MAR 20060033: CALLING LAKE

Received date: Dec 15, 2006

Public release date: Jan 16, 2008

20060033

Assessment Report

Calling Lake Project, Alberta

2004-2006 Exploration and Drill Program Summary

Metallic and Industrial Minerals Permit
NO. 9304110426

Halmco Inc.

Submitted by Halmco Inc.

ACTUAL EXPENDITURE STATEMENT OF WORK BREAKDOWN

	AMOUNT SPENT
1. Prospecting	$ 15 430.01
2. Geological Mapping & Petrography	$ 4 875.00
3. Geophysical Surveys	
a. Airborne	$
b. Ground	$
4. Geochemical Surveys	$
5. Trenching and Stripping	$
6. Drilling	$ 46 970.00
7. Assaying & whole rock analysis	$ 1 474.00
8. Other Work confirm that anomalies are NOT culture by air and ground surveys	$ 4 600.00
SUBTOTAL	$ 73 349.01
9. Administration (10% of subtotal)	$ 3 193.00
TOTAL	$ 76 542.01

MUST BE CONSISTANT WITH EXPENDITURES IN PART A

[redacted]
SIGNATURE

June 7, 2007
DATE

LEO HALONEN

INDEX

20060033
eUSD
APRIL 17/07

1

Summary

Halmco Inc. is the holder of 5 Metallic and Industrial mineral permits collectively referred to as the Calling Lake Project. The Calling Lake Project area is centered on the Calling River and Calling Lake area of northern Alberta (approximately 200 kms. North of Edmonton, AB. on Provincial Highway 813).The project area is approximately 40,192 hectares.Halmco Inc. has been conducting exploration on the project since 2004.

In 2004 Halmco retained R. Haimila and T. Yoshida to design an Exploration Program to discover the source of the highly anomalous diamond indicator sites located on the west and south shores of Calling Lake and the highly anomalous diamond indicator sites along the Calling River East. These anomalous diamond indicator sites are significant in that they include diamond inclusion quality chrome diopsides, diamond inclusion eclogitic garnets, high magnesium picroilmenites, diamond inclusion olivines, a complete suite of pyrope garnets (G1 to G12) including 65 Gurney G10 garnets, diamond inclusion chromites – as well as a gem quality macro diamond.

Mssr.s Haimila and Yoshida began to stake the Calling Lake Property in 1993 on the basis of the basement geology and the favourable regional geological and structural setting for the occurrence of kimberlites as well as their discovery of the anomalous quantities of kimberlitic indicators. Their recommendations for the project area are:

1. review of indicators to "target the best sub-calcic garnets, the highest chrome chromites, the biggest population of high sodium eclogitic garnets and the most magnesian ilmenites should be accorded the highest priority" (GSC bulletin 423)
2. review previous exploration of up-ice drilling and sampling to provide a Northern cut-off to the highly anomalous diamond indicator sites located along the south shore of Calling Lake and sites located on Calling River east (diamond discovery)
3. review previous assessment data to locate magnetic, resistive and seismic anomalies that are at or south of the Northern cut-off to the anomalous diamond indicator locations and located in Halmco Project area.
4. confirm that anomalies are NOT culture by air and ground surveys
5. prioritize anomalies that are in the same east-west trend as the anomalous diamond indicator locations
6. prioritze anomalies that are in the same drainage systems as the anomalous diamond indicator locations
7. anomalies (6&7) that are coincidental and have multiple geophysical signatures should be afforded the highest priority in a drilling program

APR 17/07

2

The Halmco Calling Lake Diamond Exploration Project was designed according to "the theory of geological prospecting systems reliability which is based on the study of failure of the systems or elements". This exploration method is described in chapter 3- "Search For Diamond Deposits (page 75) of the " **Field Guide Book –Kimberlites of Yakutia"** (Novosibirsk, 1995) see appendix..1.........

In summary, Maps are designed " as a basis for evaluation of prospecting reliability and for protecting a higher quality scheme of prospecting"- and is based on 5 types of failure.

1. failures of targets to be indicated in expected manner
(i.e. lower resistivity of target-crater fascies-10 to 20 ohm meter)
2. failures attributed to landscape geological surroundings
(i.e. basal till may actually be layered crater fascies lake deposits)
3. failures of technical type
(i.e. resistive anomalies interpreted as culture because of video failure at time of the resistive/magnetic survey)
4. failures of geological interpretation
(i.e. diamond indicator sites may be at source and/or on drainage systems from the south rather than from up-ice targets)
5. failures of evaluation and verification
(follow up ground and air surveys of cultural anomalies and indicator sampling of drainage systems associated with highly anomalous diamond indicator sites)

The Maps A & B (appendix..13...) are the result of the review of data bases of past exploration programs of the Calling Lake area using the evaluation of prospecting reliability which is based on the above mentioned failure of systems.

Map A is the result of reviewing geochemical data bases of kimberlitic indicators (approx. 2200 grains from past exploration projects, assessment reports, etc. between 1994 and 2004) and then filtering out single sample location sites that are of a lower quality/ quantity kimberlitic indicators in favour of higher quality/quantity diamond indicators. This provides Map A and shows area of multiple sites of higher quality/ quantity diamond indicators. This map is then interpreted to provide a Northern cut-off to the significant diamond indicator sites and provides the Major Trend and/or trends in diamond indicator data. (i.e. narrows the window for the source of the highly significant diamond indicator sites.)

Map B is the result of reviewing geotechnical data bases of seismic, magnetic, resisitive surveys and anomalies and their proximity to the significant diamond indicator site. Again, the anomalies are reviewed based on the 5 failure system of prospecting reliability.

Specific to Mineral Permit 930411426

The high priority anomalies six (drill site 6) and seven (drill site 7) in Priority Area (1) of Map B were initially Classified as culture in the Dighem Resistive/Magnetic survey. Follow up air surveys and ground surveys by Halmco Inc. has proven many of the anomalies classified as culture (previous geophysical surveys) were resistive/magnetic anomalies. Ground surveys and sampling surveys (see Appendix 5) were conducted in November 2004 and in the spring and summer of 2005. Three air surveys were conducted -April 2005, July 2005 and October 2005) . The anomalies on Map B (appendix 13) and the anomalies identified on the Ground survey map (appendix 5) have been identified as resistive and/or magnetic anomalies and not culture.

The magnetic/resistive anomalies on Map B (appendix 13) and anomaly location map (appendix 5) have been prioritized according to the "evaluation of prospecting reliability".(see appendix 1). This resulted in two priority anomalies on mineral permit 930411426 (Calling River east area) High priority anomaly six (drill site #6..see appendix 8) and high priority anomaly seven (drill site #7..see appendix 7). Both anomalies have multiple geophysical signatures, both anomalies are in the same east-west trend as the anomalous diamond indicators and both anomalies are in the same drainage systems as the diamond indicators.

In September and October 2005, suitable drilling equipment access routes were determined to anomalies six and seven. In February 2006, drill sites were located on anomaly six (drill site #6) and on anomaly seven (drill site #7). These drill sites were specific to the magnetic and resistive peaks and lows of the anomalies and fall within the cross-over phases of the electro-resistive tomography survey. (see appendix 7 and 8)

In April 2006, drill site #7 was prepared and drill moved on site..(see appendix 11). Due to mechanical problems,etc.; the drill was only able to drill to a depth of 9.5 meters.. (see appendix 12 for well logging data and analysis). April 26 to 30- demobilization of equipment and site clean up.

Because of the eclogitic indicators and some of the natural diamonds (possible contamination) found in the drill cuttings- anomaly seven is still a high priority target. Halmco Inc decided to redrill anomaly seven in the fall of 2006. In October 2006 a drill rig was engaged to redrill anomaly seven. On October 15 2006, equipment was mobilized back to prepare Drill site #7. In November 2006, the drilling equipment was in a highway accident in Edmonton- and the program to drill site #7 has been rescheduled for 2007.

As of November 15, 2006; only a single hole has been drilled . That hole was drilled in April, 2006 and was located on anomaly seven (drill site #7) on Mineral Permit 930411426.

Introduction and Terms of Reference

The following report was prepared to describe exploration activities that took place on the Calling Lake Project's Mineral Permit NO. 9304110426 during 2004 /2006. This report has been structured to meet the assessment requirements of Alberta Resource Development and was not written to National Instrument Policy 43-101.

Property Location and Description

Metallic and Industrial Mineral Permit NO. 9304110426is centered on the eastern portion of the Calling River about 50 kms north of the town of Athabasca within the Pelican River, 1:250,000 scale National Topographic System (NTS) map sheet 83P.

Metallic and Industrial Minerals Permit
NO. 9304110426

TERM COMMENCEMENT DATE:

NOVEMBER 17, 2004

AGGREGATE AREA:

9216 HECTARES

DESCRIPTION OF LOCATION AND PERMITTED SUBSTANCES:

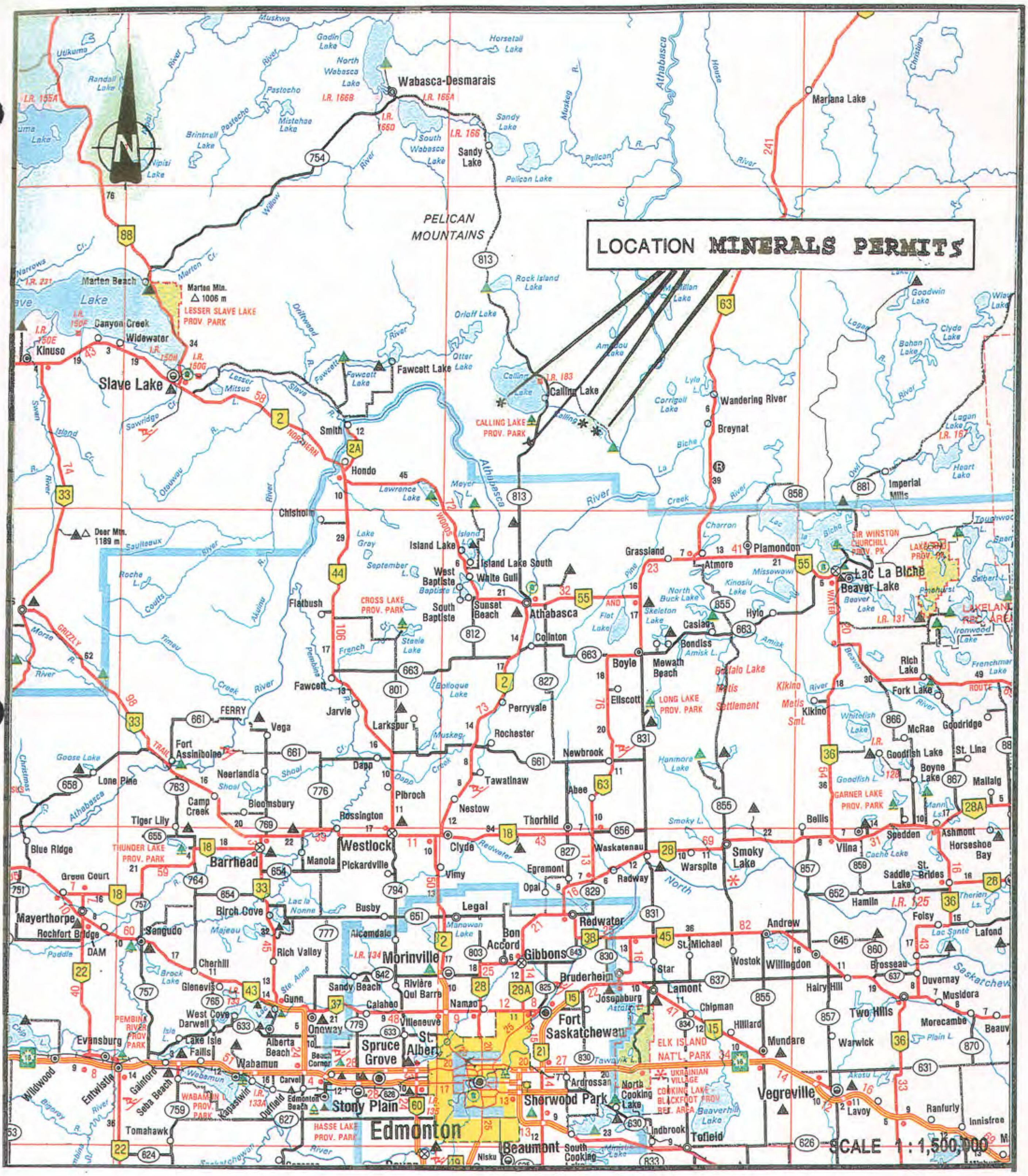
4-19-071: 2-5;7-9;16-22;27;28;33;34
4-20-071: 2;11-15;22-33

Some **Descriptions and References** that follow are from previous Calling Lake area Assessment Reports filed by: R. Haimila, 656405 Alberta Ltd., and Buffalo Diamonds, (exploration periods 1994 –2002.)

Accessibility, Climate, Local Resources, Infrastructure and Physiography

The Calling Lake property may be accessed via Provincial Highway 813, all weather and dry weather gravel roads, cart trails and seismic lines. Portions of the permit areas may be accessed by four-wheel drive vehicles or argos. There are two small airfields within the Calling Lake area, one at the communication tower at Orloff Lake and the second just north of Calling Lake. In addition, a seaplane anchorage is located on the east shore of Calling Lake. Accommodation, food, fuel, and supplies are best obtained in Athabasca. Camping facilities may be available in Calling Lake Provincial Park.

The Calling Lake property is situated near the northern border of the Alberta Plain physiographic zone and the southern border of the Alberta Plateau (Klassen, 1989). Relief is generally low-lying. Elevation in the region generally varies from 590 to 700 m above sea level

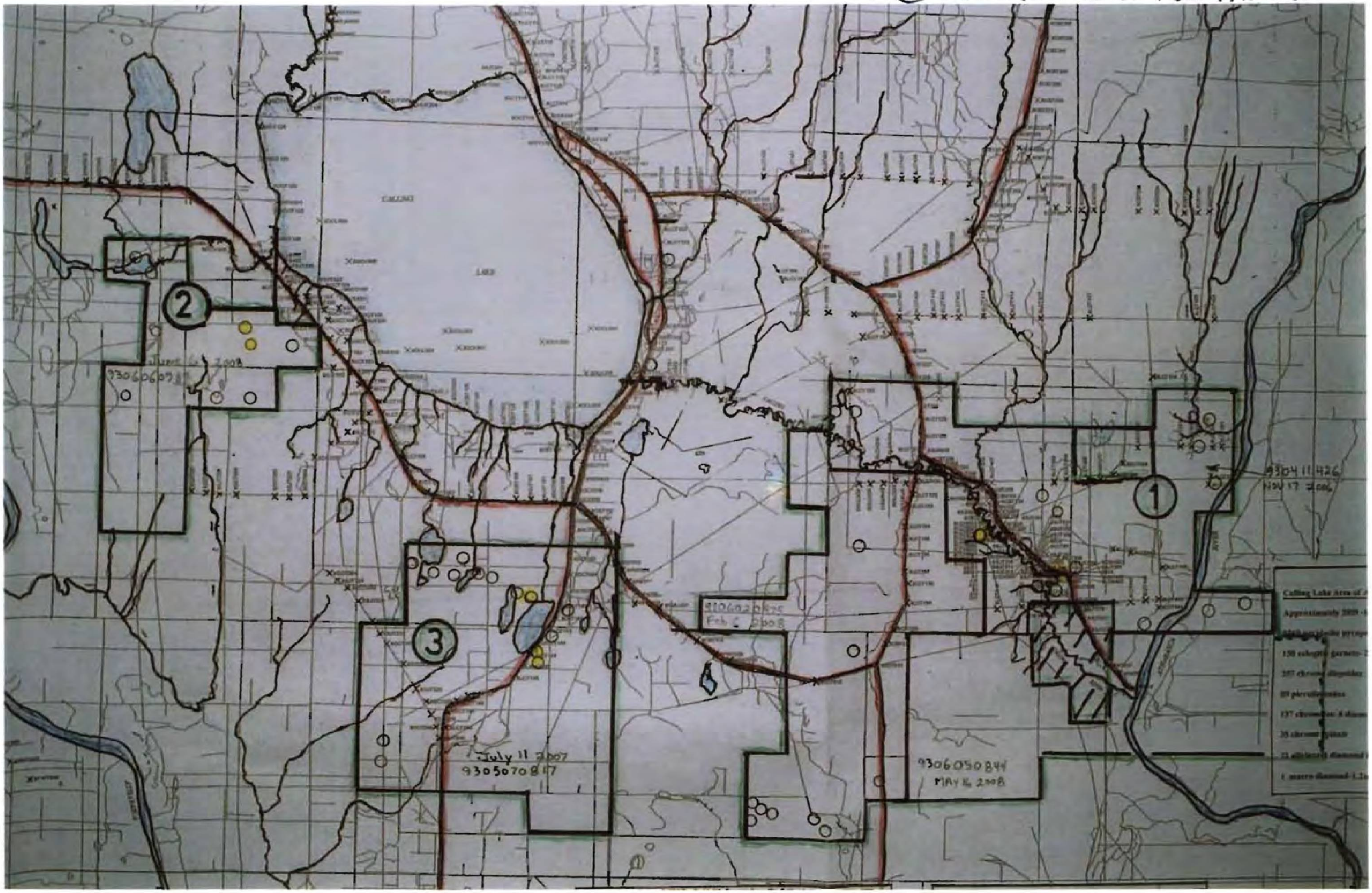


HALMCO INC.

LOCATION MAP

9

① MINERAL PERMIT 9304110426



(asl.), except along the Athabasca and Calling river valleys which drop steeply to approximately 480 m asl. Major topographic features in the region include: Calling Lake, situated in the centre of the property; Pelican Mountains to the northwest of the property; and the Athabasca and Calling rivers. Numerous streams and creeks drain the region, flowing into Calling Lake, which in turn drains into the Athabasca River via the Calling River or directly into the Athabasca River which wraps around the west, south and east borders of the property. In addition to the numerous small lakes and ponds, most of the property is covered by swamps, marshes and fens. A boreal forest containing mainly spruce and jack pine covers the property. Annual temperatures range from -40°C in January to 25°C in July.

Regional Geology

The Regional Geology description and references remains unchanged and has been reproduced from "Diamond Potential of Buffalo Diamonds Ltd's Calling Lake Property, Alberta" by Dufresne and Copeland (1999).

Precambrian

The Calling Lake permits lie in the Western Canadian Sedimentary Basin along the southern flank of the Peace River Arch (PRA). However, Precambrian rocks are not exposed within the Calling Lake area (NTS 83P). The basement underlying the PRA is comprised of several terranes including the Buffalo Head and the Chinchaga, both of which collectively form the Buffalo Head Craton (Ross *et al.*, 1991, 1998). The Buffalo Head Craton was accreted to the western edge of the Churchill Structural Province (Rae Subprovince) approximately 1.8 to 2.4 billion years ago (Ga). Due to their relatively stable history since accretion, the Buffalo Head and Chinchaga terranes are currently the focus of extensive diamond exploration in northern Alberta.

The basement underlying the Calling Lake permits borders the Buffalo Head Terrane (BHT), the Talston Magmatic Zone (TMZ) and an unnamed domain (Figure 3). Basement underlying the northeast portion of the Calling Lake Permits is part of the Talston Magmatic Zone (TMZ), a 2.0 to 1.8 Ga aged terrane that represents a magmatic arc related to collisional orogeny during the Proterozoic. The TMZ is characterised by a highly corrugated internal fabric comprised of extremely high relief, north-trending sinuous magnetic anomalies. The northwestern portion of the Calling Lake permits is underlain by basement of the BHT, an area of high positive magnetic relief with a north to northeasterly fabric (Villeneuve *et al.*, 1993). The area of Ashton Mining of Canada Inc.'s (Ashton) Buffalo Head Hills kimberlite discovery is underlain by basement of the BHT.

The bulk of the basement underlying the Calling Lake permits is part of an unnamed domain (Figure 3). The gravity and magnetic signatures of the unnamed domain are very similar to those of the BHT and Wabamun Terrane and, therefore, may in fact be an extension of either one of these terranes. The Wabamun Terrane is geologically and magnetically similar to the BHT and was likely accreted to the western edge of the Churchill Structural Province between 2.4 to 1.8 Ga. The BHT and the Wabamun Terrane are thought to represent either Archean crust that has been thermally reworked during the Hudsonian (Proterozoic) Orogeny (Burwash *et al.*, 1962; Burwash and Culbert, 1976; Burwash *et al.*, 1994) or accreted Proterozoic terranes that may or may not have an Archean component (Ross and Stephenson, 1989; Ross *et al.*, 1991; Villeneuve *et al.*, 1993). Precambrian rocks which have been intersected in drill core from the BHT and the Wabamun Terrane comprise felsic to intermediate metaplutonic rocks, felsic metavolcanic rocks and high-grade gneisses (Villeneuve *et al.*, 1993). The presence of a large number of eclogitic garnets and eclogitic pyroxenes in association with kimberlites or related intrusions in northern Alberta may indicate the presence of a significant volume of subducted basaltic and sedimentary protolith in the upper mantle and lower crust beneath the Buffalo Head Craton. The Calling Lake permits lie within an area with an intermediate to high residual gravity signature. Seismic refraction and reflection studies indicate that the crust in the Calling Lake region is likely around 35

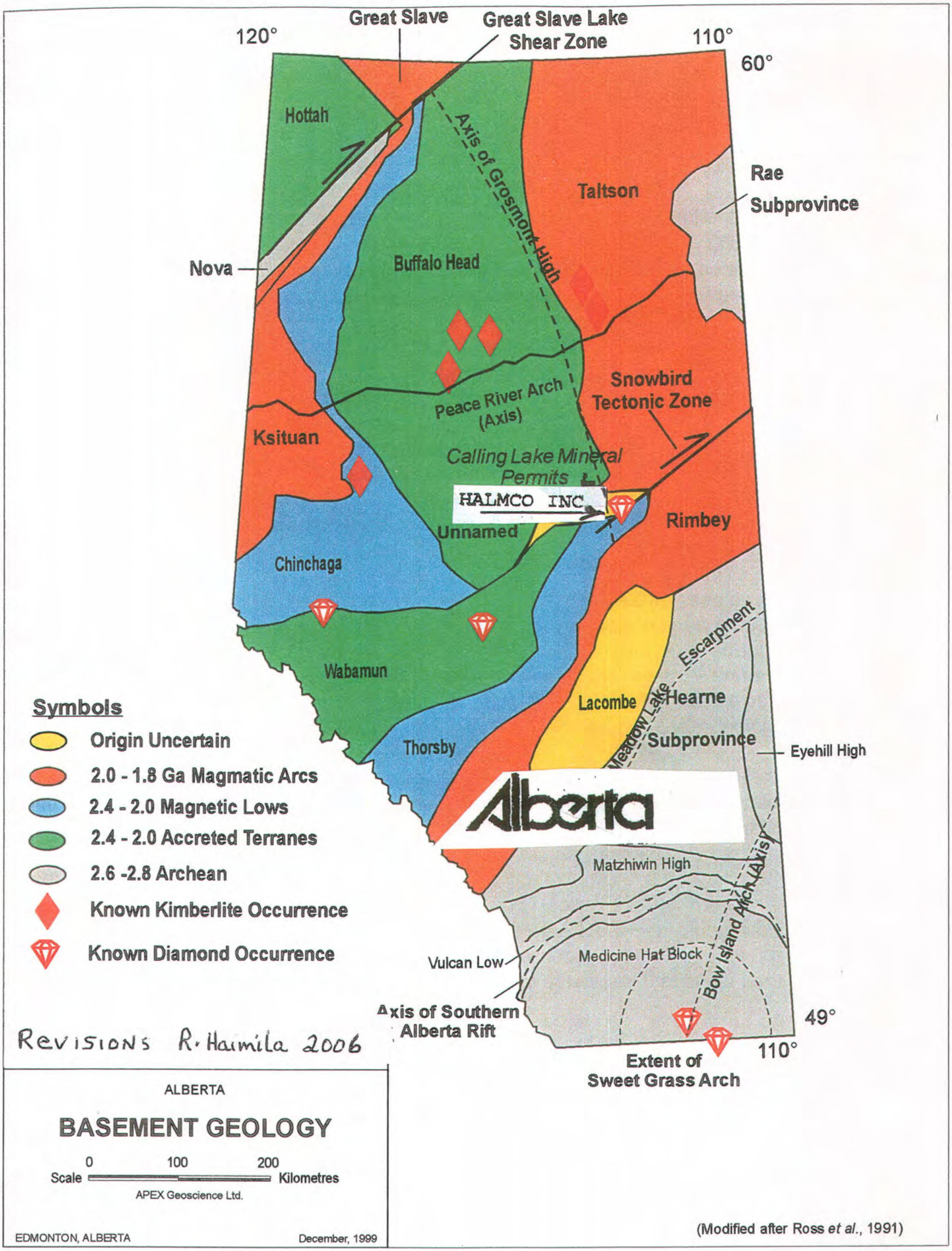

Great Slave
Great Slave Lake Shear Zone
120°
110°
60°
Hottah
Axis of Grosmont High
Taltson
Rae Subprovince
Nova
Buffalo Head
Peace River Arch (Axis)
Snowbird Tectonic Zone
Ksituan
Calling Lake Mineral Permits
HALMCO INC.
Rimbey
Unnamed
Chinchaga
Wabamun
Escarpment
Lacombe
Meadow Lake
Hearne Subprovince
Eyehill High
Thorsby
Alberta
Matzhiwin High
Bow Island Arch (Axis)
Vulcan Low
Medicine Hat Block
Axis of Southern Alberta Rift
49°
110°
Extent of Sweet Grass Arch
Symbols
Origin Uncertain
2.0 - 1.8 Ga Magmatic Arcs
2.4 - 2.0 Magnetic Lows
2.4 - 2.0 Accreted Terranes
2.6 -2.8 Archean
Known Kimberlite Occurrence
Known Diamond Occurrence
Revisions R. Haimila 2006
ALBERTA
BASEMENT GEOLOGY
Scale 0 100 200 Kilometres
APEX Geoscience Ltd.
EDMONTON, ALBERTA
December, 1999
(Modified after Ross et al., 1991)

FIGURE 2.

to 40 km thick, a trait favourable for the formation and preservation of diamonds in the upper mantle (Dufresne *et al.*, 1996). In addition, studies by Lithoprobe have indicated that a deep mantle root, as illustrated by Figure 25 in Helmstaedt (1993), exists proximal to the area (Haimila, 1997).

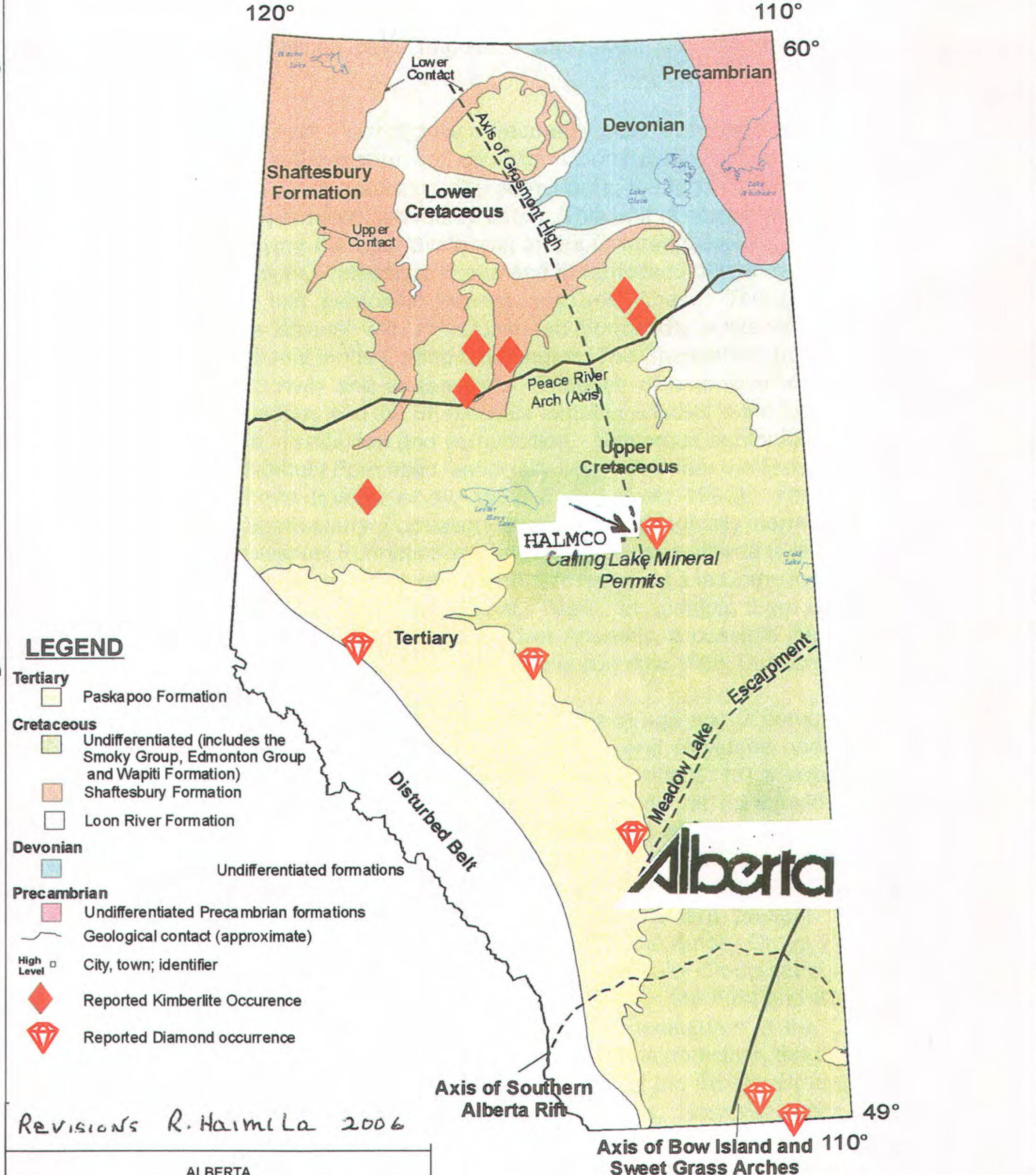
Directly south of the Calling Lake permits, the basement is part of the Proterozoic Thorsby Magnetic Low (2.4 – 2.0 Ga), which merges into the Snowbird Tectonic Zone to the northeast (Figure 3). The Thorsby Low is a narrow northeasterly trending, curvilinear aeromagnetic low that is similar in character to the Chinchaga Low. It is collinear with a gravity gradient between the adjacent domains and contains numerous basement faults that extend into the overlying Paleozoic and Mesozoic succession (Edwards and Brown, 1994). The Snowbird Tectonic Zone (STZ) is a major northeast-trending crustal lineament that is a prominent lineament on both the aeromagnetic and the gravity maps of Canada (Geological Survey of Canada, 1990a, b). The STZ separates the Churchill Structural Province into two distinct basement domains, the Rae and Hearne Subprovinces, and extends to the northeast as far as Baker Lake, Nunavut (Ross *et al.*, 1991).

Phanerozoic

Overlying the basement in the Calling Lake region is a thick sequence of Phanerozoic rocks comprised mainly of Cretaceous sandstones and shales near surface and Mississippian to Devonian carbonates and salts at depth (Glass, 1990). Bedrock exposure within the permit blocks is limited primarily to river and stream cuts and topographic highs. Table 1 shows the upper units found in the region. Further information pertaining to the distribution and character of these and older units can be obtained from well log data in government databases and various geological and hydrogeological reports (Carrigy, 1971; Green *et al.*, 1970; Glass, 1990).

Underlying the near surface Cretaceous units in the Calling Lake area is a thick succession of Devonian to Mississippian carbonates, calcareous shales and salt horizons (Mossop and Shetson, 1994). Several of the Devonian carbonate units are part of the Grosmont Reef Complex, a large structure that extends in a northwesterly direction from the Calling Lake area to the N.W.T. (Bloy and Hadley, 1989). The Grosmont Reef Complex is likely the result of tectonic uplift during the Devonian along this trend (the Grosmont High on Figure 4). This structure in conjunction with the PRA could have played a significant role in the localisation of faults and other structures that could have provided favourable pathways for kimberlite volcanism.

In general, the Cretaceous strata underlying the Calling Lake permits is composed of alternating units of marine and nonmarine sandstones, shales, siltstones, mudstones and bentonites. The oldest documented units exposed in the permit area belong to the Smoky Group, a sequence of Upper Cretaceous calcareous and noncalcareous shales (Figure 4). However, older units from the base of the Fort St. John and/or the top of the Colorado groups may be exposed in river and stream cuts.



Revisions R. Haimila 2006

ALBERTA

GENERALIZED GEOLOGY

Scale 0 100 200 Kilometres

APEX Geoscience Ltd.

EDMONTON, ALBERTA

December, 1999

(Modified after Dufresne *et al.*, 1996)

FIGURE 3.

TABLE 2
GENERALIZED STRATIGRAPHY
CALLING LAKE PERMIT AREA

SYSTEM	GROUP	FORMATION	AGE* (MA)	DOMINANT LITHOLOGY
PLEISTOCENE			Recent	Glacial till and associated sediments
TERTIARY			6.5 to Recent	Preglacial sand and gravels
UPPER CRETACEOUS		Wapiti	70 to 80	Sandstone, minor coal seams and conglomerate lenses
	Smoky	Puskwaskau	75 to 86	Shale, silty-shale and ironstone, First White Specks
		Bad Heart	86 to 88	Sandstone
		Kaskapau	88 to 92	Shale, silty-shale and ironstone, Second White Specks
		Dunvegan	92 to 95	Sandstone and siltstone
	Fort St. John	Shaftesbury	95 to 98	Shale, bentonites, Fish-Scale Fm.
LOWER CRETACEOUS	Colorado	Pelican	98 to 100	Glauconitic sands, siltstone, mudstone and conglomerate
		Joli Fou	100 to 103	Shale, glauconitic sandstone and bentonite

*Ages approximated from Green *et al.* (1970), Glass (1990), Dufresne *et al.* (1996) and Leckie *et al.* (1997).

The Colorado Group is Lower Cretaceous in age and contains numerous formations, including the Joli Fou and the Pelican formations, which are correlative with the Peace River Formation of the Fort St. John Group further west (Dufresne *et al.*, 1996). The Joli Fou Formation is comprised of shale with interbedded, bioturbated to glauconitic sandstones and minor amounts of bentonite, pelecypod coquinas, nodular phosphorite and concretionary layers of calcite, siderite and pyrite (Glass, 1990). The Pelican Formation disconformably overlies the Joli Fou Formation and is gradational with the overlying Shaftesbury Formation (shales of the Colorado Group) and is correlative with the Cadotte and Paddy Sands of the Peace River area (Fort St. John Group). The Pelican Formation is comprised of glauconitic sands, interbedded siltstone and mudstone with minor amounts of conglomerate. Coalified plant fragments and bioturbated sandstones are locally abundant.

The La Biche Formation is a frequently incorrectly used term correlative to units of the Shaftesbury Formation and other formations within the Smoky and Colorado groups (Glass, 1990). In the Calling Lake permit area, the term Shaftesbury Formation (Fort St. John Group) is more commonly used. This unit is correlative with the shales overlying and underlying the Fish Scale unit in the Colorado Group. The Shaftesbury Formation is lower Upper Cretaceous in age and is comprised of marine shales with fish- scale bearing silts, thin bentonitic streaks and ironstones. The upper contact is conformable and transitional with the Dunvegan Formation, however, the Dunvegan Formation may be absent in the Calling Lake region. The Shaftesbury Formation may be exposed along deep river and stream cuts. Evidence of extensive volcanism during deposition of the Kaskapau and the Shaftesbury formations exists in the form of bentonites of variable thickness, distribution and composition. Numerous bentonitic horizons exist throughout the Shaftesbury Formation, especially within and near the Fish Scales horizon across much of Alberta (Leckie *et al.*, 1992; Bloch *et al.*, 1993). The time span of deposition of the Shaftesbury Formation is also chronologically correlative with the deposition of the Crowsnest Formation volcanics of southwest Alberta (Olson *et al.*, 1994; Dufresne *et al.*, 1995) and with kimberlitic volcanism near Fort à la Corne in Saskatchewan (Lehnert–Thiel *et al.*, 1992; Scott Smith *et al.*, 1994). In addition, there is documented igneous activity associated with the Steen River Anomaly, a possible impact structure, which formed in northwestern Alberta about this time (Carrigy, 1968; Dufresne *et al.*, 1995).

The Smoky Group is Upper Cretaceous in age and is comprised of thinly bedded, marine, silty shale with occasional ironstone and claystone nodules and thin bentonite streaks. The group is divided into three formations: (a) a lower shale unit, Kaskapau, which includes the Second White Specks marker unit; (b) a middle sandstone, named the Bad Heart; and, (c) an upper shale, Puskwaskau, which contains the First White Specks marker unit. The Smoky Group is conformably and transitionally overlain by the Wapiti Formation. Ammonite fossils and concretions are present in both the Puskwaskau and the Kaskapau formations. In addition, foraminifera are present in the lower arenaceous units (Glass, 1990). The upper formations of the Smoky Group are correlative with the Lea Park Formation. The lower portions of the Smoky Group are correlative with the middle to upper units of the Colorado Group, including the First and Second White Speckled Shale marker units (Glass, 1990). Bedrock exposures in the Calling Lake permits are likely comprised of the Kaskapau Formation, in particular, the Second White Specks unit or lower, since most of the upper portions of the Smoky Group have been eroded away by glacial and/or post-depositional processes. However, areas, where the Smoky Group is overlain by the Wapiti Formation, may still have most of the Bad Heart and/or Puskwaskau formations still intact with minimal erosion. In general, exposures of the Smoky Group are limited to river and stream cuts, topographic highs, and regions with thin drift veneer. There is strong evidence of volcanism associated within the depositional time span of the Smoky Group in the vicinity of the PRA (Auston, 1998; Carlson *et al.*, 1998). Ashton's recently discovered Buffalo Head Hills kimberlites intrude Kaskapau shale and yield emplacement ages of 86 to 88 Ma (Auston, 1998; Carlson *et al.*, 1998).

The youngest bedrock unit in the Calling Lake area is the Wapiti Formation of Upper Cretaceous age, comprised of non-marine, thinly bedded to massive sandstone with minor coal seams and thin conglomerate lenses. The upper surface of the Wapiti Formation is generally erosional. Thickness of the unit may exceed 100 m (Glass, 1990). The Wapiti Formation is exposed in the northwestern portions of the Calling Lake permits west of Calling Lake. In addition, smaller outliers or remnants of the Wapiti Formation are known to be present south and east of the permits (Green *et al.*, 1970). The Mountain Lake Kimberlite near Grande Prairie intrudes the Wapiti Formation sediments and yields an emplacement age of 75 Ma (Leckie *et al.*, 1997).

Quaternary

Data and information about the surficial geology in central to northern Alberta is sparse and regional in nature. Prior to continental glaciation during the Pleistocene, most of Alberta, including the Calling Lake region, had reached a mature stage of erosion. Large, broad paleochannels and their tributaries drained much of the region, flowing in an east to northeasterly direction (Dufresne *et al.*, 1996). In addition, Late Tertiary to Quaternary fluvial sand and gravel was deposited preglacially over much of the region.

During the Pleistocene, multiple southwesterly and southerly glacial advances of the Laurentide Ice Sheet across the region resulted in the deposition of ground moraine and associated sediments (Figure 5 in Dufresne *et al.*, 1996). In addition, the advance of glacial ice resulted in the erosion and glaciotectonism of the underlying bedrock. Ice thrusted bedrock has been documented just south of the Athabasca River (Klassen, 1989) and smaller occurrences of glaciotectonism within the Calling Lake permits are possible. Remnants of preglacial sands and gravel have been documented on topographic highs, including the Pelican Mountains just northwest of the Calling Lake permits (Dufresne *et al.*, 1996). Glacial sediments infilled low-lying and depressional areas, draped topographic highs and covered much of the Calling Lake area as veneers and/or blankets of till and diamict. Localised pockets of deposits from glacial meltwater and proglacial lakes infill the numerous spillway channels present near the area.

Glacial ice is believed to have receded from the area about 15,000 years ago. After the final glacial retreat, lacustrine clays and silts were deposited in low-lying regions along with organic sediments. Rivers previously re-routed due to glaciation, re-established easterly to northeasterly drainage regimes similar to that of the pre-Pleistocene. Extensive colluvial and alluvial sediments accompanied post-glacial river and stream incision.

The majority of area within the Calling Lake permits is underlain by drift of variable thickness, ranging from less than 2 m to likely over 45 m (Pawlowicz and Fenton, 1995a,b). Drift thickness decreases considerably outside of infilled depressions and meltwater channels and in areas of high topographic relief, in particular near the Pelican Mountains. However, local drift thicknesses can not be confirmed without detailed compilation of available drill hole data. Information regarding bedrock topography and drift thickness in northwest Alberta is available from the logs of holes drilled for petroleum, coal or groundwater exploration and from regional government compilations (Pawlowicz and Fenton, 1995a,b; Dufresne *et al.*, 1996).

Structural Geology

In north-central Alberta, the PRA is a region where the younger Phanerozoic rocks which overlie the Precambrian basement, have undergone periodic vertical and, possibly, compressive deformation from the Proterozoic into Tertiary time (Cant, 1988; O'Connell *et al.*, 1990; Dufresne *et al.*, 1995, 1996). This pattern of long-lived, periodic uplift and subsidence has imposed a structural control on the deposition patterns of the Phanerozoic strata in northern Alberta. In addition, this periodic movement has resulted in a rectilinear pattern of faults that not only is responsible for structurally controlled oil and gas pools, but may have provided potential pathways for later deep-seated intrusive kimberlitic magmas.

During the mid-Cretaceous and Early Tertiary, compressive deformation occurred as a result of the orogenic event that eventually led to the formation of the Rocky Mountains. The PRA was emergent during this period resulting in the reactivation of many prominent basement faults. The Phanerozoic rocks beneath the Calling Lake permits lie within the southeastern edge of the PRA and are underlain by and proximal to basement faults related to the STZ and the underlying Grosmont Reef Complex, which was formed over the Grosmont High (Bloy and Hadley, 1990; Dufresne *et al.*, 1996). Basement faults may have controlled the emplacement of the Mountain Lake Kimberlite and the Buffalo Head Hills kimberlites northwest of the Calling Lake permits (Dufresne *et al.*, 1996; Leckie *et al.*, 1997). Therefore, structures in the Calling Lake area resulting from tectonic activity associated with movement along the PRA, the Grosmont High, the STZ or even along contacts between different basement terranes could be pathways for kimberlitic volcanism.

Previous Exploration Excerpts are from Calling Lake assessment report 2002004 (June 27/02)

To date over $2,500,000 has been expended on exploration on the Calling Lake Property and immediate area. Several phases of surface and auger assisted indicator mineral sampling programs, airborne geophysical surveys and compilation of seismic and regional geological information led to the identification of numerous drill targets characteristic of kimberlite pipes. Details of previous work are well summarized by Dufresne and Copeland (1999).

The following page is from BHP Billiton's macroscopic drill core study (p2) of Buffalo Diamonds/New Claymore Resources 1999/2000 assessment report 2002004. Those comments of interest to Halmco's exploration program have been underlined

(type 5 failure)

On 28 March , 2002 seventy-four (74) boxes of drill core were macroscopically examined for diamond potential at the BHP Billiton Diamonds Inc. Core Facility in Kelowna, BC, Canada.

Background

No information about the drill core was provided. This was not a concern because the goal of this study was to determine if any of any material recovered was of economic significance for diamonds or indicated the presence of a primary source for diamond bearing material (i.e. non-alluvial). The core was examined for similarities to the following primary diamond sources relevant to diamond exploration: kimberlite, group 2 kimberlite, lamproite, and melilitite. A macroscopic review of the core was possible for this study because the facility contains a relatively extensive world-wide library of samples mostly from primary diamond deposits for comparative studies of this nature.

The Buffalo Diamonds Ltd. web-site was reviewed before the study to provide a summary of public information on the project related to the drilling.

Drill Core

The following inventory was examined and consisted of 74, 4-run, five foot wooden core trays with plastic depth markers for depth and loss of core recovery. The box lids were fastened with nails and not sealed or made tamper-proof. Chain of custody and sample integrity can not be determined from this type of collection system. The trays are numbered in a series CLK-001 to CLK-010 with individual boxes marked with box number and from – to depths. Without accounting for empty rows, approximately 1 400 feet of core was studied. Except where the end of hole was encountered, the core trays were full and appear fully packed with complete drill cores. The core is mostly 7 cm diameter with some 4.5 cm intervals likely drilled due to hole squeezing. Most of the cores are dry and competent material, with minor intervals of sand sized material completely unconsolidated. Overall the core is in good condition and has been well handled.

Stratigraphy

It was decided after a detailed examination of every core interval not to undertake a detailed description and accompanying diamond drill log of the these cores for the following reasons:

1. Lack of background data on the drilling program.
2. Regional geology details have not been provided. This does not allow the a meaningful interpretation of the stratigraphy.
3. Target data on the anomalies are not available.
4. No primary diamond host rock types were macroscopically identified.

Interpretation and Recommendations

Given the world-wide variety of emplacement models, age relationships to host strata and genetic origins of primary diamondiferous source rocks, the core was reviewed to examine the potential of any known model as a source of the diamond geochemistry results in sampling to date. The most common exploration model used is a diamondiferous kimberlite pipe that has intruded to within the depths drilled by these holes.

If all of the holes are drilled vertically into discrete geophysical targets, them there is a possibility the relatively shallow holes were terminated too early if the deposit model is a pipe now completely capped by younger cover strata as seen at other localities (i.e. Saskatchewan). However, with increasing cover thickness, the probability of an economic deposit rapidly decreases and the generation of significant indicator grains at the present surface becomes more difficult to explain.

If the targets drilled are resolvable into anomalies within the depths drilled, no further work is recommended until improved target generation techniques are employed. (type 5 failure)

RAH

CONCLUSIONS

Early in 2006 the Halmco database was reviewed by P.A.R.Brown, P.Geo and Stephen Mlot, P.Eng and input given to the exploration team.

Two site visits were made, one to collect and verify the indicator mineral chemistry and another to spot several drillholes on mineral permit 9304110426 in the Calling Lake area.

The first visit resulted in the collection of two panned concentrates from the Calling River East. One sample from close to proposed drill site #6 and one from proposed drill site #7. see appendix 8.

Mineral picking for kimberlite indicator minerals was carried out by Overburden Drilling Management in Ottawa and microprobe analysis of picked grains was carried out by the O.G.S lab in Sudbury , Ontario. Results are attached.

The ilmenites fall into the medium and high grade classification of MgO vs Cr2O3 using the chart in appendix 14.

One good quality chromite and one good garnet were also found.

The second visit was made to spot several drillholes and decide the priority of each.

Fiscal constraints , weather and drill availability will determine the initial drill target.

Submitted by P.A.R.Brown P.Geo

[redacted]

GEOLOGIST'S CERTIFICATE:

I, Philip A. R. Brown P.Geo do certify that:

1. **I am a consulting geologist residing at 189, Astorville Road, Corbeil, Ontario, P0H1K0.**
2. **I am a graduate in Mining Geology from The Royal School of Mines, Imperial College, London University, England.**
3. **I am a practicing P.Geo registered in Ontario with APGO.**
4. **I have had many year's experience in diamond exploration for many companies in Canada, Sierra Leone and Brasil.**
5. **This report is for assessment purposes only and does not conform to National Instrument Policy 43-101.**
6. **I consent to the use of this report by Halmco Inc. for use of this report for assessment purposes only.**

Dated at Calling Lake December 15th 2006

Philip A. R. Brown P.Geo
Tel/fax 705 752 1123
e-mail pgeophil@hotmail.com

PROFESSIONAL GEOSCIENTIST
PHILIP A. R. BROWN
PRACTISING MEMBER
0200
ONTARIO

Background in Earth Sciences

1963-64: Integrated Velocity Services (Oil and Gas well-log interpretation).

1977 to present: Prospecting for Industrial and Metallic Minerals in Western Canada. This is a continuing project based on: Remote Sensing (Geotechnical Interpretations of Satellite Imagery) developed by Dr. N. Hamila. (Geologist – Geological Engineer): Reviewing and interpreting Seismic/Magnetic/Gravity data bases of Western Canada.

1991-92: Gained Intervenor Status between the Alberta Governments Natural Resources Conservation Board and Three Sisters Golf Resort. Presentation was an oral/visual presentation showing the Geotechnical Hazards associated with abandoned underground mining operations.

1993: Thesis Paper: (The Environmental Geology of the Canmore Mine Site) for Geology 1159, Mt. Royal College, Calgary.

1993: The Natural Resources-Conservation Board recommended the town of Canmore (3 Sisters Decision Report) utilize my geotechnical expertise. Appointed as a committee member of the town of Canmore Geotechnical Advisory Group. The mandate was to develop a set of undermining guidelines that would allow for safe development on undermined lands. The Province of Alberta adopted these guidelines in 1997.

1994-98: Co-owner operator of 656405 Alberta Ltd. (Alberta Diamond Exploration Company). Discovered the highly anomalous diamond indicator sites in Calling Lake Area in 1993-94 with partner Dr. Yoshida.

1996-98: Authored Alberta Mineral Assessment Reports for Dr. T. Yoshida, 656405 AB. Ltd. And co-authored assessment report for Buffalo Diamonds.
1998-2002: Co-founder and Director of Buffalo Diamonds (Public Diamond Exploration Company).

2003: Thesis Paper (Rheology and the Genesis of Diamonds) Theory demonstrates that the mechanics of rock and the rheological response of rock initiates a primary force that allows for a single species/element (carbon) to be converted to and/or deposited as the allotropic form of pure carbon-diamond.

2004 to present: Retained by Halmco Inc. to help design and implement a diamond exploration program for Halmco's Calling Lake project.

As co-author of this report, I consent to the use of this report by Halmco Inc. for use of this report for assessment purposes only.

[redacted]

RAYMOND HAIMILA
BOX 8264 Stn Main
CANMORE AB. T1W 2V2

REFERENCES

Auston, J. (1998) Discovery and Exploration of the Buffalo Hills Kimberlites, North-central Alberta; Mineral Exploration 'Group, 7th Galgary Mining Forum, Aril 8-9, 1998, p.24.

Bauman, P.D. and Hinnell, A.C. (1998). Geophysical investigation at Calling Lake, AB. Komex International Ltd., report with maps.

Burwash, R.A., McGregor, C.R. and Wilson, J.A. (1994). Precambrian basement beneath the Western Canada Sedimentary Basin; In G.D. Mossop and I. Shetsen (eds.) Geological Atlas of the Western Canada Sedimentary Basin, Published Jointly by the Canadian Society of Petroleum Geologists and the Alberta Research Council, Chapter 5, pp. 49-56.

Campbell, C. (1999). Airborne geophysics interpretation report of the Calling Lake properties, Alberta, Canada, NTS 831/3 83P/2 83P/3 83P/4 83P/5 83P/6 and 83P/7. Unpublished confidential report prepared for Buffalo Diamonds Ltd. By C. Campbell.

Darlson, S.M., Hiller, W.D., Hood, C.T., Pryde, R.P. and Skelton, D.N. (1998). The Buffalo Hills Kimberlite Province, North-Central Alberta, Canada; unpublished abstract by Ashton Mining of Canada, April 1998.

Christopher, J.E. (1990). Notes on the Sweetgrass Arch Mesozoic tectonics and sedimentation; In Tectonic Controls on Sedimentation, National Conference on Earth Sciences, University of Alberta, Conference Notes.

Dufresne, M. B., and Balzer, S.A. (1998)

Dufresne, M.B., Olson, R.A., Schmitt, D.R., McKinstry, B., Eccles, D.R., Fenton, M.M., Pawlowicz, J.G., Edwards, W.A.D. and Richardson, R.J.H. (1995). The Diamond Potential of Alberta: A Regional Synthesis of the Structural and Stratigraphic Setting, and Other Preliminary Indications of Diamond Potential. MDA Project M93-04-037, Alberta Research Council Open File Report 1994-10.

