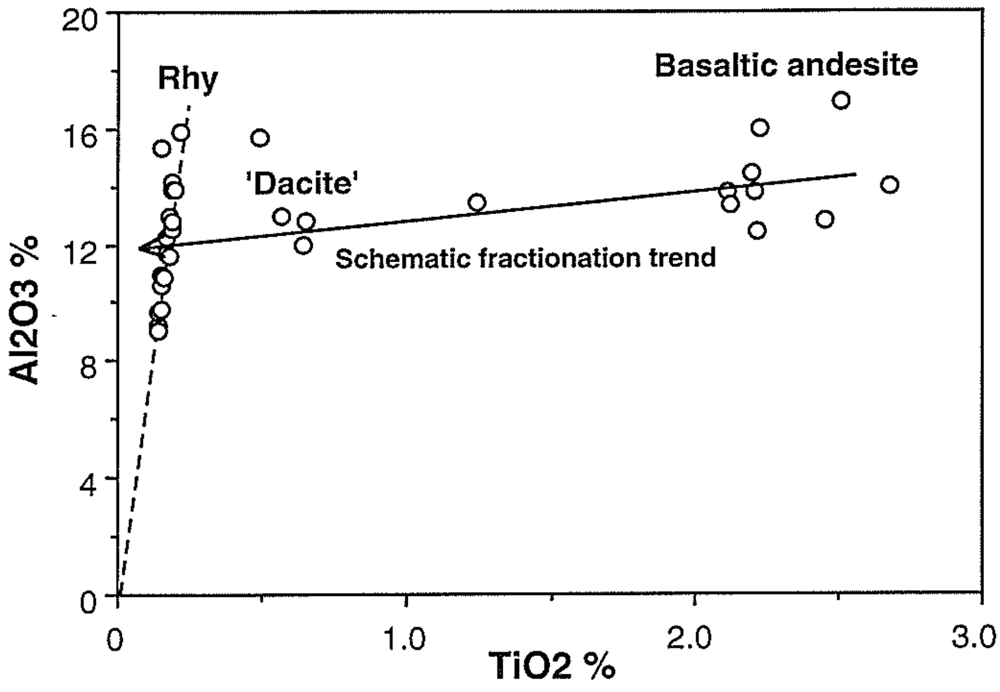


Fig. 3a

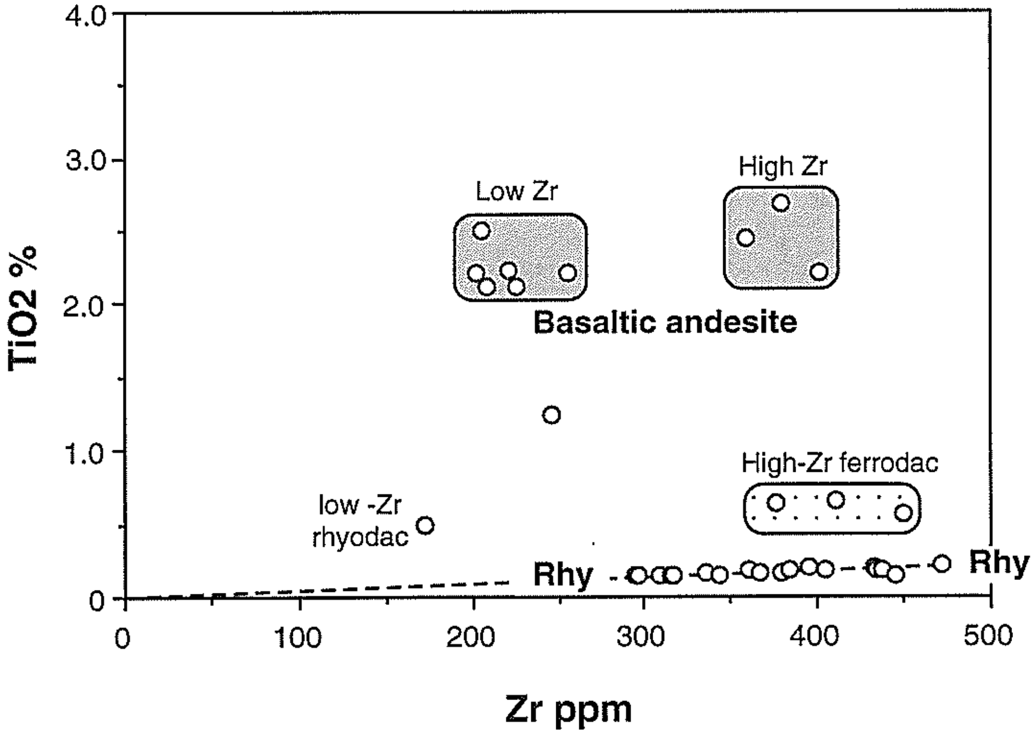


Fig. 3b

Composition of volcanic rocks in Four Corners area, southwest Jessop Township (holes K93-1, 2, 3)

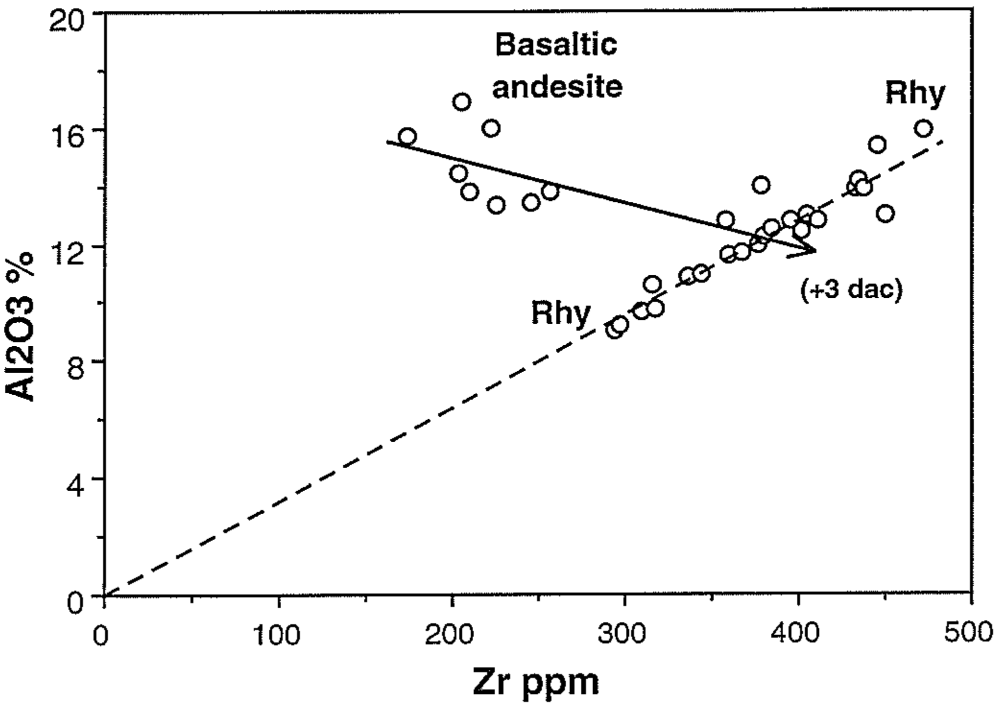


Fig. 4a

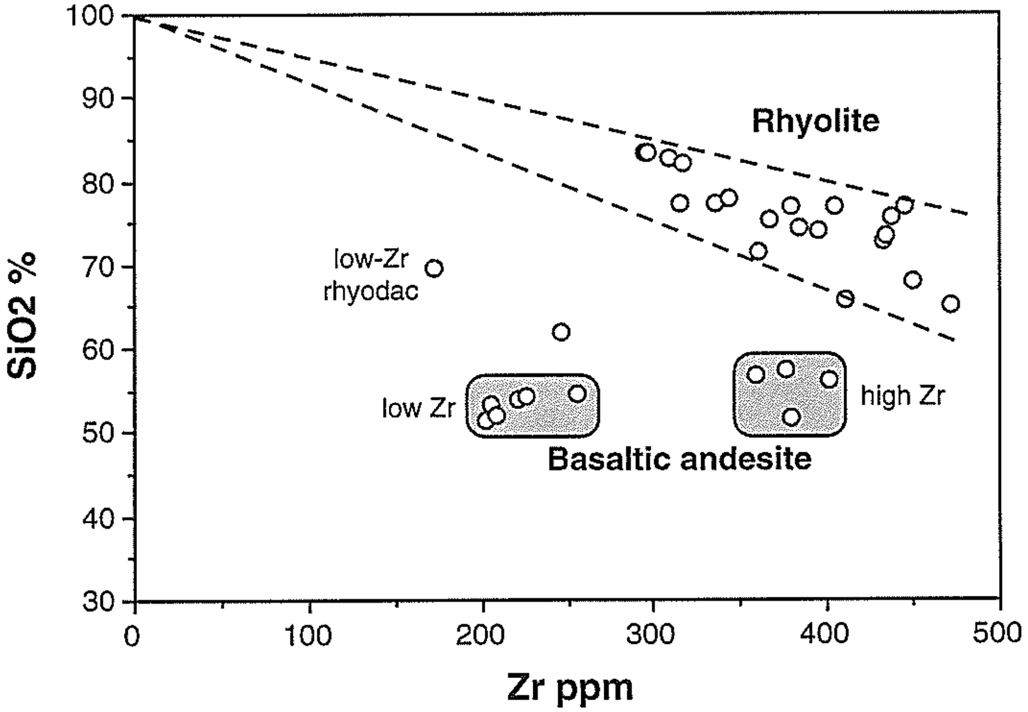


Fig. 4b

A plot of Y versus Zr (Fig. 5a) shows that the rhyolites fall into two groups, mainly due to their contrasting Y contents. The high-Y rhyolites have Zr/Y ratios in the 2.9-4.2 range, indicating a tholeiitic affinity. The low-Y rhyolites have Zr/Y ratios in the 6.0-7.3 range, indicating a transitional affinity. The basaltic andesites also fall into two groups, as a result of their contrasting Zr contents. The basaltic andesites have Zr/Y ratios mainly in the 6-9 range, indicating transitional to mildly calc-alkaline affinities. The ferro-dacites are in the 5.0-6.3 range.

Normally, incompatible element contents such as Y-Zr-Nb-Yb will increase, but their ratios will remain constant, in a sequence of mafic to felsic volcanic rocks related by fractional crystallization. The fractionation trends in cross-plots of these elements should emanate from the origin. [Note, however, that much of the spread in the rhyolite points in these plots is due to alteration, which moves points towards or away from the origin.]

A plot of Nb versus Zr (Fig. 5b) shows that rhyolites and the low-Zr basaltic andesites lie more or less along one trend, which would support the idea that these rocks are related genetically. By contrast, the high-Zr basaltic andesites and the high-Zr dacite lie below the trend due to their lower Nb contents; this suggests that these rocks have been derived from a different magma type. [If the rhyolites and the low-Zr basaltic andesites are indeed related, then they would define a trend in the Y-Zr plot (Fig. 5a) that would not extend towards the origin, but would intersect the X-axis at Zr values of about 100-150 ppm. This would require that the starting mafic liquid was enriched in Zr relative to Y. It would also mean that the low-Zr basaltic andesites could be tholeiitic (lying on a Zr/Y slope of ≈3-4) as opposed to the Zr/Y values of 6-9 inferred above on the basis of a fractionation trend that passes through the origin.]

Rare-Earth Elements

Although no samples from the 1993 drilling program have as yet been analyzed for REE, we have acquired data for two rhyolites and two basaltic andesites from holes K2-87-02 and 87-03, located 0.5-0.7 miles to the east (Fig. 2). The results are given in Table 2 and shown as chondrite-normalized plots in Fig. 6. The two rhyolites are characterized by relatively flat REE patterns, and by high total REE contents (Fig. 6a). The REE patterns are almost identical to those of the Kidd Creek and Kamiskotia rhyolites, and other FIIIb rhyolites (Lesher et al., 1986; Barrie et al., 1993). The rhyolites from holes 87-2 and 87-3 also have high Y contents of 95 and 156 ppm, respectively, and tholeiitic Zr/Y ratios of 4.5 and 4.7 (Barrett and MacLean, 1993b).

Composition of volcanic rocks in Four Corners area, southwest Jessop Township (holes K93-1, 2, 3)

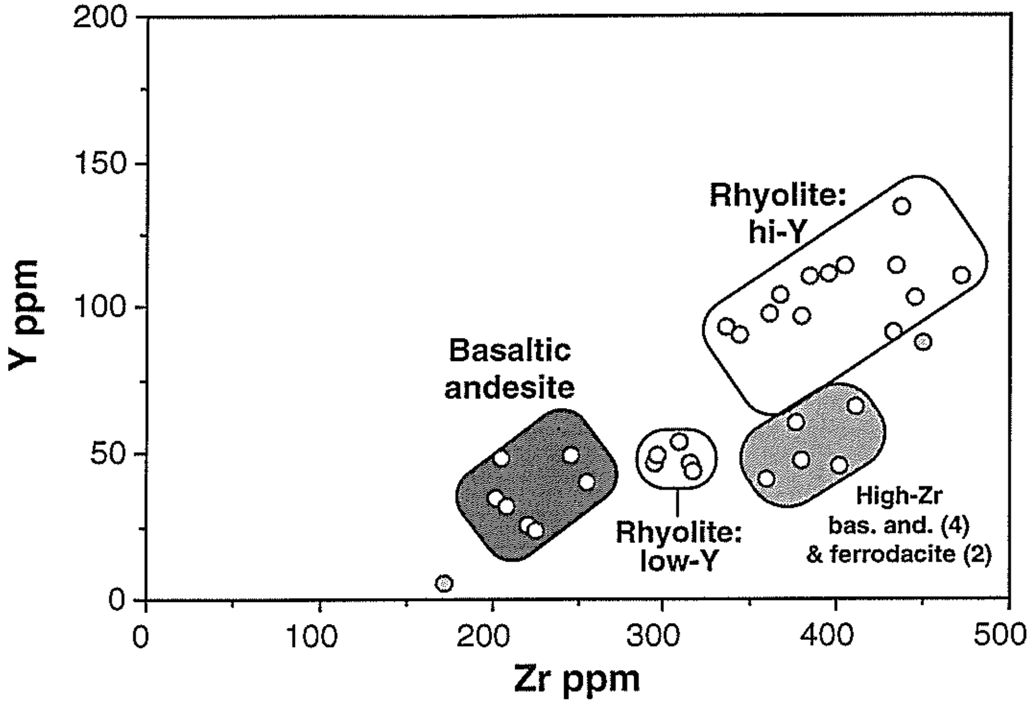


Fig. 5a

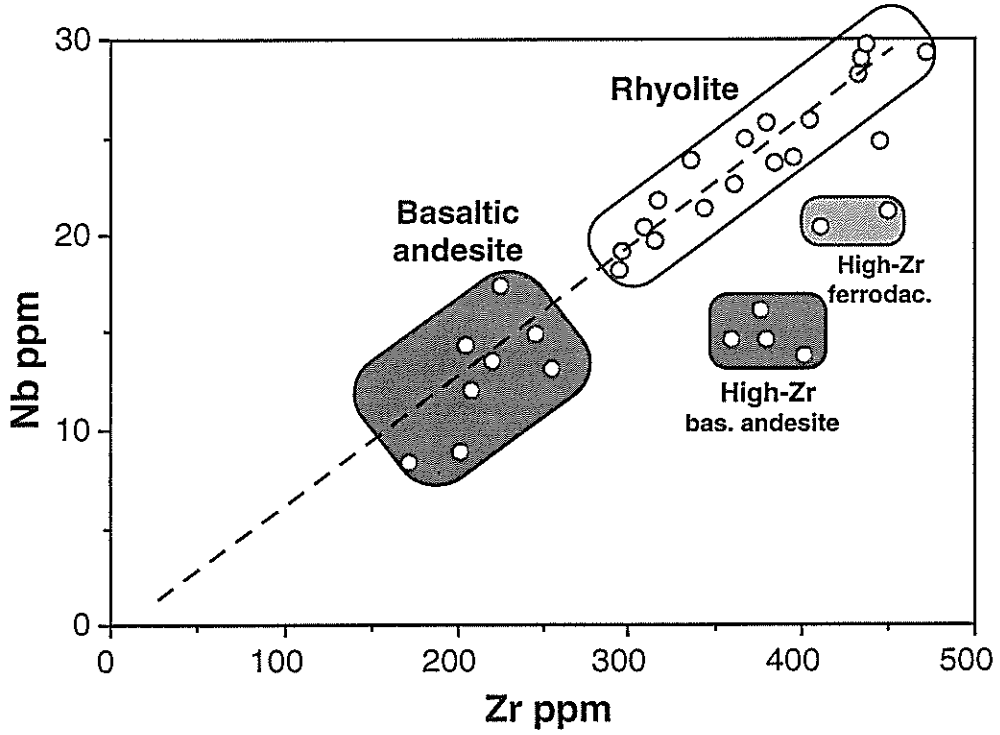


Fig. 5b

South Jessop Township rhyolites

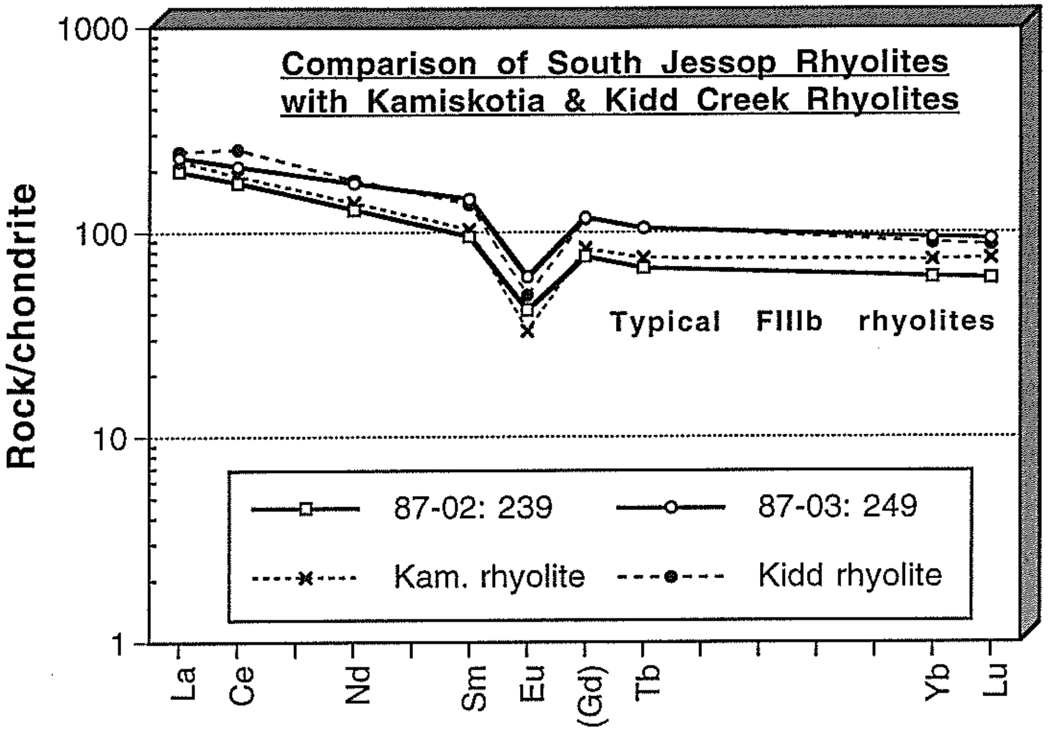


Fig. 6a

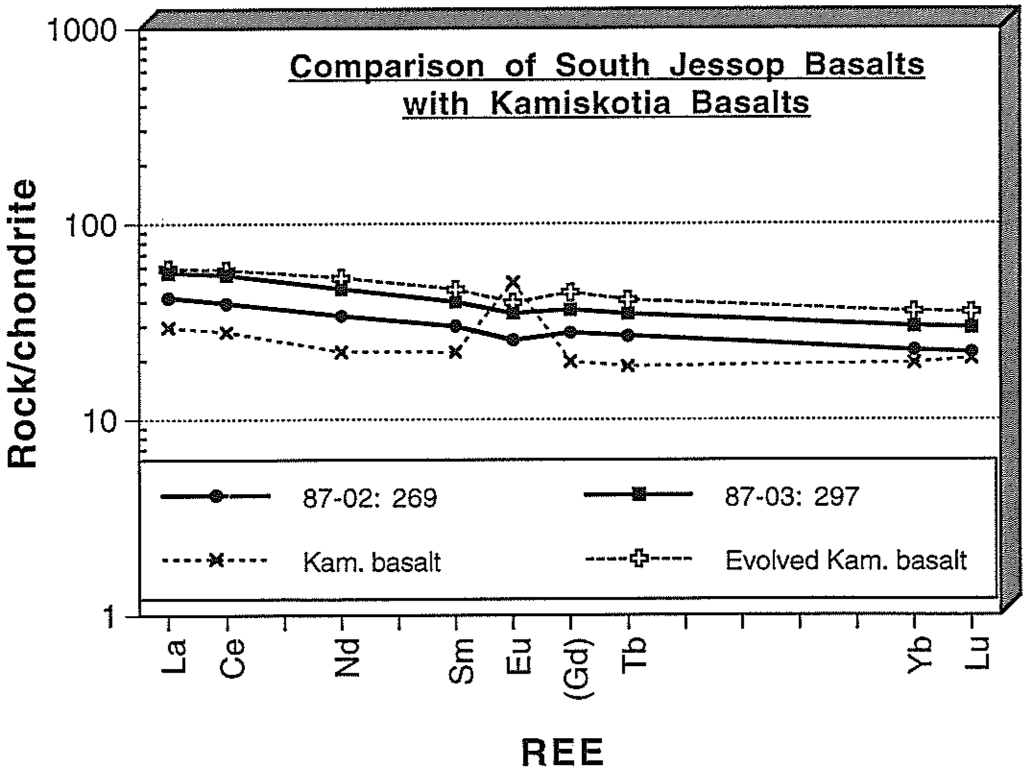


Fig. 6b

The REE patterns of the two basaltic andesites from holes 87-2 and 87-3 are almost flat, with relatively high total REE contents (Fig. 6b). These features are similar to those of the evolved basalts at Kamiskotia (Barrie et al., 1991). The basaltic andesite from hole 87-3 lies near the end of the mafic fractionation trend outlined in Barrett and MacLean (1993b). Relative to the sample from 87-2, it has higher contents of Zr (241 versus 149 ppm), P_2O_5 and TiO_2. The two basaltic andesite samples have transitional to slightly calc-alkaline Zr/Y ratios of 5.2 and 7.1.

