000

824001

88-2765

MINES

File Ref. EL 29/83

11 JAN 1988

Doc. Ref.

Action Officer	Initials
LETTER	
7.1.88	
REFERS	
Resubmit to	Date

RELINQUISHMENT REPORT

EXPLORATION LICENCE 29/83

LEMONTHYME

December, 1987

N. Charchalis

Base Resources Ltd.

CONTENTS

APPENDIXES

1. SUMMARY AND CONCLUSIONS

1.1 This report summarises diamond exploration work completed within the Lemonthyme E.L. 29/83.

1.2 The work was carried out under the supervision of consulting Geologist Dr B L Wood and comprised an initial stream sediment survey, followed up by exhaustive laboratory optical and analytical tests in the search for leath clastic diamonds and kimberlitic indicator minerals.

1.3 No kimberlitic indicator minerals or clastic diamonds were discovered ~~discussed~~, and the clastic assemblages within the stream sediments were readily correlatable ~~like~~ with the leosic basic geology of the area.

1.4 In view of the negative results of the survey, it was decided to relinquish the Exploration Licence.

2. INTRODUCTION

E.L. 29/83, Lemonthyme, was initally granted to Base Resources Ltd for one year, to remain in force until 21st September, 1984, and was subsequently renewed in yearly increments until September 1987, when it was relinquished.

The area comrises some 110 sq km and lies immediately north of E.L. 48/82 Borrodaile Plains which was relinquished by Base Resources in August 1987.

Both the Lemonthyme and Borrodaile Plains E.L.'s were the subject of exploration for diamondiferous kimberlite pipes, with the work carried out under the supervision of Consulting Geologist, Dr B.L. Wood.

The rationale for the exploration programme has been outlined in prior annual reports and is not reiterated here.

The field and laboratory techniques employed within E.L. 29/83 in the search for diamonds and indicator minerals may be summarised as follows;

3. 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 Tetra-bromoethane (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 slow-moving 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 100 samples is considered adequate for a first phase survey of 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 relatevely short stream lengths involved, in contrast to the long poorly defined streams of the West Kimberly, W.A., where bulk samples of up to several tonnes are necessary, (Gregory, 1984).

4. 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 each, with additional time for various tests of individual grains. Most samples are also examined under U.V. light to check for fluorescent grains.

4.1 Indicator Minerals

The indicator species generally sought are as follows (After Gregory, 1984):

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	"	

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. In addition, the widespread scattering by glacier-ice transport of many different rock types has tended to homogenise the mineral assemblages of most stream sediments.

Thus almost all samples include doleritic-basaltic diopside, augite, enstative 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 possible 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 schists 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 further tests and Electron Microprobe Analysis (E.P.M.A.).

4.2 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.

4.3 Fluorescence Test

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

4.4 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. of 1.67 to 1.78 are retained, as are pyroxenes with R.I. of 1.65 to 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 a few 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 definate 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).

5. RESULTS OF PROSPECTING

Our initial literature search and air photo scan was completed, and a stream sediment survey completed over selected portions of the E.L.

A total of 103 stream sediment samples were collected during December, 1983. (for locations refer to Annual Report for 1984).

84-2196

Two sediment samples were collected at each locality, one consisting of seived (-20+80 mesh) sand bagged directly to a weight of about 8 kg, the other comprised 3 pans full (10 kg) of seived sand, hand concentrated to about 200 gm.

The panned concentrates were subsequently processed in the laboratory (see below), while the raw bulk samples are being retained for later treatment by a specialist servicing laboratory. Only a selection of the bulk samples, made on the basis of results from the present work, will be submitted.

5.1 Laboratory Followup Work

All stream sediment pan concentrates were processed in heavy liquid Tetrabromoethane (T.B.E.) to recover mineral species having densities of 2.9 or more.

All heavy fractions were then scanned under the binocular microscope to search for possible indicator minerals, during which various tests were carried out on single grains suspected to be indicator species.

Many of the samples are profusely laden with minerals of the same species as the indicators being sought such as diopside, enstatite, augite from dolerite and basalt, or garnet from metasediments, and these render the search slow and laborious. Also several other species present may resemble indicators, e.g. brown tourmaline like perovskite, green epidote like chrome diopside, and in many cases brilliant colourless zircon simulated diamond to a degree that warranted frequent testing of fluorescence or hardness. Most fluorescent zircons showed golden yellow colours like some kimberlitic zircons, but a few (and some diopsides) showed blue colours like those of some diamonds. The hardness test is a final diagnostic check and is destructive for all but diamond.

Almost all samples contained pyroxenes and other minerals derived from basalt and dolerite, even though many sample localities are some distance from either of these rock types. This is evidently due to the widespread scattering of glacial debris by ice-transport, with exotic components derived from the distant sources. On the other hand some localities directly downstream from basaltic plateaus contained significant amounts of mica, chlorite and brown spessartine-almandine garnet derived close at hand from the underlying Pre-cambrian metasedimentary rocks.

Binocular scanning and other testing by Dr. B. Wood of the 103 stream sediment samples resulted in the selection of seventeen samples of possible kimberlitic garnets and pyroxenes being submitted to AMDEL for microprobe analysis.

Results of the microprobe assays (samples prefixed "L" for E.L. 29/83, remainder from E.L 48/82) are appended.

In spite of the rigorous selection of appropriate mineral grains, the results are disappointingly negative and in only one sample (No L024) is the garnet significantly pyropic.

In this latter case, the composition is not definitely kimberlitic, however it does not exclude that possibility but also lies within the range of granulitic-metamorphic garnet.

No significantly chromiferous diopside was revealed by assays.

On the basis of the optical tests on the original 103 samples, followed by micropobe analyses of selected samples by AMDEL, seven samples were identified as being most appropriate for full scale minerological assay by a diamond search laboratory.

The seven samples were forwarded to Diamond Laboratory Services Pty Ltd, Sydney, where the samples were washed and heavy and light fractions prepared.

The heavy fraction was observed under the binocular stereo-microscope for diamonds and other kimberlitic indicator minerals.

The laboratory reported results as follows,

Sample L010

Contained 3 almandine garnets, together with some mica and pyroxene grains.

Sample L011

Contained 2 almandine garnets, together with mica and pyroxene grains. 15 green coloured grains that may have been chrome diopside were isolated for further analysis.

Sample L012

Contained 6 almandine garnets, together with 2 green coloured grains which may be chrome diopside.

Sample L013

Contained 4 orange coloured garnets and two possible chrome diopside grains. In addition 35 almandine garnets were identified.

Sample L024

Contained only mica grains.

Sample L091

Contained abundant almandine garnets.

Sample L099

Contained 10 almandine garntes and abundant mica.

Grains from samples L011, L013 were further isolated and their chemical compositions determined by the electron probe microanoy ser.

This work showed the compositional ranges of the clumopy pyroxenes overlap known analyses of kimberlitic chrome diopsides, with the chromium content on the lower boundary of the known ranges. The garnet grains were found to be manganese rich with minor grossular and almandine components, and have probably originated from quartz rich or granitic pedmatites of low pressure paragenesis.

The laboratory concluded that although analyses of the green eluiopy coscene grains show overlap with known kimberlitic grains, the relatively low chromium content and the supporting evidence given by the nature of the garnets indicates an origin other than rocks with kimberlitic affinity.

They further concluded that there appears to be no indication that further study of the areas from which the samples were collected, would prove fruitful.

5.2 Provenance of the Clastic Assemblages

The geology of the region is dominated by these major rock units - the low grade metasedimentary Proterozoic basement, the remnant high-level plateaux of Tertiary basalt, and the elevated sheets of jurdssic dolerite. Although none of the latter occur within the E.L. area, debris transported by former ice sheets is widespread and has been derived from sources which are not far distant. Minor sources of some clastic minerals within the area are the small stocks of Dove Granite and their associated contact metamorphic aureoles (refer Geological Plan in Annual Report for 1984).

