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REPORT ON THE PINHORN DIAMOND/GOLD PROPERTY MILK RIVER AREA, ALBERTA

prepared for

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1. SUMMARY

The Sweet Grass intrusives are characterized by two populations of biotite-phlogopite (phenocryst and groundmass), diopsidic clinopyroxene, olivine, chromite, magnetite, ilmenite, alkali feldspar and carbonate with apatite and analcite reported as well. They have been interpreted as lamprophyres due to the high proportion of biotite-phlogopite. Alternatively, the presence of leucite and analcime together with the uncertainty as to whether sanidine (alkali feldspar) is primary or secondary suggests the occurrences might be ultramafic lamprophyres (ouachitite, damkjernite). Furthermore, they might also be considered as madupitic lamproites (having groundmass phlogopite).

They have variable xenolith content which includes both crustal (host sediment and basement inclusions) and mantle xenoliths (glimmerites, phlogopite-clinopyroxenite, clinopyroxenite; depending upon variable mica content). Mineral analyses of clinopyroxenes, ilmenites, chromites and garnets have been determined and are comparable to "kimberlitic indicator minerals"; documenting G3/G5 garnets, high chrome diopsides and diamond inclusion field chromites. Mica analyses from different occurrences and phases plot within the primitive field and document both minette and kimberlite trends in composition.

Geochemically, they are potassic to ultrapotassic, peralkaline ([K + Na]/Al >1) and perpotassic (K/Al >1), with anomalous levels of Ba, Ti, Cr, Sr, Y, Zr. The LREE (Light Rare Earth Elements) are enriched relative to the HREE and have similar patterns to South African and Siberian kimberlites (no data currently available for comparison to lamproites). Although the data obtained to date is generally comparable to lamprophyres, there are lamproitic and kimberlitic trends evident. Therefore, it is concluded that the Sweet Grass intrusives are lamprophyres (specifically minettes) having a lamproitic affinity.

BHP reported recovery of a 100 by 92 micron microdiamond from a heavy mineral separate of a 38.2 kg sample from the Black Butte occurrence. Recovery of a microdiamond is consistent with mineral chemistry determined for clinopyroxene, ilmenite, chromite and garnet grains analyzed using electron microporbe analysis. Petrography, whole rock, trace and mineral geochemistry support the conclusion that the southern Alberta alkalic occurrences were derived at or within the diamond inclusion field (Kjarsgaard 1994, pers. comm.).

2. INTRODUCTION

The Pinhorn Property encompasses an area of 43,000 acres, having approximate dimensions of 12 miles north-south and 6 miles east-west. There are two alkalic exposures documented on the property, the JD-4 (Coulee 29; Kjarsgaard 1994, Cavell et al. 1992, Burwash and Cavell 1992) and JD-2 (Pakowki Coulee, Kjarsgaard 1994). The following general description of the geological setting of the Sweet Grass intrusives is summarized from Westgate (1968).

2.1 Surficial Geology

Southern Alberta has been subjected to several periods of glaciation, which has resulted in the deposition of between 0 and 50 feet of glacial detritus. The maximum thickness of the Laurentide icesheet is interpreted to have been approximately 1000 feet in the Aden area, leaving the Sweet Grass Hills and the Cypress Hills exposed as nunataks. The iceflow associated with the Laurentide icesheet is generally southeasterly, while later, less extensive icesheets had dominant flow directions toward the south and southwest.

The glacial deposits of the Milk River area consist of ice-flow features, comprised of moraine deposits which include washboard moraine, ground moraine, hummocky and ridged end moraine in the vicinity of the JD-4 occurrence. In contrast the JD-2 occurrence is located in a paleo-meltwater channel presently identified as the Pakowki Coulee.

2.2 Stratigraphy

The depth to basement of the Alberta Basin is reported to vary from 3400 to 3700 feet in the Milk River area. Numerous drill holes have penetrated the Phanerozoic succession, primarily for Cretaceous oil and gas, however some drill holes have penetrated basement, and stratigraphic control is reasonably good in this area.

The geology of the Milk River area is underlain by Cretaceous (Campanian) sediments of the Pakowki, Foremost and Oldman Formations. These formations range in age from 78 (Pakowki Formation) to 72 Ma (upper contact of the Oldman Formation) (Jackson 1975). The Oldman and Foremost Formations comprise the Belly River Group of southeastern Alberta.

The Pakowki Formation is interpreted to be of marine origin, consisting of dark grey shale, with occasional thin beds of sandstone, siltstone and bentonite. The lower contact is commonly marked by thin beds of grey to black chert pebbles while the upper contact is transitional with the overlying Foremost Formation. The thickness of the Pakowki Formation in the Milk River area is approximately 500 feet thick.

The Foremost Formation, exposed along the Milk River canyon, consists primarily of arenaceous shale. It is comprised of a mixture of brackish water and freshwater deposits, consisting mainly of shaly siltstones, sandstones, coal seams, ironstone concretions and silicified oyster-shell beds and having a thickness of approximately 270 feet.

The Oldman Formation typically consists of a light-coloured, argillaceous sandstone, interbedded with green, sandy shales. Coal seams are present in the upper part of the formation. Coarser beds commonly show crossbedding and are lenticular.

2.3 Structure

The southern Alberta plains are situated on the Sweet Grass Arch, a broad, northerly plunging anticline. The Pinhorn Property lies to the east of this arch and therefore the regional dip of the beds is to the east-northeast. Local deviations are reported in "... nose- and dome-like structures ... developed around the igneous intrusions of the Sweet Grass Hills" (Westgate 1968).

> Furthermore, "The nature and orientation of some surficial lineaments can not be explained by glaciation. These non-glacial lineaments ... are several miles long, and may intersect, or be sub-parallel. It is believed that these lineaments represent fault or joint traces that have been reflected through the unconsolidated glacial drift. This reflection occurred when adjustment took place along the faults, possibly due to differential isostatic rebound" (Westgate 1968).

2.4 Alkalic Occurrences

There are a total of seven small alkalic intrusives are exposed just north of the Montana-Alberta border and south of the Milk River (Fig. 1). They are coeval and almost certainly related to the Sweet Grass Hills, immediately to the south in Montana (Fig. 2). They were first described as "mica traps" (Dawson 1884) and more recently as minettes and olivine minettes (Kjarsgaard 1993, 1994). The occurrences are generally intrusive (except JD-4, having two extrusive phases), ranging from small discontinuous dykes to larger resistant diatremes having positive relief. They are evident on the Geological Survey of Canada Cypress Hills aeromagnetic data set acquired in 1992 and released in May 1993. Recent interpretation of aeromagnetic and geochronological data by the G.S.C. indicates southern Alberta is underlain by Archean basement of the Hearn Province.

3. PROPERTY DESCRIPTION

The author has been informed by Marum Resources Inc. that it has entered into an option agreement with D.I.M. Holdings and Douglas B. Nelson concerning the "D.I.M. Lands" and the "Nelson Lands", described in the option agreement as follows:

" D.I.M. Lands

Being a legal description of parts of an Alberta Metallic Minerals Permit held by D.I.M. Holdings Limited.

No. 6892080011 Township 2, Range 8, west half (17 sections),
No. 6892080010 Township 2, Range 9, east half (14 sections),
No. 6892080014 Township 3, Range 8, west half (18 sections),
No. 6892080003 Township 1, Range 9, east half (18 sections),
comprising an area of 67 sections.

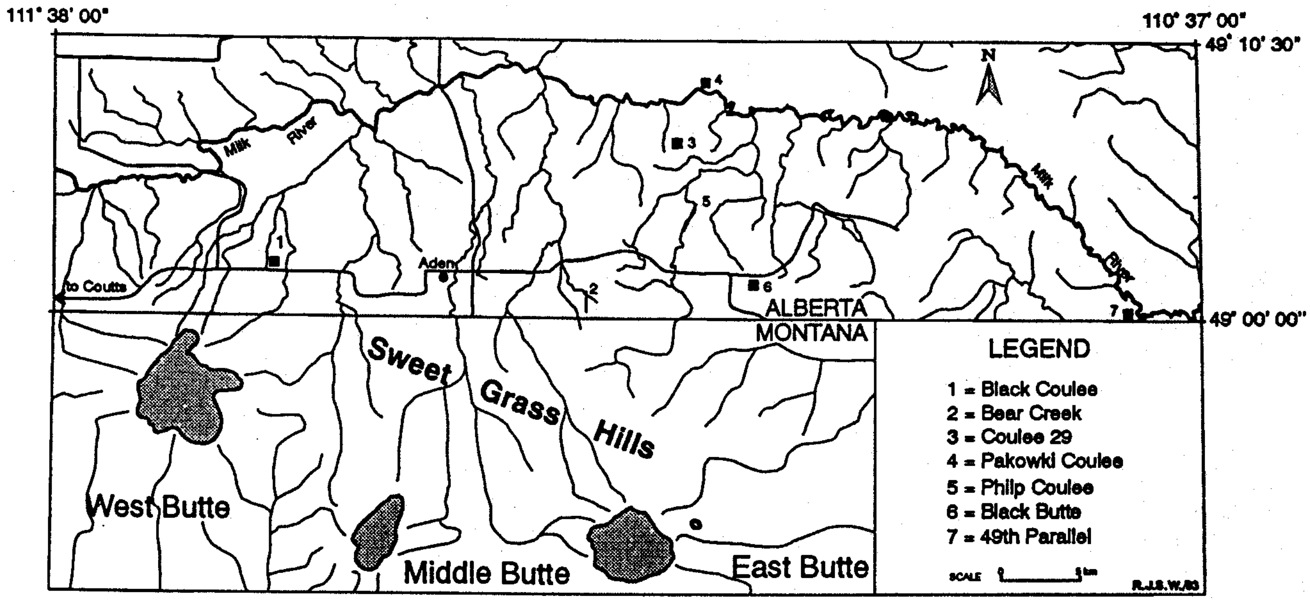

Figure 1 - Location map for the southern Alberta alkalic occurrences. The locality names referred to in the text differ from that of Kjarsgaard (1994) as follows: 2 = JD-5, 3 = JD-4, 4 = JD-2, 5 = JD-3, and 6 = JD-1. The Pinhorn Property contains the JD-2 (Pakowki Coulee) and JD-4 (Coulee 29) occurrences. The Sweet Grass Hills are located south of the Alberta-Montana border and are represented by the shaded masses (from Kjarsgaard (1994)).

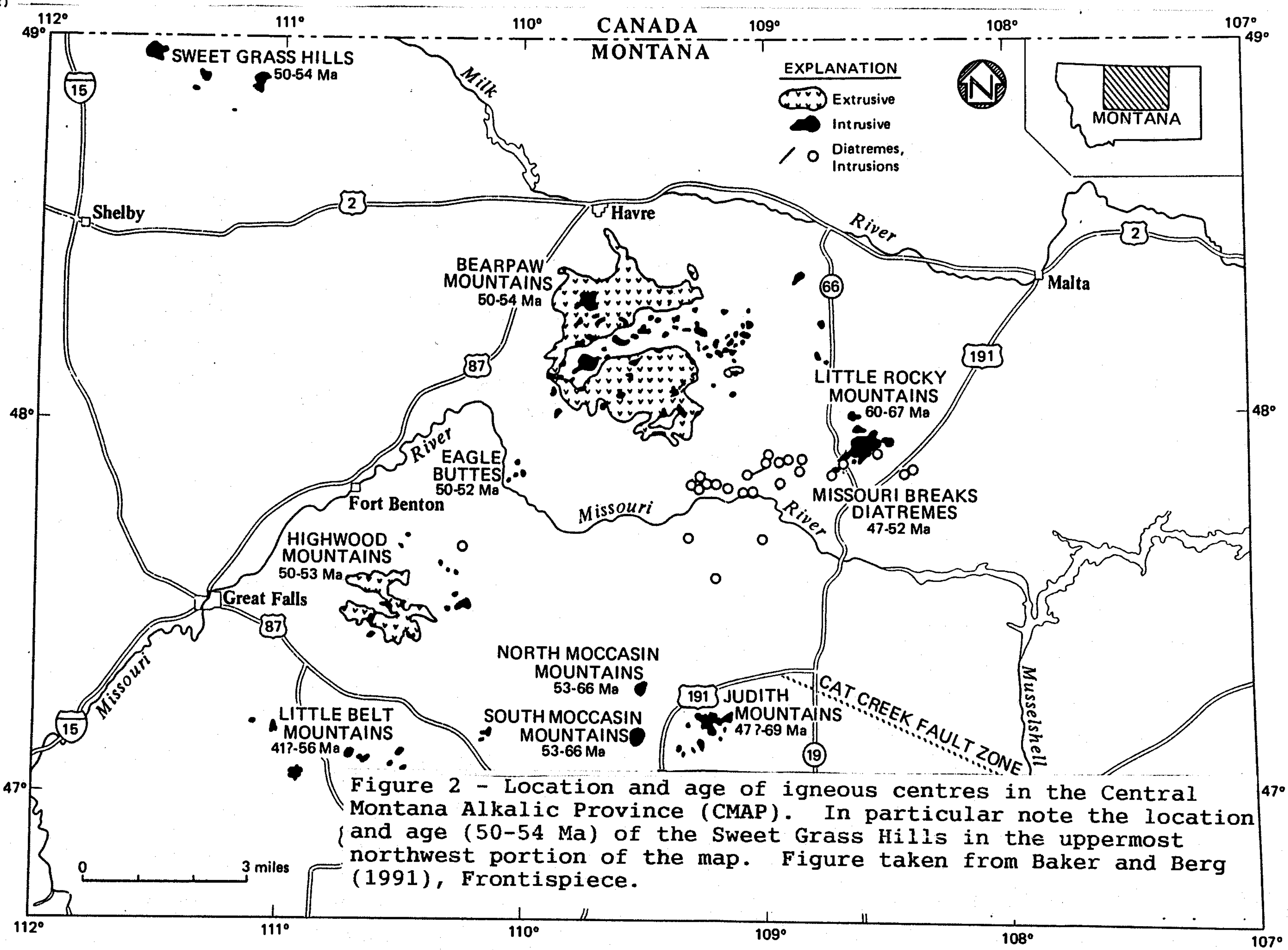

Figure 2 - Location and age of igneous centres in the Central Montana Alkalic Province (CMAP). In particular note the location and age (50-54 Ma) of the Sweet Grass Hills in the uppermost northwest portion of the map. Figure taken from Baker and Berg (1991), Frontispiece.

Nelson Lands
Being a legal description of an Alberta Metallic Minerals Permit (No. 6890010001) held by Douglas B. Nelson."

The property consists of approximately 43,000 acres, in an irregular rectangle measuring 12 miles from north to south and 6 miles east to west.

The author has not verified ownership of the Metallic Minerals Permits but has been advised by Mr. Richard A. Boulay, President of Marum Resources Inc., that a title check made on July 26, 1993 confirmed the Mineral Permit ownership as described above.

4. GENERAL GEOLOGICAL CONSIDERATIONS

The Milk River area of southern Alberta is considered a highly favourable location for diamond exploration for several reasons:

1) alkalic intrusive to extrusive occurrences having characteristics similar to diatremes in the Central Montana Alkalic Province with a similar emplacement age (Fig. 1 and 2);
2) the possible presence of a failed triple junction providing a conduit from the mantle for alkalic magmas (Fig. 3 and 4);
3) the presence of a thickened lithospheric keel, possibly extending as deep as the diamond stability field (Fig. 5); and
4) the recovery of Archean age zircon separates from deep, basement penetrating drill holes, interpreted as evidence for stable Archean craton underlying the Alberta basin (Fig. 6).

Each of these points is individually significant and encouraging for diamond exploration. Kimberlites and lamproites are the only two primary lithologies currently known to contain economic quantities of diamond, requiring a conduit to allow access to the surface from the mantle. Furthermore, diamondiferous occurrences are associated with stable cratonic shield areas, having thickened keels extending into the diamond stability field.

Firstly, numerous alkalic intrusions (including kimberlite and lamproite) are exposed throughout central Montana to the Alberta border (of which the Sweet Grass Hills and associated intrusives are the northernmost exposed). The Sweet Grass Hills are comprised of granitic to syenitic intrusives whereas the Sweet Grass alkalic intrusives are characterized by significant sodium and, in particular, potassium enrichment. Furthermore, geochemical analyses of rock and mineral samples document characteristics similar with occurrences in the Central Montana Alkalic Province and diamond inclusion field mineralogy (see section 7.0). Finally, although separated from intrusions having similar characteristics in Montana by the Great Falls Tectonic Zone, they have a similar age of emplacement (Fig. 2). The alkalic occurrences in the Central Montana Alkalic Province, underlain by Archean basement of the Wyoming craton, were generally intruded or erupted in the Eocene between 67 and 47 Ma. The Sweet Grass Hills igneous bodies have been dated at between 50 and 54 Ma and similar dates (50±5 Ma; Cavell 1994, pers. comm.) have been determined

Figure 3 - Aeromagnetic anomaly map of southeastern British Columbia and Alberta. Domain boundaries indicated by thick white lines, see Figure 6 for reference and key to domain names and ages. The Home Pacific Knappen well is located immediately north of the Montana-Alberta border. Zircons recovered from basement penetrated and sampled by the drill have returned an age of 3278±22 Ma. Note the colour of the Vulcan Low magnetic low and the southeast projecting unlabeled low with possible reference to a failed triple junction/aulacogen model discussed in the text. Figure taken from Villeneuve et al. (1993).

Figure 4 - Bouguer Anomaly map of southeast British Columbia and Alberta. The Vulcan Low is apparent and can be traced to the leading edge of Cordilleran deformation where it is obscured or truncated. In addition, the possible southeast projecting arm to a failed triple junction/aulacogen is not apparent. Figure taken from Villeneuve et al. (1993).

Photo.

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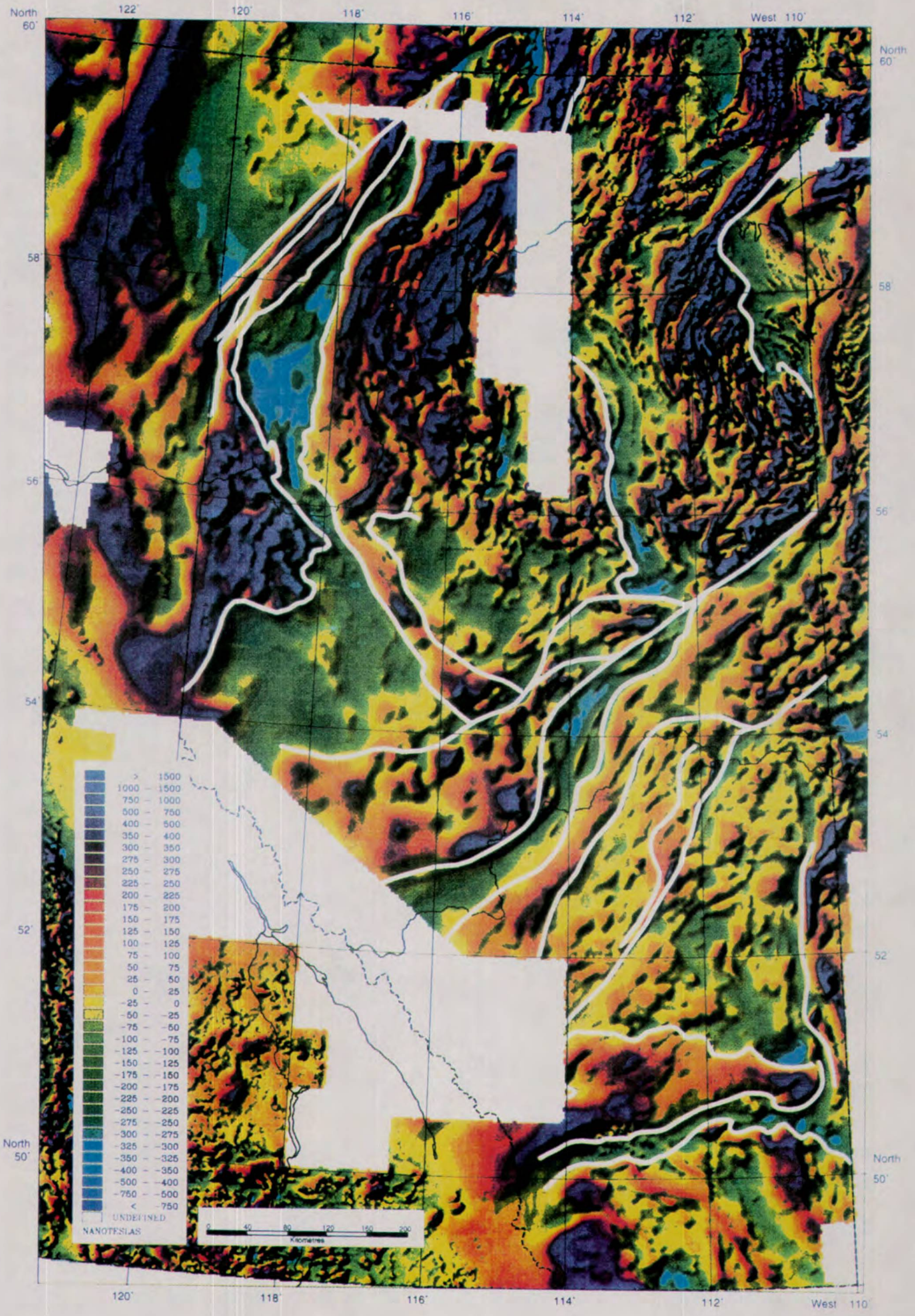
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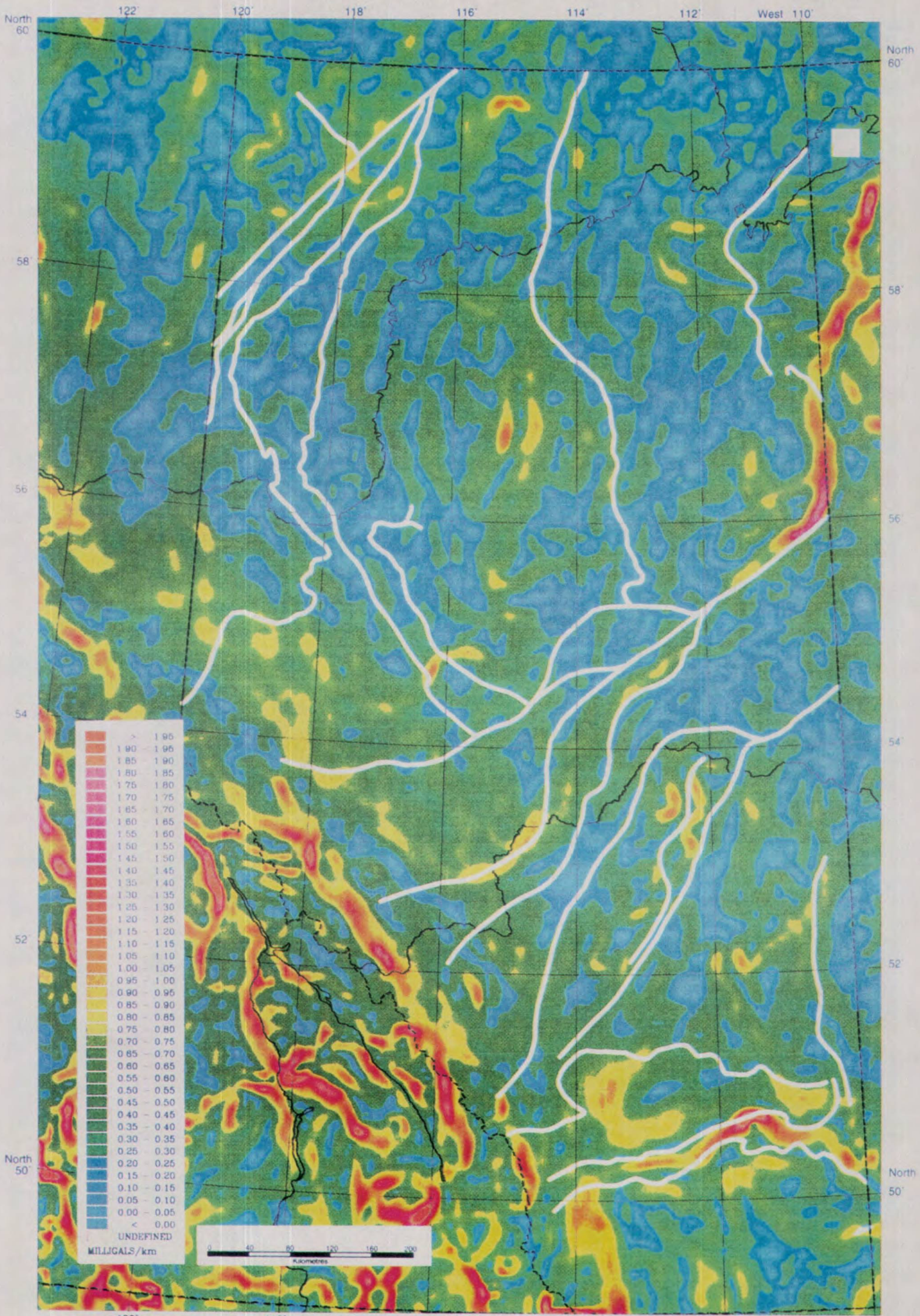

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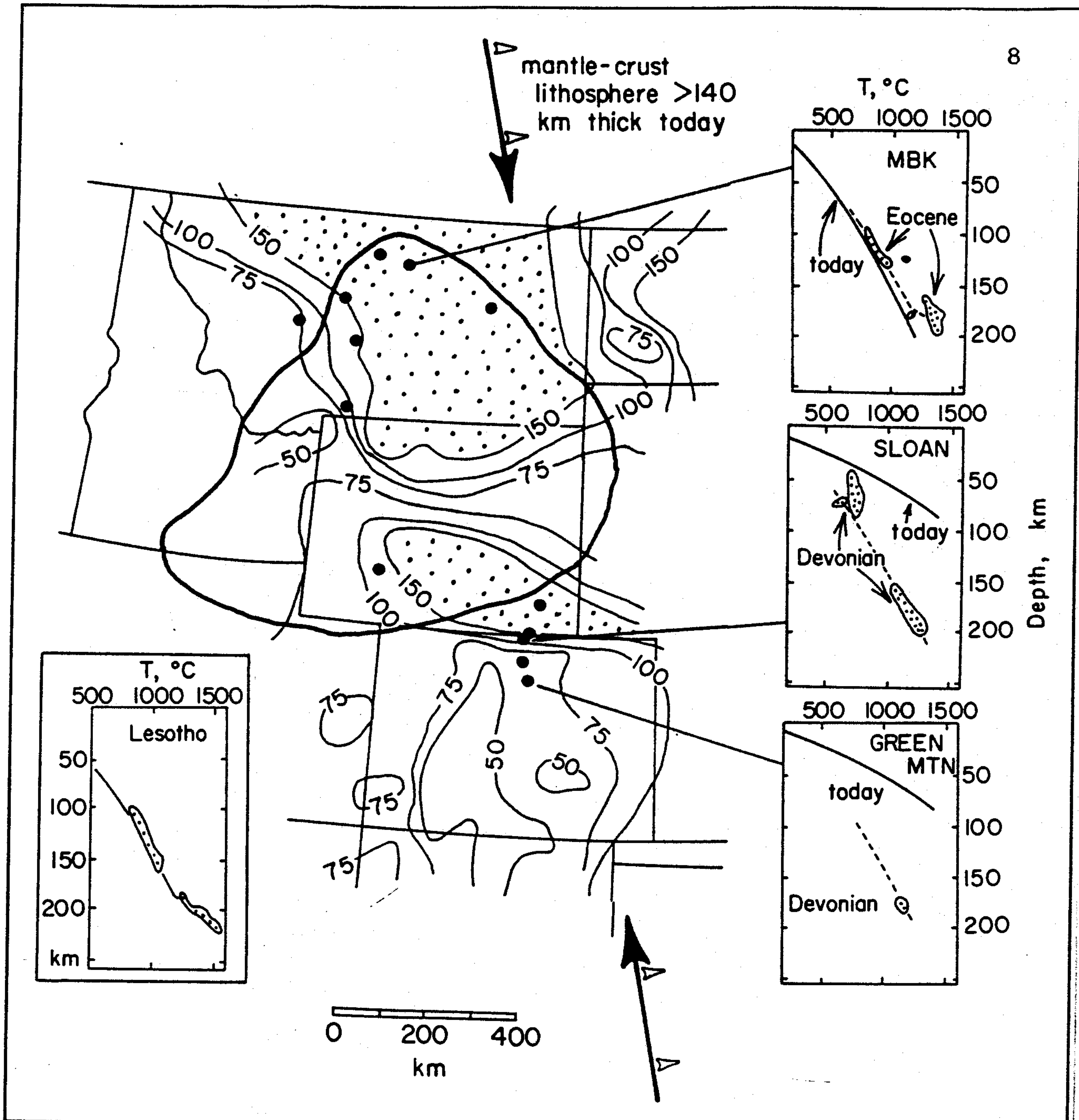


Figure 5 - Present day thickness of the lithosphere (km) calculated from heat flow data. The boundary between the lithosphere and asthenosphere is taken as the 1200°C isotherm. The heavy arrows at top and bottom indicate the proposed regional edge of thick (>140 km) mantle lithosphere. The regional enclosed by the thick line indicates the interpreted present day extent of the Wyoming craton, separated from the Hearn Province under Alberta and Saskatchewan by the Great Falls Tectonic Zone. The dots are areas of magmatic activity (see Figure 2 for more detail). The inset figures show fossil geotherms from xenolith samples recovered from the stated occurrences. The conclusion reached is that the thick mantle lithosphere that was once present under much of the present day western Great Plains and leading edge of the Rocky Mountains is now significantly reduced, represented today by a thickened area under central Montana and Wyoming. Figure taken from Eggler and Furlong (1991).

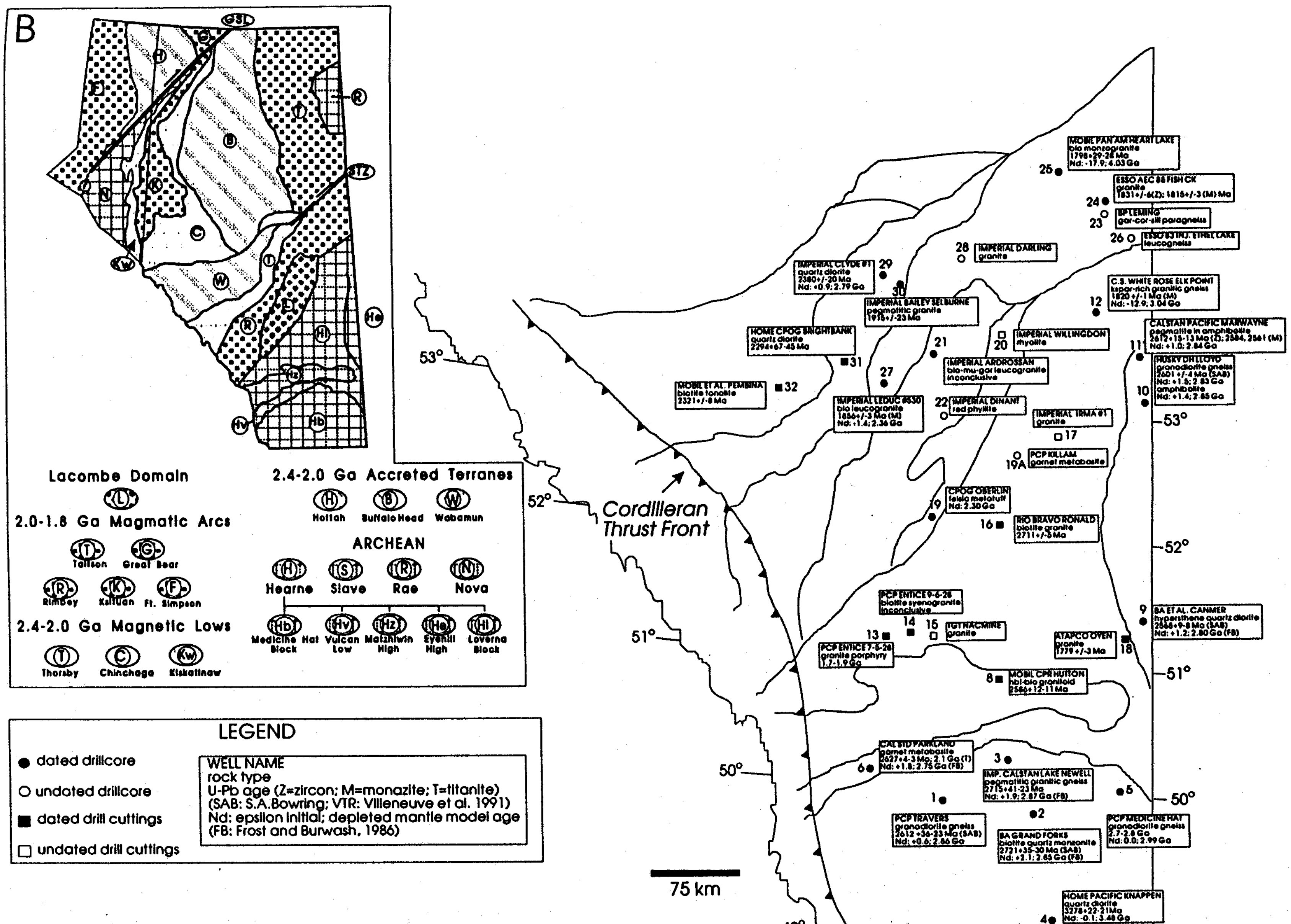


Figure 6 - Drill hole locality map of Alberta showing the location of basement penetrating drill holes from which zircon samples were obtained for geochronological dating relative to domain boundaries. Key to domains indicated in inset figure. Note location of Home Pacific Knappen well relative to approximate position of southern Alberta Sweet Grass intrusives. Figure taken from Villeneuve et al. (1993).

for the Sweet Grass intrusives of southern Alberta (Burwash et al. 1992, Cavell and Nelson 1992).

Secondly, some centres of alkalic igneous activity are associated with continental rifting (eg. East African Rift system). Kanasewich et al. (1968) interpreted the presence of a long lived rift system extending northeast from southeastern British Columbia into southern Alberta. It has been interpreted as episodically active from the Middle Proterozoic to the Early Paleozoic, and perhaps as recently as the Upper Cretaceous (Dufresne and Williamson 1993). That arm of the aulacogen would probably project too far to the north to be associated with alkalic activity in the Milk River area. However, a south to southeast projecting arm of a continental-rift associated triple junction may have produced crustal scale faults providing conduits for alkalic magmas to reach surface.

A distinct magnetic low (Fig. 3) is spatially associated with the rift proposed by Kanasewich et al. (1968), identified as the Vulcan Low (Ross et al. 1991). A southeast projecting low is evident, in possible contact and contiguous with, the Vulcan Low. It has a signature similar to the Vulcan Low, however the configuration is inconsistent with a "typical" triple junction. It is possible that subsequent deformation during the Laramide orogeny (compression) and/or during the Eocene (extension) may have modified a failed triple junction signature.

It should be pointed out that the interpretation of Villeneuve et al. (1993) differs markedly in that they interpret the Vulcan Low to be a geophysical expression of a former north-dipping subduction zone of which the Matziwin High is the associated magmatic belt. Furthermore, the Vulcan Low appears to have a southern curvature at its western edge where it terminates within the broad aeromagnetic high associated the leading edge of the Canadian Cordillera (Varsek 1994, pers. comm.). However, "... this does not preclude younger reactivation of this boundary to produce the southern Alberta aulacogen" (Ross et al. 1991).

Thirdly, recent research documented a very low geothermal gradient, interpreted to indicate a thick lithospheric keel (Fig. 5) (Eggler and Furlong 1991). The thickened lithospheric keel is interpreted to be oriented north-northwest - south-southeast and to extend from southern Wyoming, through central Montana into southeast Saskatchewan and southwest Alberta. An extremely interesting study (Eggler and Furlong 1991) proposed the presence of a "fossil" lithospheric keel underlying most of Wyoming and much of Montana. A study of mantle xenoliths resulted in the interpretation that the present day lithospheric keel is the relict of a former keel which had a greater extent in the past (pre-Cretaceous) and has since been thermally eroded. Furthermore, mantle xenoliths in the Missouri River Breaks area document pressures and temperatures consistent with an origin very close to, or within, the diamond inclusion field during the Eocene (see inset Fig. 5).

Finally, C.M. Ross (1991) reported preliminary results of a multidisciplinary study in which "... Aeromagnetic and gravity anomaly maps were combined with U-Pb zircon and monazite geochronology of selected samples of crystalline basement to develop an age domain map for Alberta..." (Fig 6). In this study, exposures of Canadian Shield in northwestern Alberta and Saskatchewan were correlated to specific aeromagnetic and gravity signatures in the Alberta Basin. U/Pb dating of zircon and monazite samples served as a control on proposed correlations. Of particular interest to the southern Alberta area is the extension of Archean age basement of the Hearn Province into the southern third of Alberta. Five ages determined for the "Medicine Hat Block" range from 2612 to 3278 Ma. The single date of 3278+22 Ma was obtained from a drill hole just north of the Montana border and south of Milk River. It is extremely interesting with regard to the age of peridotitic diamonds of 3300 Ma recovered world wide (Kirkley et al. 1992, Levinson et al. 1992).

5. SWEET GRASS INTRUSIVES

The Sweet Grass intrusives were first described by Dawson (1884) as "mica traps" and more recently as minettes (Kjarsgaard 1994). There are seven separate occurrences documented in southern Alberta, all south of Milk River and north of the Montana-Alberta border (Fig. 1), ranging from thin discontinuous dykes to a crater-facies minette vent complex (Kjarsgaard 1994). The alkalic occurrences present at the surface coincide well with geophysical anomalies evident on government aeromagnetic maps (Mariano, 1994, pers. comm.). In addition, many linear geophysical anomalies are present in the subsurface and are best modelled as vertical to sub-vertical dykes having a "blow" at upper levels (Ross 1994, pers. comm.).

The Sweet Grass intrusives are mica-rich potassic rocks consisting of "... phenocrysts of phlogopite and diopside ± olivine in a groundmass of phlogopite, apatite, magnetite, K-feldspar, clinopyroxene ± carbonate ± analcite" (Kjarsgaard, 1993). Phlogopite analyses indicate "... a zoning trend of increasing FeO and TiO_2 at near constant Al_2O_3" (Kjarsgaard, 1993).

Based on the composition and zoning trends, the Sweet Grass intrusives were interpreted as minettes, a lamprophyre consisting of biotite with subordinate diopside as phenocrysts in a groundmass of orthoclase or sanidine (alkali feldspar) (Kjarsgaard 1993, 1994). Alternatively, they have been classified as verites, a glassy olivine-diopside-phlogopite lamproite (Ash and Associates 1993) and as a sanidine-phlogopite lamproite (Williams (1993).

Note: For the sake of convenience the southern Alberta alkaline occurrences will be referred to, in general, as intrusives. Except for sections discussing the extrusive and/or intrusive features specifically, the reader should remember that "intrusives" as used in the following text is a generalization utilized for the sake of brevity and is not strictly correct.

5.1 JD-4 Diatreme

5.11 General Description

The JD-4 diatreme complex is a very dramatic, multi-phase intrusion (Fig. 7 and 8) exposed on the east side of a coulee (Kjarsgaard 1994; Coulee 29) approximately three kilometres south of Milk River (UTM 493700, 5439525 on NTS Mapsheet 72E/3-Aden). It has been described as a minette vent complex having at least four separate magmatic events, including a pyroclastic vent phase, which intrudes Cretaceous sediments of the Pakowki and Foremost Formations (Fig. 7 and 8) (Kjarsgaard, 1994).

The diatreme complex consists of a main pipe or "blow" with up to 10 separate dykes present (Fig. 7), representing an early extrusive, pyroclastic phase with at least two, probably three, separate and distinct, cross-cutting intrusive events. The diatreme complex is exposed over a vertical distance of approximately 75m, from the coulee floor to the top. The main pipe or vent complex is approximately 175m in diameter. The overall complex is oriented north-northeast - south southwest and cores the east side of the coulee for up to 750 metres (Fig. 8).

The complex consists of a buff to light grey coloured early (pyroclastic) phase comprised of blocks up to a metre in size, with an associated brown weathering vent phase (Kjarsgaard 1994). The third phase consists of several exposures of brown weathering dykes which cross-cut the earlier vent phases. The last phase present are dark green dykes which cross-cut all of the earlier phases, exposed in "Kimberlite Gulch" (Fig. 9) and described by Kjarsgaard (1994) as olivine minettes (comprised of olivine + phlogopite + diopside phenocrysts in a groundmass of mica phlogopite-biotite$_{ss}$ + salite + sanidine + magnetite + apatite ± analcime ± calcite) (Fig. 10, see Appendix 2). Phlogopite is present in two populations, as an euhedral, phenocryst phase up to 2 cm in long dimension and as a groundmass phase up to 3 mm in long dimension. Diopside crystals are present as a phenocryst phase and have been identified in dark green, euhedral, columnar crystals up to 1.25 cm in length.

5.12 Light coloured, extrusive phase

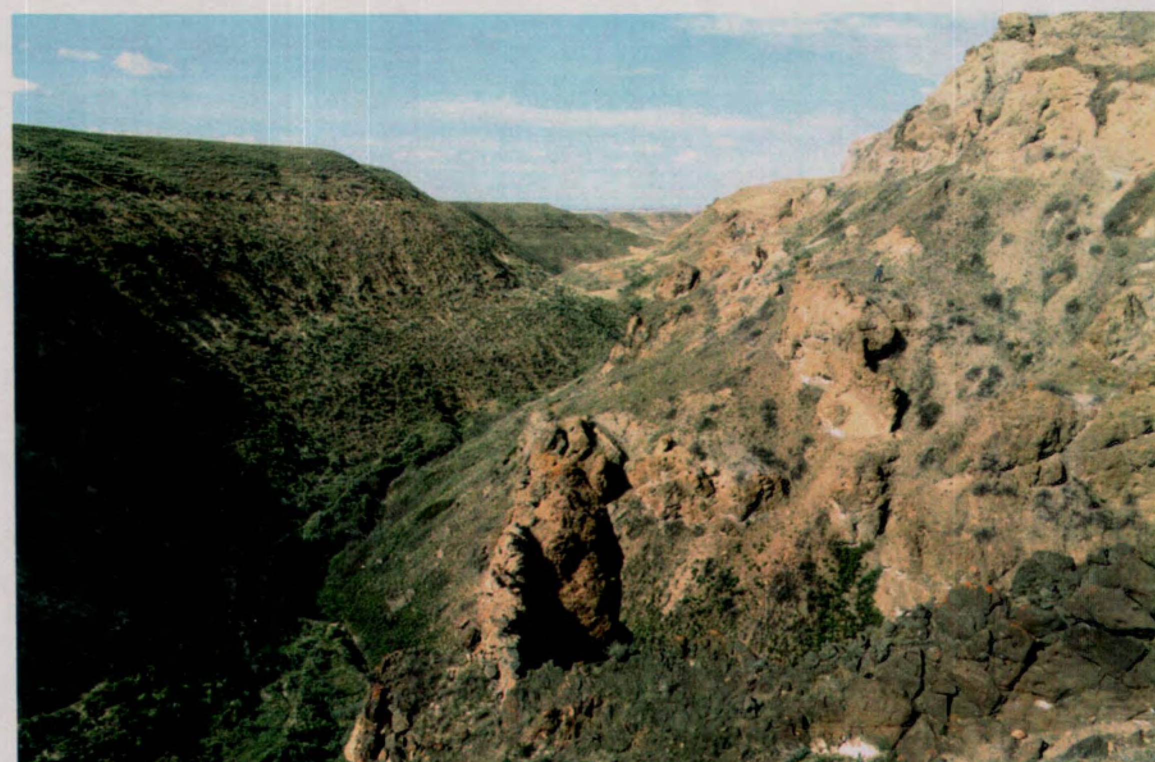
The light coloured portion of the diatreme complex comprises almost 2/3 of the exposure (Fig. 7 and 8) and consists of buff to rusty coloured, resistant weathering, inclusion-rich material. The exposure is comprised of up to 85% (by volume) lithic fragments in a light coloured, poorly indurated matrix. Lithic fragments comprising these breccias consist predominantly of sandstones, mudstones and shales, derived from the host Cretaceous Pakowki and Foremost Formations, however granitoids and granitic gneisses are present, representing Canadian Shield equivalents derived from the basement of the Alberta Basin (Fig. 11).

The primary mineral assemblage of the tan vent breccia phase is reported as hornblende + plagioclase + diopside + salite + phlogopite

Figure 7 - Panoramic compilation photograph of the entire JD-4 exposure, taken from the southern margin of the southern tributary coulee. The Milk River valley can be seen in the far distance to the left. The main composite complex is at the centre of the photograph, consisting of at least three distinct and separate phases. A number of dykes can be seen, including five to the right (east) of the main complex, at least four evident within the main complex and two coring the right (east) side of the main coulee draining to the north into the Milk River. There are two dyke phases evident; the first is brown weathering (associated with the proximal vent volcanic complex (Kjarsgaard 1994) such as the large mass to the right of the main complex and the dark green, olivine minette phase visible in Kimberlite Gulch (small tributary coulee just north of the main complex just left of centre).

Figure 8 - (a) View looking northeast from the south side of the coulee hosting the JD-4 occurrence. At least three phases are evident in the photo, the light buff to grey vent complex unit, the brown minette dykes and the dark green olivine minette dykes (kjarsgaard 1994). Although not clear in the photograph, the dark green dyke on the skyline to the right of the vent complex undergoes transition into a sill just below the centre right portion of the photograph. Note the figure at the centre of the photograph for scale. (b) View north along the coulee draining into the Milk River valley, just visible in the far distance at the end of the coulee. Host sediments of the Cretaceous Pakowki and Foremost Formations comprise the left side of the coulee and include fossiliferous coquina, contained as inclusions in the diatreme. Dark green olivine minette visible in the foreground, buff to light grey vent breccia and brown weathering proximal vent volcanic rocks present in the near distance. Again, note figure just above centre right for scale.

Figure 9 - Two views of "Kimberlite Gulch". (a) View looking to the southeast from the main drainage at the spire on the southwest margin of Kimberlite Gulch. The spire is cored by resistant weathering dark green olivine minette, the extent of which can be seen relative to the figure on the coulee floor at the centre of the dyke exposure. (b) View looking to the north northeast from the main coulee toward Kimberlite Gulch. The JD-4 exposure can be seen continuing along the main coulee wall toward the left edge of the photograph.



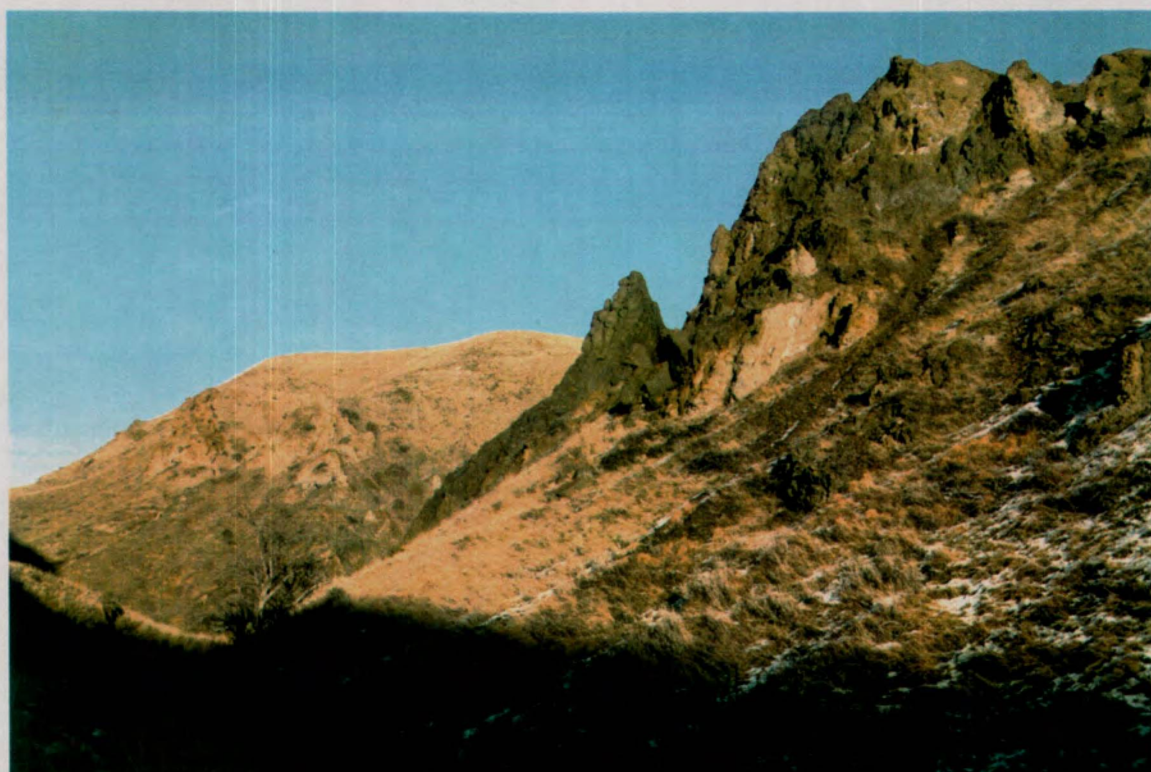
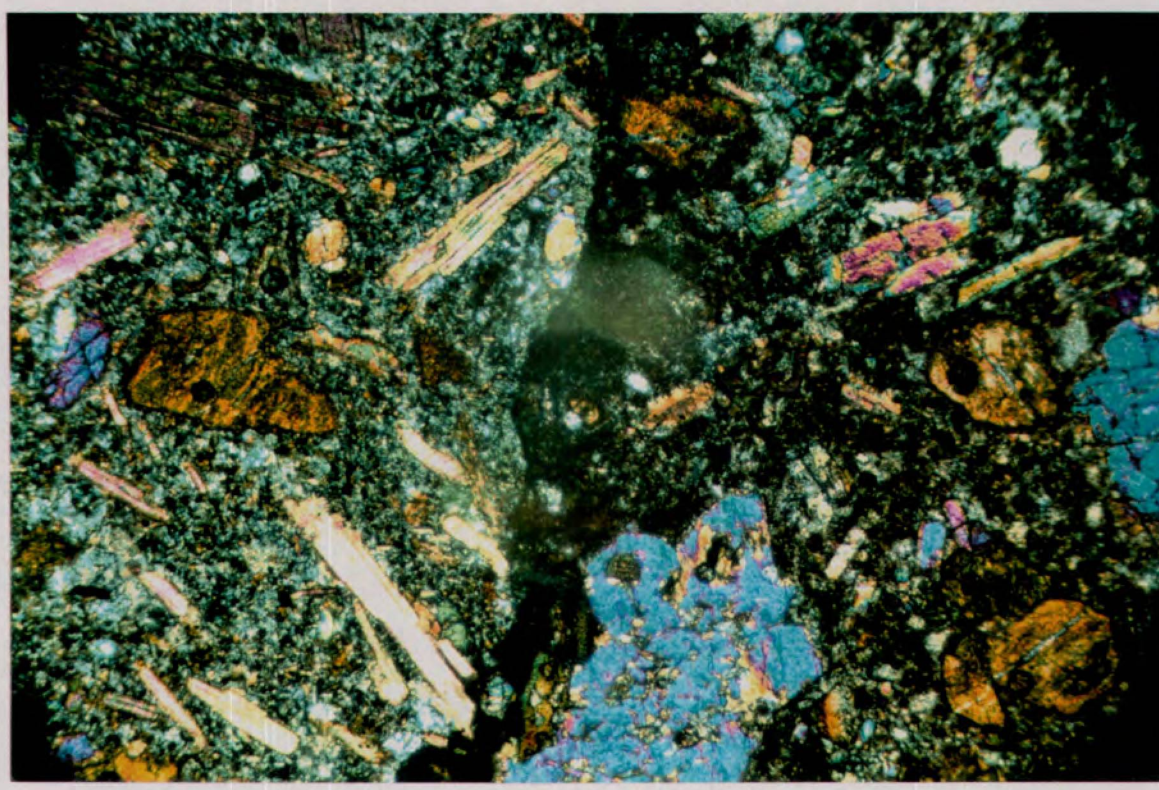


Figure 10 - (a) Photomicrograph of contact between two phases of groundmass. May also represent an alteration front, although unlikely with such a sharp contact. Major difference between the two phases is the increased opaques present on the right side of the photograph. Note large clinopyroxene aggregate at bottom centre (euhedral, blue interference colours). Similar mineralogy on both sides of photograph, comprised of phlogopite laths, euhedral to subhedral clinopyroxene and altered olivine in a fine grained groundmass reported to consist of carbonate, Fe-Ti oxides and sanidine. (b) Groundmass and phenocrysts in matrix phase of minette. Groundmass same as above. Note large euhedral, zoned clinopyroxene phenocryst at centre of photograph. Narrow laths with speckled interference colours are phlogopites, note lack of preferred orientation.



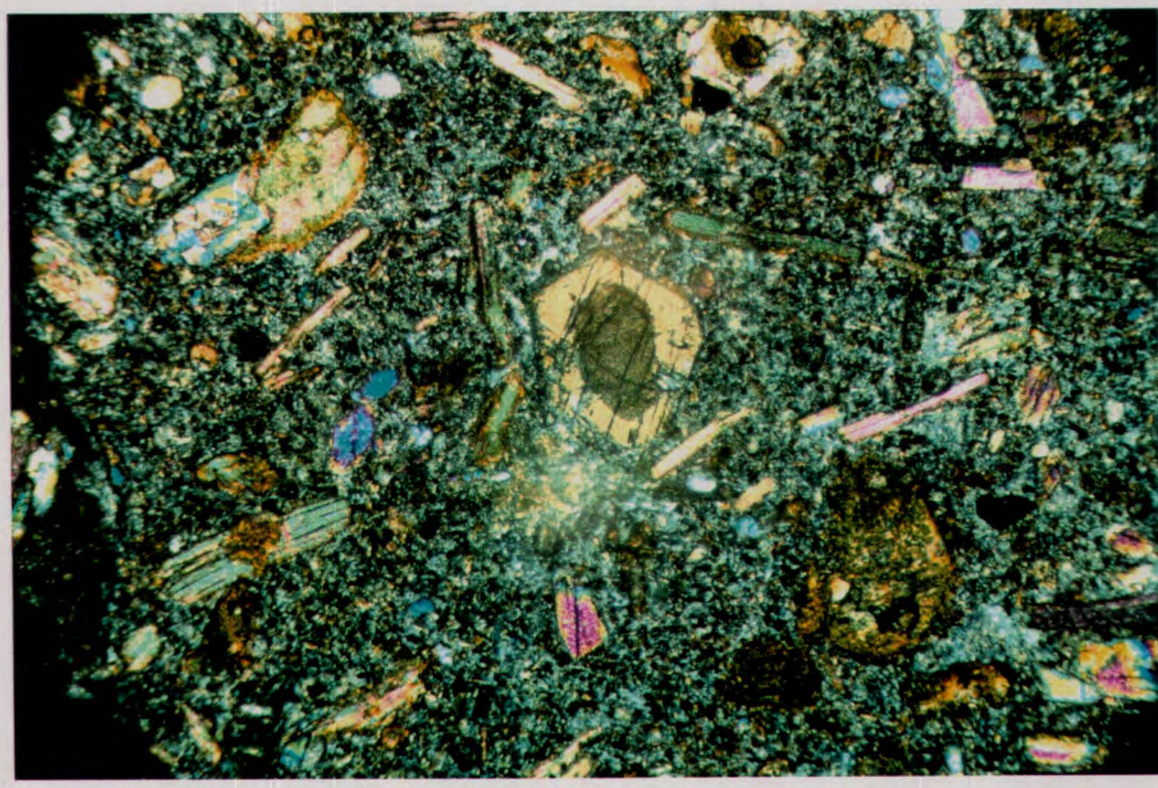
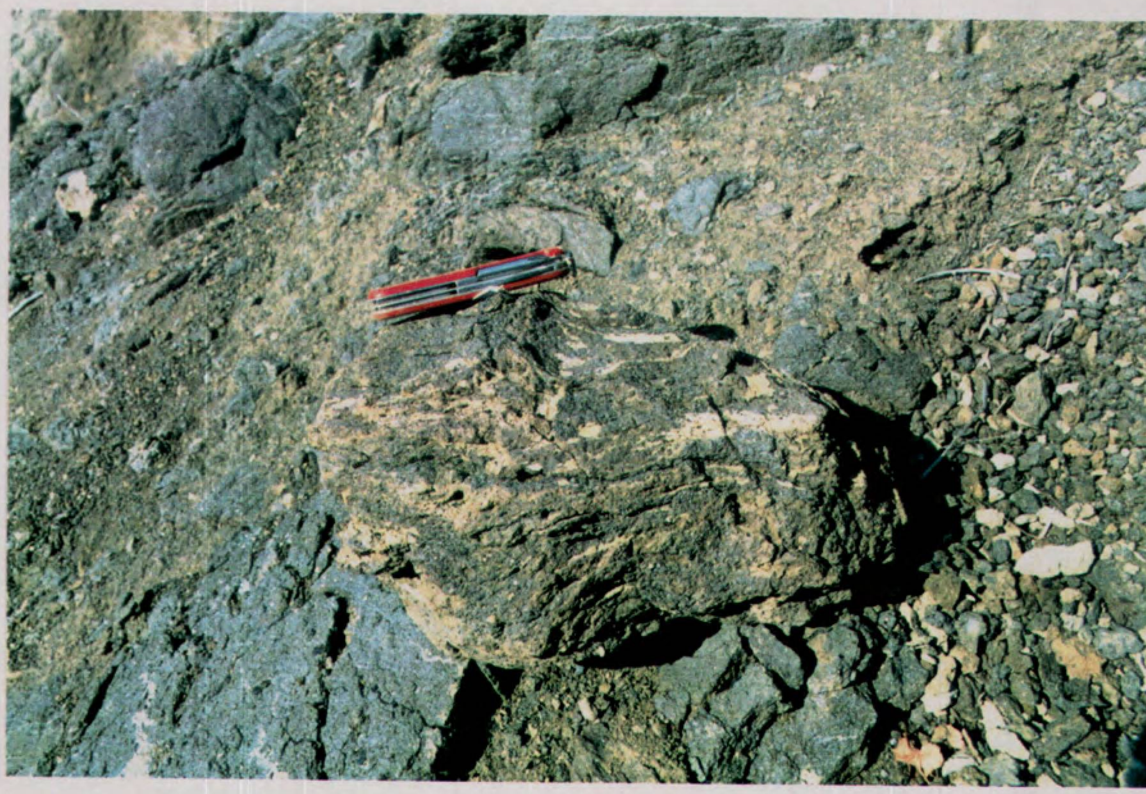
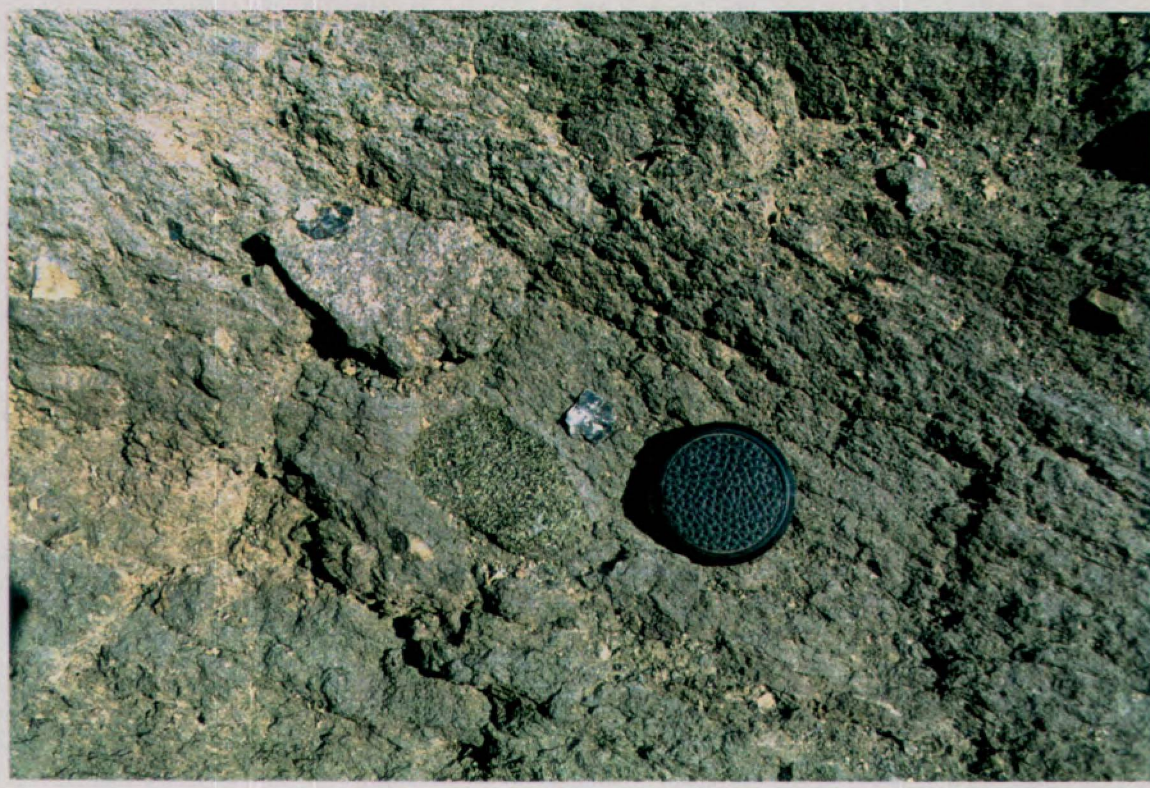


Figure 11 - Cognate inclusions (autoliths) and xenoliths contained in the JD-4. (a) Irregular shaped, extrusive, buff to light grey minette (vent breccia) boulder partially mantled by later dark green olivine minette intrusive phase. Other xenoliths apparent in both the olivine minette and the earlier extrusive minette. In addition, note the presence of brown weathering proximal vent volcanic phase minette to left of mantled inclusion. (b) Spindle-shaped volcanic bomb associated with early, buff to light grey weathering tan vent complex (Kjarsgaard 1994) with knife for scale. (c) Xenoliths contained within the dark green olivine minette phase of the JD-4 complex. Inclusions present include granitic gneiss (Canadian Shield equivalent of Alberta Basin), brown weathering dolomite (Cambrian - Mississippian, just above $1.00 coin), possible granulite fragments (lower crust) and a layered mantle-type xenolith (top centre). Note that none of the inclusions have any visible indications of assimilation and/or alteration rinds. (d) Garnet pyroxenite xenolith mantled by minette contained in buff to light grey, vent breccia phase. The rind is considered to be the magmatic equivalent of the extrusive material which chilled against the lower crustal xenolith and was therefore preserved. The surrounding matrix is an example of the ash to lapilli sized extrusive phase described in the text. Note $1.00 coin for scale in crack in upper right of xenolith. (e) Rounded, medium green clinopyroxenite (mantle) xenolith located in slightly foliated, dark green olivine minette dyke. In addition, note the loose, subhedral phlogopite flakes lying on the surface of the exposure. As with previous examples, note the lack of any indications of thermal alteration, partial assimilation or other visible evidence of xenolith-melt interaction. (f) Contact between dark green olivine minette and buff to light grey vent breccia phase. Large, rounded, dark green phlogopite clinopyroxenite xenolith evident in breccia phase to left of centre, together with light sickly green granulite xenolith and baked sedimentary equivalents. The unmetamorphosed sediments are the only xenoliths in which thermal and/or alteration effects of intrusion are evident, probably due to infiltration of the sediments by volatiles associated with the magmas.





+ biotite phenocrysts (1-5 mm), in a fine-grained groundmass of plagioclase and alkali feldspar + diopside + salite + biotite + magnetite + quartz (Kjarsgaard 1994) (see Appendix 2 and 3). In addition, ultramafic xenoliths are present, comprised of phlogopite- and diopside-bearing inclusions which include "glimmerite" or clinopyroxene biotitite, phlogopite clinopyroxenite and clinopyroxenite (Fig. 11 and 12). Inclusions are up to 1 metre in long dimension and vary from rounded to highly angular. Some of the inclusions have a rind up to 3cm thick composed of medium grey igneous material (Fig. 11 and 12), interpreted as a chilled rind of minette magma. Other inclusions are composed of minette and some are similar to spindle shaped volcanic bombs (Fig. 11b). The matrix appears to be volcanic ash and includes a very high percentage of lithic material including sand and lapilli to coarse ash-sized shale chips.

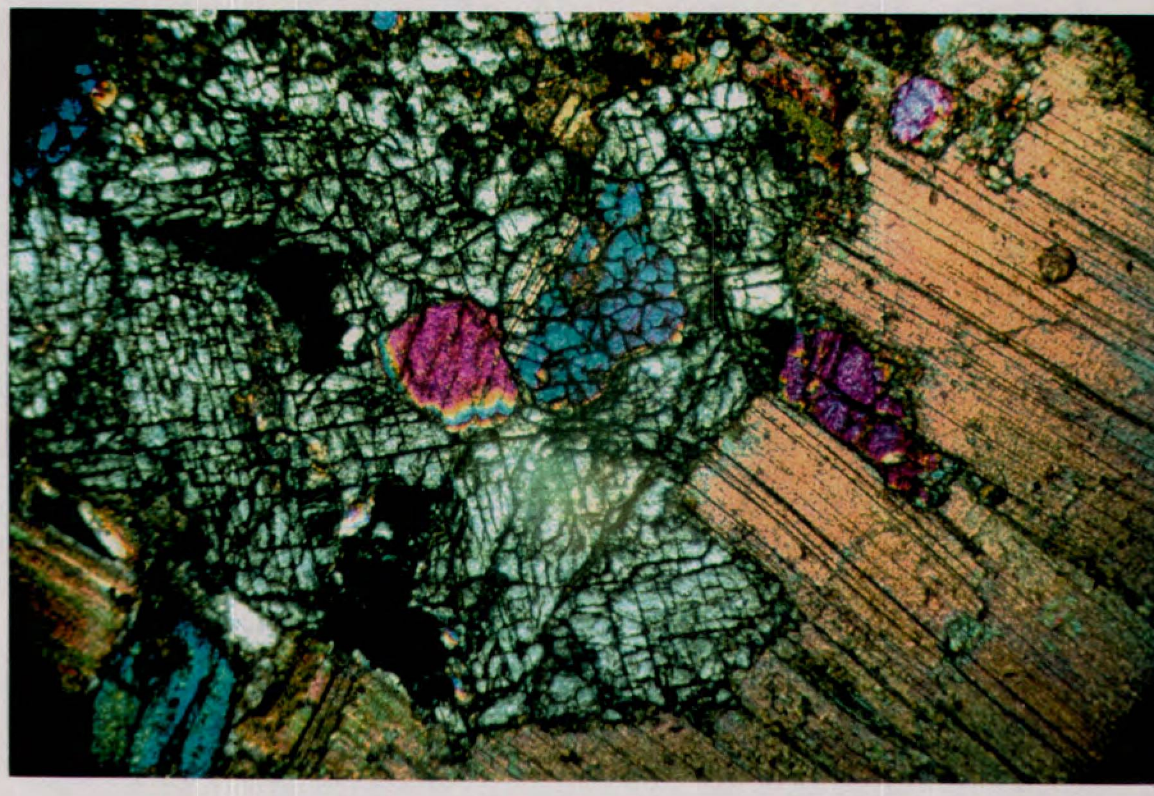
The light coloured phase described above is brecciated and intruded by a later medium grey phase. Blocks of the light coloured phase up to 3 metres in long dimension are entirely contained (in two dimensions) within the medium grey phase. The medium grey phase has significantly fewer inclusions than the light coloured phase, up to 50% by volume. Xenolith content and character is similar to the light coloured phase, comprised of rounded to highly angular sedimentary to ultramafic inclusions.

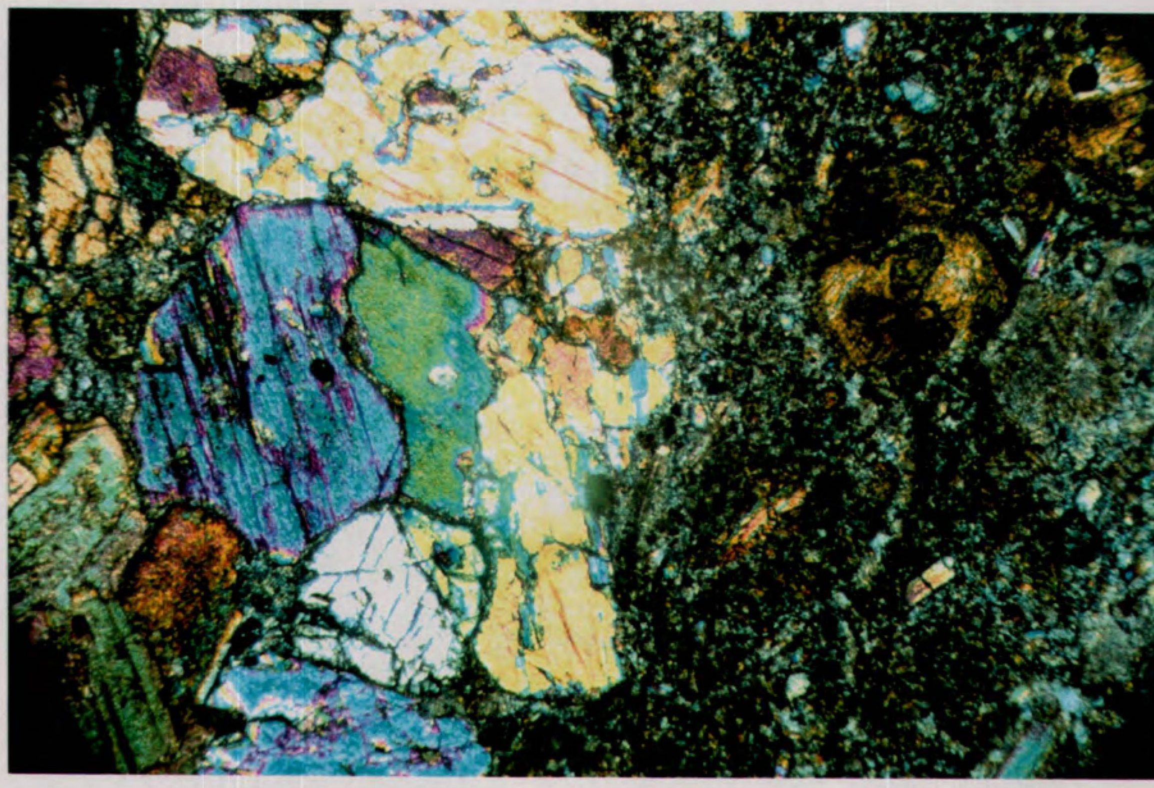
Compositionally, the medium grey phase differs form the light coloured phase. Phlogopite is the dominant mineral and is present as both a phenocrysts and groundmass phase. Phlogopite phenocrysts are euhedral to subhedral, black to dark brown in colour with no zoning apparent (optically). Diopside is a subordinate phase and appears to consist of at least two populations: 1) abundant, euhedral, prismatic to columnar, pale to light grass-green crystals and fragments and 2) blocky, highly angular fragments (probably derived from ultramafic nodules and inclusions). Olivine is present as a highly subordinate primary or accessory phase. Euhedral, equant, green crystals are moderately abundant. Ilmenite, magnetite, spinel and apatite are present as accessory phases.

Two interpreted ash occurrences are present, dipping moderately to the north and separated by at least one dyke. The eastern one is a 2-4 cm thick, white, coarse to fine ash bed that is laterally continuous for at least 12 metres. This thin ash bed occurs within a clast-supported breccia, and is impinged upon from above by some of the larger breccia clasts, reminiscent of bomb sag features within air-fall tephra layers proximal to lava domes in subaerial settings.

Another less continuous deposit is a 30 cm thick, fining upward bed consisting of poorly consolidated lapilli to very fine ash-sized grains. Most of the recognizable lithic fragments in this bed are subrounded, elongate shale chips. The deposit is graded and well sorted. The lower 10 cm of the bed is composed predominantly of lithic fragments and is depleted in fines. This texture could only be produced in a subaerial environment.

Figure 12 - Nodule Suite. (a) Field of view dominated by clinopyroxene (note low interference colours and well defined cleavage) poikilitically enclosing olivine (2nd order interference colours and characteristic fractures). Clinopyroxene in contact with phlogopite (right side of photograph. The phlogopite-clinopyroxene and olivine-clinopyroxene contacts are very sharp, indicating growth and contact under equilibrium conditions. Clinopyroxenite inclusion in minette, nodule comprised primarily of phlogopite with subordinate clinopyroxene and olivine, a clinopyroxene-olivine biotitite ("glimmerite"). (b) Contact between nodule (left) and host (right). Olivine probably Mg-rich (Mg-rich host and high interference colours). The phlogopite, olivine and clinopyroxene grains comprising the nodule are coarse-grained. In contrast, the phlogopite in matrix of host minette is fine-grained. The matrix consists of abundant Fe-Ti oxides, clinopyroxene, and phlogopite.





The buff to light grey unit has been divided into two separate phases by Kjarsgaard (1994), a "tan vent breccia" and "proximal vent volcanic rocks", although the distinction is not clear. Associated with the brown proximal vent volcanic rocks are brown weathering dykes, the third phase of magmatic activity.

5.13 **Dykes**

There are at least nine separate or en echelon dykes associated with the diatreme complex (Fig. 7). The dykes are relatively abundant and range from 1 metre up to 6 metres thick. They are described as phlogopite- and diopside-phyric (porphyritic) with olivine as a minor to rare, pseudomorphed phenocryst phase. The dykes are north trending and cross-cut the earlier phases. Intrusive breccias are also present, evident in the eastern brecciated dykes.

The dykes can be subdivided into two groups (Fig. 7), corresponding to those phases described in the diatreme complex itself. Five of the dykes are rusty orange to brown coloured, resistant weathering and xenolith-rich. The largest of these dykes is approximately 200 metres east of the diatreme complex and is up to 6 metres thick. It has inclusions of an earlier magmatic phase, consisting of xenoliths with rinds of intrusive material. Xenoliths comprise up to 80% of the exposure and include sedimentary, crustal and ultramafic lithologies. Xeno- and/or phenocrysts include green clinopyroxene in addition to abundant phlogopite.

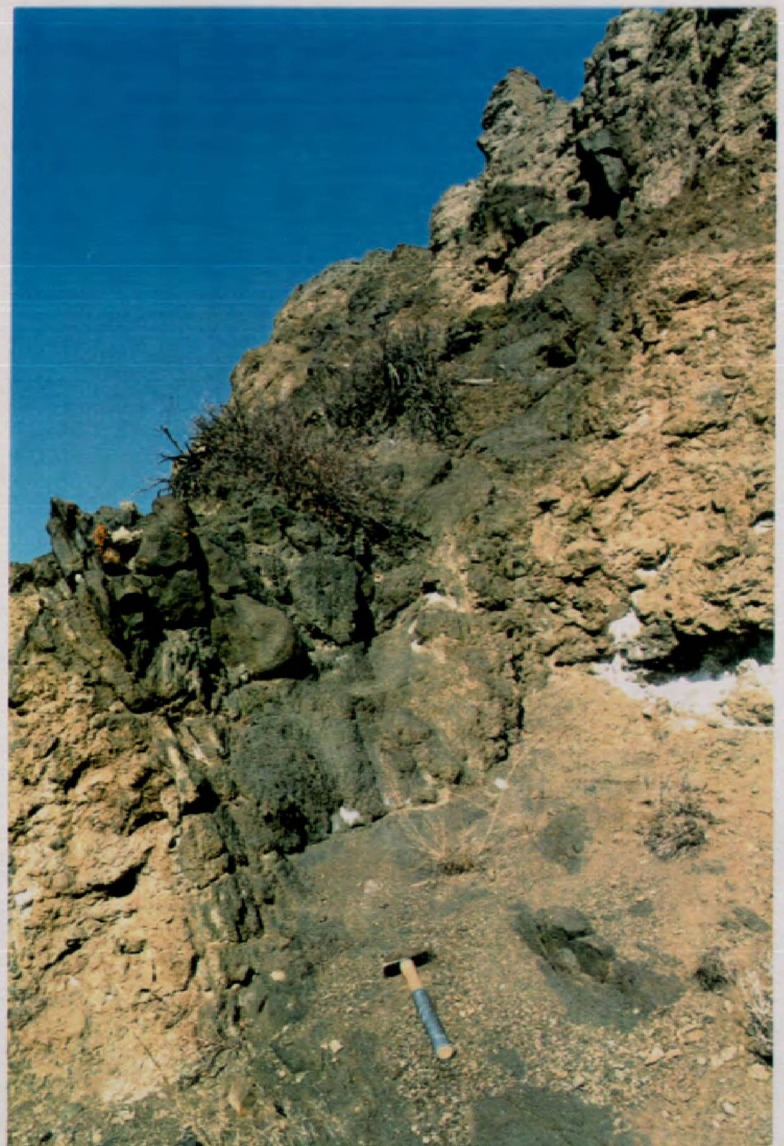
The second set of dykes consist of medium olive-green to grey coloured, resistant weathering outcrop (Fig. 9 and 13) with abundant phlogopite, both as a phenocryst and groundmass phase. There are two exposures lying between the diatreme complex and easternmost dyke. One appears to undergo transition from sill to dyke in the exposure examined (Fig. 8).

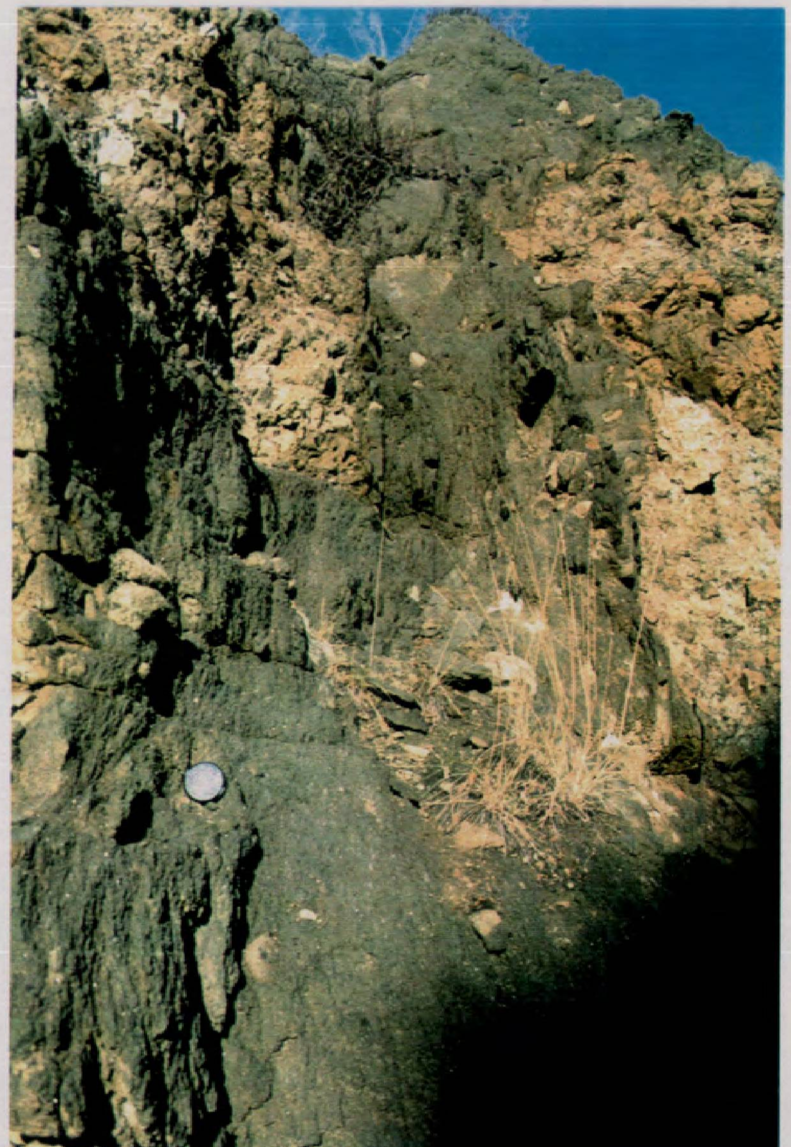
Generally speaking, the dykes appear similar (with regard to composition and character) to phases exposed in the diatreme complex. However, there are subtle variations between the dykes and the diatreme complex. For example, preliminary microscopic examination suggests that olivine phenocrysts are somewhat larger in the dykes. In addition, the dykes are a darker rusty colour than the buff to rusty coloured diatreme complex however, this feature may be a function of the volume of igneous material exposed to weathering processes.

5.14 **Discussion**

In terms of depositional environment, the ash beds described in "Kimberlite Gulch" probably represent fallout deposition from an eruption cloud between more violent coarse-grained tuff-breccia producing events. Tephra fallout deposits mantle irregular topography so that original dips in excess of 30° are possible. The dips of the ash layers in "Kimberlite Gulch" may therefore be original dips. However, because the breccias and interbedded ash layers were later intruded by more fluidal phases (Fig. 13) of the minette, post-

Figure 13 - (a) and (b) Two examples of the irregular nature of the contact between the dark green olivine minette and the host phases, both the buff to light grey vent breccia and the brown proximal vent volcanic phase (Kjarsgaard 1994). In (a) the olivine minette has intruded the brown weathering proximal vent volcanic phase. Note how the intrusive has been deflected around the brown resistant weathering inclusion on the left skyline. To the upper right, the dyke can be seen intruding the buff to light grey vent breccia. In (b), the dyke has a slight foliated texture apparent in the left foreground where it is in contact with the proximal vent volcanic phase.





deformational tilting related to intrusive deformation is possible. It is also possible that blocks of tuff-breccia could have been broken off near the surface and slumped down within the intrusive pipe.

The ash beds are interbedded with coarse clast-supported breccias. The breccia fragments are rounded to subrounded blocks, typically less than 30 cm in diameter (although much larger blocks exist), composed of minette and country rock. These breccias are interpreted as tuff-breccias based upon their association with subaerially deposited ash layers, presence of bomb-like minette fragments (Fig 11b) and the rounded nature for the fragments. Their clast supported nature suggests that they are either avalanche deposits (derived from crater walls or a volcanic edifice) or co-ignimbrite lag-fall breccias (Wright and Walker 1977).

There is evidence that some of the breccias were subaerially exposed during their formation in the form of two fallout tephra deposits observed along the north margin of "Kimberlite Gulch". An important characteristic of tuff-breccias that contrasts with the intrusive breccias is the degree of rounding of the breccia fragments. Pyroclastic fragments tend to become rounded during the process of liberation and eruption, whereas intrusive breccia clasts tend to be more angular.

5.2 JD-2 Diatreme

The JD-2 diatreme comprises the second known surface outcropping alkaline occurrence on the Pinhorn Property. It is located in the broad Pakowki Coulee on the northern margin of the Milk River, in a broad south-facing meander curve. It has been described (Kjarsgaard 1994; his Pakowki Coulee locality) as a brown minette dyke/plug which intrudes the Cretaceous Pakowki Formation (Fig. 14). It is an elongate, positive feature oriented north-northwest - south-southeast, approximately 20m x 25m and rising approximately 10m above the Milk River.

The eastern contact with host sediments (Fig. 14a and b) is moderately shallowly east dipping (30°) while the western contact is steep to vertical (Fig. 14c). Host sediments of the Pakowki Formation are comprised of alternating yellow-orange siltstone and yellow-grey mudstone/shale layers between 1 and 6 cm thick. These sediments are more competent immediately adjacent to the intrusive/sedimentary contact for up to 30 cm away from the intrusive contact (Fig. 14c).

There is very little disruption of the sediments at the contact as evidenced by a lack of change in orientation of the bedding. The contact is sharp, with no evidence of a brecciated or transitional contact at the level of exposure. However, sediments similar to host lithologies are contained as an inclusion (in two dimensions) and may represent either a large xenolith or a sedimentary screen into the intrusion. The intrusion has a foliated texture immediately adjacent to the sedimentary contact which extends approximately 25 cm into the intrusion. The foliation is most pronounced at the contact and diminishes in intensity toward the interior of the intrusion.

Figure 14 - Contact relations evident at the JD-2 occurrence. (a) Sedimentary inclusion or screen of the Cretaceous Pakowki Formation within the intrusion. Note the lack of disruption in the sedimentary laminations/thin beds of the sedimentary rock. The exposure of intrusive material represented here is the cross-cutting olivine minette described by Kjarsgaard (1994). (b) Another view of the exposure looking to the northwest. The view shown in (a) is present at the lower left of the photograph. The cross-cutting nature of the olivine-rich dyke/sill can be plainly seen in this photograph. The material exposed above the dyke/sill is the xenolith-rich, brown minette breccia of the middle portion of the exposure (another view in Figure (d)). (c) Western contact of the JD-2 intrusive minette against thickly laminate to thinly bedded sediments of the Cretaceous Pakowki Formation. The different colouration of the sediments against the intrusion relative to the sediments 1 metre away is due to their more resistant nature, interpreted as infiltration of the sediments by volatiles related to the intrusion. Also note that the sediments in the indurated zone are disrupted, having a slightly steeper dip with respect to the more "distal" sediments. (d) Another view of the upper xenolith-rich minette breccia. Xenoliths observed at this locality consist entirely of sedimentary inclusions, including shale, sandstone, mudstone and limestone fragments of the upper crust (Paleozoic strata overlying basement).

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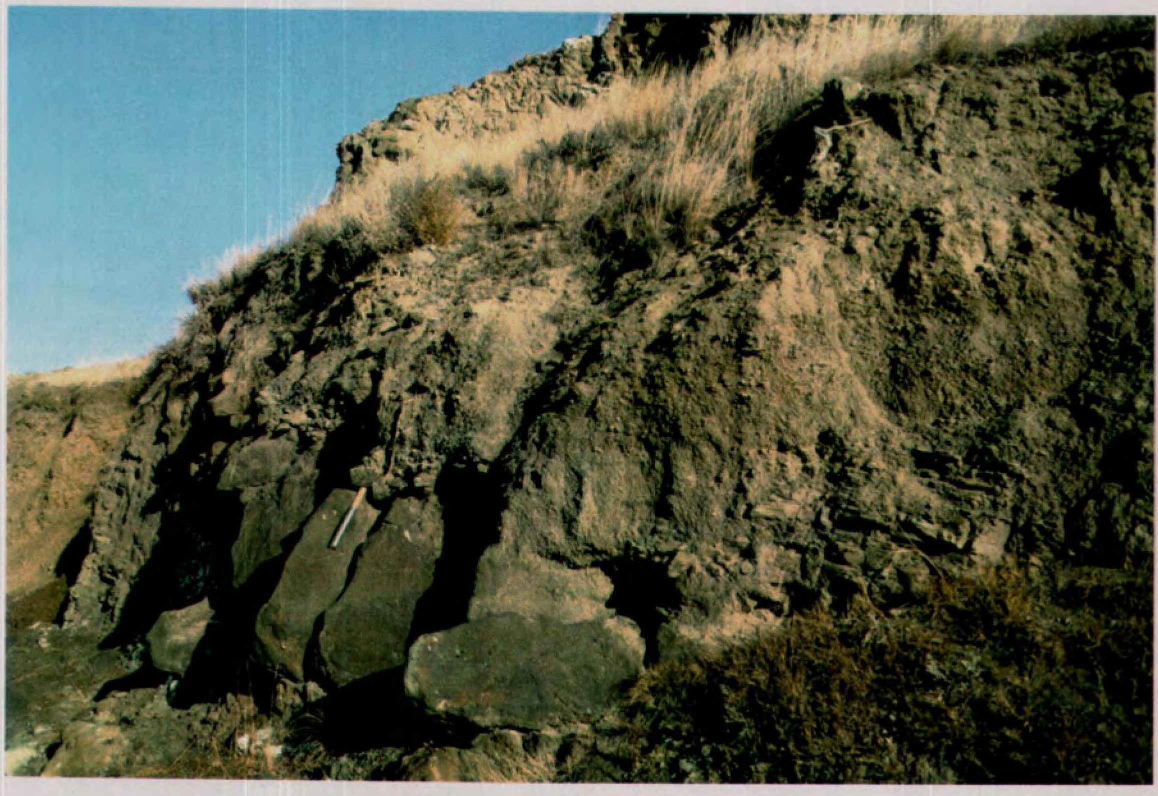

Two phases of igneous activity are evident within the intrusion at the level of the river (Fig. 14b and d). One is a reddish brown xenolith-bearing phase and the other a dark green to black, relatively inclusion-free phase. The upper levels of the exposure consist of a xenolith-poor phase having abundant small carbonate veins. Xenoliths identified are comprised exclusively of crustal inclusions of sedimentary lithologies and include limestone as well as laminated mudstones, shales and siltstones similar to host lithologies. No ultramafic xenoliths were identified and none have been reported in the literature available.

The lower reddish-brown minette has relatively abundant xenoliths comprised of well indurated, rounded to angular crustal fragments up to 30 cm in long dimension. It has a transitional contact with the dark green to black phase, which may indicate an alteration feature or a separate intrusive phase. Kjarsgaard (1994) interprets it as a separate phase which is consistent with an apparent difference in xenolith content. There are no inclusions of either phase in the other. Furthermore, they appear to be mineralogically similar, which in itself is unequivocal, and the contact appears to be gradational over approximately 8 cm. It would appear more probable that they are, in fact, two separate phases in which the dark green phase intruded shortly after the reddish brown phase and both were modified along their mutual contact. Perhaps the lack of inclusions of one phase in the other is a result of the earlier phase being hot and ductile, yet essentially solidified during intrusion of the dark green phase.

Finally, the dark green phase appears to cut the upper brown phase and therefore is most likely the last intrusive event evident at this outcrop. This phase has been interpreted as an olivine-rich, black minette sill and dyke which intrudes the brown phlogopite- and diopside-phyric minette phases (Kjarsgaard 1994).

6.0 HEAVY MINERAL SUITE

Initial heavy mineral concentrates have been recovered from samples submitted to Loring Laboratories Ltd. A copy of Loring Laboratories Diamond Exploration "Sample Processing Flow Chart" is included as Figure 15 for reference. Note the addition of hydrochloric acid following initial crushing to eliminate matrix carbonate and liberate primary minerals and xenocrysts. Furthermore, following magnetic separation of the resulting heavy mineral fraction, the light (<2.96 S.G.) and heavy (>3.3 S.G.) fractions were sent to the author for binocular microscope examination and indicator mineral picking.

Indicator minerals were subsequently submitted to the University of Calgary and the University of Alberta for quantitative electron microprobe determination of mineral chemistry (see Section 7.0 and Appendix 1).

The procedure established for recovery of a heavy mineral suite from a multi-kilogram geochemical rock sample is as follows:

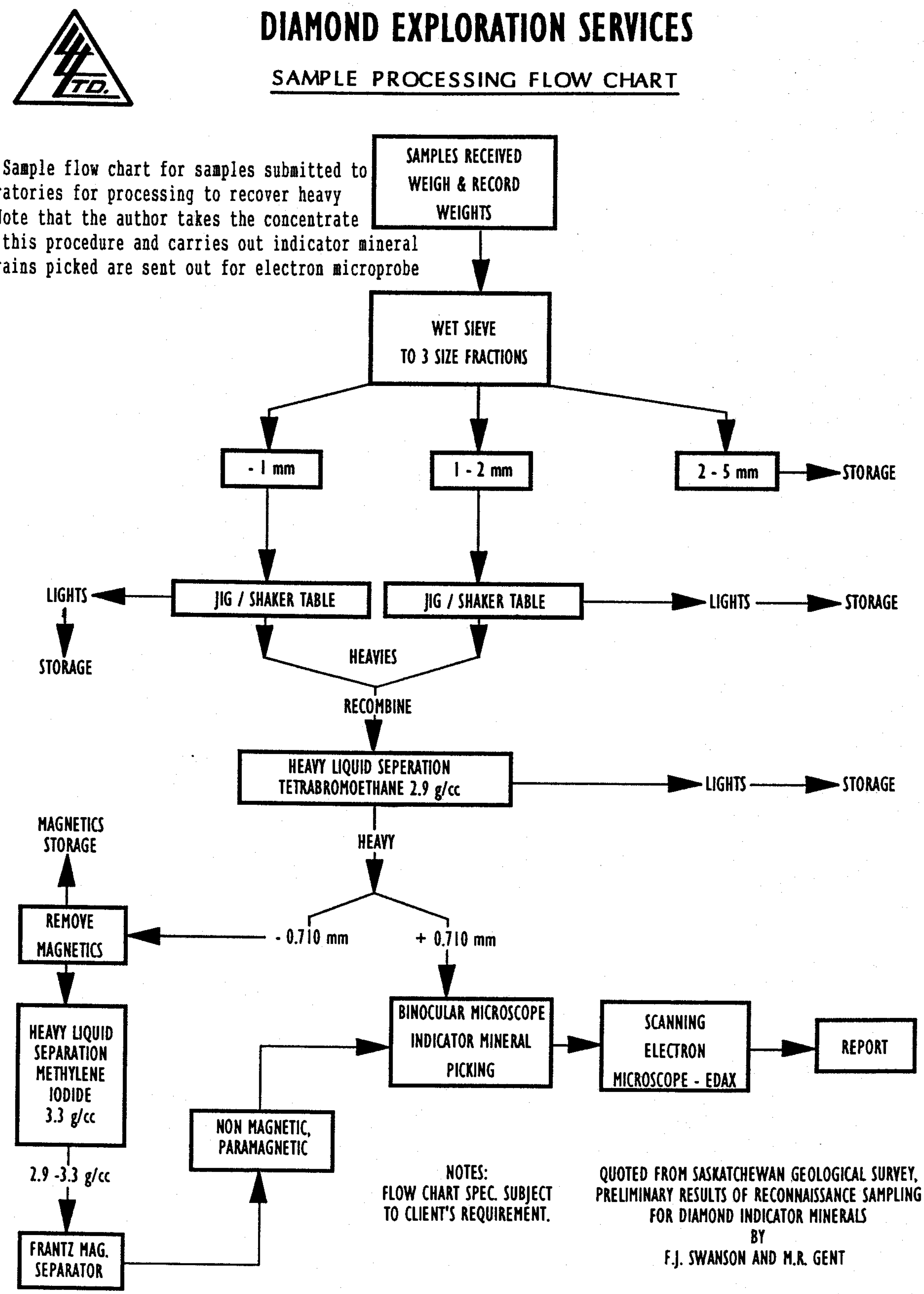

Figure 15 - Sample flow chart for samples submitted to Loring Laboratories for processing to recover heavy minerals. Note that the author takes the concentrate produced in this procedure and carries out indicator mineral picking. Grains picked are sent out for electron microprobe analysis.

1) Crush sample to 10 Mesh, acid bath 24 hours in hydrochloric acid.

2) Process sample on jig/shaker table
   - store light fraction.

3) Heavy liquid separation (Tetrabromoethane - 2.9 g/cc)
   - store light fraction.

4) Remove magnetic fraction
   - store magnetic fraction.

5) Heavy liquid separation (Methylene iodide - 3.3 g/cc)
   - store light fraction.

6) Frantz magnetic separator
   - store magnetic fraction.

7) Mineral picking/examination.

Thorough examination of resulting heavy mineral suites followed by determination of composition by electron microprobe analysis has been undertaken on possible indicator minerals. Determination of mineral composition has been completed on all garnets submitted to date while analysis of chromite, ilmenites and clinopyroxenes is currently underway.

Problems encountered with Loring Laboratories and a very real potential for contamination of samples processed at their facilities has led to a decision by Marum Resources to set up and operate independent facilities to process rock samples for recovery of heavy minerals. The remainder of the samples from the 1993 field season will be processed at Marum Resources' laboratory.

7. GEOCHEMICAL ANALYSES

7.1 Mineral Analyses

Preliminary examination of samples processed to date reveals abundant diopside, chromite, garnet, ilmenite and phlogopite (see Appendix 1) as well as apatite, spinel and sulfides. The non-magnetic fraction is dominated by pale grass-green diopside, primarily as angular fragments, however, some euhedral, columnar crystals remain. Spinel is present as euhedral, equant crystals having a black metallic lustre. As they are non-magnetic they are tentatively identified as chromites subject to confirmation by electron microprobe analysis. A minor proportion of the spinels are sub-rounded, probably indicating that they are xenocrysts incorporated into the magma.

A brief literature search of previous studies on the southern Alberta intrusives produced a report in which Ash and Associates (1993) describe the results of a 56.5 kg sample submitted to C.F. Minerals in Kelowna for recovery of heavy minerals. They document recovery of 37 chromites, 40 picroilmenites, 1 G9 garnet, 1 G11 garnet, 15 CP5 clinopyroxenes and 1 CP6 clinopyroxene, together with other phases associated with lamproitic lithologies (eg. armacolite and Sr-apatite). In addition, Williams (1993) reports recovery of 5 G5 garnets, 2 G4 garnet and one chromite grain from four soil samples taken "down-ice" from the magnetic "bull's eye" anomalies identified on the Bear Creek Property and associated with a minette or sanidine phlogopite lamproite occurrence (Kjarsgaard 1994 - Bear Creek minette).

In the course of evaluating the Pinhorn Property, electron microprobe quantitative determinations were made of phlogopite, garnet, ilmenite, clinopyroxene and chromite grains (see Appendix 1). A total of 345 clinopyroxene, 179 phlogopite, 67 garnet, 112 chromite and 22 ilmenite (picroilmenite) analyses have been obtained to date in the course of Marum Resources' southern Alberta exploration programme. The results for each mineral is discussed below.

7.11 Garnet

Of the 67 garnet grains analyzed in the course of this study; 33 are interpreted to be of crustal origin (eg. amphibolite to granulite grade metamorphic host). In addition, 23 G5 garnets, 9 G3 garnets and 2 G6 garnets (Dawson and Stephens 1975) have been documented from the JD-1 and JD-2 occurrences. The JD-2 occurrence is dominated by crustal (29 garnets) and G5 (10 garnets) with a highly subordinate G3 (2 garnets) population. Kjarsgaard (1994, pers. comm.) recommended a much tighter and restrictive limit on FeO_{Total} to distinguish crustal garnets from G5 garnets (approximately 24 weight percent FeO_{Total}, as opposed to approximately 30 weight percent as determined from Dawson and Stephens (1975)). Such a modification in garnet classification would result in all the G5 garnets being reclassified as crustal. However, these results should be considered preliminary as more samples are currently being processed for heavy mineral recovery and subsequent examination may result in identification of garnets of deeper origin. In particular, the recovery of chromites which plot within the diamond inclusion field (see Section 7.13) indicates the distinct possibility of such garnets.

7.12 Clinopyroxene

As stated above, 345 clinopyroxenes have been analyzed for quantitative determination of composition using electron microprobe analysis (Appendix 1). The clinopyroxenes analyzed are all sodium-poor and plot within the "Pyroxene Quadrilateral" field of Morimoto et al. (1988) (Fig. 16). Therefore, they can be fully described with reference to the Wollastonite (Ca)-Enstatite (Mg)-Ferrosilite (Fe) ternary diagram. The majority of clinopyroxenes plot within the diopside field although a highly subordinate proportion are augitic in composition. A further comparison of clinopyroxene compositions, with subdivision of the diopside field into diopside and salite (Deer, Howie and Zussman 1983), indicates that the pyroxenes may be best described as salites, with overlap into the diopside and augite fields.

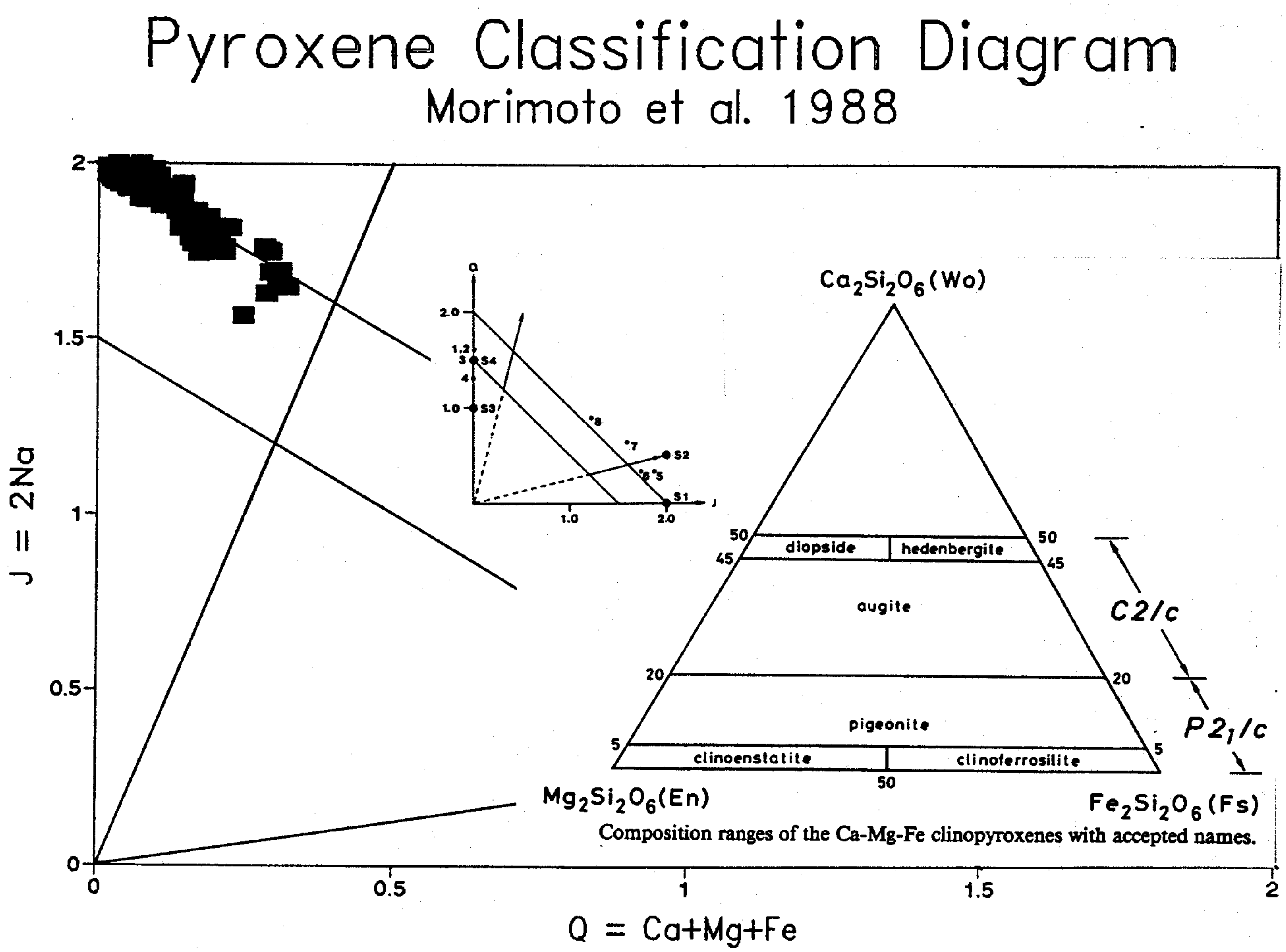

Figure 16 - Clinopyroxene data from southern Alberta plotted with reference to the pyroxene classification diagram of Morimoto et al. (1988), shown in the inset. It can be seen that all data points lie within the area defined by the pyroxene quadrilateral and can therefore be described completely with reference to Enstatite - Ferrosilite - Diopside - Hedenbergite on the pyroxene ternary.

Clinopyroxenes analyzed are generally chrome-poor, however, subordinate chrome-rich diopsides are present. No diopsides analyzed to date are comparable to worldwide diamond inclusion compositions (in excess of 1% Cr_2O_3). The range of clinopyroxenes recovered from analysis of diatreme rock and nodule suites includes: CP1, CP2, CP3, CP4, CP5 and CP8 compositions (Stephens and Dawson 1977). More specifically, the JD-4 property is dominated by CP4 clinopyroxenes (84 grains) with subordinate CP2 (37 grains). A wider variety of clinopyroxenes have been recovered from the JD-2 property, including 57 CP4, 33 CP3 and one each of CP1 and CP8 clinopyroxenes. The majority of clinopyroxene grains from the Pinhorn samples have yet to be analyzed.

7.13 **Chromite**

Chromite analyses in southern Alberta are still in the preliminary stage. Equant, euhedral, non-magnetic spinels have been observed in heavy mineral separates and quantitative analysis is anticipated in the future. The lack of magnetism together with a deep red colour noted in some thin sections leads to preliminary interpretation as chrome-rich spinel to chromite, consistent with analyses obtained. Several probe mounts are awaiting analysis from the JD-1 property, comprising the bulk of opaque analyses to date. Initial results are extremely encouraging (see Appendix 1).

Additional chromite analyses were received as the report was being completed and the results are therefore not included in the graphical representations of the data. The analyses received are all from spinels picked from the heavy mineral separate of the JD-2 occurrence. The spinels picked are all low Al_2O_3, low FeO_{Total}, high Cr_2O_3 spinels, interpreted as chromites.

Of the 80 chromites analyzed, 23 have Cr_2O_3 weight percents greater than 60%, placing them within the world-wide diamond inclusion field. Furthermore, all of those analyses have Al_2O_3 contents less than 10% (Fig. 17b) and 22 have MgO contents between 11 and 16% (Fig. 17a), with the missing value just below the cutoff (having a value of 10.97 weight percent MgO). Therefore, approximately 30% of the spinels picked for electron microprobe analysis have chromite compositions comparable with diamond inclusions field compositions determined for world-wide occurrences. All the diamond inclusion field chromites analyzed to date for the Pinhorn Property have been recovered from the JD-2 occurrence. Only three analyses have been determined for the JD-4 occurrence and all have been magnesian spinels.

Griffin et al. (1992) define kimberlitic chromite macrocrysts as those having the following weight percent ranges: Cr2O3 (45-65%), Al2O3 (2-12%) and MgO (8-15%). A brief examination of the chromite data in Appendix 1 documents chromite compositions which compare extremely well with the above values. Griffin et al. (1992) further subdivide the chromite analyses into sub-groups P1 through P4.

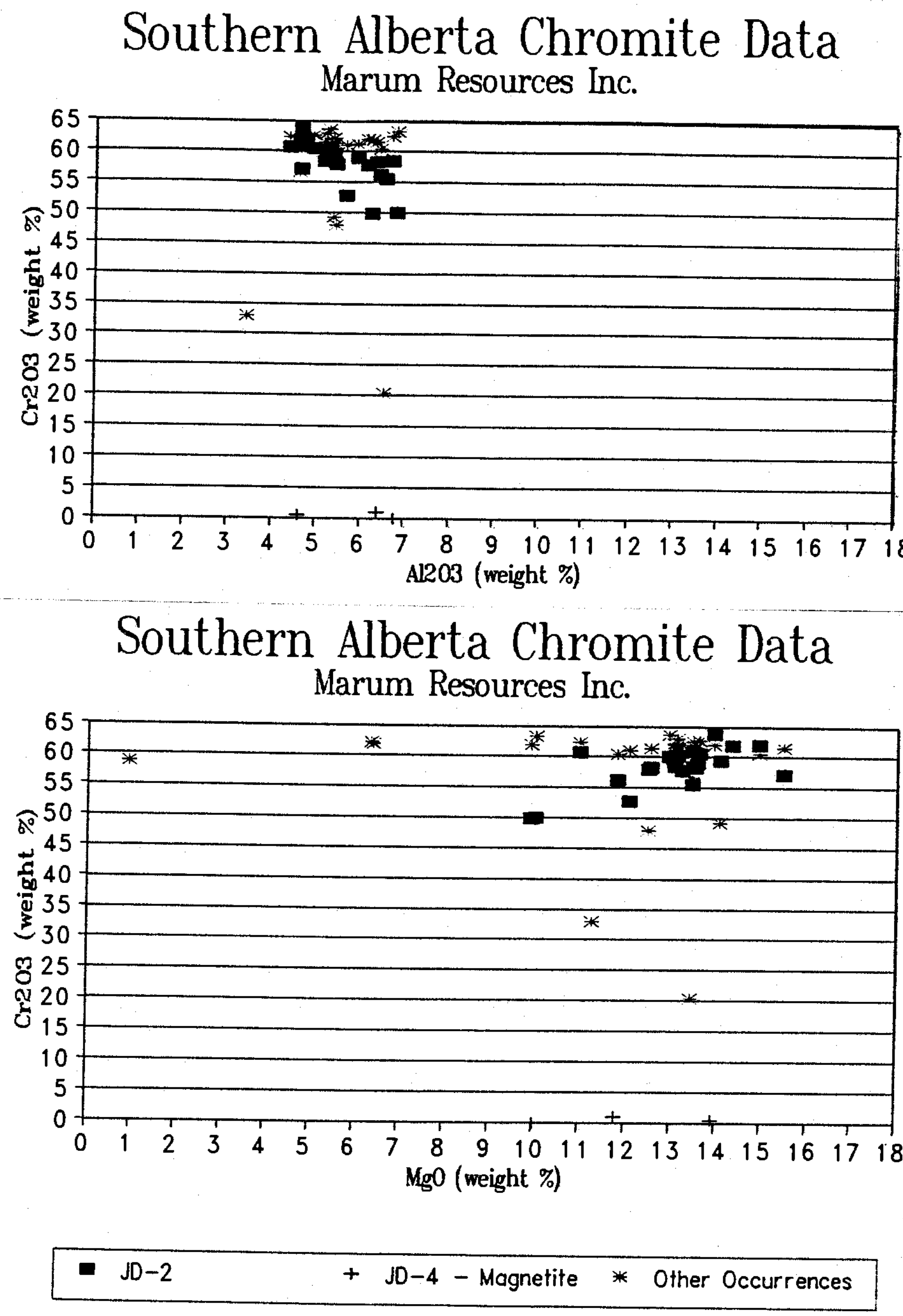

Figure 17 - Southern Alberta Chromite Data - plotted with reference to: (a) Cr_2O_3 vs. Al_2O_3 and (b) Cr_2O_3 vs. MgO graphs. Note the high proportion that plot above 60 weight percent, comparable to world-wide diamond inclusion field compositions. In addition, the data compares very well with P1 and P2 chromite values for Group 1 (basaltic) and Group 2 (micaceous) kimberlites, particularly Group 2 values (see Griffin et al. 1992). Note: other occurrences include JD-1 and JD-5, Milk River area.

Using the classification scheme of Griffin et al. (1992), the chromites can be differentiated into two populations, 38 chromites of P1 composition and approximately the same number which are just outside the chemical screen limits for P1 composition. The non-P1 chromites have Cr_2O_3 values between 53 and 63 weight percent but have Al_2O_3 below the cutoff of 5 weight percent Al_2O_3. Of these chromites, 22 have Al_2O_3 values between 4.26 and 4.99 weight percent and therefore lie just outside the P1 field so defined.

P1 chromites are considered characteristic of Group 1 kimberlites. None of the chromites analyzed correspond to lamproitic chromites (P3) or lamproitic xenolith chromites (P4) which are both much higher in Al_2O_3 than those analyzed to date. Furthermore, preliminary semi-quantitative Ni and Zn content in chromites indicates a wide range in temperature, from approximately 1200°C down to approximately 700°C. Quantitative analyses for these trace elements should be determined using a proton microprobe or long counting times on an electron microprobe. Therefore, the above statements are based on semi-quantitative results.

7.14 Ilmenite

Very few ilmenite analyses have been obtained on the Pinhorn Property (14 grains) (Fig. 18). As with the chromites, two probe mounts are currently awaiting analysis which contain the opaque phases, including ilmenite. Analyses obtained thus far, including data from BHP, indicate the ilmenite grains analyzed are slightly to moderately magnesian in content (0.06 to 7.63 weight percent). The data indicates low to moderate MgO content in the picroilmenites, ranging from 2.36 to 7.63 MgO weight percent. Six of the analyses (total of 10) have MgO greater than 4 weight percent. Ideally, magnesian contents between 8 and 14 weight percent are interpreted to indicate sufficiently reduced conditions for preservation of diamonds. Two ilmenite analyses from the JD-2 occurrence fall just short of the 8 weight percent minimum (at 7.44 and 7.63 wt.%). However, the lack of statistically significant data at this point in time precludes any reasonable statement with regard to diamond preservation.

Slightly low total major element sums suggest the presence of minor Fe_2O_3. However, ferric iron may be a product of post emplacement weathering (haematite content), particulary in view of picroilmenitic compositional trend and low ferric iron values. An interesting feature of these ilmenite analyses is a possible positive correlation between elevated MgO and elevated nickel. The most MgO ilmenites (picroilmenites) have NiO contents between 0.10 and 0.15 weight percent. These values are just above the minimum detection limit of 0.0684 weight percent and therefore subject to uncertainty and caution is recommended with any such observations. However, it is interesting that an element associated with ultramafic lithologies is present in slightly elevated quantities in the "kimberlitic" ilmenites. The combination of picroilmenite compositions associated with anomalous nickel values may be significant with regard to possible paragenesis of picroilmenites.