Downhole Lithogeochemical Variations

As an example of how downhole lithological and magmatic affinity can be monitored on a first-pass basis, it is useful to examine, respectively, the Al_2O_3/TiO_2 and Zr/Y ratios (which ideally are insensitive to alteration). Results for hole 93-1, the longest of the three holes drilled in the 1993 program, are shown in Fig. 7. It should be borne in mind that not all lithological units (e.g. polylithic fragmental units and argillites) were sampled in our initial data set.

The Al_2O_3/TiO_2 ratio (Fig. 7a) shows that the hole intersected major upper and lower felsic units with an intervening sequence of basaltic andesites and some dacite. The basaltic andesites show only a limited lithological variation (≈5-8), but there is a wider range in the rhyolites (≈62-73). In particular, there are two discrete rhyolite types within the felsic sequence in the lower part of the hole below 1300 ft. In Fig. 7a, these have been labelled TH and CA on the basis of their Zr/Y ratios (Fig. 7b). The TH = tholeiitic rhyolites occur at the end of the hole, that is, immediately north of the CA = calc-alkaline rhyolites. If the stratigraphy youngs to the north, then the tholeiitic rhyolite unit is younger than the calc-alkaline unit. The change in Al_2O_3/TiO_2 ratio shows that the tholeiitic rhyolite unit is also more fractionated than the calc-alkaline unit. Note also that: i) the rhyolites in the upper part of the hole (200-400 ft.) are mainly tholeiitic; and ii) the sampled mafic units within the 500-1300 ft. portion of the hole seems to become more tholeiitic downhole (Fig. 7b).

Alteration Geochemistry

The new analyses show that the felsic rocks are commonly K-altered, and a subgroup is notably silicified. The effects on silica mobility on immobile element contents in the rhyolites were illustrated in Figures 3 and 4 above. Below, we further examine the effects of element mobility during alteration.

Downhole variations in hole K93-1, Four Corners area, southwest Jessop Township

Lithology

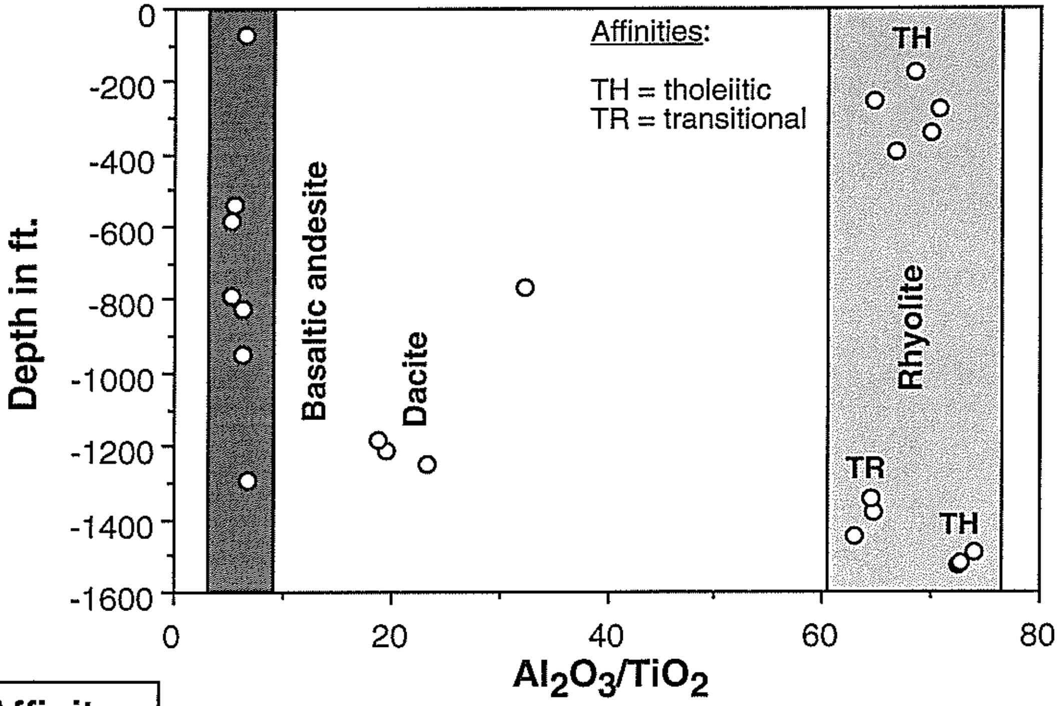


Fig. 7a

Affinity

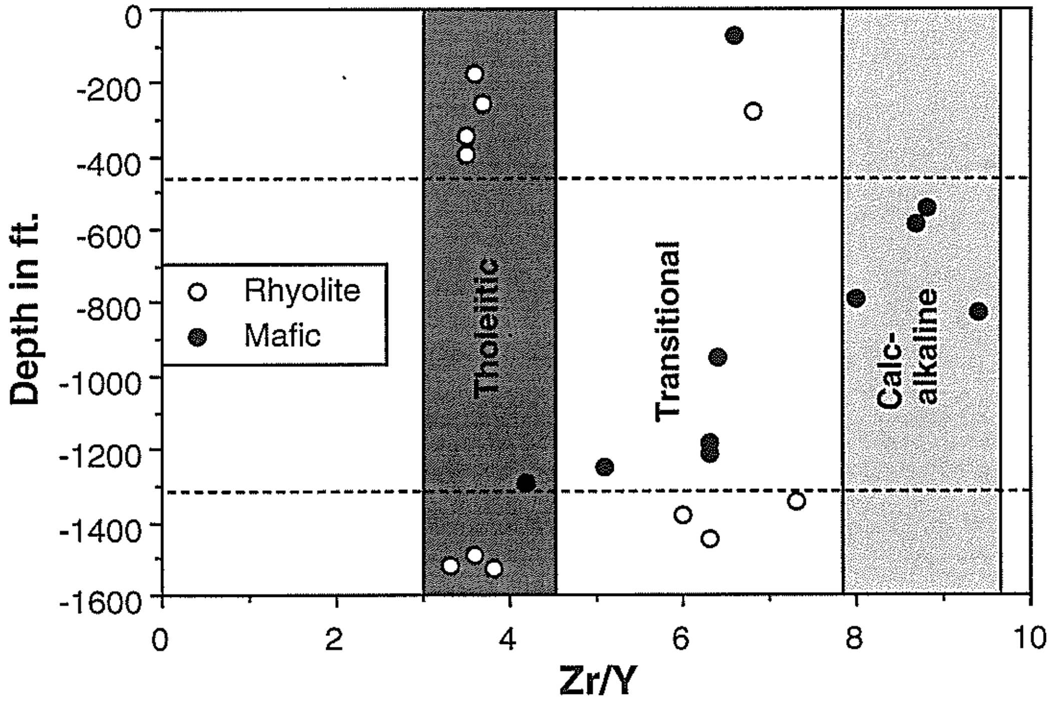


Fig. 7b

Although we do not have CO_2 data, many rocks commonly show carbonatization, in particular some of the mafic rocks. The effect of abundant sericite and carbonate in a sheared mafic rock is to give the rock a rather felsic appearance, which has led to some misidentifications in the drill logs; however, even in thin section it is difficult to tell if the rock had a mafic or felsic precursor. In these cases, only the lithogeochemistry clarifies the nature of the precursors.

A plot of K_2O versus Al_2O_3 (Fig. 8a) shows although K_2O contents have increased from precursor (least altered) values of <1% to values of up to 6%, the Al_2O_3 values are mainly in the 9-17% range. If all of the K in the rock were present in the form of the stable phase sericite, such samples would lie along a sericite alteration line extending from the origin to the composition of end-member sericite (≈11% K_2O and 35% Al_2O_3). However, many samples lie below this line, suggesting that they contain some K-feldspar. This phase could still be a hydrothermal alteration product (and one which also could have been partly converted to later sericite). Some XRD work would be useful to estimate the proportions of K-feldspar and sericite. Perhaps small domains within plagioclase are first altered to K-feldpsar as potassium is added to the rock from fluids, and then, when sufficient residual Al to stabilize sericite becomes available through processes such as leaching of adjacent glass, these domains are converted to sericite.

As K_2O is added to the rock, Ba increases (Fig. 8b), as does Rb contents (not shown), indicating that these traces are incorporated into the K-bearing alteration minerals.

An effective way of examining alteration relationships in the rhyolites is to plot a mobile element against TiO_2, which can be used as a type of fractionation monitor once TiO_2 begins to systematically decrease from its highest content (in the most fractionated basaltic andesites) down through andesites to dacite and rhyolite. In plots of both K_2O versus TiO_2 (Fig. 9a) and FeO versus TiO_2 (Fig. 9b), rhyolites appear to lie along single "alteration lines". The variations in TiO_2 contents in the rhyolites are actually proportionally the same as the Zr variations shown for the rhyolites in Figures 3 and 4, but because of the broad scale of the TiO_2 X-axes in Fig. 9, the rhyolite are compressed into a narrow subvertical band. The trends along which they lie are not strictly alteration lines, as K and Fe are normally considered as mobile elements. A true alteration line only exists on plots of one immobile element against another, and in these it will pass through the origin. Note that the rhyolite trends in Fig. 9 emanate instead from the composition of least altered rhyolite.

Composition of volcanic rocks in Four Corners area, southwest Jessop Township (holes K93-1, 2, 3)

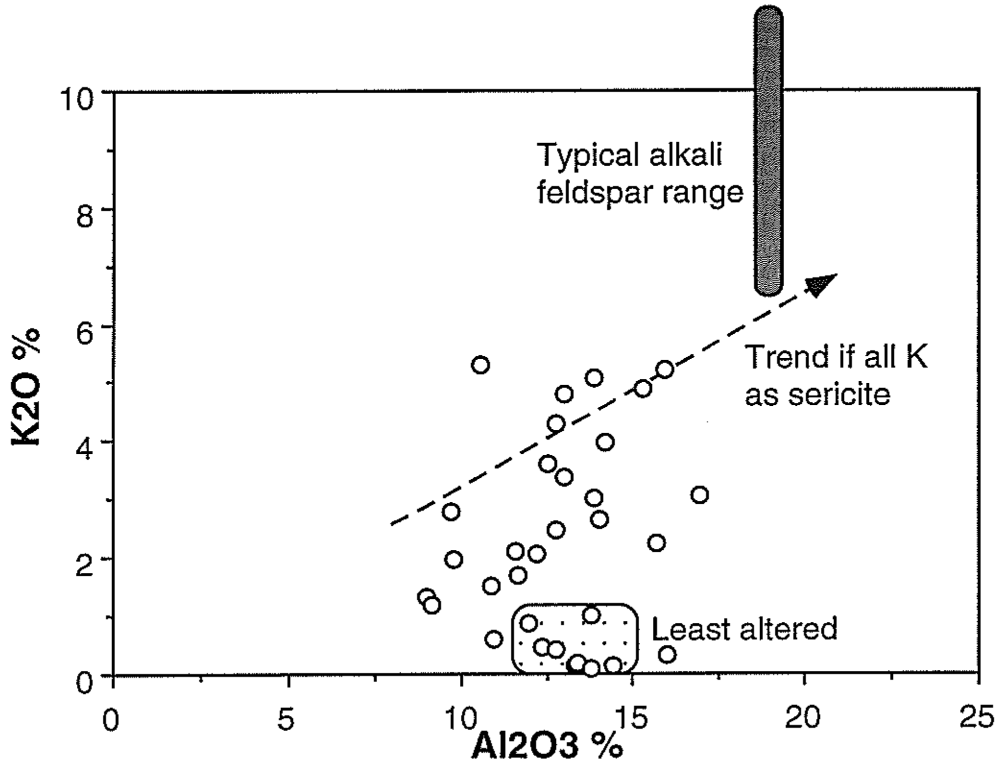


Fig. 8a

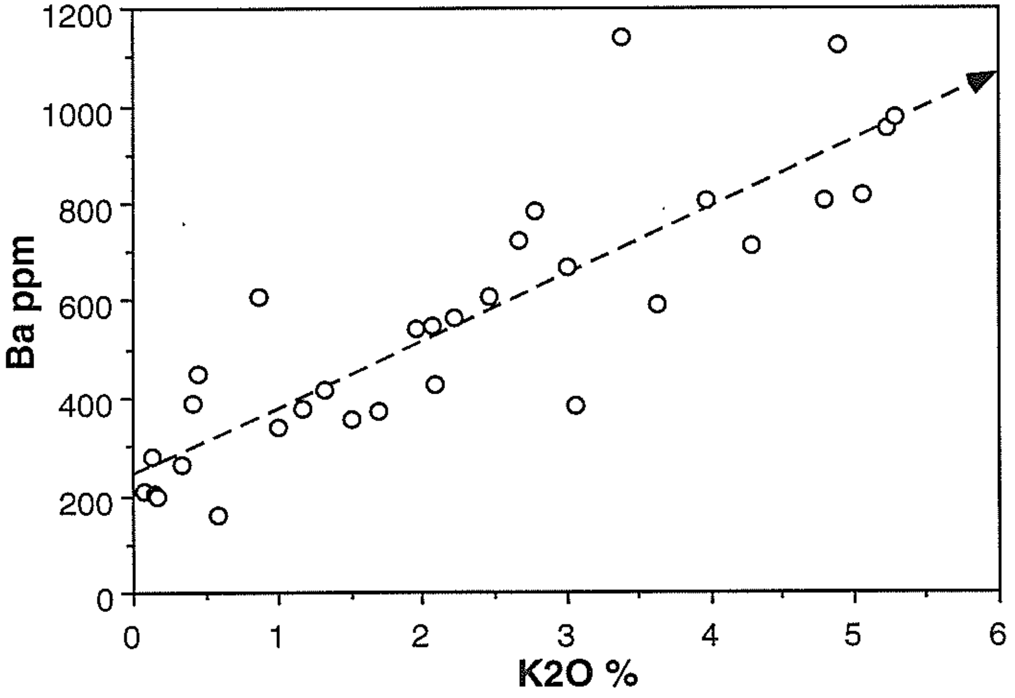


Fig. 8b

Composition of volcanic rocks in Four Corners area, southwest Jessop Township (holes K93-1, 2, 3)

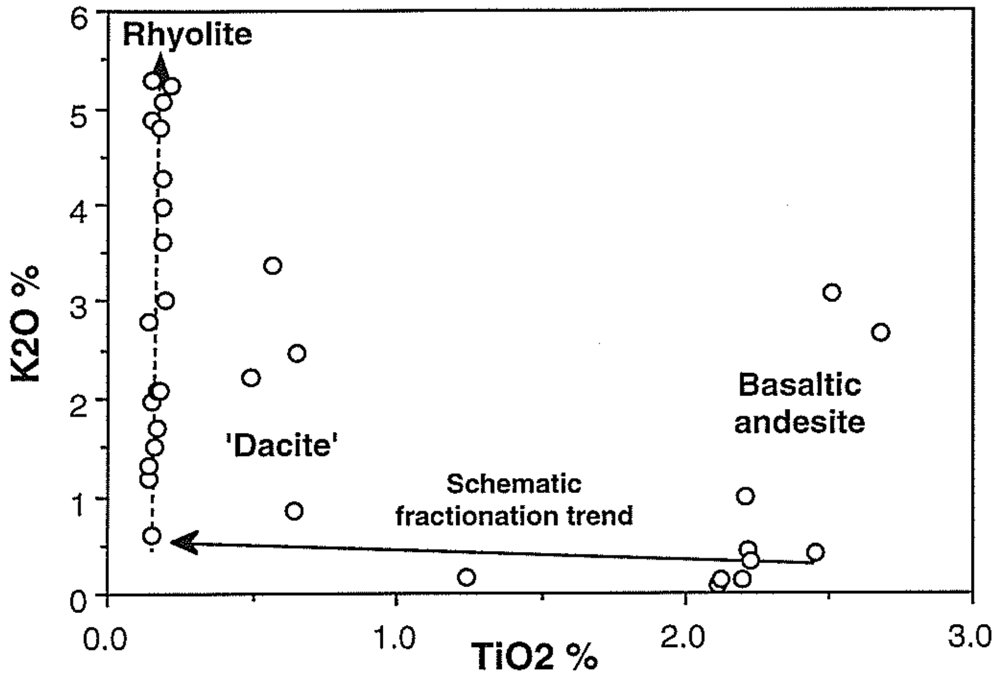


Fig. 9a

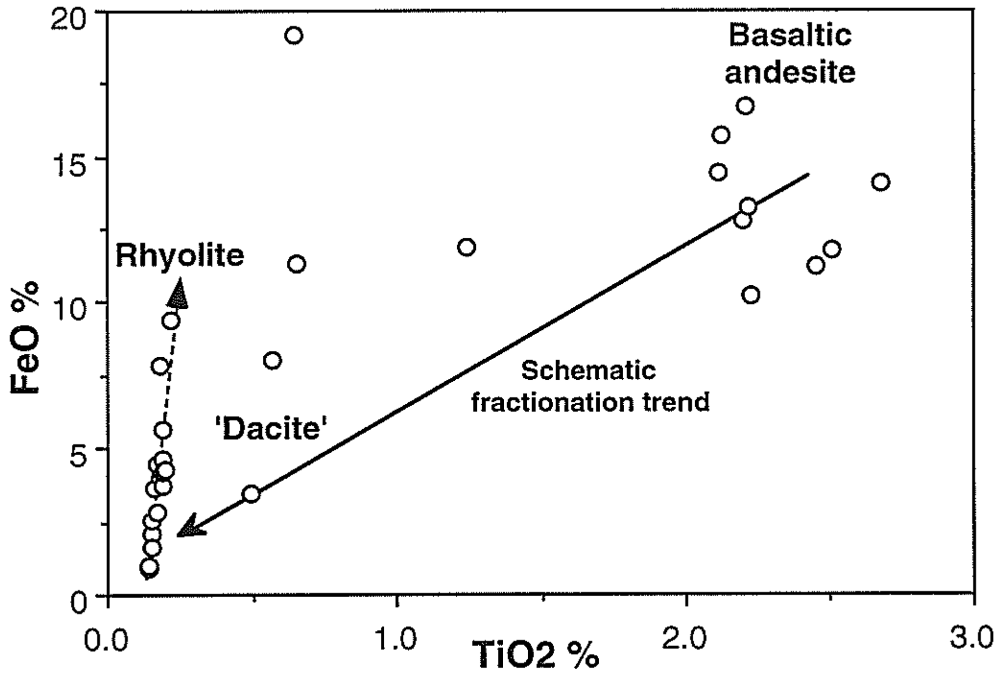


Fig. 9b

Nonetheless, an idea can be gained from these plots of the relative amounts of K and Fe that were added during alteration. The actual amounts must be calculated, as they depend on the other effects occurring in the rock during alteration. For example, a rhyolite with 5% K_2O might have had the same amount of K added as a rhyolite with 3% K_2O, the difference being that the former rock had undergone much stronger leaching of silica and other alkalis, leading to the residual concentration of K (in a stable Al-silicate phase). Note that a couple of mafic rocks have also experienced significant K addition (Fig. 9a).

