BASE RESOURCES LTD

EXPLORATION LICENCE 48/82

BORRADAILE PLAINS

Technical Report on Year's Work
from 29 August 1983

(To accompany application for renewal)

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INTRODUCTION

E.L.48/82 Borradaile Plains was granted to Base Resources Ltd for one year to remain in force until 29 August 1984. The area applied for was approximately 220 sq km in extent and corresponded in large part to former E.L.28/80. held by Shell Company of Australia Ltd, Metals Division. The area granted to Base Resources was reduced by the Department of Mines to 190 sq. km, by excision of an area in the upper Campbell River designated a Proposed National Park Extension.

EXPLORATION CONCEPT

The following brief outline gives the rationale for the exploration programme, the targets of which are diamondiferous kimberlite pipes. The concept is based on the following four points:

(1) Diamonds were found in alluvial gold workings at Corinna in 1894 (and elsewhere nearby) in the drainage basin of the Pieman River (Twelvetrees, 1918). Tributaries of the Pieman system drain the Proterozoic terrain of the north-central highlands, and the diamond sources are more likely to occur in the Proterozoic terrain (as pipes) than elsewhere.

(2) Recent developments in seismo-tectonics indicate possible extensions of either Victorian and South Australian kimberlitic terrains through Tasmania (B.M.R. Record 1979/2, Stracke, et al., 1979). Former continuity (i.e. pre-kimberlitic) between Tasmania and the known kimberlitic areas of Proterozoic crust of mainland Australia is also indicated by evidence from plate tectonics and structural geology (e.g. Harrington and Korsch, 1976). These points all confirm that the Proterozoic crust of Tasmania may be an appropriate host to kimberlitic intrusives, some of which may be diamondiferous (e.g. like the Orroroo kimberlites

at Eurelia, South Australia).

(3) Much of the north-central highlands of Tasmania consists of Proterozoic rocks of low metamorphic grade and high structural level, which in spite of pre-Permian erosion and removal of Permo-Triassic and Jurassic cover, may contain the upper levels of kimberlitic diatremes rather than the deeper zones of dyke emplacement. Thus structural level and crustal thickness are probably conducive to any kimberlites that may be present being diamondiferous.

(4) The published information on the Corinna diamonds, the predictive inferences such as those by A.C. Moore (1973), and other as-yet unpublished information on possible diamond sources in the central highlands all point to the Proterozoic terrain as being the most appropriate for a systematic search for kimberlitic source rocks.

FIELD EXPLORATION METHODS

The methods employed are those of classical stream sediment heavy mineral search for indicator minerals, in which both pan-concentrate and sieved -20+80 bulk sediment samples are collected at each site. The pan concentrates are subsequently re-concentrated in heavy liquid Tetrabromoethane (T.B.E.), to recover minerals of density greater than 2.9. These are washed in alcohol and dried for visual scanning under the binocular microscope.

The E.L. area comprises steep to mountainous topography, with a well developed, youthful trellised-drendritic drainage system most of which is actively eroding and loaded with abundant sediment. In parts however, upper reaches of streams drain basalt plains or dolerite plateaus, and are slowmoving and swampy with little usable sediment.

The attrition rate of the indicator minerals being sought is not well known for such high energy conditions, but maximum transit-survival distances are inferred to be less than 5 km and probably more than 3 km. At an optimum spacing of sample localities between these limits a total of approximately 500 samples should be adequate for the area.

In the present area bulk samples of between 5 and 8 kg and pan concentrates of about 200 gm, equivalent to about 10 kg weight of raw sieved sediment, were used. These are thought to be adequate because of the relatively short stream lengths involved, in contrast to the long poorly defined streams of the West Kimberley, W.A., where bulk samples of up to several tonnes are necessary,(Gregory 1984).

LABORATORY FOLLOWUP METHODS

The ultimate purpose of this stage is to locate and identify true indicator minerals of undoubted kimberlitic origin in the rather widely variable assemblages of species in the heavy-concentrate samples.

The first step involves close examination under the binocular microscope, and systematic search through all the sample grains for the diagnostic features of the minerals being sought. In the case of voluminous samples this may take up to two hours, with additional time for various tests of individual grains. Most samples are also examined under U.V. light to check for fluorescent grains.

INDICATOR MINERALS AND SPECIFIC TESTS

The indicator species generally sought are as follows:

Mineral	Significance	Transit-Survival Distance
Picro Ilmenite	Diagnostic	Tens of km
Pyrope Garnet	"	" " "
Chrome Diopside	"	A few km
Kimberlitic Chromite	"	"
Kimberlitic Zircon	"	"
Olivine	Depends on country rocks	
Corundum	"	
Perovskite	"	
Apatite	"	(After Gregory, 1984)

In the present E.L. area the common occurrence of doleritic and basaltic rocks, and of low grade metamorphics in the Proterozoic basement results in a profusion of species in the stream sediments similar to many of those in the above list.

Thus almost all samples include doleritic-basaltic diopside, enstatite and olivine, ilmenite, black spinels - some chromitic, magnetite and zircon. Also very common are garnets of all colours (except green) mainly of metamorphic origin but possibly also igneous from unmapped porphyries or minor granite bodies. Several other minerals in the stream sediments resemble indicators under the binocular microscope, for example clasts of dark tourmaline from Proterozoic schist may often resemble perovskite, fragments of anatase resemble corundum, and dark-green epidote resemble chrome diopside.

In view of this profusion of distractors, the present search is concentrated mainly on garnet and diopside, and where other possible indicators (e.g. perovskite) may be present (but noted in the tables as Tourmaline) the sample is designated for E.P.M.A.

Hardness Test

This was carried out on many individual grains in a search for clastic diamond using a tablet of natural corundum. Limpid quartz fragments and zircons were tested frequently and collapsed on being firmly pressed against the test tablet. No diamond has yet been found.

Fluorescence Test

Carried out under the microscope at close range this revealed many zircons with golden fluorescence, but too many to be diagnostic of kimberilite. Fifty three blue fluorescent grains proved to be diopside, not diamond. These tests are continuing.

REFRACTIVE INDEX AND OTHER TESTS

After visual recognition of possible indicator grains, tests of refractive index in oils are carried out, particularly on garnet and pyroxene grains. This is to check that the sample grains fall within the specific ranges of pyrope and of diopside. Garnets with R.I. 1.67 to 1.78 are retained, as are pyroxenes with R.I. 1.65-1.70. Representative grains are then further checked by XRD either by goniometer or by powder camera photography.

At an early stage of the work further checks were made using the Scanning Electron Microscope fitted with an EDAX system, to obtain partial analyses of diagnostic elements in garnet and pyroxene, in particular Mg and Cr respectively. In the later stages this step is being omitted and most reliance is placed on the R.I. determination to screen out inappropriate compositions.

In spite of these lengthy and laborious search and screening procedures, results may still not be definite or certain, and the best that can be expected is that the most appropriate mineral samples have been obtained for the final step, which is Electron Microprobe Analysis (EPMA).

SAMPLE FACTORS

In general the concentrate-samples are highly variable as to quantity, composition and quality, with variations strongly reflecting the general geology of the locality from which each was obtained. Thus the most voluminous concentrates contain mainly the pyroxenes and olivine derived from erosion of dolerite and basalt escarpments, the smallest concentrates contain much limonitic material derived from swampy headwater areas on mainly plateaus of dolerite or basalt or occasionally on schist. In both types of sample the quality is poor because on the one hand any kimberlitic minerals would be diluted by the monotonous profusion of similar but non-indicator species and on the other hand the low energy, high chemical activity of the swampy source areas probably degrades and obscures with limonitic coatings any indicators that may be present.

Large samples diluted by profuse doleritic-basaltic pyroxenes and olivine are indicated in the result tables, as 'dol', samples with much limonitic material as 'limonitic', and samples of insufficient size by asterisks against the sample numbers.

WORK PERFORMED DURING THE YEAR

An initial literature search and airphoto scan was carried out at Hobart, and at the Devonport office of the previous title holder, Shell Company of Australia, Metals Division. As a result of discussions with Supervising Geologist, Mr R.G. Wright, Shell provided gratis to Base Resources a large collection of suitable stream sediment samples, approximately 600 in number. Processing of samples was commenced in Sydney under the writer's supervision, and to date 510 have been concentrated in TBE. Of these 250 have been scanned and results listed in the attached Appendix 1.