Edwards D.J. and Brown, R.J. (1994). Tectonic heredity in West-Central Alberta: recognition and significance; In Ross, G.M. (ed.), Lithoprobe Alberta Basement Transect Workshop, Lithoprobe Secretariat, University of British Columbia, Lithoprobe Report 37:164-194

Edwards, D., Scafe, D., Eccles, R., Miller, S., Berezniuk, T., and Biosvert, D. (1994). Mapping and resource evaluation of the Tertiary and preglacial sand and gravel formations of Alberta; Alberta Geological Survey; Energy and Utilities Board, Open File Report 94-06.

Fipke, C.E. (1993). Significance of chromite, ilmenite, G5 Mg-almandine garnet, zircon and tourmaline in heavy mineral detection of diamond bearing lamproite. GAC-MAG Joint Annual Meeting, Edmonton, Alberta, May 17-18, 1993, unpublished Program with Abstracts, 30pp.

Fipke, C.E., Gurney, J.J. and Moore, R.O. and Moore, R.O. (1995). Diamond exploration techniques and emphasising indicator mineral geochemistry and Canadian examples; Geological Survey of Canada, Bulletin 423, 86pp.

Geological Survey of Canada (1990a). Gravity anomaly maps of Canada; Canadian Geophysical Atlas, Maps 4, 5 and 6, scale 1:10,000,000.

Griffin, W.L., Ryan, C.G., Gurney, J.J., Sobolev, N.V., and Win, T.T. (1991). Chromite macrocrysts in kimberlites and lamproites: geochemistry and origin. In H.O.A. Mayer (ed.), Proceedings Vol., Fifth International Kimberlite Conference, Araxa, Brazil, 1991, Special Publication 2/91, p. 142-144.
Gurney, J.J. and Moore, R.O. (1993). Geochemical correlation's between kimberlitic indicator minerals and diamonds; In Diamonds: Exloration, Sampling and Evaluation; Proceedings of a short course presented by the Prospectors and Developers Association of Canada, March 27, 1993, Toronto, Ontario, p. 147-171.
Haimila, R. (1995) 1995 Assessment Report, Metallic and Industrial Permits Nos: 9393080543 to 939080547; Unpublished assessment report prepared by R. Haimila for Dr. T. Yoshida; ID#: 19950029
Haimila, R. (1996). 1996 Assessment Report, Metallic and Industrial Permits Nos; 9394110001 to 9394110004; Unpublished assessment report; ID# 19970001.
Haimila, R. (1997). 1996 Assessment Report, Metallic and Industrial Permits Nos: 9394020021 to 9394020023 and 9394030001; Unpublished and confidential report.
Hellmstaedt, H.H. (1993). Natural diamond occurrences and tectonic setting of "primary" diamond deposits; In Proceedings of a short course presented by the Propectors and Developers Association of Canada; March 27, 1993, Toronto, Ontario, p.3-72.
Jago, B.C., Daniels, D., and Irwin, B. (1999). Diamond valuation certificate and comment on diamond recovery and indicator mineral chemistry reports. Unpublished confidential report prepared for Buffalo Diamonds Ltd. By Lakefield Research Ltd.
Leckie, D.A., Singh, C., Bloch, J., Wilson, M. and Wall, J. (1992). An Anoxic event at the Albian-Cenomanian Boundary: the Fish Scale Marker Bed, Northern Alberta, Canada; Palaeogeography, Palaeoclimatology, Palaeoecology, vol. 92, pp. 139-166.
Mitchell, R.H. (1986). Kimberlite: Mineralogy, Geochemistry and Petrology. Plenum Press, New York, 442 pp.
Nutcgekkm /r.H. (1989) Aspects of the pretology of kimberlites and lamproites: some definitions and distinctions; In Kimberlites and Related Rocks, Volume 1, Their Composition, Occurrence and Emplacement: Geological Society of Australia, S[ecoa; {ib;ocatopm Mp/ 14, pp. 7-46.
Mitchelll, R.H. (1991). Kimberlites and lamproites: Primary sources of diamond. Geoscience Canada, vol. 18, p. 1-16.
Ross, G.M., Parrish, R;.R., Villeneuve, M. (1998). Buffalo Head Terrane and Buffalo Head Craton; What's the difference and does it matter?; Calgary Mineral Exploration Group, 7th Annual Galgary Mining Forum, p.19-20
Scott Smith, B.H., (1995). Petrology and diamonds. Exploration and Mining Geology, vol. 4, no.2, p. 127-140.
SPECTRA (1997). HRAM Hanna Survey; SPECTRA Exploration Geoscience Corp.; various maps and figures.
SPECTRA (1998) HRAM Calling Lake Survey; SPECTRA Exploration Geoscience Corp.; various maps and figures.

Calling Lake Project Alberta. Mineral Assessment report 202004 Buffalo Diamonds (2000).
Novo Sibirsk (1995) Kimberlites of Yakutia Field Guide Book no.

REPRINTED FROM KIMBERLITES OF YAKUTIA FIELD GUIDE BOOK
NOVOSIBIRSK 1995

Chapter 3

UNDERLININGS + NOTATIONS HAIMILA 2004

SEARCH FOR DIAMOND DEPOSITS

to be APPIED to HALMCO CALLING LAKE AREA

STAGES OF GEOLOGICAL PROSPECTING PROCESS AND RELIABILITY OF PROSPECTING SYSTEMS IN SEARCH FOR DIAMONDS

In searching for Middle Paleozoic kimberlites, the territory of Yakutia is divided into the following landscape/geological areas:

– wide distribution of Post-Middle Paleozoic formations of thickness 200 to 300 m (exploration is not expedient on economic grounds);

– wide distribution of Post-Middle Paleozoic formations of different lithologies and thickness from 10 to 300 m (extremely complicated conditions for exploration);

– a wide distribution of Post-Middle Paleozoic formations of a few meters, wide development of ancient and present-day crusts of weathering, and flat, smooth relief (complicated conditions for exploration); and

– a thin autochthonous cover of Quaternary sediments with weak development of weathering crusts and moderately smooth relief (favorable conditions for exploration).

Search for kimberlite bodies in Yakutia is divided into two stages that are distinguished by a changing geological and economic objective of diamond prospecting.

At first stage, the geological and economic objective was prospecting over a vast area with the aim of developing an economically viable mining complex or complexes for a long production period. At this stage, limited resources dictated the type of exploration model and what targets and what processes should be specified.

The objectives of prospecting at first stage were to findthat the kimberlite bodies be sufficiently large in size, have distinct indicating parameters, and occur in relatively favourable landscape and geological conditions for prospecting. Such targets were discovered by heavy mineral sampling and magnetic surveys and by conducting the prospecting work uniformly over vast areas (i.e. using a reduced or "prospector scheme" in the search process).

Searching for kimberlites by heavy mineral sampling within areas of favourable and complicated landscape-geological conditions proved to be highly effective in diamond prospecting. This method found virtually all the kimberlite bodies in the investigated areas.

Kimberlite bodies occurring in conditions less favourable for heavy mineral sampling were discovered firstly by airborne magnetics and later at investigations on the ground. In that case, it was observed that commercially valuable sites were often characterized by fairly weak magnetization in comparison to highly magnetic non-diamondiferous pipes situated nearby.

In the "prospector scheme" processes good results were obtained during experimental investigations using aerogamma spectrometry in combination with aeromagnetics.

Finally, in search for non-magnetic kimberlites in fairly complicated conditions for diamond prospecting, EM and geochemical methods were used to detect secondary dispersion haloes.

The "prospector scheme" of searching for diamonds recently gained recognition in Tsyganov's "theory of reliability of geological prospecting systems". From analysis of data for known kimberlite fields which exhibit the above-mentioned exponential distributions of indicating properties, and taking into account the typomorphism of pipes in different fields, the exploration models for predicting lower limits for economic pipes for particular mining and geological conditions are being developed.

The accuracy requirements of prospecting grids and the desired representativeness of sampling in the "prospecting scheme" are defined for of each prospective area separately, depending on the model of target and the landscape-geological conditions. It allowed to re-estimate the prospecting results for previously investigated areas and distinguish additional possibilities of primary diamond occurrences for them.

A combination of criteria for evaluation of any diamond mineralization found in each particular are is used in all stages of prospecting.

The great effectiveness of the "prospector scheme" led to attempts to apply it in complicated landscape-geological conditions. A substantial amount of drilling, seismic prospecting and EM prospecting with large depth penetration, was added to combination of diamond prospecting methods. Although some favourable results were obtained, a large portion of the investigated areas turned out to be practically untested, so that even some economic pipes were not found.

The above-mentioned difficulties and limited effectiveness of the "prospector scheme" under complicated conditions, despite a considerable increase in cost, showed a necessity to change the technology in search for diamonds under complicated conditions.

The second stage of prospecting involves working in a region containing an operating mine. It required firstly a different exploration model than that used in the "prospector scheme". Study showed that targets near operating mines are kimberlite bodies of small size, of low- contrast indicating parameters, or they occur in landscape-geological conditions unfavourable for prospecting. There, a discovering of such targets is virtually impossible or requires an extremely considerable increase in the cost.

Based on the available scientific data on regional and local controls of diamond deposit locations in the Siberian platform and world, the following hierarchical sequence of intermediate targets was developed by Tsyganov: subprovince of diamondiferous magmatism investigation – "mineragenic zone" – kimberlite field – cluster of kimberlite pipes – locally narrow kimberlite prospective site - kimberlite body – diamond deposit. Each on these items has its own corresponding field work and its own set parameters for modelling and data processing.

Schematically, the prospecting stages are combined into four groups:

- early stages with the target being a territory prospective for a kimberlite field;
- later stages with the target being a locally narrow kimberlite prospective site;
- a stage of verification work with the target being a kimberlite body; and
- evaluation stages with the final target being an economic diamond deposit developed for operation.

The prospecting-searching models for the targets of each stage are the most valuable developments of geologists and researchers of "Almazy-Rossii Sakha" Company which have already led the Company to the new positive geological results in Russia and now are being appcated in abroad.

To solve the problems of diamond deposit searching confidently "the theory of geological prospecting systems-reliability" or "the theory of geological prospecting mistakes" has been introduced into the geological prospecting practice of Almazy [Tsyganov, 1986, 1994].

This "theory of geological prospecting systems-reliability" is based on the study of failure of the systems or their elements. Here, a failure means any possible or real omission of only one deposit of minimum commercial grade.

During the investigations of geological prospecting systems reliability, two definitions of "target" are used, common and special. Common means any element of the above-mentioned hierarchical sequence. Depending on the stage of diamond prospecting, one element of the sequence is chosen as a "common target". While investigating reliability of the systems, tectonic, geophysical and mineralogical indicating parameters become "special targets" for study by one or other method.

As a result, every geological prospecting system is divided into simple components, for example "the target of prospecting - the exploration method". The reliability investigations are worked out separately for every target-method pair and finally, the results are united using common quantitative indices of geological-prospecting system reliability.

Further, for every target-method pair the possible failures of method are classified and five types of failures are as follows:

- failures of targets to be indicated in the expected manner (bound up with variability of indicator properties of prospecting targets);
- failures attributed to landscape geological surroundings (bound up with the masking effect of components on the environment surrounding a target);
- failures of technical type (bound up with equipment error and/or insufficient density and/or accuracy of observation);
- failures of geological interpretation (bound up with mistakes made during geological interpretation and forecasting); and
- failures of evaluation and verification (bound up with mistakes made during assessment of prospecting results).

The next stage of reliability investigations was classification of failures according to their frequency and their influence on effective prospecting. Then, for the more essential of them, specific quantitative and qualitative indices were assigned. On that basis, a conventional special legend for mapping according to changes of factors which determine the prospecting reliability was worked out. Maps were made which serve as a basis for evaluation of

MAPS A+B for Halmco INC.

prospecting reliability and for protecting a higher quality scheme of prospecting.

The main results of using the theory of geological prospecting systems reliability in diamond prospecting investigations in the Yakutian diamondiferous province are as follows:

In mining areas [Tsyganov et al., 1991, 1993], there are known minimal commercial parameters of targets (kimberlite bodies). However, indicated features of pipes for each kimberlite field were determined and methodical techniques for increasing reliability were recommended.

By investigation of failures attributed to geological surrounding and failures of technical type, special maps defining reliability methods were made. The ways of reserving under these circumstances were then worked out. Early investigations of geological interpretation and evaluation reliability [Tsyganov, 1985] in the time then available, led to recommended choices of local kimberlite prospective areas in difficult landscape-geological situations and the use of the radio shading method. As a result the Amakinskaya expedition discovered six new kimberlites in difficult landscape-geological setting of the Alakit-Marshinskoe kimberlite field.

The most important result that an appreciation of prospecting reliability has in mining regions is expansion of the resource base.

Early study of diamond prospecting-reliability by the Almazy geological enterprises achieved quantitative results for use in shortening prospecting schemes and in defining areas where it would be effective. Also, in difficult landscape geological settings where prospecting was least effective, ways of transformation to staged technological prospecting were worked out. Nowadays the staging technology of investigations is being introduced widely. As the theory of prospecting systems reliability is used more widely in prospecting investigations, its principles have been adapted to geological mapping and to exploration for diamond deposits and other minerals.

TECHNIQUES OF GEOLOGICAL PROSPECTING WORKS

Continuous study of the Yakutian diamondiferous province implies several stages, each of them is aimed to solve the geological searching problems of different scale. They are as follows: regional geological investigations, geological mapping, and search for kimberlite occurrences.

Regional OF geological investigations of 1 : 1 000 000 to 1 : 500 000 scale include the deciphering of satellite images, deep seismic sounding (DSS) and deep magnetotelluric sounding along individual profiles supplemented by analysis of areal small-scale gravity, magnetic and geological prospecting has been carried out up to that time. These works provide information on the structure, depth of bedding, relief of earth crust and upper mantle, crystalline basement, and kimberlite-host Lower Paleozoic rocks. Finally, a conclusion either this territory is prospect for kimberlite magmatism, or not is made.

So called "covered" areas, within which diamond deposits are overlain by Upper Paleozoic - Mesozoic rocks, require the refinement of created before small-scale geological maps. This type of works, carried out in separate areas while regional investigating, is called "deep geological mapping". It is fulfilled in 1: 200 000 scale and includes remote investigations, analysis of gravimetry-magnetic maps of 1: 00,000 scale, field geology-geomorphological and geochemical works, profiles of searching drillholes at a 8 to 8 km up to 4 to 2 km grid, and drillholes for structural investigations (1 drillhole per 5000 km^2).

These works provide a creation of specialized paleogeological maps and, finally, a review diamond forecasting map in which the areas promising for kimberlite occurrences are shown.

Geological mapping of 1 : 50 000 scale for general search predictions is aimed to compile a common geological map, to study the structure of kimberlite-host Paleozoic basement, to study and map intermediate collectors of diamonds and indicator minerals, to map tectonic faults, folds, and magmatic rocks, and finally to indicate the areas promising in respect to kimberlite bodies and their associations (clusters).

Geological mapping process applies a number of geology-geophysical methods (deciphering of satellite images and aeropictures, airborne magnetics of 1:25 000 scale – at the preliminary stage), and furthermore, geology-geomorphlogical and search routes for sampling of collectors on indicator minerals and geochemical sampling. Field works are aimed to outline, analyze and re-check geophysical, geochemical and geological anomalies.

Within "covered" areas the geological mapping using natural outcrops and open-pit mines is added with deep geological mapping plus, if necessary, 1: 50 000 gravimetry mapping and special electrical investigations (along lines or areal) that are principally carried out to solve structural mapping problems.

To discover exposed kimberlite bodies it is enough to perform heavy mineral sampling and small-volume sampling of alluvium. Discovery of buried kimberlite bodies requires the study of ancient diamond collectors with the help of mining (running of prospecting pits and explorating trenches) and drilling. Traditionally, at general geological mapping, initially one hole per 10-20 km^2 is drilled. Furthermore, at individual promising areas the grid of search drilling is determined by a specific geological environment (lithology-facial features of the basal horizon of collectors, features of ancient relief, and so on). The areas promising for discovery of buried kimberlites are used to be drilled at a 4 to 2, 2 to 2, and 2 to 1 grid. The lines of pits and trenches are put around the contour of exposure of productive collector horizons in order to evaluate their diamond content.

In each case mine-drill works are accompanied by detailed study and sampling of sections. Geological and geophysical data are processed and interpreted. Geological, geomorphological and mineral resources maps together with a set of special maps (paleogeographical, paleogeomorphological, paleotectonic, lithology-facial and geochemical maps) are eventually created to serve as a base for a forecast map. Forecast map must represent a prospect evaluation of the studied territory where plots for further searching must be outlined.

Searching process itself is conducted at prospect plots that were outlined during the previous works. The main purpose of searching is the discovery of diamond deposits.

Geological and mining conditions of searching in the territory of the Yakutian diamondiferous province are very complicated and diverse. This causes a wide differentiation in application of special search methods and techniques which are able to provide positive results in any definite search situation. Nevertheless, two main types of landscape-geological environments can be recognized conventionally: 1) "open" territories where kimberlites are exposed or overlain by a thin (up to 5 m) eluvial-deluvial layer, and 2) "covered" territories within which kimberlite bodies are overlain by younger, than host rocks, magmatic and sedimentary rock sequences of different thickness.

At the stage of searching not only the set of methods, but also the succession of carried out geology-geophysical investigations are of high importance.

For "open" areas the set includes airborne magnetic investigations of 1: 10 000 scale, geology-geomorphological field routes for sampling plus somewhere surface magnetic and electric prospecting of 1:5000 scale. These works are performed at the initial stage of searching. At the second (final) stage the revealed mineralogical, geophysical, and geochemical anomalies are attested by drills and pits, and the plots of buried and modern alluvial sediments and basal horizons, where high concentration of indicator minerals was established, are sampled on diamonds.

Traditionally, during the sampling is done by core-drilling of 112 mm to 90 mm diameter. Permafrost occurrence gives an opportunity to use a compressed air to cool a drill bit and remove slime. Search pits have a mean section of 1.25 m^2. While sampling alluvium with a help of special light manual unit equipped with grading sieves of 8 mm to 1 mm cell dimension, the samples of 1 m^3 to 3 m^3 volume are washed out. Standard sample that is washed out using a Siberian trough is of 20 liters volume.

At the early stages of exploitation of "covered" areas the drilling was accompanied by seismic investigations. Now, they try to make the search process as cheap as possible, therefore, seismics is used only to resolve structural questions at the stage of general searching.

Search drilling at the prospect plots of "covered" areas is preceded by preliminary laboratory studies that are aimed to reconstruct the tectonic environment existed in the territory during the epoch of kimberlite magmatism. Such investigations apply the results of general searching and geological mapping. Besides, the whole available additional information is analyzed to suppress the negative effect of overlapping assemblages on the search process.

Mineralogical sampling search method plays a major role while searching for kimberlites in almost all the environments. This method has been developed during the period of exploitation of the Yakutian diamondiferous province to provide the prediction and evaluation of kimberlite diamond content and the solution of paleogeological problems concerning the development of indicator mineral haloes.

GEOPHYSICAL SUPPLEMENT FOR DIAMOND EXPLORATION

Geophysical methods are applied at all the stages of diamond searching to solve two main problems:

– preparation of areas to carry out the detail geological-geophysical searching works;

– searching for kimberlites as local geophysical targets.

The first problem is aimed to distinguish most promising areas within vast territories. The investigations are carried out using a complex of geophysical methods with final compilation of 1: 100 000, 1: 500 000, and 1: 200 000 scale maps and schemes to conclude on the probability for occurrence of unknown kimberlite field within any part of the territory under study.

Geophysical methods at the stage of regional searching are as follows:

- deep seismic and magneto-telluric sounding;
- profile seismic investigations;
- airborne magnetic and ground gravimetric studies.

Deep seismic and magneto-telluric sounding studies the structural features of the earth's crust and upper mantle. Previous works revealed that the territories where kimberlitic magmatism is manifested are characterized by abnormal deep section parameters – sharp increase of seismic velocities along the Moho interface up to 8.6–8.9 km/sec, strong complexity of surface structure of the upper mantle and intracrustal boundaries, growth of electric resistance in individual Earth crust layers. These and some other parameters compose a base for the interpretation of regional geophysical data while outlining the areas where unknown kimberlite fields could be found.

Areal deep seismic and magneto-telluric sounding implies the 10×10 km mean distribution of observation points using digital registration apparatus. Seismic stations function autonomously, without personnel. To stimulate seismic waves the chemical explosive substances are employed.

Profile seismic investigation is a main method to study the structure and tectonics of the territory while marking the areas promising for kimberlite occurrences.

The method of reflected waves as common deep point which main procedures were taken from the oil-searching practice has gained widest acceptance.

Seismic diffraction

Seismic section within the Siberian diamondiferous province incorporates the horizons with lithologic parameters that are stable along the strike on hundred and thousand kilometers. The horizons are separated by contrasting seismic boundaries where the reflection and refraction of elastic waves takes place. Recognition of such boundaries using seismic method allows to fulfill the very detailed study of the territory's structural outline.

Tectonic disjunctives represent the very important structural elements for they control the emplacement of kimberlite bodies. To date, a group of methods to reveal and trace the faults in wave fields that is based on the usage of dynamic and kinematic wave field parameters has been developed. To carry out seismic investigations the digital station with elastic waves stimulated by power-driven vibrational installation is employed. Moreover, such installation answers the ecological demands.

Primarily, the airborne magnetic and ground gravimetric methods provide the study of tectonics and structure of the territory to describe the families of faults that control the localization of the groups of kimberlite bodies.

As magnetic field elements, the faults are shown as extended linear anomalies which correspond to either basaltic dikes of different age intruding through tectonically weakened zones, or tectonic contacts that separate the metamorphic units of crystalline basement.

As gravitational elements, the faults relate to linear negative anomalies which correspond to the tectonic zones of leaky rocks.

The observation scales for the methods studying potential field are 1: 50 000 and 1: 25 000 when routes and profiles are laid across the strike of tectonic elements.

The second task of geophysical works is the search for kimberlite bodies as local geophysical targets. The complex of geophysical searching methods involves airborne and ground magnetic prospecting, electric prospecting using direct and alternating current, seismic prospecting and the method of interhole radiowave exposure.

To increase the searching reliability one or several methods are applied depending on the geological structure features of definite area.

Within the Siberian diamondiferous province there are two main types of geological structures on which the choice of applied geophysical methods depends.

The first type includes the areas where search targets are outcropped at the present surface level or buried beneath the thin alluvial sequences. In these conditions the search for kimberlite pipes is restricted by the application of airborne and ground magnetic prospecting of 1: 10 000 and 1: 5 000 scale and electric (direct current) prospecting of 1: 5 000 scale areal observations.

In magnetic field kimberlite bodies are seen as the isometric positive anomalies with the "off-contour" minimums typical of vertical heterogeneities. Magnetization of targets is of inductive type. Remnant magnetization of kimberlitic melt is commonly insignificant. Since kimberlites are hosted by carbonate rocks it is possible to reveal both high and weak magnetized targets by the usage of high-sensitive quantum and proton magneto-meters with 0.1 nT resolving ability.

Long-standing experience showed that some kimberlite bodies are not present as magnetic field anomalies due to epigenetic kimberlite alterations which disintegrated ore magnetic minerals. That is why the electric prospecting aimed to reveal local anomalies with increased conductivity has gained wide implementation. In these conditions the seismic and radiowave exposure methods are most informative.

wide implementation. In these conditions the seismic and radiowave exposure methods are most informative.

Seismic method implies the tracing of elastic waves reflected from not-deep seismic boundaries throughout the section of kimberlitic rocks. If seismic waves meet kimberlite body, the secondary waves will be generated at the boundaries of kimberlite pipe and inside it. As a result at the seismic section the local target is represented by wave diffraction. Despite high costs for areal seismic investigation the economical efficiency is achieved due to the less volumes of areal drilling.

Recently, the main technical problems of interhole radiowave exposure method have been solved and the method was introduced into everyday practice. The method is based on the mechanisms for the propagation of electromagnetic radio-frequency range waves in geological conditions. Aerial-feeder equipment emplaced into the boreholes is used as radiation and registration units.

MINERALOGICAL CRITERIA FOR KIMBERLITE DIAMONDGRAGE

The foundations of mineralogical criteria for kimberlite diamondiferousness were laid in the beginning of 70-ties in the work of N.V. Sobolev [1971] "On the mineralogical criteria for kimberlite diamondiferousness". He was the first to suggest that the minerals of mantle diamondiferous parageneses can be captured by kimberlite melts and transported to the earth's surface, and that the portion of these minerals in kimberlites must positively correlate with the portion of diamonds.

The detailed study of compositional features of crystal inclusions in diamonds, such as garnet, Cr-spinel, pyroxene, olivine, etc., allowed to recognize the types of upper mantle diamondiferous rocks and typomorphic compositional features of minerals associated with diamonds in nature.

The Siberian platform diamonds were shown to form in a rather wide compositional range of natural systems – from Cr-pyrope dunites extremely depleted in basaltic components to coesite-kyanite eclogites and grospydites essentially enriched in Si, Ca, and Al [Sobolev, 1974; Ponomarenko et al., 1976; 1977; Pokhilenko et al., 1977, 1980, 1982, 1993; Sobolev et al., 1984].

Among the various xenoliths of mantle diamondiferous rocks from the Yakutian diamondiferous province kimberlites there were found the exotic xenoliths of garnet pyroxenites [Ponomarenko et al., 1980], and ilmenite-pyrope lherzolites [Pokhilenko et al., 1976; Ponomarenko, 1977]. Mass-study of crystal inclusions (thousands inclusions) in diamonds from Yakutian kimberlites showed that over 95% of Yakutian diamonds relate to ultramafic assemblages, harzburgite-dunites paragenesis dominating (about 80%) [Sobolev, 1974; Efimova & Sobolev, 1977]. On the basis of available knowledge, while developing the mineralogical methods of the search for diamondiferous kimberlites, the main attention was paid to the study of specific compositional features of diamondiferous harzburgite-dunite minerals. It should be noted that for the search and forecast of diamondiferous kimberlites we use another compositional ranges for Cr-bearing subcalcium pyropes and Cr-spinels than South African geologists (Fig. 3.1).

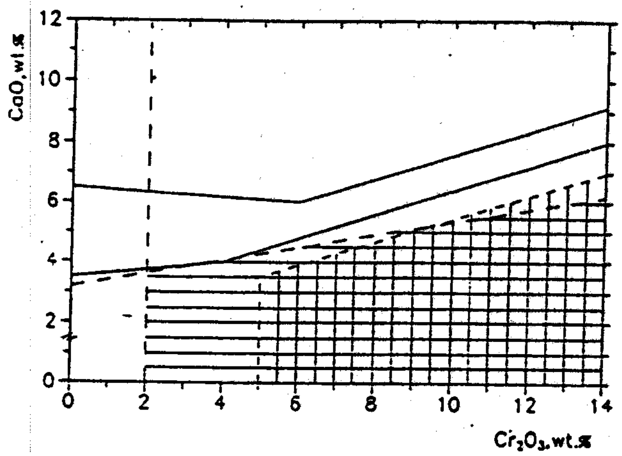


Fig.3.1. Estimation of a diamond content in kimberlites: western system – composition of garnets from G10 group (horyzontal shading); Russian system – composition of garnets from a diamond-bearing association (vertical shading)

According to our method the compositional field of subcalcium Cr-pyropes, that is used to determine the degree of potential kimberlite diamondiferousness, is restricted by $CaO = 1.6 + 0.38\ Cr_2O_3$ wt. %, $Cr_2O_3 = 5$ wt. %. The field of G10 garnets that is accepted by foreign geologists occupies quite larger area in the Cr_2O_3–CaO plot. Moreover, to increase the reliability of applied method we analyzed the compositional variations of pyropes from diamondiferous harzburgites (Ol-Ga-Opx-Chr-Diam) and xenoliths of graphite-bearing peridotites. Taking into consideration these results added with experimental data on the pyrope-knorringite immiscibility and reaction Ol+Pyr $\Leftrightarrow$ Opx + Chr in $SiO_2 - MgO - Al_2O_3 - Cr_2O_3$ system [Malinovsky & Doroshev, 1975; Kesson & Ringwood, 1989] we distinguished the narrow stripe in CaO– Cr_2O_3 coordinates which separates the field of Cr-pyropes from chromite-bearing harzburgites within the fields of graphite and diamond stability

6th International Kimberlite Conference

(Fig.3.2). All the points that occur to the right from this line belong to the diamond stability field. Varying portion of pyrope compositional points located to the left from this line relates to the graphite stability field – sometimes this portion can reach 100 %.

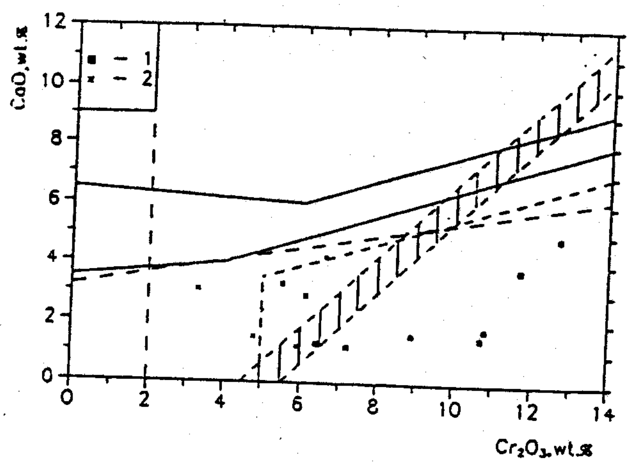


Fig.3.2. Composition of pyropes associating with chromite and enstatite in xenoliths of diamond- (black squares) and graphite-bearing (crosses) peridotites. Shaded stripe (14–17 mol. % of knorringite component) divides the fields of pyropes stability.

Thus, if the compositional points of Cr-bearing subcalcium pyropes fall to the right from the line, that separates the compositional fields for pyropes from Cr-graphite-bearing harzburgites and diamondiferous harzburgites according to the content of knorringite component, the pipe is uniquely diamondiferous.

If pyrope compositional points fall to the right from this line, the pipe seems to be diamond-free, since it can be related to the absence of mantle material that was captured at the levels where the pressure required for diamond stability can be reached.

The diamond-free kimberlite pipes with significant amount of such pyropes are available in both Yakutian and South African diamondiferous provinces.

The second mineral important for the evaluation of potential diamondiferousness of kimberlites is diamond associated chromite. Study of compositional features of chromite inclusions in diamonds and chromites from the xenoliths of diamondiferous harzburgite-dunites [Meyer & Boyd, 1972; Sobolev, 1974; Sobolev et al., 1975, 1984; Pokhilenko et al., 1993; Griffin et al., 1993] indicated that most of them contain over 62 wt.% Cr_2O_3 and less 0.7 wt.% TiO_2, and are characterized by quite low Fe^{3+}/Fe^{2+} ratio (Fig.3.3).

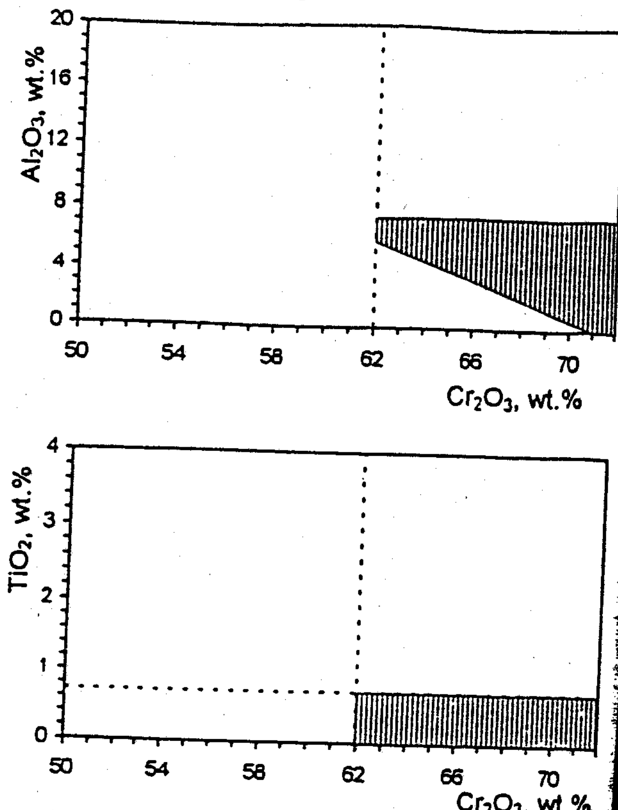


Fig. 3.3. Composition of chromites for estimation of a diamond-content.

Compositional field of chromites which we use in the forecast and search for potentially diamondiferous kimberlites is restricted by Cr_2O_3 wt. % = 71 – 1.637 Al_2O_3 wt. %, $Cr_2O_3 \geq 62$, $Al_2O_3 \leq 7.5$ wt. %, $TiO_2 \leq 0.7$ wt.%.

Aforesaid data show that our used compositional features of diamond-associated chromite are rather different from those used by South-African geologists [Gurney & Moore, 1994].

Also, we performed the analysis of the composition of diamond-associated olivines. Most olivines are high-magnesium varieties (Mg# = = 91.5 – 94.5) with low CaO (< 0.06 wt.%). This indicates high pressures and rather low temperatures of their equilibrium. These olivines certainly contain Cr_2O_3 impurity (> 0.02 wt.%). A distinct positive correlation between relative olivine content and grade of kimberlite diamond content is recorded.

Significant portion of eclogite assemblage garnets that are associated with diamonds are characterized by 0.n wt. % Na_2O impurity [Sobolev

& Lavrentiev, 1971; Sobolev, 1974; McCandless & Gurney, 1986, 1989]. In search goals we use the following compositional ranges of eclogite garnets that are present only in diamondiferous pipes: $Na_2O > 0.1$ wt. %; $FeO > 15.0$ wt. % $Cr_2O_3 <$ < 0.2 wt.%.

Above characterized compositional features of minerals from diamond-bearing natural assemblages were established basing on several thousands of analyses of mineral inclusions in Yakutian diamonds on one hand, and over 50 thousands analyses of indicator minerals from over 120 kimberlite pipes of Yakutian diamondiferous province on the other hand.

PROSPECTING FOR DIAMOND DEPOSITS BY MINERALOGICAL METHODS

Mineralogical searching is a leading method for the discovery of diamond deposits and would remain so in the nearest future. The possibility of the search for kimberlites is secured by the occurrence of indicator minerals, that are stable enough to be preserved in exogenic environment, such as pyrope, picroilmenite, Cr-spinel, some times olivine and clinopyroxene, plus diamond itself. Due to their mechanical and physico-chemical stability these minerals can be transported at great distances and preserved for a long time in ancient deposits, even in corrosive environment. Just the mineral steadiness allows them to keep the "memory" about those historical events that are recorded in minerals as their morphological features, physical, chemical and other properties. By studying these properties it is possible to reconstruct the history of minerals and conditions under which they existed during the formation of mineral haloes. Without such information it is impossible to choose the necessary technique for searching and to evaluate the prospects.

Two main problems are to be solved during the process of mineralogical searching: 1 – identification of indicator mineral haloes; 2 – localization of kimberlite body.

Identification implies to clear up the question – due to what known or unknown primary source this halo has formed. If the studied halo or its fragment is identified to a known kimberlite body, the search task is thought to be fulfilled. If the occurrence of unknown kimberlite body (bodies) is presumed, the next stage of identification is the determination of its expected diamond content basing on mineralogical criteria for diamondiferousness. In general, the solution of identification tasks permits to gain more-or-less detailed "portrait" of the search target and to conclude whether the search for given kimberlite body is expedient. If the search is expedient, the locality of kimberlite body should be defined.

Both problems are solved using the same mineralogical material – the samples of indicator minerals selected from present and ancient productive deposits. However, the methods of investigation of this material are different. Besides, the mentioned search scheme is idealization. What actually happens is that the solution of each problems is unfailingly connected with big difficulties and uncertainties. Traditionally, identification is complicated by three main groups of factors:

1) physico-chemical and mechanical wearing of minerals during the formation of haloes that results in significant changes of mineral appearance and composition of mineral assemblages;

2) polygenetic character of haloes, i.e. in one halo the minerals from different primary sources can be mixed;

3) heterogeneous and heterochronous character of haloes, i.e. they can result from the re-deposition of indicator minerals from more ancient haloes of different litho-dynamic type and different age.

Moreover, the accumulation of indicator minerals and the size of haloes depend on the amplitude of erosion levels.

Primary morphology of indicator minerals

To estimate the degree and mode of alteration of minerals during the formation of haloes correctly, the knowledge of their initial "primary" state in a kimberlite body is necessary.

The term "primary" state of mineral implies morphology, first of all. Mineral morphology is more sensitive to the change of geological environment. Along with chemical composition it provides the main body of information for searching. Morphology of kimberlite minerals results from their long deep development, and magmatic and post-magmatic alterations. The major indicator minerals valuable for searching are pyrope, picroilmenite and Cr-spinel.

The morphogenesis of pyrope from kimberlite includes four stages: 1 – idiomorphic growth, 2 – resorption, 3 – keliphitization, 4 – post-magmatic alteration [Afanasiev et al., 1979].

The first stage is illustrated by faceted pyropes that were preserved as inclusions in xenoliths and thus prevented from later alterations. However, such findings are very rare, hence it is difficult to evaluate the scale of idiomorphic growth processes in deep conditions. The display of other processes is universal. The fractured oval pyrope grains coated by keliphitic rim are typical of kimberlites.

The fracturing of pyrope is a very important process related to post-magmatic processes. The cooling of pyropes suppresses the movement of dislocations inside crystal lattice, so that inner pyrope strains cannot be relaxed. Thus, under cooling and decompression the pyrope behavior resembles that of fragile objects. The action of thermal solutions with high surface energy reduces the surface energy of a mineral. As a result, inner strain can exceed the value of crucial strain, and fracturing takes place. The behavior of other mantle minerals is similar. Inner strains of diamonds are seen as abnormal two-refraction. Besides, the zones of elastic strains inside crystals are distributed unevenly, and their amount of accumulated energy is different. First, fractures appear within the highest-energy zones. Then, fracturing can be caused by the action of substances with high surface energy. In particular, the processes of corrosional fracturing of minerals continue in erosion environment, during the formation of weathering crusts.

The fracturing of pyrope in the post-magmatic stage is favourable to the penetration of thermal solutions and development of chlorite and corrosional relief on the walls of fractures. Hindered access of thermal solutions into developed fractures is responsible for dendritic, streamy, and cavernous relief of their walls, whereas over the oval grain surface the geometrically regular tilled relief is found. The walls of some fractures, that are later likely, are clean and smooth. Thus, a typical shape of pyrope, that is transported due to re-washing of kimberlite body, is an angular fragment with corrosional relief or initial oval surface, plus chlorite and keliphite rims or without them.

Our knowledge of the initial stages of picroilmenite morphogenesis is poor. Oval picro-ilmenite grains were found in ilmenite-clinopyroxene-garnet xenolith with graphic texture. Picroilmenite that resulted from the re-crystallization of lamellae, i.e. the coarsening of ilmenite grains through the amalgamation of lamellae, took place. So, we can not affirm that any picroilmenite crystals were idiomorphic like pyrope. Also, there is no evidence on the oval picroilmenite habite as a result of magmatic resorption. Nevertheless, oval shape is typical of picroilmenite from kimberlite.

Oval surface is covered by the relief of two types: rough and micro-pyramidal. The latter likely has late-magmatic or early post-magmatic origin and resulted from a more rapid dissolution of defected boundaries between the microblocks of picroilmenite surface.

There are three types of picroilmenite grains: 1 – single crystals, 2 – aggregates, 3 – combined modes. X-ray investigations showed that single crystals possess highly defective structure. Individual blocks from picroilmenite aggregates are of rather perfect structure. Combined picroilmenites are characterized by highly defective single crystal part and aggregate part with a high-quality individual blocks. Investigations indicated that aggregate grains form due to the recrystallization of single crystals. This process is a result of mineral tendency to relieve the excessive elastic energy that is typical of plastically deformed picroilmenite single crystals. Combined modes illustrate the uncompleted recrystallization.

Kimberlite bodies are quite differing in the ratio of the mentioned groups. In most pipes there are 20–30% of picroilmenite aggregates, whereas in some pipes, the Uralskaya pipe as example, almost all picroilmenite grains are presented as aggregates.

One more typical feature of picroilmenite inner structure is exsolution texture. It represents the lamellae that are oriented parallely to picroilmenite pinacoid and characterized by wide compositional range – from Cr-titanomagnetite to chromite (up to 61 wt.% of Cr_2O_3). The specific surface of lamellae in picroilmenite is very large and tends to be lowered by two ways: 1 – coalescence of fine lamellae into coarser ones, 2 – lamellae become isometric to form faceted grains. The display of both processes can be seen within a single crystal. In picroilmenite we observed the octahedral crystals of Cr-spinel that resulted from the transformation of exsolved texture. These Cr-spinel inclusions practically lose the features typical of exsolved grains.

Study of thermo-electric properties allows the suggestion that ultra-minor exsolved elements in picroilmenite are rather widely distributed. However, large enough exsolved grains visible under optic microscope are rare. Their occurrence causes the cleavage of picroilmenite grains which is exhibited as lighter splitting of a crystal parallely to lamellae orientation. There are three pipes in which all the picroilmenites are characterized by well-exhibited exsolved structures: Zimnyaya (Verkhne-Muna field), Grenada and Nadezhda (norther Yakutian province).

In post-magmatic conditions the alteration of picroilmenite proceeds in two principle ways: 1 – replacement by secondary minerals, 2 – corrosional fracturing. Replacement results in the formation of grey-brown rim around picroilmenite that is composed of weakly crystallized rutile or anatase. Corrosional fracturing is similar to that of pyrope.

Due to the whole set of morphogenesis processes, the kimberlite haloes are supplied by angular fragments of picroilmenite grains with/without the traces of initial bossy-oval surface. The described morphological and structural features are exhibited to a different extent.

According to the degree of isomorphism, Cr-spinel from kimberlite holds the second place after diamond. There are three groups of faceted crystals: 1 – sharp-edge octahedrons with smooth faces; 2 – octahedrons which edges and points are smoothed by vicinal faces, i.e irregular surfaces of octahedral anti-skeletal growth; 3 – crystals with only vicinal faces or the relics of octahedral faces. X-ray investigation indicates that octahedral crystals have rather perfect structure of crystalline lattice, octahedrons with vicinals have a blocky structure, and vicinal crystals are composed of numerous disoriented blocks. Crystal morphology does not relate to crystal chemistry. One xenolith can contain Cr-spinels of the same composition but differing in morphology.

Cr-spinel with polished intact faces are rare in kimberlites. Traditionally, crystals are subjected to magmatic corrosion to a variable degree. Two types of corrosion are distinguished: 1 – the corrosion that affects only vicinal surfaces, whereas octahedral faces remain untouched; 2 – corrosion that develops evenly over the whole crystal surface. The degree of corrosion varies from weak to strong one. The latter practically annihilates the primary morphology.

The main mode of post-magmatic processes is corrosional fracturing. In most cases the fracturing happens as crystal spalling. In some kimberlite bodies the other type of fracturing was reported – microfracturing of the outer rim of crystal. Such fracturing is typical of Australian lamproites. Microfracturing is responsible for the origination of vast surface along fracture walls. This activates diffusive processes and therefore induces the change of the composition of microfractured zone.

The behaviour of chemical elements is differing, although the increase of Ti-content is a common tendency. Our investigations confirmed that compositional zonation of Cr-spinels, including that of Australian lamproites, was formed during epigenetic processes, but not growth.

Thus, kimberlite haloes are supplied by Cr-spinel crystals of differing morphology, that have undergone magmatic corrosion and corrosional fracturing, sometimes with a microfractured outer rim.

Thus, the study of Cr-spinels showed that kimberlite bodies can be differentiated statistically according to their morphological features (habite, type and degree of magmatic corrosion, intactness).

Secondary alternation of indicator minerals

At day surface and in sedimentary sequences indicator mineral occur in unequilibrium conditions. This is responsible for exogenic alterations. The unequilibrium of minerals and their assemblages relate to two groups of factors: mechanical and physico-chemical.

Mechanical factors are induced by gravitational instability of a relief unit, within which a kimberlite body is outcropped. As a result, the body erodes and indicator minerals are transported towards most negative relief modes. As peneplanation proceeds, the processes of erosion and transport of minerals attenuate, whereas the processes of their fixation and sedimentation enhance. The mechanical factors of evolution are manifested as three forms: hydraulic grading, change of mineral concentration in haloes, and mechanical wearing.

In general, the distribution of transported minerals relative to the primary source is of exponential shape:

$$P(x) = P_oe^{-bx},$$

where P(x) is a mineral concentration at x distance from the primary source; Po, the initial concentration of minerals in the primary source; b, the coefficient of mineral inertness that is proportional to hydraulic size of the minerals [Afanasiev, Babenko, 1988]. More large and heavy minerals with increased b values drop behind small and light minerals during transportation. This leads to the gravitational and granulometric differentiation of transported assemblages. For kimberlite mineral haloes this process is exhibited in the concentration of heavier picroilmenite (compared to pyrope) and accumulation of coarse-grained minerals near the primary sources. A relative portion of pyrope increases and mean grain size decreases far from primary source. The b coefficient depends on the transporting power of water flows. The greater is this power, the better proceeds the differentiation. Thus, the minerals are drawn farther and the initial assemblage changes to a greater extent. As the peneplanation proceeds, the range of mineral scattering decreases and grading of their assemblages deteriorates. So, the deterioration of granulometry and density indicates the low hydrodynamic activity of the environment and, consequently, a small distance of transfer. Also, this formula shows that the concentration of indicator minerals, as they move away from kimberlite body, decreases exponentially. Therefore, although indicator minerals can be transported at a great distance, their majority is concentrated nearby the kimberlite body.

These tendencies take place only in continental environment. In marginal basins minerals fall into quite different hydraulic environment that is characterized by to-and-fro motions of clastic matter under the effect of waves. The distribution pattern of kimberlite minerals is not stream like on the continent, but band-like with across zonation. Minerals realize their hydraulic properties due to persistent stirring-up. Thus, size and density differentiation reach the highest degree there. Even monomineral separations of a narrow size range can accumulate.

Another type of alteration is mechanical attrition of minerals. The degree of wearing depends on the diameter of particles, their density, abrasive stability and the rate and distance of transportation. For the sake of simplicity, the degree of wearing is often considered as a distance function, only. We believe, that it is necessary to take into account the kinematic and dynamic factors of transportation. They, in general, characterize the lithodynamic environment of transportation and, eventually, the lithodynamic type of a collector of kimberlite minerals [Afanasiev, 1896]. There are three ways of transportation of clastic particles: as a suspension, saltation, and dragging. Mechanical attrition is obviously caused by another type of transportation. The latter is realized in a mass of moving clastic matter, when the wearing results from not only mineral-bottom double interaction, but at least triple interaction, like a ball-free mill. This mechanism does not play a significant role in the bed-river plain flows that possess a low hydraulic activity. Our observations at a standard object (Verkhne-Muna kimberlite field and the halo in the Muna River bed) showed that at a distance to 100 km only pyrope grains over 2 mm size have the traces of attrition. In beach environment, hydrodynamic regime is much more intense to result in the movement of a whole sequence of clastic matter. In these conditions the "mill" effect plays the leading role. Besides, the velocity of waves is higher than that of bed flows, and the total way passed by clastic particles during to-and-fro motions exceeds all possible distances of their transport on the continent. Granulometric grading of minerals promotes mechanical attrition in these conditions, since the particles of nearly equal size contact each other multiply, and their rotation due to the transportation results in their intense mutual friction. Thus, the degree of wearing depends on the environment of wearing, rather than the distance of transportation.

According to abrasive stability the major deep-seated kimberlite minerals form a following sequence (decrease): diamond – zircon – Cr-spinel – garnet – olivine – picroilmenite – Cr-diopside. It should be noted that the common opinion of low mechanical steadiness of olivine is wrong. Olivine strength is close to that of garnet. In present haloes they are transported together at tens kilometers. Olivine is preserved even in ancient sea-beach collectors not disturbed by crusting processes, e.g. in Jurassic conglomerates of the Lena River region. Quick "disappearance" of olivine from indicator mineral assemblages relate to its low content in most kimberlite bodies. Therefore, moving away from a primary source olivine soon stops to be detected by equal volumes of sampling. As olivine is low tolerant to erosion processes it is absent in ancient haloes.

Each kimberlite indicator mineral belongs to different paragenetic type, whose properties range widely. For example, due to increased fracturing, orange pyropes are less stable in abrasiveness, relative to most violet pyropes. Most "mature" i.e. strongly mechanically evolved sea-beach heavy mineral assemblages are represented by only monomineral garnet assemblages, or nearly so (e.g. the halo in Early Carboniferous gravellites of the Kyutyungdin graben). In these haloes diamond, that is similar in density and granulometry to garnet, can be accumulated to form rich diamondiferous placers. The absence of picroilmenite is explained by its almost complete annihilation due to attrition. According to our investigations picroilmenite abrasive stability is 9-10 time less than that of pyrope [Afanasiev et al., 1994].

Physico-chemical alteration of kimberlite minerals proceeds in a sedimentary sequence after the haloes are completely formed. There are four types of such changes known: weathering, diagenetic, metagenetic, under metasomatism.

The diagenesis processes effect rather weakly on kimberlite minerals found in a sediment. The main mode of alteration is corrosional fracturing.

Crust-formation processes are most powerful factors of epigenetic alteration of kimberlite minerals [Afanasiev et al., 1986]. The weathering of minerals is displayed as replacement, dissolution, and fracturing.

For garnet, two types of dissolution, were recognized: cuboid and dislocative.

Cuboid type is characteristic of garnets with a few of defects. Dissolution results in positive relief forms: drop-like, rugged, and eventually convex-face cuboid (Fig. 3.4). Dislocative type of dissolution is characteristic of the grains with a lot of defects (Fig.3.5). Corrosional fracturing and etching slits and channels develop by the dislocation and their accumulations (junctions).

Picroilmenite is either replaced by leucoxene (Fig.3.6), or dissolves to form a disordered cavernous relief (Fig. 3.7). The aggregate grains become loose.

Cr-spinel is rather stable during epigenetic alteration. The main form of weathering is corrosional fracturing that results in scattering and micro-fracturing (Fig. 3.8).

Weathering stability of kimberlite indicator minerals reduces from diamond to zircon, Cr-spinel, picroilmenite, pyrope, Cr-diopside and finally olivine. Haloes undergone weathering contain no olivine. Cr-diopside is preserved very rarely.

Fig. 3.4. Pyrope cuboid.

Fig.3.5. Pyrope with dislocation type of corrosion.

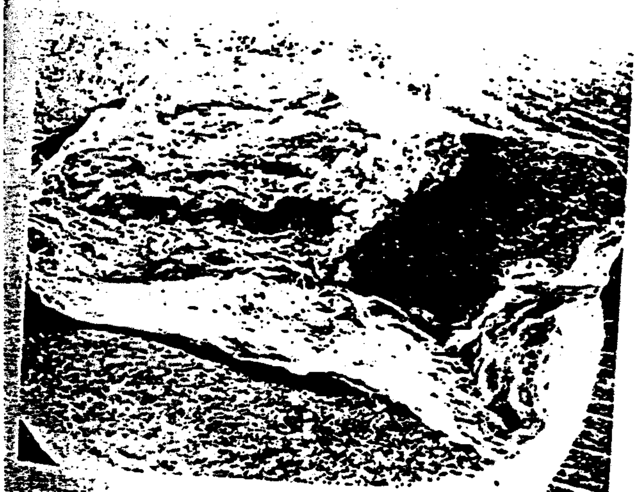


Fig. 3.6. Picroilmenite with leucoxene.