Mass Changes

Mass changes have been calculated for rhyolites from K93-1, 93-2 and 93-3, based on a single precursor composition and the use of Al_2O_3 as the immobile anchor. Details of the method are given in MacLean and Kranidiotis (1987) and Barrett and MacLean (1991). Table 3 gives the composition of the rhyolites, their reconstituted values, and the calculated mass changes (which represent the difference between the reconstituted and precursor values). Results based on the use of Zr as the anchor, instead of Al_2O_3, are very similar for most samples. In the rhyolites, the main mass changes (Δ symbol) involve silica, iron and the alkalis. Mg changes have been relatively small. In the following plots, the intersection of the dashed lines indicates the precursor composition (no mass change). Samples that plot well away from the precursor have experienced significant mass changes.

A plot of ΔK_2O versus ΔSiO_2 (Fig. 10a), fields of silica gain and silica loss can be distinguished. The former field tends to have higher values of K_2O gain than the latter field. It is of interest that the felsic sequence encountered in the lower part of hole K93-1 (samples from 1343-1526 ft.) shows both types of alteration. The 3 samples of the calc-alkaline rhyolite unit, which is presumably stratigraphically lower, are strongly silicified with only minor K_2O gain, whereas 2 of 3 samples of the tholeiitic rhyolite unit are silica-leached with notable K_2O gain (Table 3).

A plot of ΔFeO versus ΔSiO_2 (Fig. 10b) shows that some of the silica-leached rhyolites are also enriched in iron, whereas none of the silica-gain rhyolites are. [Although some rhyolites appear to have undergone minor mass loss of FeO, this is probably an artifact of a estimated precursor FeO content that is too high by about 1%.] The silica-leached rhyolites also tend to be most strongly depleted in sodium (Fig. 11a). Increasing chloritization can be monitored by a plot showing breakdown of the plagioclase component of the rock as FeO and MgO are added (Fig. 11b). To examine sericitization as a function of breakdown of the plagioclase component, K_2O can be plotted on the Y-axis.

Mass changes for rhyolites from holes K93-1, 2, 3 in southwest Jessop Township

NB: All mass changes in absolute weight %

Fig. 10a

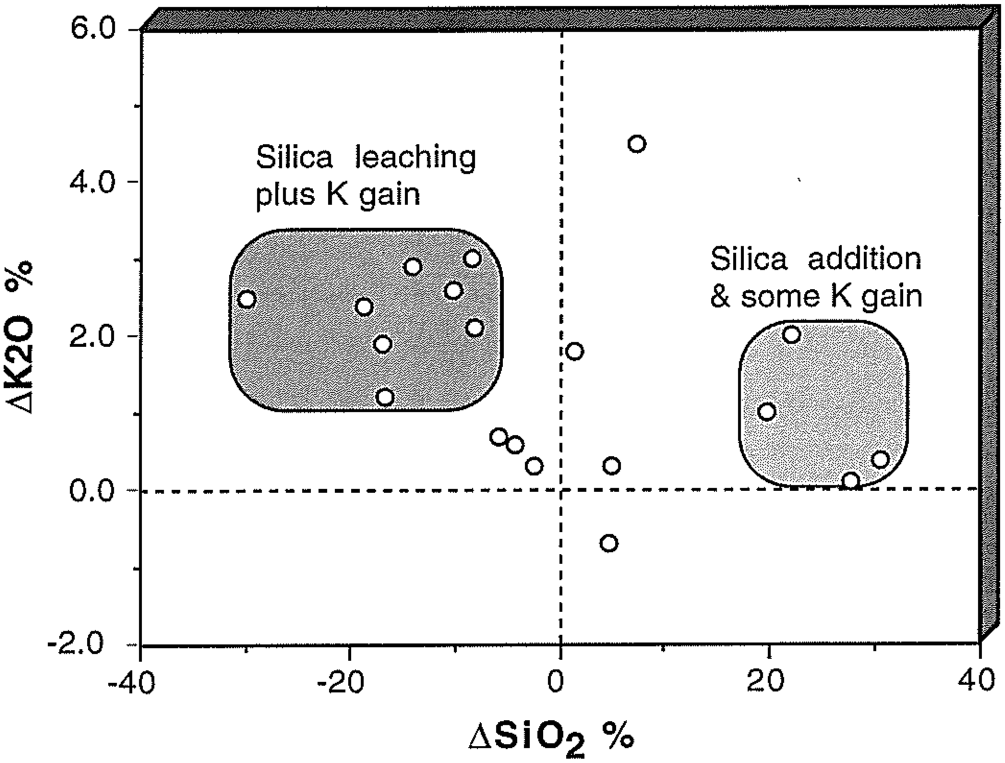
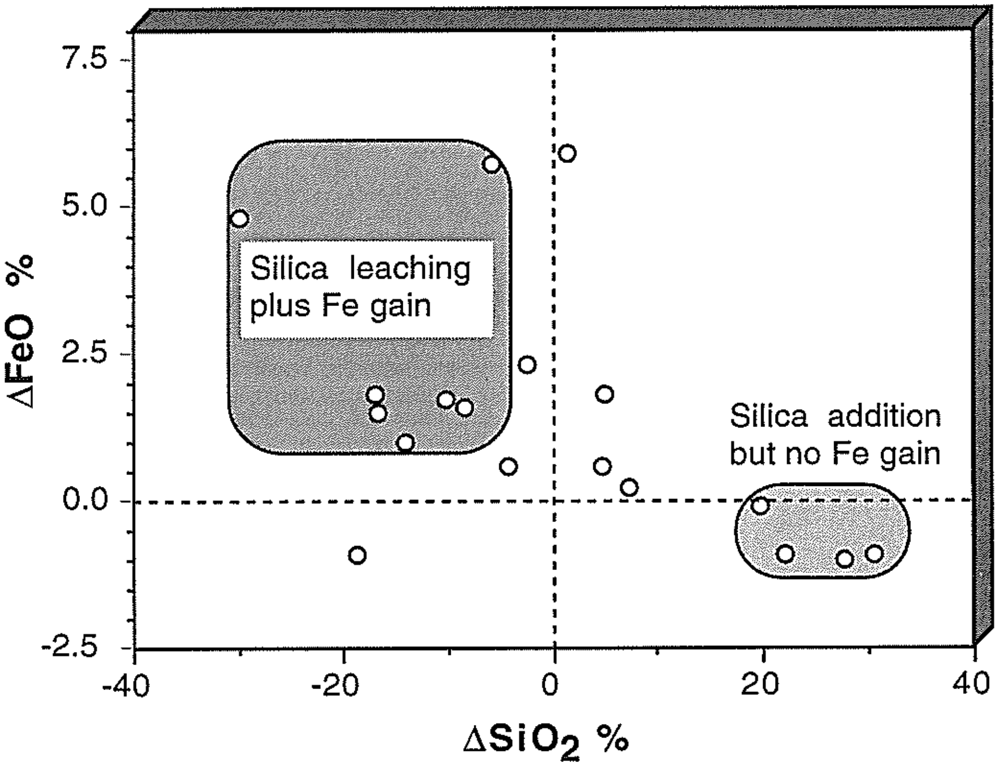


Fig. 10b



Mass changes for rhyolites from holes K93-1, 2, 3 in southwest Jessop Township

NB: All mass changes in absolute weight %

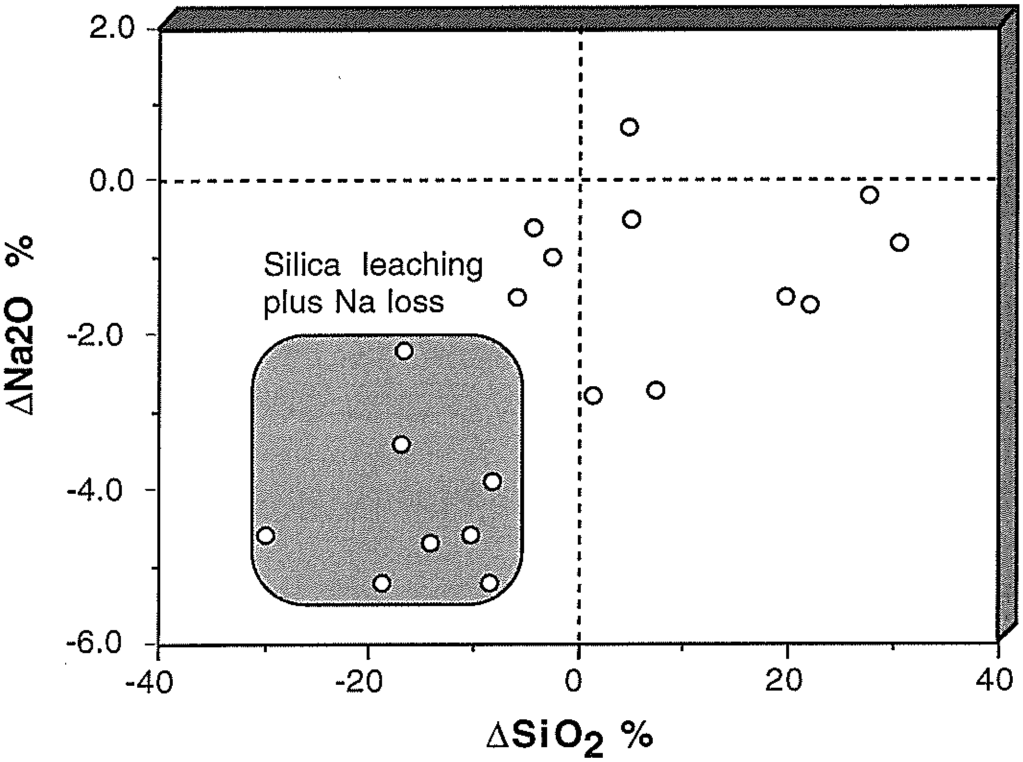


Fig. 11a

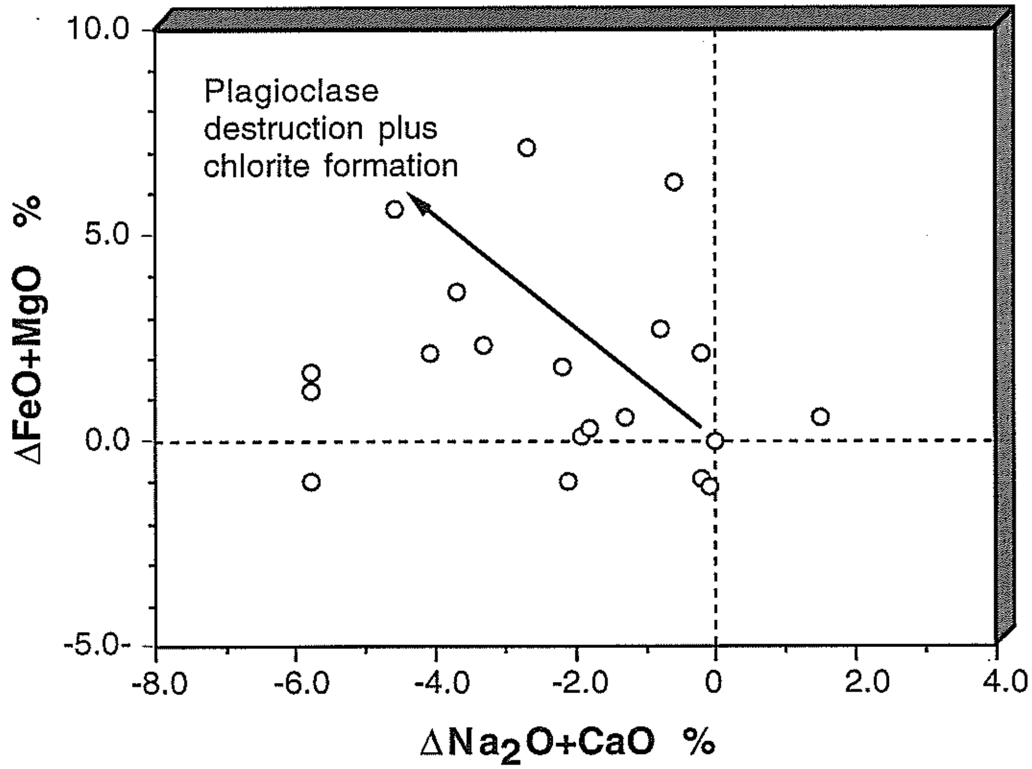


Fig. 11b

Noranda's 1994 East Grid Area

Volcanic Geochemistry

The lithogeochemical data from holes JS 24-1 and 24-2, located on the eastern margin of Noranda's 1994 East Grid area, are given in Table 4 and plotted in Figs. 12-14. These plots also show the Four Corners data for comparative purposes. An Al_2O_3 versus TiO_2 plot (Fig. 12a) highlights the differences between these two areas, as neither the mafic nor felsic lithologies match. The felsic rocks in JS 24-1 and 24-2 are closer to rhyodacite in composition as shown by their Fe-Ti-P-Zr-Si relations, and in fact closely resemble the "rhyolite B" lithology noted in several drill holes located 0.5-1.0 miles east of the Four Corners (Barrett and MacLean, 1993a).

These various rhyodacitic rocks are all less fractionated than the Four Corners rhyolites encountered in holes K93-1, 93-2 and 93-3 (which correspond to the "rhyolite A" lithology defined by Barrett and MacLean, 1993a). On the eastern margin of Noranda's 1994 East Grid area, rhyolite A seems to be absent. By contrast, rhyolite B occurs in this area, and also in drill holes located 0.5-1.0 miles east of the Four Corners, but is absent at the Four Corners. As shown in Fig. 13a, most of the rhyodacites in JS 24-1 and 24-2 have much lower Zr contents than typical rhyolite A (and even lower Zr than some of the basaltic andesites). This indicates that these rhyodacites were derived from a different, Zr-poor magma relative to rhyolite A (which is enriched in incompatible elements).

The mafic rocks in JS 24-1 and 24-2 have high contents of TiO_2, P_2O_5, and FeO (Table 4), and are here referred to as icelandites. They plot near the fields of low-Zr basaltic andesites found in the Four Corners area, but at slightly higher levels of Ti-Zr-P (Figs. 12b and 13b). The icelandites conceivably represent the most fractionated version of a basaltic magma similar to that which formed the low-Zr basaltic andesites of the Four Corners area.

In terms of alteration in JS 24-1 and 24-2, a plot of K_2O versus TiO_2 (Fig. 14a) shows that moderate K addition has affected the rhyodacites, and one of the icelandites. Iron addition is only minor, as indicated by a plot of FeO versus TiO_2 (Fig. 14b).

Geochemical comparison of Four Corners area and Noranda 1994 East Grid area, south Jessop Township

Fig. 12a

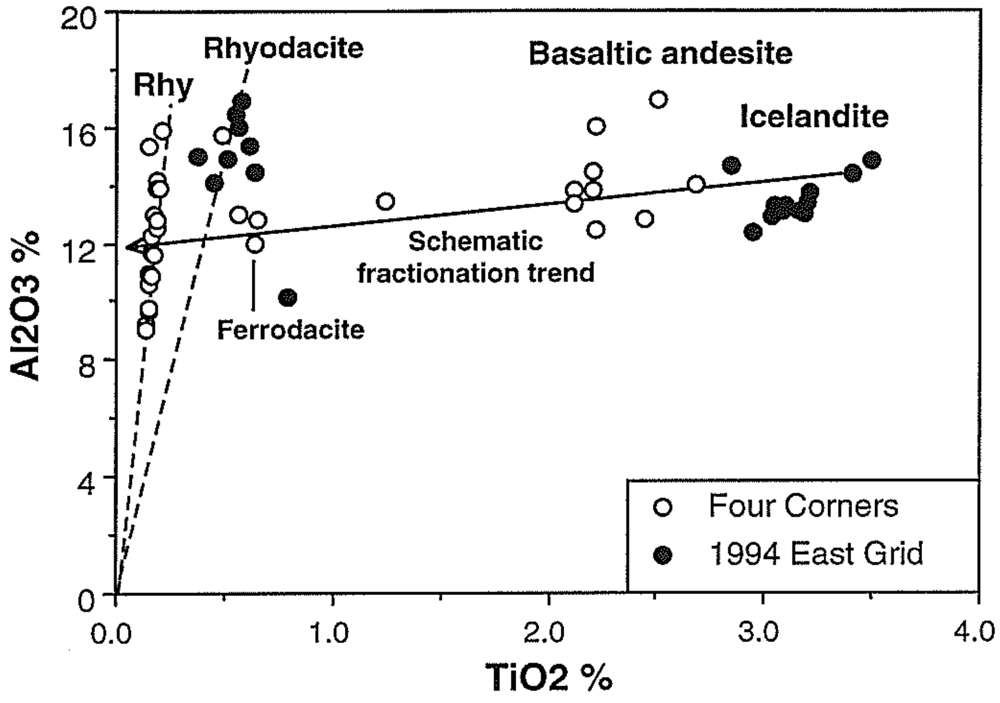
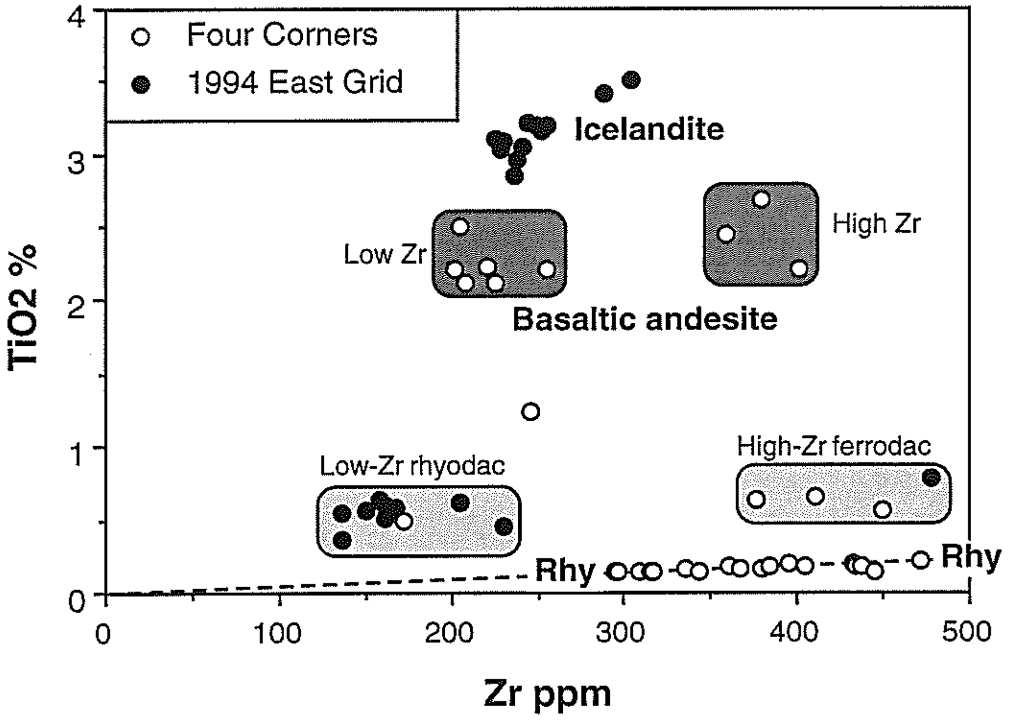