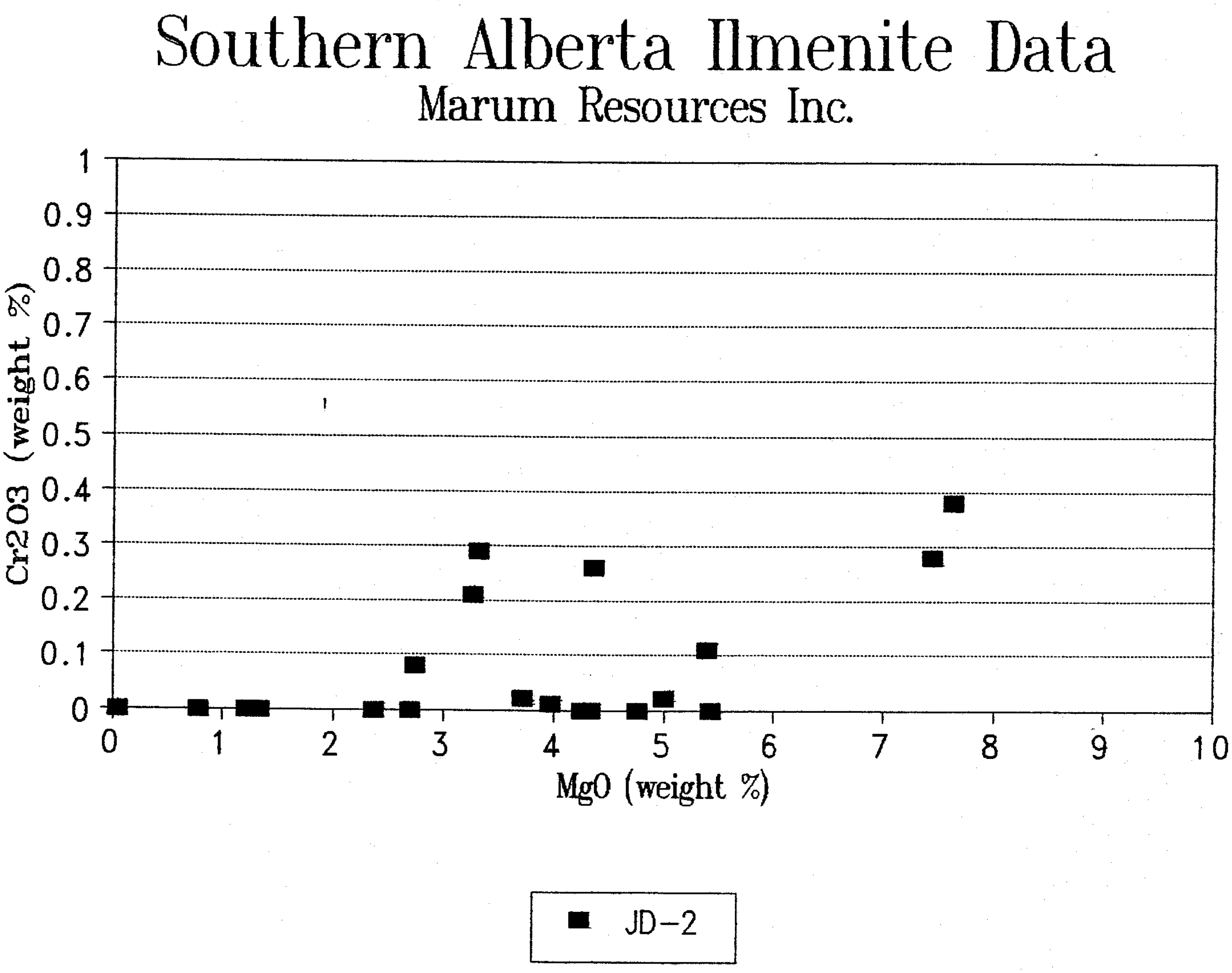

Figure 18 - Cr_2O_3 vs. MgO graph of ilmenite data determined from grains recovered in southern Alberta. The data shows weak to moderate picroilmenite (MgO) content in the ilmenites analyzed. The six picroilmenite analyses (MgO > 3 wt.%) indicate only moderately reduced conditions, suggesting poor to moderate diamond preservation potential. However, very few ilmenite grains have been analyzed and such interpretations are tenuous at best.

7.15 Micas

Mica compositions as determined by electron microprobe analysis plot within the phlogopite ($K_2Mg_6[Si_6Al_2O_{20}](OH)_4$) field with some solid solution tendency toward annite ($K_2Fe_6[Si_6Al_2O_{20}](OH)_4$) and eastonite ($K_2Mg_5Al[Si_5Al_3O_{20}](OH)_4$). The micas can be best referred to as members of the phlogopite-biotite$_{solid\ solution\ (SS)}$ but will be referred to as phlogopites for convenience.

When compositions for southern Alberta phlogopites are plotted with reference to the Al_2O_3 vs. TiO_2 of Mitchell (1986) (Fig. 19a), it can be seen that there is indeed a "minette trend" apparent, described asa trend of increasing TiO_2 with constant Al_2O_3 (eg. JD-3, JD-4 and JD-5). Similarly, a plot of Al_2O_3 vs FeO (Fig. 19b) shows a minette trend for JD-3 and JD-5. However, in both cases, JD-1 shows a kimberlitic trend of increasing Al_2O_3 with increasing TiO_2 and FeO. Furthermore, scatter in the data for the JD-4 phlogopites suggests two possible populations are present; one showing a kimberlitic trend and a second having a minette trend.

7.16 Diamond

BHP reported the recovery of a small microdiamond from a 38.2 kg sample taken from the Black Butte (JD-1) occurrence. "(A) single microdiamond was recovered from the sample processed. The stone is clear, moderately resorbed, beige green in colour and measures 100 by 92 microns. It is a modified octahedron with fractures which have resulted in a loss of 60% of the original stone".

7.17 Gold

Free gold has been noticed during processing for a heavy mineral separate and during hand picking of grains for elctron microprobe analysis. In a Press Release (January 18, 1994) Marum Resources Inc. announced "... that a composite sample from the JD-2 pipe on the Pinhorn diamond exploration property in southern Alberta contains high geochemical gold values. Fire assays have returned up to 1 gram per tonne gold ().035 oz.t), representing approximately $15 per ton, a value which falls at the low end of the economic spectrum for leaching operations". At present it is not known which phase or phases host gold, the value of gold, whether it is free milling or contained as inclusions in sulfides and if there is gold enrichment of the host sediments.

7.2 <u>Whole Rock Geochemistry</u>

Whole rock geochemistry (see Appendix 4) confirm a silica-poor to silica-deficient, potassium-enriched composition with lamproitic affinity (eg. K_2O/Na_2O values close to or greater than 3.0). Furthermore, in contrast with data documented by Kjarsgaard (1994), the southern Alberta intrusives are, in fact, peralkaline ([K+Na/Al]>1) and perpotassic (K/Al>1). All major element values fall within the limits defined by Dawson (1980) for kimberlites, with the exception of MgO (low) and Na_2O (some values slightly high).

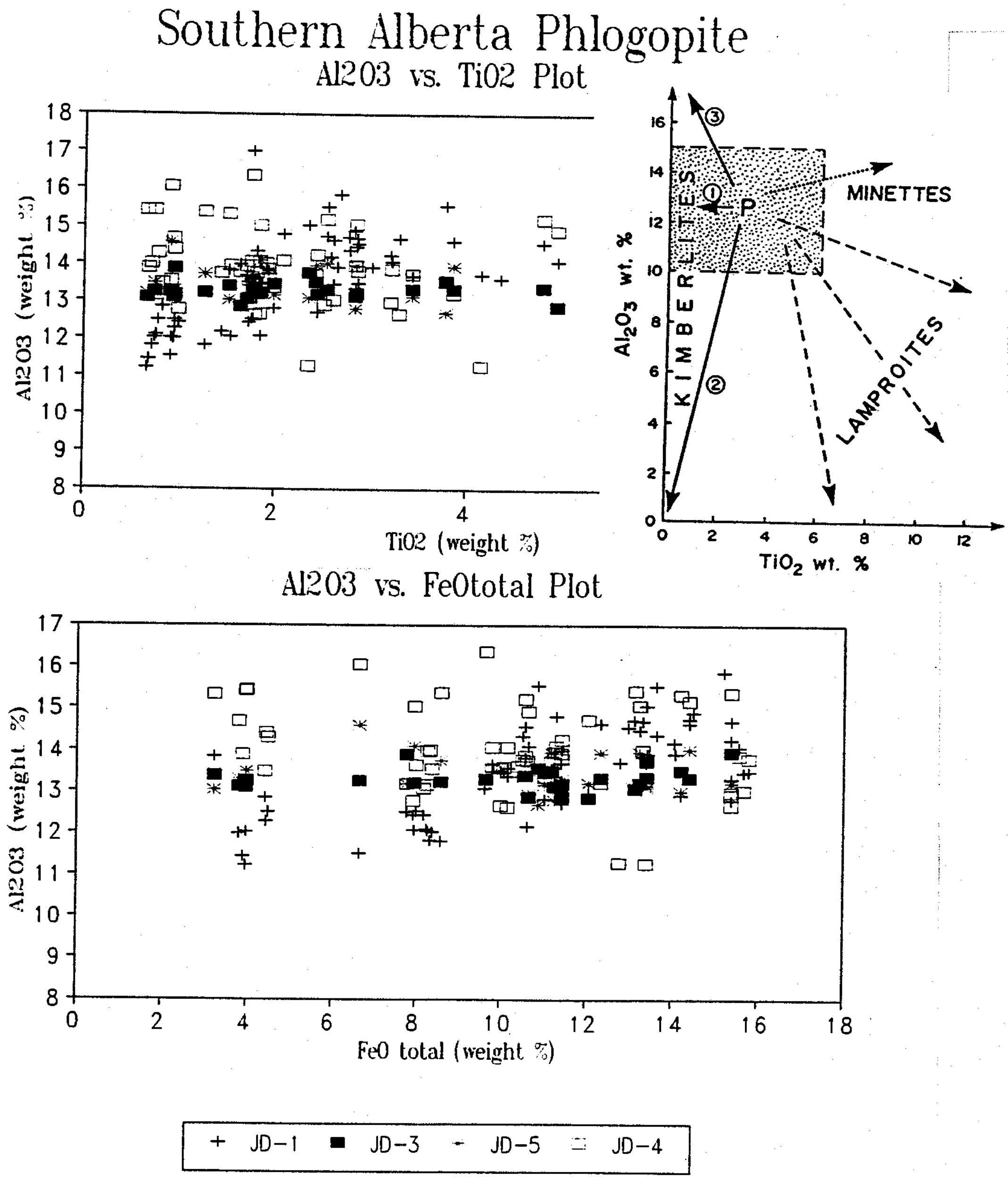

Figure 19 - Southern Alberta Phlogopite Compositions - plotted with reference to: (a) Al_2O_3 vs. TiO_2 and (b) Al_2O_3 vs. FeO_{Total} graphs. Comparison to similar graphs in Kjarsgaard (1994) indicates that the data has a minette trend in evidence (see inset), increasing TiO_2 and FeO_{Total} with near constant Al_2O_3. However, some data, particularly for JD-1 and, to a lesser degree, JD-4, shows a trend of increasing TiO_2 and FeO_{Total} with increasing Al_2O_3, which is indicative of a kimberlitic trend (Mitchell 1986).

Potassium (K_2O) values are all higher than those for kimberlites but approach or are comparable to limits given for lamproites.

Trace element geochemistry is consistent with a phlogopite dominated, potassium-rich alkaline intrusive. Phlogopite (mica) dominated lithologies can be expected to have elevated levels of Ba and Rb, while subordinate olivine would result in depressed values of Sc, V, Cr, Co, Ni, Cu and Zn. The presence of spinels may result in elevated Cr, Fe, Mg, etc. dependent upon the spinel composition.

With the above in mind, a phlogopite-dominated magma is indicated on the basis of values for the elements mentioned above. In particular, Ba levels 3 to 4 times greater than average kimberlite values are consistent with both a phlogopitic magma and lamproitic composition. Rare Earth Element (REE) values (Fig. 20 and 21) indicate substantial Light REE (LREE) enrichment (La/Y ratios between 11.3 and 47.7), again consistent with a phlogopite-dominated composition and a phlogopite-rich source rock (eg. phlogopite-garnet lherzolite).

The trace elements Sc, V, Co, Ni, Cu and Zn tend to be low for average kimberlite values (none available at present for lamproites) while Cr is comparable or enriched relative to the kimberlitic average. Spinels have been observed in the mineral separate obtained from the Southern Alberta diatremes and several preliminary analyses indicate chromites are present. Therefore, elevated Cr values in trace element geochemical analyses are interpreted as a result of chromium-bearing spinel and chromite.

8. DISCUSSION

In their report, Ash and Associates (1993) interpret the JD-1 (Black Butte) occurrence to be a verite, an olivine-diopside-phlogopite lamproite. In addition, in a report requested by BHP for their examination of the JD-1 (Black Butte) occurrence, Dr. B. Scott Smith interprets the sample submitted for thin section analysis as a minette, further stating it is unlikely to be a lamproite due to: "... the colour of the mica, the zoning and colour of the clinopyroxene, the presence of fine spinels ... and in the absence of olivines and the twinning in the feldspar ...". (Note: it has been documented that olivine is present as a moderately abundant phase). In the report by Williams (1993), thin section analysis (by Dr. B. Scott Smith led to the interpretation that the JD-5 occurrence is a minette or a sanidine-phlogopite lamproite.

Finally, Kjarsgaard (1994) interpreted the Sweet Grass intrusives to be minettes based upon mineralogy and on geochemical grounds. The mineral assemblage he describes for minettes (biotite + augite + potassium feldspar + olivine) together with the lamprophyric texture is compelling. However, the presence of analcime, leucite and carbonate, (Kjarsgaard 1994, Cavell et al. 1992) with (late) alkali feldspar content (greater than that of plagioclase feldspar) would lead to an interpretation as a damkjernite (an ultramafic lamprophyre) (Rock 1991). Furthermore, if groundmass sanidine had been

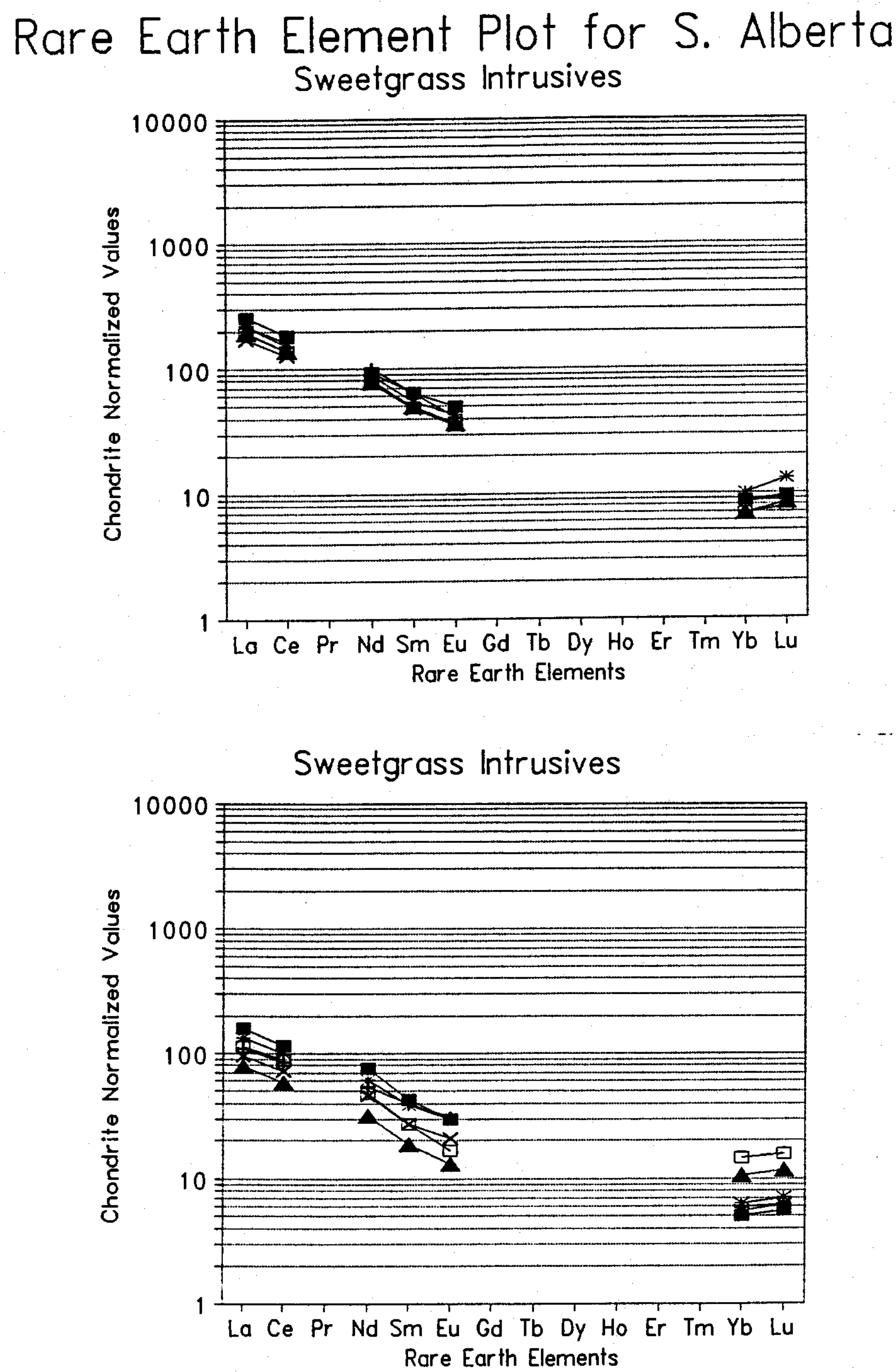

Figure 20 - (a) and (b): Plots of REE for southern Alberta intrusive data of Marum Resources Inc. Note the tight, identical trends evident in the data, suggesting an identical source for all occurrences despite variable mineral assemblages described at surface. LREE enrichment, lack of a Eu anomaly plus Nd isotopic evidence has been cited as evidence for "... significant mid-Proterozoic LIL (LREE) enrichment of the mantle source ..." Cavell and Nelson 1992).

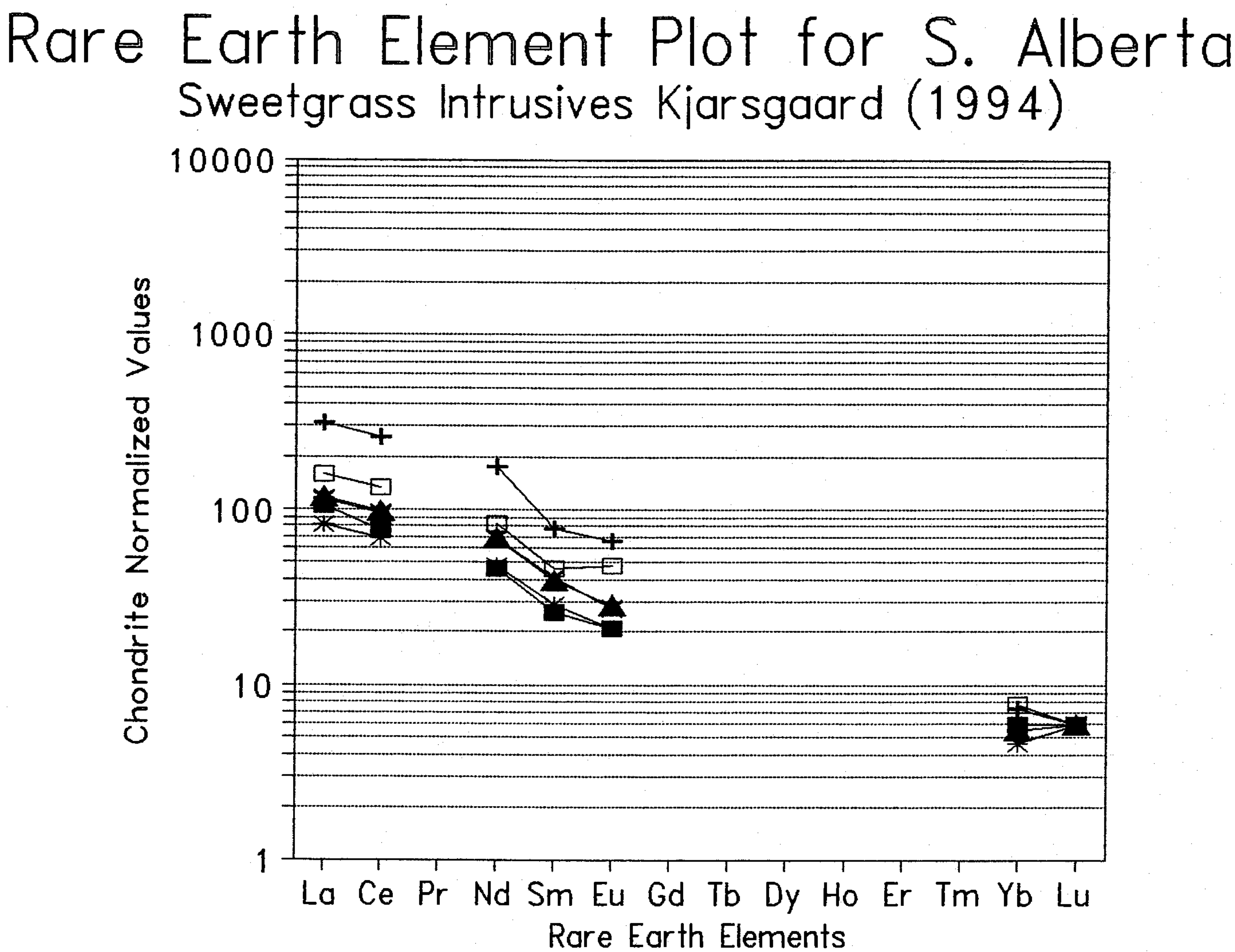

Figure 21 - Plot of REE for southern Alberta intrusive data of Kjarsgaard (1994). Note that the data compares well with the low to intermediate plots of South African kimberlite values (see Figure 23). In addition, note the lack of a Eu anomaly, indicating crystallization depths below feldspar stability.

misidentified and was, in fact, nepheline, the rock would be classified as an ouachitite (also an ultramafic lamprophyre). For these reasons, caution is advised in placing too much reliance on the petrographic interpretations.

The phlogopite zoning trend "... of increasing FeO and TiO_2 at near constant Al_2O_3", is interpreted as supportive of classification of these intrusives as minettes, stating that the trend is unlike that of lamproites (Kjarsgaard 1994). Furthermore, he supports his arguments with whole rock and trace element geochemical trends. As discussed previously, some phlogopites plot within the primitive field of Mitchell (1986) with a trend of increasing TiO_2 content at constant or slightly increased Al_2O_3 content (Fig. 19a and b). Such a trend is indicative of a trend toward kimberlitic composition as defined by Mitchell (1986). In addition, major element geochemistry obtained by Marum Resources Inc. indicates that the majority of points plot within the lamproite field defined by Mitchell and Bergman (1991) on a CaO vs. Al_2O_3 graph (Fig. 22). Furthermore, on a similar graph defined by Foley et al. (1987), the same data straddles the boundary for lamproites. Cavell et al (1992) report data that plots "... intermediate between lamproites and kamafugites in the classification scheme ... for potassic rocks". As a group, the Sweet Grass intrusives are ultrapotassic, peralkaline and perpotassic, satisfying major element criteria for kimberlitic and, especially, lamproitic lithologies. Their silica-poor to silica-deficient character is reflected in their nepheline normative (silica undersaturated) compositions (Burwash and Cavell 1992).

With regard to the clinopyroxene classification scheme of Stephens and Dawson (1977), CP1 clinopyroxenes are defined as sub-calcic diopsides, derived predominantly from South African kimberlites. Group CP2 clinopyroxenes overlap CP1 pyroxenes, differing in MgO/CaO ratios and are again dominated by kimberlite (South Africa and U.S.S.R.) with subordinate garnet lherzolite/garnet-olivine pyroxenite. CP3 clinopyroxenes are considered Ti-Cr diopsides, recovered from kimberlite, garnet lherzolite and garnet pyroxenite. CP4 are low chrome diopsides primarily from kimberlitic occurrences in South Africa. CP5 are chrome diopsides associated primarily with peridotites of kimberlitic and lherzolitic composition and subordinate pyroxenites. CP8 clinopyroxenites are dominated by clinopyroxenes of eclogitic paragenesis. Unfortunately it is difficult, on the basis of their data, to assign a preferential clinopyroxene composition coexisting with diamonds.

However, their equivalent classification scheme for garnets (Dawson and Stephens 1978) indicates that G3, G6 and G10 garnets are those preferentially associated with diamonds. Furthermore, it has been widely reported that G10 garnets are kimberlitic in origin, however G3 and G6 garnets are associated with eclogites. Schulze (1992) states that "... (the) observation that diamonds are approximately two orders of magnitude more abundant in diamond eclogites than in diamond peridotites may help to explain why the number of finds of diamond eclogites far outnumbers diamond peridotites". Furthermore, "... only small quantities of very

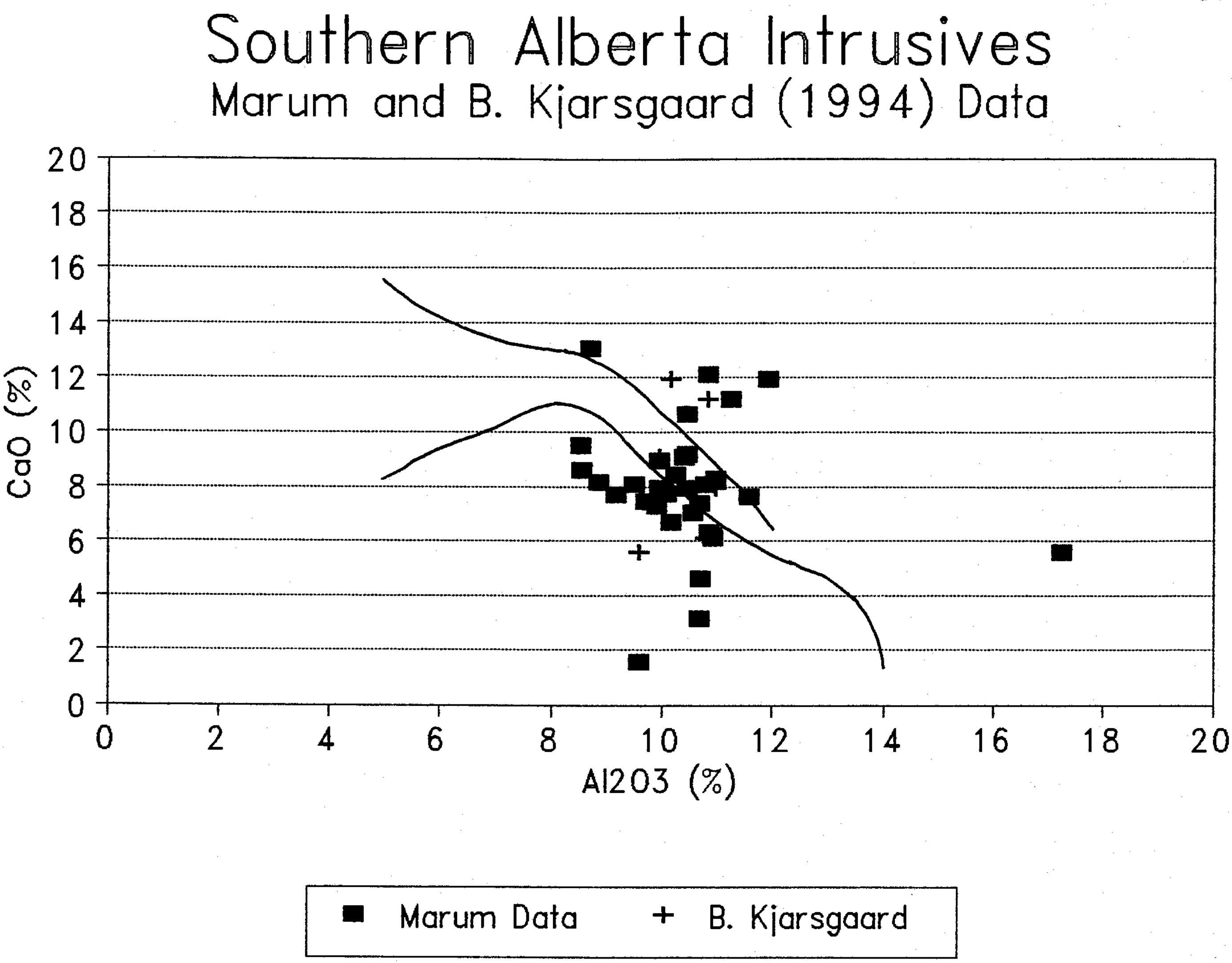

Figure 22 - Data collected by Marum Resources Inc. plotted with Kjarsgaard (1994) data for comparative purposes on a CaO vs. Al_2O_3 graph. The upper bounding curve is that of Mitchell and Bergman (1991), separating lamproitic compositions from other potassic lithologies. The lower bounding curve is the equivalent discriminant of Foley et al. (1987). Note that much of the data plots within or immediately adjacent to the lamproite field of composition. Figure from Kjarsgaard (1994).

diamond-rich eclogite are needed to account for the diamonds in kimberlites dominated by eclogitic diamonds, and xenoliths of eclogite (with or without diamonds) need not consitute a major portion of the xenolith suites in such kimberlites". Therefore, the presence of G3 and G6 garnets is encouraging despite the apparent lack of G10 (pyrope garnets). Finally, as discussed previously, the G5 garnets reported for the Pinhorn Property are most probably deep crustal garnets.

Preliminary electron microprobe analyses of spinels document a P1 dominated chromite population associated with Group 1 kimberlites. The chromite data obtained by Marum Resources compares extremely well with values defined for kimberlitic macrocrysts by Griffin et al. (1992). Furthermore, approximately 30% of the chromites plot within the worldwide diamond inclusion field (defined as Cr_2O_3 >60 wt.%, Al_2O_3 <10 wt.% and MgO between 11 and 14 wt.%).

The composition of the diatremes in terms of both whole rock and trace element geochemistry are encouraging with regard to diamond potential. They have similar compositions (possibly co-magmatic and probably coeval), being phlogopite-bearing, ultrapotassic, perpotassic, peralkaline intrusives of lamproitic affinity. The mineral chemistry returned so far is consistent with diamond-bearing lithologies. Phlogopite analyses compare favourably with kimberlitic compositions, while showing relationship to minette trends. Diopsides are all low chrome diopsides, alternatively interpreted as salites with subordinate diopside and highly subordinate augite, in contrast to Kjarsgaard (1994) petrographic interpretation of an augite-dominated mineral assemblage.

It should be noted that limited recovery of "kimberlitic indicator minerals" should be expected from lamproitic occurrences. It is a documented feature of lamproites that indicator minerals are generally moderately abundant to absent. Therefore, the sparse mantle-type minerals (pyrope garnet, high chrome diopside and picroilmenite) may be a function of "features" specific to generation of a lamproitic melt in the mantle.

The Rare Earth Element data obtained by Marum Resources' (Fig. 20) is still in the preliminary stages of examination, however, some early conclusions can be reached. The data is very similar for the occurrences sampled (Fig. 20 and 21), suggesting a common genesis for the melts, both in terms of source and emplacement/extrusion history. Light Rare Earth Elements (LREE) are distinctly enriched relative to HREE. The REE plots (normalized using the data of Nakamura 1974) are comparable to those of South African kimberlites (Fesq et al. 1974) (Fig. 23), specifically with regard to low and intermediate values, namely an enrichment of the LREE relative to the HREE, the general lack of an Eu anomaly and a relatively steep gradient from the LREE to the HREE. Again, in contrast with the data of Kjarsgaard (1994), the data of Marum Resources' compares well with that of lamproite data from Leucite Hills Phlogopite Lamproite and Prairie Creek Olivine Lamproite.

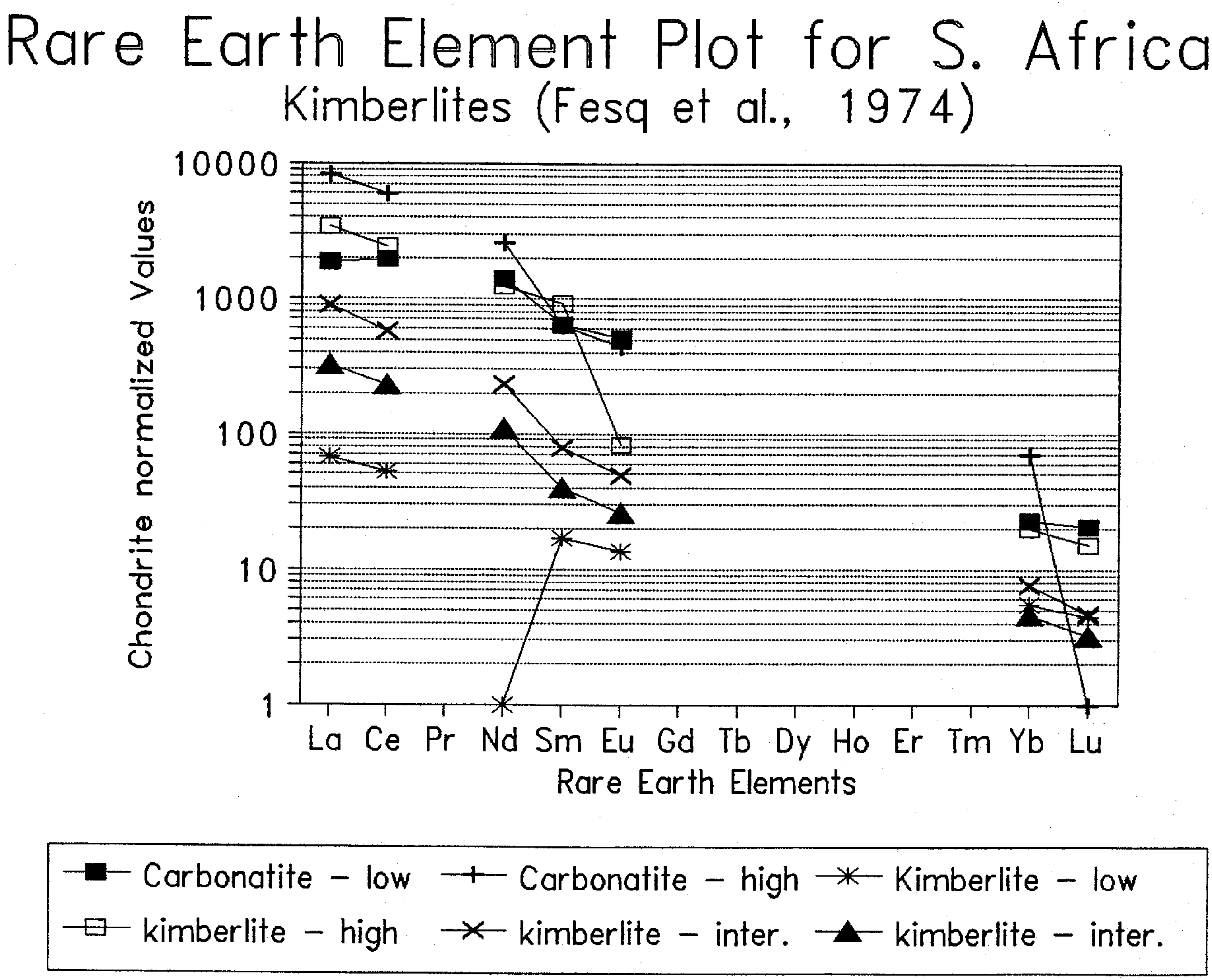

Figure 23 - Plot of Rare Earth Element (REE) data for South African kimberlites (data from Fesq et al. 1974). Note the steep trend from the light REE (LREE) to heavy REE (HREE). The plot shows approximately 20 to 155-fold enrichments of LREE relative to HREE. In addition, note the lack of a Eu anomaly, with the exception of the high kimberlite value. Note that two carbonatite values are also plotted. Finally, the two anomalously low values (Nd and Lu) are artifacts of missing data at those two points and should be ignored.

Data obtained by Marum Resources Inc. document LREE enrichments of between 10 and 50, whereas Burwash and Cavell (1992) report ten to hundred-fold enrichments. They state that LREE- and Mg-enrichment together with Eu anomaly argue against assimilation of sialic (silica-rich) crust as the lack of a Eu anomaly indicates depths below feldspar stability. Furthermore, using their Nd isotopic data they interpret "formation of an enriched mantle source by Proterozoic metasomatism ..." (Burwash and Cavell 1992, Cavell et al 1992). Subsequent partial melting of the LIL and volatile enriched lherzolitic upper mantle around 50 Ma resulted in the ultrapotassic melts exposed today in southern Alberta.

A recent development with regard to future exploration are preliminary geophysical maps produced from recent Geological Survey of Canada aeromagnetic data from southern Alberta. Processed data reveals many small closed anomalies ("bulls-eyes"), several of which have been spatially correlated to known surface exposures. Several additional large targets have been identified (with possible associated pyroclastic aprons) and many more smaller diatremes (?) are present. In addition, long, linear anomalies are present and have been modelled most successfully by the Geological Survey of Canada as vertical to sub-vertical dykes which taper with increasing depth and have a "blow" at or near the surface (Ross 1994, pers. comm.).

Preliminary results obtained from a limited program are extremely exciting and encouraging. Surface exposures have been identified and correlated to near sub-surface geophysical targets identified over a huge area of southern Alberta. Geochemical results (whole rock, trace element and mineral) are consistent with potentially diamondiferous igneous lithologies. Mantle-type xenoliths have been identified several of the occurrences. The presence of abundant phlogopite (both as euhedral phenocrysts and as a major groundmass phase) indicates a minimum depth of 75 kilometres for the source magma (amphibole is the stable hydrous phase at depths less than 75 kilometres). Finally, the Colorado School of Mines (1988) identified thick mantle lithosphere (a thickened keel to the North American craton (Hearn Province in Alberta)) which extends from "... southeastern Wyoming, through central Montana and into southern Alberta and Saskatchewan" and has been dated at 3.278±22 Ma (Archean).

Finally, the reported recovery of a microdiamond from the Black Butte occurrence (JD-1) supports the conclusion that, based upon mineral, whole rock and trace element geochemistry together with initial petrographic analyses, the southern Alberta alkalic occurrences have a distinct possibility of hosting diamonds and/or gold.

9. GEOPHYSICS

A $40,800, 1020 line km Dighem helicopter survey was flown along north-south lines to verify and improve resolution of anomalies identified from the Geological Survey of Canada aeromagnetic data.

The Dighem survey resulted in the identification of 1663 geophysical anomalies of which 196 were identified as being cultural in origin. An additional 701 were identified as indicative of thick cover or basement rock units. The remaining anomalies were classified as discrete bedrock conductors (711) or representing the edge of a wide conductor (55). Preliminary examination of the data must be completed before any final conclusions can be reached, however some preliminary observations are apparent from the preliminary report.

The Dighem report (R.A. Pritchard, 1994) describes "... several anomalous features, many of which are considered to be of moderate to high priority as exploration targets. Most of the inferred bedrock conductors appear to warrant further investigation using appropriate surface exploration methods".

In general, the total field magnetic data, upon processing, documents "... broad, regional features which are intersected by many anomalies indicative of narrower magnetic sources". This would appear to record possible diatremes (intrusive and/or extrusive with possible pyroclastic aprons (?)) with associated vertical or near vertical dykes.

"There are at least three circular, highly magnetic features which are of interest within the survey area as possible pipe-like targets. The largest is situated in the southeast portion of the survey block ... coincident with a circular topographic high. This feature exhibits an almost circular shape, and seems to have several weaker anomalies radiating out from it to the northeast and southwest". This occurrence documents the magnetic expression of the JD-1 (Black Butte) occurrence.

Further, "... the magnetic map is dominated by a large, semi-circular magnetic high situated in the central region of the block ... (and) appears to be circular in shape, although the enhanced magnetic map displays possible extensions to the northwest and southwest ... (which) gives the magnetic feature an arcuate appearance". This is interpreted to describe the geophysical expression of the JD-4 occurrence.

Finally, "a third weaker, circular magnetic feature ... is situated within the Milk River valley. This anomaly differs from the previous two in that it has no distinct resistivity anomaly, and is situated within a topographic low". This is correlates with the JD-2 occurrence. Numerous other geophysical features are described which are interpreted to represent north-northeast trending dykes and diatremes (circular magnetic features).

Confirmation of the magnetic expression of several known alkalic occurrences using the geophysical data recovered by Dighem allows greater reliability in interpreting other geophysical features. In addition, the limited ground survey conducted by the Geological Survey of Canada and the subsequent interpretation that the north-northeast trending anomalies represented vertical to sub-vertical dykes is particularly relevant with regard to the narrow, linear features described in the Dighem report. Furthermore, similar features are present on the regional scale Geological Survey of Canada aeromagnetic dataset. Therefore, these geophysical features should be regarded as potential alkalic diatreme and dyke occurrences, similar to the occurrences described in this report, and followed up accordingly.

10. CONCLUSION AND GENERAL RECOMMENDATIONS

Conclusion: There is a distinct possibility of identifying (a) diamond-bearing diatreme(s) in southern Alberta.

Southern Alberta intrusives should be aggressively pursued to evaluate their diamond potential since the intrusives (and extrusives) examined in the course of Marum Resources' 1993 field programme are interpreted as minettes with lamproitic affinity on the basis of work completed to date. This is primarily due to the difficulty in determining the **primary** mineralogy of the groundmass phases, in particular, whether sanidine is primary or secondary (late alkali feldspar of Cavell et al. 1992). Further, the presence of Na feldspathoids (analcime and leucite) as primary phases has great significance as to the classification of the lamprophyres as either minettes or lamproites (Rock 1991).

As considerable economic significance is associated with any lithology identified as "lamproite" or "kimberlite", care must be taken in assigning a lithological name to any of these occurrences. Rock (1991) stated "... lamprophyre is a broad field term implying knowledge only of mode of occurrence and macroscopic petrology, whereas kimberlite is a precise petrological term implying detailed knowledge of both rock and mineral chemistry ... Lamprophyres are currently unified as the only confirmed magmatic source of diamond, and hence have the deepest origins of igneous rocks ... Continuing exploration has also now revealed microdiamonds in AL (alkaline lamprophyres) and UML (ultramafic lamprophyres)". Therefore, further work is strongly recommended to allow more precise identification of the southern Alberta alkaline occurrences using all available lines of reasoning.

The results of field work undertaken to date indicate that Marum's Pinhorn Property is an excellent candidate for diamond exploration with possibilities for gold. This conclusion is based upon the following observations:

i) There is a postulated deep lithospheric keel which extends into southeastern Alberta, associated with the Wyoming craton of the Central Montana Alkalic Province,

ii) The Hearn Province is interpreted to underlie the Alberta Basin in southern Alberta and has been dated at 3.278±22 Ma in the immediate vicinity of the southern Alberta minettes,

iii) The alkaline exposures (both intrusive and extrusive) have affinity to both kimberlitic and lamproitic trends described in the literature, coeval with alkaline igneous activity in the CMAP, documented to include lamproitic and kimberlitic lithologies,

iv) Geophysical anomalies evident on aeromagnetic surveys associated with several of the diatremes and distinct, extensive linear magnetic features (verified by at least one ground survey) which have been successfully modelled as dykes, tapering with depth, having a "blow" at surface,

v) Kimberlitic indicator minerals have been documented, with compositions comparable to: a) kimberlites world-wide (eg. phlogopite, chromite, high chrome diopside and G3 garnets) and b) world-wide diamond inclusion field compositions (chromite), and

vi) Recovery of a microdiamond from a small (38.2 Kg) rock sample taken from the JD-1 (Black Butte) occurrence.

Continued exploration on these occurrences is strongly recommended. A rigorous, follow-up programme should include the following:

1) Thoroughly examine and map the igneous and sedimentary exposures to identify:

a) Intrusive relationships and relative timing,
b) Number of phases,
c) Identity of ultramafic nodule suite, and
d) Phases suitable for pressure-temperature determinations.

2) Determine whether the alkaline occurrences are minettes, or lamproites using whole rock and trace element geochemistry, thin section analysis of textures and mineral assemblages, electron microprobe analysis of mineral compositions.

3) Sample each igneous phase and dyke for whole rock and trace element geochemistry, heavy mineral suites, electron microprobe analysis, thin section analysis, base and precious metal content. In addition, with the identification of a pyroclastic vent breccia and associated proximal vent facies, the possibility of pyroclastic aprons surrounding other, possibly buried, exposures should be seriously considered as an exploration target. Furthermore, pyroclastic aprons are considered as the most favourable targets for diamond exploration in Saskatchewan and any possible occurrence should

be aggressively investigated. The JD-4 diatreme is recommended as the highest priority sample location at this time.

4) Carry out detailed ground geophysics (magnetics, gravity and resistivity) over a grid extending at least 200 metres in each direction from the coulee in which the diatreme complex is exposed to determine the orientation of the diatreme in the subsurface.

5) Carry out soil geochemistry in conjunction with geophysics (using the same grid) to determine whether economic enrichment of host sediments during or subsequent to diatreme emplacement occurred and to what extent.

6) Carry out microscopic examination of heavy mineral concentrate to identify "indicator minerals", heavy mineral populations and recover diamonds.

7) Pursue the airbourne geophysical anomalies to determine if they are cultural features, artifacts of processing or real geological structures. Furthermore, the linear geophysical anomalies examined by the Geological Survey of Canada should have soil sampling, ground geophysics and/or drilling to identify their nature.

8) Upon return of favourable results in any of the above recommendations, drill the exposure:

   a) To determine variations in diatreme complex with depth.
   b) To obtain pristine, unweathered samples for analysis.

11. RECOMMENDED 1994 PROGRAMME

Based on the above general conclusions, the following exploration programme is recommended for the 1994 field season:

PHASE I

Mapping and Sampling	
Geologist and helper	
Field - 30 days at $700/day	$21,000
Office - 20 days at $400/day	$ 8,000
Thin Sections and Analysis	$ 3,000
Accommodation - 30 days at $100/day	$ 3,000
Supplies and Support	$ 5,000
Ground Geophysical Programme	
Geophysicist and helper	
Field - 30 days at $600/day	$ 18,000
Office - 20 days at $300/day	$ 6,000
Accommodation - 30 days at $100/day	$ 3,000
Supplies and Support	$ 5,000
Report and Deliverables	$ 5,000
Geochemical Programme	
Field collection	
Soil samples	
Two samplers - 30 days at $500/day	$ 15,000
Rock - 50 100 Kg samples	
Geologist/helper - 15 days at $700/day	$ 10,500
Rock - 1 ton samples	
Cat operator/cat - 5 days at $800/day	$ 4,000
Geochemical Analyses	
Rock - 50 at $44.75/sample	$ 2,240
Soil - 2000 at $22.75/sample	$ 45,500
Transport	$ 10,000
Heavy Mineral Analysis	
50 100 Kg samples at $800/sample	$ 40,000
Picking and Microprobe	$ 15,000
Report and Deliverables	$ 10,000
Sub-total	$229,240
Contingency at 10%	$ 22,924
Total	$252,164

PHASE II

Drilling	
5000 feet at $50.00/feet inclusive	$250,000

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APPENDIX 1

RESULTS OF
ELECTRON MICROPROBE
ANALYSIS
OF
SELECTED INDICATOR
MINERALS

GARNETS
Southern Alberta

Formula Based on 12 O
Molecular Weight of Oxides

Sample Number	Locality	Colour	UN #	SiO_2	TiO_2	Al_2O_3	FeO	MnO	MgO	CaO	Na_2O	Cr_2O_3	Total	Garnet Classn.
				60.09	79.90	101.94	71.85	70.94	40.32	56.08	61.98	151.99		
ABRW93R-55	JD-1	clear	109	38.24	0.01	21.72	30.09		8.39	1.96		0.09	100.50	Crustal
ABRW93R-55	JD-1	clear	110	39.04	0.01	22.42	24.01		10.50	4.86		0.00	100.84	G5
ABRW93R-55	JD-1	clear	111	39.46	0.03	22.14	29.18		8.90	1.99		0.05	101.75	G5
ABRW93R-55	JD-1	lt. pink	112	38.68	0.00	21.73	30.35		8.45	1.83		0.05	101.09	Crustal
ABRW93R-55	JD-1	lt. pink	113	38.57	0.00	22.27	27.06		10.38	2.27		0.03	100.58	G5
ABRW93R-55	JD-1	dirty orange	114	38.59	0.00	22.03	29.57		9.20	1.81		0.02	101.22	G5
ABRW93R-55	JD-1	lt. orange	115	41.38	0.05	23.16	14.52		15.62	6.23		0.11	101.07	G3
ABRW93R-55	JD-1	med. orange	116	38.57	0.07	21.90	25.53		8.44	6.19		0.00	100.70	G5
ABRW93R-55	JD-1	med. orange	117	39.56	0.05	22.31	22.42		10.51	5.77		0.03	100.65	G3
ABRW93R-55	JD-1	med. orange	118	39.64	0.11	21.75	22.32		10.35	6.05		0.00	100.22	G3
ABRW93R-55	JD-1	med. orange	119	39.44	0.06	21.32	25.70		7.95	5.88		0.01	100.36	G5
ABRW93R-55	JD-1	lt. orange	128	39.52	0.07	21.38	24.94		8.78	5.77		0.00	100.46	G5
ABRW93R-55	JD-1	lt. orange	129	40.04	0.12	22.89	14.22		10.27	12.94		0.00	100.48	G6
ABRW93R-55	JD-1	dirty orange	130	38.95	0.07	21.35	24.22		9.37	5.94		0.01	99.91	G5
ABRW93R-55	JD-1	dirty orange	131	38.21	0.05	21.80	25.30		7.99	6.80		0.02	100.17	G5
ABRW93R-55	JD-1	dirty orange	132	37.82	0.08	21.53	25.24		8.81	5.88		0.00	99.36	G5
ABRW93R-55	JD-1	clear	133	41.57	0.05	23.36	14.25		15.73	6.07		0.10	101.13	G3
ABRW93R-55	JD-1	clear	134	39.28	0.02	21.71	29.73		8.23	1.97		0.04	100.98	G5
ABRW93R-55	JD-1	clear	135	41.10	0.02	23.25	14.09		15.82	6.12		0.06	100.46	G3
ABRW93R-55	JD-1	clear	136	39.16	0.02	22.63	23.62		10.26	5.07		0.01	100.77	G3
ABRW93R-55	JD-1	clear	137	40.28	0.07	22.70	14.48		10.91	12.04		0.00	100.48	G6
ABRW93R-55	JD-1	orange	138	39.84	0.06	22.32	23.17		9.88	6.52		0.01	101.80	G3
ABRW93R-55	JD-1	clear	139	39.20	0.02	22.30	27.26		10.33	2.36		0.03	101.50	G5
ABRW93R-55	JD-1	clear	140	39.27	0.01	22.39	24.17		10.43	4.67		0.00	100.94	G5
ABRW93R-55	JD-1	clear	141	38.49	0.02	21.70	30.29		8.11	2.11		0.11	100.83	Crustal
ABRW93R-55	JD-1	lt. pink	142	38.20	0.00	21.72	30.33		8.42	2.03		0.08	100.78	Crustal
ABRW93AA-88	JD-2		B1	35.62	0.00	21.54	29.96	2.44	6.23	1.29	0.00	0.00	97.08	G5
ABRW93AA-88	JD-2		C1	36.91	0.05	21.21	30.32	1.93	4.68	3.58	0.05	0.00	98.73	Crustal
ABRW93AA-88	JD-2		D1	38.35	0.01	22.34	32.97	0.28	6.76	0.92	0.03	0.03	101.69	Crustal
ABRW93AA-88	JD-2		D2	38.56	0.02	22.48	32.74	0.42	6.73	1.03	0.01	0.04	102.03	Crustal

GARNETS (cont'd)
Southern Alberta

Formula Based on 12 O
Molecular Weight of Oxides

Sample Number	Locality	Colour	UN #	SiO_2	TiO_2	Al_2O_3	FeO	MnO	MgO	CaO	Na_2O	Cr_2O_3	Total	Garnet Classn.
				60.09	79.90	101.94	71.85	70.94	40.32	56.08	61.98	151.99		
ABRW93AA-88	JD-2		E1	37.27	0.02	21.62	29.63	6.00	3.05	3.25	0.05	0.00	100.89	G5
ABRW93AA-88	JD-2		F1	37.27	0.00	21.48	32.85	0.71	3.02	4.22	0.06	0.00	99.61	Crustal
ABRW93AA-88	JD-2		G1	37.41	0.06	21.38	29.69	7.65	1.82	3.23	0.02	0.01	101.27	G5
ABRW93AA-88	JD-2		H1	37.55	0.02	22.16	29.27	1.39	6.43	2.82	0.04	0.05	99.73	G5
ABRW93AA-88	JD-2		J1	36.80	0.04	21.57	34.31	0.74	4.34	1.10	0.05	0.01	98.96	Crustal
ABRW93AA-88	JD-2		I1	37.32	0.00	21.99	33.43	0.97	5.09	1.56	0.00	0.01	100.37	Crustal
ABRW93AA-88	JD-2		A2	36.82	0.00	21.11	33.72	0.60	3.73	2.92	0.01	0.00	98.91	Crustal
ABRW93AA-88	JD-2		B2	45.78	0.02	17.06	20.41	10.41	1.13	3.12	0.56	0.00	98.49	G3
ABRW93AA-88	JD-2		C2	37.41	0.09	20.97	31.54	0.72	2.14	8.18	0.00	0.04	101.09	Crustal
ABRW93AA-88	JD-2		D2	36.78	0.03	21.71	36.07	1.04	3.27	1.06	0.05	0.03	100.04	Crustal
ABRW93AA-88	JD-2		E2	35.82	0.00	20.98	25.86	13.83	0.62	0.84	0.08	0.05	98.08	G5
ABRW93AA-88	JD-2		G2	36.68	0.01	21.40	29.94	9.38	1.14	1.55	0.07	0.03	100.20	G5
ABRW93AA-88	JD-2		H2	36.90	0.00	21.74	32.98	7.17	1.71	1.22	0.01	0.00	101.73	Crustal
ABRW93AA-88	JD-2		I2	37.87	0.08	22.11	32.25	1.11	5.44	2.22	0.03	0.00	101.11	Crustal
ABRW93AA-88	JD-2		J2	36.50	0.01	21.23	33.25	6.80	1.21	1.33	0.08	0.00	100.41	Crustal
ABRW93AA-88	JD-2		A3	36.03	0.05	21.42	34.26	2.84	3.23	0.90	0.00	0.00	98.73	Crustal
ABRW93AA-88	JD-2		A3	37.69	0.00	22.07	34.31	2.82	3.32	0.95	0.06	0.06	101.28	Crustal
ABRW93AA-88	JD-2		B3	37.86	0.00	22.04	30.94	3.62	5.10	1.67	0.03	0.00	101.26	Crustal
ABRW93AA-88	JD-2		C3	36.91	0.05	22.20	35.11	0.75	4.45	0.90	0.00	0.04	100.41	Crustal
ABRW93AA-88	JD-2		E3	37.92	0.04	21.93	31.34	0.65	3.08	6.85	0.01	0.00	101.82	Crustal
ABRW93AA-88	JD-2		F3	38.11	0.08	22.06	31.42	0.56	5.96	2.72	0.02	0.09	101.02	Crustal
ABRW93AA-88	JD-2		G3	37.16	0.00	21.80	37.16	1.60	2.75	0.94	0.03	0.00	101.44	Crustal
ABRW93AA-88	JD-2		H3	37.09	0.00	21.90	32.81	0.79	4.60	2.47	0.08	0.00	99.74	Crustal
ABRW93AA-88	JD-2		I3	37.79	0.07	21.91	28.63	2.76	3.67	6.03	0.02	0.00	100.88	G5
ABRW93AA-88	JD-2		J3	36.55	0.02	21.60	28.81	1.34	4.36	5.34	0.00	0.00	98.02	G5
ABRW93AA-88	JD-2		A4	36.65	0.00	21.42	30.75	9.36	1.84	0.39	0.05	0.00	100.46	Crustal
ABRW93AA-88	JD-2		B4	37.42	0.00	21.67	35.43	1.82	3.71	1.05	0.00	0.02	101.12	Crustal
ABRW93AA-88	JD-2		C4	38.07	0.03	22.75	32.80	0.43	6.46	1.22	0.02	0.01	101.79	Crustal
ABRW93AA-88	JD-2		D4	37.02	0.01	22.09	28.99	0.60	7.77	1.66	0.02	0.05	98.21	G5
ABRW93AA-88	JD-2		D4	38.14	0.00	22.62	29.04	0.58	7.92	1.66	0.04	0.00	100.00	G5
ABRW93AA-88	JD-2		E4	37.79	0.06	21.60	35.28	1.48	3.31	3.16	0.04	0.06	102.78	Crustal
ABRW93AA-88	JD-2		E4	37.89	0.10	21.50	34.02	1.48	2.97	3.34	0.03	0.00	101.33	Crustal
ABRW93AA-88	JD-2		F4	37.34	0.02	21.76	32.87	4.87	3.42	0.74	0.03	0.01	101.06	Crustal
ABRW93AA-88	JD-2		H4	38.31	0.02	22.04	32.51	0.89	6.05	1.14	0.05	0.01	101.02	Crustal
ABRW93AA-88	JD-2		I4	37.36	0.07	21.49	32.96	0.96	2.29	6.29	0.04	0.02	101.48	Crustal
ABRW93AA-88	JD-2		J4	37.95	0.00	22.23	33.93	0.86	4.70	1.25	0.03	0.02	100.97	Crustal
BHP				44.57	0.11	22.26	11.68	0.34	15.84	4.71	0.33	0.17	100.01	G3

CLINOPYROXENE
Southern Alberta

Molecular Weight of Oxides

		60.09	79.90	101.94	71.85	70.94	40.32	56.08	61.98	94.20	152.02	
PT.#	Local	SiO2	TiO2	Al2O3	FeO*	MnO	MgO	CaO	Na2O	K2O	Cr2O3	Total
RW-3	JD-1	54.43	0.10	0.61	4.59	0.16	15.83	23.14	0.58			99.44
RW-3	JD-1	54.35	0.17	0.35	3.57	0.08	18.34	21.66	0.13			98.65
RW-3	JD-1	54.72	0.13	0.62	5.70	0.17	15.32	23.03	0.60			100.29
RW-3	JD-1	54.99	0.20	0.56	3.81	0.08	17.45	22.86	0.24			100.19
RW-3	JD-1	53.96	0.18	0.90	5.98	0.18	15.57	22.29	0.49			99.55
RW-3	JD-1	55.44	0.12	0.23	3.26	0.08	18.79	22.11	0.11		0.17	100.31
RW-3	JD-1	53.86	0.18	0.86	5.56	0.11	16.15	22.51	0.41		0.00	99.64
RW-3	JD-1	54.90	0.12	0.30	3.33	0.07	18.36	22.41	0.13		0.07	99.69
RW-3	JD-1	53.15	0.07	3.09	5.92	0.14	13.50	20.41	2.00		0.06	98.34
RW-3	JD-1	52.88	0.05	2.73	5.69	0.13	13.62	20.26	1.92		0.15	97.43
RW-3	JD-1	53.17	0.05	3.11	5.72	0.14	13.51	20.70	1.99		0.16	98.55
RW-3	JD-1	52.50	0.12	0.64	5.80	0.16	15.52	22.22	0.40		0.07	97.43
RW-3	JD-1	53.93	0.18	0.54	4.76	0.10	17.19	22.43	0.31		0.05	99.49
RW-3	JD-1	53.99	0.11	0.63	4.30	0.12	17.22	22.28	0.30		0.07	99.02
RW-3	JD-1	54.36	0.09	0.57	4.97	0.11	16.92	22.46	0.33		0.02	99.83
RW-3	JD-1	54.35	0.14	0.45	3.79	0.10	17.98	22.25	0.23		0.17	99.46
RW-3	JD-1	54.11	0.15	0.52	4.84	0.11	16.86	22.38	0.34		0.04	99.35
RW-3	JD-1	51.35	0.71	1.37	10.82	0.31	12.35	21.80	0.92		0.00	99.63
RW-4	JD-1	50.39	0.64	5.67	8.74	0.06	11.78	20.41	1.37		0.01	99.07
RW-4	JD-1	50.18	0.63	5.79	8.80	0.07	11.87	20.68	1.35		0.02	99.39
RW-4	JD-1	51.09	0.60	4.73	7.90	0.06	12.52	20.91	1.42		0.02	99.25
RW-4	JD-1	54.05	0.07	0.21	3.60	0.11	17.86	22.77	0.11		0.10	98.88
RW-4	JD-1	54.15	0.11	0.21	3.97	0.11	18.69	21.41	0.13		0.11	98.89
RW-4	JD-1	52.82	0.18	1.25	8.37	0.20	13.76	21.80	0.88		0.05	99.31
RW-4	JD-1	54.67	0.14	0.98	4.19	0.17	16.70	23.17	0.44		0.07	100.53
RW-4	JD-1	54.98	0.11	0.47	3.26	0.06	17.63	23.47	0.18		0.08	100.24
RW-4	JD-1	54.43	0.05	1.62	4.90	0.12	15.05	22.58	1.14		0.10	99.99
RW-4	JD-1	50.51	0.71	5.51	8.88	0.03	11.72	20.82	1.38		0.01	99.57
RW-4	JD-1	50.47	0.64	5.82	8.61	0.06	11.55	21.08	1.40		0.02	99.65
RW-4	JD-1	50.39	0.70	5.78	8.79	0.06	11.42	20.83	1.45		0.02	99.44
RW-4	JD-1	51.15	0.67	5.67	9.25	0.08	11.63	20.50	1.17		0.03	100.15
RW-4	JD-1	50.69	0.62	5.78	8.67	0.05	11.63	21.05	1.39		0.03	99.91
RW-4	JD-1	50.23	0.55	5.51	9.06	0.07	11.72	20.63	1.39		0.03	99.19
RW-4	JD-1	50.35	0.64	5.55	8.81	0.07	11.47	20.90	1.46		0.01	99.26
RW-4	JD-1	50.43	0.63	5.44	8.67	0.06	11.64	20.96	1.39		0.02	99.24
RW-4	JD-1	50.66	0.62	5.21	8.68	0.06	11.87	20.87	1.34		0.02	99.33
RW-4	JD-1	50.99	0.55	4.75	8.51	0.06	12.23	20.88	1.36		0.02	99.35
RW-4	JD-1	50.37	0.40	3.66	9.27	0.11	13.00	21.45	0.55		0.04	98.85
RW-4	JD-1	51.08	0.10	2.95	11.98	0.24	10.76	20.92	1.26		0.00	99.29
RW-4	JD-1	53.21	0.15	0.91	5.83	0.16	15.66	22.02	0.54		0.07	98.55
RW-4	JD-1	53.51	0.10	0.94	5.95	0.14	16.50	21.30	0.43		0.08	98.95
RW-4	JD-1	53.80	0.12	0.77	5.33	0.14	16.81	21.50	0.36		0.09	98.92
RW-4	JD-1	53.35	0.13	0.70	5.22	0.14	17.05	21.56	0.35		0.13	98.63

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Molecular Weight of Oxides

PT.#	Local	SiO2	TiO2	Al2O3	FeO*	MnO	MgO	CaO	Na2O	K2O	Cr2O3	Total
		60.09	79.90	101.94	71.85	70.94	40.32	56.08	61.98		152.02	
RW-4	JD-1	53.46	0.15	0.65	5.90	0.16	16.15	21.72	0.47		0.03	98.69
RW-4	JD-1	53.75	0.07	2.02	6.16	0.17	14.06	21.27	1.54		0.05	99.09
RW-4	JD-1	53.93	0.05	1.40	6.19	0.17	14.69	21.74	1.14		0.06	99.37
RW-4	JD-1	53.74	0.08	1.48	6.62	0.30	14.45	21.09	1.05		0.08	98.89
RW-4	JD-1	53.59	0.11	0.80	6.02	0.16	15.24	22.51	0.68		0.07	99.18
RW-4	JD-1	53.53	0.14	0.73	5.54	0.12	16.18	22.27	0.41		0.09	99.01
RW-4	JD-1	53.40	0.19	0.48	7.14	0.25	15.42	20.94	0.86		0.00	98.68
RW-4A	JD-1	55.04	0.15	0.71	2.84	0.06	17.38	24.57	0.19			100.94
RW-4A	JD-1	54.93	0.03	1.92	4.75	0.12	14.35	23.02	1.53			100.65
RW-4A	JD-1	54.96	0.04	1.66	4.80	0.11	14.65	23.29	1.29			100.80
RW-4A	JD-1	55.42	0.04	2.01	4.42	0.12	14.61	23.37	1.41			101.40
RW-4A	JD-1	55.21	0.13	0.56	4.16	0.09	16.86	24.16	0.31			101.48
RW-4A	JD-1	54.00	0.24	0.78	4.97	0.15	15.82	23.34	0.46			99.76
RW-4A	JD-1	54.83	0.16	0.43	2.97	0.10	18.10	23.47	0.18			100.24
RW-4A	JD-1	51.28	0.61	5.46	7.48	0.06	11.96	21.53	1.34			99.72
RW-4A	JD-1	54.87	0.05	0.12	2.85	0.10	16.73	24.80	0.34			99.86
RW-4A	JD-1	54.34	0.17	0.48	2.65	0.07	18.46	22.71	0.24			99.12
RW-4A	JD-1	54.75	0.17	0.46	2.71	0.07	18.49	22.73	0.24			99.62
RW-4A	JD-1	54.08	0.16	0.58	4.29	0.12	17.12	22.86	0.27			99.48
RW-4A	JD-1	54.17	0.18	1.57	5.49	0.17	14.64	22.13	1.21			99.56
RW-4A	JD-1	55.26	0.13	0.40	3.18	0.06	18.07	23.27	0.18			100.55
RW-4A	JD-1	50.59	0.66	5.81	7.75	0.05	11.70	21.57	1.32			99.45
RW-4A	JD-1	54.79	0.03	0.17	3.26	0.10	17.14	23.94	0.36			99.79
RW-4A	JD-1	54.41	0.14	0.69	5.35	0.16	15.68	23.39	0.55			100.37
RW-4A	JD-1	54.32	0.18	0.57	4.67	0.11	16.13	23.89	0.37			100.24
RW-4A	JD-1	54.73	0.16	0.79	5.13	0.11	16.06	23.28	0.34			100.60
RW-5	JD-1	54.74	0.13	0.73	5.47	0.12	15.65	23.47	0.36			100.67
RW-5	JD-1	54.48	0.18	0.73	6.05	0.15	15.12	23.92	0.38			101.01
RW-5	JD-1	54.03	0.17	1.40	7.05	0.21	14.04	23.44	0.67			101.01
RW-5	JD-1	54.65	0.18	0.55	4.49	0.12	16.76	23.38	0.26			100.39
RW-5	JD-1	54.62	0.23	0.87	5.71	0.13	15.43	24.04	0.35			101.38
RW-5	JD-1	49.86	0.13	0.86	7.03	0.13	13.61	21.06	0.43		0.00	93.11
RW-5	JD-1	53.81	0.19	0.94	7.48	0.16	14.61	23.25	0.48		0.01	100.93
RW-5	JD-1	53.96	0.18	0.85	7.02	0.14	14.91	23.21	0.41		0.01	100.69
RW-5	JD-1	53.96	0.20	0.81	6.52	0.13	15.21	23.38	0.36		0.01	100.58
RW-5	JD-1	53.95	0.19	0.70	6.25	0.14	15.60	23.14	0.35		0.01	100.33
RW-5	JD-1	53.94	0.19	0.66	6.32	0.13	15.65	23.08	0.34		0.00	100.31
RW-5	JD-1	53.56	0.20	0.85	7.27	0.16	15.02	22.81	0.43		0.01	100.31
RW-5	JD-1	53.73	0.18	0.84	7.15	0.15	15.08	22.77	0.43		0.00	100.33
RW-5	JD-1	53.20	0.18	0.76	7.07	0.18	15.19	22.19	0.46		0.00	99.23
RW-5	JD-1	52.82	0.15	0.83	7.27	0.20	14.86	22.18	0.47		0.00	98.78
RW-5	JD-1	52.94	0.19	0.96	7.60	0.18	14.60	22.34	0.56		0.00	99.37
RW-5	JD-1	54.87	0.09	0.42	3.62	0.09	18.09	22.29	0.17		0.11	99.75
RW-5	JD-1	50.24	0.94	5.74	7.43	0.04	12.37	20.61	1.47		0.05	98.89
RW-5	JD-1	53.03	0.20	1.90	8.14	0.19	14.22	21.75	0.66		0.05	100.14
RW-5	JD-1	53.74	0.16	0.80	6.49	0.15	15.50	22.08	0.40		0.06	99.38
RW-5	JD-1	53.86	0.15	0.51	5.03	0.11	17.09	21.63	0.26		0.05	98.69
RW-5	JD-1	52.71	0.15	0.86	6.99	0.19	15.37	21.63	0.43		0.05	98.38
RW-5	JD-1	53.09	0.15	0.70	6.28	0.15	15.92	21.65	0.35		0.06	98.35
ABRW93-55	JD-2	52.89	0.45	4.61	8.49		12.03	19.30	2.02		0.01	99.80
ABRW93-55	JD-2	52.76	0.52	4.65	8.48		12.13	19.32	2.14		0.02	100.02

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Molecular Weight of Oxides

PT.#	Local	SiO2	TiO2	Al2O3	FeO*	MnO	MgO	CaO	Na2O	K2O	Cr2O3	Total
		60.09	79.90	101.94	71.85	70.94	40.32	56.08	61.98	94.20	152.02	
ABRW93-88	JD-2	53.91	0.21	0.83	5.15	0.13	16.79	22.82	0.31	0.00	0.00	100.15
ABRW93-88	JD-2	53.99	0.23	0.91	4.73	0.20	17.79	22.13	0.34	0.00	0.12	100.44
ABRW93-88	JD-2	54.23	0.18	1.01	4.29	0.09	17.57	22.86	0.26	0.00	0.12	100.61
ABRW93-88	JD-2	54.50	0.24	1.03	4.42	0.11	17.50	22.72	0.27	0.00	0.09	100.88
ABRW93-88	JD-2	53.86	0.33	1.04	4.57	0.16	17.83	22.38	0.23	0.00	0.08	100.48
ABRW93-88	JD-2	53.64	0.31	1.08	4.52	0.11	18.16	22.06	0.26	0.00	0.09	100.23
ABRW93-88	JD-2	53.53	0.22	1.20	4.77	0.12	17.16	22.44	0.35	0.00	0.25	100.04
ABRW93-88	JD-2	54.08	0.22	1.30	4.65	0.13	17.54	21.77	0.26	0.07	0.15	100.17
ABRW93-88	JD-2	53.98	0.25	1.11	5.46	0.16	16.59	22.70	0.39	0.00	0.03	100.67
ABRW93-88	JD-2	53.80	0.27	1.02	6.07	0.15	16.70	22.20	0.37	0.00	0.05	100.63
ABRW93-88	JD-2	54.18	0.32	1.20	5.26	0.12	17.21	22.77	0.26	0.00	0.04	101.36
ABRW93-88	JD-2	53.05	0.22	1.11	6.21	0.20	16.03	22.49	0.42	0.00	0.00	99.73
ABRW93-88	JD-2	53.48	0.30	1.25	5.84	0.15	16.20	22.36	0.43	0.00	0.02	100.03
ABRW93-88	JD-2	53.20	0.23	1.16	6.42	0.22	16.16	21.86	0.35	0.00	0.05	99.65
ABRW93-88	JD-2	53.49	0.21	1.15	6.48	0.19	16.29	22.17	0.32	0.00	0.09	100.39
ABRW93-88	JD-2	53.32	0.25	1.25	6.28	0.21	15.81	22.44	0.54	0.00	0.08	100.18
ABRW93-88	JD-2	53.37	0.24	1.26	6.39	0.17	16.01	22.43	0.45	0.00	0.02	100.34
ABRW93-88	JD-2	53.40	0.24	1.23	6.60	0.18	15.80	22.54	0.50	0.00	0.01	100.50
ABRW93-88	JD-2	53.44	0.22	1.26	6.47	0.19	15.69	22.42	0.43	0.00	0.03	100.15
ABRW93-88	JD-2	51.86	0.24	1.26	6.51	0.23	15.52	21.85	0.51	0.00	0.04	98.02
ABRW93-88	JD-2	53.08	0.23	1.50	5.59	0.17	16.07	22.41	0.44	0.00	0.13	99.62
ABRW93-88	JD-2	53.21	0.35	1.33	6.54	0.18	16.09	21.93	0.48	0.00	0.05	100.16
ABRW93-88	JD-2	52.82	0.32	1.51	6.16	0.16	15.97	22.80	0.43	0.00	0.02	100.19
ABRW93-88	JD-2	52.64	0.24	1.45	7.11	0.24	15.75	22.22	0.46	0.00	0.05	100.16
ABRW93-88	JD-2	53.07	0.24	1.53	6.74	0.25	15.42	22.21	0.59	0.00	0.13	100.18
ABRW93-88	JD-2	52.82	0.25	1.58	6.73	0.21	15.36	22.14	0.56	0.00	0.07	99.72
ABRW93-88	JD-2	52.34	0.34	1.70	6.52	0.14	16.13	22.18	0.52	0.00	0.07	99.94
ABRW93-88	JD-2	52.73	0.26	1.47	7.74	0.26	14.66	21.96	0.63	0.00	0.00	99.71
ABRW93-88	JD-2	54.15	0.01	1.80	7.57	0.43	14.28	20.63	1.73	0.00	0.30	100.90
ABRW93-88	JD-2	51.88	0.54	2.31	6.34	0.12	16.08	21.54	0.58	0.00	0.05	99.44
ABRW93-88	JD-2	52.12	0.66	2.44	6.57	0.24	16.06	21.24	0.59	0.00	0.07	99.99
ABRW93-88	JD-2	53.24	0.33	2.06	8.26	0.25	14.73	22.13	0.77	0.00	0.05	101.82
ABRW93-88	JD-2	52.78	0.30	2.00	8.95	0.26	13.63	22.07	0.72	0.00	0.02	100.73
ABRW93-88	JD-2	51.64	0.28	3.00	8.90	0.22	13.37	22.26	0.79	0.00	0.12	100.58
ABRW93-88	JD-2	49.98	0.52	3.13	10.32	0.37	12.44	22.37	0.72	0.00	0.03	99.88
ABRW93-88	JD-2	51.51	0.42	3.19	10.26	0.05	12.40	21.21	0.75	0.00	0.00	99.79
ABRW93-88	JD-2	50.46	0.55	3.28	10.54	0.35	12.10	22.25	0.75	0.00	0.00	100.28
ABRW93-88	JD-2	50.69	0.45	3.96	9.62	0.18	12.98	21.06	0.83	0.00	0.10	99.87
ABRW93-88	JD-2	50.69	0.31	3.61	10.68	0.25	12.41	21.21	0.76	0.01	0.05	99.98
ABRW93-88	JD-2	49.12	0.61	5.53	12.18	0.08	10.16	21.38	1.00	0.00	0.07	100.13
RW-6	JD-3	54.39	0.19	0.53	3.88	0.10	18.52	22.14	0.15		0.39	100.29
RW-6	JD-3	53.97	0.24	0.87	3.99	0.11	17.79	22.13	0.25		0.56	99.91
RW-6	JD-3	54.44	0.19	0.50	3.71	0.10	18.55	22.27	0.14		0.31	100.21
RW-6	JD-3	52.81	0.62	1.23	5.71	0.10	16.89	22.16	0.26		0.23	100.01
RW-6	JD-3	54.91	0.25	0.79	3.90	0.09	18.45	22.88	0.25		0.65	102.17
RW-6	JD-3	54.89	0.17	0.51	3.87	0.12	18.88	22.06	0.19		0.45	101.14
RW-6	JD-3	55.12	0.23	0.89	3.84	0.08	18.18	22.73	0.28		0.69	102.04
RW-6	JD-3	54.66	0.20	0.46	3.75	0.09	18.59	22.04	0.15		0.38	100.32
RW-6	JD-3	52.99	0.40	1.01	4.82	0.10	17.37	21.86	0.26		0.50	99.31
RW-6	JD-3	54.11	0.42	0.97	4.85	0.10	17.66	22.64	0.25		0.47	101.47
RW-6	JD-3	54.92	0.20	0.46	3.94	0.11	18.79	22.17	0.15		0.41	101.15

CLINOPYROXENE
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Molecular Weight of Oxides

PT.#	Local	60.09 SiO2	79.90 TiO2	101.94 Al2O3	71.85 FeO*	70.94 MnO	40.32 MgO	56.08 CaO	61.98 Na2O	94.20 K2O	152.02 Cr2O3	Total
RW-6	JD-3	54.64	0.26	0.81	3.82	0.08	18.41	22.40	0.26		0.76	101.44
RW-7	JD-3	51.42	0.25	0.69	3.85	0.11	18.78	22.09	0.25		0.70	98.14
RW-7	JD-3	50.75	0.23	0.78	3.81	0.10	18.49	22.14	0.28		0.67	97.25
RW-7	JD-3	53.10	0.16	0.58	4.06	0.10	18.63	22.35	0.25		0.27	99.50
RW-7	JD-3	53.99	0.16	0.60	4.27	0.10	18.93	22.27	0.24		0.25	100.81
RW-7	JD-3	53.71	0.20	0.72	3.46	0.08	18.56	22.64	0.29		0.74	100.40
RW-7	JD-3	53.65	0.40	0.90	5.37	0.10	17.67	22.46	0.24		0.27	101.06
RW-7	JD-3	53.78	0.16	0.64	4.51	0.10	18.42	22.76	0.21		0.11	100.69
RW-7	JD-3	53.72	0.17	0.47	3.69	0.11	19.14	22.27	0.19		0.51	100.27
RW-7	JD-3	53.19	0.25	0.68	3.72	0.09	18.44	22.89	0.23		0.60	100.09
RW-7	JD-3	53.70	0.20	0.66	3.61	0.10	18.47	22.66	0.26		0.70	100.36
RW-7	JD-3	52.81	0.11	1.33	5.13	0.14	16.47	22.45	0.71		0.05	99.20
RW-7	JD-3	54.65	0.11	0.51	3.49	0.07	18.58	23.39	0.19		0.10	101.09
RW-7	JD-3	53.84	0.11	0.51	3.48	0.09	18.66	23.19	0.15		0.10	100.13
RW-7	JD-3	53.83	0.11	0.52	3.41	0.07	18.91	23.20	0.18		0.16	100.39
RW-7	JD-3	54.84	0.13	0.51	3.59	0.07	18.72	23.11	0.17		0.12	101.26
RW-7	JD-3	54.32	0.12	0.56	3.55	0.09	18.81	23.20	0.19		0.17	101.01
RW-7	JD-3	54.73	0.13	0.56	3.39	0.06	18.68	23.30	0.17		0.24	101.26
RW-7	JD-3	53.56	0.06	1.78	5.95	0.18	15.46	22.84	1.00		0.08	100.91
RW-7	JD-3	54.29	0.21	0.63	3.71	0.11	18.58	22.80	0.23		0.49	101.05
RW-7	JD-3	54.23	0.21	0.51	3.96	0.11	19.14	22.32	0.19		0.49	101.16
RW-7	JD-3	54.19	0.28	0.51	3.95	0.07	18.71	22.55	0.19		0.62	101.07
RW-7	JD-3	51.80	0.22	0.51	3.95	0.10	19.04	21.73	0.21		0.54	98.10
RW-7	JD-3	50.15	0.54	0.91	4.83	0.11	17.73	22.07	0.26		0.30	96.90
RW-7	JD-3	51.87	0.30	0.78	4.19	0.08	17.94	22.94	0.26		0.74	99.10
RW-7	JD-3	52.56	0.41	0.99	4.80	0.13	17.77	22.46	0.29		0.75	100.16
RW-8	JD-4	53.33	0.15	0.52	4.23	0.07	18.27	22.97	0.20		0.02	99.76
RW-8	JD-4	53.13	0.14	0.47	4.13	0.06	18.59	23.06	0.18		0.01	99.77
RW-8	JD-4	52.78	0.16	0.54	4.53	0.10	18.13	23.09	0.20		0.01	99.54
RW-8	JD-4	53.38	0.15	0.54	4.19	0.12	18.27	23.26	0.20		0.07	100.18
RW-8	JD-4	53.99	0.16	0.59	4.11	0.06	18.38	23.24	0.19		0.04	100.76
RW-8	JD-4	53.25	0.14	0.56	4.03	0.05	18.54	23.03	0.21		0.01	99.82
RW-8	JD-4	52.94	0.17	0.60	4.16	0.05	18.35	22.91	0.19		0.05	99.42
RW-8	JD-4	53.00	0.15	0.55	3.99	0.07	18.74	22.90	0.17		0.03	99.60
RW-8	JD-4	52.62	0.17	0.57	3.85	0.05	18.72	23.01	0.18		0.05	99.22
RW-8	JD-4	52.60	0.19	0.68	3.69	0.06	18.66	22.94	0.17		0.22	99.21
RW-8	JD-4	52.52	0.26	0.66	3.65	0.08	18.80	23.07	0.17		0.16	99.37
RW-8	JD-4	51.49	0.25	0.61	4.39	0.07	18.42	22.84	0.13		0.01	98.21
RW-8	JD-4	50.76	0.28	0.82	4.75	0.09	18.26	22.52	0.17		0.02	97.67
RW-8	JD-4	52.98	0.36	0.81	4.83	0.08	17.91	22.85	0.17		0.01	100.00
RW-8	JD-4	54.11	0.15	0.52	3.74	0.07	18.69	23.30	0.18		0.02	100.78
RW-8	JD-4	54.65	0.12	0.69	5.61	0.13	16.72	23.41	0.31		0.02	101.66
RW-10	JD-4	54.13	0.14	0.98	4.07	0.09	16.96	22.93	0.22			99.52
RW-10	JD-4	54.65	0.15	0.80	3.63	0.11	17.18	23.40	0.20			100.12
RW-10	JD-4	52.27	0.25	2.03	8.50	0.22	12.93	22.60	0.49			99.29
RW-10	JD-4	54.79	0.20	0.69	5.60	0.11	15.27	23.85	0.35			100.86
RW-10	JD-4	54.27	0.19	0.86	3.79	0.07	17.23	23.34	0.20			99.95
RW-10	JD-4	54.78	0.21	0.69	3.87	0.10	17.11	23.51	0.20			100.47
RW-10	JD-4	53.79	0.17	0.79	4.86	0.13	15.86	23.26	0.21			99.07
RW-10	JD-4	52.56	0.59	4.88	8.17	0.05	13.42	20.90	1.14		0.07	101.78
RW-10	JD-4	51.10	0.69	6.09	8.34	0.05	12.78	21.49	1.17		0.11	101.82

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Molecular Weight of Oxides

		60.09	79.90	101.94	71.85	70.94	40.32	56.08	61.98	94.20	152.02	
PT.#	Local	SiO2	TiO2	Al2O3	FeO*	MnO	MgO	CaO	Na2O	K2O	Cr2O3	Total
RW-10	JD-4	51.61	0.62	4.81	7.92	0.07	13.22	21.15	1.11		0.09	100.60
RW-10	JD-4	51.53	0.49	5.06	7.46	0.04	13.30	20.85	1.08		0.10	99.91
RW-10	JD-4	49.91	1.02	5.10	8.04	0.05	12.88	20.39	1.07		0.12	98.58
RW-10	JD-4	51.74	0.57	5.34	7.79	0.04	13.25	21.53	1.09		0.11	101.46
RW-10	JD-4	50.68	0.65	6.07	8.36	0.07	12.67	20.54	1.11		0.13	100.28
RW-10	JD-4	50.93	0.74	5.97	8.43	0.06	12.51	21.29	1.16		0.11	101.20
RW-10	JD-4	50.61	0.62	5.77	8.59	0.07	12.69	20.06	1.14		0.11	99.66
RW-10	JD-4	52.09	0.45	4.07	7.45	0.06	13.62	20.97	0.97		0.11	99.79
RW-10	JD-4	51.29	0.47	4.84	7.68	0.07	13.19	20.71	1.09		0.11	99.45
RW-10	JD-4	51.38	0.62	6.30	8.20	0.05	12.62	20.88	1.19		0.11	101.35
RW-10	JD-4	51.61	0.62	4.81	7.92	0.07	13.22	21.15	1.11		0.09	100.60
RW-10	JD-4	51.53	0.49	5.06	7.46	0.04	13.30	20.85	1.08		0.10	99.91
RW-10	JD-4	49.91	1.02	5.10	8.04	0.05	12.88	20.39	1.07		0.12	98.58
RW-10	JD-4	51.21	0.99	2.25	8.00	0.15	14.77	21.30	0.38		0.04	99.09
RW-10	JD-4	51.59	0.66	2.08	7.72	0.15	15.04	21.02	0.36		0.07	98.69
RW-10	JD-4	52.97	0.44	1.00	6.01	0.09	16.21	22.39	0.21		0.05	99.37
RW-10	JD-4	53.70	0.04	1.49	5.88	0.19	14.77	22.72	0.77		0.02	99.58
RW-10	JD-4	53.65	0.17	1.16	5.92	0.16	16.08	22.33	0.33		0.05	99.85
RW-10	JD-4	54.28	0.15	0.70	4.18	0.10	17.51	22.77	0.18		0.07	99.94
RW-10	JD-4	53.63	0.18	0.92	4.42	0.13	17.29	22.30	0.23		0.09	99.19
RW-10	JD-4	54.31	0.12	0.71	4.08	0.12	17.62	22.45	0.22		0.24	99.87
RW-10	JD-4	54.74	0.11	0.75	3.82	0.11	17.42	22.75	0.22		0.40	100.32
RW-10	JD-4	54.18	0.14	0.77	4.07	0.12	17.47	22.19	0.18		0.38	99.50
RW-10	JD-4	51.21	0.99	2.25	8.00	0.15	14.77	21.30	0.38		0.04	99.09
RW-10	JD-4	51.59	0.66	2.08	7.72	0.15	15.04	21.02	0.36		0.07	98.69
RW-10	JD-4	52.97	0.44	1.00	6.01	0.09	16.21	22.39	0.21		0.05	99.37
RW-10	JD-4	53.33	0.19	1.16	5.09	0.13	16.52	22.13	0.31		0.02	98.88
RW-10	JD-4	53.11	0.09	0.52	3.99	0.12	16.62	22.47	0.29		0.10	97.31
RW-10	JD-4	53.27	0.11	0.76	4.17	0.12	17.17	22.25	0.26		0.14	98.25
RW-10	JD-4	53.80	0.13	0.80	4.12	0.11	17.01	22.39	0.28		0.24	98.88
RW-10	JD-4	54.04	0.14	0.47	5.24	0.10	16.44	22.98	0.23		0.00	99.64
RW-10	JD-4	54.28	0.16	0.40	5.94	0.12	15.69	22.82	0.32		0.00	99.73
RW-10	JD-4	53.22	0.18	1.02	4.62	0.09	17.19	21.92	0.25		0.23	98.72
RW-10	JD-4	53.10	0.06	1.51	6.10	0.21	14.78	22.33	0.68		0.04	98.81
RW-10	JD-4	53.82	0.14	0.82	4.16	0.12	17.63	22.16	0.20		0.09	99.14
RW-10	JD-4	53.59	0.08	0.49	3.97	0.13	17.36	22.64	0.18		0.20	98.64
RW-10	JD-4	54.09	0.10	0.67	4.10	0.09	17.62	21.88	0.20		0.17	98.92
RW-10	JD-4	53.87	0.12	0.77	3.86	0.13	17.75	21.92	0.23		0.31	98.96
RW-10	JD-4	53.50	0.13	0.71	3.84	0.12	17.54	22.34	0.21		0.23	98.62
RW-10	JD-4	54.08	0.15	0.89	3.89	0.09	17.54	21.96	0.26		0.51	99.37
RW-10	JD-4	53.31	0.17	0.97	4.72	0.10	17.28	21.92	0.25		0.17	98.89
RW-10	JD-4	53.92	0.14	0.87	4.21	0.09	17.56	22.14	0.20		0.09	99.22
RW-10	JD-4	52.68	0.14	0.83	4.23	0.10	17.21	21.88	0.19		0.07	97.33
RW-10	JD-4	51.11	0.44	2.37	8.06	0.17	14.09	21.67	0.48		0.05	98.44
RW-10	JD-4	53.65	0.14	0.78	4.53	0.11	17.36	22.08	0.20		0.09	98.94
RW-11	JD-4	51.05	0.41	2.60	11.08	0.25	13.04	21.55	0.99		0.00	100.97
RW-11	JD-4	53.05	0.24	0.69	4.65	0.10	18.60	22.57	0.22		0.36	100.48
RW-11	JD-4	53.00	0.20	0.57	4.18	0.10	18.68	22.81	0.18		0.18	99.90
RW-11	JD-4	53.69	0.17	0.70	5.42	0.09	17.96	22.81	0.26		0.07	101.17
RW-11	JD-4	52.85	0.22	1.30	7.38	0.14	16.08	22.57	0.52		0.03	101.09
RW-11	JD-4	51.66	0.49	1.18	6.75	0.12	16.66	22.91	0.22		0.13	100.12

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Sample #	Pipe Number	Analysis I.D.	SiO2	TiO2	Al2O3	FeO*	MnO	MgO	CaO	Na2O	NiO	ZnO	Cr2O3	Total
			60.08	79.88	102	71.85	70.94	40.3	56.08	61.98		94.2	151.99	
	JD-1		0.00	0.85	3.43	20.56	0.00	11.28	0.18	0.00	0.08	0.22	63.24	99.84
	JD-1		0.00	1.18	3.93	24.06	0.22	9.86	0.15	0.00	0.03	0.06	60.34	99.83
	JD-1		0.00	0.85	3.74	22.43	0.01	10.18	0.11	0.00	0.12	0.13	61.93	99.50
	JD-1		0.00	0.90	3.63	24.86	0.24	8.65	0.21	0.00	0.14	0.14	60.98	99.75
	JD-1		0.00	0.83	3.92	22.33	0.19	10.10	0.15	0.00	0.17	0.00	62.98	100.67
	JD-1		0.00	0.69	3.53	24.03	0.23	9.02	0.19	0.00	0.19	0.19	61.35	99.42
	JD-1		0.00	0.67	3.55	21.00	0.00	10.56	0.14	0.00	0.12	0.04	62.56	98.64
	JD-1		0.00	0.86	3.96	20.31	0.00	11.63	0.21	0.00	0.00	0.12	62.73	99.82
	JD-1		0.00	0.81	3.16	25.13	0.86	7.96	0.20	0.00	0.00	0.16	62.24	100.52
	JD-1		0.00	1.06	3.72	24.42	0.39	8.67	0.19	0.00	0.23	0.19	60.56	99.43
	JD-1		0.00	0.99	3.77	23.47	0.00	9.78	0.21	0.00	0.04	0.26	61.26	99.78
	JD-1		0.00	1.21	4.22	21.74	0.00	11.42	0.14	0.00	0.04	0.09	61.11	99.97
	JD-1		0.00	0.92	3.47	24.68	0.14	8.78	0.16	0.00	0.12	0.09	61.48	99.84
	JD-1		0.00	0.86	3.31	24.87	0.25	8.56	0.17	0.00	0.11	0.22	61.96	100.31
	JD-1		0.00	0.83	3.55	23.39	0.29	8.07	0.18	0.01	0.03	0.08	61.49	97.92
	JD-1		0.00	0.95	3.64	22.55	0.00	10.00	0.20	0.00	0.06	0.21	62.34	99.95
	JD-1		0.00	0.98	3.65	25.29	0.08	8.72	0.14	0.00	0.22	0.08	61.80	100.96
	JD-1		0.00	0.98	3.86	18.24	0.00	12.53	0.23	0.00	0.21	0.19	63.69	99.93
	JD-1		0.00	0.50	15.76	17.98	0.30	7.29	0.09	0.12	0.23	0.19	56.73	99.19
	JD-1		0.00	0.92	3.67	24.27	0.03	8.81	0.17	0.00	0.18	0.21	61.47	99.73
	JD-1		0.00	0.11	17.73	26.86	0.27	5.61	0.11	0.34	0.00	0.19	47.98	99.20
	JD-1		0.00	0.12	18.08	23.68	0.26	7.64	0.16	0.17	0.00	0.12	49.21	99.44
	JD-1		0.00	0.90	3.45	25.07	0.06	8.14	0.19	0.00	0.00	0.12	61.98	99.91
	JD-1		0.00	1.02	3.69	30.15	0.22	4.84	0.10	0.00	0.03	0.03	59.27	99.35
	JD-1		0.00	0.12	45.12	15.38	0.00	17.52	0.11	3.00	0.14	0.12	20.37	101.88
	JD-1		0.00	0.93	3.33	22.03	0.00	10.67	0.18	0.00	0.12	0.16	62.24	99.66
	JD-1		0.00	0.88	3.44	22.79	0.00	10.24	0.16	0.00	0.14	0.04	61.84	99.53
	JD-1		0.00	0.07	10.17	20.60	0.00	9.74	0.16	0.00	0.11	0.13	58.76	99.74
	JD-1		0.00	0.02	34.36	17.94	0.00	13.93	0.05	0.40	0.00	0.22	32.98	99.90
RW-3	JD-1		0.00	0.91	3.19	22.68	0.37	10.83	0.02	0.00			62.12	100.12
RW-3	JD-1		0.00	0.84	3.11	22.85	0.40	10.81	0.03	0.00			62.00	100.04
RW-3	JD-1		0.01	0.90	3.16	22.88	0.38	10.78	0.02	0.00			62.20	100.33

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Sample #	Pipe Number	Analysis I.D.	SiO2	TiO2	Al2O3	FeO*	MnO	MgO	CaO	Na2O	NiO	ZnO	Cr2O3	Total
			60.08	79.88	102	71.85	70.94	40.3	56.08	61.98		94.2	151.99	
ABRW-88	JD-2	C1	0.09	1.43	6.79	29.75	0.30	10.02			0.29	0.20	49.97	98.84
ABRW-88	JD-2	D1	0.06	0.93	6.41	22.40	0.24	11.80			0.04	0.00	56.21	98.09
ABRW-88	JD-2	E1	0.13	0.51	4.64	16.24	0.19	13.94			0.24	0.01	63.82	99.72
ABRW-88	JD-2	F1	0.09	1.32	5.66	25.71	0.32	12.07			0.15	0.06	52.78	98.16
ABRW-88	JD-2	G1	0.17	0.63	5.21	18.56	0.26	13.11			0.12	0.11	60.17	98.34
ABRW-88	JD-2	H1	0.01	0.71	5.38	21.06	0.39	12.53			0.22	0.01	58.21	98.52
ABRW-88	JD-2	I1	0.11	0.65	6.68	18.84	0.35	13.47			0.13	0.00	58.45	98.68
ABRW-88	JD-2	C2	0.17	0.70	4.92	17.43	0.31	13.61			0.21	0.16	60.50	98.01
ABRW-88	JD-2	D2	0.20	0.75	5.35	19.81	0.30	13.04			0.14	0.00	59.03	98.62
ABRW-88	JD-2	E2	0.12	0.92	4.61	15.72	0.24	14.95			0.41	0.07	62.07	99.11
ABRW-88	JD-2	G2	0.09	0.81	5.29	18.95	0.31	13.08			0.16	0.19	59.67	98.55
ABRW-88	JD-2	H2	0.13	0.70	5.90	18.86	0.31	13.57			0.18	0.00	58.97	98.62
ABRW-88	JD-2	C3	0.18	0.69	6.33	18.65	0.26	13.52			0.24	0.00	58.24	98.11
ABRW-88	JD-2	D3	0.07	0.69	6.12	20.29	0.33	13.22			0.16	0.17	57.76	98.81
ABRW-88	JD-2	E3	0.17	0.75	5.16	19.39	0.39	13.07			0.12	0.00	58.43	97.48
ABRW-88	JD-2	I3	0.11	0.61	4.38	21.41	0.32	10.97			0.14	0.06	60.78	98.78
ABRW-88	JD-2	J3	0.07	1.39	6.24	30.17	0.38	9.91			0.16	0.08	49.82	98.22
ABRW-88	JD-2	A4	0.15	0.57	5.27	18.5	0.36	12.93			0.23	0.00	60.03	98.04
ABRW-88	JD-2	B4	0.15	0.59	4.59	18.03	0.34	13.46			0.25	0.00	60.85	98.26
ABRW-88	JD-2	C4	0.04	1.27	4.63	19.70	0.21	15.47			0.34	0.00	57.09	98.75
ABRW-88	JD-2	D4	0.11	0.76	5.42	21.12	0.25	12.49			0.11	0.00	57.99	98.25
ABRW-88	JD-2	F4	0.21	0.86	5.37	18.69	0.19	14.08			0.22	0.00	59.43	99.05
ABRW-88	JD-2	H4	0.10	0.65	4.72	16.32	0.33	14.35			0.16	0.06	61.77	98.46
ABRW-88	JD-2	I4	0.09	0.72	5.36	18.63	0.26	13.08			0.20	0.00	59.49	97.83
ABRW-88	JD-2	J4	0.15	1.18	6.56	20.50	0.32	13.46			0.24	0.17	55.56	98.14
ABRW-88	JD-2	A5	0.15	0.75	3.63	16.08	0.32	13.64			0.24	0.14	62.34	97.29
ABRW-88	JD-2	B5	0.15	0.97	5.2	19.14	0.28	13.59			0.23	0.11	58.72	98.39
ABRW-88	JD-2	C5	0.16	0.81	4.26	18.22	0.24	13.76			0.16	0.01	60.12	97.74
ABRW-88	JD-2	D5	0.06	1.25	4.76	22.76	0.3	12.2			0.13	0.03	55.63	97.12
ABRW-88	JD-2	E5	0.11	1.24	3.76	20.67	0.27	11.78			0.16	0.03	60.14	98.16
ABRW-88	JD-2	I5	0.15	0.99	5.79	19.86	0.26	13.06			0.27	0.2	58.12	98.70
ABRW-88	JD-2	A6	0.12	0.83	4.96	19.11	0.24	13.18			0.29	0.24	59.55	98.52
ABRW-88	JD-2	D6	0.15	0.93	3.67	15.4	0.23	14.24			0.26	0.06	62.84	97.78
ABRW-88	JD-2	E6	0.09	0.69	5.53	17.87	0.19	13.82			0.19	0.12	59	97.50
ABRW-88	JD-2	F6	0.13	1.6	6.13	28.99	0.32	10.53			0.09	0.17	49.82	97.78
ABRW-88	JD-2	H6	0.13	0.77	5.24	18.44	0.28	13.9			0.26	0.12	58.5	97.64
ABRW-88	JD-2	I6	0.14	0.98	5.61	19.69	0.3	13.25			0.13	0.15	58.05	98.30
ABRW-88	JD-2	A7	0.07	1.47	7.44	26.41	0.35	11.22			0.2	0.19	50.33	97.68
ABRW-88	JD-2	C7	0.14	0.95	4.99	19.53	0.25	13.48			0.23	0.23	58.8	98.60
ABRW-88	JD-2	D7	0.33	0.72	4.46	17.21	0.3	13.78			0.18	0.12	60.28	97.38

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Formula Based on 32 O
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Sample #	Pipe Number	Analysis I.D.	SiO2	TiO2	Al2O3	FeO*	MnO	MgO	CaO	Na2O	NiO	ZnO	Cr2O3	Total
			60.08	79.88	102	71.85	70.94	40.3	56.08	61.98		94.2	151.99	
ABRW-88	JD-2	E7	0.09	0.67	4.35	16.01	0.29	14.2			0.25	0.15	62.3	98.31
ABRW-88	JD-2	F7	0.1	0.04	4.7	28.82	0.49	4.14			0	0.54	58.45	97.28
ABRW-88	JD-2	G7	0.05	0.99	5.07	18.84	0.26	13.62			0.19	0.05	59.38	98.45
ABRW-88	JD-2	H7	0.4	1.53	5.54	25.93	0.34	10.82			0.14	0.22	52.83	97.75
ABRW-88	JD-2	I7	0.08	0.72	4.62	18.94	0.22	13.29			0.2	0.09	59.45	97.61
ABRW-88	JD-2	J7	0.12	1.43	5.27	24.46	0.29	11.03			0.12	0.18	54.88	97.78
ABRW-88	JD-2	A8	0.17	1.17	4.91	20.63	0.21	12.9			0.18	0.06	57.01	97.24
ABRW-88	JD-2	C8	0.14	0.87	4.78	19.05	0.24	13.52			0.14	0.15	58.62	97.51
ABRW-88	JD-2	E8	0.12	0.84	5.05	16.86	0.29	14.02			0.18	0.07	59.7	97.13
ABRW-88	JD-2	G8	0.11	0.82	5.23	18.03	0.26	13.21			0.27	0.08	59.11	97.12
ABRW-88	JD-2	H8	0.11	0.77	5.13	18.7	0.28	13.16			0.18	0.17	58.94	97.44
ABRW-88	JD-2	J8	0.09	0.91	4.67	19.5	0.33	12.81			0.19	0.12	58.54	97.16
ABRW-88	JD-2	B8-2	0.16	1.39	4.75	22.36	0.34	11.09			0.12	0.28	57.06	97.55
ABRW-88	JD-2	E1	0.11	1.11	6.22	20.71	0.26	13.62			0.18	0.01	56.66	98.88
ABRW-88	JD-2	H1	0.15	1.11	6.89	22.31	0.36	13.01			0.21	0.01	55.46	99.51
ABRW-88	JD-2	I1	0.11	0.67	5.55	18.5	0.22	13.39			0.2	0.01	59.64	98.29
ABRW-88	JD-2	J1	0.13	1.42	6.4	30.42	0.33	9.82			0.13	0.02	49.67	98.34
ABRW-88	JD-2	C2	0.1	0.8	5.15	20.25	0.35	13.44			0.16	0.01	59	99.26
ABRW-88	JD-2	D2	0.12	0.86	5.65	20.33	0.35	13.18			0.09	0.02	58.44	99.04
ABRW-88	JD-2	E2	0.08	0.65	5	16.09	0.3	14.26			0.28	0.01	62.13	98.80
ABRW-88	JD-2	G2	0.12	0.98	4.98	20.24	0.23	12.8			0.16	0	58.81	98.32
ABRW-88	JD-2	I2	0.15	0.62	4.83	18.8	0.32	13.01			0.21	0	61.84	99.78
ABRW-88	JD-2	J2	0.22	1.45	6.08	30.66	0.37	9.43			0.12	0	50.1	98.43
ABRW-88	JD-2	A3	0.11	0.7	5.27	18.3	0.19	12.9			0.15	0.01	61.12	98.75
ABRW-88	JD-2	B3	0.12	0.78	5.16	20.39	0.27	13.28			0.15	0.01	58.77	98.93
ABRW-88	JD-2	A9	0.06	0.87	4.26	19.84	0.36	12.98			0.21	0	60.74	99.32
ABRW-88	JD-2	D9	0.07	0.71	4.95	18.97	0.27	13.57			0.22	0	60.36	99.12
ABRW-88	JD-2	E9	0.12	0.89	6.02	19.74	0.33	13.21			0.19	0	58.65	99.15
ABRW-88	JD-2	F9	0.18	0.92	6.07	19.91	0.32	13.09			0.18	0	57.85	98.52
ABRW-88	JD-2	G9	0.11	0.81	5.02	19.29	0.32	13.4			0.17	0	60.26	99.38
ABRW-88	JD-2	H9	0.05	0.64	3.83	21.91	0.36	11.19			0.18	0.01	61.39	99.56
ABRW-88	JD-2	J9	0.08	0.69	5.91	19.76	0.24	13.26			0.22	0.01	58.02	98.19
ABRW-88	JD-2	A10	0.08	0.59	5.85	17.46	0.26	13.9			0.18	0	60.94	99.26
ABRW-88	JD-2	C10	0.04	0.75	5.02	19.47	0.31	12.93			0.16	0.01	60.41	99.10
ABRW-88	JD-2	D10	0.12	1.27	5.54	24.8	0.32	10.99			0.17	0	55.09	98.30
ABRW-88	JD-2	G10	0.08	1.23	6.25	20.74	0.34	13.54			0.22	0	56.44	98.84
ABRW-88	JD-2	H10	0.08	1.63	6.03	31.6	0.37	9.65			0.11	0.02	48.73	98.22
RW-10	JD-4		0.07	1.57	46.76	44.71	0.31	6.35	0.02				0.00	99.79
RW-10	JD-4		2.30	2.08	44.30	43.40	0.42	6.39	0.03				0.88	99.80
RW-10	JD-4		0.09	4.67	6.41	78.88	0.57	0.93	0.03				0.48	92.06

ILMENITE
Southern Alberta

Formula Based on 6 O
Molecular Weight of Oxides

Sample #		SiO2	TiO2	Al2O3	FeO*	MnO	MgO	CaO	Na2O	K2O	NiO	ZnO	Cr2O3	Total
		60.08	79.88	102	71.85	70.94	40.3	56.08	61.98	94.2			151.99	
	JD-1	2.04	44.67	0.27	45.85	1.29	2.70	0.07	0.00	0.00			0.00	96.89
	JD-1	0.00	52.90	0.03	44.22	1.41	1.22	0.01	0.00	0.00			0.00	99.79
	JD-1	0.00	42.96	0.71	50.64	0.73	4.75	0.04	0.00	0.00			0.00	99.83
	JD-1	0.00	41.92	0.75	50.98	0.72	5.42	0.07	0.00	0.00			0.00	99.86
	JD-1	0.00	44.37	0.00	55.74	0.76	0.78	0.10	0.00	0.00			0.00	101.75
	JD-1	0.00	43.78	0.16	53.74	0.73	1.34	0.06	0.00	0.00			0.00	99.81
	JD-1	0.00	44.41	0.11	53.42	0.63	1.33	0.01	0.00	0.00			0.00	99.91
RW-3	JD-1	2.64	50.28	1.79	41.09	2.54	0.06	0.02	0.00	0.58			0.00	99.00
ABRW93AA-88	JD-2	0.03	43.46	0.29	44.1	0.28	7.63				0.15	0.04	0.38	96.36
ABRW93AA-88	JD-2	0	46.71	0.7	46.8	0.47	3.72				0	0.24	0.02	98.66
ABRW93AA-88	JD-2	0.03	47.24	0.63	46.59	0.62	2.74				0	0.21	0.08	98.14
ABRW93AA-88	JD-2	0.01	47.45	0.26	46.03	0.34	4.25				0.01	0.15	0	98.50
ABRW93AA-88	JD-2	0.1	48.74	0.59	44.42	0.46	3.96				0	0.15	0.01	98.43
ABRW93AA-88	JD-2	0.05	48.76	0.26	44.14	0.52	4.33				0	0.15	0	98.21
ABRW93AA-88	JD-2	0.07	47.59	0.51	46.87	0.64	2.36				0	0.2	0	98.24
ABRW93AA-88	JD-2	0	43.05	0.28	44.75	0.22	7.44				0.07	0.02	0.28	96.11
ABRW93AA-88	JD-2	0	49.2	0.44	43.48	0.44	4.99				0	0.1	0.02	98.67
ABRW93AA-88	JD-2	0.14	44.55	0.43	44.45	0.43	6.81				0.1	0	1.03	97.94
RW-10	JD-4	1.17	46.82	0.58	42.56	0.61	5.38	0.08					0.11	97.31
RW-10	JD-4	0.00	45.51	0.57	46.55	0.55	4.36	0.04					0.26	97.84
RW-10	JD-4	0.00	44.73	0.43	48.71	0.23	3.27	0.03					0.21	97.61
RW-10	JD-4	0.25	43.50	1.15	48.01	0.39	3.31	0.04					0.29	96.94

MICAS
Southern Alberta
COMMENTS:Cr2O3 not used in calculation.

Formula Based on 12 O + (OH+F+Cl)
Molecular Weights of Oxides

			60.090	79.900	101.940	152.020	71.850	70.940	40.320	56.080	61.980	94.200	153.360	35.457	19.000	17.000	18.010	
			SiO2	TiO2	Al2O3	CR2O3	FeO*	MnO	MgO	CaO	Na2O	K2O	BaO	Cl	F	(F,Cl)	H2O	Total
BB	JD-1		40.650	1.760	17.020	0.070	9.650	0.120	20.290	0.060	0.850	9.530		0.000		0.000	4.344	104.34
BB	JD-1		43.170	1.510	13.820	1.350	3.190	0.060	21.030	0.000	0.980	9.600		0.050		-0.011	4.204	98.95
BB	JD-1		40.280	3.780	15.550	0.040	10.660	0.100	19.210	0.000	0.960	9.290		0.000		0.000	4.311	104.18
BB	JD-1		41.760	2.830	13.360	0.160	11.240	0.150	20.260	0.040	1.140	8.980		0.020		-0.005	4.306	104.24
BB	JD-1		44.160	2.350	13.040	0.230	12.410	0.230	16.400	0.160	1.250	7.050		0.530		-0.120	4.375	102.06
BB	JD-1		38.590	5.440	13.670	0.130	13.410	0.170	16.370	0.000	0.940	9.190		0.010		-0.002	4.137	102.05
BB	JD-1		39.970	4.220	12.790	0.130	13.380	0.210	17.160	0.000	0.920	9.170		0.000		0.000	4.168	102.12
BB	JD-1		40.640	4.940	14.070	0.150	10.640	0.140	19.030	0.000	1.000	9.230		0.010		-0.002	4.301	104.15
BB	JD-1		39.540	5.970	12.910	0.180	14.200	0.210	16.840	0.000	0.870	9.220		0.000		0.000	4.217	104.16
BB	JD-1		40.380	7.010	12.940	0.040	12.050	0.170	17.450	0.000	1.140	8.420		0.000		0.000	4.275	103.87
BB	JD-1		39.750	7.070	13.150	0.170	13.120	0.200	16.540	0.000	0.930	9.010		0.000		0.000	4.246	104.19
BB	JD-1		40.380	4.790	14.550	0.260	10.570	0.180	19.120	0.000	0.940	9.260		0.000		0.000	4.305	104.36
RW 3	JD-1		37.650	0.660	11.210	1.190	3.940	0.000	24.220	2.860	2.870	0.000			1.100	-0.463	3.378	88.61
RW 3	JD-1		40.010	0.930	11.990	0.670	3.800	0.000	24.490	2.620	0.610	1.000			1.390	-0.585	3.388	90.31
RW 3	JD-1		39.650	0.740	12.020	0.840	3.970	0.010	24.050	2.840	1.160	0.000			1.020	-0.429	3.512	89.38
RW 3	JD-1		37.700	0.900	11.510	0.360	6.650	0.040	23.210	2.370	0.420	4.020			1.850	-0.779	3.094	91.34
RW 3	JD-1		38.530	1.840	12.080	0.000	7.950	0.030	21.960	3.480	0.430	0.050			1.040	-0.438	3.496	90.45
RW 3	JD-1		36.860	2.540	14.730	0.120	14.400	0.130	15.950	0.120	0.460	8.740			0.980	-0.413	3.547	98.16
RW 3	JD-1		37.880	2.840	14.460	0.100	13.250	0.160	16.230	0.150	0.440	8.630			1.190	-0.501	3.495	98.32
RW 3	JD-1		37.600	1.250	11.810	0.080	8.570	0.070	21.530	1.100	0.310	5.320			1.500	-0.632	3.227	91.74
RW 3	JD-1		33.840	3.860	14.610	0.200	12.340	0.050	16.320	0.010	0.410	7.620			0.830	-0.349	3.437	93.18
RW 4	JD-1		39.300	2.440	12.700	0.100	11.430	0.070	19.670	0.080	0.560	8.410			1.310	-0.552	3.513	99.03
RW 4	JD-1		38.730	2.420	13.550	0.140	11.190	0.100	19.390	0.090	0.570	8.470			1.300	-0.547	3.512	98.91
RW 4	JD-1		41.030	0.940	12.490	1.200	7.780	0.050	21.960	0.030	0.730	9.050			1.650	-0.695	3.413	99.63
RW 4	JD-1		39.620	1.980	12.810	0.100	11.020	0.100	20.240	0.010	0.620	9.250			1.360	-0.573	3.524	100.06
RW 4	JD-1		39.110	1.630	13.980	0.190	11.430	0.090	19.120	0.040	0.550	9.090			1.340	-0.564	3.507	99.51
RW 4	JD-1		38.890	1.700	13.670	0.170	11.410	0.080	19.620	0.060	0.590	9.130			1.520	-0.640	3.427	99.63
RW 4	JD-1		39.380	0.710	11.820	0.910	8.330	0.050	22.120	0.140	0.440	7.210			2.010	-0.846	3.109	95.38
RW 4	JD-1		39.620	0.760	12.090	0.860	8.240	0.040	22.910	0.180	0.440	5.220			2.060	-0.867	3.112	94.66
RW 4	JD-1		39.850	0.900	12.030	0.550	8.380	0.030	22.620	0.200	0.370	5.310			2.080	-0.876	3.110	94.55
RW 4	JD-1		42.520	0.680	11.450	0.370	3.880	0.000	24.230	0.220	0.310	9.220			1.940	-0.817	3.308	97.31
RW 4	JD-1	112.000	37.430	1.760	13.660	0.670	9.810	0.080	19.300	0.110	0.610	8.280			1.470	-0.619	3.309	95.87
RW 4	JD-1	224.000	38.830	1.830	13.470	0.440	9.790	0.080	20.140	0.100	0.630	8.400			1.530	-0.644	3.389	97.98
RW 4	JD-1	336.000	38.910	1.720	13.500	0.470	10.000	0.090	20.510	0.100	0.640	8.340			1.610	-0.678	3.375	98.59
RW 4	JD-1	448.000	38.230	1.780	13.350	0.390	10.150	0.080	20.190	0.060	0.620	8.440			1.310	-0.552	3.453	97.50
RW 4	JD-1	560.000	38.150	1.750	13.570	0.360	10.160	0.090	19.050	0.280	0.640	8.150			1.120	-0.472	3.496	96.34
RW 4	JD-1	672.000	38.640	1.900	13.840	0.420	13.320	0.080	19.360	0.100	0.630	8.060			1.060	-0.446	3.645	100.61
RW 4	JD-1	784.000	39.960	1.850	13.440	0.410	10.070	0.060	19.610	0.130	0.630	8.240			1.230	-0.518	3.562	98.67
RW 4	JD-1	896.000	38.110	1.930	13.350	0.390	10.410	0.080	19.270	0.610	0.630	8.590			1.100	-0.463	3.530	97.54
RW 4	JD-1	1008.000	38.520	1.800	14.330	0.370	10.520	0.070	19.500	0.050	0.650	8.880			1.310	-0.552	3.505	98.95
RW 4	JD-1	1120.000	39.330	1.830	13.440	0.370	10.000	0.070	20.140	0.080	0.630	8.660			1.550	-0.653	3.415	98.86
RW 4	JD-1		36.390	4.150	13.690	0.070	12.790	0.100	18.260	0.060	0.630	8.390			1.270	-0.535	3.465	98.73
RW 4	JD-1		36.300	3.300	14.690	0.050	15.380	0.080	16.120	0.010	0.400	8.600			0.610	-0.257	3.726	99.01
RW 4	JD-1		37.530	2.610	13.440	0.050	15.670	0.070	17.030	0.000	0.300	8.890			0.670	-0.282	3.724	99.70
RW 4	JD-1		35.830	3.210	14.230	0.060	15.390	0.080	16.310	0.000	0.340	8.590			0.630	-0.265	3.671	98.08

MICAS
Southern Alberta
COMMENTS:Cr203 not used in calculation.