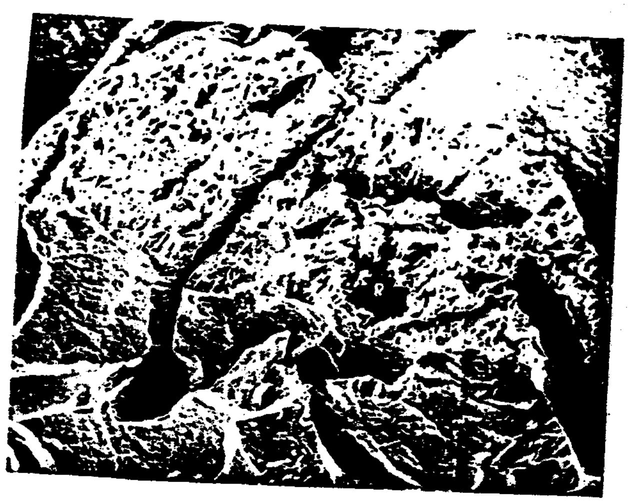


Fig. 3.7. Picroilmenite with dissolution relief.

The pyrope stability is sufficient for it to be kept in weathering crusts, however, pyrope is most sensitive indicator of the process of weathering. Picroilmenite and Cr-spinel can bear no signs of weathering, while they are available on the pyrope. No changes of diamond and zircon within the crust of weathering are established. There are also differences in stability of one-mineral varieties. Stability of pyrope depends on Cr-content [Afanasiev et. al., 1984]. Therefore, weathered assemblages are rich in violet Cr-garnet from ultramafic assemblages, since Cr-poor orange garnets from mafic assemblages are predominantly destroyed. Thus, the same regularity is noted like for mechanical stability. There are several individual samples where mainly Cr-rich spinels are disrupted.

Fig. 3.8. Chromespinelide with microfissured rim.

The haloes of the Malo-Botuobiya region contain Mg- and Ti-poor picroilmenites that are ferromagnetic at room temperature. However, these picroilmenites are endemic for this region. As for paramagnetic picroilmenite, they show no distinct regularities in the change of assemblage composition.

As a whole, the processes of weathering cause a significant change in composition of heavy mineral assemblages and physiographic features of kimberlite minerals.

Metasomatic alteration of kimberlite minerals was established at the contact zones between the intrusions of differentiated traps and either kimberlite, or sedimentary rocks. The signs of metasomatism processes are found on the minerals from Upper Paleozoic sequences of the Malo-Botuobiya region and in the south-western Alakit field, where the Krasnopresnenskaya pipe is cut by differentiated trap intrusion. Under these conditions, garnet is replaced by chlorite to form pyramidal-tilled relief along the reactionary front [Afanasiev, 1985]. Picroilmenite dissolves to form crystal brushes of brown anatase. Cr-spinel is covered by tiny caverns and becomes loose due to corrosional fracturing. Diamond is unstable in metasomatic environment and therefore acquires the signs of catalytic oxidation. Relative stability of minerals during metasomatism is not estimated, yet. A stronger replacement of orange garnets by chlorite relative to Cr-rich violet garnets is noted. The intensity of alteration decreases far from the contact with intrusive body. In the near exocontact zone kimberlite minerals can completely disappear.

Metagenetic alteration of kimberlite minerals is established in folded zones, particularly, in Triassic sea-beach collectors of the Near-Upper Yana region [Afanasiev et. al., 1985], and in the Takatinskaya suite deposits of the Urals. The alteration is principally caused by the temperature and pressure growth. Pyrope alteration in these conditions is close to metasomatism: replacement by chlorite and creation of pyramidal-tiled relief take place. Orange Cr-poor garnets are replaced more intensively. As only sea-beach pyrope-bearing collectors were studied, the behavior of other minerals is unknown, yet.

A general trend of mechanical and physico-chemical alterations is responsible for the "maturation" of heavy mineral assemblages, i.e. elimination of non-stable individuals. Often the "maturation" is expressed as lowered dispersion of various properties of mineral assemblages, such as size, morphology and composition of mineral grains, etc. General course of evolution of mineral assemblages is exhibited on one hand in simplification of mineral composition due to the elimination of less-stable minerals. On the other hand, a partial erasure of "primary" signs, that characterize the mineral state in kimberlite, and their replacement by "secondary" signs, that reflect exogenic condition of mineral existence, take place. Exogenic alterations are specific for their character can provide our knowledge of the conditions under which they occurred. However, such phenomena as corrosional fracturing of minerals or creation of pyramidal-tiled relief can take place in different environment. Therefore, the type of geological setting should be taken into consideration.

The types of haloes of indicator minerals

The reconstruction of ancient halo formation conditions shows that haloes form in three lithodynamic environments, according to which the three types of haloes are recognized: 1 – alluvial, 2 – alluvial-beach, 3 – sea-beach.

Alluvial type of halo is formed in continental environment. There, indicator minerals from eroded kimberlite are transported by rivers, and together with other clasts migrate towards the sea. Typical features of these haloes are: 1 – by-stream distribution of indicator minerals, 2 – exponential decrease of mineral concentrations away from kimberlite bodies, 3 – low velocity of mineral grading, 4 – weak mineral wearing (minerals are found at a distance of tens kilometers).

Alluvial-beach haloes are formed within depressions with unstable hydraulic regime, periodical flooding by sea, irregular shore line and existence of ephemeral reservoirs. This environment is responsible for important specific features of haloes such as: 1 – filament-net areal distribution of indicator minerals, 2 – local display of high graded mineral assemblages, 3 – local display of increased concentration of indicator minerals, 4 – moderate wearing of minerals.

Sea-beach haloes are formed within a sea shore zone. There, for a long time the indicator minerals carried from continent are subjected to to-and-fro motions caused by the action of sea waves. As a results, in sea-beach setting the haloes with following typical features are formed: 1 – highest mineral wearing, 2 – formation of mainly pyrope-diamond assemblage due to the annihilation of less stable picroilmenite, 3 – highest grading of minerals, 4 – areal character of mineral distribution, 5 – unusually high mineral accumulations due to the additional mineral supply from the continent. The major and most reliable sign for the distinction of halo types is the degree of mineral mechanical wearing. We would like to note once again that the degree of mineral mechanical wearing depends not on the distance of mineral transportation, but the conditions of halo formation. If kimberlite body occurs not far from the sea shore line, the relative minerals would be strongly rounded just near to it. Nevertheless, our investigations of the present stream scattering in the Verkhne-Muna field showed that mineral transport by alluvial agents at distances over hundred kilometers causes only weak wearing evidences. In respect to searching studies each halo type possesses its own favourable features and restrictions. Alluvial type of haloes is most favourable to the search for primary sources. This results from the weak alteration of indicator minerals and their assemblages during the formation of haloes, and from the location of mineral concentration maximums near a kimberlite body. In these conditions diamond placers are formed at the cost of diamond-rich kimberlites and dispose near them. Sea-beach type of haloes is less favourable to the search for kimberlites. Mechanical alteration of minerals and the grading of mineral assemblages strongly distort the primary appearance of minerals. Besides, the minerals from different kimberlite bodies are mixed in these haloes. High concentrations of minerals are formed independently on their remoteness from primary source. Nevertheless, such environment is favourable to the accumulation of placers. As the coastal zone is supplied by diamonds from many kimberlite bodies, the diamond-rich placers can be formed from low-diamondiferous primary sources.

The areal character of the distribution of indicator minerals was mentioned to be an important feature of sea-beach type haloes. Actually, the ancient sea-beach haloes are of the same sort. They result from the transgressive movement of shore line towards the continent. Thus, the minerals that were re-sorted within a coastal zone appear at the bottom, away from the zone of wave action. Further, they are retained and buried by finer sediments. Being formed within a narrow belt of coastal zone the halo remains at the sea bottom, behind the moving shore line, and occupies a vast territory.

Heterogeneous and heterochronous character of the haloes of indicator minerals

Above there were described the "primary" types of haloes. The reason for their formation is that kimberlite bodies are a single deliverer of indicator minerals into haloes. This situation exists at the first stage of kimberlite re-washing. The formation of haloes stops when the cycle of sedimentation is finished, i.e. after the retain of minerals in a sediment and their burial by finer deposits. The same deposits cover kimberlites. In geological history, however, after the formation of kimberlite bodies, usually several cycles of sedimentation take place, during which the formed before deposits that contained indicator minerals can be partially or fully washed out. In this case indicator minerals travel from the ancient deposits to younger ones. Simultaneously, the buried kimberlite bodies are unsealed to deliver indicator minerals into the deposits under formation. Thus, in the following stage of sedimentation the haloes are supplied by minerals from two sources: 1 – ancient deposits, 2 – kimberlites. Therefore, in the forming halo the indicator minerals from the same kimberlite bodies, that were however washed out in several time stages, are mixed. Thus, indicator mineral assemblage acquires the heterochronous character.

Besides, the change of sedimentation regime can result in the mixing of the indicator minerals of different halo lithodynamic types, for example, sea-beach and continental.

Heterogeneous and heterochronous character of indicator mineral assemblages in alluvial and ancient deposits is typical of all the diamondiferous regions, in particular, the territory of Yakutian diamondiferous province. Only primary haloes related to the initial stage of kimberlite re-washing can be monogeneous and monochronous. The relics of these haloes can preserve fragmentally in a favourable structural-tectonic environment.

Re-deposition of minerals and heterogeneous-heterochronous character of halo assemblages cause big difficulties to the process of searching. Re-depositing breaks the direct link of indicator collector. In the Alakit field, the Upper Paleozoic deposits that cover kimberlites, contain also the minerals from Middle Paleozoic collector. However, the portion of minerals that were directly taken from kimberlites during Upper Paleozoic sedimentation is significantly higher.

Thus, the ancient haloes, like the present alluvial haloes of the II type of search setting, contain re-deposited, i.e. heterogeneous and heterochronous, material. Due to the multiple re-deposition in many haloes of the Malo-Botuobiya region, the minerals of all three lithodynamic halo types and altered in different degree can be found in a single sample. Taking into account the difficulties of sampling and the re-deposited character of most indicator minerals, the use of mineralogical method is insufficient to provide the discovery of kimberlite body. The facilities of this method are restricted by the recognition of somewhat certain area, within which the further searching should be carried out using either geophysical methods, or drilling on a dense grid. Like in the II type of search setting, the search results depend on the proportion of amplitudes of kimberlite erosion before and during the formation of the deposits that cover kimberlites.

In the Malo-Botuobiya region, where Upper Paleozoic collectors are widely distributed, the pre-Upper Paleozoic erosional level reaches 300 m, whereas the Upper Paleozoic erosional level is ten times lower. As a result, the bigger haloes overlap each other and contain chiefly re-deposited material. In these environment to separate the local prospect areas is very difficult.

In the Alakit field, the amplitudes of pre-Upper Paleozoic and Upper Paleozoic erosion are low and nearly equal. That is why rather small haloes occur close to primary source and contain both re-deposited material and the products of the Upper Paleozoic re-washing of kimberlites. Therefore, although both regions are situated in the same setting the results of their searching significantly differ: none kimberlite pipes were found beneath Upper Paleozoic deposits in the Malo-Botuobiya region, and tens buried pipes were discovered in the Alakit field.

Type IV. This setting is characterized by the wide distribution of ancient primary or re-deposited haloes of sea-beach lithodynamic type. In both, primary and re-deposited states these haloes were noted above to be unfavorable to the search for primary diamond deposits. Nevertheless, many diamond placers are connected with those haloes. Often, rich diamond placers are formed due to the re-deposition, since the streams accumulate in their beds the diamonds from the whole area which they drain.

Ancient sea-beach haloes are widespread in all the diamondiferous regions. We faced just these haloes in the first stage of searching. As the final aim is the discovery of primary diamond sources, the question arises is it possible to use these haloes for primary evaluation of diamond content. Special studies revealed that in the Yakutian province, at adjacent areas, the sea-beach parts of heterogeneous haloes are differing in the chemical features of pyrope and picroilmenite assemblages. This proves, that different segments of a single vast sea-beach collector were fed by different groups of kimberlite bodies, likely not very remote relatively each other. The character of the relief of the Siberian platform helps to understand this fact. The Siberian platform represented a peneplanated territory with low hydrodynamically active relief. Low hydrodynamic activity could not provide the transport of clastic material, including indicator minerals, at great distances. Fluctuation of the World Ocean level resulted in rapid transgressions and regressions of shallow-water seas, which in turn were responsible for the formation of sea-beach haloes. Thus, these haloes were supplied by not too remote kimberlite bodies. The transgression of basin could lead to the covering of kimberlites by sea-beach deposits. For example, we found rounded (up to balls) and corroded pyrope grains from sea-beach halo in the sample from eluvium of the Zarnitsa pipe, the Daldyn field. This proves that before the pipe was buried by sea-beach collector, after its washing out, the pyrope found themselves at the surface of pipe.

Thus, although it is impossible to search for kimberlite bodies after sea-beach haloes, the latter can be useful for small-scale forecast.

In conclusion, we can affirm that the various kinds of exogenic alteration of indicator minerals, differing lithodynamic environments for halo formation, differing geological structure and history of studied areas determine the different manner of searching – its facilities, restrictions, and results – in each definite situation. The available information promotes to choose the best fashion of searching process, or, if the prediction is unfavourable, to refuse from searching over that territory and in doing so avoid redundant time losses and save funds.

Identification and localization: implications for the prediction of diamond deposits

The discovery of diamond deposits by mineralogical methods requires solving two problems: 1) finding and identifying an indicator mineral halo; 2) localizing the primary source. Identification of haloes and localization of deposits are the components of prediction process being individual in each certain case. Nevertheless, there are some common rules that concern the procedure of identification and localization.

Identification regards those features of indicator minerals and their assemblages that do not strongly change during erosion, or when such changes can be taken into account. These features must illustrate the "portrait" of sought kimberlite body, i.e. they must keep the primary information about this body. In practice, two groups of features are used widely – physiographic and chemical features. Physiographic features include morphology, colour, fracturing, inclusions in transparent minerals, i.e. those signs that can be visually observed. One can always find those features according to which kimberlite bodies can be distinguished.

Most popular method for the determination of mineral chemical composition is X-ray microprobe analysis. The processing of microprobe results is aimed to solve two problems: 1) to evaluate the diamond content of primary source; 2) to compare samples in order to decide either they originate from a single source, or from different sources.

Theoretically, there is a lot of mineralogical features that can be used in identification goals. In practice, their number in limited by our research facilities, mostly: 1 – analytical database, 2 – possibility to interpret the obtained data in terms of identification. The latter situation is not trivial. If there are no reliable interpretation methods or they are poor, the intense mineralogical investigations (including those expensive) provide either poor search effect, or even false information.

Most identification features require the study of representative selection. Besides, it is difficult to identify the halo according to one-two features. Traditionally, the reliable solving of identification problems demands the use of several related features.

The signs of localization are those that strongly and regularly change away from a primary source. Firstly, these signs relate to the migration properties of minerals. The solving of localization problems is most topical for the third types of search setting, because in first and second types the migration of minerals is easily traced by the streams. When the searching is carried out accordin to the ancient haloes, the sampling is performed without the referencing to ancient streams, i.e. blindly. Therefore, the supposed whereabout of kimberlite body can be determined only by analyzing of the distribution of indicator mineral samples over the area, applying the signs of localization. We use the following set of major localization signs: 1 – concentration of minerals (exponentially decreases away from the source); 2 – granulometry – grain size (assemblage becomes poor in coarse grains away from the source); 3 – ratio of silicate to heavier ore minerals, firstly pyrope and picroilmenite (increases away from the source); 4 – degree of size grading (becomes higher away from the source); 5 – degree of wearing (becomes higher away from the source) [Afanasiev, 1989b]. In exotic cases, some more complex signs can be used.

Each sign is applied with account to its individual search value. The noted above signs are listed in the order of their value reduce.

We have worked out a special algorithm that allows the quantitative estimation of samples and recognition of local mineralogical anomalies related to kimberlite bodies.

Special method of mapping the haloes during exploration for buried diamond deposits has been developed and successfully tested in the Alakit field. There, this method permitted to find a large number of local mineralogical anomalies, some of them seemed to be related to the already known kimberlite bodies. For other anomalies the kimberlite occurrences are predicted. And some anomalies are referred to primary sources that were discovered within the recognized prospect areas using mainly geophysical methods.

Conclusion

Mineralogical methods of the searching for diamond deposits possess their own possibilities and restrictions. Their balance defines the effectiveness of these methods. In turn, on one hand, this balance depends on certain geological setting of search areas, geological history, lythodynamic types of haloes, and character and degree of exogenic alteration of indicator minerals. One the other hand, this balance depends on the mineralogy, size, age, erosion level, and other features of kimberlite bodies themselves. Therefore, there are no simple and universal rules to the search for diamond deposits. In each case, the search problem requires imaginative approach that should be based on extensive knowledge which some aspects were briefly characterized.

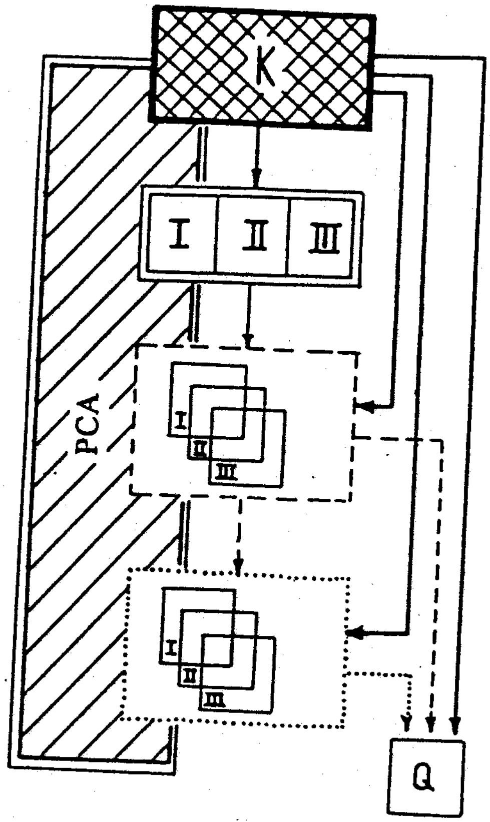
On the whole, the system of mineralogical search used in Russia has solved the problem of diamond exploration for different types of exploration condition, and permits one to evaluate possibilities and predict results. Due to the genetic approach to various aspects of the mineralogical search system, it could be adapted to most types of searching condition in different diamondiferous regions.

minerals and their primary source. According to the re-deposited minerals only local areas, where kimberlite bodies could occur, are possible to be predicted. Locality of forecasting depends on the type of re-deposited halo. Alluvial haloes are more favourable for searching.

To differentiate the re-deposited mineral is possible according to several signs, which most important are: 1 – a discrepancy between the wearing degree of minerals and formation conditions of their hosting deposits (for example, highly rounded pyropes of sea-beach halo type are found in present alluvial deposits in which they could not acquire such degree of rounding); 2 – recorded physico-chemical alteration of minerals that is incompatible with the conditions of formation and further existence of their host deposits (when present alluvial deposits contain the minerals with the signs of weathering). Therefore, a mineral keep the "memory" about the preceding events of its history. Sometimes, the signs of several sedimentation cycles, which traces are superimposed on previous ones, can be seen on the mineral. The knowledge of the regularity of indicator mineral behaviour in different exogenic environments allows the reconstruction of geological history during those periods which are impossible to describe (for example, if there are no geologically documented sedimentary sequences available).

During the re-depositing, indicator minerals displace relative to their previous location, i.e. haloes are dispersed (crawled away). However, often, newly formed continental deposits, being host for re-deposited minerals, are deluvial-proluvial or alluvial deposits of small rivers, i.e. formed in the setting of near transport of clastic matter. Thus, in most cases indicator minerals displace at small distances, and the newly formed halo, to a first approximation, inherits the location of preceding halo, or is displaced insignificantly. This is an important fact for it allows the usage of re-deposited minerals in forecasting goals.

Thus, the formation of indicator mineral haloes, according to which the search for diamond mineral deposits is carried out, is a complex multi-stage process. The general scheme of halo development is shown in Fig.3.9.



IMP.

Fig. 3.9. Evolution of haloes of indicator minerals. K– kimberlite body, I, II, III – lithodynamical halo types: I – alluvial, II – alluvial-beach, III – beach, PCA – physics-chemical alterations; Q – modern alluvium, → erosion of kimberlite body; ==> – redeposition of indicator minerals from ancient collectors.

Mineralogical types of search setting

Individual character of geological structure and geological history of each diamondiferous region, diversity of lithodynamic halo types, widespread processes of mineral re-deposition and their related heterogeneous and heterochronous character of mineral assemblages are responsible for the individual manner of searching that is required for each individual plot. In general, four search settings can be distinguished [Afanasiev et. al., 1981a].

Type I. Kimberlite bodies are exposed, ancient collectors of indicator minerals, and therefore re-deposited minerals are absent. Thus, alluvium is supplied by indicator minerals immediately from kimberlites by only those rivers that drain kimberlite bodies themselves. In this case the manner of searching is simple – by the "road" of indicator minerals, up stream of a river or brook, and along the slopes of valley, as far as the kimberlite body outcrops. However, one stream can be supplied by indicator minerals from several kimberlite bodies. Hence, it is necessary to sample not only river bed sediments, but all side tributaries and slopes in order to miss no one pipe. This type of search setting deals with only alluvial halo type which indicator minerals are weakly altered relative to those from a primary source.

Therefore in this situation, the detailed mineralogical investigations are not topical. They can be compensated by a dense grid of sampling of river-beds and slopes, that is sufficient to record all the targets. While using the mineralogical criteria only the evaluation of the diamond content of sought target is needed.

This type of search setting is not typical of the Yakutian diamondiferous province. It is available only in the Central-Aldan region, at the Khatystyr, Tobuk, and Chompolin clusters of pipes, the latter being not diamondiferous. The age of these pipes is post-Middle Jurassic, the younger deposits are unknown. The study of the structure and mineralogy of haloes confirmed the absence of re-deposited minerals there.

Type II. Kimberlite bodies are exposed; the existed ancient collectors were fully washed out. Therefore, there are two sources of indicator minerals – ancient collectors, from which the minerals are re-deposited into new deposits, and kimberlites. While being re-deposited, the minerals are spreading away and fall in all the streams within given area. The minerals from kimberlites fall only in those streams that drain kimberlite body. Thus, the streams washing kimberlites will carry both minerals from kimberlites and re-deposited minerals. The other streams will carry only the re-deposited material. In this setting the searching process must be based on the minerals from kimberlites. The re-deposited minerals are not suitable for searching. So, there appears the problem of reliable recognition of re-deposited minerals and minerals supplied instantly from kimberlites. The solution of this problem demands detailed mineralogical investigations that should be based on the knowledge of exogenic alteration features of indicator minerals. Along with, the mineralogical criteria for diamondiferousness are to be used, however, individually for each group.

This type of search setting is available at the vast territories of the northern Yakutian province. There, kimberlite-hosting Lower Paleozoic rocks outcrop. However, the results of mineralogical searching highly vary from one part of this territory to another.

In the Daldyn field, the results of searching are rather successful. Today, this field is thought to be a standard of search. In the Ebelyakh region (northern province), we failed to find kimberlites using mineralogical search methods in spite of a great amount of indicator minerals. This principally relates to the proportion of the amplitudes of ancient and present kimberlite erosion. In the Daldyn field, these amplitudes are comparable, therefore it is rather simple to observe the minerals taken from kimberlites among the re-deposited minerals. In the Ebelyakh region, the amplitude of ancient erosion is much higher, therefore, a great amount of indicator minerals was released. On the background of abundant indicator minerals, the products of coeval re-washing of kimberlites are very difficult to be recognized.

In the II type of search setting the mineralogical method is applicable if to success to distinguish the minerals arrived from kimberlites and re-deposited minerals. The search is held only by first group minerals. However, mineralogical methods are better to be added with geophysical methods, in particular, magnetic prospecting (airborne and ground magnetics).

This type of search setting if typical of not only the Yakutian diamondiferous province, but other world diamondiferous regions, where kimberlite bodies are exposed. If there is a lack of geological information about the existence of ancient collectors, it will be provided by the study of kimberlite indicator minerals in terms of the character and mode of exogenic alterations.

Type III. Kimberlite bodies are buried beneath the younger sediments that are the collectors of indicator minerals. This type of search setting is more complex due to the covering of both kimberlite bodies and indicator mineral haloes. Their sampling is performed either by mines and open pits, or drilling holes. In this case, we are not able to carry out "aimed" sampling, i.e. to select the most suitable places for sampling like on the opened areas. Besides, the volumes of sampling are small. Moreover, our investigations showed that the ancient haloes of Yakutian province also contain indicator minerals re-deposited from earlier collectors. So, Upper Paleozoic haloes of the Malo-Botuobiya region chiefly contain the minerals re-deposited from completely re-washed Middle Paleozoic (Upper Devonian ?) collector. Jurassic deposits from this region contain the minerals re-deposited from Upper Paleozoic collector, that in turn include the minerals from Middle Paleozoic collector. In the Alakit field, the Upper Paleozoic

Devyatov V. P., Knyazev V. G., Sapjyanik V. V. (1988). Marking horizons in the Siberian Lower–Middle Jurassic deposits. In: Regional stratigraphy of oil-and-gas Siberian regions. Novosibirsk, SNIIGGiMS, pp. 53–60.

Diday E. (1973). The dynamic clusters method in nonhierarchicol clastering. Intern Jour. of Computer and Information Sciences, № 2, pp. 61–88.

Dobretsov N. L. (1980). Introduction to global petrology. Novosibirsk, Nauka, 199 p.

Fainshtein G. H. (1947). The main features of geological structure of the eastern Tungus basin. Materials on geology and useful minerals of East Siberia, issue 22.

Gaiduk V. V. (1988). The Vilyui Middle Paleozoic rift system.Yakutian Branch SB AS USSR. Yakutsk, 128 p.

Genshaft Yu. S., Ilupin I. P., Kulichin V. M., Vitorzhents G. Ch. (1983) Typomorphism of ilmenites of deep–seated magmatic rocks. In: Composition and peculiarities of deep–seated rocks of the Earth crust and upper mantle of platforms", Institute of the Earth Physics, Academy of Sciences (USSR). Moscow, pp. 95–90.

Griffin W. L., Sobolev N. V., Ryan C. G. et al. (1986) Trace elements in garnets and chromites: diamond formation in the Siberian Lithosphere. Lithos,V. 29, pp. 235–256.

Gurney J. J., Moore R. O. (1994) Geochemical correlations between kimberlitic indicator minerals and diamonds on the Kalachari Craton. Geol. & Geophys., V. 35, № 2, pp.12–24.

Ilyukhina N. P., Verbitskaya N. G. (1976) Formation conditions and stratigraphy of coaliferous Carboniferous deposits on the Siberian platform. Sov. Geol., № 5, pp. 45–59.

Ilupin I. P. (1979) Content of phosphorous and sera in Yakutian kimberlites. Geochem., № 9, pp. 1042–1052.

Ilupin I. P., Kryuchkov A. I. (1975) To some regular relationships between various xenoliths from the Udachnaya pipe. Sov. Geol., № 4, pp. 115–118.

Ilupin I. P., Kaminsky F. V., Francesson E. V. (1978) Geochemistry of kimberlites. Leningrad, Nedra, 353 p.

Ilupin I. P., Kortman R. V., Nikolaev L. I., Simonenko V. Ph. (1979) New data on geochemical zonality of kimberlite fields of the Yakutian province. Doklady AN SSSR, V. 249, № 2, pp. 449–451.

Ilupin I. P., Vaganov V. I., Osipov Yu. A., Podchasov V. M. (1981) Two groups of kimberlites in the Daldyn field of the Siberian kimberlite province. Doklady AN SSSR, V. 261, № 4, pp. 957–960.

Ilupin I. P., Kuligin V. M., Rakovsky E. E. (1982) Peculiarities of chemical composition of ilmenite as indication to specifics of deep–seated magmatic chambers. In: Physics–chemical investigations of products of deep–seated magmatism, Institute of the Earth Physics, Academy of Sciences (USSR). Moscow.

Ilupin I. P., Sviridov A. M. (1987) New data on geochemical zonality of the Daldyn kimberlite field, Doklady AN SSSR, V. 297, № 1, pp. 200–203.

Ilupin I. P., Vaganov V. I., Prokopchuk B. I. (1990) Kimberlites: Directory. Moscow, Nedra, 248 p.

Ilupin I. P., Lebedeva L. I. (1991) Peculiarity of picritic porphyrites from Kuoyksky field of the Yakutian kimberlite province. Geochemistry of magmatic rocks, Abstracts of 16th All–Union seminar, Geochemical Institute, Academy of Sciences (USSR). Moscow, pp. 150–151.

Ivanov V. V., Ilupin I. P., Starozhitskaya M. I., Grosse Yu. I. (1977) Distribution of copper, silver and gold in deep–seated inclusions and kimberlites of Yakutia. Geochem., № 7, pp. 1038–1051.

Kanygin A. V., Moskalenko T. A., Yadrenkina A. G. et al. (1985) Stratigraphy of Ordovician and Silurian deposits, West Yakutia (drilling constrains). Biostratigraphy and biogeography of Siberian Paleozoic. Novosibirsk, pp. 43–55.

Kesson S. E., Ringwood A. E. (1989) Slab–mantle interactions. 2. The formation of diamonds. Chem. Geol. V. 78, pp. 97–118.

Kimberlites, diatremes and diamonds: Thier Geology, Petrology and Geochemistry / Eds. G. R. Boid, H. O. A. Meger (1979). Amer. Geophys. Union. Washington D. C. 20006, p. 400.

Kirina T. I., Mesezhnikov M. S., and Repin Yu. S. (1978) To the new local Jurassic divisions in West Yakutia. In: The new data on stratigraphy and fauns of the Jurassic and Cretaceous in Siberia. Novosibirsk, pp. 70–85.

Kostrovitsky S. I., Egorov K I. (1983) Multi–stage character and mechanism of kimberlite pipe fillif. Geol. & Geophys., № 5, pp. 42–49.

Kryuchkov A. I., Nikulin V. I., Krasinets S. S. et al. (1991) Conditions of localizations and structural features of a new kimberlite body in the Aikhal region. Geol. & Geophys., № 5, pp. 61–68.

Lebedev–Zinoviev A A., Ilupin I. P. (1981) ? Concerning geochemical zonality of kimberlite fields of the Yakutian province. Doklady AN SSSR, 1976, V. 230, № 1, pp. 206–208

Lipatova V. A., Afanasiev V. P. (1986) Mineralogical and palinological ground for existence of pre–Middle Carbon intermediate collectors of kimberlite minerals at the north of Malo–Botuobyn region. Doklady AN SSSR, V. 288, № 6, pp. 1453–1456.

Malinovsky I. Yu., Doroshev A. M. (1975) Stability of garnet of pyrope–knorrinsite row in the field T=1000–15000°C and P=20—25 kb. Novosibirsk, Nauka, pp.23–3

Maximov V. M. (1941) To the stratigraphy of Jurassic deposits near the Yakutsk Town. Izv. AN SSSR. Ser. geol., № 6, pp. 16–26.

McCandless T. E., Curney J. J. (1986) Sodium in garnet and potassium in clinopyroxene: criteria for classifying mantle eclogites. 4th Intern. Kimber. Conf., Perth, Ext. Abst. Vol., pp.282–284.

Meyer H. O. A. (1987) Inclusions in diamonds. In: Mantle xenoliths. Chichester, England, J. Wiley & Sons, pp. 501–522.

Meyer H. O. A., Boyd F. R. (1972) Composition and origin of crysstalline inclusions in natural diamonds. Geochem. Cosmochem. Acta, V. 36, pp.1255–273

Mikailov M. V., Tesakov Yu. I. (1972) Upper Cambrian, Ordovician, and Silurian stratigraphy of the mide–setrams of Vilyui River. Geol. & Geophys., № 1, pp. 32–42.

Milashev V. A. (1972) Physico–chemical conditions of kimberlite formation., Leningrad, Nedra, 176 p.

Milashev V. A. (1979) The structure of kimberlite bodies. Leningrad, Nedra..

Odintsova M. M., Gutova L. N., Bogdasheva L. I. (1967) Stratigraphy. In: Jurassic continenta; deposits of the southern Siberian platform. Moscow, pp. 19–118.

Ogienko L. V., Byalyi V. I., Kolosnistyna G. R. (1983). Ordovician and Silurian biostratigraphy in the Daldyn–Alakit region, Yakutia. Geologie & Geofizika, № 26, pp. 29–34.

Petrochemistry of kimberlites (1991) Kharkiv A. D., Zuenko V. V., Zinchuk N. N. (Eds). Moscow, Nedra, 304 p.

Pokhilenko N. P., Sobolev N. V., Lavrent'ev Yu. G. (1976) Xenolith of diamondiferous ilmenite–pyrope lherzolite from the Udachnaya kimberlite pipe, Yakutia. Doklady AN SSSR, V. 231, № 2, pp. 238–441.

Pokhilenko N. P., Sobolev N. V., Lavrent'ev Yu. G. (1977) Xenoliths of diamondiferous ultramafic rocks from Yakutian kimberlites. Ext.Abst., 2nd Intern.Kimberlite Conf., Santa Fe A.G.U.

Pokhilenko N. P., Pearson D. G., Boyd F. R., Sobolev N. V. (1991) Megacrystalline dunites and peridotites: Hosts for siberian diamonds. Annual Rep.Dir.Geophys.Lab.Carn.Inst.Wash., pp. 11—18

Pokhilenko N. P., Sobolev N. V., Boyd F. R. et al. (1993) Megacrystalline pyrope peridotites in the Siberian Platform Lithosphere: mineralogy, geochemical peculiarities and the problem of their origin. Geologia & Geofizika, № 1, pp. 62—81.

Ponomarenko A. I., Sobolev N. V., Pokhilenko N. P., Lavrent'ev Yu. G. (1976) Diamondiferous grospydite and diamondiferous kyanite eclogites from the Udachnaya kimberlite pipe, Yakutia. Doklady AN SSSR, V. 226, pp. 927–930.

Ponomarenko A. I., Spetsius Z. V., Lyubushkin V. A. (1977) Kyanite eclogite with coesite. Doklady Academii Nauk SSSR, V. 236, pp. 200–203.

Radchenko G. P., Shvedov N. A. (1940) Upper Paleozoic flora from coaliferous deposits in the western Nizhnyaya Tunguska River basin. SRIGA (NIIGA) Publ., Leningrad, V. 157.

Rozhkov I. S. (1964) The localization of placers and their primary sources within the Yakutian territory. In: Geology of Yakutian placers. Moscow, Nauka, pp. 5–43.

Sarsadskikh N. N., Blagulkina V. A. (1970) Petrochemical features and composition of Siberian kimberlites. In: Geology and and conditions of formation fo diamondiferous deposits. Publish., Perm'.

Shabanov Yu. Ya., Astashkin V. A., Vaganova N. V. et al. (1987) Lower Paleozoic deposits of SW flank of the Anabar anticlise: drilling constrains. Novosobirsk, Nauka, 208 p.

Sobolev V. S., Nai B. S., Sobolev N. V. et al. (1969) Xenoliths of diamondiferous pyrope serpentinites from the Aikhal pipe, Yakutia. Dokl. Acad. Nauk SSSR, № 5, p.188.

BACKGROUND INFORMATION FOR KIMBERLITES
DIAMOND EXPLORATION (NORTH AMERICA), SPECIFICALLY CALLING LAKE

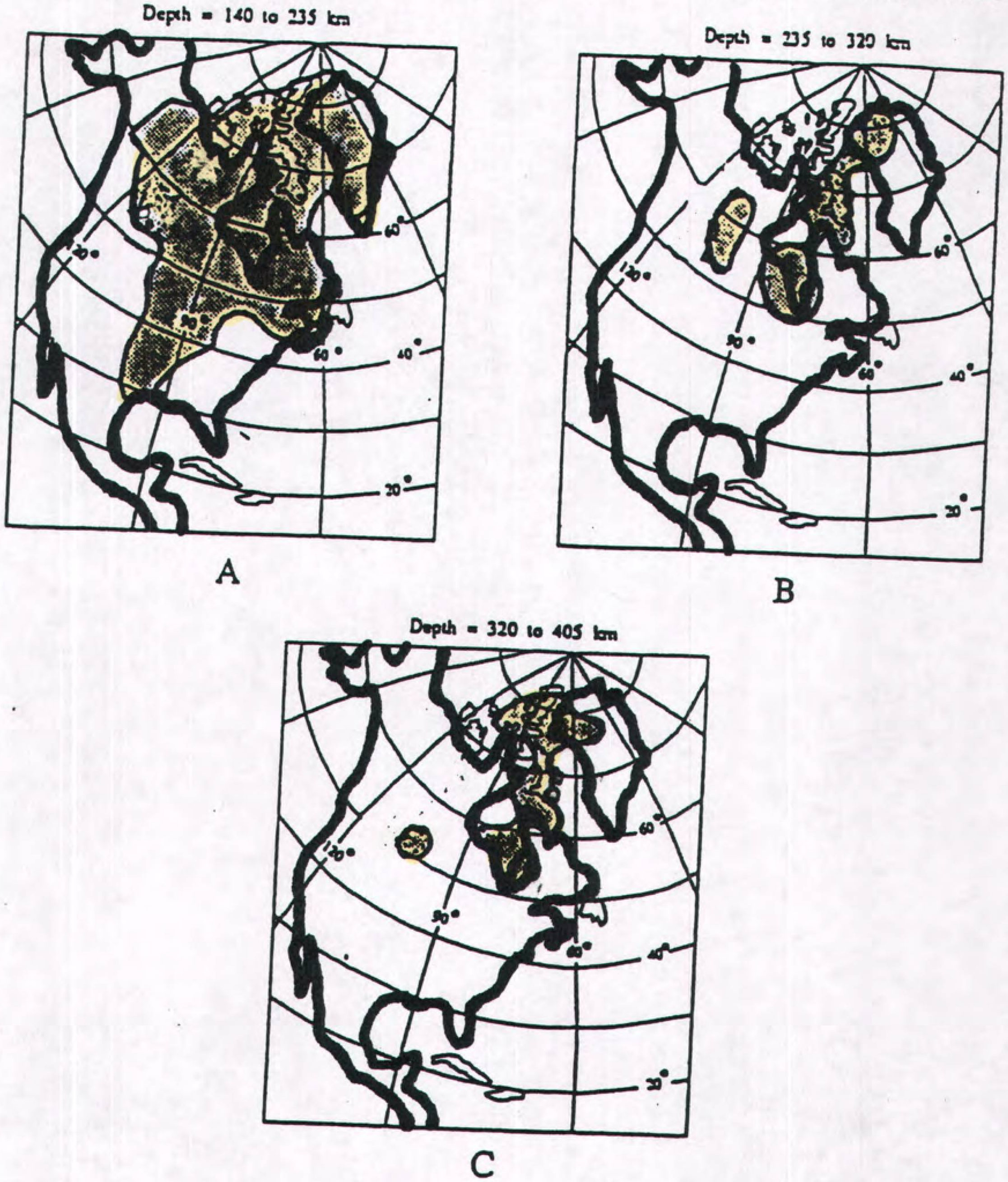
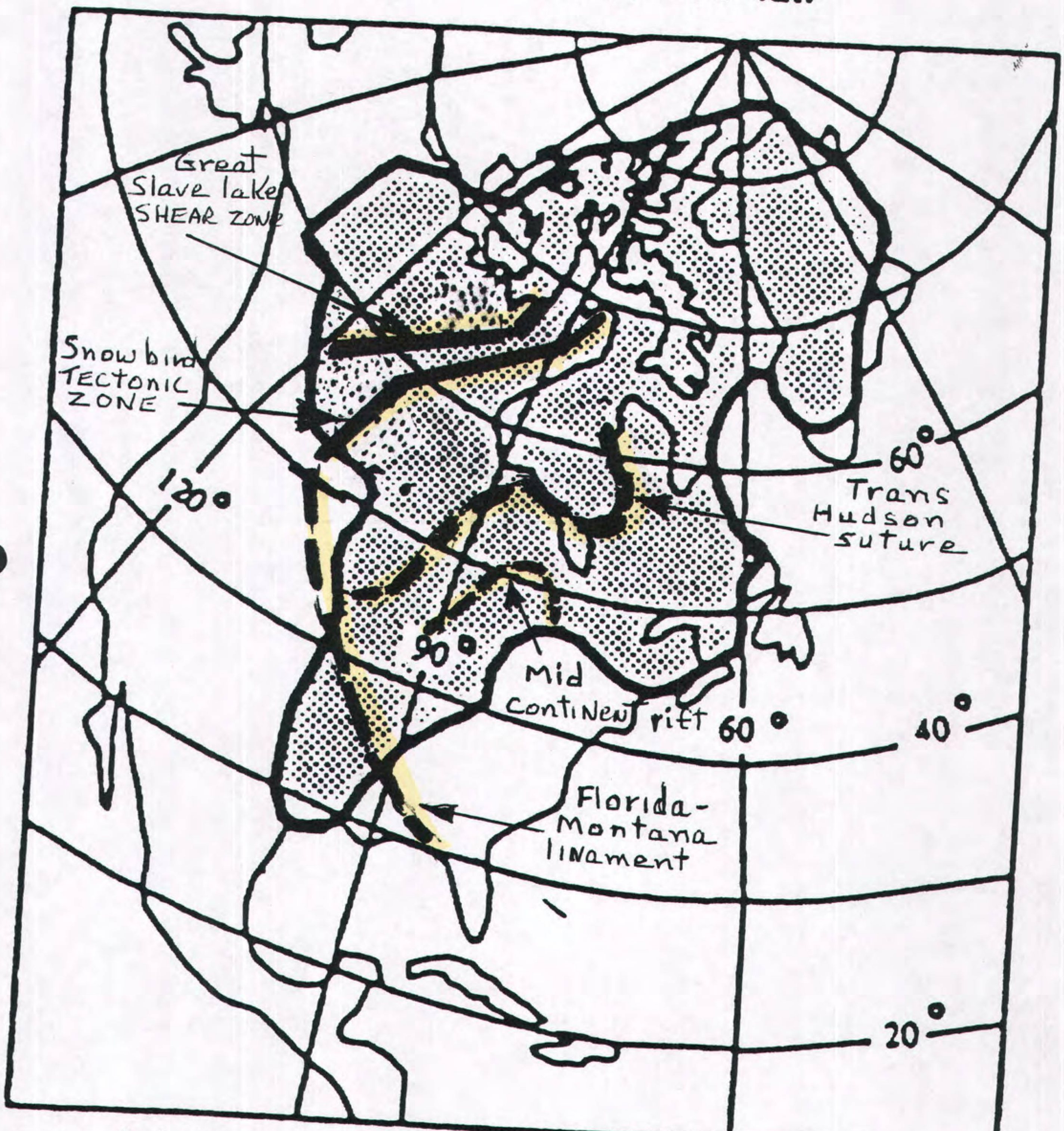


Figure 29. Shear wave velocity perturbations under North America from seismic tomography (after Grand, 1987). For clarity, only the +3% contour is indicated for depths of 140-235 km (A) and 235-320 km (B). Contour for 320-405 km (C) is +1.5%. Note that deep mantle roots exist under the Archean Slave and Superior Provinces, but not under the Nain and Wyoming provinces (see Helmstaedt and Gurney, 1992).

(reprinted from "DIAMONDS - Theory and Exploration"
GEOLOGICAL ASSOCIATION of CANADA, 1995)

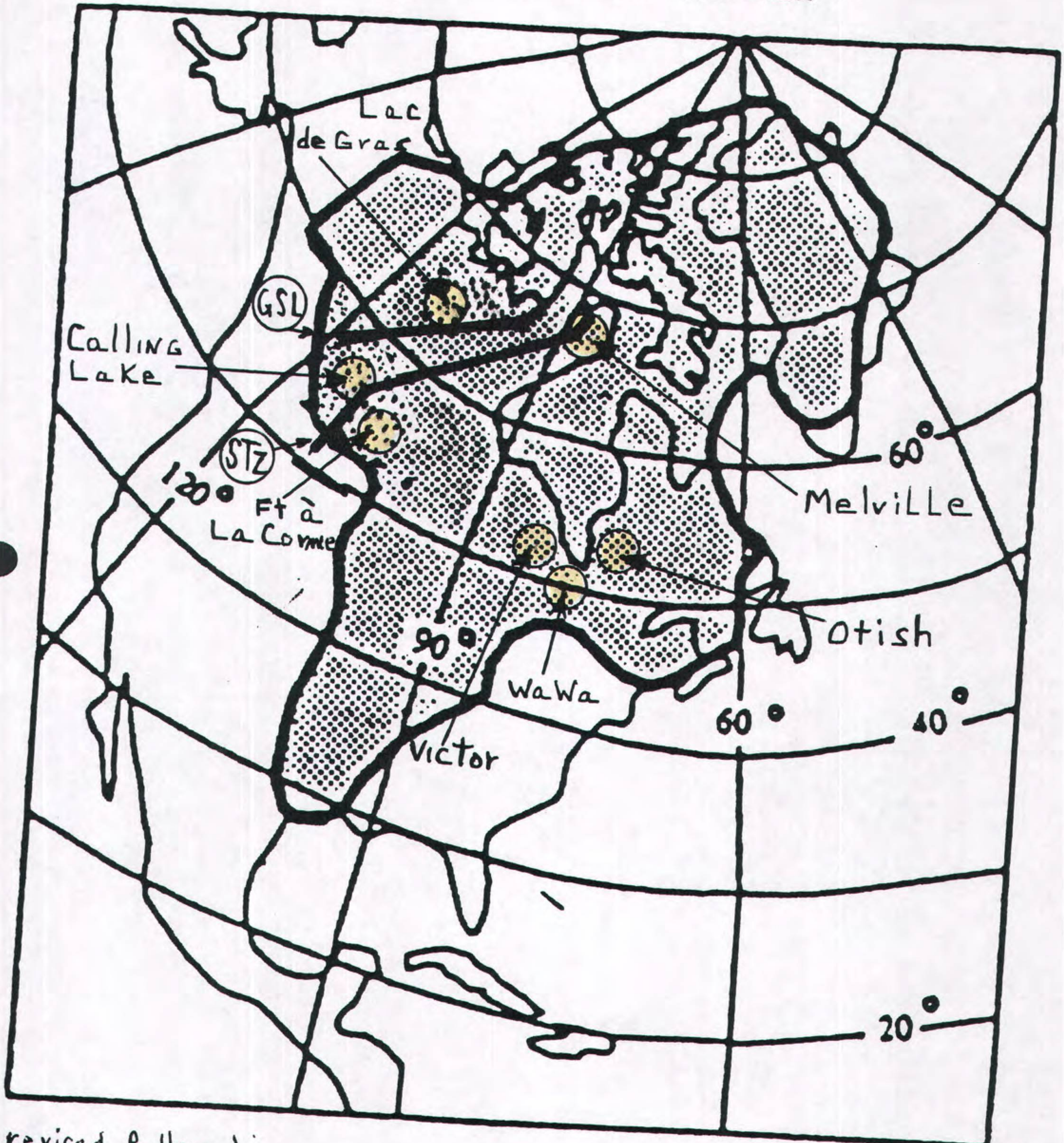
Depth = 140 to 235 km



revised R Haimila

A1

Depth = 140 to 235 km



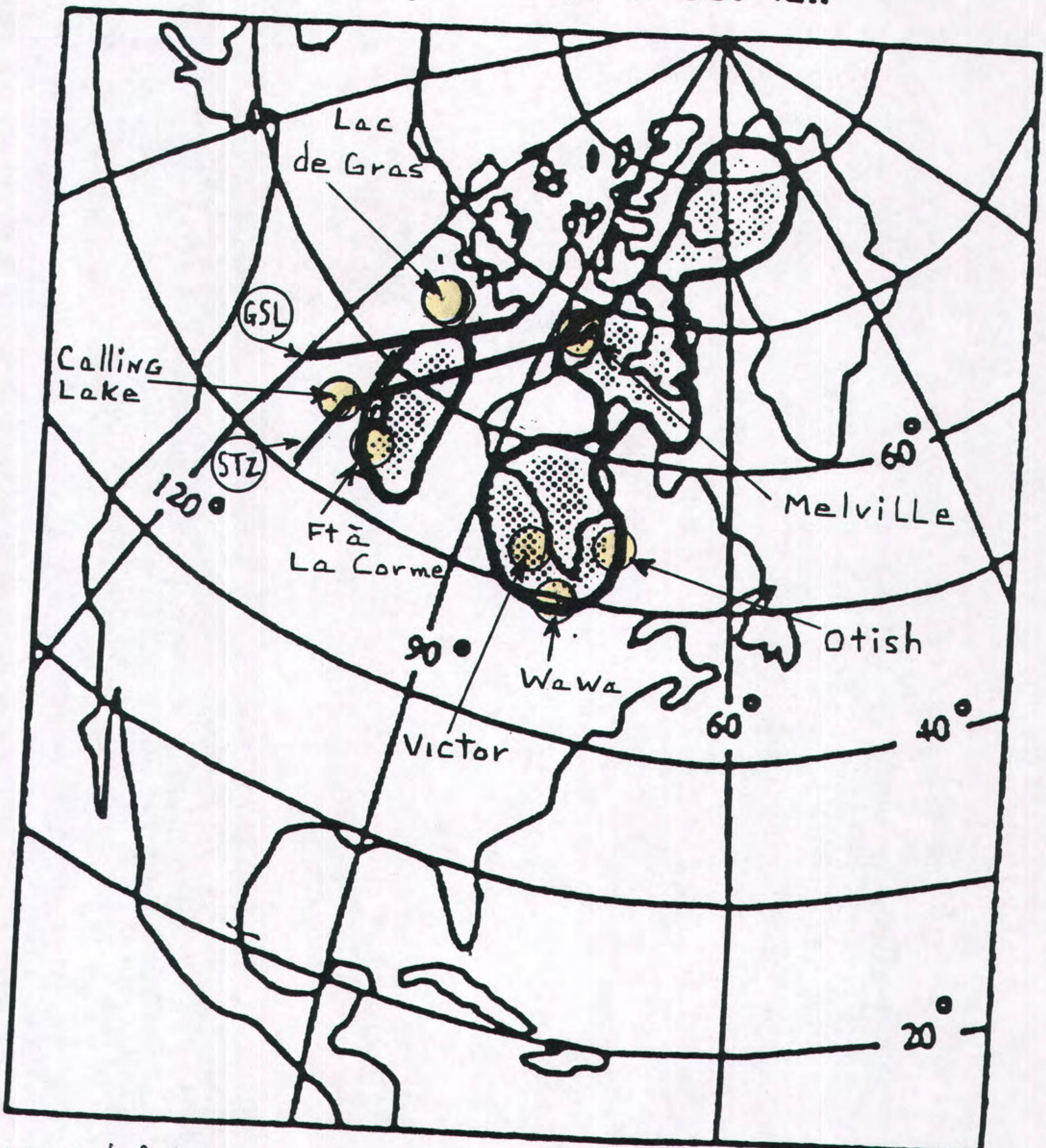
revised R. Haimila

A 2

GSL = Great Slave Lake shear zone

STZ = Snowbird Tectonic Zone.

