

KIMBERLITES OF THE CENTRAL CAPE PROVINCE, R.S.A.

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Volume 2: Appendix.

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CONTENTS

Volume 2 : Appendix

1. Brief descriptions of the different kimberlite localities.
2. Brief petrographic descriptions of the different xenolith suites.
 - A) Peridotites.
 - B) Pyroxenites.
 - C) Eclogites.
 - D) Garnet granulites.
3. Analytical techniques.
4. Clinopyroxene endmember calculation.
5. Plates.
6. Figures.
7. Tables.

The following abbreviations, unless where specified, are used in this appendix volume:

| | | | |
|-----------|--------------------------------|---------|----------------------------------|
| Gt | - garnet | Tetr | - tetrahedral |
| Cpx | - clinopyroxene | Av | - average |
| Opx | - orthopyroxene | Fo | - fosterite - Mg/Mg+Fe at. prop. |
| Amph | - amphibole | Fa | - fayalite - Fe/Mg+Fe " |
| Plag | - plagioclase | Ab | - albite - Ab/Ab+An+Or " |
| Ol | - olivine | Or | - orthoclase - Or/Ab+An+Or " |
| Sp | - spinel | An | - anorthite - An/Ab+An+Or " |
| Ilm | - ilmenite | Ca | - Ca/Ca+Mg+Fe |
| Phl | - phlogopite | Mg | - Mg/Ca+Mg+Fe |
| Rut | - rutile | Fe | - Fe/Ca+Mg+Fe |
| Ap | - apatite | M | - Mg/Mg+Fe |
| Ky | - kyanite | C | - Ca/Ca+Mg |
| Qtz | - quartz | Norm | - normative |
| K-sp | - K-feldspar | < | - less than |
| Scap | - scapolite | blank | - not analysed |
| Opag | - opaque oxide | ND | - \leq .01 wt. %. |
| Serp | - serpentine | Gt. Lhz | - garnet lherzolite |
| Nat | - natrolite | Lhz | - lherzolite |
| Zeol | - zeolite | Htz | - harzburgite |
| D. Gt | - discrete gt | Porp | - porphyroclast(ic) |
| I. Gt | - garnet inclusion | Neob | - neoblast(ic) |
| D. Cpx | - discrete cpx | Cg | - coarse granular |
| I. Cpx | - cpx inclusion | Mg | - medium granular |
| L. Cpx | - lamellar cpx | Cgb | - coarse granuloblastic |
| I. Opx | - opx inclusion | Mgb | - medium granuloblastic |
| I. Ol | - ol inclusion | Fgb | - fine granuloblastic |
| L. Ilm | - lamellar ilm | Cmgb | - coarse mosaic granuloblastic |
| Ilm | - ilm with silicate inclusions | Mmgb | - medium mosaic granuloblastic |
| D. Ilm | - discrete ilm | Fmgb | - fine mosaic granuloblastic |
| Pk | - phlogopite kimberlite | mm | - millimeter |
| Dk | - diopside kimberlite | cm | - centimeter |
| Ck | - calcite kimberlite | | |
| Poik | - poikilitic | | |
| Interstit | - interstitial | | |
| Center | - grain center | | |
| Edge, rim | - grain edge | | |
| Adj | - adjacent | | |
| Polyxtal | - polycrystalline | | |
| Rextald | - recrystallised | | |
| Sec | - secondary | | |
| P | - primary | | |

APPENDIX 1: BRIEF DESCRIPTIONS OF THE KIMBERLITES IN THE STUDY AREA
(see Fig. II-1).

This section is a summary of field observations and data extracted from the literature concerning the occurrence or reported occurrence of kimberlites in the study area (Fig. II-1).

To avoid repetition the following subscripts are used in the text to identify the data sources:

1. De Beers Consolidated Mines - company reports.
2. Rogers and du Toit (1909)
3. du Toit (1908)
4. Keyser (1940)
5. Mathias et al. (1970)
6. Rickwood et al. (1969)
7. Rickwood (1969)
8. This work

Observations and comments about each reported kimberlite are given in the following ranked order:

1:250 000 Topo-Cadastral Sheet : District : Alphabetic.

Three 1:250 000 Topo-cadastral sheets (South Africa) cover the study area. They are:

| | | |
|------------|---------------|-------------|
| Sheet 3022 | BRITSTOWN | (date 1973) |
| Sheet 3122 | VICTORIA WEST | (date 1966) |
| Sheet 3024 | COLESBERG | (date 1971) |

In the following list the kimberlites have been compiled alphabetically as a ready guide to the descriptions that appear in this appendix.

| Locality | Topo-sheet | VC | VNC | RD | ND | Per. | Ec. | Gr. | Meg. | Page No. |
|---------------------|---------------|----|-----|----|----|------|-----|-----|------|----------|
| Alarmkraal | VICTORIA WEST | | | | x | | | | | 13 |
| Andriesfontein | COLESBERG | x | | | | x | | | | 18 |
| Beyersberg | BRITSTOWN | x | | | | x | | x | | 7 |
| Beyersfontein | VICTORIA WEST | x | | | | x | x | x | | 14 |
| Bottelsput | BRITSTOWN | | x | | | | x | x | | 7 |
| Brandewynskuil | BRITSTOWN | x | | | | x | | x | | 11 |
| Britstown Commonage | BRITSTOWN | x | | | | | | x | | 4 |
| Cordaatskuil | BRITSTOWN | x | | | | x | x | x | | 11 |
| Doornkuil | BRITSTOWN | | x | | x | | | | | 4 |
| Doorskuilen | BRITSTOWN | | x | | x | | | | | 4 |
| Du Plessis Dam | COLESBERG | | | x | | | x | x | | 17 |
| Elandsbeen | BRITSTOWN | | x | x | | | | | | 10 |
| Gansfontein | VICTORIA WEST | | | x | | x | | | | 13 |
| Goede Hoop | COLESBERG | x | | | | | x | x | x | 19 |
| Hebron | VICTORIA WEST | x* | | | | x* | | x | x | 14 |
| Holpan | BRITSTOWN | | | | x | | | | | 4 |
| Hugo's Dam | VICTORIA WEST | | | x | x | | | | | 15 |
| Jachtfontein | COLESBERG | x | | | | x | x | | | 19 |
| Kalkput | BRITSTOWN | x | | | | x | | x | x | 10 |
| Kareeboschpan | BRITSTOWN | | | | x | | | | | 4 |
| Kareeput | BRITSTOWN | | | | x | | | | | 4 |
| Klein-Doornpan | BRITSTOWN | x | | | | | | x | | 10 |
| Klein Modderfontein | BRITSTOWN | | | x | x | | | | | 10 |
| Klipgatsfontein-N | VICTORIA WEST | x | | | | x | x | x | | 15 |
| Klipgatsfontein-S | VICTORIA WEST | x* | | | | x | | | | 15 |
| Koos-syn-kamp | COLESBERG | | x | | | | | | | 19 |
| Kromaar | BRITSTOWN | | x | | | | | | | 12 |
| Lekkerfontein | COLESBERG | x | | | | | x | x | x* | 20 |
| Leuwefontein | COLESBERG | x | | | | x | x | x | | 19 |
| Leyfontein | VICTORIA WEST | | | x | | x | | x | | 16 |
| Louwsplaas | BRITSTOWN | | | | | x | x | x | | 7 |
| Lovedale | BRITSTOWN | x | | | | | x | x | x | 4 |
| Lushof | BRITSTOWN | x | | | | x | x | | | 12 |
| Markt | BRITSTOWN | x* | | | | x | x | x | | 8 |
| Melton Wold | VICTORIA WEST | x* | | | | x | | | | 16 |
| Middlewater | BRITSTOWN | | x | x | | | | | | 10 |
| Mokasdam | BRITSTOWN | | | | x | | | | | 5 |
| Mount Pierre | VICTORIA WEST | | | | x | | | | | 17 |
| Omdraaisvlei | BRITSTOWN | | x | x | | | | | | 11 |
| Paardekraal | BRITSTOWN | | | | x | | | | | 5 |
| Paarde Vallei | BRITSTOWN | | x | x | | | | x | | 6 |
| Pampoenspoort | VICTORIA WEST | | x | x | | | | | | 17 |
| Pettspot | BRITSTOWN | | | | x | | | | | 6 |
| Pine Grove | COLESBERG | x | | | | x | x | | | 20 |
| Platsjambok | BRITSTOWN | | | x | | | | | | 11 |
| Request | BRITSTOWN | | x | | x | | | | | 9 |
| Rhooide Draai | BRITSTOWN | | | x | | | | | | 11 |
| Rietfontein | VICTORIA WEST | x | | | | | x | x | | 13 |
| Rietgat | VICTORIA WEST | | | x | | | | | | 15 |
| Roodekraal | COLESBERG | x | | | | | x* | | | 18 |
| Roodevloer | BRITSTOWN | | x | | | | | | | 11 |
| Rooidam | BRITSTOWN | | | | x | | | | | 6 |
| Silvery Home | VICTORIA WEST | x* | | | | | | | | 13 |
| Slypsteen | BRITSTOWN | | x | | | | | | | 11 |
| Soetvlei | BRITSTOWN | | x | | | | | | | 11 |

| Locality | Topo-sheet | VC | VNC | RD | ND | Per. | Ec. | Gr. | Meg. | Page No. |
|---------------------|---------------|----|-----|----|----|------|-----|-----|------|----------|
| Sweetput | BRITSTOWN | x | | | | | x | | | 6 |
| Uitjiesberg | BRITSTOWN | x* | | | | x | x | x | x | 9 |
| Uitkyk | BRITSTOWN | x | | | | | | | | 6 |
| Vetlaagte | COLESBERG | | | x | | x | | x | | 18 |
| Vioolkraal | BRITSTOWN | x | | | | | | x | | 7 |
| Vogelstruisch Poort | BRITSTOWN | | | | x | | | | | 7 |
| Windhoek | COLESBERG | x | | | | | | | | 20 |
| Witbank | VICTORIA WEST | x | | | | | | x | | 17 |

- VC = Site visited and kimberlite confirmed.
VNC = Site visited but kimberlite not confirmed.
RD = Descriptions in the literature noting the presence of kimberlite.
ND = No details apart from that a kimberlite occurrence is reported.
Per. = Peridotites, pyroxenites.
Ec. = Eclogites.
Gr. = Garnetiferous granulites.
Meg. = Megacrysts.
* = localities where the best exposures of fresh kimberlite, xenolith suites and megacryst suites can be found.

TOPO CADASTRAL SHEET : 3022 BRITSTOWN (1:250 000).

Britstown District

1) Britstown Commorage-Gemsbokfontein (30°35' S, 23°28' E)

Two kimberlites, a dyke^{1,3,5,6} and a pipe (?),⁸ occur immediately W and SW of Britstown respectively. Both are of unknown extent¹ though pitting⁸ has proved kimberlite^{1,3}.

The dyke, on the western fringes of the town and just south of the road to Vosburg, has yielded fragments of garnet granulite^{3,6} and hornblende-schist³.

The pipe (?) situated further to the SW and about 1.5 kms. south of the homestead Brasdoring⁹ was sampled. An old pit exists and though only highly altered, calcretized kimberlite is seen, relatively abundant green ortho- and clinopyroxene and ilmenite (up to 2 mm. in size) can be sampled. Garnets are rare. One garnet granulite xenolith was found.

2) Doorskuilen (30°38' S, 23°19' E)

A pipe feature situated on the eastern side of the Smartt Syndicate Dam^{1,9}. This locality was visited but the farmer knows of no excavations in the area mentioned. There is no further mention in the literature of this kimberlite.

3) Doornkuil (30°27' S, 23°40' E)

A fissure trending N-S reported 1 km. west of the homestead Blomvlakte¹. This fissure could not be located.

4) Holpan (30°23' S, 23°08' E)

A fissure trending NNE is reported¹.

5) Kareeboschpan (30°31' S, 23°36' E)

A pipe feature is reported¹.

6) Kareeput (30°32' S, 23°07' E)

A fissure trending NNE is reported¹.

7) Lovedale ~ Blaauboschputs, C.P. (30°35' S, 23°36' E)
(sample code = 02)

9 kms. due E of Britstown 2 small pipes occur just to the north of the Britstown-de Aar road near the Lovedale homestead and within 200 m. east of the secondary road leading to the homestead Brakfontein¹. These are the Lovedale pipes.

South-west of the Lovedale pipes and south of the de Aar road between the railway siding van Heerden and the homestead Bloubosputs is a new trending dyke reported as Blaauwbosch Put^{1,3,5,6}.

The southerly Lovedale No. 2 pipe is roughly circular, has a diameter of about 55 m¹ and has not been excavated though a strong vegetation anomaly marks its position. Within a few hundred metres to the north is the main Lovedale No. 1 pipe also semi-circular and with a diameter between 60 and 75 m¹. There is evidence of recent pitting and the shaft according to local

information bottomed at 30 m. The shaft is sited towards the southern end of the pipe while a trench-shaped excavation now totally caved can be found towards the northern rim. All the Lovedale samples were collected from this No. 1 pipe.

Only 1 relatively fresh specimen of kimberlite was found and sampled and it is a hard, grey-black prophyritic variety lacking crustal inclusions but rich in altered olivine and phlogopite. The kimberlite is a hypabyssal kimberlite. Petrographically it is of the calcite-phlogopite-serpentine variety rich in opaques. The concentrate dump is rich in garnet (both eclogitic and peridotitic varieties), pale to dark green clinopyroxene (mainly eclogitic), phlogopite with common Cr-diopside, green orthopyroxene and ilmenite. Deep brown, glassy orthopyroxenes (up to 2 cms. in size) showing little cleavage and with a strong concoidal fracture are common. These resemble the glassy orthopyroxene megacrysts described by Jakob (1977) from the Monastery kimberlite and are interpreted as such.

The Lovedale No. 1 kimberlite has scavenged a good collection of eclogite and granulite xenoliths. No ultrabasic peridotites or pyroxenites were found or are reported in the literature. Upper crustal xenoliths are mainly shale, dolerite and vesicular basalt of presumed Karroo age. The following parageneses were observed and are reported^{3,5,6} for the Lovedale eclogites and garnet granulites. Note that kyanite-bearing varieties are common. Only primary phases are listed.

Eclogites

| | |
|------------------------------|----------|
| gt + cpx | abundant |
| gt + cpx + rut | abundant |
| gt + cpx + amph | rare |
| gt + cpx + ky | abundant |
| gt + cpx + ky + amph | rare |
| gt + cpx + ky + qtz | common |
| gt + cpx + ky + qtz + k-spar | common |
| cpx + ky | rare |

Granulites

| | |
|-----------------------------|-----------|
| gt + cpx + plag | very rare |
| gt + cpx + plag + ky | common |
| gt + cpx + plag + ky + scap | rare |

A few small diamonds were reputedly found in 1904 from the No. 1 pipe¹.

The Blaauwbosch Put dyke is 10 m. wide and at least 75 m. in length¹. Weathered kimberlite was encountered during pitting. Eclogites (gt+cpx+ky^{3,6}, gt+cpx+rut^{5,6}, gt+cpx+qtz^{5,6}) and garnet granulites¹ are reported.

8) Mokasdam (30°15' S, 23°25' E)

A pipe feature is reported¹ just NNE of the homestead Damlaagte.

9) Paardekraal (30°08' S, 23°32' E)

2 pipe features, 1 km. apart are reported¹ just south of Bulberg along the western boundary of the farm Ringpoort.

10) Paarde Vallei ~ New Nietgedacht (30°38' S, 23°15' E)

A pipe and a fissure, 3 km. south of the pipe and trending NNE is reported as Paarde Vallei^{3,6} but given the more recent farm name Nietgedacht¹.

The pipe has a diameter of 135 m³. Xenoliths include garnetiferous granulites, biotite granite and hornblende schist³. The description of the kyanite granulite (No. 1956, du Toit¹) and renamed as a ky-plag eclogite by Rickwood⁶ sounds very similar to the garnet granulite 12133A (Markt kimberlite⁸) which shows textural evidence of the breakdown of plagioclase.

This locality was not sampled owing to flood water conditions in the Smartt Syndicate dam.

11) Pettspot (30°40' S, 23°33' E)

2 fissures trending N and NW respectively are reported north of the homestead Witfontein¹. The site was visited but the fissures could not be located nor was any information forthcoming from the farmer.

12) Rooidam (30°38' S, 23°22' E)

2 fissures trending NW are reported to the SW of the homestead Brakwater¹. The fissures could not be located.

13) Sweetput group (30°17' S, 23°30' E)
(locality code = 03)

2 pipes are reported on the farm Maconieke Fontein¹. From the No. 1 more northerly pipe garnets and ilmenites (some cms. in size), phlogopite and rare olivine and Cr-diopside are reported¹.