Formula Based on 12 O + (OH+F+Cl)
Molecular Weights of Oxides

			SiO2	TiO2	Al2O3	CR2O3	FeO*	MnO	MgO	CaO	Na2O	K2O	BaO	Cl	F	(F,Cl)	H2O	Total
			60.090	79.900	101.940	152.020	71.850	70.940	40.320	56.080	61.980	94.200	153.360	35.457	19.000	17.000	18.010	
RW 4	JD-1		37.640	2.510	13.280	0.030	15.390	0.070	17.050	0.000	0.270	8.990			0.560	-0.236	3.761	99.31
RW 4A	JD-1		40.080	1.720	12.430	0.150	8.170	0.060	21.630	0.140	0.640	9.500			1.470	-0.619	3.472	98.84
RW 4A	JD-1		39.970	1.430	12.170	0.180	10.630	0.080	21.000	0.420	0.400	7.330			1.550	-0.653	3.402	97.91
RW 4A	JD-1		37.910	2.860	13.470	0.080	15.780	0.070	16.690	0.040	0.300	9.140			0.660	-0.278	3.755	100.48
RW 4A	JD-1		39.240	1.920	13.800	0.380	10.570	0.090	19.800	0.070	0.670	9.030			1.300	-0.547	3.545	99.87
RW 4A	JD-1		41.470	1.530	12.050	0.520	8.270	0.060	21.670	0.250	0.650	9.710			1.430	-0.602	3.550	100.56
RW 4A	JD-1		40.160	1.750	12.530	0.320	8.000	0.070	22.120	0.170	0.500	9.250			1.440	-0.606	3.505	99.21
RW 4A	JD-1		37.270	3.220	14.050	0.050	15.570	0.080	16.520	0.010	0.330	9.230			0.570	-0.240	3.791	100.45
RW 4A	JD-1		40.470	0.980	12.430	0.790	7.930	0.050	22.610	0.070	0.530	8.610			1.470	-0.619	3.477	98.80
RW 4A	JD-1		41.420	0.820	12.840	1.590	4.420	0.030	24.560	0.040	0.500	10.150			1.650	-0.695	3.488	100.81
RW 4A	JD-1		40.630	0.780	12.500	1.400	4.480	0.010	24.800	0.230	0.370	9.700			1.510	-0.636	3.492	99.27
RW 4A	JD-1		37.880	2.080	14.790	0.610	11.290	0.090	18.980	0.150	0.650	9.060			1.270	-0.535	3.524	99.84
RW 4A	JD-1		40.330	1.790	13.060	0.280	9.620	0.070	20.940	0.020	0.620	10.160			1.400	-0.589	3.562	101.26
RW 4A	JD-1		38.630	4.350	13.590	0.060	11.220	0.090	18.630	0.090	0.630	8.960			1.580	-0.665	3.447	100.61
RW 5	JD-1		38.580	2.550	15.520	0.180	13.630	0.140	15.490	0.050	0.940	8.970			0.680	-0.286	3.787	100.23
RW 5	JD-1		38.240	2.650	13.890	0.030	13.420	0.090	17.310	0.010	0.690	8.480			0.810	-0.341	3.689	98.97
RW 5	JD-1		37.790	2.850	14.690	0.140	13.310	0.140	17.160	0.010	0.700	8.930			0.860	-0.362	3.691	99.91
RW 5	JD-1		36.690	2.820	14.880	0.190	14.500	0.160	16.090	0.150	0.730	8.630			0.720	-0.303	3.683	98.94
RW 5	JD-1		37.000	2.760	14.710	0.330	13.120	0.140	17.050	0.000	0.730	8.520			0.830	-0.349	3.642	98.48
RW 5	JD-1		37.280	2.770	14.360	0.240	13.660	0.150	17.090	0.000	0.710	8.620			0.880	-0.371	3.635	99.02
RW 5	JD-1		35.800	2.670	15.850	0.080	15.210	0.120	15.960	0.010	0.660	8.890			0.630	-0.265	3.722	99.34
RW 5	JD-1		37.110	2.610	14.630	0.050	14.400	0.120	16.320	0.020	0.670	8.210			0.800	-0.337	3.644	98.25
RW 5	JD-1		37.100	2.580	14.180	0.060	14.050	0.110	16.940	0.010	0.650	8.470			0.880	-0.371	3.607	98.27
RW 5	JD-1		37.890	3.010	13.900	0.080	14.080	0.110	16.950	0.010	0.710	8.780			0.900	-0.379	3.653	99.69
RW 5	JD-1		37.350	2.860	14.520	0.060	12.980	0.100	17.560	0.000	0.770	8.610			1.000	-0.421	3.602	98.99
RW 6	JD-3		40.130	1.460	13.300	0.300	5.360	0.010	23.390	0.000	0.310	9.930			0.920	-0.387	3.744	98.47
RW 6	JD-3		40.020	1.330	13.390	0.920	5.540	0.010	23.240	0.100	0.410	9.270			0.850	-0.358	3.759	98.48
RW 6	JD-3		40.950	1.270	13.550	1.900	4.490	0.000	23.720	0.000	0.230	10.190			1.070	-0.451	3.724	100.64
RW 6	JD-3		40.170	1.260	13.120	1.330	6.470	0.060	22.310	0.000	0.340	9.740			1.880	-0.792	3.296	99.18
RW 6	JD-3		40.540	1.470	13.750	0.610	5.540	0.040	23.480	0.000	0.320	10.040			0.870	-0.366	3.821	100.11
RW 6	JD-3		41.330	1.620	13.330	0.420	5.530	0.010	23.430	0.000	0.330	10.010			0.750	-0.316	3.898	100.34
RW 6	JD-3		40.450	1.460	13.950	0.300	5.520	0.020	23.450	0.020	0.340	9.820			0.770	-0.324	3.863	99.64
RW 6	JD-3		37.210	5.970	12.870	0.020	14.870	0.120	15.340	0.030	0.380	8.840			1.590	-0.669	3.337	99.91
RW 6	JD-3		40.630	1.500	13.500	0.760	5.330	0.020	23.220	0.010	0.310	9.610			0.910	-0.383	3.774	99.19
RW 6	JD-3		36.530	5.850	12.830	0.030	16.710	0.190	13.740	0.010	0.360	8.570			1.620	-0.682	3.252	99.01
RW 6	JD-3		40.650	1.460	13.060	0.470	5.210	0.030	23.480	0.010	0.320	10.070			0.880	-0.371	3.782	99.05
RW 6	JD-3		41.380	1.160	13.380	1.280	4.540	0.020	23.850	0.020	0.330	10.060			0.850	-0.358	3.838	100.35
RW 7	JD-3	187.000	39.480	1.480	13.090	0.460	5.170	0.030	23.130	0.010	0.330	10.000			1.930	-0.813	3.252	97.55
RW 7	JD-3	374.000	40.260	1.410	13.110	0.310	5.010	0.020	23.550	0.000	0.300	10.120			0.840	-0.354	3.776	98.35
RW 7	JD-3	561.000	40.560	1.040	13.240	0.390	4.730	0.020	23.710	0.000	0.250	10.260			0.960	-0.404	3.733	98.49
RW 7	JD-3	748.000	40.800	1.360	13.250	0.680	4.770	0.020	23.710	0.040	0.280	10.310			0.840	-0.354	3.815	99.52
RW 7	JD-3	935.000	40.540	1.420	13.200	0.580	4.720	0.020	23.680	0.000	0.290	10.180			0.790	-0.333	3.817	98.90
RW 7	JD-3	1122.000	40.400	1.370	13.310	0.540	4.800	0.020	23.720	0.000	0.180	10.210			0.870	-0.366	3.779	98.83
RW 7	JD-3	1309.000	40.650	1.420	13.210	0.560	4.820	0.010	23.510	0.000	0.190	10.320			0.850	-0.358	3.793	98.97
RW 7	JD-3	1496.000	40.480	1.450	13.230	0.470	4.860	0.020	23.500	0.000	0.180	10.260			0.910	-0.383	3.759	98.74

MICAS (cont'd)
Southern Alberta
COMMENTS:Cr2O3 not used in calculation.

Formula Based on 12 O + (OH+F+Cl)
Molecular Weights of Oxides

			60.090 SiO2	79.900 TiO2	101.940 Al2O3	152.020 CR2O3	71.850 FeO*	70.940 MnO	40.320 MgO	56.080 CaO	61.980 Na2O	94.200 K2O	153.360 BaO	35.457 Cl	19.000 F	17.000 (F,Cl)	18.010 H2O	Total
RW 7	JD-3	1683.000	40.570	1.470	13.320	0.360	4.910	0.010	23.790	0.000	0.200	10.270			0.920	-0.387	3.778	99.21
RW 7	JD-3	1870.000	40.760	1.250	13.180	0.680	4.760	0.010	23.750	0.000	0.160	10.410			0.920	-0.387	3.769	99.26
RW 7	JD-3	2057.000	40.450	1.420	13.500	0.450	4.890	0.030	23.680	0.010	0.170	10.310			0.940	-0.396	3.766	99.22
RW 7	JD-3		39.660	1.740	13.880	0.440	5.600	0.010	22.500	0.060	0.360	9.630			0.720	-0.303	3.811	98.11
RW 7	JD-3		39.910	1.800	13.450	0.060	6.440	0.020	22.490	0.120	0.540	9.150			0.900	-0.379	3.746	98.25
RW 7	JD-3		39.830	1.240	12.860	1.150	4.390	0.010	22.860	0.010	0.220	10.020			0.860	-0.362	3.679	96.77
RW 7	JD-3		39.110	1.380	13.060	0.430	4.900	0.010	22.610	0.020	0.290	9.810			0.860	-0.362	3.655	95.77
RW 8	JD-5	420.000	40.940	1.050	13.310	0.660	4.670	0.000	24.160	0.030	0.250	10.240			1.170	-0.493	3.684	99.67
RW 8	JD-5	840.000	40.530	1.100	13.020	0.380	4.940	0.010	23.910	0.000	0.200	10.380			0.850	-0.358	3.784	98.75
RW 8	JD-5	1260.000	40.880	0.980	12.690	0.610	4.690	0.000	24.040	0.000	0.190	10.550			0.820	-0.345	3.797	98.90
RW 8	JD-5	1680.000	41.160	1.060	12.800	0.400	4.770	0.010	24.210	0.000	0.190	10.510			0.910	-0.383	3.791	99.43
RW 8	JD-5	2100.000	40.930	1.090	13.080	0.370	4.660	0.010	24.120	0.000	0.130	10.490			0.820	-0.345	3.824	99.18
RW 8	JD-5	2520.000	41.040	1.070	13.130	0.520	4.820	0.000	24.050	0.000	0.110	10.490			0.820	-0.345	3.831	99.54
RW 8	JD-5	2940.000	41.000	1.060	13.190	0.530	4.710	0.010	23.960	0.000	0.130	10.560			0.890	-0.375	3.797	99.46
RW 8	JD-5	3360.000	40.820	1.070	12.930	0.560	4.690	0.020	23.900	0.000	0.120	10.530			0.870	-0.366	3.780	98.92
RW 8	JD-5	3780.000	40.890	1.070	13.000	0.600	4.490	0.020	24.050	0.000	0.100	10.520			0.910	-0.383	3.771	99.04
RW 8	JD-5	4200.000	41.090	1.100	13.210	0.580	4.510	0.030	23.890	0.000	0.130	10.570			0.890	-0.375	3.798	99.42
RW 8	JD-5	4620.000	41.370	1.100	13.040	0.410	4.720	0.010	24.120	0.000	0.180	10.530			0.800	-0.337	3.858	99.80
RW 8	JD-5	5040.000	42.280	1.080	13.370	0.380	4.750	0.020	24.450	0.000	0.180	10.700			0.870	-0.366	3.910	101.62
RW 8	JD-5	5460.000	42.180	1.130	13.190	0.410	4.980	0.020	24.640	0.000	0.220	10.770			0.890	-0.375	3.904	101.96
RW 8	JD-5	5880.000	42.090	1.100	13.280	0.430	5.000	0.030	24.530	0.010	0.200	10.750			0.900	-0.379	3.894	101.84
RW 8	JD-5	6300.000	42.220	1.080	13.480	0.550	5.290	0.010	24.230	0.000	0.240	10.700			0.860	-0.362	3.921	102.22
RW 8	JD-5	6720.000	40.770	1.120	14.570	0.410	5.670	0.010	23.430	0.000	0.270	10.650			0.760	-0.320	3.915	101.26
RW 8	JD-5	7140.000	41.180	1.130	14.090	0.750	5.550	0.030	23.790	0.000	0.220	10.710			0.870	-0.366	3.880	101.83
RW 8	JD-5	7560.000	41.730	1.160	14.010	0.810	5.300	0.010	23.770	0.010	0.220	10.720			0.840	-0.354	3.913	102.14
RW 8	JD-5	7980.000	41.190	1.130	13.950	0.820	5.250	0.030	24.030	0.000	0.200	10.650			0.800	-0.337	3.905	101.62
RW 8	JD-5	8400.000	41.730	1.070	13.730	0.430	4.760	0.020	24.640	0.000	0.220	10.780			0.860	-0.362	3.912	101.79
RW 8	JD-5	8820.000	41.350	1.070	13.920	1.440	4.640	0.010	23.970	0.010	0.230	10.610			0.940	-0.396	3.833	101.63
RW 8	JD-5		42.240	1.070	13.280	0.430	5.010	0.010	24.580	0.000	0.120	10.750			0.960	-0.404	3.874	101.92
RW 8	JD-5		41.180	1.080	13.950	0.920	4.650	0.020	24.240	0.010	0.270	10.410			1.070	-0.451	3.779	101.13
RW 8	JD-5		41.410	1.760	13.180	0.070	7.000	0.010	22.810	0.010	0.250	10.230			0.730	-0.307	3.920	101.07
RW 8	JD-5		40.240	2.000	13.150	0.030	6.370	0.050	23.160	0.010	0.260	10.330			1.460	-0.615	3.553	100.00
RW 10	JD-4		38.070	1.830	16.360	0.080	11.090	0.110	17.760	0.000	0.480	9.290			0.650	-0.274	3.808	99.25
RW 10	JD-4		39.330	1.490	15.320	0.180	10.460	0.120	18.650	0.040	0.460	9.320			0.690	-0.291	3.819	99.59
RW 10	JD-4		39.410	1.270	13.520	1.000	5.890	0.040	23.310	0.030	0.360	9.860			1.310	-0.552	3.550	99.00
RW 10	JD-4		38.840	1.390	13.950	0.270	6.470	0.030	22.590	0.040	0.390	9.630			1.190	-0.501	3.577	97.87
RW 10	JD-4		41.460	1.070	11.270	0.350	5.630	0.020	25.050	0.120	0.340	8.690			0.990	-0.417	3.729	98.30
RW 10	JD-4		40.010	1.380	13.720	0.360	6.330	0.030	23.370	0.030	0.300	9.860			0.860	-0.362	3.801	99.69
RW 10	JD-4		39.140	1.570	15.370	0.150	10.630	0.090	18.460	0.040	0.440	9.300			0.630	-0.265	3.835	99.39
RW 10	JD-4	80.000	37.710	1.750	14.910	0.180	9.610	0.110	18.090	0.120	0.460	9.270			0.710	-0.299	3.672	96.29
RW 10	JD-4	160.000	38.270	1.680	15.320	0.180	10.460	0.120	18.000	0.060	0.440	9.130			0.650	-0.274	3.757	97.79
RW 10	JD-4	240.000	37.210	1.430	14.700	0.170	10.700	0.100	17.990	0.150	0.410	8.900			0.720	-0.303	3.631	95.81
RW 10	JD-4	320.000	37.490	1.500	15.400	0.180	10.380	0.110	18.140	0.050	0.450	8.950			0.650	-0.274	3.711	96.74
RW 10	JD-4	400.000	38.990	1.520	15.210	0.210	10.670	0.120	18.390	0.030	0.460	9.270			0.640	-0.269	3.811	99.05
RW 10	JD-4	480.000	38.690	1.570	15.420	0.170	10.560	0.110	18.570	0.070	0.440	9.160			0.700	-0.295	3.784	98.95

MICAS (cont'd)
Southern Alberta
COMMENTS:Cr203 not used in calculation.

Formula Based on 12 O + (OH+F+Cl)
Molecular Weights of Oxides

			60.090 SiO2	79.900 TiO2	101.940 Al203	152.020 CR203	71.850 FeO*	70.940 MnO	40.320 MgO	56.080 CaO	61.980 Na2O	94.200 K2O	153.360 BaO	35.457 Cl	19.000 F	17.000 (F,Cl)	18.010 H2O	Total
RW 10	JD-4	560.000	37.020	1.320	14.670	0.100	9.870	0.110	16.640	0.070	0.520	9.000			0.680	-0.286	3.561	93.27
RW 10	JD-4	640.000	38.940	1.720	15.440	0.070	10.930	0.130	18.380	0.060	0.480	9.190			0.640	-0.269	3.833	99.54
RW 10	JD-4	720.000	38.700	1.880	16.050	0.080	8.530	0.090	19.690	0.050	0.480	9.440			0.800	-0.337	3.789	99.24
RW 10	JD-4		37.170	3.070	15.030	0.010	15.600	0.090	15.360	0.120	0.470	8.640			0.350	-0.147	3.872	99.63
RW 10	JD-4		37.160	3.120	15.170	0.020	16.110	0.100	14.680	0.040	0.540	8.850			0.410	-0.173	3.842	99.87
RW 10	JD-4		40.010	1.610	15.050	0.190	10.700	0.100	18.160	0.040	0.460	9.930			0.810	-0.341	3.792	100.51
RW 10	JD-4		36.440	2.970	15.370	0.020	15.560	0.120	15.280	0.010	0.480	8.980			0.380	-0.160	3.831	99.28
RW 10	JD-4		40.710	1.550	13.200	0.390	6.420	0.030	23.470	0.040	0.250	9.690			0.810	-0.341	3.845	100.06
RW 11	JD-4	286.000	39.750	1.660	14.240	0.370	6.520	0.020	22.390	0.000	0.480	9.760			1.080	-0.455	3.696	99.51
RW 11	JD-4	572.000	38.500	1.730	13.710	0.950	12.680	0.060	17.470	0.000	0.550	9.350			0.950	-0.400	3.597	99.15
RW 11	JD-4	858.000	39.810	1.130	13.180	0.500	13.340	0.100	18.370	0.010	0.420	9.660			0.860	-0.362	3.712	100.73
RW 11	JD-4	1144.000	40.540	1.210	13.340	0.350	8.670	0.050	21.670	0.000	0.180	10.350			1.070	-0.451	3.704	100.68
RW 11	JD-4	1430.000	41.230	1.230	13.780	0.360	5.290	0.020	23.700	0.000	0.210	10.440			1.220	-0.514	3.706	100.67
RW 11	JD-4	1716.000	40.700	1.240	13.920	0.650	5.060	0.020	23.590	0.000	0.180	10.500			1.070	-0.451	3.739	100.22
RW 11	JD-4	2002.000	40.690	1.240	14.000	0.630	5.210	0.030	23.690	0.000	0.180	10.520			1.090	-0.459	3.742	100.56
RW 11	JD-4	2288.000	40.730	1.170	13.150	0.460	7.310	0.030	22.590	0.000	0.290	10.290			1.020	-0.429	3.733	100.34
RW 11	JD-4	2574.000	39.220	1.150	13.540	0.580	11.960	0.090	18.890	0.010	0.320	9.850			0.960	-0.404	3.645	99.81
RW 11	JD-4	2860.000	39.040	1.260	13.870	1.050	12.470	0.080	18.200	0.020	0.660	9.060			0.980	-0.413	3.626	99.90
RW 11	JD-4	3146.000	39.260	0.540	14.390	0.030	8.560	0.050	20.430	0.010	0.560	9.670			1.210	-0.509	3.543	97.74
RW 11	JD-4	3432.000	39.250	1.190	13.560	0.050	7.480	0.050	21.450	0.000	0.530	9.770			1.260	-0.531	3.525	97.58
RW 11	JD-4		40.070	1.260	14.060	0.740	6.070	0.020	23.100	0.000	0.200	10.310			0.990	-0.417	3.747	100.15
RW 11	JD-4		37.860	1.850	13.550	0.060	9.450	0.060	19.610	0.010	0.390	9.340			1.280	-0.539	3.426	96.35
RW 11	JD-4		40.820	1.300	12.620	0.170	7.930	0.030	22.500	0.010	0.570	9.750			0.800	-0.337	3.821	99.98
RW 11	JD-4		39.130	1.510	14.050	0.810	6.500	0.020	22.450	0.010	0.450	10.070			1.270	-0.535	3.571	99.31
RW 11	JD-4		39.610	1.380	14.000	0.930	6.430	0.030	22.540	0.000	0.370	10.090			1.280	-0.539	3.586	99.71
RW 11	JD-4		40.610	1.160	13.580	0.660	5.240	0.010	23.460	0.000	0.190	10.300			0.670	-0.282	3.883	99.48
RW 11	JD-4		40.140	1.100	13.610	0.620	5.190	0.000	23.420	0.040	0.310	10.110			0.670	-0.282	3.854	98.78
RW 12	JD-4	900.000	39.040	1.430	13.760	0.450	6.560	0.030	23.100	0.020	0.370	9.860			0.900	-0.379	3.731	98.87
RW 12	JD-4	1800.000	40.250	1.070	12.650	0.220	5.810	0.020	24.280	0.000	0.210	10.270			0.820	-0.345	3.796	99.05
RW 12	JD-4	3600.000	40.550	1.080	12.650	0.200	5.530	0.030	24.560	0.020	0.190	10.330			0.810	-0.341	3.824	99.43
RW 12	JD-4	4500.000	40.520	1.060	13.020	0.290	5.220	0.030	24.480	0.000	0.120	10.590			0.810	-0.341	3.831	99.63
RW 12	JD-4	5400.000	40.840	1.090	12.980	0.270	5.290	0.010	24.350	0.010	0.110	10.560			0.750	-0.316	3.869	99.81
RW 12	JD-4	6300.000	40.920	1.110	12.910	0.220	5.310	0.020	24.350	0.010	0.110	10.620			0.830	-0.349	3.838	99.90
RW 12	JD-4	7200.000	40.970	1.150	13.070	0.360	5.930	0.030	23.810	0.010	0.220	10.440			0.750	-0.316	3.877	100.30
RW 12	JD-4	8100.000	39.650	1.500	13.740	0.250	6.660	0.020	22.900	0.010	0.390	10.100			1.090	-0.459	3.683	99.53
RW 12	JD-4		40.190	1.750	13.790	0.050	8.440	0.040	21.180	0.030	0.360	9.950			0.830	-0.349	3.805	100.07
RW 12	JD-4		40.240	1.780	13.860	0.070	9.110	0.040	20.540	0.030	0.420	9.850			0.790	-0.333	3.819	100.22
RW 12	JD-4		39.410	1.800	13.960	0.030	9.210	0.050	20.900	0.040	0.530	9.600			0.770	-0.324	3.804	99.78
RW 12	JD-4		40.060	1.670	13.620	0.040	7.820	0.050	22.340	0.070	0.420	9.540			0.870	-0.366	3.798	99.93
RW 12	JD-4		40.000	1.390	13.850	0.030	8.890	0.040	20.910	0.100	0.390	9.180			0.780	-0.328	3.793	99.02
RW 12	JD-4		40.590	1.140	12.770	0.620	5.170	0.010	24.220	0.010	0.120	10.560			0.820	-0.345	3.809	99.49
RW 12	JD-4		39.830	1.610	13.480	0.050	8.520	0.050	21.490	0.190	0.410	8.860			0.770	-0.324	3.793	98.73
RW 12	JD-4		38.740	2.620	14.280	0.100	11.800	0.060	18.630	0.000	0.450	9.960			0.620	-0.261	3.851	100.85
RW 12	JD-4		40.050	1.750	14.090	0.060	8.930	0.040	20.990	0.010	0.450	9.310			0.690	-0.291	3.867	99.95

APPENDIX 2

DESCRIPTIONS OF HEAVY MINERAL SEPARATES

The following are brief notes made during microscopic examination of preliminary heavy mineral separates produced by Loring Laboratories on Pinhorn samples. All samples were taken from the JD-4 (Coulee 29) occurrence south of the Milk River. All descriptions are based upon observations made under binocular microscope.

SAMPLE 93-RW-10 - Nodule suite.

Clinopyroxene - very abundant, anhedral fragments to euhedral, columnar crystals, light to medium grass green, some evidence of alteration to amphibole, some acicular. Minor component of medium lime green anhedral pyroxene. Magnetite present as abundant black, iridescent schiller on some faces, anhedral to subhedral, generally <1.5 mm in long dimension. Phlogopite very abundant, generally black, minor component brown, no zoning noted, subhedral to anhedral. Spinels - glassy black, non-magnetic, subhedral, relatively rare. Olivine noted, equant, medium green. Dark pink garnet (knorringite?), well rounded.

SAMPLE 93-RW-11 - Dark lamprophyre phase (olivine minette).

Small nodule of intergrown phlogopite (40%) and ilmenite (60%). Much more abundant spinel, octahedral to distorted octahedral morphology, euhedral to subhedral, non-magnetic --> chromite(?). Clinopyroxene similar to RW-10, mainly blocky fragments, subordinate euhedral columnar crystals, however fewer darker green (high chrome) crystals. Phlogopite, subhedral, black to dark brown, no zoning apparent optically. Ilmenite rounded xeno/phenocrysts, black, metallic, anhedral.

SAMPLE 93-RW-12 - Deeply weathered dyke phase east of vent phase.

Dominated by abundant anhedral, pale green diopside, minor component with euhedral relict crystal morphology, majority now angular fragments. Phlogopite, anhedral to subhedral, black to dark brown. Oscillatory zoning noted in one groundmass sample. Subordinate euhedral, equant (octahedral to distorted octahedral) spinel crystals; black, metallic, <0.5 mm, non-magnetic --> chromite(?). Many poikilitically enclose phlogopite. Minor component of larger spinels, rounded, $\leq$ 1.5 mm diameter. Minor component of darker green (high chrome) diopside, zoning apparent, angular fragments. Chromite/spinel overgrown by phlogopite. Ilmenite up to 2 mm in long dimension; black, anhedral to subhedral. Olivine larger in this sample than in previous samples, equant, euhedral.

APPENDIX 3

THIN SECTION DESCRIPTIONS

SAMPLE **ABRW93Z-70**

Mineralogy

Large crystals of **hornblende**, very altered, constitute about 35% of the volume, **phlogopite** (20%) showing some alteration at the rims of the grains. Altered **plagioclase** and **K-feldspar** constitute about 40-45% (≈20% each) of the sample, and they show sericitic alteration. The feldspars are interstitial to the hornblende and phlogopite. There are also traces (a few grains) of **olivine** and **aegirine**.

Texture

The texture is seriate and hypidiomorphic granular. One important feature to note in this sample is that it has a chilled margin, which brings in fingerlike protrusions of glassy material, olivine, phlogopite and Fe-Ti oxides.

Provenance Intrusive

Name **Minette**

SAMPLE **ABRW93Z-71**

Mineralogy

Pyroxene ([titaniferous?] diopside) phenocrysts constitute about 30% of the volume of the rock. They are relatively fresh, save for a few grains showing faint reaction rims. **Olivine** (20%) occurs as fresh microphenocrysts or as large phenocrysts which are now serpentinized and have calcite core (indicating that the monticellite component must have been high - if in fact those relict grains weren't entirely monticellite). Poikilitic **sanidine** occurs as about 10% of the total volume of the sample. **Phlogopite** constitutes about 25% of the volume and it occurs as phenocrysts and in the groundmass. The rest of the sample is devitrified **glass** and **Fe-Ti oxides**.

Texture

The texture of the sample is porphyritic, with poikilitic patches of sanidine. No flow alignment can be detected.

Provenance Extrusive

Name Pyroxene-phlogopite lamprophyre

ABRW93AA-90

Phenocrysts

Phlogopite	Mode:	30%
	Size Range:	up to 1 mm
	Shape:	euhedral
	General:	Reddish (Fe, Ti-rich) rims
Clinopyroxene	Mode:	35%
	Size Range:	up to 2 mm
	Shape:	subhedral
	General:	Colourless, often with strongly altered cores
Olivine	Mode:	5-10%
	Size range:	up to 1 mm
	Shape:	euhedral
	General:	Completely pseudomorphed by calcite and a very fine-grained serpentine-like alteration mineral. Tentatively identified as having been olivine based on pseudomorph shape.

Matrix

Minerals: Clinopyroxene, Biotite, Sanidine(?), very fine-grained opaques

Texture: Texture is fine-grained and turbid, making matrix mineral identification somewhat difficult. Possible sanidine in the matrix based on low relief, low birefringence, and radiating habit.

Rock Name: Biotite-Augite lamprophyre

APPENDIX 4

WHOLE ROCK
AND
TRACE ELEMENT
GEOCHEMICAL ANALYSES

Sample			SiO2 (%)	TiO2 (%)	Al2O3 (%)	Fe2O3 (%)	MnO (%)	MgO (%)	CaO (%)	Na2O (%)	K2O (%)	P2O5 (%)	BaO (%)
Detection Limits													
Avg. Ultramafic			43.4	0.13	2.7	8.34	0.13	4.11	3.8	0.3	0.06	0.05	
Kimberlite(Low)			20	0.5	0.5	2		12	0.5	0	0	0	
Kimberlite (High)			48	8	13	11		40	15	2	3	1.5	
Kimberlite (avg)			35.2	2.32	4.4	9.8	0.11	27.9	7.6	0.32	0.98	0.7	
Lamproite (Low)			40	1	4				2	0.2	5	0.5	
Lamproite (High)			55	5	10				10	1.5	10	2	
RW93-1		1	50.14	0.89	10.97	7.37	0.15	8.46	8.28	2.12	7.13	0.96	
RW93-2 - Host Sediments		2	76.84	0.42	9.58	2.16	0.02	0.93	1.59	1.75	2.22	0.21	
RW93-3		3	50.06	0.88	9.96	7.26	0.13	7.66	8.97	2.19	6.28	0.95	
RW93-4		4	49.29	0.96	10.78	7.55	0.14	8.64	8.11	2.58	7.01	1.06	
RW93-5		5	41.89	0.99	10.81	9.01	0.16	11.23	12.10	1.65	4.28	1.32	
RW93-6		6	48.58	1.00	10.89	8.04	0.14	8.98	6.21	1.75	5.61	0.91	
RW93-7		7	49.09	1.05	10.15	8.57	0.14	9.62	6.69	1.67	6.33	1.01	
RW93-8		8	45.85	1.04	10.68	8.23	0.14	10.99	7.42	1.19	7.97	0.98	
RW93-9		9	31.61	0.56	5.99	8.94	0.18	2.22	22.67	0.62	8.28	1.28	
RW93-10		10	42.49	1.30	10.45	11.89	0.21	10.44	10.65	1.36	3.17	1.14	
RW93-11		11	47.61	1.01	10.07	9.39	0.15	11.90	7.76	1.79	4.83	0.98	
RW93-12		12	46.35	0.98	9.19	9.40	0.15	13.16	7.69	1.54	4.56	0.90	
RW 93-14 (Soil)		13											
RW 93-15 (Soil)		14											
RW 93-16 (Soil)		15											
RW 93-18		16	50.55	0.92	10.85	7.96	0.10	9.21	6.33	1.73	4.91	1.00	
RW 93-19		17	47.54	0.92	9.91	8.97	0.13	10.54	7.32	1.82	4.73	1.07	
RW 93-20		18	54.03	0.87	10.56	6.9	0.12	7.72	7.08	2.67	6.52	1.13	
Cerro Negro #1		19	50.97	0.89	10.45	7.06	0.13	8.24	7.96	2.50	6.92	0.97	
Cerro Negro #2		20	49.88	0.89	10.25	7.20	0.13	8.83	8.47	2.45	6.51	0.97	
Cerro Negro #3		21	46.10	1.10	10.44	8.38	0.15	11.72	9.22	2.32	6.42	0.91	
Cerro Negro #4		22	50.71	1.00	11.56	7.43	0.13	8.32	7.67	2.72	7.04	1.08	
ABRW93AA-90	JD-2	-27	46.36	0.99	8.56	9.62	0.14	13.31	8.59	0.85	4.56	1.11	0.36
ABRW93AA-91	JD-2	-28	38.1	1.02	8.71	9	0.22	8.11	13.06	1.1	5.1	1.03	0.36
ABRW93Z-70	JD-4	-29	47.47	1.01	8.52	7.91	0.11	13.74	9.52	0.88	4.57	0.79	0.34
ABRW93Z-71	JD-4	-30	49.14	0.97	8.86	9.28	0.13	11.79	8.16	1.34	4.59	1.09	0.36
ABRW93Z-73	JD-4	-31	51.96	1.02	9.69	9.65	0.15	12.02	7.45	1.77	4.87	1.01	0.33
ABRW93Z-78 - Sed.	JD-4	-32	60.55	0.61	10.7	5.25	0.07	5.11	4.62	1.71	3.29	0.35	0.16
ABRW93Z-82	JD-4	-33	62.89	0.55	10.67	5.16	0.08	5.58	3.16	1.89	3.28	0.29	0.14
ABRW93Z-70	JD-4	-34											
KIA92 200A	JD-4	35	48.74	1.05	9.94	10.12	0.14	13.63	7.96	1.14	4.43	1.11	
KIA92 205	JD-8	36	60.71	0.47	17.24	5.82	0.15	1.71	5.6	4.03	2.71	0.31	
KIA92 217B	JD-1	37	50.93	0.95	10.41	7.66	0.16	9.97	9.11	1.62	6.14	1.07	
KIA92 221A	JD-3	38	51.9	1.1	10.92	8.99	0.13	10.37	6.1	1.64	5.99	1.12	
KIA92 222B	JD-5	39	46.15	1.06	11.24	8.47	0.19	11.03	11.2	0.62	7.15	1.07	
KIA92 224E	JD-2	40	47.39	1.07	9.5	10.74	0.15	14.5	8.12	0.74	4.7	1.13	
KIA92 225		41	45.01	1.5	11.93	6.64	0.12	6.91	11.94	1.19	8.56	1.57	

*NOTE: KIA92 samples from Kjarsgaard's paper in Current Research 1994-B

LOI (%)	Total (%)	K2O/Na2O	K/Al	K + Na Al	Mg/ (Mg+Fe)	La/Yb	Au PPB	Ag PPM	Ag PPM	Al %	As PPM	B PPM	Ba PPM	Ba PPM	Be PPM	Bi PPM	Br PPM
							2	5	5		0.5		50				0.5
		0.20	0.02	0.13									20				
													137				
		1.50	0.23	0.38									1970				
10.7		3.06	0.22	0.30			0.01	0.13	0.1			36	1100	1100	1.6		
		>3	>1	>1													
														Calc.			
3.23	99.70	3.36	1.02	1.41		44.2	0.02	0.05	0.0	5.8	0.05		5200	4530	4	0.5	0.05
3.19	98.94	1.27	0.37	0.63		14.8	2	0.05	0.0	5.01	7.9		720	744	2	0.5	0.9
5.26	99.61	2.87	0.95	1.30		38.4	2	0.05	0.0	5.51	2.3		4700	4431	5	0.5	0.05
3.72	99.83	2.72	1.03	1.43		38.5	0.02	0.05	0.0	5.44	2.5		5100	5084	5	0.5	0.05
5.28	98.72	2.59	0.60	0.84		27.7	0.02	0.05	0.0	5.91	3.4		3500	3461	3	0.5	0.05
6.52	98.62	3.21	0.82	1.09		32.3	3	0.05	0.0	5.65	3.3		3200	3480	4	0.5	0.05
4.92	99.23	3.79	0.96	1.23		37.5	3	0.05	0.0	5.47	2.7		3900	3873	4	0.5	0.05
4.40	98.88	6.70	1.11	1.29		27.3	0.02	0.05	0.0	5.94	2.1		6400	3950	4	0.5	0.05
17.76	100.11	13.35	0.91	1.06		25.8	0.02	0.05	0.0	2.88	3.8		2300	2304	2	0.5	0.05
6.68	99.77	2.33	0.76	0.97		26	0.02	0.05	0.0	5.3	2.8		4000	3820	2	0.5	0.05
3.74	99.21	2.70	0.76	1.06		31.1	4	0.05	0.0	5.26	2.7		3700	3511	4	0.5	0.05
5.29	99.22	2.96	0.76	0.99		31.4	5	0.05	0.0	5.01	1.9		2800	3245	4	0.5	0.05
			0.33	0.58		12.2	3	<5	0.5	4.4	5.1		680		<2	<5	2.8
			0.31	0.55		11.3	<2	<5	<.4	4.87	6.5		740		<2	<5	3.9
			0.28	0.39		11.6	<2	<5	<.4	6.89	9.8		710		<2	<5	7.4
5.70	99.26	2.84	0.71	2.86		31.5	8	<5	<0.4	5.53	22		3127	2500	2	<5	3
6.31	99.26	2.60	0.70	3.19		35.1	<5	<5	<0.4	5.08	6		3297	2600	2	<5	2
2.1	99.69	2.44	0.96	4.33		47.7	<5	<5	<0.4	5.34	41		4375	3400	4	<5	<1
3.24	99.33	2.77	1.02	1.35		45.7	7	0.05	0.0	5.63	2		4100	4675	5	0.5	3.8
3.20	98.76	2.66	1.01	1.35		42	3	0.05	0.0	5.36	1.9		4200	4550	4	0.5	4.2
3.88	100.64	2.77	1.04	1.33		40	6	0.05	0.0	5.13	0.05		3500	4425	5	0.5	0.05
3.05	100.71	2.59	1.04	1.37		42.7	2	0.05	0.0	5.62	1.2		4300	5556	4	0.5	0.05
5.54	99.99	5.36	0.54	0.63		13.3	5	<.2		3.03	<5	10	2280			25	<0.5
14.2	100.01	4.64	0.51	0.69		15.4	5	<.2		2.54	<5	10	1170			15	<0.5
5.15	100.01	5.19	0.90	0.94		12.5	5	<.2		3.02	<5	8	925			25	<0.5
4.28	99.99	3.43	0.63	0.72		13.3	5	<.2		2.81	5	12	1835			20	<0.5
0.1	100.02	2.75	0.58	0.76		12.5	5	<.2		2.92	<5	8	1505			20	<0.5
7.59	100.01	1.92	0.34	0.48		7.14	5	<.2		3.06	<5	8	595			15	<0.5
6.32	100.01	1.74	0.32	0.47		4.55	5	<.2		3.46	<5	8	595			20	<0.5
			0.90	0.94		ERR		<.2		3.19	<5	8	935			30	<0.5
3.91	102.17	3.89	0.70	0.70		32.5	<5	<.2		5.26			3210				
1.24	99.99	0.67	0.25	0.25		26.9	<5	<.2		9.13			937				
3.88	101.9	3.79	0.92	0.92		44.2	<5	<.2		5.51			4771				
3.54	101.8	3.65	0.86	0.86		31.2	<5	<.2		5.78			3651				
7.01	105.19	11.53	1.00	1.00		27	2	<.2		5.95			3730				
4.73	102.77	6.35	0.78	0.78		31.7	4	<.2		5.03			3383				
9.83	105.2	7.19	1.12	1.12		63.8	5	<.2		6.32			4943				

Ca	Ca	Cd	Co	Cr	Cs	Cu	Fe	Hf	Hg	Ir	K	Mg	Mn	Mo	Na	Nb	Ni	Ni	P	Pb	Pd	Pt
%	%	PPM	PPM	PPM	PPM	PPM	%	PPM	PPM	PPB	%	%	PPM	PPM	%	PPM	PPM	PPM	%	PPM	PPB	PPB
1	1		1	5	1		0.0	1	1	5				1	0.01		20	20				
			110	3090	0.006			0.6						0.2			1450	1450				
			35	550	0			1.6						0.1			710	710				
			130	2900	8.7			30						0.9			1600	1600				
		0.07	65	893	2.2	93		5.6	8	3			1160	1.7			965	965	3.88	15	8.1	0.2
9	6.77	0.05	42	690	4	61	7	12	0.0	0.05	5.92	5.87	910	0.01	2.24		<30	120	0.50	29		
1	1.25	0.05	9	200	2	9	1.7	5	0.0	0.05	1.85	0.55	165	0.01	1.33		<20	17	0.05	10		
8	7.26	0.05	42	690	3	64	6.6	11	0.0	0.05	5.21	5.5	923	0.01	1.97		260	134	0.47	45		
8	6.16	0.05	40	680	3	55	6.5	12	0.0	0.05	5.61	5.6	869	0.01	2.18		150	114	0.48	25		
11	9.80	0.05	68	480	8	118	8	3	0.0	0.05	3.55	7.74	1117	0.01	1.4		140	158	0.64	6		
5	4.84	0.05	43	830	4	39	7.1	12	0.0	0.05	4.66	5.82	934	0.01	1.48		190	191	0.41	21		
7	5.35	0.05	49	960	3	45	7.8	13	0.0	0.05	5.25	6.39	935	0.01	1.49		250	232	0.47	23		
6	6.16	0.05	60	1500	3	75	7.6	7	0.0	0.05	6.62	7.49	938	3	1.05		190	281	0.45	16		
21	16.31	0.05	33	440	0.01	51	7.8	5	0.0	0.05	2.63	1.45	992	2	0.43		170	154	0.28	10		
10	8.10	0.05	72	720	3	61	11	5	0.0	0.05	4.01	6.75	1321	0.01	1.12		210	274	0.50	9		
7	6.01	0.05	63	1100	5	77	8.3	10	0.0	0.05	4.01	7.6	939	0.01	1.57		290	363	0.42	21		
7	6.22	0.05	56	970	2	90	7.4	7	0.0	0.05	3.79	8.66	986	0.01	1.15		360	404	0.41	15		
2	1.86	1.00	5	40	1	22	1.5	6	<1	<5	1.43	0.68	283	<1	1.11		<20	16	0.05	125		
2	2.35	<.5	7	51	2	22	1.8	7	<1	<5	1.52	0.9	307	<1	1.18		<20	17	0.05	71		
2	2.15	<.5	13	71	4	23	3.5	6	<1	<5	1.9	1.54	474	2	0.78		<20	26	0.07	19		
5	4.86	<0.5	42	620	3	75	5.5	6	<1	<5	3.93	5.68	673	<5	11.9		480	222	0.37	19		
6	5.46	<0.5	44	720	3	79	6.1	5.1	<1	<5	3.58	6.37	846	<5	12.6		380	259	0.38	15		
6	5.39	<0.5	32	460	3	60	4.7	6.9	<1	<5	5.13	4.91	787	<5	18		350	103	0.42	37		
6	6.46	0.05	33	550	4	56	5.4	10	0.0	0.05	5.75	5.67	855	0.01	1.85		120	115	0.46	29		
7	6.66	0.05	34	670	3	53	5.5	9	0.0	0.05	5.4	5.89	850	0.01	1.81		130	124	0.44	22		
6	6.88	0.05	39	960	3	55	5.7	8	0.0	0.05	5.33	7.29	927	0.01	1.49		110	175	0.38	26		
7	5.72	0.05	33	500	3	57	5.3	10	0.0	0.05	5.84	5.29	813	0.01	1.84		150	111	0.46	25		
2.67		<1	59	505		126	5.6	7	<1	<5	1.65	6.69	813	6	0.26		452		0.43	24		
9.17		<1	57	673		113	5.9	7	<1	<5	1.3	4.9	1722	2	0.45		434		0.41	16		
2.66		<1	53	660		94	4.4	5	<1	<5	2.72	6.01	528	1	0.12		274		0.31	12		
1.96		<1	52	502		111	5.2	7	<1	<5	1.77	5.6	608	1	0.25		381		0.44	28		
1.66		<1	50	484		102	5.3	7	<1	<5	1.68	5.66	789	<1	0.54		363		0.41	26		
3.45		<1	25	193		45	3.9	7	<1	<5	1.03	3.32	586	<1	0.43		102		0.18	22		
2.41		<1	23	212		45	3.9	6	<1	<5	1.1	3.93	635	3	0.53		78		0.16	26		
2.76		<1	56	694		99	4.7				2.87	6.3	553	2	0.12		289		0.33	18		
				1015		90		6			3.68					12	492			22		
				39		21		3			2.25					11	39			18		
				561		43		7			5.1					14	195			49		
				818		54		9			4.97					18	324			29		
				1436		86		4			5.93					10	321			20		
				1075		91		6			3.9					11	535			18		
				587		95		11			7.1					22	147			36		

Rb PPM	Rh PPB	Sb PPM	Sc PPM	Se PPM	Sn PPM	Sr PPM	Sr PPM	Sr PPM	Ta PPM	Tb PPM	Ti %	U PPM	V PPM	W PPM	Y PPM	Y PPM	Zn PPM	Zn PPM	Zr PPM
5		0.1	0.1	5	100	500	500	500	0.5	0.2		0.5		1			50	50	
1.2			15	0.02	0.52	22	22	22	<.1								56	56	
0			7	0.05	1	40	40	40	1.4								15	15	
350			30	0.28	30	1900	1900	1900	21.3								287	287	
73	7.1		14	0.15	5.4	851	851	851	11	17		3.1	100		22	22	69	69	184
210		1.1	28	0.03	<170	2700	1645	1750	0.05	14	0.5	4	113	3	22	19	146	72	239
81		1	7.6	0.03	<100	<500	206	225	0.05	8.6	0.21	3.3	47	0.01	23	11	57	40	114
210		1	26	0.03	<150	2600	1653	1678	0.05	13	0.47	3.8	111	0.01	22	18	130	85	236
220		0.6	26	0.03	<160	1900	1811	1669	1.2	14	0.47	2.6	106	0.01	23	18	129	67	241
150		0.4	33	0.03	<130	<500	748	745	0.05	3	0.52	0.05	129	4	19	14	130	76	66
210		1.1	24	0.03	<140	1700	1229	1185	0.05	16	0.5	2.9	112	0.01	25	19	139	74	276
230		0.5	25	0.03	<140	2500	1378	1374	0.05	16	0.55	3.4	119	0.01	26	19	127	79	279
300		0.8	28	0.03	<140	1900	1059	1094	0.05	6.9	0.56	3.2	130	0.01	23	14	198	68	147
93		0.6	18	0.03	<100	1600	990	972	0.05	6	0.29	1.5	80	0.01	20	12	83	44	99
180		0.6	34	0.03	<140	1400	634	597	0.05	5.6	0.64	2.9	200	0.01	21	14	194	100	111
180		0.6	30	0.03	<140	1700	1035	997	0.05	11	0.51	2.1	135	0.01	23	17	140	91	190
310		0.5	25	0.03	<120	1300	863	876	0.05	7.5	0.51	2	133	0.01	18	16	122	72	172
57		1.5	4.3	<3	<100	<500	191		<.5	5.8	0.13	1.6	32	<1	11		119	142	
54		1.2	5.3	<3	<100	<500	198		<.5	6.9	0.15	2	38	<1	13		68	59	
90		1.2	12	<3	<100	<500	132		1.6	11	0.26	2	83	<1	19		125	85	
160		0.4	21	<5	<0.01	917	1000	916	<1	7.9	0.45	2.6	126	<4	19	17	84	140	225
120		<0.2	22	<5	<0.01	940	1200	912	<1	7.2	0.45	1.4	131	<4	19	17	78	140	214
180		<0.2	19	<5	<0.01	1727	1700	1707	<1	9.7	0.43	2.2	101	<4	17	18	78	130	295
370		0.4	22	0.03	<140	2200	1749	1775	0.05	11	0.47	38	103	0.01	20	18	125	62	253
190		0.4	24	0.03	<140	2200	1729	1705	0.05	12	0.45	3.2	102	0.01	21	18	134	61	226
210		0.4	23	0.03	<130	2000	1605	1461	0.05	11	0.52	3.8	107	0.01	18	16	71	67	228
190		0.4	19	0.03	<130	2500	1940	1756	0.05	11	0.47	3.5	98	0.01	19	18	123	63	254
150		40	25	<3	400	551			0.9	7.7	0.34	<10	149	<10	27		86		
170		40	23	<3	580	698			0.9	7.6	0.23	<10	168	<10	25		91		
180		35	31	<3	640	279			1.2	5.2	0.31	<10	135	<10	23		70		
140		45	23	<3	420	402			<0.5	8.4	0.3	<10	144	<10	26		80		
160		45	23	<3	400	349			<0.5	8.6	0.31	<10	145	<10	25		83		
110		30	14	<3	80	240			1.4	11	0.17	<10	100	<10	18		75		
120		35	12	<3	120	202			<0.5	8.3	0.18	<10	113	<10	17		79		
		45			680	293					0.33	<10	142	<10	24		74		
141			21			902			0.7	8		2.2	209			16	86		224
65			10			1140			0.7	7.8		2	73			13	93		122
172			22			1999			0.8	10.9		2.7	154			17	94		271
179			16			1465			0.9	13		3.9	181			18	88		359
237			19			1069			0.6	5.5		1.6	188			13	68		158
140			20			1102			0.9	8.1		2.2	206			15	84		221
330			20			2026			0.3	40.5		17.7	190			26	96		351

La PPM	Ce PPM	Pr PPM	Nd PPM	Sm PPM	Eu PPM	Gd PPM	Tb PPM	Dy PPM	Ho PPM	Er PPM	Tm PPM	Yb PPM	Lu PPM	La PPM	Ce PPM	Pr PPM	Nd PPM	Sm PPM	Eu PPM	Gd PPM	Tb PPM	Dy PPM	Ho PPM	Er PPM	Tm PPM	Yb PPM	Lu PPM
0.5	3		5	0.1	0.2		0.5					0.2	0.05	0.3	0.9		0.6	0.2	0.077	0.3		0.3		0.2		0.2	0.0
0.9	1.9		1.4	0.4	0.2		0.12					0.4	0.06														
26	45		25	4.2	1.1		0.43					0.9	0.09														
200	522		180	29	6.5		2.05					2	0.22														
150	200		85	13	3		1					1.2	0.16														
84	160		59	13	3.8		0.05					1.9	0.32	255	185		94	64	49							9	9
37	73		22	4.7	3.2		0.7					2.5	0.4	112	84		35	23	42							11	12
73	130		63	13	3.1		0.05					1.9	0.29	222	150		100	64	40							9	9
77	140		62	32	3.5		0.05					2	0.31	234	162		98	158	45							9	9
36	74		34	8.1	2.4		1.1					1.3	0.21	109	86		54	40	31							6	6
71	140		56	11	3.3		0.05					2.2	0.44	216	162		89	54	43							10	13
75	140		61	12	3.5		0.05					2	0.4	228	162		97	59	45							9	12
41	88		31	7.8	2.4		0.05					1.5	0.27	125	102		49	38	31							7	8
31	62		29	5.5	1.6		0.05					1.2	0.21	94	72		46	27	21							5	6
39	77		33	7.9	2.2		0.05					1.5	0.26	119	89		52	39	29							7	8
56	110		48	9.7	2.7		0.05					1.8	0.32	170	127		76	48	35							8	9
44	87		39	7.8	2.3		0.05					1.4	0.24	134	101		62	38	30							6	7
22	41		15	3.1	0.9		<.5					1.8	0.32	67	47		24	15	12							8	9
26	50		20	3.8	1		<.5					2.3	0.4	79	58		32	19	13							10	12
37	76		30	5.5	1.3		<.5					3.2	0.53	112	88		48	27	17							15	16
41	79		41	7.3	1.9		0.7					1.3	0.22	124	91		65	36	25							6	6
39	77		40	7.2	2		<0.5					1.1	0.2	117	89		63	35	26							5	6
53	100		48	8.7	2.3		0.7					1.1	0.19	160	116		76	43	30							5	6
64	120		53	10	3		0.05					1.4	0.005	195	139		84	49	39							6	0
63	120		49	10	2.8		1.2					1.5	0.28	191	139		78	49	36							7	8
52	100		39	8.4	2.4		1.1					1.3	0.24	158	116		62	41	31							6	7
64	120		51	9.9	2.8		0.05					1.5	0.26	195	139		81	49	36							7	8
20			37	7.7			1.1					1.5	0.25	61	0		59	38	0							7	7
20			29	7.4			0.6					1.3	0.16	61	0		46	36	0							6	5
10			23	5.4			<0.5					0.8	0.12	30	0		37	27	0							4	4
20			37	7.4			<0.5					1.5	0.23	61	0		59	36	0							7	7
20			40	7.4			<0.5					1.6	0.23	61	0		63	36	0							7	7
20			28	5.8			<0.5					2.8	0.4	61	0		44	29	0							13	12
10			29	5			<0.5					2.2	0.4	30	0		46	25	0							10	12
10																											
39	85	10	43	7.9	2.2	7	0.7	3.6	0.6	1.6	0.2	1.2	0.2	119	98		68	39	29							5	6
35	66	7	29	5.3	1.6	4.8	0.5	2.6	0.5	1.3	0.2	1.3	0.2	106	76		46	26	21							6	6
53	113	14	54	9.5	2.6	8.6	0.7	4	0.6	1.6	0.2	1.2	0.2	161	131		86	47	34							5	6
53	116	14	53	9.3	3.7	8.9	1	3.8	0.7	1.7	0.2	1.7	0.2	161	134		84	46	48							8	6
27	59	7	30	5.9	1.6	5.1	0.5	2.8	0.5	1.3	0.2	1	0.2	82	68		48	29	21							5	6
38	82	10	43	8.2	2.1	5.3	0.6	3.3	0.6	1.5	0.2	1.2	0.2	116	95		68	40	27							5	6
102	225	28	111	16	5.1	12	1.2	4.6	0.8	1.9	0.2	1.6	0.2	310	260		176	78	66							7	6

APPENDIX 5

STATEMENT OF QUALIFICATIONS

STATEMENT OF QUALIFICATIONS

I, Richard T. Walker, of [redacted] Cranbrook, BC, hereby certify that:

1) I am a graduate of the University of Calgary of Calgary, Alberta, having obtained a Bachelors of Science in 1986.

2) I obtained a Masters of Geology at the University of Calgary of Calgary, Alberta in 1989.

3) I am a member in good standing of the Association of Professional Engineers, Geologists and Geophysicists of Alberta.

4) I am a member of good standing of the Association of Professional Engineers and Geoscientists of the Province of British Columbia.

5) My specific field of interest and expertise is in ultramafic lithologies and I have been actively involved in this field for four years, working in the Northwest Territories, British Columbia and Alberta.

6) I am the author of this report which is based on work I personally performed on the property between May 1st, 1993, and November 11th, 1993.

7) I presently own 70,000 common shares of Marum Resources Inc..

8) I hereby grant permission to Marum Resources Inc. to use this report, or any portion of it, for any legal purposes normal to the business of the company, so long as the excerpts used do not materially deviate from the intent of this report as set out in the whole.

Dated at Cranbrook, British Columbia this 8th day of March, 1994.

Richard T. Walker, P.Geol.

Marum Resources Inc. 19950022

#400, 407 8th Avenue Sw, Calgary, Alberta, T2P 1E5
Alberta Stock Exchange Symbol --"MMU" Tel: (403) 243-9500 Fax: (403) 243-9517

October 24, 1995

OCT 26 9 03 AM '95
ENERGY / ENV. PROT.

Mr. Brian Hudson
Alberta Energy
Petroleum Plaza - North Tower
9945 - 108 Street
Edmonton, Alberta, T5K 2G6

Dear Brian:

Exploration Assessment Work
Metallic and Industrial Minerals Permits No. 9392080001 to 9392080032 and Permits 9392060002, 390010002 and 6890010001

We hereby submit assessment work allocations in connection with the captioned permits. Please be advised that Marum Resources holds a fully earned interest in some of the permits by virtue of an option arrangement with Roman Wall Corporation and Douglas B. Nelson.

As a matter of convenience, this assessment submission is a joint submission of both Marum Resources and Roman Wall Corporation who have been jointly exploring the subject lands for approximately four years. We have compiled the expenses allocations from worksheets and data submitted from Roman Wall Corporation and from internal work and accounting records maintained by Marum Resources.

A total of $535,958 in exploration work expenditure allocations have been incurred in the search for diamonds and exploration work continues.

We attach the following technical documentation:

- additional copy of Dighem geophysical survey (previously submitted)
- Report on the Pinhorn Diamond/Gold Property, Alberta
- Evaluation Report on the JD-1 (Black Butte) Lamproite Diatreme
- A Report of the Black Butte Diamond Property

Yours truly,
MARUM RESOURCES INC.

[redacted]

Richard A. Boulay
President

Marum Resources Inc.

400, 407 8th Avenue S.W., Calgary, Alberta, T2P 1E5 Tel:(403) 264-2220 Fax:(403) 234-9686

October 24, 1995

Certificate of Exploration Expenditure
Metallic and Industrial Minerals Permits No. 9392080001 to 9392080032 and
Permits 9392060002, 390010002 and 6890010001

The undersigned certifies that the following outlined exploration work has been performed in connection with the exploration of the captioned permits.

Work Performed by Marum Resources Inc.

Geological Services	**Days**	**Rate /Day**	**Travel & Accom/Day**	**Total**	
[redacted] Geologist	65	$400	$100	$32,500	
[redacted] (Lab & Admin.)	130	$400	$0	$52,000	
[redacted], Geologist	50	$400	$100	$25,000	
[redacted], reports & lab.	20	$400	$100	$10,000	
Casual Labourers	20	$150	$100	$5,000	
Geological Assistants	23	$150	$100	$5,750	
				$130,250	$130,250
Field Expenses					
Field Supplies				$11,500	
Vehicle Rental	180	$100		$18,000	
Fuel	180	$20		$3,600	
Local Sample Storage	200	$3		$600	
				$33,700	$33,700
Geophysical Services					
Dighem Helocopter Magnetic-EM Survey (75% of $40,800)				$30,600	
Previously allocated for assessment				$960	$29,640

Marum Calgary Laboratory Cost Allocations

	Days	**Rate /Day**	**Total**	
Attrition & Grinding	140	$150	$21,000	
De-Sliming	93	$150	$13,950	
Table Concentration	175	$150	$26,250	
Crusher Rental	75	$50	$3,750	
Impactor Rental	75	$50	$3,750	
Gravity Table Rental	63	$50	$3,150	
Sample Shipping			$890	
Mineral Picking	65	$400	$26,000	
Petrology			$800	
Exploration Materials			$2,699	
			$102,239	$102,239
Total Exploration Expenditures				**$295,829**

... / 2

Marum Resources Inc.

Certificate of Exploration Expenditure
Metallic and Industrial Minerals Permits No. 9392080001 to 9392080032 and
Permits 9392060002, 390010002 and 6890010001

Work Performed by Roman Wall Corporation

Geological Services	Days	Rate /Day	Travel & Accom/Day	Total	
[redacted] Geologist	40	$400	$100	$20,000	
[redacted] Geologist	25	$400	$100	$12,500	
[redacted] Geol. Engr.	47	$400	$100	$23,500	
[redacted] Geologist	39	$400	$100	$19,500	
[redacted] Geologist	20	$400	$100	$10,000	
Geological Assistants	125	$150	$100	$31,250	
				$116,750	$116,750
Field Expenses					
Field Supplies				$9,000	
Vehicle Rental	140	$100		$14,000	
Fuel	140	$20		$2,800	
Local Sample Storage	160	$3		$480	
				$26,280	$26,280
Geophysical Services					
Dighem Helocopter Magnetic-EM Survey (25% * $40,800)				$10,200	$10,200

Marum Calgary Laboratory Cost Allocations

	Days	Rate /Day	Total	
Attrition & Grinding	120	$150	$18,000	
De-Sliming	85	$150	$12,750	
Table Concentration	150	$150	$22,500	
Crusher Rental	60	$50	$3,000	
Impactor Rental	60	$50	$3,000	
Gravity Table Rental	60	$50	$3,000	
Sample Shipping			$750	
Mineral Picking	50	$400	$20,000	
Petrology			$1,200	
Exploration Materials			$2,699	
			$86,899	$86,899
Total Exploration Expenditures				**$240,129** ✓

... / 3

Marum Resources Inc.

Certificate of Exploration Expenditure (Page 3)

Certificate of Exploration Expenditure
Metallic and Industrial Minerals Permits No. 9392080001 to 9392080032 and Permits 9392060002, 390010002 and 6890010001

Pinhorn Diamond Project Exploration Expense Allocations

	M-Rge-Twp	Hectares	Amount	Total	
Marum Resource Inc. exploration expense allocations					$295,829
Roman Wall Corporation exploration expense allocations					$240,129
Expenditures represented by this certificate					$535,958
DeVeaux/Roman Wall Permits					
Applied to Permit No 9392080001	4-07-01	8,704	$5	$43,520	
Applied to Permit No 9392080002	4-08-01	8,688	$5	$43,440	
Applied to Permit No 9392080003	4-09-01	7,156	$5	$35,780	
Applied to Permit No 9392080004	4-10-01	8,640	$5	$43,200	
Applied to Permit No 9392080005	4-11-01	8,768	$5	$43,840	
Applied to Permit No 9392080006	4-12-01	8,768	$5	$43,840	
Applied to Permit No 9392080009	4-10-02	8,768	$5	$43,840	
Applied to Permit No 9392080010	4-09-02	7,872	$5	$39,360	
Applied to Permit No 9392080011	4-08-02	8,512	$5	$42,560	
Applied to Permit No 9392080014	4-03-03	8,768	$5	$43,840	
Applied to Permit No 9392080015	4-09-03	8,768	$5	$43,840	
Applied to Permit No 9392080016	4-10-03	8,768	$5	$43,840	
Applied to Permit No 9392060002	4-08-02	64	$10	$640	
Applied to Permit No 9390010002	4-08-01	64	$15	$960	
Douglas Bruce Nelson					
Applied to Permit No 6890010001	4-08-02	256	$25	$6,400	
Allocated for Assessment		102,564		$518,900	$518,900
Unallocated exploration expenditures					$17,058

MARUM RESOURCES INC.

[redacted]

Richard A. Boulay
President
October 24, 1995

Prepared for:

Dankoe Mines Limited, Bismilah Ventures Inc.
2425 Quebec Street, Vancouver, B.C. V5T 4L6
&
Roman Wall Corporation
535 Howe Street, Suite 600, Vancouver, B.C. V6C 2Z4

A Report of the

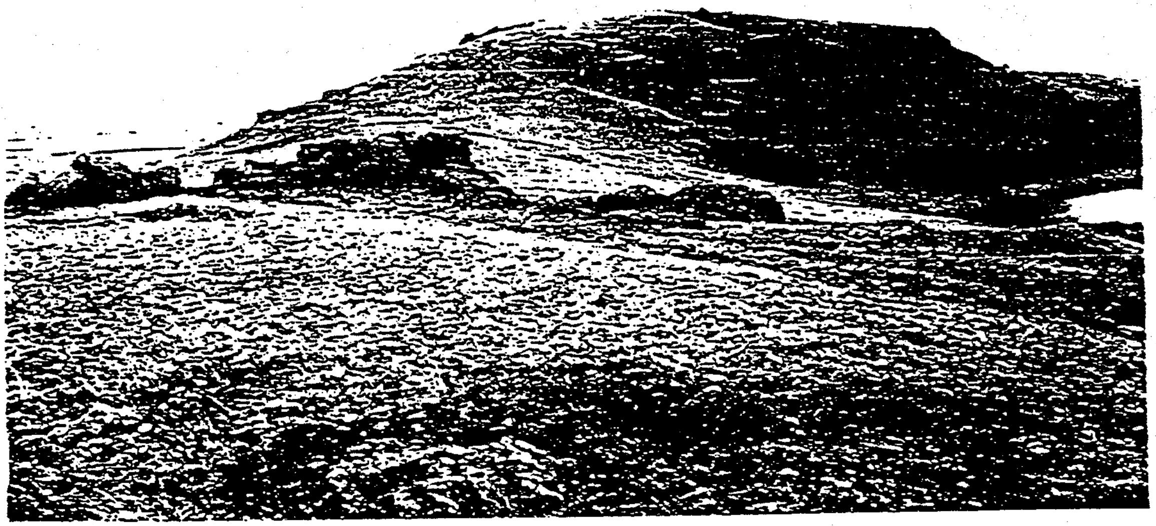
BLACK BUTTE DIAMOND PROPERTY

Milk River Area, Alberta

Prepared By:

Richard T. Walker, P.Geo.
Dynamic Exploration Ltd.
1916 5th Street South, Cranbrook, B.C. V1C 1K4

August 18, 1994



Photograph taken from Black Butte pipe showing typical outcrop and Sweetgrass Hills in background

Black Butte prominently exposed with Sweetgrass Hills of Montana in the background.

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APPENDICES

Appendix 1 - Results of Electron Microprobe Analyses
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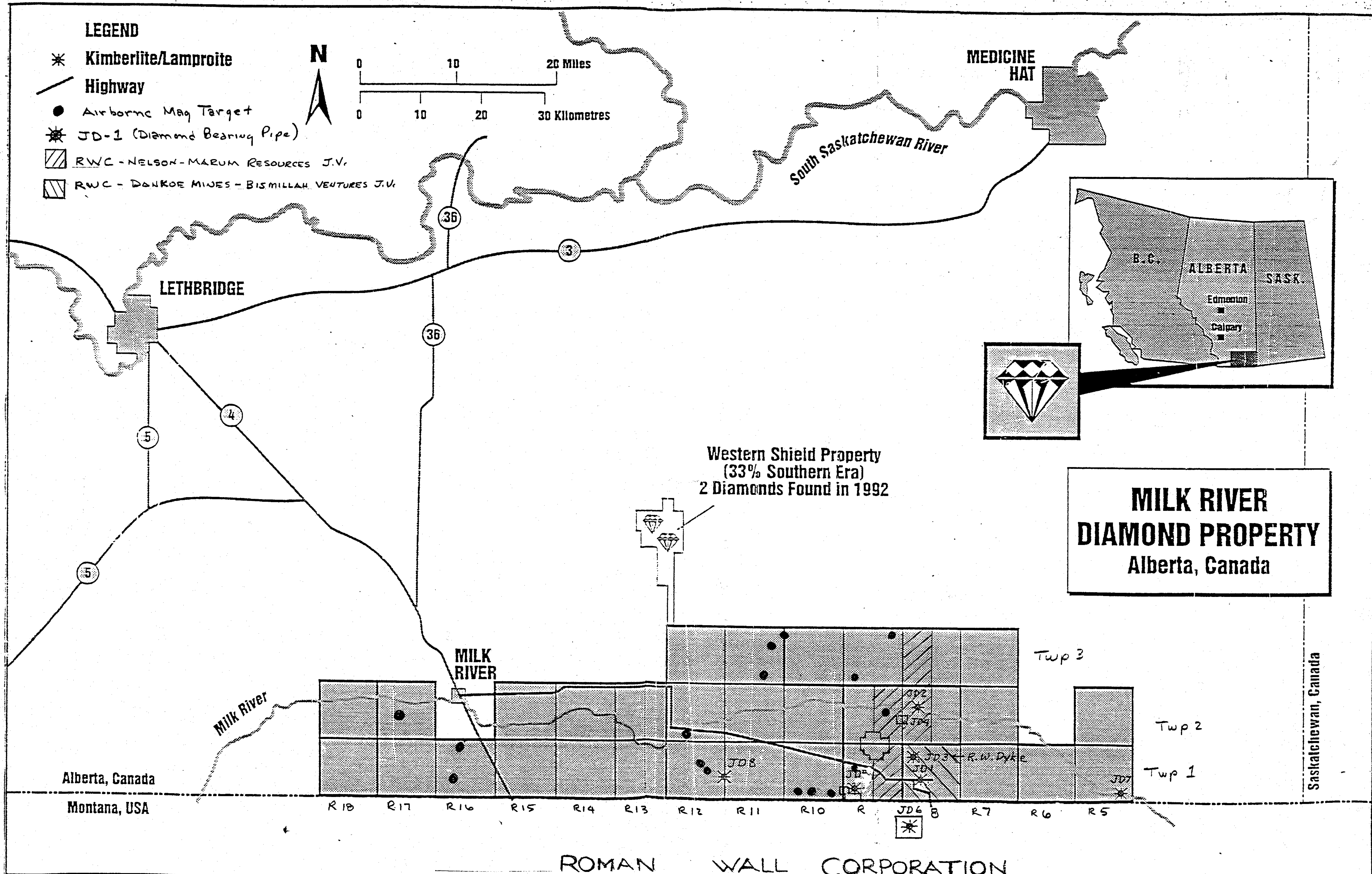


LEGEND
Kimberlite/Lamproite
Highway
Airborne Mag Target
JD-1 (Diamond Bearing Pipe)
RWC - NELSON - MARUM RESOURCES J.V.
RWC - DANKOE MINES - BISMILLAH VENTURES J.V.
N
0 10 20 Miles
0 10 20 30 Kilometres
MEDICINE HAT
South Saskatchewan River
LETHBRIDGE
B.C.
ALBERTA
SASK.
Edmonton
Calgary
Western Shield Property
(33% Southern Era)
2 Diamonds Found in 1992
MILK RIVER
DIAMOND PROPERTY
Alberta, Canada
MILK RIVER
Milk River
Twp 3
Twp 2
Twp 1
JD2
JD4
JD3
R.W. Dyke
JD1
JD8
JD5
JD7
JD6
Alberta, Canada
Montana, USA
Saskatchewan, Canada
R18 R17 R16 R15 R14 R13 R12 R11 R10 R R7 R6 R5
ROMAN WALL CORPORATION

1. SUMMARY

This report summarizes the results of three years of exploration work performed in the Pinhorn area of southern Alberta. This work was performed by Roman Wall Corporation and Marum Resources Inc. The Roman Wall work was primarily performed on the property which is the subject of this report, especially the Black Butte diatreme (Figure 1(a)). The Marum Resources work was performed on the property immediately to the west and northwest but also included geochemical and mineralogical analysis of Black Butte material. Both companies have generously allowed the use of their data to be utilized in this report. We estimate that over $300,000 has been spent on exploration of the Pinhorn diatremes. Of this, at least $100,000 in exploration expenditures can be directly allocated to the property which is the subject of this report.

There are at least seven intrusive occurrences in the vicinity of the Milk River, immediately north of the Sweet Grass Hills in Montana. One has been described as a grey hypabyssal diorite porphyry and the remainder have been interpreted as minettes (Kjarsgaard 1994). As a generalization, these intrusives will be referred to as the Sweet Grass Intrusives.

The Sweet Grass intrusives are characterized by two populations of biotite-phlogopite (phenocryst and groundmass), diopsidic clinopyroxene, olivine, chromite, magnetite, ilmenite, alkali feldspar and carbonate with apatite and analcite reported as well. They have been interpreted as lamprophyres due to the high proportion of biotite-phlogopite. Alternatively, the presence of leucite and analcime together with the uncertainty as to whether sanidine (alkali feldspar) is primary or secondary suggests the occurrences might be ultramafic lamprophyres (ouachitite, damkjernite). Furthermore, they might also be considered as madupitic lamproites (having groundmass phlogopite).

They have variable xenolith content which includes both crustal (host sediment and basement inclusions) and mantle xenoliths (glimmerites, phlogopite-clinopyroxenite, clinopyroxenite; depending upon variable mica content). Mineral analyses of clinopyroxenes, ilmenites, chromites and garnets have been determined and are comparable to "kimberlitic indicator minerals"; documenting G3 / G5 garnets, high chrome diopsides and diamond inclusion field chromites. Mica analyses from different occurrences and phases plot within the primitive field and document both minette and kimberlite trends in composition.

Geochemically, they are potassic to ultrapotassic, peralkaline ([K + Na] / Al >1) and perpotassic (K / Al >1), with anomalous levels of Ba, Ti, Cr, Sr, Y, Zr. The LREE (Light Rare Earth Elements) are enriched relative to the HREE and have patterns similar to South African and Siberian kimberlites (no data currently available for comparison to lamproites). Although the data obtained to date are generally comparable to lamprophyres, there are lamproitic and kimberlitic trends evident. Therefore, it is concluded that the Sweet Grass intrusives are lamprophyres (specifically minettes) having a lamproitic affinity.

In 1993, BHP reported recovery of a 100 by 92 micron microdiamond from a heavy mineral separate of a 38.2 kg sample from the Black Butte occurrence. Recovery of a microdiamond is consistent with mineral chemistry determined for clinopyroxene, ilmenite, chromite and garnet grains analyzed using electron microprobe analysis. Petrography, rock and mineral geochemistry support the conclusion that the southern Alberta alkalic occurrences were derived at or within the diamond inclusion field (Kjarsgaard 1994, pers. comm.). As such, they are potentially diamondiferous and therefore represent legitimate exploration targets.

2. INTRODUCTION

The Black Butte Property encompasses an area of approximately one township (Township 1, Range 8, west of the Fifth Meridian; excluding sections 8 and 26), having dimensions of 6 miles north-south and 6 miles east-west (Figure 1a). There are two known alkalic exposures documented on the property (Figure 1b), the prominent Black Butte pipe (JD-1) and the Roman Wall dyke (JD-3), both locations having been inspected by the writer on several separate occasions. The JD-4 occurrence is located several kilometres to the northwest and has been described as a vent facies pyroclastic minette (Coulee 29; Kjarsgaard 1994, Cavell et al. 1992, Burwash and Cavell 1992). In addition, the JD-2 occurrence (Pakowki Coulee; Kjarsgaard 1994) is located north of JD-4 on the north bank of the Milk River. These intrusives are alkalic in composition and mineralogy and are coeval with the Sweet Grass intrusives immediately south in Northern Montana. The following general description of the geological setting of the Sweet Grass intrusives is summarized from Westgate (1968).

2.1 Surficial Geology

Southern Alberta has been subjected to several periods of glaciation, which has resulted in the deposition of between 0 and 50 feet of glacial detritus. The maximum thickness of the Laurentide icesheet is interpreted to have been approximately 1000 feet in the Aden area, leaving the Sweet Grass Hills and the Cypress Hills exposed as nunataks. The iceflow associated with the Laurentide icesheet is generally southeasterly, while later, less extensive icesheets had dominant flow directions toward the south and southwest.

The glacial deposits of the Milk River area consist of ice-flow features, comprised of moraine deposits which include washboard moraine, ground moraine, hummocky and ridged end moraine in the vicinity of the JD-4 occurrence. In contrast the JD-2 occurrence is located in a paleo-meltwater channel presently identified as the Pakowki Coulee. The JD-3 (Roman Wall) occurrence is similarly located in an underfit stream valley (Philp Coulee).

2.2 Stratigraphy

The depth to basement of the Alberta Basin is reported to vary from 3400 to 3700 feet in the Milk River area. Numerous drill holes have penetrated the Phanerozoic succession, primarily for Cretaceous oil and gas, however some drill holes have penetrated basement, and stratigraphic control is reasonably good in this area.

The geology of the Milk River area is underlain by Cretaceous (Campanian) sediments of the Pakowki, Foremost and Oldman Formations. These formations range in age from 78 (Pakowki Formation) to 72 Ma (upper contact of the Oldman Formation) (Jackson 1975). The Oldman and Foremost Formations comprise the Belly River Group of southeastern Alberta.

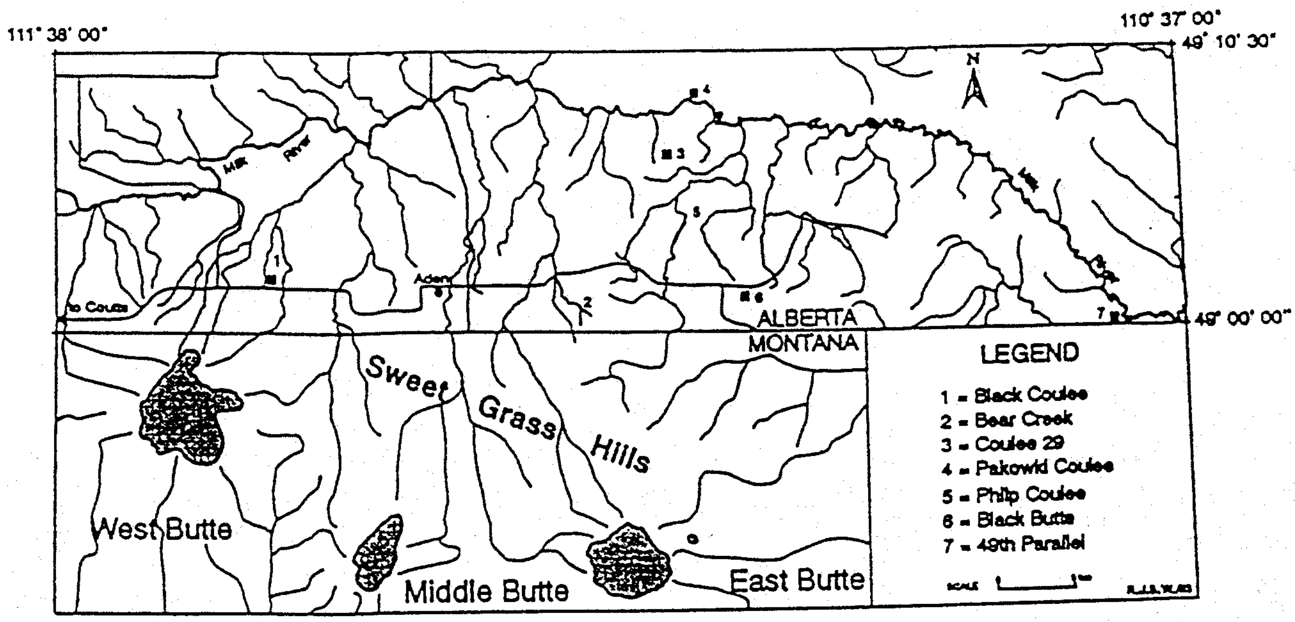


Figure 1b · Location map for the southern Alberta alkalic occurrences. The locality names referred to in the text differ from that of Kjarsgaard (1994) as follows: 2 = JD-5, 3 = JD-4, 4 = JD-2, 5 = JD-3 (Roman Wall), and 6 = JD-1 (Black Butte). The Black Butte property contains the JD-3 (Roman Wall) and JD-1 (Black Butte) occurrences. The Sweet Grass Hills are located south of the Alberta-Montana border and are represented by the shaded masses (from Kjarsgaard (1994)).

The Pakowki Formation is interpreted to be of marine origin, consisting of dark grey shale, with occasional thin beds of sandstone, siltstone and bentonite. The lower contact is commonly marked by thin beds of grey to black chert pebbles while the upper contact is transitional with the overlying Foremost Formation. The thickness of the Pakowki Formation in the Milk River area is approximately 500 feet thick.

The Foremost Formation, exposed along the Milk River canyon, consists primarily of arenaceous shale. It is comprised of a mixture of brackish water and freshwater deposits, consisting mainly of shaly siltstones, sandstones, coal seams, ironstone concretions and silicified oyster-shell beds and having a thickness of approximately 270 feet.

The Oldman Formation typically consists of a light-coloured, argillaceous sandstone, interbedded with green, sandy shales. Coal seams are present in the upper part of the formation. Coarser beds commonly show crossbedding and are lenticular.

2.3 Structure

The southern Alberta plains are situated on the Sweet Grass Arch, a broad, northerly plunging anticline. The Black Butte Property lies to the east of this arch and therefore the regional dip of the beds is to the east-northeast. Local deviations are reported in "... nose- and dome-like structures ... developed around the igneous intrusions of the Sweet Grass Hills" (Westgate 1968).

Furthermore, "The nature and orientation of some surficial lineaments can not be explained by glaciation. These non-glacial lineaments ... are several miles long, and may intersect, or be sub-parallel. It is believed that these lineaments represent fault or joint traces that have been reflected through the unconsolidated glacial drift. This reflection occurred when adjustment took place along the faults, possibly due to differential isostatic rebound" (Westgate 1968).

2.4 Alkalic Occurrences

There are a total of seven small alkalic intrusives exposed just north of the Montana-Alberta border and south of the Milk River (Fig. 1b). They are coeval and almost certainly related to the Sweet Grass Hills, immediately to the south in Montana (Fig. 2). They were first described as "mica traps" (Dawson 1884) and more recently as minettes and olivine minettes (Kjarsgaard 1993, 1994). The occurrences are generally intrusive (except JD-4, having two extrusive phases), ranging from small discontinuous dykes to larger resistant diatremes having positive relief. They are evident on the Geological Survey of Canada Cypress Hills aeromagnetic data set acquired in 1992 and released in May 1993. Recent interpretation of aeromagnetic and geochronological data by the Geological Survey of Canada indicates southern Alberta is underlain by Archean basement of the Hearn Province.

3. PROPERTY DESCRIPTION

The author is in receipt of a Dankoe Mines Limited news release (dated August 8, 1994) describing the terms of an option arrangement whereby Dankoe Mines Limited and Bismillah Ventures

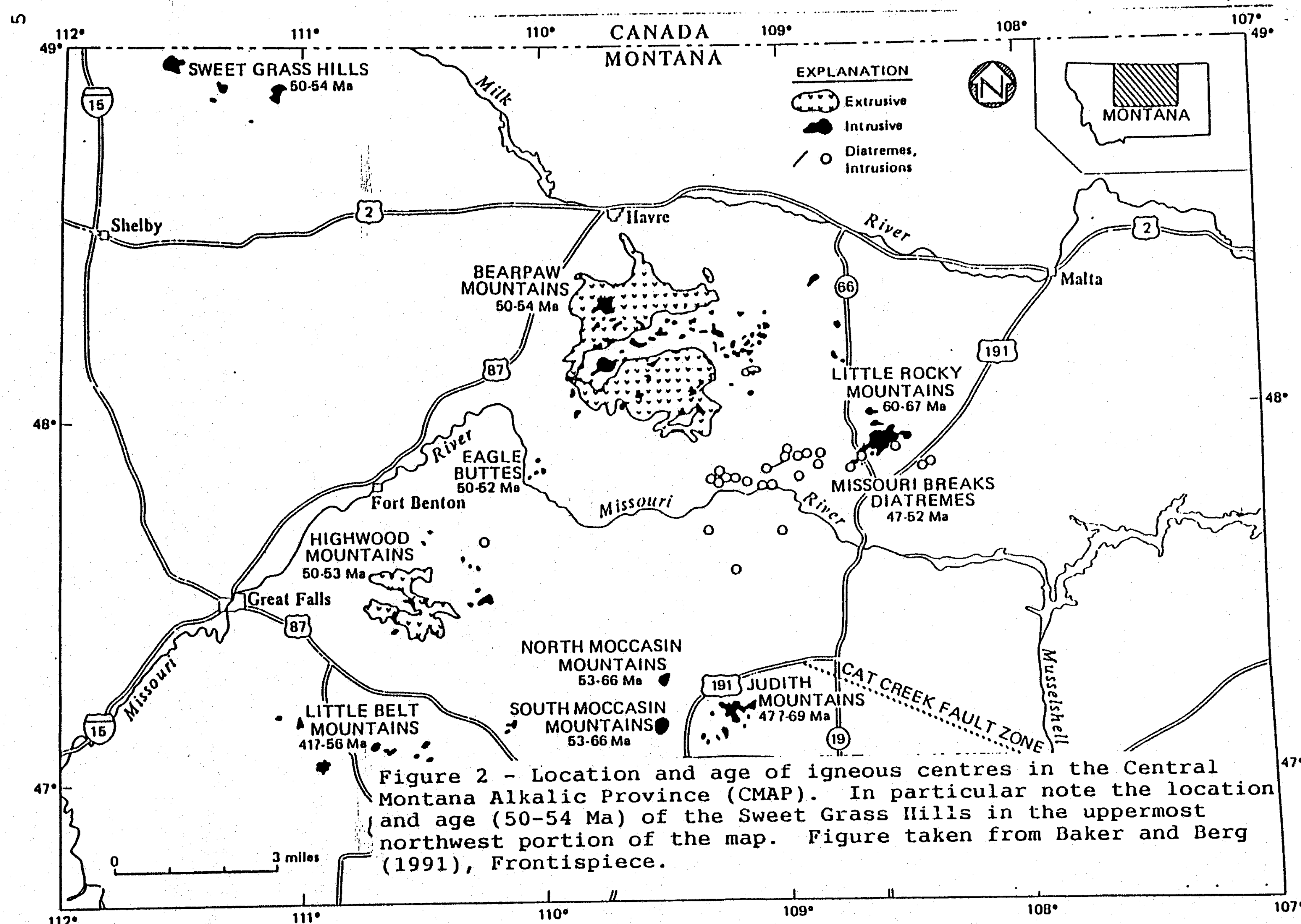


Figure 2 - Location and age of igneous centres in the Central Montana Alkalic Province (CMAP). In particular note the location and age (50-54 Ma) of the Sweet Grass Hills in the uppermost northwest portion of the map. Figure taken from Baker and Berg (1991), Frontispiece.

Inc. intend to enter into an option agreement with Roman Wall Corporation (formerly D.I.M. Holdings) to acquire an interest in Alberta Metallic Minerals Permits No.: 9390 01 0002 and 9392 08 0002 (Figure 1(b)). These permits encompass an area of approximately one township (Township 1, Range 8, west of the Fifth Meridian), excluding sections 8 and 26, having the dimensions 6 miles east-west and 6 miles north-south, equivalent to approximately 34 square miles.

In order to determine the chain of title to the property, the author has requested and has received fax copies of the two Metallic Minerals Permits held by Patrick J. DeVeaux and trust documents signed by Patrick J. DeVeaux stating that Mr. DeVeaux is holding permits in trust for Roman Wall Corporation. The author has not obtained original copies of the Permits directly from the Alberta Government.

4. GENERAL GEOLOGICAL CONSIDERATIONS

The Milk River area of southern Alberta is considered a highly favourable location for diamond exploration for several reasons:

1) alkalic intrusive to extrusive occurrences having characteristics similar to diatremes in the Central Montana Alkalic Province with a similar emplacement age (Fig. 1 and 2);
2) the possible presence of a failed triple junction providing a conduit from the mantle for alkalic magmas (Fig. 3 and 4);
3) the presence of a thickened lithospheric keel, possibly extending as deep as the diamond stability field (Fig. 5); and
4) the recovery of Archean age zircon separates from deep, basement penetrating drill holes, interpreted as evidence for stable Archean craton underlying the Alberta basin (Fig. 6a).

Each of these points is individually significant and encouraging for diamond exploration. Kimberlites and lamproites are the only two primary lithologies currently known to contain economic quantities of diamond, requiring a conduit to allow access to the surface from the mantle. Furthermore, diamondiferous occurrences are associated with stable cratonic shield areas, having thickened keels extending into the diamond stability field.

Firstly, numerous alkalic intrusions (including kimberlite and lamproite) are exposed throughout central Montana to the Alberta border (of which the Sweet Grass Hills and associated intrusives are the northernmost exposed). The Sweet Grass Hills are comprised of granitic to syenitic intrusives whereas the Sweet Grass alkalic intrusives are characterized by significant sodium and, in particular, potassium enrichment. Furthermore, geochemical analyses of rock and mineral samples document characteristics similar with occurrences in the Central Montana Alkalic Province and diamond inclusion field mineralogy (see section 7.0). Finally, although separated from intrusions having similar characteristics in Montana by the Great Falls Tectonic Zone (Maughan 1993), they have a similar age of emplacement (Fig. 2). The alkalic occurrences in the Central Montana Alkalic Province, underlain by Archean basement of the

Figure 3 - Aeromagnetic anomaly map of southeastern British Columbia and Alberta. Domain boundaries indicated by thick white lines, see Figure 6 for reference and key to domain names and ages. The Home Pacific Knappen well is located immediately north of the Montana-Alberta border. Zircons recovered from basement penetrated and sampled by the drill have returned an age of 3278±22 Ma. Note the colour of the Vulcan Low magnetic low and the southeast projecting unlabeled low with possible reference to a failed triple junction/aulacogen model discussed in the text. Figure taken from Villeneuve et al. (1993).

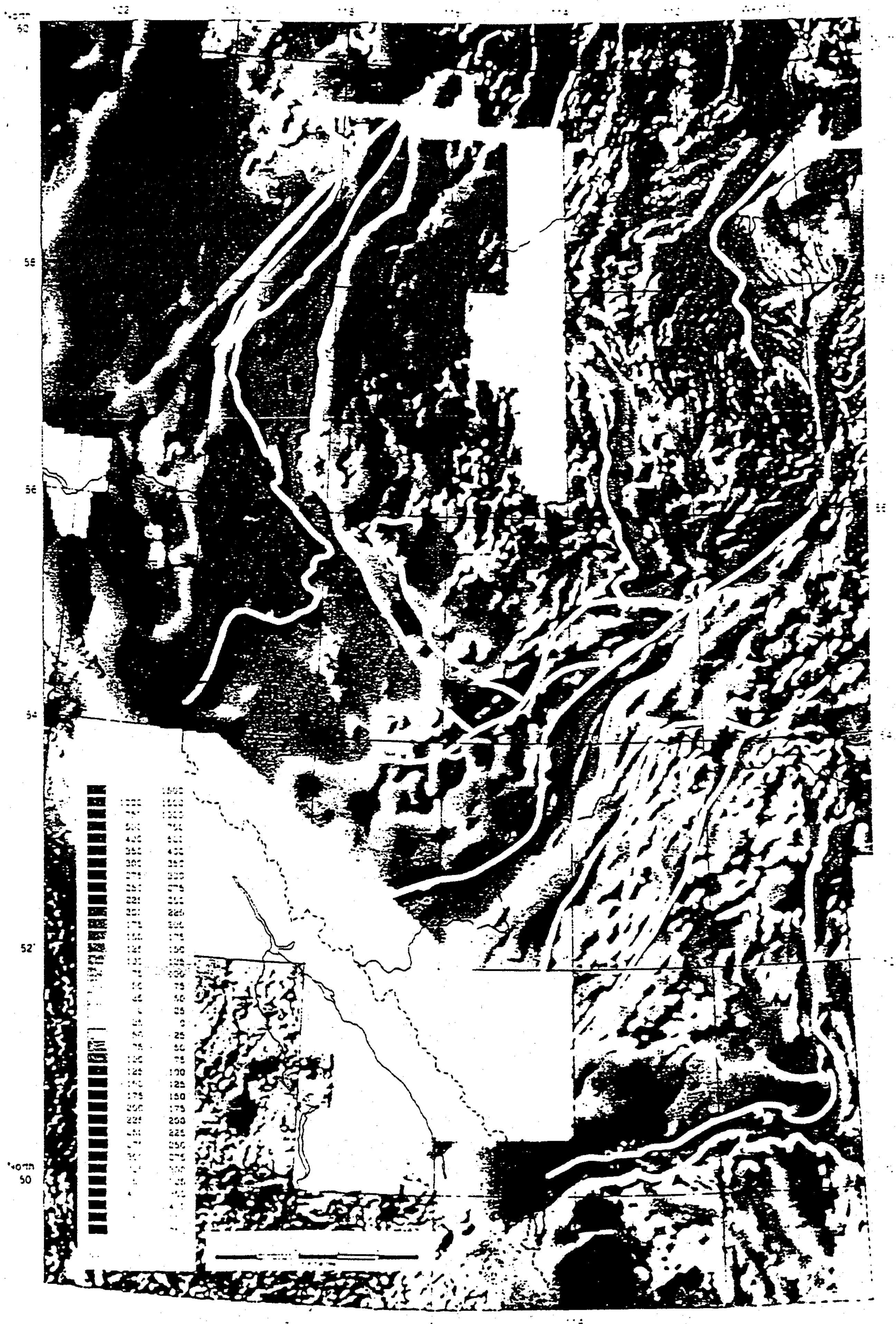


Figure 3

Figure 4 - Bouguer Anomaly map of southeast British Columbia and Alberta. The Vulcan Low is apparent and can be traced to the leading edge of Cordilleran deformation where it is obscured or truncated. In addition, the possible southeast projecting arm to a failed triple junction/aulacogen is not apparent. Figure taken from Villeneuve et al. (1993).

Figure 4

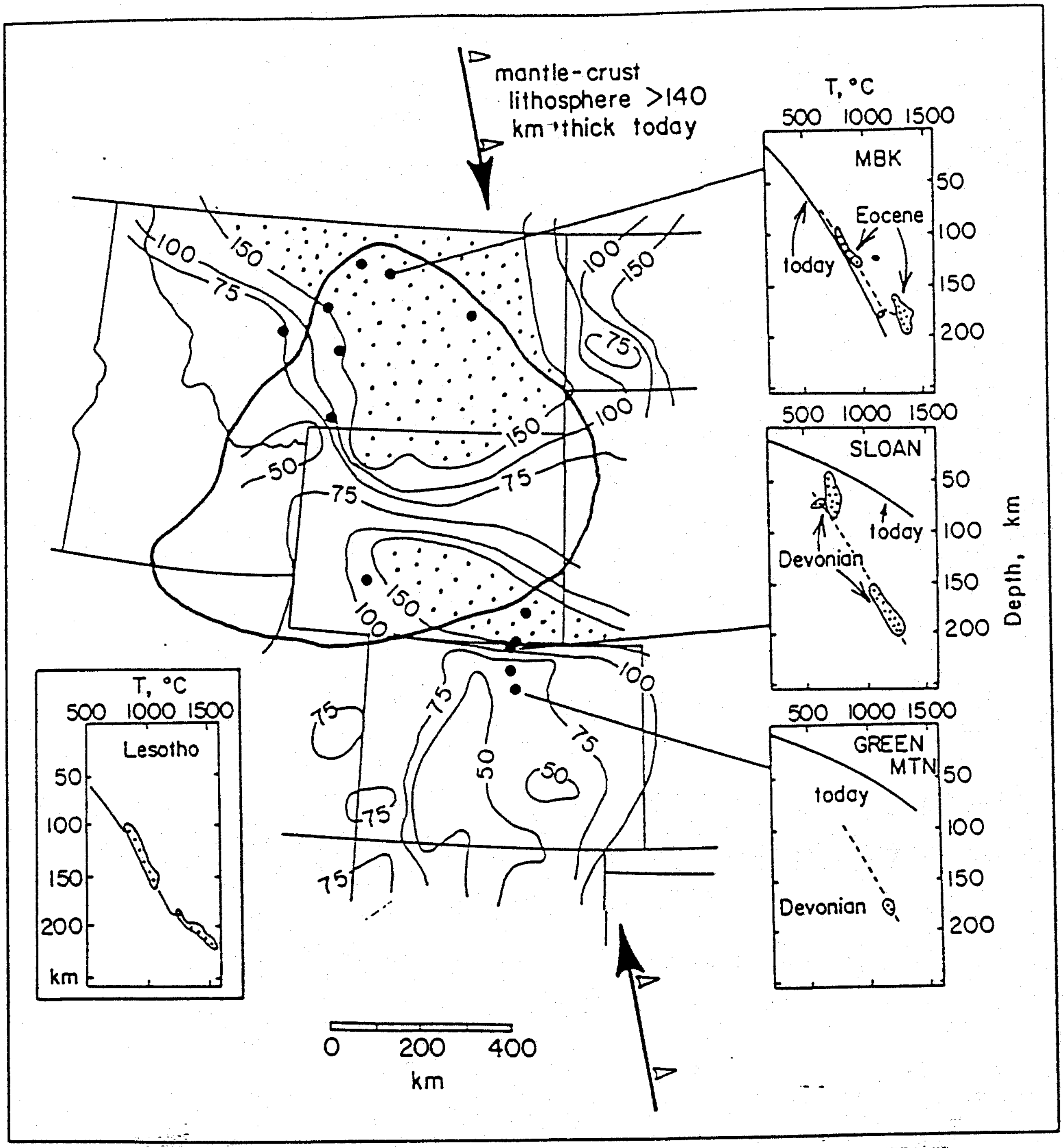


Figure 5 - Present day thickness of the lithosphere (km) calculated from heat flow data. The boundary between the lithosphere and asthenosphere is taken as the 1200°C isotherm. The heavy arrows at top and bottom indicate the proposed regional edge of thick (>140 km) mantle lithosphere. The regional enclosed by the thick line indicates the interpreted present day extent of the Wyoming craton, separated from the Hearn Province under Alberta and Saskatchewan by the Great Falls Tectonic Zone. The dots are areas of magmatic activity (see Figure 2 for more detail). The inset figures show fossil geotherms from xenolith samples recovered from the stated occurrences. The conclusion reached is that the thick mantle lithosphere that was once present under much of the present day western Great Plains and leading edge of the Rocky Mountains is now significantly reduced, represented today by a thickened area under central Montana and Wyoming. Figure taken from Eggler and Furlong (1991).

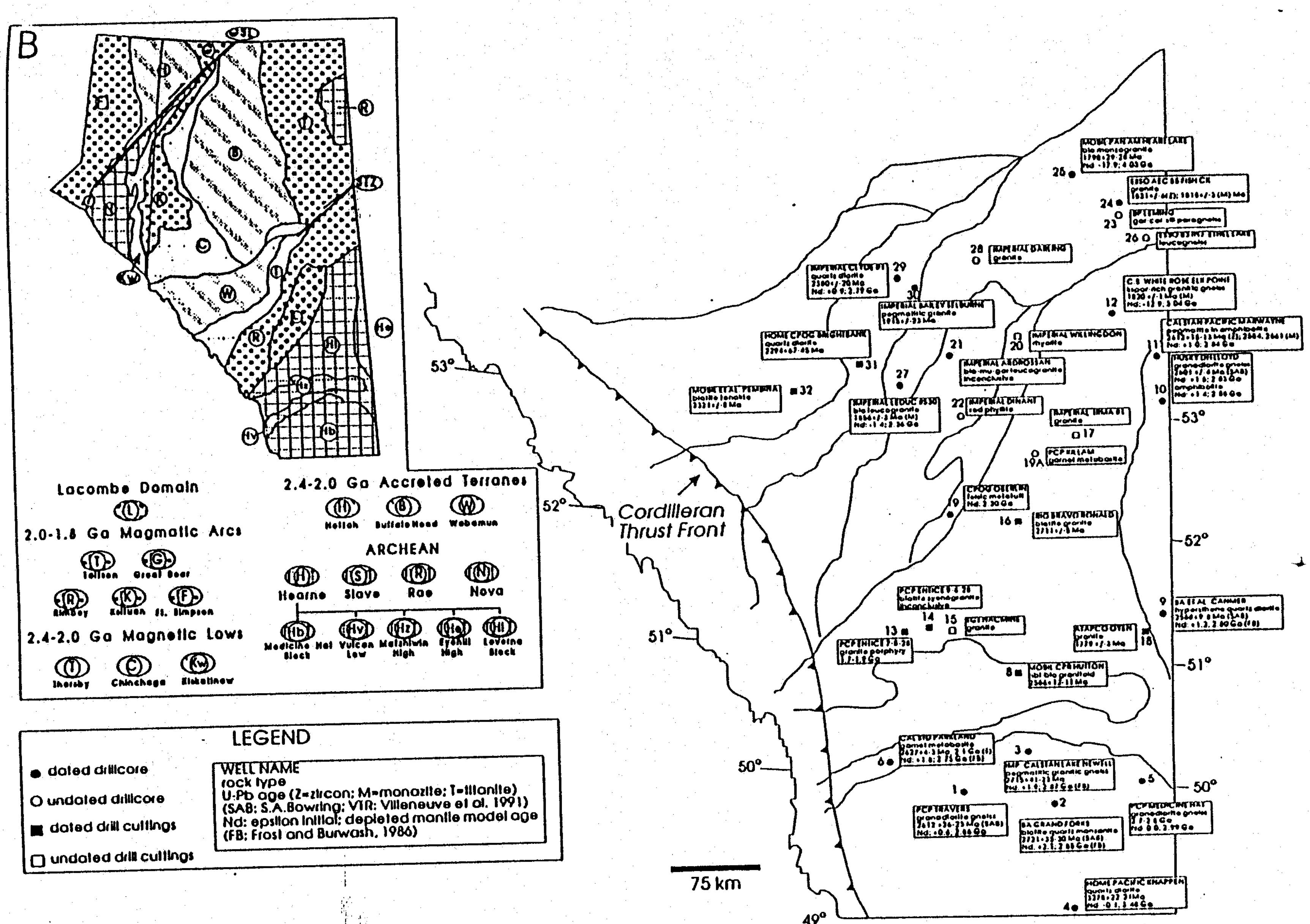


Figure 6a Drill hole locality map of Alberta showing the location of basement penetrating drill holes from which zircon samples were obtained for geochronological dating relative to domain boundaries. Key to domains indicated in inset figure. Note location of Home Pacific Knappen well relative to approximate position of southern Alberta Sweet Grass intrusives. Figure taken from Villeneuve et al. (1993).

Wyoming craton, were generally intruded or erupted in the Eocene between 67 and 47 Ma. The Sweet Grass Hills igneous bodies have been dated at between 50 and 54 Ma and similar dates (50 ± 5 Ma; Cavell 1994, pers. comm.) have been determined for the Sweet Grass intrusives of southern Alberta (Burwash et al. 1992, Cavell and Nelson 1992).

Secondly, some centres of alkalic igneous activity are associated with continental rifting (e.g. East African Rift system). Kanasewich et al. (1968) interpreted the presence of a long lived rift system extending northeast from southeastern British Columbia into southern Alberta. It has been interpreted as episodically active from the Middle Proterozoic to the Early Paleozoic, and perhaps as recently as the Upper Cretaceous (Dufresne and Williamson 1993). That arm of the aulacogen would probably project too far to the north to be associated with alkalic activity in the Milk River area. However, a south to southeast projecting arm of a continental-rift associated triple junction may have produced crustal scale faults providing conduits for alkalic magmas to reach surface.

Support for this hypothesis is evident in the geological background provided for diamond claims staked in Saskatchewan (Fig. 6b) (Dale Resources, 1994; from Gent 1989). The report describes both northeast and northwest trending faults (non-glacial linears of Westgate 1968), several associated with earthquakes (one reportedly as recent as 1991). In a property description, Dale Resources include a figure indicating two northwest trending "Zones of Rifting" and a northwest trending "Earthquake Line / Zone of Rifting" associated with the Kuroki Fault / Great Falls Shear Zone (Maughan 1993; Shaunavon Linear (?), Gent 1992). One of the northwest trending Zones of Rifting noted by Dale Resources passes through the Sweet Grass Hills / Milk River area.

A recent geophysical compilation of aeromagnetic data for southern Alberta may support such a hypothesis. A distinct magnetic low (Fig. 3) is spatially associated with the rift proposed by Kanasewich et al. (1968), identified as the Vulcan Low (Ross et al. 1991). A southeast projecting low is evident, in possible contact and contiguous with, the Vulcan Low. It has a signature similar to the Vulcan Low, however the configuration is inconsistent with a "typical" triple junction. It is possible that subsequent deformation during the Laramide orogeny (compression) and / or during the Eocene (extension) may have modified a failed triple junction signature.

It should be pointed out that the interpretation of Villeneuve et al. (1993) differs markedly in that they interpret the Vulcan Low to be the geophysical expression of a former north-dipping subduction zone of which the Matziwin High is the associated magmatic belt. Furthermore, the Vulcan Low appears to have a southern curvature at its western edge where it terminates within the broad aeromagnetic high associated the leading edge of the Canadian Cordillera (Varsek 1994, pers. comm.). However, "... this does not preclude younger reactivation of this boundary to produce the southern Alberta aulacogen" (Ross et al. 1991).

Thirdly, recent research documented a very low geothermal gradient, interpreted to indicate a thick lithospheric keel (Fig. 5) (Eggler and Furlong 1991). The thickened lithospheric keel is interpreted to be oriented north-northwest - south-southeast and to extend from southern Wyoming, through central Montana into southeast Saskatchewan and southwest Alberta. An extremely interesting study (Eggler and Furlong 1991) proposed the presence of a "fossil" lithospheric keel underlying most of Wyoming and

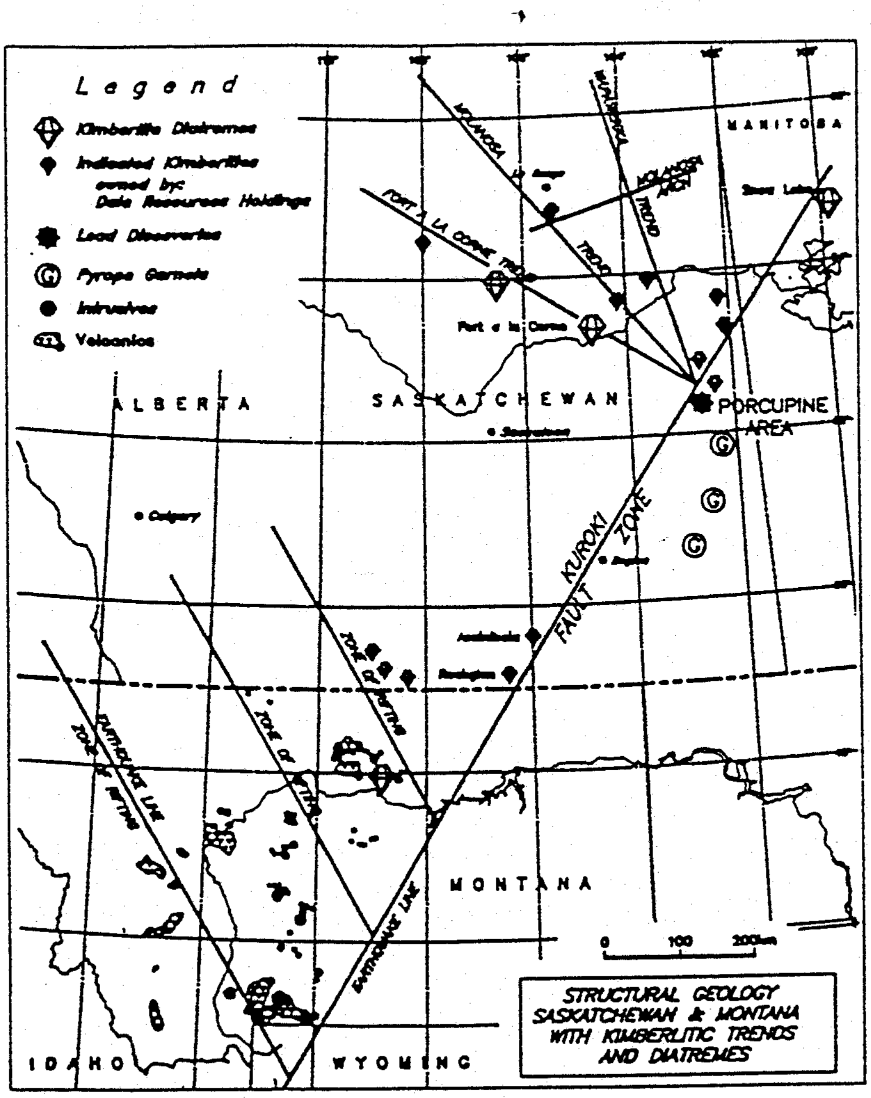


Figure 6 (b) - Compilation schematic map of major linears in northern Montana, southern Saskatchewan and southern Alberta from Dale Resources promotional brochure. The northeast trending "Kuroki Fault Zone" is probably equivalent to the Great Falls Tectonic / Shear Zone (Maughan 1993) and the Shaunovan Linear (Gent 1989). The northwest trending "Zones of Rifting" and / or Earthquake Line are probably equivalent to the "nonglacial linears" of Westgate (1968). Note that the central "Zone of Rifting" passes through the Sweet Grass intrusives area and broadly correlates to the southeast - northwest trending aeromagnetic low in Figure 3.

much of Montana. A study of mantle xenoliths resulted in the interpretation that the present day lithospheric keel is the relict of a former keel which had a greater extent in the past (pre-Cretaceous) and has since been thermally eroded. Furthermore, mantle xenoliths in the Missouri River Breaks area document pressures and temperatures consistent with an origin very close to, or within, the diamond inclusion field during the Eocene (see inset Fig. 5).

Finally, Ross (1991) reported preliminary results of a multidisciplinary study in which "... Aeromagnetic and gravity anomaly maps were combined with U-Pb zircon and monazite geochronology of selected samples of crystalline basement to develop an age domain map for Alberta..." (Fig 6a). In this study, exposures of Canadian Shield in northwestern Alberta and Saskatchewan were correlated to specific aeromagnetic and gravity signatures in the Alberta Basin. U-Pb dating of zircon and monazite samples served as a control on proposed correlations. Of particular interest to the southern Alberta area is the extension of Archean age basement of the Hearn Province into the southern third of Alberta. Five ages determined for the "Medicine Hat Block" range from 2612 to 3278 Ma. The single date of 3278 ± 22 Ma was obtained from a drill hole just north of the Montana border and south of Milk River. It is extremely interesting with regard to the age of peridotitic diamonds of 3300 Ma recovered world wide (Kirkley et al. 1992, Levinson et al. 1992).

5. SWEET GRASS INTRUSIVES

The Sweet Grass intrusives were first described by Dawson (1884) as "mica traps" and more recently as minettes (Kjarsgaard 1994). There are seven separate occurrences documented in southern Alberta, all on or south of Milk River and north of the Montana-Alberta border (Fig. 1), ranging from thin discontinuous dykes to a crater-facies minette vent complex (Kjarsgaard 1994). The alkalic occurrences present at the surface coincide well with geophysical anomalies evident on government aeromagnetic maps (Ross et al. 1994). In addition, many linear geophysical anomalies are present in the subsurface and are best modelled as vertical to sub-vertical dykes having a "blow" at upper levels (Ross et al. 1994).

The Sweet Grass intrusives are mica-rich potassic rocks consisting of "... phenocrysts of phlogopite and diopside ± olivine in a groundmass of phlogopite, apatite, magnetite, K-feldspar, clinopyroxene ± carbonate ± analcite" (Kjarsgaard, 1993). Phlogopite analyses indicate "... a zoning trend of increasing $Fe0$ and $Ti0_2$ at near constant Al_20_3" (Kjarsgaard, 1993).

Based on composition and zoning trends, the Sweet Grass intrusives were interpreted as minettes, a lamprophyre consisting of biotite with subordinate diopside as phenocrysts in a groundmass of orthoclase or sanidine (alkali feldspar) (Kjarsgaard 1993, 1994). Alternatively, they have been classified as verites, a glassy olivine-diopside-phlogopite lamproite (Ash and Associates 1993) and as a sanidine-phlogopite lamproite (Williams 1993).

Note: For the sake of convenience the southern Alberta alkaline occurrences will be referred to, in general, as intrusives. Except for sections discussing the extrusive and / or intrusive features specifically, the reader should remember that "intrusives" as used in the following text is a generalization utilized for the sake of brevity and is not strictly correct.

5.1 Black Butte (JD-1)

Black Butte (JD-1) is a large, boss-like plug which rises approximately 30 metres above the surrounding plains (Kjarsgaard 1994). Workers from the University of Alberta consider the Black Butte occurrence to represent a small stock rather than a diatreme (P. Cavell 1993, pers. comm.). In plan view the occurrence has an elongate, northeast - southwest trending ovoid shape, having the approximate dimensions 400 metres by 200 metres. It is an intrusive occurrence hosted by sediments of the Cretaceous Oldman Formation.