Depth = 235 to 320 km



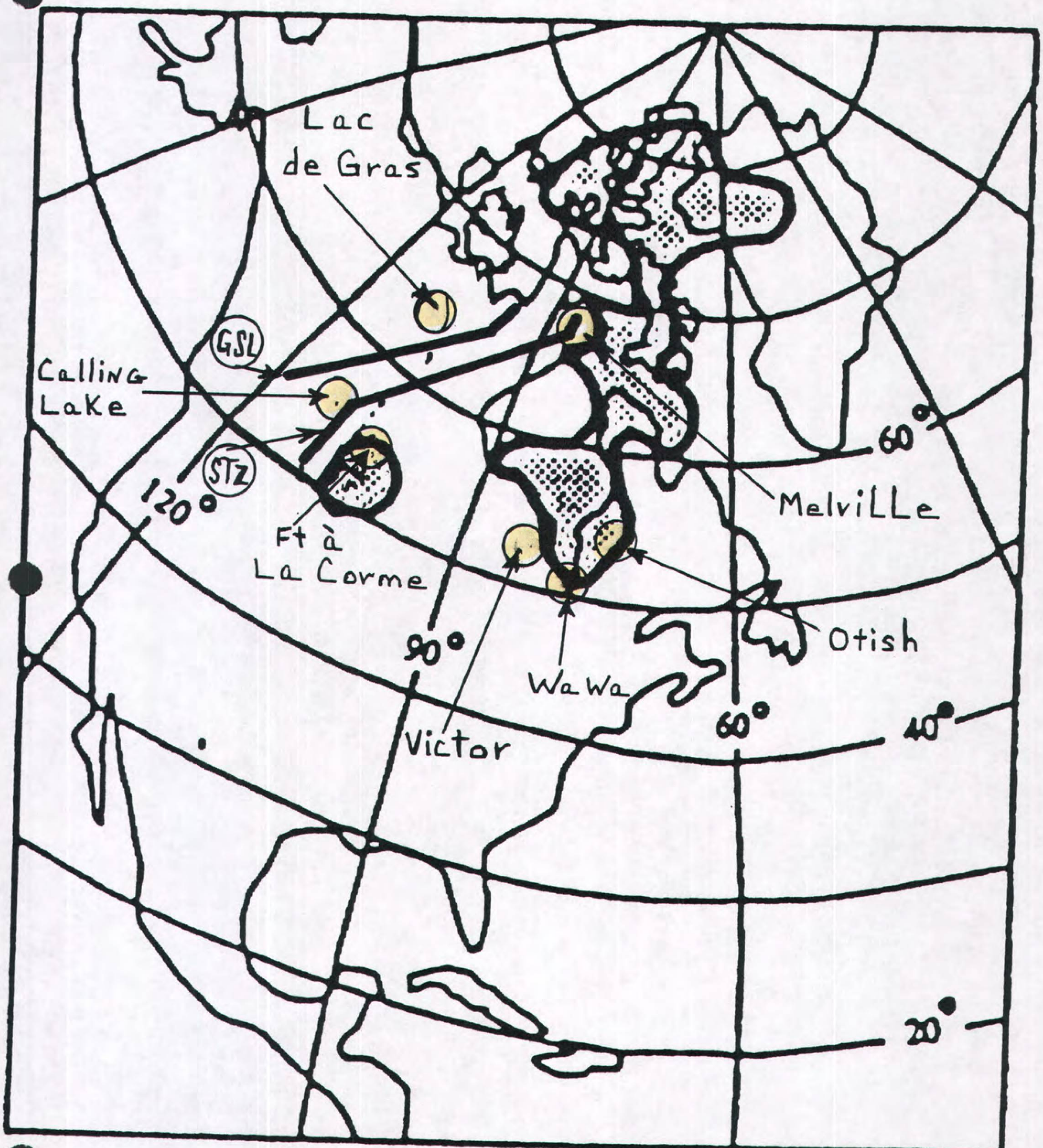
revised R. Haimila

B

GSL = Great Slave Lake shear zone

STZ = Snowbird Tectonic Zone.

Depth = 320 to 405 km



evised R. Haimila

C

GSL = Great Slave Lake shear zone

STZ = Snowbird Tectonic Zone.

DIAMOND EXPLORATION TECHNIQUES
EMPHASISING INDICATOR MINERAL
GEOCHEMISTRY AND CANADIAN EXAMPLES

GEOLOGICAL SURVEY OF CANADA
BULLETIN 423
C.E. Fipke, J.J. Gurney, and R.O Moore 1995

In general, the target with the best sub-calcic garnets, the highest chrome chromites, the biggest population of high sodium eclogitic garnets and the most magnesian ilmenites should be accorded highest priority in an exploration program. Equally it is so unlikely that any mantle derived rock will retain abundant diamonds and absolutely no trace of the original diamond host rocks, that to pursue any target that is forecast to be barren is to pursue the least potential target. However, Argyle is an exception which demonstrates that even these low rank potential targets may warrant pursuit.

35

<u>Calling Lake Property</u> - See ENCLOSED MAP (samples + anomalies)
MAPS A+B for Halmco Inc

Customer: DIA MET MINERALS LTD. BUFFALO DIAMOND
File:buffalo Inv#:

ELECTRON MICROPROBE ANALYSES FROM C.F. MINERAL RESEARCH LTD.
Batch File "00-1439"

"3-Jun-2000,1":07 am

Sample #	Mount	Cell	Grain	Classifications SA	DI	CFM	SiO2	TiO2	Al2O3	V2O3	Cr2O3	Fe2O3	FeO	MgO	CaO	MnO	NiO	ZnO	Nb2O5	Na2O	Max Trace Na2O	K2O	Totals
322.15	3151	3	9			CR	.01	.58	16.10	.17	44.25	6.80	24.04	6.65	.00	.46	.07	.14					99.26
322.15	3151	3	1	CE		CPX	54.53	.00	.43		.19		4.42	15.21	24.38	.18	.00			.66		.00	99.99
322.15	3151	3	5	CE		CPX	54.37	.04	.85		.28		4.47	15.07	23.79	.17	.03			.82		.01	99.88
322.15	3151	3	7	CE		CPX	53.74	.01	1.35		.28		7.99	12.77	22.89	.35	.02			.60		.03	100.04
322.15	3151	3	8	CE		CPX	53.58	.01	.98		.00		5.27	13.65	24.40	.24	.00			.64		.00	98.77
322.15	3151	2	19	CE	-	CPX	54.37	.18	.76		.37		4.24	16.64	23.01	.16	.01			.19		.00	99.94
322.15	3151	3	3	CE	-	CPX	52.55	.23	2.75		.00		5.22	14.38	23.18	.10	.00			1.06		.00	99.48
322.15	3151	2	17	CP		CP2	54.02	.08	1.35		.92		3.79	16.21	22.45	.24	.12			.56		.01	99.73
322.15	3151	3	2	CP		CPX	53.62	.15	1.74		.71		6.04	14.33	21.75	.19	.03			1.11		.00	99.66
322.15	3151	2	18	CP	-	CP2	55.14	.03	1.12		.55		4.01	16.66	22.04	.09	.04			.44		.01	100.12
322.15	3151	3	4	CP	-	CPX	53.80	.10	1.40		.67		4.78	15.12	22.66	.17	.06			.78		.00	99.54
322.15	3151	3	6	CV		CP2	52.35	.10	4.24		.42		5.17	14.58	21.93	.17	.08			1.03		.00	100.05
322.15	3153	1	3	CV		CP5	52.83	.19	6.01		.94		2.74	14.88	21.37	.08	.07			1.38		.00	100.49
322.15	3151	2	20	CV		CP6	51.91	.35	7.38		1.07		2.62	14.21	19.73	.09	.03			1.93		.01	99.33
322.15	3151	2	6	P		G 1	41.86	.82	20.90		2.24		9.13	19.67	4.97	.30	.00			.05		.00	99.92
322.15	3151	2	24	P		G 1	42.48	.49	21.05		3.19		7.14	20.83	4.87	.29	.00			.04		.00	100.38
322.15	3151	2	12	P		G 9	42.02	.00	22.02		3.08		8.21	19.20	5.17	.44	.03			.00		.00	100.16
322.15	3151	2	8	P		G 9-1	42.08	.13	21.07		4.22		7.60	19.45	5.10	.46	.02			.06		.01	100.19
322.15	3151	2	10	P		G 9-1	41.85	.08	21.18		3.66		8.89	19.46	4.75	.48	.00			.04		.00	100.39
322.15	3151	2	15	P		G 9-1	42.07	.19	21.37		3.91		7.95	19.87	4.51	.46	.00			.05		.00	100.37
322.15	3151	2	23	P		G 9-1	41.96	.13	21.85		3.25		7.93	20.06	4.38	.38	.01			.04		.00	99.99
322.15	3151	2	7	P		G11	41.41	.31	19.01		6.12		7.90	18.64	6.03	.42	.00			.03		.01	99.87
322.15	3151	2	13	P		G11	41.43	.02	19.46		6.20		7.49	18.63	6.29	.45	.02			.02		.00	99.99
322.15	3151	2	4	P		G11-1	41.74	.80	19.19		4.55		7.71	20.13	5.45	.28	.02			.07		.01	99.95
322.15	3151	2	5	P		G11-1	41.45	1.12	19.13		4.97		8.30	19.49	5.44	.39	.01			.06		.00	100.34
322.15	3151	2	9	P		G11-1	41.38	.72	17.94		6.80		7.61	19.14	6.17	.39	.05			.07		.00	100.26
322.15	3151	2	11	P		G11-1	41.32	.33	18.96		6.17		7.64	19.47	5.30	.41	.02			.04		.01	99.67
322.15	3151	2	14	P		G11-1	41.53	.04	18.99		6.58		7.75	18.90	6.01	.45	.03			.02		.00	100.31
322.15	3151	2	16	P		G11-1	41.65	.50	19.19		5.62		7.66	19.41	5.71	.38	.02			.06		.00	100.17
322.15	3151	2	21	P		G11-1	41.47	1.05	18.41		5.53		7.19	19.97	5.64	.29	.02			.07		.01	99.62
322.15	3151	2	22	P		G11-1	41.58	.63	18.15		6.67		6.77	20.32	5.56	.27	.06			.07		.01	100.09
322.15	3153	1	1	P		G11-1	41.49	.32	20.15		4.67		8.00	19.50	4.90	.40	.01			.06		.01	99.50
322.15	3153	1	2	P		G11-1	41.57	.13	20.11		4.93		7.43	19.33	5.17	.49	.03			.04		.00	99.22
8CBT-102.5	3151	2	1			CR	.00	4.04	7.96	.17	33.87	23.70	18.96	11.31	.00	.44	.20	.11					100.75
8CBT-102.5	3151	2	2			CR	.03	1.96	16.25	.39	34.24	15.83	22.34	8.75	.00	.36	.24	.18					100.57
8CBT-102.5	3151	1	38	CE	-	CP2	55.42	.03	.41		.27		3.99	17.40	22.44	.10	.01			.37		.00	100.44
8CBT-102.5	3151	1	39	CP		CPX	54.09	.03	1.12		.71		2.81	15.42	25.29	.35	.01			.25		.00	100.07
8CBT-102.5	3153	1	12	CP		CPX	52.24	.25	6.33		1.29		3.57	15.18	18.99	.14	.03			1.60		.00	99.61
8CBT-102.5	3151	1	35	CP	-	CP5	54.65	.07	1.01		.58		3.01	15.72	23.92	.09	.04			.79		.00	99.66

Added to INDICATOR PLOTS PRE[illegible]ed for Halmco Inc in 2004

18-Sep-2001

BUFFALO DIAMONDS

BUFFALO DIAMONDS — CFM Batch: 00-1439, AA290HM

ID	Batch#	CR.WT (kg)	-20+80M IL Weight (gms) Sample	-20+80M IL Weight (gms) Picked	-20+80M PY CRD Weight (gms) Sample	-20+80M PY CRD Weight (gms) Picked	Purple PP	ORANGE OR	CD	OLV/ OPX	TOUR	GOLD	OTH	BLACK OXIDES BLKS	# of INDICATORS PICKED
322.15	00-1439	22.06	8063.98	1221.99	229.36	157.71	218	152	332	166	0	0	2	432	1294
8CBT102.5	00-1439	22.40	7737.95	1916.54	277.69	266.43	301	159	331	172	0	0	9	1135	2107
98035-100	00-1439	14.26	11641.51	1100.56	224.81	181.21	155	121	205	55	3	0	21	275	833

(-20+80M PY CRD + IL)

ONLY 120 grains Probed Approximately

INDICATORS PICKED NORMALIZED to 100%.

322.15. 20% → 1294 (150' NORTH of SAMPLE 8SJT 322 (Buffalo Diamonds) from a WESTERN DRAINAGE
100% → 6470

8CBT 102.5 31% → 2104. (50m West of 8CBT 102 (Buffalo Diamonds) on a drainage from South of Calling Lake Park)
100% → 6796.

9803 5-100 13% → 833 (9803 sample site on DRAINAGE from South Calling Lake Park)
100% → 6407

most of GRAINS are on the included plots. Revised by R. Haimila
these ANALYSTS added to Plots in 2004

e/2

Customer: DIA MET MINERALS LTD. BUFFALO DIAMOND
File:buffalo Inv#:

ELECTRON MICROPROBE ANALYSIS FROM C.F. MINERAL RESEARCH LTD.
Batch File "00-1439"

13-Jun-2000,11:07 am

Sample #	Mount	Cell	Grain	Classifications SA	DI	CFM	SiO2	TiO2	Al2O3	V2O3	Cr2O3	Fe2O3	FeO	MgO	CaO	MnO	NiO	ZnO	Nb2O5	Na2O	Max Trace Na2O	K2O	Totals
8CBT-102.5	3151	1	37	CP	-	CP5	54.54	.08	1.69		1.42		1.94	15.99	22.05	.08	.00			1.41		.00	99.20
8CBT-102.5	3153	1	11	CP	-	CP5	53.58	.18	2.35		.77		3.17	15.30	23.28	.12	.07			.70		.00	99.49
8CBT-102.5	3151	1	36	CP	-	CPX	54.20	.04	1.25		.63		3.65	15.80	23.16	.16	.06			.51		.00	99.47
8CBT-102.5	3151	1	41	CP	-	CPX	54.07	.05	1.44		.51		4.50	15.83	22.12	.11	.04			.79		.00	99.46
8CBT-102.5	3153	1	10	CP	-	CPX	53.02	.14	1.58		1.88		3.94	14.82	23.46	.15	.02			.66		.00	99.66
8CBT-102.5	3151	1	40	CV		CP2	53.11	.34	3.39		1.07		3.77	15.74	21.01	.08	.06			.90		.18	99.66
8CBT-102.5	3151	2	3	CV		CP3	52.19	.58	6.30		.57		2.79	14.58	21.08	.08	.01			1.54		.00	99.72
8CBT-102.5	3151	1	22	E	G2	G 3	39.50	.10	22.35		.04		20.57	8.69	8.97	.38	.03				.012	.00	100.62
8CBT-102.5	3151	1	28	E	HPM	G 1	42.88	.57	22.38		.90		7.78	21.05	4.53	.24	.01				.073	.00	100.42
8CBT-102.5	3151	1	27	E	HPM	G 2	41.58	.97	22.19		.52		10.96	18.95	4.80	.37	.00				.075	.00	100.41
8CBT-102.5	3151	1	29	E	HPM	G 2	42.30	1.31	22.43		.48		9.35	20.66	3.78	.32	.02				.074	.00	100.73
8CBT-102.5	3151	1	26	E	HPM	G 4	41.52	.76	22.20		.22		11.99	17.92	5.01	.31	.00				.125	.00	100.05
8CBT-102.5	3151	1	19	E	LPM	G 3	40.27	.10	23.10		.09		17.80	13.20	5.59	.54	.01				.016	.00	100.72
8CBT-102.5	3151	1	14	P		G 1	42.33	.57	20.24		3.94		7.22	20.82	5.06	.28	.01			.06		.00	100.51
8CBT-102.5	3151	1	20	P		G 1	41.94	.84	20.99		2.36		8.83	19.80	4.96	.36	.04			.07		.00	100.19
8CBT-102.5	3151	1	21	P		G 1	41.78	.70	20.82		2.88		8.58	19.85	5.02	.32	.02			.06		.00	100.03
8CBT-102.5	3151	1	30	P		G 1	42.44	.46	21.70		2.05		8.20	20.75	4.41	.31	.00			.05		.00	100.88
8CBT-102.5	3151	1	32	P		G 1	42.10	.87	20.36		3.24		7.52	20.60	5.18	.29	.00			.04		.00	100.20
8CBT-102.5	3151	1	33	P		G 1	42.13	.72	21.05		2.06		8.25	20.44	4.76	.25	.00			.04		.00	99.71
8CBT-102.5	3151	1	34	P		G 1	41.95	.80	21.25		2.05		8.68	19.96	4.89	.29	.02			.07		.00	99.94
8CBT-102.5	3153	1	9	P		G 1	42.11	.58	20.42		3.87		7.59	20.35	5.06	.32	.00			.07		.01	100.36
8CBT-102.5	3151	1	31	P		G 2	41.67	1.13	20.14		3.07		8.49	19.85	5.24	.33	.00			.06		.00	99.97
8CBT-102.5	3151	1	11	P		G 9	41.88	.03	21.26		3.86		8.79	18.01	6.37	.62	.00			.01		.00	100.83
8CBT-102.5	3151	1	2	P		G 9-1	42.23	.22	21.54		3.48		7.42	20.68	4.27	.40	.01			.05		.01	100.31
8CBT-102.5	3151	1	9	P		G 9-1	41.97	.15	21.07		3.85		7.47	19.89	4.88	.37	.00			.02		.00	99.67
8CBT-102.5	3151	1	12	P		G 9-1	41.58	.09	20.96		4.25		8.14	19.13	5.39	.47	.03			.05		.00	100.06
8CBT-102.5	3151	1	15	P		G 9-1	41.83	.06	20.94		4.10		7.97	20.11	4.39	.44	.00			.04		.01	99.89
8CBT-102.5	3151	1	24	P		G 9-1	42.20	.24	21.68		3.78		7.18	20.21	5.29	.35	.03			.01		.00	100.95
8CBT-102.5	3151	1	25	P		G 9-1	41.87	.30	20.99		3.56		7.76	20.03	4.61	.37	.04			.03		.02	99.57
8CBT-102.5	3151	1	3	P		G11	42.09	.02	20.81		4.57		7.55	19.36	5.55	.43	.06			.02		.01	100.46
8CBT-102.5	3151	1	4	P		G11	40.46	.18	18.11		7.02		10.46	15.48	7.49	.44	.01			.01		.00	99.59
8CBT-102.5	3151	1	5	P		G11	41.21	.11	18.59		6.22		8.78	17.48	6.59	.52	.00			.01		.00	99.51
8CBT-102.5	3151	1	8	P		G11	41.05	.11	18.43		6.91		8.23	18.15	6.41	.41	.02			.01		.00	99.73
8CBT-102.5	3151	1	10	P		G11	41.41	.06	18.04		7.19		7.42	18.88	6.35	.41	.01			.00		.01	99.79
8CBT-102.5	3151	1	16	P		G11	40.97	.10	18.99		6.02		8.79	17.72	6.56	.54	.00			.01		.00	99.69
8CBT-102.5	3151	1	18	P		G11	40.98	.15	16.85		8.19		7.33	17.69	8.06	.33	.04			.00		.00	99.62
8CBT-102.5	3151	1	1	P		G11-1	41.75	.56	17.66		6.74		7.15	19.76	5.90	.26	.01			.04		.02	99.84
8CBT-102.5	3151	1	6	P		G11-1	41.63	.23	19.61		6.10		7.28	19.79	5.51	.39	.04			.05		.00	100.64
8CBT-102.5	3151	1	7	P		G11-1	41.44	.31	17.89		7.46		7.07	18.94	6.21	.43	.04			.03		.01	99.81
8CBT-102.5	3151	1	13	P		G11-1	41.50	.05	15.61		9.75		6.83	18.86	6.56	.32	.03			.00		.00	99.52
8CBT-102.5	3151	1	17	P		G11-1	41.99	.80	19.15		4.61		7.66	20.27	5.24	.28	.01			.07		.00	100.05

Customer: DIA MET MINERALS LTD. BUFFALO DIAMOND
File:buffalo Inv#:

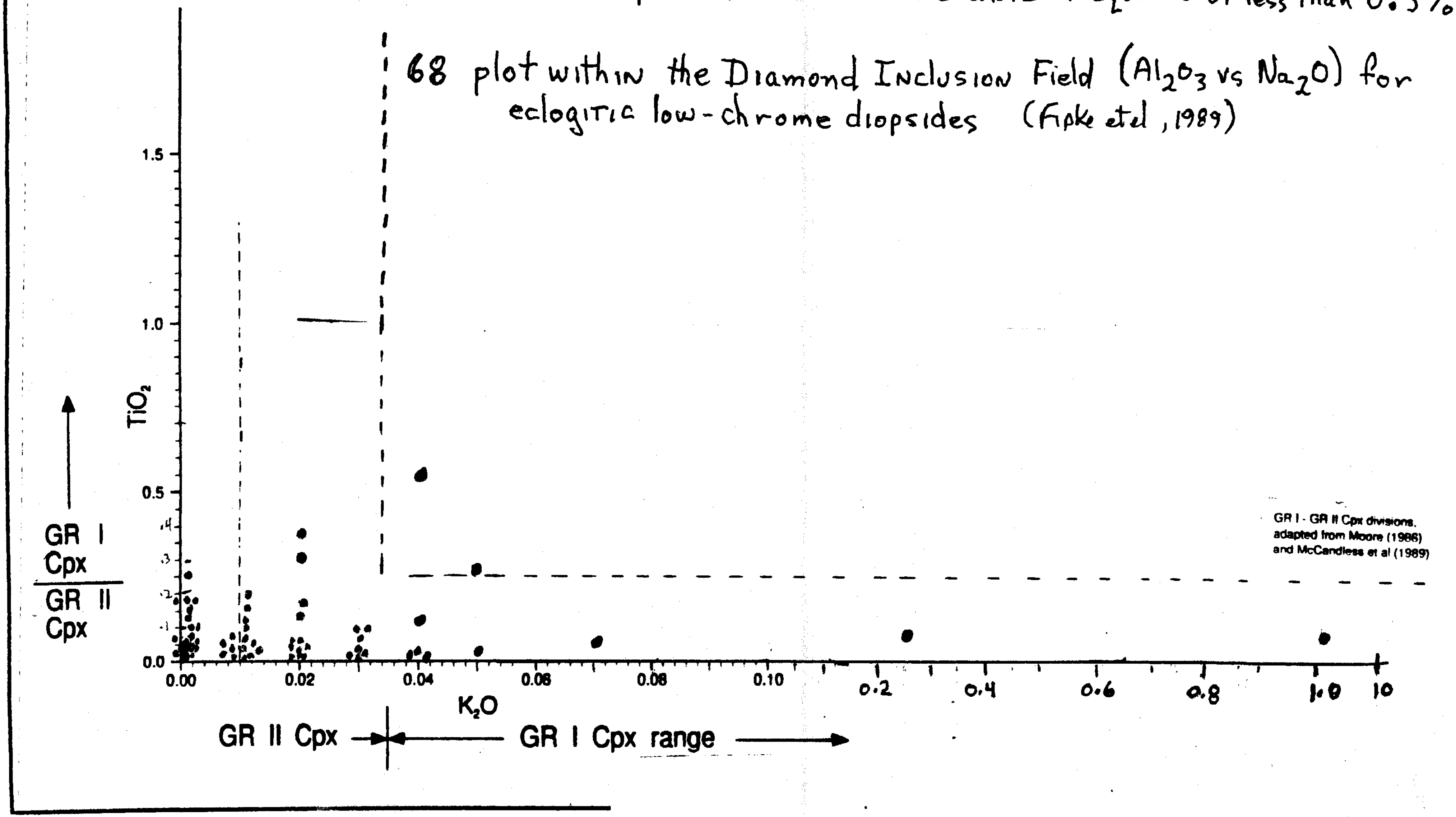
ELECTRON MICROPROBE ANALYSIS FROM C.F. MINERAL RESEARCH LTD.
Batch File "00-1439"

13-Jun-2000,11:07 am

Sample #	Mount	Cell	Grain	Classifications SA	D1	CFM	SiO2	TiO2	Al2O3	V2O3	Cr2O3	Fe2O3	FeO	MgO	CaO	MnO	NiO	ZnO	Nb2O5	Na2O	Max Trace Na2O	K2O	Totals
BCBT-102.5	3151	1	23	P		GT	42.29	.91	20.12		3.39		8.20	20.31	5.09	.32	.02			.07		.00	100.71
98035-100	3151	5	5			CR	.00	.08	8.06	.18	53.34	7.36	23.73	5.38	.00	1.02	.08	.46					99.70
98035-100	3151	5	6			CR	.09	.38	12.88	.10	51.75	6.78	15.72	11.94	.00	.27	.16	.09					100.16
98035-100	3151	5	7			CR	.02	.55	25.38	.17	27.85	14.43	22.62	8.70	.01	.40	.20	.27					100.59
98035-100	3151	5	8			CR	.00	1.28	13.81	.23	30.15	22.96	24.11	6.76	.00	.43	.19	.15					100.07
98035-100	3151	4	17	CE	-	CPX	54.35	.07	.78		.02		4.49	15.32	23.23	.07	.02			1.22		.00	99.58
98035-100	3151	4	20	CE	-	CPX	53.97	.04	1.03		.46		4.73	15.69	23.03	.22	.14			.48		.00	99.78
98035-100	3151	4	19	CP		CP2	54.11	.08	1.51		.55		4.16	15.30	23.10	.24	.01			.66		.00	99.71
98035-100	3151	4	18	CP	-	CP2	53.69	.09	1.74		.91		3.69	15.96	22.73	.10	.05			.55		.00	99.52
98035-100	3151	5	1	CP	-	CP2	54.31	.05	1.31		.52		3.33	15.89	23.56	.11	.10			.43		.00	99.61
98035-100	3151	5	2	CP	-	CP5	54.42	.05	1.15		.51		2.95	16.34	23.42	.11	.10			.50		.01	99.55
98035-100	3151	5	3	CP	-	CPX	53.14	.16	2.56		.80		3.71	16.50	22.22	.17	.03			.38		.00	99.65
98035-100	3151	5	4	CV		CP2	53.24	.22	3.33		1.25		3.87	14.40	22.17	.10	.01			1.11		.00	99.68
98035-100	3151	4	16	E	NPN	G 2	41.55	.97	21.52		1.63		10.33	18.99	4.96	.32	.00				.080	.00	100.35
98035-100	3151	4	14	E	NPN	G 3	41.20	.52	22.12		.42		13.91	16.57	5.25	.57	.00				.080	.00	100.61
98035-100	3151	4	9	P		G 1	41.98	.67	20.21		3.65		7.32	20.51	5.17	.30	.03			.04		.00	99.89
98035-100	3151	4	10	P		G 1	42.24	.49	21.27		2.86		7.13	20.85	4.87	.31	.06			.04		.01	100.11
98035-100	3151	4	11	P		G 1	42.28	.68	20.67		2.97		7.49	20.52	4.96	.28	.01			.07		.01	99.93
98035-100	3153	1	4	P		G 1	42.17	.55	20.89		3.35		7.11	20.63	4.87	.28	.02			.05		.01	99.93
98035-100	3151	4	3	P		G 9	41.87	.01	22.07		3.18		8.48	18.86	5.39	.50	.03			.00		.00	100.36
98035-100	3151	4	6	P		G 9	42.00	.01	21.85		3.63		7.79	19.46	5.48	.49	.00			.02		.01	100.74
98035-100	3151	4	7	P		G 9	41.66	.00	21.64		3.63		7.97	19.17	5.48	.55	.01			.02		.00	100.13
98035-100	3151	4	15	P		G 9	42.22	.08	21.75		3.44		7.54	19.94	5.30	.38	.02			.01		.00	100.68
98035-100	3153	1	6	P		G 9	42.09	.04	21.42		3.62		7.21	19.77	5.48	.47	.02			.02		.01	100.15
98035-100	3151	4	4	P		G 9-1	41.95	.19	21.54		3.04		8.24	19.89	4.55	.39	.04			.06		.00	99.87
98035-100	3151	4	13	P		G 9-1	42.39	.05	20.13		4.43		6.88	20.29	5.35	.27	.00			.01		.00	99.80
98035-100	3153	1	5	P		G 9-1	42.42	.32	20.94		3.48		6.84	21.19	4.92	.26	.00			.04		.00	100.42
98035-100	3153	1	7	P		G 9-1	42.14	.25	22.06		2.82		8.16	20.09	4.61	.35	.03			.04		.00	100.56
98035-100	3151	4	1	P		G11	40.22	.11	15.10		10.74		7.59	16.84	8.20	.49	.01			.03		.01	99.34
98035-100	3151	4	2	P		G11-1	41.58	.74	18.80		5.30		7.55	19.58	5.60	.30	.00			.03		.00	99.47
98035-100	3151	4	5	P		G11-1	41.77	.55	18.83		5.66		6.79	20.41	5.55	.28	.06			.03		.00	99.92
98035-100	3151	4	8	P		G11-1	41.80	.48	19.61		4.90		7.24	20.56	4.77	.25	.02			.04		.00	99.66
98035-100	3151	4	12	P		G11-1	41.93	.82	19.47		4.81		7.15	20.36	5.48	.26	.00			.05		.00	100.33
98035-100	3153	1	8	P		G11-1	41.69	.09	20.65		4.65		8.33	19.25	5.08	.47	.01			.03		.00	100.25

Calling River / LAKE AREA Clinopyroxenes

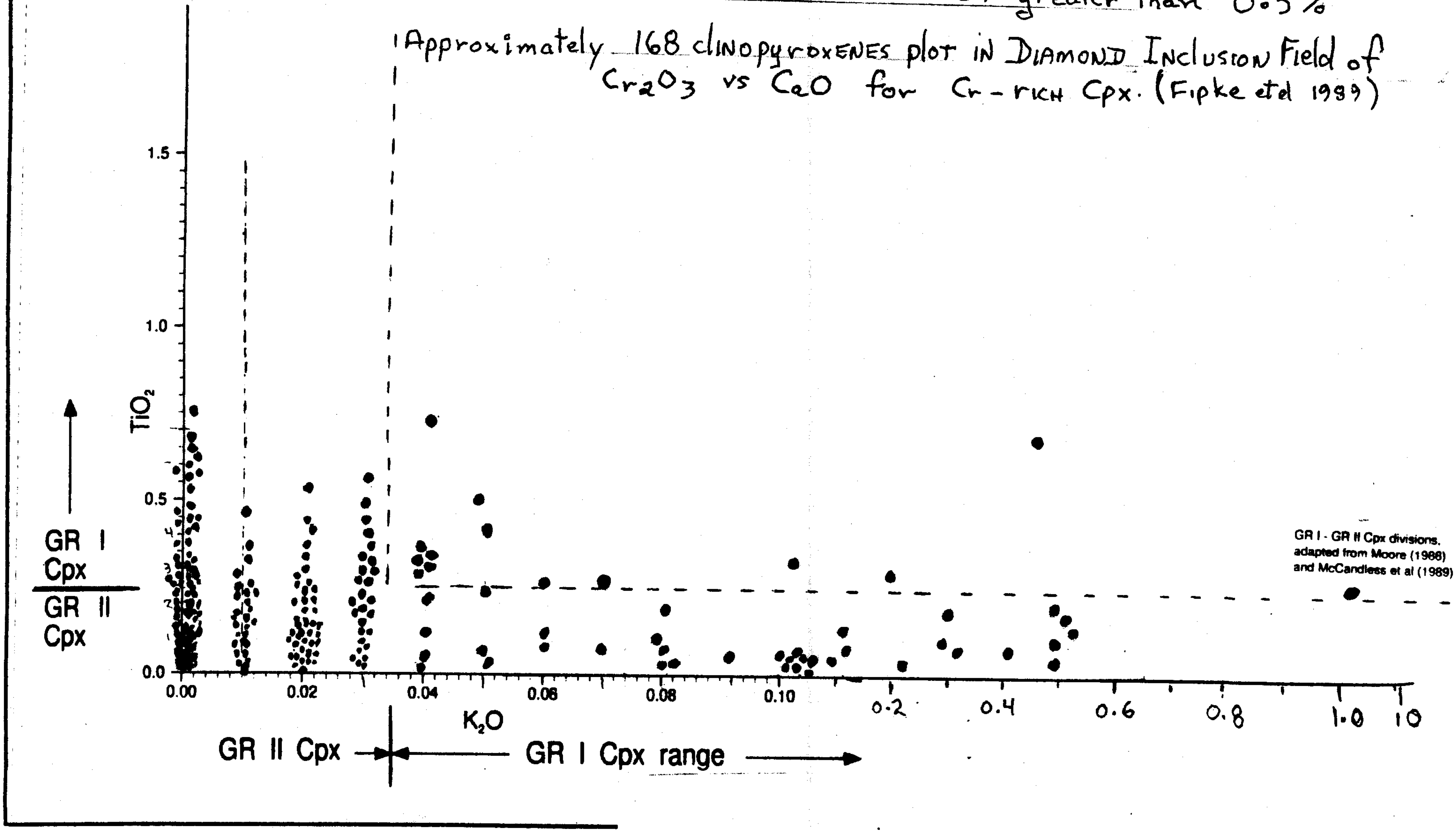
Appr. 78 Low-chrome diopsides with chrome CONTENT equal to or less than 0.5%



TiO_2–K_2O plot

Calling River / LAKE Area Clinopyroxenes

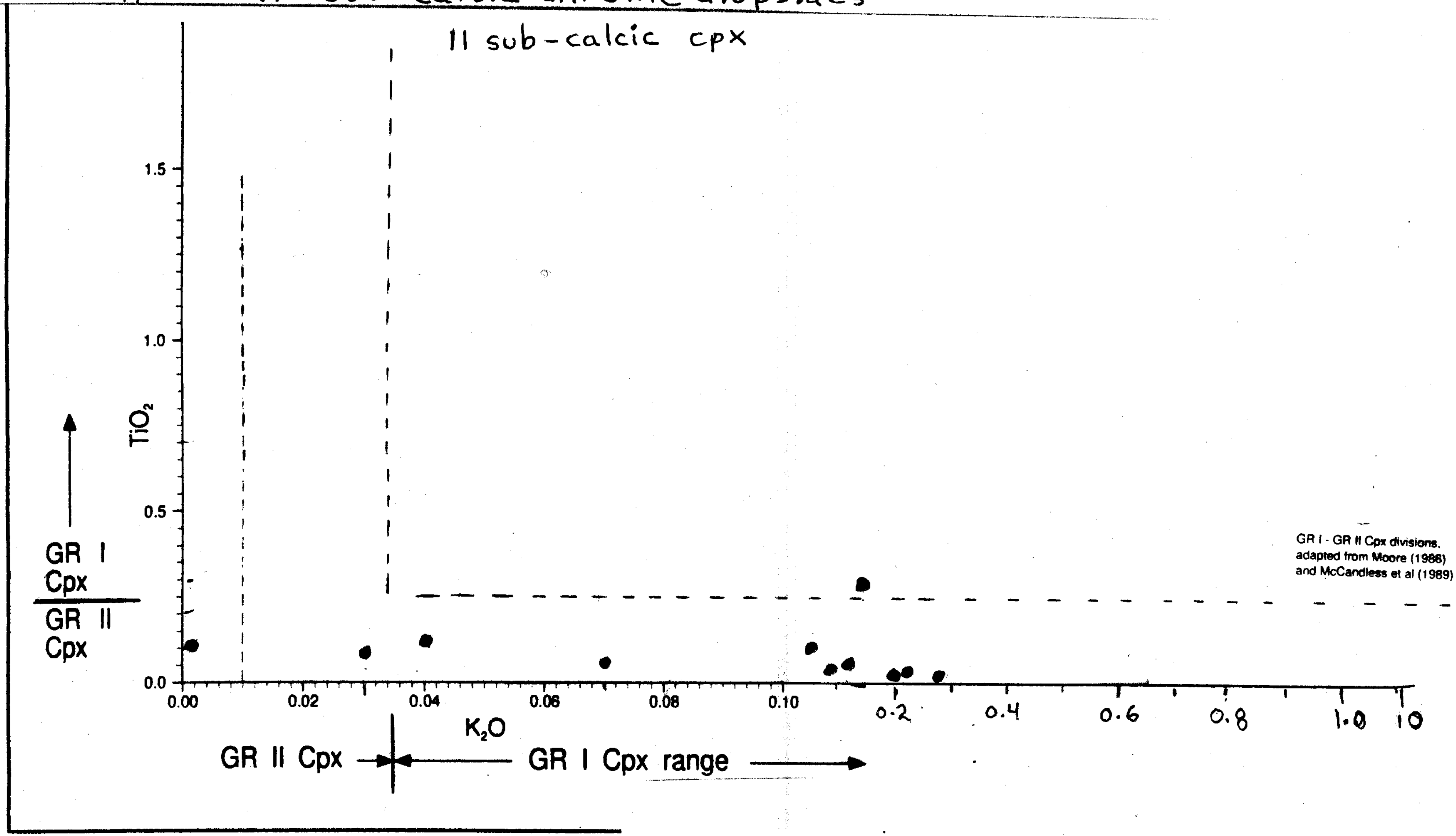
Appr. 299 Chrome diopsides with chrome content greater than 0.5%



. TiO_2–K_2O plot

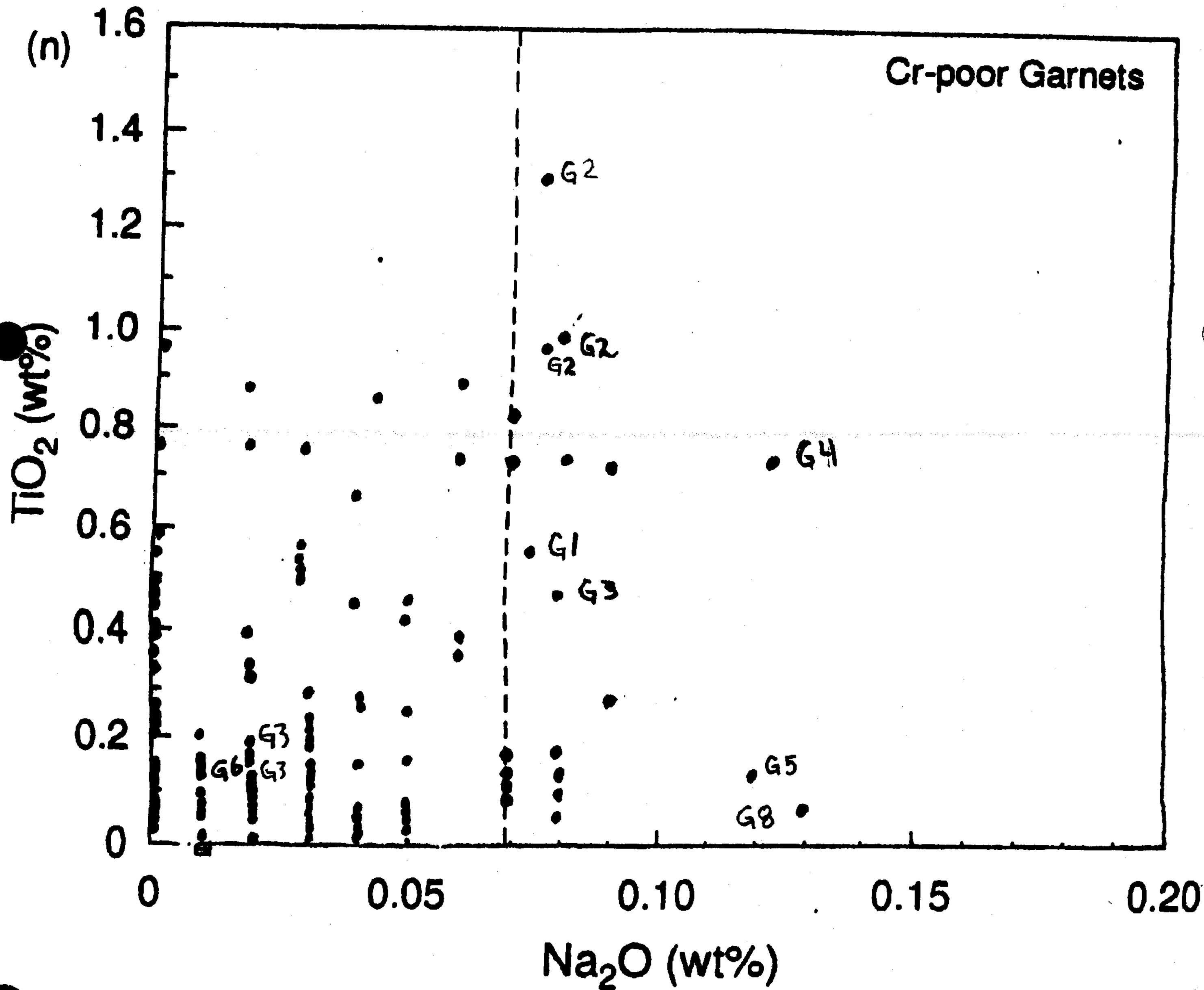
Calling River/Lake Area Clinopyroxenes

Appr. II Sub-calcic chrome diopsides

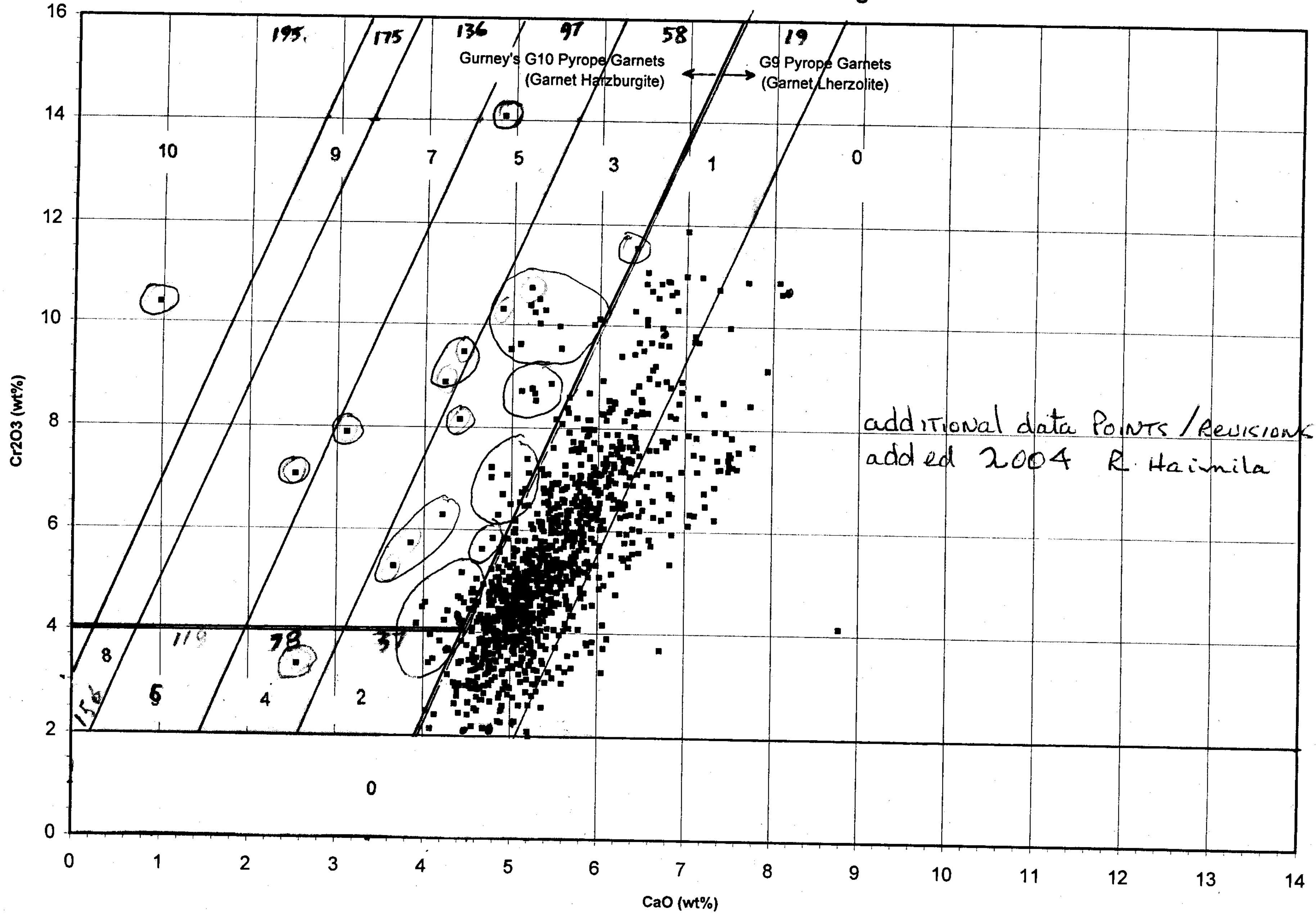


TiO_2–K_2O plot

Na2O vs TiO2 For Eclogitic Garnets From The Calling Lake Area



CaO vs Cr2O3 For Peridotitic Garnets From The Calling Lake



: Gurney's J factor for quantifying comparisons between suites of Cr-pyropes, after Lee (1993).

DE BEERS
CANADA

September 15, 2005

Mr. Raymond Haimila
P.O.Box 8254 Stn Main
Canmore AB T1W 2V1

Dear Mr. Haimila:

I would like to thank you for the document you sent to me some weeks ago entitled: "Rheology and the Genesis of Diamond".

It is unfortunate that I have personally lost touch with the level of science and theory which your document covers, but understand enough to find your ideas of great interest. The document has been handed on to our research department where I am sure it will create considerable interest as well.

Enclosed is a small token of my appreciation for your document.

Yours sincerely,

[redacted]

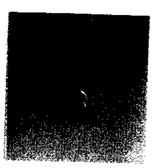
Richard Molyneux
President & CEO

DE BEERS CANADA INC.
65 OVERLEA BOULEVARD, SUITE 400, TORONTO, ON, M4H 1P1 TEL 1 (416) 645-1710 FAX 1 (416) 429-2462
www.debeerscanada.com

RHEOLOGY

and

the GENESIS OF DIAMOND



Raymond Haimila
PO BOX 8264 STN Main
Canmore AB T1W 2V1
Canada

CANMORE, AB T1W 2V1

ABSTRACT

A sequence of events associated with a tectonic shear fracture that allows for carbon to be converted to graphite and/or diamonds.

Carbon/graphite and other reactants available for conversion to diamond would be limited to availability in early geological time. Graphite would be the result of a strongly reducing environment present in plate and craton formation in association with metallic iron and other archetypical compounds.The high ambient temperature of this early earth would limit the plate activity until such time as a cratonic root system was rheologically strong. The activity of these super plates would be limited to colliding plates and intermediate/deep focus shear fractures.

The initial shock wave associated with a high magnitude shear fracture instantly converts one allotropic form of carbon (graphite) to another form of pure carbon-**diamond.** (graphite was converted to diamond by a shock wave in 1961).

It is the combination of a shock wave/shear wave traveling simultaneously along a shear fracture – at or near equal velocities – that allows for the occurance of a natural diffusion pump. The combination of shear fracture/shock wave/ shear wave and rupture front passing through a solid (craton root) creates molecular diffusion. A **vacuum state** is created by the opposite directional movement of molecules created by the shock/shear waves.**Carbon and diamond and other reactants, such as N2 are all present in the resultant vapours. This allows for the process known as physical-chemical vapour deposition to occur and this allows for the growth on the substrate-diamond. This growth of the diamond can occur at lower temperatures and pressures because of the vacuum state and the presence of organometallic reactants.**

[redacted]

Rheology and the Genesis of Diamond

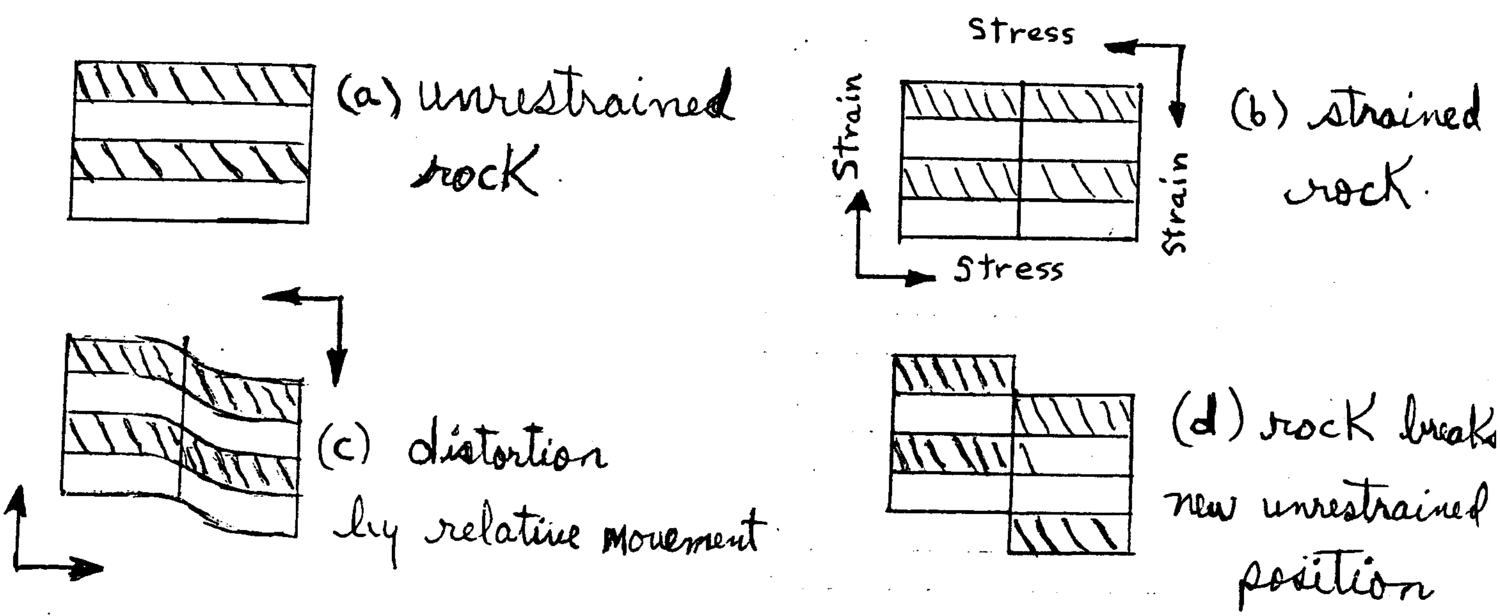
The following hypothesis is said without prejudice and is based on facts as I know them…….Raymond Haimila

This hypothesis will demonstrate that the mechanics of rock and the rheological response of rock initiates a primary force that allows for a single species/element (carbon) to be converted to and/or deposited as the allotropic form of pure carbon – diamond.

This hypothesis is based on the physical ability for rock to store energy in the form of stress energy in magnitudes much greater than the strength of the rock mass itself. This physical ability of rock mass – " allows for the existence of tectonic residual stresses LOCKED-IN the rock as a result of its long geological history." (McGraw-Hill Encyclopedia of Science and Technology vol. 15, p.606; 1997)

The rheological response of rock at the moment the "locked-in" stress energy is released is the basis of this hypothesis.