An initial batch of eleven samples, selected from 159 concentrates was forwarded to AMDEL for microprobe analysis in October 1983. Results are included herewith as Appendix 2.

At the present time a further collection of sixteen possible indicator samples has been obtained and is undergoing R.I. testing prior to forwarding for microprobe analysis.

All scanning, and subsequent detailed tests were carried out by the writer or in the case of SEM tests, under his supervision.

EPMA RESULTS FOR GARNET AND DIOPSIDE

The MgO content of the garnets is as follows:

Sample	MgO (wt%)
057	3,33, 15.79
265	3.28, 8.43
277	1.12, 1.92
485	8.83, 9.82, 10.00, 12.34
498	9.30, 9.34, 9.53, 12.00

Almost all are low pressure almandines probably derived from regional low grade metamorphics or possibly from contact zones around small as yet unmapped intrusions of granite or porphyry.

However three are definitely pyropic and signify a relatively high pressure deep-seated origin.

These are characterised as:

057 - 15.79%MgO = $Py_{.56}$ $Al_{.38}$ $Gross_{.05}$ $Spess_{.01}$

485 - 12.34%MgO = $Py_{.44}$ $Al_{.36}$ $Gross_{.19}$ $Spess_{.01}$

498 - 12.00%MgO = $Py_{.44}$ $Al_{.45}$ $Gross_{.09}$ $Spess_{.01}$

These could all be termed pyrope-almandine, and they correspond approximately to Group 3 Calcic-pyrope-almandine of Dawson and Stephens (1976, p.495) but are consistently lower in CaO. Group 3 garnets are reported by Dawson and Stevens (1975) from eclogites, diamondiferous eclogites, kimberlites, ultramafic rocks, and diamond inclusions, but the present samples may just as well be derived from originally deep seated crustal rocks of high amphibolite facies, and transported to the surface as xenocrysts. Although none are conclusively kimberlitic they all give cause for suspecting that they have been derived from deeper crustal levels than are exposed in the local geology. That is, they may have been transported to the surface in diatremes, or more remotely as xenocrysts in dolerite or basalt.

The Cr_2O_3 content of the diopsides is as follows:

Sample	Cr_2O_3 (wt %)
009	0.30
033	0.13, 0.36, 0.76
057	0.70, 0.80, 0.98
213	0.73
250	0.77, 1.00
265	0.12, 0.77, 0.82
277	0.62, 0.88
457	0.70

These are not sufficiently high to indicate kimberlitic chrome diopside, the range of which is given by Stephens and Dawson (1977) as 0.21-2.81%, but since they lie within the range they do not exclude the possibility.

XRD RESULTS ON OTHER GARNETS

During the course of binocular scanning, a number of garnets were checked by XRD powder camera photography, mainly for purposes of identification in the early stages of the work. Results are inconclusive, but enabled the rejection during subsequent scanning of a large number of grains of inappropriate composition.

Sample No	Colour	°2θ 420	1040	Garnet Species*
499A	red	40.45	112.70	Spessartine-Almandine
530	red	40.40	113.05	Almandine-Spessartine
237	brn-pink	40.45	113.00	Almandine-Spessartine
210A	brown	40.70**	112.85	Almandine-Spessartine
007A	orange	40.40	112.85	Almandine-Spessartine
247A	orange	40.45	112.80	Almandine-Spessartine
"A"	tan	40.55	112.70	Almandine-Spessartine
277	red	40.80**	113.45	Almandine
235B	tan	40.30	112.45	Spessartine-Almandine
336	pink	40.45	112.85	Almandine-Spessartine

* Based on Table 7.6, p.208 of Hutchinson (1974).
The position of the 1040 line is said to give a better indication of the garnet composition.

** Based on the 420 line the composition is Almandine-Pyrope.

XRD RESULTS ON OTHER MINERALS

In the early stages of the work a number of different mineral species were checked by XRD powder camera photography, to confirm visual identifications made under the binocular microscope. Results are summarised as follows:

Sample No.	Mineral	Sample No.	Mineral
007	Garnet, orange-pink	256	Quartz, colourless
069	Diopside, green		
009	Diopside, green	259	Quartz, colourless
210	Garnet, Brown	261	Anatase, black
210	Diopside, green	331	Rutile, red brown
		334	Spinel, black
214	Anatase, blue	336	Enstatite, grey green
235	Olivine	336	Garnet, pink
235	Garnet, tan	336	Rutile, crimson
237	Garnet, brn-pink	336	Tourmaline, dk brn
241	Enstatite	336	Spinel, black
244	Rutile, deep red	337	Diopside, grey green
244	Garnet, brown	474	Diopside, green
245	Anatase, green-blue	499	Garnet, red
246	Olivine, colourless	518	Tourmaline, gold brown
247	Olivine, yellow	530	Garnet, lilac
247	Zircon, colourless		
247	Garnet, orange		

Note that No. 334 Spinel, black was also confirmed on the SEM as being significantly chromiferous, whereas No. 336 Spinel, black proved to be ferrian pleonaste.

PROVENANCE OF THE CLASTIC ASSEMBLAGES

The geology of the area is dominated by three major rock units, the low grade metasedimentary Proterozoic basement, the elevated sheets of Jurassic dolerite, and the remnant high-level Tertiary basalts. To a limited extent a fourth unit is also significant, that is, minor porphyritic or granitic intrusives in the basement, or their secondarily derived erosion products from Permian and Triassic sedimentary residuals. These are all shown on the attached Geological Map, and have been described at length by Jennings (1963).

The clastic assemblages in the stream sediment samples can readily be correlated with these major geological units.

The basement metasediments contribute much spessartine-garnet, rutile, ilmenite, magnetite, epidote, anatase and zircon (described in in-situ samples by Jennings, 1963 and Collins et al., 1981). The dolerites contribute the common brown diopside, grey enstatite, yellow olivine and other pyroxenes not distinguished here such as pigeonite and augite (McDougall, 1964). Minor granophyres in the dolerites probably contribute darker varieties of olivine (fayalite) and dark ferraugite. The dominant light brown mafics in the sediments are probably all derived from dolerites. The basalts contribute significant yellow-green olivine and some dark grey pyroxene, as well as magnetite and probably spinel. Unmapped intrusives such as porphyries and minor granitic bodies (referred to by Jennings 1963 and Collins et al., 1981) are believed to contribute some almandine-garnet, rutile, and zircon, as well as tourmaline, magnetite, ilmenite and spinel.

CONCLUSIONS ON RESULTS TO DATE

(1) Definite kimberlitic indicator minerals have not yet been discovered, nor have clastic diamonds.

(2) The two indicator mineral species most intensively studied, that is garnet and diopside, have in a few samples compositions that lie within the known ranges of kimberlitic indicators, but which also lie within the ranges of mafic igneous rocks.

(3) The profusion in the stream sediments of non-indicator mineral species of the same kind as the indicators being sought, adds considerably to the difficulties of the work and is an unexpected but significant impediment.

(4) Some encouragement is provided by the finding in three samples of pyropic garnets which were formed at deeper crustal levels than are exposed in the present geology, and which may have reached the surface via kimberlitic diatremes or as xenocrysts in dolerite or basalt.

(5) The original exploration concept still stands, and further work of the same kind is warranted on the remaining samples.

PROPOSED FUTURE WORK

(1) Scanning, testing and selection of possible indicators:

Approximately 260 heavy concentrates remain to be scanned, and this is proposed for the next two quarterly periods. Progress in this work has been set back somewhat, as some concentrated samples were not sufficiently washed free of TBE, by alcohol, and require a second washing.

With specific tests and checks, this work is expected to be completed before the end of the second quarter.

(2) Electron microprobe analyses:

At present possible indicators from sixteen samples have been selected for EPMA from a total of 91 samples, and are undergoing R.I. checks. Providing these are all passed, they be forwarded to AMDEL in the next quarter. A third batch is expected to be selected for EPMA by the end of the second quarter.

(3) Full assay of bulk raw samples:

When results are returned from the second batch of microprobe samples, a selected number of bulk sediment samples (including several from the first EPMA batch) will be forwarded to an appropriate laboratory - probably Diamond Services Laboratory, Sydney - for full scale mineralogical search and assay for kimberlitic indicators.

(4) Field stream-sediment surveys:

Contingent on results of the foregoing work, it is expected that limited more intensive stream-sediment surveys will be performed at several locations during the second half of the next licence period. These will be for the purpose of narrowing down the search area, and may possibly include localised soil orcolluvium sampling as well.