The outcrop weathers light to dark grey and is comprised of phenocrysts of phlogopite + clinopyroxene ± olivine (in subequal proportions) in a groundmass dominated by phlogopite and subordinate pyroxene, altered mafics, opaques and K-feldspar (?) (Ash and Associates 1993; see Appendix 3). Bimodal phlogopites are up to 2 centimetres in diameter (phenocrysts) with groundmass phlogopites less than 3 millimetres in diameter. Zoning is evident in the phlogopites, from black / dark brown cores to brown coloured rims. Euhedral to subhedral clinopyroxene crystals are up to 2 cm in length. Accessory phases include chromite, magnetite, spinel, ilmenite, picroilmenite, garnet and chrome diopside. Other phases reportedly present include: low-Al amphibole, picrotitanite, Sr apatite and armacolite. The Black Butte occurrence has been interpreted as a minette plug (Kjarsgaard 1994) and as an olivine - diopside - phlogopite lamproite (verite) (Ash and Associates 1993).

Medium grey weathering xenoliths (up to 20 cm in long dimension) vary from rounded ultramafics to angular felsic inclusions. Xenoliths observed (Fig. 11 - 12) and reported include tonalite and amphibolite gneiss (interpreted to have a basement (lower crustal) origin), clinopyroxenite, phlogopite clinopyroxenite, glimmerite and mafic syenite cognate xenoliths (Kjarsgaard 1994).

5.2 JD-2 Diatreme

The JD-2 diatreme comprises one of two known surface outcropping alkaline occurrences on Marum Resources Inc.'s Pinhorn Property. It is located in the broad Pakowki Coulee on the northern margin of the Milk River, in a broad south-facing meander curve. It has been described (Kjarsgaard 1994; his Pakowki Coulee locality) as a brown minette dyke / plug which intrudes the Cretaceous Pakowki Formation (Fig. 14). It is an elongate, positive feature oriented north-northwest - south-southeast, approximately 20m x 25m and rising approximately 10m above the Milk River.

Two phases of igneous activity are evident within the intrusion at the level of the river (Fig. 14b and d). One is a reddish brown xenolith-bearing phase and the other a dark green to black, relatively inclusion-free phase. The upper levels of the exposure consist of a xenolith-poor phase having abundant small carbonate veins. Xenoliths identified are comprised exclusively of crustal inclusions of sedimentary lithologies and include limestone as well as laminated mudstones, shales and siltstones similar to host lithologies. No ultramafic xenoliths were identified and none have been reported in the literature available.

The lower reddish-brown minette has relatively abundant xenoliths comprised of well indurated, rounded to angular crustal fragments up to 30 cm in long dimension. It has a transitional contact with the dark green to black phase, which may indicate an alteration feature or a separate intrusive phase.

Kjarsgaard (1994) interprets it as a separate phase which is consistent with an apparent difference in xenolith content. There are no inclusions of either phase in the other. Furthermore, they appear to be mineralogically similar, which in itself is unequivocal, and the contact appears to be gradational over approximately 8 cm. It would appear more probable that they are; in fact, two separate phases in which the dark green phase intruded shortly after the reddish brown phase and both were modified along their mutual contact. Perhaps the lack of inclusions of one phase in the other is a result of the earlier phase being hot and ductile, yet essentially solidified during intrusion of the dark green phase.

Finally, the dark green phase appears to cut the upper brown phase and therefore is most likely the last intrusive event evident at this outcrop. This phase has been interpreted as an olivine-rich, black minette sill and dyke which intrudes the brown phlogopite- and diopside-phyric minette phases (Kjarsgaard 1994).

5.3 Roman Wall (JD-3 Dyke)

The JD-3 (Roman Wall) occurrence is exposed in 40 to 100 metre segments over approximately 700 metres in Philp Coulee (Philp Coulee occurrence, Kjarsgaard 1994). The occurrence is exposed as a series of en echelon dykes ranging between 1 and 3 metres in thickness (Fig. 7). The dykes have sub-vertical dips at the surface and strike 029°. In areas of poor exposure the dykes can be traced by a ridge of strongly hornfelsed sediments (Kjarsgaard 1994). These exposures are characterized by large phenocrysts of phlogopite with subordinate clinopyroxene in a fine-grained light to medium grey groundmass. Kjarsgaard (1994) reports olivine as a phenocryst phase in addition to phlogopite and diopside (clinopyroxene). "A moderately pronounced trachytoid texture is also observed, defined by 0.3 - 3 mm mica plates" (Kjarsgaard 1994), which is probably an intrusive flow related texture.

5.4 JD-4 Diatreme

The JD-4 diatreme complex is a very dramatic, multi-phase intrusion (Fig. 7 - 9) exposed on the east side of a coulee (Kjarsgaard 1994; Coulee 29) approximately three kilometres south of Milk River. It has been described as a minette vent complex having at least four separate magmatic events, including a pyroclastic vent phase, which intrudes Cretaceous sediments of the Pakowki and Foremost Formations (Fig. 7 and 8) (Kjarsgaard, 1994).

The diatreme complex consists of a main pipe or "blow" with up to 10 separate dykes present (Fig. 7), representing an early extrusive, pyroclastic phase (Fig. 13) with at least two, probably three, separate and distinct, cross-cutting intrusive events. The diatreme complex is exposed over a vertical distance of approximately 75m, from the coulee floor to the top. The main pipe or vent complex is approximately 175m in diameter. The overall complex is oriented north-northeast - south southwest and cores the east side of the coulee for up to 750 metres (Fig. 8).

The complex consists of a buff to light grey coloured early (pyroclastic) phase comprised of blocks up to a metre in size, with an associated brown weathering vent phase (Kjarsgaard 1994). The third phase consists of several exposures of brown weathering dykes which cross-cut the earlier vent phases. The last phase present are dark green dykes which cross-cut all of the earlier phases, exposed in "Kimberlite

Figure 7 - (a) and (b) Two views of the JD-3 (Roman Wall) occurrence in Philp Coulee. These photographs were taken at the northernmost occurrence of the dyke exposed in the coulee. To the north, the dyke is covered under glacial material. Several exposures of dyke material are evident where meander curves of Philp Coulee have intersected the dykes. The dyke is blocky weathering and has narrow hornfelsed contacts with host sedimentary exposures. (c) Panoramic compilation photograph of the entire JD-4 exposure, taken from the southern margin of the southern tributary coulee. The Milk River valley can be seen in the far distance to the left. The main composite complex is at the centre of the photograph, consisting of at least three distinct and separate phases. A number of dykes can be seen, including five to the right (east) of the main complex, at least four evident within the main complex and two coring the right (east) side of the main coulee draining to the north into the Milk River. There are two dyke phases evident; the first is brown weathering (associated with the proximal vent volcanic complex (Kjarsgaard 1994) such as the large mass to the right of the main complex and the dark green, olivine minette phase visible in Kimberlite Gulch (small tributary coulee just north of the main complex just left of centre).

Figure 8 - (a) View looking northeast from the south side of the coulee hosting the JD-4 occurrence. At least three phases are evident in the photo, the light buff to grey vent complex unit, the brown minette dykes and the dark green olivine minette dykes (kjarsgaard 1994). Although not clear in the photograph, the dark green dyke on the skyline to the right of the vent complex undergoes transition into a sill just below the centre right portion of the photograph. Note the figure at the centre of the photograph for scale. (b) View north along the coulee draining into the Milk River valley, just visible in the far distance at the end of the coulee. Host sediments of the Cretaceous Pakowki and Foremost Formations comprise the left side of the coulee and include fossiliferous coquina, contained as inclusions in the diatreme. Dark green olivine minette visible in the foreground, buff to light grey vent breccia and brown weathering proximal vent volcanic rocks present in the near distance. Again, note figure just above centre right for scale.

Figure 9 - Two views of "Kimberlite Gulch". (a) View looking to the southeast from the main drainage at the spire on the southwest margin of Kimberlite Gulch. The spire is cored by resistant weathering dark green olivine minette, the extent of which can be seen relative to the figure on the coulee floor at the centre of the dyke exposure. (b) View looking to the north northeast from the main coulee toward Kimberlite Gulch. The JD-4 exposure can be seen continuing along the main coulee wall toward the left edge of the photograph.

Figure 7(a)

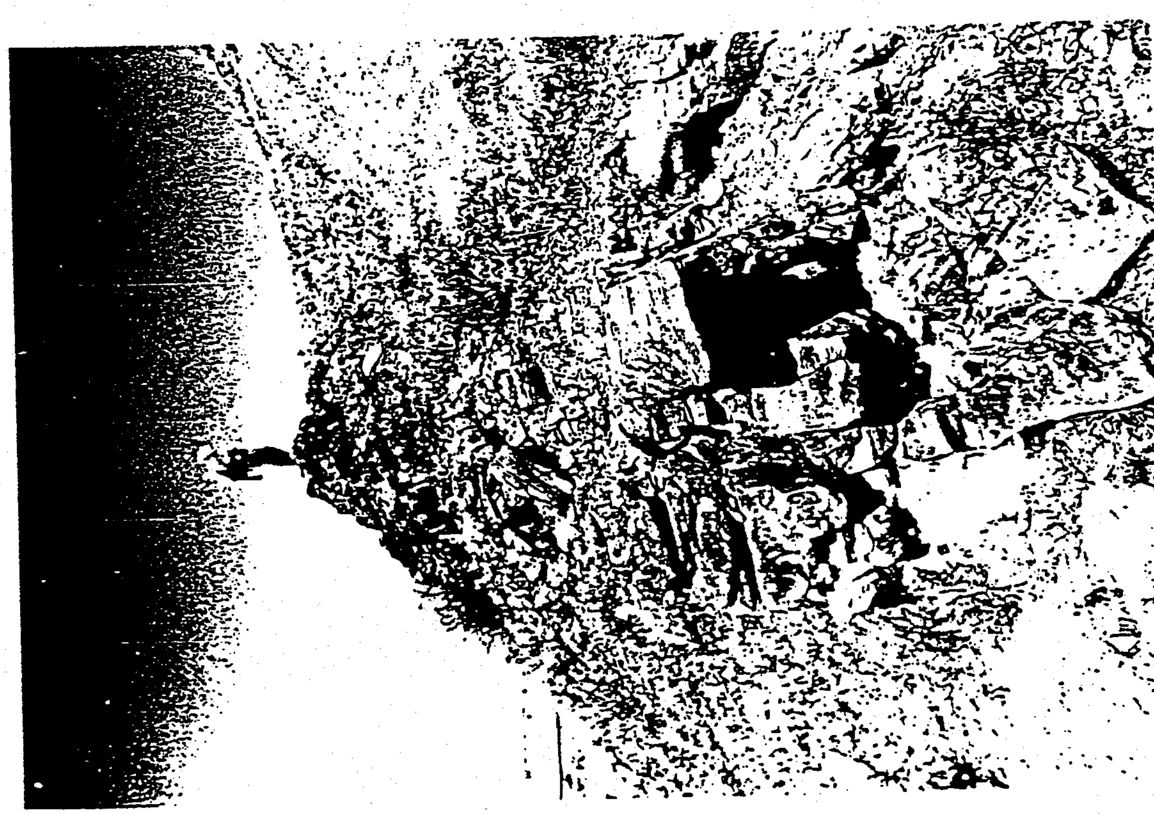


Figure 7(b)

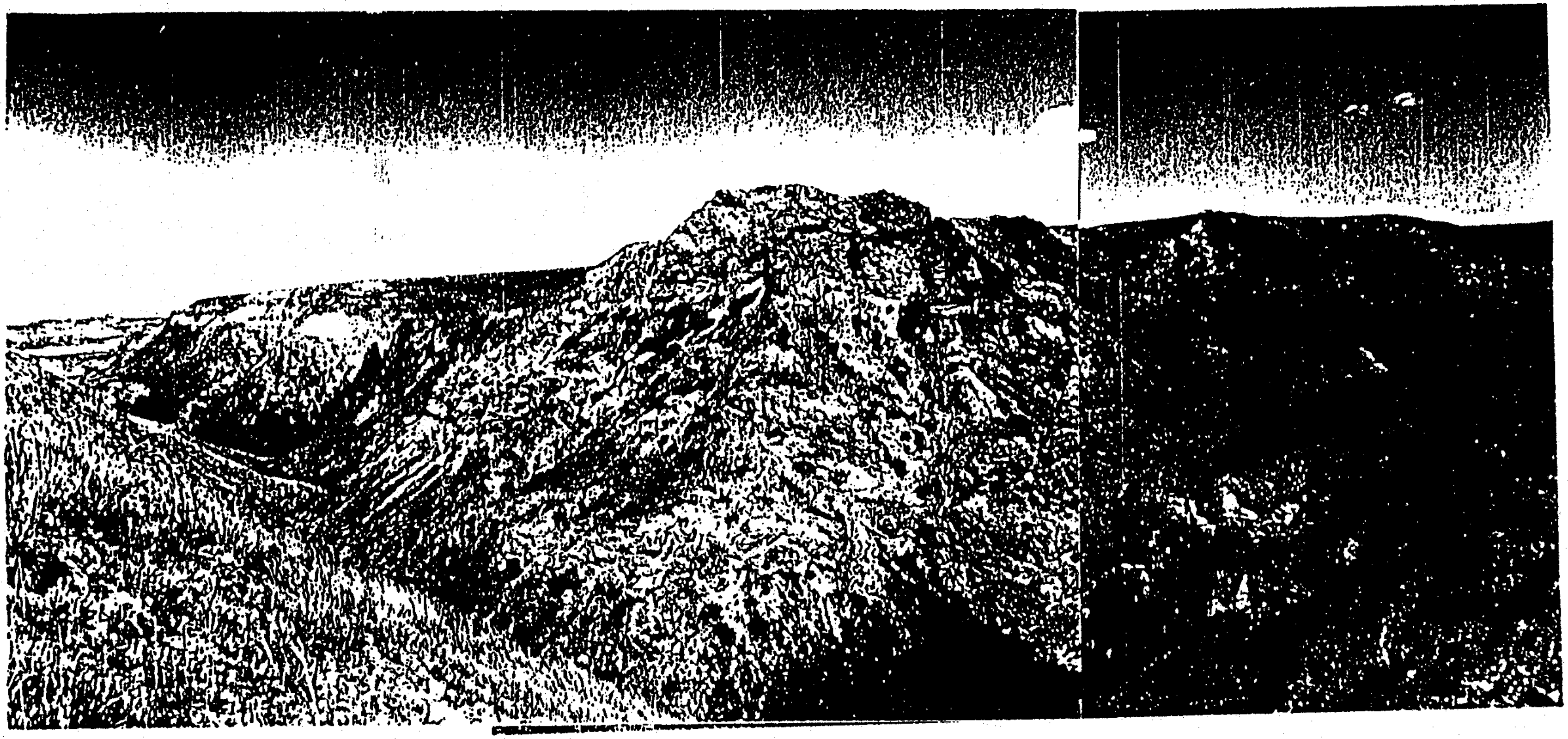


Figure 7(c)

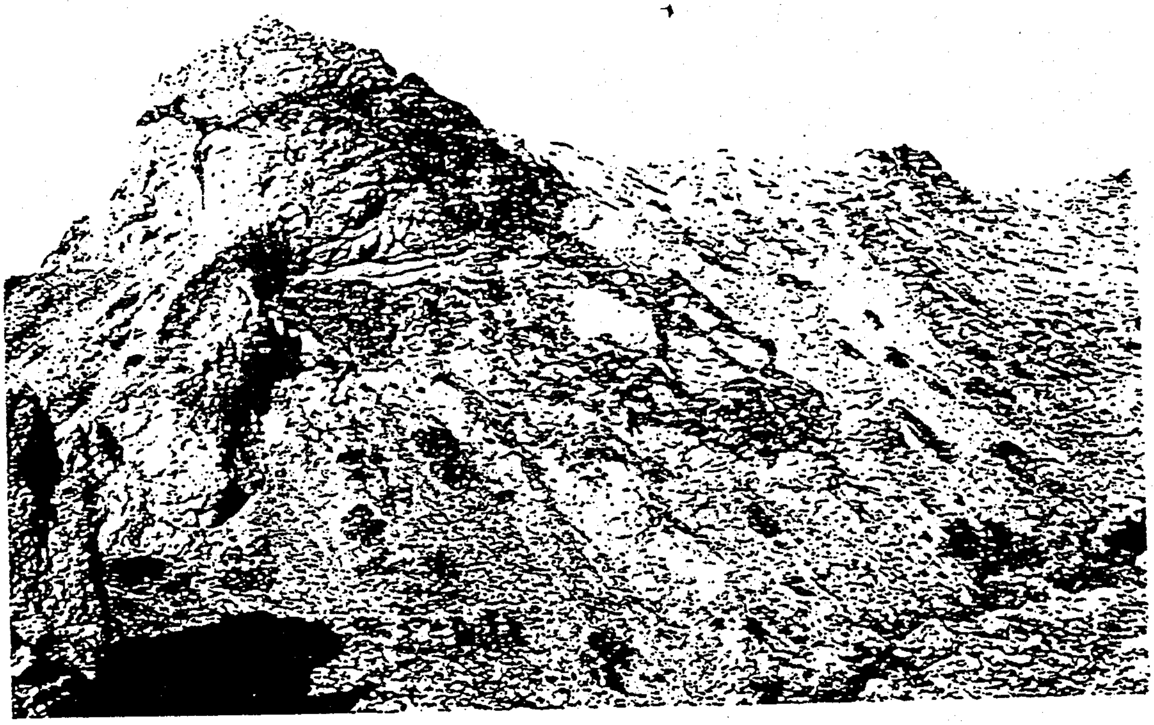


Figure 8(a)

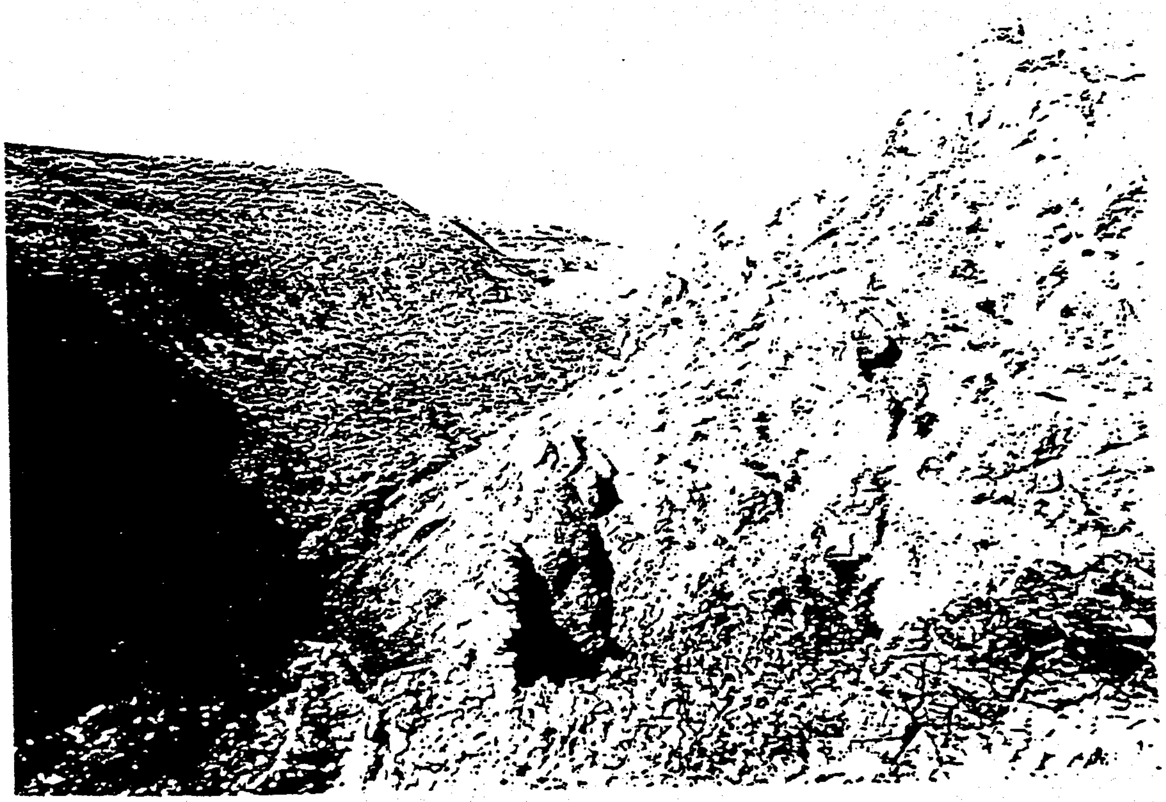


Figure 8(b)

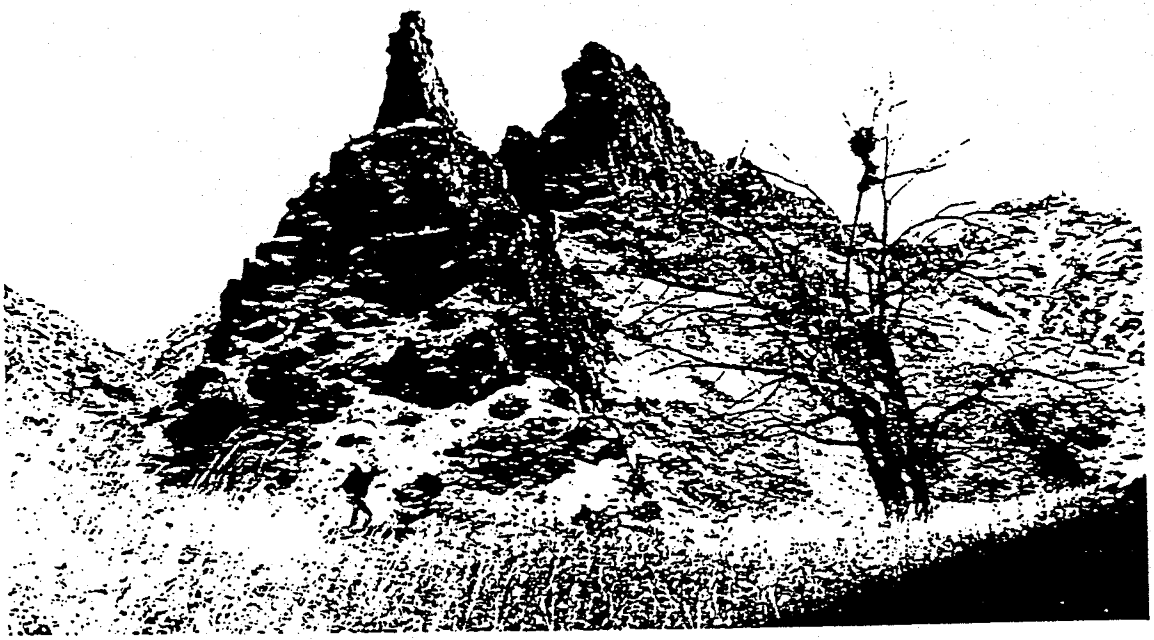


Figure 9(a)

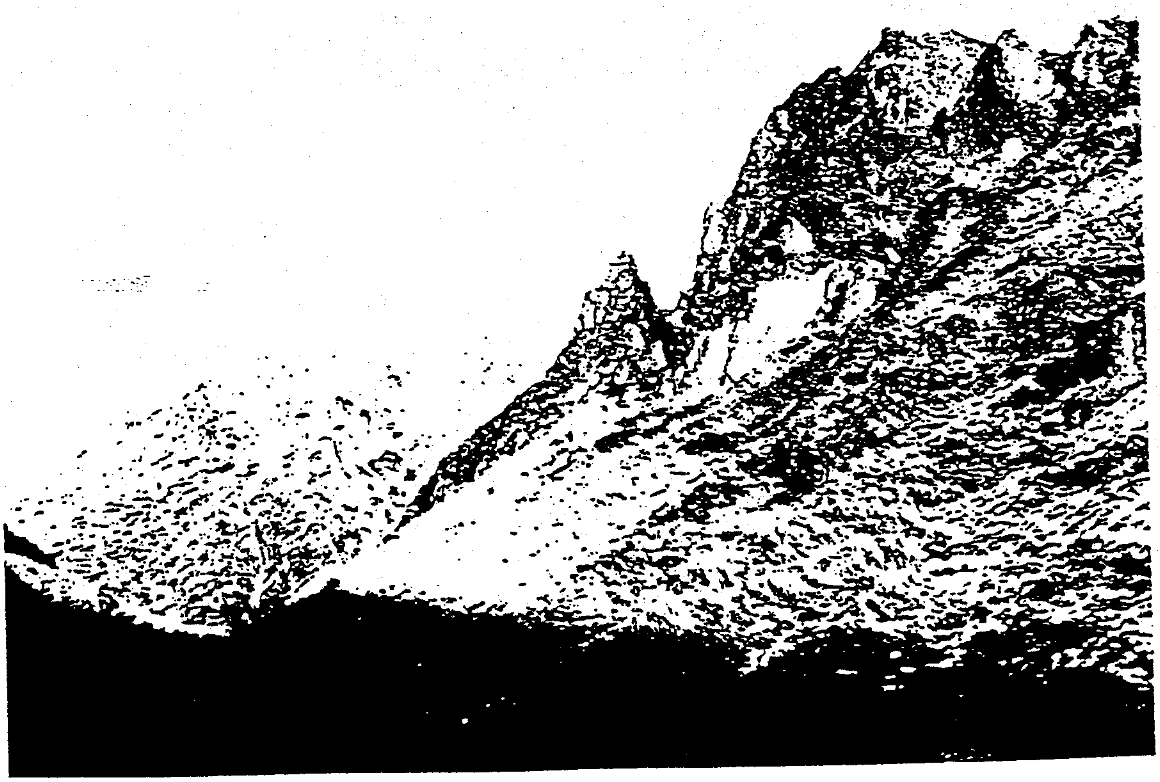


Figure 9(b)

Figure 10 - (a) Photomicrograph of contact between two phases of groundmass. May also represent an alteration front, although unlikely with such a sharp contact. Major difference between the two phases is the increased opaques present on the right side of the photograph. Note large clinopyroxene aggregate at bottom centre (euhedral, blue interference colours). Similar mineralogy on both sides of photograph, comprised of phlogopite laths, euhedral to subhedral clinopyroxene and altered olivine in a fine grained groundmass reported to consist of carbonate, Fe-Ti oxides and sanidine. (b) Groundmass and phenocrysts in matrix phase of minette. Groundmass same as above. Note large euhedral, zoned clinopyroxene phenocryst at centre of photograph. Narrow laths with speckled interference colours are phlogopites, note lack of preferred orientation.

Figure 10(a)

Figure 10(b)

Figure 11 - Cognate inclusions (autoliths) and xenoliths contained in the Sweet Grass intrusives. Figures 11(a) and (b) from Black Butte. (a) Rounded granitoid inclusion, most probably derived from Alberta Basin basement exposures (Canadian Shield Hearn Province equivalent). (b) Phlogopite clinopyroxenite xenolith from mantle. Note the dark brown to black phlogopite books and the green clinopyroxene (diopsidic) matrix. Also note the lack of an apparent alteration rind on the elongate, rounded xenolith. Figures 11 (c) to (h) from JD-4 occurrence. (c) Irregular shaped, extrusive, buff to light grey minette (vent breccia) boulder partially mantled by later dark green olivine minette intrusive phase. Other xenoliths apparent in both the olivine minette and the earlier extrusive minette. In addition, note the presence of brown weathering proximal vent volcanic phase minette to left of mantled inclusion. (d) Spindle-shaped volcanic bomb associated with early, buff to light grey weathering tan vent complex (Kjarsgaard 1994) with knife for scale. (e) Xenoliths contained within the dark green olivine minette phase of the JD-4 complex. Inclusions present include granitic gneiss (Canadian Shield equivalent of Alberta Basin), brown weathering dolomite (Cambrian - Mississippian, just above $1.00 coin), possible granulite fragments (lower crust) and a layered mantle-type xenolith (top centre). Note that none of the inclusions have any visible indications of assimilation and/or alteration rinds. (f) Garnet pyroxenite xenolith mantled by minette contained in buff to light grey, vent breccia phase. The rind is considered to be the magmatic equivalent of the extrusive material which chilled against the lower crustal xenolith and was therefore preserved. The surrounding matrix is an example of the ash to lapilli sized extrusive phase described in the text. Note $1.00 coin for scale in crack in upper right of xenolith. (g) Rounded, medium green clinopyroxenite (mantle) xenolith located in slightly foliated, dark green olivine minette dyke. In addition, note the loose, subhedral phlogopite flakes lying on the surface of the exposure. As with previous examples, note the lack of any indications of thermal alteration, partial assimilation or other visible evidence of xenolith-melt interaction. (h) Contact between dark green olivine minette and buff to light grey vent breccia phase. Large, rounded, dark green phlogopite clinopyroxenite xenolith evident in breccia phase to left of centre, together with light sickly green granulite xenolith and baked sedimentary equivalents. The unmetamorphosed sediments are the only xenoliths in which thermal and/or alteration effects of intrusion are evident, probably due to infiltration of the sediments by volatiles associated with the magmas.

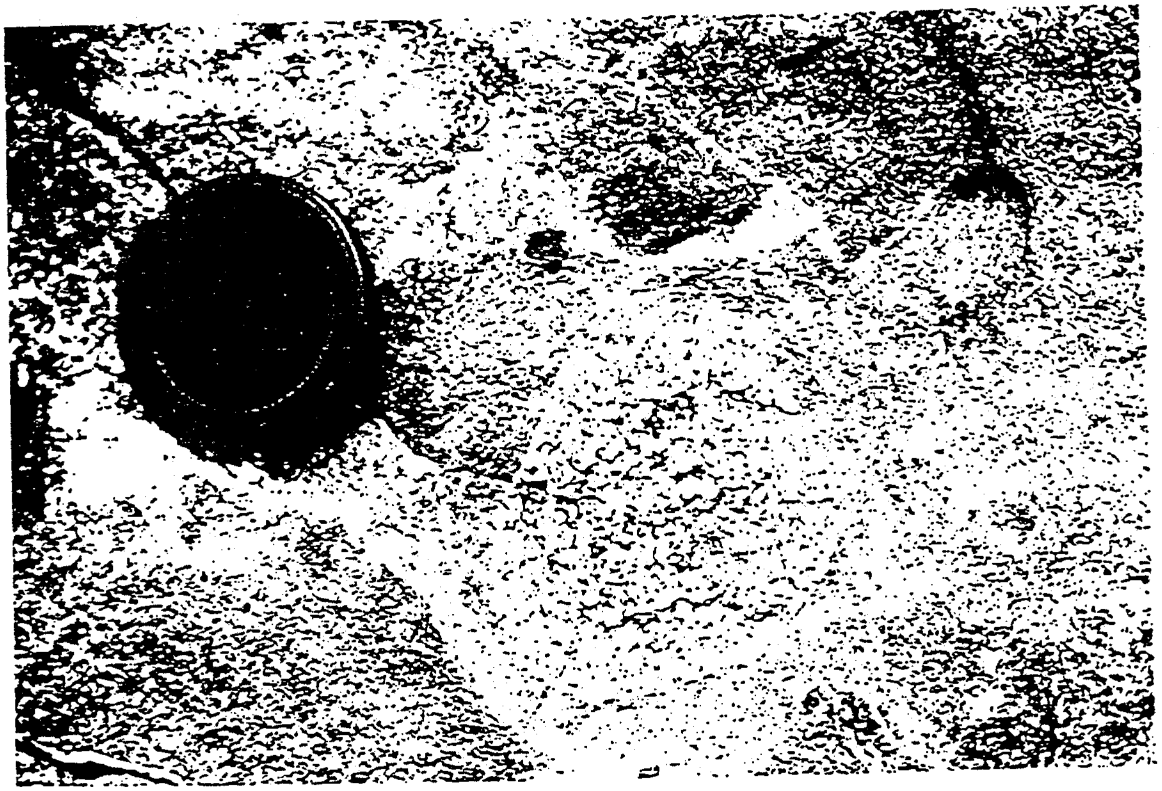


Figure 11(a)

Figure 11(b)

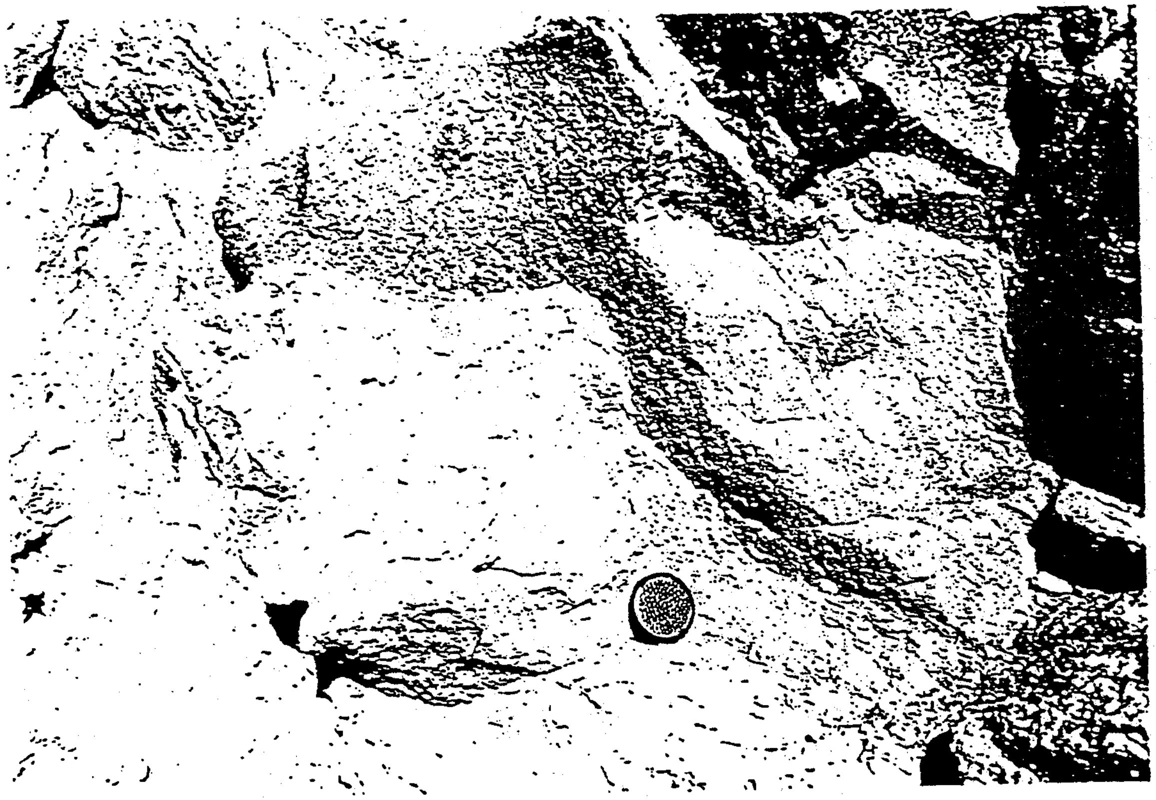


Figure 11(c)

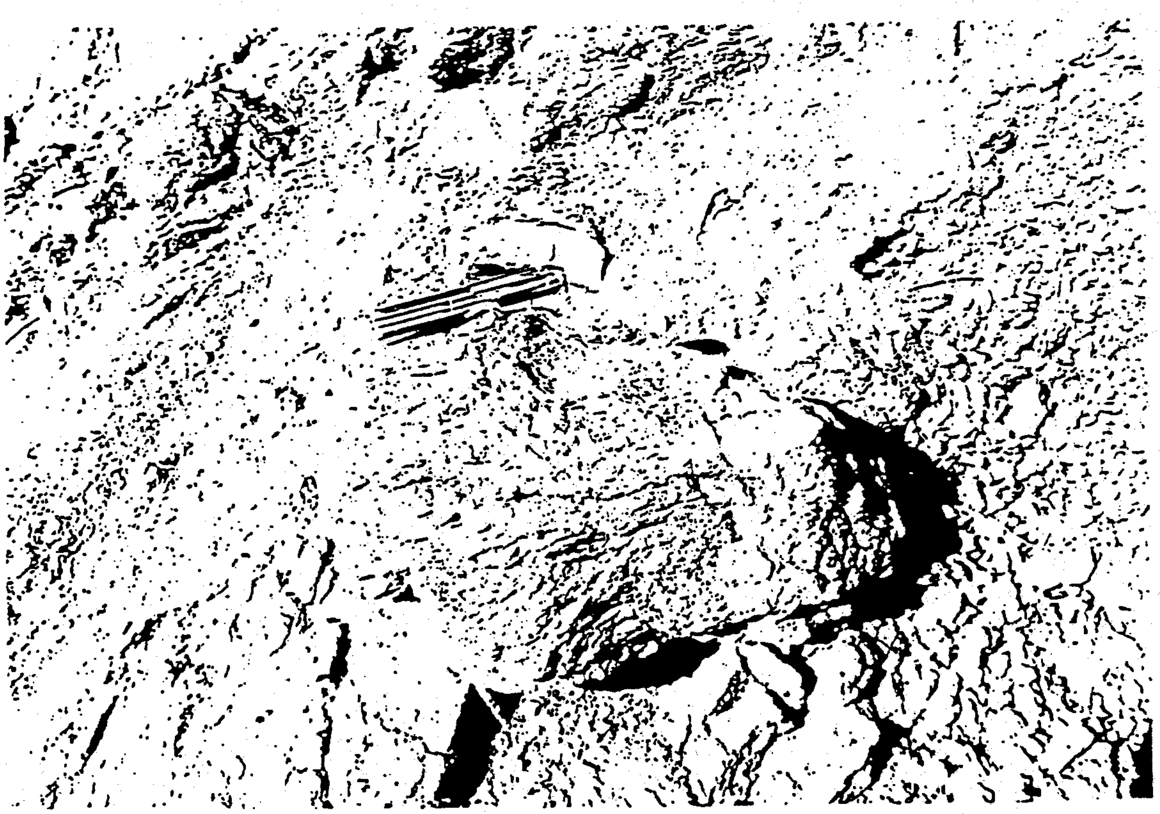
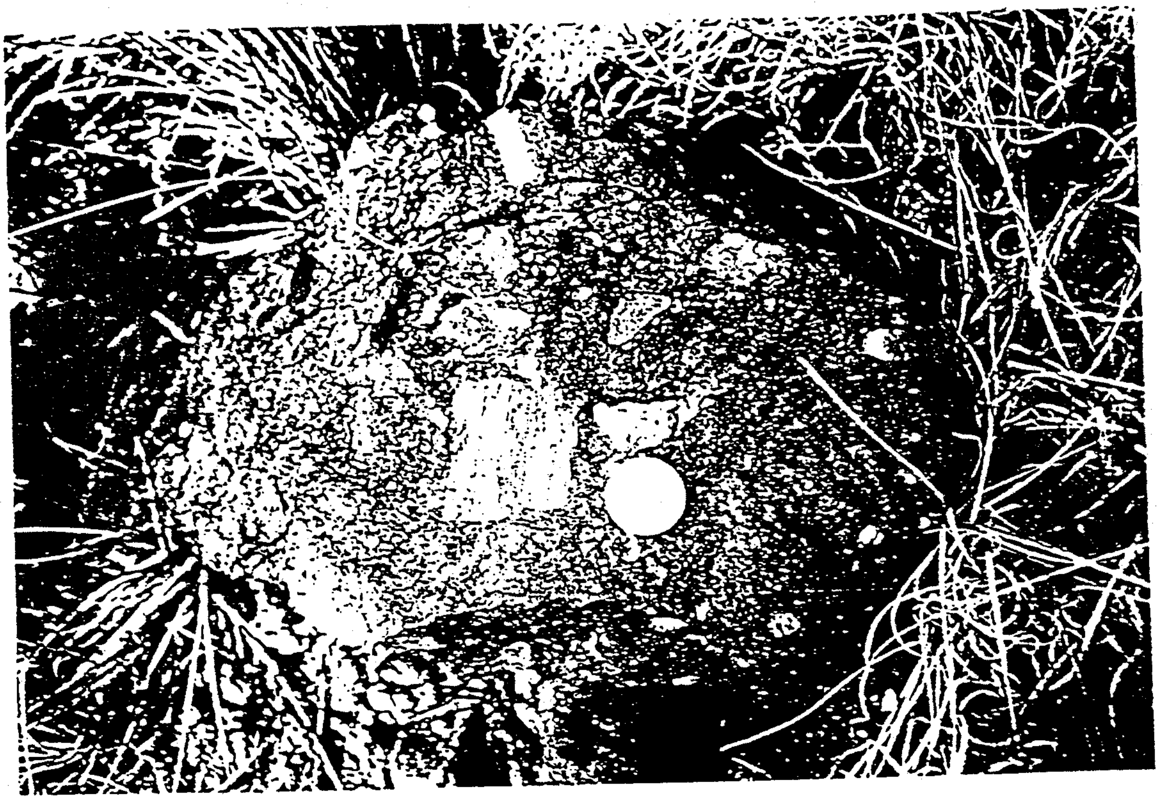


Figure 11(d)



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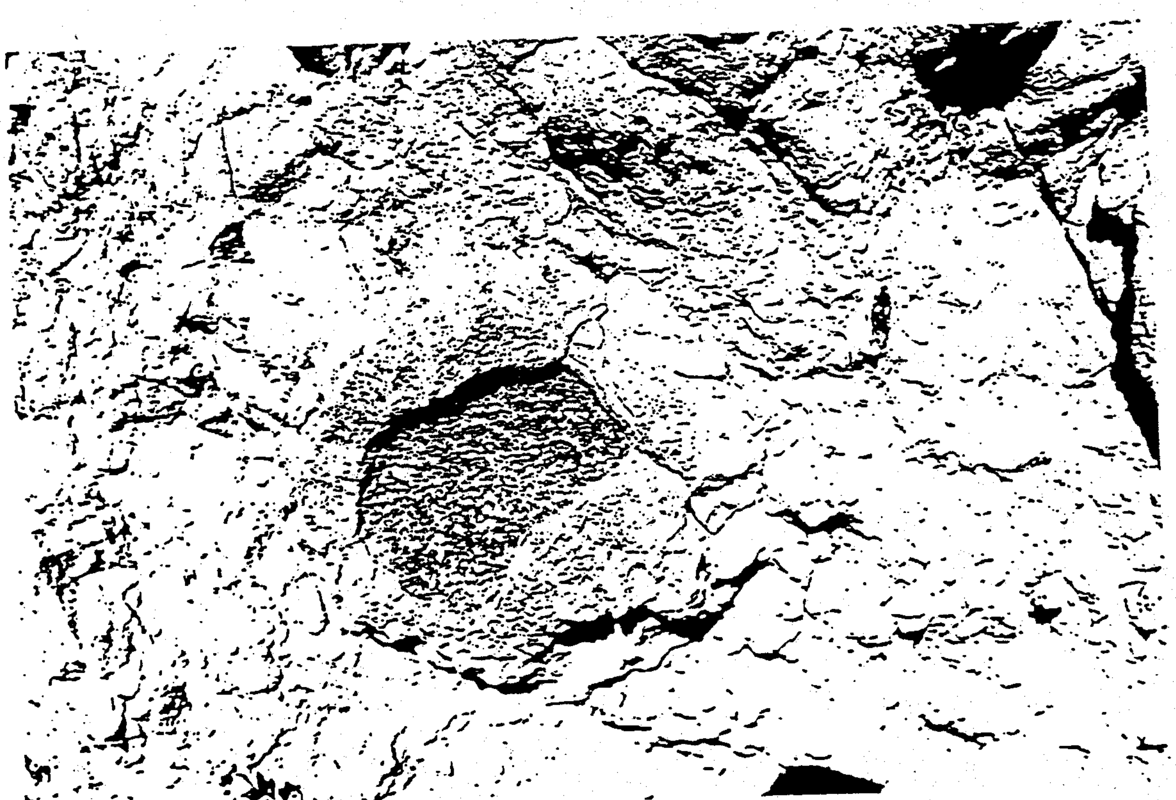


Figure 11(f)

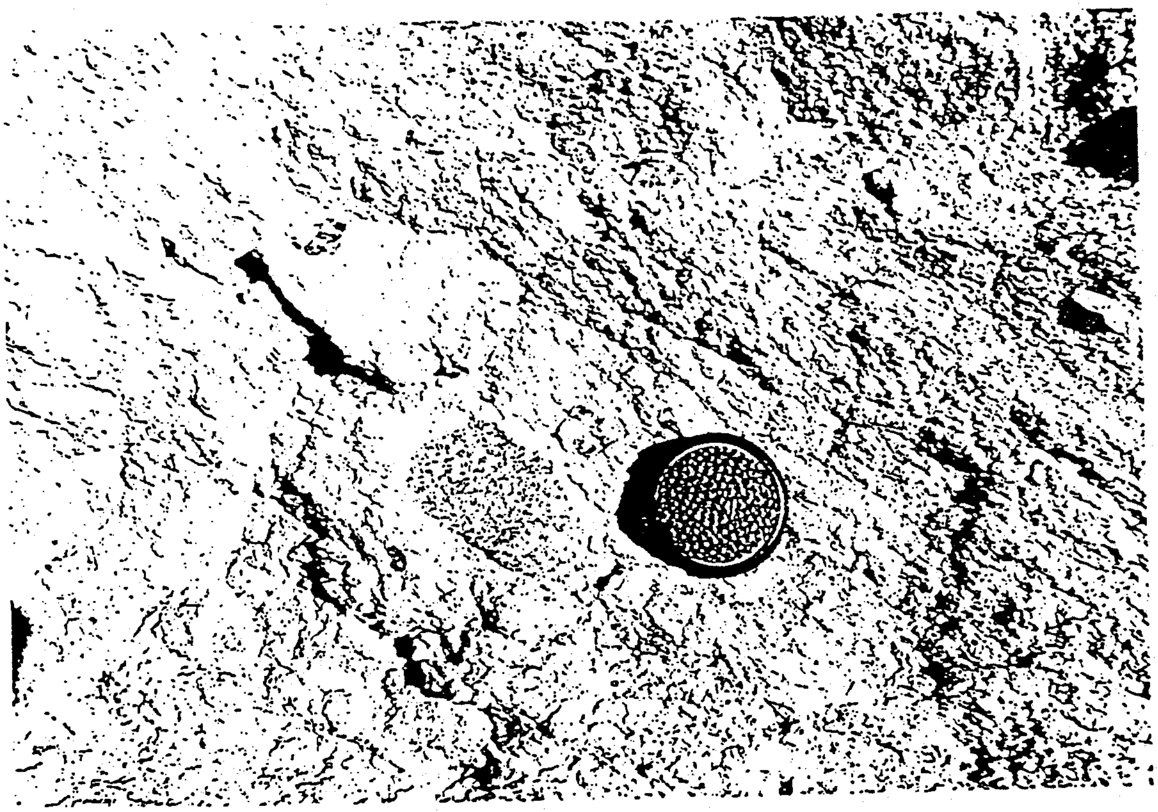


Figure 11(g)

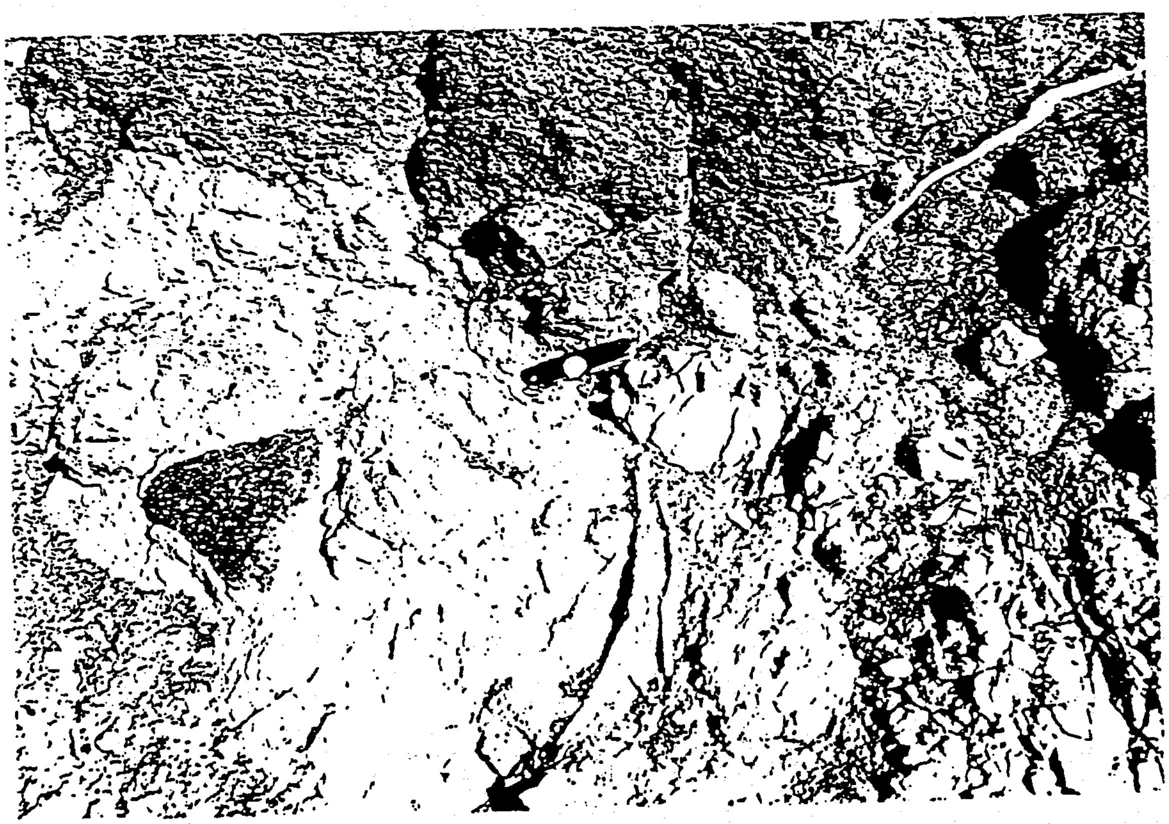


Figure 11(h)

Figure 12 - Nodule Suite. (a) Field of view dominated by clinopyroxene (note low interference colours and well defined cleavage) poikilitically enclosing olivine (2nd order interference colours and characteristic fractures). Clinopyroxene in contact with phlogopite (right side of photograph. The phlogopite-clinopyroxene and olivine-clinopyroxene contacts are very sharp, indicating growth and contact under equilibrium conditions. Clinopyroxenite inclusion in minette, nodule comprised primarily of phlogopite with subordinate clinopyroxene and olivine, a clinopyroxene-olivine biotitite ("glimmerite"). (b) Contact between nodule (left) and host (right). Olivine probably Mg-rich (Mg-rich host and high interference colours). The phlogopite, olivine and clinopyroxene grains comprising the nodule are coarse-grained. In contrast, the phlogopite in matrix of host minette is fine-grained. The matrix consists of abundant Fe-Ti oxides, clinopyroxene, and phlogopite.

Figure 12(a)

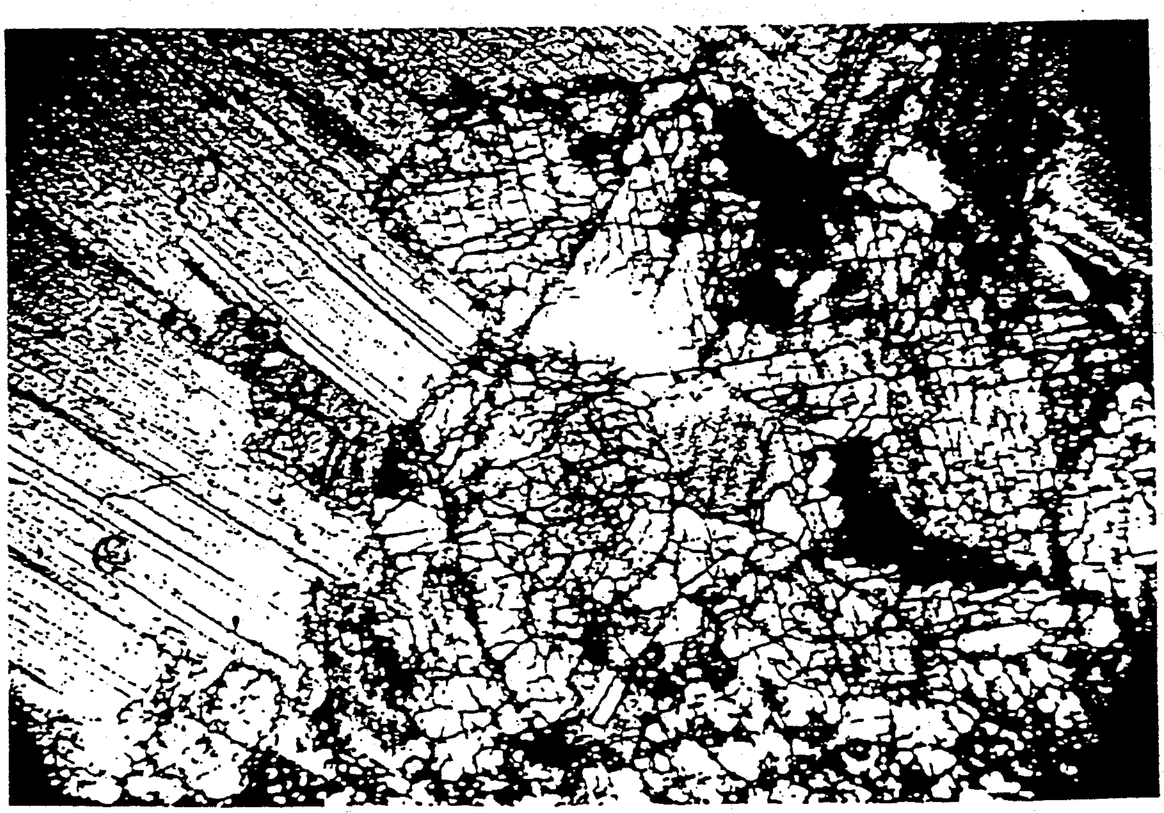


Figure 12(b)

Figure 13 - (a) and (b) Two examples of the irregular nature of the contact between the dark green olivine minette and the host phases, both the buff to light grey vent breccia and the brown proximal vent volcanic phase (Kjarsgaard 1994). In (a) the olivine minette has intruded the brown weathering proximal vent volcanic phase. Note how the intrusive has been deflected around the brown resistant weathering inclusion on the left skyline. To the upper right, the dyke can be seen intruding the buff to light grey vent breccia. In (b), the dyke has a slight foliated texture apparent in the left foreground where it is in contact with the proximal vent volcanic phase.

Figure 13(a)

Figure 13(b)

Figure 14 - Contact relations evident at the JD-2 occurrence. (a) Sedimentary inclusion or screen of the Cretaceous Pakowki Formation within the intrusion. Note the lack of disruption in the sedimentary laminations/thin beds of the sedimentary rock. The exposure of intrusive material represented here is the cross-cutting olivine minette described by Kjarsgaard (1994). (b) Another view of the exposure looking to the northwest. The view shown in (a) is present at the lower left of the photograph. The cross-cutting nature of the olivine-rich dyke/sill can be plainly seen in this photograph. The material exposed above the dyke/sill is the xenolith-rich, brown minette breccia of the middle portion of the exposure (another view in Figure (d)). (c) Western contact of the JD-2 intrusive minette against thickly laminate to thinly bedded sediments of the Cretaceous Pakowki Formation. The different colouration of the sediments against the intrusion relative to the sediments 1 metre away is due to their more resistant nature, interpreted as infiltration of the sediments by volatiles related to the intrusion. Also note that the sediments in the indurated zone are disrupted, having a slightly steeper dip with respect to the more "distal" sediments. (d) Another view of the upper xenolith-rich minette breccia. Xenoliths observed at this locality consist entirely of sedimentary inclusions, including shale, sandstone, mudstone and limestone fragments of the upper crust (Paleozoic strata overlying basement).

Figure 14(a)

Figure 14(b)

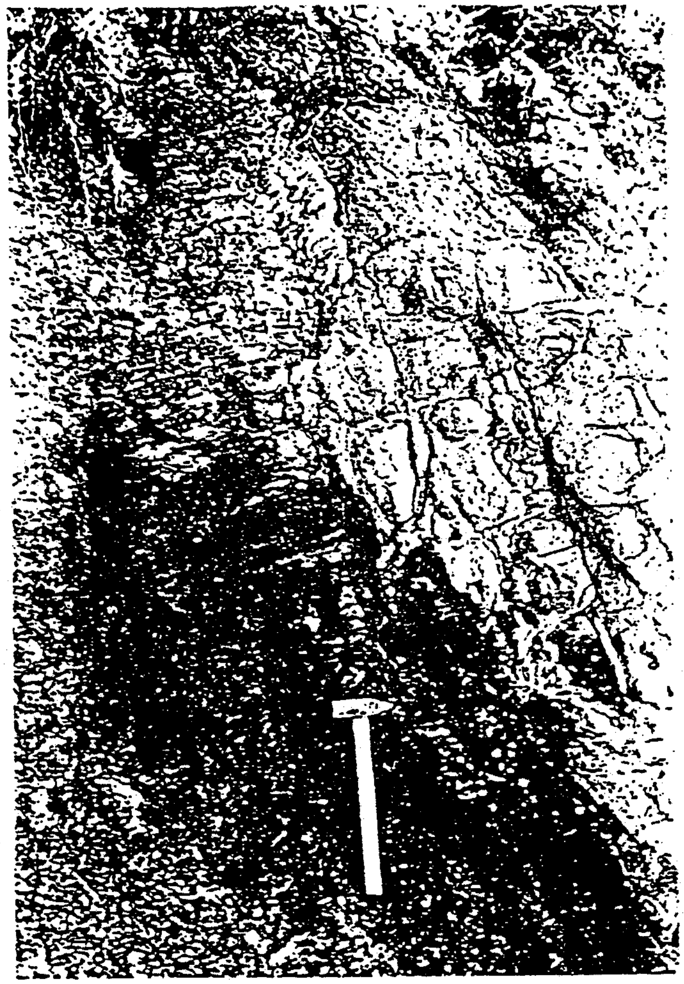


Figure 14(c)

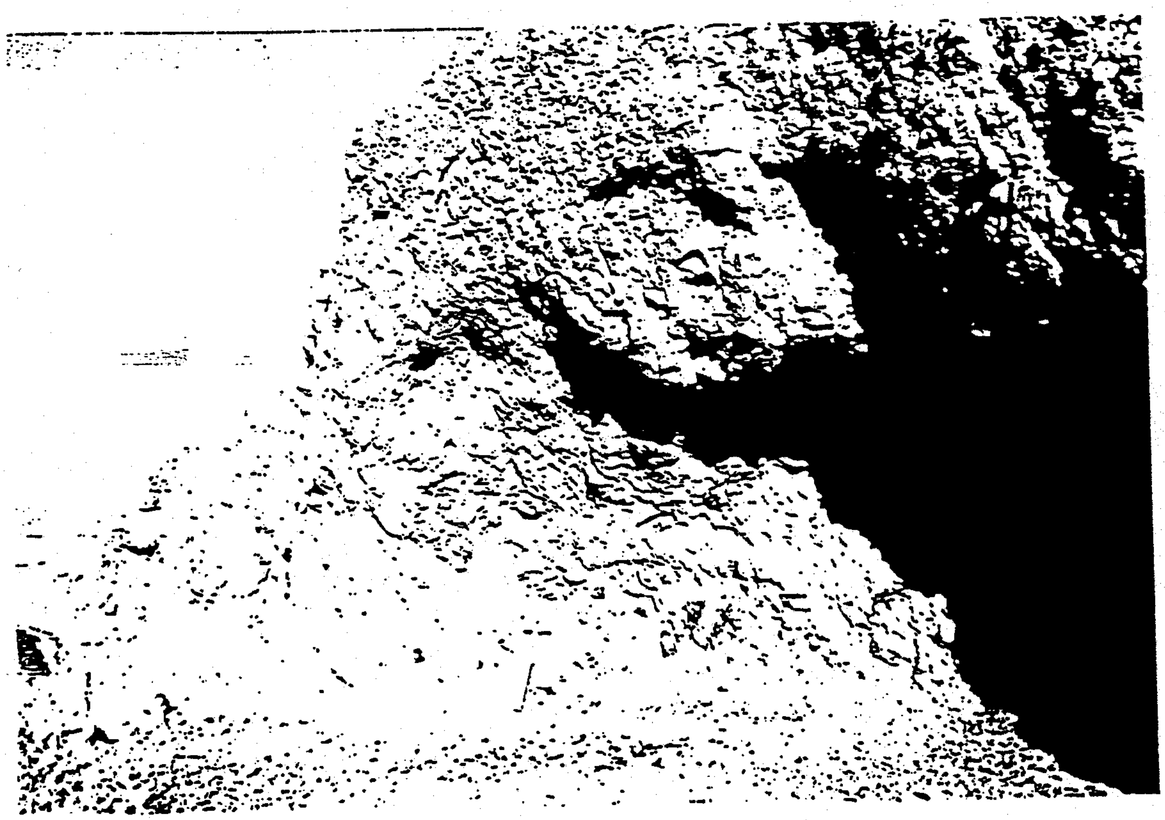


Figure 14(d)

Gulch" (Fig. 9) and described by Kjarsgaard (1994) as olivine minettes (comprised of olivine + phlogopite + diopside phenocrysts in a groundmass of mica phlogopite-biotite$_{ss}$ + salite + sanidine + magnetite + apatite ± analcime ± calcite) (Fig. 10, see Appendix 2). Phlogopite is present in two populations, as an euhedral, phenocryst phase up to 2 cm in long dimension and as a groundmass phase up to 3 mm in long dimension. Diopside crystals are present as a phenocryst phase and have been identified in dark green, euhedral, columnar crystals up to 1.25 cm in length. There are at least nine separate or en echelon dykes associated with the diatreme complex (Fig. 7). The dykes are relatively abundant and range from 1 metre up to 6 metres thick. They are described as phlogopite- and diopside-phyric (porphyritic) with olivine as a minor to rare, pseudomorphed phenocryst phase. The dykes are north trending and cross-cut the earlier phases. Intrusive breccias are also present, evident in the eastern brecciated dykes.

6.0 HEAVY MINERAL SUITE

Initial heavy mineral concentrates have been recovered from samples submitted to Loring Laboratories Ltd. A copy of Loring Laboratories Diamond Exploration "Sample Processing Flow Chart" is included as Figure 15 for reference. Note the addition of hydrochloric acid following initial crushing to eliminate matrix carbonate and liberate primary minerals and xenocrysts. Furthermore, following magnetic separation of the resulting heavy mineral fraction, the light (<2.96 S.G.) and heavy (>3.3 S.G.) fractions were sent to the author for binocular microscope examination and indicator mineral picking.

Indicator minerals were subsequently submitted to the University of Calgary and the University of Alberta for quantitative electron microprobe determination of mineral chemistry (see Section 7.0 and Appendix 1).

The procedure established for recovery of a heavy mineral suite from a multi-kilogram geochemical rock sample is as follows:

1) Crush sample to 10 Mesh, acid bath 24 hours in hydrochloric acid.

2) Process sample on jig / shaker table
   - store light fraction

3) Heavy liquid separation (Tetrabromoethane - 2.9 g / cc)
   - store light fraction

4) Remove magnetic fraction
   - store magnetic fraction

5) Heavy liquid separation (Methylene iodide - 3.3 g / cc)
   - store light fraction

6) Frantz magnetic separator
   - store magnetic fraction

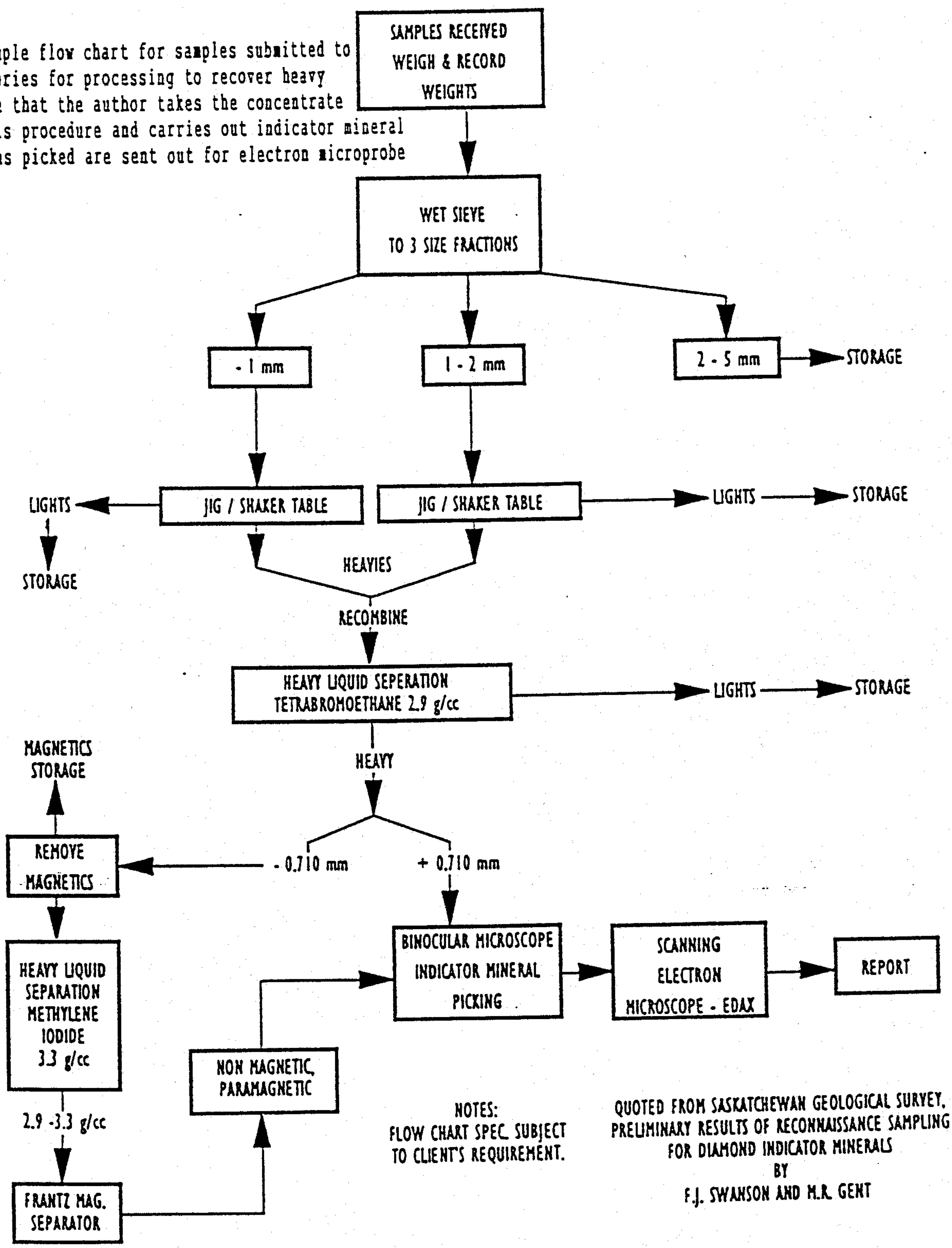
7) Mineral picking / examination

Figure 15

DIAMOND EXPLORATION SERVICES

SAMPLE PROCESSING FLOW CHART

Figure 15 - Sample flow chart for samples submitted to Loring Laboratories for processing to recover heavy minerals. Note that the author takes the concentrate produced in this procedure and carries out indicator mineral picking. Grains picked are sent out for electron microprobe analysis.



NOTES:
FLOW CHART SPEC. SUBJECT
TO CLIENT'S REQUIREMENT.

QUOTED FROM SASKATCHEWAN GEOLOGICAL SURVEY,
PRELIMINARY RESULTS OF RECONNAISSANCE SAMPLING
FOR DIAMOND INDICATOR MINERALS
BY
F.J. SWANSON AND M.R. GENT

Thorough examination of resulting heavy mineral suites followed by determination of composition by electron microprobe analysis has been undertaken on possible indicator minerals. Quantitative determinations of mineral compositions have been completed on all garnet, chromite, ilmenite and clinopyroxene mineral grains submitted to date (see Appendix 1).

7. GEOCHEMICAL ANALYSES

7.1 Mineral Analyses

Preliminary examination of samples processed to date reveals abundant diopside, chromite, garnet, ilmenite and phlogopite (see Appendix 1) as well as apatite, spinel and sulfides. The non-magnetic fraction is dominated by pale grass-green diopside, primarily as angular fragments, however, some euhedral, columnar crystals remain. Spinel is present as euhedral, equant crystals having a black metallic lustre. As they are non-magnetic they are tentatively identified as chromites subject to confirmation by electron microprobe analysis. A minor proportion of the spinels are sub-rounded, probably indicating that they are xenocrysts incorporated into the magma.

A previous examination of the Black Butte intrusive involved submission of a 56.5 kg sample to C.F. Minerals in Kelowna for recovery of heavy minerals. Processing resulted in recovery of 37 chromites, 40 picroilmenites, 1 G9 garnet, 1 G11 garnet, 15 CP5 clinopyroxenes and 1 CP6 clinopyroxene, together with other phases associated with lamproitic lithologies (eg. armacolite and Sr-apatite). In addition, Williams (1993) reports recovery of 5 G5 garnets, 2 G4 garnet and one chromite grain from four soil samples taken "down-ice" from the magnetic "bull's eye" anomalies identified on the Bear Creek Property and associated with a minette or sanidine phlogopite lamproite occurrence (Kjarsgaard 1994 - Bear Creek minette).

In the course of work by the author evaluating Marum Resources Inc.'s Pinhorn Property, electron microprobe quantitative determinations were made of phlogopite, garnet, ilmenite, clinopyroxene and chromite grains (see Appendix 1). A total of 408 clinopyroxene, 179 phlogopite, 67 garnet, 112 chromite and 22 ilmenite (picroilmenite) analyses have been obtained to date in the course of the author's evaluation of the southern Alberta alkalic intrusives. The results for each mineral are discussed below.

7.11 **Garnet**

Of the 67 garnet grains analyzed in the course of this study; 33 are interpreted to be of crustal origin (eg. amphibolite to granulite grade metamorphic host). In addition, 23 G5 garnets, 9 G3 garnets and 2 G6 garnets (Dawson and Stephens 1975) have been documented from the JD-1 and JD-2 occurrences. A total of 14 G5, 7 G3, 2 G6 and 4 crustal magnesium almandine garnets were recovered from the JD-1 (Black Butte) occurrence. The JD-2 occurrence is dominated by crustal (29 garnets) and G5 (10 garnets) with a highly subordinate G3 (2 garnets) population.

Kjarsgaard (1994, pers. comm.) recommended a much tighter and restrictive limit on FeO_{Total} to distinguish crustal garnets from G5 garnets (approximately 24 weight percent FeO_{Total}, as opposed to approximately 30 weight percent as determined from Dawson and Stephens (1975)). Such a modification in garnet classification would result in all the G5 garnets being reclassified as crustal. However, these results should be considered preliminary as more samples are currently being processed for heavy mineral recovery and subsequent electron microprobe analysis may result in identification of garnets of deeper origin. In particular, the recovery of chromites which plot within the diamond inclusion field (see Section 7.13) indicates the distinct possibility of such garnets.

7.12 Clinopyroxene

A total of 408 clinopyroxenes have been analyzed for quantitative determination of composition using electron microprobe analysis (Appendix 1). The clinopyroxenes analyzed are all sodium-poor and plot within the "Pyroxene Quadrilateral" field of Morimoto et al. (1988) (Fig. 16). Therefore, they can be fully described with reference to the Wollastonite (Ca)-Enstatite (Mg)-Ferrosilite (Fe) ternary diagram. The majority of clinopyroxenes plot within the diopside field although a highly subordinate proportion are augitic in composition. A further comparison of clinopyroxene compositions, with subdivision of the diopside field into diopside and salite (Deer, Howie and Zussman 1983), indicates that the pyroxenes may be best described as salites, with overlap into the diopside and augite fields.

Clinopyroxenes analyzed are generally chrome-poor, however, subordinate chrome-rich diopsides are present. No diopsides analyzed to date are comparable to worldwide diamond inclusion compositions (in excess of 1% Cr_2O_3). The range of clinopyroxenes recovered from analysis of diatreme rock and nodule suites includes: CP1, CP2, CP3, CP4, CP5 and CP8 compositions (Stephens and Dawson 1977). Of 92 clinopyroxene analyses for the Black Butte occurrence, 74 grains are CP4, 13 are CP2 and 5 are CP5 in composition. A wider variety of clinopyroxenes have been recovered from the JD-2 property, including 57 CP4, 33 CP3 and one each of CP1 and CP8 clinopyroxenes. The JD-2 property is dominated by CP2 (27 grains) with subordinate CP4 (9 grains) and one CP1. Finally, the JD-4 is comprised of CP4 clinopyroxenes (84 grains) with subordinate CP2 (37 grains). Therefore, the clinopyroxenes recovered from the Sweet Grass intrusives strongly suggest derivation from a kimberlitic source with eclogitic affinity.

7.13 Chromite

Chromite analyses in southern Alberta are still in the preliminary stage. Equant, euhedral, non-magnetic spinels have been observed in heavy mineral separates and quantitative analysis is anticipated in the future. The lack of magnetism together with a deep red colour noted in some thin sections leads to preliminary interpretation as chrome-rich spinel to chromite, consistent with analyses obtained. The analyses received are from spinels picked from the heavy mineral separate of the JD-1 and JD-2 occurrences. The spinels picked are all low Al_2O_3, low FeO_{Total}, high Cr_2O_3 spinels, interpreted as chromites. Initial results are extremely encouraging (see Appendix 1).

A total of 32 spinels were analyzed from the JD-1 (Black Butte) occurrence. Of these spinels, only seven have compositions not compatible with world-wide diamond field compositions. Approximately 88 per cent of the spinels analyzed have chromite compositions which plot within the region defined by world-wide diamond inclusion compositions. Furthermore, with regard to the chromite classification parameters of Griffin et al. (1992), the chromites are transitional between P1 and P2

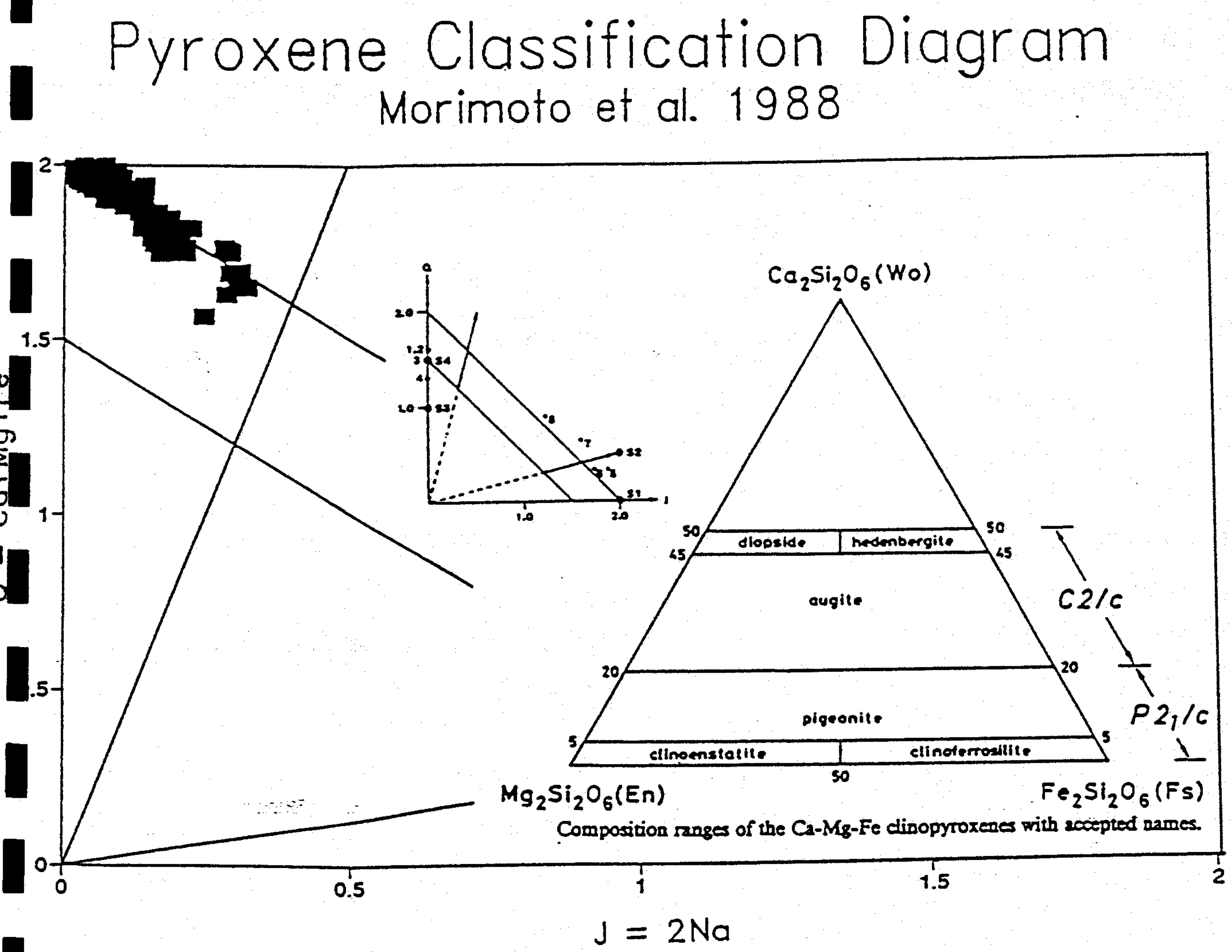


Figure 16 - Clinopyroxene data from southern Alberta plotted with reference to the pyroxene classification diagram of Morimoto et al. (1988), shown in the inset. It can be seen that all data points lie within the area defined by the pyroxene quadrilateral and can therefore be described completely with reference to Enstatite - Ferrosilite - Diopside - Hedenbergite on the pyroxene ternary.

compositions. Low TiO_2 and high Cr_2O_3 are compatible with P1 compositions while low Al_2O_3 and low MgO are more comparable with P2 chromites.

Of the 80 chromites analyzed from the JD-2 occurrence, 23 have Cr_2O_3 weight percents greater than 60%, placing them within the world-wide diamond inclusion field. Furthermore, all of those analyses have Al_2O_3 contents less than 10% (Fig. 17b) and 22 have MgO contents between 11 and 16% (Fig. 17a), with the missing value **just** below the cutoff (having a value of 10.97 weight percent MgO). Therefore, approximately 30% of the spinels picked for electron microprobe analysis have chromite compositions comparable with diamond inclusions field compositions determined for world-wide occurrences.

Griffin et al. (1992) define kimberlitic chromite macrocrysts as those having the following weight percent ranges: Cr_2O_3 (45-65%), Al_2O_3 (2-12%) and MgO (8-15%). A brief examination of the JD-2 chromite data in Appendix 1 documents chromite compositions which compare extremely well with the above values. Griffin et al. (1992) further subdivide the chromite analyses into sub-groups P1 through P4. Using the classification scheme of Griffin et al. (1992), the chromites can be differentiated into two populations, 38 chromites of P1 composition and approximately the same number which are **just** outside the chemical screen limits for P1 composition. The non-P1 chromites have Cr_2O_3 values between 53 and 63 weight percent but have Al_2O_3 below the cutoff of 5 weight percent Al_2O_3. Of these chromites, 22 have Al_2O_3 values between 4.26 and 4.99 weight percent and therefore lie just outside the P1 field so defined.

P1 (xenocrysts in Group I kimberlites) chromites are interpreted to have been sources from disaggregated dunite, harzburgite and subordinate lherzolite lithologies. P2 chromites were interpreted as high pressure magmatic chromites from Group II (micaceous) kimberlites. None of the chromites analyzed correspond to lamproitic chromites (P3) or lamproitic xenolith chromites (P4) which are both much higher in Al_2O_3 than those analyzed to date. Furthermore, preliminary semi-quantitative Ni and Zn content in chromites indicates a wide range in temperature, from approximately 1200°C down to approximately 700°C. Quantitative analyses for these trace elements should be determined using a proton microprobe or long counting times on an electron microprobe. Therefore, the above statements are based on semi-quantitative results.

7.14 Ilmenite

Very few ilmenite analyses have been obtained from the Sweet Grass intrusives (22 grains) (Fig. 18). Analyses obtained thus far, including data from BHP, indicate the ilmenite grains analyzed are slightly to moderately magnesian in content (0.06 to 7.63 weight percent). The data indicates low to moderate MgO content in the picroilmenites, ranging from 2.36 to 7.63 MgO weight percent. Six of the analyses (total of 10) have MgO greater than 4 weight percent. Ideally, magnesian contents between 8 and 14 weight percent are interpreted to indicate sufficiently reduced conditions for preservation of diamonds. Two ilmenite analyses from the JD-2 occurrence fall just short of the 8 weight percent minimum (at 7.44 and 7.63 wt.%). However, the lack of statistically significant data at this point in time precludes any reasonable statement with regard to diamond preservation.

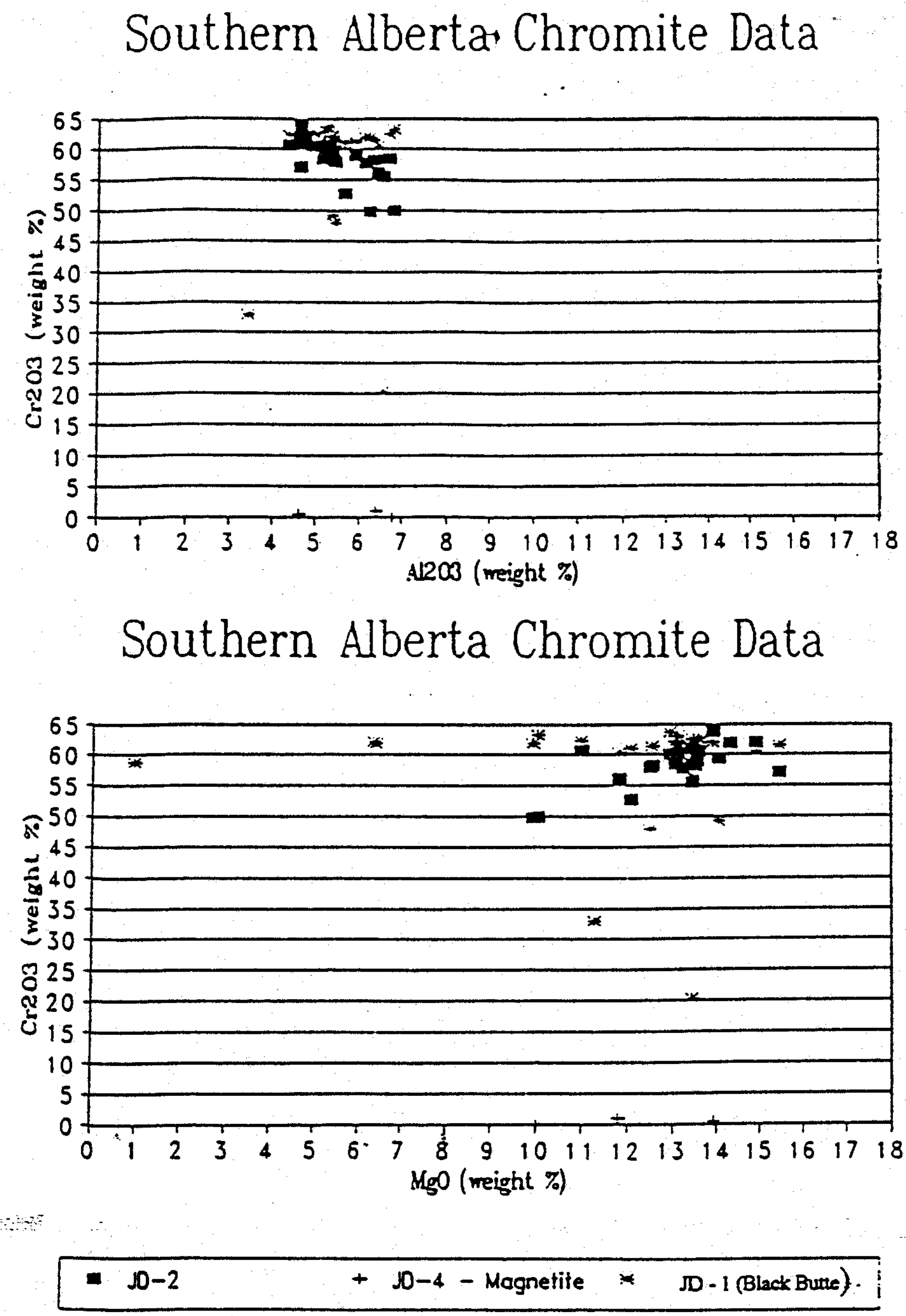


Figure 17 - Southern Alberta Chromite Data - plotted with reference to: (a) Cr_2O_3 vs. Al_2O_3 and (b) Cr_2O_3 vs. MgO graphs. Note the high proportion that plot above 60 weight percent (particularly from the Black Butte (approximately 88 %) and JD-2 (approximately 30%) occurences), comparable to world-wide diamond inclusion field compositions. In addition, the data compares very well with P1 and P2 chromite values for Group I (basaltic) and Group II (micaceous) kimberlites (see Griffin et al. 1992). Note: other occurrences include the JD-2 and JD-4 occurrences north and south of Milk River, respectively.

Southern Alberta Ilmenite Data

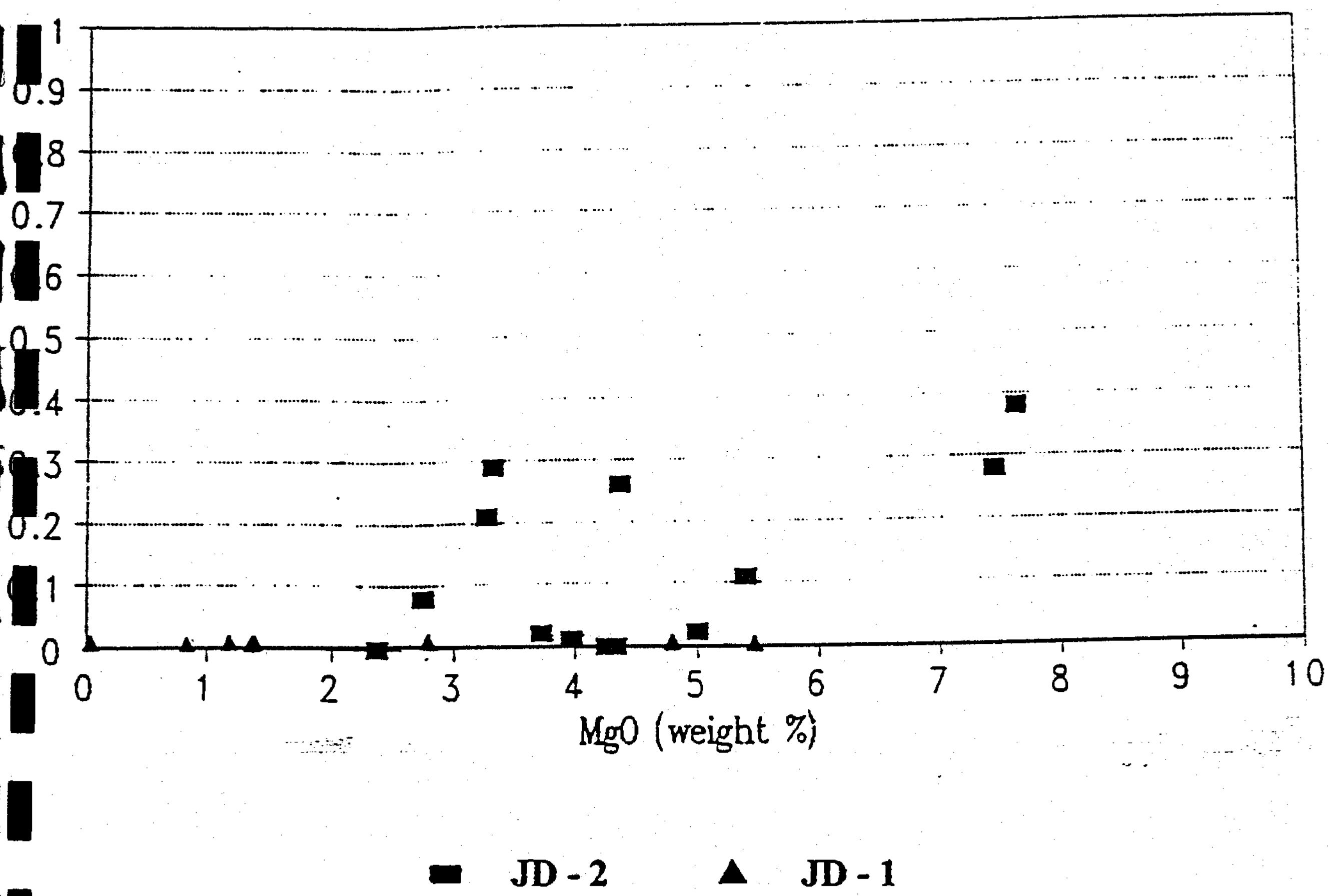


Figure 18 - Cr_2O_3 vs. MgO graph of ilmenite data determined from grains recovered in southern Alberta. The data shows weak to moderate picroilmenite (MgO) content in the ilmenites analyzed. The six picroilmenite analyses (MgO > 3 wt.%) indicate only moderately reduced conditions, suggesting poor to moderate diamond preservation potential. However, very few ilmenite grains have been analyzed and such interpretations are tenuous at best.

Slightly low total major element sums suggest the presence of minor Fe_2O_3. However, ferric iron may be a product of post emplacement weathering (haematite content), particularly in view of the picroilmenitic compositional trend and low ferric iron values. An interesting feature of these ilmenite analyses is a possible positive correlation between elevated MgO and elevated nickel. The most MgO-rich ilmenites (picroilmenites) have NiO contents between 0.10 and 0.15 weight percent. These values are just above the minimum detection limit of 0.0684 weight percent and therefore subject to uncertainty and caution is recommended with any such observations. However, it is interesting that an element associated with ultramafic lithologies is present in slightly elevated quantities in the "kimberlitic" ilmenites. The combination of picroilmenite compositions associated with anomalous nickel values may be significant with regard to possible paragenesis of picroilmenites.

7.15 Micas

Mica compositions as determined by electron microprobe analysis plot within the phlogopite ($K_2Mg_6[Si_6Al_2O_{20}](OH)_4$) field with some solid solution tendency toward annite ($K_2Fe_6[Si_6Al_2O_{20}](OH)_4$) and eastonite ($K_2Mg_5Al[Si_5Al_3O_{20}](OH)_4$). The micas can be best referred to as members of the phlogopite-biotite$_{\text{solid solution (SS)}}$ but will be referred to as phlogopites for convenience.

When compositions for southern Alberta phlogopites are plotted with reference to the Al_2O_3 vs. TiO_2 of Mitchell (1986) (Fig. 19a), it can be seen that there is indeed a "minette trend" apparent, described as a trend of increasing TiO_2 with constant Al_2O_3 (eg. JD-3, JD-4 and JD-5). Similarly, a plot of Al_2O_3 vs FeO (Fig. 19b) shows a minette trend for JD-3 and JD-5. However, in both cases, JD-1 shows a kimberlitic trend of increasing Al_2O_3 with increasing TiO_2 and FeO. Furthermore, scatter in the data for the JD-4 phlogopites suggests two possible populations are present; one showing a kimberlitic trend and a second having a minette trend.

7.16 Diamond

BHP reported the recovery of a small microdiamond from a 38.2 kg sample taken from the Black Butte (JD-1) occurrence. "(A) single microdiamond was recovered from the sample processed. The stone is clear, moderately resorbed, beige green in colour and measures 100 by 92 microns. It is a modified octahedron with fractures which have resulted in a loss of 60% of the original stone".

7.17 Gold

Free gold has been noticed during processing for a heavy mineral separate and during hand picking of grains for elctron microprobe analysis. In a Press Release (January 18, 1994) Marum Resources Inc. announced "... that a composite sample from the JD-2 pipe on the Pinhorn diamond exploration property in southern Alberta contains high geochemical gold values. Fire assays have returned up to 1 gram per tonne gold (0.035 oz.t), representing approximately $15 per ton, a value which falls at the low end of the economic spectrum for leaching operations". At present it is not known which phase or phases host gold, the value of gold, whether it is free milling or contained as inclusions in sulfides and if there is gold enrichment of the host sediments.

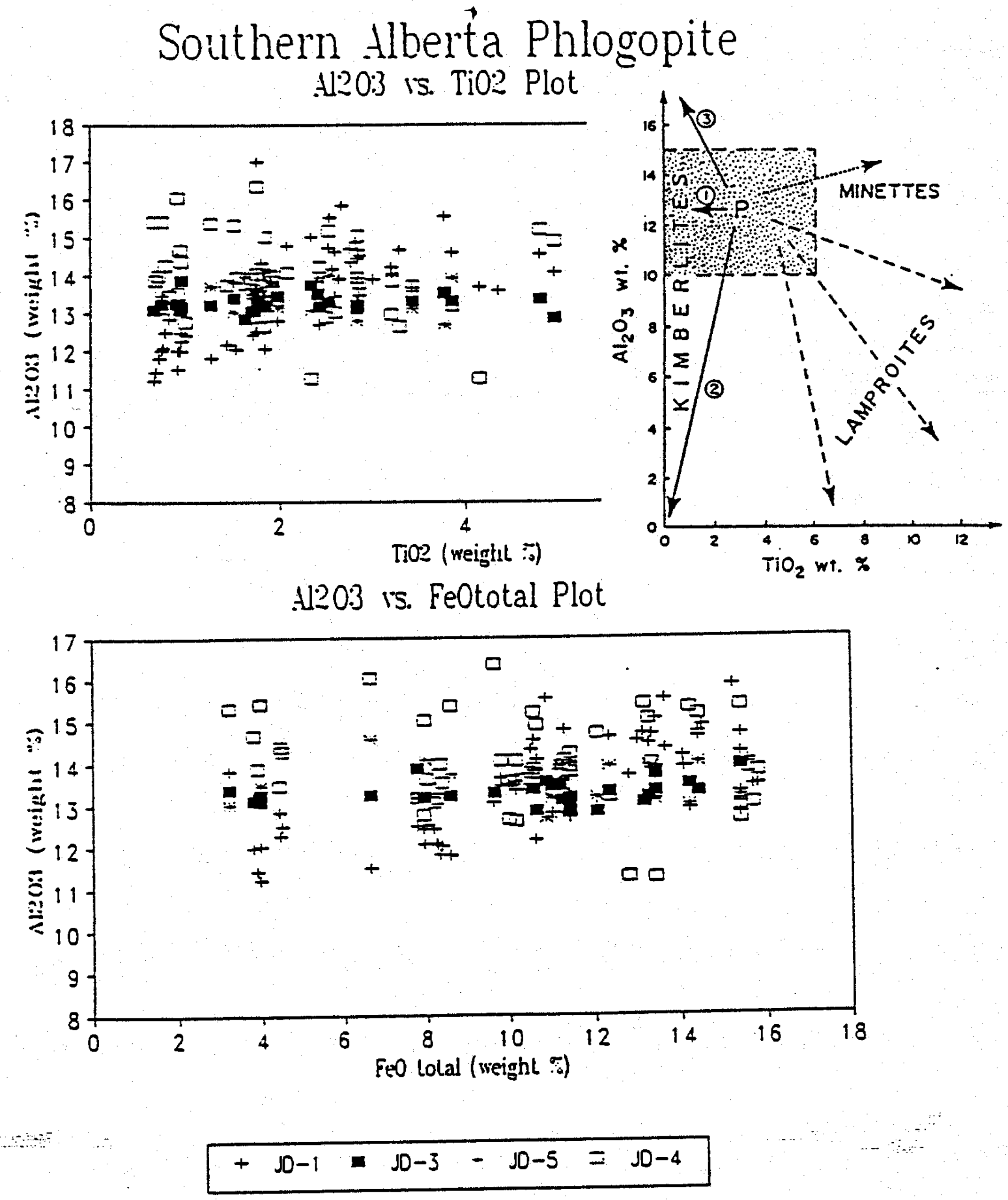


Figure 19 - Southern Alberta Phlogopite Compositions - plotted with reference to: (a) Al_2O_3 vs. TiO_2 and (b) Al_2O_3 vs. FeO_{Total} graphs. Comparison to similar graphs in Kjarsgaard (1994) indicates that the data has a minette trend in evidence (see inset), increasing TiO_2 and FeO_{Total} with near constant Al_2O_3. However, some data, particularly for JD-1 and, to a lesser degree, JD-4, shows a trend of increasing TiO_2 and FeO_{Total} with increasing Al_2O_3, which is indicative of a kimberlitic trend (Mitchell 1986).

7.2 **Whole Rock Geochemistry**

Whole rock geochemistry (see Appendix 4) confirm a silica-poor to silica-deficient, potassium-enriched composition with lamproitic affinity (eg. K_2O / Na_2O values close to or greater than 3.0). Furthermore, in contrast with data documented by Kjarsgaard (1994), the southern Alberta intrusives are, in fact, peralkaline ([K+Na / Al]>1) and perpotassic (K / Al>1). All major element values fall within the limits defined by Dawson (1980) for kimberlites, with the exception of MgO (low) and Na_2O (some values slightly high). Potassium (K_2O) values are all higher than those for kimberlites but approach or are comparable to limits given for lamproites.

Trace element geochemistry is consistent with a phlogopite dominated, potassium-rich alkaline intrusive. Phlogopite (mica) dominated lithologies can be expected to have elevated levels of Ba and Rb, while subordinate olivine would result in depressed values of Sc, V, Cr, Co, Ni, Cu and Zn. The presence of spinels may result in elevated Cr, Fe, Mg, etc. dependent upon the spinel composition.

With the above in mind, a phlogopite-dominated magma is indicated on the basis of values for the elements mentioned above. In particular, Ba levels 3 to 4 times greater than average kimberlite values are consistent with both a phlogopitic magma and lamproitic composition. Rare Earth Element (REE) values (Fig. 20 and 21) indicate substantial Light REE (LREE) enrichment (La/Y ratios between 11.3 and 47.7), again consistent with a phlogopite-dominated composition and a phlogopite-rich source rock (eg. phlogopite-garnet lherzolite).

The trace elements Sc, V, Co, Ni, Cu and Zn tend to be low for average kimberlite values (none available at present for lamproites) while Cr is comparable or enriched relative to the kimberlitic average. Spinels have been observed in the mineral separate obtained from the Southern Alberta diatremes and several preliminary analyses indicate chromites are present. Therefore, elevated Cr values in trace element geochemical analyses are interpreted as a result of chromium-bearing spinel and chromite.

8. DISCUSSION

Of particular significance is the identification of sample ABRW93Z-73 (JD-4) as a pyroxene-phlogopite lamproite. Note that the difference lies primarily in the abundance of olivine phenocrysts relative to ABRW93AA-91 (phlogopite lamprophyre from JD-2). It is apparent that there is very little difference between the lamprophyre and pyroxene-phlogopite lamproite in the basis of a subjective thin section description.

In their report, Ash and Associates (1993) interpret the JD-1 (Black Butte) occurrence to be a verite, an olivine-diopside-phlogopite lamproite. In addition, in a report requested by BHP for their examination of the JD-1 (Black Butte) occurrence, Dr. B. Scott Smith interprets the sample submitted for thin section analysis as a minette, further stating it is unlikely to be a lamproite due to: "... the colour of the mica, the zoning and colour of the clinopyroxene, the presence of fine spinels ... and in the absence of olivines and the twinning in the feldspar ...". (Note: it has been documented that olivine is present as a moderately abundant phase). In the report by Williams (1993), thin section analysis (by Dr. B. Scott Smith) led to the interpretation that the JD-5 occurrence is a minette or a sanidine-phlogopite lamproite.

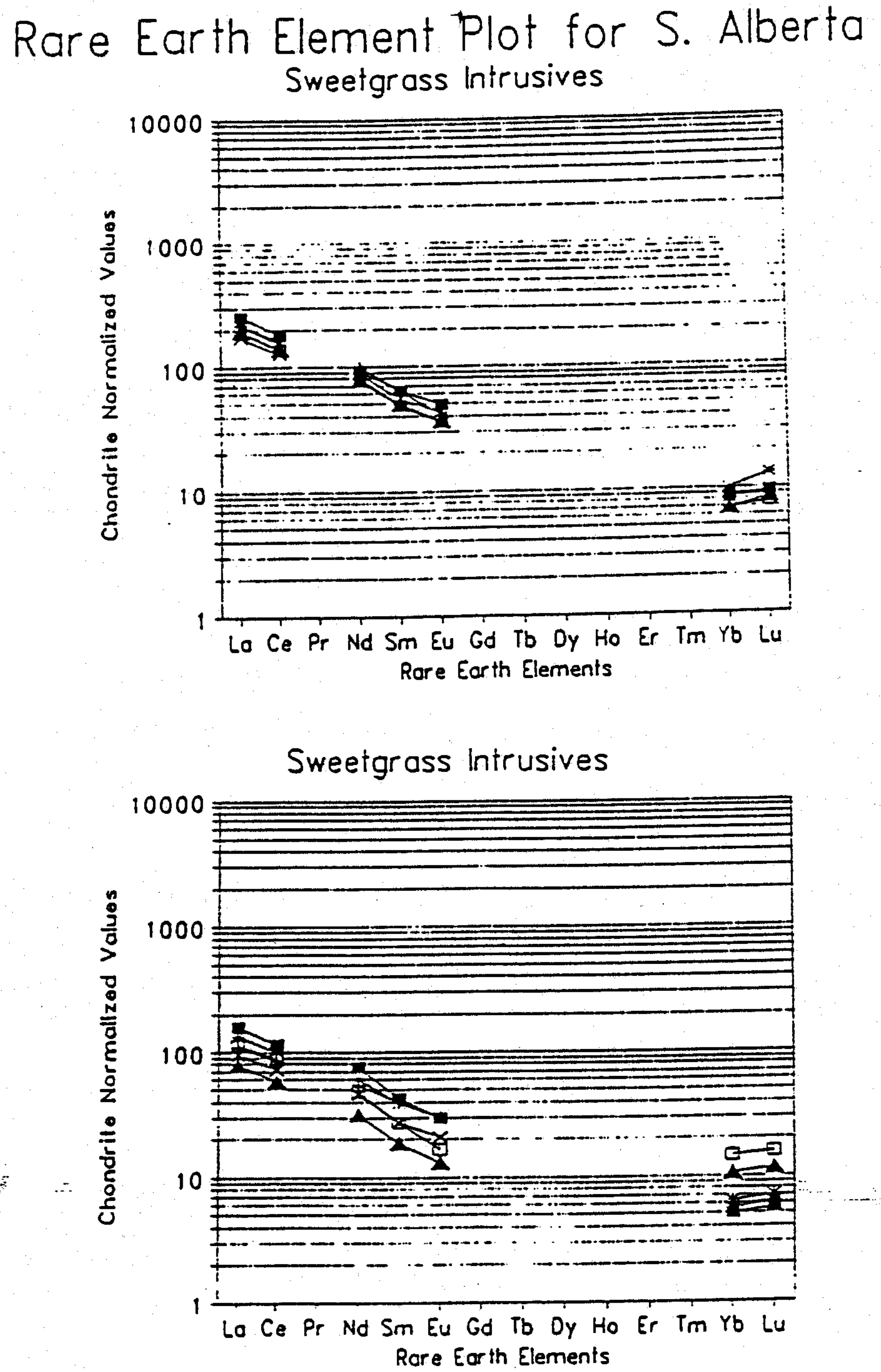


Figure 20 - (a) and (b): Plots of REE for the alkalic Sweet Grass intrusive data from southern Alberta. Note the tight, identical trends evident in the data, suggesting an identical source for all occurrences despite variable mineral assemblages described at surface. LREE enrichment, lack of a Eu anomaly plus Nd isotopic evidence has been cited as evidence for "... significant mid-Proterozoic LIL (LREE) enrichment of the mantle source ..." Cavell and Nelson 1992).

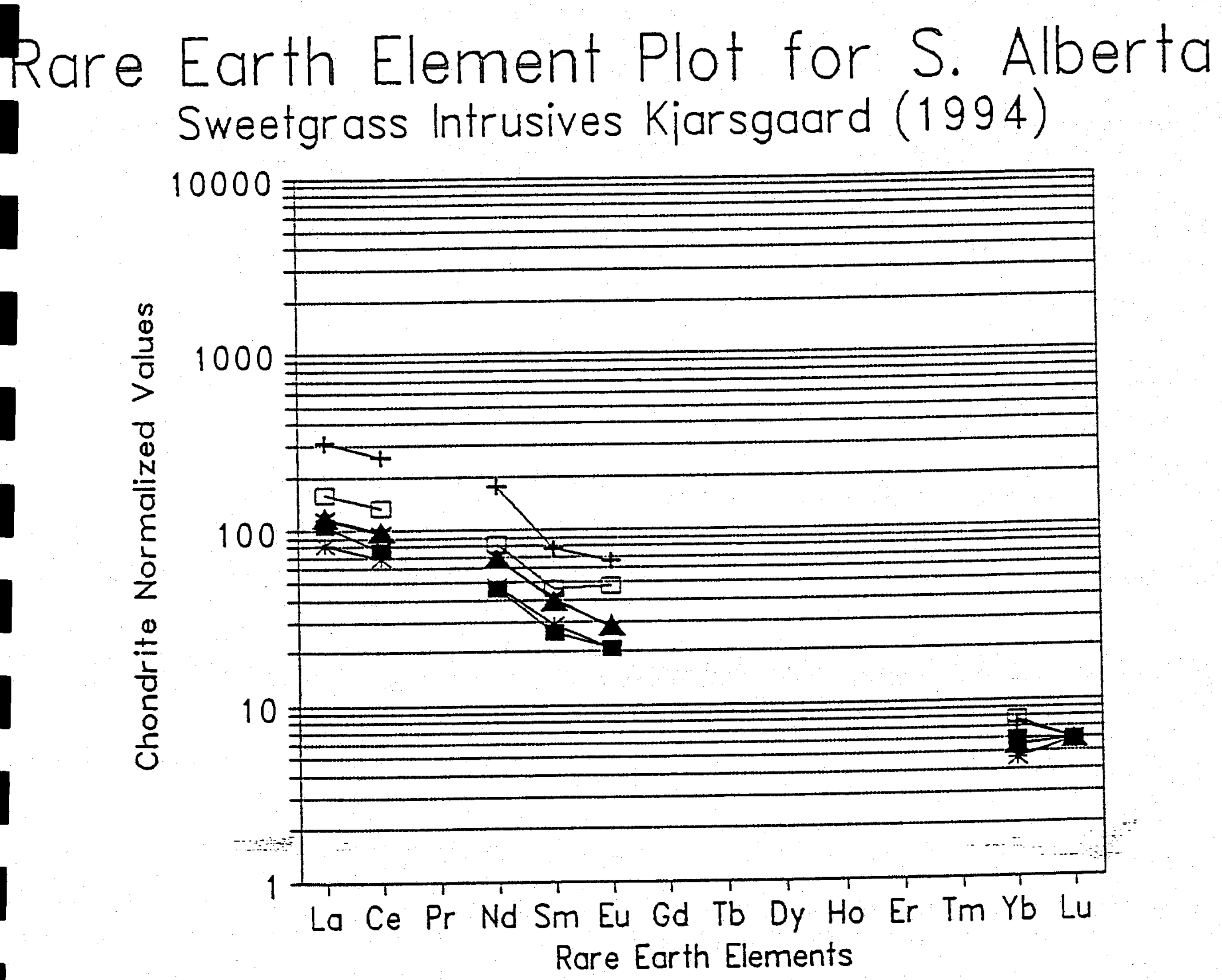


Figure 21 - Plot of REE for southern Alberta intrusive data of Kjarsgaard (1994). Note that the data compares well with the low to intermediate plots of South African kimberlite values (see Figure 23). In addition, note the lack of a Eu anomaly, indicating crystallization depths below feldspar stability.

Finally, Kjarsgaard (1994) interpreted the Sweet Grass intrusives to be minettes based upon mineralogical and geochemical evidence. The mineral assemblage he describes for minettes (biotite + augite + potassium feldspar + olivine) together with the lamprophyric texture is compelling. However, the presence of analcime, leucite and carbonate, (Kjarsgaard 1994, Cavell et al. 1992) with (late) alkali feldspar content (greater than that of plagioclase feldspar) would lead to an interpretation as a damkjernite (an ultramafic lamprophyre) (Rock 1991). Furthermore, if groundmass sanidine had been misidentified and was, in fact, nepheline, the rock would be classified as an ouachitite (also an ultramafic lamprophyre). For these reasons, caution is advised in placing too much reliance on the petrographic interpretations.

The phlogopite zoning trend "... of increasing FeO and TiO_2 at near constant Al_2O_3", is interpreted as supportive of classification of these intrusives as minettes, stating that the trend is unlike that of lamproites (Kjarsgaard 1994). Furthermore, he supports his arguments with whole rock and trace element geochemical trends. As discussed previously, some phlogopites plot within the primitive field of Mitchell (1986) with a trend of increasing TiO_2 content at constant or slightly increased Al_2O_3 content (Fig. 19a and b). Such a trend is indicative of a trend toward kimberlitic composition as defined by Mitchell (1986). In addition, major element geochemistry obtained by Marum Resources Inc. indicates that the majority of points plot within the lamproite field defined by Mitchell and Bergman (1991) on a CaO vs. Al_2O_3 graph (Fig. 22). Furthermore, on a similar graph defined by Foley et al. (1987), the same data straddles the boundary for lamproites. Cavell et al (1992) report data that plots "... intermediate between lamproites and kamafugites in the classification scheme ... for potassic rocks". As a group, the Sweet Grass intrusives are ultrapotassic, peralkaline and perpotassic, satisfying major element criteria for kimberlitic and, especially, lamproitic lithologies. Their silica-poor to silica-deficient character is reflected in their nepheline normative (silica undersaturated) compositions (Burwash and Cavell 1992).

With regard to the clinopyroxene classification scheme of Stephens and Dawson (1977), CP1 clinopyroxenes are defined as sub-calcic diopsides, derived predominantly from South African kimberlites. Group CP2 clinopyroxenes overlap CP1 pyroxenes, differing in MgO / CaO ratios and are again dominated by kimberlite (South Africa and U.S.S.R.) with subordinate garnet lherzolite / garnet-olivine pyroxenite. CP3 clinopyroxenes are considered Ti-Cr diopsides, recovered from kimberlite, garnet lherzolite and garnet pyroxenite. CP4 are low chrome diopsides primarily from kimberlitic occurrences in South Africa. CP5 are chrome diopsides associated primarily with peridotites of kimberlitic and lherzolitic composition and subordinate pyroxenites. CP8 clinopyroxenites are dominated by clinopyroxenes of eclogitic paragenesis. Unfortunately it is difficult, on the basis of their data, to assign a preferential clinopyroxene composition coexisting with diamonds.