Fig. 12b



Geochemical comparison of Four Corners area and Noranda 1994 East Grid area, south Jessop Township

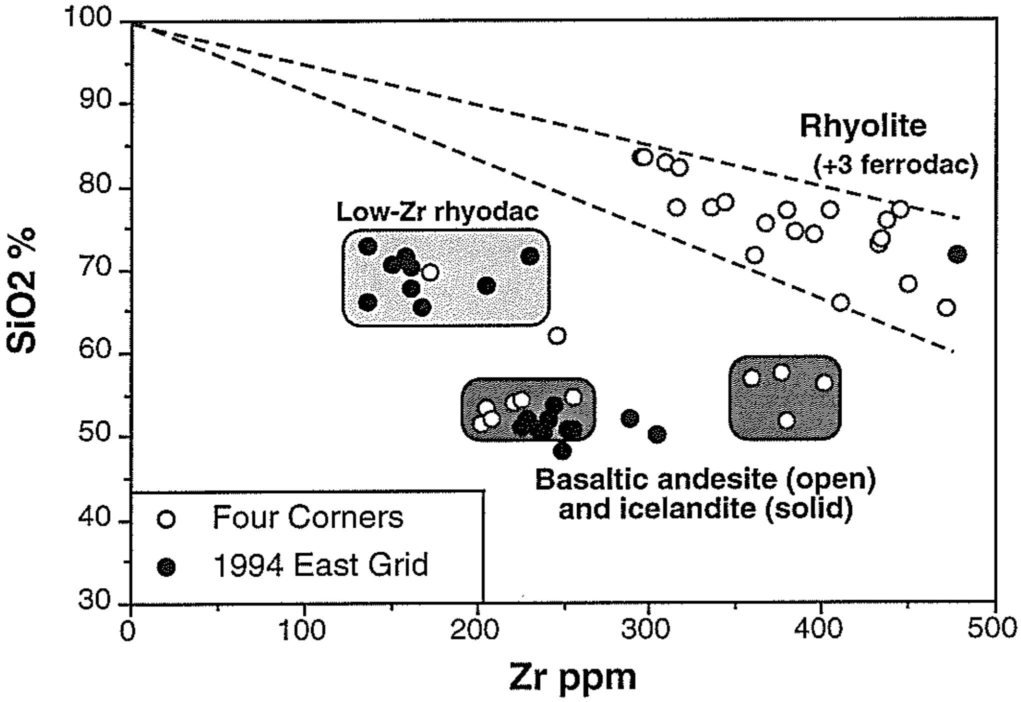


Fig. 13a

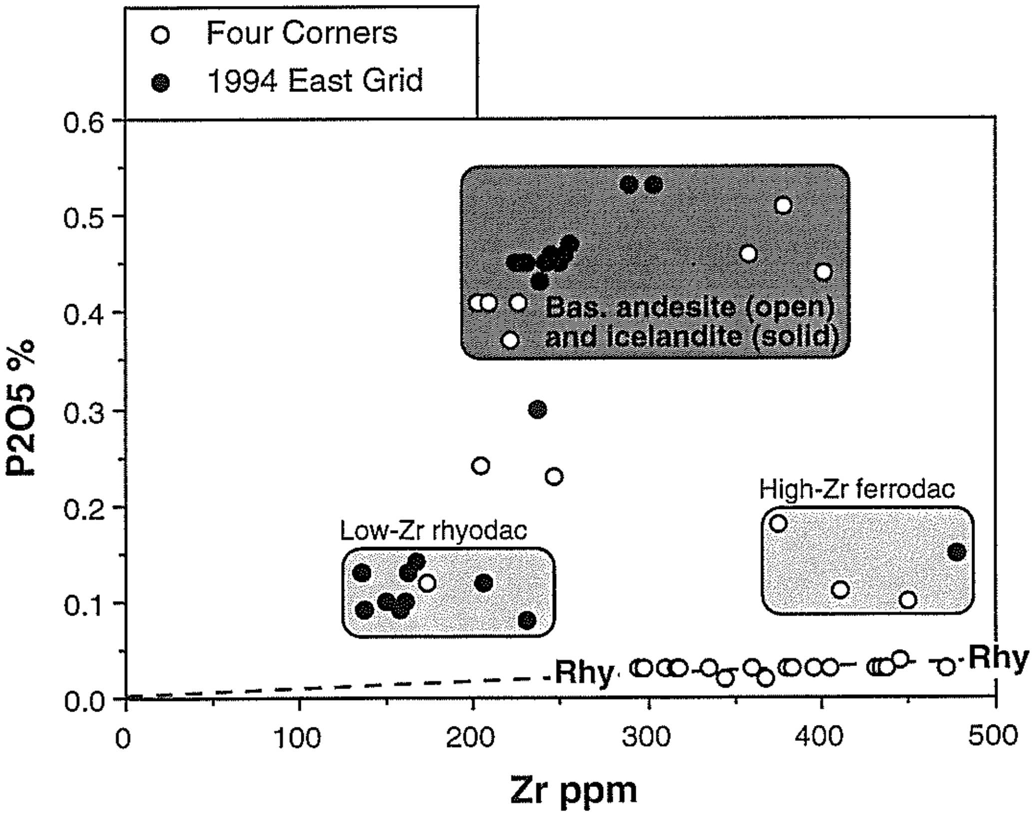


Fig. 13b

Geochemical comparison of Four Corners area and Noranda 1994 East Grid area, south Jessop Township

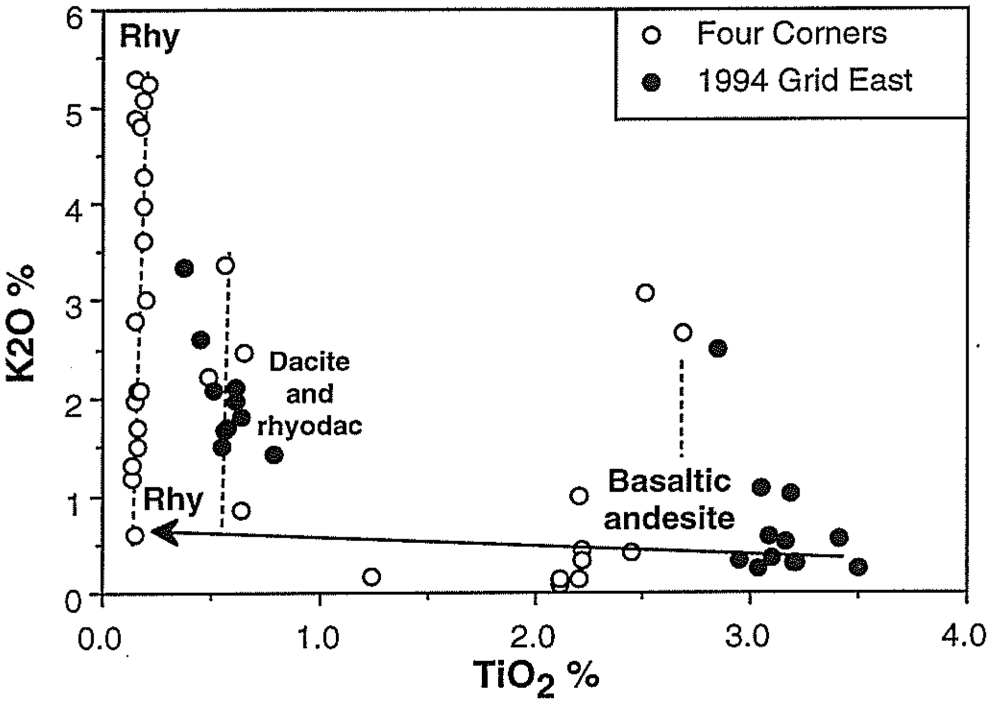


Fig. 14a

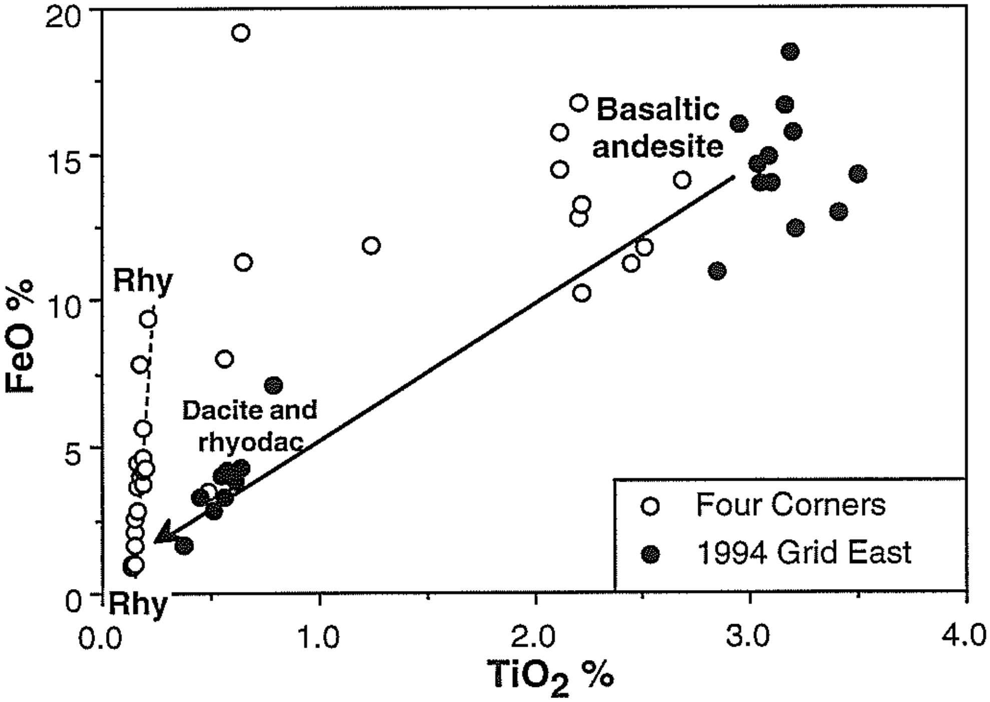


Fig. 14b

Petrography

General Comments

Most samples examined are felsic and were probably tuffs, although it is possible that deformation may have induced a pseudo-laminated aspect in originally more massive rocks; one or two samples were clearly lavas. There was one fresh aphyritic rhyolite lava. Many of the tuffs carry single crystal quartz phenocrysts, and thus are definitely rhyolitic. Some of the tuffs appear to be have been reworked and sedimented. A couple of samples had basalt or andesite fragments in a felsic matrix.

There are some good examples of dark (chloritic) flattened fragments identified as "fiamme" (collapsed and altered pumice). There is one tuff sample with downward bent layers of fine tuff below a felsic clast - a fragment fall onto a tuff bed. In many samples, the tuffs are strongly sheared (shear planes are obvious). Alteration is mainly sericitization and carbonitization, which are fairly pervasive. Chloritization is more spotty.

The rocks have undergone lower amphibolite facies metamorphism. Biotite is stable. It is likely that the sericite (muscovite) has a high Mg-Fe content (celadonite end-member). This imparts a darker than normal birefringence to the sericite, and gives it a slight grey-green colour in plane light. Some samples are up to 50% sericite. The biotite is very porphyroblastic. The carbonate is also probably recrystallized, and porphyryoblastic, although grains are termed crystalloblasts below (possibly blastic prior to metamorphism). The carbonates probably contain some Mg-Fe.

Photographs were taken at magnifications such that the negatives were 10X and 40X the true size. The corresponding magnifications of the prints are 45X and 175X the true size. All but four samples have been chemically analyzed (exceptions are noted below).

PLATE 1 - upper

Baseline 0, 60E:
Sheared Rhyolite, possibly lapilli tuff.
(Four Corners)

PLATE 1 - lower

Baseline 0, 75E:
Rhyolite, possibly tuffaceous.
(Four Corners)

PLATE 1

PLATE 2 - upper

25N, 100E:
Rhyolite, possibly tuffaceous.
(Four Corners)

PLATE 2 - lower

100S, 50E:
Mafic breccia.
(Four Corners)

PLATE 2

Hole 93-1: 174' (19952)
Sheared Rhyolite Tuff (or Lava)

- quartz-sericite foliated rock.
- contains about 10% carbonate crystalloblasts and 1% epidote; no chlorite.
- much of the quartz is in rounded polygranular grains, reminiscent of amygdules.
- sericite is somewhat dark; probably has a high Mg-Fe component - as celadonite.
- large quartz-carbonate veins are later, and contain minor albite along vein margins.

The rock looks like a tuff except for the polygranular quartz grains which look like deformed quartz amygdules, suggesting it is a lava. There are definite shear planes.

PLATE 3 - upper

45 X. Rounded polygranular quartz grains in foliated quartz-sericite matrix.

PLATE 3 - lower

175 X. Detail of stretched quartz grain and undeformed carbonate crystalloblast in quartz-sericite schistose rock.

PLATE 3

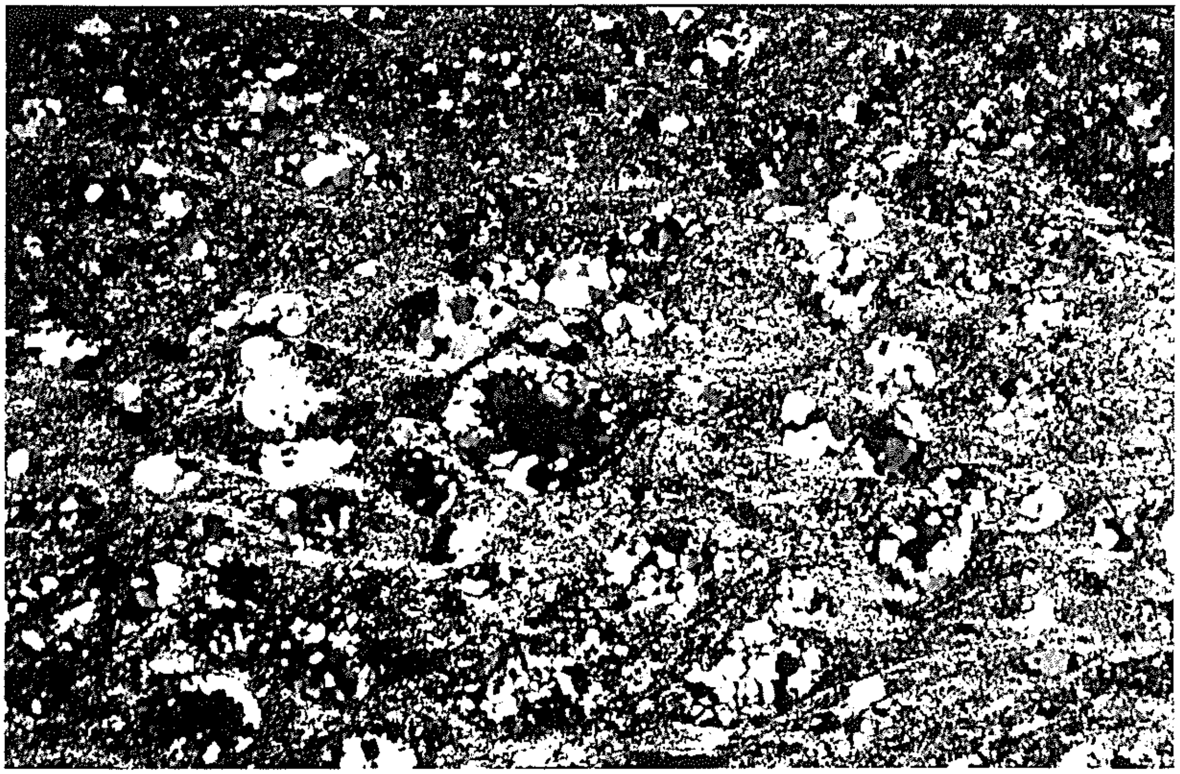


PLATE 4 - upper

Hole 93-1: 344' (19955)

Sheared Rhyolite Tuff

- fine-grained foliated felsic rock composed of quartz, sericite, 15% carb. crystalloblasts.
- no chlorite in rock.
- 15% quartz-carbonate veinlets

175 X. Quartz-sericite foliated tuff containing carbonate crystalloblast; cut by quartz vein.

PLATE 4 - lower

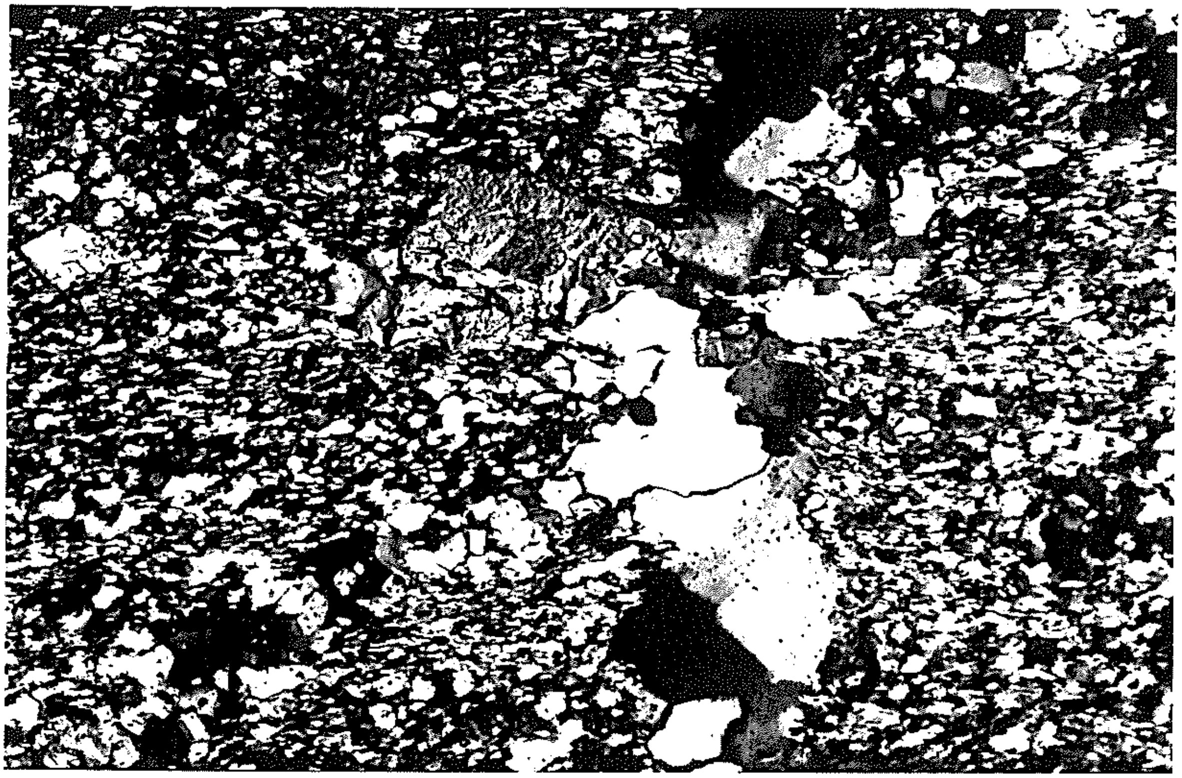
Hole 93-1: 396' (19956)

Sheared Fine-Grained Rhyolite - Probably a Tuff

- quartz-sericite-carbonate schist.
- carbonate crystalloblasts are sheared.
- no chlorite present.
- definite shear planes.
- the dark lines are sheared-out carbonate grains.