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

The basement metasediments contribute much spessartine-garnet, rutile, ilmenite, magnetite, eipidote, anatase and zircon (described in in-situ samples by Jennings (1963) and Collings 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 ferroaugite. The dominant light brown mafics in the sediments are probably all derived from basalt and dolerite. The basalt also contributes significant yellow-green olivine and some dark grey pyroxene as well as magnetite and probably spinel. The stocks of Dove Granite and possibly other unmapped intrusives such as porphyries are believed to contribute some almandine-garnet, rutile and zircon, as well as tourmaline, magnetite, ilmenite and spinel.

Thus no definite kimberlitic indicator minerals, or clastic diamonds were discovered with the E.L. and in view of the negative results, the area was relinquished.

N. Charchalis.

APPENDIX I

AMDEL REPORTS

Analysis for Kimberlitic indicator minerals

Note: Samples prefixed "L" pertain to E.L. 29/83

Remainder to E.L. 48/82

The Australian Mineral Development Laboratories

Flemington Street, Frewville,
South Australia 5063
Phone Adelaide (08) 79 1662
Telex AA82520

Please address all correspondence to
P.O. Box 114 Eastwood
SA 5063
In reply quote:

010

amdel

824011

18 December 1984

GS 3/0/0

Belwood Pty Limited
753 Kingsway
GYMEA NSW 2227

Attention: Dr B L Wood

REPORT G 6170/85 - PART I

YOUR REFERENCE:	Letter dated 8 November 1984
IDENTIFICATION:	L007, L010, L011, L012
MATERIAL:	43 sand grains from 4 locations
DATE RECEIVED:	15 November 1984
WORK REQUIRED:	Analysis for Kimberlite Indicator Minerals

Investigation and Report by: Michael Till

Chief, Geological Services Section: Dr Keith J Henley

Keith Henley

for Dr William G Spencer
Manager, Mineral and Materials Sciences Division

ba

Head Office:
Flemington Street, Frewville
South Australia 5063
Telephone (08) 79 1662
Telex: Amdel AA82520
Pilot Plant:
Osman Place
Thebarton, S.A.
Telephone (08) 43 5733
Telex: Amdel AA82725
Branch Laboratories:
Melbourne, Vic.
Telephone (03) 645 3093
Perth, W.A.
Telephone (09) 325 7311
Telex: Amdel AA94893
Sydney, N.S.W.
Telephone (02) 439 7735
Telex: Amdel AA20053
Townsville
Queensland 4814
Telephone (077) 75 1377

ANALYSIS OF SAND GRAINS FOR KIMBERLITE INDICATOR MINERALS

011

824012

1. INTRODUCTION

Sand grain samples from thirty two localities were received from Dr B L Wood on behalf of Base Resources Limited, Sydney with a request for brief microscopic examination and microprobe analyses of suspected kimberlite indicator minerals.

2. PROCEDURE

The samples were examined microscopically in loose grain mounts, the diopside grains in an oil of refractive index of 1.66 and the garnet grains in an oil of refractive index of 1.77. The diopside grains with a refractive index of not less than 1.66 and with inclined extinction or indeterminable extinction were mounted in a polished section and analysed by an electron probe microanalyser. The garnet grains with a refractive index of not greater than 1.77 were also mounted in a polished section and analysed by an electron probe microanalyser.

Several vials with clear plastic tops were loose upon receipt of the sample container. A summary of the grains received, examined and probed is as follows:

Sample	Grains Received/Examined	Grains mounted in polished section	Grains probed
L010	5 garnet, 12 diopside	3 garnet, 12 diopside	2 garnet 10 diopside 2 other
L011	14 diopside	10 diopside	10 diopside
L012	4 garnet, 4 diopside	4 diopside	2 diopside
L007	-	-	-
Loose grains	1 garnet, 3 diopside	1 garnet, 1 diopside	1 garnet 1 diopside

012

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

824013

Element/Oxide	Detection Limit (Wt. %)
Al_2O_3	0.06
CaO	0.07
Cl	0.04
Cr_2O_3	0.13
FeO	0.15
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_2	0.11
SiO_2	0.06
V_2O_3	0.14

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
L010	garnet	3	1.77	-	✓
	"	2	>1.77	-	x
	diopside	6	>1.66	27-40°	✓
	"	1	>1.66	5°	✓
	"	5	>1.66	-	✓
L011	diopside	8	>1.66	27-45°	✓
	"	2	>1.66	-	✓
	"	1	>1.66	0°	x
	"	1	<1.66	27°	x
	"	2	<1.66	-	x
L012	diopside	3	>1.66	23-32°	✓
	"	1	>1.66	-	✓
	garnet	4	>1.77	-	x
Loose grains	diopside	1	>1.66	30°	✓
	"	2	<1.66	25°	x
	garnet	1	<1.77	-	✓

The results of the electron probe analyses are as follows (weight %). (Note that FeO refers to total Fe as FeO).

SAMPLE LO10

Diopside

Analysis No.	1	2	3	4	5	6
SiO_2	48.9	48.9	49.4	49.0	48.6	49.9
TiO_2	0.6	0.7	0.6	0.7	0.8	0.4
Al_2O_3	3.3	3.1	3.0	3.4	3.8	2.2
V_2O_3	-	-	-	-	-	-
Cr_2O_3	1.0	0.9	1.0	1.1	0.8	0.7
FeO	5.9	6.3	5.9	6.0	6.4	6.4
MnO	-	-	-	-	0.2	-
MgO	15.5	15.5	15.9	15.7	15.2	16.8
CaO	19.3	18.7	18.8	19.1	19.0	18.0
Na_2O	0.2	0.2	-	0.2	0.2	0.2
TOTAL	94.7	94.3	94.6	95.2	95.0	94.6

Analysis No.	7	8	9	10	11	12
SiO_2	49.2	49.4	49.0	52.1	48.9	48.9
TiO_2	0.5	0.7	0.7	-	0.6	0.6
Al_2O_3	2.7	3.6	3.6	0.6	3.2	3.3
V_2O_3	-	0.2	-	-	-	-
Cr_2O_3	0.8	1.1	1.0	-	1.0	1.0
FeO	6.1	6.5	6.3	4.9	6.3	5.9
MnO	-	-	0.2	-	-	-
MgO	16.1	16.0	15.5	14.4	15.8	15.5
CaO	18.5	18.1	19.1	23.5	18.6	19.3
Na_2O	0.3	0.2	0.2	-	-	0.2
TOTAL	94.2	95.8	95.6	95.5	94.4	94.7

- = not detected at limit quoted above

SAMPLE L010 (cont.)

Garnet

Analysis No.	1	2
SiO_2	38.1	37.6
Al_2O_3	20.8	21.1
Cr_2O_3	0.1	-
FeO	22.0	23.4
MnO	0.8	0.6
MgO	9.8	8.6
CaO	5.7	5.2
TOTAL	97.3	96.5

Other - orthopyroxene (?bronzite)

Analysis No.	1	2
SiO_2	52.2	52.3
TiO_2	0.3	0.1
Al_2O_3	3.5	2.2
Cr_2O_3	0.3	0.4
FeO	10.4	10.0
MnO	-	0.1
MgO	25.3	28.2
CaO	2.4	1.8
TOTAL	94.4	95.1

- = not detected at limit quoted above

015 SAMPLE LO11

824016

Diopside

Analysis No.	1	2	3	4	5
SiO_2	50.4	50.4	50.7	50.7	50.5
TiO_2	0.2	0.3	0.2	0.3	0.3
Al_2O_3	7.2	6.8	6.6	7.1	7.0
Cr_2O_3	0.7	0.6	0.8	0.7	0.7
FeO	3.2	2.9	2.2	3.1	2.8
MgO	14.6	14.8	14.2	14.8	14.5
CaO	18.3	19.0	21.1	18.4	19.3
Na_2O	1.5	1.4	0.9	1.6	1.6
TOTAL	96.1	96.2	96.7	96.7	96.7