The southerly No. 2 pipe was located and is now marked by two pits and a trench. Yellow ground with abundant mica plates is found on small dumps. The only xenoliths noted were shale, dolerite and very abundant fine grained, amygdaloidal basalt fragments. The basaltic fragments show remarkable flow textures.

2 eclogites from Sweetput were found in the U.C.T. rock collection. Both have been severely phlogopitised.

Diamonds were reputedly recovered from the No. 1 pipe.

14) Uitkyk group ~ Barendsfontein (30°14' S, 23°37' E)

3 pipes are reported in this area¹. The Uitkyk pipe is north of the homestead Uitkyk and on the western side of the Britstown-Strydenburg road. This pipe was not sampled and no information exists in the records.

South of the homestead Barendsfontein on the east side of the Strydenburg road 2 pipes are reported. This site was visited and signs of very old pitting can be seen in 3 places. The presence of 2 pipes is difficult to ascertain. The strong vegetation anomaly characteristically growing on kimberlites in the Karroo is present. A bush lineation (probably a fissure) trends NE and where an enlargement occurs at its northern end a pit shows the presence of micaceous yellow ground inferred to be kimberlite. The weathered kimberlite carries in situ altered olivine and ilmenite.

- 15) Violkraal group (30°10' S, 23°35' E)
(locality code = east = 18, west = 22)

2 pipes are reported¹. At the eastern pipe an old pit (6 m. deep) and a dump of yellow ground can be seen. Xenoliths include 1 garnet granulite, a variety of gneisses, pink granite and quartzitic rocks. At the western pipe a small pit remains. Fragments of relatively fresh, micaceous kimberlite with ilmenite and highly kelyphitized garnet were sampled. The kimberlite is a carbonated micaceous hypabyssal kimberlite.

- 16) Vogelstruisch Poort (30°21' S, 23°35')

2 fissures are reported¹. The NE trending fissure of the homestead Volstruispoort and on the west side of the Britstown-Strydenburg road was not found. A vague NE trending bush lineation 1 km. east of the Volstruispoort homestead crosses the road to Brinkspan and presumably marks the location of the second fissure.

Carnarvon District

- 17) Beyersberg (30°57' S, 22°30' E)

A small blow on a 30 cm. wide fissure occurs on the NW slopes of the Beyersberg mountain on the eastern side of the Victoria West-Carnarvon road and just SE of the Beyersburg rail siding. Weathered kimberlite is seen in one small pit and is rich in phlogopite. Rare garnets, ilmenites and altered olivine can be seen. Xenoliths include shale, dolerite, a few highly decomposed, small (<5 cm.) garnet-free ultrabasics and a garnet granulite.

- 18) Bottelsput group (30°31' S, 22°10' E)

A fissure with a possible sill is reported 1 km. NW of the homestead Dalkeith¹. The kimberlite contains abundant mica, orange garnet and ilmenite while eclogitic and granulitic rubble is found in the surface float¹. This area was visited but the kimberlite could not be located.

- 19) Louwsplaas ~ Kaffir's Kraal^{3,6} (30°59' S, 22°21' E)
(locality code = 05)

2 pipes apparently connected by a N-S fissure are found on the farm Swavelfontein, a few hundred meters south of the Louwsplaas rail siding next to the Carnarvon-Victoria West road, some 15 kms. E of Carnarvon.

The northern pipe is about 100 m. in diameter while a strong vegetation anomaly suggests the southern pipe to be 150 x 120 m. in size with the long axis NE¹.

Slight upturning of near contact shales and 3 old pits mark the northern pipe. Yellow-green altered kimberlite, garnets (peridotitic mainly), Cr-diopside, ilmenite and phlogopite can be bound. Garnet granulite and gabbroic/amphibolitic xenoliths are reported^{2,6}. Fragments of eclogites and garnet granulites were sampled as well as a spinel+cpx+opx+gt (occurring as reaction rims or as exsolved products) rock that appears similar to the garnet pyroxenites described by Reid and Eggleton (1977). In the latter pyroxenites, garnet has formed during the cooling of an assemblage of aluminous clinopyroxenes and spinel.

20) Markt group (30°15' S, 22°21' E)
(locality code = 10 for No. 1 pipe, 12 for No. 2 pipe)

2 pipes (No's 1,2 are located 3 km. north of the homestead Beespan on the farm Markt¹. A third kimberlite (No. 3), a small enlargement at the intersection of two kimberlite dykes was pointed out by the farm owner.

The No. 2 pipe is elongate (230 x 90 m.)¹ and 2 pits and a shallow trench mark its position. The kimberlite is decomposed to yellow ground, not too micaceous with the concentrate being very rich in garnet. Crustal xenoliths of amphibolite, biotite schist, gneiss, granite and amygdaloidal basalt are abundant. Fragments of badly decomposed garnet lherzolites are common. In these samples only the garnets and clinopyroxenes (Cr-diopside) remain relatively unaltered. Olivine is totally serpentinized while orthopyroxene has been converted to bastite with calcite stringers. One ultramafic lacks garnet but is richer in Cr-diopside. These coarse grained (1-5 mm.) peridotites fall into the coarse peridotite variety of Harte's (1977) classification scheme. Pyroxenite, eclogite and garnet granulite specimens were also found. The following assemblages are recorded.

Eclogite, pyroxenite

- gt+cpx+rut - coarse grained (>5 mm.), similar in texture and grain size to the Rovic type 1 eclogites (Hatton, 1978)
- cpx+gt+amph - medium grained (1-2 mm.) granuloblastic clinopyroxenite. Garnet is clearly derived from subsolidus exsolution.
- cpx+sp+(gt) - layered spinel pyroxenite. Garnet is a reaction product at clinopyroxene-spinel grain contacts. Similar to the spinel pyroxenite from the Louwslaas kimberlite.

Granulites

- gt+cpx+plag - 2 samples one of which shows plagioclase breaking down to the eclogite assemblage of ky+qtz+cpx (<Al, >Na).

The more northerly No. 1 pipe is the largest in the study area measuring some 300x75 m¹. Numerous old pits can be seen and the farm owner had opened a new pit to a depth of 10 m. Two types of kimberlite occur. Both are grey-black hypabyssal kimberlites of the phlogopite-calcite variety. One type is relatively fine-grained while the other is coarser-grained and contains more foreign inclusions (ultramafics, shale). The kimberlite resembles the hypabyssal kimberlite at Uintjiesberg. The concentrate like that of the No. 2 pipe is dominated by garnet with lesser amounts of Cr-diopside and ilmenite. Similarly the crustal xenoliths are gneisses and schists rich in biotite, amphibolite and basalt. Large cobble-sized high decomposed garnet lherzolites are common while eclogitic fragments are rarer. No garnet granulites were found though a scapolite-bearing garnet granulite is reported^{3,6}.

The Markt No. 3 kimberlite is found approximately 2 km. SW (241° MN) of the No. 1 pipe. Here a fissure strikes 46° MN and is cut and off-set (8 m.) by a more ESE trending (115° MN) large kimberlite dyke. An enlargement (blow) 20 m. at its widest and about 100 m. in length occurs on the

ESE fissure. Dyke and blow outlines are marked by strong vegetation growth and upturned host sediments at the contacts.

Diamonds are reported to have been recovered from the No. 1 pipe¹.

21) Request (30°32' S, 22°30' E)

A kimberlite is reported in the NW sector of the farm Kareebosch Fontyn¹. The farmer has no knowledge of any old pits but did point out a marked bush lineation (presumably a kimberlite dyke) that strikes 58° MN.

22) Uintjiesberg (30°50' S, 22°32' E)
(locality code = 09)

A kimberlite pipe and N trending dyke system occurs at the foot of the SW end of the prominent mountain Uintjiesberg and due E of the homestead Eureka. A clear NW trending bush lineation marks the kimberlite dyke associated with the pipe while further west two parallel shorter dykes are reported¹. The pipe is 180x120 m. (elongate NS)¹ and has been pitted and trenched in numerous places. A caved inclined shaft can be seen towards the southern perimeter.

3 kimberlite types can readily be distinguished in the field. The first is a greenish black rock, fresh in appearance with visible olivine, phlogopite and ilmenite. Handspecimens that show distinct olivine flow layering textures are common. This kimberlite is classified as a hypabyssal phlogopite-serpentine-calcite variety. The second variety from a pit towards the north central part of the pipe is black in colour and studded with crustal fragments of basement and bleached shale as well as fragments of a garnet-free, coarse grained lherzolite. Recently on a return visit a garnet-lherzolite was found by M. Skinner at this site. This second kimberlite is classified as a hypabyssal kimberlite breccia. Petrographically it is similar to the hypabyssal variety but is distinguished by being more apatite-rich. The third kimberlite type is a tuffisitic variety, seen as thin veins and stringers cutting a large floating reef of sediments in the north central part of the pipe.

The concentrate is overwhelmingly rich in ilmenite with lesser amounts of clinopyroxene and garnet. The megacryst assemblage is represented by black-green, sub-calcic clinopyroxenes, lamellar clinopyroxene-ilmenite intergrowths (first reported by Boyd and Dawson, 1972) and rare brown-orange garnets.

Nodules recovered from the dumps are of the following type:

1) Marid suite

Fragments with the mineral assemblage ilmenite + diopside + phlogopite + rutile are assigned to the Marid suite (Dawson and Smith, 1977) and are possibly cognate with respect to the kimberlite.

2) Ultramafics

a) Garnet lherzolites (gt+cpx+opx+ol) are totally decomposed but can still be recognised.

b) Lherzolites rich in orthopyroxene and olivine in which clots of a phlogopite-chromite intergrowth are associated with and appear to replace clinopyroxene.

3) Eclogite

One sample with the assemblage gt+cpx+apatite. Texturally this xenolith appears related to the garnet granulites.

4) Garnet granulites with the assemblage gt+cpx+plag+apatite+amph+bi+scap are relatively common and have been reported before^{3,6}.

Prieska District

23) Elandsbeen group (30°26' S, 22°32' E)

2 dykes trending NE are reported just to the NW of the homestead Elandsbeen. Further NW, at the homestead Witwater a small pipe and allied dyke is also shown¹.

The Elandsbeen dykes are mentioned by du Toit¹ but could not be located in the field. At Witwater a dyke exposed in the side of an old pit could be that shown and identified as kimberlite by du Toit (Fig. 3³).

24) Klein Doornpan (30°14' S, 22°29' E)
Groot Doornpan (30°13' S, 22°34' E)
Grenaat Kop - Kafferskolk (30°06' S, 22°24' E).

These 4 localities are discussed by du Toit (Fig. 1³). N to NW trending fissures (Kafferskolk, Klein and Groot Doorn Pan, Grenaatkop) marked by yellow decomposed ground and sometimes containing garnetiferous granulites are thought to be kimberlitic or lamprophyric³. Breccia pipes (Loskopje on the farm Grenaatkop) occur on the general trend of the dykes. The Loskopje breccia plug was visited and sampled. The breccia is extremely hard, studded with angular quartz-rich rock fragments and cemented by a yellowish matrix in which calcite and relict olivine can be identified.

25) Kalkput (30°28' S, 22°46' E)
(locality code = 11)

The Kalkput kimberlite occurs about 1 km. NW of the abandoned homestead Kalkput (farmer now lives at the Vleiplaas homestead) and some 18 km. due NW of Vosburg.

The kimberlite is extremely poorly exposed. Weathered, brownish, highly micaceous ground and a tremendous amount of calcrete marks the sites of two shallow pits.

The concentrate dump yielded abundant black-green clinopyroxene (sub-calcic megacryst variety), garnet (orange, red and mauve hues) with lesser amounts of phlogopite, Cr-diopside and ilmenite.

Fragments of an altered garnet peridotite as well as a single garnet granulite were found while du Toit³ notes that the elongate pipe when pitted yields boulders of gneiss, pegmatite and amphibolite.

26) Klein Modderfontein (30°02' S, 22°39' E)

A NE trending fissure is reported E of the homestead Vrede on the Carnarvon-Prieska road^{1,3}. This site was not visited.

27) Middelwater (22°43' S, 30°10' E)

The small pipe and NE trending dyke on the farm Middelwater is described by du Toit³ but could not be located in the field.

28) Omdraaisvlei (30°09' S, 23°05' E)

The NW striking fissure reported as situated on or near the Doornberg fault is probably a lamprophyre^{1,3}. It could not be found in the field.

29) Platsjambok (30°00' S, 22°21' E)

A new fissure is reported^{1,3} but was not visited.

30) Rhooë Draai (30°21' S, 22°32' E)

A pipe 40 m. in diameter is reported south of the homestead Rooidraai^{1,3}.

31) Roodevloer (30°15' S, 22°44' E)

2 fissures occur W of the homestead Poortjie on the Vosburg-Prieska road¹. One fissure (strike NS) has not been pitted but is marked by a bush lineation. The second fissure striking NNW and 300 m. west of the first has been pitted over some length. The dyke rock is highly micaceous and is probably lamprophyric. No kimberlite concentrate minerals or any inclusions were found.

32) Slypsteen (30°04' S, 23°05' E)

This fissure trends ENE and is clearly marked by a strong bush lineation and disturbed outward dipping country rock. It appears to have a maximum thickness of 4 m.

33) Soetvlei (30°05' S, 22°58' E)

A fissure striking NW is reported¹. This site was visited but apart from what appears to be an old asbestos prospect trench, nothing else was seen.

Victoria West District

34) Brandewynskuil-Humansdam group (30°37' S, 22°41' E)
(locality code = 13)

2 pipes (180x120, 90x130 m.) and a dyke are reported NW of the homestead Brandewynskuil on the Vosburg-Carnarvon road.

The larger pipe to the SE has been pitted (one pit is down to 12 m.). The kimberlite is weathered, highly micaceous and contains a tremendous variety of inclusions that are mainly crustal - varieties of gneisses (most commonly a biotite gneiss), mica schists, granite, pegmatite, dolerite and shale. The kimberlite is classified as a hypabyssal kimberlite breccia. Fragments of garnet granulite and altered garnet peridotite were seen. Du Toit³ describes a kyanite garnet granulite (gt+plag+ky+cpx ?) from this locality.

The concentrate is rich in orange to mauve garnets with some orthopyroxene, clinopyroxene but very little ilmenite.

The NW pipe is poorly exposed in one small caved pit. The kimberlite dyke trends 320°MN.

35) Cordaatskuil (30°45' S, 22°50' E)
(locality code = 06)

A kimberlite pipe (270x90 m.^{1,3}) occurs NE of the homestead

Cordaatskuil near the boundary fence. The site is marked by a windmill and 3 pits, the largest of which is 10 m. wide and 2 m. deep.

Du Toit³ reports that pale blue kimberlite was proved in a number of pits though today no fresh kimberlite can be seen. The kimberlite is a highly weathered brown rock rich in phlogopite, altered olivine and inclusions.

The concentrate yielded rare ilmenite and very scarce garnet and clinopyroxene.

Crustal inclusions are common and include dolerite, shale, amphibole-bearing metamorphics, gneisses and pink syenite.

Garnet granulites are common while eclogites and ultrabasics are rare. The following assemblages have been reported or sampled.

1) Ultramafics

Ol+cpx+opx. Rare highly altered yellowish lherzolites can be seen in situ. One specimen is 40 cm. in length with 1 cm. size orthopyroxene and smaller green diopside clearly visible. Alteration has formed the secondary minerals serpentine, bastite, calcite and quartz.

2) Eclogite

One fresh equigranular (1-2 mm.) gt+cpx+rut eclogite was found in the U.C.T. rock collection. A similar assemblage is reported by du Toit³ and Rickwood⁶.

3) Garnet granulites

The assemblage gt+cpx+plag+amph+rut+ap+scap is the most common^{3,6,8}. 1 kyanite-bearing granulite was also sampled. In these samples the plagioclase is typically altered to a fibrous zeolite (natrolite) while the mafics minerals have remained remarkably fresh.

36) Kromaar (30°35' S, 22°54' E)
Renswoude (30°31' S, 22°52' E)

The NW trending Kromaar fissure is reported¹ 2 km. due E of Vosburg and is probably related to the Renswoude kimberlite further to the NW.

The 2 small Renswoude blows (6,30 m. in diameter) are reported as developed at the intersection of a WNW and NE trending dyke set about 6 km. N of Vosburg on the Prieska road and along the southern edges of Otterpan.

A small pit within a circular area rimmed by breccia outcrop and float today marks the Renswoude site, though mud and silt in-wash to the pan makes positive identification difficult.

37) Lushof (30°48' S, 23°01' E)
(locality code = 14)

2 pipes and a fissure are reported north of the homestead Lushof¹ east of the Vosburg-Victoria West road.

5 pits mark the site of the main pipe (150x90 m.). A smaller

sedimentary inclusion-rich pipe with only mineral interstitial kimberlite occurs east of the main pipe. A thin fissure (<1 m., strike 54° MN) is associated with this smaller vent¹.