However, their equivalent classification scheme for garnets (Dawson and Stephens 1978) indicates that G3, G6 and G10 garnets are those preferentially associated with diamonds. Furthermore, it has been widely reported that G10 garnets are kimberlitic in origin, however G3 and G6 garnets are associated with eclogites. Schulze (1992) states that "... (the) observation that diamonds are approximately two orders of magnitude more abundant in diamond eclogites than in diamond peridotites may help to explain why the number of finds of diamond eclogites far outnumbers diamond peridotites". Furthermore, "... only small quantities of very diamond-rich eclogite are needed to account for the diamonds in kimberlites dominated by eclogitic diamonds, and xenoliths of eclogite (with or without diamonds) need not consitute a major portion of the xenolith suites in such kimberlites". Therefore, the presence of G3 and G6 garnets is

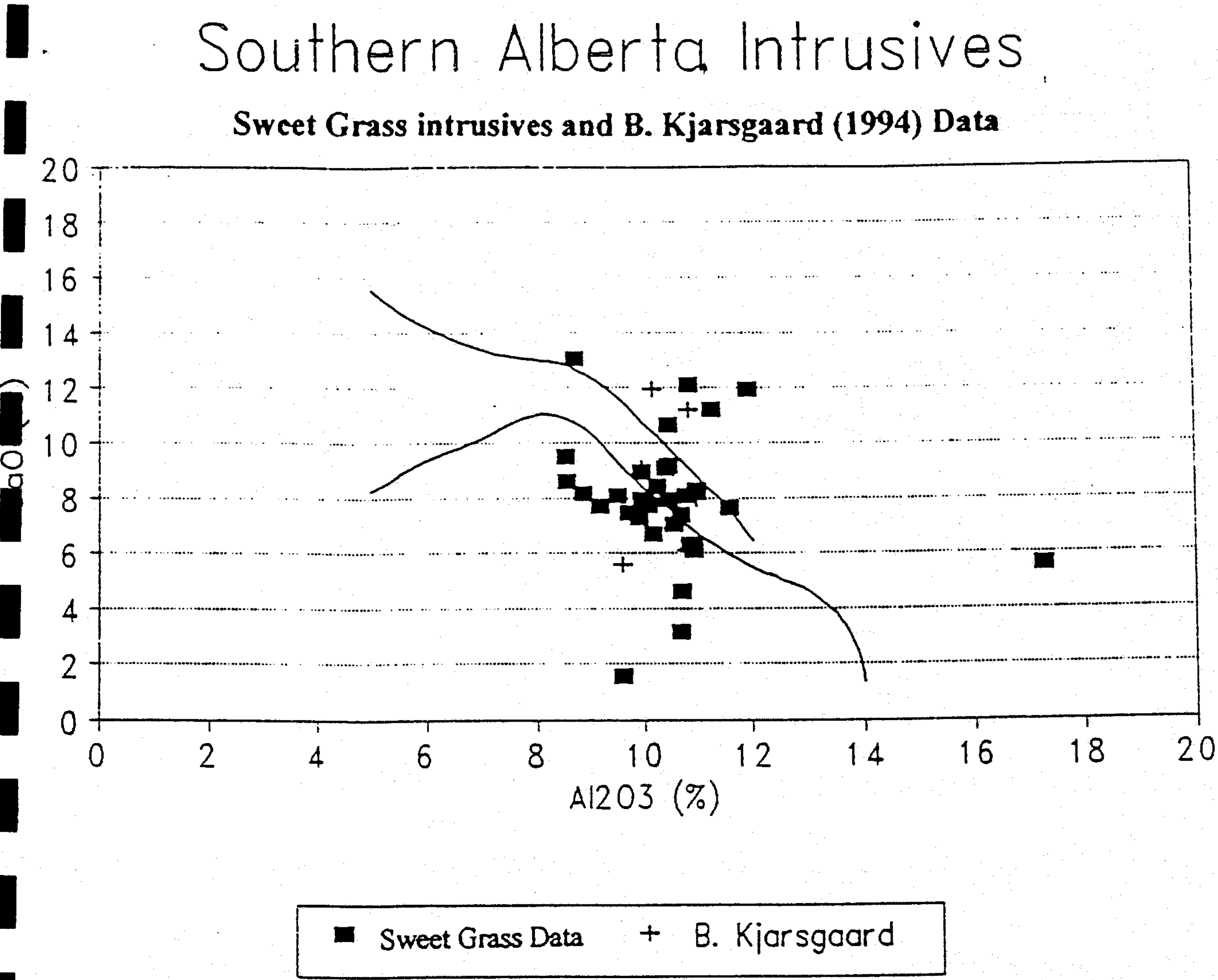


Figure 22 - Data collected for the Sweet Grass intrusives plotted with Kjarsgaard (1994) data for comparative purposes on a CaO vs. Al_2O_3 graph. The upper bounding curve is that of Mitchell and Bergman (1991), separating lamproitic compositions from other potassic lithologies. The lower bounding curve is the equivalent discriminant of Foley et al. (1987). Note that much of the data plots within or immediately adjacent to the lamproite field of composition. Figure from Kjarsgaard (1994).

encouraging despite the apparent lack of G10 (pyrope garnets). Finally, as discussed previously, the G5 garnets reported for the Milk River area are most probably deep crustal garnets.

Preliminary electron microprobe analyses of spinels document a P1 dominated chromite population associated with Group 1 kimberlites. The chromite data obtained compares extremely well with values defined for kimberlitic macrocrysts by Griffin et al. (1992). Furthermore, approximately 88 per cent of the Black Butte chromites and 30 per cent of the JD-2 chromites have compositions comparable to worldwide diamond inclusion field compositions (defined as Cr_2O_3 >60 wt.%, Al_2O_3 <10 wt.% and MgO between 11 and 14 wt.%).

The composition of the diatremes in terms of both whole rock and trace element geochemistry are encouraging with regard to diamond potential. They have similar compositions (possibly co-magmatic and probably coeval), being phlogopite-bearing, ultrapotassic, perpotassic, peralkaline intrusives of lamproitic affinity. The mineral chemistry returned so far is consistent with diamond-bearing lithologies. Phlogopite analyses compare favourably with kimberlitic compositions, while showing relationship to minette trends. Diopsides are all low chrome diopsides, alternatively interpreted as salites with subordinate diopside and highly subordinate augite, in contrast to Kjarsgaard (1994) petrographic interpretation of an augite-dominated mineral assemblage.

It should be noted that limited recovery of "kimberlitic indicator minerals" should be expected from lamproitic occurrences. It is a documented feature of lamproites that indicator minerals are generally moderately abundant to absent. Therefore, the sparse mantle-type minerals (pyrope garnet, high chrome diopside and picroilmenite) may be a function of "features" specific to generation of a lamproitic melt in the mantle.

The Rare Earth Element data obtained for southern Alberta (Fig. 20) is still in the preliminary stages of examination, however, some early conclusions can be reached. The data is very similar for the occurrences sampled (Fig. 20 and 21), suggesting a common genesis for the melts, both in terms of source and emplacement / extrusion history. Light Rare Earth Elements (LREE) are distinctly enriched relative to HREE. The REE plots (normalized using the data of Nakamura 1974) are comparable to those of South African kimberlites (Fesq et al. 1974) (Fig. 23), specifically with regard to low and intermediate values, namely an enrichment of the LREE relative to the HREE, the general lack of an Eu anomaly and a relatively steep gradient from the LREE to the HREE. Again, in contrast with the data of Kjarsgaard (1994), the data compares well with that of lamproite data from Leucite Hills Phlogopite Lamproite and Prairie Creek Olivine Lamproite.

Data for southern Alberta alkalic occurrences document LREE enrichments of between 10 and 50, whereas Burwash and Cavell (1992) report ten to hundred-fold enrichments. They state that LREE- and Mg-enrichment together with Eu anomaly argue against assimilation of sialic (silica-rich) crust as the lack of a Eu anomaly indicates depths below feldspar stability. Furthermore, using their Nd isotopic data they interpret "formation of an enriched mantle source by Proterozoic metasomatism ..." (Burwash and Cavell 1992, Cavell et al 1992). Subsequent partial melting of the LIL and volatile enriched lherzolitic upper mantle around 50 Ma resulted in the ultrapotassic melts exposed today in southern Alberta.

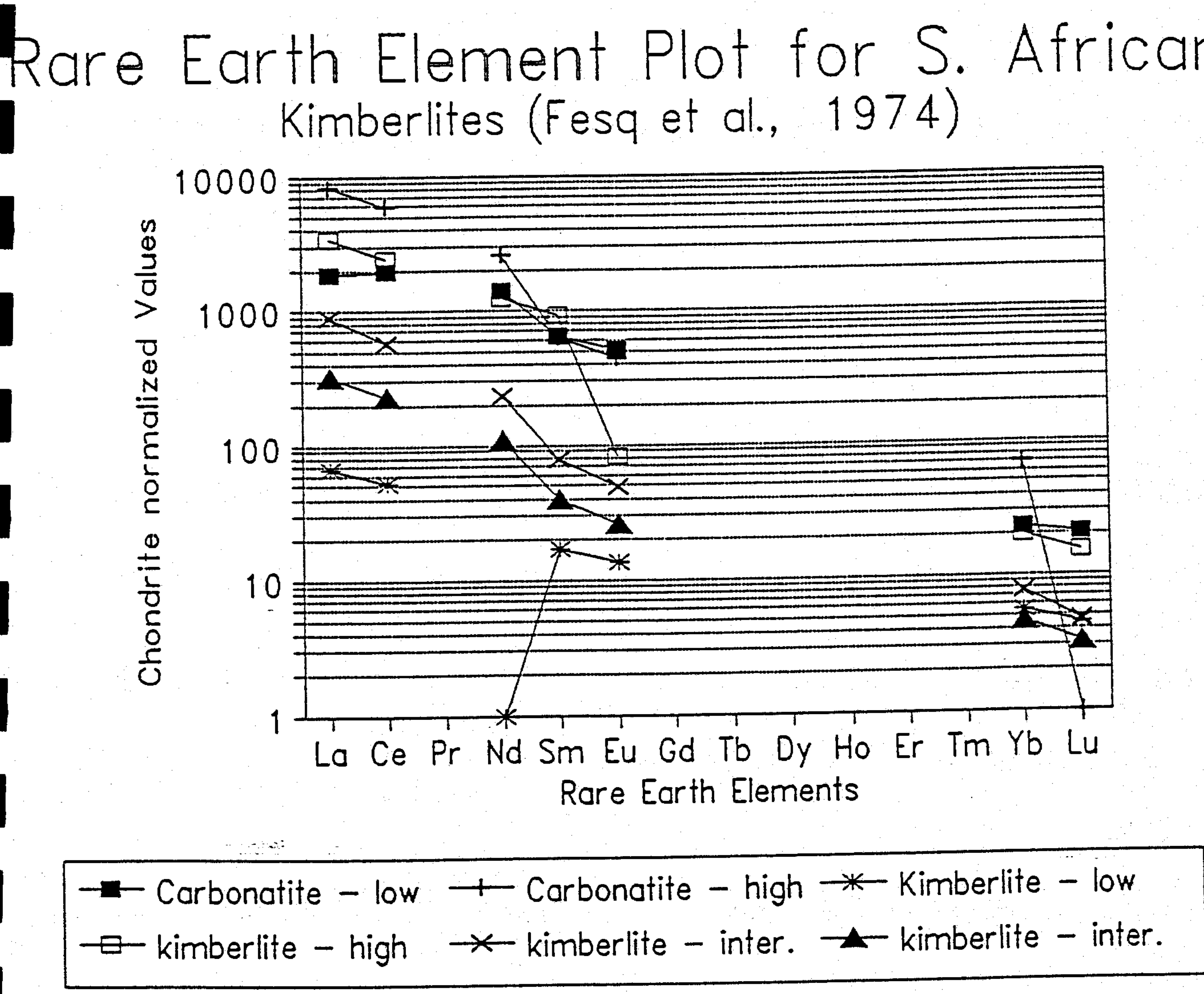


Figure 23 - Plot of Rare Earth Element (REE) data for South African kimberlites (data from Fesq et al. 1974). Note the steep trend from the light REE (LREE) to heavy REE (HREE). The plot shows approximately 20 to 155-fold enrichments of LREE relative to HREE. In addition, note the lack of a Eu anomaly, with the exception of the high kimberlite value. Note that two carbonatite values are also plotted. Finally, the two anomalously low values (Nd and Lu) are artifacts of missing data at those two points and should be ignored.

Preliminary results obtained from a limited program are extremely exciting and encouraging. Surface exposures have been identified and correlated to near sub-surface geophysical targets identified over a huge area of southern Alberta. Geochemical results (whole rock, trace element and mineral) are consistent with potentially diamondiferous igneous lithologies. Mantle-type xenoliths have been identified at several of the occurrences. The presence of abundant phlogopite (both as euhedral phenocrysts and as a major groundmass phase) indicates a minimum depth of 75 kilometres for the source magma (amphibole is the stable hydrous phase at depths less than 75 kilometres). The Colorado School of Mines (1988) identified thick mantle lithosphere (a thickened keel to the North American craton (Hearn Province in Alberta)) which extends from "... southeastern Wyoming, through central Montana and into southern Alberta and Saskatchewan" and has been dated at 3.278 ± 22 Ma (Archean).

Finally, the reported recovery of a microdiamond from the Black Butte occurrence (JD-1) supports the conclusion that, based upon mineral, whole rock and trace element geochemistry together with initial petrographic analyses, the southern Alberta alkalic occurrences have a distinct possibility of hosting diamonds and / or gold.

9. GEOPHYSICS

A recent development with regard to future exploration are preliminary geophysical maps produced from recent Geological Survey of Canada aeromagnetic data from southern Alberta. Processed data reveals many small closed anomalies ("bulls-eyes"), several of which have been spatially correlated to known surface exposures. Several additional large targets have been identified (with possible associated pyroclastic aprons) and many more smaller diatremes (?) are present. In addition, long, linear anomalies are present and have been modelled most successfully by the Geological Survey of Canada as vertical to sub-vertical dykes which taper with increasing depth and have a "blow" at or near the surface (Ross et al. 1994). A plot of the Geological Survey of Canada Cypress Hills aeromagnetic data for the Black Butte property and surrounding area reveals a well defined anomaly ("bullseye") spatially associated with the Black Butte exposure (Figure 24). A second, linear anomaly is associated with Philp Coulee (northwest portion of Section 30 and west half of Section 31), west of the surface exposure of the JD-3 (Roman Wall) occurrence. This linear anomaly represents a southeast extension of a larger anomaly to the north, within which the JD-4 occurrence is contained.

In November, 1993 Marum Resources Inc. and Roman Wall Corporation jointly commissioned a 1020 line kilometre Dighem helicopter survey. The geophysical survey was flown along north - south flight lines to verify and improve resolution of anomalies identified on the Geological Survey of Canada Aeromagnetic survey. Significantly better resolution achieved by the Dighem aeromagnetic survey (Fig. 25 and 26) confirms the well defined anomaly produced by the Black Butte occurence, closely associated spatially with the known surface exposure. In addition, the following table has been taken from the Dighem report produced for Marum Resources Inc.and Roman Wall Corporation Pinhorn Property. All geophysical anomalies have been tabulated in the upper portion and have been interpreted in terms of their most probable sources in the lower portion.

Figure 25 - Dighem 1:25,000 scale Enhanced Magnetic plot of aeromagnetic data jointly commissioned by Marum Resources Inc. and Roman Wall Corporation. Note there is a well defined regional gradient from east to west with a number of closed ("bullseye") anomalies representing both cultural and geological features. Anomalies having an "L" to the upper right are interpreted as cultural in origin. The geophysical expression of Black Butte is evident at centre right of the figure. There are a total of four closely associated anomalies which correspond very well spatially with the surface outcrop of the akalic pipe.

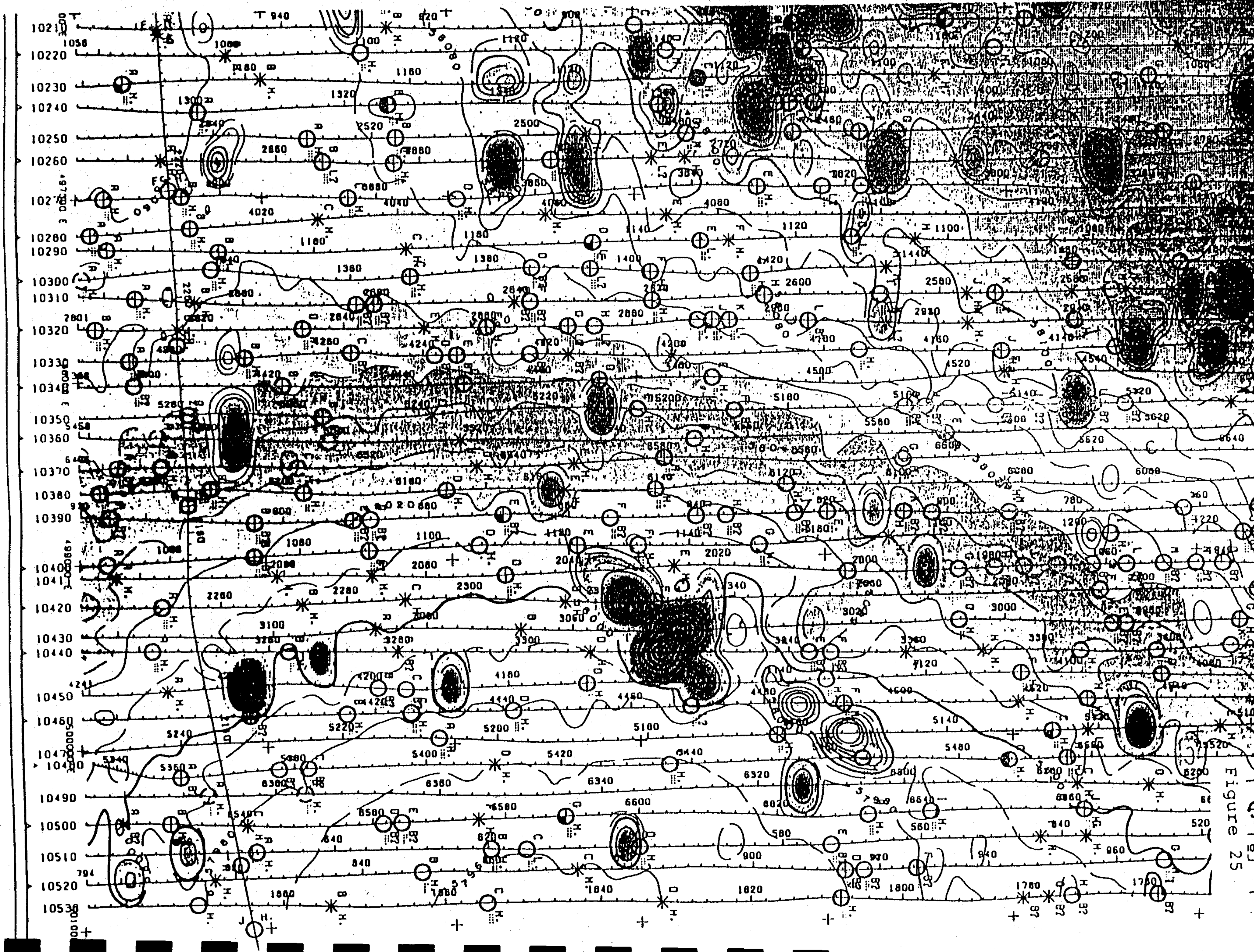


Figure 25

Figure 26 - 1:50,000 scale Shadowed Total Field Magnetics plot (artificial sun azimuth: 35 degrees, inclination: 25 degrees). Artificial illumination of the Dighem geophysical data used to enhance the anomalies resulting from the survey. Once again, the geophysical expression of Black Butte is very clear to the lower right (compare to Figure 25). The wedge shaped feature to the left represents pipelines to a gas compressor at the apex. At the left edge of the figure, just above centre, is a linear array of anomalies with a second, less defined set to the right. These are intrepreted (by the author) to be geophysical expressions of alkalic dykes in the Milk River area. The weakly defined set to the right spatially correlated to the JD-3 (Roman Wall) dyke occurrence. There is no known surface outcrop correlating to the western set (at the left edge of the figure). Also of note is the large number of anomalies evident on this image, most of unknown origin.

EM ANOMALY STATISTICS

MILK RIVER AREA

CONDUCTOR GRADE	CONDUCTANCE RANGE SIEMENS (MHOS)	NUMBER OF RESPONSES
7	>100	7
6	50 - 100	7
5	20 - 50	39
4	10 - 20	135
3	5 - 10	639
2	1 - 5	508
1	<1	31
*	INDETERMINATE	297
TOTAL		1663

CONDUCTOR MODEL	MOST LIKELY SOURCE	NUMBER OF RESPONSES
B	DISCRETE BEDROCK CONDUCTOR	711
H	ROCK UNIT OR THICK COVER	701
E	EDGE OF WIDE CONDUCTOR	55
L	CULTURE	196
TOTAL		1663

The Dighem survey resulted in the identification of 1663 geophysical anomalies of which 196 were identified as being cultural in origin. There are 1467 geophysical anomalies remaining to be evaluated in the Pinhorn Property. An additional 701 were identified as indicative of thick cover or basement rock units. The remaining anomalies were classified as discrete bedrock conductors (711) or representing the edge of a wide conductor (55). Preliminary examination of the data must be completed before any final conclusions can be reached, however some preliminary observations are apparent from the preliminary report.

In general, the total field magnetic data, upon processing, documents "... broad, regional features which are intersected by many anomalies indicative of narrower magnetic sources. The total field magnetic data are subjected to a processing algorithm .. (which) enhances the response of magnetic bodies in the upper 500 m and attenuates the response of deeper (magnetic) bodies. The resulting enhanced magnetic map provides better definition and resolution of near-surface magnetic units (Figure 25). The Dighem report (R.A. Pritchard, 1994) describes "... several anomalous features, many of which are

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considered to be of moderate to high priority as exploration targets. Most of the inferred bedrock conductors appear to warrant further investigation using appropriate surface exploration methods". The sections in quotations have been taken, verbatim, from the Dighem report on the Pinhorn Property for Marum Resources Inc. and Roman Wall Corporation.

"There are at least three circular, highly magnetic features which are of interest within the survey area as possible pipe-like targets. The largest is situated in the southeast portion of the survey block, centered at fiducial 3320 on line 10440. It is coincident with a circular topographic high. This feature exhibits an almost circular shape, and seems to have several weaker anomalies radiating out from it to the northeast and southwest. This anomaly gives rise to a circular resistivity high, suggesting that its source is more resistive than the surrounding, highly conductive material. Magnetite contained in this zone may suppress the inphase component of the EM response, enhancing the high resistivity response. A weakly magnetic dyke-like feature extends northeast approximately half a kilometer to the northeast of this strong anomaly. It has no associated resistivity response." The circular anomaly documents the geophysical expression of the JD-1 (Black Butte) occurrence. The signature is very good with six separate anomalies, five having closures (bulls-eyes), identified on the Total Field Magnetics which may represent individual magmatic phases. Furthermore, there is a weakly defined zone comprised of 11 magnetic anomalies which trends east-northeast / west-southwest which may represent a localized cluster of diatremes along a zone of weakness (ie. a fault).

"Numerous other geophysical features are described which are interpreted to represent north-northeast trending dykes and diatremes (circular magnetic features). There are several other magnetic anomalies which may be of interest and do not appear to reflect cultural sources. Two possible magnetic dykes trend north-northeast from fiducial 3006 on line 10030 to fiducial 1278 on line 10080 and from fiducial 3616 on line 10160 to fiducial 735 on line 10210. They reflect thin, parallel magnetic sources approximately $1^1/_2$ km apart. The easternmost dyke is indicative of the stronger of the two sources. Neither is associated with a distinct resistivity anomaly." The eastern geophysical response corresponds to the surface expression of the JD-3 (Roman Wall) occurrence.

Confirmation of the magnetic expression of several known alkalic occurrences using the geophysical data recovered by Dighem allows greater reliability in interpreting other geophysical features. In addition, the limited ground geophysical survey conducted by the Geological Survey of Canada and the subsequent interpretation that north-northeast trending anomalies identified south of Lethbridge represent vertical to sub-vertical dykes is particularly relevant with regard to the narrow, linear features described in the Dighem report. Furthermore, similar features are present on the regional scale Geological Survey of Canada aeromagnetic dataset. Therefore, these geophysical features should be regarded as potential alkalic diatreme and dyke occurrences, similar to the occurrences described in this report, and followed up accordingly.

Several of the anomalies on the Enhanced Magnetic and Shadow Maps can be correlated to oil and gas wells with relative certainty. Several of the remaining geophysical anomalies have signatures similar or identical to these cultural features. It is therefore recommended that a current map showing detailed locations of oil and gas wells (any wells which contain casing) be obtained for comparison to geophysical anomalies identified by the Dighem survey. Furthermore, several buildings are present which

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are not indicated on the topographic maps currently available and are likely present as geophysical anomalies on the Dighem survey. Correlation of these cultural features with geophysical anomalies would eliminate misidentification of such anomalies as potential drill targets and save considerable expense in the field.

10. GOLD CHEMISTRY

Microscopic examination of diatreme materials from the JD-2 and JD-4 locations resulted in the identification of sulphide minerals, mainly pyrite and pyrrhotite, and a few flakes of gold. Subsequent analysis of selected samples yielded gold values up to 0.03 ounces per ton. These anomalous gold values are interesting in the context of the area's epithermal gold potential as originally identified by Noranda prior to their permitting of the land immediately to the west of the Pinhorn Property. To the author's knowledge, no gold determinations have been carried out on samples from JD-1 or JD-3. Neither has any gold related exploration apparently been performed on the sedimentary rocks occurring in Township 1, Range 8. A cursory examination of selected samples for gold content should be undertaken as a matter of course during the next exploration program.

The gold potential of the diatremes cannot be ignored given that commercial diatreme-hosted gold deposits exist in Montana. Moreover, the potential for epithermal gold deposits in the enclosing sediments should be investigated by a sampling and shallow drilling program.

11. CONCLUSION AND GENERAL RECOMMENDATIONS

Conclusion: There is a distinct possibility of identifying (a) diamond-bearing diatreme(s) in southern Alberta.

Support for this conclusion is evident from mineral chemistry (particularly chromite chemistry), whole rock and trace element geochemistry, mineralogy and geophysics.

Southern Alberta intrusives should be aggressively pursued to evaluate their diamond potential since the intrusives (and extrusives) examined during the 1993 field programme were interpreted as minettes **with lamproitic affinity**. This is primarily due to the difficulty in determining the **primary** mineralogy of the groundmass phases, in particular, whether sanidine is primary or secondary (late alkali feldspar of Cavell et al. 1992). Further, the presence of Na feldspathoids (analcime and leucite) as primary phases has great significance as to the classification of the lamprophyres as either minettes or lamproites (Rock 1991).

As considerable economic significance is associated with any lithology identified as "lamproite" or "kimberlite", care must be taken in assigning a lithological name to any of these occurrences. Rock (1991) stated "... *lamprophyre* is a broad field term implying knowledge only of mode of occurrence and macroscopic petrology, whereas *kimberlite* is a precise petrological term implying detailed knowledge of both rock and mineral chemistry ... Lamprophyres are currently unified as the only confirmed magmatic source of diamond, and hence have the deepest origins of igneous rocks ... Continuing exploration has also now revealed microdiamonds in AL (alkaline lamprophyres) and UML (ultramafic lamprophyres)".

Therefore, further work is strongly recommended to allow more precise identification of the southern Alberta alkaline occurrences using all available lines of reasoning.

The results of field work undertaken to date indicate that the Sweet Grass intrusives are excellent candidates for diamond exploration and have distinct possibilities for hosting gold. This conclusion is based upon the following observations:

i) There is a postulated deep lithospheric keel which extends into southeastern Alberta, associated with the Wyoming craton of the Central Montana Alkalic Province,

ii) The Hearn Province is interpreted to underlie the Alberta Basin in southern Alberta and has been dated at 3.278 ± 22 Ma in the immediate vicinity of the southern Alberta minettes,

iii) The alkaline exposures (both intrusive and extrusive) have affinity to both kimberlitic and lamproitic trends described in the literature, coeval with alkaline igneous activity in the CMAP, documented to include lamproitic and kimberlitic lithologies,

iv) Geophysical anomalies evident on aeromagnetic surveys associated with several of the diatremes and distinct, extensive linear magnetic features (verified by at least one ground survey) which have been successfully modelled as dykes, tapering with depth, having a "blow" at surface,

v) A possible aulacogen exists in southern Alberta which may be associated with northwest - southeast trending linears representing failed arms of ancient triple junctions,

vi) Kimberlitic indicator minerals have been documented, with compositions comparable to: a) kimberlites world-wide (eg. phlogopite, chromite, high chrome diopside and G3 garnets) and b) world-wide diamond inclusion field compositions (chromite), and

vii) Recovery of a microdiamond from a small (38.2 Kg) rock sample taken from the JD-1 (Black Butte) occurrence.

Continued exploration on these occurrences is strongly recommended. A rigorous, follow-up program should include the following:

1) Bulk sample the JD-1 alkalic occurrence (and / or additional exposure(s)) following investigation of major geophysical anomalies.

2) Carry out detailed ground geophysics (magnetics, gravity and resistivity) over a grid extending at least 200 metres in each direction from the Black Butte exposure to determine the orientation of the diatreme in the subsurface.

3) Carry out soil geochemistry in conjunction with geophysics (using the same grid) to determine whether economic enrichment of host sediments during or subsequent to diatreme emplacement occurred and to what extent.

4) Thoroughly examine and map the igneous and sedimentary exposures to identify:
   a) Intrusive relationships and relative timing,
   b) Number of phases present,
   c) Identity of ultramafic nodule suite, and
   d) Phases suitable for pressure-temperature determinations.

5) Sample each igneous phase and dyke for whole rock and trace element geochemistry, heavy mineral suites, electron microprobe analysis, thin section analysis, base and precious metal content. In addition, with the identification of a pyroclastic vent breccia and associated proximal vent facies at the JD-4 occurrence, the possibility of pyroclastic aprons (hosting secondary deposits of diamonds) surrounding other, possibly buried, exposures should be seriously considered as an exploration target. Furthermore, pyroclastic aprons are considered as the most favourable targets for diamond exploration in Saskatchewan and any possible occurrence should be aggressively investigated.

6) Carry out microscopic examination of heavy mineral concentrate to identify "indicator minerals", heavy mineral populations and recover diamonds.

7) Evaluate the airborne geophysical Dighem anomalies to determine if they are cultural features, artifacts of processing or real geological features. Furthermore, the linear geophysical anomalies examined by the Geological Survey of Canada should have soil sampling, ground geophysics and / or drilling to identify their nature.

8) Upon return of favourable results in any of the above recommendations, drill the exposure:
   a) To determine variations in diatreme complex with depth.
   b) To obtain pristine, unweathered samples for analysis.

9) Determine whether the alkaline occurrences are minettes or lamproites using whole rock and trace element geochemistry, thin section analysis of textures and mineral assemblages, and electron microprobe analysis of mineral compositions.

Two options are proposed for the Black Butte property, an integrated geological, geochemical and geophysical program and a second bulk sampling program designed solely to test the diamond content of the occurrence. The first option would allow for determination of the extent of the occurrence in the subsurface and assist in identifying optimum drill site localities. The second option is designed solely to determine the diamond content (approximate grade) of the pipe and the composition of a limited suite of indicator minerals.

12. RECOMMENDED 1994 PROGRAM

Based on the above general conclusions, the following exploration programme is recommended for the 1994 field season:

		Option A	Option B
Project Management	**$ 15,000**	**$ 15,000**	**$ 15,000**
Mapping and Sampling			
Geologist and helper			
Field - 15 days at $700/day	$ 10,500		
Office - 15 days at $400/day	$ 6,000		
Thin Sections and Analysis	$ 3,000		
Accommodation - 15 days at $100/day	$ 1,500		
Supplies and Support	$ 2,500		
	$ 23,500	**$ 23,500**	**$ 23,500**
Ground Geophysical Programme			
Geophysicist and helper			
Field - 15 days at $600/day	$ 9,000		
Office - 10 days at $300/day	$ 3,000		
Accommodation - 15 days at $100/day	$ 1,500		
Supplies and Support	$ 2,500		
Report and Deliverables	$ 2,500		
	$ 18,500	**$ 18,500**	
Geochemical Programme			
Field collection - Soil samples			
Two samplers - 10 days at $500/day	$ 5,000		
Soil - 200 at $22.75/sample	$ 4,550		
	$ 9,550	**$ 9,550**	
Bulk Sample			
Land Access Fee	$ 5,000		
Drilling and Blasting	$ 5,000		
3 tonne bulk sample removal			
Cat and Breaker	$ 5,000		
Transport	$ 3,000		
Primary Crushing	$ 2,500		
Processing			
25 100 kg samples @ $800 / sample	$ 20,000		
Picking, microprobe and X-ray	$ 7,500		
Waste Removal	$ 2,000		
Report and Deliverables	$ 10,000		
	$ 60,000	$ 60,000	$ 60,000
Sub-Total		$126,550	$ 98,500
Contingency at 10%		$ 12,655	$ 9,850
Total		$139,205	$108,350

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STATEMENT OF QUALIFICATIONS

I, Richard T. Walker, of [redacted] South, Cranbrook, BC, hereby certify that:

1) I am a graduate of the University of Calgary of Calgary, Alberta, having received a Bachelors of Science degree in 1986.

2) I obtained a Masters of Geology degree at the University of Calgary of Calgary, Alberta in 1989.

3) I am a member in good standing of the Association of Professional Engineers, Geologists and Geophysicists of Alberta (P.Geol.).

4) I am a member in good standing of the Association of Professional Engineers and Geoscientists of the Province of British Columbia (P.Geo.).

5) My specific field of interest and expertise is in ultramafic lithologies and I have been actively involved in this field for five years, working in the Northwest Territories, British Columbia and Alberta.

6) I am the author of this report which is based on work I personally performed on the property and surrounding area between May 1st, 1993 and November 11th, 1993.

7) I have no interest, either direct or indirect, in Dankoe Mines Limited and / or Bismillah Ventures Inc.

8) I hereby grant permission to Dankoe Mines Limited and / or Bismillah Ventures Inc. to use this report, or any portion of it, for any legal purposes normal to the business of the company, so long as the excerpts do not materially deviate from the intent of this report as set out in the whole.

Dated at Cranbrook, British Columbia, this 18th day of August, 1994.

PROFESSIONAL GEOLOGIST ALBERTA
RICHARD T. WALKER

PROFESSIONAL
PROVINCE OF BRITISH COLUMBIA
R. T. WALKER
GEOSCIENTIST

Richard T. Walker, P.Geol., P.Geo.

APPENDIX 1

RESULTS OF
ELECTRON MICROPROBE
ANALYSIS
OF
SELECTED INDICATOR
MINERALS

GARNETS
Southern Alberta

Formula Based on 12 O
Molecular Weight of Oxides

Sample Number	Locality	Colour	UN #	SiO2	TiO2	Al2O3	FeO	MnO	MgO	CaO	Na2O	Cr2O3	Total	Garnet Classn.
				60.09	79.90	101.94	71.85	70.94	40.32	56.08	61.98	151.99		
ABRW93R-55	JD-1	clear	109	38.24	0.01	21.72	30.09		8.39	1.96		0.09	100.50	Crustal
ABRW93R-55	JD-1	clear	110	39.04	0.01	22.42	24.01		10.50	4.86		0.00	100.84	G5
ABRW93R-55	JD-1	clear	111	39.46	0.03	22.14	29.18		8.90	1.99		0.05	101.75	G5
ABRW93R-55	JD-1	lt. pink	112	38.68	0.00	21.73	30.35		8.45	1.83		0.05	101.09	Crustal
ABRW93R-55	JD-1	lt. pink	113	38.57	0.00	22.27	27.06		10.38	2.27		0.03	100.58	G5
ABRW93R-55	JD-1	dirty orange	114	38.59	0.00	22.03	29.57		9.20	1.81		0.02	101.22	G5
ABRW93R-55	JD-1	lt. orange	115	41.38	0.05	23.16	14.52		15.62	6.23		0.11	101.07	G3
ABRW93R-55	JD-1	med. orange	116	38.57	0.07	21.90	25.53		8.44	6.19		0.00	100.70	G5
ABRW93R-55	JD-1	med. orange	117	39.56	0.05	22.31	22.42		10.51	5.77		0.03	100.65	G3
ABRW93R-55	JD-1	med. orange	118	39.64	0.11	21.75	22.32		10.35	6.05		0.00	100.22	G3
ABRW93R-55	JD-1	med. orange	119	39.44	0.06	21.32	25.70		7.95	5.88		0.01	100.36	G5
ABRW93R-55	JD-1	lt. orange	128	39.52	0.07	21.38	24.94		8.78	5.77		0.00	100.46	G5
ABRW93R-55	JD-1	lt. orange	129	40.04	0.12	22.89	14.22		10.27	12.94		0.00	100.48	G6
ABRW93R-55	JD-1	dirty orange	130	38.95	0.07	21.35	24.22		9.37	5.94		0.01	99.91	G5
ABRW93R-55	JD-1	dirty orange	131	38.21	0.05	21.80	25.30		7.99	6.80		0.02	100.17	G5
ABRW93R-55	JD-1	dirty orange	132	37.82	0.08	21.53	25.24		8.81	5.88		0.00	99.36	G5
ABRW93R-55	JD-1	clear	133	41.57	0.05	23.36	14.25		15.73	6.07		0.10	101.13	G3
ABRW93R-55	JD-1	clear	134	39.28	0.02	21.71	29.73		8.23	1.97		0.04	100.98	G5
ABRW93R-55	JD-1	clear	135	41.10	0.02	23.25	14.09		15.82	6.12		0.06	100.46	G3
ABRW93R-55	JD-1	clear	136	39.16	0.02	22.63	23.62		10.26	5.07		0.01	100.77	G3
ABRW93R-55	JD-1	clear	137	40.28	0.07	22.70	14.48		10.91	12.04		0.00	100.48	G6
ABRW93R-55	JD-1	orange	138	39.84	0.06	22.32	23.17		9.88	6.52		0.01	101.80	G3
ABRW93R-55	JD-1	clear	139	39.20	0.02	22.30	27.26		10.33	2.36		0.03	101.50	G5
ABRW93R-55	JD-1	clear	140	39.27	0.01	22.39	24.17		10.43	4.67		0.00	100.94	G5
ABRW93R-55	JD-1	clear	141	38.49	0.02	21.70	30.29		8.11	2.11		0.11	100.83	Crustal
ABRW93R-55	JD-1	lt. pink	142	38.20	0.00	21.72	30.33		8.42	2.03		0.08	100.78	Crustal
ABRW93AA-88	JD-2		B1	35.62	0.00	21.54	29.96	2.44	6.23	1.29	0.00	0.00	97.08	G5
ABRW93AA-88	JD-2		C1	36.91	0.05	21.21	30.32	1.93	4.68	3.58	0.05	0.00	98.73	Crustal
ABRW93AA-88	JD-2		D1	38.35	0.01	22.34	32.97	0.28	6.76	0.92	0.03	0.03	101.69	Crustal
ABRW93AA-88	JD-2		D2	38.56	0.02	22.48	32.74	0.42	6.73	1.03	0.01	0.04	102.03	Crustal

GARNETS (cont'd)
Southern Alberta

Formula Based on 12 O
Molecular Weight of Oxides

Sample Number	Locality	Colour	UN #	SiO2	TiO2	Al2O3	FeO	MnO	MgO	CaO	Na2O	Cr2O3	Total	Garnet Classn.
				60.09	79.90	101.94	71.85	70.94	40.32	56.08	61.98	151.99		
ABRW93AA-88	JD-2		E1	37.27	0.02	21.62	29.63	6.00	3.05	3.25	0.05	0.00	100.89	G5
ABRW93AA-88	JD-2		F1	37.27	0.00	21.48	32.85	0.71	3.02	4.22	0.06	0.00	99.61	Crustal
ABRW93AA-88	JD-2		G1	37.41	0.06	21.38	29.69	7.65	1.82	3.23	0.02	0.01	101.27	G5
ABRW93AA-88	JD-2		H1	37.55	0.02	22.16	29.27	1.39	6.43	2.82	0.04	0.05	99.73	G5
ABRW93AA-88	JD-2		J1	36.80	0.04	21.57	34.31	0.74	4.34	1.10	0.05	0.01	98.96	Crustal
ABRW93AA-88	JD-2		I1	37.32	0.00	21.99	33.43	0.97	5.09	1.56	0.00	0.01	100.37	Crustal
ABRW93AA-88	JD-2		A2	36.82	0.00	21.11	33.72	0.60	3.73	2.92	0.01	0.00	98.91	Crustal
ABRW93AA-88	JD-2		B2	45.78	0.02	17.06	20.41	10.41	1.13	3.12	0.56	0.00	98.49	G3
ABRW93AA-88	JD-2		C2	37.41	0.09	20.97	31.54	0.72	2.14	8.18	0.00	0.04	101.09	Crustal
ABRW93AA-88	JD-2		D2	36.78	0.03	21.71	36.07	1.04	3.27	1.06	0.05	0.03	100.04	Crustal
ABRW93AA-88	JD-2		E2	35.82	0.00	20.98	25.86	13.83	0.62	0.84	0.08	0.05	98.08	G5
ABRW93AA-88	JD-2		G2	36.68	0.01	21.40	29.94	9.38	1.14	1.55	0.07	0.03	100.20	G5
ABRW93AA-88	JD-2		H2	36.90	0.00	21.74	32.98	7.17	1.71	1.22	0.01	0.00	101.73	Crustal
ABRW93AA-88	JD-2		I2	37.87	0.08	22.11	32.25	1.11	5.44	2.22	0.03	0.00	101.11	Crustal
ABRW93AA-88	JD-2		J2	36.50	0.01	21.23	33.25	6.80	1.21	1.33	0.08	0.00	100.41	Crustal
ABRW93AA-88	JD-2		A3	36.03	0.05	21.42	34.26	2.84	3.23	0.90	0.00	0.00	98.73	Crustal
ABRW93AA-88	JD-2		A3	37.69	0.00	22.07	34.31	2.82	3.32	0.95	0.06	0.06	101.28	Crustal
ABRW93AA-88	JD-2		B3	37.86	0.00	22.04	30.94	3.62	5.10	1.67	0.03	0.00	101.26	Crustal
ABRW93AA-88	JD-2		C3	36.91	0.05	22.20	35.11	0.75	4.45	0.90	0.00	0.04	100.41	Crustal
ABRW93AA-88	JD-2		E3	37.92	0.04	21.93	31.34	0.65	3.08	6.85	0.01	0.00	101.82	Crustal
ABRW93AA-88	JD-2		F3	38.11	0.08	22.06	31.42	0.56	5.96	2.72	0.02	0.09	101.02	Crustal
ABRW93AA-88	JD-2		G3	37.16	0.00	21.80	37.16	1.60	2.75	0.94	0.03	0.00	101.44	Crustal
ABRW93AA-88	JD-2		H3	37.09	0.00	21.90	32.81	0.79	4.60	2.47	0.08	0.00	99.74	Crustal
ABRW93AA-88	JD-2		I3	37.79	0.07	21.91	28.63	2.76	3.67	6.03	0.02	0.00	100.88	G5
ABRW93AA-88	JD-2		J3	36.55	0.02	21.60	28.81	1.34	4.36	5.34	0.00	0.00	98.02	G5
ABRW93AA-88	JD-2		A4	36.65	0.00	21.42	30.75	9.36	1.84	0.39	0.05	0.00	100.46	Crustal
ABRW93AA-88	JD-2		B4	37.42	0.00	21.67	35.43	1.82	3.71	1.05	0.00	0.02	101.12	Crustal
ABRW93AA-88	JD-2		C4	38.07	0.03	22.75	32.80	0.43	6.46	1.22	0.02	0.01	101.79	Crustal
ABRW93AA-88	JD-2		D4	37.02	0.01	22.09	28.99	0.60	7.77	1.66	0.02	0.05	98.21	G5
ABRW93AA-88	JD-2		D4	38.14	0.00	22.62	29.04	0.58	7.92	1.66	0.04	0.00	100.00	G5
ABRW93AA-88	JD-2		E4	37.79	0.06	21.60	35.28	1.48	3.31	3.16	0.04	0.06	102.78	Crustal
ABRW93AA-88	JD-2		E4	37.89	0.10	21.50	34.02	1.48	2.97	3.34	0.03	0.00	101.33	Crustal
ABRW93AA-88	JD-2		F4	37.34	0.02	21.76	32.87	4.87	3.42	0.74	0.03	0.01	101.06	Crustal
ABRW93AA-88	JD-2		H4	38.31	0.02	22.04	32.51	0.89	6.05	1.14	0.05	0.01	101.02	Crustal
ABRW93AA-88	JD-2		I4	37.36	0.07	21.49	32.96	0.96	2.29	6.29	0.04	0.02	101.48	Crustal
ABRW93AA-88	JD-2		J4	37.95	0.00	22.23	33.93	0.86	4.70	1.25	0.03	0.02	100.97	Crustal
BHP				44.57	0.11	22.26	11.68	0.34	15.84	4.71	0.33	0.17	100.01	G3

Molecular Weight of Oxides

PT.#	Local	SiO2	TiO2	Al2O3	FeO*	MnO	MgO	CaO	Na2O	K20	Cr2O3	Total	X Fs	X En	X Wo	Pyroxe Classn
		60.09	79.90	101.94	71.85	70.94	40.32	56.08	61.98	94.20	152.02					
RW-3	JD-1	54.43	0.10	0.61	4.59	0.16	15.83	23.14	0.58			99.44	0.073	0.451	0.474	CP4
RW-3	JD-1	54.35	0.17	0.35	3.57	0.08	18.34	21.66	0.13			98.65	0.056	0.510	0.433	CP2
RW-3	JD-1	54.72	0.13	0.62	5.70	0.17	15.32	23.03	0.60			100.29	0.091	0.436	0.471	CP4
RW-3	JD-1	54.99	0.20	0.56	3.81	0.08	17.45	22.86	0.24			100.19	0.059	0.484	0.456	CP2
RW-3	JD-1	53.96	0.18	0.90	5.98	0.18	15.57	22.29	0.49			99.55	0.096	0.444	0.457	CP4
RW-3	JD-1	55.44	0.12	0.23	3.26	0.08	18.79	22.11	0.11		0.17	100.31	0.050	0.514	0.435	CP2
RW-3	JD-1	53.86	0.18	0.86	5.56	0.11	16.15	22.51	0.41		0.00	99.64	0.088	0.455	0.456	CP4
RW-3	JD-1	54.90	0.12	0.30	3.33	0.07	18.36	22.41	0.13		0.07	99.69	0.051	0.505	0.443	CP2
RW-3	JD-1	53.15	0.07	3.09	5.92	0.14	13.50	20.41	2.00		0.06	98.34	0.105	0.428	0.465	CP4
RW-3	JD-1	52.88	0.05	2.73	5.69	0.13	13.62	20.26	1.92		0.15	97.43	0.102	0.433	0.463	CP4
RW-3	JD-1	53.17	0.05	3.11	5.72	0.14	13.51	20.70	1.99		0.16	98.55	0.101	0.426	0.470	CP4
RW-3	JD-1	52.50	0.12	0.64	5.80	0.16	15.52	22.22	0.40		0.07	97.43	0.093	0.445	0.459	CP4
RW-3	JD-1	53.93	0.18	0.54	4.76	0.10	17.19	22.43	0.31		0.05	99.49	0.074	0.477	0.447	CP4
RW-3	JD-1	53.99	0.11	0.63	4.30	0.12	17.22	22.28	0.30		0.07	99.02	0.068	0.482	0.448	CP4
RW-3	JD-1	54.36	0.09	0.57	4.97	0.11	16.92	22.46	0.33		0.02	99.83	0.078	0.471	0.450	CP4
RW-3	JD-1	54.35	0.14	0.45	3.79	0.10	17.98	22.25	0.23		0.17	99.46	0.059	0.497	0.442	CP2
RW-3	JD-1	54.11	0.15	0.52	4.84	0.11	16.86	22.38	0.34		0.04	99.35	0.076	0.472	0.450	CP4
RW-3	JD-1	51.35	0.71	1.37	10.82	0.31	12.35	21.80	0.92		0.00	99.63	0.177	0.360	0.457	CP4
RW-4	JD-1	50.39	0.64	5.67	8.74	0.06	11.78	20.41	1.37		0.01	99.07	0.156	0.375	0.467	CP4
RW-4	JD-1	50.18	0.63	5.79	8.80	0.07	11.87	20.68	1.35		0.02	99.39	0.156	0.374	0.469	CP4
RW-4	JD-1	51.09	0.60	4.73	7.90	0.06	12.52	20.91	1.42		0.02	99.25	0.138	0.391	0.469	CP4
RW-4	JD-1	54.05	0.07	0.21	3.60	0.11	17.86	22.77	0.11		0.10	98.88	0.056	0.492	0.451	CP2
RW-4	JD-1	54.15	0.11	0.21	3.97	0.11	18.69	21.41	0.13		0.11	98.89	0.061	0.514	0.423	CP2
RW-4	JD-1	52.82	0.18	1.25	8.37	0.20	13.76	21.80	0.88		0.05	99.31	0.137	0.402	0.458	CP4
RW-4	JD-1	54.67	0.14	0.98	4.19	0.17	16.70	23.17	0.44		0.07	100.53	0.066	0.466	0.465	CP2
RW-4	JD-1	54.98	0.11	0.47	3.26	0.06	17.63	23.47	0.18		0.08	100.24	0.050	0.485	0.464	CP2
RW-4	JD-1	54.43	0.05	1.62	4.90	0.12	15.05	22.58	1.14		0.10	99.99	0.081	0.441	0.476	CP4
RW-4	JD-1	50.51	0.71	5.51	8.88	0.03	11.72	20.82	1.38		0.01	99.57	0.157	0.370	0.472	CP4
RW-4	JD-1	50.47	0.64	5.82	8.61	0.06	11.55	21.08	1.40		0.02	99.65	0.153	0.366	0.480	CP4
RW-4	JD-1	50.39	0.70	5.78	8.79	0.06	11.42	20.83	1.45		0.02	99.44	0.157	0.364	0.478	CP4
RW-4	JD-1	51.15	0.67	5.67	9.25	0.08	11.63	20.50	1.17		0.03	100.15	0.164	0.368	0.466	CP4
RW-4	JD-1	50.69	0.62	5.78	8.67	0.05	11.63	21.05	1.39		0.03	99.91	0.154	0.367	0.478	CP4
RW-4	JD-1	50.23	0.55	5.51	9.06	0.07	11.72	20.63	1.39		0.03	99.19	0.161	0.370	0.468	CP4
RW-4	JD-1	50.35	0.64	5.55	8.81	0.07	11.47	20.90	1.46		0.01	99.26	0.157	0.364	0.477	CP4
RW-4	JD-1	50.43	0.63	5.44	8.67	0.06	11.64	20.96	1.39		0.02	99.24	0.154	0.368	0.477	CP4
RW-4	JD-1	50.66	0.62	5.21	8.68	0.06	11.87	20.87	1.34		0.02	99.33	0.153	0.374	0.472	CP4
RW-4	JD-1	50.99	0.55	4.75	8.51	0.06	12.23	20.88	1.36		0.02	99.35	0.149	0.382	0.468	CP4
RW-4	JD-1	50.37	0.40	3.66	9.27	0.11	13.00	21.45	0.55		0.04	98.85	0.154	0.386	0.458	CP4
RW-4	JD-1	51.08	0.10	2.95	11.98	0.24	10.76	20.92	1.26		0.00	99.29	0.206	0.329	0.461	CP4
RW-4	JD-1	53.21	0.15	0.91	5.83	0.16	15.66	22.02	0.54		0.07	98.55	0.094	0.449	0.454	CP4
RW-4	JD-1	53.51	0.10	0.94	5.95	0.14	16.50	21.30	0.43		0.08	98.95	0.095	0.468	0.435	CP4
RW-4	JD-1	53.80	0.12	0.77	5.33	0.14	16.81	21.50	0.36		0.09	98.92	0.085	0.476	0.437	CP4
RW-4	JD-1	53.35	0.13	0.70	5.22	0.14	17.05	21.56	0.35		0.13	98.63	0.082	0.479	0.436	CP4

Southern Alberta

Mol Weig Oxid

PT.#	Local	60.09 SiO2	79.90 TiO2	101.94 Al2O3	71.85 FeO*	70.94 MnO	40.32 MgO	56.08 CaO	61.98 Na2O	94.20 K20	152.02 Cr2O3	Total	X Fs	X En	X Wo	Pyrox Classn
RW-4	JD-1	53.46	0.15	0.65	5.90	0.16	16.15	21.72	0.47		0.03	98.69	0.094	0.459	0.444	CP4
RW-4	JD-1	53.75	0.07	2.02	6.16	0.17	14.06	21.27	1.54		0.05	99.09	0.105	0.427	0.465	CP4
RW-4	JD-1	53.93	0.05	1.40	6.19	0.17	14.69	21.74	1.14		0.06	99.37	0.102	0.433	0.461	CP4
RW-4	JD-1	53.74	0.08	1.48	6.62	0.30	14.45	21.09	1.05		0.08	98.89	0.111	0.431	0.453	CP4
RW-4	JD-1	53.59	0.11	0.80	6.02	0.16	15.24	22.51	0.68		0.07	99.18	0.097	0.437	0.464	CP4
RW-4	JD-1	53.53	0.14	0.73	5.54	0.12	16.18	22.27	0.41		0.09	99.01	0.088	0.457	0.453	CP4
RW-4	JD-1	53.40	0.19	0.48	7.14	0.25	15.42	20.94	0.86		0.00	98.68	0.116	0.445	0.435	CP4
RW-4A	JD-1	55.04	0.15	0.71	2.84	0.06	17.38	24.57	0.19			100.94	0.043	0.474	0.482	CP5
RW-4A	JD-1	54.93	0.03	1.92	4.75	0.12	14.35	23.02	1.53			100.65	0.079	0.427	0.492	CP4
RW-4A	JD-1	54.96	0.04	1.66	4.80	0.11	14.65	23.29	1.29			100.80	0.079	0.429	0.490	CP4
RW-4A	JD-1	55.42	0.04	2.01	4.42	0.12	14.61	23.37	1.41			101.40	0.073	0.430	0.495	CP4
RW-4A	JD-1	55.21	0.13	0.56	4.16	0.09	16.86	24.16	0.31			101.48	0.064	0.460	0.474	CP2
RW-4A	JD-1	54.00	0.24	0.78	4.97	0.15	15.82	23.34	0.46			99.76	0.079	0.446	0.473	CP4
RW-4A	JD-1	54.83	0.16	0.43	2.97	0.10	18.10	23.47	0.18			100.24	0.045	0.493	0.460	CP5
RW-4A	JD-1	51.28	0.61	5.46	7.48	0.06	11.96	21.53	1.34			99.72	0.133	0.378	0.489	CP4
RW-4A	JD-1	54.87	0.05	0.12	2.85	0.10	16.73	24.80	0.34			99.86	0.044	0.462	0.492	CP5
RW-4A	JD-1	54.34	0.17	0.48	2.65	0.07	18.46	22.71	0.24			99.12	0.041	0.508	0.450	CP5
RW-4A	JD-1	54.75	0.17	0.46	2.71	0.07	18.49	22.73	0.24			99.62	0.042	0.508	0.449	CP5
RW-4A	JD-1	54.08	0.16	0.58	4.29	0.12	17.12	22.86	0.27			99.48	0.067	0.475	0.456	CP4
RW-4A	JD-1	54.17	0.18	1.57	5.49	0.17	14.64	22.13	1.21			99.56	0.091	0.434	0.472	CP4
RW-4A	JD-1	55.26	0.13	0.40	3.18	0.06	18.07	23.27	0.18			100.55	0.049	0.493	0.457	CP2
RW-4A	JD-1	50.59	0.66	5.81	7.75	0.05	11.70	21.57	1.32			99.45	0.138	0.370	0.491	CP4
RW-4A	JD-1	54.79	0.03	0.17	3.26	0.10	17.14	23.94	0.36			99.79	0.050	0.473	0.475	CP2
RW-4A	JD-1	54.41	0.14	0.69	5.35	0.16	15.68	23.39	0.55			100.37	0.084	0.441	0.473	CP4
RW-4A	JD-1	54.32	0.18	0.57	4.67	0.11	16.13	23.89	0.37			100.24	0.073	0.448	0.477	CP4
RW-4A	JD-1	54.73	0.16	0.79	5.13	0.11	16.06	23.28	0.34			100.60	0.081	0.449	0.468	CP4
RW-5	JD-1	54.74	0.13	0.73	5.47	0.12	15.65	23.47	0.36			100.67	0.086	0.439	0.473	CP4
RW-5	JD-1	54.48	0.18	0.73	6.05	0.15	15.12	23.92	0.38			101.01	0.095	0.422	0.480	CP4
RW-5	JD-1	54.03	0.17	1.40	7.05	0.21	14.04	23.44	0.67			101.01	0.113	0.402	0.482	CP4
RW-5	JD-1	54.65	0.18	0.55	4.49	0.12	16.76	23.38	0.26			100.39	0.070	0.464	0.465	CP4
RW-5	JD-1	54.62	0.23	0.87	5.71	0.13	15.43	24.04	0.35			101.38	0.089	0.429	0.480	CP4
RW-5	JD-1	49.86	0.13	0.86	7.03	0.13	13.61	21.06	0.43		0.00	93.11	0.120	0.415	0.462	CP4
RW-5	JD-1	53.81	0.19	0.94	7.48	0.16	14.61	23.25	0.48		0.01	100.93	0.118	0.410	0.469	CP4
RW-5	JD-1	53.96	0.18	0.85	7.02	0.14	14.91	23.21	0.41		0.01	100.69	0.111	0.419	0.469	CP4
RW-5	JD-1	53.96	0.20	0.81	6.52	0.13	15.21	23.38	0.36		0.01	100.58	0.102	0.425	0.470	CP4
RW-5	JD-1	53.95	0.19	0.70	6.25	0.14	15.60	23.14	0.35		0.01	100.33	0.098	0.435	0.464	CP4
RW-5	JD-1	53.94	0.19	0.66	6.32	0.13	15.65	23.08	0.34		0.00	100.31	0.099	0.436	0.463	CP4
RW-5	JD-1	53.56	0.20	0.85	7.27	0.16	15.02	22.81	0.43		0.01	100.31	0.115	0.422	0.461	CP4
RW-5	JD-1	53.73	0.18	0.84	7.15	0.15	15.08	22.77	0.43		0.00	100.33	0.113	0.424	0.461	CP4
RW-5	JD-1	53.20	0.18	0.76	7.07	0.18	15.19	22.19	0.46		0.00	99.23	0.113	0.431	0.453	CP4
RW-5	JD-1	52.82	0.15	0.83	7.27	0.20	14.86	22.18	0.47		0.00	98.78	0.117	0.425	0.456	CP4
RW-5	JD-1	52.94	0.19	0.96	7.60	0.18	14.60	22.34	0.56		0.00	99.37	0.122	0.417	0.459	CP4
RW-5	JD-1	54.87	0.09	0.42	3.62	0.09	18.09	22.29	0.17		0.11	99.75	0.056	0.500	0.443	CP2
RW-5	JD-1	50.24	0.94	5.74	7.43	0.04	12.37	20.61	1.47		0.05	98.89	0.133	0.394	0.472	CP4

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PT.#	Local	SiO2	TiO2	Al2O3	FeO*	MnO	MgO	CaO	Na2O	K20	Cr2O3	Total	X Fs	X En	X Wo	Pyroxe Classn
		60.09	79.90	101.94	71.85	70.94	40.32	56.08	61.98	94.20	152.02					
RW-5	JD-1	53.03	0.20	1.90	8.14	0.19	14.22	21.75	0.66		0.05	100.14	0.132	0.412	0.453	CP4
RW-5	JD-1	53.74	0.16	0.80	6.49	0.15	15.50	22.08	0.40		0.06	99.38	0.104	0.442	0.452	CP4
RW-5	JD-1	53.86	0.15	0.51	5.03	0.11	17.09	21.63	0.26		0.05	98.69	0.079	0.481	0.438	CP4
RW-5	JD-1	52.71	0.15	0.86	6.99	0.19	15.37	21.63	0.43		0.05	98.38	0.112	0.440	0.445	CP4
RW-5	JD-1	53.09	0.15	0.70	6.28	0.15	15.92	21.65	0.35		0.06	98.35	0.100	0.454	0.444	CP4
ABRW93-88	JD-2	54.10	0.22	0.82	3.34	0.13	18.18	22.76	0.26	0.00	0.47	100.28	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	54.76	0.23	0.84	3.41	0.05	18.11	23.09	0.28	0.00	0.47	101.24	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	53.59	0.20	0.77	3.55	0.10	18.13	22.62	0.23	0.00	0.23	99.42	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	54.05	0.24	0.83	3.55	0.13	17.63	23.03	0.25	0.00	0.30	100.01	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	53.67	0.24	0.79	3.57	0.12	17.98	22.76	0.24	0.00	0.23	99.60	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	54.51	0.16	0.76	3.59	0.05	17.10	23.14	0.24	0.00	0.20	99.75	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	54.32	0.18	0.70	3.67	0.10	17.99	22.87	0.32	0.00	0.24	100.39	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	54.66	0.19	0.61	3.69	0.12	18.04	22.66	0.19	0.00	0.09	100.25	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	54.77	0.20	0.77	3.69	0.06	17.97	22.63	0.25	0.00	0.22	100.56	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	53.99	0.15	0.68	3.71	0.08	18.73	22.31	0.22	0.00	0.20	100.07	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	54.33	0.25	0.72	3.72	0.11	17.90	23.14	0.25	0.00	0.18	100.60	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	53.87	0.21	0.77	3.74	0.11	17.91	22.83	0.28	0.01	0.23	99.96	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	53.77	0.24	0.70	3.74	0.10	18.04	22.75	0.25	0.00	0.13	99.72	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	54.39	0.19	0.53	3.78	0.12	17.96	22.78	0.30	0.00	0.05	100.10	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	54.22	0.19	0.63	3.84	0.10	18.09	22.73	0.25	0.00	0.15	100.20	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	53.79	0.27	0.69	3.86	0.13	17.76	23.06	0.19	0.00	0.21	99.96	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	54.62	0.13	0.65	3.86	0.12	17.87	22.45	0.27	0.00	0.14	100.11	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	53.55	0.20	0.76	3.87	0.13	17.92	22.63	0.29	0.00	0.17	99.52	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	53.11	0.28	0.93	3.87	0.09	17.42	22.84	0.23	0.00	0.36	99.13	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	53.86	0.29	0.86	3.88	0.08	18.12	22.30	0.26	0.00	0.20	99.85	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	54.12	0.21	0.80	3.89	0.12	17.95	22.52	0.28	0.00	0.16	100.05	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	54.39	0.25	0.99	3.93	0.11	17.99	22.90	0.27	0.00	0.10	100.93	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	53.78	0.23	0.56	3.93	0.13	17.95	22.88	0.22	0.00	0.10	99.78	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	54.48	0.17	0.53	3.99	0.10	18.28	22.48	0.24	0.00	0.06	100.33	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	53.97	0.16	0.82	4.00	0.11	17.81	23.06	0.24	0.00	0.00	100.17	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	54.11	0.25	0.80	4.02	0.11	18.19	22.63	0.31	0.00	0.21	100.63	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	53.28	0.29	0.84	4.04	0.08	17.47	22.88	0.21	0.00	0.39	99.48	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	53.37	0.24	0.75	4.07	0.14	17.71	23.23	0.24	0.00	0.03	99.78	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	54.11	0.17	0.54	4.08	0.12	17.97	22.50	0.28	0.00	0.13	99.90	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	53.85	0.19	0.63	4.09	0.12	17.35	23.09	0.25	0.00	0.05	99.62	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	52.94	0.27	0.78	4.12	0.09	17.06	23.46	0.14	0.03	0.21	99.10	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	54.26	0.17	0.39	4.22	0.12	17.93	22.94	0.23	0.00	0.00	100.26	0.155	0.393	0.452	CP3
ABRW93-88	JD-2	53.90	0.17	0.57	4.37	0.13	17.62	22.16	0.25	0.00	0.08	99.25	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.57	0.20	0.62	4.97	0.11	17.19	22.60	0.30	0.00	0.05	99.61	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	54.25	0.20	0.68	4.69	0.16	17.67	22.54	0.26	0.00	0.02	100.47	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.92	0.19	0.74	4.34	0.14	18.04	22.17	0.27	0.00	0.05	99.86	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.40	0.18	0.70	4.60	0.16	17.11	22.47	0.30	0.00	0.09	99.01	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.78	0.25	0.75	4.45	0.12	17.29	22.76	0.20	0.00	0.02	99.62	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.95	0.28	0.77	4.34	0.09	17.64	22.77	0.26	0.00	0.00	100.10	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.47	0.18	0.79	4.32	0.11	17.17	23.26	0.31	0.00	0.15	99.76	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.64	0.22	0.81	4.41	0.10	17.91	22.77	0.35	0.00	0.09	100.30	0.155	0.393	0.452	CP4

CLINOPYROXENE (Cont'd)

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Molecular Weight of Oxides

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		60.09	79.90	101.94	71.85	70.94	40.32	56.08	61.98	94.20	152.02					Pyroxe
PT.#	Local	SiO2	TiO2	Al2O3	FeO*	MnO	MgO	CaO	Na2O	K20	Cr2O3	Total	X Fs	X En	X Wo	Classn
ABRW93-88	JD-2	53.58	0.20	0.76	4.76	0.13	17.30	22.77	0.34	0.00	0.11	99.95	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.40	0.26	0.90	4.47	0.13	17.86	22.50	0.30	0.00	0.05	99.87	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.61	0.23	0.88	4.67	0.11	17.64	22.18	0.33	0.00	0.14	99.79	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.91	0.21	0.83	5.15	0.13	16.79	22.82	0.31	0.00	0.00	100.15	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.99	0.23	0.91	4.73	0.20	17.79	22.13	0.34	0.00	0.12	100.44	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	54.23	0.18	1.01	4.29	0.09	17.57	22.86	0.26	0.00	0.12	100.61	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	54.50	0.24	1.03	4.42	0.11	17.50	22.72	0.27	0.00	0.09	100.88	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.86	0.33	1.04	4.57	0.16	17.83	22.38	0.23	0.00	0.08	100.48	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.64	0.31	1.08	4.52	0.11	18.16	22.06	0.26	0.00	0.09	100.23	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.53	0.22	1.20	4.77	0.12	17.16	22.44	0.35	0.00	0.25	100.04	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	54.08	0.22	1.30	4.65	0.13	17.54	21.77	0.26	0.07	0.15	100.17	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.98	0.25	1.11	5.46	0.16	16.59	22.70	0.39	0.00	0.03	100.67	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.80	0.27	1.02	6.07	0.15	16.70	22.20	0.37	0.00	0.05	100.63	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	54.18	0.32	1.20	5.26	0.12	17.21	22.77	0.26	0.00	0.04	101.36	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.05	0.22	1.11	6.21	0.20	16.03	22.49	0.42	0.00	0.00	99.73	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.48	0.30	1.25	5.84	0.15	16.20	22.36	0.43	0.00	0.02	100.03	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.20	0.23	1.16	6.42	0.22	16.16	21.86	0.35	0.00	0.05	99.65	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.49	0.21	1.15	6.48	0.19	16.29	22.17	0.32	0.00	0.09	100.39	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.32	0.25	1.25	6.28	0.21	15.81	22.44	0.54	0.00	0.08	100.18	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.37	0.24	1.26	6.39	0.17	16.01	22.43	0.45	0.00	0.02	100.34	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.40	0.24	1.23	6.60	0.18	15.80	22.54	0.50	0.00	0.01	100.50	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.44	0.22	1.26	6.47	0.19	15.69	22.42	0.43	0.00	0.03	100.15	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	51.86	0.24	1.26	6.51	0.23	15.52	21.85	0.51	0.00	0.04	98.02	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.08	0.23	1.50	5.59	0.17	16.07	22.41	0.44	0.00	0.13	99.62	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.21	0.35	1.33	6.54	0.18	16.09	21.93	0.48	0.00	0.05	100.16	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	52.82	0.32	1.51	6.16	0.16	15.97	22.80	0.43	0.00	0.02	100.19	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	52.64	0.24	1.45	7.11	0.24	15.75	22.22	0.46	0.00	0.05	100.16	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.07	0.24	1.53	6.74	0.25	15.42	22.21	0.59	0.00	0.13	100.18	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	52.82	0.25	1.58	6.73	0.21	15.36	22.14	0.56	0.00	0.07	99.72	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	52.34	0.34	1.70	6.52	0.14	16.13	22.18	0.52	0.00	0.07	99.94	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	52.73	0.26	1.47	7.74	0.26	14.66	21.96	0.63	0.00	0.00	99.71	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	54.15	0.01	1.80	7.57	0.43	14.28	20.63	1.73	0.00	0.30	100.90	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	51.88	0.54	2.31	6.34	0.12	16.08	21.54	0.58	0.00	0.05	99.44	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	52.12	0.66	2.44	6.57	0.24	16.06	21.24	0.59	0.00	0.07	99.99	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.24	0.33	2.06	8.26	0.25	14.73	22.13	0.77	0.00	0.05	101.82	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	52.78	0.30	2.00	8.95	0.26	13.63	22.07	0.72	0.00	0.02	100.73	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	51.64	0.28	3.00	8.90	0.22	13.37	22.26	0.79	0.00	0.12	100.58	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	49.98	0.52	3.13	10.32	0.37	12.44	22.37	0.72	0.00	0.03	99.88	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	51.51	0.42	3.19	10.26	0.05	12.40	21.21	0.75	0.00	0.00	99.79	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	50.46	0.55	3.28	10.54	0.35	12.10	22.25	0.75	0.00	0.00	100.28	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	50.69	0.45	3.96	9.62	0.18	12.98	21.06	0.83	0.00	0.10	99.87	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	50.69	0.31	3.61	10.68	0.25	12.41	21.21	0.76	0.01	0.05	99.98	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	49.12	0.61	5.53	12.18	0.08	10.16	21.38	1.00	0.00	0.07	100.13	0.155	0.393	0.452	CP4
ABRW93-88	JD-2	53.96	0.21	0.70	3.76	0.11	18.39	22.95	0.25	0.00	0.15	100.48	0.057	0.496	0.445	CP2
ABRW93-88	JD-2	53.21	0.23	0.84	6.36	0.18	17.22	21.82	0.37	0.00	0.02	100.25	0.098	0.471	0.429	CP4
ABRW93-88	JD-2	54.27	0.16	1.00	4.99	0.10	17.07	22.94	0.43	0.00	0.09	101.05	0.077	0.469	0.453	CP4
ABRW93-88	JD-2	53.45	0.23	0.61	4.82	0.09	17.30	23.34	0.23	0.00	0.03	100.10	0.073	0.470	0.456	CP4

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PT.#	Local	60.09 SiO2	79.90 TiO2	101.94 Al2O3	71.85 FeO*	70.94 MnO	40.32 MgO	56.08 CaO	61.98 Na2O	94.20 K20	152.02 Cr2O3	Total	X Fs	X En	X Wo	Pyroxe Classn
ABRW93-88	JD-2	53.46	0.27	0.88	4.26	0.08	17.77	23.15	0.25	0.00	0.05	100.17	0.065	0.482	0.452	CP4
ABRW93-88	JD-2	54.35	0.21	0.67	3.82	0.05	18.18	22.93	0.26	0.00	0.13	100.60	0.058	0.494	0.448	CP2
ABRW93-88	JD-2	54.16	0.17	0.45	4.75	0.17	18.02	22.23	0.44	0.00	0.07	100.46	0.073	0.490	0.435	CP4
ABRW93-88	JD-2	53.98	0.17	0.46	3.62	0.09	18.48	23.35	0.23	0.00	0.01	100.39	0.054	0.495	0.449	CP2
ABRW93-88	JD-2	53.67	0.16	0.74	4.02	0.06	18.10	23.20	0.22	0.00	0.07	100.24	0.061	0.488	0.450	CP2
ABRW93-88	JD-2	53.09	0.26	1.30	6.52	0.22	16.35	22.19	0.53	0.00	0.01	100.47	0.101	0.453	0.442	CP4
ABRW93-88	JD-2	52.68	0.25	1.48	7.25	0.18	15.43	22.46	0.63	0.00	0.02	100.38	0.114	0.432	0.452	CP4
ABRW93-88	JD-2	54.46	0.21	0.75	3.72	0.10	18.48	22.84	0.26	0.00	0.19	101.01	0.056	0.499	0.443	CP2
ABRW93-88	JD-2	54.03	0.20	0.91	4.58	0.15	17.56	22.45	0.41	0.00	0.16	100.45	0.071	0.483	0.444	CP4
ABRW93-88	JD-2	53.89	0.23	0.99	5.56	0.13	17.47	22.04	0.28	0.00	0.03	100.62	0.085	0.478	0.434	CP4
ABRW93-88	JD-2	54.49	0.15	0.65	4.11	0.12	18.60	22.13	0.22	0.00	0.06	100.53	0.063	0.504	0.431	CP2
ABRW93-88	JD-2	52.04	0.39	2.02	7.73	0.14	15.21	22.36	0.46	0.00	0.05	100.40	0.121	0.426	0.450	CP4
ABRW93-88	JD-2	54.24	0.16	0.72	3.78	0.10	17.25	23.31	0.25	0.00	0.10	99.91	0.059	0.477	0.463	CP2
ABRW93-88	JD-2	53.46	0.33	1.27	4.43	0.09	17.93	22.38	0.29	0.00	0.22	100.40	0.068	0.490	0.440	CP4
ABRW93-88	JD-2	51.96	0.30	1.87	7.63	0.17	14.86	22.39	0.55	0.00	0.03	99.76	0.121	0.421	0.456	CP4
ABRW93-88	JD-2	53.46	0.26	0.95	6.13	0.22	16.60	22.41	0.41	0.00	0.00	100.44	0.095	0.458	0.444	CP4
ABRW93-88	JD-2	52.28	0.27	1.61	7.97	0.27	15.03	21.97	0.68	0.00	0.00	100.08	0.126	0.424	0.446	CP4
ABRW93-88	JD-2	53.58	0.15	0.40	4.54	0.18	18.88	21.57	0.23	0.00	0.09	99.62	0.069	0.510	0.419	CP2
ABRW93-88	JD-2	53.32	0.25	0.93	4.83	0.11	17.91	22.33	0.34	0.00	0.10	100.12	0.074	0.488	0.437	CP4
ABRW93-88	JD-2	53.47	0.17	0.75	3.77	0.15	18.04	23.32	0.28	0.00	0.06	100.01	0.057	0.487	0.453	CP2
ABRW93-88	JD-2	52.16	0.29	1.88	7.53	0.23	15.37	22.36	0.51	0.00	0.00	100.33	0.118	0.429	0.449	CP4
ABRW93-88	JD-2	54.26	0.18	0.88	4.80	0.08	17.77	22.30	0.38	0.00	0.09	100.74	0.074	0.486	0.439	CP4
ABRW93-88	JD-2	53.30	0.18	0.77	4.03	0.19	18.31	22.82	0.26	0.00	0.07	99.93	0.061	0.494	0.442	CP2
ABRW93-88	JD-2	52.12	0.29	1.57	7.08	0.16	15.81	22.00	0.64	0.00	0.04	99.71	0.111	0.443	0.443	CP4
ABRW93-88	JD-2	54.26	0.22	0.98	4.19	0.10	18.47	21.93	0.31	0.00	0.09	100.55	0.064	0.504	0.430	CP2
ABRW93-88	JD-2	53.77	0.25	0.80	5.02	0.15	17.74	22.27	0.33	0.00	0.05	100.38	0.077	0.484	0.437	CP4
ABRW93-88	JD-2	54.04	0.20	0.87	4.65	0.17	18.08	22.20	0.26	0.00	0.06	100.53	0.071	0.492	0.434	CP4
ABRW93-88	JD-2	53.18	0.22	0.88	4.48	0.13	17.87	22.57	0.32	0.00	0.08	99.73	0.069	0.487	0.442	CP4
ABRW93-88	JD-2	54.61	0.13	0.46	3.55	0.09	19.45	22.12	0.26	0.01	0.14	100.82	0.053	0.520	0.425	CP2
ABRW93-88	JD-2	54.36	0.18	0.45	3.46	0.13	19.08	22.10	0.25	0.00	0.21	100.22	0.052	0.516	0.430	CP2
ABRW93-88	JD-2	52.81	0.24	0.89	6.62	0.20	16.90	21.82	0.31	0.00	0.03	99.82	0.102	0.464	0.431	CP4
ABRW93-88	JD-2	54.37	0.18	0.58	3.45	0.10	18.67	22.82	0.20	0.00	0.18	100.55	0.052	0.504	0.443	CP2
ABRW93-88	JD-2	52.03	0.30	1.30	9.28	0.17	14.59	21.76	0.49	0.00	0.00	99.92	0.147	0.411	0.440	CP4
ABRW93-88	JD-2	53.17	0.26	1.23	5.83	0.16	16.94	22.32	0.42	0.00	0.03	100.36	0.090	0.466	0.441	CP4
ABRW93-88	JD-2	53.28	0.30	0.90	4.12	0.14	17.88	22.90	0.31	0.00	0.32	100.15	0.063	0.487	0.448	CP2
ABRW93-88	JD-2	53.85	0.20	1.03	5.09	0.15	17.51	22.39	0.36	0.01	0.03	100.62	0.078	0.479	0.440	CP4
ABRW93-88	JD-2	53.78	0.21	1.02	4.87	0.14	17.72	21.88	0.33	0.00	0.11	100.06	0.075	0.489	0.434	CP4
ABRW93-88	JD-2	52.68	0.27	1.32	6.55	0.21	16.25	22.18	0.48	0.00	0.08	100.02	0.102	0.451	0.443	CP4
ABRW93-88	JD-2	53.74	0.18	0.65	3.71	0.10	18.47	22.62	0.26	0.00	0.22	99.95	0.056	0.501	0.441	CP2
ABRW93-88	JD-2	54.74	0.16	0.38	3.55	0.11	18.40	22.79	0.22	0.00	0.09	100.44	0.054	0.499	0.445	CP2
ABRW93-88	JD-2	51.72	0.43	3.09	10.03	0.03	12.32	21.55	0.75	0.00	0.00	99.92	0.168	0.368	0.463	CP4
ABRW93-88	JD-2	53.44	0.25	0.95	6.85	0.17	16.33	22.23	0.39	0.00	0.00	100.61	0.106	0.450	0.441	CP4
ABRW93-88	JD-2	54.25	0.21	0.73	3.77	0.07	18.15	22.38	0.22	0.00	0.29	100.07	0.058	0.499	0.442	CP2
ABRW93-88	JD-2	54.00	0.16	0.96	4.60	0.15	16.75	22.92	0.36	0.00	0.25	100.15	0.072	0.467	0.459	CP4
ABRW93-88	JD-2	52.25	0.29	2.35	7.58	0.23	14.65	22.25	0.54	0.00	0.10	100.24	0.121	0.418	0.457	CP4
ABRW93-88	JD-2	54.01	0.21	0.77	4.84	0.18	17.58	22.08	0.33	0.00	0.11	100.11	0.075	0.485	0.438	CP4
ABRW93-88	JD-2	52.87	0.34	2.05	7.80	0.25	14.90	21.90	0.68	0.00	0.01	100.80	0.124	0.424	0.448	CP4
ABRW93-88	JD-2	54.90	0.15	0.64	3.87	0.11	18.01	23.07	0.22	0.00	0.04	101.01	0.059	0.489	0.450	CP2
ABRW93-88	JD-2	54.20	0.17	0.64	3.94	0.06	17.70	23.18	0.21	0.01	0.06	100.17	0.060	0.483	0.455	CP2
ABRW93-88	JD-2	54.38	0.15	0.85	3.84	0.10	17.46	23.49	0.28	0.00	0.12	100.67	0.059	0.478	0.462	CP2

PT.#	Local	60.09 SiO2	79.90 TiO2	101.94 Al2O3	71.85 FeO*	70.94 MnO	40.32 MgO	56.08 CaO	61.98 Na2O	94.20 K20	152.02 Cr2O3	Total	X Fs	X En	X Wo	Pyroxe Classn
ABRW93-88	JD-2	54.10	0.18	0.71	5.14	0.12	17.05	22.58	0.31	0.00	0.05	100.24	0.080	0.471	0.448	CP4
ABRW93-88	JD-2	54.37	0.18	0.61	4.20	0.12	18.13	22.21	0.18	0.00	0.04	100.04	0.065	0.496	0.437	CP2
ABRW93-88	JD-2	53.15	0.23	1.30	6.33	0.18	15.95	22.50	0.43	0.00	0.06	100.13	0.099	0.446	0.452	CP4
ABRW93-88	JD-2	53.61	0.29	1.34	4.99	0.11	17.45	21.95	0.39	0.00	0.11	100.24	0.078	0.483	0.437	CP4
ABRW93-88	JD-2	53.70	0.23	1.13	5.67	0.14	16.16	22.23	0.43	0.00	0.06	99.75	0.090	0.456	0.451	CP4
ABRW93-88	JD-2	53.83	0.17	0.62	3.60	0.11	17.88	23.38	0.28	0.00	0.09	99.96	0.055	0.486	0.457	CP2
ABRW93-88	JD-2	54.06	0.18	0.77	3.92	0.17	17.60	23.09	0.20	0.00	0.08	100.07	0.060	0.482	0.455	CP2
ABRW93-88	JD-2	53.17	0.25	1.20	6.44	0.18	15.76	22.45	0.40	0.00	0.04	99.89	0.101	0.442	0.453	CP4
ABRW93-88	JD-2	54.24	0.18	0.60	3.81	0.14	18.13	22.94	0.17	0.00	0.10	100.31	0.058	0.492	0.448	CP2
RW-6	JD-3	54.39	0.19	0.53	3.88	0.10	18.52	22.14	0.15		0.39	100.29	0.059	0.505	0.434	CP2
RW-6	JD-3	53.97	0.24	0.87	3.99	0.11	17.79	22.13	0.25		0.56	99.91	0.062	0.494	0.442	CP2
RW-6	JD-3	54.44	0.19	0.50	3.71	0.10	18.55	22.27	0.14		0.31	100.21	0.057	0.505	0.436	CP2
RW-6	JD-3	52.81	0.62	1.23	5.71	0.10	16.89	22.16	0.26		0.23	100.01	0.089	0.468	0.442	CP4
RW-6	JD-3	54.91	0.25	0.79	3.90	0.09	18.45	22.88	0.25		0.65	102.17	0.059	0.497	0.443	CP2
RW-6	JD-3	54.89	0.17	0.51	3.87	0.12	18.88	22.06	0.19		0.45	101.14	0.059	0.511	0.429	CP2
RW-6	JD-3	55.12	0.23	0.89	3.84	0.08	18.18	22.73	0.28		0.69	102.04	0.059	0.495	0.445	CP2
RW-6	JD-3	54.66	0.20	0.46	3.75	0.09	18.59	22.04	0.15		0.38	100.32	0.058	0.508	0.433	CP2
RW-6	JD-3	52.99	0.40	1.01	4.82	0.10	17.37	21.86	0.26		0.50	99.31	0.075	0.485	0.438	CP4
RW-6	JD-3	54.11	0.42	0.97	4.85	0.10	17.66	22.64	0.25		0.47	101.47	0.074	0.481	0.443	CP4
RW-6	JD-3	54.92	0.20	0.46	3.94	0.11	18.79	22.17	0.15		0.41	101.15	0.060	0.508	0.431	CP2
RW-6	JD-3	54.64	0.26	0.81	3.82	0.08	18.41	22.40	0.26		0.76	101.44	0.058	0.502	0.439	CP2
RW-7	JD-3	51.42	0.25	0.69	3.85	0.11	18.78	22.09	0.25		0.70	98.14	0.059	0.509	0.431	CP2
RW-7	JD-3	50.75	0.23	0.78	3.81	0.10	18.49	22.14	0.28		0.67	97.25	0.058	0.505	0.435	CP2
RW-7	JD-3	53.10	0.16	0.58	4.06	0.10	18.63	22.35	0.25		0.27	99.50	0.062	0.503	0.434	CP2
RW-7	JD-3	53.99	0.16	0.60	4.27	0.10	18.93	22.27	0.24		0.25	100.81	0.064	0.506	0.428	CP1
RW-7	JD-3	53.71	0.20	0.72	3.46	0.08	18.56	22.64	0.29		0.74	100.40	0.053	0.504	0.442	CP2
RW-7	JD-3	53.65	0.40	0.90	5.37	0.10	17.67	22.46	0.24		0.27	101.06	0.082	0.479	0.438	CP4
RW-7	JD-3	53.78	0.16	0.64	4.51	0.10	18.42	22.76	0.21		0.11	100.69	0.068	0.493	0.438	CP4
RW-7	JD-3	53.72	0.17	0.47	3.69	0.11	19.14	22.27	0.19		0.51	100.27	0.056	0.513	0.429	CP2
RW-7	JD-3	53.19	0.25	0.68	3.72	0.09	18.44	22.89	0.23		0.60	100.09	0.056	0.498	0.444	CP2
RW-7	JD-3	53.70	0.20	0.66	3.61	0.10	18.47	22.66	0.26		0.70	100.36	0.055	0.501	0.442	CP2
RW-7	JD-3	52.81	0.11	1.33	5.13	0.14	16.47	22.45	0.71		0.05	99.20	0.081	0.463	0.454	CP4
RW-7	JD-3	54.65	0.11	0.51	3.49	0.07	18.58	23.39	0.19		0.10	101.09	0.052	0.497	0.450	CP2
RW-7	JD-3	53.84	0.11	0.51	3.48	0.09	18.66	23.19	0.15		0.10	100.13	0.052	0.500	0.447	CP2
RW-7	JD-3	53.83	0.11	0.52	3.41	0.07	18.91	23.20	0.18		0.16	100.39	0.051	0.504	0.444	CP2
RW-7	JD-3	54.84	0.13	0.51	3.59	0.07	18.72	23.11	0.17		0.12	101.26	0.054	0.501	0.444	CP2
RW-7	JD-3	54.32	0.12	0.56	3.55	0.09	18.81	23.20	0.19		0.17	101.01	0.053	0.501	0.444	CP2
RW-7	JD-3	54.73	0.13	0.56	3.39	0.06	18.68	23.30	0.17		0.24	101.26	0.051	0.500	0.448	CP2
RW-7	JD-3	53.56	0.06	1.78	5.95	0.18	15.46	22.84	1.00		0.08	100.91	0.095	0.438	0.465	CP4
RW-7	JD-3	54.29	0.21	0.63	3.71	0.11	18.58	22.80	0.23		0.49	101.05	0.056	0.501	0.442	CP2
RW-7	JD-3	54.23	0.21	0.51	3.96	0.11	19.14	22.32	0.19		0.49	101.16	0.059	0.511	0.428	CP2
RW-7	JD-3	54.19	0.28	0.51	3.95	0.07	18.71	22.55	0.19		0.62	101.07	0.060	0.503	0.436	CP2
RW-7	JD-3	51.80	0.22	0.51	3.95	0.10	19.04	21.73	0.21		0.54	98.10	0.060	0.515	0.423	CP2
RW-7	JD-3	50.15	0.54	0.91	4.83	0.11	17.73	22.07	0.26		0.30	96.90	0.075	0.487	0.436	CP4
RW-7	JD-3	51.87	0.30	0.78	4.19	0.08	17.94	22.94	0.26		0.74	99.10	0.064	0.487	0.448	CP2
RW-7	JD-3	52.56	0.41	0.99	4.80	0.13	17.77	22.46	0.29		0.75	100.16	0.073	0.484	0.440	CP4
RW-8	JD-4	53.33	0.15	0.52	4.23	0.07	18.27	22.97	0.20		0.02	99.76	0.064	0.491	0.444	CP2
RW-8	JD-4	53.13	0.14	0.47	4.13	0.06	18.59	23.06	0.18		0.01	99.77	0.062	0.495	0.442	CP2
RW-8	JD-4	52.78	0.16	0.54	4.53	0.10	18.13	23.09	0.20		0.01	99.54	0.068	0.486	0.445	CP4
RW-8	JD-4	53.38	0.15	0.54	4.19	0.12	18.27	23.26	0.20		0.07	100.18	0.063	0.488	0.447	CP2
RW-8	JD-4	53.99	0.16	0.59	4.11	0.06	18.38	23.24	0.19		0.04	100.76	0.062	0.491	0.446	CP2
RW-8	JD-4	53.25	0.14	0.56	4.03	0.05	18.54	23.03	0.21		0.01	99.82	0.060	0.496	0.443	CP2

CLINOPYROXENE (Cont'd)
Southern Alberta

Molecular Weight of Oxides

		60.09	79.90	101.94	71.85	70.94	40.32	56.08	61.98	94.20	152.02					Pyroxe
PT.#	Local	SiO2	TiO2	Al2O3	FeO*	MnO	MgO	CaO	Na2O	K20	Cr2O3	Total	X Fs	X En	X Wo	Classn
RW-8	JD-4	52.94	0.17	0.60	4.16	0.05	18.35	22.91	0.19		0.05	99.42	0.063	0.493	0.443	CP2
RW-8	JD-4	53.00	0.15	0.55	3.99	0.07	18.74	22.90	0.17		0.03	99.60	0.060	0.500	0.439	CP2
RW-8	JD-4	52.62	0.17	0.57	3.85	0.05	18.72	23.01	0.18		0.05	99.22	0.058	0.500	0.442	CP2
RW-8	JD-4	52.60	0.19	0.68	3.69	0.06	18.66	22.94	0.17		0.22	99.21	0.056	0.501	0.443	CP2
RW-8	JD-4	52.52	0.26	0.66	3.65	0.08	18.80	23.07	0.17		0.16	99.37	0.055	0.502	0.443	CP2
RW-8	JD-4	51.49	0.25	0.61	4.39	0.07	18.42	22.84	0.13		0.01	98.21	0.066	0.493	0.440	CP4
RW-8	JD-4	50.76	0.28	0.82	4.75	0.09	18.26	22.52	0.17		0.02	97.67	0.072	0.491	0.436	CP4
RW-8	JD-4	52.98	0.36	0.81	4.83	0.08	17.91	22.85	0.17		0.01	100.00	0.073	0.483	0.443	CP4
RW-8	JD-4	54.11	0.15	0.52	3.74	0.07	18.69	23.30	0.18		0.02	100.78	0.056	0.497	0.446	CP2
RW-8	JD-4	54.65	0.12	0.69	5.61	0.13	16.72	23.41	0.31		0.02	101.66	0.086	0.455	0.458	CP4
RW-10	JD-4	54.13	0.14	0.98	4.07	0.09	16.96	22.93	0.22			99.52	0.064	0.474	0.461	CP2
RW-10	JD-4	54.65	0.15	0.80	3.63	0.11	17.18	23.40	0.20			100.12	0.056	0.476	0.466	CP2
RW-10	JD-4	52.27	0.25	2.03	8.50	0.22	12.93	22.60	0.49			99.29	0.140	0.379	0.477	CP4
RW-10	JD-4	54.79	0.20	0.69	5.60	0.11	15.27	23.85	0.35			100.86	0.088	0.429	0.481	CP4
RW-10	JD-4	54.27	0.19	0.86	3.79	0.07	17.23	23.34	0.20			99.95	0.059	0.476	0.464	CP2
RW-10	JD-4	54.78	0.21	0.69	3.87	0.10	17.11	23.51	0.20			100.47	0.060	0.472	0.466	CP2
RW-10	JD-4	53.79	0.17	0.79	4.86	0.13	15.86	23.26	0.21			99.07	0.077	0.448	0.473	CP4
RW-10	JD-4	52.56	0.59	4.88	8.17	0.05	13.42	20.90	1.14		0.07	101.78	0.139	0.406	0.455	CP4
RW-10	JD-4	51.10	0.69	6.09	8.34	0.05	12.78	21.49	1.17		0.11	101.82	0.142	0.388	0.469	CP4
RW-10	JD-4	51.61	0.62	4.81	7.92	0.07	13.22	21.15	1.11		0.09	100.60	0.135	0.402	0.462	CP4
RW-10	JD-4	51.53	0.49	5.06	7.46	0.04	13.30	20.85	1.08		0.10	99.91	0.129	0.409	0.461	CP4
RW-10	JD-4	49.91	1.02	5.10	8.04	0.05	12.88	20.39	1.07		0.12	98.58	0.141	0.401	0.457	CP4
RW-10	JD-4	51.74	0.57	5.34	7.79	0.04	13.25	21.53	1.09		0.11	101.46	0.132	0.400	0.467	CP4
RW-10	JD-4	50.68	0.65	6.07	8.36	0.07	12.67	20.54	1.11		0.13	100.28	0.146	0.394	0.459	CP4
RW-10	JD-4	50.93	0.74	5.97	8.43	0.06	12.51	21.29	1.16		0.11	101.20	0.145	0.384	0.470	CP4
RW-10	JD-4	50.61	0.62	5.77	8.59	0.07	12.69	20.06	1.14		0.11	99.66	0.151	0.397	0.451	CP4
RW-10	JD-4	52.09	0.45	4.07	7.45	0.06	13.62	20.97	0.97		0.11	99.79	0.127	0.414	0.458	CP4
RW-10	JD-4	51.29	0.47	4.84	7.68	0.07	13.19	20.71	1.09		0.11	99.45	0.133	0.407	0.459	CP4
RW-10	JD-4	51.38	0.62	6.30	8.20	0.05	12.62	20.88	1.19		0.11	101.35	0.143	0.391	0.465	CP4
RW-10	JD-4	51.61	0.62	4.81	7.92	0.07	13.22	21.15	1.11		0.09	100.60	0.135	0.402	0.462	CP4
RW-10	JD-4	51.53	0.49	5.06	7.46	0.04	13.30	20.85	1.08		0.10	99.91	0.129	0.409	0.461	CP4
RW-10	JD-4	49.91	1.02	5.10	8.04	0.05	12.88	20.39	1.07		0.12	98.58	0.141	0.401	0.457	CP4
RW-10	JD-4	51.21	0.99	2.25	8.00	0.15	14.77	21.30	0.38		0.04	99.09	0.130	0.426	0.442	CP4
RW-10	JD-4	51.59	0.66	2.08	7.72	0.15	15.04	21.02	0.36		0.07	98.69	0.125	0.435	0.437	CP4
RW-10	JD-4	52.97	0.44	1.00	6.01	0.09	16.21	22.39	0.21		0.05	99.37	0.094	0.454	0.451	CP4
RW-10	JD-4	53.70	0.04	1.49	5.88	0.19	14.77	22.72	0.77		0.02	99.58	0.096	0.428	0.473	CP4
RW-10	JD-4	53.65	0.17	1.16	5.92	0.16	16.08	22.33	0.33		0.05	99.85	0.093	0.452	0.452	CP4
RW-10	JD-4	54.28	0.15	0.70	4.18	0.10	17.51	22.77	0.18		0.07	99.94	0.065	0.483	0.451	CP2
RW-10	JD-4	53.63	0.18	0.92	4.42	0.13	17.29	22.30	0.23		0.09	99.19	0.069	0.482	0.447	CP4
RW-10	JD-4	54.31	0.12	0.71	4.08	0.12	17.62	22.45	0.22		0.24	99.87	0.063	0.488	0.447	CP2

CLINOPYROXENE (Cont'd)

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Molecular Weight of Oxides

PT.#	Local	SiO2	TiO2	Al2O3	FeO*	MnO	MgO	CaO	Na2O	K20	Cr2O3	Total	X Fs	X En	X Wo	Pyroxe Classn
		60.09	79.90	101.94	71.85	70.94	40.32	56.08	61.98	94.20	152.02					
RW-10	JD-4	54.74	0.11	0.75	3.82	0.11	17.42	22.75	0.22		0.40	100.32	0.060	0.484	0.455	CP2
RW-10	JD-4	54.18	0.14	0.77	4.07	0.12	17.47	22.19	0.18		0.38	99.50	0.064	0.488	0.446	CP2
RW-10	JD-4	51.21	0.99	2.25	8.00	0.15	14.77	21.30	0.38		0.04	99.09	0.130	0.426	0.442	CP4
RW-10	JD-4	51.59	0.66	2.08	7.72	0.15	15.04	21.02	0.36		0.07	98.69	0.125	0.435	0.437	CP4
RW-10	JD-4	52.97	0.44	1.00	6.01	0.09	16.21	22.39	0.21		0.05	99.37	0.094	0.454	0.451	CP4
RW-10	JD-4	53.33	0.19	1.16	5.09	0.13	16.52	22.13	0.31		0.02	98.88	0.081	0.467	0.450	CP4
RW-10	JD-4	53.11	0.09	0.52	3.99	0.12	16.62	22.47	0.29		0.10	97.31	0.064	0.474	0.460	CP2
RW-10	JD-4	53.27	0.11	0.76	4.17	0.12	17.17	22.25	0.26		0.14	98.25	0.066	0.483	0.450	CP2
RW-10	JD-4	53.80	0.13	0.80	4.12	0.11	17.01	22.39	0.28		0.24	98.88	0.065	0.479	0.454	CP2
RW-10	JD-4	54.04	0.14	0.47	5.24	0.10	16.44	22.98	0.23		0.00	99.64	0.082	0.457	0.459	CP4
RW-10	JD-4	54.28	0.16	0.40	5.94	0.12	15.69	22.82	0.32		0.00	99.73	0.094	0.442	0.462	CP4
RW-10	JD-4	53.22	0.18	1.02	4.62	0.09	17.19	21.92	0.25		0.23	98.72	0.073	0.483	0.443	CP4
RW-10	JD-4	53.10	0.06	1.51	6.10	0.21	14.78	22.33	0.68		0.04	98.81	0.100	0.430	0.467	CP4
RW-10	JD-4	53.82	0.14	0.82	4.16	0.12	17.63	22.16	0.20		0.09	99.14	0.065	0.490	0.443	CP2
RW-10	JD-4	53.59	0.08	0.49	3.97	0.13	17.36	22.64	0.18		0.20	98.64	0.062	0.483	0.453	CP2
RW-10	JD-4	54.09	0.10	0.67	4.10	0.09	17.62	21.88	0.20		0.17	98.92	0.064	0.494	0.441	CP2
RW-10	JD-4	53.87	0.12	0.77	3.86	0.13	17.75	21.92	0.23		0.31	98.96	0.061	0.497	0.441	CP2
RW-10	JD-4	53.50	0.13	0.71	3.84	0.12	17.54	22.34	0.21		0.23	98.62	0.060	0.490	0.448	CP2
RW-10	JD-4	54.08	0.15	0.89	3.89	0.09	17.54	21.96	0.26		0.51	99.37	0.061	0.493	0.444	CP2
RW-10	JD-4	53.31	0.17	0.97	4.72	0.10	17.28	21.92	0.25		0.17	98.89	0.074	0.483	0.441	CP4
RW-10	JD-4	53.92	0.14	0.87	4.21	0.09	17.56	22.14	0.20		0.09	99.22	0.066	0.489	0.444	CP2
RW-10	JD-4	52.68	0.14	0.83	4.23	0.10	17.21	21.88	0.19		0.07	97.33	0.067	0.487	0.445	CP2
RW-10	JD-4	51.11	0.44	2.37	8.06	0.17	14.09	21.67	0.48		0.05	98.44	0.132	0.411	0.454	CP4
RW-10	JD-4	53.65	0.14	0.78	4.53	0.11	17.36	22.08	0.20		0.09	98.94	0.071	0.484	0.443	CP4
RW-11	JD-4	51.05	0.41	2.60	11.08	0.25	13.04	21.55	0.99		0.00	100.97	0.178	0.374	0.444	CP4
RW-11	JD-4	53.05	0.24	0.69	4.65	0.10	18.60	22.57	0.22		0.36	100.48	0.070	0.496	0.433	CP4
RW-11	JD-4	53.00	0.20	0.57	4.18	0.10	18.68	22.81	0.18		0.18	99.90	0.063	0.498	0.438	CP2
RW-11	JD-4	53.69	0.17	0.70	5.42	0.09	17.96	22.81	0.26		0.07	101.17	0.081	0.480	0.438	CP4
RW-11	JD-4	52.85	0.22	1.30	7.38	0.14	16.08	22.57	0.52		0.03	101.09	0.113	0.440	0.444	CP4
RW-11	JD-4	51.66	0.49	1.18	6.75	0.12	16.66	22.91	0.22		0.13	100.12	0.102	0.450	0.445	CP4
RW-11	JD-4	52.99	0.23	0.72	4.70	0.07	18.34	22.46	0.21		0.08	99.80	0.071	0.493	0.434	CP4
RW-11	JD-4	53.70	0.20	0.70	4.08	0.05	18.45	23.10	0.19		0.17	100.64	0.061	0.494	0.444	CP2
RW-11	JD-4	50.10	0.20	2.51	8.41	0.15	14.14	21.78	0.63		0.09	98.01	0.136	0.409	0.453	CP4
RW-11	JD-4	50.85	0.25	2.79	9.66	0.16	14.20	20.20	0.70		0.11	98.92	0.158	0.415	0.424	CP4
RW-11	JD-4	51.16	0.24	2.82	10.17	0.15	14.60	17.88	0.72		0.11	97.85	0.172	0.439	0.387	CP4
RW-11	JD-4	51.30	0.27	2.87	8.91	0.16	13.96	21.92	0.72		0.13	100.24	0.144	0.401	0.453	CP4
RW-11	JD-4	51.27	0.25	2.76	9.08	0.18	14.14	21.87	0.69		0.10	100.34	0.145	0.403	0.448	CP4
RW-11	JD-4	53.48	0.18	0.73	4.36	0.08	18.67	22.74	0.18		0.17	100.59	0.065	0.498	0.436	CP4
RW-11	JD-4	53.65	0.18	0.59	4.32	0.08	18.72	22.71	0.19		0.14	100.58	0.065	0.499	0.435	CP4
RW-11	JD-4	52.97	0.41	1.26	4.91	0.10	17.38	23.16	0.26		0.56	101.01	0.075	0.472	0.452	CP4
RW-11	JD-4	50.63	0.40	2.24	8.51	0.09	14.92	21.61	0.65		0.02	99.07	0.135	0.423	0.440	CP4
RW-11	JD-4	53.32	0.24	0.89	4.33	0.09	18.35	22.91	0.26		0.49	100.88	0.065	0.492	0.442	CP4
RW-11	JD-4	55.61	0.15	0.84	4.10	0.06	18.87	22.75	0.26		0.23	102.87	0.061	0.502	0.435	CP2
RW-11	JD-4	55.42	0.16	0.82	4.15	0.06	18.74	22.72	0.24		0.25	102.56	0.062	0.501	0.436	CP2
RW-11	JD-4	53.04	0.34	0.90	5.28	0.09	17.55	23.41	0.18		0.23	101.02	0.079	0.469	0.450	CP4
RW-11	JD-4	52.30	0.52	1.07	6.28	0.11	17.10	22.73	0.22		0.14	100.47	0.095	0.462	0.441	CP4
RW-11	JD-4	53.03	0.41	3.05	7.19	0.16	14.46	22.18	0.99		0.68	102.15	0.117	0.419	0.462	CP4

CLINOPYROXENE (Cont'd)
South[redacted]lbert[redacted]

Molecular Weight of Oxides

PT.#	Local	SiO2	TiO2	Al2O3	FeO*	MnO	MgO	CaO	Na2O	K20	Cr2O3	Total	X Fs	X En	X Wo	Pyroxe Classn
		60.09	79.90	101.94	71.85	70.94	40.32	56.08	61.98	94.20	152.02					
RW-11	JD-4	53.68	0.29	2.99	7.30	0.17	14.88	21.53	0.95		0.65	102.44	0.119	0.431	0.448	CP4
RW-11	JD-4	52.56	0.22	1.10	4.76	0.11	17.93	22.52	0.29		0.20	99.69	0.072	0.486	0.439	CP4
RW-11	JD-4	51.69	0.24	0.90	5.36	0.11	17.32	22.56	0.31		0.03	98.52	0.082	0.473	0.443	CP4
RW-12	JD-4	53.48	0.11	0.50	4.72	0.12	16.88	22.77	0.27		0.02	98.87	0.074	0.469	0.455	CP4
RW-12	JD-4	53.68	0.13	0.67	5.28	0.10	16.78	22.49	0.28		0.00	99.41	0.082	0.467	0.450	CP4
RW-12	JD-4	53.11	0.15	0.59	5.56	0.12	16.70	22.25	0.28		0.01	98.77	0.087	0.465	0.446	CP4
RW-12	JD-4	53.85	0.13	0.60	5.36	0.11	16.89	22.31	0.28		0.00	99.53	0.084	0.469	0.446	CP4
RW-12	JD-4	53.77	0.15	0.64	5.49	0.13	16.64	22.51	0.31		0.02	99.66	0.086	0.462	0.450	CP4
RW-12	JD-4	53.91	0.16	0.65	5.68	0.11	16.46	22.44	0.30		0.00	99.71	0.089	0.459	0.450	CP4
RW-12	JD-4	54.11	0.14	0.64	5.48	0.13	16.66	22.52	0.29		0.00	99.97	0.085	0.463	0.450	CP4
RW-12	JD-4	53.96	0.15	0.64	5.49	0.11	16.78	22.57	0.29		0.00	99.99	0.085	0.464	0.449	CP4
RW-12	JD-4	53.22	0.17	0.78	6.98	0.16	15.48	22.37	0.40		0.01	99.57	0.110	0.435	0.452	CP4
RW-12	JD-4	54.27	0.13	0.48	4.18	0.11	17.34	23.23	0.19		0.03	99.96	0.064	0.476	0.458	CP2
RW-12	JD-4	54.10	0.12	0.50	4.55	0.11	16.85	23.23	0.23		0.01	99.70	0.071	0.466	0.462	CP4
RW-12	JD-4	55.17	0.14	0.59	4.78	0.10	16.61	23.46	0.27		0.01	101.13	0.074	0.459	0.466	CP4
RW-12	JD-4	54.48	0.12	0.50	4.83	0.11	16.57	23.40	0.32		0.01	100.34	0.075	0.458	0.465	CP4
RW-12	JD-4	54.39	0.15	0.74	5.49	0.13	16.55	22.77	0.33		0.00	100.55	0.085	0.459	0.454	CP4
RW-12	JD-4	54.95	0.13	0.55	5.11	0.16	16.17	23.56	0.32		0.00	100.95	0.080	0.448	0.470	CP4
RW-12	JD-4	54.27	0.11	0.57	5.14	0.12	16.37	22.91	0.33		0.01	99.83	0.081	0.457	0.460	CP4
RW-12	JD-4	53.94	0.17	0.84	5.98	0.16	16.43	21.88	0.35		0.01	99.76	0.094	0.461	0.442	CP4
RW-12	JD-4	53.60	0.13	0.56	4.51	0.08	16.98	22.90	0.23		0.03	99.02	0.070	0.471	0.457	CP4
RW-12	JD-4	53.91	0.14	0.57	4.84	0.14	16.63	22.87	0.31		0.04	99.45	0.076	0.464	0.458	CP4
RW-12	JD-4	54.22	0.15	0.66	5.54	0.15	16.61	22.44	0.26		0.03	100.06	0.087	0.462	0.449	CP4
RW-12	JD-4	54.08	0.12	0.53	5.01	0.11	16.60	23.06	0.33		0.02	99.86	0.078	0.460	0.460	CP4
RW-12	JD-4	54.89	0.16	0.56	4.17	0.10	16.53	23.68	0.29			100.38	0.065	0.460	0.474	CP2
RW-12	JD-4	54.32	0.23	0.89	3.74	0.07	17.04	23.43	0.24			99.96	0.058	0.473	0.468	CP2
RW-12	JD-4	53.70	0.12	0.63	4.40	0.12	16.83	22.68	0.26			98.74	0.069	0.472	0.457	CP4
RW-12	JD-4	53.13	0.17	1.05	5.66	0.15	15.84	22.22	0.40			98.62	0.091	0.452	0.455	CP4
RW-12	JD-4	55.18	0.17	0.65	4.70	0.12	16.53	23.68	0.23			101.26	0.073	0.456	0.470	CP4
RW-12	JD-4	54.07	0.13	1.33	4.80	0.10	16.09	23.32	0.26			100.10	0.076	0.452	0.471	CP4
RW-12	JD-4	54.92	0.18	0.87	5.08	0.12	16.00	23.34	0.37			100.88	0.080	0.448	0.470	CP4
ABRW93-55	JD-4	52.89	0.45	4.61	8.49		12.03	19.30	2.02		0.01	99.80	0.155	0.392	0.452	CP4
ABRW93-55	JD-4	52.76	0.52	4.65	8.48		12.13	19.32	2.14		0.02	100.02	0.155	0.394	0.451	CP4
ABRW93-55	JD-4	52.55	0.45	4.69	8.45		12.00	19.22	2.13		0.00	99.49	0.155	0.393	0.452	CP4
ABRW93-55	JD-4	53.12	0.52	4.76	8.36		11.65	19.32	2.13		0.01	99.87	0.155	0.385	0.459	CP4
ABRW93-55	JD-4	52.68	0.55	4.82	9.09		11.62	19.04	2.11		0.00	99.91	0.168	0.382	0.450	CP4
ABRW93-55	JD-4	53.55	0.42	4.61	8.08		11.78	19.12	2.24		0.02	99.82	0.151	0.392	0.457	CP8
ABRW93-55	JD-4	53.41	0.48	6.44	2.92		13.95	20.46	2.02		0.06	99.74	0.054	0.460	0.486	CP5
ABRW93-55	JD-4	51.56	0.76	9.89	3.11		12.39	21.13	1.76		0.01	100.61	0.060	0.422	0.518	CP3

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Molecular Weight of Oxides

Sample #	Pipe Number	Analysis I.D.	SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	NiO	ZnO	Cr_2O_3	Total
			60.08	79.88	102	71.85	70.94	40.3	56.08	61.98		94.2	151.99	
	JD-1		0.00	0.85	3.43	20.56	0.00	11.28	0.18	0.00	0.08	0.22	63.24	99.84
	JD-1		0.00	1.18	3.93	24.06	0.22	9.86	0.15	0.00	0.03	0.06	60.34	99.83
	JD-1		0.00	0.85	3.74	22.43	0.01	10.18	0.11	0.00	0.12	0.13	61.93	99.50
	JD-1		0.00	0.90	3.63	24.86	0.24	8.65	0.21	0.00	0.14	0.14	60.98	99.75
	JD-1		0.00	0.83	3.92	22.33	0.19	10.10	0.15	0.00	0.17	0.00	62.98	100.67
	JD-1		0.00	0.69	3.53	24.03	0.23	9.02	0.19	0.00	0.19	0.19	61.35	99.42
	JD-1		0.00	0.67	3.55	21.00	0.00	10.56	0.14	0.00	0.12	0.04	62.56	98.64
	JD-1		0.00	0.86	3.96	20.31	0.00	11.63	0.21	0.00	0.00	0.12	62.73	99.82
	JD-1		0.00	0.81	3.16	25.13	0.86	7.96	0.20	0.00	0.00	0.16	62.24	100.52
	JD-1		0.00	1.06	3.72	24.42	0.39	8.67	0.19	0.00	0.23	0.19	60.56	99.43
	JD-1		0.00	0.99	3.77	23.47	0.00	9.78	0.21	0.00	0.04	0.26	61.26	99.78
	JD-1		0.00	1.21	4.22	21.74	0.00	11.42	0.14	0.00	0.04	0.09	61.11	99.97
	JD-1		0.00	0.92	3.47	24.68	0.14	8.78	0.16	0.00	0.12	0.09	61.48	99.84
	JD-1		0.00	0.86	3.31	24.87	0.25	8.56	0.17	0.00	0.11	0.22	61.96	100.31
	JD-1		0.00	0.83	3.55	23.39	0.29	8.07	0.18	0.01	0.03	0.08	61.49	97.92
	JD-1		0.00	0.95	3.64	22.55	0.00	10.00	0.20	0.00	0.06	0.21	62.34	99.95
	JD-1		0.00	0.98	3.65	25.29	0.08	8.72	0.14	0.00	0.22	0.08	61.80	100.96
	JD-1		0.00	0.98	3.86	18.24	0.00	12.53	0.23	0.00	0.21	0.19	63.69	99.93
	JD-1		0.00	0.50	15.76	17.98	0.30	7.29	0.09	0.12	0.23	0.19	56.73	99.19
	JD-1		0.00	0.92	3.67	24.27	0.03	8.81	0.17	0.00	0.18	0.21	61.47	99.73
	JD-1		0.00	0.11	17.73	26.86	0.27	5.61	0.11	0.34	0.00	0.19	47.98	99.20
	JD-1		0.00	0.12	18.08	23.68	0.26	7.64	0.16	0.17	0.00	0.12	49.21	99.44
	JD-1		0.00	0.90	3.45	25.07	0.06	8.14	0.19	0.00	0.00	0.12	61.98	99.91
	JD-1		0.00	1.02	3.69	30.15	0.22	4.84	0.10	0.00	0.03	0.03	59.27	99.35
	JD-1		0.00	0.12	45.12	15.38	0.00	17.52	0.11	3.00	0.14	0.12	20.37	101.88
	JD-1		0.00	0.93	3.33	22.03	0.00	10.67	0.18	0.00	0.12	0.16	62.24	99.66
	JD-1		0.00	0.88	3.44	22.79	0.00	10.24	0.16	0.00	0.14	0.04	61.84	99.53
	JD-1		0.00	0.07	10.17	20.60	0.00	9.74	0.16	0.00	0.11	0.13	58.76	99.74
	JD-1		0.00	0.02	34.36	17.94	0.00	13.93	0.05	0.40	0.00	0.22	32.98	99.90
RW-3	JD-1		0.00	0.91	3.19	22.68	0.37	10.83	0.02	0.00			62.12	100.12
RW-3	JD-1		0.00	0.84	3.11	22.85	0.40	10.81	0.03	0.00			62.00	100.04
RW-3	JD-1		0.01	0.90	3.16	22.88	0.38	10.78	0.02	0.00			62.20	100.33

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Sample #	Pipe Number	Analysis I.D.	SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	NiO	ZnO	Cr_2O_3	Total
			60.08	79.88	102	71.85	70.94	40.3	56.08	61.98		94.2	151.99	
ABRW-88	JD-2	C1	0.09	1.43	6.79	29.75	0.30	10.02			0.29	0.20	49.97	98.84
ABRW-88	JD-2	D1	0.06	0.93	6.41	22.40	0.24	11.80			0.04	0.00	56.21	98.09
ABRW-88	JD-2	E1	0.13	0.51	4.64	16.24	0.19	13.94			0.24	0.01	63.82	99.72
ABRW-88	JD-2	F1	0.09	1.32	5.66	25.71	0.32	12.07			0.15	0.06	52.78	98.16
ABRW-88	JD-2	G1	0.17	0.63	5.21	18.56	0.26	13.11			0.12	0.11	60.17	98.34
ABRW-88	JD-2	H1	0.01	0.71	5.38	21.06	0.39	12.53			0.22	0.01	58.21	98.52
ABRW-88	JD-2	I1	0.11	0.65	6.68	18.84	0.35	13.47			0.13	0.00	58.45	98.68
ABRW-88	JD-2	C2	0.17	0.70	4.92	17.43	0.31	13.61			0.21	0.16	60.50	98.01
ABRW-88	JD-2	D2	0.20	0.75	5.35	19.81	0.30	13.04			0.14	0.00	59.03	98.62
ABRW-88	JD-2	E2	0.12	0.92	4.61	15.72	0.24	14.95			0.41	0.07	62.07	99.11
ABRW-88	JD-2	G2	0.09	0.81	5.29	18.95	0.31	13.08			0.16	0.19	59.67	98.55
ABRW-88	JD-2	H2	0.13	0.70	5.90	18.86	0.31	13.57			0.18	0.00	58.97	98.62
ABRW-88	JD-2	C3	0.18	0.69	6.33	18.65	0.26	13.52			0.24	0.00	58.24	98.11
ABRW-88	JD-2	D3	0.07	0.69	6.12	20.29	0.33	13.22			0.16	0.17	57.76	98.81
ABRW-88	JD-2	E3	0.17	0.75	5.16	19.39	0.39	13.07			0.12	0.00	58.43	97.48
ABRW-88	JD-2	I3	0.11	0.61	4.38	21.41	0.32	10.97			0.14	0.06	60.78	98.78
ABRW-88	JD-2	J3	0.07	1.39	6.24	30.17	0.38	9.91			0.16	0.08	49.82	98.22
ABRW-88	JD-2	A4	0.15	0.57	5.27	18.5	0.36	12.93			0.23	0.00	60.03	98.04
ABRW-88	JD-2	B4	0.15	0.59	4.59	18.03	0.34	13.46			0.25	0.00	60.85	98.26
ABRW-88	JD-2	C4	0.04	1.27	4.63	19.70	0.21	15.47			0.34	0.00	57.09	98.75
ABRW-88	JD-2	D4	0.11	0.76	5.42	21.12	0.25	12.49			0.11	0.00	57.99	98.25
ABRW-88	JD-2	F4	0.21	0.86	5.37	18.69	0.19	14.08			0.22	0.00	59.43	99.05
ABRW-88	JD-2	H4	0.10	0.65	4.72	16.32	0.33	14.35			0.16	0.06	61.77	98.46
ABRW-88	JD-2	I4	0.09	0.72	5.36	18.63	0.26	13.08			0.20	0.00	59.49	97.83
ABRW-88	JD-2	J4	0.15	1.18	6.56	20.50	0.32	13.46			0.24	0.17	55.56	98.14
ABRW-88	JD-2	A5	0.15	0.75	3.63	16.08	0.32	13.64			0.24	0.14	62.34	97.29
ABRW-88	JD-2	B5	0.15	0.97	5.2	19.14	0.28	13.59			0.23	0.11	58.72	98.39
ABRW-88	JD-2	C5	0.16	0.81	4.26	18.22	0.24	13.76			0.16	0.01	60.12	97.74
ABRW-88	JD-2	D5	0.06	1.25	4.76	22.76	0.3	12.2			0.13	0.03	55.63	97.12
ABRW-88	JD-2	E5	0.11	1.24	3.76	20.67	0.27	11.78			0.16	0.03	60.14	98.16
ABRW-88	JD-2	I5	0.15	0.99	5.79	19.86	0.26	13.06			0.27	0.2	58.12	98.70
ABRW-88	JD-2	A6	0.12	0.83	4.96	19.11	0.24	13.18			0.29	0.24	59.55	98.52
ABRW-88	JD-2	D6	0.15	0.93	3.67	15.4	0.23	14.24			0.26	0.06	62.84	97.78
ABRW-88	JD-2	E6	0.09	0.69	5.53	17.87	0.19	13.82			0.19	0.12	59	97.50
ABRW-88	JD-2	F6	0.13	1.6	6.13	28.99	0.32	10.53			0.09	0.17	49.82	97.78
ABRW-88	JD-2	H6	0.13	0.77	5.24	18.44	0.28	13.9			0.26	0.12	58.5	97.64
ABRW-88	JD-2	I6	0.14	0.98	5.61	19.69	0.3	13.25			0.13	0.15	58.05	98.30
ABRW-88	JD-2	A7	0.07	1.47	7.44	26.41	0.35	11.22			0.2	0.19	50.33	97.68
ABRW-88	JD-2	C7	0.14	0.95	4.99	19.53	0.25	13.48			0.23	0.23	58.8	98.60
ABRW-88	JD-2	D7	0.33	0.72	4.46	17.21	0.3	13.78			0.18	0.12	60.28	97.38

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Formula Based on 32 O
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Sample #	Pipe Number	Analysis I.D.	SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	NiO	ZnO	Cr_2O_3	Total
			60.08	79.88	102	71.85	70.94	40.3	56.08	61.98		94.2	151.99	
ABRW-88	JD-2	E7	0.09	0.67	4.35	16.01	0.29	14.2			0.25	0.15	62.3	98.31
ABRW-88	JD-2	F7	0.1	0.04	4.7	28.82	0.49	4.14			0	0.54	58.45	97.28
ABRW-88	JD-2	G7	0.05	0.99	5.07	18.84	0.26	13.62			0.19	0.05	59.38	98.45
ABRW-88	JD-2	H7	0.4	1.53	5.54	25.93	0.34	10.82			0.14	0.22	52.83	97.75
ABRW-88	JD-2	I7	0.08	0.72	4.62	18.94	0.22	13.29			0.2	0.09	59.45	97.61
ABRW-88	JD-2	J7	0.12	1.43	5.27	24.46	0.29	11.03			0.12	0.18	54.88	97.78
ABRW-88	JD-2	A8	0.17	1.17	4.91	20.63	0.21	12.9			0.18	0.06	57.01	97.24
ABRW-88	JD-2	C8	0.14	0.87	4.78	19.05	0.24	13.52			0.14	0.15	58.62	97.51
ABRW-88	JD-2	E8	0.12	0.84	5.05	16.86	0.29	14.02			0.18	0.07	59.7	97.13
ABRW-88	JD-2	G8	0.11	0.82	5.23	18.03	0.26	13.21			0.27	0.08	59.11	97.12
ABRW-88	JD-2	H8	0.11	0.77	5.13	18.7	0.28	13.16			0.18	0.17	58.94	97.44
ABRW-88	JD-2	J8	0.09	0.91	4.67	19.5	0.33	12.81			0.19	0.12	58.54	97.16
ABRW-88	JD-2	B8-2	0.16	1.39	4.75	22.36	0.34	11.09			0.12	0.28	57.06	97.55
ABRW-88	JD-2	E1	0.11	1.11	6.22	20.71	0.26	13.62			0.18	0.01	56.66	98.88
ABRW-88	JD-2	H1	0.15	1.11	6.89	22.31	0.36	13.01			0.21	0.01	55.46	99.51
ABRW-88	JD-2	I1	0.11	0.67	5.55	18.5	0.22	13.39			0.2	0.01	59.64	98.29
ABRW-88	JD-2	J1	0.13	1.42	6.4	30.42	0.33	9.82			0.13	0.02	49.67	98.34
ABRW-88	JD-2	C2	0.1	0.8	5.15	20.25	0.35	13.44			0.16	0.01	59	99.26
ABRW-88	JD-2	D2	0.12	0.86	5.65	20.33	0.35	13.18			0.09	0.02	58.44	99.04
ABRW-88	JD-2	E2	0.08	0.65	5	16.09	0.3	14.26			0.28	0.01	62.13	98.80
ABRW-88	JD-2	G2	0.12	0.98	4.98	20.24	0.23	12.8			0.16	0	58.81	98.32
ABRW-88	JD-2	I2	0.15	0.62	4.83	18.8	0.32	13.01			0.21	0	61.84	99.78
ABRW-88	JD-2	J2	0.22	1.45	6.08	30.66	0.37	9.43			0.12	0	50.1	98.43
ABRW-88	JD-2	A3	0.11	0.7	5.27	18.3	0.19	12.9			0.15	0.01	61.12	98.75
ABRW-88	JD-2	B3	0.12	0.78	5.16	20.39	0.27	13.28			0.15	0.01	58.77	98.93
ABRW-88	JD-2	A9	0.06	0.87	4.26	19.84	0.36	12.98			0.21	0	60.74	99.32
ABRW-88	JD-2	D9	0.07	0.71	4.95	18.97	0.27	13.57			0.22	0	60.36	99.12
ABRW-88	JD-2	E9	0.12	0.89	6.02	19.74	0.33	13.21			0.19	0	58.65	99.15
ABRW-88	JD-2	F9	0.18	0.92	6.07	19.91	0.32	13.09			0.18	0	57.85	98.52
ABRW-88	JD-2	G9	0.11	0.81	5.02	19.29	0.32	13.4			0.17	0	60.26	99.38
ABRW-88	JD-2	H9	0.05	0.64	3.83	21.91	0.36	11.19			0.18	0.01	61.39	99.56
ABRW-88	JD-2	J9	0.08	0.69	5.91	19.76	0.24	13.26			0.22	0.01	58.02	98.19
ABRW-88	JD-2	A10	0.08	0.59	5.85	17.46	0.26	13.9			0.18	0	60.94	99.26
ABRW-88	JD-2	C10	0.04	0.75	5.02	19.47	0.31	12.93			0.16	0.01	60.41	99.10
ABRW-88	JD-2	D10	0.12	1.27	5.54	24.8	0.32	10.99			0.17	0	55.09	98.30
ABRW-88	JD-2	G10	0.08	1.23	6.25	20.74	0.34	13.54			0.22	0	56.44	98.84
ABRW-88	JD-2	H10	0.08	1.63	6.03	31.6	0.37	9.65			0.11	0.02	48.73	98.22
RW-10	JD-4		0.07	1.57	46.76	44.71	0.31	6.35	0.02				0.00	99.79
RW-10	JD-4		2.30	2.08	44.30	43.40	0.42	6.39	0.03				0.88	99.80
RW-10	JD-4		0.09	4.67	6.41	78.88	0.57	0.93	0.03				0.48	92.06

ILMENITE
Southern Alberta

Formula Based on 6 O
Molecular Weight of Oxides

Sample #		SiO2	TiO2	Al2O3	FeO*	MnO	MgO	CaO	Na2O	K2O	NiO	ZnO	Cr2O3	Total
		60.08	79.88	102	71.85	70.94	40.3	56.08	61.98	94.2			151.99	
	JD-1	2.04	44.67	0.27	45.85	1.29	2.70	0.07	0.00	0.00			0.00	96.89
	JD-1	0.00	52.90	0.03	44.22	1.41	1.22	0.01	0.00	0.00			0.00	99.79
	JD-1	0.00	42.96	0.71	50.64	0.73	4.75	0.04	0.00	0.00			0.00	99.83
	JD-1	0.00	41.92	0.75	50.98	0.72	5.42	0.07	0.00	0.00			0.00	99.86
	JD-1	0.00	44.37	0.00	55.74	0.76	0.78	0.10	0.00	0.00			0.00	101.75
	JD-1	0.00	43.78	0.16	53.74	0.73	1.34	0.06	0.00	0.00			0.00	99.81
	JD-1	0.00	44.41	0.11	53.42	0.63	1.33	0.01	0.00	0.00			0.00	99.91
RW-3	JD-1	2.64	50.28	1.79	41.09	2.54	0.06	0.02	0.00	0.58			0.00	99.00
ABRW93AA-88	JD-2	0.03	43.46	0.29	44.1	0.28	7.63				0.15	0.04	0.38	96.36
ABRW93AA-88	JD-2	0	46.71	0.7	46.8	0.47	3.72				0	0.24	0.02	98.66
ABRW93AA-88	JD-2	0.03	47.24	0.63	46.59	0.62	2.74				0	0.21	0.08	98.14
ABRW93AA-88	JD-2	0.01	47.45	0.26	46.03	0.34	4.25				0.01	0.15	0	98.50
ABRW93AA-88	JD-2	0.1	48.74	0.59	44.42	0.46	3.96				0	0.15	0.01	98.43
ABRW93AA-88	JD-2	0.05	48.76	0.26	44.14	0.52	4.33				0	0.15	0	98.21
ABRW93AA-88	JD-2	0.07	47.59	0.51	46.87	0.64	2.36				0	0.2	0	98.24
ABRW93AA-88	JD-2	0	43.05	0.28	44.75	0.22	7.44				0.07	0.02	0.28	96.11
ABRW93AA-88	JD-2	0	49.2	0.44	43.48	0.44	4.99				0	0.1	0.02	98.67
ABRW93AA-88	JD-2	0.14	44.55	0.43	44.45	0.43	6.81				0.1	0	1.03	97.94
RW-10	JD-4	1.17	46.82	0.58	42.56	0.61	5.38	0.08					0.11	97.31
RW-10	JD-4	0.00	45.51	0.57	46.55	0.55	4.36	0.04					0.26	97.84
RW-10	JD-4	0.00	44.73	0.43	48.71	0.23	3.27	0.03					0.21	97.61
RW-10	JD-4	0.25	43.50	1.15	48.01	0.39	3.31	0.04					0.29	96.94

[redacted]

Southern Alberta

COMMENTS:Cr2O3 not used in calculation.