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APPENDIX I

TABLES OF
MINERAL COMPOSITIONS AND ABUNDANCES IN
STREAM SEDIMENT CONCENTRATES, D2.9+

5.

Note:	r	=	rare
	c	=	common
	a	=	abundant
	aa	=	predominant
	+	=	small sample
	++	+	insufficient sample

Mineral Compositions and Abundances in Stream Sediment Concentrates >D2.9

	Sample No.	Garnet pink	Garnet red	Rutile	Ilmen flake	Ilmen pitted	Zircon	Tourm.	Pyroxene	Olivine	Magnetite	Spinel	Vitr. clear	Vitr. white	Lithic fr.	XRD,	SEM	R.I.	H-test	Fluor.	Comment
	001																				
	2+	r	r	r	c	c	r	r	aa	a	c	c						✓	<9	di✓ z	6 green diops 4 red-pink garnets
	3																				
	4+	r		r	c		c	r	r		c		a	a					<9	Z	qu-mica-limonite
	5	r		r	c	c	r	r	a	c	c	r	c							z	qu-mica
	6																				
	7	c		r	c	c	c	r	c	r			c			✓ (gar)		✓	<9	z	almand.-spess. pink-orange garnet
	8	r			r	c	c	r	aa	a		r									dol. + qu-mica schist
EPMA	9			r	r		r	c	c				c			✓ (di.)	✓ (MgCr)	✓	<9	di z	1 green diopside
	10																				
	1																				
	2																				
	3																				
	4++	r		r	r	r	r	r	c	c		r		a							mostly gran. qutz adam. spinel H<9
	5+	r		c	r	c	c	r	c	r	r	c	a	a		✓			<9	z	green diopside
	6					c			c	c	r				a						qu + lim. + schist
	7+	r	r	r	r	r	c	r	r			r	a	a							mostly gran. qutz
	8+				r				r	r	c				aa						limonitic, schist + qutz
	9+	r		r	r		c		r	r			a	a							qu-mica - lim. mostly qu
	20					r		c	c					a							fine gran. qutz
	1																				
	2																				
	3																				
	4																				
	5																				
	6																				
	7																				
	8			r	r	c	c		r			r	c	c							qu-mica
	9																				
	30	r	r	c	c	c	c	r	a	c	c	c	c	r				✓		di✓	pink orange garnets grey green diopside
	1	r	c	c	a		a	c	c	r	c	c	a	a							
	2																				
EPMA	3			r	c	r	r	c	a	a	r		c			✓	✓	✓	<9	z	no garnet 3 green grey diopside

Mineral Compositions and Abundances in Stream Sediment Concentrates >D2.9

Sample No.	Garnet pink	Garnet red	Rutile	Ilmen flake	Ilmen pitted	Zircon	Tourm.	Pyroxene	Olivine	Magnetite	Spinel	Vitr.clear	Vitr.white	Lithic fr.	XRD,	SEM	R.I.	H-test	Fluor.	Comment
034			r	r	r	c	r	a	a	r	r	r						<9	z	mica + limon
5																				
6																				
7																				
8	r		c	a	c	a	a	c	r	c	c	r	c		(di) ✓	x	x ga	<9	z	4 green grey diopside
9	r	r	c	c	c	c	r	c	c	c	c	c	c							*
40																				
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
50+			r	c	r	c	c	c	c			c	c							
1			r	r		r	r	c	r			c	r							limonite
2	r		r	r		c	r	a	a	c		c	r							mica + limon
3																				
4	c	r	r	c	c	r	r	r			r	c						<9	z	
5			r	r	c	r	r	a	c	r	r	a								
6	r		r	r	r	r	r	a	c		r	c	r							limonite
EPMA 7	r		r	c	r	r	r	a	c	c	r	r	r		(di) ✓	MgCr ✓	✓	<9	z	pinkgarnet green grey diops.
8+	r		r	c	c	c	r	c	c	r	r	c								
9+			r	r	c	r		c				c								
60			r	r	r	r		c	c											mica + limon.
1																				
2+	r		r	r	c	c	r	c	c	r	r	c								
3																				
4+	r	r	c	c	c	c	r	a	a	c		c	r		(di) (gar)		✓ ✓		✓	grey green diopside + lilac garnet
5																				
6																				

Mineral Compositions and Abundances in Stream Sediment Concentrates >D2.9

Sample No.	Garnet pink	Garnet red	Rutile	Ilmen flake	Ilmen pitted	Zircon	Tourm.	Pyroxene	Olivine	Magnetite	Spinel	Vitr.clear	Vitr.white	Lithic fr.	XRD	SEM	R.I.	H-test	Fluor.	Comment
067																				
8																				
9			r	r	r	r	r	a	c	c	r				✓(di)	✓(sp)	✓(di)	<9	z ✓	2 green diops.
70																				
1																				
2																				
3																				
4+	r		c	c	c	c	r	a	c			r			✓		✓(di)	<9	✓ z	green grey diopside
5																				
6																				
7	r		c	c	r	a	c	r	r			c	c	c						metamorphic qu. + mica
8																				
9																				
80																				
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
90																				
1																				
2																				
3																				
4++			r	r	r	r	r	c	c	c	r	a	a				✓(di)	<9	✓ z	2 green diops no garnet, mostly qutz, mica + chlorite
5																				
6																				
7																				
8																				
9																				

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Mineral Compositions and Abundances in Stream Sediment Concentrates >D2.9

Sample No.	Garnet pink	Garnet red	Rutile	Ilmen flake	Ilmen pitted	Zircon	Tourm.	Pyroxene	Olivine	Magnetite	Spinel	Vitr.clear	Vitr.white	Lithic fr.	XRD,	SEM	R.I.	H-test	Fluor.	Comment
100	c	c		c	c	r		aa	c	r	c						√di	<9	√di √z	3 pink 3 orange garnet 2 green diopside; many small black spheres
1																				
2																				
3																				
4	r		r	c	c	c	c	aa	c	c										mica + chlorite
105 south	r		r	c	c	c	c	a	c	c	c	c	c							granitic + doleritic source
5																				
106 N +			r	c	c	c	r	a	c	c	c	c								mica + chlorite
6																				
7			r	c	c	c	c	c	r	r	c	c								granitic (?) mica
8																				
9																				
110 north				r	r	r		aa	a		r	r								
10	r		r	r	r	r		aa	a	c	c	c						<9	Z√	diopside sand
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
20																				
1																				
2																				
3																				
4	r			c	c	r		aa	c	r	r			c			√di	<9	√di Z	4 green diops 2 orange garnet; lim. schist
5																				
6																				
7																				
8																				
9																				
30																				
1			r	r	r			aa	a	r				c						dol., limonitic
2				r	r			aa	aa	r										dol, some mica-[illegible]
3																				

Mineral Compositions and Abundances in Stream Sediment Concentrates >D2.9

Sample No.	166	165	164	163	162	161	160	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144	143	142	141	140	139	138	137	136	135	134
Garnet pink								r																									
Garnet red									r																								
Rutile					r	r		r	r																								
Ilmen flake						r	r	r	c																								
Ilmen pitted	r				r	r	r	r	c																								
Zircon						r	r	r	c																								
Tourm.					r	r	r		c																								
Pyroxene	aa				aa	a	aa	aa	c																								
Olivine	a				a	a	c	a	c																								
Magnetite					r	c	r	r	r																								
Spinel						r	r																										
Vitr. clear	c					c			c																								
Vitr. white	c								c																								
Lithic fr.	c					r	c	c	c																								
XRD, SEM R.I.								Vdi																									
H-test																																	
Fluor.								Vdi																									
Comment	fibrous sillimanite grains dd. + qu-mica-limon schist				quartz-mica dol.			2 green grey diops. ?qu-mica 1 red ?garnet	granite + qrtz 2green diops 1 pink garnet ; mica-schist																								