The kimberlite is a brown, weathered rock in which abundant altered olivine (<4 mm.), rarer large phlogopite (3 mm.) and abundant shale inclusions are set in a micaceous matrix. The rock is an altered hypabyssal kimberlite breccia.

Concentrate from the main pipe is dominated by green orthopyroxene, subordinate ilmenite and rare clinopyroxene and garnet. Numerous zircons are reported¹ but only 1 small fragment was recovered during sampling.

Highly altered ultrabasic nodules are common. Patchy clinopyroxene and phlogopite occurs with relict olivine and orthopyroxene. Only 1 garnet peridotite was seen. An eclogite nodule with the assemblage gt+cp+scap is reported^{5,6}.

The Lushof pipe is one of the few kimberlites in the study area that appears to be diamondiferous to some extent¹.

TOPO CADASTRAL SHEET : 3122 VICTORIA WEST (1:250 000).

Beaufort West District

- 1) Gansfontein (31°46' S, 22°34' E)

Rickwood⁷ quoting Rogers notes the presence of ultramafics (ol+opx, ol+cp+gt) at this site. This locality was not visited.

Carnarvon District

- 2) Alarmkraal South No. 1 (31°08' S, 22°26' E)
Alarmkraal North No. 2 (31°05' S, 22°20' E)

There is no information about these 2 localities.

- 3) Rietfontein ~ Aarfontein (31°22' S, 22°26' E)
(locality code = 16)

3 small pipes are reported¹ NW of the homestead Rietfontein along the Loxton-Pampoenpoort road.

A few small trenches mark the site of the southerly kimberlite. Ilmenite and rare garnet can be sampled from the dumps.

The more northerly kimberlite is marked by a larger old pit now collapsed. The excavated yellow ground is very rich in ilmenite (up to 1 cm. in size) with subordinate amounts of mauve garnet and Cr-diopside. Tiny fragments of garnet granulite and possibly eclogite are common.

Fraserburg District

- 4) Silvery Home (31°31' S, 22°16' E)
(locality code = 21)

The main NS fissure occurs just to the SW of the Silvery Home homestead on the Loxton-Fraserburg road. Blows are developed at the north and south ends of this fissure.

Fresh kimberlite was sampled from the south blow. Two different kimberlite types were found on petrographic examination. Both are a tough, black hypabyssal kimberlite. Petrographically, one is a phlogopite-diopside variety. The other contains no diopside and is a serpentine-phlogopite kimberlite. No heavy mineral concentrations or inclusions were recovered from this kimberlite.

Victoria West District

5) Beyersfontein (31°02' S, 22°32' E)

The Beyersfontein kimberlite was first described by Rogers² and later visited by Rickwood⁶. Note that the co-ordinates given by Rickwood⁶ are incorrect.

The kimberlite is a small elongate NW blow associated with a NW trending fissure marked by a bush lineation. A pit exposes weathered kimberlite rich in altered olivine and phlogopite.

A concentrate sample yielded relatively abundant ilmenite with rarer garnet (orange and reds), clinopyroxene and very rare orthopyroxene.

Xenoliths include biotite gneiss, granite and rare garnet granulites^{2,6}, rutile eclogites^{2,6} and highly altered peridotites.

6) Hebron group, west portion of Hartebeestefontein (31°17' S, 22°34' E) (locality code = No. 1 pipe = 07, No. 5 pipe = H5).

Recent prospecting¹ has investigated the numerous kimberlites found on the farms Hartebeestefontein (portions Hebron and Leyfontein), Klipgatsfontein, Hugo's Dam and Witwater situated along the eastern side of the Loxton-Pampoenpoort road. Fissures in this area are predominantly NS and stand out clearly as bush lineations. In most cases the pipes and fissures can easily be picked out on aerial photos.

On the farm Hebron 2 old kimberlites (No. 1,5), a recently discovered pipe (No. 2) and 2 areas with strong surface anomalies are reported¹.

The No. 1 pipe (150x75 m.) appears in part intrusive through a dolerite and has in one place been pitted to a depth of 20 m. (now caved to 12 m.)¹. The hard, relatively fresh kimberlite seen dumped adjacent the pit was encountered at 20 m. depth. Two kimberlite types are seen in the pit. The soft, friable yellow ground is a tuffisitic breccia. The tough black kimberlite is a hypabyssal kimberlite of the serpentine-calcite variety. Megacryst size inclusions of ilmenite and olivine are common while glassy orthopyroxene and sub-calcic clinopyroxene and phlogopite is rarer. No megacryst garnet was found. Orange to mauve garnets and Cr-diopsides of peridotitic origin are however relatively common.

Ultramafic inclusions are abundant and fall into 2 groups. Lherzolites in which minor Cr-diopside is often associated with fine grained phlogopite predominate over garnet lherzolites with minor amphibole and Cr-spinel. Textures are coarse (see Harte, 1977). Only one nodule is of the porphyroclastic textural type. A third rare association is olivine (polygonal, <1 mm.) + ilmenite. This olivine-ilmenite rock is believed to be from a fragmented mosaic-porphyroclastic xenolith.

2 garnet granulites with the following assemblages were sampled at this site: gt+cpx+plag+rut, gt+cpx+plag+K-spar+scap+ap+amph+opaq.

The No. 2 site is marked by a strong vegetation anomaly. From dumped material adjacent small pits abundant ilmenite and some garnet and orthopyroxene can be found. Very small fragments of garnet granulite and rarer ultrabasics were sampled.

The No. 5 kimberlite is an old prospect, measures 60x30 m. and the yellow ground is rich in ilmenite, Cr-diopside and garnet¹. Garnet granulites (gt+cpx+plag, gt+cpx+plag+rut) were sampled. As at Cordaatskuil the plagioclase in these rocks is totally altered to felty natrolite.

In the western sector of the farm 2 surface anomalies (sites 3,4) suggest the presence of kimberlite¹.

7) Hugo's Dam (31°16' S, 22°39' E)

A pipe on a NS fissure is reported on this farm and forms part of the Leyfontein cluster¹.

8) Rietgat in Jacomyn's Aar (31°22' S, 22°47' E)

A small pipe (135x60 m.) is reported² to show yellow ground in pits and to contain small fragments of shale and dolerite as well as larger xenoliths of amygdaloidal basalt.

9) Klipgatsfontein North group (31°19' S, 22°37' E)
(locality code = 37)

Two small pipes situated on a NS fissure are reported¹. A nearby surface anomaly indicates a possible third pipe. The contacts of both pipes are marked by strong upturning of shale and prominent vegetation growth.

The more northerly pipe (70-80 m. in diameter) has been pitted. Ilmenite and garnet are abundant with lesser amounts of orthopyroxene and Cr-diopside. Numerous 1 cm. size fragments of garnet lherzolite (rich in Cr-diopside), fine-grained eclogite and garnet granulite were found.

The southern pipe (65 m. in diameter) has similar characteristics.

10) Klipgatsfontein South group (31°23' S, 22°36' E)
(locality code = south = 31, north = 32)

Two pipes and an associated NNE fissure (4 m. wide) occur in the SW sector of the farm.

The outline of the southern pipe (28x40 m.)¹ is beautifully shown by upturned sandstones and shales. Very tough, serpentine-calcite rich kimberlite with large inset olivine (<5 mm.), ilmenite (<10 mm.) and phlogopite was sampled from a small dump. Garnet peridotite and garnet granulite fragments are rare. The kimberlite is a hypabyssal kimberlite.

The northern pipe (75 m. diameter) has similar tough kimberlite outcropping. In thin section however the matrix kimberlite is totally altered to fine-grained calcite and clay minerals. Olivine and phlogopite phenocrysts have been severely serpentinized and calcified. The kimberlite is a hypabyssal kimberlite breccia.

Along the western side of the access road (this road takes off north from the Victoria West-Loxton main road passing east of the hill marked

Blaauspitskop) to the farm Klipgatsfontein, a NS fissure at least 2 m. wide and marked by upturned contact sediments can be traced for about 2 kms. This fissure has been pitted in 2 places and yellowish, micaceous ground indicates the probable presence of kimberlite.

11) Leyfontein group, east portion of Haartebeestfontein (31°17' S, 22°37' E)
(locality code = 01)

5 pipes (2 on NS fissures) are reported in the SE sector of the farm Leyfontein¹.

The No. 1 pipe (300x100m.) is elongate NNW and was first prospected in 1891². The kimberlite is tuffaceous and contains abundant ilmenite, garnet and mica^{1,2}.

Pipe No. 2 (200x120 m.) has similar kimberlite and contains garnet granulite and pyroxenite xenoliths. Pipe No. 3 (100 m.) is similar to No. 2.

The kimberlite of pipe No. 4 (80 m.) is of the "hardebank" variety¹ and contains large ilmenites, garnets and fresh olivine.

Further to the N 2 blows (No's. 5a, 5b) are developed on a NS fissure (3 m. wide)¹.

12) Melton Wold ~ Springbokkop (31°30' S, 22°44' E)
(locality code = 08)

A kidney-shaped pipe (elongate NS, ~120 m. in length) is developed towards the northern end of a well defined NS fissure marked by a strong vegetation growth. A few hundred feet east of the pipe at least 2 narrower fissures parallel the main fissure. The pipe has been excavated in a large trench.

Three types of kimberlite occur at Melton Wold.

The NW wall of the trench exposes soft, friable yellowish tuffisitic kimberlite breccia, rich in dolerite and shale fragments with rarer ultrabasics. Tuffisitic kimberlite is also seen at the southern end of the trench where it is found as veinlets and stringers cementing what appears to be a large brecciated sedimentary block.

The SW and NE walls are essentially a hypabyssal kimberlite breccia which contains abundant fragments of dolerite, amygdaloidal basalt and shale. This kimberlite is also autolithic but is highly weathered.

Fresh, tough black hypabyssal kimberlite is seen in a .5 m. thick dyke cutting the tuffisitic kimberlite breccia near the northern end of the trench. Petrographically this kimberlite is of the calcite-phlogopite variety. Similar kimberlite was recovered from a pit at the northern edge of the pipe.

The concentrate dump yields abundant garnet (orange to deep mauve in colours but with thick kelyphyte rims), common Cr-diopside but very rare ilmenite. Distinctive disc-shaped ultramafics can be sampled both in situ or in the dumps. The following peridotite assemblages have been previously recorded⁷. The garnet harzburgite assemblage was not confirmed during the present study.

| | | |
|----------------|---|---------------|
| gt lherzolite | - | gt+cpx+opx+ol |
| lherzolite | - | cpx+opx+ol |
| gt harzburgite | - | gt+opx+ol |

In all specimens olivine has been totally serpentinized. Relict orthopyroxene can be found while garnets and clinopyroxenes have remained relatively unaltered.

Rare gabbroic xenoliths occur. No eclogite or garnet granulite has been found. The farm owner, Mr Brian Torr, has shown the author a small diamond he recovered during prospecting this kimberlite.

At the NE end of the trench a tough kimberlite dyke (.5 m. wide) cuts pipe kimberlite. Here also can be seen a fine example of country rock - intrusive pipe relations. As the pipe contact is approached sediments are gently upturned. However, within the last 2 m. to the contact the sediment dips reverse and are downdragged adjacent the kimberlite. This slumping may be related to collapse immediately following the primary explosive eruption. 3 thin kimberlite dykes, perfectly parallel to the pipe edge, cut the sediment in the hinge area where dips reverse. An alternative explanation is that the country rock adjacent the contact have been contorted by post-consolidation weathering and expansion in volume of the kimberlite (M. Skinner - pers. comm.).

A large highly baked and brecciated sedimentary block appears to occupy the west central portion of the pipe while sediments adjacent the western contact are highly baked and have curious concentric, joint features. It was initially thought that the kimberlite was responsible for the features of the country rock but on a recent visit to Melton Wold, Mike Skinner convincingly showed that these features were imposed by the thermal effects of an earlier dolerite intrusion.

13) Mount Pierre (31°07' S, 22°32' E)

A dyke of micaceous kimberlite with common garnet and Cr-diopside can be traced NS for 2,5 km¹. This site was not visited.

14) Pampoenpoort (31°07' S, 22°43' E)

2 pipes (30, 30x60 m.) are associated with a NW fissure system. The kimberlite is reported to be "basaltic" with little mica and with rare ilmenite and Cr-diopside¹. Garnet-rich metamorphics are recorded. These pipes could not be accurately located though ilmenite was found near what looked like a filled-in pit.

15) Witbank North (31°20' S, 22°34' E)
Witbank South (31°22' S, 22°35' E)

The North pipe (30 m.) is situated on a NS fissure. The kimberlite is "basaltic" with little mica and garnet metamorphic xenoliths are common¹.

The South pipe is very poorly exposed. Reports indicate a tuffaceous kimberlite with inclusions of dolerite, shale and garnet metamorphics.

TOPO CADASTRAL SHEET : 3024 COLESBERG (1:250 000)

De Aar District

1) Du Plessis Dam (30°37' S, 24°04' E)

This small pipe NE of De Aar was first reported by du Toit³. It has

not been pitted but fragments of "garnetiferous granulites some containing cyanite"³ can be found on the ground surface. Rickwood⁶ studied 2 kyanite granulites described by du Toit and concluded that the plagioclase was secondary. The assemblages reported are:

Eclogite

gt+cpx+rut⁶ (+ ky³)
cpx+ky⁶

Granulite

plag+opx+biotite+rutile³

2) Roodekraal-Barendskuilen group (30°48' S, 24°13' E)
(locality code = 42)

The Roodekraal pipe (50 m. in diameter) occurs WNW of the Burgerville-weg rail siding 24 kms. SE of De Aar. The pipe is situated at the NW end of a fissure system that extends SE into the farms Barendskuilen and de Bad in the Hanover district.

Yellow ground is found around the edge of an old excavation but no fresh kimberlite was seen.

A large collection of eclogite xenoliths was collected at this pipe. Of the 88 eclogites collected, 79 had the assemblage gt+cpx+rutile+apatite+qtz while 9 were kyanite eclogites with the assemblage gt+cpx+ky+qtz. 1 garnet granulite was found but there are no peridotite or pyroxenite xenoliths.

3) Vetlaagte (30°41' S, 24°06' E)
(locality code = 04)

The small Vetlaagte pipe ESE of De Aar is reported to be rich in ilmenite and contains some ultra-basic xenoliths.

One garnet kyanite granulite with garnet-rich and garnet-free bands was found in the U.C.T. rock collection and was studied.

Hanover District

4) Andriesfontein group (30°57' S, 24°36' E)
(locality code = 27,28)

At least 4 pipes (93,72,40,23 m. in diameter), 3 blows (maximum 33 m. in diameter) and 8 fissures (maximum length 1.5 km., NNW strike) have been found on the farm Andriesfontein SE of De Aar and just north of the railway between the rail sidings Hanover Road and Linde.

The 2 larger pipes were located but all prospecting pits and trenches, as is common in this area, had been in-filled by the prospectors to avoid danger to farm animals. Debris around the pits included weathered yellowish kimberlite rich in olivine and phlogopite and with ilmenite. Old concentrate dumps yielded abundant ilmenite but relatively rare peridotitic and eclogitic garnets. Only one mantle xenolith, a fine-grained garnet pyroxenite (cpx+opx+gt) was found.

1 diamond has been recovered from each of the 2 larger pipes¹.

- 5) Goede Hoop group (30°50' S, 24°25' E)
(locality code = 29,30)

NW of the Andriesfontein group of kimberlites, a similar series of 3 pipes and 2 blows are associated with NW trending dykes on the farm Goede Hoop. The Goede Hoop dykes can be traced NNW to NW through the farms Palmietfontein, Windhoek and Cyprushof¹.

From debris around the blow GHI numerous fine-grained eclogite (often severely amphibolitized) fragments were sampled.

Fragments of relatively fresh hypabyssal kimberlite (a serpentine-calcite variety relatively poor in phlogopite) were sampled from an old excavation on the GHI kimberlite pipe. This kimberlite contains olivine megacrysts (<2 cm.), fragments of garnet lherzolite and minor ilmenite. The concentrate sample yielded garnet (relatively rich in the mauve colour types), clinopyroxene, orthopyroxene and a zircon. 1 garnet granulite xenolith (gt+cpx+plag) was found.

- 6) Jachtfontein (30°59' S, 24°16' E)
(locality code = 20)

The Jachtfontein pipe (43 m. in diameter) is situated WNW of Hanover and to the SW of the main road to De Aar. An old circular excavation about 6 m. deep marks the site.

The excavation exposes yellow ground rich in dolerite and shale inclusions. Tougher, black hypabyssal kimberlite samples were found on the dumps but in thin section seen to be severely altered, consisting of serpentinitized olivine, ilmenite and shale fragments set in a matrix of calcite and clay minerals.