ELASTIC REBOUND THEORY



The mechanism by which rock deforms in response to Stress

Fig. 1

Rheological response of rock

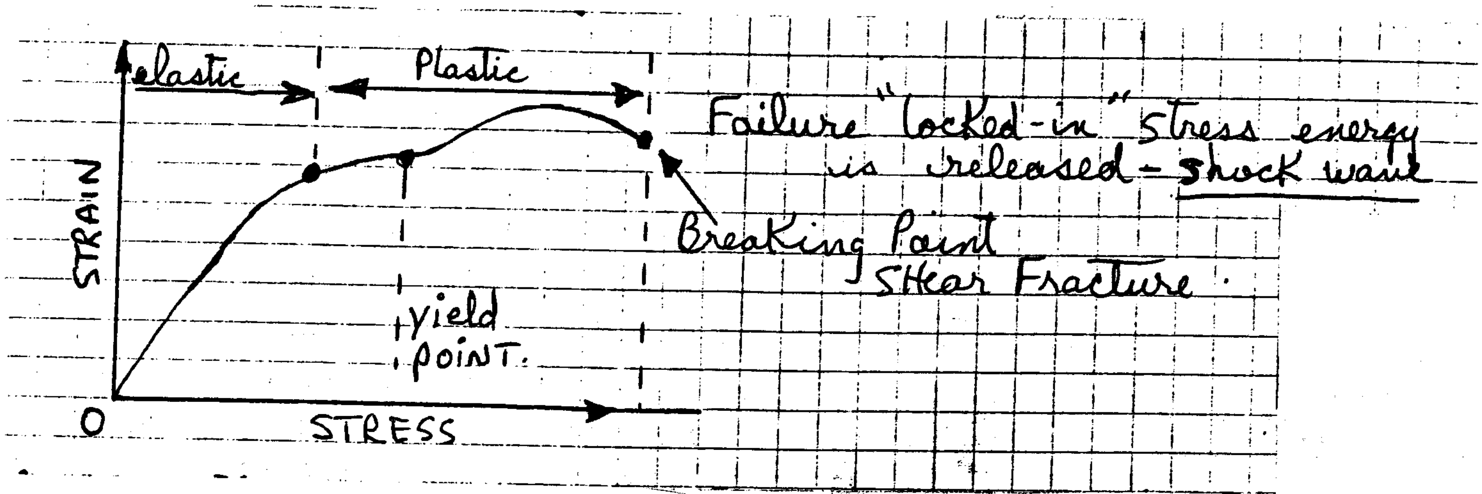


Fig. 2

Elastic limit- when stress or strain is removed material will return to original state
Plastic limit- permanent deformation when stress/strain/load removed
Yield point- sudden increase in strain and stress
Breaking point- point at which rock mass will break (shear fracture) and the tectonic "locked-in" stress energy is released as a shock wave, compressional stress wave,pressure pulse, and/or rupture front

"A shock wave in reference to solids means a large amplitude compressional stress wave or pressure pulse that produces an almost instantaneous increase in the value of stress or pressure in a material and occurs in the earth as a result of meteor impacts/earthquakes." .... "The passage of a shock wave through a solid produces changes in the physical state of the material. For example, it can redistribute atoms, change levels of electron energy and alter internal energy balance." (McGraw Hill Concise Encyclopedia of Science and Technology, p.1697, 1992.)

The initial shock wave associated with a shear fracture almost instantaneously converts one allotropic form of carbon (graphite) to another form of pure carbon- DIAMOND. This occurs if two conditions exist. The pressure present is equal to or greater than 30 Gpa and the temperature is approximately 1100 degrees C. (Graphite was converted directly to diamond by a shock wave in 1961 and the transient temperature/pressure was 30Gpa at 1100 C)

McGraw Hill Encyclopedia of Science and Technology, vol. 5, p.216, 1997……in 1961 graphite was converted directly to diamond. The transient temperature and pressure that existed was 300 kilopascals at 1100 degrees centigrade.

It is the shear fractures related to plate tectonics and plate boundaries, and the shear fractures related to intraplate cratonic root fractures (possibly caused by convective forces) that would create the energy required for diamond genesis……….The magnitude of power emitted in a few hundred seconds of movement by a shock wave/rupture front along a shear/fault is ONE BILLION MEGAWATTS and is independent of depth below surface. (McGraw Hill Encyclopedia of Science and Technology, vol. 15, p. 600, 1997)

At the moment a shear fracture occurs (earthquake)… the two sides of the fracture/fault are travelling in opposite directions at 1 to 10 miles per hour until a new unstrained position prevails. (Rheology). At the moment a shear fracture occurs (earthquake)…a compressional stress wave, a pressure pulse, a rupture front, a shock wave- travels along the shear fracture/fault at almost 5000 miles per hour or approximately three kilometres per second. At the moment a shear fracture occurs (earthquake)…. a bilateral sequence of rock ruptures occurs along the two sides of the fracture/fault. These rock ruptures or rock failures can be very explosive and are again dependent upon the amount of tectonic residual stresses "locked-in" the rock. The explosive nature of these rock failures are of such magnitude in some instances that clouds of gaseous molecules are formed.

Exaggerated Shear Fracture

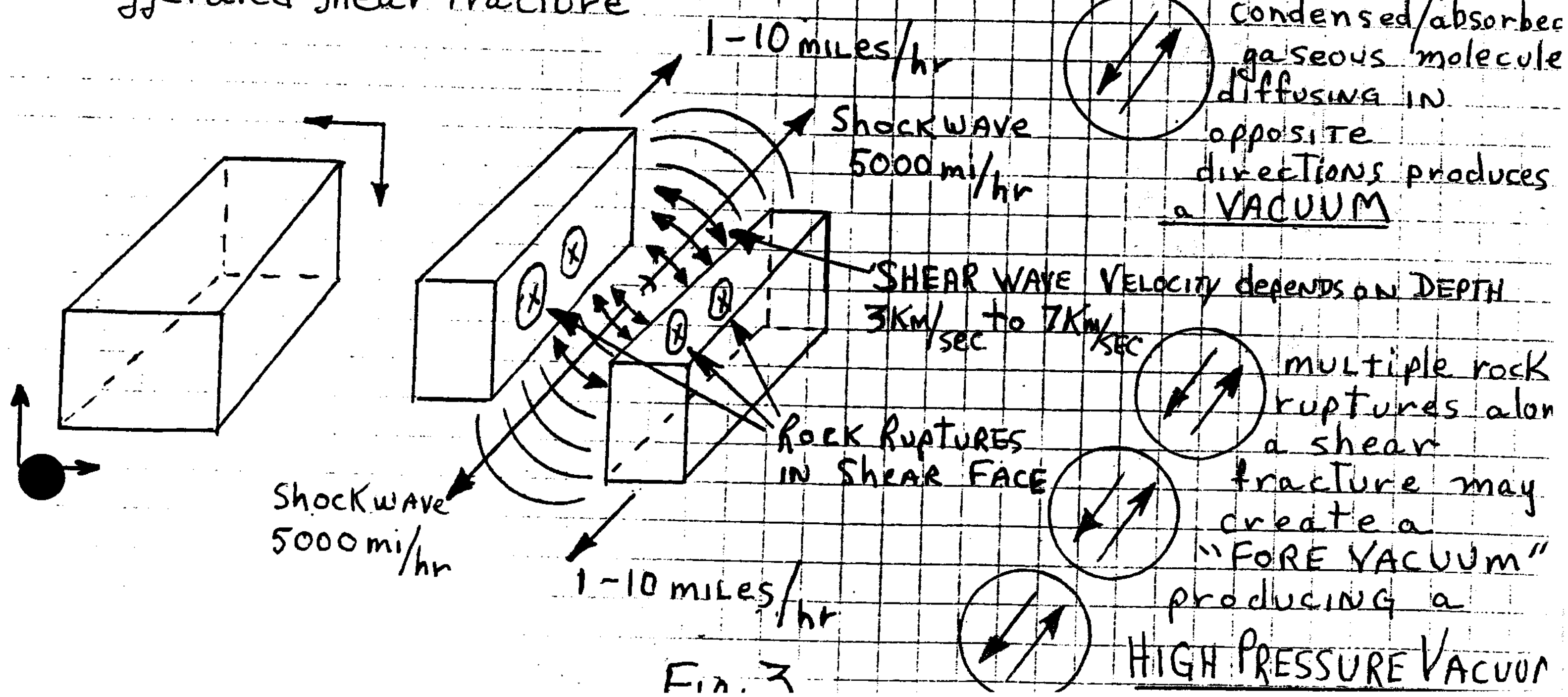


Fig. 3

In 1913 Dr. Wolfgang Gaede invented a diffusion pump. (Diffusion is a process by which different substances mix as a result of the random motions of their component atoms, molecules, and ions.- Oxford Dictionary of Science, 1999) Dr. Gaede discovered a process whereby gaseous molecules diffusing in opposite directions is condensed or absorbed by chemical materials a vacuum is produced. The diffusion pump is a vacuum pump.

The exaggerated shear fracture that is portrayed in figure 3 shows that the physical characteristics needed for the creation of a vacuum state are present during the first several hundreds of seconds of movement of a tectonic shear fracture.

If the sequence of events associated with a tectonic shear fracture create a natural diffusion pump, then the parameters needed for physical – vapour deposition and diamond growth are also present......

....species generated (graphite converted to micro diamonds by a shock wave)

....transport of species from source to substrate (diamond and vapour moving in a vacuum state

....growth on a substrate (diamond growth can occur at lower temperatures and pressures because of the vacuum state and the presence of organometallic reactants)

If this hypothesis is credible, the earth (because of tectonic activity) initiates a mechanical process that creates a vacuum state. This vacuum state allows for a process known as physical-chemical deposition to occur. This process allows for carbon to be converted to graphite and/or diamond. Graphite is converted to diamond by a shock wave. Diamond growth occurs because of the vacuum state. If the vacuum state exists, diamond growth will continue until a temperature equal to 1500 degrees centigrade occurs. In the vacuum state, diamond converts back to graphite at 1500 degrees centigrade. If oxygen is present and there is no vacuum state then diamond oxidizes to CO_2-CO/ carbon at 800 degrees centigrade. (McGraw Hill Encyclopedia of Science and Technology, 1997)

The tectonic residual stresses "locked-in" a plate as a result of its long geological history determines the following:
...the magnitude of a shear fracture
...the location of a shear fracture
...the geological age/date/time/ that the "locked-in" stress energy is released
...the magnitude and the velocity of the initial compressional stress wave, pressure pulse, rupture front, shock wave, earthquake
...the magnitude and the velocity of the initial shear wave

For example, a shear fracture that occurs at less than 70kms depth will produce a shallow earthquake. The initial shock wave will travel at approximately 5000mi/hr. The initial shear wave travels at about 2/3 the velocity of the initial shock wave. This would be a low magnitude shear fracture because it would be limited in its tectonic "locked-in" stress energy. i.e. less brittle, less strength and a higher elastic state than the cratonic root zone.

A tectonic plate shear fracture that occurs as an intermediate earthquake (70km-300km depth) or as a deep focus earthquake (300km-700km depth) would have the ability to produce an extremely high magnitude shock wave. The "locked-in" stress energy of a craton's root zone would be enormous. The shock wave would have a velocity equal to that produced by a shallow earthquake. But the shear wave produced by an intermediate or deep focus earthquake would have a velocity equal to or greater than the shock wave. The velocity of a shear wave increases with depth (up to 7km/sec) whereas the shock wave velocity remains constant. (Oxford International Encyclopedia of Science and Tecknology,1999)

It is the combination of shock wave and shear wave travelling simultaneously along a shear fracture- at or near equal velocities- that allows for the occurance of a natural diffusion pump. The consequence of a shear wave preceeding a shock wave is a "fore-vacuum". This produces an extreme high vacuum state.

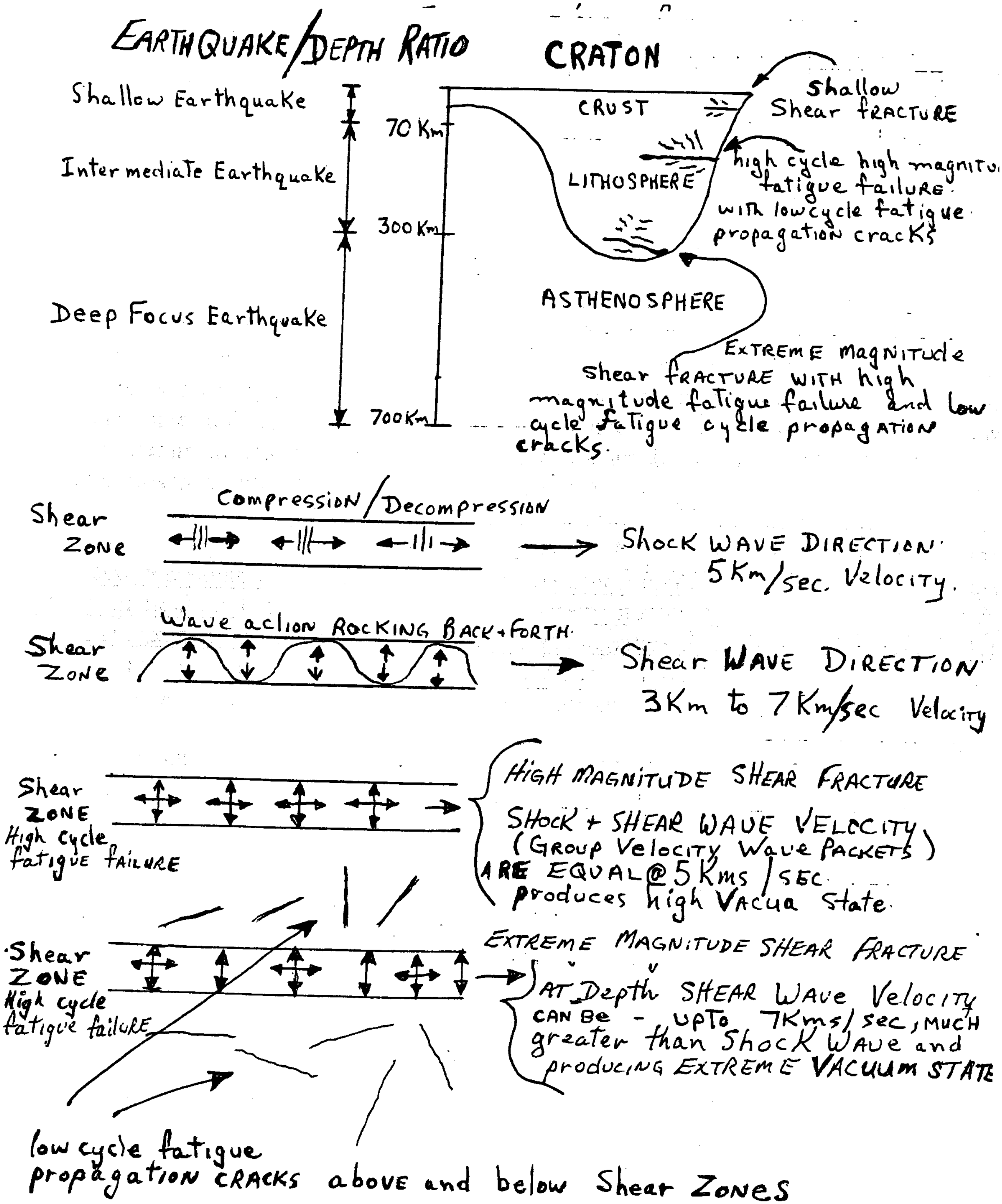

EARTHQUAKE/DEPTH RATIO
CRATON
Shallow Earthquake
70 Km
Intermediate Earthquake
300 Km
Deep Focus Earthquake
700 Km
CRUST
LITHOSPHERE
ASTHENOSPHERE
Shallow Shear FRACTURE
high cycle high magnitude fatigue failure with low cycle fatigue propagation cracks
EXTREME magnitude shear FRACTURE WITH high magnitude fatigue failure and low cycle fatigue cycle propagation cracks.
Shear Zone
Compression/Decompression
Shock WAVE DIRECTION 5 Km/sec. Velocity.
Shear Zone
Wave action ROCKING BACK+FORTH
Shear WAVE DIRECTION 3 Km to 7 Km/sec Velocity
Shear ZONE High cycle fatigue failure
HIGH MAGNITUDE SHEAR FRACTURE
SHOCK + SHEAR WAVE VELOCITY (GROUP Velocity Wave PACKETS) ARE EQUAL @ 5 Kms/SEC produces high Vacua State.
Shear ZONE High cycle fatigue failure
EXTREME MAGNITUDE SHEAR FRACTURE
AT Depth SHEAR WAVE Velocity CAN BE - UPTO 7 Kms/sec, MUCH greater than Shock Wave and producing EXTREME VACUUM STATE
low cycle fatigue propagation CRACKS above and below Shear ZONES

FIG. 4

Figure 4 is an attempt to illustrate shear fracture/earthquake depth ratio and some of the variables that accompany a shear fracture in a tectonic plate environment....depth of earthquake/fracture, decompression/compression shock wave cycles and velocities, the back and forth movement associated with rock and shear waves, shear wave velocities as they relate to depth, And low cycle and high cycle fatigue failure (shear fractures).

Shear fractures relative to a tectonic plate can be compared to high cycle fatigue failure. "....in high cycle fatigue failure there is little gross shape change associated with a fatigue failure....nevertheless, the mechanism of fracture is a ductile one in contrast to a cleavage fracture....The apparent brittleness in high cycle fatigue is the result of an extreme localization of the region that is undergoing intense plastic deformation leading to fracture. Even though a high cycle fatigue failure is quite sudden there is always low cycle fatigue cycles preceeding the actual shear fracture. (McGraw hill Encyclopedia of Science and Technology, vol. 14, p38)

It is the propagation cracks associated with the compression/decompression low cycle fatigue fracture that proceeds the high cycle fatigue fracture that I believe initiates a primary path of ascent for a much later intrusive force. And I believe that the physical results that occur in metal fatigue also occur in rock rupture under certain conditions. Crystallization occurs in metal fatigue as a result of the shear fracture.Crystallization would also occur in a rock shear fracture and in the low cycle propagation cracks that preceed a high magnitude shear fracture. The low cycle propagation cracks would be trans crystalline intrusive ascent pathways.

These trans crystalline cracks are the result of the initial shear fracture/shock wave/shear wave. And graphite converting to diamond is the result of this same process. And the growth of diamond is the result of the initial molecular diffusion produced by a high magnitude shock wave passing through a solid (craton root). The shear wave and rock rupture front cause the molecules to move in opposite directions creating a vacuum state.This allows for the process of physical-chemical vapour deposition to occur. Carbon, diamond, reactants such as N_2, etc. and other elements needed for Diamond growth are all present in the resultant vapours. The dinitrogen molecule (N_2), reactants, etc. are released from the primary rock.(97.8% of the earth's total N_2 occurs in primary rock-1.9X10 to the 17th metric tons-p14, vol.12, McGraw Hill Encyclopedia of Science and Technology, 1997).

Carbon/graphite and other reactants available for diamond growth would be limited to availability in early geological time. Graphite would be the result of a strongly reducing environment present in plate and craton formation in association with metallic iron and other archetypical compounds. The high ambient temperature of the earth would limit tectonic plate activity until such time as a cratonic root system was rheologically strong.

The high ambient temperature of this early earth would limit the activity of these super plates to colliding plates and intermediate/deep focus shear fractures. These high magnitude shear fractures would be limited to areas in the craton that were rheologically strong. These areas would be composed of archetypical ultramafics such as peridotite. Peridotite, carbon/graphite and other archetypical reactants would be the source material for physical-chemical vapour deposition and diamond growth. These diamonds would contain syngentic peridotite inclusions (p-diamonds).The oldest known diamonds are p-diamonds.

As the ambient temperature of the earth lowered, tectonic activity would include high magnitude- high cycle fatigue shear fractures due to plate contraction (p-diamonds); and high magnitude-high cycle fatigue shear fracture due to convection-basaltic rift zones. These rift zones introduced basaltic eclogite as a source material for physical-chemical vapour deposition and diamond growth. These diamonds would contain syngentic eclogite inclusions (e-diamonds). Eclogitic material from basaltic rift zones and from later tectonic plate subduction would be the source material of the younger e-diamonds. GSC Bulletin 423, 1995 gives a diamond age of 990-2700 million years for eclogitic diamonds. It is also stated.."it is noted on a worldwide basis more than 98% of the syngentic inclusions reported from diamonds can be confidently assigned to the peridotitic and eclogitic paragenesis." (GSC Bulletin 423,1995, Fipke, Gurney and Moore, p27).

Coincidentally, " peridotitic diamonds have a very restricted range of carbon-isotopic compositions (between –3 and –9 per mil). In contrast, eclogitic diamonds show carbon-isotopic compositions which range between +5 and –35 per mil)." GSC Bulletin 423,p.22. The older p-diamonds would be restricted by the lack of diversity of carbon compound reactants available for diamond growth. Younger e-diamonds would have a much greater variety of composition of carbon compound reactants available for physical-chemical vapour deposition and diamond growth-i.e. subducted plates.

The diversity of carbon and carbon compounds are important variables in the physical-chemical vapour deposition process. It is the reactants and the vacuum state that aid in the reduction of the pressure/temperature needed for the growth of a diamond. It is the vacuum degassing in this process that eliminates the frequency of and severity of inclusions. A good analogy to this process is the diffusion pump, the vacuum state, and the resultant vacuum degassing that is used in metallurgy to purify metals.(see Metullurgy and Plastics for Engineers, Nutt MC. 1976, pp. 160-170)
In metallurgy, it is the vacuum degassing that is used to eliminate the frequency of and severity of the inclusions. This criteria would be similar in the growth of a diamond in the physical-chemical vapour deposition process.

And lastly, it is the degree of the magnitude of the initial shock wave in combination with the resultant shear wave that dictates the degree of vacuum and vacuum degassing that determines the presence or absence of nitrogen in the internal crystal lattice structure of the diamond. **It is the presence or absence of infrared detectable nitrogen that determines a diamond type**

There are two major diamond types
Type I contains infrared detectable nitrogen
Type II contains no detectable infrared nitrogen
....in terms of this hypothesis....
..an extreme high cycle-high magnitude shock wave/shear wave creates an extreme vacuum state diamond with only carbon atoms in the crystal lattice
a Type II (a) diamond

..a lesser degree high cycle magnitude shock wave/shear wave creates a high vacuum state diamond with only carbon and boron atoms in the lattice (boron/carbon/nitrogen are interstitial compounds)
a Type II (b) diamond

..an even lesser degree high magnitude shock wave/shear wave creates a vacuum state diamond that allows for carbon and paired nitrogen atoms in the lattice
a Type I (b) diamond

..a shock wave/shear wave creating a vacuum state diamond with nitrogen atoms appearing as platelets/planar in the crystal lattice (similar to the original planar or layered carbon atoms of the original graphite)
a Type I (a) diamond

If this hypothesis is credible, then many of the questions that arise concerning the genesis of diamonds become self-explanatory. For example, Many of the questions posed by R.H.Mitchell in his book "Kimberlites, Orangeites, and Related Rocks; 1995." Can be addressed.

Detailed discussion of the genesis of diamond is beyond the scope of this work. Reviews of this topic may be found in Meyer (1985, 1987), Harris (1987), Gurney (1989), and Kirkley *et al.* (1991). Current models of diamond formation differ primarily with respect to the sources of carbon. One group suggests that carbon is juvenile, and deposition of it as diamond occurs as methane or other hydrocarbons are oxidized during their ascent through the upper mantle (Taylor and Green 1989) or at the lithosphere–asthenosphere boundary (Haggerty 1986). These hypotheses are favored for the generation of diamonds containing the peridotitic suite of inclusions. Other possibilities for the origin of this suite of diamonds include crystallization from kimberlitic liquids (Harte *et al.* 1980, Arima *et al.* 1993b) or from ultrabasic melts during the formation of cratonic roots (this work).

A second group of hypotheses suggests that carbon is introduced into the mantle by subduction processes (Schulze 1986, Kesson and Ringwood 1989). The carbon is not juvenile and may be of biogenic origin (Milledge *et al.* 1983, Nisbet *et al.* 1994). A subduction origin is favored for the genesis of isotopically light diamonds containing the eclogitic suite of inclusions.

Although it is now evident that several diamond-forming processes exist, many important questions remain unanswered: the origin of mega- and microdiamonds; whether or not diamonds form in the lower asthenosphere transition zone; and whether diamond-forming processes are active today. The growth of diamond crystals and the mechanism of trapping silicate inclusions within them are not understood, as it is uncertain whether diamonds grow in the solid state as porphyroblasts or from liquids.

Regardless of origin, most diamonds are now believed to be xenocrysts in their transporting magmas. Current hypotheses postulate that the roots of cratons contain diamond-bearing horizons consisting of garnet dunite, garnet harzburgite, and eclogite. Diamonds may also exist just below the lithosphere–asthenosphere boundary, where they are believed by Haggerty (1986) to be formed by methane oxidation. Other diamonds may occur in subducted oceanic material underplating the flanks of a craton. The vertical and lateral disposition of all of these diamond-bearing horizons is completely unknown.

Disruption and disaggregation of diamond-bearing zones by the passage of magmas ascending from greater depths results in the incorporation of diamonds as xenocrysts in the magma. The subsequent fate of entrained xenocrysts is dependent upon the oxygen fugacity and rate of ascent of the magma toward, and through, the crust. Slow transport in highly oxidized hot magmas, e.g., lamproites, may result in the complete resorption of all diamond originally present. From the foregoing it is apparent that only magmas derived from depths below the diamond-bearing zones will contain diamonds.

Given the multiplicity of sources and the myriad of possible ascent paths, it is not surprising that individual primary diamond deposits differ greatly in character. A given deposit may contain diamonds derived from several protoliths, as the diamond suite present depends upon which diamond-bearing horizons are intersected.

References

Bruton, E. 1978, Diamonds 2nd Edition, Published in Radnor Pennsylvania by Chilton Book Co.

Dufresne, M.B., Olson, RA, Schmitt, DR, McKinstry, B, Eccles, DR, Fenton, MM, Pawlowicz, J.G, Edwards, WAD and Richardson RJH, The Diamond Potential of Alberta Alberta Research Council Open File Report 1994-10.

Dunne, K. + Grant, B. (editors) 1993, Mid-Continent Diamonds GAC - MAC Symposium, Edmonton, AB. GAC Mineral Deposits

Fipke, C. 1989, The Development of Advanced Technology to Distinguish between Diamondiferous and Barren Diatremes Geological Survey of Canada, Calgary, AB

Fipke, CE, Gurney JJ, Moore, R.O., 1995. Diamond Exploration Techniques Emphasising Indicator Mineral Geochemistry and Canadian Examples GSC Bulletin 423, Ottawa Canada

Helmstaedt, HH, and Gurney JJ, 1992 Geotectonic controls on the formation of Diamonds and their Kimberlitic and lamproitic host rocks. Applications to Diamond Exploration 5th International Kimberlite Conference, Araxa Brazil by H.R. Nye

Helmstaedt, HH, Schulze D.J. and Kaminsky, F. 1995. Diamonds - Theory and Exploration "A Hands on" Short Course 20, Cordilleran Section, Geological Association of Canada, Vancouver BC.

McGraw-Hill Concise Encyclopedia of Science and Technology, 1992.

McGraw Hill Encyclopedia of Science and Technology, 1997.

Metallurgy and Plastics for Engineers, Nutt. M.C., 1976.

Mitchell, RH. 1989, Kimberlites, Plenum Press, New York, London.

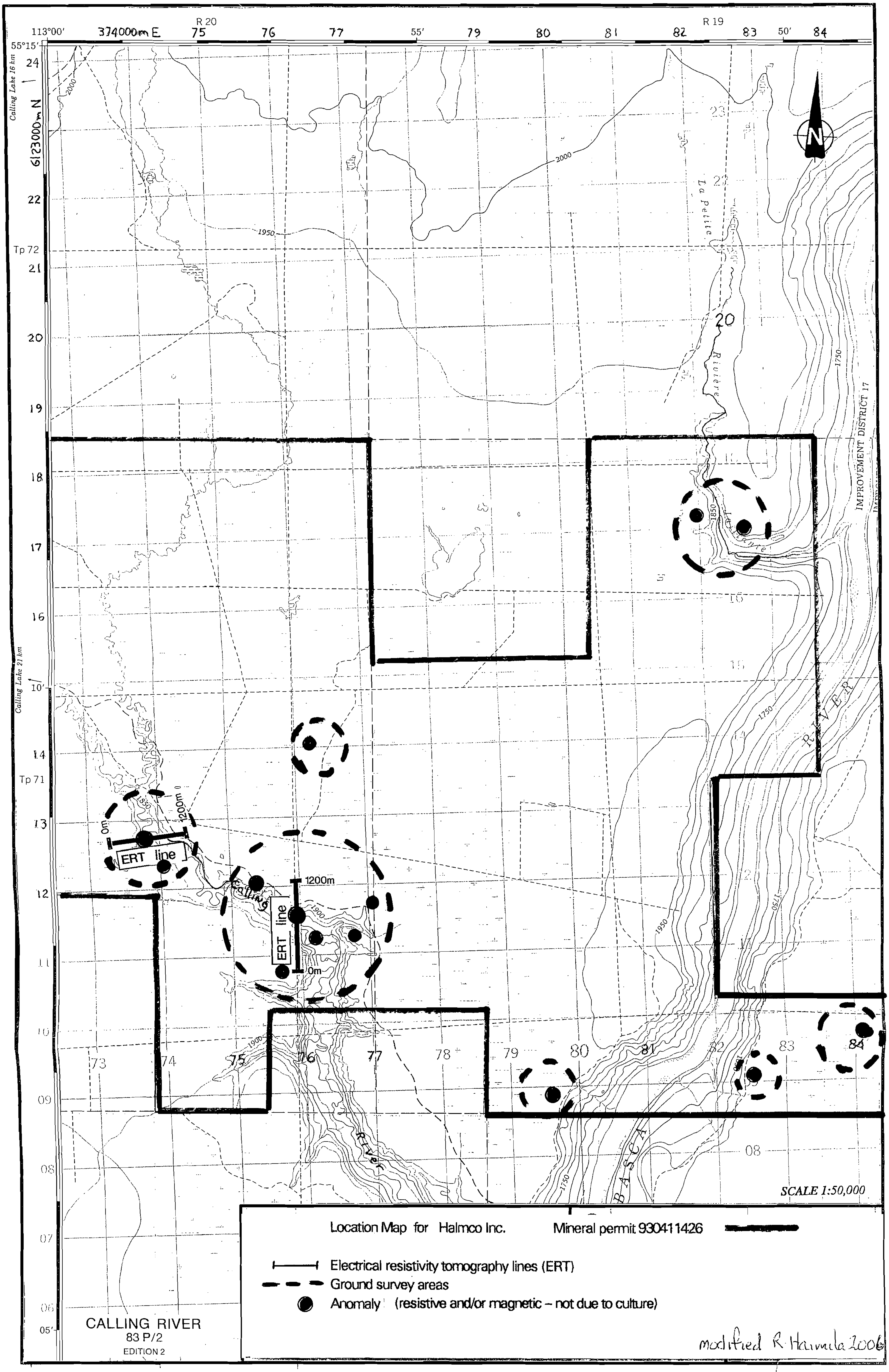
Mitchell, RH, and Bergman S. 1991, Petrology of Lamproites, Plenum Press

Mitchell, R.H., 1995, Kimberlites, Orangeites and Related Rocks, Plenum New York

Oxford International Encyclopedia of Science + Technology, 1999

Ross G.M. (editor) 1995 Alberta Basement Transects Workshop Lithoprobe Reports # 47 and # 51, Lithoprobe Secretariat, UBC

Villeneuve, ME, Ross GM, Theriault RJ, Miles W, Parrish, RR. + Boone J. 1993, Geological Survey of Canada Bulletin 447, Tectonic Subdivision and U-Pb Geochronology of the Crystalline Basement of the Alberta Basin Western Canada



113°00′
374000m E
R 20
R 19
55°15′
6123000m N
Tp 72
Tp 71
La Petite Rivière
IMPROVEMENT DISTRICT 17
RIVER
ERT line
0m
1200m
Calling
River
SCALE 1:50,000
Location Map for Halmco Inc.
Mineral permit 930411426
Electrical resistivity tomography lines (ERT)
Ground survey areas
Anomaly (resistive and/or magnetic – not due to culture)
CALLING RIVER
83 P/2
EDITION 2
modified R. Haimila 2006

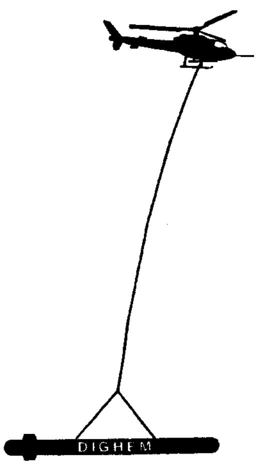
APPENDIX 5

Follow-up GROUND SURVEYS
by HALMCO 2004-2006
of EM ANOMALIES
identified as CULTURE
by DIGHEM on
MINERAL PERMIT 9304114226
(see enclosed Notations)

Report #1306-A

DIGHEM^{V} SURVEY
FOR
BUFFALO DIAMONDS LTD.
CALLING LAKE AREA
ALBERTA

REF: NTS 83P/2,3,4,5,6,7



Geoterrex-Dighem, a division of CGG Canada Ltd.
Mississauga, Ontario
May, 1998

Ruth A. Pritchard
Geophysicist
Doug McConnell, P.Eng.
Geophysicist

R1306A.98

pipe like features. Several relative high and low features which may be attributed to kimberlite sources are evident throughout the apparent resistivity data sets. These are tabulated later in this section.

Electromagnetic Anomalies

EM anomalies generally fall within one of 3 general interpreted 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. These bedrock sources are rare in the current survey area.

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 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 given the symbol "L" or "L?". The interpreted cultural responses correlate with power lines, pipe lines, buildings, and hydrocarbon wells. The effect on the electromagnetic data in the vicinity of power lines and other cultural features varies from imperceptible to high amplitude noise over several hundred metres. As a result, any interpreted conductors which are close to cultural sources should be confirmed as bedrock conductors prior to drilling.

The effect of conductive overburden is evident across the entire survey area. Although the difference channels (DFI and DFQ) are valuable in detecting bedrock conductors

HALMCO
MINERAL PERMIT 9304110426
COVERS 6109000N TO 6118000N
369000E TO 386000E
INCLUDES Flight 50920 TO 60930 (Flight LINES)

ANOMALIES COVERED by GROUND SURVEYS by HALMCO and/OR HALMCO's CONSULTANTS 2004-2006 are identIFIED by * herein
NOTATIONS Beside * identIFY RESISTIVE ANOMALIES that are NOT CULTURE.
"L" interpretation by DIGHEM IS CULTURE

Label	Fid	Interp	XUTM m	YUTM m	CX 6431 HZ Real ppm	CX 6431 HZ Quad ppm	CP 7176 HZ Real ppm	CP 7176 HZ Quad ppm	CP 335 HZ Real ppm	CP 335 HZ Quad ppm	Vertical Dike COND siemens	Vertical Dike DEPTH* m	Mag. Corr NT
LINE L50880													
E	6854.0	L	368432	6113985	14.1	8.9	7.8	10.6	2.2	1.3	0.9	143	0
F	6912.7	L	368484	6116305	56.2	50.3	102.1	88.7	0.9	9.7	0.9	79	0
G	6983.4	L	368580	6119067	46.0	24.8	54.1	25.1	2.5	9.6	1.7	89	0
LINE L50890													
A	6441.7	L	368278	6101585	64.8	46.9	112.6	78.7	8.9	21.2	1.2	75	0
B	6370.0	L	368359	6104548	45.2	22.6	71.0	48.6	8.2	16.6	1.9	92	0
C	6307.0	L	368443	6107169	16.4	5.1	30.4	13.9	5.9	9.2	2.7	136	0
D	6302.2	L	368446	6107366	18.9	5.5	8.3	5.0	1.9	2.9	3.1	136	0
LINE L50900													
A	5283.9	L	368503	6101520	61.6	55.1	101.9	95.0	4.4	16.1	0.9	82	0
B	5362.0	L	368589	6104598	24.0	29.2	34.3	35.2	4.6	8.2	0.4	112	0
C	5426.5	L	368652	6107181	1.5	3.2	23.2	0.6	1.5	3.1	---	---	0
D	5433.0	L	368659	6107439	26.4	11.9	42.6	24.1	6.4	11.4	1.8	103	0
E	5614.5	L	368851	6114749	6.1	18.0	9.0	35.8	0.1	0.2	0.1	79	0
F	5720.5	L	368982	6118951	17.7	15.9	33.1	32.6	2.3	4.0	0.6	127	0
LINE L50910													
A	5105.5	L	368771	6104588	11.8	14.6	21.9	13.9	3.9	5.6	0.3	141	0
B	5043.0	L	368858	6107147	11.9	7.5	10.9	8.1	1.5	1.7	0.8	162	0
C	5035.2	L	368883	6107478	30.5	15.8	46.3	19.9	5.4	12.0	1.5	110	0
D	4862.5	L?	369048	6114576	20.0	6.8	31.7	17.6	1.1	3.4	2.5	123	0
E	4757.3	L	369179	6118961	31.9	16.7	47.7	26.7	3.9	9.5	1.5	99	0
LINE L50920 Start of Mineral Permit													
A	4284.0	L	369175	6111766	22.7	9.1	30.4	23.2	1.5	3.4	2.0	131	0
B	4326.6	L	369236	6113492	15.0	15.8	22.2	27.6	2.1	3.6	0.4	129	0
C	4349.0	L?	369262	6114393	16.9	16.7	26.1	26.0	0.9	2.8	0.5	137	0
D	4382.5	L	369279	6115730	18.4	19.2	39.8	41.0	1.4	7.4	0.5	115	0
E	4462.0	L	369372	6118934	35.6	27.9	39.7	42.2	2.9	7.7	0.9	100	0
LINE L50930													
A	4063.0	L	369371	6111733	13.0	6.9	18.3	10.0	3.4	3.8	1.1	156	0
B	4004.0	L	369439	6114177	17.0	21.0	23.2	36.3	1.9	2.3	0.4	142	0
C	3938.8	L	369517	6116900	13.2	15.5	10.3	28.5	1.9	6.3	0.4	150	0
D	3892.6	L	369589	6118876	6.6	4.9	12.1	2.5	0.2	0.6	0.5	179	0
LINE L50940													
A	3480.2	L	369552	6111739	4.6	7.9	20.3	7.6	5.0	2.7	1.7	139	0
B	3539.0	L	369643	6114025	9.6	5.0	14.2	4.9	3.3	4.4	1.1	179	0
C	3587.5	L	369703	6115910	38.2	32.8	75.2	56.4	3.7	13.4	0.8	99	0
D	3617.4	L	369753	6117071	30.9	22.8	34.2	32.1	3.1	7.7	0.9	96	0
E	3663.4	L	369785	6118869	86.6	70.3	148.8	135.9	6.0	22.1	1.1	78	0

CX = COAXIAL
CP = COPLANAR

JOB 1306

Note: EM values shown above are local amplitudes

EM Anomaly List

* 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 magnetite/overburden effects.

Label	Fid	Interp	XUTM m	YUTM m	CX 6431 HZ Real ppm	CX 6431 HZ Quad ppm	CP 7176 HZ Real ppm	CP 7176 HZ Quad ppm	CP 335 HZ Real ppm	CP 335 HZ Quad ppm	Vertical Dike COND siemens	Vertical Dike DEPTH* m	Mag. Corr NT
LINE L50950													
A	3189.0	L	369767	6111723	5.8	1.2	0.2	5.9	3.4	1.3	3.4	219	0
B	3145.5	L	369825	6113429	26.2	13.2	30.2	22.0	5.3	7.4	1.5	120	1
C	3051.4	L	369936	6117155	43.6	38.8	82.6	65.0	11.8	24.9	0.8	86	0
D	3010.0	L	369950	6118812	6.1	2.1	56.1	1.3	1.0	13.3	1.7	203	0
LINE L50960													
A	2594.0	L	369974	6111727	13.8	7.6	25.9	13.6	2.7	6.6	1.1	156	0
B	2639.0	L	370001	6113440	21.5	10.8	26.3	15.1	4.8	7.0	1.4	130	0
C	2739.5	L	370122	6117296	57.2	38.7	90.8	66.0	10.1	26.5	1.3	81	0
D	2775.9	L	370167	6118674	12.0	14.4	12.3	15.3	0.4	1.4	0.3	163	0
LINE L50970													
A	2383.0	L	370171	6111710	11.9	2.1	29.9	15.8	1.7	6.0	4.5	204	0
B	2341.4	L	370220	6113413	14.6	1.9	14.1	3.3	3.9	5.9	7.6	209	0
C	2245.0	L	370336	6117384	27.1	28.9	40.5	43.6	3.5	8.1	0.5	107	0
D	2219.0	L	370362	6118474	11.5	8.3	30.7	15.1	1.3	5.2	0.7	149	0
LINE L50980													
A	7082.0	L	370545	6118302	101.2	79.5	226.0	168.2	0.3	36.5	1.3	68	0
LINE L50990													
A	6553.0	L	370746	6118132	5.5	3.9	15.9	10.7	16.2	13.2	0.6	202	0
LINE L51000													
A	6262.0	L	370955	6117724	64.1	37.1	136.2	66.8	7.6	21.3	1.7	77	0
LINE L51010													
A	5930.6	L	370892	6108917	82.0	55.4	114.8	83.4	10.0	22.4	1.5	67	0
B	5840.0	L	371001	6112522	32.8	29.3	60.0	62.0	8.6	14.7	0.7	100	0
C	5835.2	L	370997	6112720	19.6	9.4	5.6	14.9	1.5	4.9	1.5	129	0
D	5818.0	L	371020	6113402	50.0	40.1	87.8	71.6	10.0	18.6	1.0	82	3
E	5769.5	L?	371079	6115304	1.1	0.6	0.1	0.8	3.3	0.9	---	---	0
F	5709.6	L	371172	6117735	29.4	4.6	15.6	5.2	2.2	1.9	7.1	162	0
LINE L51020													
A	5378.0	L	371169	6111681	5.9	4.7	18.4	13.5	4.8	6.8	0.5	191	0
B	5401.4	L	371181	6112686	50.3	24.4	76.8	53.8	8.3	16.5	2.0	82	0
C	5433.8	B?	371224	6114109	48.7	32.0	97.2	67.7	11.3	20.5	1.2	85	0
D	5515.2	L	371319	6117748	3.6	38.3	111.7	84.0	6.3	18.2	1.1	56	0
LINE L51030													
A	5258.4	L	371297	6108784	45.0	30.5	80.1	64.4	11.2	20.7	1.2	86	0
B	5121.2	L	371456	6114035	51.4	37.3	76.2	67.4	9.2	14.4	1.1	78	0
C	5023.5	L	371525	6117728	64.2	54.2	82.8	95.7	4.1	14.1	1.0	83	0
D	4982.5	L	371595	6119388	14.5	14.4	39.1	35.9	2.7	7.5	0.5	138	0

CX = COAXIAL
CP = COPLANAR

JOB 1306

Note: EM values shown above are local amplitudes

EM Anomaly List

* 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 magnetite/overburden effects.

Label	Fid	Interp	XUTM m	YUTM m	CX 6431 HZ Real ppm	CX 6431 HZ Quad ppm	CP 7176 HZ Real ppm	CP 7176 HZ Quad ppm	CP 335 HZ Real ppm	CP 335 HZ Quad ppm	Vertical Dike COND siemens	Vertical Dike DEPTH* m	Mag. Corr NT
LINE L51040													
A	4744.5	L	371635	6114029	22.6	34.5	52.4	69.6	10.8	9.6	0.3	113	2
B	4828.4	L	371722	6117674	58.8	46.2	94.5	86.4	2.7	14.6	1.0	74	0
LINE L51060													
A	3970.0	L	372021	6113414	6.6	6.1	5.2	8.5	4.0	2.3	0.4	185	0
B	4060.0	L	372152	6117407	50.7	40.2	93.4	77.0	6.0	19.2	1.0	85	0
LINE L51070													
A	3688.5	L	372198	6112711	55.2	39.8	88.2	71.8	7.3	15.7	1.2	80	0
B	3670.4	L	372212	6113362	14.1	11.4	61.8	66.2	1.2	7.1	0.6	142	0
C	3569.0	L	372319	6117270	18.1	3.8	1.0	70.9	2.6	11.9	5.0	145	0
LINE L51080													
A	3272.6	L	372412	6113393	14.0	3.6	12.1	0.1	7.1	7.4	3.3	146	0
B	3355.4	L	372531	6117160	62.7	73.3	80.6	110.2	1.7	9.0	0.6	74	0
LINE L51090													
A	3027.0	L	372503	6108882	25.5	27.0	36.4	65.2	2.2	6.4	0.5	114	-1
B	3009.0	L	372539	6109610	17.6	18.8	8.4	24.9	1.9	2.9	0.4	130	0
C	2912.6	L	372623	6113351	58.4	53.6	124.1	99.1	11.9	22.7	0.8	88	0
D	2816.6	L	372729	6117055	43.1	41.1	90.5	88.8	3.8	8.1	0.7	91	0
E	2792.0	L	372753	6118020	32.7	22.4	56.6	42.2	3.5	9.0	1.1	97	0
LINE L51100													
A	2420.5	L	372741	6109894	25.5	24.8	55.8	49.9	3.6	9.2	0.6	108	0
B	2500.0	L	372811	6113380	39.7	20.8	62.2	37.3	7.6	11.1	1.7	101	0
C	2580.2	L	372922	6116905	28.6	64.9	157.9	151.9	3.3	18.9	0.3	50	0
LINE L51110													
A	2219.4	L	373006	6112754	91.8	82.0	160.5	149.4	14.5	30.0	1.0	61	-1
B	2120.6	L	373114	6116766	14.7	1.6	44.3	57.6	1.5	0.6	10.0	198	0
LINE L51120													
A	1769.0	L	373218	6112785	33.1	47.6	65.6	74.9	6.2	10.6	0.4	98	1
B	1863.6	L	373326	6116683	31.6	25.4	32.7	37.6	2.0	5.3	0.8	104	0
LINE L51130													
A	1441.0	L	373404	6112772	33.8	38.0	58.1	69.1	2.9	10.5	0.5	99	0
B	1404.0	L	373442	6114102	46.6	48.5	86.8	95.0	6.9	15.8	0.6	80	0
C	1337.2	L	373511	6116600	28.7	14.3	13.7	21.4	1.8	9.2	1.6	111	0
LINE L51140													
A	1091.5	L	373702	6116512	75.4	68.8	128.9	147.2	5.9	18.3	0.9	67	0

CX = COAXIAL
CP = COPLANAR

Note: EM values shown above are local amplitudes

EM Anomaly List

* 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 magnetite/overburden effects.

JOB 1306

Label	Fid	Interp	XUTM m	YUTM m	CX 6431 HZ Real ppm	CX 6431 HZ Quad ppm	CP 7176 HZ Real ppm	CP 7176 HZ Quad ppm	CP 335 HZ Real ppm	CP 335 HZ Quad ppm	Vertical Dike COND siemens	Vertical Dike DEPTH* m	Mag. Corr NT
LINE L51150													
* A	743.4	L	373795	6112828	47.0	25.0	89.5	48.4	14.0	18.6	1.7	86	0 DIAMOND [illegible] edge of drillsite #6
LINE T59020													
A	5987.4	L	361003	6124538	56.1	51.0	113.3	99.0	6.8	19.5	0.8	69	0
LINE T59030													
A	5753.0	L	360404	6119527	24.4	11.7	39.7	28.7	4.0	14.7	1.6	103	0
LINE T59041													
A	4236.0	L	357732	6114627	9.6	9.1	7.7	12.5	24.0	29.8	0.4	150	0
B	4435.7	L	365448	6114426	87.0	77.1	185.9	151.4	9.9	31.0	1.0	66	0
C	4536.5	L	369297	6114332	28.3	22.4	51.1	51.0	2.6	8.9	0.8	116	0
D	4666.6	L	374228	6114182	36.3	50.7	50.6	80.8	2.0	5.5	0.4	92	0
LINE T59050													
A	6315.5	L	372447	6109209	13.2	34.8	104.1	72.9	11.9	21.9	0.2	68	0
B	6264.4	L	374489	6109166	70.7	75.6	100.5	131.7	6.3	13.1	0.7	72	4
LINE T59051													
A	7063.0	L	356859	6109667	3.6	8.7	0.8	0.3	10.7	7.5	0.1	124	0
B	6958.5	L	361212	6109544	21.2	18.1	43.2	45.6	2.1	6.6	0.7	124	0
LINE T59060													
A	6637.3	L?	367487	6104343	67.2	53.2	112.2	103.6	5.2	14.8	1.1	77	0

CX = COAXIAL
CP = COPLANAR

JOB 1306

Note: EM values shown above are local amplitudes

EM Anomaly List

* 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 magnetite/overburden effects.

Label	Fid	Interp	XUTM m	YUTM m	CX 6431 HZ Real ppm	CX 6431 HZ Quad ppm	CP 7176 HZ Real ppm	CP 7176 HZ Quad ppm	CP 335 HZ Real ppm	CP 335 HZ Quad ppm	Vertical Dike COND siemens	Vertical Dike DEPTH* m	Mag. Corr NT	
LINE L60030														
A	3013.0	L	368133	6124632	28.7	13.9	52.9	36.7	4.4	9.6	1.7	120	0	OFF Property
B	2990.0	L	368172	6125328	13.3	14.5	11.6	19.1	0.2	1.7	0.4	145	0	
C	2800.0	L	368333	6131254	29.3	23.0	51.7	38.0	3.1	6.4	0.8	109	0	
LINE L60110														
A	5744.3	L?	369730	6124581	130.8	107.8	221.9	213.8	10.2	34.6	1.3	60	0	OFF Property
B	5672.0	L?	369773	6126747	66.6	58.1	127.5	115.8	2.2	15.7	0.9	80	0	
C	5528.0	L	369935	6131102	0.1	3.4	35.6	69.2	0.6	5.2	---	---	0	
LINE L60160														
A	7424.8	L?	370876	6129562	83.2	86.6	141.3	165.1	6.7	20.9	0.8	62	0	Anomaly 23 Terraquest 370883 - 6130583
LINE L60200														
A	8789.0	L?	371525	6125632	84.3	80.2	136.2	151.4	7.1	21.0	0.9	70	0	OFF Property
B	8858.0	L?	371631	6127993	46.6	39.2	84.7	83.2	4.8	14.2	0.9	91	0	
LINE L60220														
A	1243.0	L	371986	6126055	2.0	1.5	9.9	8.6	0.6	0.7	---	---	0	OFF Property
B	1285.0	L	372029	6127651	21.7	15.4	39.8	35.3	3.7	7.2	0.9	118	3	
C	1306.8	L	372064	6128472	69.3	40.9	123.9	101.6	13.7	28.3	1.7	74	0	
D	1331.3	L	372080	6129418	56.9	54.8	104.3	119.3	9.3	18.6	0.8	75	3	
LINE L60230														
A	1657.5	L?	372251	6128507	43.0	39.3	73.4	82.5	10.5	18.7	0.8	94	0	OFF Property
LINE L60280														
A	3723.0	L	373342	6131814	64.1	46.4	115.2	105.1	9.3	18.1	1.2	75	0	OFF "
LINE L60310														
A	4945.0	L	373853	6128214	26.1	16.8	8.7	8.2	6.0	1.8	1.1	121	2	OFF Property
B	4940.5	L	373854	6128366	37.4	27.7	36.5	42.5	5.0	7.2	1.0	99	0	
LINE L60320														drill site #6
A	5283.2	L	374026	6127723	89.0	56.5	154.5	125.2	11.6	28.8	1.6	61	0	Diamond site
B	5297.5	L	374048	6128224	43.8	26.5	52.7	44.1	7.5	9.8	1.4	95	0	SE corner of drill site #6
LINE L60330														
A	900.5	L	374254	6128192	18.9	10.9	17.7	19.6	5.4	5.8	1.1	140	0	
LINE L60340														CL01 Konax N.E corner of drill Site #6
* A	1902.2	L?	373995	6112473	44.2	41.6	81.1	78.4	5.2	12.0	0.7	91	0	DIAMOND discovery site "B"
* B	1889.0	L	374015	6113019	38.1	45.6	107.6	108.4	3.0	13.4	0.5	78	0	
C	1517.0	L	374444	6128204	11.5	3.0	72.5	90.8	4.8	10.3	3.2	167	0	

CX = COAXIAL
CP = COPLANAR

JOB 1306

Note: EM values shown above are local amplitudes

EM Anomaly List

See MAP
7,335 Hz

* 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 magnetite/overburden effects.