45 X. Heavily sheared and foliated fine-grained Qz-Ser-Carb felsic rock. Probably a tuff.

PLATE 4



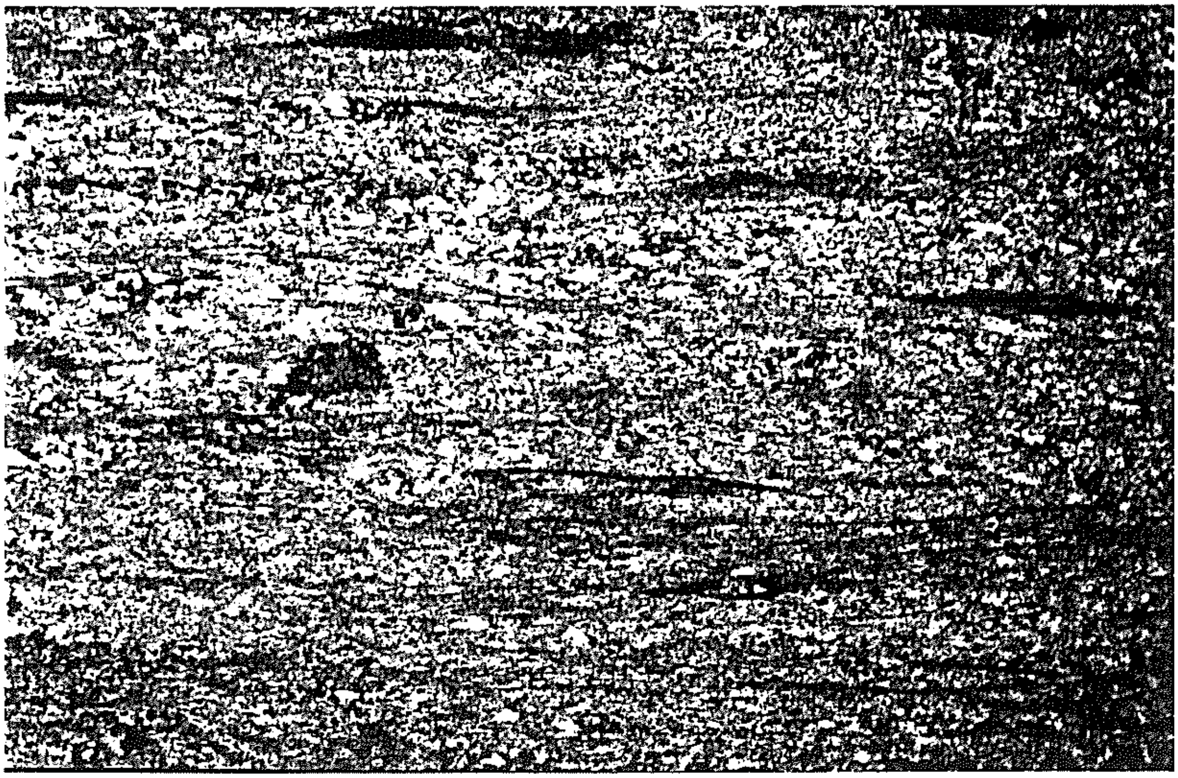


PLATE 5 - upper

Hole 93-1: 613' (19959)

Quartz Porphyry Rhyolitic Volcaniclastic -- Petrography only

- large quartz phenocrysts in a Qz-Ser-Chl matrix.
- phenocrysts are single crystal.
- chloritic fragments are probably replacements of rhyolite glass shards.
- some sericite has near-biotite pleochroism.

45 X. Quartz phenocryst and chloritized glass shard in a matrix of quartz and sericite.

PLATE 5 - lower

Hole 93-1: 675' (19960b)

Clastic Rock - Basalt Fragments in Rhyolite Matrix -- Petrography only

- 85% basalt fragments, with phenocrysts and microlites of plagioclase.
- 15% rhyolite matrix with quartz phenocrysts, probably tuff.
- the rhyolite tuff is now quartz-sericite.
- some carbonate.

45 X. Altered rhyolite tuff with quartz phenocryst, forming matrix to basalt fragments.

PLATE 5

Hole 93-1: 823' (19963)

Quartz diorite?

- the rock is quite sheared, but fragments are fresh with original igneous mineralogy.
- it contains numerous large grains of quartz and plagioclase (probably albite).
- it is probably a coarse-grained rock throughout, but could also be a quartz-feldspar porphyry with a finer-grained matrix. The quartz grains appear to be interlocking, rather than smooth-faced phenocrysts, which suggests an intrusive origin.
- there is considerable (15%) coarse carbonate.
- Berlin blue chlorite and biotite in the matrix; plagioclases slightly sericitized.

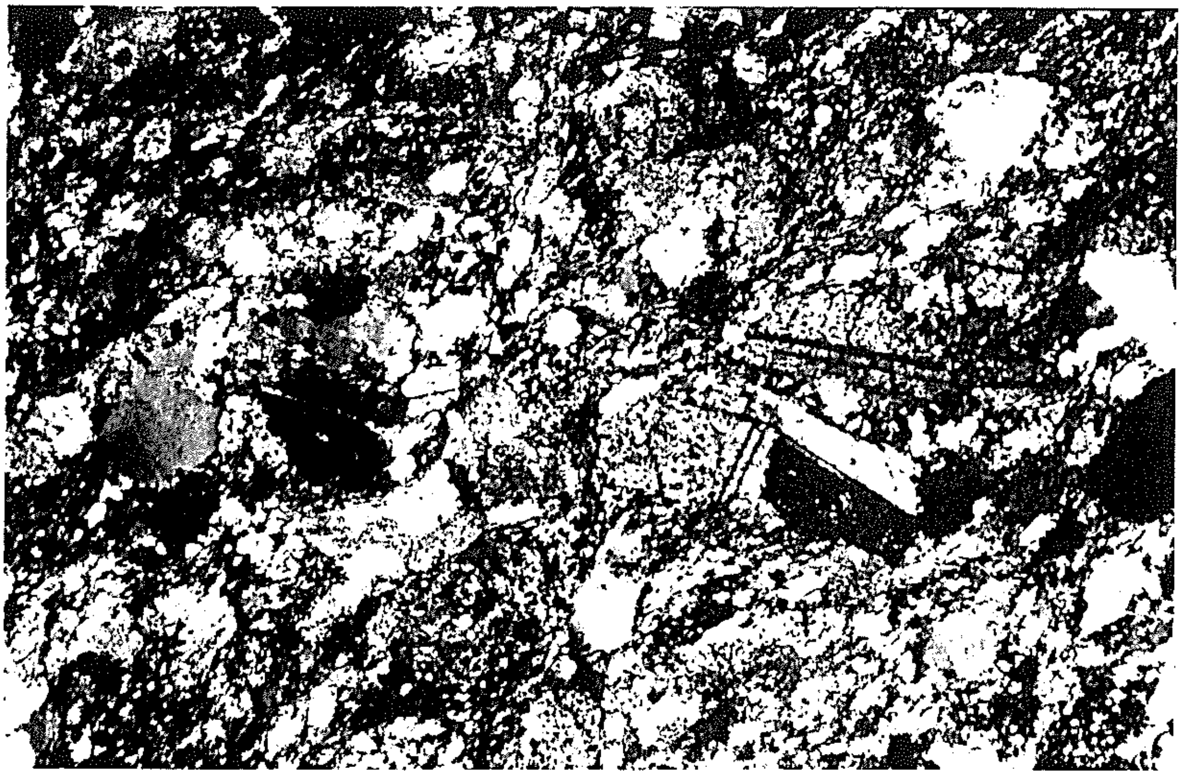
PLATE 6 - upper

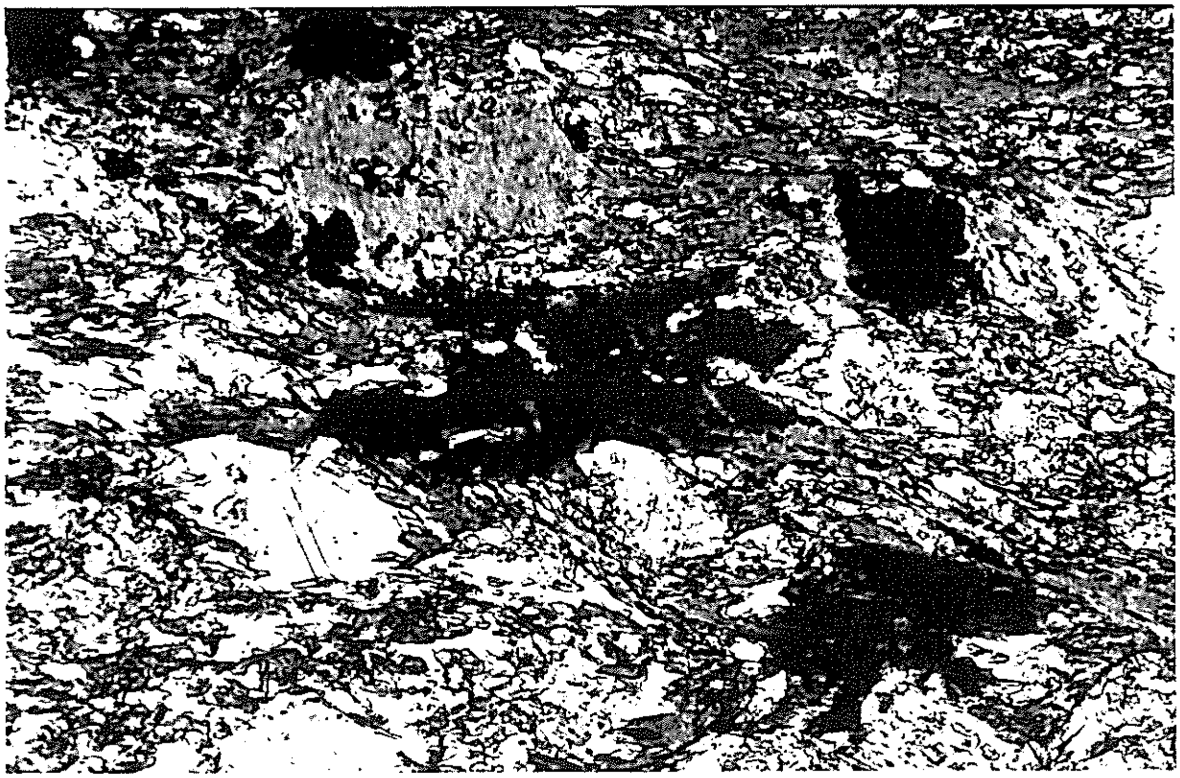
45 X. Large quartz and plagioclase grains in a quartz-chlorite-carbonate matrix.

PLATE 6 - lower

45 X. Plane light. Biot + Chl + Qtz + Sulphide in sheared zone.

PLATE 6





Hole 93-1: 947' (19964)

Basaltic andesite

- sheared and foliated rock.
- Qtz + Chl + Carb + Py + (minor Biot and Ser)
- large quartz-carbonate vein with minor albite.
- there is some sericite in the large vein, with chlorite, but not in the main rock, where biotite is present.
- in these sericite-free rocks, the Al-assemblage is Chl + Biot; there must have been little original sericite formed; Ser + Chl = Biot.

PLATE 7 - upper

45 X. Foliated tuff; quartz grains surrounded by chlorite, carbonate and sulphide.

PLATE 7 - lower

175 X. Plane light. Tourmaline (parallel extinction, very strong pleochroism, high relief). Embedded in carbonate, chlorite and quartz.

PLATE 7

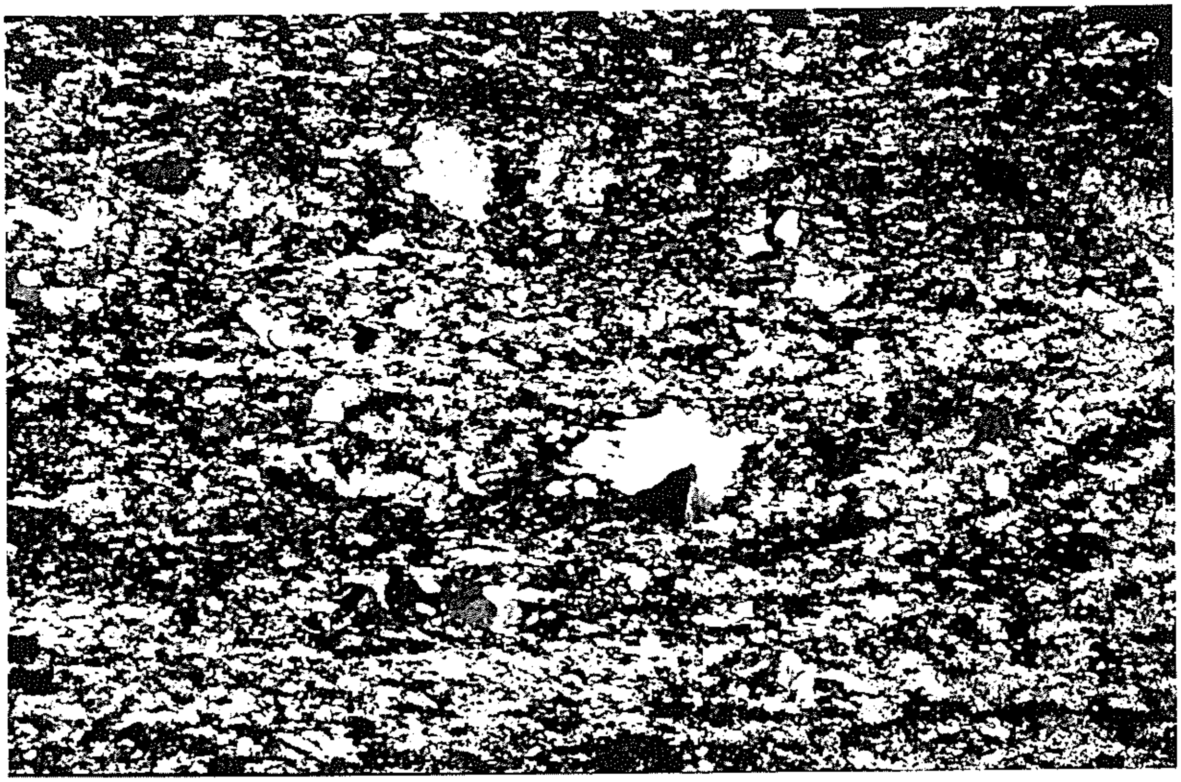


PLATE 8 - upper

Hole 93-1: 1210' (19966)

Sheared Dacitic Tuff

- very fine-grained, layered clastic rock with a few quartz phenocrysts.
- different coloured layers, and conspicuous shearing; the phenocrysts are in one layer.
- heavily carbonated.
- many flat elongated lithic grains.

45 X. Layering in Qtz-Carb-Ser-(Chl) rock; carbonate crystalloblasts.

PLATE 8 - lower

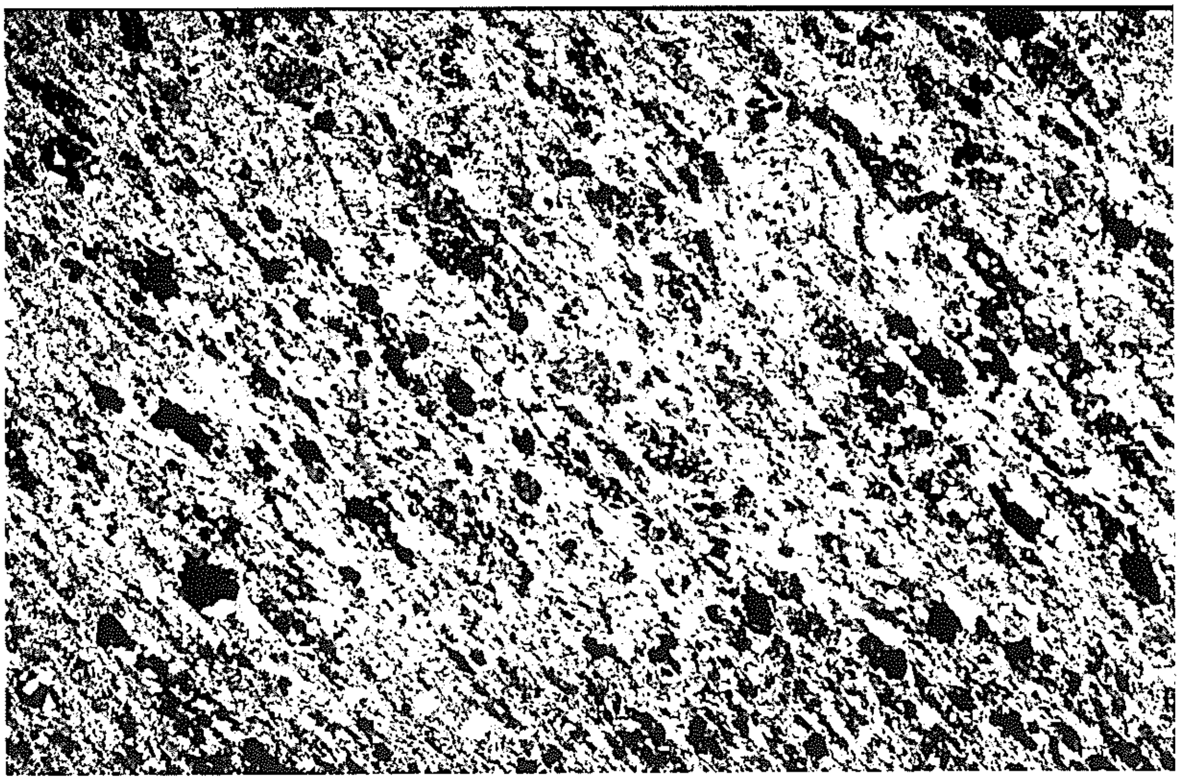
Hole 93-1: 1293' (19968)

Basaltic andesite

- sheared and heavily sericitized.
- 50% sericite; 20% carbonate, 15% pyrite; <5% chlorite.

45 X. Layered and sheared tuff: sericite + quartz + pyrite.

PLATE 8



Hole 93-1: 1381' (19970)

Aphyric Rhyolite (Fresh)

- aphanitic, Qtz-Ab fine grained massive rhyolite; fresh (least altered) rock.
- few microphenocrysts of quartz.
- 10% quartz amygdules.
- minor sericite, and <3% quartz-carbonate veins.