Formula Based on 12 O + (OH+F+Cl)

Molecular Weights of Oxides

			60.090	79.900	101.940	152.020	71.850	70.940	40.320	56.080	61.980	94.200	153.360	35.457	19.000	17.000	18.010	
			SiO2	TiO2	Al2O3	CR2O3	FeO*	MnO	MgO	CaO	Na2O	K2O	BaO	Cl	F	(F,Cl)	H2O	Total
BB	JD-1		40.650	1.760	17.020	0.070	9.650	0.120	20.290	0.060	0.850	9.530		0.000		0.000	4.344	104.34
BB	JD-1		43.170	1.510	13.820	1.350	3.190	0.060	21.030	0.000	0.980	9.600		0.050		-0.011	4.204	98.95
BB	JD-1		40.280	3.780	15.550	0.040	10.660	0.100	19.210	0.000	0.960	9.290		0.000		0.000	4.311	104.18
BB	JD-1		41.760	2.830	13.360	0.160	11.240	0.150	20.260	0.040	1.140	8.980		0.020		-0.005	4.306	104.24
BB	JD-1		44.160	2.350	13.040	0.230	12.410	0.230	16.400	0.160	1.250	7.050		0.530		-0.120	4.375	102.06
BB	JD-1		38.590	5.440	13.670	0.130	13.410	0.170	16.370	0.000	0.940	9.190		0.010		-0.002	4.137	102.05
BB	JD-1		39.970	4.220	12.790	0.130	13.380	0.210	17.160	0.000	0.920	9.170		0.000		0.000	4.168	102.12
BB	JD-1		40.640	4.940	14.070	0.150	10.640	0.140	19.030	0.000	1.000	9.230		0.010		-0.002	4.301	104.15
BB	JD-1		39.540	5.970	12.910	0.180	14.200	0.210	16.840	0.000	0.870	9.220		0.000		0.000	4.217	104.16
BB	JD-1		40.380	7.010	12.940	0.040	12.050	0.170	17.450	0.000	1.140	8.420		0.000		0.000	4.275	103.87
BB	JD-1		39.750	7.070	13.150	0.170	13.120	0.200	16.540	0.000	0.930	9.010		0.000		0.000	4.246	104.19
BB	JD-1		40.380	4.790	14.550	0.260	10.570	0.180	19.120	0.000	0.940	9.260		0.000		0.000	4.305	104.36
RV 3	JD-1		37.650	0.660	11.210	1.190	3.940	0.000	24.220	2.860	2.870	0.000			1.100	-0.463	3.378	88.61
RV 3	JD-1		40.010	0.930	11.990	0.670	3.800	0.000	24.490	2.620	0.610	1.000			1.390	-0.585	3.388	90.31
RV 3	JD-1		39.650	0.740	12.020	0.840	3.970	0.010	24.050	2.840	1.160	0.000			1.020	-0.429	3.512	89.38
RV 3	JD-1		37.700	0.900	11.510	0.360	6.650	0.040	23.210	2.370	0.420	4.020			1.850	-0.779	3.094	91.34
RV 3	JD-1		38.530	1.840	12.080	0.000	7.950	0.030	21.960	3.480	0.430	0.050			1.040	-0.438	3.496	90.45
RV 3	JD-1		36.860	2.540	14.730	0.120	14.400	0.130	15.950	0.120	0.460	8.740			0.980	-0.413	3.547	98.16
RV 3	JD-1		37.880	2.840	14.460	0.100	13.250	0.160	16.230	0.150	0.440	8.630			1.190	-0.501	3.495	98.32
RV 3	JD-1		37.600	1.250	11.810	0.080	8.570	0.070	21.530	1.100	0.310	5.320			1.500	-0.632	3.227	91.74
RV 3	JD-1		33.840	3.860	14.610	0.200	12.340	0.050	16.320	0.010	0.410	7.620			0.830	-0.349	3.437	93.18
RV 4	JD-1		39.300	2.440	12.700	0.100	11.430	0.070	19.670	0.080	0.560	8.410			1.310	-0.552	3.513	99.03
RV 4	JD-1		38.730	2.420	13.550	0.140	11.190	0.100	19.390	0.090	0.570	8.470			1.300	-0.547	3.512	98.91
RV 4	JD-1		41.030	0.940	12.490	1.200	7.780	0.050	21.960	0.030	0.730	9.050			1.650	-0.695	3.413	99.63
RV 4	JD-1		39.620	1.980	12.810	0.100	11.020	0.100	20.240	0.010	0.620	9.250			1.360	-0.573	3.524	100.06
RV 4	JD-1		39.110	1.630	13.980	0.190	11.430	0.090	19.120	0.040	0.550	9.090			1.340	-0.564	3.507	99.51
RV 4	JD-1		38.890	1.700	13.670	0.170	11.410	0.080	19.620	0.060	0.590	9.130			1.520	-0.640	3.427	99.63
RV 4	JD-1		39.380	0.710	11.820	0.910	8.330	0.050	22.120	0.140	0.440	7.210			2.010	-0.846	3.109	95.38
RV 4	JD-1		39.620	0.760	12.090	0.860	8.240	0.040	22.910	0.180	0.440	5.220			2.060	-0.867	3.112	94.66
RV 4	JD-1		39.850	0.900	12.030	0.550	8.380	0.030	22.620	0.200	0.370	5.310			2.080	-0.876	3.110	94.55
RV 4	JD-1		42.520	0.680	11.450	0.370	3.880	0.000	24.230	0.220	0.310	9.220			1.940	-0.817	3.308	97.31
RV 4	JD-1	112.000	37.430	1.760	13.660	0.670	9.810	0.080	19.300	0.110	0.610	8.280			1.470	-0.619	3.309	95.87
RV 4	JD-1	224.000	38.830	1.830	13.470	0.440	9.790	0.080	20.140	0.100	0.630	8.400			1.530	-0.644	3.389	97.98
RV 4	JD-1	336.000	38.910	1.720	13.500	0.470	10.000	0.090	20.510	0.100	0.640	8.340			1.610	-0.678	3.375	98.59
RV 4	JD-1	448.000	38.230	1.780	13.350	0.390	10.150	0.080	20.190	0.060	0.620	8.440			1.310	-0.552	3.453	97.50
RV 4	JD-1	560.000	38.150	1.750	13.570	0.360	10.160	0.090	19.050	0.280	0.640	8.150			1.120	-0.472	3.496	96.34
RV 4	JD-1	672.000	38.640	1.900	13.840	0.420	13.320	0.080	19.360	0.100	0.630	8.060			1.060	-0.446	3.645	100.61
RV 4	JD-1	784.000	39.960	1.850	13.440	0.410	10.070	0.060	19.610	0.130	0.630	8.240			1.230	-0.518	3.562	98.67
RV 4	JD-1	896.000	38.110	1.930	13.350	0.390	10.410	0.080	19.270	0.610	0.630	8.590			1.100	-0.463	3.530	97.54
RV 4	JD-1	1008.000	38.520	1.800	14.330	0.370	10.520	0.070	19.500	0.050	0.650	8.880			1.310	-0.552	3.505	98.95
RV 4	JD-1	1120.000	39.330	1.830	13.440	0.370	10.000	0.070	20.140	0.080	0.630	8.660			1.550	-0.653	3.415	98.86
RV 4	JD-1		36.390	4.150	13.690	0.070	12.790	0.100	18.260	0.060	0.630	8.390			1.270	-0.535	3.465	98.73
RV 4	JD-1		36.300	3.300	14.690	0.050	15.380	0.080	16.120	0.010	0.400	8.600			0.610	-0.257	3.726	99.01
RV 4	JD-1		37.530	2.610	13.440	0.050	15.670	0.070	17.030	0.000	0.300	8.890			0.670	-0.282	3.724	99.70
RV 4	JD-1		35.830	3.210	14.230	0.060	15.390	0.080	16.310	0.000	0.340	8.590			0.630	-0.265	3.671	98.08

MICAS
Southern Alberta
COMMENTS:Cr2O3 not used in calculation.

Formula Based on 12 O + (OH+F+Cl)
Molecular Weights of Oxides

			60.090 SIO2	79.900 TIO2	101.940 Al2O3	152.020 CR2O3	71.850 FeO*	70.940 MnO	40.320 MgO	56.080 CaO	61.980 Na2O	94.200 K2O	153.360 BaO	35.457 Cl	19.000 F	17.000 (F,Cl)	18.010 H2O	Total
RW 4	JD-1		37.640	2.510	13.280	0.030	15.390	0.070	17.050	0.000	0.270	8.990			0.560	-0.236	3.761	99.31
RW 4A	JD-1		40.080	1.720	12.430	0.150	8.170	0.060	21.630	0.140	0.640	9.500			1.470	-0.619	3.472	98.84
RW 4A	JD-1		39.970	1.430	12.170	0.180	10.630	0.080	21.000	0.420	0.400	7.330			1.550	-0.653	3.402	97.91
RW 4A	JD-1		37.910	2.860	13.470	0.080	15.780	0.070	16.690	0.040	0.300	9.140			0.660	-0.278	3.755	100.48
RW 4A	JD-1		39.240	1.920	13.800	0.380	10.570	0.090	19.800	0.070	0.670	9.030			1.300	-0.547	3.545	99.87
RW 4A	JD-1		41.470	1.530	12.050	0.520	8.270	0.060	21.670	0.250	0.650	9.710			1.430	-0.602	3.550	100.56
RW 4A	JD-1		40.160	1.750	12.530	0.320	8.000	0.070	22.120	0.170	0.500	9.250			1.440	-0.606	3.505	99.21
RW 4A	JD-1		37.270	3.220	14.050	0.050	15.570	0.080	16.520	0.010	0.330	9.230			0.570	-0.240	3.791	100.45
RW 4A	JD-1		40.470	0.980	12.430	0.790	7.930	0.050	22.610	0.070	0.530	8.610			1.470	-0.619	3.477	98.80
RW 4A	JD-1		41.420	0.820	12.840	1.590	4.420	0.030	24.560	0.040	0.500	10.150			1.650	-0.695	3.488	100.81
RW 4A	JD-1		40.630	0.780	12.500	1.400	4.480	0.010	24.800	0.230	0.370	9.700			1.510	-0.636	3.492	99.27
RW 4A	JD-1		37.880	2.080	14.790	0.610	11.290	0.090	18.980	0.150	0.650	9.060			1.270	-0.535	3.524	99.84
RW 4A	JD-1		40.330	1.790	13.060	0.280	9.620	0.070	20.940	0.020	0.620	10.160			1.400	-0.589	3.562	101.26
RW 4A	JD-1		38.630	4.350	13.590	0.060	11.220	0.090	18.630	0.090	0.630	8.960			1.580	-0.665	3.447	100.61
RW 4A	JD-1		38.580	2.550	15.520	0.180	13.630	0.140	15.490	0.050	0.940	8.970			0.680	-0.286	3.787	100.23
RW 5	JD-1		38.240	2.650	13.890	0.030	13.420	0.090	17.310	0.010	0.690	8.480			0.810	-0.341	3.689	98.97
RW 5	JD-1		37.790	2.850	14.690	0.140	13.310	0.140	17.160	0.010	0.700	8.930			0.860	-0.362	3.691	99.91
RW 5	JD-1		36.690	2.820	14.880	0.190	14.500	0.160	16.090	0.150	0.730	8.630			0.720	-0.303	3.683	98.94
RW 5	JD-1		37.000	2.760	14.710	0.330	13.120	0.140	17.050	0.000	0.730	8.520			0.830	-0.349	3.642	98.48
RW 5	JD-1		37.280	2.770	14.360	0.240	13.660	0.150	17.090	0.000	0.710	8.620			0.880	-0.371	3.635	99.02
RW 5	JD-1		35.800	2.670	15.850	0.080	15.210	0.120	15.960	0.010	0.660	8.890			0.630	-0.265	3.722	99.34
RW 5	JD-1		37.110	2.610	14.630	0.050	14.400	0.120	16.320	0.020	0.670	8.210			0.800	-0.337	3.644	98.25
RW 5	JD-1		37.100	2.580	14.180	0.060	14.050	0.110	16.940	0.010	0.650	8.470			0.880	-0.371	3.607	98.27
RW 5	JD-1		37.890	3.010	13.900	0.080	14.080	0.110	16.950	0.010	0.710	8.780			0.900	-0.379	3.653	99.69
RW 5	JD-1		37.350	2.860	14.520	0.060	12.980	0.100	17.560	0.000	0.770	8.610			1.000	-0.421	3.602	98.99
RW 5	JD-1		40.130	1.460	13.300	0.300	5.360	0.010	23.390	0.000	0.310	9.930			0.920	-0.387	3.744	98.47
RW 6	JD-3		40.020	1.330	13.390	0.920	5.540	0.010	23.240	0.100	0.410	9.270			0.850	-0.358	3.759	98.48
RW 6	JD-3		40.950	1.270	13.550	1.900	4.490	0.000	23.720	0.000	0.230	10.190			1.070	-0.451	3.724	100.64
RW 6	JD-3		40.170	1.260	13.120	1.330	6.470	0.060	22.310	0.000	0.340	9.740			1.880	-0.792	3.296	99.18
RW 6	JD-3		40.540	1.470	13.750	0.610	5.540	0.040	23.480	0.000	0.320	10.040			0.870	-0.366	3.821	100.11
RW 6	JD-3		41.330	1.620	13.330	0.420	5.530	0.010	23.430	0.000	0.330	10.010			0.750	-0.316	3.898	100.34
RW 6	JD-3		40.450	1.460	13.950	0.300	5.520	0.020	23.450	0.020	0.340	9.820			0.770	-0.324	3.863	99.64
RW 6	JD-3		37.210	5.970	12.870	0.020	14.870	0.120	15.340	0.030	0.380	8.840			1.590	-0.669	3.337	99.91
RW 6	JD-3		40.630	1.500	13.500	0.760	5.330	0.020	23.220	0.010	0.310	9.610			0.910	-0.383	3.774	99.19
RW 6	JD-3		36.530	5.850	12.830	0.030	16.710	0.190	13.740	0.010	0.360	8.570			1.620	-0.682	3.252	99.01
RW 6	JD-3		40.650	1.460	13.060	0.470	5.210	0.030	23.480	0.010	0.320	10.070			0.880	-0.371	3.782	99.05
RW 6	JD-3		41.380	1.160	13.380	1.280	4.540	0.020	23.850	0.020	0.330	10.060			0.850	-0.358	3.838	100.35
RW 6	JD-3	187.000	39.480	1.480	13.090	0.460	5.170	0.030	23.130	0.010	0.330	10.000			1.930	-0.813	3.252	97.55
RW 7	JD-3	374.000	40.260	1.410	13.110	0.310	5.010	0.020	23.550	0.000	0.300	10.120			0.840	-0.354	3.776	98.35
RW 7	JD-3	561.000	40.560	1.040	13.240	0.390	4.730	0.020	23.710	0.000	0.250	10.260			0.960	-0.404	3.733	98.49
RW 7	JD-3	748.000	40.800	1.360	13.250	0.680	4.770	0.020	23.710	0.040	0.280	10.310			0.840	-0.354	3.815	99.52
RW 7	JD-3	935.000	40.540	1.420	13.200	0.580	4.720	0.020	23.680	0.000	0.290	10.180			0.790	-0.333	3.817	98.90
RW 7	JD-3	1122.000	40.400	1.370	13.310	0.540	4.800	0.020	23.720	0.000	0.180	10.210			0.870	-0.366	3.779	98.83
RW 7	JD-3	1309.000	40.650	1.420	13.210	0.560	4.820	0.010	23.510	0.000	0.190	10.320			0.850	-0.358	3.793	98.97
RW 7	JD-3	1496.000	40.480	1.450	13.230	0.470	4.860	0.020	23.500	0.000	0.180	10.260			0.910	-0.383	3.759	98.74

MICAS (cont'd)
Southern Alberta
COMMENTS:Cr2O3 not used in calculation.

Formula Based on 12 O + (OH+F+Cl)
Molecular Weights of Oxides

			60.090 SiO2	79.900 TiO2	101.940 Al2O3	152.020 CR2O3	71.850 FeO*	70.940 MnO	40.320 MgO	56.080 CaO	61.980 Na2O	94.200 K2O	153.360 BaO	35.457 Cl	19.000 F	17.000 (F,Cl)	18.010 H2O	Total
RV 7	JD-3	1683.000	40.570	1.470	13.320	0.360	4.910	0.010	23.790	0.000	0.200	10.270			0.920	-0.387	3.778	99.21
RV 7	JD-3	1870.000	40.760	1.250	13.180	0.680	4.760	0.010	23.750	0.000	0.160	10.410			0.920	-0.387	3.769	99.26
RV 7	JD-3	2057.000	40.450	1.420	13.500	0.450	4.890	0.030	23.680	0.010	0.170	10.310			0.940	-0.396	3.766	99.22
RV 7	JD-3		39.660	1.740	13.880	0.440	5.600	0.010	22.500	0.060	0.360	9.630			0.720	-0.303	3.811	98.11
RV 7	JD-3		39.910	1.800	13.450	0.060	6.440	0.020	22.490	0.120	0.540	9.150			0.900	-0.379	3.746	98.25
RV 7	JD-3		39.830	1.240	12.860	1.150	4.390	0.010	22.860	0.010	0.220	10.020			0.860	-0.362	3.679	96.77
RV 7	JD-3		39.110	1.380	13.060	0.430	4.900	0.010	22.610	0.020	0.290	9.810			0.860	-0.362	3.655	95.77
RV 8	JD-5	420.000	40.940	1.050	13.310	0.660	4.670	0.000	24.160	0.030	0.250	10.240			1.170	-0.493	3.684	99.67
RV 8	JD-5	840.000	40.530	1.100	13.020	0.380	4.940	0.010	23.910	0.000	0.200	10.380			0.850	-0.358	3.784	98.75
RV 8	JD-5	1260.000	40.880	0.980	12.690	0.610	4.690	0.000	24.040	0.000	0.190	10.550			0.820	-0.345	3.797	98.90
RV 8	JD-5	1680.000	41.160	1.060	12.800	0.400	4.770	0.010	24.210	0.000	0.190	10.510			0.910	-0.383	3.791	99.43
RV 8	JD-5	2100.000	40.930	1.090	13.080	0.370	4.660	0.010	24.120	0.000	0.130	10.490			0.820	-0.345	3.824	99.18
RV 8	JD-5	2520.000	41.040	1.070	13.130	0.520	4.820	0.000	24.050	0.000	0.110	10.490			0.820	-0.345	3.831	99.54
RV 8	JD-5	2940.000	41.000	1.060	13.190	0.530	4.710	0.010	23.960	0.000	0.130	10.560			0.890	-0.375	3.797	99.46
RV 8	JD-5	3360.000	40.820	1.070	12.930	0.560	4.690	0.020	23.900	0.000	0.120	10.530			0.870	-0.366	3.780	98.92
RV 8	JD-5	3780.000	40.890	1.070	13.000	0.600	4.490	0.020	24.050	0.000	0.100	10.520			0.910	-0.383	3.771	99.04
RV 8	JD-5	4200.000	41.090	1.100	13.210	0.580	4.510	0.030	23.890	0.000	0.130	10.570			0.890	-0.375	3.798	99.42
RV 8	JD-5	4620.000	41.370	1.100	13.040	0.410	4.720	0.010	24.120	0.000	0.180	10.530			0.800	-0.337	3.858	99.80
RV 8	JD-5	5040.000	42.280	1.080	13.370	0.380	4.750	0.020	24.450	0.000	0.180	10.700			0.870	-0.366	3.910	101.62
RV 8	JD-5	5460.000	42.180	1.130	13.190	0.410	4.980	0.020	24.640	0.000	0.220	10.770			0.890	-0.375	3.904	101.96
RV 8	JD-5	5880.000	42.090	1.100	13.280	0.430	5.000	0.030	24.530	0.010	0.200	10.750			0.900	-0.379	3.894	101.84
RV 8	JD-5	6300.000	42.220	1.080	13.480	0.550	5.290	0.010	24.230	0.000	0.240	10.700			0.860	-0.362	3.921	102.22
RV 8	JD-5	6720.000	40.770	1.120	14.570	0.410	5.670	0.010	23.430	0.000	0.270	10.650			0.760	-0.320	3.915	101.26
RV 8	JD-5	7140.000	41.180	1.130	14.090	0.750	5.550	0.030	23.790	0.000	0.220	10.710			0.870	-0.366	3.880	101.83
RV 8	JD-5	7560.000	41.730	1.160	14.010	0.810	5.300	0.010	23.770	0.010	0.220	10.720			0.840	-0.354	3.913	102.14
RV 8	JD-5	7980.000	41.190	1.130	13.950	0.820	5.250	0.030	24.030	0.000	0.200	10.650			0.800	-0.337	3.905	101.62
RV 8	JD-5	8400.000	41.730	1.070	13.730	0.430	4.760	0.020	24.640	0.000	0.220	10.780			0.860	-0.362	3.912	101.79
RV 8	JD-5	8820.000	41.350	1.070	13.920	1.440	4.640	0.010	23.970	0.010	0.230	10.610			0.940	-0.396	3.833	101.63
RV 8	JD-5		42.240	1.070	13.280	0.430	5.010	0.010	24.580	0.000	0.120	10.750			0.960	-0.404	3.874	101.92
RV 8	JD-5		41.180	1.080	13.950	0.920	4.650	0.020	24.240	0.010	0.270	10.410			1.070	-0.451	3.779	101.13
RV 8	JD-5		41.410	1.760	13.180	0.070	7.000	0.010	22.810	0.010	0.250	10.230			0.730	-0.307	3.920	101.07
RV 8	JD-5		40.240	2.000	13.150	0.030	6.370	0.050	23.160	0.010	0.260	10.330			1.460	-0.615	3.553	100.00
RV 10	JD-4		38.070	1.830	16.360	0.080	11.090	0.110	17.760	0.000	0.480	9.290			0.650	-0.274	3.808	99.25
RV 10	JD-4		39.330	1.490	15.320	0.180	10.460	0.120	18.650	0.040	0.460	9.320			0.690	-0.291	3.819	99.59
RV 10	JD-4		39.410	1.270	13.520	1.000	5.890	0.040	23.310	0.030	0.360	9.860			1.310	-0.552	3.550	99.00
RV 10	JD-4		38.840	1.390	13.950	0.270	6.470	0.030	22.590	0.040	0.390	9.630			1.190	-0.501	3.577	97.87
RV 10	JD-4		41.460	1.070	11.270	0.350	5.630	0.020	25.050	0.120	0.340	8.690			0.990	-0.417	3.729	98.30
RV 10	JD-4		40.010	1.380	13.720	0.360	6.330	0.030	23.370	0.030	0.300	9.860			0.860	-0.362	3.801	99.69
RV 10	JD-4		39.140	1.570	15.370	0.150	10.630	0.090	18.460	0.040	0.440	9.300			0.630	-0.265	3.835	99.39
RV 10	JD-4	80.000	37.710	1.750	14.910	0.180	9.610	0.110	18.090	0.120	0.460	9.270			0.710	-0.299	3.672	96.29
RV 10	JD-4	160.000	38.270	1.680	15.320	0.180	10.460	0.120	18.000	0.060	0.440	9.130			0.650	-0.274	3.757	97.79
RV 10	JD-4	240.000	37.210	1.430	14.700	0.170	10.700	0.100	17.990	0.150	0.410	8.900			0.720	-0.303	3.631	95.81
RV 10	JD-4	320.000	37.490	1.500	15.400	0.180	10.380	0.110	18.140	0.050	0.450	8.950			0.650	-0.274	3.711	96.74
RV 10	JD-4	400.000	38.990	1.520	15.210	0.210	10.670	0.120	18.390	0.030	0.460	9.270			0.640	-0.269	3.811	99.05
RV 10	JD-4	480.000	38.690	1.570	15.420	0.170	10.560	0.110	18.570	0.070	0.440	9.160			0.700	-0.295	3.784	98.95

[redacted] (con[redacted]

Southern Alberta

COMMENTS:Cr2O3 not used in calculation.

Formula Based on 12 O + (OH+F+Cl)

Molecular Weights of Oxides

			60.090 SiO2	79.900 TiO2	101.940 Al2O3	152.020 CR2O3	71.850 FeO*	70.940 MnO	40.320 MgO	56.080 CaO	61.980 Na2O	94.200 K2O	153.360 BaO	35.457 Cl	19.000 F	17.000 (F,Cl)	18.010 H2O	Total
RW 10	JD-4	560.000	37.020	1.320	14.670	0.100	9.870	0.110	16.640	0.070	0.520	9.000			0.680	-0.286	3.561	93.27
RW 10	JD-4	640.000	38.940	1.720	15.440	0.070	10.930	0.130	18.380	0.060	0.480	9.190			0.640	-0.269	3.833	99.54
RW 10	JD-4	720.000	38.700	1.880	16.050	0.080	8.530	0.090	19.690	0.050	0.480	9.440			0.800	-0.337	3.789	99.24
RW 10	JD-4		37.170	3.070	15.030	0.010	15.600	0.090	15.360	0.120	0.470	8.640			0.350	-0.147	3.872	99.63
RW 10	JD-4		37.160	3.120	15.170	0.020	16.110	0.100	14.680	0.040	0.540	8.850			0.410	-0.173	3.842	99.87
RW 10	JD-4		40.010	1.610	15.050	0.190	10.700	0.100	18.160	0.040	0.460	9.930			0.810	-0.341	3.792	100.51
RW 10	JD-4		36.440	2.970	15.370	0.020	15.560	0.120	15.280	0.010	0.480	8.980			0.380	-0.160	3.831	99.28
RW 10	JD-4		40.710	1.550	13.200	0.390	6.420	0.030	23.470	0.040	0.250	9.690			0.810	-0.341	3.845	100.06
RW 11	JD-4	286.000	39.750	1.660	14.240	0.370	6.520	0.020	22.390	0.000	0.480	9.760			1.080	-0.455	3.696	99.51
RW 11	JD-4	572.000	38.500	1.730	13.710	0.950	12.680	0.060	17.470	0.000	0.550	9.350			0.950	-0.400	3.597	99.15
RW 11	JD-4	858.000	39.810	1.130	13.180	0.500	13.340	0.100	18.370	0.010	0.420	9.660			0.860	-0.362	3.712	100.73
RW 11	JD-4	1144.000	40.540	1.210	13.340	0.350	8.670	0.050	21.670	0.000	0.180	10.350			1.070	-0.451	3.704	100.68
RW 11	JD-4	1430.000	41.230	1.230	13.780	0.360	5.290	0.020	23.700	0.000	0.210	10.440			1.220	-0.514	3.706	100.67
RW 11	JD-4	1716.000	40.700	1.240	13.920	0.650	5.060	0.020	23.590	0.000	0.180	10.500			1.070	-0.451	3.739	100.22
RW 11	JD-4	2002.000	40.690	1.240	14.000	0.630	5.210	0.030	23.690	0.000	0.180	10.520			1.090	-0.459	3.742	100.56
RW 11	JD-4	2288.000	40.730	1.170	13.150	0.460	7.310	0.030	22.590	0.000	0.290	10.290			1.020	-0.429	3.733	100.34
RW 11	JD-4	2574.000	39.220	1.150	13.540	0.580	11.960	0.090	18.890	0.010	0.320	9.850			0.960	-0.404	3.645	99.81
RW 11	JD-4	2860.000	39.040	1.260	13.870	1.050	12.470	0.080	18.200	0.020	0.660	9.060			0.980	-0.413	3.626	99.90
RW 11	JD-4	3146.000	39.260	0.540	14.390	0.030	8.560	0.050	20.430	0.010	0.560	9.670			1.210	-0.509	3.543	97.74
RW 11	JD-4	3432.000	39.250	1.190	13.560	0.050	7.480	0.050	21.450	0.000	0.530	9.770			1.260	-0.531	3.525	97.58
RW 11	JD-4		40.070	1.260	14.060	0.740	6.070	0.020	23.100	0.000	0.200	10.310			0.990	-0.417	3.747	100.15
RW 11	JD-4		37.860	1.850	13.550	0.060	9.450	0.060	19.610	0.010	0.390	9.340			1.280	-0.539	3.426	96.35
RW 11	JD-4		40.820	1.300	12.620	0.170	7.930	0.030	22.500	0.010	0.570	9.750			0.800	-0.337	3.821	99.98
RW 11	JD-4		39.130	1.510	14.050	0.810	6.500	0.020	22.450	0.010	0.450	10.070			1.270	-0.535	3.571	99.31
RW 11	JD-4		39.610	1.380	14.000	0.930	6.430	0.030	22.540	0.000	0.370	10.090			1.280	-0.539	3.586	99.71
RW 11	JD-4		40.610	1.160	13.580	0.660	5.240	0.010	23.460	0.000	0.190	10.300			0.670	-0.282	3.883	99.48
RW 11	JD-4		40.140	1.100	13.610	0.620	5.190	0.000	23.420	0.040	0.310	10.110			0.670	-0.282	3.854	98.78
RW 12	JD-4	900.000	39.040	1.430	13.760	0.450	6.560	0.030	23.100	0.020	0.370	9.860			0.900	-0.379	3.731	98.87
RW 12	JD-4	1800.000	40.250	1.070	12.650	0.220	5.810	0.020	24.280	0.000	0.210	10.270			0.820	-0.345	3.796	99.05
RW 12	JD-4	3600.000	40.550	1.080	12.650	0.200	5.530	0.030	24.560	0.020	0.190	10.330			0.810	-0.341	3.824	99.43
RW 12	JD-4	4500.000	40.520	1.060	13.020	0.290	5.220	0.030	24.480	0.000	0.120	10.590			0.810	-0.341	3.831	99.63
RW 12	JD-4	5400.000	40.840	1.090	12.980	0.270	5.290	0.010	24.350	0.010	0.110	10.560			0.750	-0.316	3.869	99.81
RW 12	JD-4	6300.000	40.920	1.110	12.910	0.220	5.310	0.020	24.350	0.010	0.110	10.620			0.830	-0.349	3.838	99.90
RW 12	JD-4	7200.000	40.970	1.150	13.070	0.360	5.930	0.030	23.810	0.010	0.220	10.440			0.750	-0.316	3.877	100.30
RW 12	JD-4	8100.000	39.650	1.500	13.740	0.250	6.660	0.020	22.900	0.010	0.390	10.100			1.090	-0.459	3.683	99.53
RW 12	JD-4		40.190	1.750	13.790	0.050	8.440	0.040	21.180	0.030	0.360	9.950			0.830	-0.349	3.805	100.07
RW 12	JD-4		40.240	1.780	13.860	0.070	9.110	0.040	20.540	0.030	0.420	9.850			0.790	-0.333	3.819	100.22
RW 12	JD-4		39.410	1.800	13.960	0.030	9.210	0.050	20.900	0.040	0.530	9.600			0.770	-0.324	3.804	99.78
RW 12	JD-4		40.060	1.670	13.620	0.040	7.820	0.050	22.340	0.070	0.420	9.540			0.870	-0.366	3.798	99.93
RW 12	JD-4		40.000	1.390	13.850	0.030	8.890	0.040	20.910	0.100	0.390	9.180			0.780	-0.328	3.793	99.02
RW 12	JD-4		40.590	1.140	12.770	0.620	5.170	0.010	24.220	0.010	0.120	10.560			0.820	-0.345	3.809	99.49
RW 12	JD-4		39.830	1.610	13.480	0.050	8.520	0.050	21.490	0.190	0.410	8.860			0.770	-0.324	3.793	98.73
RW 12	JD-4		38.740	2.620	14.280	0.100	11.800	0.060	18.630	0.000	0.450	9.960			0.620	-0.261	3.851	100.85
RW 12	JD-4		40.050	1.750	14.090	0.060	8.930	0.040	20.990	0.010	0.450	9.310			0.690	-0.291	3.867	99.95

APPENDIX 2

DESCRIPTIONS
OF
HEAVY MINERAL
SEPARATES

The following are brief notes made during microscopic examination of preliminary heavy mineral separates produced by Loring Laboratories on Sweet Grass Intrusives. All descriptions are based upon observations made under binocular microscope.

SAMPLE 93 - RW - 2 - Sandstone host to Black Butte

The sample consists predominantly of quartz and ilmenite with lesser phlogopite, minor muscovite, trace alkali feldspar in a carbonate matrix. Quartz and feldspar grains are sub-rounded. Recognizable ß-quartz crystal morphology rare, however, relict crsytal faces are evdent on many grains. Ilmenite grains are sub-angular to angular, some almost equigranular. Phlogopite (biotite?) crenulated in some instances and is light to medium golden brown in colour, several euhedral masses observed.

SAMPLE 93 - RW - 3 - Soil sample from southeast margin of Black Butte.

Euhedral phlogopite with distinct zoning across a sharply defined boundary. Black to dark brown core with inclusions comprises 85-90% of crystal. The golden-yellow rims are inclusion-free. Black amphibole (120° cleavage) noted, not sure if it is uralitized pyroxene or primary amphibole. Ilmenites have a black metallic lustre and range from ahedral to angular in crystal morphology. Clinopyroxenes are light to medium green in colour and have a columnar to euhedral morphology.

SAMPLE 93 - RW - 4 - Black Butte

Three black to dark gun metal blue, bladed crystals with irregular (monoclinic or triclinic) crystal boundaries - kyanite(?). Clinopyroxene is present as a light to medium green, euhedral, columnar crystals. Larger fragments are blocky in nature (xenocryst fragments). Phlogopites have a golden yellow core with black to dark brown rims. Weakly defined, broad crenulations are evident in some crystals. Ilmenite is presenr as an anhedral phases with a black metallic lustre.

SAMPLE - RW - 5 - Black Butte Nodule Suite - felsic granitoid to ultramafic nodules

Abundant phlogopite comprised of predominantly subhedral crystals, subordinate euhedral, with no zoning evident. Minor black to dark brown clinopyroxenes having zircon(?) inclusions were identified. Clinopyroxenes are predominantly translucent light to medium green. The population is dominated by blocky fragments, euhedral crystals are rare. Some of the clinpyroxenes are intergrown with phlogopite (origin: biotite clinopyroxenite?)

SAMPLE - RW - 6 - Highly weathered dyke sample - JD-3

Phlogopites abundant, zoned from black / dark brown cores to yellow - brown rims, euhedral to subhedral crystal shapes. Some have a black, metallic lustre (exsolved ilmenite?). Light green, euhedral clinopyroxene is a highly subordinate phase with smaller cyrstals than previous samples. Several grains of ilmenite noted.

SAMPLE 93 - RW - 7 - Rock Sample - JD-3

Phlogopite has no clearly evident zoning present in black to dark brown, euhedral crystals. A subordinate population of phlogopite has zoning from golden yellow cores to brown rims. Clinopyroxenes are medium green with two possible populations evident: small, euhedral, columnar crystals (groundmass?) and larger, blocky fragments (xenocrysts). Ilmenites are present as anhedral submetallic grains and apatite(?) as cloudy to opaque white grains.

SAMPLE 93 - RW - 10 - Nodule suite - JD-4

Clinopyroxene - very abundant, anhedral fragments to euhedral, columnar crystals, light to medium grass green, some evidence of alteration to amphibole, some acicular. Minor component of medium lime green anhedral pyroxene. Magnetite present as abundant black, iridescent schiller on some faces, anhedral to subhedral, generally <1.5 mm in long dimension. Phlogopite very abundant, generally black, minor component brown, no zoning noted, subhedral to anhedral. Spinels - glassy black, non-magnetic, subhedral, relatively rare. Olivine noted, equant, medium green. Dark pink garnet (knorringite?), well rounded.

SAMPLE 93 - RW - 11 - Dark lamprophyre phase (olivine minette) - JD-4

Small nodule of intergrown phlogopite (40%) and ilmenite (60%). Much more abundant spinel, octahedral to distorted octahedral morphology, euhedral to subhedral, non-magnetic --> chromite(?). Clinopyroxene similar to RW-10, mainly blocky fragments, subordinate euhedral columnar crystals, however fewer darker green (high chrome) crystals. Phlogopite, subhedral, black to dark brown, no zoning apparent optically. Ilmenite rounded xeno / phenocrysts, black, metallic, anhedral.

SAMPLE 93 - RW - 12 - Deeply weathered dyke phase east of vent phase - JD-4

Dominated by abundant anhedral, pale green diopside, minor component with euhedral relict crystal morphology, majority now angular fragments. Phlogopite, anhedral to subhedral, black to dark brown. Oscillatory zoning noted in one groundmass sample. Subordinate euhedral, equant (octahedral to distorted octahedral) spinel crystals; black, metallic, <0.5 mm, non-magnetic --> chromite(?). Many poikilitically enclose phlogopite. Minor component of larger spinels, rounded, ≤ 1.5 mm diameter. Minor component of darker green (high chrome) diopside, zoning apparent, angular fragments. Chromite/spinel overgrown by phlogopite. Ilmenite up to 2 mm in long dimension; black, anhedral to subhedral. Olivine larger in this sample than in previous samples, equant, euhedral.

The following is taken from a report on a sample taken from the Black Butte occurrence and processed by C.F. Minerals.

SUMMARY OF MINERALOGICAL / CHEMICAL ANALYSIS

One 56.5 kg rock sample taken at a single location, northeast end of Black Butte, southeastern Alberta.

The Cr_2O_3 - TiO_2 plot of chromites indicates that the Black Butte diatreme is a lamproite or kimberlite. In a file of 1000 chromites from worldwide non kimberlite or lamproite sources, no chromites other than chrmoite from kimberlite or lamproite have ever plotted above the line. Abount 28% of chromites from kimberlites and lamproite, plot above the line.

The Cr2O3 - MgO plot with the field of diamond inclusion by diamond intergrowth chromites, indicates that seven chromites were detected that came from a chromite harzburgite source of diamond. The listing indicates that the Black Butte pipe may have also intruded "E" eclogitic source of diamond. The Black Butte lamproite originates from a sufficiently deep seated magma to have tapped at least one source (chromite harzburgite) of diamond.

The following minerals detected in the Black Butte sample typically occur in lamproite:

Low Al-amphibole

Armacolite

Sr apatite (former grain)

CP5 and CP6 clinopyroxenes (Cr-diopside)

G9 and G11 pyropes

(Mn-rich) ilmenite

Sr apatite occurs in lamproites of deep derivation.

Kimberlites and lamproites are the only terrestrial igneous rocks known to carry the rare mineral armacolite, which is probably mantle-derived.

Corundum and possible coesite have been reportedly found in the Black Butte lamproite. It is noteworthy that coesite is produced in the laboratory at 3500 atm and 500 to 800°C.

The whole rock analysis indicates that the major element composition of the Black Butte sample is typical of lamproites.

APPENDIX 3

THIN SECTION DESCRIPTIONS

SAMPLE **ABRW93Z-70** **(JD-4)**

Mineralogy

Large crystals of **hornblende**, very altered, constitute about 35% of the volume, **phlogopite** (20%) showing some alteration at the rims of the grains. Altered **plagioclase** and **K-feldspar** constitute about 40-45% (≈20% each) of the sample, and they show sericitic alteration. The feldspars are interstitial to the hornblende and phlogopite. There are also traces (a few grains) of **olivine** and **aegirine**.

Texture

The texture is seriate and hypidiomorphic granular. One important feature to note in this sample is that it has a chilled margin, which brings in fingerlike protrusions of glassy material, olivine, phlogopite and Fe-Ti oxides.

Provenance Intrusive

Name *Minette*

SAMPLE **ABRW93Z-71** **(JD-4)**

Mineralogy

Pyroxene ([titaniferous?] diopside) phenocrysts constitute about 30% of the volume of the rock. They are relatively fresh, save for a few grains showing faint reaction rims. **Olivine** (20%) occurs as fresh microphenocrysts or as large phenocrysts which are now serpentinized and have calcite core (indicating that the monticellite component must have been high - if in fact those relict grains weren't entirely monticellite). Poikilitic **sanidine** occurs as about 10% of the total volume of the sample. **Phlogopite** constitutes about 25% of the volume and it occurs as phenocrysts and in the groundmass. The rest of the sample is devitrified **glass** and **Fe-Ti oxides**.

Texture

The texture of the sample is porphyritic, with poikilitic patches of sanidine. No flow alignment can be detected.

Provenance Extrusive

Name *Pyroxene-phlogopite lamprophyre*

Sample: ABRW93Z-73 (JD-4)

Mineralogy:

The sample is composed largely of euhedral **diopside** (30-35% vol.), which occurs in a range of sizes, from 0.05mm to phenocrysts of several millimeters in diameter. The larger grains of diopside exhibit compositional zoning, and are often fractured. **Phlogopite** and **olivine** (15 and 10% volume, respectively) also occur as phenocrysts and as groundmass. The largest phlogopite grains also show compositional zoning. olivine is partly serpentinized, and occasionally shows calcite cores (probably alteration of monticellite-rich olivine). Some of the fresher grains of olivine contain small phlogopite inclusions. All the olivine phenocrysts are also euhedral and fractured. The remaining 45% of the sample contains devitrified and altered **glass** (25-30%), **calcite, Fe-Ti oxides** and a low relief, low birefringence anhedral mineral (possibly **sanidine** or a feldspathoid; probing is required to determine its composition).

Texture:

The sample shows a slight flow alignment of the tabular minerals. Pyroxene, olivine and phlogopite occur in glomeroporphyritic aggregates of about 2 to 5 mm in diameter. The textures of these xenolithic assemblages is granular.

Provenance: Extrusive

Name: *Pyroxene-phlogopite Lamproite*

ABRW93AA-90

Phenocrysts (JD-2)

Phlogopite
Mode: 30%
Size Range: up to 1 mm
Shape: euhedral
General: Reddish (Fe, Ti-rich) rims

Clinopyroxene
Mode: 35%
Size Range: up to 2 mm
Shape: subhedral
General: Colourless, often with strongly altered cores

Olivine
Mode: 5-10%
Size range: up to 1 mm
Shape: euhedral
General: Completely pseudomorphed by calcite and a very fine-grained serpentine-like alteration mineral. Tentatively identified as having been olivine based on pseudomorph shape.

Matrix

Minerals: Clinopyroxene, Biotite, Sanidine(?), very fine-grained opaques

Texture: Texture is fine-grained and turbid, making matrix mineral identification somewhat difficult. Possible sanidine in the matrix based on low relief, low birefringence, and radiating habit.

Rock Name: Biotite-Augite lamprophyre

Sample: ABRW93AA-91 (JD-2)

Mineralogy:

Olivine and **diopside** are the most abundant phases in this sample (35 and 30% volume, respectively). The olivine occurs as completely serpentinized phenocrysts larger than 2 mm in diameter, while the diopside is fresher and occurs as microphenocrysts between 1 and 2 mm in diameter. **Phlogopite** (15%) also occurs as large phenocrysts (>2mm long), and shows compositional zoning. **Calcite** occurs in sparse patches (~5% volume) and it is usually surrounded by **Fe-Ti oxides**, which also form part of the groundmass, together with devitrified glass.

Texture:

The sample overall shows a subtrachytic texture, as evidenced by the faint alignment of the phlogopite phenocrysts.

Provenance: Extrusive

Name: *Phlogopite Lamprophyre*

PETROGRAPHIC EXAMINATION REPORT

Black Butte

by B. Scott-Smith

Description

LAMPROPHYRE

Estimated mode

Phenocrysts		Groundmass	
Phlogopite	15%	Pyroxene	6%
Pyroxene	15%	Phlogopite	12%
Mafic pseudomorphs	16%	Altered mafics	5%
		Opaques	3%
		K-feldspar(?)	28%

This is a fine-grained, mafic-rich, porphyritic rock of distinctive composition.

Sharply euhedral phenocrysts make up about half of the rock. They are of three kinds, occuring in approximately equal proportions.

Phlogopite, as elongate flakes and stumpy books, 0.1-2.0 mm in size, and colour-less clinopyroxene (diopside), as stumpy, prismatic grains, 0.05-1.0mm in size, are strikingly fresh. The pyroxene occasionally shows skeletal or coalescent-pellety texture, and is also seen as aggregates of tiny euhedra.

The tird phenocryt type is totally altered and exists as pseudomorphs, 0.2-1.5mm in size, composite of indeterminate, minutely fibrous/felted, olivine brown secondary minerals, plus minor carbonate. These often show clearly defined, 6-sided, prismatic forms and, sometimes, a patchy/cellular internal structure. No relict cleavage is apparent. These features suggest that they may have originated as olivine. A few of them enclose tiny flakes of fresh phlogopite. Rare cases are seen where the same assemblage as makes up the pseudomorphs forms coarser, elongate-irregular or rounded patches, 2 or 3 mm in size, having the appearance of amygdules.

The phenocrysts are set in a fresh, microgranular groundmass, of grain size 5-30 microns, consisting of a meshwork of tiny prismatic grains of the same components as make up the phenocrysts, plus minute granules of opaques, set in a low-birefringent matrix which takes a strong cobaltinitrate stain, and is presumably K-feldspar.

The phenocrysts generally show random orientation. One of the slides includes local zones which have the appearance of xenoliths of the same (or closely similar) lithotype, in which a weak flow-type orientation of the elongate phenocrysts is detectable.

This rock appears to be a form of LAMPROPHYRE. The mineral assemblage, in particular the abundance of possible altered olivine, is characteristic of the variety PHLOGOPITE LAMPROITE (probably VERITE).

APPENDIX 4

WHOLE ROCK
AND
TRACE ELEMENT
GEOCHEMICAL ANALYSES

Sample			SiO2 (%)	TiO2 (%)	Al2O3 (%)	Fe2O3 (%)	MnO (%)	MgO (%)	CaO (%)	Na2O (%)	K2O (%)	P2O5 (%)	BaO (%)
Detection Limits													
Avg. Ultramafic			43.4	0.13	2.7	8.34	0.13	4.11	3.8	0.3	0.06	0.05	
Kimberlite(Low)			20	0.5	0.5	2		12	0.5	0	0	0	
Kimberlite (High)			48	8	13	11		40	15	2	3	1.5	
Kimberlite (avg)			35.2	2.32	4.4	9.8	0.11	27.9	7.6	0.32	0.98	0.7	
Lamproite (Low)			40	1	4				2	0.2	5	0.5	
Lamproite (High)			55	5	10				10	1.5	10	2	
RW93-1		1	50.14	0.89	10.97	7.37	0.15	8.46	8.28	2.12	7.13	0.96	
RW93-2 - Host Sediments		2	76.84	0.42	9.58	2.16	0.02	0.93	1.59	1.75	2.22	0.21	
RW93-3		3	50.06	0.88	9.96	7.26	0.13	7.66	8.97	2.19	6.28	0.95	
RW93-4		4	49.29	0.96	10.78	7.55	0.14	8.64	8.11	2.58	7.01	1.06	
RW93-5		5	41.89	0.99	10.81	9.01	0.16	11.23	12.10	1.65	4.28	1.32	
RW93-6		6	48.58	1.00	10.89	8.04	0.14	8.98	6.21	1.75	5.61	0.91	
RW93-7		7	49.09	1.05	10.15	8.57	0.14	9.62	6.69	1.67	6.33	1.01	
RW93-8		8	45.85	1.04	10.68	8.23	0.14	10.99	7.42	1.19	7.97	0.98	
RW93-9		9	31.61	0.56	5.99	8.94	0.18	2.22	22.67	0.62	8.28	1.28	
RW93-10		10	42.49	1.30	10.45	11.89	0.21	10.44	10.65	1.36	3.17	1.14	
RW93-11		11	47.61	1.01	10.07	9.39	0.15	11.90	7.76	1.79	4.83	0.98	
RW93-12		12	46.35	0.98	9.19	9.40	0.15	13.16	7.69	1.54	4.56	0.90	
RW 93-14 (Soil)		13											
RW 93-15 (Soil)		14											
RW 93-16 (Soil)		15											
RW 93-18		16	50.55	0.92	10.85	7.56	0.10	9.21	6.33	1.73	4.91	1.00	
RW 93-19		17	47.54	0.92	9.91	8.97	0.13	10.54	7.32	1.82	4.73	1.07	
RW 93-20		18	54.03	0.87	10.56	6.9	0.12	7.72	7.08	2.67	6.52	1.13	
Cerro Negro #1		19	50.97	0.89	10.45	7.06	0.13	8.24	7.96	2.50	6.92	0.97	
Cerro Negro #2		20	49.88	0.89	10.25	7.20	0.13	8.83	8.47	2.45	6.51	0.97	
Cerro Negro #3		21	46.10	1.10	10.44	8.38	0.15	11.72	9.22	2.32	6.42	0.91	
Cerro Negro #4		22	50.71	1.00	11.56	7.43	0.13	8.32	7.67	2.72	7.04	1.08	
ABRW93AA-90	JD-2	-27	46.36	0.99	8.56	9.62	0.14	13.31	8.59	0.85	4.56	1.11	0.36
ABRW93AA-91	JD-2	-28	38.1	1.02	8.71	9	0.22	8.11	13.06	1.1	5.1	1.03	0.36
ABRW93Z-70	JD-4	-29	47.47	1.01	8.52	7.91	0.11	13.74	9.52	0.88	4.57	0.79	0.34
ABRW93Z-71	JD-4	-30	49.14	0.97	8.86	9.28	0.13	11.79	8.16	1.34	4.59	1.09	0.36
ABRW93Z-73	JD-4	-31	51.96	1.02	9.69	9.65	0.15	12.02	7.45	1.77	4.87	1.01	0.33
ABRW93Z-78 - Sed.	JD-4	-32	60.55	0.61	10.7	5.25	0.07	5.11	4.62	1.71	3.29	0.35	0.16
ABRW93Z-82	JD-4	-33	62.89	0.55	10.67	5.16	0.08	5.58	3.16	1.89	3.28	0.29	0.14
ABRW93Z-70	JD-4	-34											
KIA92 200A	JD-4	35	48.74	1.05	9.94	10.12	0.14	13.63	7.96	1.14	4.43	1.11	
KIA92 205	JD-8	36	60.71	0.47	17.24	5.82	0.15	1.71	5.6	4.03	2.71	0.31	
KIA92 217B	JD-1	37	50.93	0.95	10.41	7.66	0.16	9.97	9.11	1.62	6.14	1.07	
KIA92 221A	JD-3	38	51.9	1.1	10.92	8.99	0.13	10.37	6.1	1.64	5.99	1.12	
KIA92 222B	JD-5	39	46.15	1.06	11.24	8.47	0.19	11.03	11.2	0.62	7.15	1.07	
KIA92 224E	JD-2	40	47.39	1.07	9.5	10.74	0.15	14.5	8.12	0.74	4.7	1.13	
KIA92 225		41	45.01	1.5	11.93	6.64	0.12	6.91	11.94	1.19	8.56	1.57	

*NOTE: KIA92 samples from Kjarsgaard's paper in Current Research 1994-B

LOI (%)	Total (%)	K_2O/ Na_2O	K/Al	K + Na / Al	Mg/ (Mg+Fe)	La/Yb	Au PPB	Ag PPM	Ag PPM	Al %	As PPM	B PPM	Ba PPM	Ba PPM	Be PPM	Bi PPM	Br PPM
							2	5	5	→	0.5		50				0.5
		0.20	0.02	0.13									20				
													137				
		1.50	0.23	0.38									1970				
10.7		3.06	0.22	0.30			0.01	0.13	0.1			36	1100	1100	1.6		
		>3	>1	>1													
														Calc.			
3.23	99.70	3.36	1.02	1.41		44.2	0.02	0.05	0.0	5.8	0.05		5200	4530	4	0.5	0.05
3.19	98.94	1.27	0.37	0.63		14.8	2	0.05	0.0	5.01	7.9		720	744	2	0.5	0.9
5.26	99.61	2.87	0.95	1.30		38.4	2	0.05	0.0	5.51	2.3		4700	4431	5	0.5	0.05
3.72	99.83	2.72	1.03	1.43		38.5	0.02	0.05	0.0	5.44	2.5		5100	5084	5	0.5	0.05
5.28	98.72	2.59	0.60	0.84		27.7	0.02	0.05	0.0	5.91	3.4		3500	3461	3	0.5	0.05
6.52	98.62	3.21	0.82	1.09		32.3	3	0.05	0.0	5.65	3.3		3200	3480	4	0.5	0.05
4.92	99.23	3.79	0.96	1.23		37.5	3	0.05	0.0	5.47	2.7		3900	3873	4	0.5	0.05
4.40	98.88	6.70	1.11	1.29		27.3	0.02	0.05	0.0	5.94	2.1		6400	3950	4	0.5	0.05
17.76	100.11	13.35	0.91	1.06		25.8	0.02	0.05	0.0	2.88	3.8		2300	2304	2	0.5	0.05
6.68	99.77	2.33	0.76	0.97		26	0.02	0.05	0.0	5.3	2.8		4000	3820	2	0.5	0.05
3.74	99.21	2.70	0.76	1.06		31.1	4	0.05	0.0	5.26	2.7		3700	3511	4	0.5	0.05
5.29	99.22	2.96	0.76	0.99		31.4	5	0.05	0.0	5.01	1.9		2800	3245	4	0.5	0.05
			0.33	0.58		12.2	3	<5	0.5	4.4	5.1		680		<2	<5	2.8
			0.31	0.55		11.3	<2	<5	<.4	4.87	6.5		740		<2	<5	3.9
			0.28	0.39		11.6	<2	<5	<.4	6.89	9.8		710		<2	<5	7.4
5.70	99.26	2.84	0.71	2.86		31.5	8	<5	<0.4	5.53	22		3127	2500	2	<5	3
6.31	99.26	2.60	0.70	3.19		35.1	<5	<5	<0.4	5.08	6		3297	2600	2	<5	2
2.1	99.69	2.44	0.96	4.33		47.7	<5	<5	<0.4	5.34	41		4375	3400	4	<5	<1
3.24	99.33	2.77	1.02	1.35		45.7	7	0.05	0.0	5.63	2		4100	4675	5	0.5	3.8
3.20	98.76	2.66	1.01	1.35		42	3	0.05	0.0	5.36	1.9		4200	4550	4	0.5	4.2
3.88	100.64	2.77	1.04	1.33		40	6	0.05	0.0	5.13	0.05		3500	4425	5	0.5	0.05
3.05	100.71	2.59	1.04	1.37		42.7	2	0.05	0.0	5.62	1.2		4300	5556	4	0.5	0.05
5.54	99.99	5.36	0.54	0.63		13.3	5	<.2		3.03	<5	10	2280			25	<0.5
14.2	100.01	4.64	0.51	0.69		15.4	5	<.2		2.54	<5	10	1170			15	<0.5
5.15	100.01	5.19	0.90	0.94		12.5	5	<.2		3.02	<5	8	925			25	<0.5
4.28	99.99	3.43	0.63	0.72		13.3	5	<.2		2.81	5	12	1835			20	<0.5
0.1	100.02	2.75	0.58	0.76		12.5	5	<.2		2.92	<5	8	1505			20	<0.5
7.59	100.01	1.92	0.34	0.48		7.14	5	<.2		3.06	<5	8	595			15	<0.5
6.32	100.01	1.74	0.32	0.47		4.55	5	<.2		3.46	<5	8	595			20	<0.5
			0.90	0.94		ERR		<.2		3.19	<5	8	935			30	<0.5
3.91	102.17	3.89	0.70	0.70		32.5	<5	<.2		5.26			3210				
1.24	99.99	0.67	0.25	0.25		26.9	<5	<.2		9.13			937				
3.88	101.9	3.79	0.92	0.92		44.2	<5	<.2		5.51			4771				
3.54	101.8	3.65	0.86	0.86		31.2	<5	<.2		5.78			3651				
7.01	105.19	11.53	1.00	1.00		27	2	<.2		5.95			3730				
4.73	102.77	6.35	0.78	0.78		31.7	4	<.2		5.03			3383				
9.83	105.2	7.19	1.12	1.12		63.8	5	<.2		6.32			4943				

Ca %	Ca %	Cd PPM	Co PPM	Cr PPM	Cs PPM	Cu PPM	Fe %	Hf PPM	Hg PPM	Ir PPB	K %	Mg %	Mn PPM	Mo PPM	Na %	Nb PPM	Ni PPM	Ni PPM	P %	Pb PPM	Pd PPB	Pt PPB
1	1		1	5	1		0.0	1	1	5		→		1	0.01		20	20				
			110	3090	0.006			0.6						0.2			1450	1450				
			35	550	0			1.6						0.1			710	710				
			130	2900	8.7			30						0.9			1600	1600				
		0.07	65	893	2.2	93		5.6	8	3			1160	1.7			965	965	3.88	15	8.1	0.2

9	6.77	0.05	42	690	4	61	7	12	0.0	0.05	5.92	5.87	910	0.01	2.24	<30	120	0.50	29
1	1.25	0.05	9	200	2	9	1.7	5	0.0	0.05	1.85	0.55	165	0.01	1.33	<20	17	0.05	10
8	7.26	0.05	42	690	3	64	6.6	11	0.0	0.05	5.21	5.5	923	0.01	1.97	260	134	0.47	45
8	6.16	0.05	40	680	3	55	6.5	12	0.0	0.05	5.61	5.6	869	0.01	2.18	150	114	0.48	25
11	9.80	0.05	68	480	8	118	.8	3	0.0	0.05	3.55	7.74	1117	0.01	1.4	140	158	0.64	6
5	4.84	0.05	43	830	4	39	7.1	12	0.0	0.05	4.66	5.82	934	0.01	1.48	190	191	0.41	21
7	5.35	0.05	49	960	3	45	7.8	13	0.0	0.05	5.25	6.39	935	0.01	1.49	250	232	0.47	23
6	6.16	0.05	60	1500	3	75	7.6	7	0.0	0.05	6.62	7.49	938	3	1.05	190	281	0.45	16
21	16.31	0.05	33	440	0.01	51	7.8	5	0.0	0.05	2.63	1.45	992	2	0.43	170	154	0.28	10
10	8.10	0.05	72	720	3	61	11	5	0.0	0.05	4.01	6.75	1321	0.01	1.12	210	274	0.50	9
7	6.01	0.05	63	1100	5	77	8.3	10	0.0	0.05	4.01	7.6	939	0.01	1.57	290	363	0.42	21
7	6.22	0.05	56	970	2	90	7.4	7	0.0	0.05	3.79	8.66	986	0.01	1.15	360	404	0.41	15
2	1.86	1.00	5	40	1	22	1.5	6	<1	<5	1.43	0.68	283	<1	1.11	<20	16	0.05	125
2	2.35	<.5	7	51	2	22	1.8	7	<1	<5	1.52	0.9	307	<1	1.18	<20	17	0.05	71
2	2.15	<.5	13	71	4	23	3.5	6	<1	<5	1.9	1.54	474	2	0.78	<20	26	0.07	19
5	4.86	<0.5	42	620	3	75	5.5	6	<1	<5	3.93	5.68	673	<5	11.9	480	222	0.37	19
6	5.46	<0.5	44	720	3	79	6.1	5.1	<1	<5	3.58	6.37	846	<5	12.6	380	259	0.38	15
6	5.39	<0.5	32	460	3	60	4.7	6.9	<1	<5	5.13	4.91	787	<5	18	350	103	0.42	37
6	6.46	0.05	33	550	4	56	5.4	10	0.0	0.05	5.75	5.67	855	0.01	1.85	120	115	0.46	29
7	6.66	0.05	34	670	3	53	5.5	9	0.0	0.05	5.4	5.89	850	0.01	1.81	130	124	0.44	22
6	6.88	0.05	39	960	3	55	5.7	8	0.0	0.05	5.33	7.29	927	0.01	1.49	110	175	0.38	26
7	5.72	0.05	33	500	3	57	5.3	10	0.0	0.05	5.84	5.29	813	0.01	1.84	150	111	0.46	25
2.67		<1	59	505		126	5.6	7	<1	<5	1.65	6.69	813	6	0.26	452		0.43	24
9.17		<1	57	673		113	5.9	7	<1	<5	1.3	4.9	1722	2	0.45	434		0.41	16
2.66		<1	53	660		94	4.4	5	<1	<5	2.72	6.01	528	1	0.12	274		0.31	12
1.96		<1	52	502		111	5.2	7	<1	<5	1.77	5.6	608	1	0.25	381		0.44	28
1.66		<1	50	484		102	5.3	7	<1	<5	1.68	5.66	789	<1	0.54	363		0.41	26
3.45		<1	25	193		45	3.9	7	<1	<5	1.03	3.32	586	<1	0.43	102		0.18	22
2.41		<1	23	212		45	3.9	6	<1	<5	1.1	3.93	635	3	0.53	78		0.16	26
2.76		<1	56	694		99	4.7				2.87	6.3	553	2	0.12	289		0.33	18
				1015		90		6			3.68					12	492		22
				39		21		3			2.25					11	39		18
				561		43		7			5.1					14	195		49
				818		54		9			4.97					18	324		29
				1436		86		4			5.93					10	321		20
				1075		91		6			3.9					11	535		18
				587		95		11			7.1					22	147		36

Rb PPM	Rh PPB	Sb PPM	Sc PPM	Se PPM	Sn PPM	Sr PPM	Sr PPM	Sr PPM	Ta PPM	Th PPM	Ti %	U PPM	V PPM	W PPM	Y PPM	Y PPM	Zn PPM	Zn PPM	Zr PPM
5		0.1	0.1	5	100	500	500	500	0.5	0.2		0.5		1			50	50	
1.2			15	0.02	0.52	22	22	22	<.1								56	56	
0			7	0.05	1	40	40	40	1.4								15	15	
350			30	0.28	30	1900	1900	1900	21.3								287	287	
73	7.1		14	0.15	5.4	851	851	851	11	17		3.1	100		22	22	69	69	184
210		1.1	28	0.03	<170	2700	1645	1750	0.05	14	0.5	4	113	3	22	19	146	72	239
81		1	7.6	0.03	<100	<500	206	225	0.05	8.6	0.21	3.3	47	0.01	23	11	57	40	114
210		1	26	0.03	<150	2600	1653	1678	0.05	13	0.47	3.8	111	0.01	22	18	130	85	236
220		0.6	26	0.03	<160	1900	1811	1669	1.2	14	0.47	2.6	106	0.01	23	18	129	67	241
150		0.4	33	0.03	<130	<500	748	745	0.05	3	0.52	0.05	129	4	19	14	130	76	66
210		1.1	24	0.03	<140	1700	1229	1185	0.05	16	0.5	2.9	112	0.01	25	19	139	74	276
230		0.5	25	0.03	<140	2500	1378	1374	0.05	16	0.55	3.4	119	0.01	26	19	127	79	279
300		0.8	28	0.03	<140	1900	1059	1094	0.05	6.9	0.56	3.2	130	0.01	23	14	198	68	147
93		0.6	18	0.03	<100	1600	990	972	0.05	6	0.29	1.5	80	0.01	20	12	83	44	99
180		0.6	34	0.03	<140	1400	634	597	0.05	5.6	0.64	2.9	200	0.01	21	14	194	100	111
180		0.6	30	0.03	<140	1700	1035	997	0.05	11	0.51	2.1	135	0.01	23	17	140	91	190
310		0.5	25	0.03	<120	1300	863	876	0.05	7.5	0.51	2	133	0.01	18	16	122	72	172
57		1.5	4.3	<3	<100	<500	191		<.5	5.8	0.13	1.6	32	<1	11		119	142	
54		1.2	5.3	<3	<100	<500	198		<.5	6.9	0.15	2	38	<1	13		68	59	
90		1.2	12	<3	<100	<500	132		1.6	11	0.26	2	83	<1	19		125	85	
160		0.4	21	<5	<0.01	917	1000	916	<1	7.9	0.45	2.6	126	<4	19	17	84	140	225
120		<0.2	22	<5	<0.01	940	1200	912	<1	7.2	0.45	1.4	131	<4	19	17	78	140	214
180		<0.2	19	<5	<0.01	1727	1700	1707	<1	9.7	0.43	2.2	101	<4	17	18	78	130	295
370		0.4	22	0.03	<140	2200	1749	1775	0.05	11	0.47	38	103	0.01	20	18	125	62	253
190		0.4	24	0.03	<140	2200	1729	1705	0.05	12	0.45	3.2	102	0.01	21	18	134	61	226
210		0.4	23	0.03	<130	2000	1605	1461	0.05	11	0.52	3.8	107	0.01	18	16	71	67	228
190		0.4	19	0.03	<130	2500	1940	1756	0.05	11	0.47	3.5	98	0.01	19	18	123	63	254
150		40	25	<3	400	551			0.9	7.7	0.34	<10	149	<10	27		86		
170		40	23	<3	580	698			0.9	7.6	0.23	<10	168	<10	25		91		
180		35	31	<3	640	279			1.2	5.2	0.31	<10	135	<10	23		70		
140		45	23	<3	420	402			<0.5	8.4	0.3	<10	144	<10	26		80		
160		45	23	<3	400	349			<0.5	8.6	0.31	<10	145	<10	25		83		
110		30	14	<3	80	240			1.4	11	0.17	<10	100	<10	18		75		
120		35	12	<3	120	202			<0.5	8.3	0.18	<10	113	<10	17		79		
		45			680	293					0.33	<10	142	<10	24		74		
141			21			902			0.7	8		2.2	209			16	86		224
65			10			1140			0.7	7.8		2	73			13	93		122
172			22			1999			0.8	10.9		2.7	154			17	94		271
179			16			1465			0.9	13		3.9	181			18	88		359
237			19			1069			0.6	5.5		1.6	188			13	68		158
140			20			1102			0.9	8.1		2.2	206			15	84		221
330			20			2026			0.3	40.5		17.7	190			26	96		351

La PPM	Ce PPM	Pr PPM	Nd PPM	Sm PPM	Eu PPM	Gd PPM	Tb PPM	Dy PPM	Ho PPM	Er PPM	Tm PPM	Yb PPM	Lu PPM	La PPM	Ce PPM	Pr PPM	Nd PPM	Sm PPM	Eu PPM	Gd PPM	Tb PPM	Dy PPM	Ho PPM	Er PPM	Tm PPM	Yb PPM	Lu PPM
0.5	3		5	0.1	0.2		0.5					0.2	0.05	0.3	0.9		0.6	0.2	0.077	0.3		0.3		0.2		0.2	0.0
0.9	1.9		1.4	0.4	0.2		0.12					0.4	0.06														
26	45		25	4.2	1.1		0.43					0.9	0.09														
200	522		180	29	6.5		2.05					2	0.22														
150	200		85	13	3		1					1.2	0.16														
84	160		59	13	3.8		0.05					1.9	0.32	255	185		94	64	49							9	9
37	73		22	4.7	3.2		0.7					2.5	0.4	112	84		35	23	42							11	12
73	130		63	13	3.1		0.05					1.9	0.29	222	150		100	64	40							9	9
77	140		62	32	3.5		0.05					2	0.31	234	162		98	158	45							9	9
36	74		34	8.1	2.4		1.1					1.3	0.21	109	86		54	40	31							6	6
71	140		56	11	3.3		0.05					2.2	0.44	216	162		89	54	43							10	13
75	140		61	12	3.5		0.05					2	0.4	228	162		97	59	45							9	12
41	88		31	7.8	2.4		0.05					1.5	0.27	125	102		49	38	31							7	8
31	62		29	5.5	1.6		0.05					1.2	0.21	94	72		46	27	21							5	6
39	77		33	7.9	2.2		0.05					1.5	0.26	119	89		52	39	29							7	8
56	110		48	9.7	2.7		0.05					1.8	0.32	170	127		76	48	35							8	9
44	87		39	7.8	2.3		0.05					1.4	0.24	134	101		62	38	30							6	7
22	41		15	3.1	0.9		<.5					1.8	0.32	67	47		24	15	12							8	9
26	50		20	3.8	1		<.5					2.3	0.4	79	58		32	19	13							10	12
37	76		30	5.5	1.3		<.5					3.2	0.53	112	88		48	27	17							15	16
41	79		41	7.3	1.9		0.7					1.3	0.22	124	91		65	36	25							6	6
39	77		40	7.2	2		<0.5					1.1	0.2	117	89		63	35	26							5	6
53	100		48	8.7	2.3		0.7					1.1	0.19	160	116		76	43	30							5	6
64	120		53	10	3		0.05					1.4	0.005	195	139		84	49	39							6	0
63	120		49	10	2.8		1.2					1.5	0.28	191	139		78	49	36							7	8
52	100		39	8.4	2.4		1.1					1.3	0.24	158	116		62	41	31							6	7
64	120		51	9.9	2.8		0.05					1.5	0.26	195	139		81	49	36							7	8
20			37	7.7			1.1					1.5	0.25	61	0		59	38	0							7	7
20			29	7.4			0.6					1.3	0.16	61	0		46	36	0							6	5
10			23	5.4			<0.5					0.8	0.12	30	0		37	27	0							4	4
20			37	7.4			<0.5					1.5	0.23	61	0		59	36	0							7	7
20			40	7.4			<0.5					1.6	0.23	61	0		63	36	0							7	7
20			28	5.8			<0.5					2.8	0.4	61	0		44	29	0							13	12
10			29	5			<0.5					2.2	0.4	30	0		46	25	0							10	12
10																											
39	85	10	43	7.9	2.2	7	0.7	3.6	0.6	1.6	0.2	1.2	0.2	119	98		68	39	29							5	6
35	66	7	29	5.3	1.6	4.8	0.5	2.6	0.5	1.3	0.2	1.3	0.2	106	76		46	26	21							6	6
53	113	14	54	9.5	2.6	8.6	0.7	4	0.6	1.6	0.2	1.2	0.2	161	131		86	47	34							5	6
53	116	14	53	9.3	3.7	8.9	1	3.8	0.7	1.7	0.2	1.7	0.2	161	134		84	46	48							8	6
27	59	7	30	5.9	1.6	5.1	0.5	2.8	0.5	1.3	0.2	1	0.2	82	68		48	29	21							5	6
38	82	10	43	8.2	2.1	5.3	0.6	3.3	0.6	1.5	0.2	1.2	0.2	116	95		68	40	27							5	6
102	225	28	111	16	5.1	12	1.2	4.6	0.8	1.9	0.2	1.6	0.2	310	260		176	78	66							7	6

Report #1159

DIGHEMV SURVEY

for

MARUM RESOURCES INC.
&
ROMAN WALL CORPORATION

MILK RIVER AREA, ALBERTA

NTS 72E/2,3

Dighem, A division of CGG Canada Ltd.
Mississauga, Ontario
February 18, 1994

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Geophysicist

A1159FEB.94R

SUMMARY

This report describes the logistics and results of a DIGHEM^{V} airborne geophysical survey carried out for Marum Resources Inc. over a property located near Milk River, Alberta. Total coverage of the survey block amounted to 1020 km. The survey was flown from November 10 to November 12, 1993.

The purpose of the survey was to define anomalies with possible pipe-like sources and to provide information that could be used to map the geology and structure of the survey area. This was accomplished by using a DIGHEM^{V} multi-coil, multi-frequency electromagnetic system, supplemented by a high sensitivity Cesium magnetometer and a four-channel VLF receiver. The information from these sensors was processed to produce maps which display the magnetic and conductive properties of the survey area. A GPS electronic navigation system, utilizing a UHF link, ensured accurate positioning of the geophysical data with respect to the base map. Visual flight path recovery techniques were used to confirm the location of the helicopter where visible topographic features could be identified on the ground.

The survey property contains several anomalous features, many of which are considered to be of moderate to high priority as exploration targets. Most of the inferred bedrock conductors appear to warrant further investigation using appropriate surface exploration techniques. Areas of interest may be assigned priorities on the basis of supporting geophysical, geochemical and/or geological information. After initial

investigations have been carried out, it may be necessary to re-evaluate the remaining anomalies based on information acquired from the follow-up program.

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APPENDICES

A. List of Personnel
B. Statement of Cost
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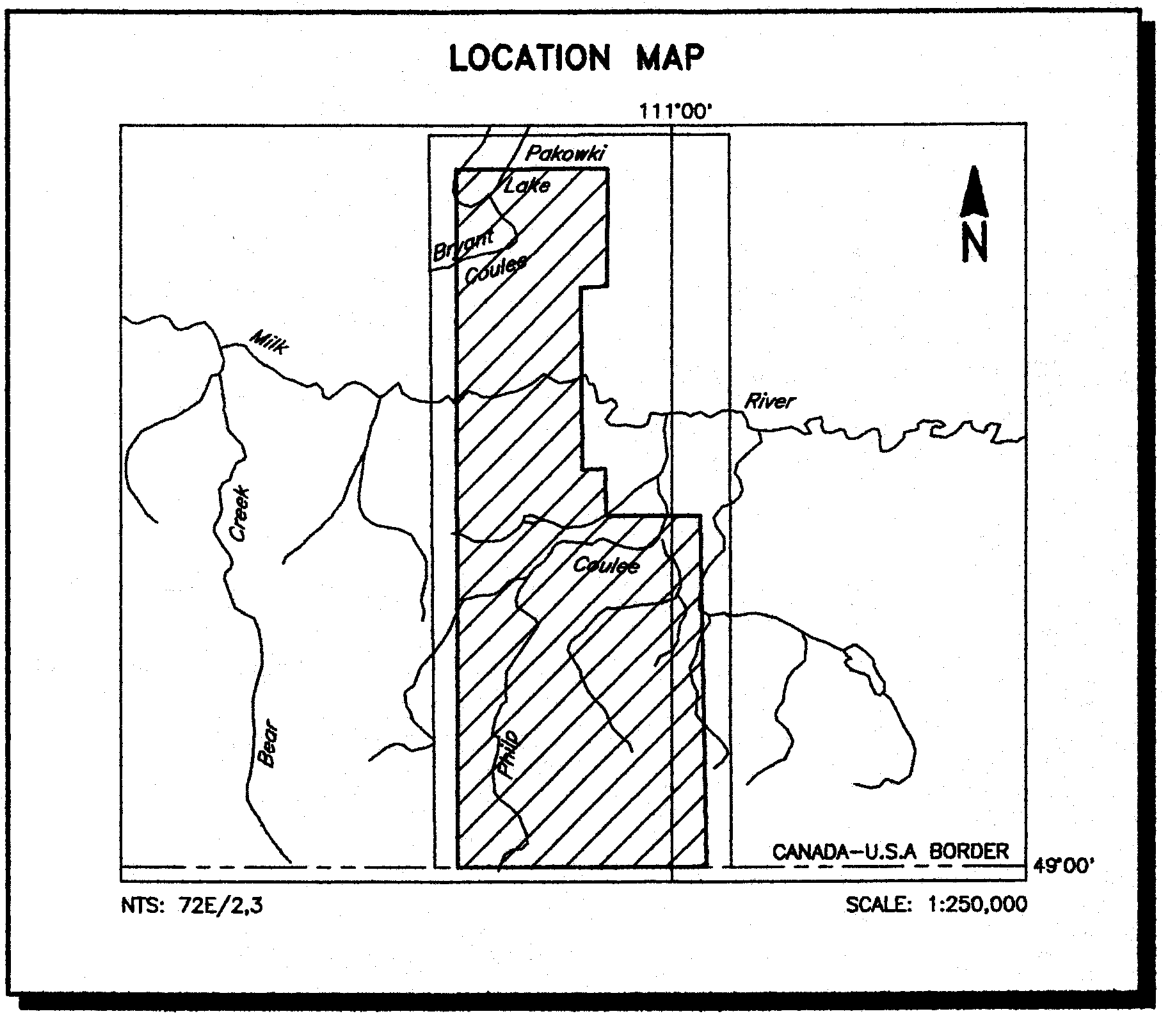

FIGURE 1

MARUM RESOURCES INC.

MILK RIVER AREA, ALBERTA - 1159

INTRODUCTION

A DIGHEM^{V} electromagnetic/resistivity/magnetic/VLF survey was flown for Marum Resources Inc. from November 10 to November 12, 1993, over a survey block located near Milk River, Alberta. The survey area can be located on NTS map sheet 72E/2,3 (see Figure 1).

Survey coverage consisted of approximately 1020 line-km, including tie lines. Flight lines were flown in an azimuthal direction of 0°/180° with a line separation of 150 metres.

The survey employed the DIGHEM^{V} electromagnetic system. Ancillary equipment consisted of a magnetometer, radar altimeter, video camera, analog and digital recorders, a VLF receiver and an electronic navigation system. Details on the survey equipment are given in Section 2.

The instrumentation was installed in an Aerospatiale AS350B turbine helicopter which was provided by Questral Helicopters Ltd. The helicopter flew at an average airspeed of 126 km/h with an EM bird height of approximately 30 m.

Section 2 also provides details on the data channels, their respective sensitivities, and the navigation/flight path recovery procedure. Noise levels of less than 2 ppm are generally maintained for wind speeds up to 35 km/h. Higher winds may cause the system to be grounded because excessive bird swinging produces difficulties in flying the helicopter. The swinging results from the 5 m^2 of area which is presented by the bird to broadside gusts.

In some portions of the survey area, the steep topography forced the pilot to exceed normal terrain clearance for reasons of safety. It is possible that some weak conductors may have escaped detection in areas where the bird height exceeded 120 m. In difficult areas where near-vertical climbs were necessary, the forward speed of the helicopter was reduced to a level which permitted excessive bird swinging. This problem, combined with the severe stresses to which the bird was subjected, gave rise to aerodynamic noise levels which are slightly higher than normal. Where warranted, reflights were carried out to minimize these adverse effects.

Due to the numerous cultural features in the survey area, any interpreted conductors which occur in close proximity to cultural sources, should be confirmed as bedrock conductors prior to drilling.

SURVEY EQUIPMENT

This section provides a brief description of the geophysical instruments used to acquire the survey data:

Electromagnetic System

Model:	DIGHEM^{V}
Type:	Towed bird, symmetric dipole configuration operated at a nominal survey altitude of 30 metres. Coil separation is 8 metres for 900 Hz, 5600 Hz and 7200 Hz, and 6.3 metres for the 56,000 Hz coil-pair.
Coil orientations/frequencies:	coaxial / 900 Hz coplanar / 900 Hz coaxial / 5,600 Hz coplanar / 7,200 Hz coplanar / 56,000 Hz
Channels recorded:	5 inphase channels 5 quadrature channels 2 monitor channels
Sensitivity:	0.1 ppm at 900 Hz 0.2 ppm at 5,600 Hz , 7200 Hz 0.5 ppm at 56,000 Hz
Sample rate:	10 per second

The electromagnetic system utilizes a multi-coil coaxial/coplanar technique to energize conductors in different directions. The coaxial coils are vertical with their axes in the flight direction. The coplanar coils are horizontal. The secondary fields are sensed simultaneously by means of receiver coils which are maximum coupled to their respective transmitter coils. The system yields an inphase and a quadrature channel from each transmitter-receiver coil-pair.

Magnetometer

Model:	Picodas 3340
Type:	Optically pumped Cesium vapour
Sensitivity:	0.01 nT
Sample rate:	10 per second

The magnetometer sensor is towed in a bird 20 m below the helicopter.

Magnetic Base Station

Model:	Scintrex MP-3
Type:	Digital recording proton precession
Sensitivity:	0.10 nT
Sample rate:	0.2 per second

A digital recorder is operated in conjunction with the base station magnetometer to record the diurnal variations of the earth's magnetic field. The clock of the base station is synchronized with that of the airborne system to permit subsequent removal of diurnal drift.

VLF System

Manufacturer:	Herz Industries Ltd.		
Type:	Totem-2A		
Sensitivity:	0.1%		
Stations:	Seattle, Washington;	NLK,	24.8 kHz
	Annapolis, Maryland;	NSS,	21.4 kHz
	Cutler, Maine;	NAA,	24.0 kHz

The VLF receiver measures the total field and vertical quadrature components of the secondary VLF field. Signals from two separate transmitters can be measured simultaneously. The VLF sensor is housed in the same bird as the magnetic sensor, and is towed 20 m below the helicopter.

Radar Altimeter

Manufacturer:	Honeywell/Sperry
Type:	AA 220
Sensitivity:	1 ft

The radar altimeter measures the vertical distance between the helicopter and the ground. This information is used in the processing algorithm which determines conductor depth.

Analog Recorder

Manufacturer:	RMS Instruments
Type:	DGR33 dot-matrix graphics recorder
Resolution:	4x4 dots/mm
Speed:	1.5 mm/sec

The analog profiles are recorded on chart paper in the aircraft during the survey. Table 2-1 lists the geophysical data channels and the vertical scale of each profile.

Table 2-1. The Analog Profiles

Channel Name	Parameter	Scale units/mm	Designation on digital profile
1X9I	coaxial inphase (900 Hz)	2.5 ppm	CXI (900 Hz)
1X9Q	coaxial quad (900 Hz)	2.5 ppm	CXQ (900 Hz)
3P9I	coplanar inphase (900 Hz)	2.5 ppm	CPI (900 Hz)
3P9Q	coplanar quad (900 Hz)	2.5 ppm	CPQ (900 Hz)
2P7I	coplanar inphase (7200 Hz)	5 ppm	CPI (7200 Hz)
2P7Q	coplanar quad (7200 Hz)	5 ppm	CPQ (7200 Hz)
4X7I	coaxial inphase (5600 Hz)	5 ppm	CXI (5600 Hz)
4X7Q	coaxial quad (5600 Hz)	5 ppm	CXQ (5600 Hz)
5P5I	coplanar inphase(56000 Hz)	10 ppm	CPI (56 kHz)
5P5Q	coplanar quad (56000 Hz)	10 ppm	CPQ (56 kHz)
ALTR	altimeter	3 m	ALT
CMGC	magnetics, coarse	20 nT	MAG
CMGF	magnetics, fine	2.0 nT	
VF1T	VLF-total: primary stn.	2%	
VF1Q	VLF-quad: primary stn.	2%	
VF2T	VLF-total: secondary stn.	2%	
VF2Q	VLF-quad: secondary stn.	2%	
CXSP	coaxial sferics monitor		
CPSP	coplanar sferics monitor		
CXPL	coaxial powerline monitor		CXP
CPPL	coplanar powerline monitor		CPP

Table 2-2. The Digital Profiles

Channel Name (Freq)		Observed parameters	Scale units/mm
MAG		magnetics	10 nT
ALT		bird height	6 m
CXI	(900 Hz)	vertical coaxial coil-pair inphase	2 ppm
CXQ	(900 Hz)	vertical coaxial coil-pair quadrature	2 ppm
CPI	(900 Hz)	horizontal coplanar coil-pair inphase	2 ppm
CPQ	(900 Hz)	horizontal coplanar coil-pair quadrature	2 ppm
CXI	(5600 Hz)	vertical coaxial coil-pair inphase	4 ppm
CXQ	(5600 Hz)	vertical coaxial coil-pair quadrature	4 ppm
CPI	(7200 Hz)	horizontal coplanar coil-pair inphase	4 ppm
CPQ	(7200 Hz)	horizontal coplanar coil-pair quadrature	4 ppm
CPI	(56 kHz)	horizontal coplanar coil-pair inphase	10 ppm
CPQ	(56 kHz)	horizontal coplanar coil-pair quadrature	10 ppm
CXP		coaxial powerline monitor	
CPP		coplanar powerline monitor	
		Computed Parameters	
DFI	(900 Hz)	difference function inphase from CXI and CPI	2 ppm
DFQ	(900 Hz)	difference function quadrature from CXQ and CPQ	2 ppm
RES	(900 Hz)	log resistivity	.06 decade
RES	(7200 Hz)	log resistivity	.06 decade
RES	(56 kHz)	log resistivity	.06 decade
DP	(900 Hz)	apparent depth	6 m
DP	(7200 Hz)	apparent depth	6 m
DP	(56 kHz)	apparent depth	6 m
CDT		conductance	1 grade

Digital Data Acquisition System

Manufacturer: RMS Instruments

Type: DGR 33

Tape Deck: RMS TCR-12, 6400 bpi, tape cartridge recorder

The digital data are used to generate several computed parameters. Both measured and computed parameters are plotted as "multi-channel stacked profiles" during data processing. These parameters are shown in Table 2-2. In Table 2-2, the log resistivity scale of 0.06 decade/mm means that the resistivity changes by an order of magnitude in 16.6 mm. The resistivities at 0, 33 and 67 mm up from the bottom of the digital profile are respectively 1, 100 and 10,000 ohm-m.

Tracking Camera

Type: Panasonic Video

Model: AG 2400/WVCD132

Fiducial numbers are recorded continuously and are displayed on the margin of each image. This procedure ensures accurate correlation of analog and digital data with respect to visible features on the ground.

Navigation System (RT-DGPS)

Model:	Sercel NR106, Real-time differential positioning
Type:	SPS (L1 band), 10-channel, C/A code, 1575.42 MHz.
Sensitivity:	-132 dBm, 0.5 second update
Accuracy:	< 5 metres in differential mode, ± 50 metres in S/A (non differential) mode

The Global Positioning System (GPS) is a line of sight, satellite navigation system which utilizes time-coded signals from at least four of the twenty-four NAVSTAR satellites. In the differential mode, two GPS receivers are used. The base station unit is used as a reference which transmits real-time corrections to the mobile unit in the aircraft, via a UHF radio datalink. The on-board system calculates the flight path of the helicopter while providing real-time guidance. The raw XYZ data are recorded for both receivers, thereby permitting post-survey processing for accuracies of approximately 2 metres.

Although the base station receiver is able to calculate its own latitude and longitude, a higher degree of accuracy can be obtained if the reference unit is established on a known benchmark or triangulation point. The GPS records data relative to the WGS84 ellipsoid, which is the basis of the revised North American Datum (NAD83).

Conversion software is used to transform the WGS84 coordinates to the system displayed on the base maps.

Field Workstation

Manufacturer:	Dighem
Model:	FWS: V2.41
Type:	80386 based P.C.

A portable PC-based field workstation is used at the survey base to verify data quality and completeness. Flight tapes are dumped to a hard drive to permit the creation of a database. This process allows the field operators to display both the positional (flight path) and geophysical data on a screen or printer.

PRODUCTS AND PROCESSING TECHNIQUES

The following products are available from the survey data. Those which are not part of the survey contract may be acquired later. Refer to Table 3-1 for a summary of the maps which accompany this report, some of which may be sent under separate cover. Most parameters can be displayed as contours, profiles, or in colour.

Base Maps

A base map of the survey area has been produced from published topographic maps. It provides a relatively accurate, distortion-free base which facilitates correlation of the navigation data to the UTM grid. Photomosaics are useful for visual reference and for subsequent flight path recovery, but usually contain scale distortions. Orthophotos are ideal, but their cost and the time required to produce them, usually precludes their use as base maps.

Electromagnetic Anomalies

Anomalous electromagnetic responses are selected and analysed by computer to provide a preliminary electromagnetic anomaly map. This preliminary map is used, by the geophysicist, in conjunction with the computer-generated digital profiles, to produce

Table 3-1 Plots Available from the Survey

MAP PRODUCT	NO. OF SHEETS	ANOMALY MAP	PROFILES ON MAP	CONTOURS INK	CONTOURS COLOUR	SHADOW MAP
Electromagnetic Anomalies	1	25,000	N/A	N/A	N/A	N/A
Probable Bedrock Conductors		-	N/A	N/A	N/A	N/A
Resistivity (900 Hz)		N/A	-	-	-	-
Resistivity (7,200 Hz)	1	N/A	-	25,000	25,000	-
Resistivity (56,000 Hz)		N/A	-	-	-	-
EM Magnetite		N/A	-	-	-	-
Total Field Magnetics	1	N/A	-	25,000	25,000	50,000
Enhanced Magnetics	1	N/A	-	25,000	25,000	-
1st Vertical Derivative Magnetics		N/A	-	-	-	-
2nd Vertical Derivative Magnetics		N/A	-	-	-	-
Filtered Total Field VLF		N/A	-	-	-	-
VLF Profiles		N/A	-	-	-	-
Electromagnetic Profiles(900 Hz)		N/A	-	-	N/A	N/A
Electromagnetic Profiles(7200 Hz)		N/A	-	-	N/A	N/A
Multi-channel stacked profiles		Worksheet profiles				-
		Interpreted profiles				25,000

N/A Not available
\- Not required under terms of the survey contract
* Recommended
25,000 Scale of delivered map, i.e, 1:25,000

Notes:

- Inked contour maps are provided on transparent media and show flight lines, EM anomalies and suitable registration. Three paper prints of each map are supplied. Three copies of the colour maps are also supplied.

the final interpreted EM anomaly map. This map includes bedrock surficial and cultural conductors. A map containing only bedrock conductors can be generated, if desired.

Resistivity

The apparent resistivity in ohm-m may be generated from the inphase and quadrature EM components for any of the frequencies, using a pseudo-layer halfspace model. A resistivity map portrays all the EM information for that frequency over the entire survey area. This contrasts with the electromagnetic anomaly map which provides information only over interpreted conductors. The large dynamic range makes the resistivity parameter an excellent mapping tool.

EM Magnetite

The apparent percent magnetite by weight is computed wherever magnetite produces a negative inphase EM response.

Total Field Magnetics

The aeromagnetic data are corrected for diurnal variation using the magnetic base station data. The regional IGRF can be removed from the data, if requested.

Enhanced Magnetics

The total field magnetic data are subjected to a processing algorithm. This algorithm enhances the response of magnetic bodies in the upper 500 m and attenuates the response of deeper bodies. The resulting enhanced magnetic map provides better definition and resolution of near-surface magnetic units. It also identifies weak magnetic features which may not be evident on the total field magnetic map. However, regional magnetic variations, and magnetic lows caused by remanence, are better defined on the total field magnetic map. The technique is described in more detail in Section 5.

Magnetic Derivatives

The total field magnetic data may be subjected to a variety of filtering techniques to yield maps of the following:

first vertical derivative (vertical gradient)

second vertical derivative

magnetic susceptibility with reduction to the pole

upward/downward continuations

All of these filtering techniques improve the recognition of near-surface magnetic bodies, with the exception of upward continuation. Any of these parameters can be produced on request. Dighem's proprietary enhanced magnetic technique is designed to provide a general "all-purpose" map, combining the more useful features of the above parameters.

VLF

The VLF data are digitally filtered to remove long wavelengths such as those caused by variations in the transmitted field strength.

Multi-channel Stacked Profiles

Distance-based profiles of the digitally recorded geophysical data are generated and plotted by computer. These profiles also contain the calculated parameters which are used in the interpretation process. These are produced as worksheets prior to interpretation, and can also be presented in the final corrected form after interpretation. The profiles display electromagnetic anomalies with their respective interpretive symbols. The differences between the worksheets and the final corrected form occur only with respect to the EM anomaly identifier.

Contour, Colour and Shadow Map Displays

The geophysical data are interpolated onto a regular grid using a modified Akima spline technique. The resulting grid is suitable for generating contour maps of excellent quality.

Colour maps are produced by interpolating the grid down to the pixel size. The parameter is then incremented with respect to specific amplitude ranges to provide colour "contour" maps. Colour maps of the total magnetic field are particularly useful in defining the lithology of the survey area.

Monochromatic shadow maps are generated by employing an artificial sun to cast shadows on a surface defined by the geophysical grid. There are many variations in the shadowing technique. These techniques may be applied to total field or enhanced magnetic data, magnetic derivatives, VLF, resistivity, etc. Of the various magnetic products, the shadow of the enhanced magnetic parameter is particularly suited for defining geological structures with crisper images and improved resolution.

Conductivity-depth Sections

The apparent resistivities for all frequencies can be displayed simultaneously as coloured conductivity-depth sections. Usually, only the coplanar data are displayed as the quality tends to be higher than that of the coaxial data.

Conductivity-depth sections can be generated in two formats:

(1) Sengpiel resistivity sections, where the apparent resistivity for each frequency is plotted at the depth of the centroid of the inphase current flow*; and,

(2) Differential resistivity sections, where the differential resistivity is plotted at the differential depth**.

Both the Sengpiel and differential methods are derived from the pseudo-layer halfspace model. Both yield a coloured conductivity-depth section which attempts to portray a smoothed approximation of the true resistivity distribution with depth. The Sengpiel method is most useful in conductive layered situations, but may be unreliable in areas of

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* Approximate Inversion of Airborne EM Data from Multilayered Ground: Sengpiel, K.P., Geophysical Prospecting 36, 446-459, 1988.

** The Differential Resistivity Method for Multi-frequency Airborne EM Sounding: Huang, H. and Fraser, D.C., presented at Intern. Airb. EM Workshop, Tucson, Ariz., 1993.

moderate to high resistivity where signal amplitudes are weak. In areas where inphase responses have been suppressed by the effects of magnetite, the computed resistivities shown on the sections may be unreliable. The differential technique was developed by Dighem to overcome problems in the Sengpiel technique. The differential resistivity section is more sensitive than the Sengpiel section to changes in the earth's resistivity and it reaches deeper.

SURVEY RESULTS

The survey results are presented on one map sheet for each parameter at a scale of 1:25,000. Table 4-1 summarizes the EM responses in the survey area, with respect to conductance grade and interpretation.

The anomalies shown on the electromagnetic anomaly map are based on a near-vertical, half plane model. This model best reflects "discrete" bedrock conductors. Wide bedrock conductors or flat-lying conductive units, whether from surficial or bedrock sources, may give rise to very broad anomalous responses on the EM profiles. These may not appear on the electromagnetic anomaly map if they have a regional character rather than a locally anomalous character. These broad conductors, which more closely approximate a half space model, will be maximum coupled to the horizontal (coplanar) coil-pair and should be more evident on the resistivity parameter. Resistivity maps, therefore, may be more valuable than the electromagnetic anomaly maps, in areas where broad or flat-lying conductors are considered to be of importance. A contoured resistivity map, based on the 7200 Hz coplanar data are included with this report.

Excellent resolution and discrimination of conductors was accomplished by using a fast sampling rate of 0.1 sec and by employing a common frequency (900 Hz) on two orthogonal coil-pairs (coaxial and coplanar). The resulting "difference channel"

TABLE 4-1

EM ANOMALY STATISTICS

MILK RIVER AREA

CONDUCTOR GRADE	CONDUCTANCE RANGE SIEMENS (MHOS)	NUMBER OF RESPONSES
7	>100	7
6	50 - 100	7
5	20 - 50	39
4	10 - 20	135
3	5 - 10	639
2	1 - 5	508
1	<1	31
*	INDETERMINATE	297
TOTAL		1663

CONDUCTOR MODEL	MOST LIKELY SOURCE	NUMBER OF RESPONSES
B	DISCRETE BEDROCK CONDUCTOR	711
H	ROCK UNIT OR THICK COVER	701
E	EDGE OF WIDE CONDUCTOR	55
L	CULTURE	196
TOTAL		1663

(SEE EM MAP LEGEND FOR EXPLANATIONS)

parameter often permits differentiation of bedrock and surficial conductors, even though they may exhibit similar conductance values.

Anomalies which occur near the ends of the survey lines (i.e., outside the survey area), should be viewed with caution. Some of the weaker anomalies could be due to aerodynamic noise, i.e., bird bending, which is created by abnormal stresses to which the bird is subjected during the climb and turn of the aircraft between lines. Such aerodynamic noise is usually manifested by an anomaly on the coaxial inphase channel only, although severe stresses can affect the coplanar inphase channels as well.

Magnetics

A Scintrex proton precession magnetometer was operated at the survey base to record diurnal variations of the earth's magnetic field. The clock of the base station was synchronized with that of the airborne system to permit subsequent removal of diurnal drift.

The background magnetic level has been adjusted to match the International Geomagnetic Reference Field (IGRF) for the survey area. The IGRF gradient across the survey block is left intact.

The total field magnetic data have been presented as contours on the base map using a contour interval of 5 nT where gradients permit. The map shows the magnetic properties of the rock units underlying the survey area.

The total field magnetic data have been subjected to a processing algorithm to produce an enhanced magnetic map. This procedure enhances near-surface magnetic units and suppresses regional gradients. It also provides better definition and resolution of magnetic units and displays weak magnetic features which may not be clearly evident on the total field map. A map of the first or second vertical magnetic derivative can also be prepared from existing survey data, if requested.

If a specific magnetic intensity can be assigned to the rock type which is believed to host the target mineralization, it may be possible to select areas of higher priority on the basis of the total field magnetic data. This is based on the assumption that the magnetite content of the host rocks will give rise to a limited range of contour values which will permit differentiation of various lithological units.

The magnetic contour patterns generally display broad, regional features which are intersected by many anomalies indicative of narrower magnetic sources. The magnetic map is dominated by a large, semi-circular magnetic high situated in the central region of the block. Its western extent is undefined by the survey.

The enhanced magnetic map removes the regional component of the magnetic field and enhances near surface, narrow features. Many of these narrow magnetic anomalies can be attributed to cultural sources with the help of the video flight records, and the topographic map. There are, however, numerous magnetic features which do not appear to be associated with culture. Many extend over several lines, although there are a number of single line, possible bedrock, responses.

There are at least three circular, highly magnetic features which are of interest within the survey area as possible pipe-like targets. The largest is situated in the southeast portion of the survey block, centered at fiducial 3320 on line 10440. It is coincident with a circular topographic high. This feature exhibits an almost circular shape, and seems to have several weaker anomalies radiating out from it to the northeast and southwest. This anomaly gives rise to a circular resistivity high, suggesting that its source is more resistive than the surrounding, highly conductive material. Magnetite contained in this zone may suppress the inphase component of the EM response, enhancing the high resistivity response. A weakly magnetic dyke-like feature extends northeast approximately half a kilometer to the northeast of this strong anomaly. It has no associated resistivity response.

Another strongly magnetic feature is centered at fiducial 2038 on line 10090. This anomaly appears to be circular in shape, although the enhanced magnetic map displays possible extensions to the northwest and southwest. This gives the magnetic feature an arcuate appearance.

This feature exhibits similar characteristics to the first anomalous zone, although it gives rise to somewhat weaker magnetic and resistivity anomalies.

A third weaker, circular magnetic feature is centered at fiducial 782 on line 10230. It is situated within the Milk River Valley. This anomaly differs from the previous two in that it has no distinct resistivity anomaly, and is situated within a topographic low.

There are several other magnetic anomalies which may be of interest and do not appear to reflect cultural sources. Two possible magnetic dykes trend north-northeast from fiducial 3006 on line 10030 to fiducial 1278 on line 10080 and from fiducial 3616 on line 10160 to fiducial 735 on line 10210. They reflect thin, parallel magnetic sources approximately 1½ km apart. The easternmost dyke is indicative of the stronger of the two sources. Neither is associated with a distinct resistivity anomaly.

A circular magnetic high is situated between these two dykes, centered at fiducial 4734 on line 10120. It reflects a single line, moderately magnetic source which does not appear to be associated with culture. It does not give rise to a distinct EM response.

There are many other single line magnetic responses, most of which can be attributed to cultural sources such as pipelines, gas wells and buildings. The video flight path records were used to distinguish cultural anomalies from valid geophysical responses.

Two single line magnetic anomalies are centered at fiducial 1424 on line 10220 and fiducial 548 on line 10210. Both are also associated with relative resistivity highs. Two other resistivity highs centered at fiducial 3814 on line 10160 and fiducial 2173 on line 10250 are situated in the vicinity of these magnetic anomalies, but have only weak magnetic correlation. None appear to be associated with any visible culture. Several magnetic anomalies, centered at fiducial 1148 and 1139 on line 10230, fiducial 6670 on line 10200 and 6304 on line 10190, reflect weak, single line sources. They do not seem to be related to cultural features but are situated in the vicinity of the gas processing plant and should be viewed with caution. They seem to be part of a possible north-northwest/south-southeast trending magnetic feature.

The magnetic results, in conjunction with the other geophysical parameters, should provide valuable information which can be used to effectively map the geology and structure in the survey area.

Resistivity

A resistivity map, which displays the conductive properties of the survey area, was produced from the 7200 Hz coplanar data. In general, the resistivity patterns show some agreement with the magnetic trends. This suggests that some of the resistivity anomalies are probably related to bedrock features, rather than conductive overburden. There are some areas, however, where contour patterns appear to be strongly influenced by highly conductive near surface material or cultural sources.

The rocks underlying the property are quite conductive, exhibiting resistivities in the 3 ohm-m to 30 ohm-m range. On the digital profiles, the top of this conductive layer appears to be at depths of between six and twelve metres. This suggests that this conductive unit, which may be due to carbonaceous sediments, or lacustrine clays, is probably covered by a few metres of resistive material. This resistive layer may be due to frozen ground or well-drained sand and gravel.

Resistivities in the southern portion of the survey block, south of the Milk River Valley, tend to be similar on all three frequencies, whereas north of the valley the 900 Hz map displays lower resistivity values than the 7200 Hz and 56,000 Hz maps. The portion or the survey block south of the valley is indicative of a half space overlain by a thin resistive layer, whereas the northern portion is probably overlain by thicker, relatively resistive cover.