The concentrate is virtually all ilmenite.

Apart from the numerous dolerite and shale xenoliths, inclusions of eclogite (gt+cpx, gt+cpx+rut, gt+cpx+ky) and pyroxenite (cpx+opx+gt) are common. No olivine-bearing ultramafics were found.

- 7) Koos-syn-kamp (30°54' S, 24°33' E)

2 pipes on a NW trending fissure are reported¹. These kimberlite appear to be on the NW extension of the Pine Grove No. 1 fissure (farm Boelhouders Draai).

The kimberlite is reported to be rich in phlogopite and with common garnet, ilmenite and Cr-diopside in the concentrate.

This site was visited but the pipes could not be found. The fissure is marked by a poor bush lineation associated with some upturning of contact sediments.

- 8) Leuwefontein (30°48' S, 24°22' E)

This pipe (45 m. in diameter) is situated NW of the Goedehoop kimberlites and is poorly exposed in 2 small pits.

The kimberlite is highly weathered and contains abundant small shale and sandstone inclusions. A concentrate sample yielded some ilmenite, Cr-diopside and rare garnet. Fragments of fine grained eclogite, garnet

pyroxenite, biotite and amphibole schists and quartzite were sampled. A single totally altered peridotite was found. The eclogites appear similar to those at the Roodekraal kimberlite further to the west.

- 9) Pine Grove No. 1 (30°55' S, 24°34' E)
Pine Grove No. 2 (30°55' S, 24°36' E)

These 2 pipes and associated fissures are on the farm Boelhouders Draai, north of Hanover and the Andriesfontein kimberlites.

The No. 1 pipe (130x60 m.) is on a NW dyke that probably extends to the Koos-syn-kamp kimberlite. Little can today be seen at this site though ilmenite and fragments of garnet granulite occur in the surface debris. Rare ultrabasics are reported¹. A few small fragments of garnet bearing ortho- and clinopyroxenites were found and examined.

Very low yields of diamond are reported for both the Pinegrove pipes and the Koos-syn-kamp kimberlite.

The Pinegrove No. 2 pipe (22 m. in maximum diameter) is further E and on a NS fissure that could be related to the Andriesfontein kimberlites.

The weathered kimberlite contains abundant ilmenite, garnet and Cr-diopside¹. This No. 2 site was not visited.

Cyprushof group

- 10) Windhoek (30°46' S, 24°24' E)
(locality code = 24,25)

At the SE end of the farm Windhoek a blow (360x11 m., elongate NW - the north blow) and a possible ring intrusion (the south blow) occur associated with a dyke. This dyke can be traced NW into the farm Cyprushof. The Windhoek-Cyprushof kimberlites form the NW extension of the Goede-hoop kimberlite trend.

Pits on the Windhoek north blow have been filled in and little can be seen. Fragments of relatively massive, mica-rich hypabyssal kimberlite were sampled and a concentrate of surface rubble yielded abundant ilmenite, garnet and rarer clinopyroxene. No xenoliths were found.

The ring feature is seen as a semi-circular bush lineation extending from the main dyke and cut into dolerite. A concentrate sample from ground in a pit located at the southern end of the ring feature - main dyke intersection yielded abundant ilmenite, garnet and common clinopyroxene. The kimberlite rock is studded with small shale and dolerite inclusions. One large, foliated garnet granulite (gt+cpx+plag) was found.

The Cyprushof dyke has been opened in a trench 2 m. wide. A concentrate sample yielded very abundant garnet (a high proportion are mauve in colour), abundant ilmenite and lesser clinopyroxene. 2 small (<.5 mm.) zircons were found in the concentrate.

Phillipstown District

- 11) Lekkerfontein (30°20' S, 24°38' E)
(locality code = 33)

This kimberlite is situated on the farm Lekkerfontein (Hondeblaf) some

20 km. NE of Phillipstown.

The site is marked by 2 large, 10 m. deep excavations and scattered dumps of mined material.

Two types of kimberlite are found on the dumps. The most common is a compact, black hypabyssal kimberlite breccia of the phlogopite-serpentine-calcite variety that contains abundant megacrysts of garnet, phlogopite, sub-calcic clinopyroxene and rarer orthopyroxene. Doleritic, gabbroic and sedimentary inclusions are common. More rare are calcitised eclogite fragments. The megacryst suite is the finest found in the study area and in many respects (see III) rivals that at Monastery. The second kimberlite type is a greyish to dark, very fine grained tuffisitic-like kimberlite with few inclusions. This variety is rare.

This kimberlite is described in some detail by Keyser⁴.

APPENDIX 2: PETROGRAPHIC DESCRIPTIONS FOR XENOLITHS.

A. PERIDOTITES.

- 07023 - HEBRON. LHERZOLITE. Ol:av.4mm, 1,5 to 8mm,irregular shapes with smoothly curving grain boundaries,strongly kink banded.Opx:2-4mm,fine scale cpx exsolution, weak undulose extinction.Cpx:,5-1,5mm,highly altered, now seen as eroded relicts set in a mass of calcite with dustings of red-brown opaques-Cr spinel.Texture-coarse.
- 07033 - HEBRON. GARNET LHERZOLITE. Ol:mostly 3-8mm,smaller grains <2mm are unstrained and more tabular than the larger grains-may indicate a previous period of recrystallisation.Opx:1-3mm,slightly tabular shapes. Cpx:2-3mm,irregular to tabular,green,spinels have a strong spatial proximity to cpx.Spinel:Cr-rich, up to 1,5mm.Gt:2-7mm,rounded outlines,reddish, slightly kelyphytised.Texture:coarse.
- 07043 - HEBRON. LHERZOLITE. Ol:av.5mm,up to 10mm,larger ol are strongly kink banded,smaller 1-2mm are strain-free. Opx:1-3mm,narrow ,1mm turbid zones mantle opx,have rod-like tiny brown spinel inclusions that are probably exsolution products.Spinel:,1mm,minute euhedra that can occur as inclusions in ol,opx.Amphibole: ,2mm inclusions in ol,opx,pale green to green-brown pleochroic,always has associated with it some brown spinel.Cpx:inferred from the presence of 'pools' of sp+phl that are seen in 07063 to be replacing primary cpx.Texture-coarse.
- 07053 - HEBRON. GARNET LHERZOLITE. Ol:<7mm,mostly irregular shaped grains though some have a tabular aspect.Opx: seen only as <2mm rounded inclusions in ol.Cpx:<2mm irregular grains,can be found included in ol.Gt: seen in hand specimen but does not occur in slide.Texture-coarse.
- 07063 - HEBRON. LHERZOLITE. Ol:up to 9mm.Opx:up to 4mm,can contain oriented lamellae of cpx that have attendant phlogopite.Cpx:one partly unaltered seen to be 2mm, core primary cpx seen to be being replaced at edges and along cleavages by secondary spongy cpx+phl+sp, 'pools' of spongy fine-grained cpx+phl+sp+ampibole inferred to after primary cpx.Spinel:<,5mm,some look primary while most are associated with cpx alteration. Amphibole: can occur in cpx aleration pools.Texture-coarse.
- 07073 - HEBRON. GARNET LHERZOLITE. Ol:1-8mm,larger grains have highly irregular shapes while smaller grains are more

definitely tabular, weak undulose extinction. Opx: 2-4mm, shapes more tabular than ol, minor cpx exsolution. Cpx: <2mm, green, clear and fresh. Gt: 1mm, always associated with 2mm red-brown spinels and very commonly associated pale yellow-green amphibole, amph and sp appear to be forming at the expense of gt. Spinel, amph: associated with gt, primary metasomatic. Texture: coarse.

- 07083 - HEBRON. GARNET LHERZOLITE. Ol: up to 7mm, larger ol have highly irregular shapes, smaller <2mm ol are more tabular. Opx: up to 8mm. Gt: 2mm, rounded. Spinel: Cr-rich discrete anhedral or as inclusions in ol, opx. Cpx: seen only in hand specimen. Secondary phl occurs in gt kelyphyte rims. Texture-coarse.
- 07093 - HEBRON. LHERZOLITE. Ol: up to 10mm, highly irregular grain shapes with curving to serrated grain boundary configurations, smaller <2mm are more tabular and strain-free not showing the undulose extinction that is commonly seen in the larger grains. Opx: replaced. Cpx: replaced by phlogopite aggregates. Spinel: minute inclusions occur in ol. Texture-coarse.
- 07103 - HEBRON. LHERZOLITE. Texture-porphyroclastic. Porphyroclasts: ol-2-5mm, strong undulose extinction and the development of neoblasts around and within grains along subgrain boundaries, opx-1-3mm, show exsolution cpx lamellae and neoblast formation, severe undulose extinction, cpx-most cpx grains are mantled by a rim of opx that is wider and better developed the more irregular and smaller the cpx core is suggesting that progressive stages of replacement are being seen, this replacement opx is markedly different from the porphyroclastic opx in that it appears dirty and can contain patches of phl as well as opaques-ilmenite and Cr-spinel. Neoblasts: ol, opx-mostly <, 2mm, highly polygonal grains, strain free, straight grain boundaries with numerous triple point grain junctions, one replacement opx rim is itself seen to be recrystallised with the formation of neoblasts. Phl: also seen as kinked plates in the neoblastic matrix. Ilmenite and Cr-spinel occur mainly in the replacement opx rims but ilm can also be discrete in the matrix.
- 07123 - HEBRON. OLIVINE-ILMENITE fragment. This is most probably a fragment from a disaggregated mosaic-porphyroclastic peridotite xenolith. Ol: <, 6mm, highly polygonal to tabular. Ilmenite: appears to cement the ol mosaic.
- 07143 - HEBRON. GARNET LHERZOLITE. Ol: 2-7mm, larger ol kinked. Opx: 3-4mm, minor cpx exsolution. Gt: <3mm, rounded elongate shapes, virtually always has a red chromite inclusion

- in it. Cpx: up to 2mm, clear, green. Spinel: chromite, <, 3mm
Texture-coarse.
- 07163 - HEBRON. GARNET LHERZOLITE. Ol: 2-6mm, kinked. Opx: 2-4mm, weak undulose extinction. Cpx: 1-4mm, fresh green, the largest cpx has fine scale exsolution lamellae. Gt: up to 4mm, rounded irregular shapes. Texture-coarse.
- 07173 - HEBRON. GARNET LHERZOLITE. Similar to other gt lherzolites except that this specimen contains an amphibole-chromite-gt symplectite surrounding the only cpx seen in thin section. Amphibole poikilistically encloses highly irregularly shaped gt and Cr-spinel and as before in 07073 the amph is believed to be forming at the expense mainly of gt. Texture-coarse.
- 07183 - HEBRON. GARNET LHERZOLITE. Ol: 2-6mm, minor kinking. Opx: 2-4mm, more tabular than ol. Cpx: up to 4mm, green, shows development of spongy outer rims. Gt: 4-10mm, every gt has developed around it a shell of primary metasomatic amphibole that can be up to 2mm wide, this amphibole is not that normally seen in gt kelyphyte rims because it has a primary textural grain boundary relationship with the other phases. Texture-coarse.
- 07303 - HEBRON. MARID-suite xenolith. Tabular opx (1mm) and red-brown opaque set in a matrix of phlogopite.
- 08033 - MELTON WOLD. LHERZOLITE. Ol: 2-4mm, relict cores set in serpentine. Opx: 2-4mm, more tabular than ol but also serpentinised. Cpx: 2mm, green, relatively fresh. Gt: 5-1, 5mm, rounded. Texture-coarse.
- 08053 - MELTON WOLD. GARNET LHERZOLITE. Ol: totally serpentinised. Opx: 1-4mm, relatively unaltered. Cpx: 5-1, 5mm, green, development of spongy outer rims similar to that described by Carswell, 1975. Gt: 2-5mm, mauve colour. Texture-coarse.
- 08063 - MELTON WOLD. GARNET LHERZOLITE. Similar to 08053.
- 08073 - MELTON WOLD. GARNET LHERZOLITE. Ol: totally serpentinised. Opx: 1-3mm, partly altered to a brownish serpentine in which the pyroxene cleavage is still evident. Cpx: only one 2mm grain seen adjacent gt. Gt: 1-4mm, mauve. Texture-coarse.
- 08083 - MELTON WOLD. GARNET LHERZOLITE. Ol: serpentinised. Opx: 1-3mm, tabular, partly altered, larger grains have undulose extinction. Cpx: 5-2mm, green with spongy outer rims. Gt: 2-4mm, rounded near spherical shapes, kelyphyte rims, 2mm wide. Texture-coarse.
- 08113 - MELTON WOLD. GARNET LHERZOLITE. Similar to 08083.

08123 - MELTON WOLD. GARNET LHERZOLITE. Similar to 08083.

In the following petrographic descriptions the textural terminology is as outlined in Fig. V-1. The following abbreviations are used:

Cg = coarse-grained granular.
 Mg = medium- " "
 Cgb = coarse- " granuloblastic.
 Mgb = medium- " "
 Fgb = fine - " "
 Cmgb = coarse- " mosaic granuloblastic.
 Mmgb = medium- " "
 Fmgb = fine - " "

B. PYROXENITES.

- 05023 - LOUWSPLAAS. Gt pyroxenite. Gt-3 habits: elongate to bleb exsolution trains in cpx, anhedral in necklace texture along grain boundaries, reaction rims between Al-rich spinel and pyroxenes. Cpx: av. 1,5mm but up to 4mm, copious exsolution of gt and brown spinel. Opx: av. 1,5mm, copious exsolution of gt and brown spinel. Megacrystic: larger cpx and opx show incipient recrystallisation textures as seen in 12123. Minor kelyphyte around gts. Texture-Mgb.
- 12123 - MARKT. Gt pyroxenite. Gt: av., 5mm, strongly polygonal to elongate, polygonal at grain boundary triple junctions, elongate when still occurring as exsolution lamellae in larger megacrystic cpx. Cpx: av. 1,0mm, strongly polygonal and recrystallised, larger 2mm sized grains are megacrystic showing gt exsolution and incipient recrystallisation features such as the formation of internal subgrain boundaries. Rutile present. Minor kelyphyte around gts. Texture-Fmgb.
- 12143 - MARKT. Spinel-gt pyroxenite. Gt: occurs only as almost continuous reaction bands separating spinel and pyroxenes. Cpx, Opx: 1-2mm, irregular to tabular shapes, opx shows very weak cpx exsolution and minor kink banding, the cpx exsolution being concentrated at the kink boundaries. Spinel: the specimen is banded into sp-rich and -poor layers, sp is dark green colour and is reacting to form gt at contacts with pyroxenes. Opaques occur within the spinel as poikilitic inclusions mostly <,4mm. Texture-Mgb.
- 20043 - JACHTFONTEIN. Gt pyroxenite. Gt: max., 5mm, mostly tabular anhedral at grain boundary triple junctions, strong

- pink-red colour. Cpx, Opx: av. 1,5mm with larger grains being tabular and the smaller grains being polygonal, opx's show minor kinking. Rutile: relatively abundant, intergranular, up to ,7mm, show exsolution of a black opaque. Ilmenite occurs as inclusions in pyroxenes or is discrete, small <,1mm. Gts are kelyphitised. Texture-Mgb.
- 20063 - JACHTFONTEIN. Gt pyroxenite. Gt: <,4mm, anhedral at grain boundaries. Cpx, Opx: av. 1,0mm, strongly polygonal grains, opx is exsolving brown spinel, most exsolved spinel occurs at opx grain centers. Ilmenite: minor, as in 20043. Texture-Mmgb.
- 26063 - LEUWEFONTEIN. Gt pyroxenite. Gt: highly irregular shapes but with straight edged grain boundaries, numerous inclusions, resembles the gt in 33023. Cpx: 1mm, intergranular. Opx: up to 3mm, some are strongly kinked. Secondary: rock is veined with fibrous fine-grained amphibole. Texture-Mgb.
- LF-1 - LEUWEFONTEIN. Gt pyroxenite. Similar to 20063. Texture-Fmgb.
- LF-2 - LEUWEFONTEIN. Spinel pyroxenite. Cpx, Opx: <1mm, strongly polygonal, larger opx and cpx show spinel exsolution. Spinel: abundant intergranular grains <,3mm or as exsolution products. Texture-Fgb.
- PG-1 - PINE GROVE. Gt orthopyroxenite. Opx: most grains are small (<1mm) and strongly polygonal, larger (4mm) grains are megacrystic relicts and contain elongate gt exsolution trains as well as being severely kink banded, opx's have a distinct tabular fabric. Gt: as exsolution lamellae in larger opxs and as small anhedral (<,2mm) at grain boundary triple junctions. Texture-Fmgb.