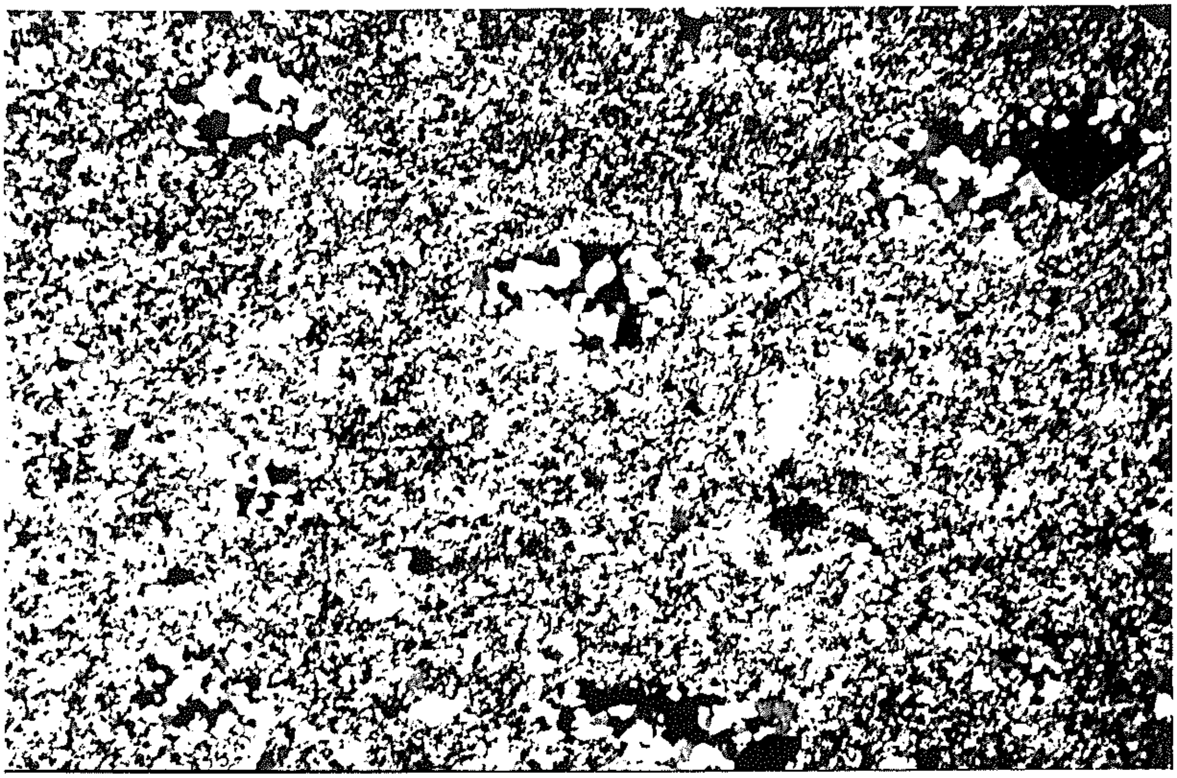
PLATE 9 - upper

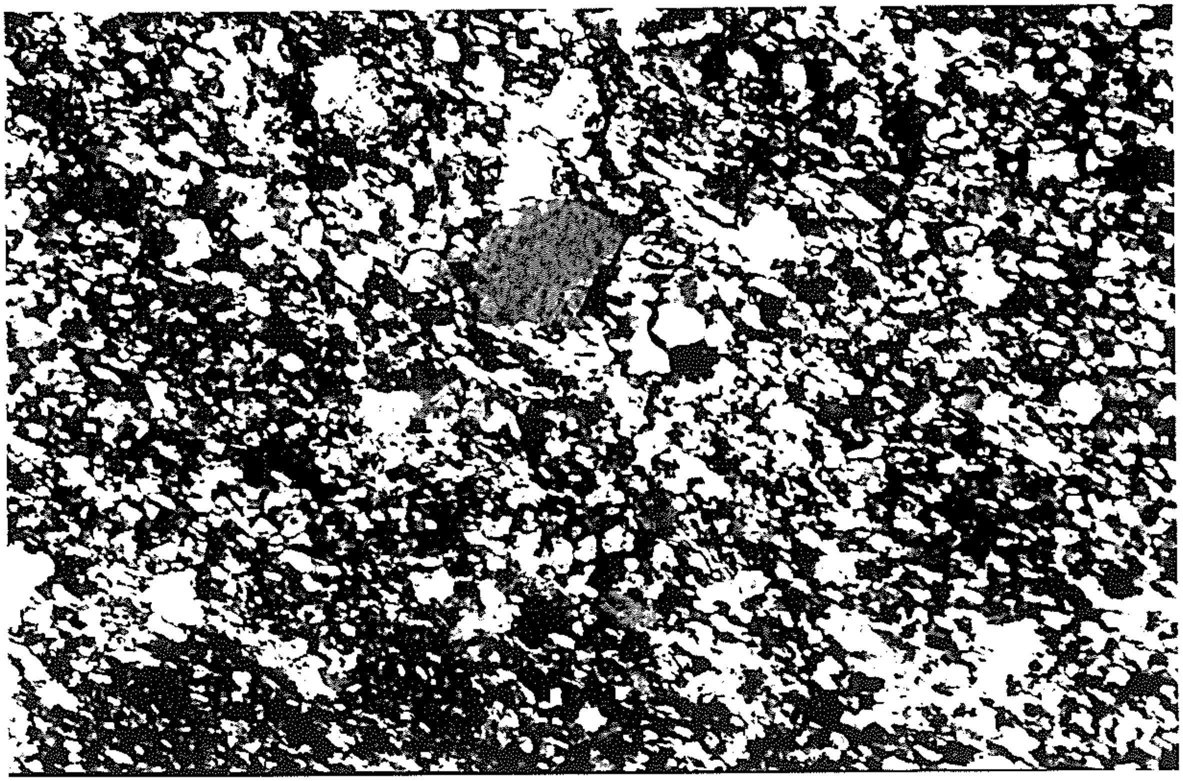
45 X. Quartz amygdules in aphanitic rhyolite. Some very fine sericite in matrix.

PLATE 9 - lower

175 X. Detail of above. Quartz microphenocrysts in a matrix of quartz, albite and traces of sericite.

PLATE 9





Hole 93-2: 277' (19974)

Sheared and Heavily Altered Rhyolite Tuff

- well banded, dark and light layers.
- dark layers are sericite-rich; light layers are quartz-sericite.
- dark single grains are biotite crystals.
- no chlorite; probably all reacted to biotite.
- 40% quartz, 35% sericite, 15% biotite, 10% carbonate.
- possibly some deformed quartz phenocrysts.

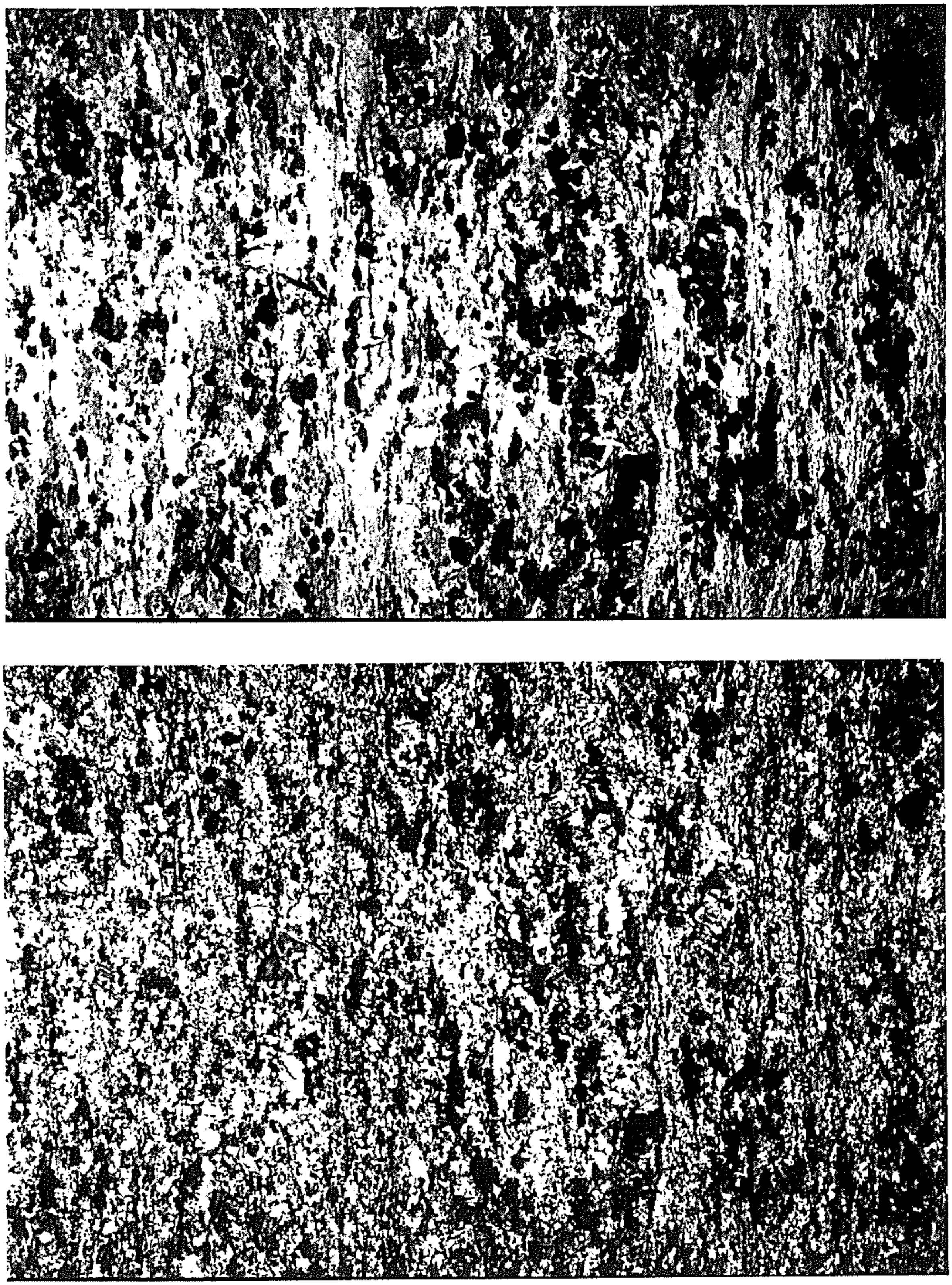
PLATE 10 - upper

45 X. Plane light. Layered felsic tuff; sericitic-carbonate-rich; many biotite porphyroblasts.

PLATE 10 - lower

45 X. Crossed polars. Same view.

PLATE 10



Hole 93-2: 614' (19977)

Quartz Porphyry Rhyolite Tuff -- Petrography only

- contains quartz phenocrysts; probably was a rhyolite.
- heavily altered and sheared.
- contains fragments (shards), some of them originally chloritic, now replaced extensively by zoisite (Fe^{+3}-poor member of epidote). Zoisite is the blue mineral in vugs and matrix.
- the dark chloritic shards were probably glass, possibly "fiamme".

PLATE 11 - upper

45 X. Plane light. Collapsed pumice fragment? Chloritic (with zoisite). Note felsic layer.

PLATE 11 - lower

45 X. Partially crossed polars. Small rock fragment pressing into fine altered tuff layers; this is a dropstone.

PLATE 11

Suggested Analytical Work

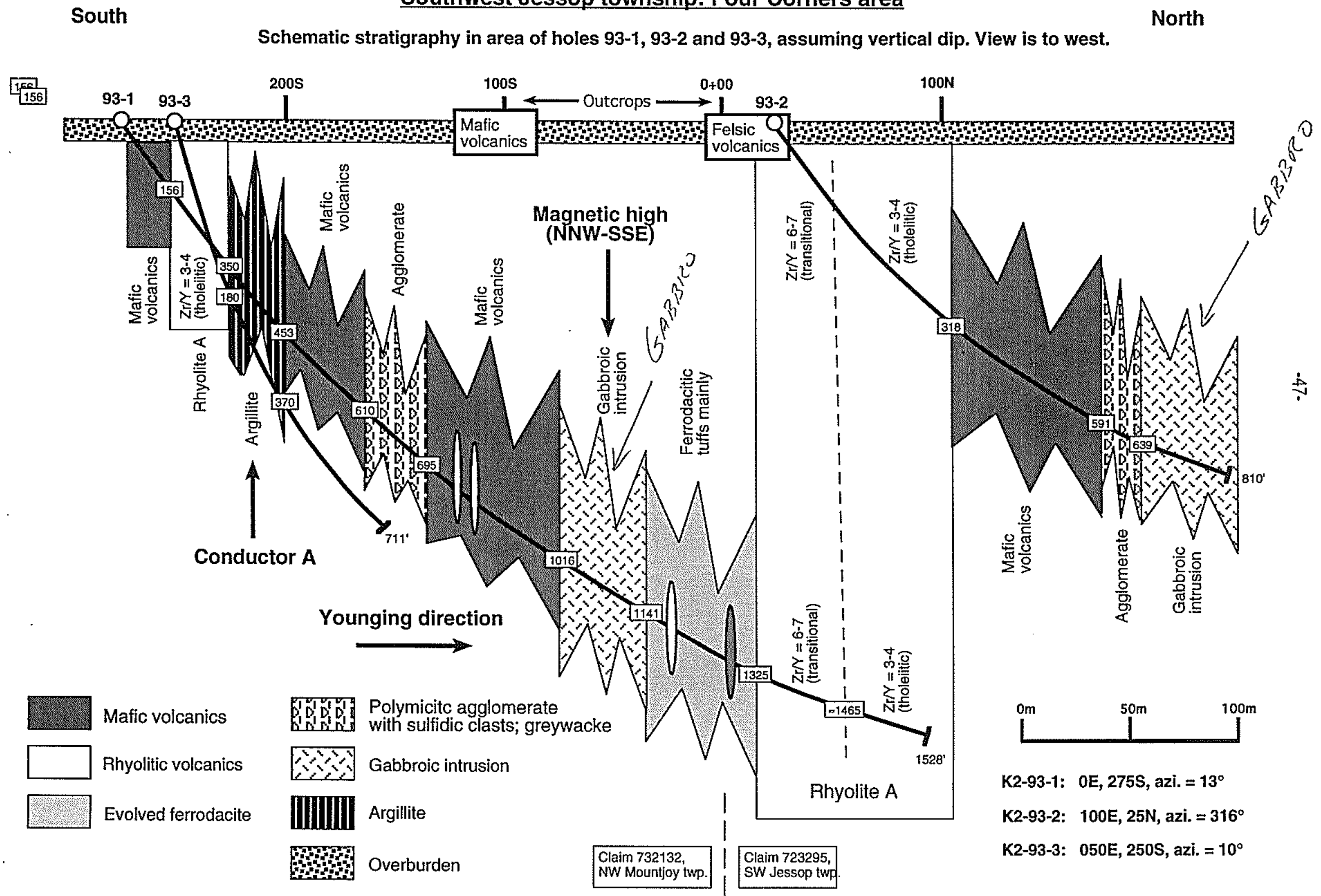
(1) With regard to the 1993 drilling program at the Four Corners, further sampling of lithological units is required in selected parts of K2-93-1 and 93-2, and in much of 93-3 (below 120 ft.). More of the fragmental and agglomeratic units in particular should be analyzed to determine if these represent a westerly continuation of rhyolite B fragmentals observed in holes 87-3 and 87-1, located 0.5-1.0 miles to the east (in southern Jessop Township). (2) Rare-earth element data (neutron activation) should be obtained for selected felsic and mafic rocks from the 1993 drilling program to determine: i) if the very favorable lithogeochemical features intersected in parts of holes 87-3 and 87-2 to the east, also extend into the Four Corners area; and ii) to further compare these results with the Kamiskotia and Kidd Creek terranes. (3) A high-precision U-Pb zircon age should be obtained to date the rhyolite A sequence at the end of hole 93-1 and the beginning of holes 93-2 (this rhyolite also outcrops some 50-100 m east of the Four Corners). With such data, it is possible to determine if the felsic stratigraphy in the Four Corners area correlates with the Kamiskotia rhyolite (2705 ma) or with the Kidd Creek rhyolite (2717 ma) (Barrie and Davis, 1990). (4) Following Noranda's drilling program, a lithogeochemical study should be completed, based on about 5 samples per 100 metres, in order to tie the new stratigraphic and alteration data into previous studies in southern Jessop Township, and to develop a paleovolcanic and hydrothermal alteration model that pertains to this region.

Discussion and Conclusions

(1) The Four Corners area is underlain by a mainly bimodal sequence of mafic and felsic volcanic rocks, with a few 'ferrodacitic' compositions (Fig. 15). The mafic rocks comprise basaltic andesites that can be divided into low-Zr and high Zr groups. Some of the mafic rocks are sufficiently high in TiO_2 (>2.0%) FeO (>12.0%) and P_2O_5 (>0.3%) to be termed icelandites. The felsic rocks in drillholes K2-93-1, 93-2 and 93-3 occur in two main intervals, one near the beginning of 93-1, the other near the end of this hole. All rhyolites in these two intervals correspond to the end-member rhyolite A composition intersected in holes 87-3 and 87-2 located 0.5-1.0 miles to the east (in southern Jessop Township). Rhyolite A at the Four Corners is a strongly fractionated rhyolite, estimated to have had precursor contents of $SiO_2 \approx 77\%$, $Al_2O_3 \approx 11.6\%$ and Zr ≈360 ppm. The rhyolite is mainly tholeiitic, with Zr/Y = 3.5-4.5 (some transitional rhyolite with Zr/Y = 6.0-7.5 occurs near the end of drillhole 93-1). The tholeiitic rhyolites have 90-110 ppm Y, and are probably FIIIb type rhyolites in the classification of Lesher et al. (1986). This assessment could be confirmed by REE data.

Southwest Jessop township: Four Corners area

Schematic stratigraphy in area of holes 93-1, 93-2 and 93-3, assuming vertical dip. View is to west.



K2-93-1: 0E, 275S, azi. = 13°
K2-93-2: 100E, 25N, azi. = 316°
K2-93-3: 050E, 250S, azi. = 10°

Note: Hole 93-3, below 200 ft: logged as mafic, intermediate and felsic tuffs, but no lithogeochemistry to date.

Fig. 15

2) Although rhyolite B, which occurs in holes 87-3 (Fig. 16) and 87-1 to the east, was not documented in the present data set (excluding one possible sample at 93-1, 766'), its presence in the stratigraphy should not be excluded due to the rather limited nature of our initial sampling program. It should also be borne in mind that the Four Corners drilling did not intersect a great thickness of stratigraphy, and therefore units intersected in holes several hundred metres to the east such as rhyolite B (87-3, 87-1, 12-2) and the very high-TiO_2 icelandites (e.g. 87-3, 85-1) could be present to the north and south, respectively, of the drilled area. Rhyolite B could also be present as clasts within the agglomerate intervals that were intersected in all three drillholes in the Four Corners area.

(3) A sequence of rhyolite A near the end of hole K2-93-1 displays two different rhyolite affinity types, with the contact occurring between the samples at 1446 and 1489 ft. The rhyolite deeper in the hole, that is, more northerly and presumably stratigraphically younger, is more tholeiitic, slightly more fractionated, and more altered. This would be a good rhyolite to further trace. The other rhyolite has a transitional affinity. The two rhyolite types should be sampled for REE to confirm their affinities. A U-Pb zircon date on the tholeiitic rhyolite would also be useful.

4) Rhyolite A in the Four Corners area does not appear to extend east into the area of drillhole 87-3, but its westward extent is untested. Given that this rhyolite has tholeiitic affinity (Zr/Y=3-4) in the uphole rhyolite interval in 93-1, and also in part of the downhole rhyolite interval, it represents a good exploration target.

(5) A group of 'ferrodacitic' rocks occurs in K2-93-1 between 1182 and 1250 ft. (four samples). These have very high Zr contents, and also high Fe and P contents. They are correlated with the evolved ferrodacites of hole 87-3 located 0.5 miles to the east (Fig. 16). Similar ferrodacites also occur in hole 86-1. The ferrodacites in holes 87-3 and 86-1 both contain distinctive blue quartz eyes. It is possible that the high-Zr ferrodacites are genetically related to the high-Zr group of basaltic andesites noted in this report.

(6) Mass changes have been calculated for the rhyolites of the Four Corners area. The results allow areas of favorable, hotter alteration (i.e. silica-leaching and potassium or iron gain) to be distinguished from areas of cooler alteration (i.e. silica addition but only minor gains in potassium or iron). The tholeiitic rhyolites at the end of hole K2-93-1 show more extensive and hotter alteration than the silicified transitional rhyolites that occur immediately uphole from these.

Southwestern Jessop and northwestern Mountjoy townships

West

East

Schematic stratigraphy in area of 1993 Four Corners drilling, and in hole 87-3.