021

Mineral Compositions and Abundances in Stream Sediment Concentrates >D2.9

382022

Sample No.	Garnet pink	Garnet red	Rutile	Ilmen flake	Ilmen pitted	Zircon	Tourm.	Pyroxene	Olivine	Magnetite	Spinel	Vitr. clear	Vitr. white	Lithic fr.	XRD,	SEM	R.I.	H-test	Fluor.	Comment
167+	r				r	r		a	c	r	r	c		c			√di	<9	√di z	3 green diopsides, 1 pink garnet, limonitic, qutz, schist
8																				
9++		r	r		r	r						c		c						limonite schist quartz
70																				
1																				
2++												c	c	c						quartz-mica schist-limonite
3																				
4																				
5				c	c	c		c	c	c			c	aa						limonitic, schist + qutz
6																				
7																				
8																				
9																				
80																				
1																				
2																				
3					r			r	r		r			aa						mostly limonite schist
4	r		r	c	r	r		c	c					aa						limonite schist, + qutz + mica
5			r		c	r		c	c	c			c	a						limonitic + qutz
6																				
7	r		r	r	a			a	c	c	r			a						limonitic schist, tan m/m gar.
8	r				a			a	c	r	r			a						lim. schist, tan garnet
9																				
90																				
1																				
2																				
3																				
4																				
5	r		r	c	c	c	r	a	c	c		r	r				√di	<9	√ z	15 green diopside, 3 lilac-brown garnet
6																				
7																				
8																				
9			c		r	c	c	c	c			c	c							granitic + blue anatase

Mineral Compositions and Abundances in Stream Sediment Concentrates >D2.9

	Sample No.	Garnet pink	Garnet red	Rutile	Ilmen flake	Ilmen pitted	Zircon	Tourm.	Pyroxene	Olivine	Magnetite	Spinel	Vitr. clear	Vitr. white	Lithic fr.	XRD,	SEM	R.I.	H-test	Fluor.	Comment
	200																				
	1	c		r	r	r	r	r	aa	a	c	r			c			√di	<9	z √di	4 garnets (tan) Notable amt. garn; 3 grn-grey diops. ; limonitic
	2	c	r	r	r	r	r	r	aa	c	c	r			c						Sample like 201; tan garnet in chlorite schist
	3	c		r	c	c	c		a	c	r	c	c						<9	z-	+ mica ; garnet l. orange √ pink-tan garnet
	4	c		r	r	r	r	r	aa	a	c	r	c	c	c						dol. + qu-mica-schist
	5+	r			r	r			c	c					c					√ds	tan m/m garnet , limonitic
E[illegible]A	6	c	c	c	c	c	c	c	a	c	c	c	c			✓(di)	✓(MgCr)	✓	<9	z	1 green pyx. 3 red brown garnets
	7	r		r	c	c	c	r	a	c	c	c						√di	<9	√di z	1 green pyx 4 l.brn 1 dk brn garnet
	8	r				r	r		c	c			c	c	a						mostly limonitic schist + qu + mica
	9+				c	c			a	c	r		c	c	c						qu-mica-chlorite ; schist
	10					r	r	r	c		r					✓(di) (gar)	✓ ga	√di √ga		√di	grey diops. almand-spess (pyropic)
	1			r	r		r	r	c	r	c	c		c							mica + limon
	2																				
EPMA	3			c	r	r	c	r	a	a			c	c		✓(di)	✓(MgCr)	√di	<9	√di z	1 green pyx + mica + limon.
	4			r	c	r	r		c				c			✓(an.)		√an			mica dom., 1 blue anatase
	5+					r	r	r	c		r										
	6			r		r	r		c		r		c								
	7			r					c	c	a		r								much limon. with magn.
	8			r	r	r	r	c	aa		r	r	c								qu-mica-limon
	9+			r	c		c	r	c		c		c								
	20																				
	1																				
	2																				
	3+					r	r	r	c						a						much limon.
	4																				
	5+				r			r		r			c	a							qutz + mica
	6																				
	7																				
	8																				
	9					r	r	r	c						a						much limon.
	30+					r			r	c			c								
	1																				
	2+			r	r	c	r	r	c	c	c	r	r							z	mica + limon
	3					r	r	r	a		r	r	c								

Mineral Compositions and Abundances in Stream Sediment Concentrates >D2.9

	Sample No.	Garnet pink	Garnet red	Rutile	Ilmen flake	Ilmen pitted	Zircon	Tourm.	Pyroxene	Olivine	Magnetite	Spinel	Vitr. clear	Vitr. white	Lithic fr.	XRD	SEM R.I.	H-test	Fluor.	Comment
	234			r	r	r	r	r	c	c	c									pale brn icositetr. garnet
	5	r		r	r	r		r	a	c	r	r	c			√ (gar.) (ol.)	√ga			+mica-limonite; spess.-alman
	6+	r			r		r	r	r		r		c					<9	z	qu-mica-limon
	7+	r		r	c		c	r	c				c			√ (gar.)			-	mica-limon. almand-spess.
	8+				r		r		c		r		c					<9	z	qu-mica-limon
	9			r	r		r	r	a	c	c					√ (ol.)				
	40					r	r	r	a	r	r	r	a							qu.
	1				r	r	r		r	c			c		c	√ (en.)	√en		√di	green enstatite much limon.
	2			r	r	r	r	r	a	c	r		c							
	3					r	r	r	c		r					√ (goeth)				brown penta-dodec. after pyrite
	4			c	r		r	r	c		c	c		c		√ (rut) (ga)				brn pent-dodeca oxide (after pyrite?) goethite
	5+	r		r	r	r	r	r	c	c	c		c			√ (an.)				tabular blue anatase qu + mica
	6			r	r	r	r	r	a	c	r		c			√ (ol.)		<9	Z	
	7	r	r	r	r	r	r	r	c	c			c			ol., z. ga	√di	<9	z	almand-spess. pale orange dodec. garnet
	8	r	c		r	c	r	r	a	c	r		aa							
	9	r			r	r		r		r	r		c	c		√	√			qu.
EPMA	50.			r	r	r	c	r	aa	c	r	r	r			(di)	di	<9	z	few green diops
	1	c	c	c	c	r	a	r	r		r	r	c							
	2+			r	r	r	c	r			r	r	a	a						+ mica
	3+			r		r	r		r				a	a						
	4	r		r	r	r	c	r	r	c			a							qu + black + blue anatase
	5+	-	-	r	r	r	a	-	r	-	r	-	aa	a						qutz + mica
	6	r		r	r	r	r		r					aa		√ (qu)				dominant quartz
	7+			r	r		c	r			r		a	a						qutz-mica
	8																			
	9	r	r	r	r		c		r				c	c		√ (qu)				qu. dom.
	60+				r	c	r	r	a	c	r		r							mica-limon.
	1	r		r	r	r	c	c	a	c	r	r	c			√ an.				black anatase
	2	r		r	c	r	c	c	a	c	c		r	c						+limonite
	3+				r		r	r	r				a	a						qu-mica-limonite
	4+	r		r	c	c	c	r	c				c							qu-mica; much ilmenite
EPMA	5		r	r	r		r	r	c		r	r	r				√di	<9	√di z	several green diops limonitic
	6			r	r		c	r			r		a	a						qu-mica

Mineral Compositions and Abundances in Stream Sediment Concentrates >D2.9

Sample No.	Garnet pink	Garnet red	Rutile	Ilmen flake	Ilmen pitted	Zircon	Tourm.	Pyroxene	Olivine	Magnetite	Spinel	Vitr.clear	Vitr.white	Lithic fr.	XRD,	SEM	R.I.	H-test	Fluor.	Comment
267			r	r	r	c	r	a	c			a	—	—	(ol)✓					qu-mica-diops-ol.
8																				
9						r	c				r	a	a							mainly qutz
70				r		r		r		r		aa	a							qu.+mica + black anatase
1+	c		r	c	r	c r	r	c r		r r	r	c c	c C							qutz-mica-limon
2+			r					r		r		c	c	c						qutz-mica-limon.
3			r				r	c				a								qu.
4+			c	r	r	a	c					a	a	c						qu + mica ¶goethite dodecah. after pyrite
5+		r	r	c		r	r	c	r	c		a	a		(ox.)✓		✓di	<9	✓di 2	" " ; few green diops.
6																				
7		r	r	r	c	r	c	c		c	r	r	r		(gar.)✓	✓ga.				brown, almandine + mica ;
8	c	C		r		a		aa		c		c								
9				c		r	c	c		r		c								qu-mica-schist
80	c	c	r	r	r	r	r	a	c	r		c								
1																				
2																				
3	c	c		r		r	r	aa	c	c	r	c								
4	c	c	r	c	r	c	r	c		c	r	c								
5																				
6																				
7	r	r	r	r	r	r	r	aa	c	c		r								
8																				
9																				
90																				
1	r	c	r	c	c	r	r	aa	a	c	c	c		c			✓di			few mauve garnets
2	r	r	r	r	r	r		a		r										
3	c	r	r	r	r	c	r	aa	c	c		c					✓di			few mauve garnets
4	r	r	r	c	r	r		aa	c	c	r			c						dol.
5	r	r		r		r	r	aa		r		r								
6																				
7																				
8	r	r	r	r				aa	c	r										
9																				