The resistivity data exhibit some correlation with the magnetic trends. As previously discussed, two of the pipe-like magnetic targets are coincident with relatively strong resistivity highs, possibly due to suppression of the EM inphase component due to magnetite. Several weakly magnetic, linear trends are associated with resistivity lows. These magnetic features are generally associated with steep ridges within the survey block. A portion of the magnetic anomaly and the EM amplitude may be due to altitude changes as the helicopter flies over the ridge. The resistivity lows seem to be associated with the river valleys, and are therefore possibly due to conductive stream sediments. One exception to this is a moderately strong resistivity high associated with the Milk River. This may be due to an increase in the thickness in the resistive cover which seems to overlie most of the survey area.

Several small resistivity anomalies may warrant further investigation. A weak resistivity high extends southeast from fiducial 1436 on line 10070 to fiducial 6998 on line 10200. This trend contains a relatively resistive, circular feature centered at fiducial 872 on line 10131. A similar resistivity low is situated approximately 600 m north of it, centered at fiducial 1971 on line 10140. Neither anomaly displays direct magnetic correlation.

Electromagnetics

The EM anomalies resulting from this survey appear to fall within one of three general categories. The first type consists of discrete, well-defined anomalies which yield marked inflections on the difference channels. These anomalies are usually attributed to conductive sulphides or graphite and are generally given a "B", "T" or "D" interpretive symbol, denoting a bedrock source. Some of these responses are quite strong, but poorly-defined, and may be due to altitude variations.

The second class of anomalies comprises moderately broad responses which exhibit the characteristics of a half space and do not yield well-defined inflections on the difference channels. Anomalies in this category are usually given an "S" or "H" interpretive symbol. The lack of a difference channel response usually implies a broad or flat-lying conductive source such as overburden. Some of these anomalies may reflect conductive rock units or zones of deep weathering.

The third class consists of cultural anomalies which are usually given the symbol "L" or "L?". Unfortunately, it is almost impossible to distinguish anomalies due to fences or metal pipelines from those caused by thin, near vertical bedrock conductors, particularly in a conductive environment such as this.

Therefore, most of the anomalies have been given a "B?" or "L?" interpretation. Where cultural features were evident on the topographic map, or could be seen on the video, an "L" interpretive symbol was used. Anomalies given a "B?" interpretation should be viewed with caution.

The value of the EM interpretation is also questionable in this complex, highly conductive environment, particularly in view of the target being sought. Weathered pipes generally do not give rise to discrete EM anomalies, but sometimes produce "S"- or "H"-type responses similar to those observed over small lakes or patches of conductive overburden.

Although the difference channels (DFI and DFQ) are extremely valuable in detecting bedrock conductors which are partially masked by conductive overburden, sharp undulations in the bedrock/overburden interface can yield anomalies in the difference channels which may be interpreted as possible bedrock conductors. Such anomalies usually fall into the "S?" or "B?" classification but may also be given an "E" interpretive symbol, denoting a resistivity contrast at the edge of a conductive unit.

Targets in the area may or may not be expected to be more magnetic than the surrounding rock, but in this highly conductive area it is unlikely that the lamproitic or kimberlitic material would be more conductive than surrounding rock units. Those magnetic targets which contain a high percentage of magnetite may be seen on the resistivity parameter as a resistivity high.

It is recommended that an attempt be made to compile a suite of geophysical "signatures" over areas of interest. Anomaly characteristics are clearly defined on the computer-processed geophysical data profiles which are supplied as one of the survey products.

A complete assessment and evaluation of the survey data should be carried out by one or more qualified professionals who have access to, and can provide a meaningful compilation of, all available geophysical, geological and geochemical data.

BACKGROUND INFORMATION

This section provides background information on parameters which are available from the survey data. Those which have not been supplied as survey products may be generated later from raw data on the digital archive tape.

ELECTROMAGNETICS

DIGHEM electromagnetic responses fall into two general classes, discrete and broad. The discrete class consists of sharp, well-defined anomalies from discrete conductors such as sulfide lenses and steeply dipping sheets of graphite and sulfides. The broad class consists of wide anomalies from conductors having a large horizontal surface such as flatly dipping graphite or sulfide sheets, saline water-saturated sedimentary formations, conductive overburden and rock, and geothermal zones. A vertical conductive slab with a width of 200 m would straddle these two classes.

The vertical sheet (half plane) is the most common model used for the analysis of discrete conductors. All anomalies plotted on the electromagnetic map are analyzed according to this model. The following section entitled **Discrete Conductor Analysis** describes this model in detail, including the effect of using it on anomalies caused by broad conductors such as conductive overburden.

The conductive earth (half space) model is suitable for broad conductors. Resistivity contour maps result from the use of this model. A later section entitled **Resistivity Mapping** describes the method further, including the effect of using it on anomalies caused by discrete conductors such as sulfide bodies.

Geometric interpretation

The geophysical interpreter attempts to determine the geometric shape and dip of the conductor. Figure 5-1 shows typical DIGHEM anomaly shapes which are used to guide the geometric interpretation.

Discrete conductor analysis

The EM anomalies appearing on the electromagnetic map are analyzed by computer to give the conductance (i.e., conductivity-thickness product) in Siemens (mhos) of a vertical sheet model. This is done regardless of the interpreted geometric shape of the conductor. This is not an unreasonable procedure, because the computed conductance increases as the electrical quality of the conductor increases, regardless of its true shape. DIGHEM anomalies are divided into seven grades of conductance, as shown in Table 5-1 below. The conductance in Siemens (mhos) is the reciprocal of resistance in ohms.

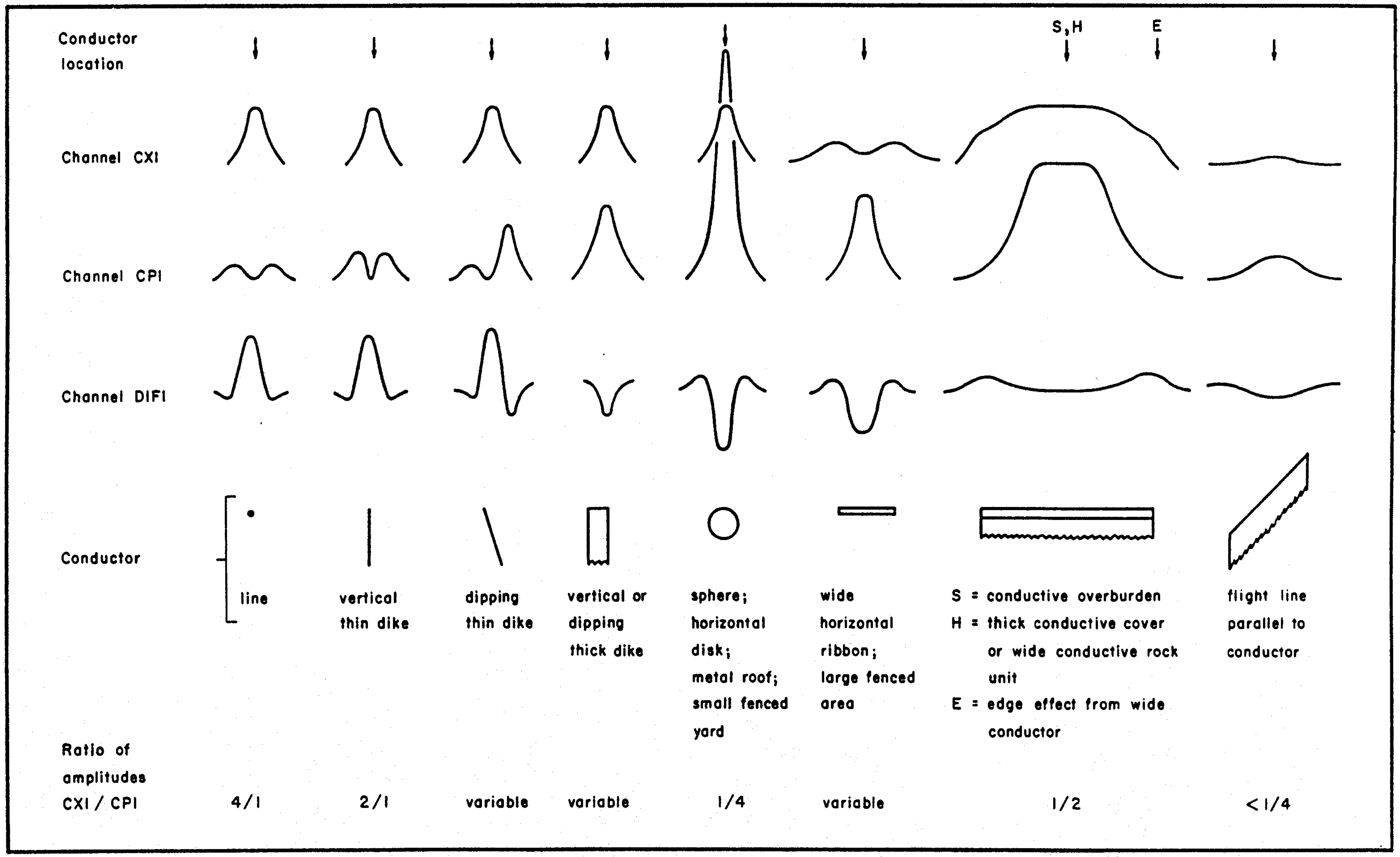

Fig. 5-1 Typical DIGHEM anomaly shapes

Table 5-1. EM Anomaly Grades

Anomaly Grade	Siemens
7	> 100
6	50 - 100
5	20 - 50
4	10 - 20
3	5 - 10
2	1 - 5
1	< 1

The conductance value is a geological parameter because it is a characteristic of the conductor alone. It generally is independent of frequency, flying height or depth of burial, apart from the averaging over a greater portion of the conductor as height increases. Small anomalies from deeply buried strong conductors are not confused with small anomalies from shallow weak conductors because the former will have larger conductance values.

Conductive overburden generally produces broad EM responses which may not be shown as anomalies on the EM maps. However, patchy conductive overburden in otherwise resistive areas can yield discrete anomalies with a conductance grade (cf. Table 5-1) of 1, 2 or even 3 for conducting clays which have resistivities as low as 50 ohm-m. In areas where ground resistivities are below 10 ohm-m, anomalies caused by weathering variations and similar causes can have any conductance grade. The anomaly shapes from the multiple coils often allow such conductors to be recognized, and these are indicated by the letters S, H, and sometimes E on the electromagnetic anomaly map (see EM map legend).

For bedrock conductors, the higher anomaly grades indicate increasingly higher conductances. Examples: DIGHEM's New Insco copper discovery (Noranda, Canada) yielded a grade 5 anomaly, as did the neighbouring copper-zinc Magusi River ore body; Mattabi (copper-zinc, Sturgeon Lake, Canada) and Whistle (nickel, Sudbury, Canada) gave grade 6; and DIGHEM's Montcalm nickel-copper discovery (Timmins, Canada) yielded a grade 7 anomaly. Graphite and sulfides can span all grades but, in any particular survey area, field work may show that the different grades indicate different types of conductors.

Strong conductors (i.e., grades 6 and 7) are characteristic of massive sulfides or graphite. Moderate conductors (grades 4 and 5) typically reflect graphite or sulfides of a less massive character, while weak bedrock conductors (grades 1 to 3) can signify poorly connected graphite or heavily disseminated sulfides. Grades 1 and 2 conductors may not respond to ground EM equipment using frequencies less than 2000 Hz.

The presence of sphalerite or gangue can result in ore deposits having weak to moderate conductances. As an example, the three million ton lead-zinc deposit of Restigouche Mining Corporation near Bathurst, Canada, yielded a well-defined grade 2 conductor. The 10 percent by volume of sphalerite occurs as a coating around the fine grained massive pyrite, thereby inhibiting electrical conduction.

Faults, fractures and shear zones may produce anomalies which typically have low conductances (e.g., grades 1 to 3). Conductive rock formations can yield anomalies of any conductance grade. The conductive materials in such rock formations can be salt water, weathered products such as clays, original depositional clays, and carbonaceous material.

On the interpreted electromagnetic map, a letter identifier and an interpretive symbol are plotted beside the EM grade symbol. The horizontal rows of dots, under the interpretive symbol, indicate the anomaly amplitude on the flight record. The vertical column of dots, under the anomaly letter, gives the estimated depth. In areas where anomalies are crowded, the letter identifiers, interpretive symbols and dots may be obliterated. The EM grade symbols, however, will always be discernible, and the obliterated information can be obtained from the anomaly listing appended to this report.

The purpose of indicating the anomaly amplitude by dots is to provide an estimate of the reliability of the conductance calculation. Thus, a conductance value obtained from a large ppm anomaly (3 or 4 dots) will tend to be accurate whereas one obtained from a small ppm anomaly (no dots) could be quite inaccurate. The absence of amplitude dots indicates that the anomaly from the coaxial coil-pair is 5 ppm or less on both the inphase and quadrature channels. Such small anomalies could reflect a weak conductor at the surface or a stronger conductor at depth. The conductance grade and depth estimate illustrates which of these possibilities fits the recorded data best.

Flight line deviations occasionally yield cases where two anomalies, having similar conductance values but dramatically different depth estimates, occur close together on the same conductor. Such examples illustrate the reliability of the conductance measurement while showing that the depth estimate can be unreliable. There are a number of factors which can produce an error in the depth estimate, including the averaging of topographic variations by the altimeter, overlying conductive overburden, and the location and attitude of the conductor relative to the flight line. Conductor location and attitude can provide an erroneous depth estimate because the stronger part of the conductor may be deeper or to one side of the flight line, or because it has a shallow dip. A heavy tree cover can also produce errors in depth estimates. This is because the depth estimate is computed as the distance of bird from conductor, minus the altimeter reading. The altimeter can lock onto the top of a dense forest canopy. This situation yields an erroneously large depth estimate but does not affect the conductance estimate.

Dip symbols are used to indicate the direction of dip of conductors. These symbols are used only when the anomaly shapes are unambiguous, which usually requires a fairly resistive environment.

A further interpretation is presented on the EM map by means of the line-to-line correlation of anomalies, which is based on a comparison of anomaly shapes on adjacent lines. This provides conductor axes which may define the geological structure over portions of the survey area. The absence of conductor axes in an area implies that anomalies could not be correlated from line to line with reasonable confidence.

DIGHEM electromagnetic maps are designed to provide a correct impression of conductor quality by means of the conductance grade symbols. The symbols can stand alone with geology when planning a follow-up program. The actual conductance values are printed in the attached anomaly list for those who wish quantitative data. The anomaly ppm and depth are indicated by inconspicuous dots which should not distract from the conductor patterns, while being helpful to those who wish this information. The map provides an interpretation of conductors in terms of length, strike and dip, geometric shape, conductance, depth, and thickness. The accuracy is comparable to an interpretation from a high quality ground EM survey having the same line spacing.

The attached EM anomaly list provides a tabulation of anomalies in ppm, conductance, and depth for the vertical sheet model. The EM anomaly list also shows the conductance and depth for a thin horizontal sheet (whole plane) model, but only the vertical sheet parameters appear on the EM map. The horizontal sheet model is suitable for a flatly dipping thin bedrock conductor such as a sulfide sheet having a thickness less than 10 m. The list also shows the resistivity and depth for a conductive earth (half space) model, which is suitable for thicker slabs such as thick conductive overburden. In the EM anomaly list, a depth value of zero for the conductive earth model, in an area of thick cover, warns that the anomaly may be caused by conductive overburden.

Since discrete bodies normally are the targets of EM surveys, local base (or zero) levels are used to compute local anomaly amplitudes. This contrasts with the use of true zero levels which are used to compute true EM amplitudes. Local anomaly amplitudes are shown in the EM anomaly list and these are used to compute the vertical sheet parameters of conductance and depth. Not shown in the EM anomaly list are the true amplitudes which are used to compute the horizontal sheet and conductive earth parameters.

Questionable Anomalies

DIGHEM maps may contain EM responses which are displayed as asterisks (*). These responses denote weak anomalies of indeterminate conductance, which may reflect one of the following: a weak conductor near the surface, a strong conductor at depth (e.g., 100 to 120 m below surface) or to one side of the flight line, or aerodynamic noise. Those responses that have the appearance of valid bedrock anomalies on the flight profiles are indicated by appropriate interpretive symbols (see EM map legend). The others probably do not warrant further investigation unless their locations are of considerable geological interest.

The thickness parameter

DIGHEM can provide an indication of the thickness of a steeply dipping conductor. The amplitude of the coplanar anomaly (e.g., CPI channel on the digital profile) increases relative to the coaxial anomaly (e.g., CXI) as the apparent thickness increases, i.e., the thickness in the horizontal plane. (The thickness is equal to the conductor width if the conductor dips at 90 degrees and strikes at right angles to the flight line.) This report refers to a conductor as thin when the thickness is likely to be less than 3 m, and thick when in excess of 10 m. Thick conductors are indicated on the EM map by parentheses "( )". For base metal exploration in steeply dipping geology, thick conductors can be high priority targets because many massive sulfide ore bodies are thick, whereas non-economic bedrock conductors are often thin. The system cannot sense the thickness when the strike of the conductor is subparallel to the flight line, when the conductor has a shallow dip, when the anomaly amplitudes are small, or when the resistivity of the environment is below 100 ohm-m.

Resistivity mapping

Areas of widespread conductivity are commonly encountered during surveys. In such areas, anomalies can be generated by decreases of only 5 m in survey altitude as well as by increases in conductivity. The typical flight record in conductive areas is characterized by inphase and quadrature channels which are continuously active. Local EM peaks reflect either increases in conductivity of the earth or decreases in survey altitude. For such conductive areas, apparent resistivity profiles and contour maps are necessary for the correct interpretation of the airborne data. The advantage of the resistivity parameter is that anomalies caused by altitude changes are virtually eliminated, so the resistivity data reflect only those anomalies caused by conductivity changes. The resistivity analysis also helps the interpreter to differentiate between conductive trends in the bedrock and those patterns typical of conductive overburden. For example, discrete conductors will generally appear as narrow lows on the contour map and broad conductors (e.g., overburden) will appear as wide lows.

The resistivity profiles and the resistivity contour maps present the apparent resistivity using the so-called pseudo-layer (or buried) half space model defined by Fraser (1978)[1]. This model consists of a resistive layer overlying a conductive half space. The depth channels give the apparent depth below surface of the conductive material. The apparent depth is simply the apparent thickness of the overlying resistive layer. The apparent depth (or thickness) parameter will be positive when the upper layer is more resistive than the underlying material, in which case the apparent depth may be quite close to the true depth.

The apparent depth will be negative when the upper layer is more conductive than the underlying material, and will be zero when a homogeneous half space exists. The apparent depth parameter must be interpreted cautiously because it will contain any errors which may exist in the measured altitude of the EM bird (e.g., as caused by a dense tree cover). The inputs to the resistivity algorithm are the inphase and quadrature components of the coplanar coil-pair. The outputs are the apparent resistivity of the conductive half space (the source) and the sensor-source distance. The flying height is not an input variable, and the output resistivity and sensor-source distance are independent of the flying height. The apparent depth, discussed above, is

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[1] Resistivity mapping with an airborne multicoil electromagnetic system: Geophysics, v. 43, p.144-172

simply the sensor-source distance minus the measured altitude or flying height. Consequently, errors in the measured altitude will affect the apparent depth parameter but not the apparent resistivity parameter.

The apparent depth parameter is a useful indicator of simple layering in areas lacking a heavy tree cover. The DIGHEM system has been flown for purposes of permafrost mapping, where positive apparent depths were used as a measure of permafrost thickness. However, little quantitative use has been made of negative apparent depths because the absolute value of the negative depth is not a measure of the thickness of the conductive upper layer and, therefore, is not meaningful physically. Qualitatively, a negative apparent depth estimate usually shows that the EM anomaly is caused by conductive overburden. Consequently, the apparent depth channel can be of significant help in distinguishing between overburden and bedrock conductors.

The resistivity map often yields more useful information on conductivity distributions than the EM map. In comparing the EM and resistivity maps, keep in mind the following:

(a) The resistivity map portrays the apparent value of the earth's resistivity, where resistivity = 1/conductivity.

(b) The EM map portrays anomalies in the earth's resistivity. An anomaly by definition is a change from the norm and so the EM map displays anomalies, (i) over narrow, conductive bodies and (ii) over the boundary zone between two wide formations of differing conductivity.

The resistivity map might be likened to a total field map and the EM map to a horizontal gradient in the direction of flight[2]. Because gradient maps are usually more sensitive than total field maps, the EM map therefore is to be preferred in resistive areas. However, in conductive areas, the absolute character of the resistivity map usually causes it to be more useful than the EM map.

Interpretation in conductive environments

Environments having background resistivities below 30 ohm-m cause all airborne EM systems to yield very large responses from the conductive ground. This usually prohibits the recognition of discrete bedrock conductors. However, DIGHEM data processing techniques produce three parameters which contribute significantly to the recognition of bedrock conductors. These are the inphase and quadrature difference channels (DFI and DFQ), and the resistivity and depth channels (RES and DP) for each coplanar frequency.

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[2] The gradient analogy is only valid with regard to the identification of anomalous locations.

The EM difference channels (DFI and DFQ) eliminate most of the responses from conductive ground, leaving responses from bedrock conductors, cultural features (e.g., telephone lines, fences, etc.) and edge effects. Edge effects often occur near the perimeter of broad conductive zones. This can be a source of geologic noise. While edge effects yield anomalies on the EM difference channels, they do not produce resistivity anomalies. Consequently, the resistivity channel aids in eliminating anomalies due to edge effects. On the other hand, resistivity anomalies will coincide with the most highly conductive sections of conductive ground, and this is another source of geologic noise. The recognition of a bedrock conductor in a conductive environment therefore is based on the anomalous responses of the two difference channels (DFI and DFQ) and the resistivity channels (RES). The most favourable situation is where anomalies coincide on all channels.

The DP channels, which give the apparent depth to the conductive material, also help to determine whether a conductive response arises from surficial material or from a conductive zone in the bedrock. When these channels ride above the zero level on the digital profiles (i.e., depth is negative), it implies that the EM and resistivity profiles are responding primarily to a conductive upper layer, i.e., conductive overburden. If the DP channels are below the zero level, it indicates that a resistive upper layer exists, and this usually implies the existence of a bedrock conductor. If the low frequency DP channel is below the zero level and the high frequency DP is above, this suggests that a bedrock conductor occurs beneath conductive cover.

The conductance channel CDT identifies discrete conductors which have been selected by computer for appraisal by the geophysicist. Some of these automatically selected anomalies on channel CDT are discarded by the geophysicist. The automatic selection algorithm is intentionally oversensitive to assure that no meaningful responses are missed. The interpreter then classifies the anomalies according to their source and eliminates those that are not substantiated by the data, such as those arising from geologic or aerodynamic noise.

Reduction of geologic noise

Geologic noise refers to unwanted geophysical responses. For purposes of airborne EM surveying, geologic noise refers to EM responses caused by conductive overburden and magnetic permeability. It was mentioned previously that the EM difference channels (i.e., channel DFI for inphase and DFQ for quadrature) tend to eliminate the response of conductive overburden. This marked a unique development in airborne EM technology, as DIGHEM is the only EM system which yields channels having an exceptionally high degree of immunity to conductive overburden.

Magnetite produces a form of geological noise on the inphase channels of all EM systems. Rocks containing less than 1% magnetite can yield negative inphase anomalies caused by magnetic permeability. When magnetite is widely distributed throughout a survey area, the inphase EM channels may continuously rise and fall, reflecting variations in the magnetite percentage, flying height, and overburden thickness. This can lead to difficulties in recognizing deeply buried bedrock conductors, particularly if conductive overburden also exists. However, the response of broadly distributed magnetite generally vanishes on the inphase difference channel DFI. This feature can be a significant aid in the recognition of conductors which occur in rocks containing accessory magnetite.

EM magnetite mapping

The information content of DIGHEM data consists of a combination of conductive eddy current responses and magnetic permeability responses. The secondary field resulting from conductive eddy current flow is frequency-dependent and consists of both inphase and quadrature components, which are positive in sign. On the other hand, the secondary field resulting from magnetic permeability is independent of frequency and consists of only an inphase component which is negative in sign. When magnetic permeability manifests itself by decreasing the measured amount of positive inphase, its presence may be difficult to recognize. However, when it manifests itself by yielding a negative inphase anomaly (e.g., in the absence of eddy current flow), its presence is assured. In this latter case, the negative component can be used to estimate the percent magnetite content.

A magnetite mapping technique was developed for the coplanar coil-pair of DIGHEM. The technique yields a channel (designated FEO) which displays apparent weight percent magnetite according to a homogeneous half space model.[3] The method can be complementary to magnetometer mapping in certain cases. Compared to magnetometry, it is far less sensitive but is more able to resolve closely spaced magnetite zones, as well as providing an estimate of the amount of magnetite in the rock. The method is sensitive to 1/4% magnetite by weight when the EM sensor is at a height of 30 m above a magnetitic half space. It can individually resolve steep dipping narrow magnetite-rich bands which are separated by 60 m. Unlike magnetometry, the EM magnetite method is unaffected by remanent magnetism or magnetic latitude.

The EM magnetite mapping technique provides estimates of magnetite content which are usually correct within a factor of 2 when the magnetite is fairly uniformly distributed. EM magnetite maps can be generated when magnetic permeability is evident as negative inphase responses on the data profiles.

Like magnetometry, the EM magnetite method maps only bedrock features, provided that the overburden is characterized by a general lack of magnetite. This contrasts with resistivity mapping which portrays the combined effect of bedrock and overburden.

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[3] Refer to Fraser, 1981, Magnetite mapping with a multi-coil airborne electromagnetic system: Geophysics, v. 46, p. 1579-1594.

Recognition of culture

Cultural responses include all EM anomalies caused by man-made metallic objects. Such anomalies may be caused by inductive coupling or current gathering. The concern of the interpreter is to recognize when an EM response is due to culture. Points of consideration used by the interpreter, when coaxial and coplanar coil-pairs are operated at a common frequency, are as follows:

1. Channels CXP and CPP monitor 60 Hz radiation. An anomaly on these channels shows that the conductor is radiating power. Such an indication is normally a guarantee that the conductor is cultural. However, care must be taken to ensure that the conductor is not a geologic body which strikes across a power line, carrying leakage currents.

2. A flight which crosses a "line" (e.g., fence, telephone line, etc.) yields a center-peaked coaxial anomaly and an m-shaped coplanar anomaly.[4] When the flight crosses the cultural line at a high angle of intersection, the amplitude ratio of coaxial/coplanar response is 4. Such an EM anomaly can only be caused by a line. The geologic body which yields anomalies most closely resembling a line is the vertically dipping thin dike. Such a body, however, yields an amplitude ratio of 2 rather than 4. Consequently, an

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[4] See Figure 5-1 presented earlier.

m-shaped coplanar anomaly with a CXI/CPI amplitude ratio of 4 is virtually a guarantee that the source is a cultural line.

3. A flight which crosses a sphere or horizontal disk yields center-peaked coaxial and coplanar anomalies with a CXI/CPI amplitude ratio (i.e., coaxial/coplanar) of 1/4. In the absence of geologic bodies of this geometry, the most likely conductor is a metal roof or small fenced yard.[5] Anomalies of this type are virtually certain to be cultural if they occur in an area of culture.

4. A flight which crosses a horizontal rectangular body or wide ribbon yields an m-shaped coaxial anomaly and a center-peaked coplanar anomaly. In the absence of geologic bodies of this geometry, the most likely conductor is a large fenced area.[5] Anomalies of this type are virtually certain to be cultural if they occur in an area of culture.

5. EM anomalies which coincide with culture, as seen on the camera film or video display, are usually caused by culture. However, care is taken with such coincidences because a geologic conductor could occur beneath a fence, for example. In this example, the fence would be expected to yield an m-shaped coplanar anomaly as in case #2 above.

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[5] It is a characteristic of EM that geometrically similar anomalies are obtained from: (1) a planar conductor, and (2) a wire which forms a loop having dimensions identical to the perimeter of the equivalent planar conductor.

If, instead, a center-peaked coplanar anomaly occurred, there would be concern that a thick geologic conductor coincided with the cultural line.

6. The above description of anomaly shapes is valid when the culture is not conductively coupled to the environment. In this case, the anomalies arise from inductive coupling to the EM transmitter. However, when the environment is quite conductive (e.g., less than 100 ohm-m at 900 Hz), the cultural conductor may be conductively coupled to the environment. In this latter case, the anomaly shapes tend to be governed by current gathering. Current gathering can completely distort the anomaly shapes, thereby complicating the identification of cultural anomalies. In such circumstances, the interpreter can only rely on the radiation channels and on the camera film or video records.

MAGNETICS

The existence of a magnetic correlation with an EM anomaly is indicated directly on the EM map. In some geological environments, an EM anomaly with magnetic correlation has a greater likelihood of being produced by sulfides than one that is non-magnetic. However, sulfide ore bodies may be non-magnetic (e.g., the Kidd Creek deposit near Timmins, Canada) as well as magnetic (e.g., the Mattabi deposit near Sturgeon Lake, Canada).

The magnetometer data are digitally recorded in the aircraft to an accuracy of 0.01 nT for cesium magnetometers. The digital tape is processed by computer to yield a total field magnetic contour map. When warranted, the magnetic data may also be treated mathematically to enhance the magnetic response of the near-surface geology, and an enhanced magnetic contour map is then produced. The response of the enhancement operator in the frequency domain is illustrated in Figure 5-2. This figure shows that the passband components of the airborne data are amplified 20 times by the enhancement operator. This means, for example, that a 100 nT anomaly on the enhanced map reflects a 5 nT anomaly for the passband components of the airborne data.

The enhanced map, which bears a resemblance to a downward continuation map, is produced by the digital bandpass filtering of the total field data. The enhancement is equivalent to continuing the field downward to a level (above the source) which is 1/20th of the actual sensor-source distance.

Because the enhanced magnetic map bears a resemblance to a ground magnetic map, it simplifies the recognition of trends in the rock strata and the interpretation of geological structure. It defines the near-surface local geology while de-emphasizing deep-seated regional features. It primarily has application when the magnetic rock units are steeply dipping and the earth's field dips in excess of 60 degrees.

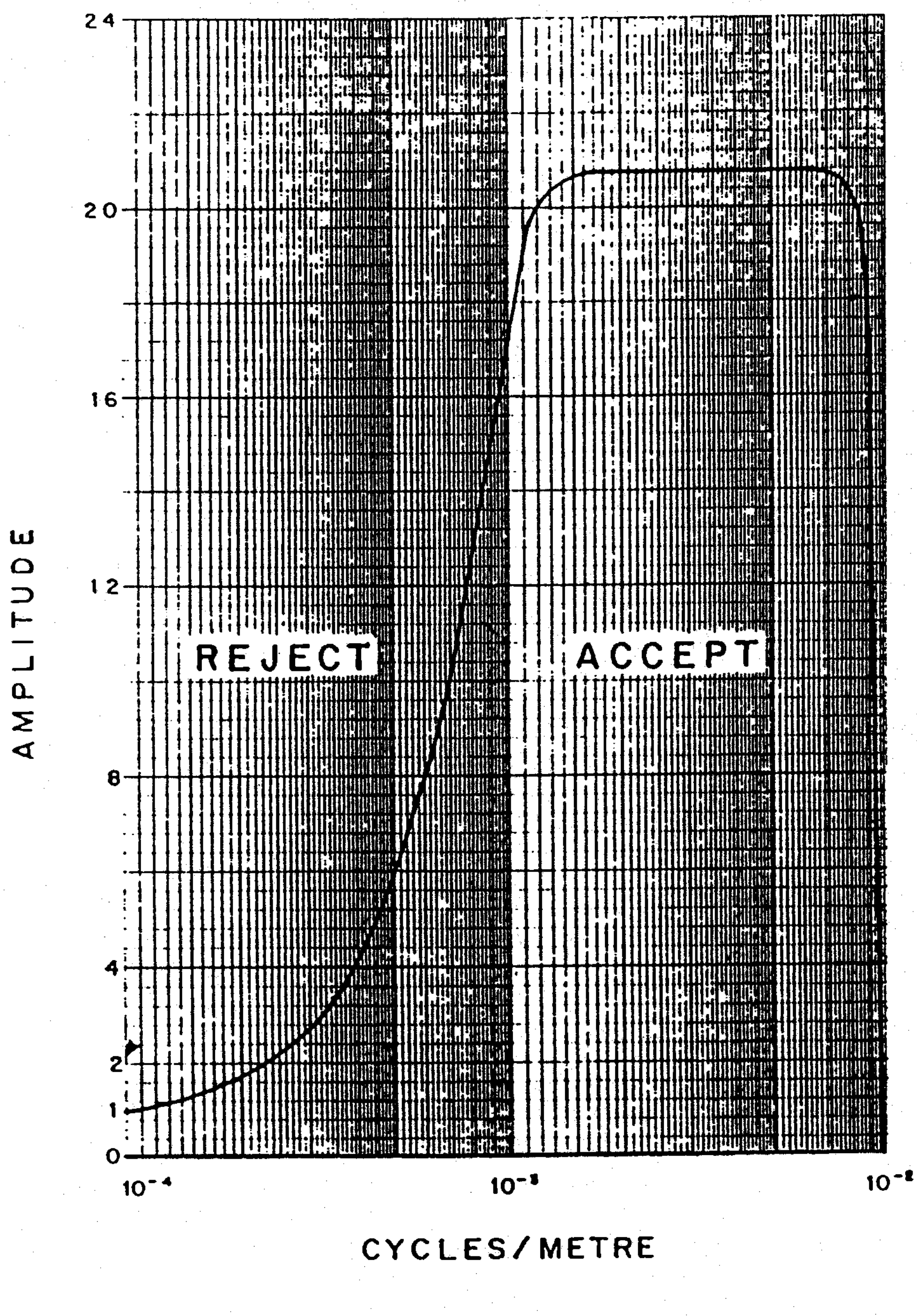

Fig. 5-2 Frequency response of magnetic enhancement operator.

Any of a number of filter operators may be applied to the magnetic data, to yield vertical derivatives, continuations, magnetic susceptibility, etc. These may be displayed in contour, colour or shadow.

VLF

VLF transmitters produce high frequency uniform electromagnetic fields. However, VLF anomalies are not EM anomalies in the conventional sense. EM anomalies primarily reflect eddy currents flowing in conductors which have been energized inductively by the primary field. In contrast, VLF anomalies primarily reflect current gathering, which is a non-inductive phenomenon. The primary field sets up currents which flow weakly in rock and overburden, and these tend to collect in low resistivity zones. Such zones may be due to massive sulfides, shears, river valleys and even unconformities.

The VLF field is horizontal. Because of this, the method is quite sensitive to the angle of coupling between the conductor and the transmitted VLF field. Conductors which strike towards the VLF station will usually yield a stronger response than conductors which are nearly orthogonal to it.

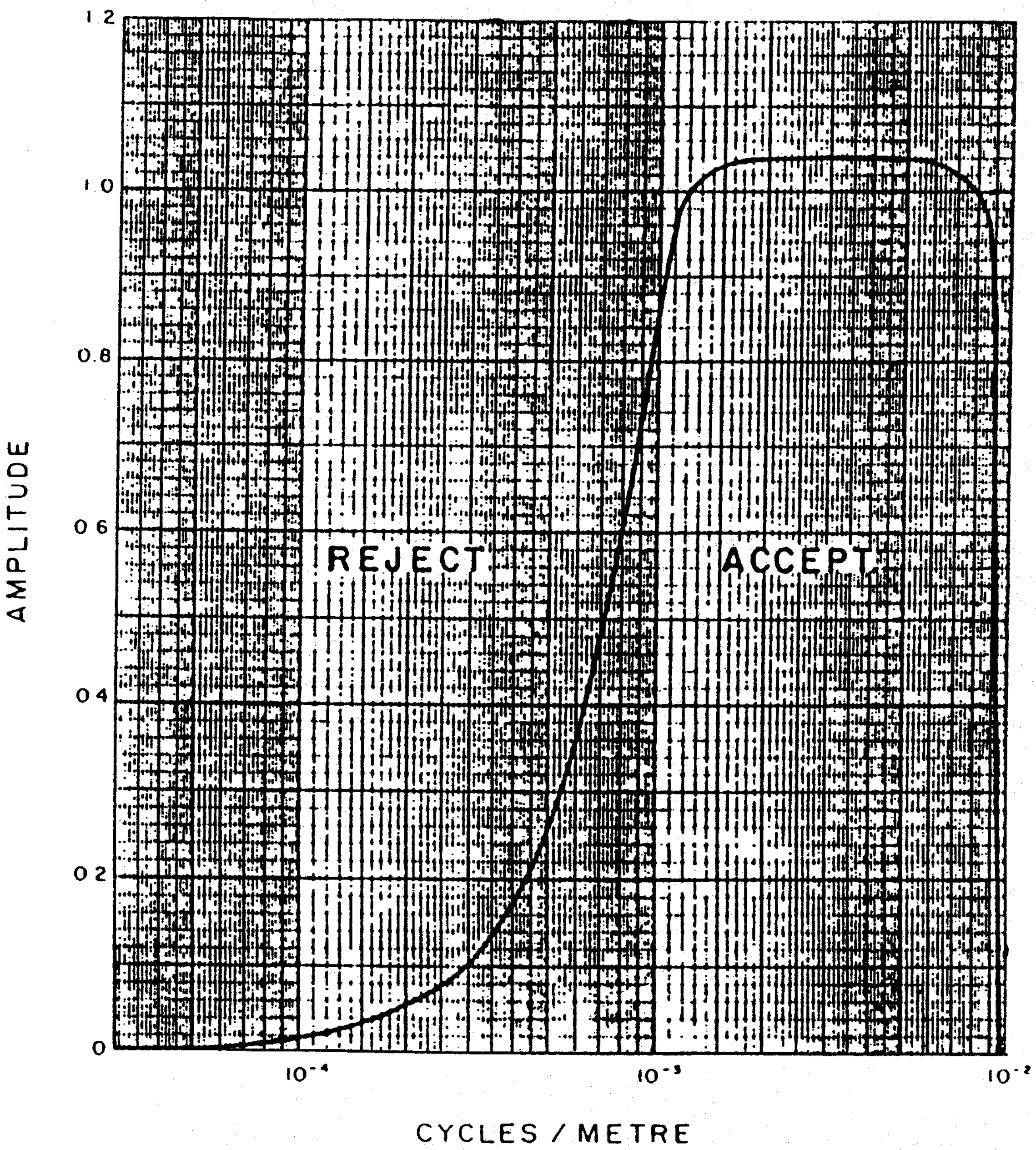

Fig. 5-3 Frequency response of VLF operator.

The Herz Industries Ltd. Totem VLF-electromagnetometer measures the total field and vertical quadrature components. Both of these components are digitally recorded in the aircraft with a sensitivity of 0.1 percent. The total field yields peaks over VLF current concentrations whereas the quadrature component tends to yield crossovers. Both appear as traces on the profile records. The total field data are filtered digitally and displayed as contours to facilitate the recognition of trends in the rock strata and the interpretation of geologic structure.

The response of the VLF total field filter operator in the frequency domain (Figure 5-3) is basically similar to that used to produce the enhanced magnetic map (Figure 5-2). The two filters are identical along the abscissa but different along the ordinant. The VLF filter removes long wavelengths such as those which reflect regional and wave transmission variations. The filter sharpens short wavelength responses such as those which reflect local geological variations.

CONCLUSIONS AND RECOMMENDATIONS

This report provides a very brief description of the survey results and describes the equipment, procedures and logistics of the survey.

The survey was successful in locating several anomalous features which may warrant additional work. The various maps included with this report display the magnetic and conductive properties of the survey area. It is recommended that the survey results be reviewed in detail, in conjunction with all available geophysical, geological and geochemical information. Particular reference should be made to the computer generated data profiles which clearly define the characteristics of the individual anomalies.

As the targets of this survey can vary greatly in geophysical signature, some may be quite poorly defined by the survey data.

The anomalous zones defined by the survey should be subjected to further investigation, using appropriate surface exploration techniques. Anomalies which are currently considered to be of moderately low priority may require upgrading if follow-up results are favourable.

It is also recommended that image processing of existing geophysical data be considered, in order to extract the maximum amount of information from the survey results. Current software and imaging techniques often provide valuable information on structure and lithology, which may not be clearly evident on the contour and colour maps. These techniques can yield images which define subtle, but significant, structural details.

Respectfully submitted,

DIGHEM

[redacted]

Ruth A. Pritchard
Geophysicist

RAP/sdp

A1159FEB.94R

APPENDIX A

LIST OF PERSONNEL

The following personnel were involved in the acquisition, processing, interpretation and presentation of data, relating to a DIGHEM^V airborne geophysical survey carried out for Marum Resources Inc., near Milk River, Alberta.

Steve Kilty	Vice President, Operations
Robert Gordon	Survey Operations Supervisor
Steven Haney	Senior Geophysical Operator
Bill Hoffstedt	Pilot (Questral Helicopters Ltd.)
Gordon Smith	Data Processing Supervisor
Ruth A. Pritchard	Interpretation Geophysicist
Lyn Vanderstarren	Drafting Supervisor
Steve Mast	Draftsperson (CAD)
Susan Pothiah	Word Processing Operator
Albina Tonello	Secretary/Expeditor

The survey consisted of 1020 km of coverage, flown from November 10 to November 12, 1993.

All personnel are employees of Dighem, except for the pilot who is an employee of Questral Helicopters Ltd.

DIGHEM

[redacted]

Ruth A. Pritchard
Geophysicist

RAP/sdp

A1159FEB.94R

APPENDIX B

STATEMENT OF COST

Date: February 18, 1994

IN ACCOUNT WITH DIGHEM

To: Dighem flying of Agreement dated November 15, 1993, pertaining to an Airborne Geophysical Survey in the Milk River area, Alberta.

Survey Charges

1020 km of flying @ $40.00/km	$40,800.00

Allocation of Costs

- Data Acquisition	(60%)
- Data Processing	(20%)
- Interpretation, Report and Maps	(20%)

DIGHEM

[redacted]

Ruth A. Pritchard
Geophysicist

RAP/sdp

A1159FEB.94R

APPENDIX C

EM ANOMALY LIST

JOB #1159 MILK RIVER AREA, ALBERTA

ANOMALY/	FID/INTERP	COAXIAL 1190 HZ REAL PPM	COAXIAL 1190 HZ QUAD PPM	COPLANAR 895 HZ REAL PPM	COPLANAR 895 HZ QUAD PPM	COPLANAR 7233 HZ REAL PPM	COPLANAR 7233 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10010	(FLIGHT 1)													
A	1595H	32	59	36	78	214	194	4.7	6	3	25	11	10	0
B	1556H	1	10	32	58	156	115	0.5	1	4	24	10	9	0
C	1543H	97	165	47	152	621	253	7.5	0	4	15	7	3	0
D	1526H	67	115	54	112	284	214	6.5	1	4	19	8	6	0
E	1520L	28	23	28	48	133	67	10.6	16	4	19	8	5	0
F	1483H	1	2	1	2	2	4	-	-	-	-	-	-	0
G	1478L?	35	41	40	84	151	79	7.8	12	4	19	8	7	0
H	1458H	24	71	8	69	689	669	3.0	7	4	21	8	9	0
I	1440H	1	2	1	2	2	4	-	-	-	-	-	-	0
J	1408B?	53	101	87	193	532	300	5.4	1	4	17	8	5	0
K	1405B?	71	145	87	193	532	400	5.7	0	4	16	8	4	0
L	1392H	1	2	1	2	2	4	-	-	-	-	-	-	0
M	1368H	37	63	48	114	297	188	5.3	2	4	18	9	5	0
N	1339H	1	2	1	2	2	4	-	-	-	-	-	-	0
O	1314H	11	48	44	110	165	307	1.6	4	4	21	9	8	0
P	1276H	1	2	1	2	2	4	-	-	-	-	-	-	0
Q	1258B?	17	27	20	31	92	96	4.4	14	4	27	10	12	0
R	1253B?	22	57	73	55	199	309	3.2	9	3	29	12	14	0
S	1247B?	58	85	74	106	257	384	7.3	10	4	26	8	13	0
T	1238B?	46	53	58	70	186	116	8.7	11	5	25	6	12	0
U	1235H	46	26	58	70	186	116	19.7	18	5	20	5	8	0
V	1226B?	100	51	151	20	106	16	30.7	6	5	22	6	10	0
W	1205B?	41	84	395	33	121	145	4.8	10	5	19	6	8	0
X	1203B?	133	251	199	33	121	915	7.5	1	5	18	6	7	0
Y	1200B?	104	184	154	327	803	758	7.4	2	4	21	6	9	0
Z	1192B?	78	193	99	277	769	964	5.1	4	4	24	8	12	0
AA	1145H	1	2	1	2	2	4	-	-	-	-	-	-	0
AB	1122L	49	56	77	90	211	212	9.0	8	4	29	8	15	0
AC	1108L?	67	65	87	101	214	79	11.8	0	4	31	9	16	0
AD	1099H	1	2	1	2	2	4	-	-	-	-	-	-	0
AE	1086L?	42	20	65	16	41	104	24.6	8	4	27	8	12	0
AF	1056H	26	57	35	80	190	316	3.8	11	4	33	7	19	0
AG	1039H	12	0	196	306	429	182	49.0	62	5	16	5	6	0
AH	1015H	71	81	118	155	508	181	10.3	8	5	15	5	5	0
LINE 10020	(FLIGHT 1)													
A	1760H	58	102	68	152	401	308	6.1	2	4	20	10	6	0
B	1788H	1	2	1	2	2	4	-	-	-	-	-	-	0
C	1817H	42	89	58	133	353	307	4.6	2	4	19	8	6	0
D	1825L?	44	69	41	85	219	115	6.2	4	4	19	8	6	0
E	1837H	1	2	1	2	2	4	-	-	-	-	-	-	0

* ESTIMATED DEPTH MAY BE UNRELIABLE BECAUSE THE STRONGER PART OF THE CONDUCTOR MAY BE DEEPER OR TO ONE SIDE OF THE FLIGHT LINE, OR BECAUSE OF A SHALLOW DIP OR OVERBURDEN EFFECTS.

JOB #1159 MILK RIVER AREA, ALBERTA

	COAXIAL 1190 HZ		COPLANAR 895 HZ		COPLANAR 7233 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH		MAG CORR
ANOMALY/ FID/INTERP	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND SIEMEN	DEPTH* M	COND SIEMEN	DEPTH M	RESIS OHM-M	DEPTH M	NT
LINE 10020 (FLIGHT 1)													
F 1958H	1	2	1	2	2	4	-	-	-	-	-	-	0
G 1993H	28	55	50	83	208	108	4.3	0	4	19	9	4	0
H 2030H	1	2	1	2	2	4	-	-	-	-	-	-	0
I 2061H	1	2	1	2	2	4	-	-	-	-	-	-	0
J 2093B?	17	44	30	47	127	124	3.0	3	3	33	12	16	0
K 2097B?	5	11	85	47	127	124	2.0	15	4	38	8	22	0
L 2106B?	27	140	88	210	487	206	2.0	0	6	18	4	7	0
M 2134H	6	30	43	55	134	156	1.2	0	5	20	6	7	0
N 2153B?	90	70	66	214	570	515	17.2	11	4	24	7	11	0
O 2159B?	113	210	158	312	816	922	7.2	6	4	25	7	13	0
P 2189H	37	54	49	81	208	166	6.3	5	5	22	5	9	0
Q 2199H	49	46	71	74	163	42	11.3	1	6	17	4	5	0
R 2212H	1	2	1	2	2	4	-	-	-	-	-	-	0
S 2222L?	16	52	2	74	184	219	2.4	0	5	30	6	15	0
T 2233H	45	51	64	81	192	133	8.8	8	4	31	8	17	0
U 2267H	3	3	44	58	132	118	3.1	57	5	22	6	10	0
V 2283E	14	21	37	17	34	95	4.6	16	4	42	7	26	0
W 2292H	21	28	41	54	140	98	5.8	14	5	24	6	11	0
X 2308H	2	18	68	41	86	59	0.4	0	7	19	3	8	0
LINE 10030 (FLIGHT 1)													
A 3146H	28	46	31	63	172	128	5.0	2	4	21	10	6	0
B 3132H	1	2	1	2	2	4	-	-	-	-	-	-	0
C 3110H	50	81	49	31	63	75	6.2	3	4	20	8	7	0
D 3090H	32	46	34	81	234	183	6.1	9	4	23	9	9	0
E 3086L?	11	16	34	81	234	36	4.2	20	4	24	9	9	0
F 3079H	32	50	41	72	180	93	5.6	0	4	19	8	5	0
G 3067L?	44	62	5	20	42	48	7.1	2	4	22	8	8	0
H 3056H	35	65	38	80	225	154	5.0	0	4	18	8	5	0
I 3004H	23	59	31	78	222	242	3.3	3	4	25	10	11	5
J 2966H	22	47	27	64	179	126	3.7	1	4	21	9	7	0
K 2940H	1	2	1	2	2	4	-	-	-	-	-	-	0
L 2888B?	42	72	55	105	283	234	5.7	2	4	21	9	8	0
M 2877H	30	50	47	80	205	114	5.2	3	4	20	8	6	0
N 2860H	12	29	40	86	234	188	2.8	8	4	21	8	7	0
O 2838B?	42	64	56	85	221	160	6.4	0	4	17	7	3	0
P 2822H	2	16	41	67	172	110	0.6	0	4	21	9	7	0
Q 2795H	1	2	1	2	2	4	-	-	-	-	-	-	0
R 2767H	1	2	1	2	2	4	-	-	-	-	-	-	0
S 2740B?	81	106	94	148	354	208	9.3	0	5	18	5	6	0
T 2728B?	32	60	51	89	247	230	4.6	3	4	25	7	11	0

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JOB #1159 MILK RIVER AREA, ALBERTA

ANOMALY/	FID/INTERP	COAXIAL 1190 HZ REAL PPM	COAXIAL 1190 HZ QUAD PPM	COPLANAR 895 HZ REAL PPM	COPLANAR 895 HZ QUAD PPM	COPLANAR 7233 HZ REAL PPM	COPLANAR 7233 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10030	(FLIGHT 1)													
U	2685B?	75	92	93	131	327	218	9.7	4	5	22	5	10	0
V	2664H	40	52	139	86	206	118	7.4	6	5	15	5	4	0
W	2629L?	27	66	48	94	161	11	3.6	0	4	27	10	11	0
X	2614L?	11	8	9	16	32	46	8.9	31	4	32	8	17	0
Y	2606H	31	34	37	41	98	126	8.2	13	4	32	9	17	0
Z	2586H	19	29	36	44	110	76	4.9	6	5	26	6	12	0
AA	2573H	108	150	146	171	399	247	9.5	1	5	22	5	11	0
AB	2524H	45	96	299	210	404	260	4.7	1	6	14	3	5	0
LINE 10040	(FLIGHT 1)													
A	3258H	1	2	1	2	2	4	-	-	-	-	-	-	0
B	3279H	3	19	17	34	90	61	0.8	4	4	21	9	7	0
C	3308H	39	56	44	80	203	100	6.6	2	4	17	8	4	0
D	3325B?	40	73	37	157	451	345	5.2	4	4	18	9	5	0
E	3340B?	75	134	86	202	529	243	6.6	1	4	20	8	7	0
F	3346L?	19	15	79	161	422	328	10.6	19	4	24	9	9	0
G	3375H	52	72	65	108	270	98	7.4	3	4	18	8	5	0
H	3387L	4	8	62	110	288	191	2.3	35	4	19	7	6	0
I	3390H	1	2	1	2	2	4	-	-	-	-	-	-	0
J	3410L?	18	37	8	67	185	149	3.5	9	4	27	10	12	0
K	3532H	7	27	15	5	99	4	1.5	0	4	23	9	8	0
L	3569B?	70	78	81	104	253	336	10.6	7	4	24	9	10	0
M	3571B?	29	55	81	51	156	192	4.5	9	4	30	9	15	0
N	3576B?	13	18	38	24	94	94	4.7	18	4	26	9	12	0
O	3582B?	35	75	38	97	298	284	4.3	2	3	26	11	11	0
P	3592B?	85	123	102	149	419	304	8.4	2	4	24	8	11	0
Q	3607B?	12	25	37	45	118	68	3.0	2	4	34	11	17	0
R	3623B?	32	64	34	77	218	181	4.4	1	4	24	9	10	0
S	3636B?	6	26	29	43	105	120	1.3	0	5	28	6	14	0
T	3643B?	146	187	213	283	682	456	11.5	3	6	22	4	11	0
U	3685H	1	2	1	2	2	4	-	-	-	-	-	-	0
V	3724H	45	44	60	79	149	68	10.4	4	5	16	5	5	0
W	3744H	48	75	70	118	302	251	6.4	5	5	24	6	12	0
X	3747L	48	75	70	118	302	251	6.4	1	5	30	7	16	9
Y	3758B?	33	70	42	95	234	435	4.2	8	4	32	10	17	0
Z	3764L?	8	6	26	59	142	17	7.7	43	4	35	8	20	0
AA	3779H	36	45	44	67	176	151	7.2	6	4	30	8	15	0
AB	3797H	1	2	1	2	2	4	-	-	-	-	-	-	0
AC	3808H	97	114	132	173	424	259	10.9	2	5	22	5	10	0
AD	3837H	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 10050	(FLIGHT 1)													
A	4640H	25	50	60	115	311	283	4.1	6	4	20	9	6	0

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JOB #1159 MILK RIVER AREA, ALBERTA

	COAXIAL 1190 HZ		COPLANAR 895 HZ		COPLANAR 7233 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH		MAG CORR
ANOMALY/ FID/INTERP	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND SIEMEN	DEPTH* M	COND SIEMEN	DEPTH M	RESIS OHM-M	DEPTH M	NT
LINE 10050 (FLIGHT 1)													
B 4632H	30	36	41	87	124	173	7.2	13	4	21	9	7	0
C 4615H	31	51	39	76	201	147	5.2	6	4	21	8	7	0
D 4595B?	57	130	67	176	530	479	4.8	0	4	17	9	4	0
E 4590B?	49	95	49	117	330	259	5.2	4	4	24	10	10	0
F 4566L	14	5	13	18	43	19	28.9	33	4	22	9	7	0
G 4556H	38	49	51	73	177	72	7.1	1	4	18	8	4	0
H 4536H	1	2	1	2	2	4	-	-	-	-	-	-	0
I 4530L	1	2	1	2	2	4	-	-	-	-	-	-	0
J 4512H	37	58	54	90	234	112	5.8	2	4	19	8	6	6
K 4460H	1	2	1	2	2	4	-	-	-	-	-	-	0
L 4419H	40	59	46	86	225	116	6.3	4	4	18	8	5	0
M 4395H	48	94	63	130	358	305	5.2	2	4	22	8	8	0
N 4380H	59	99	73	136	376	255	6.5	0	4	18	8	5	0
O 4356H	1	2	1	2	2	4	-	-	-	-	-	-	0
P 4340H	1	2	1	2	2	4	-	-	-	-	-	-	0
Q 4321H	37	68	50	96	259	198	4.9	2	4	22	8	8	0
R 4301B?	74	116	86	142	408	310	7.4	2	3	29	11	14	0
S 4291B?	16	18	23	25	67	35	6.3	10	5	34	7	18	0
T 4285B?	10	24	6	36	96	69	2.5	6	3	35	12	18	0
U 4264H	1	2	1	2	2	4	-	-	-	-	-	-	0
V 4254B?	56	66	75	97	234	124	9.2	2	5	24	5	11	0
W 4251B?	11	20	26	26	57	50	3.2	18	5	30	5	17	0
X 4237H	40	110	85	184	500	358	3.7	0	4	22	7	10	0
Y 4226B?	51	63	80	99	250	110	8.3	2	5	42	6	27	0
Z 4218B?	73	130	95	169	513	526	6.5	5	4	25	8	13	0
AA 4199H	1	2	1	2	2	4	-	-	-	-	-	-	0
AB 4160H	1	2	1	2	2	4	-	-	-	-	-	-	4
AC 4120L	25	21	17	41	117	5	10.4	14	4	32	9	16	0
AD 4096H	19	37	26	57	139	177	3.9	5	4	25	8	11	0
AE 4065E	43	32	139	181	182	224	14.0	18	5	22	5	11	0
AF 4026H	57	57	85	81	193	79	10.9	8	7	15	3	6	0
LINE 10060 (FLIGHT 1)													
A 4877H	81	36	105	253	169	660	34.0	19	4	18	8	6	0
B 4897H	36	29	49	66	195	225	12.5	20	4	19	8	7	0
C 4954L?	10	1	25	36	85	62	49.0	44	4	23	9	8	0
D 4967L?	1	2	1	2	2	4	-	-	-	-	-	-	0
E 4970L?	1	2	1	2	2	4	-	-	-	-	-	-	0
F 5005L?	1	2	1	2	2	4	-	-	-	-	-	-	0
G 5008L?	8	17	21	86	243	168	2.6	15	4	22	7	8	0
H 5011L?	26	62	21	86	243	168	3.6	2	4	19	8	6	0

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JOB #1159 MILK RIVER AREA, ALBERTA

ANOMALY/	FID/INTERP	COAXIAL 1190 HZ		COPLANAR 895 HZ		COPLANAR 7233 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH		MAG CORR
		REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND SIEMEN	DEPTH* M	COND SIEMEN	DEPTH M	RESIS OHM-M	DEPTH M	NT
LINE 10060	(FLIGHT 1)													
I	5014L?	32	65	33	87	106	78	4.3	3	4	19	8	6	0
J	5025H	31	51	49	41	121	137	5.3	10	4	20	7	7	0
K	5027L?	1	2	1	2	2	4	-	-	-	-	-	-	0
L	5049H	1	2	1	2	2	4	-	-	-	-	-	-	0
M	5106H	22	93	66	127	27	236	2.2	0	4	19	8	6	0
N	5145H	1	2	1	2	2	4	-	-	-	-	-	-	0
O	5160H	14	90	66	101	274	130	1.2	0	4	20	7	7	0
P	5189H	1	2	1	2	2	4	-	-	-	-	-	-	0
Q	5212B?	63	75	95	117	297	197	9.4	2	5	27	6	14	0
R	5239B?	61	97	81	137	333	236	6.9	7	6	23	4	12	0
S	5268B?	90	92	123	129	320	179	12.5	4	6	22	4	11	0
T	5278B?	21	36	15	43	118	182	4.5	11	4	30	7	16	0
U	5290H	41	69	56	100	285	189	5.7	7	4	22	7	10	0
V	5304H	37	47	51	84	231	195	7.2	12	5	25	6	13	0
W	5325B	121	170	133	234	603	496	9.8	5	5	23	5	12	0
X	5343H	85	103	128	174	427	281	10.1	6	5	23	5	12	0
Y	5357B?	127	182	157	262	685	494	9.7	4	5	22	5	11	0
Z	5368B?	47	86	69	117	335	8	5.5	1	4	21	7	9	0
AA	5378L	66	63	57	86	245	54	12.2	8	5	25	6	12	5
AB	5403B?	53	89	70	119	328	294	6.2	6	4	29	7	16	0
AC	5420B?	1	2	1	2	2	4	-	-	-	-	-	-	0
AD	5436B?	119	132	180	211	528	321	12.6	1	6	21	4	10	0
AE	5477H	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 10070	(FLIGHT 2)													
A	934H	28	54	36	78	206	200	4.4	6	4	23	9	9	0
B	887H	1	2	1	2	2	4	-	-	-	-	-	-	0
C	874H	46	85	68	130	356	306	5.3	4	4	19	8	6	30
D	864H	47	91	69	128	363	281	5.1	1	4	21	9	8	0
E	854L	1	2	1	2	2	4	-	-	-	-	-	-	0
F	852L	20	26	24	42	120	124	6.0	10	4	25	10	9	0
G	846L	46	80	53	111	303	209	5.7	2	4	21	10	7	0
H	820H	59	94	75	134	387	321	6.7	1	4	22	9	8	0
I	779H	1	2	1	2	2	4	-	-	-	-	-	-	0
J	776L?	1	2	1	2	2	4	-	-	-	-	-	-	0
K	755H	1	2	1	2	2	4	-	-	-	-	-	-	0
L	726B?	46	98	55	122	338	362	4.8	3	4	22	9	9	0
M	723B?	1	2	1	2	2	4	-	-	-	-	-	-	0
N	685H	37	50	49	73	190	104	6.8	5	4	19	8	5	0
O	662H	29	56	4	9	225	186	4.4	6	4	22	9	8	0
P	639H	1	2	1	2	2	4	-	-	-	-	-	-	0

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ANOMALY/	FID/INTERP	COAXIAL 1190 HZ REAL PPM	COAXIAL 1190 HZ QUAD PPM	COPLANAR 895 HZ REAL PPM	COPLANAR 895 HZ QUAD PPM	COPLANAR 7233 HZ REAL PPM	COPLANAR 7233 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10070	(FLIGHT 2)													
Q	626H	51	114	67	149	418	430	4.8	4	4	22	9	9	0
R	616B?	74	152	95	209	564	556	5.8	1	4	21	8	8	0
S	608B?	31	71	52	118	306	225	4.0	2	4	24	9	10	0
T	599B?	74	142	98	240	638	483	6.0	2	3	23	10	9	0
U	585B?	43	33	36	109	308	311	13.7	18	3	31	13	15	0
V	579B?	46	70	54	79	200	141	6.6	4	5	30	7	17	0
W	564H	32	34	89	82	150	45	8.5	16	6	21	4	10	0
X	539H	1	2	1	2	2	4	-	-	-	-	-	-	0
Y	529B?	35	57	40	69	202	220	5.6	8	4	29	8	15	0
Z	509B	111	205	121	259	720	611	7.2	2	4	21	7	10	0
AA	497H	53	80	80	117	298	303	6.9	7	5	25	6	13	0
AB	487H	41	55	52	80	190	116	7.2	2	5	19	5	7	0
AC	475H	158	262	112	390	983	834	9.0	3	5	20	5	9	0
AD	444H	78	133	118	203	552	294	6.9	0	5	16	5	5	0
AE	431L	72	82	66	114	297	212	10.2	4	5	20	5	9	0
AF	423L	45	32	54	56	124	81	15.1	13	5	27	6	14	14
AG	409B?	113	248	162	364	922	1071	6.3	4	4	22	7	11	0
AH	392B?	138	196	36	207	523	411	10.2	2	5	20	5	9	0
AI	378H	54	75	49	136	364	270	7.5	7	5	21	6	9	0
AJ	320H	147	205	203	308	769	424	10.5	3	8	14	2	7	0
LINE 10080	(FLIGHT 2)													
A	1050B	55	206	109	291	810	862	3.2	0	4	21	9	8	0
B	1074H	16	40	34	88	287	100	2.9	12	4	17	7	5	0
C	1092H	1	2	1	2	2	4	-	-	-	-	-	-	0
D	1104H	46	108	61	159	471	398	4.4	3	4	21	9	8	0
E	1111H	66	139	89	207	557	470	5.4	3	4	21	8	9	0
F	1122B?	26	45	24	70	195	149	4.7	7	4	21	9	7	0
G	1132B?	66	117	85	168	458	310	6.3	4	4	21	8	8	0
H	1137B?	70	287	88	380	1107	1238	3.3	0	4	18	8	7	0
I	1147L	14	36	69	135	378	119	2.7	5	4	26	10	11	0
J	1151L	73	119	73	139	386	39	7.1	0	4	20	9	6	0
K	1158L?	31	65	40	95	264	233	4.3	5	4	22	9	8	0
L	1166L?	45	95	33	104	329	330	4.8	5	4	25	10	11	0
M	1181H	37	75	44	95	275	272	4.6	8	4	25	8	12	0
N	1189L	14	9	8	37	103	91	12.6	35	4	24	9	9	0
O	1197L?	1	2	1	2	2	4	-	-	-	-	-	-	0
P	1201L?	43	93	40	106	319	376	4.6	6	4	23	9	10	0
Q	1221H	1	2	1	2	2	4	-	-	-	-	-	-	0
R	1245H	1	2	1	2	2	4	-	-	-	-	-	-	0
S	1256H	1	2	1	2	2	4	-	-	-	-	-	-	0

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		COAXIAL 1190 HZ		COPLANAR 895 HZ		COPLANAR 7233 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH		MAG CORR
ANOMALY/	FID/INTERP	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND SIEMEN	DEPTH* M	COND SIEMEN	DEPTH M	RESIS OHM-M	DEPTH M	NT
LINE 10080	(FLIGHT 2)													
T	1280H	1	2	1	2	2	4	-	-	-	-	-	-	0
U	1311H	40	61	74	125	336	207	6.3	0	4	21	8	7	0
V	1366H	1	2	1	2	2	4	-	-	-	-	-	-	0
W	1377H	1	2	1	2	2	4	-	-	-	-	-	-	0
X	1431H	1	2	1	2	2	4	-	-	-	-	-	-	0
Y	1448B?	29	41	111	41	118	163	5.9	11	4	33	10	18	0
Z	1455B?	123	208	192	271	738	469	8.2	3	5	24	5	13	0
AA	1467H	1	2	1	2	2	4	-	-	-	-	-	-	0
AB	1482H	85	95	121	132	307	114	11.2	0	6	18	4	6	0
AC	1491B?	7	29	49	16	68	117	1.5	2	4	31	7	16	0
AD	1497H	21	32	53	44	126	189	4.9	14	4	24	7	11	0
AE	1525H	76	95	109	143	347	203	9.4	3	5	24	5	12	0
AF	1535H	45	60	59	95	236	160	7.3	4	5	22	5	10	0
AG	1544B?	72	124	101	169	443	389	6.7	2	5	21	5	10	0
AH	1546B?	74	124	101	169	443	389	6.9	1	5	22	5	11	0
AI	1557H	52	68	74	108	251	136	7.8	2	6	19	5	7	0
AJ	1566B?	55	116	77	117	546	626	5.1	0	5	16	6	5	0
AK	1588L	41	25	29	38	128	99	17.8	17	5	23	5	11	0
AL	1596H	88	146	122	210	568	120	7.5	7	5	24	6	12	0
AM	1609H	97	142	137	204	528	323	8.7	1	5	19	5	8	0
AN	1622B?	93	140	117	172	456	304	8.4	2	5	22	5	10	0
AO	1643H	58	60	56	97	255	143	10.6	10	6	21	4	10	0
AP	1656H	1	2	1	2	2	4	-	-	-	-	-	-	0
AQ	1678H	4	2	410	432	1036	383	12.0	79	8	17	2	8	0
LINE 10090	(FLIGHT 2)													
A	2392H	43	101	56	126	368	336	4.3	2	4	22	9	9	0
B	2374H	33	54	46	82	216	134	5.4	3	4	20	8	6	0
C	2357H	1	2	1	2	2	4	-	-	-	-	-	-	0
D	2344H	55	112	71	147	443	323	5.2	0	4	21	9	7	0
E	2316H	91	160	114	210	568	348	7.0	1	4	16	6	5	0
F	2305B?	42	98	37	129	396	463	4.3	2	4	20	9	7	0
G	2299L	22	26	55	130	385	364	6.6	12	4	20	8	6	0
H	2273H	49	84	74	125	347	243	6.0	0	4	20	8	6	0
I	2270L	1	2	1	2	2	4	-	-	-	-	-	-	0
J	2260H	42	83	52	108	299	275	4.9	2	4	25	10	11	0
K	2223H	1	2	1	2	2	4	-	-	-	-	-	-	0
L	2212H	22	50	27	66	191	193	3.5	3	4	23	8	9	0
M	2171B?	42	72	60	112	294	247	5.6	3	4	24	9	10	0
N	2130H	7	19	24	48	69	73	2.0	8	4	23	8	9	0
O	2101H	39	71	58	104	289	226	5.2	3	4	20	7	7	0

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JOB #1159 MILK RIVER AREA, ALBERTA

ANOMALY/ FID/INTERP	COAXIAL 1190 HZ REAL PPM	COAXIAL 1190 HZ QUAD PPM	COPLANAR 895 HZ REAL PPM	COPLANAR 895 HZ QUAD PPM	COPLANAR 7233 HZ REAL PPM	COPLANAR 7233 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10090 (FLIGHT 2)													
P 2092H	19	42	32	65	181	150	3.4	6	4	19	7	6	0
Q 2065B?	26	50	40	74	193	171	4.2	5	4	22	8	9	0
R 2058B?	25	58	56	101	282	228	3.7	2	4	22	8	9	0
S 2046B	1	2	1	2	2	4	-	-	-	-	-	-	0
T 2031B?	47	56	69	89	226	155	8.4	7	4	32	10	17	0
U 2023B?	21	46	35	62	177	164	3.6	4	3	34	11	18	0
V 2015B?	45	54	43	5	10	134	8.2	3	4	32	10	16	0
W 2005H	9	9	44	53	130	185	6.2	36	6	21	4	9	0
X 1988H	41	31	57	46	117	121	13.6	6	6	24	5	11	0
Y 1980B?	42	72	49	89	242	204	5.7	7	4	31	8	17	0
Z 1966H	1	2	1	2	2	4	-	-	-	-	-	-	7
AA 1958H	20	33	28	45	110	90	4.6	6	5	28	6	15	0
AB 1941H	33	46	33	59	151	111	6.2	7	5	26	5	14	0
AC 1914H	1	2	1	2	2	4	-	-	-	-	-	-	0
AD 1909L?	20	7	36	39	86	64	28.6	32	6	26	4	14	0
AE 1893L	64	18	68	73	200	65	57.7	17	5	27	6	14	0
AF 1874B?	68	105	85	142	352	216	7.4	3	5	23	5	11	0
AG 1859H	0	2	1	2	2	4	-	-	-	-	-	-	0
AH 1851H	1	2	1	2	2	4	-	-	-	-	-	-	0
AI 1839B?	55	71	73	67	161	139	8.2	0	5	24	6	11	0
AJ 1817H	13	10	87	54	29	293	9.5	40	5	18	5	7	0
LINE 10100 (FLIGHT 2)													
A 2742H	58	108	79	163	445	372	5.8	3	4	20	7	8	0
B 2752H	36	68	49	106	280	224	4.9	5	4	20	7	7	0
C 2783H	46	69	60	100	253	144	6.6	1	4	22	8	8	0
D 2799H	29	50	43	81	210	132	5.0	4	4	24	8	10	0
E 2831L	21	17	17	9	22	44	9.7	12	4	22	8	7	0
F 2849H	1	2	1	2	2	4	-	-	-	-	-	-	0
G 2857L	23	15	11	11	23	7	13.4	17	4	25	8	10	0
H 2879H	44	70	64	111	284	170	6.2	0	4	21	8	8	0
I 2926H	1	2	1	2	2	4	-	-	-	-	-	-	0
J 2977E	52	83	70	115	304	221	6.5	0	4	27	9	12	0
K 3000H	22	37	29	57	158	134	4.4	8	4	24	8	10	0
L 3066H	53	101	71	148	421	289	5.4	3	4	19	7	7	0
M 3076H	44	87	63	122	345	334	5.0	6	4	24	8	11	0
N 3096H	50	94	24	135	384	448	5.4	5	4	22	9	9	0
O 3102L?	58	88	16	98	251	144	7.1	3	3	25	12	10	0
P 3116B?	99	196	101	203	569	467	6.5	2	3	23	11	9	0
Q 3122B?	18	15	68	125	324	204	9.2	18	3	35	13	17	0
R 3139B?	9	14	71	6	8	106	3.6	18	6	22	4	11	0

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JOB #1159 MILK RIVER AREA, ALBERTA

ANOMALY/ FID/INTERP		COAXIAL 1190 HZ REAL PPM	COAXIAL 1190 HZ QUAD PPM	COPLANAR 895 HZ REAL PPM	COPLANAR 895 HZ QUAD PPM	COPLANAR 7233 HZ REAL PPM	COPLANAR 7233 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10100	(FLIGHT 2)													
S	3143B?	19	16	71	108	282	395	8.7	26	5	29	6	16	0
T	3169B?	229	411	305	550	1416	1110	9.5	1	5	17	4	8	0
U	3181B?	76	139	102	191	479	347	6.4	5	5	28	5	16	0
V	3200B?	106	116	73	178	406	339	12.3	3	6	19	4	9	0
W	3203B?	116	156	73	178	527	339	10.0	0	6	18	4	7	0
X	3221B?	38	76	14	196	581	498	4.7	5	5	20	6	8	0
Y	3224B?	68	112	14	135	409	371	6.8	5	5	23	6	11	0
Z	3250H	37	41	208	291	723	389	8.6	15	6	17	4	7	0
AA	3268H	1	2	1	2	2	4	-	-	-	-	-	-	0
AB	3281B	165	297	226	440	1197	1006	8.4	4	5	19	5	9	0
AC	3294L	13	15	29	16	42	43	5.5	18	5	23	5	10	0
AD	3304L	23	43	18	61	153	102	4.1	7	6	25	3	14	0
AE	3328L	67	69	59	90	167	61	11.2	8	5	25	6	12	7
AF	3341H	107	162	157	243	615	340	8.7	1	5	21	5	9	0
AG	3379B?	31	108	95	142	404	328	2.8	0	5	25	7	12	0
AH	3381B?	53	108	95	142	404	328	5.2	0	5	25	5	12	0
AI	3409B?	98	94	279	300	869	597	13.9	9	5	16	5	6	0
AJ	3416B?	181	53	281	254	496	77	78.8	10	8	16	2	7	0
LINE 10110	(FLIGHT 2)													
A	4245H	37	67	46	95	261	217	5.1	1	4	24	9	9	0
B	4231H	90	157	123	224	596	440	7.1	0	4	20	7	8	0
C	4215H	53	86	36	118	311	205	6.4	1	4	22	8	9	0
D	4197H	62	125	84	69	206	361	5.6	0	4	19	8	6	0
E	4167L	1	2	1	2	2	4	-	-	-	-	-	-	0
F	4152L	19	38	24	54	150	133	3.7	0	4	28	9	13	0
G	4129L	34	13	43	27	167	209	31.9	25	4	20	7	7	0
H	4114H	56	113	64	164	485	523	5.3	2	4	20	9	7	0
I	4094H	28	49	27	73	215	199	4.8	10	4	25	10	11	0
J	4086H	58	94	79	161	463	402	6.7	4	4	22	8	9	0
K	4050H	32	63	5	84	240	235	4.5	6	4	27	9	13	0
L	4040H	41	74	22	111	304	278	5.3	4	4	24	8	10	0
M	4007B?	27	42	23	36	107	100	5.2	9	4	32	9	17	0
N	4000B?	13	23	11	37	92	84	3.6	15	4	30	9	15	0
O	3967H	1	2	1	2	2	4	-	-	-	-	-	-	0
P	3939H	1	2	1	2	2	4	-	-	-	-	-	-	0
Q	3930H	12	19	32	48	130	119	3.9	15	4	25	7	11	0
R	3904H	21	39	50	77	208	156	4.0	8	4	23	8	9	0
S	3895B?	11	30	24	81	127	244	2.5	10	4	26	8	13	0
T	3886B?	32	82	63	154	420	461	3.6	4	4	23	9	10	0
U	3883B?	31	78	89	163	420	461	3.6	6	4	25	8	12	0

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JOB #1159 MILK RIVER AREA, ALBERTA

		COAXIAL 1190 HZ		COPLANAR 895 HZ		COPLANAR 7233 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH		MAG CORR
ANOMALY/ FID/INTERP		REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND SIEMEN	DEPTH* M	COND SIEMEN	DEPTH M	RESIS OHM-M	DEPTH M	NT
LINE 10110	(FLIGHT 2)													
V	3870B?	42	82	71	115	326	287	4.9	1	4	21	8	8	0
W	3867B?	41	104	9	71	254	287	4.0	1	4	24	9	10	0
X	3858B?	28	45	12	24	80	106	5.2	10	4	26	9	12	0
Y	3854B?	39	74	34	67	194	177	4.9	9	3	28	10	14	0
Z	3841B?	60	140	22	212	603	535	4.9	2	4	24	10	10	0
AA	3825B?	32	44	149	176	461	282	6.4	11	6	21	4	10	0
AB	3822B?	54	40	84	63	132	109	15.7	14	6	24	4	13	0
AC	3801H	48	34	72	53	133	89	15.8	6	6	24	4	11	0
AD	3780B?	120	144	177	212	521	267	11.4	1	6	22	4	11	0
AE	3765B?	51	65	67	83	219	129	8.1	0	5	28	7	14	0
AF	3747H	1	2	1	2	2	4	-	-	-	-	-	-	0
AG	3725B?	40	45	54	56	128	43	8.7	0	6	21	5	8	0
AH	3722H	39	46	54	56	128	43	8.0	3	6	20	4	8	0
AI	3715H	48	54	76	78	189	75	9.2	0	6	22	4	10	0
AJ	3706L?	18	26	24	56	68	51	4.8	9	5	31	5	17	0
AK	3696L	27	8	26	14	27	14	43.0	21	7	26	3	14	0
AL	3667L	26	6	24	10	25	7	62.0	26	6	27	4	15	0
AM	3648H	42	40	57	63	156	79	10.6	9	6	26	4	14	0
AN	3638H	28	42	55	76	189	133	5.6	9	6	23	4	12	0
AO	3630H	88	105	133	160	376	208	10.5	6	6	23	4	12	0
AP	3618B?	54	81	91	129	344	219	6.9	4	5	24	6	12	0
AQ	3613B?	64	78	89	99	248	164	9.1	4	5	36	6	22	0
AR	3607B?	15	17	29	34	88	81	6.1	14	5	45	8	28	0
AS	3576B?	332	445	481	685	1582	731	14.4	0	8	14	2	6	0
LINE 10120	(FLIGHT 2)													
A	4499B?	58	138	160	435	1301	609	4.7	9	4	19	9	8	0
B	4513E	92	192	136	275	782	721	6.2	3	4	19	8	8	0
C	4517B?	92	192	136	287	782	721	6.2	0	4	25	8	11	0
D	4531H	32	63	57	107	324	279	4.6	7	4	19	7	7	0
E	4544B?	31	59	35	82	233	204	4.6	8	4	24	9	11	0
F	4554B?	50	103	60	145	428	414	5.1	1	4	18	9	6	0
G	4558B?	36	80	41	113	349	365	4.3	5	4	21	9	8	0
H	4564B?	49	90	59	130	374	144	5.6	4	4	23	9	9	0
I	4595H	25	52	63	104	320	277	4.0	9	4	19	8	6	0
J	4609L	43	51	39	72	215	141	8.3	10	4	21	8	8	0
K	4634L	37	117	86	160	451	323	3.2	0	4	21	8	9	0
L	4643H	46	96	56	132	401	260	4.8	1	4	17	7	5	0
M	4656B?	22	80	13	85	271	390	2.4	2	4	23	9	10	0
N	4661B?	89	180	112	232	673	619	6.2	1	4	22	9	9	0
O	4677B?	102	267	138	351	1059	1241	5.3	4	4	20	7	9	0

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JOB #1159 MILK RIVER AREA, ALBERTA

		COAXIAL 1190 HZ		COPLANAR 895 HZ		COPLANAR 7233 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH		MAG CORR
ANOMALY/	FID/INTERP	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND SIEMEN	DEPTH* M	COND SIEMEN	DEPTH M	RESIS OHM-M	DEPTH M	NT
LINE 10120	(FLIGHT 2)													
P	4700B?	8	93	57	111	311	313	0.7	0	4	23	8	9	0
Q	4705L?	52	94	48	2	13	296	5.8	4	4	26	9	12	0
R	4726H	1	2	1	2	2	4	-	-	-	-	-	-	0
S	4758B?	26	45	33	70	198	191	4.6	7	4	25	10	10	0
T	4760B?	27	44	33	70	198	191	5.1	8	4	27	9	12	0
U	4766B?	20	40	17	55	162	148	3.9	9	4	26	9	12	6
V	4781B?	34	79	25	110	303	334	4.1	5	4	23	10	10	0
W	4787B?	45	72	4	94	276	223	6.1	4	4	28	9	13	0
X	4806H	45	93	66	131	367	330	4.9	2	4	23	8	9	0
Y	4813H	29	69	39	96	287	317	3.7	4	4	23	9	10	0
Z	4835H	34	73	51	100	281	302	4.3	4	4	23	8	10	0
AA	4867H	31	142	60	198	557	473	2.2	0	4	23	8	10	0
AB	4900B?	15	14	32	8	24	91	7.5	27	4	25	9	11	0
AC	4907B?	69	166	93	230	682	632	4.9	4	3	24	10	11	0
AD	4935B?	25	62	29	96	298	284	3.4	5	4	28	10	14	0
AE	4947B?	69	73	100	99	249	208	11.0	0	5	21	5	9	0
AF	4956B?	65	106	97	151	387	275	6.8	5	5	28	6	16	0
AG	4967B?	98	69	140	127	348	451	19.9	16	5	29	5	18	0
AH	4984B?	48	134	145	178	461	160	3.9	0	6	19	4	8	0
AI	5000B?	78	134	103	173	467	372	6.9	1	4	25	7	12	0
AJ	5011B?	53	77	35	55	174	200	7.2	7	5	26	6	13	0
AK	5022B?	103	131	122	177	454	241	10.3	2	6	20	4	9	0
AL	5026B?	132	226	218	392	1098	768	8.3	3	6	16	4	7	0
AM	5032B?	62	96	131	209	565	407	7.0	11	6	22	4	12	0
AN	5056B?	6	258	82	371	1126	1075	0.7	1	5	23	6	12	0
AO	5079B?	50	8	78	62	302	173	120.4	26	6	23	4	12	0
AP	5083B?	20	77	78	116	302	224	2.2	0	6	23	3	13	0
AQ	5088L?	61	38	84	63	162	53	20.1	10	6	23	3	12	0
AR	5102H	54	1	78	113	302	67	49.0	30	5	28	5	16	0
AS	5126L	149	88	146	121	286	26	28.5	5	6	24	5	13	0
AT	5147H	21	33	42	33	99	80	4.9	14	6	24	4	12	0
AU	5156H	92	112	70	164	393	262	10.3	8	5	25	4	14	0
AV	5169B?	43	61	56	85	207	59	6.9	4	5	22	5	10	0
AW	5202B?	1	2	1	2	2	4	-	-	-	-	-	-	0
AX	5208B?	75	132	144	195	495	356	6.6	0	6	17	4	7	0
LINE 10131	(FLIGHT 3)													
A	1354B?	43	93	66	134	348	269	4.7	0	3	20	11	6	0
B	1341H	1	2	1	2	2	4	-	-	-	-	-	-	0
C	1336L	27	50	32	68	178	121	4.5	4	4	18	10	4	0
D	1329B?	19	30	18	43	118	53	4.8	9	4	18	10	4	0

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ANOMALY/	FID/INTERP	COAXIAL 1190 HZ REAL PPM	COAXIAL 1190 HZ QUAD PPM	COPLANAR 895 HZ REAL PPM	COPLANAR 895 HZ QUAD PPM	COPLANAR 7233 HZ REAL PPM	COPLANAR 7233 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10131	(FLIGHT 3)													
E	1327B?	1	2	1	2	2	4	-	-	-	-	-	-	0
F	1312H	79	136	91	194	490	318	6.9	0	4	19	9	6	0
G	1286B?	47	80	60	129	346	153	5.9	2	4	19	9	6	0
H	1282B?	47	80	60	129	346	180	5.9	3	4	16	8	3	0
I	1277B?	24	55	13	71	132	86	3.6	1	4	18	9	4	0
J	1272L	21	17	31	71	176	36	10.4	23	4	22	9	8	5
K	1270L	7	9	8	3	8	95	3.8	30	4	21	9	6	0
L	1265H	23	45	26	57	159	104	3.9	6	4	20	10	6	0
M	1255B?	31	50	42	74	185	88	5.5	2	4	17	9	4	0
N	1253B?	33	50	42	74	185	88	5.8	3	4	20	9	6	0
O	1221B?	87	180	106	245	669	626	6.1	1	4	19	9	7	0
P	1214B?	25	52	35	128	350	394	4.1	12	4	23	10	9	0
Q	1211B?	37	82	19	106	267	261	4.3	4	4	21	9	8	0
R	1191B?	57	107	57	138	365	307	5.7	3	4	19	9	6	0
S	1189B?	53	103	57	133	347	307	5.3	4	4	20	8	7	0
T	1165B?	1	2	1	2	2	4	-	-	-	-	-	-	0
U	1163B?	1	2	1	2	2	4	-	-	-	-	-	-	0
V	1161B?	44	58	20	47	88	113	7.5	5	4	20	9	6	0
W	1145H	1	2	1	2	2	4	-	-	-	-	-	-	0
X	1121H	32	64	45	98	247	207	4.5	1	3	25	12	10	0
Y	1114E	41	58	52	90	187	112	6.9	2	4	23	10	8	0
Z	1111H	41	59	52	90	205	98	6.7	0	4	20	9	5	0
AA	1049H	23	57	27	61	195	199	3.4	0	4	22	10	8	0
AB	1032H	23	44	23	57	152	136	4.1	4	4	22	10	7	0
AC	1019H	46	96	54	132	351	334	4.9	3	4	21	9	7	0
AD	998H	1	2	1	2	2	4	-	-	-	-	-	-	0
AE	971B?	58	116	10	68	229	479	5.4	4	3	26	12	12	0
AF	964B?	52	35	74	64	217	420	17.1	10	5	20	5	8	0
AG	958B?	52	35	74	63	159	97	17.1	11	5	21	5	9	0
AH	936B?	17	80	30	106	288	593	1.8	0	3	27	12	12	0
AI	925B?	106	98	143	142	288	105	14.8	0	6	18	4	7	0
AJ	913B?	90	160	120	215	603	647	7.0	0	4	19	8	6	0
AK	908B?	31	26	47	83	219	167	11.5	15	5	16	5	4	0
AL	903B?	48	84	94	113	294	315	5.7	7	5	26	6	14	0
AM	893B?	147	187	176	276	646	379	11.6	0	5	15	4	4	0
AN	877H	79	85	109	145	318	181	11.3	5	5	21	5	9	0
AO	857B?	33	48	39	54	140	157	5.9	12	5	27	6	14	0
AP	842L	49	22	17	33	79	54	28.7	17	5	21	5	9	0
AQ	799L	43	3	38	14	32	4	377.0	23	5	23	6	10	0
AR	771H	36	74	72	83	209	145	4.5	7	5	21	5	9	0
AS	753H	1	2	1	2	2	4	-	-	-	-	-	-	0

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JOB #1159 MILK RIVER AREA, ALBERTA

		COAXIAL 1190 HZ		COPLANAR 895 HZ		COPLANAR 7233 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH		MAG CORR
ANOMALY/		REAL	QUAD	REAL	QUAD	REAL	QUAD	COND	DEPTH*	COND	DEPTH	RESIS	DEPTH	
FID/INTERP		PPM	PPM	PPM	PPM	PPM	PPM	SIEMEN	M	SIEMEN	M	OHM-M	M	NT
LINE 10131		(FLIGHT		3)										
AT	718H	39	69	131	163	378	228	5.2	12	4	20	6	9	0
LINE 10140		(FLIGHT		3)										
A	1501H	1	2	1	2	2	4	-	-	-	-	-	-	0
B	1518L	35	60	38	83	210	148	5.2	3	4	21	10	7	0
C	1539H	1	2	1	2	2	4	-	-	-	-	-	-	0
D	1560L	43	42	35	62	138	49	10.2	8	4	18	8	5	0
E	1577L?	1	2	1	2	2	4	-	-	-	-	-	-	0
F	1585L?	20	34	13	38	127	68	4.4	9	4	19	10	5	0
G	1639B?	37	91	29	114	338	354	3.9	4	3	21	11	7	0
H	1646B?	117	284	140	384	1091	1176	5.9	2	3	19	10	7	0
I	1654E	38	52	81	142	343	200	6.8	6	4	21	9	7	0
J	1657B?	64	101	81	142	343	127	7.0	1	4	19	8	6	0
K	1665B?	62	58	79	169	431	295	12.3	11	4	17	8	5	0
L	1679B?	18	109	62	172	444	507	1.5	0	3	26	11	11	0
M	1683E	47	109	62	172	444	507	4.5	3	3	26	12	11	0
N	1695B?	72	134	68	155	420	379	6.3	0	4	22	10	8	0
O	1702B?	37	57	37	72	260	182	5.8	7	4	27	9	12	0
P	1706B?	16	29	21	42	116	120	4.0	11	4	27	9	12	0
Q	1712B?	19	51	22	51	146	214	2.9	4	4	29	10	14	0
R	1721B?	20	90	36	137	385	298	1.9	0	3	27	13	11	0
S	1732B?	47	62	46	101	251	283	7.7	11	4	26	10	12	0
T	1746B?	27	64	36	85	229	243	3.7	6	4	22	9	9	0
U	1780H	1	2	1	2	2	4	-	-	-	-	-	-	0
V	1803H	1	2	1	2	2	4	-	-	-	-	-	-	0
W	1844B?	17	72	12	104	314	355	2.0	2	3	27	13	12	0
X	1852B?	48	44	49	58	130	94	11.4	9	4	29	7	15	0
Y	1870H	69	96	89	176	433	328	8.3	8	5	24	5	12	0
Z	1896B?	1	2	1	2	2	4	-	-	-	-	-	-	0
AA	1900B?	18	27	145	52	494	582	5.0	15	6	19	4	8	0
AB	1904B?	93	162	68	184	501	614	7.2	8	4	25	8	13	0
AC	1925B?	66	32	71	105	206	100	27.7	11	6	17	4	6	0
AD	1938B?	105	160	127	226	571	443	8.5	3	5	20	5	9	0
AE	1941B?	66	160	102	173	440	318	4.8	0	5	20	5	9	0
AF	1949B?	26	41	45	81	197	199	5.1	11	5	24	6	11	0
AG	1954B?	74	85	90	134	314	193	10.3	3	5	22	6	10	0
AH	1963B?	39	52	60	88	211	144	7.1	7	5	26	7	13	0
AI	1981L	46	18	27	5	17	148	35.0	22	5	22	5	11	0
AJ	1994H	1	2	1	2	2	4	-	-	-	-	-	-	0
AK	2024H	1	2	1	2	2	4	-	-	-	-	-	-	0
AL	2028L	45	33	26	35	112	12	14.5	12	5	22	5	10	0

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JOB #1159 MILK RIVER AREA, ALBERTA

ANOMALY/ FID/INTERP	COAXIAL 1190 HZ REAL PPM	COAXIAL 1190 HZ QUAD PPM	COPLANAR 895 HZ REAL PPM	COPLANAR 895 HZ QUAD PPM	COPLANAR 7233 HZ REAL PPM	COPLANAR 7233 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10140	(FLIGHT	3)											
AM 2060H	1	2	1	2	2	4	-	-	-	-	-	-	0
AN 2085H	19	48	45	87	209	322	3.0	9	4	35	10	20	0
LINE 10150	(FLIGHT	3)											
A 2687H	1	2	1	2	2	4	-	-	-	-	-	-	0
B 2650L	1	2	1	2	2	4	-	-	-	-	-	-	0
C 2632H	1	2	1	2	2	4	-	-	-	-	-	-	0
D 2620B?	35	61	46	86	227	186	5.3	8	4	22	8	9	0
E 2603B?	45	75	57	111	276	197	5.9	8	4	22	7	9	0
F 2590B?	15	16	83	151	384	268	6.5	12	4	25	8	10	0
G 2581B?	93	89	70	134	304	196	13.6	0	5	17	6	5	0
H 2570B?	41	76	21	76	223	243	5.1	8	4	26	7	13	0
I 2560H	86	87	113	102	246	258	12.5	4	6	19	4	8	0
J 2525B?	22	83	23	120	353	386	2.4	1	4	24	7	12	4
K 2513H	70	94	100	152	369	207	8.5	1	6	17	4	7	0
L 2500B	142	294	179	423	1124	1176	7.2	4	5	20	5	10	0
M 2488L?	41	62	52	90	229	205	6.2	9	5	28	6	16	0
N 2475B?	106	157	144	263	582	390	8.8	2	5	19	4	9	0
O 2473B?	106	159	144	263	582	390	8.7	2	5	18	5	8	0
P 2448L	27	24	24	40	76	60	10.0	14	5	24	5	11	10
Q 2389L	61	13	145	129	287	148	89.2	21	6	21	3	11	0
R 2371B?	1	2	1	2	2	4	-	-	-	-	-	-	0
S 2365B?	7	35	18	52	177	259	1.3	0	5	24	6	11	0
T 2316B?	4	36	21	37	95	161	0.6	0	4	36	9	21	0
LINE 10151	(FLIGHT	3)											
A 3327H	37	61	52	91	231	161	5.5	0	4	22	9	7	0
B 3304H	18	34	25	52	143	111	3.9	2	4	21	10	5	0
C 3272H	1	2	1	2	2	4	-	-	-	-	-	-	0
D 3248L	27	26	18	34	101	68	8.7	13	4	22	8	8	0
E 3233L?	1	2	1	2	2	4	-	-	-	-	-	-	0
F 3214H	48	93	55	120	333	70	5.2	4	4	21	9	8	0
G 3172H	1	2	1	2	2	4	-	-	-	-	-	-	0
H 3155H	34	71	46	118	311	244	4.4	7	4	22	9	9	0
I 3120H	42	82	53	122	325	354	4.9	2	4	25	11	11	0
J 3101H	22	51	32	78	201	288	3.4	7	3	29	12	13	0
K 3082B?	24	53	20	58	159	149	3.8	2	3	29	12	13	0
L 3074E	39	68	52	106	262	207	5.4	5	4	26	10	11	0
M 3042H	1	2	1	2	2	4	-	-	-	-	-	-	0
N 3027E	25	40	35	61	157	114	5.1	3	4	20	8	6	0
O 3017H	1	2	1	2	2	4	-	-	-	-	-	-	0

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JOB #1159 MILK RIVER AREA, ALBERTA

ANOMALY/	FID/INTERP	COAXIAL 1190 HZ		COPLANAR 895 HZ		COPLANAR 7233 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH		MAG CORR
		REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND SIEMEN	DEPTH* M	COND SIEMEN	DEPTH M	RESIS OHM-M	DEPTH M	NT
LINE 10151		(FLIGHT		3)										
P	2997H	56	115	66	163	424	442	5.2	3	4	21	8	8	0
LINE 10160		(FLIGHT		3)										
A	3446B?	50	104	64	134	363	385	5.0	3	4	23	9	9	0
B	3448B?	50	104	65	137	372	350	5.0	3	4	22	9	9	0
C	3456B?	11	14	25	65	97	106	4.5	18	4	21	9	6	0
D	3462B?	16	29	37	65	163	88	3.9	7	4	20	9	6	0
E	3468B?	19	28	47	90	262	180	4.9	12	4	22	9	8	0
F	3473B?	1	2	1	2	2	4	-	-	-	-	-	-	0
G	3477B?	24	67	44	109	325	230	3.0	3	4	23	9	10	0
H	3502H	1	2	1	2	2	4	-	-	-	-	-	-	0
I	3533L	40	46	35	57	156	104	8.2	4	4	21	8	7	0
J	3546L	34	11	4	30	80	101	41.9	20	4	23	8	8	0
K	3565H	1	2	1	2	2	4	-	-	-	-	-	-	0
L	3616B?	33	54	33	73	190	166	5.4	11	4	24	9	10	0
M	3621B?	1	2	1	2	2	4	-	-	-	-	-	-	0
N	3624B?	42	84	29	91	264	243	4.9	4	4	23	9	9	0
O	3645B?	33	77	30	105	316	392	3.9	6	3	27	12	12	0
P	3652B?	56	98	55	115	303	310	6.1	6	4	27	10	13	0
Q	3678H	1	2	1	2	2	4	-	-	-	-	-	-	0
R	3727H	1	2	1	2	2	4	-	-	-	-	-	-	0
S	3739H	36	33	13	63	174	101	10.3	17	4	21	9	8	0
T	3780H	1	2	1	2	2	4	-	-	-	-	-	-	0
U	3803B?	81	170	45	235	642	527	5.9	2	4	24	10	11	0
V	3830B?	41	53	57	80	191	121	7.5	3	5	23	6	10	0
W	3841B?	71	77	26	99	247	384	10.8	9	5	27	6	14	0
X	3855B?	63	72	89	104	262	386	9.7	6	5	23	6	11	0
Y	3866B?	45	109	68	181	538	504	4.3	4	4	24	8	11	0
Z	3874B?	16	25	10	45	128	131	4.3	9	5	22	6	9	0
AA	3881B?	109	137	146	203	489	259	10.6	0	6	18	4	8	0
AB	3883B?	115	140	31	21	536	294	11.1	0	6	19	4	8	0
AC	3888L?	31	82	28	82	277	468	3.5	8	5	24	6	12	0
AD	3908B?	47	83	87	316	815	667	5.7	10	5	21	5	10	0
AE	3912B?	142	189	85	255	682	551	10.9	3	5	21	6	10	0
AF	3929B?	66	235	316	358	1147	868	3.6	0	6	21	4	11	0
AG	3955H	1	2	1	2	2	4	-	-	-	-	-	-	0
AH	3996L	42	14	46	20	50	63	39.5	15	6	27	5	14	0
AI	4013H	1	2	1	2	2	4	-	-	-	-	-	-	0
AJ	4018B?	76	90	3	119	302	195	10.1	2	5	25	6	12	0
LINE 10170		(FLIGHT		3)										
A	4873H	1	2	1	2	2	4	-	-	-	-	-	-	0

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JOB #1159 MILK RIVER AREA, ALBERTA

		COAXIAL 1190 HZ		COPLANAR 895 HZ		COPLANAR 7233 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH		MAG CORR
ANOMALY/ FID/INTERP		REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND SIEMEN	DEPTH* M	COND SIEMEN	DEPTH M	RESIS OHM-M	DEPTH M	NT
LINE 10170	(FLIGHT 3)													
B	4836H	1	2	1	2	2	4	-	-	-	-	-	-	0
C	4802L	20	20	10	16	41	62	7.8	13	4	21	7	7	0
D	4791L	1	2	1	2	2	4	-	-	-	-	-	-	0
E	4733H	1	2	1	2	2	4	-	-	-	-	-	-	0
F	4712H	17	139	110	208	540	405	1.1	0	4	20	7	8	0
G	4696B?	33	66	23	72	219	218	4.5	7	3	28	11	13	0
H	4678H	50	103	65	152	429	399	5.0	0	4	21	10	7	0
I	4668E	26	52	38	79	212	207	4.2	6	4	28	10	13	0
J	4636E	56	83	70	136	344	241	7.1	0	4	22	10	8	0
K	4626E	54	87	72	141	341	267	6.5	5	4	28	10	13	0
L	4608L	8	20	7	17	31	70	2.2	14	4	30	9	15	0
M	4593H	1	2	1	2	2	4	-	-	-	-	-	-	0
N	4581L?	27	45	31	60	168	96	5.0	10	4	21	8	8	0
O	4556H	1	2	1	2	2	4	-	-	-	-	-	-	0
P	4550B?	5	21	26	70	203	78	1.4	11	4	21	8	9	0
Q	4546B?	62	119	77	169	465	447	5.7	1	4	20	7	7	0
R	4534B?	36	71	3	81	223	255	4.7	10	4	29	8	15	0
S	4529B?	61	124	55	172	497	563	5.5	5	4	20	8	8	0
T	4514B?	16	33	76	124	316	89	3.4	14	4	25	8	12	0
U	4509B?	58	89	79	137	357	258	7.0	3	4	18	7	6	0
V	4499B?	24	56	21	59	156	182	3.6	8	4	28	10	13	0
W	4492B?	26	72	13	75	225	293	3.2	6	4	27	9	13	0
X	4478B?	62	99	109	253	679	588	6.8	5	4	25	9	11	0
Y	4476B?	83	164	123	253	679	588	6.1	2	4	25	7	12	0
Z	4465B?	35	82	60	120	318	297	4.1	4	3	30	11	15	5
AA	4461B?	70	60	56	82	216	166	14.1	10	4	25	8	11	0
AB	4442B?	50	84	68	98	263	261	6.1	6	4	28	8	15	0
AC	4431B?	79	97	113	141	344	145	9.7	0	5	21	5	9	0
AD	4420L	27	67	42	99	270	489	3.6	5	4	28	10	14	0
AE	4409H	91	97	82	149	328	86	11.9	5	5	25	5	13	0
AF	4371B?	40	87	47	127	360	386	4.5	6	5	24	6	13	0
AG	4362B?	99	136	127	205	513	320	9.4	0	5	17	4	6	0
AH	4346B?	56	77	43	107	275	281	7.8	10	5	26	6	14	0
AI	4305H	40	53	61	86	231	160	7.1	7	5	18	4	7	0
AJ	4294L?	23	31	54	86	188	115	5.9	17	6	21	4	10	0
AK	4260L	64	18	52	33	67	57	59.5	12	5	25	7	12	0
AL	4249H	38	53	53	81	201	83	6.7	4	5	23	6	10	0
AM	4239H	31	44	41	64	170	128	6.1	11	5	29	6	16	0
AN	4204B?	23	38	29	52	132	176	4.6	14	4	34	9	19	0
LINE 10180	(FLIGHT 3)													
B	5023H	1	2	1	2	2	4	-	-	-	-	-	-	0

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JOB #1159   MILK RIVER AREA, ALBERTA

ANOMALY/	FID/INTERP	COAXIAL 1190 HZ REAL PPM	COAXIAL 1190 HZ QUAD PPM	COPLANAR 895 HZ REAL PPM	COPLANAR 895 HZ QUAD PPM	COPLANAR 7233 HZ REAL PPM	COPLANAR 7233 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10180	(FLIGHT 3)													
C	5040H	1	2	1	2	2	4	-	-	-	-	-	-	0
D	5086L	24	25	8	20	38	17	7.7	12	4	22	7	8	0
E	5095L	41	39	32	55	148	139	10.2	12	4	24	8	11	0
F	5129H	55	95	65	130	347	242	6.0	1	4	19	8	6	0
G	5149H	1	2	1	2	2	4	-	-	-	-	-	-	0
H	5167H	37	17	51	86	102	161	24.6	21	4	21	8	8	0
I	5179H	42	77	52	116	326	291	5.3	8	4	22	9	9	0
J	5186B?	40	90	23	119	371	419	4.4	2	3	22	11	8	9
K	5193H	41	99	65	136	388	321	4.1	1	4	24	9	10	0
L	5238H	73	114	94	167	423	242	7.4	1	4	23	8	10	0
M	5246B?	37	56	90	202	538	162	6.1	5	3	28	13	12	0
N	5251B?	80	152	97	224	591	570	6.3	3	3	23	10	10	0
O	5266L?	9	22	35	48	125	88	2.5	11	4	31	10	16	0
P	5273H	18	44	43	96	248	263	3.0	7	4	24	9	10	0
Q	5288H	40	78	57	123	352	322	4.9	5	4	21	9	8	0
R	5321H	26	48	25	64	176	162	4.5	6	4	22	8	9	0
S	5329H	37	71	41	102	287	282	4.8	6	4	26	9	12	0
T	5341H	30	44	39	64	170	110	6.0	5	4	21	8	8	0
U	5347E	46	90	63	146	369	288	5.1	3	4	25	10	11	0
V	5353B?	22	29	26	31	80	87	5.8	14	4	35	7	20	0
W	5365B?	53	79	38	92	251	230	7.0	2	4	26	11	11	0
X	5388B?	54	135	59	184	509	540	4.4	0	4	19	8	7	0
Y	5398B?	94	115	153	195	460	233	10.3	2	5	20	4	8	0
Z	5434B?	39	196	149	207	638	321	2.3	0	6	17	4	6	0
AA	5454B?	1	2	1	2	2	4	-	-	-	-	-	-	0
AB	5461B?	110	177	167	271	687	630	8.2	6	5	22	4	12	0
AC	5464B?	157	204	190	293	732	630	11.6	2	6	17	4	7	0
AD	5475B?	35	52	34	78	205	161	6.1	8	5	24	6	12	0
AE	5487H	86	27	126	54	108	132	55.9	19	5	23	4	12	8
AF	5505H	1	2	1	2	2	4	-	-	-	-	-	-	0
AG	5512B?	50	57	166	221	559	330	9.0	7	6	19	4	8	0
AH	5515L?	124	153	166	221	559	330	11.3	7	5	26	5	15	0
AI	5528B?	71	84	89	128	310	199	9.8	5	5	25	5	14	0
AJ	5535E	99	105	157	164	342	192	12.3	1	6	25	5	13	0
AK	5550B?	44	58	136	221	500	368	7.5	9	6	19	4	9	0
AL	5556B?	72	112	104	175	466	381	7.4	8	5	22	4	12	0
AM	5560B?	81	119	118	196	492	381	8.1	7	6	21	4	10	0
AN	5582L	3	41	41	64	88	82	0.5	0	5	22	5	11	15
AO	5600B?	97	116	139	173	433	230	10.7	3	5	22	5	11	0
AP	5614L	5	23	11	13	36	26	1.1	1	5	36	7	21	0
AQ	5633B?	21	50	30	66	179	258	3.3	10	4	30	9	16	0

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JOB #1159 MILK RIVER AREA, ALBERTA

ANOMALY/	FID/INTERP	COAXIAL 1190 HZ REAL PPM	COAXIAL 1190 HZ QUAD PPM	COPLANAR 895 HZ REAL PPM	COPLANAR 895 HZ QUAD PPM	COPLANAR 7233 HZ REAL PPM	COPLANAR 7233 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10190	(FLIGHT 3)													
A	6423H	28	49	34	63	174	113	4.7	3	4	21	8	7	0
B	6397H	50	74	62	108	263	101	7.0	7	4	21	7	9	0
C	6355H	27	98	98	142	385	257	2.5	0	4	19	7	7	0
D	6349L	101	2	35	2	384	245	999.0	15	5	20	6	8	0
E	6342L	15	5	7	8	22	18	24.7	37	4	23	7	9	0
F	6320H	1	2	1	2	2	4	-	-	-	-	-	-	0
G	6304H	19	63	46	93	269	193	2.4	0	4	21	8	8	0
H	6260H	7	37	1	13	43	42	1.2	0	4	21	7	8	8
I	6226H	1	2	1	2	2	4	-	-	-	-	-	-	0
J	6199H	1	2	1	2	2	4	-	-	-	-	-	-	0
K	6181B?	27	53	29	76	209	190	4.3	6	3	33	11	17	0
L	6172E	65	124	106	189	477	403	5.8	4	4	28	9	14	0
M	6171H	73	124	106	189	477	403	6.8	2	4	25	8	12	0
N	6151H	1	2	1	2	2	4	-	-	-	-	-	-	0
O	6115H	1	2	1	2	2	4	-	-	-	-	-	-	0
P	6095B?	48	90	53	131	377	360	5.3	6	4	26	9	12	0
Q	6088B?	25	41	34	59	134	142	4.8	13	4	28	8	14	0
R	6080E	50	69	76	105	268	189	7.3	2	4	27	8	12	0
S	6070E?	52	87	66	126	325	295	6.1	6	4	34	9	19	0
T	6057B?	23	36	50	74	184	136	5.2	11	4	27	7	13	0
U	6052B?	1	2	1	2	2	4	-	-	-	-	-	-	0
V	6034B?	49	103	52	147	425	374	4.9	3	4	24	8	11	0
W	6014H	52	68	39	94	251	306	7.9	9	4	27	7	13	0
X	5993B?	40	80	154	236	629	347	4.8	7	5	18	5	8	0
Y	5989B?	47	63	59	30	113	234	7.6	13	5	21	5	10	0
Z	5983B?	193	228	229	265	602	243	13.7	0	6	20	4	10	0
AA	5968B?	86	131	206	192	514	520	8.0	0	6	17	4	6	0
AB	5957B?	134	173	173	246	583	341	11.0	4	6	19	3	9	0
AC	5948B?	127	148	149	201	480	219	12.1	2	6	18	4	8	0
AD	5938E?	79	122	12	106	262	273	7.7	5	5	25	5	13	0
AE	5903H	70	67	100	106	239	156	12.4	9	6	22	3	11	0
AF	5875B?	107	139	130	166	429	292	10.2	5	5	25	5	13	0
AG	5872B?	107	139	104	166	429	292	10.2	0	6	16	4	5	0
AH	5865B?	61	92	65	98	261	249	7.2	5	5	27	6	15	0
AI	5853B?	71	84	74	122	309	197	9.8	0	6	18	4	7	0
AJ	5850B?	58	57	74	77	186	90	11.2	8	6	20	4	9	0
AK	5842B?	17	34	42	23	82	212	3.5	15	5	29	5	17	0
AL	5838B?	43	38	35	40	109	74	11.5	11	6	20	4	9	0
AM	5834B?	70	117	46	139	359	291	6.8	7	5	24	5	13	0
AN	5819L	22	24	141	218	528	282	6.9	14	5	27	5	14	0
AO	5810H	69	157	49	250	633	404	5.2	0	6	16	4	6	0

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JOB #1159 MILK RIVER AREA, ALBERTA

ANOMALY/	FID/INTERP	COAXIAL 1190 HZ REAL PPM	COAXIAL 1190 HZ QUAD PPM	COPLANAR 895 HZ REAL PPM	COPLANAR 895 HZ QUAD PPM	COPLANAR 7233 HZ REAL PPM	COPLANAR 7233 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10190	(FLIGHT 3)													
AP	5793L?	2	13	8	17	43	90	0.6	3	5	32	6	18	0
AQ	5769B?	19	54	33	79	190	387	2.8	8	4	30	9	16	0
LINE 10200	(FLIGHT 3)													
A	6556H	31	75	53	119	298	279	3.8	5	4	21	8	9	0
B	6589H	51	78	70	117	287	157	6.7	3	4	20	7	7	0
C	6620H	1	2	1	2	2	4	-	-	-	-	-	-	0
D	6636H	36	32	40	21	70	91	11.0	20	4	18	7	6	0
E	6642L	118	6	40	8	16	28	994.2	16	5	19	6	7	0
F	6647L	79	50	65	134	385	91	20.9	10	4	22	8	9	0
G	6674H	37	107	32	81	358	242	3.4	0	4	18	7	7	0
H	6708H	54	78	45	110	312	315	7.2	8	4	21	8	8	0
I	6733H	1	2	1	2	2	4	-	-	-	-	-	-	0
J	6774H	55	103	71	147	419	118	5.6	3	4	20	8	7	0
K	6801H	63	121	77	169	448	415	5.8	2	4	23	9	9	0
L	6814B?	32	54	42	106	173	158	5.1	9	4	33	9	18	0
M	6818B?	48	95	42	119	357	384	5.1	5	4	27	10	12	0
N	6824L?	45	94	42	123	327	458	4.8	8	3	32	11	17	0
O	6838B?	19	92	51	103	243	252	1.8	0	4	23	9	10	0
P	6867H	8	29	16	44	142	35	1.8	8	4	23	9	9	0
Q	6894B?	87	167	124	251	676	548	6.4	2	4	21	7	8	0
R	6907B?	57	121	68	177	497	454	5.1	4	4	24	10	10	0
S	6914E	96	201	114	293	816	868	6.2	8	4	27	9	14	0
T	6929B?	19	26	31	83	240	81	5.3	17	4	24	7	11	0
U	6940B?	4	38	27	149	408	375	0.6	1	4	20	7	9	0
V	6944B?	6	86	116	200	535	404	0.7	0	4	21	7	10	0
W	6954B?	34	45	43	57	137	71	7.0	7	4	27	9	13	0
X	6958B?	15	14	36	50	131	61	7.6	22	4	34	9	18	0
Y	6976B?	43	53	57	61	154	276	8.1	14	4	31	8	17	0
Z	6995B?	126	152	128	251	591	492	11.6	9	6	21	4	12	0
AA	7000B?	53	115	127	239	614	606	5.0	2	6	18	4	7	0
AB	7015B?	86	173	162	231	590	558	6.2	5	6	20	3	11	0
AC	7027B?	76	174	140	274	730	573	5.3	3	6	19	4	9	0
AD	7058H	59	74	77	105	403	161	8.5	11	5	23	4	12	0
AE	7072H	44	76	63	119	318	272	5.6	10	5	27	5	16	0
AF	7093H	19	44	36	64	172	82	3.3	10	5	28	5	16	0
AG	7113H	65	61	92	85	208	41	12.6	0	6	17	4	6	0
AH	7126B?	182	250	218	266	668	293	11.4	0	6	15	4	5	0
AI	7137L	54	84	58	106	263	254	6.7	10	5	26	5	15	0
AJ	7149B?	216	298	278	434	1166	645	12.1	3	6	19	4	9	0
AK	7163B?	117	162	152	233	597	386	9.8	0	6	17	4	7	0

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JOB #1159   MILK RIVER AREA, ALBERTA