C. ECLOGITES.

- O2-1 - LOVEDALE. Gt: 2-3mm, rounded. Cpx: <2mm, colourless, about 10% of cpx is altered to symplectite. Coarse banding. Texture-Cgb.
- O2-2 - LOVEDALE. Gt: 2mm, rounded, pale pink. Cpx: 1-5mm, more irregular and intergranular in shape and habit than O2-1. Coarse banding weak. Texture-Cgb.
- O2023 - LOVEDALE. Gt: 1-2mm; straight edged to tabular, some partially melted. Cpx: 2-5mm, green, grain boundaries generally totally altered. Fine banding weak. Secondary: severe symplectisation of cpx, partial melt patches in which the following minerals have crystallised: cpx, amph, sp, zeolites, olivine? - now as chlorite -serpentine pseudomorphs, also glass. Texture-Cgb.

- 02043 - LOVEDALE. Gt: 1-2mm, rounded and irregular, partially melted. Cpx: 1-4mm, irregular intergranular, rock is cpx-poor. Rutile: minor, some look partially melted. Coarse banded. Secondary: Excellent example of eclogite partial melting textures and secondary mineral crystallisation, secondary mineral assemblages as in 02023, as well as abundant phlogopite some of which is believed to be of a primary metasomatic origin. Coarse banded. Texture -Mgb.
- 02063 - LOVEDALE. Gt: 2mm, rounded anhedral. Cpx: 2-3mm, bright green, polygonal to irregular. Coarse banding weak. Texture -Cgb.
- 02073 - LOVEDALE. Identical to 02063.
- 02083 - LOVEDALE. Gt: 2mm, polygonal. Cpx: 3mm, cpx-rich. Rutile. Coarse banded. Secondary: cpx is severely symplectised, altered cpx now has areas of mutual optical extinction that have amoeboid shapes, phlogopite, calcite. Texture -Cgb.
- 02903 - LOVEDALE. Gt: 1-2mm, polygonal, pale orange. Cpx: 2mm, polygonal, green with black symplectite along cracks and cleavages. Rutile. Massive. Texture -Cmgb.
- 02103 - LOVEDALE. Gt: 1-2mm, rounded to squarish, orange. Cpx: 2-3mm, bright green, polygonal to irregular. Rutile. Massive. Secondary. phlogopite. Texture -Cgb.
- 02123 - LOVEDALE. Gt: 1-4mm, highly irregular shapes with curving grain boundaries, colourless. Cpx: <1-3mm, dusty pale green little symplectite, highly irregular grain shapes with curving boundaries. Amph: primary, brown, intergranular, <2mm. Relict opx, now totally altered to chloritic material. Texture -Cg.
- 02203 - LOVEDALE. Gt: <2mm, rare, polygonal with gently curving grain boundaries. Cpx: 1-7mm, coarse, pale green, polygonal. Rutile. Cpx-rich band. Texture -Cgb.
- 02233 - LOVEDALE. Gt: <1mm, polygonal. Cpx: 1-2mm, polygonal and slightly tabular. Fine banding weak. Texture -Mmgb.
- 02313 - LOVEDALE. Gt: ,5-1mm, colourless, rounded to squarish grains, some up to 2mm. Cpx: 1-2mm, colourless, polygonal to irregular intergranular. Massive. Texture -Mgb.
- 02353 - LOVEDALE. Gt: 2-3mm, polygonal. Cpx: 1-3mm, grey, badly altered, polygonal. Coarse banded. Texture -Cgb.
- 02413 - LOVEDALE. Gt: ,5-2mm, orange, rounded to polygonal, some tabular. Cpx: 2-3mm, strongly polygonal, green. Rutile up to ,8mm. Apatite: trace. Massive. Texture -Mmgb.

- 02423 - LOVEDALE. Gt: 1-2mm, rounded irregular but some tabular, colourless. Cpx: av 2mm, polygonal. Massive. Secondary: severe cpx symplectisation, amph, sp, carbonate. Texture-Cgb.
- 02433 - LOVEDALE. Gt: 2-4mm, pink. Cpx: 1-4mm, rounded and highly irregular grains. Rutile: , 5mm. Coarse banding weak. Texture-Cg.
- 02443 - LOVEDALE. Gt: 2mm, some up to 4mm, polygonal grains but most edges are kelyphytised. Cpx: 2-7mm, coarse, highly symplectised. Massive. Texture-Cgb.
- 02483 - LOVEDALE. Gt: 1-2mm, squarish. Cpx: 2-3mm, polygonal but highly symplectised, green. Massive. Texture-Cgb.
- 02513 - LOVEDALE. Gt: 1, 5mm, rims severely altered to give a scalloped texture. Cpx: 2-3mm, polygonal to irregular but grains are severely symplectised. Massive. Secondary: severe partial melting textures and the crystallisation of cpx, sp, amph set in glass. Texture-Cg.
- 02523 - LOVEDALE. Similar to 02443.
- 03-1 - SWEETPUT. Gt: <1, 5mm, polygonal, pink. Cpx: <3mm, green, polygonal. Rutile: rare. Massive. Secondary: abundant phlogopite. Texture-Cgb.
- 09123 - UINTJIESBERG. Gt: 1mm, strongly polygonal, numerous rutile needle inclusions. Cpx: 1mm, green and schill-erised due to the rutile inclusions, highly polygonal. Rutile: as inclusions in gt, cpx and apatite. Apatite: as discrete anhedra and as inclusions in gt and cpx. Massive. Texture-Mmgb.
- 10043 - MARKT. Identical to 12093.
- 10053 - MARKT. Gt: , 5-3mm, polygonal. Cpx: in gt-rich band generally <2mm and intergranular to the gt, in cpx-rich band up to 9mm, highly polygonal. Coarse banding. Texture-Cmgb.
- 10063 - MARKT. Gt: <1mm, highly irregular shapes with slightly rounded grain boundaries. Cpx: <2mm, tabular to irregular intergranular. Rutile: , 5mm. K-spar(?): trace. Texture-Mg.
- 12093 - MARKT. Gt: up to 7mm, orange, polygonal. Cpx: up to 7mm, irregular but straight edged, exsolution of opx. Texture-Cgb.
- 12113 - MARKT. Gt: up to 4mm, polygonal to tabular. Cpx: up to 5mm, strongly tabular and elongate. Massive. Texture-Cgb.
- 20093 - JACHTFONTEIN. Gt: <2mm, polygonal to squarish. Cpx: <4mm, tabular. Rutile. Coarse banded. Texture-Cgb.

- 20113 - JACHTFONTEIN. Gt: <2mm, polygonal. Cpx: <2mm, polygonal. Rutile. Coarse banding. Texture-Mmgb.
- 20163 - JACHTFONTEIN. Gt: <1mm, polygonal. Cpx: up to 4mm, severely symplectised. Rutile. Coarse banding. Texture-Cgb.
- 20223 - JACHTFONTEIN. Gt: ,1mm, polygonal tabular. Cpx: up to 3mm but severely symplectised. Rutile. Texture-Cgb.
- 20253 - JACHTFONTEIN. Gt: in coarse band <7mm, in fine band < 2mm, all highly polygonal. Cpx: polygonal to irregular. Rutile. Coarse banding. Texture-Cgb.
- 20263 - JACHTFONTEIN. Gt: <1,5mm, polygonal. Cpx: <4mm, polygonal but severely symplectised. Rutile. Coarse banding. Texture-Cgb.
- 20273 - JACHTFONTEIN. Gt: <1mm, highly polygonal. Cpx: 2mm, mostly polygonal. Rutile. Coarse banding. Texture-Mmgb.
- 20323 - JACHTFONTEIN. Gt: <2mm, rare. Cpx: cpx severely symplectised and replaced by amphibole. Rutile. Coarse banding. Texture-Cgb.
- 26043 - LEUWEFONTEIN. Gt: <2mm, highly irregular shapes. Cpx: <2mm, irregular interlocking grains. Rutile. Massive. Texture-Mg.
- 33043 - LEKKERFONTEIN. Gt: <3mm, polygonal with numerous inclusions, Cpx: totally replaced by calcite. Massive. Texture-Cgb.
- 33103 - LEKKERFONTEIN. Similar to 33043, but in addition contains apatite.
- 42043 - ROODEKRAAL. Gt: <1mm, ragged. Cpx: severely symplectised and almost completely replaced by granular amphibole.
- 42073 - ROODEKRAAL. Gt: <1mm, rounded and near spherical anhedral at triple point junctions. Cpx: 1-4mm, strongly tabular fabric. Rutile: trace. Massive. Texture-Cgb.
- 42163 - ROODEKRAAL. Gt: <2mm, polygonal. Cpx: <2mm, tabular polygonal. Rutile: up to 1mm, relatively abundant. Massive. Texture-Mmgb.
- 42543 - ROODEKRAAL. Gt: <1mm, polygonal. Cpx: <2mm, more irregular than gt. Fine banded. Texture-Mgb.
- 42533 - ROODEKRAAL. Gt, cpx, rutile and apatite. Rock is severely altered and only relicts of the above minerals are seen.

KYANITE ECLOGITES.

- 02133 - LOVEDALE. Gt: 1-2mm, polygonal to rounded grains. Cpx: 3mm, strongly polygonal, totally symplectised. Ky: squarish to tabular grains, 5-1,5mm, can be included in cpx but not in gt. Rutile: trace. Fine banding. Texture-Cgb.
- 02143 - LOVEDALE. Gt: 1-2mm, polygonal. Cpx: 2-3mm, coarser in ky-rich part of rock. Ky: 1-9mm, mostly laths in diablatic intergrowths with quartz. Qtz: either intergrown with ky or discrete and intergranular to gt in the ky-poor part of rock. Coarse banding. Texture-Cgb.
- 02153 - LOVEDALE. Gt: 1mm, polygonal to tabular. Cpx: 2mm, polygonal but totally symplectised. Ky: laths, 5-1,5mm, elongation is about 3 x width, can contain tiny (<,1mm) Qtz inclusions. Qtz: rare, inclusions in ky. Fine banded. Strong ky foliation. Texture-Mmgb.
- 02173 - LOVEDALE. Gt: 1mm, rare, contains ky inclusions. Cpx: 2-3mm, polygonal, not as severely altered as other ky eclogites. Ky: 1-2mm, laths, some penetrate cpx in subophitic textures. ky foliation. Massive. Texture-Cgb.
- 02213 - LOVEDALE. Gt: 2 large areas of sieve-like gt, 7 and 4 mm in size, gt encloses ky and the ky foliation penetrates through the gt. Cpx: 1-2mm, some up to 4mm, fresh cores, rest altered. Ky: tabular to squarish, less elongate than in 02153. Qtz: rare inclusions in ky. Massive. Strong ky foliation. Texture-Mmgb.
- 02333 - LOVEDALE. Gt: 5-1mm, polygonal. Cpx: slightly coarser than gt, tabular polygonal. Ky, Qtz: occur as intergrowths in bands up to 1mm wide, ky are elongate laths, 2-1mm long set in an aggregate of polygonal to tabular Qtz (<,5mm). Fine banded. Distinct foliation. Texture-Fmgb.
- 02403 - LOVEDALE. Gt: 1-2mm, 75% of each gt is converted to a fibrous brown kelyphyte. Cpx: 2mm, strongly polygonal, totally symplectised. Ky: Vary from 1mm inclusions in cpx to 1mm discrete, squarish plates. Massive. Texture-Mmgb.
- 02453 - LOVEDALE. Gt: 1-2mm, strongly kelyphytised as in 02403. polygonal. Cpx: 2mm, polygonal, totally symplectised. Ky: <1mm, stumpy. Qtz, K-spar: occur as tiny inclusions in ky. Massive. Weak ky foliation. Texture-Mmgb.
- 02463 - LOVEDALE. Gt: <1mm, polygonal to rounded. Cpx: 1-2mm, polygonal, symplectised. Ky, Qtz: intergrowths as in 02333. K-spar: trace, in the ky-Qtz intergrowths. Fine banded. Strong ky foliation. Texture-Mmgb.
- 02473 - LOVEDALE. Gt: <1mm, polygonal to squarish. Cpx: 5-2mm

- , polygonal to slightly tabular. Ky: rare, highly elongate laths 1mm long. Massive. Texture-Mmgb.
- 02503 - LOVEDALE. Gt: 1-3mm, rounded to polygonal. Cpx: 1-4mm, polygonal, severely symplectised. Ky: rare 1mm laths, embayed edges. Fine banded. Texture: Cmgb.
- 20373 - JACHTFONTEIN. Gt: <1mm, polygonal but severely kelyphytised. Cpx: <2mm, severely symplectised. Ky: fresh, laths up to 1mm long. Secondary: partial melt textures, plag, corundum(?). Massive. Weak foliation. Texture-Mmgb.
- 42123 - ROODEKRAAL. Gt: 1-2mm, strongly polygonal. Cpx: 2-4mm, large tabular polygonal grains. Ky: up to 2mm, associated with qtz. Qtz: inclusions in ky or intergranular to the other phases. Rutile: <, 2mm, inclusion in cpx, ky or as discrete grains. Coarse banding. Texture-Cgb.
- 42203 - ROODEKRAAL. Gt: 1-3mm, polygonal, numerous small (<, 2mm) qtz inclusions mostly at gt centers. Cpx: 2mm, severely symplectised, polygonal. Ky: <1mm, tabular. Rutile. Qtz: can occur as inclusions in gt or as highly irregular grains intergranular to the other phases. Coarse banded. Texture-Cgb.
- 42313 - ROODEKRAAL. Gt: 1mm, polygonal. Cpx: 2mm, totally symplectised. Ky, Qtz: associated in cpx-rich fine grained bands. Rutile: trace. Fine banded. Ky foliation. Texture-Fmgb.

D. GARNET GRANULITES.

- H5-1 - HEBRON. Gt: <2mm, idiomorphic, numerous rutile and occasional plag inclusions. Cpx: 1mm, anhedral grains slightly polygonal but mostly irregular, schillerised. Plag: totally altered to natrolite. Rutilr: discrete, 4mm, and as inclusions in silicates. Amph: rare, very dark brown pleochroic. Apatite: anhedral up to .5mm. Massive. Texture-Mgb.
- H5-2 - HEBRON. Gt: 1,5mm, squarish to irregular in shape but with straight edges especially where in contact with plag, contains inclusions of rutile, cpx, apatite, plag. Cpx: 1mm, strong green colour, slight schiller effect, polygonal to rounded anhedral. Plag: 1,5mm, relatively fresh, shows bent deformation twin lamellae. Rutile: <, 5mm. Amph: <1mm, relatively abundant, dark brown. Scapolite: Trace, <, 5mm. Apatite: <, 5mm, discrete or as inclusions in most silicate phases. Massive. Texture-Mgb.
- 06-1 - CORDAATSKUIL. Gt: small, <, 1mm, atoll gts with strongly idiomorphic straight edges, where gt is in contact with

secondary amphibole the gt has developed internal trails of bubbles that radiate into the gt from the point of contact. Cpx: 1,5mm but can be up to 4mm, slightly elongate. Plag: almost totally altered, <1mm, polygonal shapes still evident. Rutile: <, 2mm, rare granules. Massive. Secondary: rock is severely amphibolitised. Texture-Mg.

- 06-2 - CORDAATSKUIL. Gt: <1mm, idiomorphic where in contact with plag but squarish in cpx-rich parts, inclusions of cpx, apatite, opaque. Cpx: <2mm, deep green colour, slightly pleochroic, polygonal to elongate tabular grains. Plag: mostly altered to natrolite and calcite. Rutile: Rare. Amph: deep brown colour, can have inclusions of cpx and apatite. Apatite: <, 1mm, idiomorphic. Massive. Streaky foliation imparted by the alignment of elongate cpx. Texture-Mgb.
- 06043 - CORDAATSKUIL. Gt: 5mm, idiomorphic to irregular incomplete shapes, bubble trails as in 06-1, plag and gt often forms orbicular-like textures around cpx. Cpx: <1mm, strong green colour, mostly aggregates of polygonal to slightly tabular grains, cpx can be studded with small gt inclusions. Plag: <1mm, polygonal to slightly rounded grains, rare larger 2mm grains show bent deformation twin lamellae. Scapolite: <, 1mm, every scap has a rim of gt around it. Strong foliation imparted by elongation of mafic phases. Massive. Texture-Fgb.
- 07403 - HEBRON. Gt: coarse up to 5mm, squarish with straight edges, can have inclusions of cpx, rutile, plag, apatite, strong orange colour. Cpx: 2mm, green, irregular rounded, slight schiller effect, contains rutile needles. Plag: Coarse up to 4mm though seriate grain size distribution, polygonal to rounded shapes, development of patch micro-antiperthite. Scapolite: up to 9mm, very fresh, can have rutile inclusion needles. Rutile: discrete <, 4mm anhedral or as needle inclusions in gt, cpx, scap, apatite. Apatite: <, 2mm, subidiomorphic, can occur as inclusions in gt, cpx, plag. Amph: rare, <1mm, deep brown pleochroic. Opaque: ilmenite. K-spar: only as blebs in plag. Secondary: phlogopite. Massive. Texture-Cg.
- 07413 - HEBRON. Similar to 07403, except that plag is not antiperthitic.
- 09133 - UINTJIESBERG. Gt: <, 5mm, idiomorphic, studded with inclusions of apatite, rutile, cpx, strong orange colour. Cpx: av. 1,5mm, seriate grain size distribution, anhedral rounded to more polygonal grain shapes. Plag: 2,5mm, relatively fresh, interlocking grains with gently curving grain boundaries. Scapolite: minor. Rutile: <, 8mm. Apatite: <2mm. Amph: <, 4mm, minor. Opaque. Massive. Texture-Cg.
- 09153 - UINTJIESBERG. Gt: coarse up to 8mm, rounded to idiomorphic,

inclusions of rutile needles, cpx, apatite, orange colour. Cpx: 1-2mm, green. Plag: 1-3mm, polygonal. Rutile: discrete anhedral or needle inclusions in silicates. Apatite: , 3mm. Amph: large, up to 4mm, strongly tabular. Opaque. Secondary biotite. Massive. Texture-Cgb.