Mineral Compositions and Abundances in Stream Sediment Concentrates >D2.9

Sample No.	Garnet		Rutile	Ilmen		Zircon	Tourm.	Pyroxene	Olivine	Magnetite	Spinel	Vitr. clear	Vitr. white	Lithic fr.	XRD	SEM	R.I.	H-test	Fluor.	Comment
	pink	red		flake	pitted															
300																				
1	r	r	r	r			r	aa	c	r				a						dol. + "meteoric" spheres
2	r	r	r					aa	c	r				c						dol., orange garnet
3	r			r	r	r		aa	c	c										dd. heavily coated grains
4	r	r	r	r		r		aa	c	r										
5																				
6																				
7	c	c	r	c	c	c		aa	a	c	c									dol.
8																				
9																				
10																				
1																				
2																				
3																				
4																				
5	r	r	r	r	r	r	r	a		r		r								
6																				
7																				
8	r	r	r	c	c	c		aa	a	c	c									dol.
9	r	r		r		r		aa		r	r									dol.
20	r				r			aa	c		r							×6 <9		dol.; few clear qutz grains
1																				
2	c	c	r	r	r	r		a	c	r	r	c	c	c				...		no green mins.
3	r	r			r	r		aa	c	c			c	c					✓	dol. much tan diopside
4	r	r	r		r	r	÷	aa	c	r									✓	dol. "
5	r	r	r	r	r	r		aa	a	c	r								✓	dol. "
6	r			r	r			aa	a											dol.
7	r	r	r	r	r	r	r	aa	c	c		c		c						dol., lim-schist
8	r		r	r	r	r		aa	c	c	r									
9	r	r	r	c	c	c	r	aa	a	c	c									
30	r	r	r	c	c	c	r	aa	c	c	c			c						dol.
1	c	c	c	c	c	a	r	c		a	r	c	c		✓(rut.)	✓di		<9	✓	1 blue fluor. gr., H<9 (di?) orange-mauve garnet
2	r		r	r	r	r	r	aa	c	c			r	c				<9	z	orange garnet
3	r		r	c	c	c	r	a		c	c			c						garnet orange

382027

Mineral Compositions and Abundances in Stream Sediment Concentrates >D2.9

Sample No.	Garnet pink	Garnet red	Rutile	Ilmen flake	Ilmen pitted	Zircon	Tourm.	Pyroxene	Olivine	Magnetite	Spinel	Vitr.clear	Vitr.white	Lithic fr.	XRD, SEM, R.I.	H-test	Fluor.	Comment
334	c	c	r	c		r	r	r		c	r				sp. (Cr sp)			chromian spinel octahedron
5	c	c	r	c	c	c	c	a	c	c	c							
6	a	a	c	a	c	a	r	c		r	r				(Fsp)	<9	z	XRD identification – rutile, enstatite, tourm. ferritian spinel, spess.-almand.
7	c	c		r	r			a		r					(di)	<9	Z-	poss. indicator garnets
8	c	c	r	c	c	c	r	aa	c	c	c							pink, mauve, red garnet; no green pyx
9	r	r	r	c	c	r	r	aa	a	c	c							
40	c	r		c	r	r		a	c	c								
1	c	r	r	c	r	c	r	aa	c	c	r					<9	z	dol. orange & mauve garnet
2		r		r				aa	a	r			r					dol.
3	r	r	r	r		r		aa	a	c	c		r	r				dol.
4	r			r				aa	a	r	r		r					dol.
5	c	r	r	c	c	c	r	aa	c	c	c							mauve garnet, no green pyx
6	c	r	r	c	r	c	r	aa	c	c	c							
7																		
8	r		r	r	r	r	r	aa	a	c	c			c				dol
9																		
50																		
1																		
2																		
3																		
4																		
5	r	r	r	r	r		r	aa	c	r	r			c				dol.
6	r	r	r	r	r		r	aa	c	r	r			c		<9	Z	limonitic
7	c	r	r	c	r	r		aa	c	r	r			c				limonite + lead metal frags
8	r	r		r		r		aa	c	r			r					dol. + lim. ironstone
9	r	r				r		aa	r		r							dol. + limonitic nodules
60																		
1																		
2																		
3	r	r	r	r	r	r	r	aa	c		r							dol.
4																		
5																		
6																		

027

382028

Mineral Compositions and Abundances in Stream Sediment Concentrates >D2.9

Sample No.	Garnet pink	Garnet red	Rutile	Ilmen flake	Ilmen pitted	Zircon	Tourm.	Pyroxene	Olivine	Magnetite	Spinel	Vitr.clear	Vitr.white	Lithic fr.	XRD, SEM	R.I.	H-test	Fluor.	Comment
367																			
8	c	c	r	c	c	c		aa	a	r	c								many cleaved garnets 368 P D G } for RI tests
9	c	c	r	r	r	r		aa	a		c					√di ga	<9	z	3 green diops. 2 pink, 1 red garnets much pink garnet
70	r	r	r	r	r	c	r	a		c	r	c					<9	✓	1 blue fluor. gr H<9 (di?)
1																			
2																			
3																			
4																			
5	r	r			r			aa	a		r								dol.
6																			
7																			
8																			
9	r			r	r			aa	a	r									dol
80	r			r	r			aa	c	r							<9	✓	dol
1	r		r	r	r	r		a		r		c							
2	r			r			r	a											
3	c	r	r	c	c	r		aa	c	c	c								dol. + mauve garnet
4	r		r		r		r	aa	c	c									dol
5	r	r	r	r	r	r		aa	c	r									dol.
6	r			r	c	c	c	r	r	r		a							qu + green fibr. gr. limon. nodules
7	r	r	r	r	r	r	r	aa	a	c	r						<9	z	1 grn grey diops., 2 orange garn.
8																			
9	r	r	r	r		r		aa	a	r	r								dol. heavily coated
90	r	r		r		r		aa	a	c	r								dol. " " garnet with chlorite adhering
1	r	r			r	r		aa	c	r									grains all heavily coated
2	r		r	r				aa	a	r	r								dol.
3	r	r	r	r	r	c	r	a	c	c	r	a							
4	r		r	r	r	r		aa	a	c	r		r	r					dol.
5	r	r	r	c	c	c	r	aa	a	c	c								grey diopside
6	r	r	r	r	r	r		aa	a	c	r					√di ga	<9	z	1 mauve, 1 orange garnet 1 green diopside
7	r	r		r	r	r	r	aa	a	c	r								
8	r	r		c	c	r	r	a	c	c	c	c	c	c		√di ga	<9	z	2 grey green diops., 4 red 1 pink garnet limonitic + qutz aggr.
9	c	r	r	c	c	r		aa	c	c	c								limonitic dol.

Mineral Compositions and Abundances in Stream Sediment Concentrates >D2.9

Sample No.	Garnet pink	Garnet red	Rutile	Ilmen flake	Ilmen pitted	Zircon	Tourm.	Pyroxene	Olivine	Magnetite	Spinel	Vitr. clear	Vitr. white	Lithic fr.	XRD, SEM R.I.	H-test	Fluor.	Comment
400																		
1																		
2	r					r		aa	c	r	r							dol. + much dk grey enstatite(?)
3	r	r		r	r			a	c	r	c		c	c		<9	di z-	2 grn grey diops; 4 red garnets. conspic. grn-grey diopside
4			r	c	c	r	r	aa	c	c	c			c				limonite granules
5			r	r	r			aa	a	c	c	r		c		<9	z	much limonite
6																		
7																		
8																		
9																		
10																		
1																		
2																		
3																		
4																		
5	r			c		r	c	a		r								
6																		
7																		
8	r		r	c		r	r	a	c	r								
9																		
20				c		r		a		c								
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8	r			c	c	r		aa	c	r	c	r						
9																		
30																		
1																		
2																		
3																		