ANOMALY/ FID/INTERP		COAXIAL 1190 HZ REAL PPM	COAXIAL 1190 HZ QUAD PPM	COPLANAR 895 HZ REAL PPM	COPLANAR 895 HZ QUAD PPM	COPLANAR 7233 HZ REAL PPM	COPLANAR 7233 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10200	(FLIGHT 3)													
AL	7176B?	81	147	159	221	605	494	6.6	9	5	27	5	16	0
AM	7186L?	19	60	24	50	129	176	2.5	4	5	31	6	18	0
LINE 10210	(FLIGHT 4)													
A	957H	1	2	1	2	2	4	-	-	-	-	-	-	0
B	926H	1	2	1	2	2	4	-	-	-	-	-	-	0
C	891H	15	22	37	86	486	354	4.7	25	4	21	6	9	0
D	867L	198	89	35	62	155	86	45.4	0	5	28	7	12	0
E	843H	58	58	40	105	272	65	10.9	5	5	19	5	7	0
F	831H	44	80	63	118	345	289	5.4	4	4	22	8	9	0
G	792H	1	2	1	2	2	4	-	-	-	-	-	-	0
H	748H	1	2	1	2	2	4	-	-	-	-	-	-	0
I	722H	1	2	1	2	2	4	-	-	-	-	-	-	0
J	699H	27	48	36	66	189	202	4.8	8	4	29	9	14	0
K	680E	62	114	95	163	453	497	6.0	9	4	34	10	20	0
L	676H	1	2	1	2	2	4	-	-	-	-	-	-	0
M	620H	1	10	30	116	245	242	0.3	8	4	25	7	12	0
N	588H	1	2	1	2	2	4	-	-	-	-	-	-	0
O	558B?	87	99	104	110	294	97	10.9	0	6	16	4	5	0
P	547B?	38	120	46	183	521	966	3.2	9	3	32	10	19	0
Q	511H	3	10	24	29	87	78	1.4	18	7	26	3	16	0
R	479H	1	2	1	2	2	4	-	-	-	-	-	-	0
S	439H	26	33	48	58	146	107	6.3	13	6	28	4	17	0
T	406B?	90	175	117	261	667	1165	6.4	12	5	28	6	17	0
U	394B?	65	99	111	150	411	357	7.3	9	6	27	4	16	0
V	388B?	15	99	91	150	411	357	1.3	0	6	18	3	7	0
W	383B?	16	102	156	184	465	245	1.4	0	6	18	3	8	0
X	366L?	56	105	115	169	486	638	5.7	8	5	31	5	19	40
Y	361B?	19	67	79	114	320	254	2.4	2	6	28	4	16	0
Z	343L	7	84	32	54	150	209	0.7	0	5	32	7	19	0
AA	339B?	7	15	32	54	150	209	2.5	22	5	33	6	19	0
AB	321B?	4	10	25	38	118	190	1.7	27	4	32	9	17	0
AC	316B?	17	16	43	78	211	303	7.9	32	4	36	8	22	0
LINE 10220	(FLIGHT 4)													
B	1080H	1	2	1	2	2	4	-	-	-	-	-	-	0
C	1099H	13	18	4	27	301	222	4.4	26	4	22	7	10	0
D	1141H	2	7	130	55	505	74	1.3	24	5	21	6	8	0
E	1161L	149	171	11	18	51	39	13.0	0	5	27	7	12	0
F	1187H	6	15	19	45	136	175	2.0	11	4	25	7	11	0
G	1211H	1	2	1	2	2	4	-	-	-	-	-	-	0

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ANOMALY/	FID/INTERP	COAXIAL 1190 HZ REAL PPM	COAXIAL 1190 HZ QUAD PPM	COPLANAR 895 HZ REAL PPM	COPLANAR 895 HZ QUAD PPM	COPLANAR 7233 HZ REAL PPM	COPLANAR 7233 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10220	(FLIGHT 4)													
H	1241H	5	4	45	77	157	38	6.7	56	4	23	7	10	0
I	1274L?	17	25	9	3	36	82	4.7	18	4	22	7	9	0
J	1288H	11	23	14	33	95	117	3.0	15	4	25	8	12	0
K	1318E	51	105	40	85	247	260	5.1	5	4	29	9	15	0
L	1327B?	34	62	29	80	212	241	5.0	1	4	27	9	12	0
M	1338B?	41	58	62	84	237	169	6.7	7	4	26	7	12	0
N	1380H	3	6	14	11	36	39	2.0	41	4	24	7	11	0
O	1407E	16	22	22	32	79	44	5.0	10	5	28	7	13	0
P	1435H	12	18	29	34	90	18	4.3	13	5	29	7	15	0
Q	1447E	13	20	4	18	56	75	4.2	18	4	44	8	28	0
R	1455H	71	128	177	193	489	309	6.3	0	6	20	4	9	0
S	1468B?	21	62	44	97	280	688	2.8	7	4	29	10	15	0
T	1477B?	92	94	151	163	361	138	12.7	5	5	21	5	10	0
U	1500H	48	59	77	89	230	107	8.3	12	6	25	4	14	0
V	1513H	1	2	1	2	2	4	-	-	-	-	-	-	0
W	1544H	54	65	77	108	289	232	8.9	10	6	21	3	10	0
X	1584B?	1	2	1	2	2	4	-	-	-	-	-	-	0
Y	1598H	36	56	97	79	365	162	5.9	7	6	24	4	13	0
Z	1620L?	53	71	82	102	268	136	7.8	10	5	29	5	17	0
AA	1630H	15	49	24	49	116	138	2.3	4	5	34	6	21	0
LINE 10230	(FLIGHT 5)													
A	1195H	37	25	53	89	241	81	15.5	16	4	21	8	7	0
B	1178H	1	2	1	2	2	4	-	-	-	-	-	-	0
C	1124H	55	8	65	127	297	30	155.6	23	5	20	6	8	0
D	1113L	31	61	29	71	184	186	4.5	5	4	22	7	10	8
E	1110L	34	64	29	96	297	228	4.7	6	4	22	8	9	0
F	1094H	1	2	1	2	2	4	-	-	-	-	-	-	0
G	1066H	30	48	45	69	178	16	5.3	1	4	18	7	5	0
H	1044H	24	52	35	75	226	183	3.8	5	4	23	7	10	0
I	1006H	1	2	1	2	2	4	-	-	-	-	-	-	0
J	986H	1	2	1	2	2	4	-	-	-	-	-	-	0
K	953B?	39	76	38	105	284	290	4.9	0	4	26	11	11	0
L	943B?	90	187	125	273	777	884	6.1	7	4	28	8	15	4
M	915H	1	2	1	2	2	4	-	-	-	-	-	-	0
N	895H	24	71	65	106	294	227	2.9	0	4	23	7	10	0
O	871H	77	127	120	178	470	318	7.2	0	5	22	5	10	0
P	864E	56	88	87	152	397	291	6.8	7	4	31	8	17	0
Q	858H	5	5	33	20	65	61	5.4	54	5	27	7	14	0
R	819H	52	126	195	199	486	295	4.5	0	6	20	4	10	0
S	793H	55	66	33	112	67	166	8.8	6	5	24	6	11	0

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JOB #1159 MILK RIVER AREA, ALBERTA

		COAXIAL 1190 HZ		COPLANAR 895 HZ		COPLANAR 7233 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH		MAG CORR
ANOMALY/	FID/INTERP	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND SIEMEN	DEPTH* M	COND SIEMEN	DEPTH M	RESIS OHM-M	DEPTH M	NT
LINE 10230	(FLIGHT 5)													
T	733H	58	68	84	110	270	154	9.4	2	6	21	4	10	0
U	681H	1	2	1	2	2	4	-	-	-	-	-	-	0
V	657H	26	24	39	42	106	89	9.3	10	5	26	5	13	0
W	649L	8	25	30	31	77	63	1.9	2	5	32	6	18	0
LINE 10240	(FLIGHT 5)													
A	1301H	58	106	75	139	388	123	5.8	4	4	23	8	10	0
B	1325H	47	18	9	31	92	118	34.2	20	4	21	8	8	0
C	1359H	59	85	94	129	332	149	7.5	4	5	20	6	8	0
D	1372L	27	77	41	114	318	16	3.1	0	5	26	7	13	30
E	1374L	62	77	65	152	447	233	9.0	4	5	25	7	12	0
F	1376L	55	120	73	152	447	244	5.0	0	5	24	6	11	0
G	1379L	55	120	73	93	292	244	5.0	1	5	23	6	11	4
H	1410H	1	2	1	2	2	4	-	-	-	-	-	-	0
I	1442H	1	2	1	2	2	4	-	-	-	-	-	-	0
J	1485H	1	2	1	2	2	4	-	-	-	-	-	-	0
K	1517H	1	2	1	2	2	4	-	-	-	-	-	-	0
L	1520E	69	131	118	242	679	528	6.0	7	3	31	11	16	0
M	1526B?	44	79	41	104	273	288	5.4	8	4	34	10	19	0
N	1544H	1	2	1	2	2	4	-	-	-	-	-	-	0
O	1588H	44	86	66	127	355	346	5.1	7	4	23	7	11	0
P	1611B?	42	90	42	130	352	341	4.6	3	4	27	8	13	0
Q	1622H	66	110	98	163	440	360	6.7	5	5	24	6	12	0
R	1633H	54	102	68	150	413	328	5.6	4	5	23	6	11	0
S	1642B	70	178	105	261	728	791	4.8	6	4	27	8	15	0
T	1654B	250	346	342	490	1244	776	12.7	1	6	19	3	9	0
U	1683H	40	44	32	64	207	164	8.7	12	4	27	8	13	0
V	1732H	57	78	83	124	308	145	7.7	6	6	20	3	10	0
W	1752H	23	41	29	54	148	187	4.4	13	5	35	7	22	0
X	1786H	31	47	44	69	189	163	5.7	10	5	31	6	18	0
Y	1795H	56	57	81	86	214	89	10.7	8	6	26	4	14	0
Z	1808L	1	2	1	2	2	4	-	-	-	-	-	-	0
AA	1812L	21	34	67	55	133	57	4.7	15	5	29	5	17	0
AB	1816L	12	42	55	42	114	118	2.0	1	5	29	6	16	0
AC	1831H	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 10250	(FLIGHT 5)													
A	2528H	63	102	87	146	394	215	6.9	0	4	19	7	7	0
B	2517H	39	69	51	97	276	185	5.3	2	4	23	9	9	0
C	2493H	1	2	1	2	2	4	-	-	-	-	-	-	0
D	2479H	16	138	101	25	539	141	1.1	0	4	20	7	8	0

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JOB #1159 MILK RIVER AREA, ALBERTA

ANOMALY/ FID/INTERP	COAXIAL 1190 HZ REAL PPM	COAXIAL 1190 HZ QUAD PPM	COPLANAR 895 HZ REAL PPM	COPLANAR 895 HZ QUAD PPM	COPLANAR 7233 HZ REAL PPM	COPLANAR 7233 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10250	(FLIGHT		5)										
E 2465L	20	15	13	20	55	94	10.4	22	4	25	8	11	0
F 2456L	12	16	18	30	75	13	5.0	21	4	24	7	10	0
G 2451L	4	32	1	2	85	82	0.7	0	4	26	8	13	0
H 2421H	1	1	1	2	2	4	-	-	-	-	-	-	0
I 2415H	21	21	27	103	272	118	7.9	21	4	20	7	7	0
J 2385H	36	74	47	103	310	305	4.6	5	4	23	8	10	0
K 2381B?	63	135	78	168	484	477	5.3	4	4	25	8	12	0
L 2359H	1	2	1	2	2	4	-	-	-	-	-	-	0
M 2341H	1	2	1	2	2	4	-	-	-	-	-	-	0
N 2314H	67	109	11	20	57	246	6.9	0	4	21	7	9	0
O 2294B?	43	78	38	94	258	245	5.3	4	4	33	10	18	0
P 2283E	73	122	98	177	478	384	6.9	2	4	26	8	13	0
Q 2280H	22	35	98	177	477	94	4.7	9	4	26	8	12	0
R 2246H	1	2	1	2	2	4	-	-	-	-	-	-	0
S 2222B?	44	103	59	131	371	370	4.4	0	4	24	8	10	0
T 2216B?	16	40	34	10	30	94	2.9	7	5	39	7	25	0
U 2212B?	38	91	34	58	157	147	4.0	0	5	27	6	14	0
V 2200E	47	62	71	97	240	139	7.4	2	4	31	8	16	0
W 2193H	1	2	1	2	2	4	-	-	-	-	-	-	0
X 2181H	48	72	67	106	279	185	6.8	3	4	25	7	11	0
Y 2163H	12	98	25	20	36	120	0.9	0	6	21	4	10	0
Z 2121H	49	38	149	202	555	287	13.9	16	6	20	3	10	0
AA 2097H	82	128	128	187	483	366	7.7	7	7	22	3	13	0
AB 2075B?	45	74	68	111	295	230	5.9	2	6	27	4	15	0
AC 2073B?	45	74	68	111	295	230	6.1	7	6	28	4	17	0
AD 2040H	28	35	30	45	117	132	6.8	14	5	30	6	17	0
AE 2007B?	48	52	87	193	509	480	9.5	21	5	22	4	12	0
AF 1988L?	13	5	40	48	116	98	21.0	41	5	34	5	21	0
AG 1982B?	13	36	48	69	185	236	2.6	8	5	35	6	21	0
LINE 10260	(FLIGHT		5)										
A 2644H	1	2	1	2	2	4	-	-	-	-	-	-	0
B 2666L?	44	68	57	100	272	128	6.3	4	4	20	8	7	0
C 2677H	57	121	81	181	562	483	5.2	3	4	21	9	9	0
D 2697H	39	64	40	92	241	197	5.6	7	4	27	7	13	0
E 2710L?	1	2	1	2	2	4	-	-	-	-	-	-	0
F 2715H	1	2	1	2	2	4	-	-	-	-	-	-	0
G 2741L?	29	26	12	1	122	68	9.8	12	4	27	8	13	110
H 2749H	1	2	1	2	2	4	-	-	-	-	-	-	0
I 2759H	27	17	44	67	163	104	15.2	23	5	21	6	8	0
J 2806B?	27	38	17	47	124	148	5.7	11	4	25	8	12	0

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ANOMALY/ FID/INTERP	COAXIAL 1190 HZ REAL PPM	COAXIAL 1190 HZ QUAD PPM	COPLANAR 895 HZ REAL PPM	COPLANAR 895 HZ QUAD PPM	COPLANAR 7233 HZ REAL PPM	COPLANAR 7233 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10260 (FLIGHT 5)													
K 2813H	36	76	41	105	295	268	4.4	4	4	24	8	11	0
L 2837H	2	49	32	64	208	72	0.5	0	4	22	7	9	0
M 2860H	1	2	1	2	2	4	-	-	-	-	-	-	0
N 2882E	41	112	96	172	473	385	3.7	0	3	30	12	14	0
O 2889B?	84	130	90	161	443	391	7.8	5	4	30	9	16	0
P 2903H	1	2	1	2	2	4	-	-	-	-	-	-	0
Q 2951B?	57	113	64	154	434	401	5.4	4	4	27	8	13	0
R 2957B?	65	141	72	187	533	559	5.3	6	4	27	8	14	0
S 2967B?	40	86	35	107	295	269	4.5	1	4	28	8	14	0
T 2976B?	113	193	127	263	723	656	7.9	5	4	25	7	13	5
U 2987B?	23	33	33	47	126	88	5.4	8	5	30	7	16	0
V 2994B?	100	184	139	252	709	557	7.0	3	5	23	6	12	0
W 3003B?	25	80	33	116	333	417	2.8	6	4	26	7	13	0
X 3011B?	79	115	96	142	411	373	8.3	3	6	21	4	10	0
Y 3061B?	24	75	42	52	179	359	2.8	6	5	30	6	18	5
Z 3070B?	138	154	179	205	524	325	13.1	4	6	21	3	12	0
AA 3074B?	25	2	24	177	430	239	49.0	40	6	23	3	13	0
AB 3094B?	32	136	49	181	1047	692	2.4	0	6	20	3	10	0
AC 3096B?	68	136	287	181	1047	754	5.7	3	6	17	3	8	0
AD 3112H	94	99	139	145	363	273	12.4	0	6	17	3	7	0
AE 3134H	1	2	1	2	2	4	-	-	-	-	-	-	0
AF 3160H	1	2	1	2	2	4	-	-	-	-	-	-	0
AG 3197H	52	79	87	110	280	69	6.7	6	5	28	5	16	0
AH 3202L	28	15	29	109	279	69	19.6	28	5	32	5	19	0
LINE 10270 (FLIGHT 5)													
A 3914H	40	74	56	112	321	255	5.1	7	4	22	7	10	0
B 3905H	59	90	32	145	387	215	7.1	1	5	20	7	8	0
C 3884H	64	112	87	169	485	357	6.3	2	4	20	7	7	0
D 3870H	44	88	59	124	368	343	4.9	1	4	19	8	6	0
E 3831H	90	185	136	266	795	608	6.1	0	4	19	7	7	0
F 3823L?	11	44	6	13	184	170	1.8	0	4	24	8	11	0
G 3818L?	18	31	36	42	5	51	4.0	10	4	27	8	13	0
H 3816L?	11	18	11	35	45	30	3.6	16	4	26	8	12	0
I 3773H	30	73	40	87	257	250	3.8	3	4	22	7	10	0
J 3760H	48	89	51	117	328	246	5.4	4	4	21	7	9	40
K 3752B?	39	68	41	78	226	184	5.3	5	4	27	8	13	0
L 3749B?	28	49	39	78	226	136	4.8	7	4	28	8	14	0
M 3740H	70	139	102	201	551	468	5.8	3	4	23	7	10	0
N 3718H	1	2	1	2	2	4	-	-	-	-	-	-	0
O 3704B?	35	60	21	78	235	192	5.3	6	4	26	8	12	0

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JOB #1159 MILK RIVER AREA, ALBERTA

		COAXIAL 1190 HZ		COPLANAR 895 HZ		COPLANAR 7233 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH		MAG CORR
ANOMALY/	FID/INTERP	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND SIEMEN	DEPTH* M	COND SIEMEN	DEPTH M	RESIS OHM-M	DEPTH M	NT
LINE 10270	(FLIGHT 5)													
P	3684H	1	2	1	2	2	4	-	-	-	-	-	-	0
Q	3665B?	47	84	47	108	311	270	5.5	2	4	31	10	16	0
R	3652B?	52	104	75	147	397	321	5.2	2	4	28	9	14	0
S	3603H	1	2	1	2	2	4	-	-	-	-	-	-	0
T	3573B?	84	128	107	172	465	309	7.9	1	4	27	7	14	0
U	3563B?	67	105	87	142	375	267	7.2	5	4	32	8	18	0
V	3554B?	30	44	36	64	161	94	5.9	0	4	31	8	16	0
W	3542E	89	122	7	169	472	353	9.0	4	4	28	7	14	0
X	3530H	1	2	1	2	2	4	-	-	-	-	-	-	0
Y	3499H	1	2	1	2	2	4	-	-	-	-	-	-	0
Z	3487B?	34	66	45	102	278	232	4.6	5	5	28	5	16	0
AA	3476B?	48	59	73	101	260	161	8.2	6	6	23	4	11	0
AB	3451H	43	61	61	93	247	248	7.0	6	6	23	4	12	0
AC	3407H	1	2	1	2	2	4	-	-	-	-	-	-	0
AD	3361H	26	38	44	63	170	148	5.7	10	5	27	5	15	0
AE	3352L	39	90	24	29	97	261	4.2	0	5	30	6	16	0
LINE 10280	(FLIGHT 5)													
A	3993H	90	171	111	236	682	536	6.6	2	4	21	8	9	0
B	4009H	65	99	83	150	407	259	7.3	4	4	22	7	9	0
C	4028H	1	2	1	2	2	4	-	-	-	-	-	-	0
D	4059H	1	2	1	2	2	4	-	-	-	-	-	-	0
E	4074H	1	2	1	2	2	4	-	-	-	-	-	-	0
F	4144H	1	2	1	2	2	4	-	-	-	-	-	-	0
G	4158H	41	62	58	91	244	149	6.2	1	4	23	7	9	30
H	4200H	36	53	55	87	230	99	6.2	4	4	23	7	10	0
I	4234E	71	127	99	182	507	405	6.5	2	4	26	9	12	0
J	4245H	53	80	74	132	366	258	6.9	0	4	21	9	7	0
K	4265H	10	50	18	26	71	17	1.3	0	4	25	7	11	0
L	4312H	62	118	86	171	468	420	5.7	4	4	25	7	12	0
M	4337B?	130	129	182	198	502	250	14.6	0	7	15	3	5	0
N	4347B?	40	68	57	106	292	257	5.7	5	5	28	6	15	0
O	4359B?	113	119	147	169	408	173	13.1	0	6	18	4	8	0
P	4368E	86	185	264	371	962	861	5.8	3	5	21	4	11	0
Q	4406H	14	10	113	101	99	145	10.5	40	6	24	4	13	0
R	4422B?	14	17	2	7	18	35	5.6	24	6	25	5	13	0
S	4428B?	24	44	193	22	72	253	4.3	14	5	25	5	14	0
T	4433B?	154	238	221	364	1007	673	9.7	2	6	16	4	7	0
U	4465H	1	2	1	2	2	4	-	-	-	-	-	-	0
V	4497H	25	41	44	2	3	154	5.0	9	5	28	7	15	0
W	4518H	1	2	1	2	2	4	-	-	-	-	-	-	0

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LINE 10280	(FLIGHT 5)													
X	4545H	1	2	1	2	2	4	-	-	-	-	-	-	0
Y	4555L	14	43	5	14	8	6	2.4	0	5	32	5	18	9
Z	4557L	36	27	7	27	60	96	12.8	0	5	35	6	19	0
AA	4561L	21	7	34	33	91	64	31.1	1	5	39	7	22	0
LINE 10290	(FLIGHT 6)													
A	1206H	52	76	71	122	292	130	7.0	0	4	18	8	5	0
B	1192H	43	57	52	89	213	70	7.3	3	4	19	8	6	0
C	1169H	1	2	1	2	2	4	-	-	-	-	-	-	0
D	1146L	60	59	44	88	210	142	11.4	9	4	21	8	8	0
E	1132L	48	77	18	100	290	184	6.3	3	4	19	8	6	0
F	1129H	1	2	1	2	2	4	-	-	-	-	-	-	0
G	1113L	24	29	10	35	74	12	6.4	15	4	21	8	8	0
H	1104H	1	2	1	2	2	4	-	-	-	-	-	-	0
I	1086H	1	2	1	2	2	4	-	-	-	-	-	-	0
J	1046H	74	107	88	147	416	411	8.0	7	4	19	9	7	0
K	1039L	21	50	24	59	163	202	3.3	8	4	24	9	10	0
L	1029L?	1	2	1	2	2	4	-	-	-	-	-	-	0
M	1019H	51	96	63	142	361	365	5.4	3	4	21	9	8	0
N	988H	47	86	53	117	300	257	5.5	2	4	21	9	7	0
O	970H	31	54	37	77	196	138	5.0	6	4	21	9	8	0
P	962H	42	72	7	110	273	190	5.5	2	4	22	9	8	0
Q	951B?	58	104	64	162	424	368	6.0	2	3	24	13	9	0
R	942E	99	174	129	273	690	597	7.3	2	4	22	10	8	0
S	936H	1	2	1	2	2	4	-	-	-	-	-	-	0
T	921L	11	18	69	26	74	104	3.8	25	4	22	9	9	0
U	897H	13	17	22	38	101	91	5.3	27	4	20	7	8	0
V	874H	1	2	0	2	2	4	-	-	-	-	-	-	0
W	852B?	55	98	81	154	409	348	6.0	0	4	20	9	6	0
X	849B?	58	98	81	154	409	348	6.4	0	4	26	7	12	0
Y	834H	1	2	1	2	2	4	-	-	-	-	-	-	0
Z	790H	15	22	27	39	91	48	4.7	12	6	21	4	9	0
AA	782B?	46	106	92	213	412	479	4.4	6	4	25	7	12	0
AB	745H	33	46	68	46	173	94	6.5	8	5	20	5	8	0
AC	735H	1	2	1	2	2	4	-	-	-	-	-	-	0
AD	685L	1	2	1	2	2	4	-	-	-	-	-	-	0
AE	660H	1	2	1	2	2	4	-	-	-	-	-	-	0
AF	628L	0	299	12	35	83	88	0.3	0	6	31	4	17	40
AG	625L	287	830	12	28	19	47	6.9	0	6	32	4	17	0
LINE 10300	(FLIGHT 6)													
A	1316H	8	120	48	160	476	543	0.7	0	4	17	8	5	0

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LINE 10300	(FLIGHT 6)													
B	1337H	33	113	49	155	410	559	2.9	4	4	22	9	10	0
C	1369H	45	74	47	108	306	282	5.9	10	4	20	8	7	0
D	1386B?	12	22	13	32	89	73	3.3	14	4	21	9	7	0
E	1394L?	43	58	38	80	209	147	7.3	9	4	23	8	9	0
F	1403H	36	56	41	73	170	63	6.0	4	4	17	8	4	0
G	1417H	53	102	81	154	384	102	5.4	2	4	19	7	6	0
H	1436H	1	2	1	2	2	4	-	-	-	-	-	-	0
I	1461L?	32	56	17	73	200	163	5.0	3	4	21	9	6	0
J	1475H	31	55	11	22	208	199	4.8	4	4	21	9	7	0
K	1526B?	69	133	72	180	469	431	6.0	3	4	20	9	7	0
L	1535B?	55	109	72	171	470	391	5.4	5	4	22	10	9	0
M	1548H	32	55	43	86	203	233	5.1	8	4	25	9	11	0
N	1561H	68	105	56	111	253	165	7.3	0	4	16	8	4	0
O	1573H	40	72	43	105	268	277	5.2	9	4	24	9	10	0
P	1587B?	195	515	207	706	1970	2480	6.5	5	3	19	11	8	0
Q	1594B?	23	39	26	72	182	146	4.5	5	4	28	10	13	0
R	1614B?	51	104	57	147	387	515	5.1	6	4	23	9	10	0
S	1626H	1	2	1	2	2	4	-	-	-	-	-	-	0
T	1636H	27	58	50	107	292	276	4.0	7	4	20	8	7	0
U	1645H	1	2	1	2	2	4	-	-	-	-	-	-	0
V	1663H	44	21	30	12	34	55	24.5	24	4	25	8	12	0
W	1686E	25	69	19	84	233	302	3.1	7	4	27	8	14	0
X	1694B?	130	156	159	226	539	393	11.8	0	6	16	4	6	0
Y	1696B?	124	75	159	106	291	465	26.1	8	6	19	4	8	0
Z	1698B?	48	75	47	106	291	465	6.4	6	5	17	5	6	0
AA	1707L?	23	26	78	33	85	139	7.2	25	5	25	5	14	0
AB	1746B	164	18	257	298	383	263	336.3	12	6	18	4	8	0
AC	1775B?	116	174	140	246	616	614	9.0	4	5	21	6	10	0
AD	1803H	1	2	1	2	2	4	-	-	-	-	-	-	0
AE	1843H	29	42	15	89	235	240	5.7	10	4	25	8	12	0
AF	1871H	1	2	1	2	2	4	-	-	-	-	-	-	0
AG	1899H	118	81	12	48	126	320	22.0	9	5	21	6	10	0
AH	1906L	300	432	108	107	20	234	12.9	0	4	27	8	14	0
AI	1911L	152	621	30	74	103	104	4.2	0	5	29	6	16	0
AJ	1917L	218	329	22	14	22	116	11.1	0	4	33	9	17	50
AK	1921L	82	259	8	24	47	116	4.2	0	4	32	9	17	0
LINE 10310	(FLIGHT 6)													
A	2696H	41	65	43	95	248	185	6.0	7	4	18	8	5	0
B	2687H	1	2	1	2	2	4	-	-	-	-	-	-	0
C	2663B?	64	132	78	177	427	494	5.5	3	4	18	8	6	0

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JOB #1159 MILK RIVER AREA, ALBERTA

ANOMALY/	FID/INTERP	COAXIAL 1190 HZ REAL PPM	COAXIAL 1190 HZ QUAD PPM	COPLANAR 895 HZ REAL PPM	COPLANAR 895 HZ QUAD PPM	COPLANAR 7233 HZ REAL PPM	COPLANAR 7233 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10310		(FLIGHT		6)										
D	2661B?	49	99	78	177	361	367	5.1	4	4	18	8	6	0
E	2640B?	1	2	1	2	2	4	-	-	-	-	-	-	0
F	2638B?	26	58	24	71	137	215	3.8	6	4	22	10	8	0
G	2621H	162	297	175	466	1260	552	8.3	1	4	14	7	3	0
H	2605H	73	124	87	180	560	391	6.8	2	4	15	7	3	0
I	2589L?	25	41	18	48	142	110	4.9	12	4	19	7	6	0
J	2576H	1	2	1	2	2	4	-	-	-	-	-	-	0
K	2572L?	62	95	75	137	352	218	7.1	5	4	18	7	6	0
L	2560L?	1	2	1	2	2	4	-	-	-	-	-	-	0
M	2554H	10	79	39	125	395	340	0.9	0	4	17	9	5	0
N	2552L?	1	2	1	2	2	4	-	-	-	-	-	-	0
O	2545H	1	2	1	2	2	4	-	-	-	-	-	-	0
P	2535L	1	2	1	2	2	4	-	-	-	-	-	-	90
Q	2530L	1	2	1	2	2	4	-	-	-	-	-	-	0
R	2527L	57	38	35	58	166	158	17.9	13	4	22	9	8	0
S	2505H	35	75	7	109	309	313	4.3	6	4	21	9	8	0
T	2487B?	89	175	104	248	650	619	6.4	3	4	21	9	9	0
U	2471H	28	38	33	36	103	78	6.3	8	4	22	8	8	0
V	2444H	13	24	29	60	160	117	3.4	8	4	25	9	9	0
W	2433H	1	2	1	2	2	4	-	-	-	-	-	-	0
X	2414B?	28	58	18	60	165	169	4.1	6	3	40	13	22	0
Y	2398E	21	67	52	102	300	307	2.6	1	4	25	10	11	0
Z	2393H	6	1	63	102	300	307	49.0	81	4	24	9	11	0
AA	2378H	38	82	49	124	337	337	4.4	4	4	23	8	10	0
AB	2329H	1	2	1	2	2	4	-	-	-	-	-	-	0
AC	2308B?	77	88	91	99	264	300	10.4	6	5	25	5	13	0
AD	2299B?	33	74	18	78	228	320	4.1	8	4	30	9	16	0
AE	2291B?	38	59	38	45	111	170	6.0	6	5	26	6	13	0
AF	2274H	14	33	22	56	129	49	2.9	1	4	28	8	13	0
AG	2248B?	1	2	1	2	2	4	-	-	-	-	-	-	0
AH	2243B?	48	65	84	96	222	87	7.5	2	6	20	4	8	0
AI	2237B?	32	47	48	82	204	148	5.9	6	5	25	6	11	0
AJ	2198H	39	47	54	74	180	100	7.9	6	5	25	5	12	0
AK	2085L	1	2	1	2	2	3	-	-	-	-	-	-	0
AL	2082L	59	33	64	64	135	18	22.3	10	5	28	6	15	0
AM	2080L	63	45	64	14	37	60	17.1	6	5	29	6	15	0
AN	2078L	54	59	12	24	69	57	9.8	5	5	30	6	16	0
AO	2076L	90	65	12	24	69	57	18.8	6	5	30	7	16	0
AP	2073L	76	73	16	24	69	57	12.6	6	4	30	7	16	0
AQ	2070L	136	74	20	9	31	3	30.7	3	4	30	8	15	0
AR	2067L	90	55	20	66	174	196	22.9	6	4	28	7	14	0

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JOB #1159 MILK RIVER AREA, ALBERTA

	COAXIAL 1190 HZ		COPLANAR 895 HZ		COPLANAR 7233 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH		MAG CORR
ANOMALY/ FID/INTERP	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND SIEMEN	DEPTH* M	COND SIEMEN	DEPTH M	RESIS OHM-M	DEPTH M	NT
LINE 10310	(FLIGHT		6)										
AS 2066L	90	86	26	75	205	380	13.3	2	4	27	7	13	0
AT 2063L	71	105	26	75	205	381	7.8	5	4	27	8	14	0
AU 2061L	62	105	29	75	205	381	6.6	8	4	29	8	16	0
AV 2058L	38	61	29	73	213	381	5.9	10	4	28	9	15	0
AW 2055L	33	55	19	16	39	69	5.3	10	4	29	10	14	0
LINE 10320	(FLIGHT		6)										
B 2804H	60	129	94	144	513	536	5.2	5	4	20	8	7	0
C 2816H	1	2	1	2	2	4	-	-	-	-	-	-	0
D 2834H	52	90	58	115	336	221	5.9	5	4	21	8	8	0
E 2851H	1	2	1	2	2	4	-	-	-	-	-	-	0
F 2860H	33	54	38	75	176	86	5.4	9	4	24	9	10	0
G 2871L?	75	120	91	184	495	330	7.2	2	4	17	8	5	0
H 2875L?	23	39	91	184	495	43	4.5	13	4	20	8	8	0
I 2889L	15	22	16	19	45	149	4.6	16	4	17	7	4	0
J 2891L	36	40	49	19	45	76	8.2	9	4	18	7	6	0
K 2893L	40	51	44	72	181	76	7.5	8	4	19	7	7	0
L 2904B?	65	118	81	176	477	337	6.1	3	4	19	7	7	0
M 2914L?	1	2	1	2	2	4	-	-	-	-	-	-	7
N 2925H	1	2	1	2	2	4	-	-	-	-	-	-	0
O 2940H	33	73	38	104	297	287	4.1	6	4	26	10	12	0
P 3016B?	78	160	98	233	660	696	5.9	3	4	19	8	7	0
Q 3020B?	76	100	98	119	331	251	9.0	5	4	22	9	8	0
R 3039B?	52	83	58	118	315	281	6.4	7	4	18	8	6	0
S 3052B?	49	101	84	125	360	383	5.0	8	4	21	9	9	0
T 3055B?	72	146	84	197	558	530	5.8	3	4	20	9	7	0
U 3066B?	28	52	32	76	212	174	4.6	8	4	21	9	7	0
V 3077B?	67	157	48	174	512	655	5.1	5	3	23	11	9	0
W 3086B?	53	91	52	91	227	162	6.0	0	5	20	6	8	0
X 3117H	3	8	17	31	82	93	1.8	29	4	27	9	12	0
Y 3154H	3	14	37	89	233	22	1.0	9	4	25	7	11	0
Z 3178H	41	47	58	82	215	195	8.5	12	4	25	7	12	0
AA 3186B?	29	90	18	118	351	433	3.0	4	4	26	9	13	0
AB 3193B?	61	19	71	18	50	108	50.3	12	4	25	7	12	0
AC 3210B?	33	85	110	48	302	198	3.6	0	6	22	4	11	0
AD 3212B?	33	85	110	48	302	198	3.6	0	6	21	4	10	0
AE 3220B?	39	98	111	156	371	186	4.0	2	5	24	5	13	0
AF 3250B?	53	233	58	5	772	480	2.8	0	5	22	5	11	0
AG 3256B?	23	39	106	201	513	466	4.6	17	6	17	4	7	0
AH 3266L	10	38	52	188	508	261	1.8	10	5	27	6	15	0
AI 3269B?	75	129	94	188	508	438	6.8	4	5	21	6	10	0

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JOB #1159 MILK RIVER AREA, ALBERTA

ANOMALY/ FID/INTERP	COAXIAL 1190 HZ REAL PPM	COAXIAL 1190 HZ QUAD PPM	COPLANAR 895 HZ REAL PPM	COPLANAR 895 HZ QUAD PPM	COPLANAR 7233 HZ REAL PPM	COPLANAR 7233 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10320 (FLIGHT 6)													
AJ 3282H	41	74	54	100	259	332	5.3	10	5	27	6	15	0
AK 3294H	74	95	92	139	352	185	9.1	4	5	20	5	8	0
AL 3316H	13	25	40	58	146	119	3.4	13	5	21	5	9	0
AM 3338H	26	46	37	61	159	108	4.6	11	5	25	5	13	0
AN 3384H	20	24	11	37	96	44	6.3	18	5	24	6	11	0
AO 3402H	28	34	48	67	136	108	7.2	12	5	26	6	13	0
AP 3428H	60	2	61	19	7	53	49.0	25	5	30	6	17	0
AQ 3433L	40	35	49	62	136	103	11.6	11	5	32	7	18	0
AR 3435L	39	18	38	44	92	69	25.9	17	4	32	8	18	9
AS 3445H	28	27	22	43	121	95	9.1	18	4	32	9	17	0
LINE 10330 (FLIGHT 6)													
A 4287H	45	78	61	122	336	210	5.6	3	4	18	8	5	0
B 4270H	45	48	32	11	33	183	9.4	14	4	21	8	8	0
C 4256B?	30	40	47	97	248	161	6.5	14	4	20	9	7	0
D 4238B?	11	70	37	77	220	103	1.2	0	4	20	9	7	0
E 4235B?	53	79	79	132	324	199	6.9	5	4	22	8	8	0
F 4223B?	18	39	25	52	146	113	3.5	4	4	21	10	7	0
G 4217B?	1	2	1	2	2	4	-	-	-	-	-	-	0
H 4201L	1	2	1	2	2	4	-	-	-	-	-	-	0
I 4175H	13	23	43	75	188	72	3.7	19	4	25	8	11	0
J 4149H	18	22	35	84	238	643	5.8	25	4	18	8	6	0
K 4133H	12	21	26	49	131	87	3.5	22	4	25	9	11	0
L 4122H	1	2	1	2	2	4	-	-	-	-	-	-	0
M 4089H	29	59	45	94	254	255	4.3	8	4	25	10	11	0
N 4060H	24	51	29	72	185	171	3.8	5	4	23	9	9	0
O 4049B?	41	64	47	90	236	204	6.1	8	4	25	10	11	0
P 4029H	1	2	1	2	2	4	-	-	-	-	-	-	0
Q 3987H	25	44	38	65	179	136	4.6	6	4	22	9	8	0
R 3960E	22	51	29	69	206	145	3.5	5	4	29	10	14	0
S 3939E	18	32	39	83	225	126	4.2	8	4	26	9	12	0
T 3931H	1	2	1	2	2	4	-	-	-	-	-	-	0
U 3880B?	88	153	82	196	530	445	7.1	2	4	23	9	10	0
V 3870B?	36	60	33	83	203	171	5.6	5	4	30	9	15	0
W 3858H	1	2	1	2	2	4	-	-	-	-	-	-	0
X 3805H	59	47	72	79	171	110	14.4	4	5	19	5	7	0
Y 3790H	62	91	128	148	339	153	7.4	1	6	19	4	8	0
Z 3782H	76	108	97	162	409	298	8.2	3	5	21	5	10	0
AA 3737H	1	2	1	2	2	4	-	-	-	-	-	-	0
AB 3660H	1	2	1	2	2	4	-	-	-	-	-	-	0
AC 3635H	1	2	1	2	2	4	-	-	-	-	-	-	0

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ANOMALY/ FID/INTERP	COAXIAL 1190 HZ REAL PPM	COAXIAL 1190 HZ QUAD PPM	COPLANAR 895 HZ REAL PPM	COPLANAR 895 HZ QUAD PPM	COPLANAR 7233 HZ REAL PPM	COPLANAR 7233 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10330	(FLIGHT	6)											
AD 3610L	30	33	14	12	24	15	8.0	13	5	28	6	15	0
LINE 10340	(FLIGHT	6)											
A 4397B?	28	168	65	161	479	752	1.7	0	4	20	8	8	0
B 4422H	32	50	34	77	220	39	5.6	8	4	21	9	7	0
C 4449H	29	45	6	71	173	9	5.6	8	4	19	8	6	0
D 4468L?	18	14	12	19	50	24	10.6	22	4	20	9	6	0
E 4485H	13	74	43	68	118	207	1.4	0	4	17	8	4	0
F 4527H	1	2	1	2	2	4	-	-	-	-	-	-	0
G 4592B?	26	45	31	59	167	191	4.7	9	4	23	10	9	0
H 4616L?	46	76	18	44	121	264	6.0	6	4	28	10	13	0
I 4625B?	61	97	73	138	321	291	7.0	4	4	23	9	9	0
J 4634B?	52	93	49	116	298	410	5.8	11	4	29	10	15	0
K 4655B?	42	63	41	83	220	134	6.5	6	4	22	8	9	0
L 4667B?	44	111	62	146	410	390	4.1	4	4	22	9	9	0
M 4671L?	20	47	34	57	168	228	3.4	8	4	23	9	9	0
N 4675H	28	58	39	91	258	246	4.2	8	4	22	9	9	0
O 4690E	32	63	25	64	184	214	4.5	8	4	23	9	9	0
P 4697H	71	126	102	205	550	417	6.4	2	3	24	12	10	0
Q 4711B?	109	108	84	110	261	153	13.8	0	5	17	5	4	0
R 4720B?	1	2	1	2	2	4	-	-	-	-	-	-	0
S 4731H	35	56	39	72	190	172	5.6	7	4	25	9	11	0
T 4745B?	17	33	42	76	202	162	3.7	15	4	34	9	19	0
LINE 10350	(FLIGHT	6)											
A 5277H	28	49	39	78	214	139	4.9	6	4	20	9	6	0
B 5255B?	26	41	42	70	174	97	5.2	6	4	21	9	7	0
C 5238H	1	2	1	2	2	4	-	-	-	-	-	-	0
D 5213L	1	2	1	2	2	4	-	-	-	-	-	-	0
E 5205H	33	61	45	83	188	102	4.8	1	4	15	7	2	0
F 5189B?	23	83	43	87	289	277	2.4	0	4	21	8	8	0
G 5160B?	29	88	71	154	427	293	3.1	0	4	18	9	5	0
H 5157B?	8	51	50	84	218	132	1.0	0	4	21	8	7	0
I 5145B?	15	28	26	51	144	124	3.6	11	4	25	9	10	0
J 5139B?	1	2	1	2	2	4	-	-	-	-	-	-	0
K 5135B?	17	28	29	54	150	119	4.3	13	4	28	10	13	0
L 5128B?	5	15	25	40	109	92	1.7	10	4	28	10	13	0
M 5123B?	19	31	36	57	148	105	4.3	7	4	26	10	10	0
N 5105H	1	2	1	2	2	4	-	-	-	-	-	-	0
O 5080L?	21	43	41	77	217	197	3.9	8	4	26	10	11	60
P 5067H	1	2	1	2	2	4	-	-	-	-	-	-	0

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LINE 10350	(FLIGHT 6)													
Q	5055B?	40	74	63	125	344	285	5.1	5	4	22	8	9	0
R	5053B?	36	67	63	125	344	285	4.9	7	4	27	9	13	0
S	5041B?	58	121	62	151	421	451	5.3	5	3	27	10	13	0
T	5033B?	46	79	50	89	246	240	5.8	1	4	22	9	8	0
U	5030B?	44	55	50	89	246	240	7.9	3	4	21	7	7	0
V	5008B?	25	52	45	88	238	279	3.9	5	4	28	10	13	0
W	5004B?	11	21	45	88	238	279	3.2	20	4	35	10	20	0
X	4997B?	21	30	46	62	159	130	5.4	12	4	27	9	12	0
Y	4984B?	39	91	68	175	484	536	4.2	7	4	22	9	9	0
Z	4979B?	64	116	83	169	436	324	6.2	1	4	21	9	8	0
AA	4964H	19	34	27	46	127	86	4.0	15	4	23	9	10	0
AB	4955E	5	99	53	137	377	359	0.6	0	4	24	10	10	0
AC	4936E	25	36	29	53	143	169	5.7	8	3	33	13	16	0
AD	4922B	42	85	63	146	396	376	4.8	6	4	29	10	15	0
AE	4911B?	21	32	39	57	137	57	5.0	10	4	31	9	16	0
AF	4902B?	21	35	51	73	182	128	4.7	7	4	25	8	11	0
AG	4896B?	11	34	11	49	143	165	2.3	6	4	29	9	14	0
LINE 10360	(FLIGHT 6)													
A	5472H	5	40	44	76	192	120	0.7	0	4	20	8	7	0
B	5499H	12	21	31	47	122	60	3.5	10	4	22	8	7	0
C	5518H	1	2	1	2	2	4	-	-	-	-	-	-	0
D	5552H	3	3	14	26	72	63	3.9	63	4	21	8	8	0
E	5590H	12	2	18	51	124	145	49.0	47	4	23	9	8	0
F	5644H	1	1	1	2	2	4	-	-	-	-	-	-	0
G	5677H	30	53	50	86	229	188	4.7	7	4	24	8	11	0
H	5695B?	29	46	21	73	204	180	5.4	9	4	25	9	11	0
I	5718H	1	2	1	2	2	4	-	-	-	-	-	-	0
J	5731B?	28	61	42	95	264	261	4.0	4	4	27	10	12	0
K	5737B?	42	82	50	129	352	332	4.9	4	4	24	10	10	0
L	5741B?	27	56	38	61	163	175	4.2	3	4	26	9	12	0
M	5747B?	20	40	25	57	159	140	3.8	5	4	31	11	14	0
N	5752B?	18	33	25	43	126	149	4.0	6	4	32	10	17	0
O	5763B?	65	97	87	139	318	258	7.4	0	5	23	6	10	0
P	5788H	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 10370	(FLIGHT 6)													
A	6482B?	41	63	52	94	294	192	6.2	2	4	19	8	6	0
B	6489H	34	64	54	106	275	203	4.9	6	4	22	8	9	0
C	6510H	1	85	28	130	352	321	0.4	6	4	24	8	11	0
D	6535H	1	2	1	2	2	4	-	-	-	-	-	-	0

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JOB #1159 MILK RIVER AREA, ALBERTA

	COAXIAL 1190 HZ		COPLANAR 895 HZ		COPLANAR 7233 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH		MAG CORR
ANOMALY/ FID/INTERP	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND SIEMEN	DEPTH* M	COND SIEMEN	DEPTH M	RESIS OHM-M	DEPTH M	NT
LINE 10370 (FLIGHT 6)													
E 6548H	1	2	1	2	2	4	-	-	-	-	-	-	0
F 6560H	29	39	39	60	150	58	6.4	4	4	20	7	6	0
G 6593H	28	53	35	74	201	171	4.5	5	4	24	9	10	0
H 6650H	1	2	1	2	2	4	-	-	-	-	-	-	0
I 6667L?	1	2	1	2	2	4	-	-	-	-	-	-	0
J 6690B?	29	45	4	61	173	172	5.5	10	4	21	8	8	0
K 6694B?	25	91	12	130	381	481	2.5	4	4	25	9	12	0
L 6699B?	31	67	11	80	217	202	4.1	2	4	20	8	7	0
M 6704B?	37	65	30	78	230	206	5.3	2	4	20	9	6	0
N 6715B?	44	67	51	89	248	219	6.3	4	4	21	8	7	0
O 6732H	74	117	43	73	166	307	7.3	4	4	19	7	7	0
P 6743B?	31	58	2	91	257	231	4.6	6	4	28	10	13	0
Q 6753H	1	2	1	2	2	4	-	-	-	-	-	-	0
R 6760E	48	86	73	137	365	284	5.6	0	3	25	11	9	0
S 6777H	100	119	99	170	177	390	11.0	4	4	25	7	12	0
T 6803H	19	35	86	54	157	96	4.0	14	4	24	8	11	0
LINE 10380 (FLIGHT 6)													
A 6229L?	32	50	35	72	190	146	5.6	4	4	21	9	7	0
B 6211H	67	114	68	160	447	218	6.6	3	4	18	8	6	0
C 6197H	18	16	12	7	57	12	8.4	24	4	21	8	8	0
D 6174H	9	8	41	133	44	54	6.4	37	4	15	8	3	0
E 6156H	1	2	1	2	2	4	-	-	-	-	-	-	0
F 6141H	35	51	5	88	238	105	6.1	3	4	18	8	4	0
G 6120H	11	61	99	249	614	708	1.4	0	4	18	8	6	0
H 6083H	1	2	1	2	2	4	-	-	-	-	-	-	0
I 6013H	1	2	1	2	2	4	-	-	-	-	-	-	0
J 5982H	25	53	29	75	196	169	4.0	2	4	27	9	12	0
K 5973E	73	139	87	206	561	507	6.1	4	4	24	9	11	0
L 5946H	68	121	62	181	484	379	6.3	4	4	21	8	8	0
M 5932E	46	89	69	134	356	316	5.1	5	3	30	11	15	0
N 5925B?	37	60	45	88	235	176	5.8	4	4	29	11	14	0
O 5888B?	18	17	49	70	172	63	8.0	25	4	27	9	13	0
P 5879B?	15	35	21	43	112	160	3.1	12	4	31	9	16	0
Q 5870B?	28	40	35	58	158	129	5.7	11	4	24	8	10	0
LINE 10390 (FLIGHT 7)													
A 926B?	41	51	61	100	255	113	7.7	3	4	16	9	3	0
B 904B?	27	30	40	51	141	255	7.9	14	3	21	12	6	0
C 890B?	34	51	45	73	177	92	6.1	4	4	20	9	6	0
D 888B?	18	56	45	30	73	34	2.5	0	4	22	10	8	0

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JOB #1159 MILK RIVER AREA, ALBERTA

ANOMALY/	FID/INTERP	COAXIAL 1190 HZ REAL PPM	COAXIAL 1190 HZ QUAD PPM	COPLANAR 895 HZ REAL PPM	COPLANAR 895 HZ QUAD PPM	COPLANAR 7233 HZ REAL PPM	COPLANAR 7233 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10390	(FLIGHT 7)													
E	870B?	65	57	99	122	246	74	13.3	3	5	14	6	2	0
F	854B?	24	50	42	74	205	192	4.0	6	4	20	9	6	0
G	840B?	53	119	78	185	543	499	4.8	2	4	17	9	4	0
H	836B?	26	119	60	185	543	499	2.1	0	4	17	8	5	0
I	825B?	44	102	90	172	507	420	4.3	3	4	16	8	4	0
J	820E	72	131	91	179	488	357	6.3	0	3	19	10	6	0
K	807B?	38	65	59	50	141	185	5.4	0	4	19	10	5	0
L	803B?	11	24	59	41	141	83	2.9	8	3	23	11	7	0
M	790B?	47	127	61	147	410	207	4.0	1	4	21	10	7	0
N	763H	28	58	25	80	220	221	4.1	9	3	27	12	12	0
O	751H	23	47	38	75	211	150	4.0	4	4	19	10	5	0
P	739H	27	58	42	92	249	257	4.0	7	3	24	11	10	0
Q	713H	1	2	1	2	2	4	-	-	-	-	-	-	0
R	693B?	84	184	103	272	733	683	5.7	0	4	17	9	5	0
S	687E	66	117	53	140	359	328	6.3	6	3	26	11	12	0
T	674H	1	2	1	2	2	4	-	-	-	-	-	-	0
U	645B?	50	89	46	101	286	284	5.7	6	3	28	12	13	0
V	638B?	39	95	32	134	363	418	4.1	4	3	25	11	11	0
W	624B	67	161	83	169	449	460	5.0	10	3	37	13	22	0
X	616B?	15	17	26	23	52	31	6.0	13	4	35	8	19	0
Y	609B?	49	99	47	121	318	336	5.1	2	3	27	11	12	0
Z	594B?	14	22	32	48	129	99	4.4	17	4	27	10	12	0
AA	581H	7	5	5	39	85	76	7.1	48	4	23	9	9	0
LINE 10400	(FLIGHT 7)													
A	1050H	62	146	91	242	700	579	4.8	4	4	17	8	6	0
B	1073B?	64	144	68	227	687	740	5.1	3	3	19	13	5	0
C	1091B?	64	131	105	211	588	449	5.5	0	4	17	9	4	0
D	1108H	2	6	25	13	239	88	1.2	27	3	21	11	6	0
E	1123H	59	93	76	137	355	21	6.8	3	4	16	7	4	0
F	1132H	38	170	102	252	690	501	2.4	0	4	14	7	3	0
G	1151H	17	38	41	103	288	226	3.3	9	4	20	9	6	0
H	1172H	1	2	1	2	2	4	-	-	-	-	-	-	0
I	1205H	24	58	30	81	230	282	3.5	9	3	25	12	11	0
J	1225B?	100	162	107	222	652	408	8.0	2	4	17	9	5	0
K	1228B?	68	126	107	222	652	414	6.2	3	4	20	9	7	0
L	1242L	1	2	1	2	2	4	-	-	-	-	-	-	0
M	1257H	1	29	41	71	196	185	0.4	5	4	25	10	11	0
N	1286E	61	117	88	187	483	444	5.7	2	3	22	10	8	0
O	1294B?	86	145	109	214	547	421	7.2	5	4	25	10	11	0
P	1313B?	67	124	76	163	444	341	6.0	2	4	16	7	4	0

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JOB #1159 MILK RIVER AREA, ALBERTA

ANOMALY/ FID/INTERP	COAXIAL 1190 HZ REAL PPM	COAXIAL 1190 HZ QUAD PPM	COPLANAR 895 HZ REAL PPM	COPLANAR 895 HZ QUAD PPM	COPLANAR 7233 HZ REAL PPM	COPLANAR 7233 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10400	(FLIGHT		7)										
Q 1325B?	44	91	51	115	317	302	4.8	5	4	18	8	6	0
R 1331E	44	121	70	159	481	591	3.8	4	3	25	11	11	0
S 1340B?	91	159	103	219	636	879	7.1	8	3	24	10	11	0
T 1354H	48	94	9	118	326	476	5.2	4	4	25	10	11	0
U 1360E	13	19	114	127	312	156	4.5	19	5	28	6	15	0
V 1369B	36	34	78	164	377	165	10.3	27	5	20	4	10	0
W 1374B	41	62	77	155	363	771	6.3	10	5	14	5	4	0
X 1378E	90	64	64	318	872	726	19.3	8	4	18	6	6	0
Y 1393B?	9	11	47	81	213	201	4.9	38	4	24	8	11	0
Z 1414H	10	31	17	49	153	194	2.2	11	4	23	9	10	0
LINE 10411	(FLIGHT		7)										
A 2103H	1	2	1	2	2	4	-	-	-	-	-	-	0
B 2081H	1	2	1	2	2	4	-	-	-	-	-	-	0
C 2068H	1	2	1	2	2	4	-	-	-	-	-	-	0
D 2049H	27	37	34	100	309	143	6.2	12	4	23	9	9	0
E 2026H	0	2	1	2	2	4	-	-	-	-	-	-	0
F 2003H	8	18	29	44	109	103	2.5	12	4	26	11	11	0
G 1985B?	16	31	45	73	211	293	3.6	9	4	21	10	7	0
H 1979B?	17	42	50	95	255	194	2.9	3	4	20	10	6	0
I 1974B?	9	70	57	118	341	297	1.0	0	3	24	11	9	0
J 1968B?	13	27	25	47	124	129	3.2	11	3	29	12	13	0
K 1962B?	8	17	23	36	112	78	2.8	15	3	26	12	10	0
L 1956B?	15	27	32	57	157	168	3.8	14	3	28	12	12	0
M 1950B?	28	58	51	98	262	222	4.1	7	3	26	11	12	0
N 1944B?	22	53	44	100	233	252	3.3	5	3	21	10	8	0
O 1940B?	10	19	57	100	233	252	3.2	18	4	25	10	10	0
P 1933B?	1	2	1	2	2	4	-	-	-	-	-	-	0
Q 1927B?	9	13	55	111	312	324	4.3	27	4	23	9	9	0
R 1921B?	28	77	64	136	362	356	3.3	1	4	22	9	9	0
S 1910B?	22	44	29	63	170	146	3.9	9	4	26	10	11	0
T 1904B?	33	60	44	87	252	229	4.8	5	4	23	10	9	0
U 1899B?	20	34	44	87	252	229	4.4	8	4	25	9	10	0
V 1892B?	9	29	37	60	161	120	1.9	0	4	24	9	9	0
W 1886B?	9	15	36	46	118	50	3.4	15	4	24	9	9	0
X 1875B?	16	16	30	37	93	43	7.2	10	4	28	11	11	0
Y 1869B?	3	5	64	113	295	253	1.8	28	3	31	12	14	0
Z 1862B?	36	71	64	87	249	227	4.6	9	3	34	12	18	0
AA 1857B?	12	20	32	67	175	130	4.0	0	4	18	9	3	0
AB 1853B?	32	52	32	67	175	130	5.4	8	3	32	11	16	0
AC 1850B?	14	21	65	78	194	97	4.3	16	4	23	8	9	0

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	COAXIAL 1190 HZ		COPLANAR 895 HZ		COPLANAR 7233 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH		MAG CORR
ANOMALY/ FID/INTERP	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND SIEMEN	DEPTH* M	COND SIEMEN	DEPTH M	RESIS OHM-M	DEPTH M	NT
LINE 10411 (FLIGHT 7)													
AD 1843B?	27	53	67	115	292	158	4.2	5	4	18	7	5	0
AE 1840B?	28	49	67	115	292	158	4.7	7	4	21	8	8	0
AF 1831B?	5	18	50	79	211	136	1.4	6	4	19	7	6	0
AG 1826B?	23	36	39	67	159	103	5.0	10	4	19	8	6	0
AH 1815B?	49	114	93	214	665	435	4.5	3	4	19	8	7	0
LINE 10420 (FLIGHT 7)													
A 2251H	21	58	25	69	169	59	2.9	4	3	22	10	8	0
B 2273H	1	2	1	2	2	4	-	-	-	-	-	-	0
C 2289H	1	2	1	2	2	4	-	-	-	-	-	-	0
D 2315H	1	2	1	2	2	4	-	-	-	-	-	-	0
E 2328B?	43	45	70	83	199	18	9.5	8	2	25	20	7	0
F 2394H	34	80	38	103	305	332	3.9	4	3	23	11	9	0
G 2417H	43	94	45	118	371	312	4.6	1	4	20	9	7	0
H 2427B?	27	57	27	76	216	277	4.0	7	4	25	10	11	0
I 2438B?	60	115	73	155	438	377	5.6	3	4	22	8	9	0
J 2449B?	61	116	76	161	445	336	5.7	1	4	20	8	7	0
K 2453B?	1	2	1	2	2	4	-	-	-	-	-	-	0
L 2465H	33	80	49	122	362	435	3.9	6	4	21	8	9	0
M 2479B?	54	146	58	210	616	752	4.2	3	4	21	10	8	0
N 2515H	65	103	7	144	369	225	7.0	7	4	20	7	8	0
O 2532B?	107	216	150	323	885	804	6.6	0	4	15	6	4	0
P 2543B?	109	54	85	90	248	403	32.3	10	5	29	7	16	0
Q 2546B?	109	103	73	136	389	403	14.4	10	4	30	10	16	0
R 2560B?	44	24	11	116	305	190	21.3	11	5	22	5	9	0
S 2565B?	138	287	54	416	1170	997	7.1	0	6	21	4	10	0
T 2578B?	41	65	9	57	180	252	6.0	11	4	25	9	11	0
U 2589B?	29	61	64	135	361	362	4.2	11	4	25	8	12	0
V 2602B?	37	87	66	138	401	414	4.0	5	4	26	9	12	0
W 2610B?	75	162	101	237	653	868	5.5	8	4	28	9	15	0
X 2620H	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 10430 (FLIGHT 7)													
A 3087H	1	2	1	2	2	4	-	-	-	-	-	-	0
B 3067H	1	2	1	2	2	4	-	-	-	-	-	-	0
C 3045B	4	6	44	57	167	181	2.6	36	1	58	82	25	220
D 3006H	15	34	27	53	153	140	3.2	10	4	23	9	9	0
E 2985B?	38	87	60	99	124	255	4.2	5	3	25	11	11	0
F 2983B?	26	70	60	99	124	255	3.2	4	4	24	10	10	0
G 2967H	43	75	70	120	328	226	5.6	3	4	21	8	7	0
H 2956B?	32	58	59	97	268	228	4.8	6	4	24	10	10	0

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ANOMALY/ FID/INTERP	COAXIAL 1190 HZ REAL PPM	COAXIAL 1190 HZ QUAD PPM	COPLANAR 895 HZ REAL PPM	COPLANAR 895 HZ QUAD PPM	COPLANAR 7233 HZ REAL PPM	COPLANAR 7233 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10430 (FLIGHT 7)													
I 2945H	1	2	1	2	2	4	-	-	-	-	-	-	0
J 2940E	48	83	50	123	364	294	5.8	5	4	21	8	8	0
K 2924H	24	49	32	76	217	161	4.1	10	4	20	8	8	0
L 2908B?	25	77	29	90	280	274	2.9	2	4	29	10	14	0
M 2904B?	31	60	29	90	280	211	4.4	3	4	26	8	12	0
N 2897E	57	96	64	119	315	268	6.4	7	4	29	9	15	0
O 2889H	1	2	1	2	2	4	-	-	-	-	-	-	0
P 2859B?	1	2	1	2	2	4	-	-	-	-	-	-	0
Q 2845B?	34	86	44	110	315	311	3.8	3	4	29	7	15	0
R 2828B?	17	24	37	46	129	58	4.8	17	4	40	11	23	0
S 2822B?	7	47	40	61	163	58	0.9	0	4	32	9	17	0
T 2809B?	38	70	47	95	261	250	5.1	5	4	32	9	17	0
U 2786B?	12	46	38	70	186	162	1.8	0	4	27	8	13	0
LINE 10440 (FLIGHT 7)													
A 3242H	48	104	79	151	415	26	4.8	2	4	18	9	6	0
B 3263H	14	26	60	97	153	513	3.4	18	4	12	7	1	0
C 3280B?	1	2	1	2	2	4	-	-	-	-	-	-	0
D 3309H	1	2	1	1	2	4	-	-	-	-	-	-	0
E 3343B?	17	34	140	90	277	200	3.6	17	4	19	8	7	0
F 3347B?	12	53	140	90	277	297	1.7	6	4	18	8	7	0
G 3359H	1	2	1	2	2	4	-	-	-	-	-	-	0
H 3371H	1	2	1	2	2	4	-	-	-	-	-	-	0
I 3386H	38	87	55	139	404	401	4.2	5	4	22	10	8	0
J 3398H	48	106	69	166	480	469	4.7	5	4	21	9	8	0
K 3410H	28	57	37	82	241	219	4.2	4	4	22	9	8	0
L 3429H	26	42	34	100	301	370	5.1	13	4	22	8	9	0
M 3444H	55	119	74	174	494	471	5.0	4	4	21	8	9	0
N 3452B?	20	44	16	52	156	166	3.5	7	4	24	9	10	0
O 3463H	35	56	53	100	259	186	5.7	6	4	20	7	7	0
P 3476B?	63	154	71	215	632	694	4.8	2	4	21	10	8	0
Q 3485B?	36	54	47	78	225	170	6.1	0	4	22	8	8	0
R 3505B?	52	82	56	101	267	187	6.6	4	4	22	7	9	0
S 3523H	30	57	43	88	231	162	4.5	7	4	24	9	11	0
T 3550B?	22	52	124	128	325	99	3.5	0	5	29	5	16	0
U 3558B?	85	128	120	197	554	629	8.1	3	4	25	7	12	0
V 3574B?	21	49	44	81	224	231	3.5	10	4	39	11	23	0
W 3581B?	60	62	75	107	279	209	10.6	2	4	27	8	12	0
X 3596B?	10	20	36	56	147	69	3.0	21	4	28	8	14	0
Y 3603B?	121	195	71	132	339	385	8.5	3	4	25	7	12	0
LINE 10450 (FLIGHT 7)													
A 4229H	1	2	1	2	2	4	-	-	-	-	-	-	0

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	COAXIAL 1190 HZ		COPLANAR 895 HZ		COPLANAR 7233 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH		MAG CORR
ANOMALY/ FID/INTERP	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND SIEMEN	DEPTH* M	COND SIEMEN	DEPTH M	RESIS OHM-M	DEPTH M	NT
LINE 10450 (FLIGHT 7)													
B 4199B?	40	90	93	218	642	524	4.4	5	3	16	10	4	0
C 4195B?	40	115	74	165	467	524	3.6	0	4	18	10	5	0
D 4168H	9	8	12	26	93	206	6.1	33	3	23	12	7	0
E 4134H	10	16	78	77	186	10	3.7	18	4	22	9	8	0
F 4107H	20	28	51	93	246	127	5.3	13	4	20	9	6	0
G 4087H	4	3	35	71	206	156	6.7	68	4	22	9	8	0
H 4069H	41	87	57	128	374	330	4.6	5	4	20	8	8	0
I 4045H	1	2	1	2	2	4	-	-	-	-	-	-	0
J 4030H	55	79	73	115	287	172	7.5	0	4	21	7	7	0
K 4010B?	53	85	57	109	286	180	6.5	0	3	25	11	9	0
L 4001E	37	53	59	87	220	131	6.5	6	4	29	9	14	0
M 3982H	9	13	17	23	24	51	3.8	21	4	25	9	10	0
N 3958H	33	46	56	84	212	142	6.3	5	4	24	9	9	0
O 3946B?	26	36	39	61	166	147	5.8	8	4	28	9	13	0
P 3933B?	34	159	222	335	877	721	2.2	0	6	21	4	11	0
Q 3928B?	77	64	11	170	443	389	15.1	6	6	20	4	9	0
R 3913B?	37	87	104	191	510	516	4.1	4	4	22	9	9	0
S 3906B?	33	64	59	59	151	174	4.6	1	4	26	11	11	0
T 3896B?	34	32	53	31	80	83	9.8	9	4	31	8	16	0
U 3888B?	1	2	1	2	2	4	-	-	-	-	-	-	0
V 3881B?	18	22	20	28	80	53	6.0	22	4	34	10	18	0
LINE 10460 (FLIGHT 7)													
A 4401B?	66	157	82	221	688	617	5.0	1	3	19	11	6	0
B 4416H	26	46	45	105	205	81	4.5	8	3	19	15	4	0
C 4426H	39	74	55	94	308	287	4.9	5	3	21	12	6	0
D 4442H	34	93	45	143	435	474	3.5	4	3	23	15	8	0
E 4469L?	19	39	25	62	177	174	3.7	7	3	27	13	11	0
F 4492H	27	45	42	58	157	106	5.1	4	4	23	10	9	0
G 4517H	1	2	1	2	2	4	-	-	-	-	-	-	0
H 4527H	44	82	59	114	318	257	5.2	2	4	23	9	9	0
I 4554H	33	57	46	84	225	119	5.1	2	4	19	8	6	0
J 4580H	1	2	1	2	2	4	-	-	-	-	-	-	0
K 4587B?	30	55	25	73	197	183	4.6	11	4	26	8	13	0
L 4592B?	38	137	94	217	589	492	2.9	0	4	25	9	11	0
M 4596B?	65	137	94	217	589	492	5.5	4	4	21	8	8	0
N 4600B?	37	66	32	90	248	226	5.2	13	4	26	8	13	0
O 4607B?	33	45	42	77	194	56	6.5	9	4	18	7	5	0
P 4616B?	123	247	142	356	1062	799	7.0	0	4	14	7	3	0
Q 4625B?	54	87	85	168	491	416	6.4	10	4	32	10	18	0
R 4636B?	45	75	85	129	345	232	5.8	5	4	26	8	12	0

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JOB #1159 MILK RIVER AREA, ALBERTA

ANOMALY/	FID/INTERP	COAXIAL 1190 HZ REAL PPM	COAXIAL 1190 HZ QUAD PPM	COPLANAR 895 HZ REAL PPM	COPLANAR 895 HZ QUAD PPM	COPLANAR 7233 HZ REAL PPM	COPLANAR 7233 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10460	(FLIGHT 7)													
S	4645B?	15	33	52	75	208	144	3.1	10	4	26	8	12	0
T	4647B?	17	33	52	75	208	144	3.8	12	4	26	8	12	0
U	4657B?	48	104	87	165	454	409	4.8	5	4	24	9	11	0
V	4676B?	4	27	33	52	138	134	0.7	3	4	29	8	15	0
W	4682B?	33	62	26	79	237	252	4.8	6	4	32	10	16	0
X	4687B?	23	28	85	32	82	77	6.8	14	4	38	8	22	0
Y	4697B?	131	152	49	5	11	318	12.3	0	6	22	4	11	0
Z	4704H	59	89	89	138	379	311	7.1	9	6	23	4	13	0
AA	4716H	190	336	253	489	1310	1385	9.0	6	5	21	4	11	0
LINE 10470	(FLIGHT 7)													
A	5208H	21	93	45	125	144	22	2.0	0	3	18	13	3	0
B	5163H	13	16	16	19	64	101	5.6	27	4	21	10	7	0
C	5126H	30	18	65	119	2	115	17.2	20	4	16	7	3	0
D	5121L?	1	2	1	2	2	4	-	-	-	-	-	-	0
E	5104H	1	2	1	2	2	4	-	-	-	-	-	-	0
F	5081H	16	25	18	39	105	79	4.2	12	4	23	8	9	0
G	5057B?	56	81	78	123	332	237	7.3	0	4	17	7	5	0
H	5046B?	26	42	40	70	169	95	5.1	6	4	20	8	7	0
I	5038B?	32	38	38	41	103	43	7.4	6	4	20	7	7	0
J	5028B?	54	121	39	146	439	441	4.9	1	4	23	10	9	0
K	5018B?	39	56	32	33	103	152	6.4	9	4	33	9	18	0
L	5006B?	90	166	103	206	593	515	6.8	1	4	21	9	8	0
M	5003B?	90	166	103	96	259	165	6.8	0	4	17	7	5	0
N	4996B?	4	11	60	86	239	161	1.5	23	3	33	11	18	0
O	4989B?	21	64	42	105	312	390	2.7	7	3	30	11	16	0
P	4983B?	50	111	59	156	470	454	4.7	4	4	26	10	12	0
Q	4977B?	3	99	19	133	359	281	0.5	0	4	25	8	11	0
R	4954B?	64	100	82	146	385	289	7.1	0	4	22	8	8	0
S	4943B?	25	76	45	114	332	343	3.0	1	3	30	12	14	0
T	4933B?	29	76	12	81	245	368	3.4	7	3	29	12	14	0
U	4928H	42	77	12	81	245	367	5.2	0	4	25	8	11	0
V	4920B?	12	24	37	46	115	83	3.0	13	5	43	7	28	0
W	4913B?	6	8	4	35	29	76	3.5	38	5	39	5	25	0
LINE 10480	(FLIGHT 7)													
A	5361B?	86	170	127	267	754	341	6.2	3	4	20	8	8	0
B	5378B?	38	93	53	144	427	521	4.0	6	4	22	10	9	0
C	5382B?	15	36	89	193	567	366	3.0	14	3	20	10	7	0
D	5410H	1	2	1	2	2	4	-	-	-	-	-	-	0
E	5437H	25	48	41	66	208	119	4.3	8	4	19	10	6	0

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JOB #1159 MILK RIVER AREA, ALBERTA

		COAXIAL 1190 HZ		COPLANAR 895 HZ		COPLANAR 7233 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH		MAG CORR
ANOMALY/	FID/INTERP	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND SIEMEN	DEPTH* M	COND SIEMEN	DEPTH M	RESIS OHM-M	DEPTH M	NT
LINE 10480	(FLIGHT 7)													
F	5465H	11	45	21	122	274	393	1.6	3	3	25	10	11	0
G	5488H	14	5	12	12	26	7	28.9	43	4	19	9	5	0
H	5496H	55	104	79	149	28	98	5.6	0	4	18	8	5	0
I	5529H	82	150	96	211	580	650	6.6	4	4	22	8	10	0
J	5551H	22	49	23	67	192	205	3.6	9	4	25	8	12	0
K	5559B?	44	106	62	153	424	422	4.2	3	4	24	8	11	0
L	5562B?	55	106	62	153	424	422	5.5	5	4	21	8	9	0
M	5565B?	38	58	62	54	140	156	6.1	10	4	25	8	12	0
N	5571B?	12	32	8	39	130	214	2.6	12	4	27	10	13	0
O	5580B?	39	112	28	145	455	525	3.6	5	3	23	12	10	0
P	5588B	90	162	74	205	618	561	6.9	4	4	22	9	10	0
Q	5599B?	19	20	21	11	28	48	7.0	13	4	20	7	6	0
R	5605B?	24	36	22	63	157	208	5.2	10	4	23	8	10	0
S	5622E	35	41	25	43	132	212	7.8	4	4	29	9	13	0
T	5641B	39	73	43	92	265	273	5.0	5	3	29	11	13	0
U	5644B	20	58	30	56	179	218	2.8	4	4	31	9	17	0
V	5648B	35	51	76	83	229	185	6.2	10	4	36	11	20	0
W	5661B	63	67	5	7	10	33	10.6	1	4	29	8	15	0
X	5669B	131	113	107	312	702	1076	17.1	6	4	16	8	5	0
Y	5684B	56	152	64	190	324	728	4.2	5	3	23	10	11	0
Z	5689B	82	146	85	52	185	145	6.7	6	4	27	8	14	0
AA	5720B	12	35	244	416	1071	866	2.3	13	6	17	4	8	0
AB	5747B?	3	10	76	83	234	209	1.2	23	4	28	9	14	0
AC	5770B?	78	7	69	256	715	677	337.3	21	4	20	8	8	0
AD	5794B	64	245	191	328	900	666	3.3	0	5	18	5	8	0
LINE 10490	(FLIGHT 7)													
A	6389H	3	81	40	26	69	33	0.5	0	4	20	8	7	0
B	6376H	7	67	11	35	156	106	0.7	0	4	22	9	8	0
C	6276H	1	2	1	2	2	4	-	-	-	-	-	-	0
D	6267H	1	2	1	2	2	4	-	-	-	-	-	-	0
E	6239H	1	2	1	2	2	4	-	-	-	-	-	-	0
F	6220B?	64	120	67	144	416	402	6.0	5	3	26	10	12	0
G	6203B?	45	73	60	109	324	271	6.1	4	4	25	9	11	0
H	6201B?	53	71	60	99	276	193	7.8	7	4	29	8	15	0
I	6190B?	16	34	113	213	577	635	3.4	17	4	21	8	9	0
J	6169B?	150	229	166	253	674	413	9.6	3	5	24	5	13	0
K	6158B?	82	98	118	130	326	197	10.1	2	5	20	6	8	0
L	6149B?	58	107	78	156	464	416	5.8	6	5	24	6	12	0
M	6140B?	36	77	106	135	352	324	4.4	5	4	26	7	13	0
N	6135B?	143	186	158	232	630	434	11.3	0	5	22	5	11	0

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JOB #1159 MILK RIVER AREA, ALBERTA

ANOMALY/ FID/INTERP		COAXIAL 1190 HZ REAL PPM	COAXIAL 1190 HZ QUAD PPM	COPLANAR 895 HZ REAL PPM	COPLANAR 895 HZ QUAD PPM	COPLANAR 7233 HZ REAL PPM	COPLANAR 7233 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10490		(FLIGHT		7)										
O	6130B?	22	85	167	232	630	392	2.2	0	5	24	6	11	0
P	6126B?	5	85	25	109	318	392	0.6	0	4	29	10	15	0
Q	6114B?	33	38	43	48	132	87	7.9	8	4	39	7	23	0
R	6104E	49	127	58	187	585	614	4.2	2	3	25	12	11	0
S	6095B?	24	35	19	57	105	153	5.6	10	4	30	9	15	0
T	6081B?	35	54	39	88	263	305	5.9	7	4	28	9	13	0
U	6073B?	32	76	43	109	318	367	3.9	6	4	34	11	18	0
V	6051B?	22	41	7	47	146	385	4.0	16	3	37	11	21	0
LINE 10500		(FLIGHT		7)										
A	6522B?	1	2	1	2	2	4	-	-	-	-	-	-	0
B	6529H	50	93	45	101	314	373	5.5	7	4	21	8	8	0
C	6541H	1	2	1	2	2	4	-	-	-	-	-	-	0
D	6562B?	16	78	21	84	296	302	1.7	0	3	21	17	6	0
E	6564B?	15	70	21	84	296	383	1.7	1	2	22	18	6	0
F	6576H	1	2	1	2	2	4	-	-	-	-	-	-	0
G	6589H	42	34	16	79	519	242	12.6	21	3	23	16	8	0
H	6632H	33	61	47	93	263	295	4.8	7	4	26	10	11	0
I	6641H	17	44	20	57	175	243	2.8	5	3	28	12	13	0
J	6662H	33	52	41	76	201	108	5.6	8	4	20	7	7	0
K	6686H	1	5	47	95	275	280	0.7	24	4	22	8	9	0
L	6704H	1	2	1	2	2	4	-	-	-	-	-	-	0
M	6707L	40	62	2	84	223	152	6.1	2	4	23	8	10	0
N	6731E	63	127	92	177	504	453	5.5	5	4	28	10	14	0
O	6738B?	19	26	17	40	116	107	5.3	14	4	37	11	20	0
P	6749B?	39	62	43	95	268	278	6.0	11	4	35	11	19	0
Q	6754B?	6	29	32	52	120	267	1.1	0	4	33	10	17	0
R	6758B?	1	2	1	2	2	4	-	-	-	-	-	-	0
S	6770B?	31	37	23	6	18	67	7.3	12	4	35	10	19	0
T	6779B?	30	85	47	109	313	421	3.3	6	3	29	11	15	0
U	6785B?	21	46	22	22	77	144	3.6	6	4	34	9	19	0
V	6790B?	27	30	22	48	129	165	7.6	9	5	31	7	16	0
W	6792B?	26	30	22	48	129	165	7.1	17	4	36	9	21	0
X	6808B?	85	146	156	230	827	725	7.1	5	4	22	7	10	0
Y	6813B?	15	9	79	162	471	583	13.6	33	5	29	6	15	0
Z	6821B?	1	2	1	2	2	4	-	-	-	-	-	-	0
AA	6828B?	21	57	1	164	491	583	3.0	11	3	28	10	14	0
AB	6847B?	70	118	84	157	455	409	6.8	6	4	26	9	13	0
AC	6858B?	22	26	24	34	91	60	6.5	9	4	27	9	11	0
AD	6866B?	1	2	1	2	2	4	-	-	-	-	-	-	0
AE	6870B?	71	121	106	203	595	617	6.8	3	4	25	9	11	0

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JOB #1159 MILK RIVER AREA, ALBERTA

ANOMALY/ FID/INTERP		COAXIAL 1190 HZ REAL PPM	COAXIAL 1190 HZ QUAD PPM	COPLANAR 895 HZ REAL PPM	COPLANAR 895 HZ QUAD PPM	COPLANAR 7233 HZ REAL PPM	COPLANAR 7233 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10500	(FLIGHT 7)													
AF	6872B?	71	121	106	203	595	617	6.8	2	4	30	9	16	0
AG	6885H	4	22	48	93	277	243	0.8	5	4	22	7	10	0
AH	6903B?	70	82	57	122	337	298	9.9	5	5	20	5	8	0
LINE 10510	(FLIGHT 8)													
A	650H	6	10	8	11	28	19	3.2	29	3	27	11	11	0
B	620H	43	92	51	132	379	284	4.6	0	3	17	15	2	0
C	615L	13	27	44	120	99	267	3.3	10	3	23	18	6	0
D	600H	17	27	24	71	160	125	4.6	18	3	20	17	4	0
E	573B?	28	72	45	121	403	368	3.5	4	3	17	11	4	0
F	543H	1	2	1	2	2	4	-	-	-	-	-	-	0
G	537H	1	2	1	2	2	4	-	-	-	-	-	-	0
H	518H	36	66	54	108	185	177	5.0	5	4	19	8	6	0
I	468H	53	87	76	140	364	214	6.4	4	4	17	8	5	0
J	446B?	27	49	69	98	233	140	4.5	8	4	23	9	9	0
K	441B?	60	103	80	158	381	250	6.3	3	4	21	9	7	0
L	429B?	1	2	1	2	2	4	-	-	-	-	-	-	0
M	421B?	28	61	34	79	199	248	4.0	9	3	28	11	13	0
N	416B?	2	6	33	74	187	39	1.1	26	4	31	10	16	0
O	411B?	29	62	31	100	273	295	4.1	5	3	25	11	10	0
P	409B?	25	58	31	100	273	295	3.6	8	3	28	11	13	0
Q	403E	43	76	61	120	308	228	5.4	4	4	23	10	9	0
R	382H	70	175	99	261	696	801	4.8	5	4	24	10	11	0
S	368H	33	62	52	96	244	167	4.7	6	4	20	7	7	0
T	346B?	87	240	127	357	968	1095	4.8	0	3	19	10	6	0
U	333B?	36	87	35	117	320	388	3.9	3	4	28	10	14	0
V	328B?	24	12	44	64	165	108	19.1	34	4	28	9	14	0
LINE 10520	(FLIGHT 8)													
A	816H	1	2	1	2	2	4	-	-	-	-	-	-	0
B	849H	9	37	16	33	43	82	1.6	1	3	20	15	4	0
C	873H	1	2	1	2	2	4	-	-	-	-	-	-	0
D	914B?	29	48	30	70	200	96	5.2	5	3	17	12	3	0
E	917B?	17	43	30	70	200	93	3.0	4	3	21	11	6	0
F	927B?	42	50	23	27	185	131	8.1	7	4	24	9	9	0
G	967H	32	68	45	93	257	249	4.3	3	4	20	9	7	0
H	1011H	1	2	1	2	2	4	-	-	-	-	-	-	0
I	1030H	34	51	45	84	222	132	6.0	4	4	18	8	5	0
J	1057H	1	2	1	2	2	4	-	-	-	-	-	-	0
K	1083B?	41	70	43	86	166	282	5.6	9	4	21	8	8	0
LINE 10521	(FLIGHT 8)													
A	1308B?	39	83	51	116	294	299	4.6	6	4	24	9	11	0

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JOB #1159 MILK RIVER AREA, ALBERTA

ANOMALY/		COAXIAL 1190 HZ		COPLANAR 895 HZ		COPLANAR 7233 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH		MAG CORR
FID/INTERP		REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND SIEMEN	DEPTH* M	COND SIEMEN	DEPTH M	RESIS OHM-M	DEPTH M	NT
LINE 10521	(FLIGHT 8)													
B	1318B?	33	66	54	109	296	223	4.4	5	4	21	8	8	0
C	1344B?	27	59	50	108	298	314	4.0	10	4	27	9	13	0
D	1374B?	76	153	92	217	595	568	6.0	6	4	23	8	11	0
E	1390H	33	11	47	59	141	160	40.2	30	4	20	8	7	0
F	1404B?	78	141	86	195	517	368	6.5	5	4	22	8	10	0
G	1426B?	56	139	62	153	437	492	4.5	1	3	24	10	10	0
H	1436B?	81	131	116	195	536	527	7.4	2	4	20	8	7	0
LINE 10530	(FLIGHT 8)													
A	1891H	12	47	28	63	180	156	1.9	1	3	26	11	11	0
B	1874H	1	2	1	2	2	4	-	-	-	-	-	-	0
C	1855H	53	122	69	181	508	61	4.7	1	3	18	12	4	0
D	1832H	1	2	1	2	2	4	-	-	-	-	-	-	0
E	1807H	52	110	27	30	89	89	5.0	1	3	23	12	8	0
F	1781B?	1	2	1	2	2	4	-	-	-	-	-	-	0
G	1777B?	1	2	1	2	2	4	-	-	-	-	-	-	0
H	1773B?	24	56	46	85	294	356	3.5	8	3	27	11	12	0
I	1758B?	52	93	79	150	411	269	5.8	0	4	20	9	7	0
J	1741H	15	17	30	40	99	111	5.8	19	4	23	9	9	0
K	1720H	20	31	35	54	144	84	4.7	9	4	23	8	9	0
L	1691H	11	17	32	41	90	50	4.1	21	4	27	8	13	0
M	1668H	1	2	1	2	2	4	-	-	-	-	-	-	0
N	1649H	19	37	63	106	267	205	3.7	14	4	27	8	14	0
O	1632B?	36	63	62	114	303	211	5.3	6	4	21	8	8	0
P	1629B?	11	46	20	114	303	211	1.7	0	4	21	8	8	0
Q	1622B?	1	2	1	2	2	4	-	-	-	-	-	-	0
R	1600H	40	112	49	164	433	295	3.6	1	4	18	7	6	0
S	1578B?	49	106	72	173	494	427	4.8	3	4	27	9	13	0
LINE 19010	(FLIGHT 8)													
A	2347H	1	2	1	2	2	4	-	-	-	-	-	-	0
B	2316H	1	2	1	2	2	4	-	-	-	-	-	-	0
C	2285H	56	45	72	134	370	301	14.1	13	4	21	8	8	0
D	2272B?	36	62	45	92	253	178	5.3	4	4	21	9	8	0
E	2240H	1	2	1	2	2	4	-	-	-	-	-	-	0
F	2216H	48	73	64	114	291	157	6.6	3	4	19	7	6	0
G	2191H	18	31	26	81	191	170	4.1	13	4	18	7	6	0
H	2165H	39	65	53	102	274	186	5.5	4	4	21	9	7	0
I	2131H	9	27	8	33	114	104	2.1	5	4	23	10	9	0
J	2127H	10	18	8	30	94	105	3.3	15	4	23	9	8	0

* ESTIMATED DEPTH MAY BE UNRELIABLE BECAUSE THE STRONGER PART OF THE CONDUCTOR MAY BE DEEPER OR TO ONE SIDE OF THE FLIGHT LINE, OR BECAUSE OF A SHALLOW DIP OR OVERBURDEN EFFECTS.

PROPERTY EVALUATION REPORT

of the

JD-1 (BLACK BUTTE) LAMPROITE DIATREME

Milk River Area

Southeastern Alberta

for

600 - 535 Howe Street
Vancouver, B.C.
V6C 2Z4

Prepared by

ASH & ASSOCIATES CONSULTING LTD.
201 - 314 West Pender Street
Vancouver, B.C. V6B 1T1

August 20, 1993

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BLACK BUTTE JD-1 KIMBERLITE/LAMPROITE PIPE

SUMMARY

Tigris Minerals Corporation has secured an option to acquire a fifty percent interest in the 64 hectare JD-1 (Black Butte) property, located some 150 km southeast of Lethbridge in southeastern Alberta.

The property encompasses a large lamproite diatreme with a surface expression measuring some 450 metres (1400 ft.) long, and 200 metres (700 ft.) wide.

The geological setting and mineral constituents of the Black Butte JD-1 deposit appears to be ideal for the occurrence of diamonds.

A 38.2 kg sample taken from the deposit was submitted to BHP Minerals Canada Ltd. and appears to have yielded one beige-green diamond (believed to be part of a larger stone) measuring 100 by 92 microns.

The following report discusses the occurrence of diamonds in general, the geology and mineralogy of the Black Butte diatreme, and recommends a two-phase exploration program for the property, of $85,000.

INTRODUCTION

With continuing unsettled political conditions predicted for southern Africa and Russia, major international diamond-mining companies have increased their exploration activities in regions which have until recently, received (at best) cursory attention. The discovery of diamond-bearing kimberlite diatremes (pipes) in the Prince Albert (Saskatchewan) area in 1988 kicked-off a drive to explore the Interior Platform of western Canada. This platform, consisting of a sedimentary-capped Archean basement complex, represents an ideal geological setting for the occurrence of diamond-bearing pipe deposits. The recent news of Dia-Met's major diamond discovery at Lac de Gras has created a grand-scale staking rush.

Until quite recently, it was presumed that primary diamond deposits were restricted, without exception, to diatremes and associated dikes composed of kimberlite. In the early to mid-1980's extremely rich diamond pipes were discovered (and are now in production) in Australia. These "kimberlite-like" pipes were, in fact, subsequently assessed as being lamproite diatremes. This led to a re-examination of hitherto-ignored lamproite pipes in other parts of the world. It was found, for instance, that the diatremes mined in Arkansas were also lamproites. Thus, it has been established that either kimberlites <u>or</u> lamproites may carry diamonds.

In September, 1992, Tigris Minerals Corporation acquired a fifty percent interest in the mineral exploration permit of the Black Butte JD-1 property, which hosts a large lamproite diatreme.

The interest was acquired from D.I.M. Holdings Ltd., of Delta, B.C., a private company.

As an independent Professional Engineer in the Province of British Columbia, the author has twice visited the property.
The following report is written as a discussion regarding the occurrences of kimberlite/lamproite deposits, the geology, mineralogy and prospects for the Black Butte JD-1 lamproite diatreme, and recommends an exploration program on the property.

LOCATION & ACCESS:

The Black Butte JD-1 kimberlite/lamproite pipe is located 151 km (94 mi.) ESE of Lethbridge, Alberta, less than 3.5 km north of the Montana border, at 49 degrees 01 minute 35 seconds north latitude and 111 degrees 17 seconds west longitude (see Fig. 1).

Access from Lethbridge is by highway No. 4. southeast for 85 km (53 mi.) to the town of Milk River, then by secondary road No. 501 for a distance of 53 km (33 mi.) in an easterly direction (of which 52 km. is paved), then south for 20 km along secondary road No. 880 to an intersection some 2 km east of Aden, and finally east along a secondary road for a distance of 21 km., for a total distance of 179 km, of which 138 km is paved and 41 km is good gravel (see Figs. 1,2 & 3).

TOPOGRAPHY, CLIMATE & LAND USE:

The topography of the area is generally flat, with gentle sloping rises. This table-land is incised by occasional coulees and river valleys with rather steep banks. Black Butte protrudes some 40 metres (130 ft.) above the surrounding plain to an elevation of 1090 metres (3577 ft.) above sea level and can be seen as a conspicuous knob from a distance of several miles. To the southwest the land gradually rises toward the Sweetgrass Hills, located in Montana some 20 km to the southwest.

The area generally receives and average of about 18 cm (seven inches) of annual precipitation. The winters are dry and can be relatively cold but Chinooks are very common. Ice may remain on the local lakes until as late as early May, or may be clear (as in 1992) by mid-March. The local occurrence of prickly pear cactus and rattle snakes are indicative of the hot summer temperatures and aridity of the region.

The main economic livelihoods in the area include cattle ranching, wheat farming, oil and natural gas production. Wheat farming is conducted on the flat lands while cattle ranching is relegated to more hilly areas or where the soils are too rocky for farming. The area to the north of the deposit is cultivated while the area surrounding the deposit and to the south apparently consists of government-owned range land.

PROPERTY:

The Black Butte JD-1 property is some 64 hectares (160 acres) in area and encompasses a large lamproite pipe, which measures some 450 metres long and 200 metres wide (see Figures 3 & 4). The property is composed of four lots with legal description as follows:

RANGE	TOWNSHIP	SECTION	LOT
8	1	7	13
8	1	8	16
8	1	9	04
8	1	10	01

Permit No. MMEP 6890010002, the exploration permit for the above property is apparently held in the name of P.J. DeVeaux, in trust for D.I.M. Holdings Ltd. (the name of D.I.M. Holdings Ltd. is presently being changed to "Roman Wall Corporation"). It is understood that Tigris Minerals Ltd. secured a fifty percent interest in the mineral rights from D.I.M., in September, 1992, on the basis of conditions which are beyond the scope of this report.

The author knows of no legal disputes and encumbrances attached to the property but accepts no responsibility as to the property's title or status.

HISTORY:

During his exploration trek in 1883, George M. Dawson reported the occurrence of a "small mass of dark mica-trap" on the bank of the Milk River in the southeastern section of what is now Alberta. As early as the 1890's, others noted the occurrence of dark, igneous outcrops on a prominent knoll some thirteen kilometers further to the south, termed "Black Butte".

In 1979, John DeLatre, a geologist with extensive diamond-related experience, investigated the occurrences and assessed them as being lamproitic in nature. However, at that time, gold and precious stones were reserved to the Crown. This restriction was lifted in the late 1980's and Mr. DeLatre secured an exploration permit to the Black Butte JD-1 deposit in 1990. Negotiations between DeLatre and D.I.M. Holdings Ltd. commenced in mid-January, 1992 and final papers for the transference of the property to Mr. DeVeaux, president of D.I.M. Holdings Ltd. were completed in March of that year. By September, 1992 agreement was reached in which Tigris acquired a fifty percent interest in the property.

A preliminary magnetometer survey conducted over the property in May, 1992 confirmed the suseptibility of the deposit to magnetometer work. A small sample taken by a Professional Geologist early 1993 was tested by BHP Utah and yielded one diamond chip.

GENERAL GEOLOGY

ORIGIN AND GENERAL GEOLOGY OF KIMBERLITE & LAMPROITE PIPES:

In order to appreciate the origin and geology with respect to primary diamond deposits, a general review of the simple geological nomenclature is summarized below.

The structure of the Earth, as determined by seismic observations, is believed to be made up of three broad layers: the crust, the mantle and the core.

The Earth's crust (hardened surface layer) is composed mainly of acid to intermediate igneous and metamorphic rock-types (such as granite and gneiss), plus overlying phanerozoic (sedimentary) rock formations.

The boundary between the crust and the mantle beneath the oceans is generally found at a depth of only 10 km. However, under the continents this depth boundary may vary from 35 km (beneath the newer mountain chains) to 70 km beneath the cratons (stable plates forming the centre sections of continents).

The Earth's mantle appears to continue to a depth of 2,900 km and is composed mainly of peridotitic facies (dark-colored, ultra-basic magmas). The mantle is sub-divided into two layers. The upper mantle is restricted to the upper 700 km of depth. Finally, the upper mantle is sub-divided further into two sections, the lithosphere and the asthenosphere. The lithosphere is composed of various phases ranging from complete liquids to complete solids and is restricted to the approximate upper 200 km. The asthenosphere, restricted to the lower 500 km of the upper mantle, is almost completely liquid.

The Earth's core (which is beyond the scope of this discussion) is composed mainly of iron and nickel.

Diamonds are formed (and stored) within the lower portion of the lithosphere at depths ranging from 140 to 200 kilometers (see Figure 5) within a zone of rather specific temperature-pressure conditions. Natural diamonds studied to date indicates ages ranging from one billion to 3.3 billion years. The diamonds in any given primary deposit may vary considerably in age, and have often been formed in various zones containing differing impurities; hence, the difference in character, colour and quality of the diamonds from the same deposit.

To date, primary diamond-bearing deposits have been restricted to kimberlite and lamproite diatremes (pipes) (or placers stemming from the disintegration of these primary deposits). Ages of the pipes explored range from forty million to 1.3 billion years old (usually much younger than the diamonds which they enclose). Thus, the evidence suggests diamonds are not formed within the kimberlite or lamproite themselves, but that these magmas act only as the transport medium by which the diamonds are brought to the surface.

Both kimberlite and lamproite are 'hybrid' rocks (mixtures of upper mantle xenoliths and xenocrysts as well as the crystallization products from the magmas themselves). The differences between kimberlites and lamproites are rather subtle since the mineral constituents of each are almost identical. The main difference is that kimberlite appears to recrystallize at a somewhat higher temperature than does lamproite. The chemistry and crystal structure of kimberlites and lamproites indicate that:

a) These magmas originate at depths greater than the zone of diamond formation (exceeding 150 km).

b) Near-vertical cracks formed in the crust and into the lithosphere act as the conduits through which these ultra-basic magmas ascend.

c) Individual diamond-bearing diatremes must be formed by the rapid rise of magma through the 150 km to surface within an extremely short time frame (estimated at just five to fifteen hours).

d) Due to gas expansion, the speed of ascent of the magma increases as the surface of the craton is approached, perhaps reaching speeds of several hundred kilometers per hour.

e) The violent magmatic action rips pieces of rock from the walls of the conduit, which form xenoliths in the magma. Since the xenoliths are abraded (through attrition), the rounded pieces are more often found to be products from lower depths while the more angular pieces are generally from nearer surface (see Figure 6).

Magmas ascending through crustal sections less than (perhaps) 60 km thick do not rise at speeds necessary to maintain the temperature-pressure conditions within the bounds essential for the continued preservation of diamonds. Thus, under thin-mantle conditions inherent diamonds are rapidly reconverted to graphite or other carbon forms. This is probably why studies of the locations of kimberlite and lamproite pipes show they most often occur in younger, generally flat-lying sedimentary platforms that rest on the thickest, Archean (>2.5 billion years old) portions of cratons.

Although it is apparent that these diatremes originate at depths of over 150 kilometers, our knowledge of them is restricted to the upper few kilometers. The studied section is broken into three zones (see Figure 7):

a) Root
b) Diatreme
c) Crater

a) Root Zone: The root is the deepest part of the pipe. Although it is believed to extend through the Archean basement complex and into the lithosphere, only the upper 500 metres of depth have been studied. This zone is made up of narrow dikes (perhaps averaging 0.6 metres in width) which may enclose diamond-bearing xenoliths and/or diamond xenocrysts within the magma matrix.

b) Diatreme Zone: The diatreme zone is of much greater vertical extent than the root-depth studied, typically ranging from one to two thousand metres in height. It contains the rounded xenoliths and xenocrysts from the lithosphere as well as wall-rock fragments of the crustal formations through which the kimberlite passes (i.e. gneiss, shale). Due to its shear volume (as compared to the root and crater sections) the diatreme zone constitutes the most important source of diamonds. Gasses within the kimberlitic mass expand rapidly as the surface is approached, resulting in an increase in upward velocity of the mass and resultant reaming of the side-walls to produce roughly circular, inverted cone-shaped pipe forms.

The kimberlite (or lamproite) is not necessarily a magma. The portion around the perimeter travels at a slower rate than that in the centre. The kimberlite around the perimeter mixes more with the wall rock and usually solidifies, while the core portion remains in its purer form, and, due to the cooling effect of the rapidly expanding gases, can be made up almost entirely of volcanic ash and ejecta which are discharged into the atmosphere like the charge of a blunderbuss.

Diamonds may be found within the xenoliths but most often occur as individual xenocrysts within the matrix itself.

c) Crater Zone: The crater zone occupies the upper section (perhaps the upper sixty to one hundred metres) of a typical kimberlite diatreme. Because of the magmatic cooling and escaping gasses, the kimberlite erupts as fragments of rock (pyroclasts, tuffs and lapilli) pile up as an outer ring around the cone. The crater areas are quickly eroded and only a few examples of crater zones presently exist (in central Africa). At times, the eruption can be so violent as to leave a crater several hundred meters deep. Much of the air-borne ash and ejecta falls back into the crater and side-walls begin to collapse. Thus, chunks of wall rock measuring tens of feet across are sometimes found within the diatreme well beneath their horizon of origin.

Due to the rapid ascent of diamondiferous kimberlites and lamproites, the mixture of nodules and diamonds at any one horizon within the pipe should theoretically be rather homogeneous, but the overall frequency of occurrence of diamonds within a diatreme usually decreases with depth. Perhaps this is natural since the initial rush of kimberlite is likely to rip a great number of diamond-bearing rock chunks from the sides of the rough, lithospheric channel-ways whereas the tail end of the eruption passes through fissures already smoothed-out.

Unfortunately, all diatremes do not fit the perfect geological model. The initial eruption may be followed by later eruptions if ground movement continues to occur. Later eruptions may or may not contain diamonds. Later phases of eruption can follow up the centre of the cone (where the ground is the loosest), and/or can intrude as dikes along radial cracks in the surrounding country rock formed during the initial eruption. Consequently, lateral homogeneity in a diatreme is more of an exception rather than the rule. This situation, as well as the extremely low concentration of diamonds (as a function of the total pipe mass), means that large samples are required to assess the grade of any individual diatreme. Bulk samples ranging from 200 to 20,000 tons may be necessary for an adequate evaluation of any individual diatreme.

Kimberlite (or lamproite) pipes are seldom found as individuals, but usually occur in groups or "clusters", along local zones of weakness (such as faults or plate contacts) through the Archean basement complex.

GEOLOGY OF THE BLACK BUTTE AREA:

Drill-cuttings of many widely-scattered oil well drill holes in southeastern Alberta and southwestern Saskatchewan indicate that the basement complex is composed of Archean gneiss (2.5 to 3.3 billion years old).

Colorado School of Mines research studies indicate that a very low geothermal gradient (indicative of a very thick mantle) exists in an area encompassing northern Wyoming and central Montana. This is illustrated in Figure 8 as that portion of central Montana which shows a temperature of 500 degrees celsius (or lower) at a depth of 50 km. As will be noted, this low geothermal gradient area extends into western Saskatchewan and eastern Alberta. Based upon the same data, it would appear that the keel of the craton (< 300 degrees C. at 50 km depth) occurs beneath the Sweetgrass Hills and extends northward, at least to the Black Butte area (and possibly considerably further north). Obviously, the keel, upon which the JD-1 (Black Butte) property rests, constitutes the most favorable environment for the emplacement of diamonds.

The Sweet Grass Hills outcrop some 20 km. to the southeast of Black Butte (see Fig.10). This short, easterly-trending range of low mountains (in which some peaks attain elevations of some 1050 metres (3,500 ft) above the surrounding flat-lands) is the expression of massive intrusions believed to be of late-mid Eocene age (some 48 million years old), which intruded through a zone of crustal weakness. The core of this range includes syenite and other products of deep-seated intrusive activity.

While the regional magnetic maps indicate that crustal deformation in the area follows a north-northwesterly trend (parallel to the Rocky Mountains), the axis of the Black Butte outcrops appears to line up in a northeasterly direction. Investigation of other kimberlitic intrusions in the area (JD-4 & JD-6) show a similar northeasterly trend. The intrusions may have occurred along radial (tension) cracks stemming from the areal uplift of the Sweetgrass Hills intrusions, since warping parallel to the Rocky Mountains is a function of compression and therefore would be less likely to offer paths of low resistance.

The Black Butte diatreme appears to change in character from one outcrop to another. The area about the highest elevation point appears to consist of a facies which has shown a resistance to erosion (hence the probable reason for this diatreme standing out above the surrounding flatlands), while outcrops on the flank of the high spot show greater concentrations of xenoliths and display considerable weathering. A quick magnetometer test conducted over the diatreme in 1992 suggests that radial dikes may splay out into the surrounding phanerozoic country rocks beneath the overburden. Thus, the Black Butte diatreme appears to be somewhat complex, perhaps with several stages of intrusion.

Favorable geological features present in areas of kimberlite intrusions (including the Black Butte area) also include:

a) epeirogenic warping or arching: Black Butte lies along the east limit of the Sweetgrass Arch.

b) contacts between basement domains or deep-seated faulting and indications of movement of sub-cratonic blocks which may be zones of crustal weakness: the formation of the Sweetgrass Hills and the observance of other alkaline intrusives along a northeasterly trend may indicate deep-seated faulting parallel to the axis of the Sweetgrass Arch.

c) The Black Butte JD-1 deposit is located along the eastern boundary of a strong magnetic anomaly, measuring some ten to twelve miles in diameter (see Figure 10). Coincidental with this anomaly are a number of gas and oil wells (see Figure 3), suggestive that the anomaly may be the magnetic expression of the doming of the basement and overlying sedimentary complexes.

d) The Black Butte JD-1 lamproite pipe protrudes up through the surrounding Oldman formation (Upper Cretaceous Period)(see Figure 11). However, the pipe is most likely to have been emplaced during the Eocene Epoch (contemporaneously with the syenite stocks of the Sweetgrass Hills and all other kimberlitic diatremes discovered within this alkaline province).

e) The deposit is located near the southern limit of glaciation. Therefore, the Black Butte JD-1 pipe may be less eroded than most diatremes discovered to-date in Canada and may thus have added production potential.

PETROLOGY AND CHEMISTRY OF BLACK BUTTE

On behalf of the original vendor (DeLatre), C.F. Mineral Research Ltd., of Kelowna, visited the property in 1991 and took a single 56.5 kg sample at the location shown as an asterisk on Figure 4. They then conducted a mineralogical/chemical analysis of the heavy minerals concentrated from the sample. Some 168 mineral samples (comprising over 2,000 mineral grains) were tested:

MINERAL	SAMPLES
Amphibole	7
Chromite	37
Ilmenite	7
Picrotitanite	7
Picroilmenite	40
Spinel	18
Clinopyroxene	19
G9 pyrope garnet	1
G11 pyrope garnet	1
CP5 chrome diopside	15
CP6 chrome diopside	1
Sr apatite	1
Armacolite	2
Low-aluminum amphibole	1

From the results of these analyses the following was deduced:

1. Approximately 60% of the 37 chromite samples tested possessed TiO2:Cr2O3 ratios which are indicative of a kimberlite or lamproite source.

2. The G9 & G11 pyrope garnets, the CP5 & CP6 chrome diopsides, Sr Apatite, Armacolite and low-aluminum amphibole are minerals which typically occur in olivine lamproite or potassic kimberlite.

3. The G9 & G11 pyrope garnets are considered to be derived from the mantle.

4. The presence of Mg-rich (rather than Mn-rich) ilmenites is suggestive of a deep-seated kimberlite affiliation.

5. The chromite-magnesium oxide plot of the 37 samples of chromite particles tested indicates that seven samples came from a chromite hartzburgite diamond source.

6. The heavy mineral concentrate yielded four eclogite garnets. Whether or not these were formed in a Group I (diamond-bearing) eclogite can only be determined by additional high-precision laboratory test work.

The author has reviewed the available data covering the previous geological work on the JD-1 and JD-2 occurrences. It appears that one rock sample was thin-sectioned and petrographically examined, and the other rocks analyzed chemically. The description gives the following breakdown for major mineral constituents of the matrix:

PHENOCRYSTS	PERCENT
Phlogopite	15%
Pyroxene	15%
Mafic (olivine) pseudomorphs	16%
GROUNDMASS	
Phlogopite	12%
Pyroxene	6%
Altered mafics	5%
Opaques	3%
K-feldspar	28%

Chemical analyses conducted by Bondar-Clegg indicate that the rock-type is a typical lamproite. The hand lens and microscopic work conducted by Delatre classify it as an olivine diopside phlogopite lamproite, or 'verite'. On the other hand, the presence of pyrope, picroilmenite and chrome diopside (which are rare to non-existent in lamproites), suggests a kimberlite affiliation. In practical terms the difference between an olivine lamproite and a kimberlite is rather tenuous since all gradations in composition and texture are possible between the two rock-types.

Kimberlites and lamproites contain concentrations of trace elements characteristic of carbonatites and associated alkalic rocks. The contents of these in lamproites and kimberlites, as semi-qualitative analysis, are compared below, with the magmatic material of the Black Butte deposit:

	AVERAGE LAMPROITE (ppm)	BLACK BUTTE LAMPROITE (ppm)	AVERAGE KIMBERLITE (ppm)
Carbon	5,000	8,000	16,000
Barium	5,000	5,100	1,100
Rubidium	270	160	70
Cerium	400	120	200
Cesium	1.7	3	20
Thorium	45	14	20
Uranium	5	3.9	3

From these analyses it would appear that the Black Butte diatreme is a borderline facies between a lamproite and a kimberlite.

In April 1993, a 38.2 kg sample made up of surface pieces of the diatreme outcrops of the exposed portion of the diatreme, was taken by James Brown, a Professional Geologist from Winnipeg, and was sent to BHP Utah for analysis. The results confirmed that the rock-type is kimberlitic in nature. Furthermore, BHP Utah recovered a small diamond chip from the test work, suspected of having been broken from a much larger diamond. Rory Moore, Manager, Diamond Exploration, BHP Utah Canada Ltd. says of this micro-diamond,

> "It is difficult to assess the significance of this result because the possibility that the single micro-diamond could represent contamination cannot be dismissed. This is always the case when only one or two stones are recovered. Great care is taken in the laboratory to avoid contamination, but because micro-diamonds are so small, one can never be sure that equipment is 100% clean. Whatever the case, the result is encouraging."

Thus, while it is not 100% guaranteed, it is likely that the diamond did come from the JD-1 sample. If that is so, it will prove conclusively that:

a) the magmatic matrix material has a sufficiently deep-seated origin to have tapped at least one source of diamonds (chromite hartzburgite) and perhaps a second (Group I eclogite).

b) The eruption of the diatreme was rapid enough to prevent the burn-up of the enclosed diamonds.

CONCLUSIONS

The location, geological setting and mineralogy of the Black Butte JD-1 deposit consist of apparently ideal conditions for the emplacement and exploitation of diamonds:

1. The deposit lies within an Interior Platform environment

2. The basement complex consists of Archean Era gneissic metaplutonic rocks

3. There is strong evidence of upper mantle movement in this region during the Eocene Epoch

4. Geothermal evidence suggests that the deposit lies on the keel of greatest crustal thickness of the Montana alkali province

5. The deposit appears to be roughly oval in shape, a typical diatreme shape, with indications of dike-like "tentacles", a common occurrence with diatremes.

6. The mineralogy of the matrix and xenoliths indicate the magmatic depth origin to be in the range of 150 km, and to be consistent with diamond-bearing pipes on a world-wide basis. Furthermore, it is likely that the diamond chip recovered in the milling of the sample, actually came from the sample submitted.

7. Erosion since the emplacement of the pipe would appear to be relatively low. Thus, it is likely that the surface exposure lies within the upper half of the diatreme, the horizon which is likely to be richer in diamond content.

8. The pipe appears to be at least nine to ten hectares in area, suggesting a large open pit mining potential

9. The pipe outcrops through a flat region in apparently-government-owned range land. This fortunate state of affairs would allow the exploration, development and exploitation of the deposit with minimal property negotiations and costs.

10. The climatic conditions in the region must be considered superior to the climates prevalent around any other pipes discovered to-date in Canada.

11. Access to the property and availability to supplies is excellent.

RECOMMENDATIONS

A magnetometer test survey was conducted over the deposit in 1992 by James Brown, on behalf of D.I.M. Holdings Ltd. The purpose was not to delineate this particular deposit, but to test the magnetic response of a known lamproitic deposit in order to ensure that ground magnetic surveying would be a viable method for prospecting for other possible hidden diatremes in the area. The magnetometer survey not only confirmed that ground magnetics are an excellent geophysical approach to prospecting, but also that the size of the Black Butte deposit was much larger than the outcrops suggested.

Assessment of the viability of the diatreme by taking a bulk sample from the present outcrops would be as foolhardy as assessing the viability of a gold property by sampling a single location. Thus, while bulk-sampling in the outcrop area would be an easy task, it would be of questionable value.

It is obvious that diamond drilling of the deposit should be done. The body will have to be intersected in many places and must yield at least five (and preferably ten) tonnes of core for initial assessment purposes. The drilling and subsequent diamond-recovery programs will be very expensive and thus, the company must ensure that the drill holes are representative of the entire deposit. In order to accomplish this, magnetometer and gravity surveys must be conducted and carefully evaluated in order to get good impressions of the size, complexity and attitude of the body. Descriptions of the programs are discussed below:

1. PHASE 1: MAGNETOMETER SURVEY

Due to the anticipated complexity of the diatreme, line spacings and stations must be close together. It is recommended that lines be set out at fifteen-metre intervals, with 7.5 metre station intervals. The lines should be run in a northwesterly direction since the axis of the deposit appears to strike northeasterly. The magnetometer should be capable of reading to an accuracy of ten gammas and careful diurnal control must be maintained. A total of 5,576 stations will be required and frequent tie-ins will be necessary for diurnal correction. Environment Canada should be contacted to ensure that the mag survey is conducted during a period of expected low sun-spot activity.

The geophysicist/operator is charged out at a base cost of $300 per day and his work would include setting up all stations for magnetometer and subsequent gravity survey, and setting up the bases stations for diurnal, as well as conducting the survey itself. Rates include $0.30 per kilometre for the 4-wheel drive truck (rental, gas, depreciation, profit), and $70 per man-day for accommodations and food. Program preparation, mobilization and demob are expected to cost in the range of $2,000, rental of a proton magnetometer at $3,000 per month, and daily round-trip travel of 260 km from Milk River, the nearest town with a motel.

2. PHASE 2: GRAVITY SURVEY & EVALUATION OF GEOPHYSICAL DATA

Recommended line and station spacings for the gravity survey are at 30-metre intervals. For large oil projects, the cost per station averages about $40, which includes a three-man team of topographical surveyor, survey helper and geophysical operator, plus the equipment, computerization and drafting. However, taking into account the distance from the nearest town (and consequent long daily travel times and associated costs, the price is increased herein to $60 per station.

3. RESULTS INTERPRETATION AND REPORTING

A budget of $7,500 has been outlined for interpretation of the magnetometer data and reporting, On completion of Phase 2. Due to the relatively-low anticipated variation in magnetic response between expected diatreme facies, special care must be taken to ensure accuracy of data. The geophysicist must massage the mag data to eliminate extraneous influences in magnetic response due to potential sun-spots, radical changes in elevation, etc. Finally, the data from the magnetometer work must be combined with the gravity data to produce a 3-dimensional image-estimate of the shape, complexity and attitude of the deposit.

Submitted by,
ASH & ASSOCIATES CONSULTING LTD.

Wayne M. Ash, P. Eng August 20, 1993.

budget costs

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CERTIFICATE OF QUALIFICATIONS

I, Wayne M. Ash, P. Eng., of [redacted], West Vancouver, British Columbia, hereby certify as follows:

1. I am a graduate of the Haileybury School of Mines (Ontario), and Michigan Technological University, and hold a Bachelor of Science degree in Mining Engineering.

2. I have been a member of the Association of Professional Engineers of British Columbia since 1971 and have been directly involved in the minerals industry for the past thirty-three years.

3. I have no interest, either directly or indirectly in the Black Butte JD-1, or other D.I.M. Holdings property, nor do I expect to receive any.

4. I have no direct interest in Tigris Minerals Ltd. but do hold stock in a company which holds 50,000 shares of Tigris Minerals. However the shares were purchased in 1990, long before the major Canadian diamond-play came into being.

4. I visited the Black Butte property in 1992 and 1993, reviewed and interpreted the data available to arrive at the conclusions submitted in this report.

5. I hereby grant my permission to Tigris Minerals Ltd. to use this report, or any portion of it, for any legal purposes normal to the business of his firm, so long as the excerpts used do not materially deviate from the intent of this report as set out in the whole.

Dated at Vancouver, B.C. this 20th day of August, 1993.

Wayne M. Ash, P. Eng.