Analysis No.	6	7	8	9	10
SiO_2	51.0	51.3	50.7	49.9	49.5
TiO_2	0.2	0.4	0.2	0.4	0.3
Al_2O_3	6.3	6.8	5.7	6.8	6.9
Cr_2O_3	1.0	0.6	0.7	0.7	0.8
FeO	2.8	2.8	4.1	3.0	2.4
NiO	-	0.2	-	-	-
MnO	0.1	-	-	-	-
MgO	15.3	14.8	22.1	14.8	14.0
CaO	18.8	19.8	12.1	18.7	19.6
Na_2O	1.4	1.4	0.6	1.5	1.5
TOTAL	96.9	98.1	96.2	95.8	95.0

- = not detected at limit quoted above

016 SAMPLE LO12

824017

Diopside

Analysis No.	1	2
SiO_2	49.7	49.7
TiO_2	0.2	-
Al_2O_3	6.6	6.3
Cr_2O_3	0.6	0.7
FeO	2.9	3.0
MgO	14.5	16.2
CaO	19.1	17.8
Na_2O	1.5	0.9
TOTAL	95.1	94.6

Loose grains: sample number not known

Analysis No.	Diopside 1	Garnet 1
SiO_2	49.6	36.1
TiO_2	0.5	-
Al_2O_3	3.6	20.2
Cr_2O_3	0.8	-
FeO	6.5	31.8
MnO	-	1.8
MgO	17.0	0.7
CaO	16.8	6.5
Na_2O	0.3	-
TOTAL	95.1	97.1

- = not detected at limit quoted above

4. DISCUSSION

The values of % Cr_2O_3 in diopside are within the range of chrome diopside (0.2 - 2.8% Cr_2O_3) but these values do not necessarily indicate a kimberlite source.

The values of % MgO in garnet indicate the pyrope garnet (defined as 11.5+ % MgO) is not present.

The Australian Mineral Development Laboratories

Flemington Street, Frewville, South Australia 5063
Phone Adelaide (08) 79 1662
Telex AA82520

Please address all correspondence to P.O. Box 114 Eastwood SA 5063
In reply quote:

018

amdel

824019

14 February 1985

GS 3/0/0

Belwood Pty Limited
753 Kingsway
GYMEA NSW 2227

Attention: Dr B.L. Wood

REPORT G 6170/85 - PART II - FINAL

YOUR REFERENCE:	Letter dated 8 November 1984
IDENTIFICATION:	002-403, L006-L102 (not inclusive)
MATERIAL:	153 sand grains from 28 locations
DATE RECEIVED:	15 November 1984
WORK REQUIRED:	Analysis for kimberlite indicator minerals

Investigation and Report by: Michael Till

Chief - Geological Services Section: Dr Keith J. Henley

Keith Henley

for Dr William G. Spencer
Manager, Mineral and Materials Sciences Division

cap

Head Office:
Flemington Street, Frewville
South Australia 5063
Telephone (08) 79 1662
Telex: Amdel AA82520
Pilot Plant:
Osman Place
Thebarton, S.A.
Telephone (08) 43 5733
Telex: Amdel AA82725
Branch Laboratories:
Melbourne, Vic.
Telephone (03) 645 3093
Perth, W.A.
Telephone (09) 325 7311
Telex: Amdel AA94893
Sydney, N.S.W.
Telephone (02) 439 7735
Telex: Amdel AA20053
Townsville
Queensland 4814
Telephone (077) 75 1377

019

1. INTRODUCTION

Sand grain samples from thirty two localities were received from Dr B.L. Wood on behalf of Base Resources Limited, Sydney with a request for brief microscopic examination and microprobe analyses of suspected kimberlite indicator minerals.

2. PROCEDURE

The samples were examined microscopically in loose grain mounts, the diopside grains in an oil of refractive index of 1.66 and the garnet grains in an oil of refractive index 1.77. The diopside grains with a refractive index of not less than 1.66 and with inclined extinction or indeterminable extinction were mounted in a polished section and analysed by an electron probe microanalyser. The garnet grains with a refractive indix of not greater than 1.77 were also mounted in a polished section and analysed by an electron probe microanalyser.

Several vials with clear plastic tops were loose upon receipt of the sample container. A summary of the grains received, examined and probed is as follows:

Sample	Grains Received/Examined	Grains Submitted for Mounting in Polished Section	Grains Probed
	Diopside:Garnet	Diopside:Garnet	Diopside:Garnet
002	5:4	4:4	3:3
100	2:6	0:3	0:3
124	4:2	2:2	2:1
159	2:1	2:0	2:0
160	2:1	2:0	2:0
167	3:1	3:1	3:1
195	16:3	15:3	15:1
201	2:5	2:4	2:4
207	1:4	1:0	1:0
368	6:9	2:6	2:5
369	3:3	2:2	2:2
387	1:2	1:1	1:1
396	1:2	1:2	1:2
398	2:5	1:2	1:2
403	1:3	1:3	1:3
L006	0:4	0:0	0:0
L008	0:6	0:0	0:0
L009	0:2	0:0	0:0

020

824021

Sample	Grains Received/Examined	Grains Submitted for Mounting in Polished Section	Grains Probed
	Diopside:Garnet	Diopside:Garnet	Diopside:Garnet
L024	6:8	6:7	6:6
L028	2:0	2:0	2:0
L032	1:5	0:0	0:0
L039	1:1	1:0	1:0
L048	3:3	3:0	2:0
L065	3:0	1:0	1:0
L087	2:2	1:0	1:0
L091	1:1	1:0	1:0
L099	0:0	0:0	0:0
L102	0:0	0:0	0:0

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	0.13
FeO	0.15
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_2	0.11
SiO_2	0.06
V_2O_3	0.14

3. RESULTS

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

Sample	Inferred Mineral	No. of Grains	Refractive Index	Extinction Angle	Submitted for EPMA	
002	Diopside	1	<1.66	0°	x	tourmaline
		2	>1.66	22°,27°	✓	
		2	>1.66	n.d.	✓	
	Garnet	4	<1.77	-	✓	
100	Diopside	2	<1.66	n.d.	x	
	Garnet	1	>1.77	-	x	
		3	<1.77	-	✓	
124	Diopside	2	>1.66	0°	x	
		1	>1.66	n.d.	✓	
		1	n.d.*	n.d.	✓	
159	Garnet	2	<1.77	-	✓	
	Diopside	1	>1.66	33°	✓	
		1	>1.66	n.d.	✓	
160	Garnet	1	>1.77	-	x	
	Diopside	1	>1.66	n.d.	✓	
		1	n.d.*	n.d.	✓	
167	Garnet	1	>1.77	-	x	(rutile)
	Diopside	2	>1.66	30°,45°	✓	
		1	>1.66	n.d.	✓	
195	Garnet	1	1.77	-	✓	
	Diopside	7	>1.66	12-35°	✓	
		8	>1.66	n.d.	✓	
		1	>1.66	n.d.	x	(olivine)
	Garnet	3	<1.77	-	✓	
201	Diopside	1	>1.66	40°	✓	
		1	>1.66	n.d.	✓	
	Garnet	1	>1.77	-	x	
		4	n.d.*	-	✓	
207	Diopside	1	>1.66	n.d.	✓	
		3	>1.77	-	x	
		1	>1.77	-	x	iron oxide

*Grains too large to determine refractive index.