Mineral Compositions and Abundances in Stream Sediment Concentrates >D2.9

382030

Sample No.	Garnet pink	Garnet red	Rutile	Ilmen flake	Ilmen pitted	Zircon	Tourm.	Pyroxene	Olivine	Magnetite	Spinel	Vitr. clear	Vitr. white	Lithic fr.	XRD,	SEM	R.I.	H-test	Fluor.	Comment
434																				
5																				
6																				
7	r	r		c		r	r	c		r										
8																				
9																				
40																				
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
50																				
1	c	r		c		c	r	a		r								<9	z	
2																				
3																				
4																				
5		r		c		r	r	c										<9		1. hi-RI clear flake H<9
6																				
7+	c		c	c	c	c	r	a			r	r	r		✓	✓		<9	di z	deep blue anatase 6 green pyroxenes
8	c	c	r	c	r	r	r			r										
9	c	c	r	c	c	c	r	a	r	c		c								few mauve garnets
60																				
1																				
2	c	r		c	c	c	r	a		c		c								
3																				
4																				
5																				
6	c	r	r	c	c	a	a	c		r	c	a					✓di	<9	✓di	2 blue fluor. grains H<9, (di) mauve garnet

Mineral Compositions and Abundances in Stream Sediment Concentrates >D2.9

Sample No.	Garnet pink	Garnet red	Rutile	Ilmen flake	Ilmen pitted	Zircon	Tourm.	Pyroxene	Olivine	Magnetite	Spinel	Vitr.clear	Vitr.white	Lithic fr.	XRD,	SEM	R.I.	H-test	Fluor.	Comment
467																				
8																				
9																				
70																				
1																				
2																				
3																				
4	r		r	r	r	r		aa		c		c			✓ (di)					
5				r	r			aa		r		r								
6																				
7																				
8				r				aa		r										diops. sand
9																				
80				r	r	r		aa		r		r								diops sand
1																				
2	r	r	r	r	r	r		aa	a	r	r	r								doleritic diops. sand
3	r	r		c	r	c	r	aa	c	c	r	c								
4																				
5	c	c	c	c	c	c	r	aa	a	c		c								few green grey diopside
6	c	r	c	c	c	r		aa	a	c	c	c								
7	c	c	c	c	c	c	r	a	c	c	r	r	r							+ rounded milky qtz
8																				
9																				
90																				
1																				
2																				
3	a	a		c	r	c	r	c		r	r									nonmagn oct.
4	c	c		c		a	r				r	c								
5																				
6			r	c	c	c	r	aa	c		c	c								
7	r		r	c	c	c		a	c	c	c									dol. no green minerals
8	c	c	c	c	c	r	r	a	a	c	c	r			✓	✓				6 lilac garnets
9	a	a		c	r	c	r	c		r	r				✓ (gar)					spcss. - almand.

031

Mineral Compositions and Abundances in Stream Sediment Concentrates >D2.9

382032

Sample No.	Garnet pink	Garnet red	Rutile	Ilmen flake	Ilmen pitted	Zircon	Tourm.	Pyroxene	Olivine	Magnetite	Spinel	Vitr.clear	Vitr.white	Lithic fr.	XRD,	SEM	R.I.	H-test	Fluor.	Comment
500																				
1+	c	c	r	c	r	c	c	a	c	r	r	a	c							qu. dom.
2+	c	c	c	c	c	c		c	c	r	c	c								pink, orange, red garnets
3																				
4																				
5																				
6	c	r	r	r	c	c	r	r		r	r	c								few mauve garnets vitr. brown grains
7																				
8																				
9																				
10																				
1	r	r	r	c	r	r	c	a	r	c										
2	r	r	r	r	r	c	r	c	r	r										
3																				
4																				
5																				
6																				
7																				
8	c	c	c	c	c	a	r	r	r	c					✓ (tour)					qu-mica - anatase
9																				anatase
20	r			r		r				c				aa						magn. mica schist, chert
1																				
2						r				a										much mica + schist
3																				
4																				
5																				
6																				
7																				
8																				
9																				
30	r	r		r		r		a					c		✓ (gar)					almand-spess.
1																				
2																				
3	r			r		r				c				aa						magn. mica schist frags

032

382033

APPENDIX 2

ANALYSIS OF SAND GRAINS FOR
KIMBERLITIC INDICATOR MINERALS
OCTOBER, 1983

by Australian Mineral Development Laboratories, S.A.

033

382034

amdel

ANALYSIS OF SAND GRAINS FOR
KIMBERLITE INDICATOR MINERALS

Belwood Pty Limited

3/0/0-GS 5966/84 October 1983

service report

03A

382035

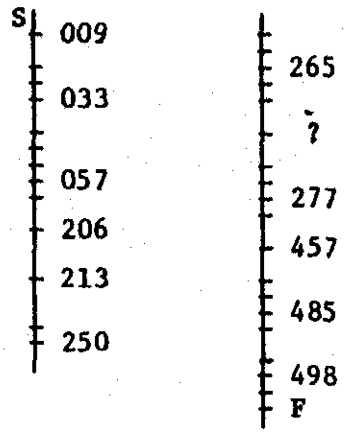
ANALYSIS OF SAND GRAINS FOR KIMBERLITE INDICATOR MINERALS

1. INTRODUCTION

Twenty three suspected diopside and twenty one suspected garnet sand grains were received from Dr B.L. Wood on behalf of Base Resources Limited, Sydney with a request for microscopic examination and microprobe analyses of suspected kimberlite indicator minerals.

2. PROCEDURE

The samples were examined microscopically in loose grain mounts. The grains were considered to be too small to be separated on the Frantz isodynamic magnetic separator (which can be used to separate almandine from pyrope, for example). Selected diopside and garnet grains were then carefully mounted in a polished section (PS 32009) in the following order.



Despite the care that was taken with mounting the grains, the diopside grain from sample 206 was plucked during polishing. One garnet grain from sample 498 could not be located in the vial. The identity of the diopside grain fragment marked '?' is not known.

The following elements/oxides were analysed. Their detection limits are as follows:

Element/Oxide	Detection Limit (wt %)
Al_2O_3	0.06
CaO	0.07
Cl	0.04
Cr_2O_3	0.12
FeO	0.14
K_2O	0.05
MgO	0.05
MnO	0.13
Na_2O	0.05
NiO	0.22
P_2O_5	0.07
SO_3	0.10
TiO	0.11

Element/Oxide	Detection Limit (wt %)
SiO_2	0.06
V_2O_3	0.11

3. RESULTS

The results of the microscopic examination of the submitted grains are as follows:

Sample No.	Inferred Mineral	No. of Grains	Refractive Index	Extinction Angle	Submitted for EPMA
009	Diopside	1	1.661	43°	✓
033	Diopside	3	1.661	33°	✓
057	Garnet	2	<1.77	-	✓
		1	<1.65	-	X
	Diopside	3	1.663	30 - 43°	✓
206	Diopside	1	1.661	43°	✓
	Garnet	3	>1.79	-	X
213	Diopside	1	1.661	33°	✓
250	Diopside	2	1.661	44°	✓
265	Garnet	2	1.775	-	✓
		1	>1.80	-	X
	Diopside	2	1.661	36 - 40°	✓
		1	1.663	0°	✓
277	Garnet	2	1.78	-	✓
		1	>1.80	-	X
	Diopside	2	1.683	30°	✓
457	Diopside	1	1.661	32°	✓
		4	<1.650	-	X
485	Diopside	2	<1.650	-	X
	Garnet	4	<1.77	-	✓
498	Garnet	1	>1.78	-	X
		5	1.775	-	✓

- = not determined.

The results of the electron probe microanalyses are as follows. (Note the FeO refers to total Fe as FeO).