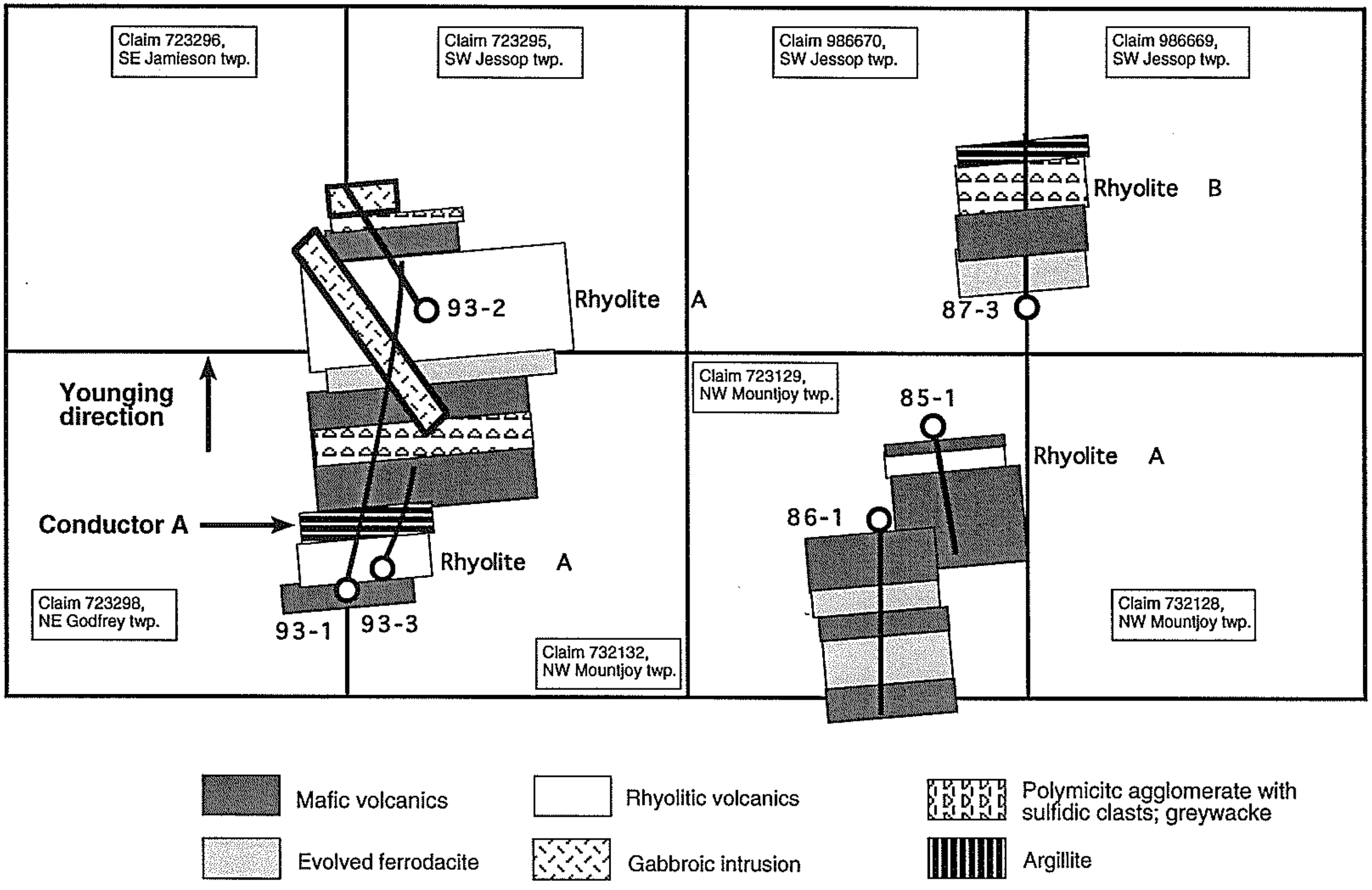


Fig. 16

-- Ore Systems Consulting --

(7) The main alteration types are sericitization, silicification and carbonatization; some K-feldspar is also inferred to be present. Chlorite is generally minor in the rhyolites. However, fine-grained biotite is a common accessory, and may mark the former existence of hydrothermal sericite and chlorite that have combined during regional metamorphism (lower amphibolite facies). The sericite-carbonate alteration together with locally strong shear fabrics makes identification of some lithologies speculative without geochemical data.

(8) Volcanic rocks from holes JS 24-01 and 24-02, located near the eastern margin of Noranda's 1994 proposed East Grid, are also bimodal, but the felsic rocks correspond to rhyolite B compositions, and the mafics to strongly fractionated icelandites (these are similar to the basaltic andesites in the Four Corners area, but have TiO_2 >2.5%). The East Grid volcanic rocks are therefore generally somewhat different from the rhyolite A - basaltic andesite units sampled in the Four Corners area. The East Grid volcanic rocks are however, similar to those encountered 0.5-1.0 miles east of the Four Corners (Barrett and MacLean, 1993a,b).

Acknowledgements

We would like to thank Mr. L. Bonhomme of Timmins for initiating this project, and for providing information during the course of the study. We are grateful to Ed van Hees for geological and logging work on the 1993 program, and to Noranda Exploration and Falconbridge Ltd. for providing earlier drill logs and lithogeochemical analyses.

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Table 1. Chemical composition of volcanic rocks from holes K2-93-1, 2, 3, southwestern Jessop Township.

Hole	Depth (ft)	Lithology	Pet.	Number	SiO2	Al2O3	TiO2	Fe2O3	MnO	CaO	MgO	K2O	Na2O	P2O5	LOI
93-01	75	Icelandite		19951	47.2	12.5	1.92	14.6	0.27	8.41	4.24	0.07	2.69	0.37	7.48
93-01	163-168*	Rhyolite A		23710	68.3	10.1	0.200	7.69	0.21	1.08	1.23	2.68	2.14	0.04	4.12
93-01	174	Rhyolite A	Yes	19952	74.5	10.5	0.153	3.87	0.10	1.34	0.51	1.45	4.29	0.03	3.40
93-01	259	Rhyolite A		19953	66.4	10.8	0.166	8.09	0.15	1.88	0.73	1.93	3.46	0.03	5.55
93-01	275	Rhyolite A		19954	74.4	10.2	0.144	2.24	0.07	1.82	0.24	5.08	2.25	0.03	2.40
93-01	344	Rhyolite A	Yes	19955	72.7	11.3	0.161	4.79	0.16	1.36	0.65	1.63	4.18	0.02	3.60
93-01	396	Rhyolite A	Yes	19956	71.0	12.3	0.184	4.47	0.09	2.59	0.88	4.11	0.73	0.03	3.65
93-01	543	Icelandite		19957	52.8	11.6	2.08	13.8	0.27	8.03	3.98	0.42	1.81	0.41	3.40
93-01	583	Icelandite		19958	54.0	12.2	2.33	11.9	0.24	7.65	4.05	0.40	3.09	0.44	2.05
93-01	766	Rhyodacite (B)		19962	66.9	15.1	0.466	3.70	0.06	1.88	1.07	2.13	4.96	0.12	2.75
93-01	790	Icelandite		19961	45.8	12.4	2.37	13.8	0.32	8.86	2.82	2.36	0.62	0.45	9.15
93-01	823	Icelandite	Yes	19963	49.8	12.2	1.95	16.0	0.25	6.68	3.02	0.14	2.99	0.38	6.95
93-01	947	Icelandite	Yes	19964	50.1	12.7	2.03	17.1	0.29	5.58	2.49	0.92	1.99	0.43	6.25
93-01	1174-1175*	Rhyodacite (B)		23730	81.5	8.22	0.250	1.67	0.08	1.86	0.48	2.31	1.29	0.06	2.40
93-01	1182	Ferrodacite		19965	53.5	11.2	0.596	19.8	0.82	3.27	3.39	0.80	1.52	0.17	4.85
93-01	1210	Ferrodacite	Yes	19966	61.3	11.9	0.606	11.7	0.35	3.10	2.12	2.30	0.83	0.10	5.60
93-01	1229-1232*	Ferrodacite		23733	58.5	12.7	0.680	11.23	0.27	4.31	2.08	3.25	0.06	0.10	5.81
93-01	1250	Ferrodacite		19967	63.8	12.2	0.525	8.34	0.24	4.19	1.18	3.17	0.91	0.09	5.00
93-01	1293	Basaltic andesite	Yes	19968	48.1	15.3	2.27	11.8	0.22	7.15	1.71	2.77	2.06	0.22	6.60
93-01	1343	Rhyolite A		19969	79.3	9.49	0.147	1.77	0.04	0.65	0.34	1.89	3.03	0.03	1.50
93-01	1381	Rhyolite A	Yes	19970	82.6	9.13	0.141	0.98	0.04	1.02	0.11	1.16	3.96	0.03	1.15
93-01 EXT.	1446	Rhyolite A		19504	82.5	8.89	0.141	1.05	0.07	1.35	0.14	1.30	3.43	0.03	1.40
93-01 EXT.	1489	Rhyolite A		19503	74.2	12.5	0.170	4.35	0.08	0.56	0.36	4.62	0.08	0.03	3.15
93-01 EXT.	1517	Rhyolite A		19502	73.9	13.6	0.187	4.08	0.03	0.12	0.53	4.94	0.66	0.03	2.15
93-01 EXT.	1526	Rhyolite A		19501	76.4	10.8	0.149	2.78	0.09	1.80	0.18	0.58	5.54	0.02	1.95
93-02	37	Rhyolite A		19971	81.2	9.51	0.142	1.05	0.04	0.54	0.10	2.74	3.02	0.03	0.85
93-02	92	Rhyolite A		19972	70.5	13.6	0.180	5.00	0.08	0.54	0.63	3.81	2.20	0.03	2.50
93-02	197	Rhyolite A	Yes	19973	74.8	11.9	0.164	3.05	0.10	0.48	0.25	2.01	4.73	0.03	1.60
93-02	277	Rhyolite A		19974	72.0	12.1	0.185	6.12	0.14	1.42	0.60	3.52	1.41	0.03	2.75
93-02	352	Icelandite		19975	51.5	15.2	2.12	10.8	0.24	10.20	3.08	0.31	2.56	0.35	4.20
93-02	545	Icelandite		19976	45.9	12.9	1.97	12.7	0.28	8.58	5.31	0.12	2.58	0.37	7.90
93-02	629	Agglomerate		19978	58.3	12.6	1.17	12.4	0.15	2.48	3.66	0.15	4.14	0.22	3.20
93-03	83	Rhyolite A		19979	59.8	14.6	0.201	9.65	0.24	1.52	1.28	4.80	0.88	0.03	7.00
93-03	115	Rhyolite A		19980	74.6	14.8	0.149	1.75	0.05	0.68	0.17	4.74	0.13	0.04	2.40

Petrography only: 19959, 19960a, 19960b, 19977.
Chemical data from this report, analyzed at XRAL, Toronto. Majors analyzed on beads, traces on pressed pellets.
* = analyzed by ICAP, Swastika. Traces by XRF on pellets at XRAL.

Table 1. Chemical composition of volcanic rocks from holes K2-93-1, 2, 3, southwestern Jessop Township.

Hole	Depth (ft)	Lithology	Number	Sum	Ba	Sr	Y	Zr	Rb	Nb	Zr/Y	Zr/Nb	Al2O3/ TiO2
93-01	75	Icelandite	19951	99.75	188	140	29	190	8	11	6.6	17.3	6.5
93-01	163-168*	Rhyolite A	23710	97.82	642	58	121	352	85	27	2.9	13.0	50.5
93-01	174	Rhyolite A	19952	100.14	342	53	90	323	51	23	3.6	14.0	68.6
93-01	259	Rhyolite A	19953	99.19	396	59	91	334	55	21	3.7	15.9	65.1
93-01	275	Rhyolite A	19954	98.87	939	75	45	304	74	19	6.8	16.0	70.8
93-01	344	Rhyolite A	19955	100.55	359	80	100	354	53	24	3.5	14.8	70.2
93-01	396	Rhyolite A	19956	100.03	682	48	107	379	124	23	3.5	16.5	66.8
93-01	543	Icelandite	19957	98.60	424	181	43	377	12	13	8.8	29.0	5.6
93-01	583	Icelandite	19958	98.35	369	95	39	341	10	14	8.7	24.4	5.2
93-01	766	Rhyodacite (B)	19962	99.14	543	64	<10	166	56	8	>16	20.8	32.4
93-01	790	Icelandite	19961	98.95	640	114	42	335	56	13	8.0	25.8	5.2
93-01	823	Icelandite	19963	100.36	186	136	22	207	4	16	9.4	12.9	6.3
93-01	947	Icelandite	19964	99.88	313	78	37	235	24	12	6.4	19.6	6.3
93-01	1174-1175*	Rhyodacite (B)	23730	100.16	959	68	58	307	84	17	5.3	18.1	32.9
93-01	1182	Ferrodacite	19965	99.92	564	91	56	350	34	15	6.3	23.3	18.8
93-01	1210	Ferrodacite	19966	99.91	566	77	61	383	86	19	6.3	20.2	19.6
93-01	1229-1232*	Ferrodacite	23733	98.95	813	59	90	421	105	20	4.7	21.1	18.6
93-01	1250	Ferrodacite	19967	99.65	1070	60	82	422	83	20	5.1	21.1	23.2
93-01	1293	Basaltic andesite	19968	98.20	348	118	44	185	74	13	4.2	14.2	6.7
93-01	1343	Rhyolite A	19969	98.19	524	45	42	306	49	21	7.3	14.6	64.6
93-01	1381	Rhyolite A	19970	100.32	375	38	49	294	35	19	6.0	15.5	64.8
93-01 EXT.	1446	Rhyolite A	19504	100.30	412	48	46	291	40	18	6.3	16.2	63.0
93-01 EXT.	1489	Rhyolite A	19503	100.10	776	26	110	391	131	25	3.6	15.6	73.5
93-01 EXT.	1517	Rhyolite A	19502	100.23	799	13	131	427	133	29	3.3	14.7	72.7
93-01 EXT.	1526	Rhyolite A	19501	100.29	155	509	89	337	19	21	3.8	16.0	72.5
93-02	37	Rhyolite A	19971	99.22	769	78	53	304	67	20	5.7	15.2	67.0
93-02	92	Rhyolite A	19972	99.07	773	54	110	417	150	28	3.8	14.9	75.6
93-02	197	Rhyolite A	19973	99.11	531	45	94	369	60	25	3.9	14.8	72.6
93-02	277	Rhyolite A	19974	100.28	574	71	107	372	99	23	3.5	16.2	65.4
93-02	352	Icelandite	19975	100.56	248	249	24	211	9	13	8.8	16.2	7.2
93-02	545	Icelandite	19976	98.61	248	65	31	181	6	8	5.8	22.6	6.5
93-02	629	Agglomerate	19978	98.47	187	1094	46	231	6	14	5.0	16.5	10.8
93-03	83	Rhyolite A	19979	100.00	876	75	102	434	137	27	4.3	16.1	72.6
93-03	115	Rhyolite A	19980	99.51	1090	21	100	432	88	24	4.3	18.0	99.3

Petrography only: 19959, 19960a, 19960b, 19977.
Chemical data from this report, analyzed at XRAL, Toronto. Majors analyzed on beads, traces on pressed pellets.
* = analyzed by ICAP, Swastika. Traces by XRF on pellets at XRAL.

Table 2. Rare-earth-element composition of some volcanic rocks from K2-87-2 and K87-3, southwestern Jessop Township.

Hole	Sample	Depth	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Th	U	Zr	Nb	Y	Zr/Y	Zr/Nb
K87-03	9711	297-299'	13.8	35	22	6.14	2.03	1.3	4.94	0.75	1.6	0.2	241	16	34	7.1	15.1
K87-02	9714	239-241'	48.6	111	61	14.6	2.42	2.5	10.0	1.52	6.6	1.9	430	24	95	4.5	17.9
K87-02	9715	269-271'	10.3	25	16	4.64	1.48	1.0	3.73	0.56	1.0	0.2	149	10	28	5.3	14.9
K87-03	9721	249'	56.9	134	82	22.2	3.51	3.9	15.5	2.35	8.2	2.3	734	31	156	4.7	23.7
		chondrite*	0.245	0.638	0.474	0.154	0.058	0.038	0.165	0.025							

REE normalized to chondrite

Hole	Sample	Depth	(La)n	(Ce)n	(Nd)n	(Sm)n	(Eu)n	(Tb)n	(Yb)n	(Lu)n	(La/Yb)n
K87-03	9711	297-299'	56.3	54.9	46.4	39.9	35.0	34.7	29.9	29.5	*1.88*
K87-02	9714	239-241'	198.4	174.0	128.7	94.8	41.7	66.7	60.6	59.8	*3.27*
K87-02	9715	269-271'	42.0	39.2	33.8	30.1	25.5	26.7	22.6	22.0	*1.86*
K87-03	9721	249'	232.2	210.0	173.0	144.2	60.5	104.0	93.9	92.5	*2.47*

*Chondrite abundances from Evensen et al. (1978).

Table 3. Calculated mass changes for rhyolites from K2-93-1, 2, 3, southwestern Jessop Township.

Hole	Depth (ft)	Lithology	Number	SiO2 %	Al2O3 %	TiO2 %	Fe2O3 %	FeO# %	MnO %	CaO %	MgO %	K2O %	Na2O %	P2O5 %	Ba ppm	LOI %
Lab data																
93-01	163-168	Rhyolite	*	68.3	10.1	0.200	7.69	6.92	0.21	1.08	1.23	2.68	2.14	0.04	530	4.12
93-01	174	Rhyolite	19952	74.5	10.5	0.153	3.87	3.48	0.10	1.34	0.51	1.45	4.29	0.03	342	3.40
93-01	259	Rhyolite	19953	66.4	10.8	0.166	8.09	7.28	0.15	1.88	0.73	1.93	3.46	0.03	396	5.55
93-01	275	Rhyolite	19954	74.4	10.2	0.144	2.24	2.02	0.07	1.82	0.24	5.08	2.25	0.03	939	2.40
93-01	344	Rhyolite	19955	72.7	11.3	0.161	4.79	4.31	0.16	1.36	0.65	1.63	4.18	0.02	359	3.60
93-01	396	Rhyolite	19956	71.0	12.3	0.184	4.47	4.02	0.09	2.59	0.88	4.11	0.73	0.03	682	3.65
93-01	1343	Rhyolite	19969	79.3	9.5	0.147	1.77	1.59	0.04	0.65	0.34	1.89	3.03	0.03	524	1.50
93-01	1381	Rhyolite	19970	82.6	9.1	0.141	0.98	0.88	0.04	1.02	0.11	1.16	3.96	0.03	375	1.15
93-01 EXT.	1446	Rhyolite	19504	82.5	8.9	0.141	1.05	0.94	0.07	1.35	0.14	1.30	3.43	0.03	412	1.40
93-01 EXT.	1489	Rhyolite	19503	74.2	12.5	0.170	4.35	3.91	0.08	0.56	0.36	4.62	0.08	0.03	776	3.15
93-01 EXT.	1517	Rhyolite	19502	73.9	13.6	0.187	4.08	3.67	0.03	0.12	0.53	4.94	0.66	0.03	799	2.15
93-01 EXT.	1526	Rhyolite	19501	76.4	10.8	0.149	2.78	2.50	0.09	1.80	0.18	0.58	5.54	0.02	155	1.95
93-02	37	Rhyolite	19971	81.2	9.5	0.142	1.05	0.94	0.04	0.54	0.10	2.74	3.02	0.03	769	0.85
93-02	92	Rhyolite	19972	70.5	13.6	0.180	5.00	4.50	0.08	0.54	0.63	3.81	2.20	0.03	773	2.50
93-02	92	Rhyolite	19972	69.6	13.3	0.190	4.51	4.06	0.12	1.32	0.64	2.87	3.46	0.03	639	2.75
93-02	197	Rhyolite	19973	74.8	11.9	0.164	3.05	2.74	0.10	0.48	0.25	2.01	4.73	0.03	531	1.60
93-02	277	Rhyolite	19974	72.0	12.1	0.185	6.12	5.51	0.14	1.42	0.60	3.52	1.41	0.03	574	2.75
93-03	83	Rhyolite	19979	59.8	14.6	0.201	9.65	8.68	0.24	1.52	1.28	4.80	0.88	0.03	876	7.00
93-03	115	Rhyolite	19980	74.6	14.8	0.149	1.75	1.57	0.05	0.68	0.17	4.74	0.13	0.04	1090	2.40
								# FeO =0.9*Fe2O3								
LOI-free basis																
93-01	163-168	Rhyolite	*	73.5	10.9	0.215		7.45	0.23	1.16	1.32	2.88	2.30	0.04	570	
93-01	174	Rhyolite	19952	77.3	10.9	0.159		3.61	0.10	1.39	0.53	1.50	4.45	0.03	355	
93-01	259	Rhyolite	19953	71.5	11.6	0.179		7.84	0.16	2.03	0.79	2.08	3.73	0.03	427	
93-01	275	Rhyolite	19954	77.3	10.6	0.150		2.09	0.07	1.89	0.25	5.28	2.34	0.03	976	
93-01	344	Rhyolite	19955	75.4	11.7	0.167		4.47	0.17	1.41	0.67	1.69	4.33	0.02	372	
93-01	396	Rhyolite	19956	74.0	12.8	0.192		4.19	0.09	2.70	0.92	4.28	0.76	0.03	711	
93-01	1343	Rhyolite	19969	82.2	9.8	0.152		1.65	0.04	0.67	0.35	1.96	3.14	0.03	543	
93-01	1381	Rhyolite	19970	83.4	9.2	0.142		0.89	0.04	1.03	0.11	1.17	4.00	0.03	379	
93-01 EXT.	1446	Rhyolite	19504	83.5	9.0	0.143		0.96	0.07	1.37	0.14	1.32	3.47	0.03	417	
93-01 EXT.	1489	Rhyolite	19503	76.9	13.0	0.176		4.06	0.08	0.58	0.37	4.79	0.08	0.03	804	
93-01 EXT.	1517	Rhyolite	19502	75.7	13.9	0.191		3.76	0.03	0.12	0.54	5.06	0.68	0.03	818	
93-01 EXT.	1526	Rhyolite	19501	77.9	11.0	0.152		2.55	0.09	1.84	0.18	0.59	5.65	0.02	158	

Table 3. Calculated mass changes for rhyolites from K2-93-1, 2, 3, southwestern Jessop Township.