Label	Fid	Interp	XUTM m	YUTM m	CX 6431 HZ Real ppm	CX 6431 HZ Quad ppm	CP 7176 HZ Real ppm	CP 7176 HZ Quad ppm	CP 335 HZ Real ppm	CP 335 HZ Quad ppm	Vertical Dike COND siemens	Vertical Dike DEPTH* m	Mag. Corr NT
LINE L60350													
A	2096.0	L	374134	6110534	22.8	12.6	29.5	26.4	9.7	9.3	1.3	120	0
B	2173.5	L	374207	6113421	38.8	25.6	85.8	45.6	7.0	20.4	1.2	77	0
C	2555.5	L	374645	6128245	85.0	69.8	175.6	139.0	10.8	30.4	1.1	77	0
LINE L60360													
A	3304.0	L	374398	6113088	33.4	29.8	55.4	59.1	5.3	10.7	0.7	97	0
B	3298.4	L	374411	6113311	28.4	5.6	27.8	23.7	8.8	9.9	5.0	148	0
C	3296.0	L	374417	6113407	22.0	0.6	25.5	24.4	6.9	8.8	49.0	177	0
D	3160.5	L	374582	6118979	16.1	14.4	28.3	28.1	1.6	4.5	0.6	134	0
LINE L60370													
A	3477.5	L	374496	6109199	19.9	13.7	14.6	13.2	3.6	4.1	0.9	123	0
B	3577.5	L	374604	6113310	43.1	3.2	14.8	2.6	5.1	4.9	25.2	132	0
C	3684.5	L	374724	6117565	22.9	21.8	41.7	43.3	1.0	6.4	0.6	115	0
D	3951.0	L	375036	6128193	36.3	7.3	14.4	20.3	4.0	2.3	6.8	107	0
LINE L60380													
A	4791.0	L	374677	6108619	86.7	31.5	138.2	68.8	3.4	21.3	3.7	72	0
B	4785.4	L	374691	6108838	72.4	75.9	170.4	167.4	4.5	22.7	0.7	72	3
C	4676.0	L	374820	6113294	46.0	12.6	31.0	13.1	5.6	1.8	4.6	90	0
D	4592.0	L	374923	6116800	50.9	42.0	106.3	87.1	6.7	19.8	0.9	82	0
E	4416.2	L	375119	6124074	79.8	80.1	176.0	169.3	9.8	30.4	0.8	67	0
F	4318.5	L	375257	6128188	30.1	22.5	111.3	109.0	4.4	14.6	0.9	102	0
G	4289.0	L	375290	6129457	60.2	51.0	127.6	104.1	6.5	22.2	0.9	77	0
H	4259.0	L?	375320	6130738	37.0	22.7	59.2	42.8	5.3	12.4	1.3	109	0
LINE L60390													
A	4932.0	L	374985	6112286	18.6	14.7	22.9	27.2	0.3	1.4	0.7	134	0
B	4960.0	L	375009	6113385	21.3	1.6	41.5	7.9	3.8	4.4	18.6	173	0
C	4981.0	L	375050	6114243	19.9	39.7	46.8	82.4	3.0	5.4	0.2	119	7
D	5031.0	L	375094	6116279	8.3	17.3	38.1	43.1	2.3	3.0	0.2	107	0
E	5312.0	L	375422	6127539	41.7	36.2	67.2	66.7	4.1	12.3	0.8	89	0
F	5328.5	L	375442	6128189	41.6	32.9	38.3	39.0	3.4	4.0	0.9	88	0
G	5390.0	L	375508	6130694	0.0	0.0	0.6	0.6	6.0	12.2	---	---	0
LINE L60400													
A	6061.0	L	375237	6113476	58.0	5.7	71.6	38.1	5.9	10.1	18.3	114	0
B	5695.5	L	375658	6128154	34.8	22.4	57.7	44.1	3.4	9.0	1.2	94	0
C	5633.5	L	375703	6130688	41.3	43.4	138.2	93.3	7.6	28.1	0.6	91	0
LINE L60410													
* A	6320.1	L?	375383	6112017	43.6	54.6	92.4	109.2	1.0	12.8	0.5	95	1
B	6358.0	L	375434	6113571	78.5	61.7	85.3	87.9	5.9	6.5	1.2	67	0
C	6387.0	L	375461	6114780	39.2	27.5	23.1	11.1	0.8	3.6	1.1	91	0
D	6712.5	L	375830	6128185	46.1	32.3	60.6	48.8	5.0	11.9	1.1	82	0

ANOMALY West of drill site #7

Paleo dated ~~dated~~ 78 to 84 million yrs.

CX = COAXIAL
CP = COPLANAR

JOB 1306

Note: EM values shown above are local amplitudes

EM Anomaly List

* 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 magnetite/overburden effects.

Label	Fid	Interp	XUTM m	YUTM m	CX 6431 HZ Real ppm	CX 6431 HZ Quad ppm	CP 7176 HZ Real ppm	CP 7176 HZ Quad ppm	CP 335 HZ Real ppm	CP 335 HZ Quad ppm	Vertical Dike COND siemens	Vertical Dike DEPTH* m	Mag. Corr NT	
LINE L60420														
* A	7444.0	L	375632	6113647	50.9	11.5	27.1	18.1	1.8	0.8	6.4	86	0	gas line
B	7417.0	L	375663	6114763	13.6	10.1	6.5	5.6	0.3	0.3	0.7	142	0	
C	7097.0	L	376045	6128177	25.7	10.6	124.4	66.4	10.6	27.5	2.0	106	0	
D	7036.0	L	376128	6130686	16.1	22.2	31.9	17.0	2.8	7.5	0.3	131	0	
LINE L60430														
A	7756.0	L	375834	6113726	46.5	8.9	29.6	16.9	2.3	1.7	6.2	124	0	
LINE L60440														
* A	1344.5	L	375952	6111340	16.6	6.5	31.7	16.3	7.5	11.5	1.9	139	12	
B	1313.5	L	375986	6112500	16.0	9.6	2.3	11.4	1.1	1.3	1.0	139	0	
* C	1281.0	L	376049	6113796	38.7	9.9	19.7	4.2	0.5	0.1	4.8	98	0	gas line
D	1257.0	L	376070	6114757	42.1	31.3	18.5	30.7	0.3	3.2	1.0	91	0	gas line
E	1202.0	L	376139	6116950	51.2	52.6	90.2	101.0	2.5	10.9	0.7	82	0	
F	1097.5	L	376243	6121189	20.0	23.4	47.3	45.8	1.8	5.9	0.4	119	9	
G	1090.0	L	376254	6121487	18.3	14.9	46.3	33.4	2.1	6.6	0.7	126	0	
H	1052.5	L	376507	6123005	62.4	52.0	121.7	101.7	7.2	18.8	1.0	76	0	
I	1014.0	L	376353	6124551	80.7	66.5	182.7	130.2	12.9	33.2	1.1	68	0	
J	987.5	L	376374	6125597	16.0	17.1	28.7	33.2	0.9	3.7	0.4	132	0	
K	923.0	L	376454	6128146	33.0	20.5	44.3	32.3	4.5	8.7	1.2	103	0	
L	909.2	L	376475	6128678	113.3	77.7	242.4	148.7	23.5	52.2	1.6	53	0	
LINE L60450														
* A	1550.0	L	376178	6111056	32.6	45.7	96.3	84.9	7.2	19.0	0.4	103	0	
B	1625.0	L	376227	6113901	70.5	41.0	56.6	71.6	1.4	6.2	1.7	78	0	
C	1648.0	L	376263	6114789	19.1	10.4	14.7	25.2	1.3	2.8	1.2	129	0	gas line
D	1993.5	L	376632	6128176	36.8	18.9	30.9	35.4	4.1	6.4	1.7	103	0	
LINE L60460														
A	2835.0	L	376312	6109638	15.3	29.5	75.4	37.6	4.3	13.2	0.2	144	0	
* B	2722.0	L	376432	6113911	85.1	50.8	84.6	90.3	2.7	10.0	1.8	68	3	
C	2701.0	L	376458	6114776	33.1	30.8	41.1	41.9	3.0	5.7	0.7	94	0	
D	2688.0	L	376481	6115295	25.4	11.6	29.4	19.9	2.6	6.3	1.8	112	0	
E	2679.0	L	376488	6115646	48.0	44.7	94.3	97.5	3.7	14.3	0.8	82	0	
F	2362.0	L	376844	6128141	45.3	35.4	82.6	84.5	3.4	10.8	1.0	84	0	
LINE L60470														
* A	2996.5	L	376570	6111576	58.3	55.2	113.1	96.5	5.0	13.0	0.8	87	10	
B	3060.0	L	376627	6114039	55.5	31.5	43.5	35.4	1.7	0.5	1.6	79	0	gas line
C	3077.0	L	376641	6114693	2.6	0.9	10.8	8.6	1.1	2.3	---	---	0	
D	3420.0	L	377044	6128147	24.5	11.4	24.2	14.6	4.1	4.4	1.7	123	0	
LINE L60480														
A	4163.0	L	376857	6114107	60.0	18.4	45.9	33.4	1.4	4.4	4.2	79	0	gas line
B	3814.0	L	377251	6128116	32.5	12.1	35.3	19.6	4.6	8.1	2.6	112	0	

HZ

drill site #7
#7 Anomaly

CL 03 Komax
Vertical
significant structure
including faulting

150m SE of #7 (Edge of Anomaly drill site #7)

MAG NOT due to gas line ?

400 metres EAST of drill site #7

CX = COAXIAL
CP = COPLANAR

JOB 1306

Note: EM values shown above are local amplitudes

EM Anomaly List

* 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 magnetite/overburden effects.

Label	Fid	Interp	XUTM m	YUTM m	CX 6431 HZ Real ppm	CX 6431 HZ Quad ppm	CP 7176 HZ Real ppm	CP 7176 HZ Quad ppm	CP 335 HZ Real ppm	CP 335 HZ Quad ppm	Vertical Dike COND siemens	Vertical Dike DEPTH* m	Mag. Corr NT
LINE L60490													
A	4506.0	L	377034	6114192	106.8	48.1	100.3	80.3	1.5	12.1	2.9	65	0
B	4667.0	L	377229	6120336	1.3	1.0	1.2	0.5	1.3	0.3	---	---	0
C	4863.0	L	377440	6128156	32.4	15.5	38.3	24.7	3.2	7.5	1.8	91	0
LINE L60500													
A	5643.0	L	377125	6109746	14.7	16.7	17.5	28.7	1.6	2.2	0.4	139	0
*B	5630.0	L	377137	6110230	31.0	50.8	56.8	109.0	4.2	8.6	0.3	101	0
C	5526.5	L	377252	6114269	58.1	22.0	36.8	23.1	2.1	2.4	3.0	82	0
D	5410.5	L	377377	6118771	67.0	83.4	131.0	170.9	3.4	18.7	0.6	79	1
E	5374.0	L	377424	6120194	42.8	35.8	56.6	69.4	3.0	8.2	0.9	93	0
F	5221.5	L	377587	6126074	74.3	77.5	143.9	152.2	5.9	22.7	0.7	77	0
G	5169.6	L	377642	6128118	43.7	22.9	68.3	44.9	6.7	12.9	1.7	76	0
LINE L60510													
A	5856.5	L	377444	6114344	50.1	12.7	39.5	66.8	2.8	7.7	5.3	89	0
B	5907.5	L	377501	6116194	5.9	3.0	21.7	7.8	0.4	3.5	0.9	208	0
C	6001.0	L	377605	6120053	15.5	9.2	7.7	11.6	0.5	1.4	1.0	138	0
D	6038.0	L	377652	6121556	16.3	12.2	29.4	29.2	1.7	4.3	0.7	130	0
E	6205.5	L	377834	6128123	21.7	12.2	37.8	19.2	4.6	9.4	1.2	126	0
LINE L60520													
A	6657.8	L	377657	6114397	59.6	30.4	65.8	55.3	2.8	9.3	2.0	81	0
B	6536.3	L	377807	6119422	49.3	44.5	94.8	91.1	5.2	14.8	0.8	79	0
C	6315.0	L	378060	6128107	15.8	8.4	19.7	10.2	1.9	2.4	1.2	150	0
LINE L60530													
A	6953.8	L	377793	6112578	15.6	31.4	49.8	68.6	1.0	6.2	0.2	87	7
B	7001.5	L	377853	6114506	11.2	3.8	3.2	0.4	0.2	2.8	2.1	167	0
C	7113.4	L	377959	6119267	23.8	19.6	36.1	49.4	3.4	5.7	0.7	115	1
D	7122.5	L	377973	6119658	16.7	13.9	6.5	11.2	0.9	1.2	0.6	130	0
E	7337.5	L	378250	6128134	48.6	27.8	116.7	97.0	6.4	21.6	1.6	80	0
LINE L60540													
A	7804.5	L	378064	6114563	17.0	1.9	16.9	8.4	3.0	2.1	10.1	192	0
B	7694.0	L	378185	6118987	12.4	24.9	28.4	47.6	3.7	4.4	0.2	94	0
C	7683.0	L	378196	6119404	20.1	12.1	11.7	15.6	0.4	1.1	1.1	127	0
D	7648.5	L	378240	6120775	23.6	13.1	41.5	29.6	2.4	7.7	1.3	105	5
E	7460.0	L	378452	6128088	49.1	22.9	60.9	43.0	3.8	9.0	2.1	87	0
LINE L60550													
A	8043.0	L	378131	6110005	55.2	55.1	111.0	102.4	4.5	16.3	0.7	79	0
B	8156.0	L	378258	6114677	37.0	17.8	37.9	28.2	2.4	4.1	1.8	105	0
C	8255.5	L	378386	6118838	29.4	25.1	75.0	57.1	6.5	13.0	0.7	98	0
D	8265.0	L	378391	6119247	7.9	3.7	3.9	7.5	0.3	1.6	1.1	182	4
E	8306.5	L	378433	6121046	5.4	10.2	19.6	18.5	2.7	3.0	0.1	206	0

Anomaly Resistive
Seismic (Basement) coincidental

CX = COAXIAL
CP = COPLANAR

JOB 1306

Note: EM values shown above are local amplitudes

EM Anomaly List

* 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 magnetite/overburden effects.

Label	Fid	Interp	XUTM m	YUTM m	CX 6431 HZ Real ppm	CX 6431 HZ Quad ppm	CP 7176 HZ Real ppm	CP 7176 HZ Quad ppm	CP 335 HZ Real ppm	CP 335 HZ Quad ppm	Vertical Dike COND siemens	Vertical Dike DEPTH* m	Mag. Corr NT
LINE L60550													
F	8474.0	L	378649	6128088	62.4	40.8	79.9	61.9	4.6	13.6	1.4	77	0
LINE L60560													
A	8941.0	L	378476	6114747	11.7	0.5	35.4	28.2	5.6	7.0	39.5	238	3
B	8787.0	L	378653	6121121	29.5	36.6	60.1	54.5	2.6	7.9	0.4	101	0
C	8768.9	L?	378656	6121867	49.1	50.0	84.5	98.8	5.3	14.1	0.7	83	0
D	8682.0	L	378747	6125461	12.6	10.6	30.1	24.3	0.5	2.0	0.6	149	0
E	8617.5	L	378847	6128058	21.0	8.3	5.6	3.8	0.4	0.8	2.0	131	0
LINE L60570													
A	9303.2	L	378676	6115385	73.4	63.2	143.3	117.0	8.8	26.0	1.0	66	0
B	9344.0	L	378744	6117119	11.6	17.4	29.8	35.6	2.7	4.9	0.2	148	0
C	9376.0	L	378764	6118523	30.2	28.8	78.0	67.5	1.3	8.5	0.6	101	0
D	9437.6	L	378862	6121176	51.7	37.3	66.6	74.0	6.2	11.9	1.1	83	0
E	9525.5	L	378943	6124980	21.1	20.4	29.5	22.4	3.3	5.7	0.6	124	0
F	9546.0	L	378975	6125826	40.2	45.9	79.0	92.9	5.9	15.7	0.5	101	0
G	9600.0	L	379037	6128063	24.8	9.5	0.4	14.3	0.2	0.4	2.2	115	0
LINE L60580													
A	1211.0	L	378875	6115148	18.7	12.1	42.2	27.8	3.6	8.3	1.0	134	0
B	1141.0	L	378972	6118282	13.7	10.4	7.5	9.5	0.2	1.7	0.7	145	0
C	1134.0	L	378979	6118600	34.2	32.7	61.7	58.7	3.0	10.4	0.7	96	4
D	1078.5	L	379049	6121128	28.8	8.2	35.6	21.7	3.6	9.1	3.7	111	0
E	1000.0	L	379152	6124748	30.4	27.1	62.0	56.2	6.4	13.6	0.7	107	0
F	968.0	L	379200	6126165	12.0	9.9	20.2	20.4	1.8	4.8	0.6	160	0
G	925.0	L	379249	6128058	49.9	46.5	85.1	64.8	6.6	17.4	0.8	80	0
LINE L60590													
A	1587.5	L	379084	6115482	18.9	11.9	34.0	29.5	2.4	5.1	1.0	119	0
B	1599.5	L	379095	6115986	18.6	13.3	19.6	41.7	5.7	7.1	0.8	125	0
C	1604.2	L	379103	6116178	62.3	79.2	137.8	163.7	4.1	17.5	0.5	74	0
D	1606.7	L	379108	6116279	70.9	71.2	140.0	120.7	3.3	15.4	0.8	69	0
E	1653.5	L	379148	6118188	3.4	6.6	0.5	16.8	3.5	11.1	0.1	237	0
F	1659.3	L	379155	6118423	23.9	16.0	19.2	17.2	1.0	3.6	1.0	116	9
G	1727.5	L	379245	6121160	6.2	8.8	1.4	4.0	0.3	0.8	0.2	187	0
H	1758.0	L	379274	6122382	6.0	1.5	4.1	24.5	0.2	1.0	2.7	208	0
I	1811.5	L	379330	6124600	3.7	3.5	1.1	1.1	0.3	3.6	0.3	233	0
J	1835.0	L?	379380	6125587	7.6	10.2	18.3	15.4	1.7	3.9	0.2	174	0
K	1895.8	L	379438	6128105	70.3	35.2	95.9	67.4	7.7	19.4	2.1	81	0
LINE L60600													
A	2407.0	L	379165	6111396	7.6	8.9	15.4	20.7	1.1	1.3	0.3	177	0
B	2371.0	L	379210	6113007	27.2	16.9	42.1	22.5	2.6	10.3	1.1	112	0
C	2306.3	L	379307	6115841	13.5	2.8	41.9	8.0	23.4	17.6	4.7	132	0
D	2304.0	L	379305	6115937	16.4	0.0	18.8	26.6	8.2	9.8	49.0	187	0
E	2257.8	L	379349	6117956	70.9	55.2	120.4	90.3	7.6	23.4	1.1	70	4

CX = COAXIAL
CP = COPLANAR

JOB 1306

Note: EM values shown above are local amplitudes

EM Anomaly List

* 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 magnetite/overburden effects.

Label	Fid	Interp	XUTM m	YUTM m	CX 6431 HZ Real ppm	CX 6431 HZ Quad ppm	CP 7176 HZ Real ppm	CP 7176 HZ Quad ppm	CP 335 HZ Real ppm	CP 335 HZ Quad ppm	Vertical Dike COND siemens	Vertical Dike DEPTH* m	Mag. Corr NT
LINE L60600													
F	2187.8	L	379455	6121100	10.0	9.0	36.3	1.1	1.4	9.7	0.5	170	0
G	2113.0	L	379549	6124345	29.2	19.2	35.6	26.4	3.4	5.6	1.1	107	0
H	2029.5	L	379642	6127940	21.3	5.0	30.5	5.7	29.4	1.7	4.6	108	0
LINE L60610													
A	2568.0	B?	379320	6110171	3.1	7.5	29.5	29.2	1.7	0.1	0.5	102	0
B	2729.0	L	379493	6116176	30.7	41.2	45.5	76.7	4.7	4.1	0.4	100	0
C	2862.0	L	379640	6121138	17.6	2.9	13.1	9.0	1.3	1.8	5.5	189	0
D	3018.0	L	379823	6127093	28.8	29.5	69.0	59.8	5.3	14.0	0.6	103	0
E	3043.2	L	379834	6128056	16.8	15.3	32.6	21.1	6.1	9.1	0.6	130	0
LINE L60620													
A	3481.3	L	379639	6113763	1.7	0.9	0.6	1.1	1.7	0.5	---	---	0
B	3429.5	L	379729	6116125	15.7	15.8	29.8	18.7	4.6	4.5	0.5	137	0
C	3320.0	L	379847	6121096	8.3	14.2	71.9	54.3	4.3	13.3	0.2	167	0
D	3291.7	L?	379888	6122413	43.2	48.1	89.6	87.1	6.0	16.1	0.6	84	0
E	3257.5	L	379920	6123038	15.1	7.0	4.7	4.2	0.4	0.2	1.4	147	0
F	3164.0	L	380039	6128056	73.3	71.2	124.0	102.8	10.4	23.9	0.8	70	0
LINE L60630													
A	3855.5	L	379893	6116156	17.5	15.0	30.5	23.4	1.8	2.2	0.6	124	0
B	3868.0	L	379913	6116637	30.7	41.0	84.1	82.0	0.6	14.2	0.4	104	0
C	3988.0	L	380039	6121132	21.0	11.3	13.6	8.3	2.3	1.3	1.3	125	0
D	4060.0	L	380122	6123782	40.8	37.3	78.1	71.3	4.6	13.0	0.7	89	0
E	4173.5	L	380241	6128060	17.0	6.5	4.7	7.9	0.3	1.3	2.0	149	0
LINE L60640													
A	4583.0	L	380111	6116196	31.2	17.3	40.2	35.4	8.0	4.4	1.4	107	0
B	4470.5	L	380245	6121116	13.6	0.0	20.1	30.7	1.5	4.1	49.0	224	0
C	4312.5	L	380432	6128035	8.6	15.6	41.8	28.6	3.3	7.2	0.2	164	0
LINE L60650													
A	5010.4	L	380292	6116137	10.1	10.2	5.4	2.7	3.6	0.3	0.4	155	0
B	5119.6	L	380417	6120321	12.9	12.9	21.5	24.3	1.2	3.9	0.4	144	0
C	5141.5	L	380435	6121154	2.2	9.5	5.3	12.5	0.6	1.5	---	---	0
D	5322.0	L	380627	6128069	60.7	53.2	98.7	94.0	3.6	14.5	0.9	80	0
LINE L60660													
A	612.0	L	380318	6108843	0.7	13.6	0.8	8.9	1.9	0.3	---	---	0
B	438.2	L	380517	6116087	32.3	29.4	39.1	56.8	3.8	6.5	0.7	99	2
C	317.0	L	380642	6121088	11.6	15.2	1.9	0.8	2.4	0.8	0.3	145	0
D	198.0	L?	380790	6125830	9.8	7.4	18.9	17.8	0.8	3.6	0.6	169	0
E	181.0	L	380813	6126512	77.1	68.9	164.7	133.4	9.7	30.0	0.9	74	0
F	144.0	L	380842	6128042	16.2	3.3	2.0	91.3	0.7	0.0	5.1	139	0

CX = COAXIAL
CP = COPLANAR

Note: EM values shown above are local amplitudes

* 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 magnetite/overburden effects.

Label	Fid	Interp	XUTM m	YUTM m	CX 6431 HZ Real ppm	CX 6431 HZ Quad ppm	CP 7176 HZ Real ppm	CP 7176 HZ Quad ppm	CP 335 HZ Real ppm	CP 335 HZ Quad ppm	Vertical Dike COND siemens	Vertical Dike DEPTH* m	Mag. Corr NT
LINE L60670													
A	878.3	L	380690	6116112	37.0	28.2	48.1	49.9	4.9	7.8	0.9	97	0
B	1006.0	L	380847	6121089	40.5	20.0	63.2	32.1	3.6	9.8	1.8	95	0
C	1180.0	L	381049	6128055	2.3	1.5	15.9	0.3	2.5	2.1	---	---	0
LINE L60680													
A	1499.0	L?	380723	6108677	35.6	43.3	211.3	212.6	2.0	10.3	0.5	96	0
B	1478.0	L	380734	6109487	13.6	20.5	22.4	33.4	4.0	2.4	0.2	144	0
C	1434.0	L	380748	6111296	9.7	7.8	20.9	19.5	2.5	4.1	0.6	155	0
D	1318.0	L	380895	6116094	9.1	2.8	0.4	0.1	2.2	0.4	2.2	175	0
E	1206.0	L	381059	6121070	11.1	3.1	22.1	16.5	5.2	5.8	2.7	168	0
LINE L60690													
A	1578.5	L	380901	6109282	30.2	0.0	93.1	56.4	13.2	20.1	49.0	177	0
B	1646.0	L	380961	6111933	12.5	11.4	31.9	23.1	2.9	7.2	0.5	149	6
C	1742.0	L	381075	6116059	12.4	4.0	7.1	17.3	2.6	0.4	2.3	157	0
D	1859.0	L	381244	6121090	19.4	21.1	23.3	25.6	3.1	4.4	0.4	122	0
E	2027.0	L	381453	6128042	28.6	18.9	36.6	33.2	1.3	5.8	1.1	109	0
LINE L60700													
A	2446.1	L	381279	6116076	98.2	79.8	160.5	158.0	12.4	28.2	1.2	62	0
B	2324.0	L	381418	6121074	5.6	7.2	34.6	1.3	2.5	0.8	0.2	197	0
C	2157.4	L	381648	6127984	33.4	15.2	39.9	31.9	1.3	7.3	1.9	101	0
LINE L60710													
A	2884.7	L	381543	6116099	67.3	41.2	132.5	80.1	9.1	23.3	1.6	64	0
B	2962.6	L?	381599	6119370	11.4	7.5	20.7	14.5	0.4	2.4	0.8	157	0
C	3003.5	L	381630	6121093	7.1	2.7	28.7	5.2	1.1	2.6	1.4	195	0
D	3026.0	L	381667	6122067	29.8	24.3	61.9	53.1	5.0	11.8	0.8	108	0
E	3167.0	L	381831	6128021	40.3	26.1	76.2	51.5	5.4	14.3	1.2	91	0
LINE L60720													
A	3585.8	L	381714	6116039	11.7	2.0	8.9	8.9	2.8	3.3	4.6	221	0
B	3464.0	L	381849	6121061	9.1	5.2	6.8	10.2	1.0	2.7	0.9	172	0
C	3300.3	L	382061	6127972	48.5	35.0	64.3	57.2	3.5	10.3	1.1	88	0
LINE L60730													
A	4011.5	L	381900	6116089	5.7	0.1	6.4	5.3	2.2	2.8	49.0	307	0
B	4133.5	L	382018	6121085	80.4	68.2	240.4	222.5	12.1	39.8	1.0	73	0
C	4306.0	L	382236	6128020	64.8	41.6	99.1	81.1	5.1	15.2	1.4	79	0
LINE L60740													
A	4729.8	L	382108	6116075	35.2	28.0	76.7	49.9	8.2	16.1	0.9	102	0
*B	4696.0	L	382133	6117392	13.9	16.0	31.6	24.2	8.1	8.3	0.4	137	1
C	4434.0	L	382459	6127969	12.8	4.2	2.9	1.3	1.5	0.8	2.3	156	0

ANOMALY Resistive

Le Petite Juene (Both sides of creek)

Similar surface features to drill site # 7

CX = COAXIAL
CP = COPLANAR

JOB 1306

Note: EM values shown above are local amplitudes

EM Anomaly List

* 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 magnetite/overburden effects.

Label	Fid	Interp	XUTM m	YUTM m	CX 6431 HZ Real ppm	CX 6431 HZ Quad ppm	CP 7176 HZ Real ppm	CP 7176 HZ Quad ppm	CP 335 HZ Real ppm	CP 335 HZ Quad ppm	Vertical Dike COND siemens	Vertical Dike DEPTH* m	Mag. Corr NT
LINE L60750													
A	5419.6	L	382644	6128004	27.5	14.1	58.9	42.5	3.5	10.9	1.5	116	0
LINE L60760													
A	5849.0	L	382485	6115696	18.9	6.0	25.1	18.9	1.9	4.6	2.7	144	0
LINE L60770													
A	6396.2	L	382847	6121080	42.5	25.6	73.3	49.4	6.2	14.3	1.4	89	0
B	6562.0	L	383024	6127999	21.1	7.5	21.4	12.1	3.1	4.3	2.4	125	0
LINE L60780													
A	7160.5	L?	382756	6110701	25.1	28.7	43.0	47.9	5.0	9.4	0.5	117	0
B	7141.0	L?	382781	6111378	12.4	10.7	34.1	20.3	1.9	5.5	0.5	155	0
C	7056.8	L?	382856	6114546	37.7	43.8	85.5	93.1	4.9	16.0	0.5	103	2
D	6876.0	L	383059	6121052	14.3	5.6	17.9	7.8	1.8	3.9	1.8	150	0
E	6693.5	L	383258	6127959	61.5	40.4	113.5	73.7	9.5	22.7	1.4	77	0
LINE L60790													
A	7532.0	L	383202	6119294	32.4	33.4	74.2	66.2	5.0	13.3	0.6	93	0
B	7580.0	L?	383247	6121921	22.1	25.0	49.8	44.4	4.9	9.1	0.4	123	0
C	7760.5	L	383445	6127988	36.0	20.7	52.4	32.7	6.0	10.4	1.4	95	0
LINE L60800													
A	7890.0	L	383648	6127934	73.3	55.8	140.4	100.6	8.9	25.3	1.2	72	0
LINE L60810													
A	8937.5	L	383839	6127970	52.7	42.6	80.4	70.1	2.3	11.4	1.0	92	0
LINE L60820													
A	9352.0	L	383675	6115652	23.8	23.8	47.7	43.0	5.3	10.4	0.5	121	0
B	9348.0	L	383680	6115804	22.3	14.5	29.8	27.4	0.8	5.0	1.0	133	0
C	9050.5	L	384062	6127941	31.3	23.1	50.5	41.6	2.8	8.4	0.9	98	0
LINE L60830													
A	9755.4	L?	383840	6115398	30.4	24.4	63.4	42.7	5.2	13.4	0.8	108	0
B	10066.9	L	384246	6127972	119.9	73.4	215.4	131.8	15.0	38.6	1.9	67	0
LINE L60840													
A	715.6	L	384467	6127936	20.8	9.8	43.7	23.0	6.6	12.4	1.6	120	0
LINE L60850													
A	1690.0	L	384639	6127960	17.3	6.9	23.6	13.0	4.4	6.2	1.9	146	0
LINE L60860													
A	1834.0	L	384847	6127932	20.5	15.8	44.8	30.2	5.8	8.7	0.8	131	0

CX = COAXIAL
CP = COPLANAR

Note: EM values shown above are local amplitudes

EM Anomaly List

* 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 magnetite/overburden effects.

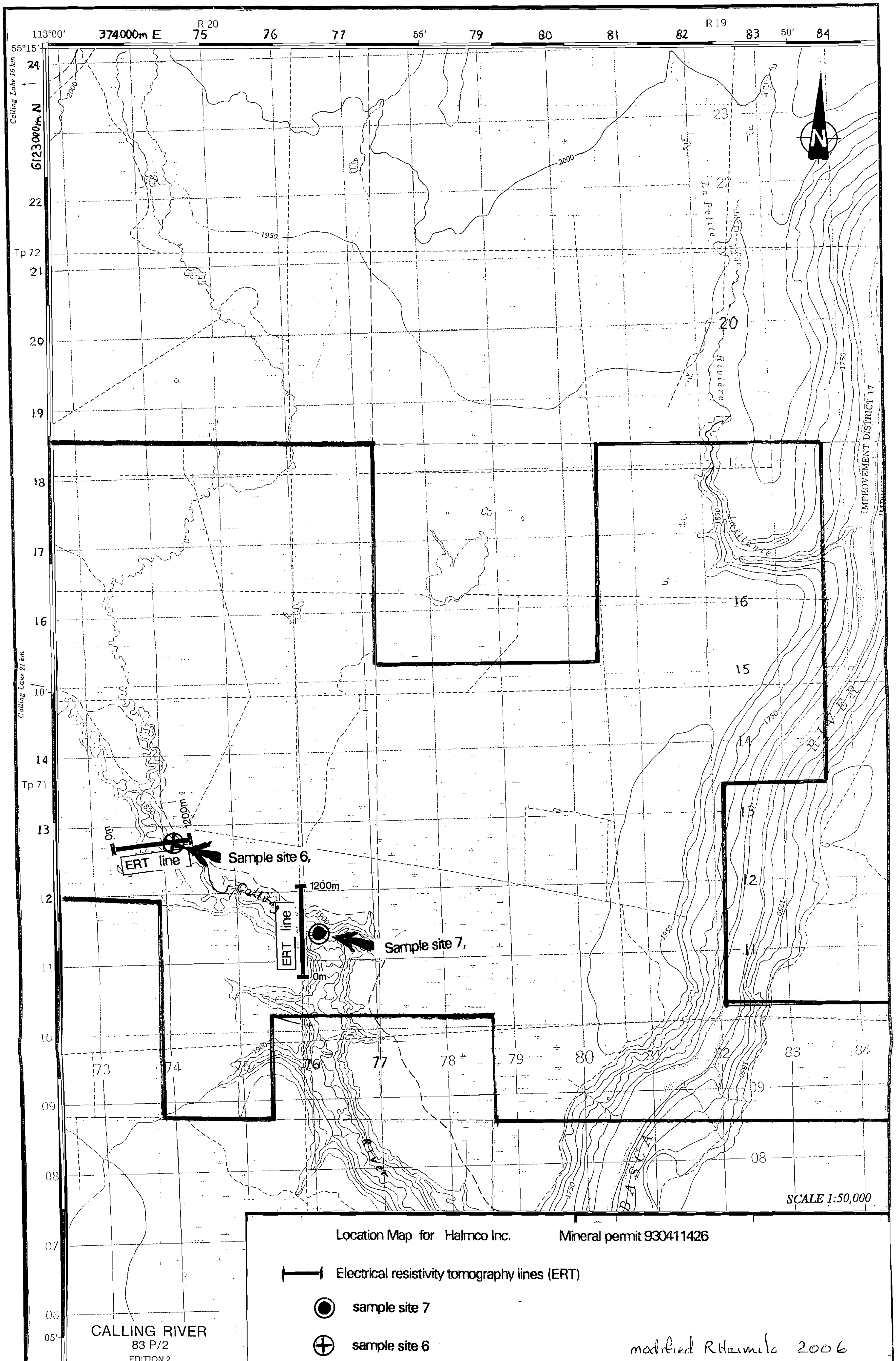
Label	Fid	Interp	XUTM m	YUTM m	CX 6431 HZ Real ppm	CX 6431 HZ Quad ppm	CP 7176 HZ Real ppm	CP 7176 HZ Quad ppm	CP 335 HZ Real ppm	CP 335 HZ Quad ppm	Vertical Dike COND siemens	Vertical Dike DEPTH* m	Mag. Corr NT	
LINE L60870														
A	2819.0	L	385014	6127922	3.8	0.4	32.5	1.6	4.8	8.8	32.1	154	0	anomaly S.E CORNER of PERMIT
LINE L60880														
A	3402.0	L	384715	6109596	31.5	36.7	57.7	75.5	10.6	14.2	0.5	99	0	COINCIDENTAL seismic diffraction
B	2942.5	L	385241	6127904	25.9	36.6	58.4	74.8	4.1	9.6	0.3	95	0	
LINE L60890														
A	3939.0	L	385422	6127929	7.6	2.4	1.8	9.1	1.1	0.1	2.0	198	0	
LINE L60900														
A	4079.0	L?	385643	6127863	3.8	7.6	3.0	1.6	0.5	1.7	0.1	224	0	
LINE L60910														
A	4951.0	L	385656	6122250	51.1	16.6	75.8	27.9	10.9	17.4	3.7	77	0	
B	5089.5	L	385833	6127942	17.2	17.5	24.0	43.1	0.0	1.5	0.5	133	0	
LINE L60920														
A	5592.0	L	385644	6113934	22.1	19.4	58.8	46.6	6.5	11.3	0.6	116	0	
B	5556.0	L	385685	6115344	16.8	12.5	32.6	22.0	2.8	7.8	0.7	125	0	
C	5514.4	L	385730	6116982	8.2	8.8	22.4	24.3	4.7	7.7	0.3	171	0	
D	5231.8	L	386055	6128026	8.0	5.5	5.0	12.8	1.0	2.1	0.7	180	0	
LINE L60930														
A	4189.0	L	385868	6114756	44.7	29.9	59.4	61.8	4.9	11.2	1.2	90	5	end of Property
B	4513.6	L	386209	6127404	28.8	16.6	53.1	27.9	7.3	12.5	1.3	94	0	
LINE L60940														
A	3798.0	L	386057	6114722	42.2	41.9	90.8	90.3	5.9	14.1	0.7	79	0	
LINE L60950														
A	2976.0	L	386257	6114750	35.0	27.0	46.4	42.5	3.5	9.6	0.9	96	4	
B	3047.0	L	386338	6117545	18.5	14.0	16.0	28.0	3.7	8.5	0.8	129	0	
C	3131.5	L	386437	6120780	24.4	7.5	51.8	14.1	3.5	10.3	3.1	124	0	
LINE L60960														
A	2575.5	L	386474	6114701	46.0	26.6	73.5	35.2	2.8	8.7	1.5	87	0	
B	2500.0	L	386523	6117682	1.0	0.7	40.8	32.9	1.4	8.8	---	---	0	
LINE L60970														
A	1698.0	L	386667	6114747	20.6	4.3	8.7	19.6	0.6	3.8	5.3	123	0	
B	1768.0	L	386749	6117560	15.4	1.1	2.3	1.0	3.4	4.0	19.0	199	0	
LINE L60980														
A	1293.5	L	386862	6114618	10.7	16.3	37.5	34.2	3.6	4.6	0.2	156	0	
B	1217.0	L	386948	6117540	27.0	27.1	50.9	39.3	5.4	12.3	0.6	108	0	

CX = COAXIAL
CP = COPLANAR

Note: EM values shown above are local amplitudes

EM Anomaly List

* 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 magnetite/overburden effects.



Sample site 6,
Sample site 7,
ERT line
ERT line
0m
1200m
1200m
0m
SCALE 1:50,000
IMPROVEMENT DISTRICT 17
La Petite Rivière
CALLING RIVER
83 P/2
EDITION 2
Location Map for Halmco Inc.
Mineral permit 9304111426
Electrical resistivity tomography lines (ERT)
sample site 7
sample site 6
modified R Haimila 2006

APPENDIX 6

CALLING River EAST (ERT ANOMALES).

MINERAL PERMIT 930411426

Drill Sites

#6 (diamond site)

N55°08'853'

W112°58'943'

(vertical structure)

#7

N 55° 08' 222"

W 112° 56' 849"

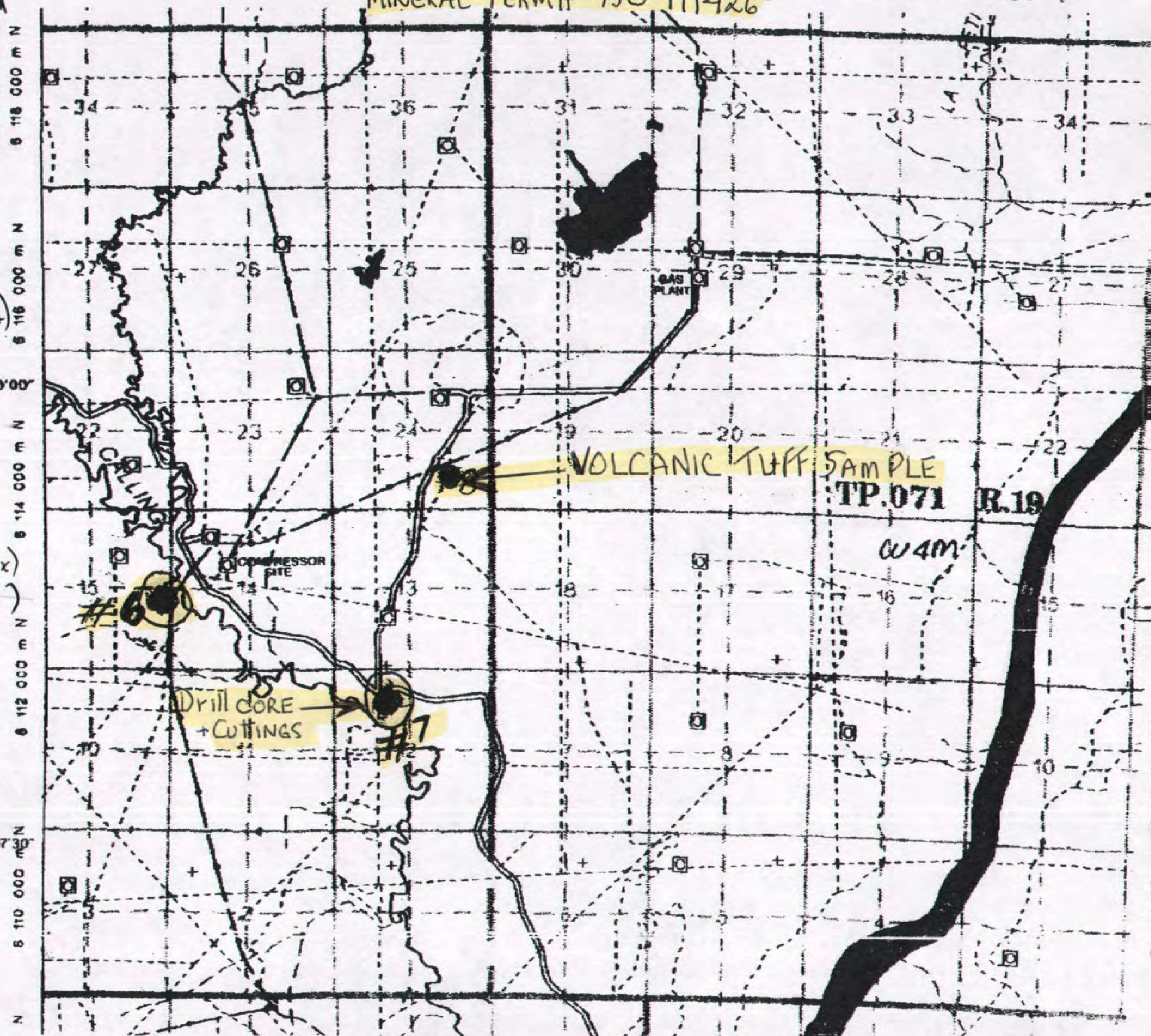
Below hill (approx)

(vertical structure)

N55° 08' 315"

W 112° 56' 849'

ON ROAD (Approx)



EXPLORING HEAVY MINERALS

September 29, 2006

Mr. Phil Brown, P. Geo
189 Astorville Road
Corbeil, Ont
P0H 1K0

E-Mail: pgeophil@hotmail.com

P2 DRILL SITE #7 — P1 DRILL SITE #6

Dear Mr. Brown:

Re: Indicator Minerals in Pan Concentrates East 102 and West 100

Attached please find our laboratory data for the above two pan concentrates. Sample West 100 yielded ~24 KIMs along with ~30 grains of gahnite, a key indicator of metamorphosed volcanogenic or Broken Hill-type Zn mineralization. However your pan concentrate and the refined concentrate that we extracted from it are both unusually large, suggesting that you panned a lot of sediment to obtain the concentrate. If so, the anomalies are exaggerated and may indicate nothing more than a regionally elevated background.

I hope these observations are helpful. Please call me if you have any questions.

Yours sincerely,

[redacted]

Stuart Averill, P.Geo.
President

Overburden Drilling Management Limited
107-15 Capella Court
Ottawa ON Canada K2E 7X1
Tel. 613 226 1771
Fax 613 226 8753
odm@storm.ca

TER ASSEMBLAGE AND REMARKS DATA HERE

INPUT REMARKS

SEM checks from 0.5-1.0 mm fraction: 3 IM versus crustal ilmenite candidates = 3 crustal ilmenite; and 1 FO versus diopside candidate = 1 corundum. SEM checks from 0.25-0.5 mm fraction: 10 IM versus crustal ilmenite candidates = 10 crustal ilmenite; and 2 green gahnite versus spinel candidates = 1 gahnite and 1 spinel.

SEM checks from 0.5-1.0 mm fraction: 6 IM versus crustal ilmenite candidates = 3 IM and 3 crustal ilmenite; 3 CR versus andradite candidates = 1 CR, 1 andradite and 1 rutile; and 1 FO versus diopside candidate = 1 siderite. SEM checks from 0.25-0.5 mm fraction: 5 GO versus almandine candidates = 2 GO (Cr-poor pyrope) and 3 almandine; 11 IM versus crustal ilmenite candidates = 2 IM and 9 crustal ilmenite; 5 CR candidates = 3 CR and 2 crustal ilmenite; and 10 representative blue-green gahnite versus spinel candidates = 8 gahnite and 2 spinel.

*Most sand and gravel (but few till) samples prescreened to <3.5 in the field.

OVERBURDEN DRILLING MANAGEMENT LIMITED
KIMBERLITE INDICATOR MINERAL PICKING FOOTNOTES

Project: East and West
Filename: Brown - EW - Sept 2006
Total Number of Samples in this Report = 2
Batch Number: 3337

SAMPLE NO.	REMARKS:
East sample 102	Almandine/epidote-kyanite-staurolite assemblage. SEM checks from 0.5-1.0 mm fraction: 3 IM versus crustal ilmenite candidates = 3 crustal ilmenite; and 1 FO versus diopside candidate = 1 corundum. SEM checks from 0.25-0.5 mm fraction: 10 IM versus crustal ilmenite candidates = 10 crustal ilmenite; and 2 green gahnite versus spinel candidates = 1 gahnite and 1 spinel.
West sample 100	Almandine/epidote-kyanite-staurolite assemblage. SEM checks from 0.5-1.0 mm fraction: 6 IM versus crustal ilmenite candidates = 3 IM and 3 crustal ilmenite; 3 CR versus andradite candidates = 1 CR, 1 andradite and 1 rutile; and 1 FO versus diopside candidate = 1 siderite. SEM checks from 0.25-0.5 mm fraction: 5 GO versus almandine candidates = 2 GO (Cr-poor pyrope) and 3 almandine; 11 IM versus crustal ilmenite candidates = 2 IM and 9 crustal ilmenite; 5 CR candidates = 3 CR and 2 crustal ilmenite; and 10 representative blue-green gahnite versus spinel candidates = 8 gahnite and 2 spinel.

*Most sand and gravel (but few till) samples prescreened to <3.5 in the field.

EN'

INPUT ASSEMBLAGE
Almandine/epidote-kyanite-staurolite
Almandine/epidote-kyanite-staurolite

*Most sand and gravel (but few till) samples prescreened to <3.5 in the field.

OVERBURDEN DRILLING MANAGEMENT LIMITED
LABORATORY SAMPLE LOG
KIMBERLITE INDICATOR MINERAL COUNTS

Project: East and West
Filename: Brown - EW - Sept 2006
Total Number of Samples in this Report = 2

Batch Number: 3337

	Weight (g)										
	Submitted Table Concentrate										
			0.25-2.0 mm Heavy Liquid Separation S.G 3.20								
					Nonferromagnetic HMC						
						Processed Split					
								Total			
Sample Number	Total	-0.25 mm	Heavy Liquid Lights	Mag HMC	Total	%	Weight	<0.25 mm (wash)	0.25 to 0.5 mm	0.5 to 1.0 mm	1.0 to 2.0 mm
East sample 102	84.8	39.3	43.0	0.3	2.2	100	2.2	0.2	1.5	0.4	0.1
West sample 100	458.9	107.5	161.6	2.0	187.8	100	187.8	20.9	164.6	2.3	0.0

	Number of Grains																										
	Selected MMSIMs									KIMs																	
	1.0 to 2.0 mm			0.5 to 1.0 mm			0.25 to 0.5 mm			1.0 to 2.0 mm						0.5 to 1.0 mm						0.25 -to 0.5 mm					
Sample Number	Low-Cr diopside	Cpy	Gh	Low-Cr diopside	Cpy	Gh	Low-Cr diopside *	Cpy	Gh *	GP	GO	DC	IM	CR	FO	GP	GO	DC	IM	CR	FO	GP	GO	DC	IM *	CR *	FO	Total
East sample 102	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
West sample 100	No Sample			0	0	0	10(30)	8	8(30)	No Sample						0	0	0	3	1	0	8	2	0	2(5)	3(5)	0	24

* Numbers in brackets are estimated total indicator grains present in samples where not all of the grains were picked.

*Most sand and gravel (but few till) samples prescreened to <3.5 in the field.

*Most sand and gravel (but few till) samples prescreened to <3.5 in the field.

CERTIFICATE OF ANALYSIS

Ontario

GEO LABS

GEOSCIENCE LABORATORIES

Geoscience Laboratories (Geo Labs)
933 Ramsey Lake Road, Bldg A4
Sudbury, ON P3E 6B5
Phone: (705) 670-5637
Toll Free : 1-866-436-5227
Fax: (705) 670-3047

Issued To : **Mr. P Brown**

-

189 Astorville Road
Corbeil, ON P0H 1K0 Canada

Phone : **705-752-1123**

Fax : **-**

E-Mail : **pgeophil@hotmail.com**

Client No. : **1007**

Certificate Date : **11/17/2006**

Certificate No. : **18791**

Project Number : **SampleWest100**

Geo Labs Job No. : **06-0316**

Submission Date : **10/19/2006**

Delivery Via : **E-MAIL**

QC Requested : **NO**

Method Code reported with this certificate : **EMP-100**

Method Code	Description	Qty	Status
EMP-100	Microprobe/ Grain	1	COMPLETE

Legend:

N.D.= Not detected

N.M. = Not measured

Please refer to Geo Labs Job No. 06-0316 if you have any questions.

CERTIFIED BY

[redacted] Date : November 17, 2006

Ed Debicki, Laboratory Manager

Client	**Phil Brown**
Mineral	Garnet
Sample	**Various**
Job #	**06-0316**
Analyst	**Dave Crabtree**
Analyst Approved	**November 6th 2006**

GEOSCIENCE LABORATORIES REPORT
ELECTRON MICROPROBE ANALYSIS
Data reviewed by Dave Crabtree

Sample Label	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO*	Na2O	K2O	Total
Cr-pyrope garnets (Includes lherzolitic types)											
06-0316-P1-001	41.783	0.238	21.682	2.604	20.848	4.235	0.399	7.727	0.054	0.004	99.573
06-0316-P1-002	41.323	0.001	19.403	6.009	19.821	5.451	0.429	7.269	0.028	0.007	99.740
06-0316-P1-003	40.426	0.097	15.462	10.481	17.990	7.227	0.451	7.396	0.021	0.006	99.557
06-0316-P1-004	41.328	0.600	17.902	6.583	20.212	5.551	0.302	6.998	0.058	0.000	99.533
06-0316-P1-005	41.445	0.028	20.179	4.906	19.986	5.114	0.414	7.606	0.017	0.003	99.698
06-0316-P1-006	41.569	0.123	20.821	3.780	20.341	4.570	0.449	7.957	0.044	0.005	99.659
06-0316-P1-008	41.921	0.146	21.059	3.363	20.778	4.265	0.391	7.764	0.047	0.000	99.733
06-0316-P1-010	42.247	0.677	21.007	2.034	21.487	4.594	0.273	7.492	0.066	0.000	99.878
Low Cr pyrope (Hi Fe)											
06-0316-P1-009	40.741	0.131	22.688	0.138	15.108	5.894	0.330	14.635	0.016	0.002	99.682
Other grains pickes as garnet											
06-0316-P1-007	Zircon										

Sample Label	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO*	Na2O	K2O	Total

QUALITY CONTROL

Instrument:	**Cameca SX-100**
Analytical Conditions:	**Majors - 20kV & 20nA**
Routine:	**WDS aquisition.**
Correction Procedure:	**PAP**

Important note:

Due to variations in LOD and LOQ with sample matrix, these values are approximated in this report. Precision is best when data exceed the LOQ. The Geoscience Laboratories tracks long and short term precision on a variety of mineral standards. If you have any specific requirements please contact us.

garKNZ	41.528	0.444	23.202	0.110	18.799	5.131	0.323	10.415	0.020	0.000	99.971
garRV3	41.923	0.041	19.890	5.764	23.077	2.488	0.335	6.365	0.010	0.003	99.895
pyxBRN	50.428	0.483	7.569	0.873	17.393	17.107	0.134	4.758	0.865	0.000	99.608
ampKNZ	40.701	4.855	14.501	0.000	12.876	10.062	0.084	10.643	2.601	2.074	98.395

Standard	garKNZ	garKNZ	garKNZ	garRV3	garKNZ	garKNZ	garKNZ	garKNZ	ampKNZ	ampKNZ
Average wt%	41.528	0.444	23.202	5.764	18.799	5.131	0.323	10.415	2.601	2.074
Expected wt% *	41.460	0.440	23.140	5.770	18.810	5.134	0.320	10.500	2.600	2.100
Accuracy % rel.	0.16	0.80	0.27	-0.11	-0.06	-0.05	0.78	-0.81	0.02	-1.26
			WDS				**note #8**			
Mode	WDS	WDS		WDS	WDS	WDS	WDS	WDS	WDS	WDS
XTAL	TAP	LPET	TAP	LLiF	TAP	LPET	LLIF	LLIF	LTAP	LPET
L.O.D. wt%	0.023	0.014	0.019	0.017	0.015	0.012	0.012	0.015	0.005	0.006
L.O.Q. wt%	0.078	0.047	0.063	0.056	0.050	0.041	0.041	0.049	0.017	0.021
Count time (seconds)	20	15	20	20	30	15	30	20	70	40
Beam Current (nA)	20	20	20	20	20	20	20	20	20	20

* Expected Values are from long term in-house charcterization of mineral standards.