Sample 009 Diopside	Wt %	Cations (O = 6)
SiO_2	52.70	1.906
TiO_2	0.32	0.008
Al_2O_3	5.90	0.251
Cr_2O_3	0.80	0.022
FeO	2.50	0.075
MgO	15.86	0.855
CaO	20.19	0.737
Na_2O	1.25	0.082
Total	99.52	

Sample 033 Diopside 1	Wt %	Cations (O = 6)
SiO_2	52.72	1.909
TiO_2	0.14	0.003
Al_2O_3	5.96	0.254
Cr_2O_3	0.76	0.021
FeO	2.63	0.079
MgO	15.14	0.817
CaO	21.22	0.823
Na_2O	1.06	0.074
Total	99.63	

Sample 033 Diopside 2	Wt %	Cations (O = 6)
SiO_2	53.66	1.988
Al_2O_3	1.17	0.051
FeO	6.71	0.207
MgO	14.26	0.787
CaO	23.66	0.939
Na_2O	0.33	0.023
Total	99.78	

Sample 033 Diopside 3	Wt %	Cations (O = 6)
SiO_2	52.66	1.929
TiO_2	0.56	0.015
Al_2O_3	2.76	0.119
Cr_2O_3	0.36	0.010
Feo	8.11	0.248
MnO	0.18	0.005
MgO	17.96	0.980
CaO	17.17	0.674
Na_2O	0.22	0.015
Total	99.98	

Sample 057 Garnet 1	Wt %	Cations (0= 24)
SiO_2	38.58	6.024
Al_2O_3	21.64	3.981
FeO	27.66	3.612
MnO	0.90	0.118
MgO	3.33	0.775
CaO	8.80	1.472
Total	100.90	

Sample 057 Garnet 2	Wt %	Cations (0= 24)
SiO_2	41.35	5.973
Al_2O_3	23.58	4.015
FeO	19.06	2.302
MnO	0.41	0.050
MgO	15.79	3.399
CaO	1.79	0.277
Total	101.98	

038

Sample 057 Diopside 1	Wt %	Cations (0 = 6)
SiO_2	52.94	1.934
TiO_2	0.25	0.006
Al_2O_3	2.65	0.114
Cr_2O_3	0.80	0.023
FeO	7.07	0.216
MgO	18.25	0.994
CaO	17.73	0.694
Na_2O	0.21	0.014
Total	99.90	

Sample 057 Diopside 2	Wt %	Cations (0 = 6)
SiO_2	52.23	1.916
TiO_2	0.60	0.016
Al_2O_3	2.83	0.122
Cr_2O_3	0.98	0.028
FeO	7.20	0.221
MgO	17.21	0.941
CaO	18.82	0.739
Na_2O	0.16	0.011
Total	100.04	

Sample 057 Diopside 3	Wt %	Cations (0 = 6)
SiO_2	51.07	1.891
TiO_2	0.83	0.023
Al_2O_3	3.82	0.166
Cr_2O_3	0.70	0.020
FeO	7.22	0.223
MgO	17.47	0.964
CaO	17.56	0.696
Na_2O	0.18	0.013
Total	98.85	

Sample 206	Wt %	Cations (O = 6)
Diopside - This grain was plucked during polishing. The analysis of another unidentified diopside found in the polished section is:		
SiO_2	52.68	1.914
TiO_2	0.20	0.005
Al_2O_3	5.47	0.234
Cr_2O_3	0.70	0.020
FeO	2.40	0.072
MgO	15.23	0.825
CaO	21.72	0.845
Na_2O	1.02	0.071
Total	99.41	

Sample 213 Diopside	Wt %	Cations (O = 6)
SiO_2	52.32	1.915
Al_2O_3	5.19	0.223
Cr_2O_3	0.73	0.021
FeO	2.23	0.068
MgO	15.81	0.062
CaO	21.50	0.843
Na_2O	0.79	0.055
Total	98.58	

Sample 250 Diopside 1	Wt %	Cations (O = 6)
SiO_2	52.72	1.879
Al_2O_3	6.51	0.273
Cr_2O_3	1.00	0.028
FeO	2.27	0.067
MgO	15.73	0.836
CaO	21.75	0.830
K_2O	0.06	0.002
Na_2O	0.98	0.067
SO_3	0.21	0.005
Total	101.24	

Sample 250 Diopside 2	Wt %	Cations (0 = 6)
SiO_2	51.20	1.895
TiO_2	0.59	0.016
Al_2O_3	3.59	0.156
Cr_2O_3	0.77	0.022
FeO	7.03	0.217
MgO	16.81	0.927
CaO	19.06	0.755
Na_2O	0.22	0.015
Total	99.27	

Sample 265 Garnet 1	Wt %	Cations (0= 24)
SiO_2	39.63	6.010
Al_2O_3	22.06	3.943
FeO	24.26	3.077
MnO	0.53	0.068
MgO	8.43	1.905
CaO	6.24	1.013
Total	101.14	

Sample 265 Garnet 2	Wt %	Cations (0= 24)
SiO_2	38.97	6.033
Al_2O_3	21.77	3.972
FeO	23.33	3.821
MnO	0.70	0.091
MgO	3.28	0.757
CaO	12.68	2.103
Total	100.73	

Sample 265 Diopside 1	Wt %	Cations (0 = 6)
SiO_2	53.50	1.993
Al_2O_3	0.71	0.031
FeO	8.00	0.249
MnO	0.33	0.010
MgO	13.93	0.773
CaO	23.37	0.933

Sample 265 Diopside 2	Wt %	Cations (0 = 6)
SiO_2	52.01	1.916
TiO_2	0.78	0.021
Al_2O_3	2.96	0.128
Cr_2O_3	0.77	0.022
FeO	4.96	0.152
MgO	16.03	0.880
CaO	21.53	0.850
Na_2O	0.42	0.029
Total	99.45	

Sample 265 Diopside 3	Wt %	Cations (0 = 6)
SiO_2	51.21	1.882
TiO_2	0.91	0.025
Al_2O_3	4.23	0.183
Cr_2O_3	0.82	0.023
FeO	4.88	0.150
MgO	16.08	0.881
CaO	20.96	0.825
Na_2O	0.47	0.033
Total	99.57	

Sample 277 Garnet 1	Wt %	Cations (0= 24)
SiO_2	37.01	5.991
$Al2O_3$	21.02	4.009
FeO	27.08	3.665
MnO	12.72	1.744
MgO	1.12	0.269
CaO	1.69	0.292
Na_2O	0.21	0.065
Total	100.84	

Sample 277 Garnet 2	Wt %	Cations (0= 24)
SiO_2	37.48	6.003
Al_2O_3	21.30	4.021
FeO	31.06	4.160
MnO	8.20	1.112
MgO	1.92	0.457
CaO	1.12	0.192
Na_2O	0.25	0.076
Cl	0.05	0.014
Total	101.39	

Sample 277 Diopside 1	Wt %	Cations (0 = 6)
SiO_2	53.06	1.944
TiO_2	0.35	0.009
Al_2O_3	2.51	0.108
Cr_2O_3	0.62	0.017
FeO	7.37	0.226
MnO	0.16	0.005
MgO	18.13	0.990
CaO	17.32	0.680
Total	99.52	

Sample 277 Diopside 2	Wt %	Cations (0 = 6)
SiO_2	52.24	1.926
TiO_2	0.52	0.014
Al_2O_3	2.89	0.125
Cr_2O_3	0.88	0.025
FeO	6.62	0.204
MgO	16.82	0.924
CaO	19.15	0.756
Na_2O	0.18	0.012
Total	99.32	

Sample 277 Garnet 2	Wt %	Cations (0= 24)
SiO_2	37.48	6.003
Al_2O_3	21.30	4.021
FeO	31.06	4.160
MnO	8.20	1.112
MgO	1.92	0.457
CaO	1.12	0.192
Na_2O	0.25	0.076
Cl	0.05	0.014
Total	101.39	

Sample 277 Diopside 1	Wt %	Cations (0 = 6)
SiO_2	53.06	1.944
TiO_2	0.35	0.009
Al_2O_3	2.51	0.108
Cr_2O_3	0.62	0.017
FeO	7.37	0.226
MnO	0.16	0.005
MgO	18.13	0.990
CaO	17.32	0.680
Total	99.52	

Sample 277 Diopside 2	Wt %	Cations (0 = 6)
SiO_2	52.24	1.926
TiO_2	0.52	0.014
Al_2O_3	2.89	0.125
Cr_2O_3	0.88	0.025
FeO	6.62	0.204
MgO	16.82	0.924
CaO	19.15	0.756
Na_2O	0.18	0.012
Total	99.32	

Sample 457 Diopside	Wt %	Cations (O = 6)
SiO_2	52.92	1.944
TiO_2	0.28	0.007
Al_2O_3	2.53	0.109
Cr_2O_3	0.70	0.020
FeO	6.88	0.211
MgO	17.91	0.981
CaO	18.00	0.708
Total	99.21	

Sample 485 Garnet 1	Wt %	Cations (O= 24)
SiO_2	40.08	5.995
Al_2O_3	22.42	3.952
FeO	24.40	3.052
MnO	0.66	0.083
MgO	9.82	2.190
CaO	4.32	0.692
SO_3	0.17	0.017
Total	101.88	