Samp.	Mineral	Grains	Index	Angle		
368	Diopside	3	<1.66	0°,35°,n.d.	x	(one grain is tourmaline)
		1	>1.66	0°	x	
		2	>1.66	40°	✓	
	Garnet	3	>1.77	-	x	
		6	<1.77	-	✓	
369	Diopside	2	>1.66	33°,n.d.	✓	
		1	<1.66	n.d.	x	
	Garnet	2	1.77	-	✓	
		1	>1.77	-	x	
387	Diopside	1	n.d.	42°	✓	
	Garnet	1	<1.77	-	✓	
		1	>1.77	-	x	
396	Diopside	1	>1.66	25°	✓	
	Garnet	2	<1.77	-	✓	
398	Diopside	1	>1.60	0°	x	
		1	n.d.	n.d.	✓	
	Garnet	3	>1.77	-	x	
		2	<1.77	-	✓	
403	Diopside	1	>1.66	45°	✓	
	Garnet	3	<1.77	-	✓	
L006	Garnet	4	>1.77	-	x	
L008	Garnet	6	>1.77	-	x	
L009	Garnet	2	>1.77	-	x	
L024	Diopside	5	>1.66	n.d.	✓	
		1	>1.66	11°	✓	
	Garnet	7	<1.77	-	✓	
		1	>1.77	-	x	
L028	Diopside	2	>1.66	38°,40°	✓	
L032	Diopside	1	<1.66	0°	x	
	Garnet	5	>1.77	-	x	
L039	Diopside	1	>1.66	44°	✓	
	Garnet	1	>1.77	-	x	
L048	Diopside	2	>1.66	n.d.	✓	
		1	>1.66	30°	✓	
	Garnet	3	>1.77	-	x	
L065	Diopside	2	<1.66	n.d.	x	(one is tourmaline)
		1	>1.66	n.d.	✓	
L087	Diopside	1	>1.66	40°	✓	
		1	1.66	0°	x	
		2	>1.77	-	x	

022

824023

Sample	Inferred Mineral	No. of Grains	Refractive Index	Extinction Angle	Submitted for EPMA
023 L091	Diopside	1	>1.66	10°	✓
	Garnet	1	>1.77	-	x

824024

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

Sample 002: PS33683

	Diopside 1		Diopside 2	
	Wt %	Cations (O=6)	Wt %	Cations (O=6)
SiO_2	51.5	1.93	50.3	1.88
TiO_2	0.6	0.02	0.7	0.02
Al_2O_3	2.3	0.10	4.4	0.19
Cr_2O_3	0.3	0.01	1.2	0.03
FeO	8.3	0.26	6.4	0.19
MgO	15.3	0.85	15.5	0.87
CaO	20.1	0.81	19.7	0.79
Na_2O	0.4	0.03	0.3	0.02
Total	98.8		98.5	

	Diopside 3		Garnet 1	
	Wt %	Cations (O=6)	Wt %	Cations (O=24)
SiO_2	50.5	1.90	38.7	5.95
TiO_2	0.6	0.02	-	-
Al_2O_3	3.8	0.17	22.0	3.99
Cr_2O_3	0.9	0.03	-	-
FeO	6.4	0.20	23.0	2.96
MnO	0.2	0.01	3.0	0.39
MgO	15.8	0.88	7.2	1.65
CaO	19.6	0.79	6.7	1.10
Na_2O	0.2	0.02	-	-
Total	98.0		100.6	

- = not detected at limit quoted above.

	Garnet 2		Garnet 3	
	Wt %	Cations (O=20)	Wt %	Cations (O=24)
SiO_2	38.3	6.01	38.3	5.96
Al_2O_3	21.5	3.98	22.0	4.03
FeO	27.9	3.66	31.4	4.09
MnO	1.0	0.13	0.7	0.09
MgO	7.6	1.78	6.8	1.59
CaO	2.7	0.45	1.6	0.27
Total	99.0		100.8	

Sample 100: PS33684

	Garnet 1		Garnet 2	
	Wt %	Cations (O=24)	Wt %	Cations (O=24)
SiO_2	38.5	6.00	39.1	5.91
Al_2O_3	21.4	3.93	22.1	3.98
FeO	26.4	3.44	24.3	3.10
MnO	0.5	0.06	0.7	0.08
MgO	6.6	1.53	8.4	1.91
CaO	6.1	1.02	6.1	1.00
Total	99.5		100.7	

	Garnet 3	
	Wt %	Cations (O=24)
SiO_2	38.7	5.98
Al_2O_3	22.1	4.02
FeO	31.9	4.12
MnO	0.9	0.12
MgO	6.9	1.59
CaO	1.1	0.18
Total	101.6	

- = not detected at limit quoted above.

025

Sample 124: PS33685

	Diopside 1		Diopside 2	
	Wt %	Cations (O=6)	Wt %	Cations (O=6)
SiO_2	51.7	1.91	51.6	1.92
TiO_2	0.6	0.02	0.5	0.01
Al_2O_3	3.3	0.15	2.7	0.12
Cr_2O_3	0.9	0.03	0.9	0.03
FeO	7.4	0.23	6.9	0.21
MgO	16.6	0.92	16.7	0.92
CaO	18.6	0.74	19.3	0.77
Total	99.1		98.6	

	Garnet 1	
	Wt %	Cations (O=24)
SiO_2	39.0	5.98
Al_2O_3	21.9	3.96
FeO	24.2	3.10
MnO	0.5	0.06
MgO	8.3	1.90
CaO	6.2	1.03
Total	100.1	

Sample 159: PS33686

	Diopside 1		Diopside 2	
	Wt %	Cations (O=6)	Wt %	Cations (O=6)
SiO_2	50.3	1.84	52.6	1.90
TiO_2	0.4	0.01	0.3	0.01
Al_2O_3	8.8	0.38	6.3	0.27
Cr_2O_3	0.2	0.01	0.6	0.02
FeO	7.4	0.23	2.8	0.08
MgO	16.6	0.91	15.4	0.83
CaO	13.8	0.54	20.5	0.79
Na_2O	1.4	0.10	1.3	0.09
Total	98.9		99.8	

- = not detected at limit quote above.

Sample 160: PS33687

	Diopside 1 (Orthopyroxene)		Diopside 2	
	Wt %	Cations (O=6)	Wt %	Cations (O=6)
SiO_2	55.3	1.90	51.4	1.92
TiO_2	-	-	0.6	0.02
Al_2O_3	4.8	0.20	2.8	0.12
Cr_2O_3	0.3	0.09	0.4	0.01
FeO	6.5	0.19	7.5	0.23
MgO	32.6	1.67	16.8	0.93
CaO	0.6	0.02	18.6	0.75
Total	100.1		98.1	

Sample 167: PS33688

	Diopside 1		Diopside 2	
	Wt %	Cations (O=6)	Wt %	Cations (O=6)
SiO_2	48.6	1.85	50.7	1.92
TiO_2	1.3	0.04	0.5	0.01
Al_2O_3	5.2	0.23	2.9	0.13
Cr_2O_3	0.3	0.01	0.6	0.02
FeO	8.2	0.26	7.3	0.23
MgO	13.6	0.77	16.1	0.91
CaO	20.2	0.82	19.3	0.78
Total	97.4		97.4	

	Diopside 3		Garnet 1	
	Wt %	Cations (O=6)	Wt %	Cations (O=24)
SiO_2	50.7	1.90	37.4	5.93
TiO_2	0.8	0.02	-	-
Al_2O_3	3.4	0.15	21.5	4.02
Cr_2O_3	0.7	0.02	-	-
FeO	7.5	0.23	32.2	4.27
MnO	-	-	1.5	0.20
MgO	15.9	0.88	4.9	1.16
CaO	19.5	0.78	2.6	0.43
Total	98.5		100.1	

- = not detected at limit quoted above.