QC note

1) None of the reported values for these mineral standards are certified:" accuracy" is therefore based on available chemical data.
2) n.d. not determined for the specified mineral standard.
3) L.O.D. = Limit of Detection, precision ~ +/- 100%.
4) L.O.Q. = Limit of quantification (3.3 x L.O.D), precision ~ 10-30%.
5) Reported count times are for both peak and background measurements.

Sample Label	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO*	Na2O	K2O	Total

6) FeO* - total Iron expressed as FeO
7) n.a. not applicable.
8) standard may be inhomogeneous with respect to this element.

Client	**Phil Brown**
Mineral	**Chromite/Ilmenite**
Sample	**Various**
Job #	**06-0316**
Analyst	**Dave Crabtree**
Analyst Approved	**November 6th 2006**

GEOSCIENCE LABORATORIES REPORT
ELECTRON MICROPROBE ANALYSIS
Data reviewed by Dave Crabtree

Sample Label	SiO2	TiO2	Al2O3	V2O3	Cr2O3	Nb2O3	MgO	CaO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
Chromite																
06-0316-P1-011	0.062	0.712	22.411	0.285	31.873	0.000	11.085	0.000	0.199	31.996	0.074	0.083	98.779	14.580	18.876	100.240
06-0316-P1-012	0.033	2.772	4.052	0.206	38.502	0.000	6.090	0.000	0.311	44.996	0.252	0.142	97.355	22.460	24.786	99.605
06-0316-P1-013	0.083	0.177	12.499	0.211	43.057	0.000	2.956	0.001	0.257	38.507	0.047	0.749	98.544	11.087	28.531	99.655
06-0316-P2-001	0.034	0.060	3.945	0.049	59.814	0.000	7.931	0.002	0.256	26.632	0.053	0.133	98.908	7.361	20.008	99.646
Ilmenite																
06-0316-P1-014	0.101	53.769	0.372	0.224	1.056	0.149	12.743	0.017	0.316	30.588	0.102	0.029	99.466	5.876	25.301	100.054
06-0316-P1-015	0.005	49.696	0.186	0.316	0.565	0.374	11.123	0.011	0.210	35.911	0.092	0.000	98.488	12.613	24.562	99.752
06-0316-P2-002	0.018	46.520	0.332	0.346	0.266	0.246	7.740	0.009	0.250	42.557	0.020	0.010	98.317	16.430	27.773	99.963
06-0316-P2-003	0.029	54.096	0.388	0.234	0.997	0.129	12.889	0.019	0.311	30.129	0.109	0.021	99.350	5.421	25.252	99.893
06-0316-P2-004	0.034	53.962	0.394	0.227	1.010	0.142	12.954	0.016	0.245	29.992	0.112	0.013	99.100	5.439	25.098	99.645

QUALITY CONTROL

Analytical Conditions:	**Majors - 20kV & 20nA. Trace 20kV & 200nA.**
Routine:	**WDS acquisition.**
Correction Procedure:	**PAP**

Important note:

Due to variations in LOD and LOQ with sample matrix, these values are approximated in this report. Precision is best when data exceed the LOQ. The Geoscience Laboratories tracks long and short term precision on a variety of mineral standards. If you have any specific requirements please contact us.

chrRV1	0.064	0.403	9.263	0.140	62.487	0.000	13.989	0.000	0.116	13.350	0.071	0.087	99.969	1.142	12.323	100.084
ilmMSU	0.020	47.131	0.017	0.063	0.042	0.908	0.305	0.001	4.524	46.225	0.000	0.054	99.291	9.985	37.241	100.291
gahBRZ	0.047	0.000	55.955	0.000	0.003	0.010	0.024	0.000	0.357	1.890	0.000	41.389	99.676	0.000	1.890	99.676

Standard	chrRV1	ilmMSU	chrRV1	chrRV1	chrRV1	ilmMSU	chrRV1	chrRV1	ilmMSU	ilmMSU	chrRV1	gahBRZ
Average wt%	0.064	47.131	9.263	0.140	62.487	0.908	13.989	0.000	4.524	46.225	0.071	41.389
Expected wt% *	n.d.	46.756	8.900	n.d.	62.850	0.862	13.840	L.O.D.	4.600	46.419	n.d.	41.870
Accuracy % rel.		0.80	4.08		-0.58	5.31	1.07		-1.66	-0.42		-1.15
						note 8			**note 8**			
Mode	WDS	WDS	WDS	WDS	WDS	WDS	WDS	WDS	WDS	WDS	WDS	WDS
XTAL	TAP	PET	TAP	LLiF	PET	LPET	TAP	PET	LLiF	LLiF	LLIF	LLIF

Sample Label	SiO2	TiO2	Al2O3	V2O3	Cr2O3	Nb2O3	MgO	CaO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
L.O.Q. wt%	0.014	0.079	0.064	0.023	0.103	0.027	0.052	0.005	0.088	0.066	0.020	0.090				
Count time (seconds)	40	25	25	20	25	40	25	40	15	15	20	20				
Beam Current (nA)	200	20	20	200	20	200	20	200	20	20	200	20				

* Expected Values are from long term in-house charcterization of mineral standards.

QC note

1) None of the reported values for these mineral standards are certified:" accuracy" is therefore based on available chemical data.
2) n.d. not determined for the specified mineral standard.
3) L.O.D. = Limit of Detection, precision ~ +/- 100%.
4) L.O.Q. = Limit of quantification (3.3 x L.O.D), precision ~ 10-30%.
5) Reported count times are for both peak and background measurements.
6) FeO* - total Iron expressed as FeO
7) Fe2+/Fe3+ calculations are based on charge balance using the specified # of oxygens.
8) ilmMSU is heterogeneous with respect to these elements
9) n.a. not applicable.

Client	**Phil Brown**		**GEOSCIENCE LABORATORIES REPORT**
Mineral	**Garnet**		**ELECTRON MICROPROBE ANALYSIS**
Sample	**Various**		Data reviewed by Dave Crabtree
Job #	**06-0316**		
Analyst	**Dave Crabtree**		
Analyst Approved	**November 6th 2006**		

Sample Label	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO*	Na2O	K2O	Total
Cr-pyrope garnets (includes lherzolitic types)											
06-0316-P1-001	41.783	0.238	21.682	2.604	20.848	4.235	0.399	7.727	0.054	0.004	99.573
06-0316-P1-002	41.323	0.001	19.403	6.009	19.821	5.451	0.429	7.269	0.028	0.007	99.740
06-0316-P1-003	40.426	0.097	15.462	10.481	17.990	7.227	0.451	7.396	0.021	0.006	99.557
06-0316-P1-004	41.328	0.600	17.902	6.583	20.212	5.551	0.302	6.998	0.058	0.000	99.533
06-0316-P1-005	41.445	0.028	20.179	4.906	19.986	5.114	0.414	7.606	0.017	0.003	99.698
06-0316-P1-006	41.569	0.123	20.821	3.780	20.341	4.570	0.449	7.957	0.044	0.005	99.659
06-0316-P1-008	41.921	0.146	21.059	3.363	20.778	4.265	0.391	7.764	0.047	0.000	99.733
06-0316-P1-010	42.247	0.677	21.007	2.034	21.487	4.594	0.273	7.492	0.066	0.000	99.878
Low Cr pyrope (Hi Fe)											
06-0316-P1-009	40.741	0.131	22.688	0.138	15.108	5.894	0.330	14.635	0.016	0.002	99.682
Other grains pickes as garnet											
06-0316-P1-007	Zircon										

QUALITY CONTROL

Instrument:	**Cameca SX-100**
Analytical Conditions:	**Majors - 20kV & 20nA**
Routine:	**WDS aquisition.**
Correction Procedure:	**PAP**

Important note:

Due to variations in LOD and LOQ with sample matrix, these values are approximated in this report. Precision is best when data exceed the LOQ. The Geoscience Laboratories tracks long and short term precision on a variety of mineral standards. If you have any specific requirements please contact us.

Sample Label	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO*	Na2O	K2O	Total
garKNZ	41.528	0.444	23.202	0.110	18.799	5.131	0.323	10.415	0.020	0.000	99.971
garRV3	41.923	0.041	19.890	5.764	23.077	2.488	0.335	6.365	0.010	0.003	99.895
pyxBRN	50.428	0.483	7.569	0.873	17.393	17.107	0.134	4.758	0.865	0.000	99.608
ampKNZ	40.701	4.855	14.501	0.000	12.876	10.062	0.084	10.643	2.601	2.074	98.395
Standard	garKNZ	garKNZ	garKNZ	garRV3	garKNZ	garKNZ	garKNZ	garKNZ	ampKNZ	ampKNZ	
Average wt%	41.528	0.444	23.202	5.764	18.799	5.131	0.323	10.415	2.601	2.074	
Expected wt% *	41.460	0.440	23.140	5.770	18.810	5.134	0.320	10.500	2.600	2.100	
Accuracy % rel.	0.16	0.80	0.27	-0.11	-0.06	-0.05	0.78	-0.81	0.02	-1.26	
							note #8				
Mode	WDS	WDS	WDS	WDS	WDS	WDS	WDS	WDS	WDS	WDS	
XTAL	TAP	LPET	TAP	LLiF	TAP	LPET	LLIF	LLIF	LTAP	LPET	
L.O.D. wt%	0.023	0.014	0.019	0.017	0.015	0.012	0.012	0.015	0.005	0.006	
L.O.Q. wt%	0.078	0.047	0.063	0.056	0.050	0.041	0.041	0.049	0.017	0.021	
Count time (seconds)	20	15	20	20	30	15	30	20	70	40	
Beam Current (nA)	20	20	20	20	20	20	20	20	20	20	

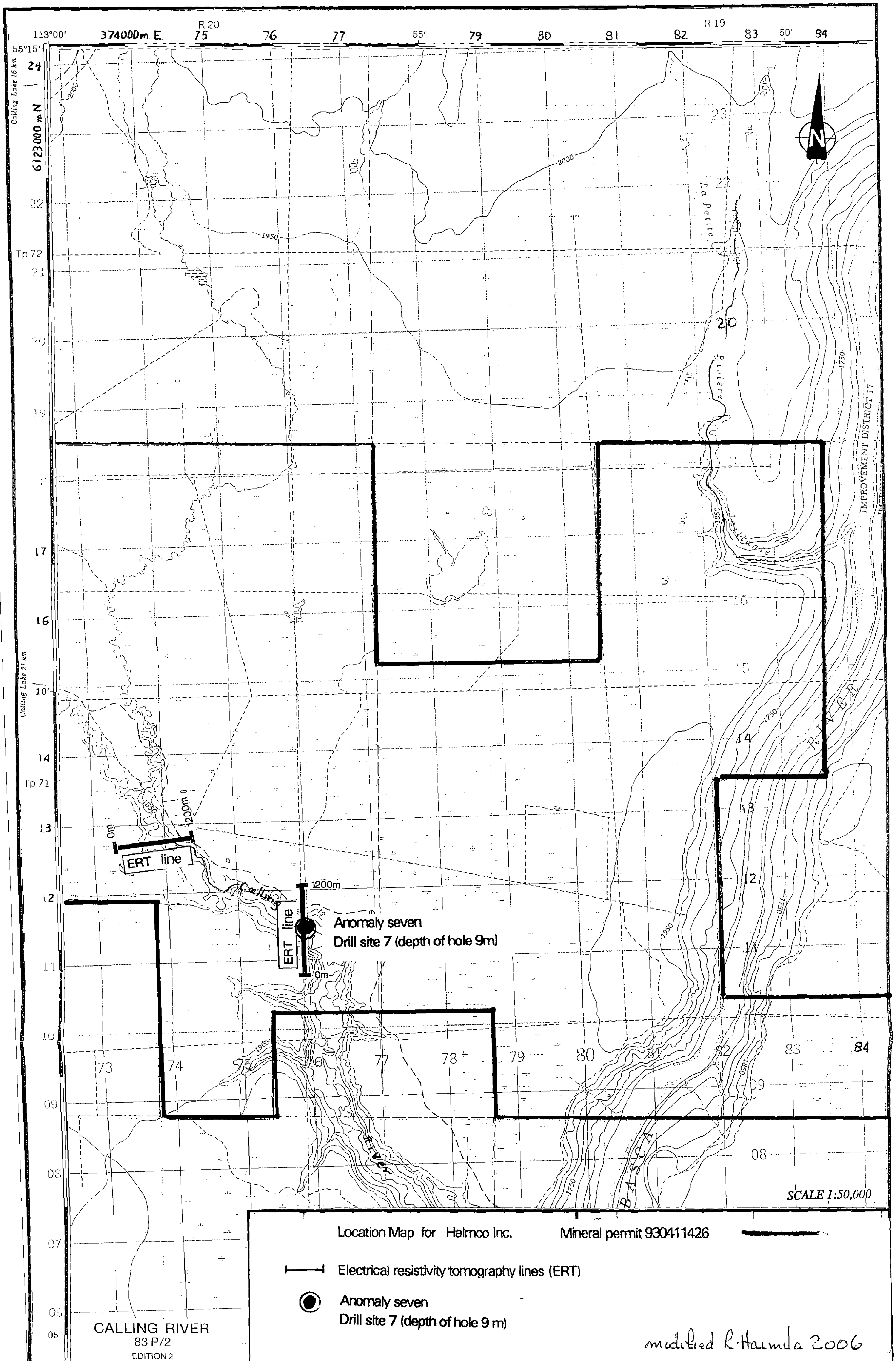
* Expected Values are from long term in-house charcterization of mineral standards.

QC note

1) None of the reported values for these mineral standards are certified:" accuracy" is therefore based on available chemical data.
2) n.d. not determined for the specified mineral standard.
3) L.O.D. = Limit of Detection, precision ~ +/- 100%.
4) L.O.Q. = Limit of quantification (3.3 x L.O.D), precision ~ 10-30%.

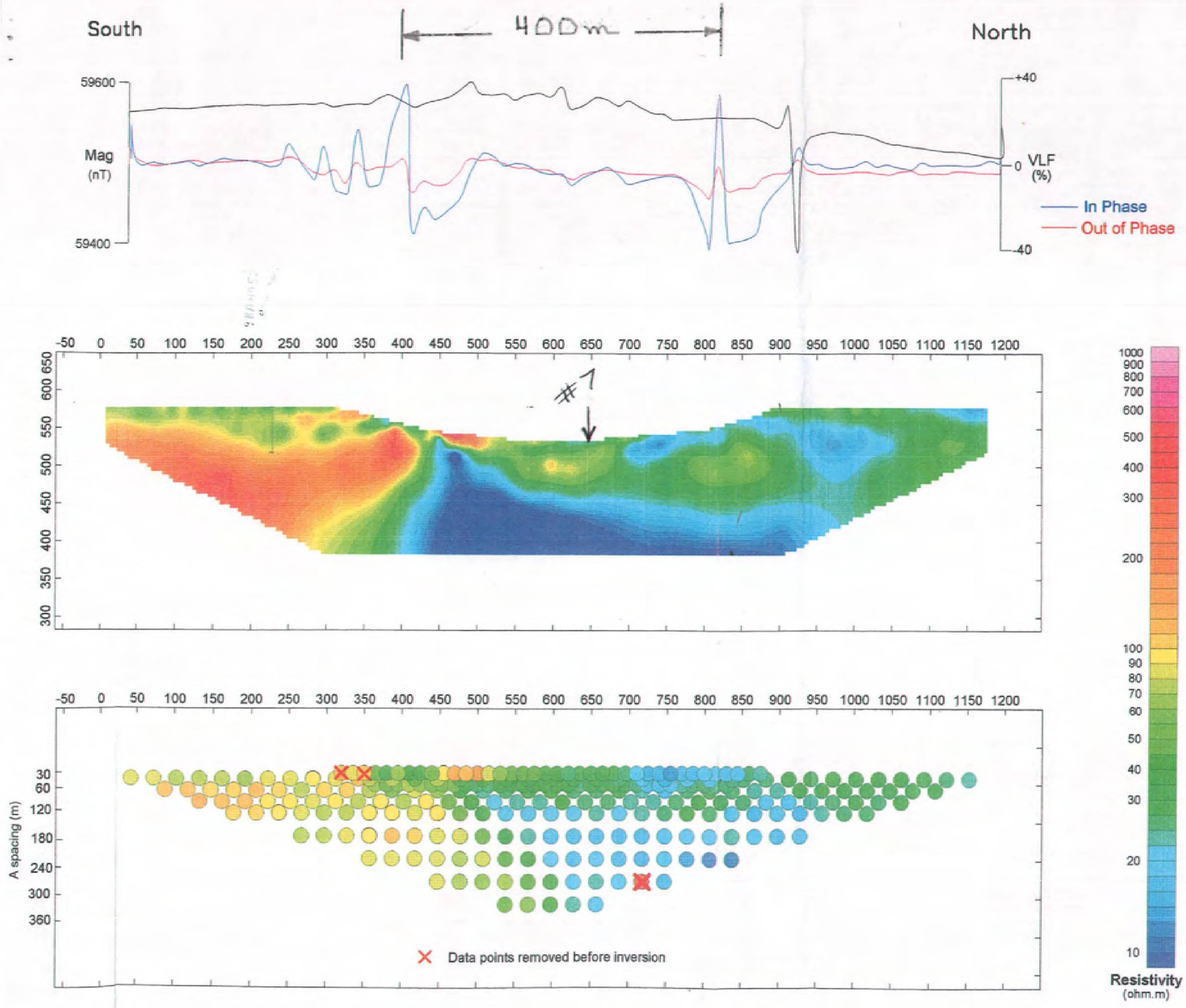
Sample Label	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO*	Na2O	K2O	Total

5) Reported count times are for both peak and background measurements.
6) FeO* - total Iron expressed as FeO
7) n.a. not applicable.
8) standard may be inhomogeneous with respect to this element.


Location Map for Halmco Inc.
Mineral permit 930411426
Electrical resistivity tomography lines (ERT)
Anomaly seven
Drill site 7 (depth of hole 9 m)
ERT line
0m
1200m
Anomaly seven
Drill site 7 (depth of hole 9m)
CALLING RIVER
83 P/2
EDITION 2
SCALE 1:50,000
modified R Hamda 2006
374000m E.
6123000m N
R 20
R 19
Tp 72
Tp 71
IMPROVEMENT DISTRICT 17
N

APPENDIX 7

drill site #7 ELECTRO RESISTIVE TOMOGRAPHY (KOMEX)



drill site #7

ERT anomaly
dighem anomaly
seismic diffraction
magnetic anomaly
anomalous indicators

Physical Characteristics of Canadian Kimberlites

T.J. Katsube and B.A. Kjarsgaard

Katsube, T.J. and Kjarsgaard, B.A., 1996: Physical Characteristics of Canadian Kimberlites; in Searching for Diamonds in Canada, A.N. LeCheminant, D.G. Richardson, R.N.W. DiLabio, and K.A. Richardson (ed.); Geological Survey of Canada, Open File 3228, p. 241-242.

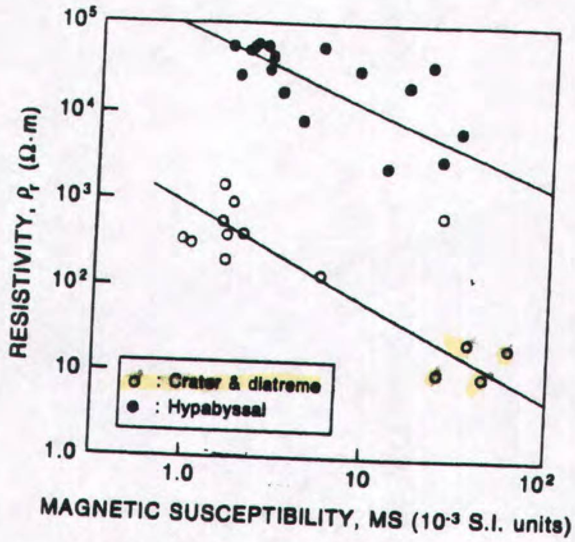


***Figure 2:** Bulk electrical resistivity (ρ_r) as a function of magnetic susceptibility (MS), showing two distinct groups: one for the hypabyssal (HB) kimberlites and the other for the diatreme/crater (DT/CR) kimberlites.*

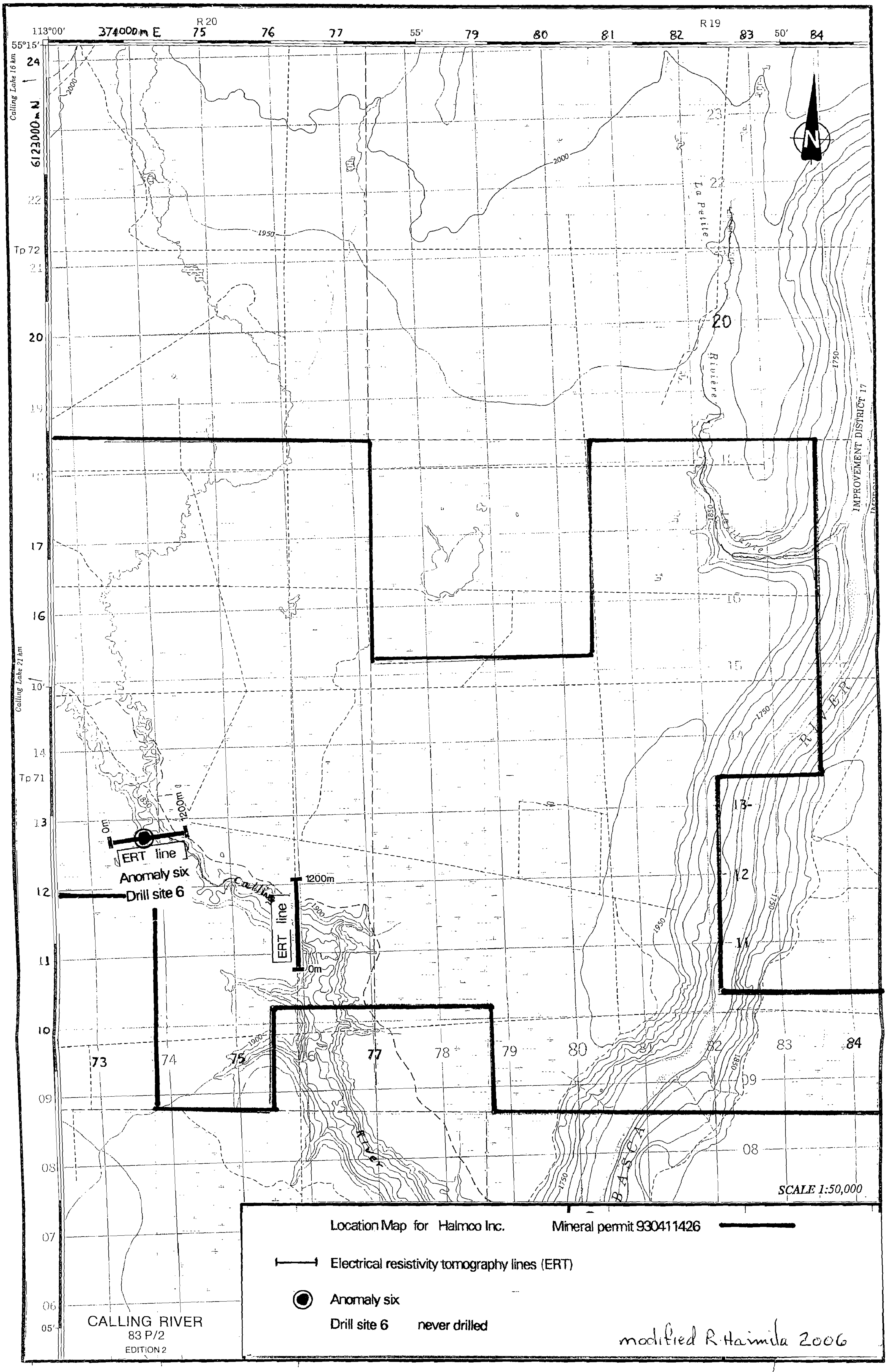
Tonnage Estimates for Craters and Diatremes (KAISER BOTTOM FISHING)

Surface Area			Crater Depth (m)			Diatreme Depth (m)		
Ha	acres	Diameter	100	200	300	100	200	300
1	2.5	113	1,675,000	3,350,000	5,025,000	2,500,000	5,000,000	7,500,000
2	4.9	160	3,350,000	6,700,000	10,050,000	5,000,000	10,000,000	15,000,000
5	12.4	252	8,375,000	16,750,000	25,125,000	12,500,000	25,000,000	37,500,000
10	24.7	357	16,750,000	33,500,000	50,250,000	25,000,000	50,000,000	75,000,000
20	49.4	505	33,500,000	67,000,000	100,500,000	50,000,000	100,000,000	150,000,000
30	74.1	618	50,250,000	100,500,000	150,750,000	75,000,000	150,000,000	225,000,000
50	123.5	798	83,750,000	167,500,000	251,250,000	125,000,000	250,000,000	375,000,000
100	247.0	1128	167,500,000	335,000,000	502,500,000	250,000,000	500,000,000	750,000,000

Use this table to estimate a circular pipe's size potential. Note that the crater numbers assume angled walls while the diatreme assumes a cylindrical shape. If you know the diameter (metres) of a circular target, calculate the hectare area as follows: 0.8 x diameter squared divided by 10000, or use the diameter column in the table.

crop out and the remainder are covered with up to 127 metres of glacial sediments. This is a photograph of the outcrop at K6. Several of the kimberlites are quite dramatic hills sticking up out of the relatively flat glacial terrain. This is an airphoto background with digital elevation topography showing the boundaries of K5. Kimberlite crops out at the top of this hill. Drilling has shown that most of the kimberlites are cone-like hills rising up out of the less resistant shale bedrock that were subsequently surrounded by glacial sediments. K5 is one of the largest of the kimberlites at 45 hectares, there would be at least 80 million tonnes of kimberlite amenable to mining at K5 were it to contain an economic quantity of diamonds.

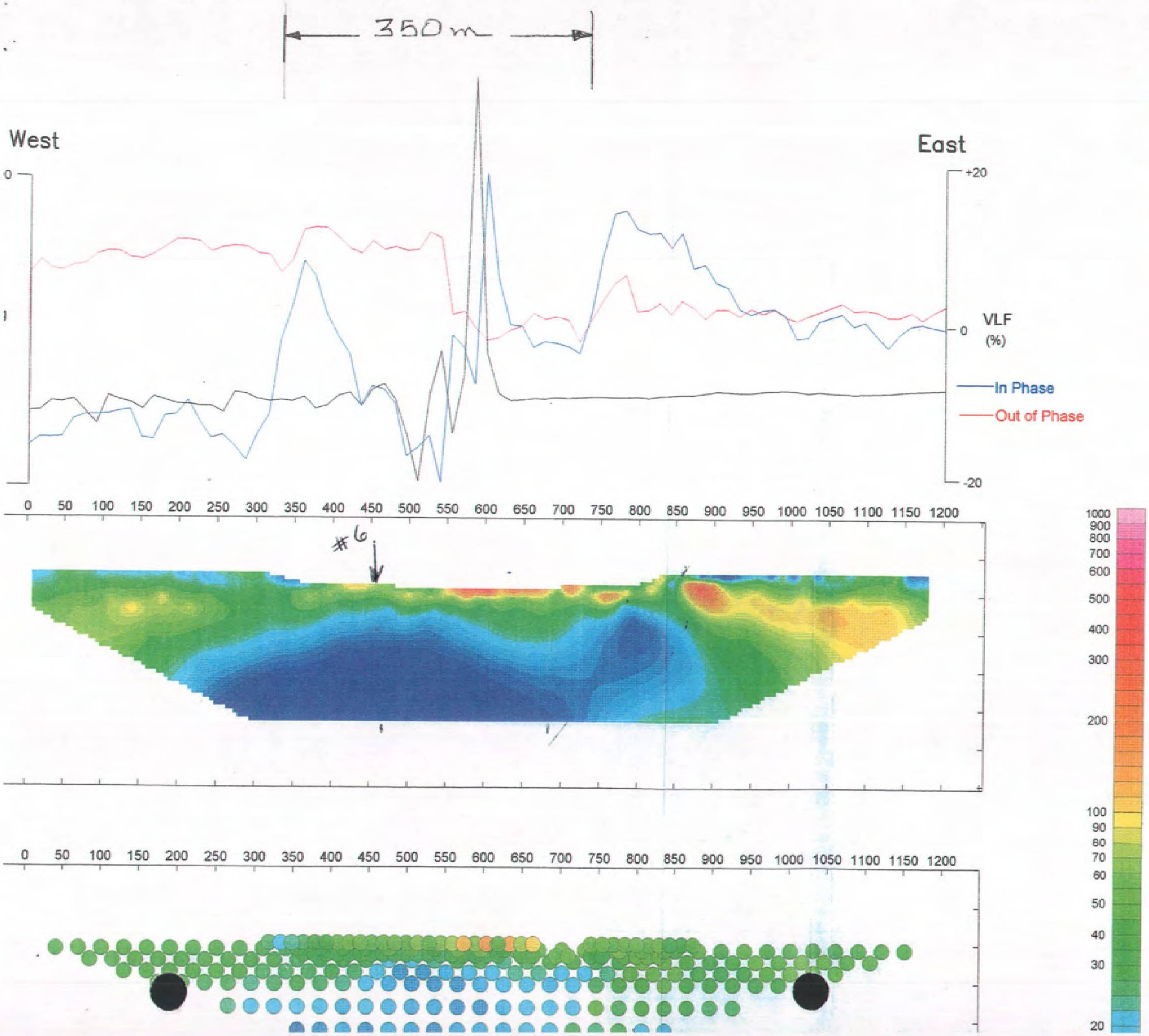
(ASHTON - MAR 22, 2002)

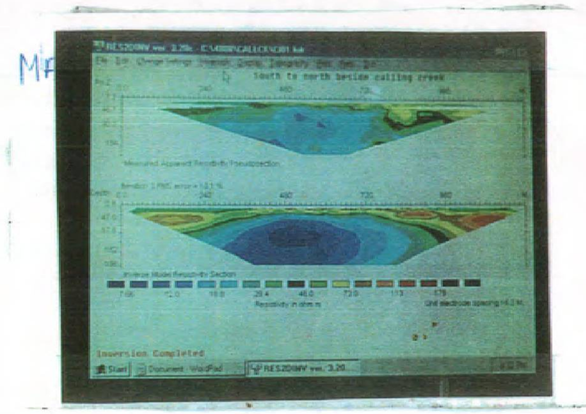


Location Map for Halmco Inc.
Mineral permit 930411426
Electrical resistivity tomography lines (ERT)
Anomaly six
Drill site 6
never drilled
modified R.Haimila 2006
CALLING RIVER
83 P/2
EDITION 2
SCALE 1:50,000
ERT line
Anomaly six
Drill site 6
0m
1200m
374000m E
6123000m N
R 20
R 19
Tp 72
Tp 71
IMPROVEMENT DISTRICT 17
La Petite Rivière

APPENDIX 8

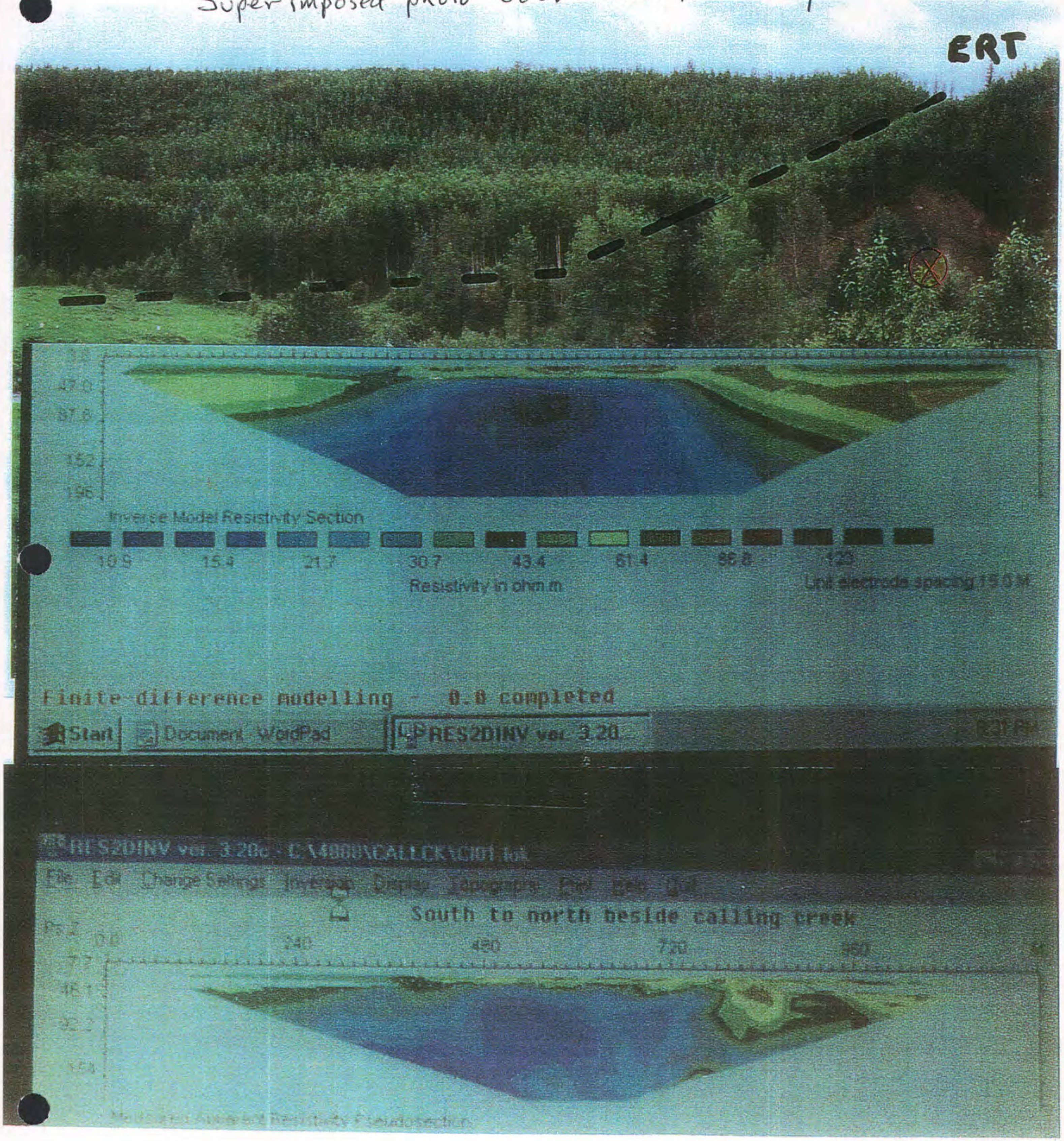
⊗ LOCATION of rock CONTAINING DIAMOND, UNULTERED OLIVINES, Picroilmenite
- - - Location of ERT Line (electro RESISTIVE Tomography) over UNUSUAL TOPOGRAPHIC FEATURE (CRATER LIKE)
• drill site #6





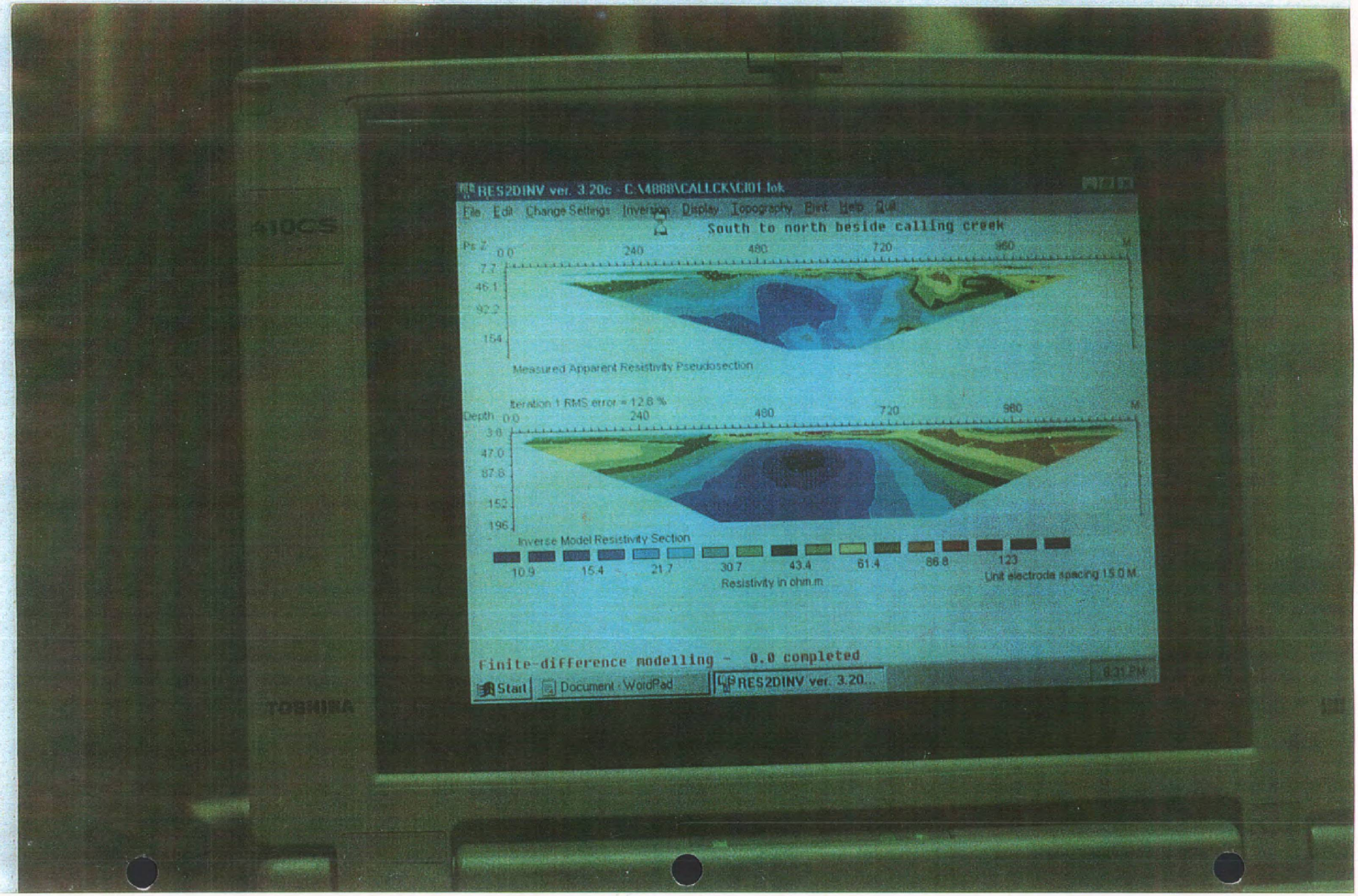
drill site # 6
ERT anomaly
Seismic diffractions
diamond site
anomalous diamond indicators
topographical crater ?

Super-imposed photo over ERT ANOMALY



ERT shows vertical structure at diamond site
2 samples of "basal till" dated Campanian Age (Palynological)
these anomalies with multiple geophysical signatures never drilled

Fig 81



Haimila Samples IV

A single sample was submitted by Mike Clark to be palynologically analysed for age determinations and paleoenvironments. Two portions of the sample were processed and analysed to assure assemblage definition.

The assemblages of both portions were closely comparable containing abundant and well preserved palynomorphs. A neritic marine environment is indicated by the presence of common dinoflagellates. Strong freshwater influx is suggested by common to abundant chlorophytic algae comprising *Pediastrum*, *Schizophacus* and *Schizocysta*.

Similar to the previous sample (Haimila Sample 3) the assemblage has mixed origins (Mid and Late Cretaceous). The moderate abundances of the dinoflagellate genus *Chatangiella* (*C.ditissima*, *C.victoriense*, *C.tripartita*) are considered to be *in situ* along with the dinoflagellates *Heterosphaeridium difficile*, *Isabelidinium bakeri*, *Isabelidinium belfastensis*, *Isabelidinium cooksoniae*, *Nelsoniella aceras*, and the pollen *Aquilapollinites quadrilobatus*, *Mancicorpus clavus* and *Multiporopollenites sp.* suggesting a Campanian age. The other Albian component comprises the dinoflagellates Astrocysta sp., Chichaouadinium vestitum, Ovoidinium scabrosum, Ovoidinium verrucosum as well as numerous spores. The age of the sample is taken to be represented by the youngest fossils which indicate a Campanian age. No Quaternary or Paleogene forms were observed suggesting that the formation of the rock occurred most-likely during the Campanian.

Unless otherwise noted, single specimens were observed.

Sample 1: Core Preparation #1 (diamond site)

basal till?

Age

Campanian with Albian/Cenomanian reworking   80m ± 5
Mancicorpus tripodiformis Zone.

Dinoflagellates

Alterbidinium spp. (Rare)
Astrocysta
Canningia collivera
Chatangiella ditissima
Chatangiella sp.
Chatangiella victoriense
Chichaouadinium vestitum
Cleistosphaeridium spp.

Cribroperidinium sp.
Cyclonephelium distinctum (Rare)
Cyclonephelium vannophorum
Diconodinium sp. indet.
Eurydinium glomeratum
Exochosphaeridium bifidum (Rare)
Heterosphaeridium difficile
Imbatodinium sp. indet.
Isbelidinium belfastensis Kellstrom
Isabelidinium cooksoniae (Rare)
Nelsoniella aceras
Odontochitina operculata
Oligosphaeridium pulcherrimum (Rare)
Ovoidinium scabrosum (Common)
Spiniferites membranaceus
Spiniferites sp. (Rare)
Trithyrodinium sp.

Other Algae & Miscellanea

Pediastrum sp. (Common)
Pterospermopsis spp.
Schizophacus grandis
Schizophacus parvus (Rare)

Angiospermous Pollen

Aquilapollenites quadrilobatus
Mancicorpus clavus

Gymnospermous Pollen

Araucariacites australis
Cedripites canadensis (Common)
Pinuspollenites spp. (Abundant)
Taxodiaceaepollenites hiatus (Dominant)

Pteridophyte & Bryophyte Spores

Cicatricosisporites spp.
Deltoidospora hallii
Gleicheniidites senonicus (Rare)
Januasporites spiniferus
Osmundacidites claytonites
Plicatella macrorhyza

Rousisporites reticulatus
Stereisporites antiquasporites

Comments

This sample contained an excellent assemblage with components derived from the Middle Cretaceous admixed with the presumed *in situ* material from the Campanian. Numerous fragmented palynomorphs were present especially the dinoflagellates of Chatangiella suggesting a site of high energy sedimentation.

4.5m Outcrop 98-2B

Age & Zone

Campanian with Albian/Cenomanian reworking
Mancicorpus tripodiformis Zone.

Dinoflagellates

Alterbidinium spp.	(Rare)
Aptea polymorpha	
Astrocysta	
Chatangiella sp.	(Rare)
Chatangiella tripartita	
Chichaouadinium vestitum	
Cyclonephelium distinctum	(Rare)
Diconodinium sp. indet.	(Rare)
Dictyopyxidia spp.	
Dinogymnium euclaensis	(Common)
Exochosphaeridium bifidum	(Rare)
Heterosphaeridium difficile	
Isabelidinium bakeri	
Isabelidinium sp.	
Odontochitina operculata	(Common)
Oligosphaeridium complex	
Ovoidinium scabrosum	
Ovoidinium verrucosum	
Palaeoperidinium pyrophorum	
Spiniferites sp.	(Common)
Stiphrosphaeridium sp. indet.	

Other Algae & Miscellanea

Lecaniella dictyota

Pediastrum sp. (Common)
Schizocysta laevigata
Schizophacus grandis

Angiospermous Pollen

Aquilapollenites quadrilobatus
Multiporopollenites sp.

Gymnospermous Pollen

Cedripites canadensis (Common)
Piceaepollenites spp. (Common)
Pinuspollenites spp. (Rare)
Podocarpidites spp.
Rugubivesiculites rugosus
Taxodiaceaepollenites hiatus (Dominant)

Pteridophyte & Bryophyte Spores

Deltoidospora hallii (Rare)
Foraminispora asymmetrica
Gleichenliidites senonicus
Impardecispora spp.
Rouseisporites radiatus
Stereisporites antiquasporites

Comments

This sample contained an excellent assemblage with components derived from the Middle Cretaceous admixed with the presumed *in situ* material from the Campanian.