- 11-1 - KALKPUT. Gt: occurs as idio- to subidiomorphic grains arranged in atoll-like aggregates up to 3mm in size. Cpx: <2mm, polygonal to tabular rounded; strong deep green to green-brown pleochroic. Plag: <2mm, polygonal, rock is plag rich. Rutile: minor. Apatite: minor, tiny <, 1mm. Opaque: ilmenite occur as scattered anhedral <, 2mm. Coarse banding weak. Weak foliation imparted by tabular cpx. Texture-Mgb.
- 12133 - MARKT. Gt: , 2-1, 5mm, squarish grains, can be studded with cpx and irregularly shaped plag inclusions. Cpx: 1, 5mm, pale green, polygonal to irregular shapes, cpx altered to symplectite because of its high Na content (>4 wt %). Plag: 1mm, polygonal, moderately altered. Rutile: minor <, 2mm. Coarse banding weak. Texture-Mgb.
- 25023 - WINDHOEK SOUTH. Gt: 1, 5mm, polygonal to rounded, cpx inclusions are common. Cpx: 1-2mm, tabular polygonal, green, fresh. Plag: seriate up to 3mm, smaller 1mm grains are highly polygonal, slightly altered. Rutile: trace. Coarse and fine banding. Moderate foliation. Texture-Mgb.
- 30-1 - GOEDEHOOP-GH I. Gt: 1mm, highly polygonal, pale orange. Cpx: 1mm, more equigranular than gt, green, polygonal tabular. Plag: 1, 5mm, polygonal. Weak foliation. Texture-Mgb.
- 33013 - LEKKERFONTEIN. Gt: <1mm, idiomorphic, straight edges. Cpx: 1mm, slightly tabular. Plag: 1mm, polygonal, badly altered. Rutile: trace <, 2mm. Opaque: minor. Fine banding weak. Texture-Fgb.
- 33023 - LEKKERFONTEIN. Gt: reaction gt forming at opx-plag contacts, reaction band width about , 3mm, highly angular gt growth forms. Cpx: 1mm, deep green, polygonal to irregular. Plag: seriate grain size distribution, up to 1, 5mm , most plag show deformation twin lamellae consisting of albite and pericline twin combinations. Apatite: trace. Amph: abundant, deep brown to dark green pleochroic, tabular, up to 3mm. Opx: , 2-, 4mm relicts after reaction with plag to form gt. Coarse banded. Foliation from the alignment of tabular amphibole. Texture-Mgb.
- 42303 - ROODEKRAAL. Gt: highly irregular shaped gt clots up to 3mm in size, angular shapes, abundant inclusions of qtz in gt, minor amounts of cpx and plag as inclusions in gt. Cpx: in plag-poor band cpx is 1-2mm, in plag-rich

band cpx is <1mm, green, strongly polygonal. Plag: in plag-rich band 1,5mm and strongly polygonal, in gt and cpx-rich band plag can be as small as ,1mm. Rutile: trace, ,2mm. Qtz: restricted to gt and cpx-rich band, occurs as inclusions in gt as well as intergranular to gt and cpx, can be up to 1mm, inclusions of qtz are <,3mm. Coarse banded. Texture-Mgb.

KYANITE GARNET GRANULITES.

- 02223 - LOVEDALE. Gt: seriate, <2mm, av. mm, highly polygonal especially in plag-rich areas, in plag-poor areas ky-gt intergrowths occur, gts in plag-rich areas are clear and inclusion-free. Cpx: ,1-1mm, highly polygonal shapes, reaction intergrowths at gt-plag contacts forms a second type of cpx that is intergrown with acicular to tabular ky. Plag: <1mm, polygonal. Ky: occurs either discrete or intergrown with cpx at plag-gt contacts. Coarse banding weak. Ky foliation. Texture-Fgb.
- 02243 - LOVEDALE. Identical to 02223 but more mosaic granuloblastic. Foliation stronger. Texture-Mmgb.
- 02263 - LOVEDALE. Identical to 02243, the reaction textures are beautifully shown. Also scapolite. Texture-Fmgb.
- 02273 - LOVEDALE. Similar to 02223. Texture-Mmgb.
- 02323 - LOVEDALE. Similar to 02263. Ky tend to more discrete and some gt-ky intergrowths are also seen. Texture-Fmgb.
- 02343 - LOVEDALE. Gt: <1mm, polygonal. Cpx: 1-2mm, polygonal to irregular. Plag: 1-2mm, polygonal to squarish, relatively fresh. Ky: tiny <,5mm laths at gt-plag contacts. Massive. Texture-Mgb.
- 02363 - LOVEDALE. This rock looks more like a kyanite eclogite than the above described granulites, it has been classified as a granulite because there occur large 2mm sized grains now made up of an aggregate of anorthite. Gt: rare, <1mm. Cpx: 2mm, badly symplectised. Amph: large plates mm intergranular and sometimes poikilitic to the cpx. Anorthite aggregates may have been primary scapolite or plag. Ky: stubby to elongate laths. Massive. Texture-Cgb.
- 02493 - LOVEDALE. Similar to 02323.
- 04-1 - VETLAAGTE. Coarse banded rock: gt-rich and gt-free. Gt-rich band: gt are strongly idiomorphic, up to 2mm, riddled with inclusions of elongate ky, irregular plag and scapolite, occasionally have cpx cores. Cpx

are small <,5mm ,polygonal grains and can be intergrown with ky. Plag:1mm, tabular polygonal, strongly altered. Rutile:rare. Scapolite:1mm. Opx:rare as cores to cpx-ky intergrowths. Gt-free band:Cpx:2 types, Al-rich discrete tabular polygonal grains or more commonly as Al-poor cpx-ky intergrowths at Al-rich cpx or opx-plag contacts. Plag: less abundant, badly altered. Opx: large pale pink pleochroic grains always found to be rimmed by a cpx-ky intergrowth. Scapolite:rare. Texture-Fgb.

12133A - MARKT. Gt:av. 1,5mm, up to 3mm, can have inclusions of cpx, plag. Cpx:<1mm, polygonal discrete or the reaction type where the cpx is Al-poor and intergrown with Qtz and ky. Plag: up to 2mm, shows breakdown textures and the formation of Qtz-ky-cpx in graphic to acicular intergrowth patches at the expense of plag. Ky: tabular to acicular associated with plag breakdown. Qtz: polygonal. Rutile: minor. Coarse banded. Texture-Mgb.

APPENDIX 3: ANALYTICAL TECHNIQUES.

Whole rock major and trace element compositions were determined using X-ray fluorescence (XRF) and gas chromatography (GC) techniques. Mineral analyses were performed on an electron microprobe (EMP). All analytical data were determined in the laboratories of the Dept. of Geochemistry, UCT.

The operating conditions and data reduction processes applicable to XRF analysis at UCT were outlined by Willis et. al. (1971, 1972). Since then new equipment has been acquired and analysis runstreams upgraded. The most recent summary of these operating conditions is that of Bristow (1980).

A) SAMPLE PREPARATION..

Samples to be analysed for major and trace element contents were first split and coarse crushed in two jaw crushers. The material was then powdered to <120 mesh in an agate SIEB mill. Finally, aliquots of this powder were fine-ground to ~300 mesh in automatic agate mortars.

B) MAJOR ELEMENTS.

Major elements with the exception of Na were analysed on duplicate lithium tetraborate fusion discs following the method of Norrish and Hutton (1969). Na was determined on the pressed powder briquettes prepared for trace element analysis.

The major elements were analysed on a Siemens SRS-1 spectrometer. Operating conditions and data precision statistics are given in Table 3A. All Fe was determined as FE203.

H₂O- and LOI were determined by volatile loss at 110 and 1000°C respectively. For the kimberlites, H₂O+ and CO₂ were analysed separately using GC (utilising the Hewlett Packard 185B C-N-H analyser and 3380A integrator system).

C) TRACE ELEMENTS.

All trace elements were determined on pressed powder briquettes. Zn, Cu and Ni were analysed on a Phillips PW1220 spectrometer. The rest were run on the Siemens spectrometer. Mass absorptions were either determined at the Rb wavelength by measurement of the Compton peak or were calculated from the major element data using Heinrich's values. Operating conditions and data precision statistics are given in Table 3B. Raw data were reduced using routine computational techniques devised mainly by Prof. A. Duncan and Dr. J. Willis of the Dept. of Geochemistry.

D) MINERAL ANALYSIS.

Minerals were analysed on doubly polished and carbon-coated thin sections, using EMP techniques. The microprobe used is a Cambridge Microscan 5 model that is linked on-line to a Varian 620L-100 mini-computer where data are corrected for matrix effects using the method of Bence and Albee (1968).

The microprobe operating conditions used were:

EHT-----15kV

Beam current-----1500nA

Dectectors-----Flow counters with a 97.5% Argon /
2.5% CO2 gas mixture

Analysing

crystals-----Quartz : Fe,Mn,Ca,Ti,Cr,K

RAP : Si,Al,Mg,Na

Beam focus-----Fine 5 micronon

Coarse 10 micron

Samples were run against the following natural and synthetic standards :Kakanui pyrope, Kakanui hornblende , Marjalahti olivine, Stillwater chromite, synthetic diopside, rutile and anorthite. The compositions of these standards are tabulated by Lawless (1974).

For most minerals a fine-focused beam was used. The beam had however to be defocused when analysing feldspars, glass, micas and other hydrous secondary minerals. For the silicates all Fe is quoted as FeO. Ferric iron in spinels and ilmenites was calculated assuming stoichiometry and using a computer subroutine written by Dr. A. le Roex.

Estimates of the precision of EMP data are given in Table 3C.

TABLE 3A: XRF OPERATING CONDITIONS FOR MAJOR ELEMENTS AND DATA PRECISION STATISTICS (FROM BRISTOW, 1980).

| | FE | MN | TI | CA | K | P | AL | MG | NA |
|------------|--------------|--------|---------------|-----------|--------|-------------|---------|-----------|-----|
| TUBE | W..... | | CR..... | | | | | | |
| KV | 60..... | | 50..... | | | | | | |
| mA | 50..... | | | | | | | | |
| COUNTER | FLOW..... | | | | | | | | |
| COLLIMATOR | FINE..... | | COARSE | FINE..... | | COARSE..... | | FINE..... | |
| CRYSTAL | LiF(220).... | | LiF(200)..... | | | GE...PET... | | TLAP..... | |
| COUNTING | | | | | | | | | |
| TIME ON | | | | | | | | | |
| PEAK(SEC) | 10.... | 40.... | 10..... | 10.... | 20.... | 100.. | 100.... | 200.... | 200 |

| OXIDE | WT.% | PRECISION | ACCURACY | DETECTION LIMIT |
|-------|------|-----------|----------|-----------------|
| FE2O3 | 9.0 | .038 | .064 | .014 |
| MNO | .15 | .008 | .003 | .008 |
| TIO2 | 1.0 | .008 | .008 | .005 |
| CAO | 12.0 | .028 | .030 | .008 |
| K2O | .20 | .002 | .022 | .002 |
| P2O5 | .20 | .012 | .018 | .011 |
| SI02 | 50.0 | .140 | .264 | .036 |
| AL2O3 | 15.0 | .080 | .079 | .022 |
| MGO | 8.0 | .148 | .086 | .072 |
| NA2O | 2.5 | .032 | .067 | .080 |

PRECISION IS GIVEN AS AN ABSOLUTE ERROR(2σ) ON THE GIVEN OXIDE WT.%.

TABLE 3B: XRF OPERATING CONDITIONS FOR TRACE
ELEMENTS AND DATA PRECISION STATISTICS
(BRISTOW, 1980).

| | | | | | | | | | | | | | |
|--------------------------------|-------------------|--------|----|--------|----|-----------------------------|------------|---------|----|-----------|--------|----|---|
| | SR | RB | ZR | Y | NB | BA | SC | ZN | CU | NI | CO | CR | V |
| TUBE | MO..... | W..... | | | | CR..... | | AU..... | | | W..... | | |
| KV | 60..... | | | | | 50..... | | 60..... | | | | | |
| MA | 50..... | | | | | | | | | | | | |
| COUNTER | SCINTILLATION.... | | | FLOW.. | | | SCINT..... | | | FLOW..... | | | |
| COLLIMATOR | FINE..... | | | | | | | | | | | | |
| CRYSTAL | LiF(220)..... | | | | | | | | | | | | |
| COUNT TIME ON PEAK (SEC) | 2x200..... | | | | | 2x100..... | | | | | | | |
| VACUUM | NO..... | | | | | YES..... | | | | | | | |
| M.A.C | RB(MEASURED) | | | | | CALCULATED FROM MAJORS..... | | | | | | | |

| ELEMENT | RANGE PPM. | ERROR | DETECTION LIMIT |
|---------|------------|---------|-----------------|
| ZR | 40-100 | .9-1.4 | 1.4 |
| NB | 4-150 | 1.0-1.2 | 1.8 |
| Y | 20-40 | .8-1.0 | 1.3 |
| RB | 2.5-90 | .8-1.1 | 1.5 |
| BA | 10-800 | 2.1-6.0 | 3.7 |
| SR | 80-800 | 1.0-1.7 | 1.5 |
| CO | 18-100 | 1.9-2.5 | 4.5 |
| CR | 25-350 | 1.5-2.1 | 2.2 |
| NI | 10-208 | 2.5-3.7 | 4.0 |
| V | 50-350 | 2.4-3.7 | 5.5 |
| ZR | 8-150 | .9-1.7 | 1.4 |
| CU | 5-90 | 1.8-2.1 | 2.9 |
| SC | 25-40 | 1.0-1.2 | 1.2 |
| GA | 15-20 | .38-.46 | .45 |

ABSOLUTE ERROR AND DETECTION LIMITS ARE
GIVEN AT 2σ AND 3σ RESPECTIVELY.

TABLE 3C: PRECISION STATISTICS FOR MICROPROBE DATA.

| OXIDE | AV. | SD. | ERROR | DETECTION LIMIT |
|--------|-------|-----|-------|-----------------|
| SI02 | 41.97 | .08 | .08 | .06 |
| TIO2 | 3.92 | .08 | .10 | .07 |
| AL2O3 | 13.51 | .06 | .06 | .04 |
| FE0 | 6.82 | .15 | .16 | .10 |
| MGO | 16.34 | .07 | .10 | .05 |
| CAO | 12.10 | .07 | .08 | .05 |
| NA2O | 2.71 | .12 | .14 | .09 |
| K2O | 1.18 | .06 | .10 | .07 |
| CR2O3* | .78 | .02 | .02 | .03 |
| MNO* | .26 | .01 | .01 | .03 |

DATA IN WT.%. ALL VALUES OTHER THAN CR2O3 AND MNO ARE FROM REID(1977)-- AVERAGE IS OF 12 REPLICATE ANALYSES ON THE SAME SPOT IN A PARAGASITIC HORNBLLENDE.

CR2O3 AND MNO ARE DATA FOR 12 ANALYSES OF A GARNET MEGACRYST (SHEE, 1978).

ABSOLUTE ERROR AND DETECTION LIMITS ARE GIVEN AT 2 σ AND 3 σ RESPECTIVELY.

APPENDIX 4: PYROXENE ENDMEMBER CALCULATION

The method used to calculate pyroxene endmembers is as proposed by Hatton (1978, pages 9-11).