Sample 195: PS33689

824028

027

	Diopside 1		Diopside 2	
	Wt %	Cations (O=6)	Wt %	Cations (O=6)
SiO_2	51.3	1.92	51.2	1.91
TiO_2	0.5	0.01	0.6	0.02
Al_2O_3	3.1	0.14	3.2	0.14
Cr_2O_3	0.8	0.02	1.1	0.03
FeO	7.1	0.22	6.9	0.21
MgO	16.5	0.92	16.0	0.89
CaO	18.8	0.75	19.1	0.76
Total	98.1		98.1	

	Diopside 3		Diopside 4	
	Wt %	Cations (O=6)	Wt %	Cations (O=6)
SiO_2	50.7	1.91	50.2	1.89
TiO_2	0.7	0.02	0.6	0.02
Al_2O_3	3.4	0.15	3.9	0.17
Cr_2O_3	0.9	0.03	1.0	0.03
FeO	6.9	0.22	7.0	0.22
MgO	15.9	0.89	15.5	0.87
CaO	19.3	0.78	19.2	0.78
Total	97.8		97.4	

	Diopside 5		Diopside 6	
	Wt %	Cations (O=6)	Wt %	Cations (O=6)
SiO_2	51.1	1.90	51.5	1.90
TiO_2	0.7	0.02	0.7	0.02
Al_2O_3	3.5	0.15	3.4	0.15
Cr_2O_3	1.1	0.03	1.0	0.03
FeO	6.8	0.21	7.1	0.22
MgO	15.8	0.87	16.0	0.88
CaO	20.2	0.80	20.0	0.79
Total	99.2		99.7	

	Diopside 7 (orthopyroxene)		Diopside 8	
	Wt %	Cations (O=6)	Wt %	Cations (O=6)
SiO_2	54.9	1.98	52.7	1.95
TiO_2	-	-	0.4	0.01
Al_2O_3	1.2	0.05	2.3	0.10
Cr_2O_3	0.2	0.01	0.5	0.02
FeO	14.3	0.43	7.1	0.22
MgO	26.6	1.43	17.5	0.97
CaO	2.2	0.09	18.0	0.71
Total	99.4		98.5	

- = not detected at limit quoted above

Sample 195: (Continued)

028

	Diopside 9		Diopside 10	
	Wt %	Cations (O=6)	Wt %	Cations (O=6)
SiO_2	51.7	1.92	51.5	1.91
TiO_2	0.4	0.01	0.7	0.02
Al_2O_3	2.9	0.12	3.4	0.15
Cr_2O_3	0.7	0.02	1.1	0.03
FeO	7.1	0.21	7.0	0.22
MgO	17.1	0.94	16.0	0.88
CaO	18.6	0.74	19.6	0.78
Total	98.5		99.3	

	Diopside 11		Diopside 12	
	Wt %	Cations (O=6)	Wt %	Cations(O=6)
SiO_2	52.2	1.93	50.6	1.89
TiO_2	0.4	0.01	0.7	0.02
Al_2O_3	2.1	0.09	3.8	0.17
Cr_2O_3	0.6	0.02	0.9	0.03
FeO	7.4	0.23	7.4	0.23
MgO	17.6	0.97	16.2	0.90
CaO	18.6	0.74	18.3	0.73
Total	98.9		97.9	

	Diopside 13		Diopside 14	
	Wt %	Cations (O=6)	Wt %	Cations (O=6)
SiO_2	51.7	1.93	51.6	1.93
TiO_2	0.4	0.01	0.5	0.01
Al_2O_3	2.5	0.11	2.6	0.11
Cr_2O_3	0.9	0.03	0.8	0.02
FeO	6.7	0.21	6.9	0.21
MgO	17.0	0.95	16.6	0.92
CaO	18.7	0.75	18.9	0.76
Total	97.9		97.9	

- = not detected at limit quoted above.

029

	Diopside 15		Garnet 1	
	Wt %	Cations (O=6)	Wt %	Cations (O=24)
SiO_2	51.0	1.89	38.0	5.99
TiO_2	0.9	0.02	-	-
Al_2O_3	4.2	0.18	21.8	4.05
Cr_2O_3	0.9	0.03	-	-
FeO	7.0	0.22	30.6	4.02
MnO	-	-	1.5	0.21
MgO	15.6	0.86	5.8	1.35
CaO	18.9	0.77	2.2	0.37
Total	98.5		99.9	

Sample 201: PS33690

	Diopside 1		Diopside 2	
	Wt %	Cations (O=6)	Wt %	Cations (O=6)
SiO_2	49.6	1.87	49.5	1.87
TiO_2	0.8	0.02	0.7	0.02
Al_2O_3	4.8	0.21	4.9	0.22
Cr_2O_3	0.8	0.02	0.8	0.02
FeO	7.0	0.22	6.8	0.21
MgO	14.9	0.83	15.1	0.85
CaO	20.0	0.81	19.5	0.79
Total	97.9		97.3	

	Garnet 1		Garnet 2	
	Wt %	Cations (O=24)	Wt %	Cations (O=24)
SiO_2	37.2	6.00	36.9	5.93
Al_2O_3	20.9	3.98	21.2	4.02
FeO	22.5	3.03	26.6	3.58
MnO	15.0	2.05	13.0	1.76
MgO	0.6	0.15	0.8	0.18
CaO	4.5	0.78	2.8	0.48
Total	100.7		101.3	

- = not detected at limit quoted above.

Sample 201: (Continued)

	Garnet 3		Garnet 4	
	Wt %	Cations (O=24)	Wt %	Cations (O=24)
SiO_2	36.8	5.86	41.6	6.56
Al_2O_3	21.7	4.06	19.0	3.54
FeO	25.4	3.39	24.9	3.29
MnO	14.9	2.01	14.5	1.94
MgO	1.0	0.23	1.0	0.24
CaO	2.2	0.37	0.5	0.08
Total	102.0		101.5	

Sample 207: PS33691

	Diopside 1	
	Wt %	Cations (O=6)
SiO_2	51.7	1.91
TiO_2	0.3	0.01
Al_2O_3	5.8	0.25
Cr_2O_3	0.7	0.02
FeO	2.5	0.08
MgO	15.0	0.83
CaO	20.4	0.81
Na_2O	1.4	0.10
Total	97.8	

Sample 368: PS33692

	Diopside 1		Diopside 2	
	Wt %	Cations (O=6)	Wt %	Cations (O=6)
SiO_2	51.3	1.97	51.7	1.96
TiO_2	0.3	0.01	0.2	0.01
Al_2O_3	1.4	0.06	1.4	0.06
Cr_2O_3	-	-	-	-
FeO	13.3	0.43	12.3	0.39
MgO	14.3	0.82	15.1	0.86
CaO	17.0	0.70	17.4	0.71
Total	97.6		98.1	

- = not detected at limit quoted above.

	Garnet 1		Garnet 2	
	Wt %	Cations (O=24)	Wt %	Cations (O=24)
SiO_2	38.6	5.97	38.2	5.95
Al_2O_3	21.3	3.88	21.6	3.96
FeO	25.7	3.33	29.5	3.84
MnO	1.4	0.18	1.0	0.13
MgO	7.5	1.74	5.8	1.34
CaO	6.0	0.99	4.7	0.78
Total	100.5		100.8	

	Garnet 3		Garnet 4	
	Wt %	Cations (O=24)	Wt %	Cations (O=24)
SiO_2	38.4	5.97	38.7	5.95
Al_2O_3	21.8	3.99	22.3	4.05
FeO	28.0	3.64	29.4	3.78
MnO	0.8	0.10	0.3	0.04
MgO	5.7	1.32	8.6	1.98
CaO	6.1	1.01	1.3	0.22
Total	100.8		100.6	

	Garnet 5	
	Wt %	Cations (O=24)
SiO_2	37.7	5.96
Al_2O_3	21.6	4.03
FeO	33.1	4.37
MnO	1.8	0.23
MgO	5.3	1.24
CaO	1.2	0.20
Total	100.7	

Sample 369: PS33693

	Diopside 1		Diopside 2	
	Wt %	Cations (O=6)	Wt %	Cations (O=6)
SiO_2	51.7	1.98	51.6	1.97
TiO_2	-	-	0.1	0.01
Al_2O_3	0.8	0.04	1.1	0.05
Cr_2O_3	-	-	-	-
V_2O_3	-	-	0.2	0.01
FeO	21.7	0.69	13.6	0.43
MnO	0.4	0.01	0.3	0.01
MgO	18.0	1.03	14.2	0.81
CaO	5.9	0.24	17.3	0.71
Total	98.5		98.4	