GLACIAL till

Basal till

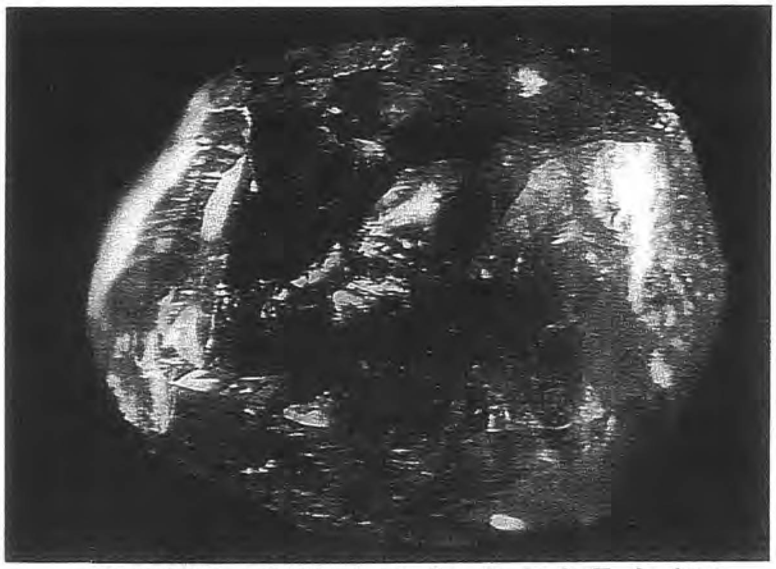
(X) SAMPLE site

Fig 2

East Calling River Diamond

PICTURE 12

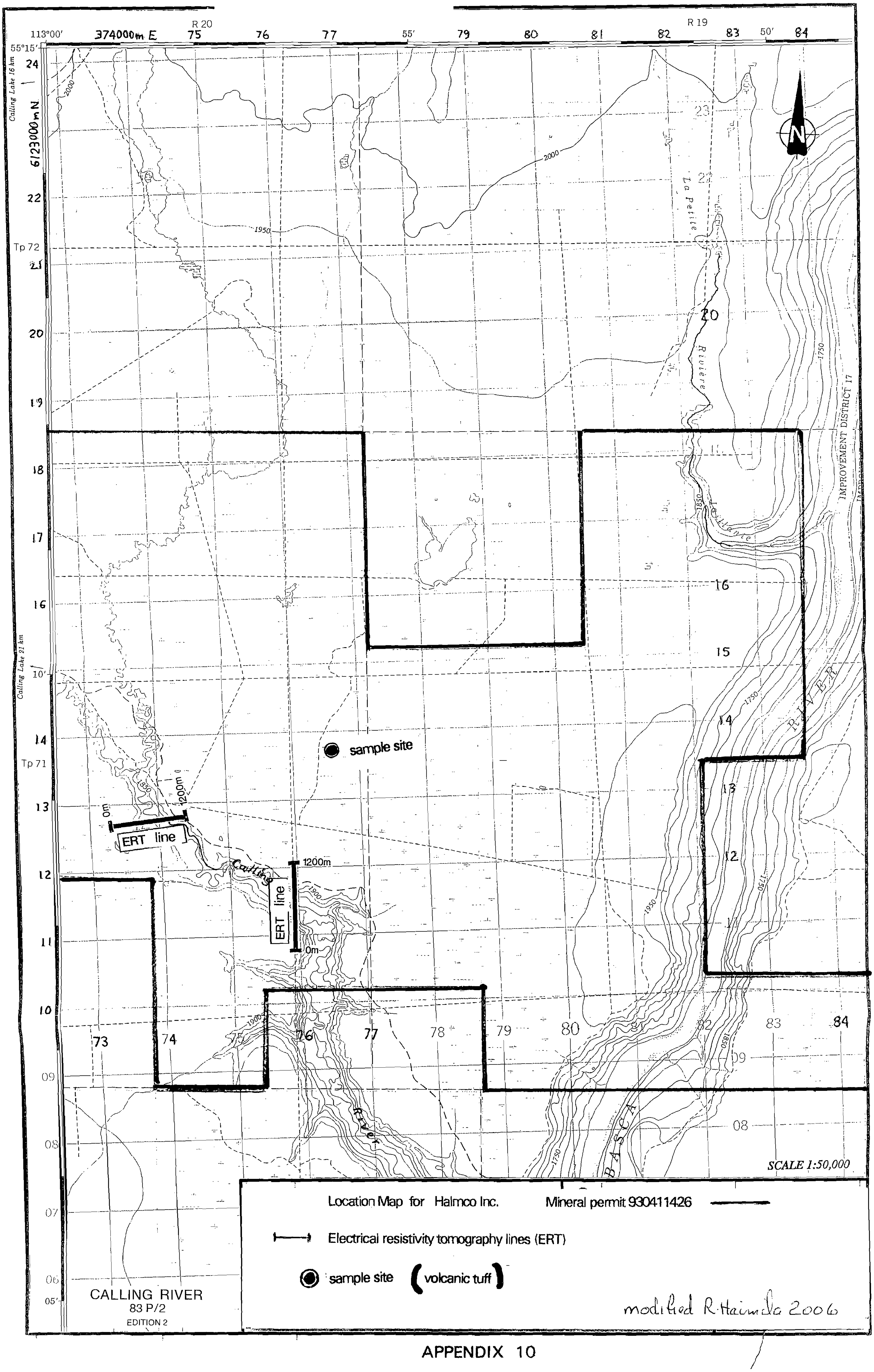
DIAMOND RECOVERED FROM SAMPLE - A FRACTION 1.7 - 0.175 mm. (MAGNIFICATION - 70x))



DIAMOND: SIZE L-1.2; W-1.0;T-0.1mm

(CLEAVAGE)

Fig 3

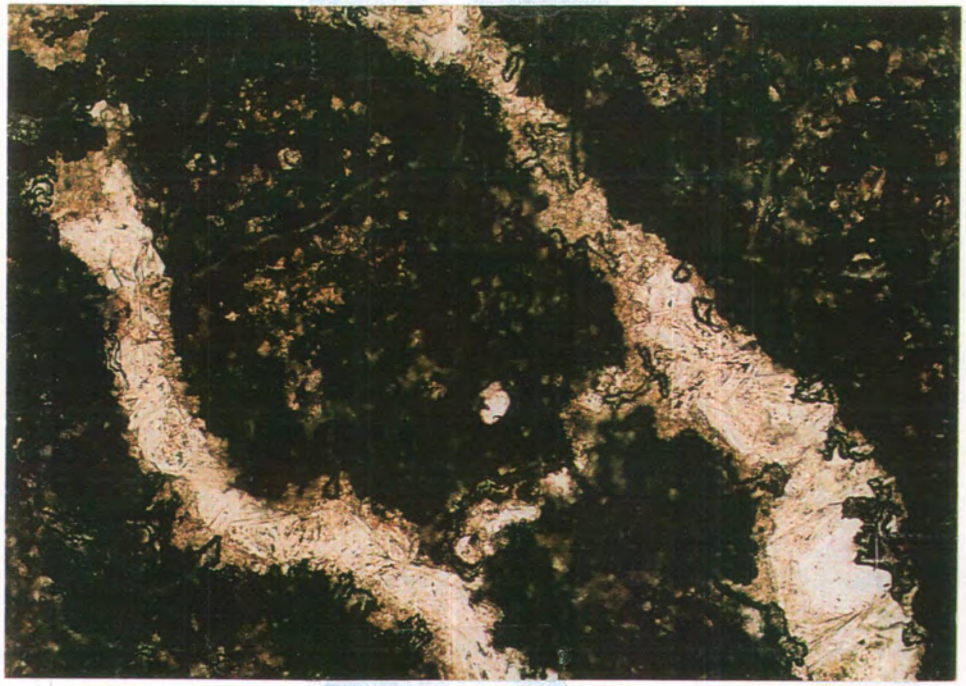

Location Map for Halmco Inc.
Mineral permit 930411426
Electrical resistivity tomography lines (ERT)
sample site (volcanic tuff)
sample site
ERT line
ERT line
0m
1200m
1200m
0m
CALLING RIVER
83 P/2
EDITION 2
SCALE 1:50,000
modified R. Haimila 2006
374000m E
6123000m N
IMPROVEMENT DISTRICT 17
La Petite Rivière
Calling River
R 20
R 19
Tp 72
Tp 71
113°00'
55°15'
55'
50'

APPENDIX 10

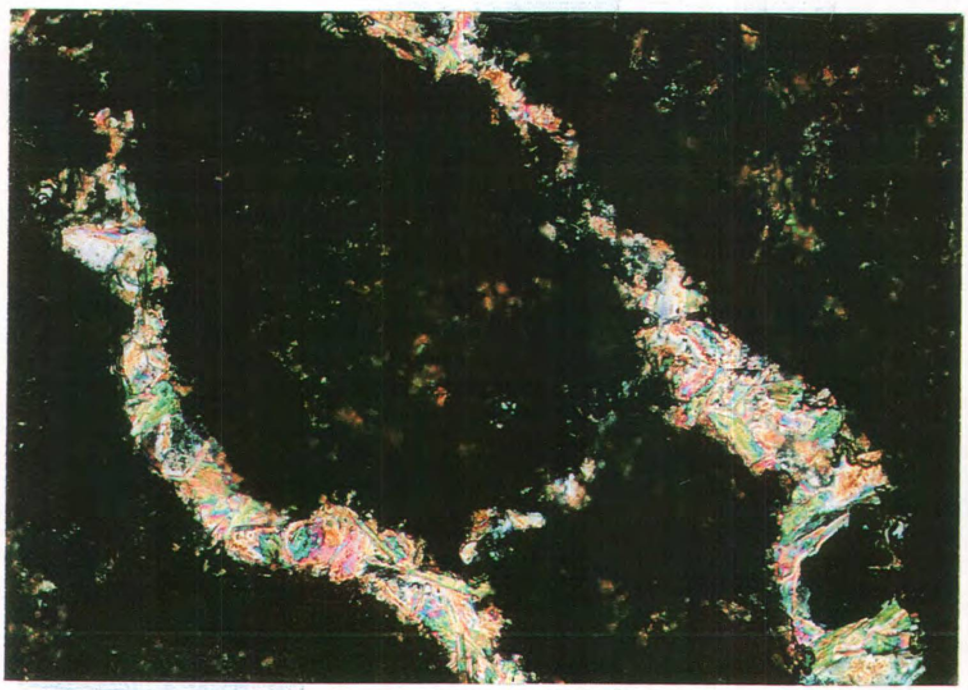
VOLCANIC TUFF SAMPLE Located 1.5 miles NORTH of drillsite #7

Thin section descriptions provided by staff at the GSC, Calgary (Dr. Nassichuk)

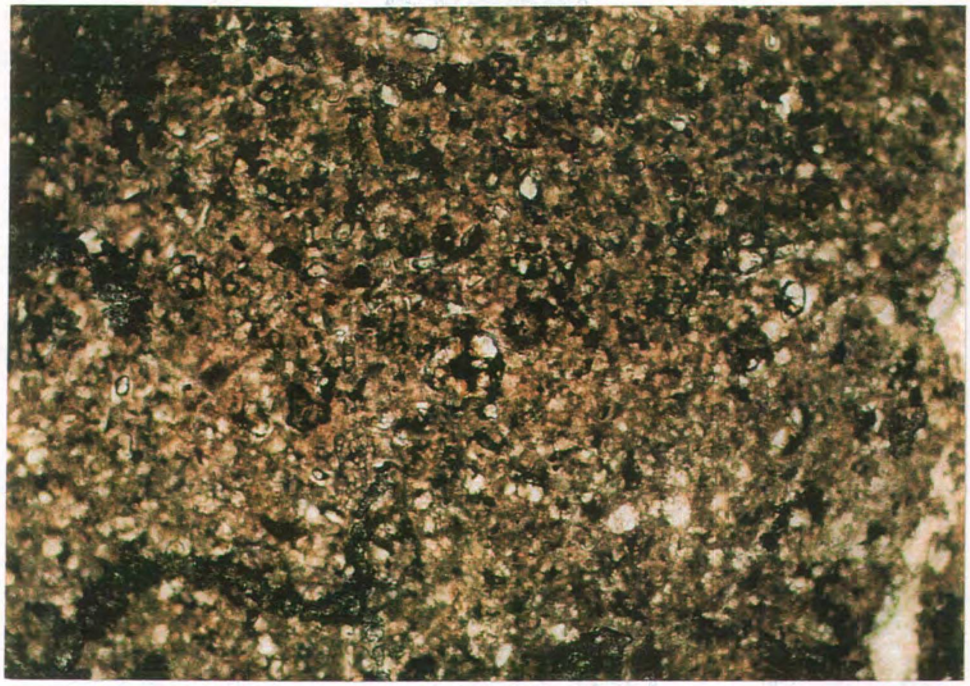
2a general view of a fine textured tuff showing microfractures which give a pseudo-breccia fabric (X20)



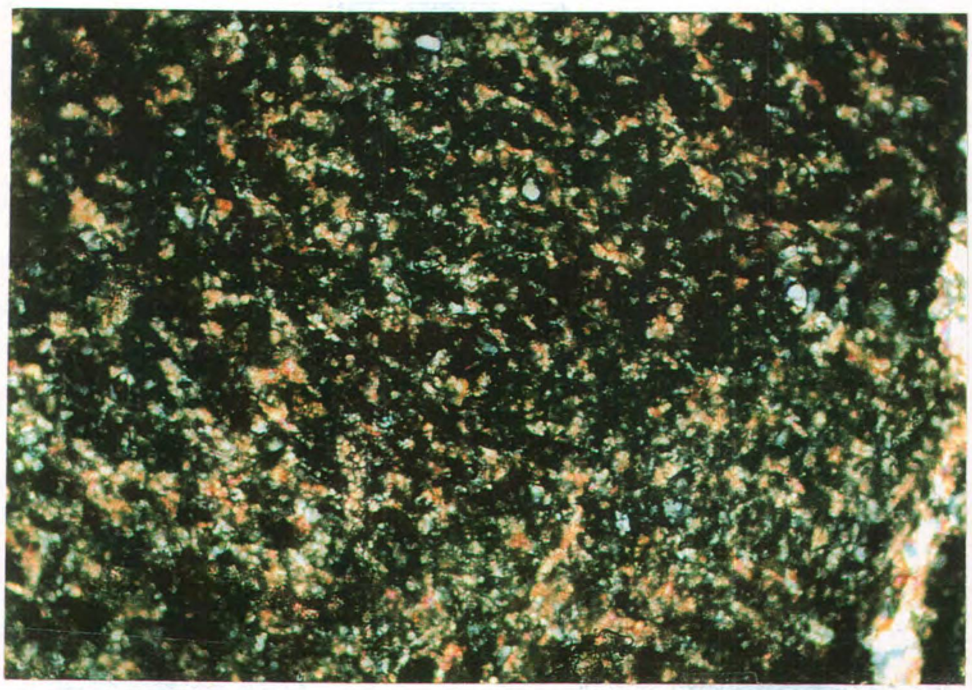
3a high magnification (X100) of fracture infilled by high birefringent low relief fibrous mineral (unidentified) probable calcite or barite but not a zeolite because of the high birefringence



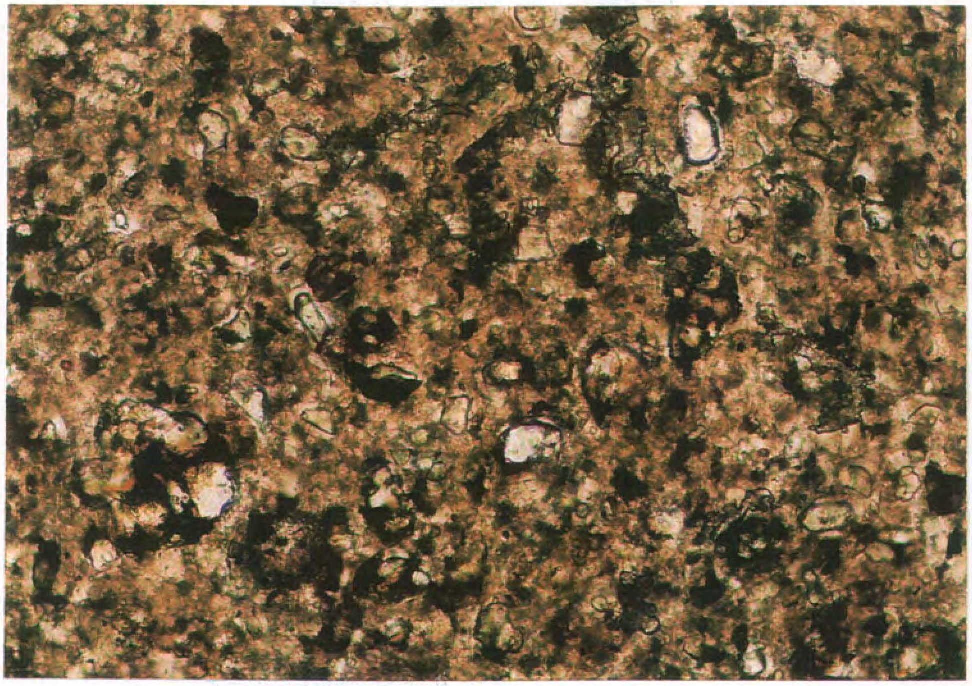
4a same view in cross polarized light



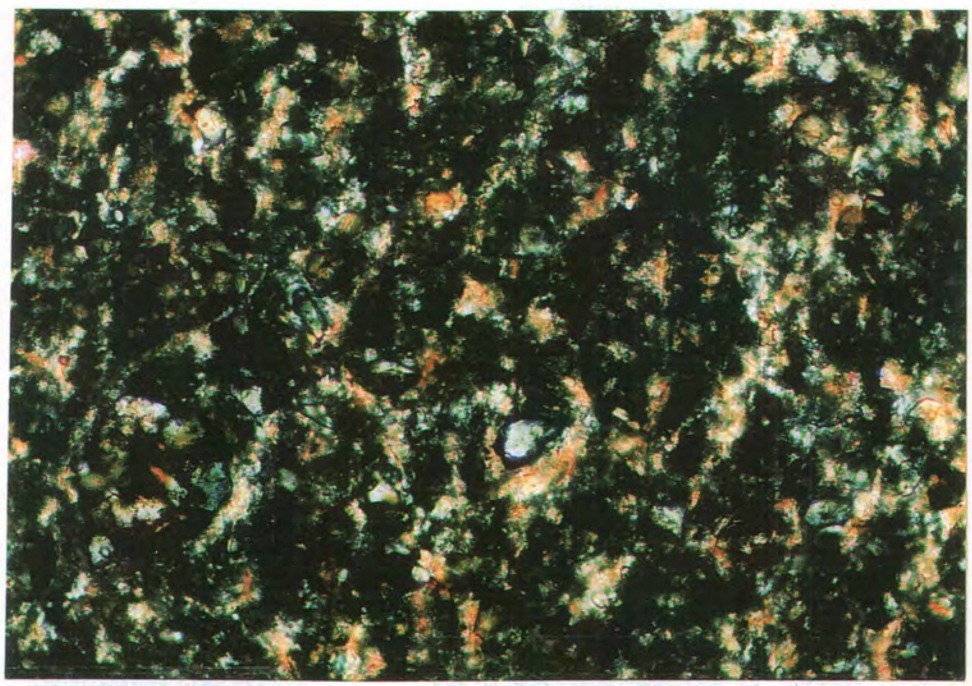
5a same view in plain polarized light



6a same view shows fine micro particulate,glassy matrix , in cross polarized light



7a same view but at X200



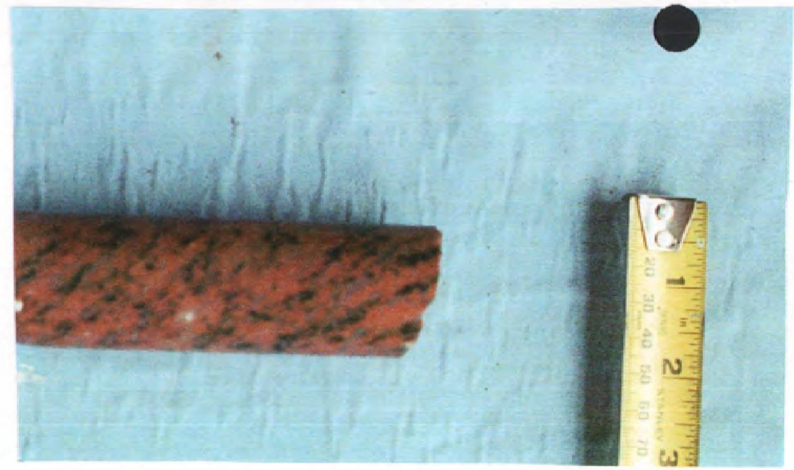
8a cross polarized light shows apparent crystals in glassy matrix

MOBILIZATION

MOBILIZATION

drill site #7

drill-site #7



Boulder bed

Boulder bed

END of HOLE (EOH) CLAY

ANOMALY #7 WINTER 2006 New Drill Site 70 m east
ON Anomaly #7

P. BROWN (GEOLOGIST) S. MLOT (MINING ENGINEER) Dr. YOSHIDA (CONSULTANT)
drill site #7

PROJECT Co-ordinator R. Hämäle + P. BROWN (GEOLOGIST)
REVIEWING Data Calling LAKE Lodge 2006

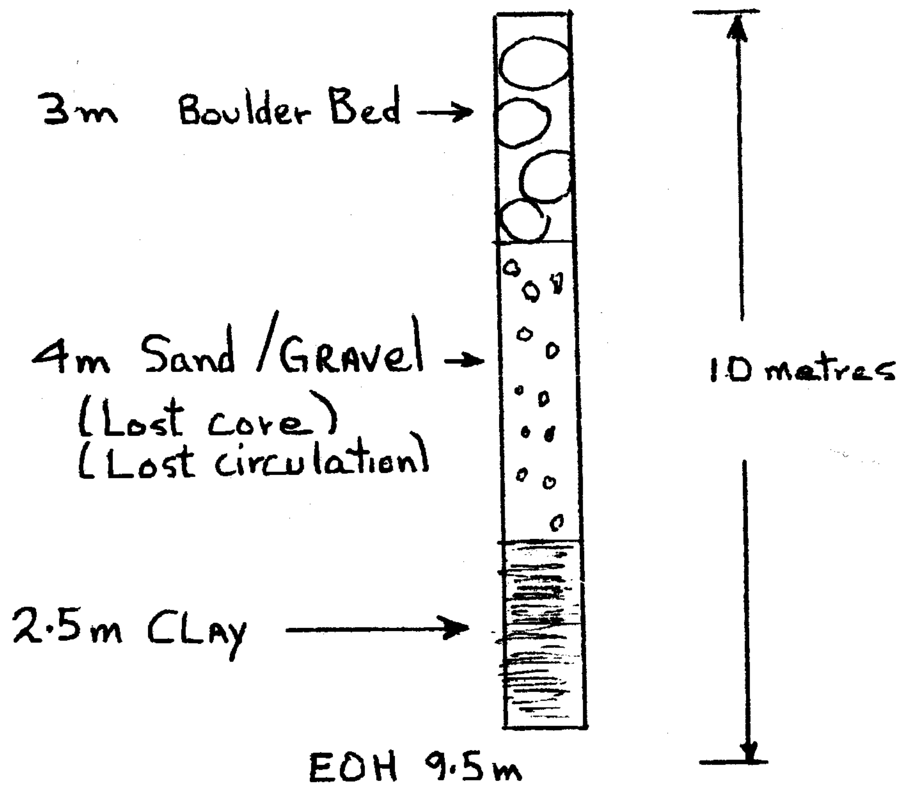
Ph 3

DRILL Site # 7 hole drilled to depth of 9.5m APRIL 2006

MINERAL PERMIT 930411426 (HALMCO INC)

HOLE-CEMENTED PLUG.

N55° 08' 22
W112° 56' 84

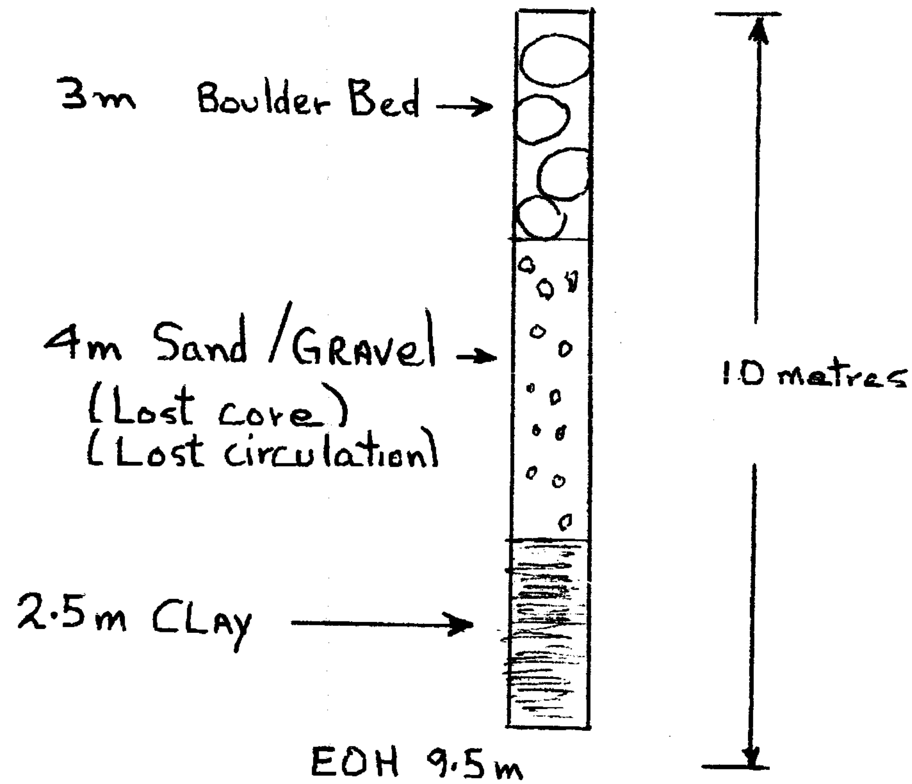


3.4-.5 KG of drill cutting analysed by CF Minerals (see enclosed data)

End of hole core (clay) analysed at Geological Survey of Canada (Calgary) (see enclosed data)

Appendix 12

MARCH
WINTER 2006 Drill Hole #8 (ELECTRO RESISTIVE TOMOGRAPHY ANOMALY) drill site #7
MINERAL PERMIT 930411426 (HALMCO INC)
HOLE-CEMENTED PLUG.



4-5KG of drill cutting analysed by CF MINERALS (see enclosed data)

End of hole core (clay) analysed at Geological Survey of Canada (Calgary)
(see enclosed data)

19-Jun-06 PROVISIONAL PICKING RESULTS

WO	#	Batch	Sample Name	Sample Weight	Fract Code	Fraction	Weight	Pck wt	PP	OR	CD	Olv/ Opx	Sap/ Oth	Blks	?? Nat Dia*	drill-bit Syn Dia*	Beta value
GA44	1	06-3192	CR#8	3.44	30-Y00	-16I-H	17.10	17.10	0	0	0	0	0	0	0	0	1.0
GA44	1	06-3192	CR#8	3.44	38-520	-16+80HIL	12.75	12.75	0	0	0	0	0	5	0	37	1.0
GA44	1	06-3192	CR#8	3.44	38-530	-16+80HPY	.62	.62	0	4	6	0	0	1	1	65	1.0
GA44	1	06-3192	CR#8	3.44	38-540	-16+80HD	.47	.47	0	0	0	0	60	0	145	139	1.0

* Preliminary assessment of diamonds only. Further testing of diamonds is required to confirm if they are natural or synthetic.

drill cuttings drillsite #7

Customer: GA44
Probe Batch: jun13 (p06)
Comment:

ELECTRON MICROPROBE ANALYSIS FROM C.F. MINERAL RESEARCH LTD.
Batch File: 06-3192

31-Jul-2006 11:07 am
File: prb3192.prn

Sample Name	Fraction	Mount	Cel	Grn	=== Classifications ======= SA	CFM	DI	SiO2	TiO2	Al2O3	V2O3	Cr2O3	Fe2O3	FeO	MgO	CaO	MnO	NiO	ZnO	Nb2O5	Na2O	Max Trace Na2O	K2O	Total
CR#8	38-530	5031	1	103		*																		
CR#8	38-530	5031	1	104		*																		
CR#8	38-530	5031	1	202		*																		
CR#8	38-520	5031	1	203		*																		
CR#8	38-520	5031	1	204		*																		
CR#8	38-520	5031	1	205		*																		
CR#8	38-530	5031	1	101		ALM-Mn		37.99	.15	21.26		.00		22.52	4.46	9.08	4.68	.00			.02		.00	100.16
CR#8	38-520	5031	1	206		PIL			52.38	.58		.54	8.98	24.51	12.91	.03	.25		.01	.13				100.31
CR#8	38-520	5031	1	207		PIL			52.59	.58		.47	8.80	24.72	12.87	.01	.27		.00	.05				100.35
CR#8	38-530	5031	1	105	CE	CP2	-	53.82	.16	1.19		.39		5.45	14.37	23.08	.06	.00			1.14		.01	99.66
CR#8	38-530	5031	1	109	CE	CP2	-	53.81	.09	.97		.41		5.45	14.48	22.90	.05	.02			1.13		.01	99.32
CR#8	38-530	5031	1	106	CE	CPX	-	53.63	.13	1.01		.41		5.53	14.49	22.96	.07	.00			1.11		.00	99.33
CR#8	38-530	5031	1	107	CE	CPX	-	53.49	.10	1.07		.40		5.33	14.26	23.17	.05	.03			1.11		.01	99.01
CR#8	38-530	5031	1	108	CE	CPX	-	53.56	.14	1.09		.44		5.41	14.44	23.13	.04	.00			1.15		.00	99.40
CR#8	38-530	5031	1	201	CE	CPX	-	53.61	.10	.99		.40		5.45	14.38	23.11	.04	.05			1.05		.00	99.18
CR#8	38-530	5031	1	102	R	ALM		37.45	.07	21.55		.04		33.13	5.01	2.57	.57	.03			.00		.00	100.41

- Total was outside the range of 98.50-101.00, therefore total confirmed by re-analysis.
* - grain mounted, SEM scanned, but not worthy of probing

Figure 8: MgO vs Cr_2O_3 Ilmenite Plot

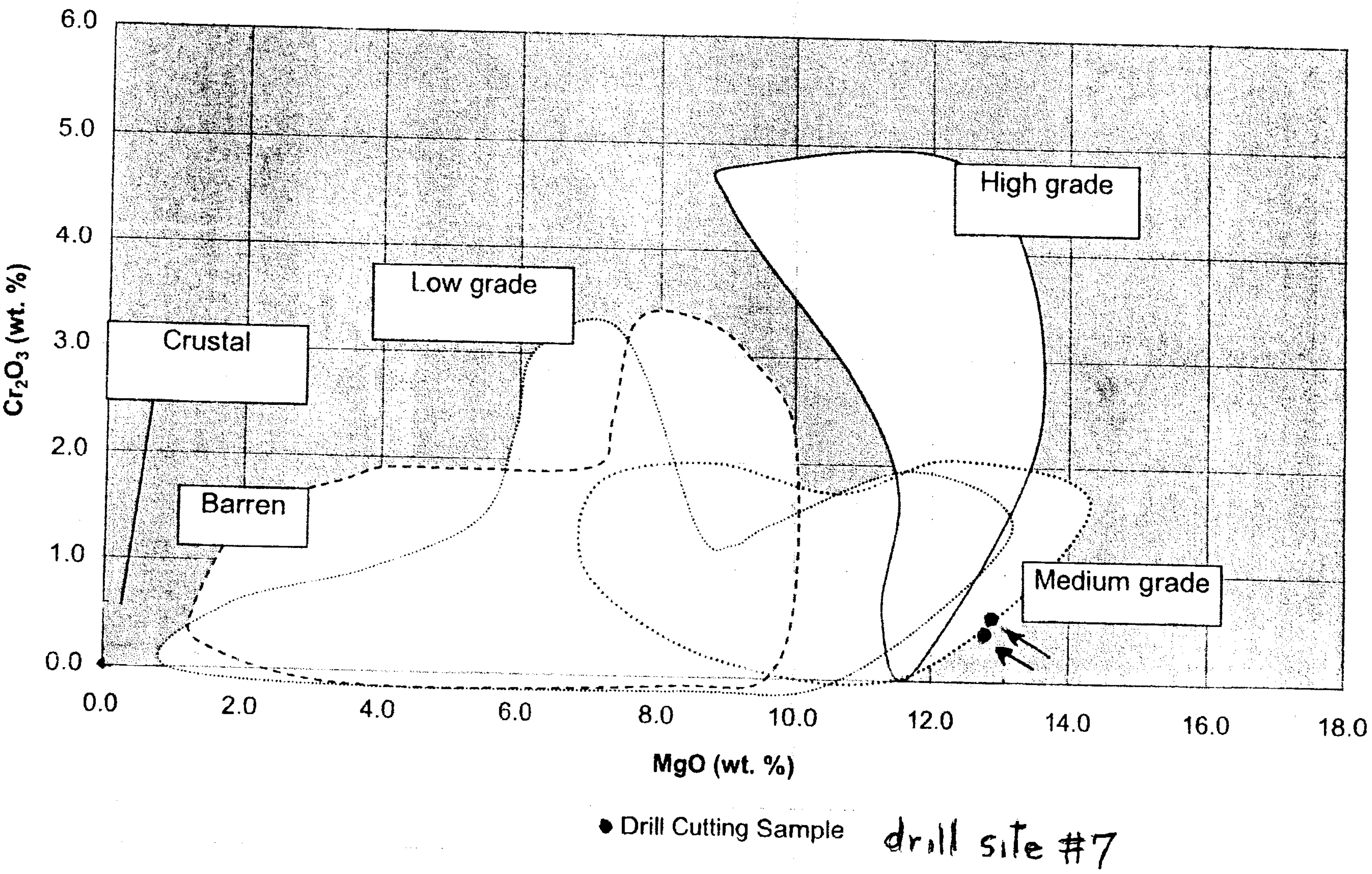
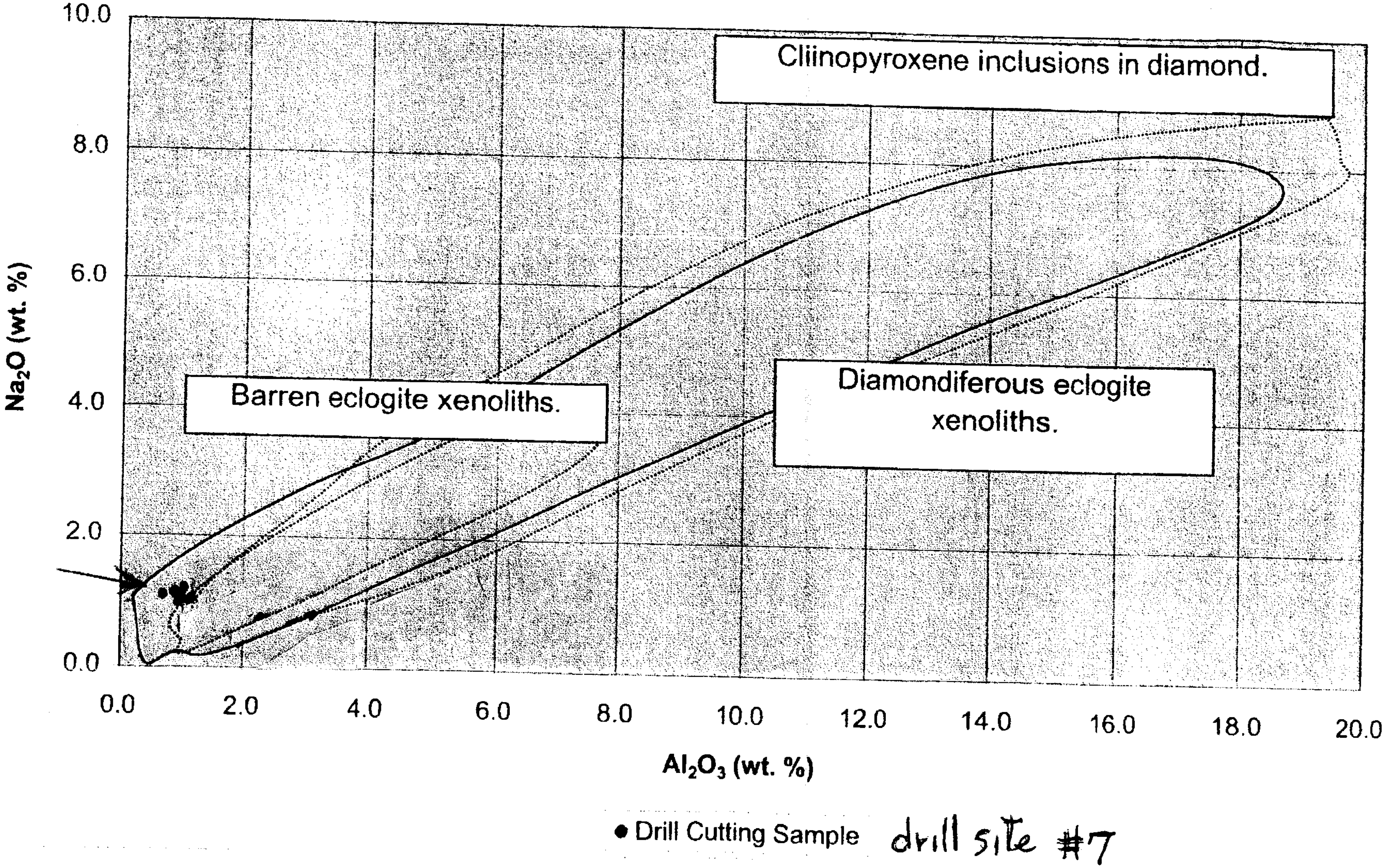


Figure 6: Al_2O_3 vs Na_2O Clinopyroxene Plot



Core (end of hole)
drill site #7

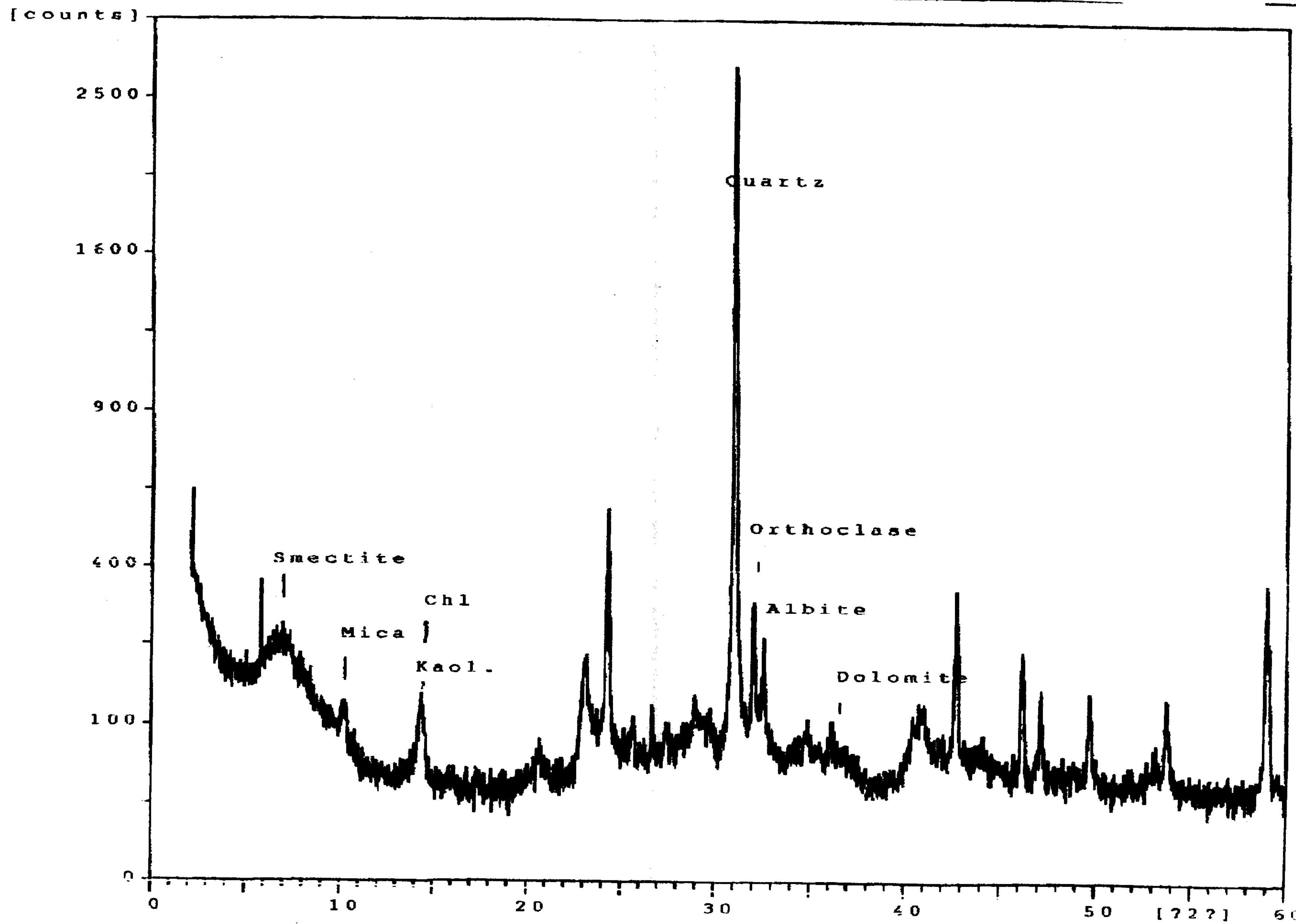
RE: **XRD Analysis of One Rock Samples (Calling Lake N 55 08 22 W112 56 84)**

XRD reveals.

Smectite	**9%**
Mica	**1%**
Kaolinite	**2%**
Clinochlore	**trace**
Quartz	**75%**
Orthoclase	**8%**
Albite	**5%**
Dolomite	**trace**

Sample identification: Calling Lake sample

GSC CALGARY



CALLINGL.RD

lites (Fieremans and Ottenburgs 1979b). The nodules have been replaced by quartz along chlorite cleavage planes. The chlorites identified by X-ray diffraction as clinochlore have similar calculated compositions to Tompkins *et al.*'s (1984) low Fe chlorites (Table 6.33). Fieremans and Ottenburgs (1979b) regard the chlorites as a primary phase. Pre-existing enstatite, olivine, and spinel are considered to react with melt to form chlorite and phlogopite.

6.13.3. Pseudomorphs after Phlogopite

Macrocrystal, microphenocrystal, and groundmass phlogopites are commonly replaced by chlorite (Tompkins *et al.* 1984, Mitchell and Meyer 1980, Skinner and Scott 1979, Frantsesson 1970, Mitchell 1970). The replacement initially occurs along cleavages and at grain margins. The chloritization is commonly accompanied by the introduction of quartz and calcite resulting in expansion of the mica along cleavage planes (Fieremans and Ottenburgs 1979). The chlorites vary in their color from colorless to pale green to bright emerald green. The strongly colored varieties are commonest in kimberlites which have been altered by groundwater, and are particularly characteristic of the weathered portions of micaceous kimberlites found at Bellsbank (Bosch 1971) Swartruggens (Skinner and Scott 1979), Roberts Victor, and New Elands (this work). Many micas which are apparently fresh optically, are, upon analysis, found to be partially altered to chlorite, i.e., hydromica. Fieremans and Ottenburgs (1979b) determined by XRD that chlorites in the Mbuji-Mayi kimberlites were possibly kammererite-kotschubeites, although Cr contents were not determined. Few compositional data exist for chlorites from this paragenesis. Chlorites from Mir, Koidu, and New Elands (Table 6.33) are all Fe-rich clinochlores, and are Al-rich relative to chlorites replacing serpentines.

Chloritization of phlogopite is considered to be either a primary and/or deuteric phenomenon (Tompkins *et al.* 1984, Mitchell and Meyer 1980), or secondary and associated with weathering (Bosch 1971). Zinchuk and Kharkiv (1978) have shown that complete pseudomorphing of phlogopite macrocrysts in the Mir Pipe is confined to the upper 35–40 m. From 40 to 335 m, phlogopites are partially chloritized, and below 335 m are unaltered.

6.13.4. Primary Chlorite

Primary groundmass chlorite has only been conclusively identified in kimberlites from Koidu (Tompkins *et al.* 1984). Here it forms euhedral blue-green platelets (0.05 mm) disseminated throughout the calcite-silicate groundmass or aggregates of crystals in carbonate segregations. Primary chlorites are abundant only in samples rich in calcite, and are rare in kimberlites rich in phlogopite and serpentine. Tompkins *et al.* (1984) have shown these chlorites to be Fe-rich

 {Mitchell, Roger 1989}.

clinochlores similar in their composition to the high Fe chlorites occurring in chlorite nodules, and as pseudomorphs after phlogopite.

6.13.5. Clay Minerals are mostly Smectite minerals

A wide variety of clay minerals and related phyllosilicates have been reported from kimberlites. These include montmorillonite, nontronite, halloysite, kaolinite, sepiolite, stevensonite, vermiculite, and saponite. Hydromicas, interstratifications of vermiculite and other phyllosilicates, are common (Ruotsala 1975, Kresten 1973b, Fairbairn and Robertson 1966, Smirnov 1959).

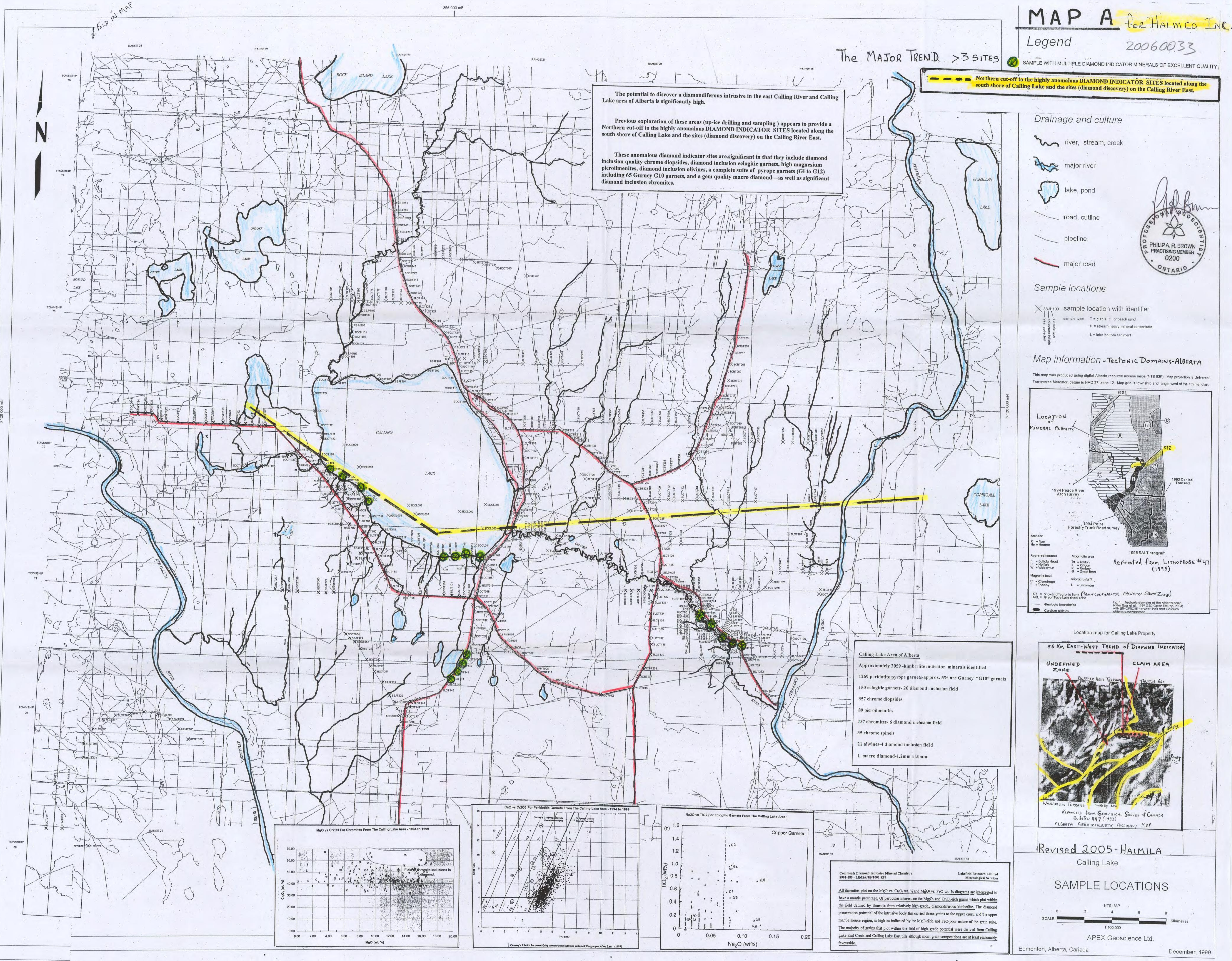
Talc has been identified by optical and X-ray methods in the Sloan diatreme (McCallum and Eggler 1971), Yakutian kimberlites (Milashev *et al.* 1963), and the Premier kimberlite (Scott Smith and Skinner 1979). Kresten (1973b) has proposed that the deuteric alteration of kimberlites proceeds via three stages: a talc-serpentine stage, a chlorite-vermiculite stage, and a saponite stage. However most of the kimberlites studied by Kresten (1973b) appear also to have been subjected to weathering (Clement 1982) and it is considered unlikely that saponite and vermiculite formation is related to deuteric alteration. Kresten's (1973b) scheme, together with the ultimate stage of laterite formation (Fairbairn and Robertson 1966), provides a satisfactory guide to the late-stage deuteric alteration and weathering of kimberlite. Detailed discussion of secondary alteration is beyond the scope of this work.

6.14. BRUCITE AND RELATED MINERALS

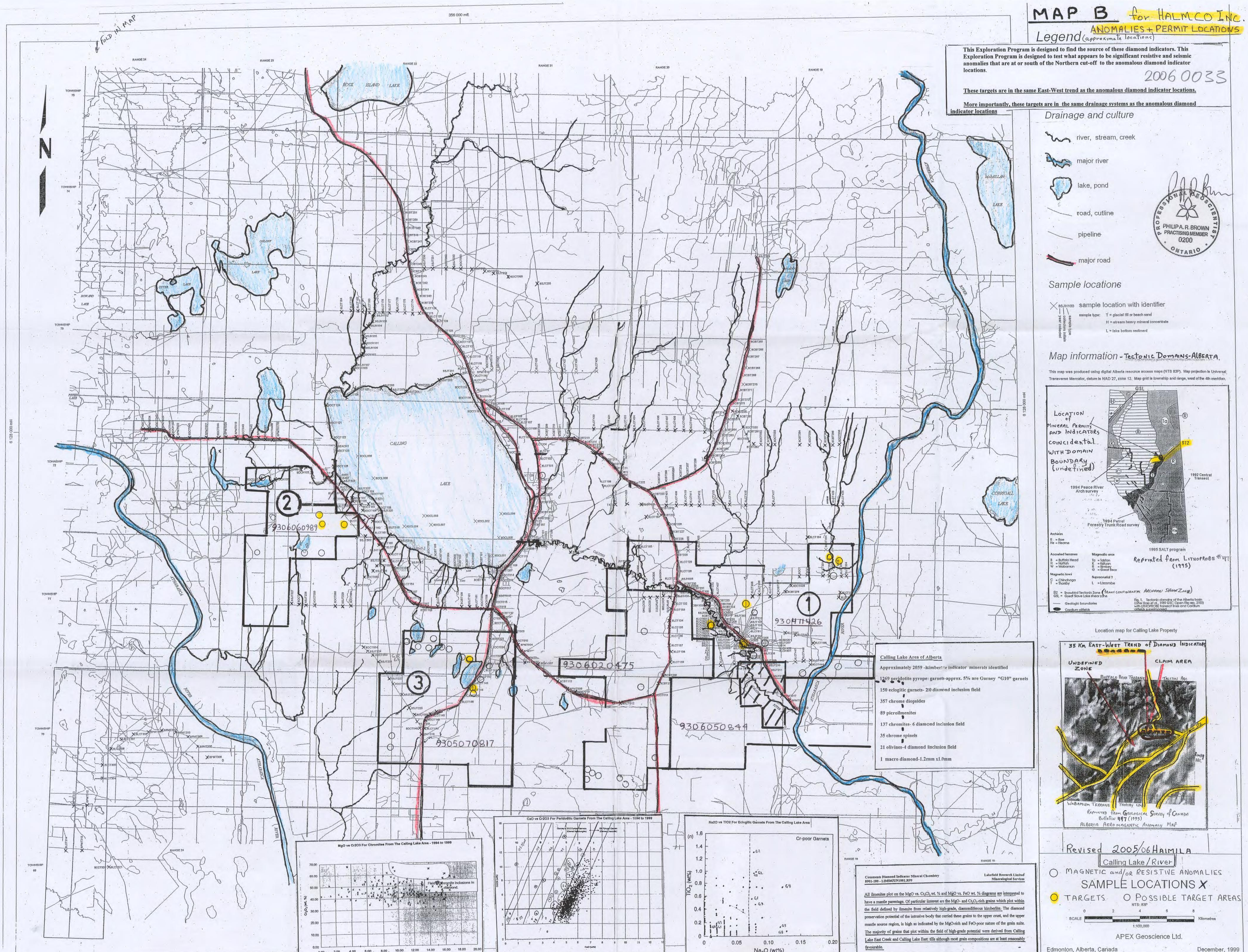
Few investigations have reported the presence of brucite, $Mg(OH)_2$, despite the H_2O- and MgO-rich nature of kimberlite. Malkov (1974) identified brucite in the East Udachnaya and Novinka kimberlites by X-ray and DTA methods. It was shown that brucite occurred only in rocks which had undergone complete serpentinization of the olivines, and that partially serpentinized or phlogopite-bearing rocks lack brucite. The deuteric alteration of olivine to serpentine-brucite mixtures is apparently an isochemical process accompanied by volume increase and density decrease. Zinchuk *et al.* (1983) noted that kimberlitic brucite is a very pure magnesian variety showing very little solid solution with other cations. Brucites were also shown to contain chlorine either replacing hydroxyl groups (iowaite) or occurring as sub-microscopic impurities. Malkov (1974) considers that the presence of brucite should be suspected in any kimberlites that contain an excess of MgO over SiO_2 in terms of serpentine stoichiometry.

Zinchuk *et al.* (1984) have discussed the genesis of pyroaurite, rhombohedral $Mg_6Fe_2(CO)_3(OH)_{16}.4H_2O$, in Yakutian kimberlites where it occurs in thin veins together with halite and calcite, and in segregations composed of calcite

underlining - NOTATIONS R. Haimila 2006



MAP A for HALMCO INC.
20060033
Legend
The MAJOR TREND >3 SITES
SAMPLE WITH MULTIPLE DIAMOND INDICATOR MINERALS OF EXCELLENT QUALITY
Northern cut-off to the highly anomalous DIAMOND INDICATOR SITES located along the south shore of Calling Lake and the sites (diamond discovery) on the Calling River East.
The potential to discover a diamondiferous intrusive in the east Calling River and Calling Lake area of Alberta is significantly high.
Previous exploration of these areas (up-ice drilling and sampling) appears to provide a Northern cut-off to the highly anomalous DIAMOND INDICATOR SITES located along the south shore of Calling Lake and the sites (diamond discovery) on the Calling River East.
These anomalous diamond indicator sites are.significant in that they include diamond inclusion quality chrome diopsides, diamond inclusion eclogitic garnets, high magnesium picroilmenites, diamond inclusion olivines, a complete suite of pyrope garnets (Gl to G12) including 65 Gurney G10 garnets, and a gem quality macro diamond—as well as significant diamond inclusion chromites.
Drainage and culture
river, stream, creek
major river
lake, pond
road, cutline
pipeline
major road
PROFESSIONAL GEOSCIENTIST
PHILIP A. R. BROWN
PRACTISING MEMBER
0200
ONTARIO
Sample locations
sample location with identifier
Map information - Tectonic Domains-Alberta
LOCATION of MINERAL PERMITS
Reprinted from LITHOPROBE #47 (1993)
Location map for Calling Lake Property
35 Km EAST-WEST TREND of DIAMOND INDICATORS
UNDEFINED ZONE
CLAIM AREA
Reprinted from Geological Survey of Canada Bulletin 447 (1993)
ALBERTA AEROMAGNETIC ANOMALY MAP
Revised 2005-HAIMILA
CALLING LAKE
ROCK ISLAND LAKE
McMILLAN LAKE
CORRIGALL LAKE
ATHABASCA RIVER
Calling Lake Area of Alberta
Approximately 2059 -kimberlite indicator minerals identified
1269 peridotite pyrope garnets-approx. 5% are Gurney "G10" garnets
150 eclogitic garnets- 20 diamond inclusion field
357 chrome diopsides
89 picroilmenites
137 chromites- 6 diamond inclusiom field
35 chrome spinels
21 olivines-4 diamond inclusion field
1 macro diamond-1.2mm x1.0mm
MgO vs Cr2O3 For Chromites From The Calling Lake Area - 1994 to 1999
CaO vs Cr2O3 For Peridotitic Garnets From The Calling Lake Area - 1994 to 1999
Na2O vs TiO2 For Eclogitic Garnets From The Calling Lake Area
Cr-poor Garnets
Comments Diamond Indicator Mineral Chemistry
8901-180 - LIMS#JUN1001.R99
Lakefield Research Limited
Mineralogical Services
All ilmenites plot on the MgO vs. Cr2O3 wt. % and MgO) vs. FeO wt. % diagrams are interpreted to have a mantle parentage. Of particular interest are the MggO- and Cr2O3-rich grains which plot within the field defined by ilmenite from relatively high-grade;, diamondiferous kimberlite. The diamond preservation potential of the intrusive body that carried these grains to the upper crust, and the upper mantle source region, is high as indicated by the MgO-riich and FeO-poor nature of the grain suite. The majority of grains that plot within the field of high-grade potential were derived from Calling Lake East Creek and Calling Lake East tills although most grain compositions are at least reasonably favourable.
Calling Lake
SAMPLE LOCATIONS
NTS: 83P
SCALE 1:100,000
Kilometres
APEX Geoscience Ltd.
Edmonton, Alberta, Canada
December, 1999



1 PRIORITY AREA

O - ANOMALIES - DIGHEM/SPECTRA/TERRAQUEST-INTREPID/APEX/CSI, etc.