Sample 485 Garnet 2	Wt %	Cations (O= 24)
SiO_2	40.34	6.025
Al_2O_3	22.35	3.934
FeO	22.37	2.794
MnO	0.48	0.060
MgO	10.00	2.225
CaO	6.04	0.967
Total	101.58	

Sample 485 Garnet 3	Wt %	Cations (0= 24)
SiO_2	39.55	5.973
Al_2O_3	22.11	3.935
FeO	24.84	3.137
MnO	0.32	0.041
MgO	8.83	1.987
CaO	5.79	0.937
SO_3	0.13	0.014
Total	101.57	

Sample 485 Garnet 4	Wt %	Cations (0= 24)
SiO_2	40.97	5.999
Al_2O_3	22.87	3.947
FeO	18.03	2.208
MnO	0.25	0.030
MgO	12.34	2.692
CaO	7.32	1.147
Total	101.77	

Sample 498 Garnet 1	Wt %	Cations (0= 24)
SiO_2	39.55	5.962
Al_2O_3	22.74	4.039
V_2O_3	0.11	0.013
FeO	27.24	3.433
MnO	0.47	0.059
MgO	9.38	2.090
CaO	2.54	0.410
Total	101.95	

Sample 498 Garnet 2	Wt %	Cations (0= 24)
SiO_2	40.26	6.007
Al_2O_3	22.87	4.021
FeO	25.01	3.121
MnO	0.52	0.066
MgO	9.34	2.078
CaO	4.29	0.685
Total	102.30	

Sample 498 Garnet 3	Wt %	Cations (O= 24)
SiO_2	40.47	5.994
Al_2O_3	23.11	4.034
FeO	21.70	2.687
MnO	0.49	0.060
MgO	12.00	2.648
CaO	3.53	0.560
Total	101.31	

Sample 498 Garnet 4	Wt %	Cations (O= 24)
SiO_2	39.95	6.031
Al_2O_3	22.28	3.950
Cr_2O_3	0.14	0.016
FeO	26.03	3.287
MnO	0.54	0.069
MgO	9.53	2.145
CaO	3.00	0.485
Total	101.39	

A summary of the Cr_2O_3 content of the diopsides is as follows:

Sample	Cr_2O_3 (wt %)
009	0.30
033	<0.13, 0.36, 0.76
057	0.70, 0.80, 0.98
206	-
213	0.73
250	0.77, 1.00
265	<0.12, 0.77, 0.82
277	0.62, 0.88
457	0.70

A summary of the MgO content of the garnets is as follows:

Sample	MgO (wt %)
057	3.33, 15.79
265	3.28, 8.43
277	1.12, 1.92
485	8.83, 9.82, 10.00, 12.34
498	9.30, 9.34, 9.53, 12.00

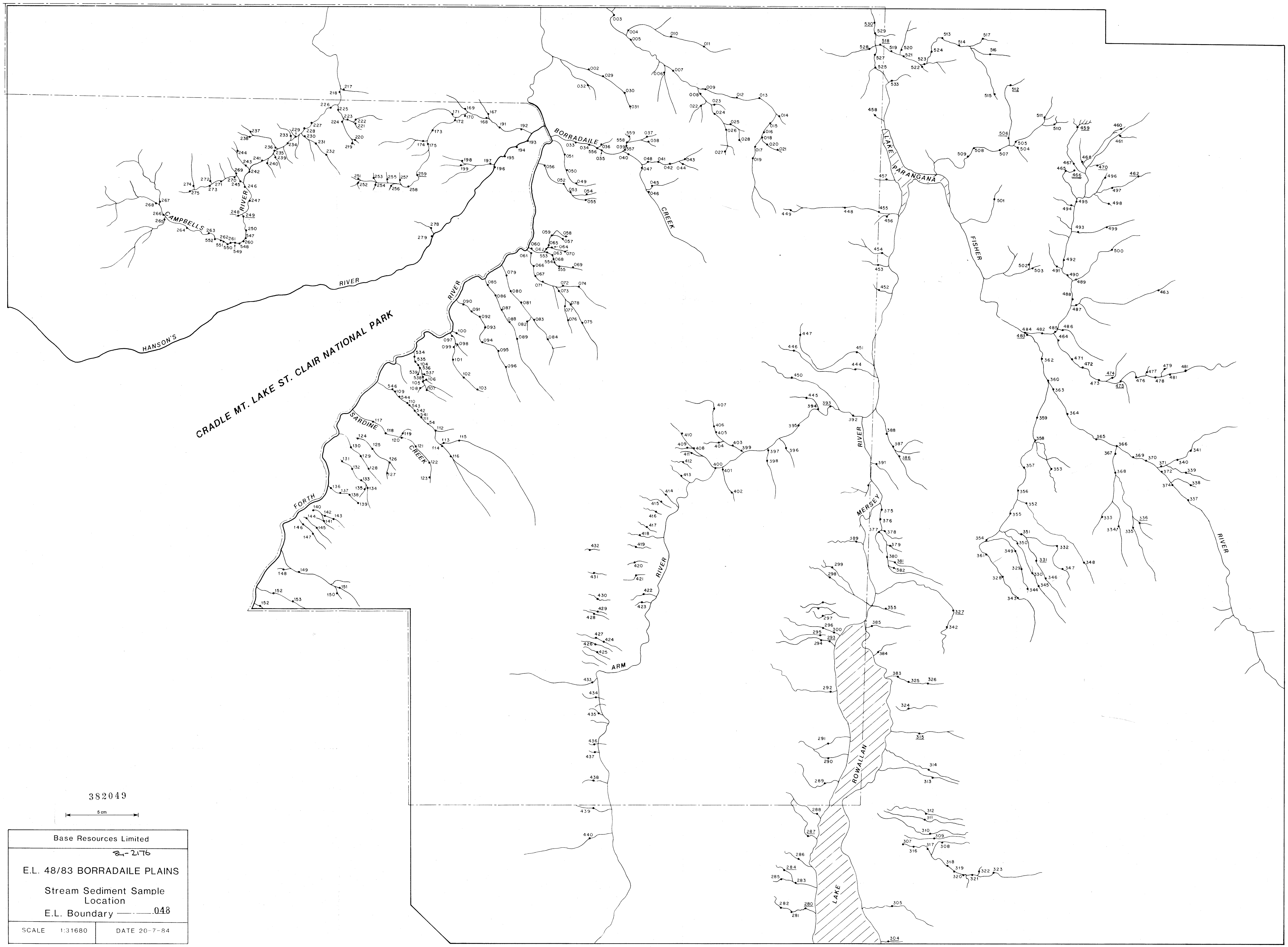
Cr_2O_3 was detected only in garnet 4, sample 498 (detection limit).12%). V_2O_5 was detected in garnet 1, sample 498.

4. DISCUSSION

The values of % Cr_2O_3 in diopside in these samples are within the range of chrome diopside (0.21-2.81%), as defined by Stephens and Dawson (1977)*, but at the lower end. These values do not necessarily indicate a kimberlite source.

The values of % MgO in garnet in these samples indicate that pyrope garnet (defined as 11.5 + % MgO) is present in samples 057, 485 and 498. One garnet from sample 057 contains 15.8% MgO. While kimberlitic garnets typically have 18.0 + % MgO, some pyrope garnets in kimberlites have reported values as low as 11.75% MgO.

*STEVENS W.E. and DAWSON J.B. 1977. Statistical comparison between pyroxenes from kimberlites and their associated xenoliths. J. Geology, Vol. 85, pp. 433 - 449.



Base Resources Limited

84-2176

E.L. 48/83 BORRADAILE PLAINS

Stream Sediment Sample Location

E.L. Boundary —·—·— .048

SCALE 1:31680	DATE 20-7-84


DOVE GROUP
BORRADAILE
McCOYS PROSPECT
LAKE PARANGANA
CAMPBELLS
RIVER
CREEK
FISHER GROUP
RIVER
HANSON'S
CRADLE MT. LAKE ST. CLAIR NATIONAL PARK
FISHER
RIVER
RIVER
SARDINE
CREEK
RIVER
RIVER
FORTH
HOWELL GROUP
MERSEY
ARM
ROWALLAN
LAKE
LEGEND
Glacial till/alluvium/talus
Tertiary volcanics & Jurassic Dolerites
Permian sediments
MAJOR UNCONFORMITY
Precambrian (Quartzite horizons)
382050
5 cm
Base Resources Limited
E.L. 48/83 BORRADAILE PLAINS
Geology
049
84-2176.
SCALE 1:31680
DATE 20-7-84