Using atomic proportions calculated for 6 oxygens in the pyroxene formula, this method is as follows:

$$A) \quad \text{Tsch} = 2 - (\text{Si} + \text{Ti})$$

$$\text{Jad} = (\text{Al} + \text{Cr}) - (2 \text{ Tsch})$$

$$\text{Acm} = (\text{Na} + \text{K}) - \text{Jad} \quad (\text{if Acm is negative, see B})$$

$$\text{Wo} = \frac{\text{Ca} - \text{Tsch}}{2}$$

$$\text{Ens} = \frac{\text{Mg}}{2}$$

$$\text{Fs} = \frac{\text{Fe}}{2}$$

B) if Acm is negative, then:

$$\text{Pseudojad} = - (\text{Acm})$$

$$\text{Jad} = \text{Jad} - \text{pseudojad}$$

(i.e. only one of acmite or pseudojadeite is calculated)

| <u>Abbreviations</u> | <u>Endmember</u> | <u>Formula</u> |
|----------------------|--------------------|---|
| Tsch | calcium tschermaks | $\text{CaAl}_2\text{SiO}_6$ |
| Jad | jadeite | $\text{NaAlSi}_2\text{O}_6$ |
| Acm | acmite | $\text{NaFe}^{3+}\text{Si}_2\text{O}_6$ |
| Wo | wollastonite | $\text{Ca}_2\text{Si}_2\text{O}_6$ |
| Ens | enstatite | $\text{Mg}_2\text{Si}_2\text{O}_6$ |
| Fs | ferrosilite | $\text{Fe}_2^{2+}\text{Si}_2\text{O}_6$ |
| Pseudojad | pseudojadeite | $\text{Ca}_{.5}\text{AlSi}_2\text{O}_6$ |

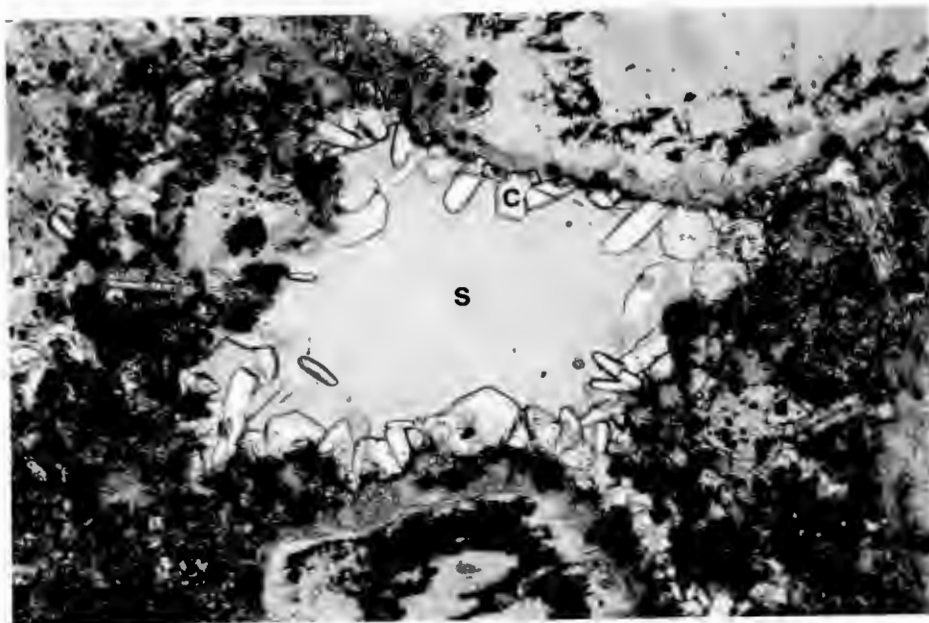
APPENDIX 5: PLATES

The photographs were taken on 35 mm film using a Nikon Multiphot system and Nikon F2 camera. The line scale, unless otherwise stated, is 2 mm. I acknowledge and thank Dr. J. MacPherson for technical advice and Mr. C. Basson for printing all the plates.

PLATE II-1.

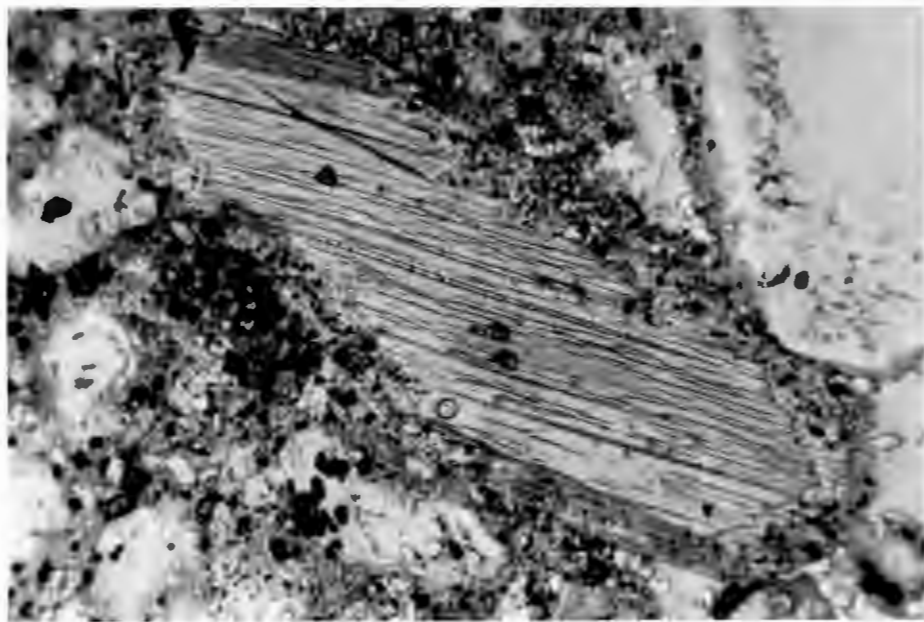


II-1A: Calcite-serpentine-phlogopite segregation in calcite kimberlite 10012. Serpentine (S) is pale yellow and primary interstitial to calcite (C). Field of view (FOV) = 1 mm.

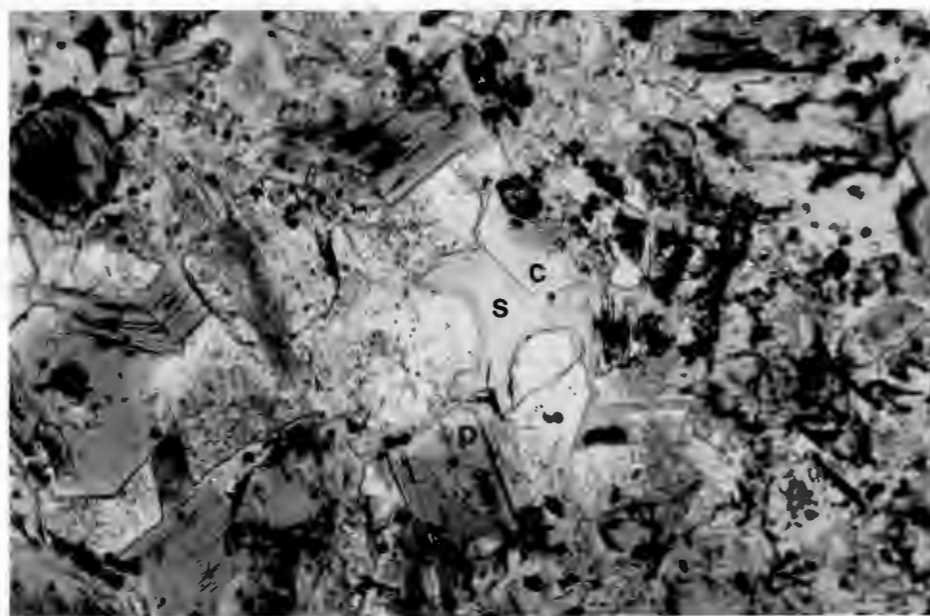


II-1B: Calcite-serpentine segregation in calcite kimberlite 09012. FOV = 1 mm.

PLATE II-2.

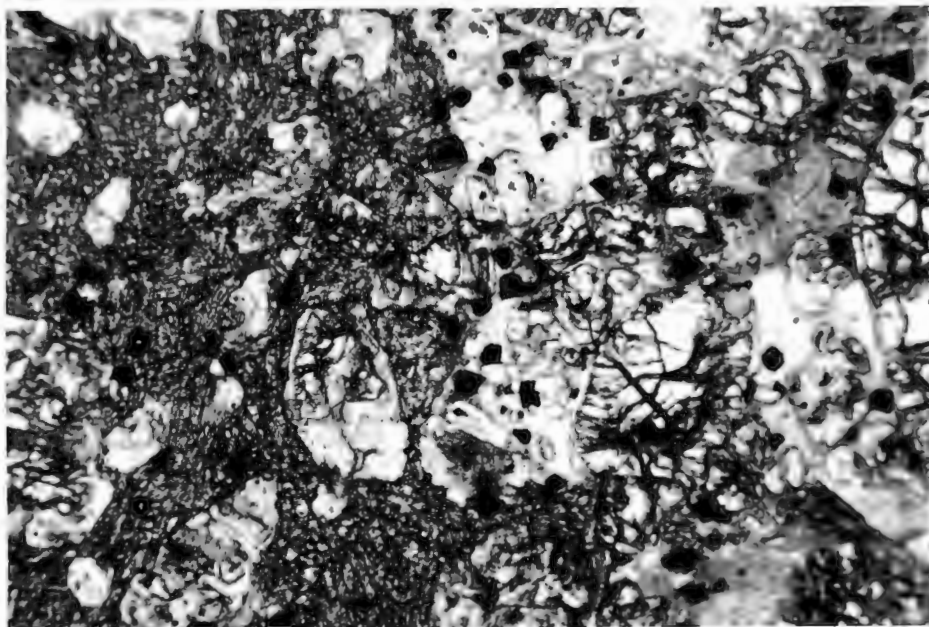


II-2A: Phlogopite macrocryst in calcite kimberlite O9012. Note that top and bottom edges are slightly more red-brown pleochroic than center. Also edges being partly replaced by calcite and opaque dustings. FOV = 2 mm.

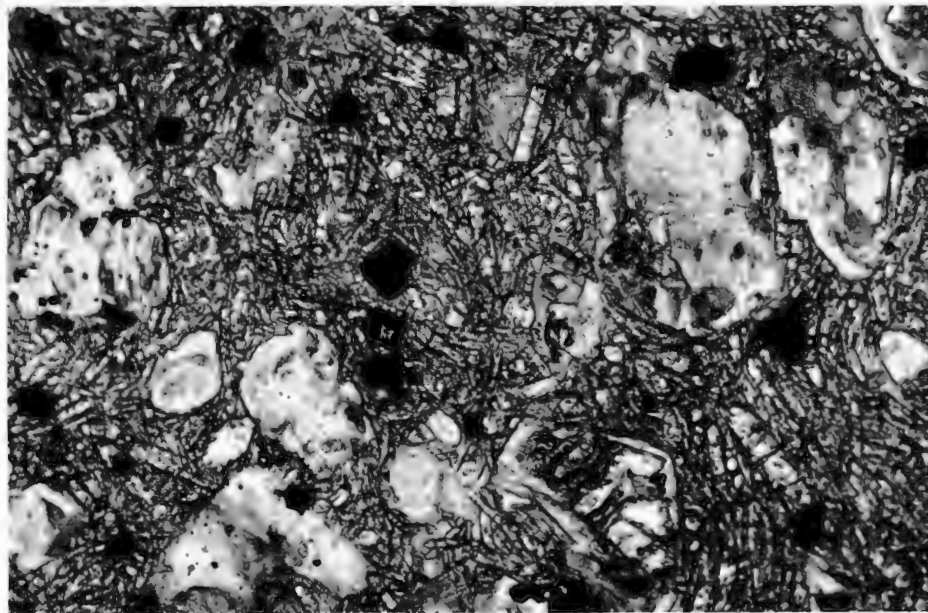


II-2B: Phlogopite (P), calcite (C) and serpentine (S) in phlogopite kimberlite O8022. Note how phlogopite cleavages are wedged open by calcite as well as the primary interstitial nature of the serpentine. FOV = 1 mm.

PLATE II-3.



II-3A: Contact between the diopside kimberlite (left) and phlogopite kimberlite (right) in sample 21012. Olivines are subhedral and serpentinised. Diopsides are high relief grains with elongate forms. Small dark euhedra are perovskite. FOV = 2,5 mm.



II-3B: Detail of diopside in 21012. Note the interstitial phlogopite as well as the strong tabular habit of the diopside. Some diopsides appear to be pitted. FOV = 1 mm.

PLATE IV-1.

IV-1A: General view of the Hebron coarse garnet lherzolite 07163.

OL - olivine, OP - orthopyroxene,

C - clinopyroxene, G - garnet.

IV-1C: Kink banding in olivine of 07163.

IV-1E: Primary metasomatic replacement of gt (G) by amph (A) in garnet lherzolite 07073.

IV-1G: Total replacement of primary cpx by a pool of secondary cpx (C) + phlogopite (P) + chromite (black) - this in lherzolite 07063.

IV-1B: General view of coarse garnet lherzolite 07073.

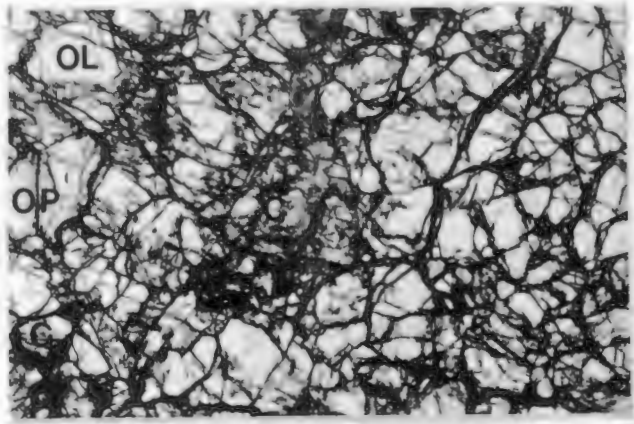
IV-1D: Symplectite of gt (G), amphibole (A) and Cr-spinel (black) formed around cpx (C) in garnet lherzolite 07173.

IV-1F: Primary metasomatic amph (A) around gt (G) in garnet lherzolite 07183.

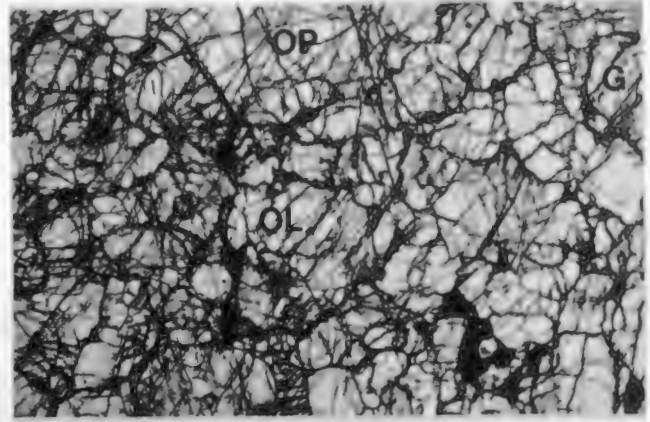
IV-1H: The replacement process seen in Pl. IV-1G at its initiation. Ca - primary cpx, Cb - secondary cpx, P - phlogopite.