- = not detected at limit quoted above

Sample 369: (Continued)

	Garnet 1		Garnet 2	
	Wt %	Cations (O=24)	Wt %	Cations (O=24)
SiO_2	38.5	5.92	39.2	5.95
Al_2O_3	22.4	4.05	22.2	3.97
FeO	29.0	3.73	26.8	3.40
MnO	0.4	0.05	1.3	0.16
MgO	9.6	2.20	9.7	2.20
CaO	0.8	0.12	2.3	0.38
Total	100.7		101.5	

Sample 387: PS33694

	Diopside 1		Garnet 1	
	Wt %	Cations (O=6)	Wt %	Cations (O=24)
SiO_2	47.7	1.81	39.7	6.00
TiO_2	1.7	0.05	-	-
Al_2O_3	6.4	0.28	21.9	3.91
Cr_2O_3	0.5	0.01	-	-
FeO	7.2	0.23	19.3	2.44
MnO	-	-	0.2	0.03
MgO	13.5	0.76	8.4	1.88
CaO	20.5	0.83	11.1	1.79
Total	97.5		100.6	

Sample 396: PS33695

	Diopside 1	
	Wt %	Cations (O=6)
SiO_2	51.5	1.94
Al_2O_3	2.1	0.09
Cr_2O_3	0.2	0.01
FeO	7.3	0.23
MgO	16.5	0.93
CaO	19.6	0.79
Total	97.2	

- = not detected at limit quoted above.

Sample 396: (Continued)

	Garnet 1		Garnet 2	
	Wt %	Cations (O=24)	Wt %	Cations (O=24)
SiO_2	38.6	5.92	39.7	5.98
Al_2O_3	22.3	4.03	22.5	3.99
FeO	30.6	3.92	18.7	0.03
MnO	0.2	0.02	0.4	2.36
MgO	9.0	2.04	12.2	0.05
CaO	0.7	0.12	5.5	2.72
Total	101.4		99.0	

Sample 398: PS33696

	Diopside 1	
	Wt %	Cations (O=6)
SiO_2	50.5	1.88
TiO_2	1.2	0.03
Al_2O_3	4.1	0.18
Cr_2O_3	0.3	0.01
FeO	7.2	0.22
MgO	14.9	0.83
CaO	20.5	0.82
Total	98.7	

	Garnet 1		Garnet 2	
	Wt %	Cations (O=24)	Wt %	Cations (O=24)
SiO_2	39.0	6.07	38.9	5.95
Al_2O_3	19.5	3.57	22.0	3.97
FeO	6.2	0.81	25.2	3.23
MnO	1.0	0.14	0.5	0.07
MgO	-	-	8.5	1.93
CaO	33.3	0.55	5.6	0.02
Total	99.0	5.55	100.7	

- = not detected at limit quoted above.

Sample 403: PS33697

	Diopside 1		Garnet 1	
	Wt %	Cations (O=6)	Wt %	Cations (O=24)
SiO_2	50.9	1.91	38.1	5.99
TiO_2	0.4	0.01	0.2	0.01
Al_2O_3	3.4	0.15	21.1	3.90
Cr_2O_3	1.0	0.03	-	-
FeO	6.4	0.20	28.2	3.70
MnO	-	-	1.1	0.15
MgO	17.0	0.95	5.1	1.19
CaO	18.3	0.74	6.5	1.09
Total	97.4		100.3	

	Garnet 2		Garnet 3	
	Wt %	Cations (O=24)	Wt %	Cations (O=24)
SiO_2	38.2	5.99	38.5	6.00
Al_2O_3	21.3	3.94	21.4	3.94
FeO	29.3	3.83	27.5	3.59
MnO	1.1	0.14	1.0	0.13
MgO	5.1	1.20	5.5	1.29
CaO	5.6	0.94	6.5	1.08
Total	100.6		100.4	

Sample L024: PS33701

	Diopside 1		Diopside 2	
	Wt %	Cations (O=6)	Wt %	Cations (O=6)
SiO_2	51.8	1.96	52.6	1.96
TiO_2	0.4	0.01	0.4	0.01
Al_2O_3	1.5	0.07	2.0	0.09
Cr_2O_3	0.4	0.01	0.7	0.02
FeO	8.7	0.28	8.4	0.26
MgO	17.0	0.96	17.4	0.97
CaO	16.9	0.69	16.8	0.67
Total	96.7		98.3	

- = not detected at limit quoted above.

Sample 2024: (continued)

	Diopside 3		Diopside 4	
	Wt %	Cations (O=6)	Wt %	Cations (O=6)
SiO_2	52.0	1.94	51.7	1.94
TiO_2	0.6	0.02	0.5	0.01
Al_2O_3	2.0	0.09	2.2	0.10
Cr_2O_3	0.9	0.03	0.7	0.02
FeO	8.3	0.26	8.3	0.26
MgO	16.9	0.94	16.7	0.94
CaO	17.3	0.69	17.9	0.72
Total			98.0	

	Diopside 5		Diopside 6	
	Wt %	Cations (O=6)	Wt %	Cations (O=6)
SiO_2	49.8	1.89	50.5	1.91
TiO_2	0.7	0.02	0.8	0.02
Al_2O_3	3.4	0.15	3.8	0.17
Cr_2O_3	1.0	0.03	0.4	0.01
FeO	8.0	0.25	8.9	0.28
MgO	14.9	0.84	15.9	0.90
CaO	19.6	0.80	16.4	0.67
Total	97.4		96.7	

	Garnet 1		Garnet 2	
	Wt %	Cations (O=24)	Wt %	Cations (O=24)
SiO_2	39.8	5.95	39.4	5.98
Al_2O_3	22.8	4.01	22.2	3.96
Cr_2O_3	0.3	0.03	0.2	0.02
FeO	20.6	2.58	26.8	3.40
MnO	0.6	0.08	0.3	0.04
MgO	10.8	2.41	10.8	2.43
CaO	6.0	0.96	1.2	0.19
Total	100.9		100.9	

	Garnet 3		Garnet 4	
	Wt %	Cations (O=24)	Wt %	Cations (O=24)
SiO_2	39.4	6.00	38.9	5.95
Al_2O_3	22.0	3.94	22.2	4.01
FeO	23.6	3.00	25.7	3.29
MnO	0.3	0.04	1.3	0.17
MgO	9.1	2.07	6.9	1.56
CaO	5.9	0.97	6.0	0.99
Total	100.3		101.0	

- = not detected at limit quoted above.

036

Sample L024: (Continued)

	Garnet 5		Garnet 6	
	Wt %	Cations (O=24)	Wt %	Cations (O=24)
SiO_2	38.9	5.94	38.5	5.97
Al_2O_3	22.3	4.02	21.9	4.00
FeO	28.5	3.64	28.7	3.72
MnO	0.6	0.08	0.9	0.12
MgO	8.6	1.95	6.6	1.51
CaO	2.1	0.34	4.0	0.67
Total	101.0		100.6	

Sample L028: PS33702

	Diopside 1		Diopside 2	
	Wt %	Cations (O=6)	Wt %	Cations (O=6)
SiO_2	52.2	1.95	51.7	1.94
TiO_2	0.6	0.02	0.4	0.01
Al_2O_3	2.2	0.97	2.4	0.11
Cr_2O_3	0.6	0.02	0.8	0.02
FeO	6.5	0.20	6.2	0.19
MgO	16.4	0.91	16.2	0.90
CaO	19.6	0.78	19.7	0.79
Total	98.1		97.4	

Sample L039: PS33703

	Diopside 1	
	Wt %	Cations (O=6)
SiO_2	54.4	1.99
Al_2O_3	1.6	0.07
Cr_2O_3	1.1	0.03
FeO	2.4	0.07
MgO	16.1	0.88
CaO	22.3	0.87
Na_2O	0.9	0.06
Total	98.8	

- = not detected at limit quoted above.