Hole	Depth (ft)	Lithology	Number	SiO2 %	Al2O3 %	TiO2 %	Fe2O3 %	FeO %	MnO %	CaO %	MgO %	K2O %	Na2O %	P2O5 %	Ba ppm
LOI-free basis (continued)															
93-02	37	Rhyolite	19971	82.6	9.7	0.145		0.96	0.04	0.55	0.10	2.79	3.07	0.03	783
93-02	92	Rhyolite	19972	73.4	14.2	0.187		4.68	0.08	0.56	0.66	3.97	2.29	0.03	805
93-02	92	Rhyolite	19972	72.8	13.9	0.199		4.25	0.13	1.38	0.67	3.00	3.62	0.03	668
93-02	197	Rhyolite	19973	76.9	12.2	0.169		2.82	0.10	0.49	0.26	2.07	4.87	0.03	546
93-02	277	Rhyolite	19974	74.3	12.5	0.191		5.68	0.14	1.47	0.62	3.63	1.45	0.03	592
93-03	83	Rhyolite	19979	65.0	15.9	0.218		9.43	0.26	1.65	1.39	5.22	0.96	0.03	952
93-03	115	Rhyolite	19980	77.0	15.3	0.154		1.62	0.05	0.70	0.18	4.89	0.13	0.04	1124
Least altered rhyolites															
93-02	197	Rhyolite	19973	76.9	12.2	0.169		2.82	0.10	0.49	0.26	2.07	4.87	0.03	546
93-01 EXT.	1526	Rhyolite	19501	77.9	11.0	0.152		2.55	0.09	1.84	0.18	0.59	5.65	0.02	158
Average				**77.43**	**11.63**	**0.160**		**2.09**	**0.10**	**1.16**	**0.22**	**1.33**	**5.26**	**0.03**	**158**
								*FeO est. includes 19970							*Ba: 19501 only
Unaltered excluding silicification															
93-01	1381	Rhyolite	19970	83.4	9.2	0.142		0.89	0.04	1.03	0.11	1.17	4.00	0.03	379
Reconstituted values: based on precursor Al2O3 of 11.63%															
93-01	163-168	Rhyolite	*	78.68	11.63	0.23		7.97	0.24	1.24	1.42	3.09	2.46	0.05	610
93-01	174	Rhyolite	19952	82.52	11.63	0.17		3.86	0.11	1.48	0.56	1.61	4.75	0.03	379
93-01	259	Rhyolite	19953	71.50	11.63	0.18		7.84	0.16	2.02	0.79	2.08	3.73	0.03	426
93-01	275	Rhyolite	19954	84.83	11.63	0.16		2.30	0.08	2.08	0.27	5.79	2.57	0.03	1071
93-01	344	Rhyolite	19955	74.82	11.63	0.17		4.44	0.16	1.40	0.67	1.68	4.30	0.02	369
93-01	396	Rhyolite	19956	67.13	11.63	0.17		3.80	0.09	2.45	0.83	3.89	0.69	0.03	645
93-01	1343	Rhyolite	19969	97.18	11.63	0.18		1.95	0.05	0.80	0.42	2.32	3.71	0.04	642
93-01	1381	Rhyolite	19970	105.22	11.63	0.18		1.12	0.05	1.30	0.14	1.48	5.04	0.04	478
93-01 EXT.	1446	Rhyolite	19504	107.93	11.63	0.18		1.24	0.09	1.77	0.18	1.70	4.49	0.04	539
93-01 EXT.	1489	Rhyolite	19503	69.04	11.63	0.16		3.64	0.07	0.52	0.33	4.30	0.07	0.03	722
93-01 EXT.	1517	Rhyolite	19502	63.20	11.63	0.16		3.14	0.03	0.10	0.45	4.22	0.56	0.03	683
93-01 EXT.	1526	Rhyolite	19501	82.27	11.63	0.16		2.69	0.10	1.94	0.19	0.62	5.97	0.02	167

Table 3. Calculated mass changes for rhyolites from K2-93-1, 2, 3, southwestern Jessop Township.

Hole	Depth (ft)	Lithology	Number	SiO2 %	Al2O3 %	TiO2 %	Fe2O3 %	FeO %	MnO %	CaO %	MgO %	K2O %	Na2O %	P2O5 %	Ba ppm
Reconstituted values (continued)															
93-02	37	Rhyolite	19971	99.30	11.63	0.17		1.16	0.05	0.66	0.12	3.35	3.69	0.04	940
93-02	92	Rhyolite	19972	60.29	11.63	0.15		3.85	0.07	0.46	0.54	3.26	1.88	0.03	661
93-02	92	Rhyolite	19972	60.86	11.63	0.17		3.55	0.10	1.15	0.56	2.51	3.03	0.03	559
93-02	197	Rhyolite	19973	73.10	11.63	0.16		2.68	0.10	0.47	0.24	1.96	4.62	0.03	519
93-02	277	Rhyolite	19974	69.20	11.63	0.18		5.29	0.13	1.36	0.58	3.38	1.36	0.03	552
93-03	83	Rhyolite	19979	47.64	11.63	0.16		6.92	0.19	1.21	1.02	3.82	0.70	0.02	698
93-03	115	Rhyolite	19980	58.62	11.63	0.12		1.24	0.04	0.53	0.13	3.72	0.10	0.03	857
Mass changes															
93-01	163-168	Rhyolite	*	1.3	0.0	0.07		5.9	0.1	0.1	1.2	1.8	-2.8	0.02	452
93-01	174	Rhyolite	19952	5.1	0.0	0.01		1.8	0.0	0.3	0.3	0.3	-0.5	0.01	221
93-01	259	Rhyolite	19953	-5.9	0.0	0.02		5.7	0.1	0.9	0.6	0.7	-1.5	0.01	268
93-01	275	Rhyolite	19954	7.4	0.0	0.00		0.2	0.0	0.9	0.1	4.5	-2.7	0.01	913
93-01	344	Rhyolite	19955	-2.6	0.0	0.01		2.3	0.1	0.2	0.4	0.3	-1.0	-0.01	211
93-01	396	Rhyolite	19956	-10.3	0.0	0.01		1.7	0.0	1.3	0.6	2.6	-4.6	0.00	487
93-01	1343	Rhyolite	19969	19.8	0.0	0.02		-0.1	0.0	-0.4	0.2	1.0	-1.5	0.01	484
93-01	1381	Rhyolite	19970	27.8	0.0	0.02		-1.0	0.0	0.1	-0.1	0.1	-0.2	0.01	320
93-01 EXT.	1446	Rhyolite	19504	30.5	0.0	0.02		-0.9	0.0	0.6	0.0	0.4	-0.8	0.01	381
93-01 EXT.	1489	Rhyolite	19503	-8.4	0.0	0.00		1.6	0.0	-0.6	0.1	3.0	-5.2	0.00	564
93-01 EXT.	1517	Rhyolite	19502	-14.2	0.0	0.00		1.0	-0.1	-1.1	0.2	2.9	-4.7	0.00	525
93-01 EXT.	1526	Rhyolite	19501	4.8	0.0	0.00		0.6	0.0	0.8	0.0	-0.7	0.7	0.00	9
93-02	37	Rhyolite	19971	21.9	0.0	0.01		-0.9	0.0	-0.5	-0.1	2.0	-1.6	0.01	782
93-02	92	Rhyolite	19972	-17.1	0.0	-0.01		1.8	0.0	-0.7	0.3	1.9	-3.4	0.00	503
93-02	92	Rhyolite	19972	-16.6	0.0	0.01		1.5	0.0	0.0	0.3	1.2	-2.2	0.00	401
93-02	197	Rhyolite	19973	-4.3	0.0	0.00		0.6	0.0	-0.7	0.0	0.6	-0.6	0.00	361
93-02	277	Rhyolite	19974	-8.2	0.0	0.02		3.2	0.0	0.2	0.4	2.1	-3.9	0.00	394
93-03	83	Rhyolite	19979	-29.8	0.0	0.00		4.8	0.1	0.0	0.8	2.5	-4.6	0.00	540
93-03	115	Rhyolite	19980	-18.8	0.0	-0.04		-0.9	-0.1	-0.6	-0.1	2.4	-5.2	0.01	698

Note: Mass changes calculated on the basis of a precursor Zr content of 361 ppm yield closely similar mass change results.

Table 4. Chemical composition of some volcanic rocks from southern Jessop Township (mainly JS 24-01, 24-02).

Hole	Depth	Number	Lithology	SiO_2	Al_2O_3	TiO_2	Fe_2O_3	MnO	CaO	MgO	K_2O	Na_2O	P_2O_5	LOI
Holes JS 24-01 and 24-02, Noranda East Grid area*														
JS 24-01	41.0-44.0	8507	Dacite	65.9	15.0	0.52	3.38	0.05	2.72	1.26	1.56	3.37	0.09	4.62
JS 24-01	62.0-65.0	8508	Dacite	68.1	13.7	0.61	4.49	0.07	2.61	1.35	1.71	2.81	0.09	4.70
JS 24-01	86.0-89.0	8509	Dacite	65.6	14.3	0.57	3.96	0.06	2.67	1.33	1.96	3.15	0.09	4.54
JS 24-01	131.0-134.0	8510	Basaltic andesite	46.1	11.7	2.75	11.80	0.22	8.09	3.80	0.25	1.73	0.39	11.77
JS 24-01	178.0-179.0	8511	Basaltic andesite	44.5	13.2	3.11	14.10	0.27	7.72	2.96	0.22	3.77	0.47	8.70
JS 24-01	202.0-205.0	8512	Basaltic andesite	45.0	12.4	2.95	12.50	0.30	8.00	2.90	0.48	2.72	0.46	10.77
JS 24-01	230.0-233.0	8513	Basaltic andesite	42.4	12.3	2.40	10.30	0.26	9.36	3.84	2.09	2.11	0.25	13.54
JS 24-01	239.0-242.0	8514	Evolved dacite	65.9	9.33	0.73	7.31	0.18	3.59	0.77	1.31	3.56	0.14	5.31
JS 24-02	31.7-34.9	9545	Basaltic andesite	45.8	12.0	2.88	15.70	0.25	7.63	4.37	0.28	2.24	0.42	7.39
JS 24-02	55.0-58.0	9546	Basaltic andesite	44.6	10.9	2.61	15.70	0.26	9.19	3.85	0.29	2.12	0.38	8.23
JS 24-02	66.5-69.5	9547	Basaltic andesite	46.2	11.9	2.87	16.80	0.28	7.27	4.39	0.48	1.97	0.42	5.77
JS 24-02	107.0-11.0	9548	Basaltic andesite	47.5	11.8	2.77	14.90	0.28	9.45	3.93	0.22	1.76	0.41	5.54
JS 24-02	138.0-141.0	9549	Basaltic andesite	46.8	11.9	2.81	15.10	0.30	8.16	4.31	0.52	2.18	0.41	5.77
JS 24-02	176.0-179.0	9550	Basaltic andesite	42.6	11.5	2.82	18.10	0.26	7.79	4.09	0.89	1.66	0.40	5.70
JS 24-02	211.0-214.0	9551	Basaltic andesite	45.4	11.7	2.76	13.80	0.30	8.85	3.61	0.31	3.19	0.40	6.54
JS 24-02	230.0-233.0	9552	Basaltic andesite	47.2	12.0	2.77	14.10	0.25	7.82	3.73	0.97	2.99	0.41	3.62
JS 24-02	251.0-254.0	9553	Rhyodacite	68.1	13.4	0.43	3.53	0.07	2.59	1.25	2.47	3.72	0.08	2.54
JS 24-02	289.0-291.0	9554	Dacite	66.1	14.9	0.60	4.42	0.08	3.42	1.42	1.92	4.59	0.12	1.39
JS 24-02	320.0-323.0	9555	Dacite	62.9	16.2	0.56	4.50	0.07	3.57	1.74	1.64	5.02	0.13	2.39
JS 24-02	345.0-348.0	9556	Dacite	63.4	15.7	0.53	4.30	0.07	3.77	1.71	1.44	5.10	0.12	2.93
JS 24-02	368.3-371.3	9557	Rhyodacite	69.4	14.3	0.35	1.71	0.05	2.69	0.88	3.18	2.71	0.09	3.46
JS 24-02	402.4-404.4	9558	Dacite	62.8	13.8	0.48	2.92	0.11	6.14	0.74	1.94	4.04	0.12	5.24

*Data courtesy of Falconbridge Limited.

Hole	Depth	Number	Lithology	SiO_2	Al_2O_3	TiO_2	Fe_2O_3	MnO	CaO	MgO	K_2O	Na_2O	P_2O_5	LOI
Four Corners: surface samples**														
19251	BL0, 100 mE		Rhyolite	80.4	10.7	0.17	1.38	0.03	0.08	0.19	2.70	3.61	0.03	0.75
19252	105 MS, 30 mE		Andesite	64.1	13.3	1.39	8.80	0.17	1.86	2.07	0.97	4.31	0.20	3.40
19253	110 MS, 34 mE		Basaltic andesite	51.1	13.0	2.40	14.10	0.21	6.15	4.70	0.50	2.70	0.26	3.75
19254	BL0, 75mE		Rhyolite	78.0	9.4	0.20	3.35	0.07	0.36	0.39	3.31	1.38	0.03	1.65
19256	25mN, 100mE		Rhyolite	82.5	9.5	0.15	1.49	0.03	0.23	0.17	2.52	2.85	0.02	0.60
19257	110 mS, 34 mE		Andesite	64.7	13.2	1.49	7.77	0.15	2.18	2.25	0.70	4.80	0.22	2.90
19258	100 mS, 15 mE		Basaltic andesite	49.1	12.4	1.93	17.90	0.25	8.75	5.15	1.38	1.91	0.24	1.05
Hole 86-1 mafic unit**														
86-01	137.0-137.5		Andesite	59.6	13.4	1.39	10.00	0.28	4.29	1.64	1.03	3.65	0.45	2.95
86-01	170.5-171.0		Andesite	62.4	14.0	1.43	7.83	0.20	2.78	1.30	3.12	2.17	0.46	3.55
86-01	184.5-185.0		Andesite	56.8	11.9	1.26	12.10	0.40	5.58	1.79	1.32	2.54	0.40	6.05
86-01	509.0-509.5		Basaltic andesite	50.7	12.5	1.97	14.70	0.23	6.57	3.09	0.14	3.89	0.33	5.40

**Data from this report, analyzed at XRAL, Toronto. Majors analyzed on beads, traces on pressed pellets.

Table 4. Chemical composition of some volcanic rocks from southern Jessop Township (mainly JS 24-01, 24-02).

Hole	Depth	Number	Lithology	Sum	Ba	Sr	Y	Zr	Rb	Nb	Zr/Y	Zr/Nb	Al2O3/ TiO2
Holes JS 24-01 and 24-02, Noranda East Grid area*													
JS 24-01	41.0-44.0	8507	Dacite	98.47	400	360	10	140	50	20	14	7.0	28.8
JS 24-01	62.0-65.0	8508	Dacite	100.24		180	20	150	80	30	7.5	5.0	22.5
JS 24-01	86.0-89.0	8509	Dacite	98.23		200	5	150	80	30	30	5.0	25.1
JS 24-01	131.0-134.0	8510	Basaltic andesite	98.60		140	50	210	20	20	4.2	10.5	4.3
JS 24-01	178.0-179.0	8511	Basaltic andesite	99.02		110	40	270	20	30	6.8	9.0	4.2
JS 24-01	202.0-205.0	8512	Basaltic andesite	98.48	400	110	40	250	20	20	6.3	12.5	4.2
JS 24-01	230.0-233.0	8513	Basaltic andesite	98.85	800	190	50	200	70	30	4.0	6.7	5.1
JS 24-01	239.0-242.0	8514	Evolved dacite	98.13		120	130	440	40	30	3.4	14.7	12.8
JS 24-02	31.7-34.9	9545	Basaltic andesite	98.96	200	100	40	230	10	30	5.8	7.7	4.2
JS 24-02	55.0-58.0	9546	Basaltic andesite	98.13	200	110	40	210	30	20	5.3	10.5	4.2
JS 24-02	66.5-69.5	9547	Basaltic andesite	98.35		80	40	230	40	40	5.8	5.8	4.1
JS 24-02	107.0-11.0	9548	Basaltic andesite	98.56		150	40	210	20	20	5.3	10.5	4.3
JS 24-02	138.0-141.0	9549	Basaltic andesite	98.26	200	90	50	210	20	30	4.2	7.0	4.2
JS 24-02	176.0-179.0	9550	Basaltic andesite	95.81		80	40	220	20	30	5.5	7.3	4.1
JS 24-02	211.0-214.0	9551	Basaltic andesite	96.86		90	50	200	20	20	4.0	10.0	4.2
JS 24-02	230.0-233.0	9552	Basaltic andesite	95.86	400	100	40	220	50	10	5.5	22.0	4.3
JS 24-02	251.0-254.0	9553	Rhyodacite	98.18	500	240	60	220	100	20	3.7	11.0	31.2
JS 24-02	289.0-291.0	9554	Dacite	98.96	600	300	50	200	80	30	4.0	6.7	24.8
JS 24-02	320.0-323.0	9555	Dacite	98.72		330	30	160	70	10	5.3	16.0	28.9
JS 24-02	345.0-348.0	9556	Dacite	99.07		340	40	130	60	20	3.3	6.5	29.6
JS 24-02	368.3-371.3	9557	Rhyodacite	98.82	600	150	20	130	100	20	6.5	6.5	40.9
JS 24-02	402.4-404.4	9558	Dacite	98.33		490	20	150	60	20	7.5	7.5	28.8
*Data courtesy of Falconbridge Limited.													
Four Corners: surface samples**													
19251	BL0, 100 mE		Rhyolite	100.04	632	24	71	336	49	22	4.7	15.3	61.5
19252	105 MS, 30 mE		Andesite	100.57									9.6
19253	110 MS, 34 mE		Basaltic andesite	98.87	306	175	22	166	17	10	7.5	16.6	5.4
19254	BL0, 75mE		Rhyolite	98.15	624	20	68	299	76	20	4.4	15.0	48.3
19256	25mN, 100mE		Rhyolite	100.06	690	29	86	280			3.3		63.3
19257	110 mS, 34 mE		Andesite	100.36	320	96	33	244	20		7.4		8.9
19258	100 mS, 15 mE		Basaltic andesite	100.06	419	162	22	140	53		6.4		6.4
Hole 86-1 mafic unit**													
86-01	137.0-137.5		Andesite	98.68	558	214	64	304	29	16	4.8	19.0	9.6
86-01	170.5-171.0		Andesite	99.24	879	68	73	309	78	16	4.2	19.3	9.8
86-01	184.5-185.0		Andesite	100.14	489	144	53	259	35	14	4.9	18.5	9.4
86-01	509.0-509.5		Basaltic andesite	99.52	166	99	30	197	6	12	6.6	16.4	6.3

**Data from this report, analyzed at XRAL, Toronto. Majors analyzed on beads, traces on pressed pellets.