037

Sample L048: PS33704

	Diopside 1		Diopside 2	
	Wt %	Cations (O=6)	Wt %	Cations (O=6)
SiO_2	52.4	1.94	51.7	1.91
TiO_2	0.7	0.02	0.7	0.02
Al_2O_3	2.3	0.10	3.3	0.14
Cr_2O_3	0.4	0.01	1.1	0.03
FeO	7.4	0.23	6.9	0.21
MgO	17.3	0.95	15.8	0.87
CaO	18.5	0.73	20.0	0.79
Na_2O	0.2	0.02	0.3	0.02
Total	99.2		99.8	

Sample L065: PS33705

	Diopside 1 (?High Fe Chlorite)
	Wt %
SiO_2	22.1
Al_2O_3	23.2
FeO	32.2
MnO	0.4
MgO	8.5
Total	86.4

Sample L087: PS33706

	Diopside 1	
	Wt %	Cations (O=6)
SiO_2	51.9	1.89
TiO_2	0.3	0.01
Al_2O_3	7.0	0.30
Cr_2O_3	0.9	0.03
FeO	2.5	0.08
MgO	14.6	0.79
CaO	20.2	0.79
Na_2O	1.6	0.11
Total	99.0	

- = not detected at limit quoted above.

038

	Garnet 1		Garnet 2	
	Wt %	Cations (O=24)	Wt %	Cations (O=24)
SiO_2	37.3	5.93	37.4	5.93
Al_2O_3	19.3	3.61	23.3	4.35
FeO	8.9	1.19	12.1	1.60
MnO	27.3	3.68	-	-
MgO	0.6	0.14	0.2	0.04
CaO	9.3	1.58	23.2	3.94
Total	102.7		96.2	

Sample LO91: PS33707

	Diopside 1 (Epidote)
	Wt %
SiO_2	37.2
Al_2O_3	21.6
FeO	13.1
CaO	23.0
Total	94.9

- = not detected at limit quoted above.

4. SUMMARY

A summary of the Cr_2O_3 contents of the diopsides analysed and the MgO content of the garnets analysed is as follows:

Sample	Diopside Cr_2O_3 (Wt %)	Garnet MgO (Wt %)
002	0.30, 0.86, 1.16	6.84, 7.20, 7.60
100	-	6.59, 6.92, 8.40
124	0.88, 0.94	8.29
159	0.16, 0.61	-
160	0.41	-
167	0.30, 0.55, 0.71	4.89
195	0.54, 0.56, 0.74, 0.76, 0.80, 0.84, 0.91, 0.92, 0.94, 0.99, 1.01, 1.05, 1.09, 1.14	5.77
201	0.79, 0.83	0.63, 0.66, 0.97, 1.02
207	0.72	-
368	≤0.13, <0.13	5.71, 5.79, 7.54, 8.64
369	<0.13, <0.13	9.61, 9.74
387	0.45	8.36
396	0.19	8.95, 12.15
398	0.34	<0.05, 8.47
403	0.99	5.09, 5.13, 5.53
L024	0.43, 0.44, 0.68, 0.70, 0.92, 0.96	6.55, 6.85, 8.57, 9.13, 10.75, 10.83
L028	0.63, 0.82	-
L039	1.12	-
L048	0.41, 1.05	0.19, 0.58
L087	0.91	

APPENDIX II

Reports by Diamond Exploration Services Pty Ltd

Analysis for Kimberlitic indicator minerals

041

Diamond Exploration Services Pty. Ltd.

GEOLOGICAL SERVICES

824042

P.O. Box A 151,
SYDNEY SOUTH,
N.S.W. 2000.
Telephone: (02) 264 8788

27th February, 1986.

JML
4/3/86

Dr. Bryce L. Woods.,
Base Mines P/L.,
Box N90.,
P.O. Grosvenor Street,
SYDNEY N.S.W. 2000.

Dear Dr. Woods,

Please find enclosed the report on the 11 samples sent to our laboratory for further inspection, together with the invoice for same.

As you will see from the report, samples L 11, L 12, L 13, appear to be of some interest and further analysis is recommended on the grains isolated in these samples. As we discussed in our telephone conversation, if the analyses are plotted on a ternary diagram, a good indication of the nature of the grains can be obtained.

Should you have need for electron microprobe analysis of these grains, we can arrange this. If you have an electron microprobe analysis facility available at your disposal then I strongly recommend that this follow up work be performed. I would be happy to then look at the analysis and advise accordingly.

If you want any of your previous analysis plotted, please let me know - I would be happy to assist you in this way.

I trust that the work performed by our laboratory is satisfactory and hope that the results obtained helps to lead you toward the right decision about your prospect.

I thank you for the opportunity to work with you and hope that we can be of further assistance in your exploration programme.

Yours faithfully,

.....

Bill Sechos.

Australian Representative for:
DIAMOND LABORATORY SERVICES PTY LTD.

042 824043

Diamond Exploration Services Pty. Ltd.

GEOLOGICAL SERVICES

P.O. Box A 151,
SYDNEY SOUTH,
N.S.W. 2000.
Telephone: (02) 264 8788

HEAVY MINERAL CONCENTRATE ANALYSIS

EXAMINATION FOR KIMBERLITIC MINERAL INDICATOR GRAINS

CONSIGNMENT (Laboratory Ref No.):	AA 16550
CLIENT:	BASE MINES PTY LTD.
SAMPLE NUMBERS (Client's Ref No.):	BP 051, 396, 485, 498 L 10, 11, 12, 17 24, 91 & 99. 13
TOTAL NUMBER OF SAMPLES:	11
DATE SAMPLES RECEIVED:	3.2.86
DATE SAMPLES COMPLETED:	26.2.86

The above consignment has been sorted and checked and the results are tabulated on the accompanying report sheets:

Key to symbols used in report:-

	Etched
l.abr.	Lightly abraded
abr.	Abraded
R.O.S.	Remnant of Original Surface
R.O.K.	Remnant of Kelyphitic Surface
	Diamond
N.K.	Non-Kimberlitic.

..... 26.2.86

Laboratory Supervisor Date

043

METHOD OF EXAMINATION

Eleven samples labelled BP 051, BP 396, BP 485, BP 498, L 10, L 11, L 12, L 13, L 24, L 91, L 99. were received at the Sydney Premises of Diamond Laboratory Services for examination.

The samples were washed and concentrated into a heavy fraction and a light fraction and then were sieved into size fraction to facilitate inspection.
No further work was performed on the light fractions of each sample which were kept aside for further inspection if required.

The heavy fraction was observed for diamond and other associated indicator minerals of possible diamondiferous ore.

Visual examination of the concentrate was carried out by experienced sorters using steriomicroscopes and any grains of interest were noted and isolated for further analysis.

Initial identification was made using morphological characteristics of the grains together with physical properties but it is recommended that grains of interest are further identified by electron microprobe analysis.

RESULTS:

Sample No. BP 051.	No garnets, ilmenites, chrome diopside or spinel were identified in this sample.
Sample No. BP 396	No grains of note were identified.
Sample No. BP 485	Some grains of mica were noted.
Sample No. BP 498	No grains of interest were noted.
Sample No. L 10.	3 garnets of the almandine series were noted, together with some mica and pyroxene grains.
Sample No. L 11	Two garnets of the almandine series were noted together with mica and pyroxene grains. 15 grains, green in colour thought to be chromiferous were isolated for further analysis.
Sample No. L 12	Six garnets of the almandine series were noted, together with two green grains which were thought to be chromiferous These two grains have been isolated for further analysis.
Sample No. L 13.	Four orange garnets thought to be of high temperature/ pressure formation, (possibly kimberlitic) have been isolated for further analysis together with 2 green possible chromiferous grains (possible chrome diopsides) 35 almandine garnets were also noted.
Sample No. L 24.	Some mica grains were noted in this sample.
Sample No. L 91.	The sample was abundant in almandine series garnets.
Sample No. L 99.	Ten garnets of the almandine series were noted, together with an abundance of mica.

Grains from samples L 11, 12, 13 have been isolated and further analysis is recommended by electron microprobe so that their compositional ratios can be plotted.

A Tabular list of the results is appended.

045 824046

Diamond Laboratory Services Pty. Ltd.

HEAVY MINERALS DIVISION

3rd Floor
89 York Street
Sydney, N.S.W. 2000
Telephone (02) 290 1022

CONSIGNMENT ..... SAMPLE No's. BP-057, BP 396, BP 485, BP 498, L-10, L-11 ... DATE 26.2.86

Sample No.	Mesh Size	Garnet	Ilmenite	Chrome Diopside	Spinel	Other Grains	Remarks
BP 057	+16 1.0mm	-	-	-	-	130 Mica	
	+25 0.7	-	-	-	-	t Mica ± 10 Pyroxene	
	+44 0.4	-	-	-	-	Mica 3 Pyroxene	
	+60 0.35mm	-	-	-	-	-	
BP - 396	+16	-	-	-	-	-	
	+25	-	-	-	-	-	
	+44	-	-	-	-	-	
	+60	-	-	-	-	-	
BP - 485	+16	-	-	-	-	Mica	
	+25	-	-	-	-	Mica	
	+44	-	-	-	-	Mica	
	+60	-	-	-	-	-	
BP - 498	+16	-	-	-	-	-	
	+25	-	-	-	-	-	
	+44	-	-	-	-	-	
	+60	-	-	-	-	-	
L - 10	+16	-	-	-	-	Mica	
	+25	3 NK	-	-	-	Pyroxene Mica	
	+44	-	-	-	-	-	
	+60	-	-	-	-	-	
L - 11	+16	-	-	-	-	-	
	+25	-	-	? 4	-	± 20 Mica	
	+44	2 NK	-	? 8	-	6 Pyroxene	
	+60	-	-	-	-	-	

SAMPLES RECEIVED IN LAB ..... 3.2.86 ..... SAMPLES SEPARATED ..... 10.2.86 .....

SAMPLES UNPACKED AND CHECKED ..... 11.2.86 ..... SLIDES CHECKED ..... 26.2.86 .....

046 824047

Diamond Laboratory Services Pty. Ltd.

HEAVY MINERALS DIVISION

3rd Floor
89 York Street
Sydney, N.S.W. 2000
Telephone (02) 290 1022

CONSIGNMENT ..... SAMPLE No's. L12, L13, L24, L91, L99. DATE 26.2.86

Sample No.	Mesh Size	Garnet	Ilmenite	Chrome Diopside	Spinel	Other Grains	Remarks
	+16	-	-	-	-	-	
	+25	4 NK	-	?2	-	-	
	+44	2 NK	-	-	-	-	
L-12	+60	-	-	-	-	-	
	+16	-	-	-	-	-	
	+25	?2, 5NK	-	-	-	-	
	+44	?2, 30NK	-	?2	-	-	
L-13	+60	-	-	-	-	-	
	+16	-	-	-	-	Mica	
	+25	-	-	-	-	Mica	
	+44	-	-	-	-	Mica	
L-24	+60	-	-	-	-	-	
	+16	-	-	-	-	-	
	+25	±30 NK.	-	-	-	-	
	+44	±30 NK.	-	-	-	-	
L-91	+60	-	-	-	-	-	
	+16	-	-	-	-	±30 Mica	
	+25	± 10 NK	-	-	-	Mica	
	+44	-	-	-	-	-	
L-99	+60	-	-	-	-	-	
	+16						
	+25						
	+44						
	+60						

SAMPLES RECEIVED IN LAB ..... 3.2.86 ..... SAMPLES SEPARATED ..... 10.2.86 .....

SAMPLES UNPACKED AND CHECKED ..... 11.2.86 ..... SLIDES CHECKED ..... 26.2.86 .....

DISCUSSION

Although the majority of the samples observed proved barren of any indicator grains the L series showed some results which may prove of interest.

In sample L 11, L 12, L 13 grains were found whose morphological characteristics are consistent with those noted from kimberlitic sources. Physical properties also appear to be in the right area.

However, because of the extremely small size of these grains, it is suggested that electron microprobe analysis and plotting of the compositional ratios of these grains will determine their exact nature.

It is therefore recommended that further quantitative analysis be performed on these grains to determine their composition.

824049
Diamond Exploration Services Pty. Ltd.

GEOLOGICAL SERVICES

P.O. Box A 151,
SYDNEY SOUTH,
N.S.W. 2000.
Telephone: (02) 264 8788

Appendix to Diamond Exploration Services P/L report No. 16550 for Base Mines P/L.

RESULTS OF MICROPROBE ANALYSIS OF GRAINS FROM SAMPLES L 11, L 12, L 13.

Fifteen grains designated P1 - P10 and G1 - G5 were analysed and the following results were achieved.

1. GREEN GRAINS (P1 - P10)

The grains are clinopyroxenes as shown by the analysis.
These clinopyroxene analyses fall into three distinct groups.

These are:	P 2, 7, 8, 10 P 1, 3, 9.	both diopside fields but of different compositions
	P 4, 5, 6.	subcalcic clinopyroxene or subcalcic augite.

The subcalcic clinopyroxene field is reminiscent of the subcalcic augites described in spinel pyroxenite xenoliths from New England area N.S.W.

The two diopside groups are similar in composition and may have come from spinel lherzolite xenoliths of slightly different composition and/or pressure regimes.

Compositional ranges of the groups:
(a) Two diopside fields.

Na_2O	1.19 - 1.78%
MgO	14.4 - 16.0 %
Al_2O_3	6.23 - 6.93%
SiO_2	49.53 - 51.45%
CaO	19.57 - 21.87%
TiO_2	0.33 - 0.50%
Cr_2O_3	0.72 - 0.89%
MnO	0.09 - 0.12%
FeO	2.49 - 3.02%

... /2 ...

Note:
Although these compositional ranges overlap known analyses of Kimberlitic Chrome Diopsides, the chromium content is on the lower boundary of the known ranges.

(b) Subcalcic clinopyroxene/augites.

Na_2O	0.35	-	0.59%
MgO	25.73	-	28.01%
Al_2O_3	5.39	-	6.57%
SiO_2	52.10	-	53.24%
CaO	5.23	-	9.5 %
TiO_2	0.14	-	0.17%
Cr_2O_3	0.54	-	0.66%
MnO	0.13	-	0.14%
FeO	4.91	-	5.72%

2. GARNETS GI - G5

The grains are manganese rich with minor grossular and almandine components. They have probably originated from quartz rich or granitic pegmatites of low pressure paragenesis.
There is some zoning which also supports a pegmatitic / granitic origin under relatively low pressure.

Compositional ranges for this group.

MgO	0.19	-	0.21%
Al_2O_3	17.84	-	18.35%
SiO_2	35.19	-	35.52%
CaO	6.79	-	10.65%
TiO_2	0.12	-	0.32%
Cr_2O_3	0.00	-	0.002
MnO	27.75	-	31.45%
FeO	5.87	-	7.15%

Note: The paucity of both Magnesium and chromium in the analyses of these grains also supports a low pressure origin.
These grains can best be described as spessartites with some grossular and almandine components.

... / 3 ...

CONCLUSION

Although analyses of the green clinopyroxene grains shows overlap with known kimberlitic grains the relatively low chromium content and the supporting evidence given by the nature of the garnets indicates an origin other than rocks with kimberlitic affinity.

There appears to be no indication in any of the samples, therefore, that further study of the areas from which they were collected would prove fruitful.