PLATE IV-1

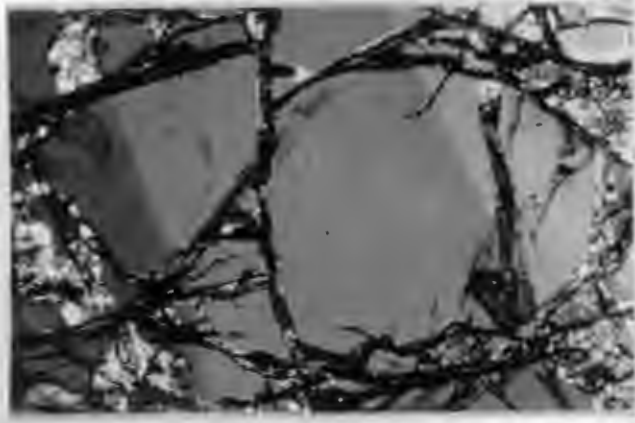
A



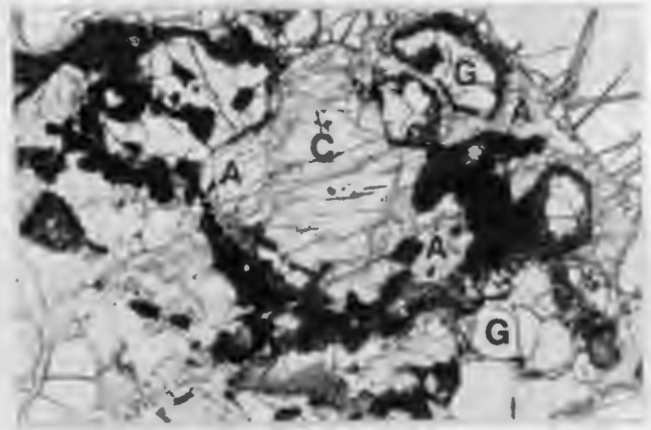
B



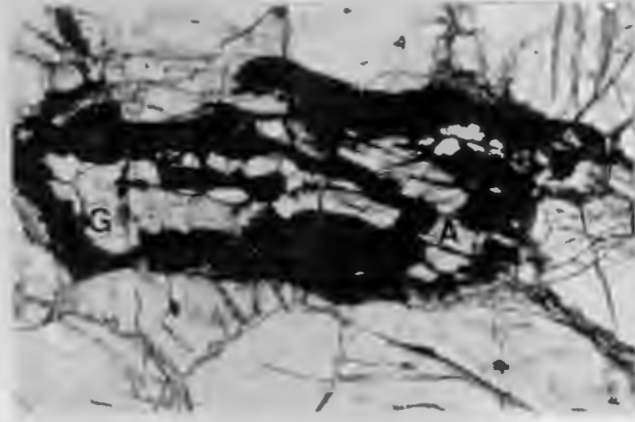
C



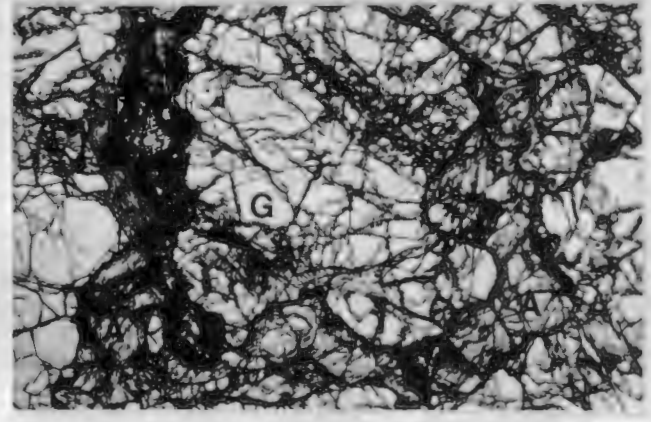
D



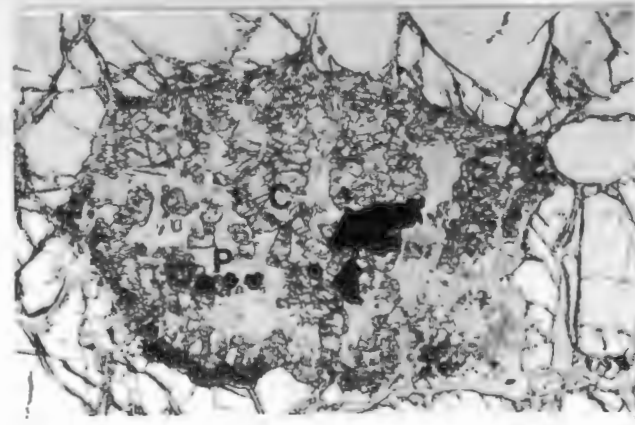
E



F



G



H

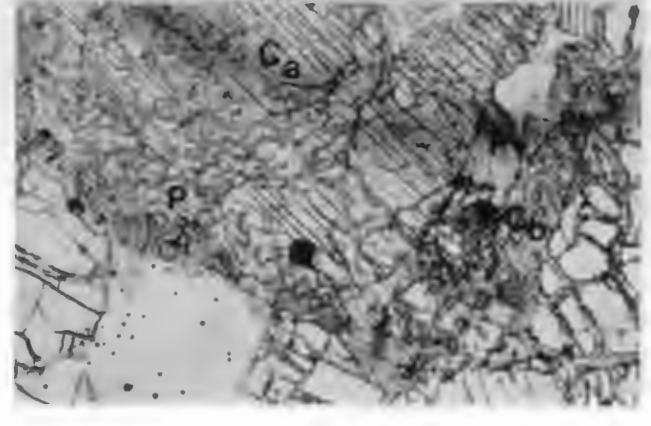


PLATE IV-2.

IV-2A: Olivine porphyroclast (P) and neoblasts (N) in porphyroclastic lherzolite 07103.

IV-2C: Primary clinopyroxene (O) being replaced by orthopyroxene (C) in 07103.

IV-2E: As in Pl. IV-2C. Here the primary cpx (O) is relatively ragged and the replacement rim of opx (C) is large, recrystallised and contains phlogopite and opaques.

IV-2G: Primary metasomatic phlogopite in the neoblastic matrix of 07103.

IV-2B: Orthopyroxene porphyroclast (P) and neoblasts (N) in 07103.

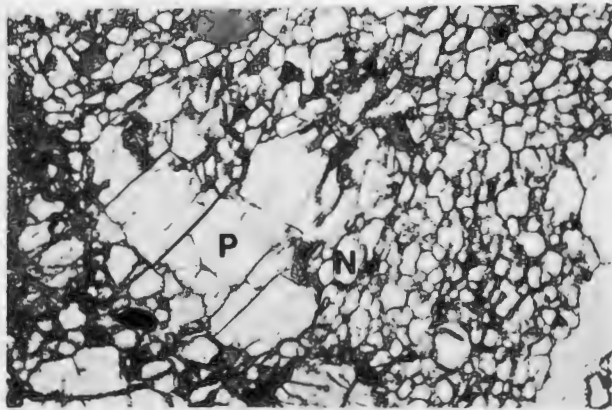
IV-2D: As in Pl. IV-2C.

IV-2F: The area in Pl. IV-2E shown under X-nicols.

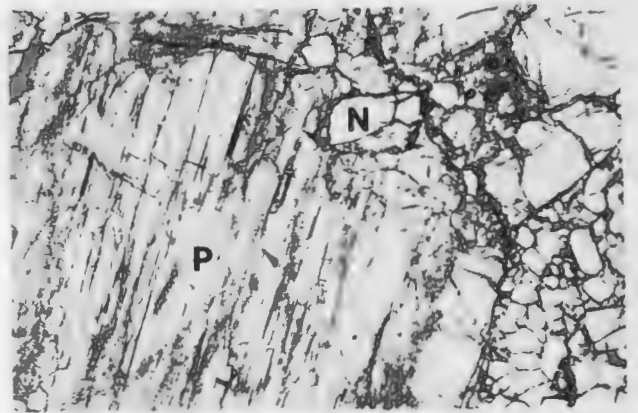
IV-2H: Recrystallised olivine + ilmenite xenolith fragment (07123) from Hebron.

PLATE IV -2

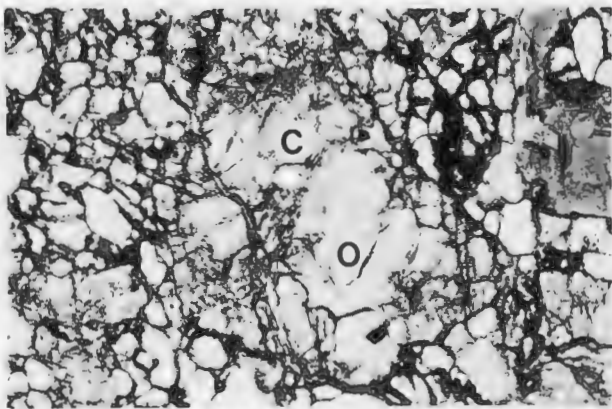
A



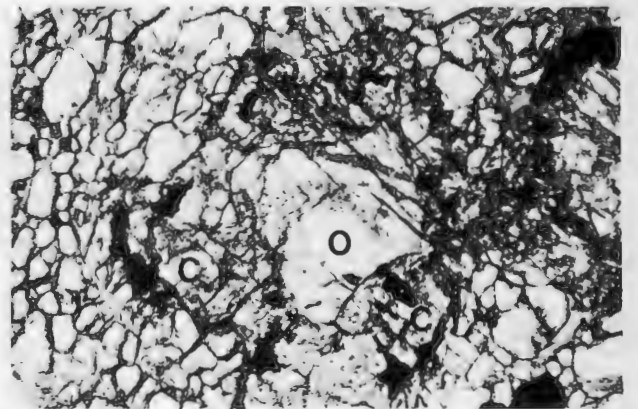
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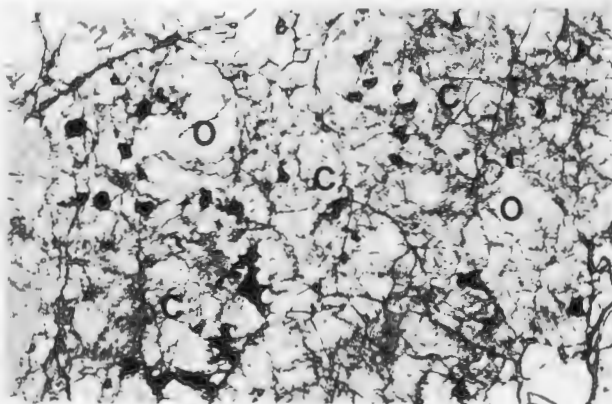
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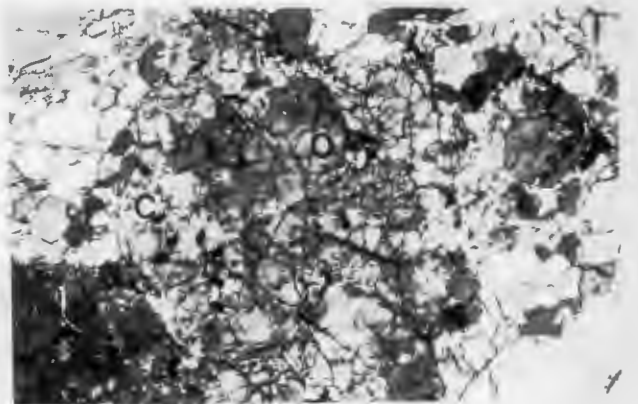
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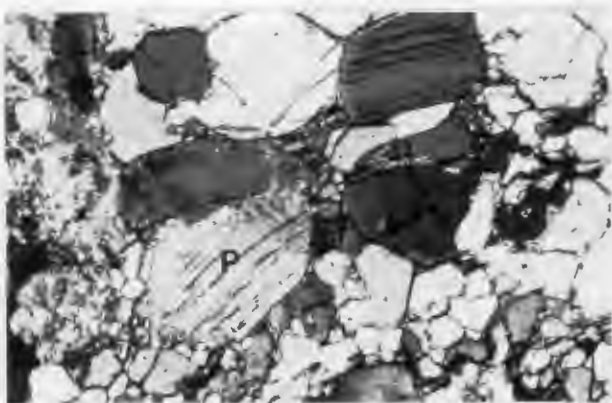
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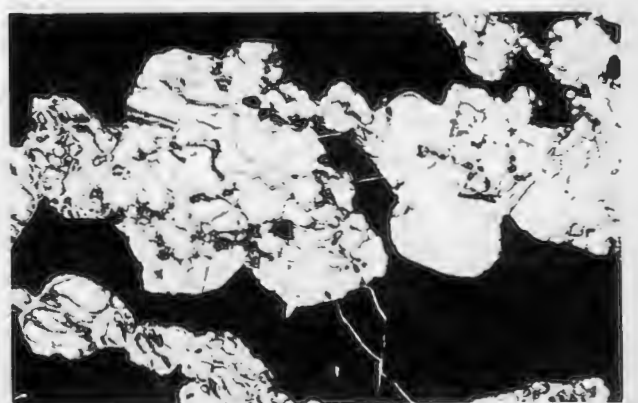
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PLATE IV-3.

IV-3A: MARID suite xenolith
07303. O - opx, P - phlogopite,
Cr-spinel is black.

IV-3B: General view of Melton Wold
garnet lherzolite 08063. Large
gt in upper right. Relict opx set
in a mass of serpentine.

IV-3C: Primary cpx (C) with
secondary spongy outer rims similar
to that described by Carswell
(1975).

IV-3D: Harzburgite 09053.
Areas of phlogopite (P) + Cr-spinel
(black) intergrowth that may have
formed from original gt.

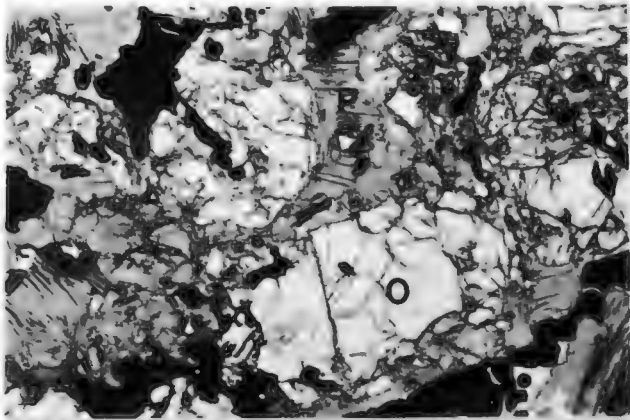
IV-3E: Simplectite amph + Cr-spinel
intergrowths in harzburgite 09053,
to lower right of olivine (OL).

IV-3F: Spinel pyroxenite 12143
showing gt reaction bands
separating spinel from clinopyroxene.

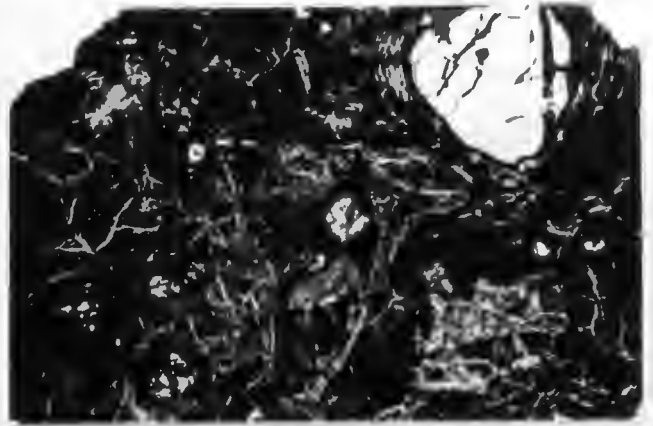
IV-3G: Gt reaction and
exsolution textures in spinel
gt pyroxenite 05023. Note the
large primary spinels (S).

PLATE IV-3

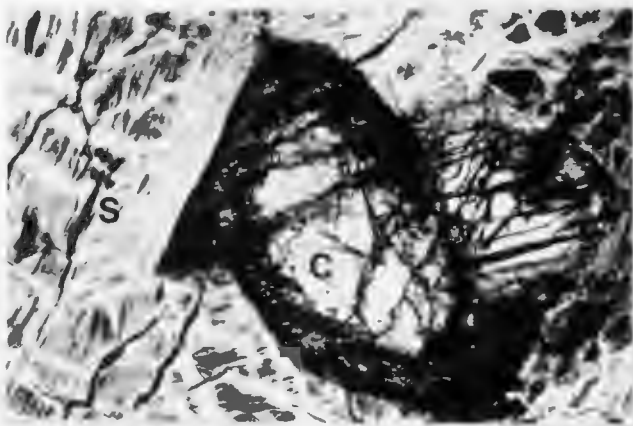
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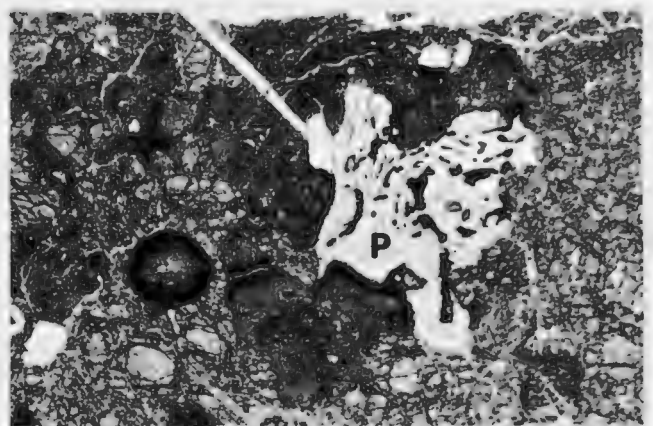
B



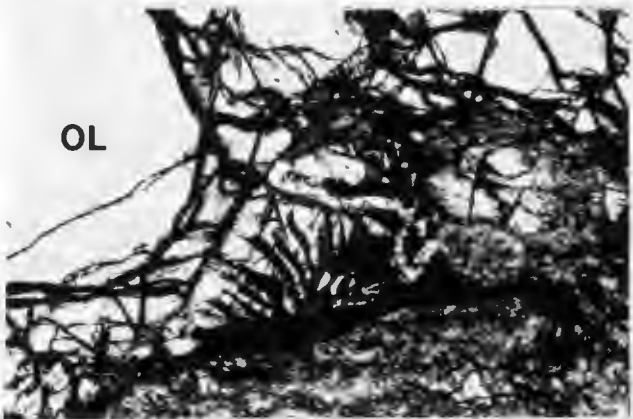
C



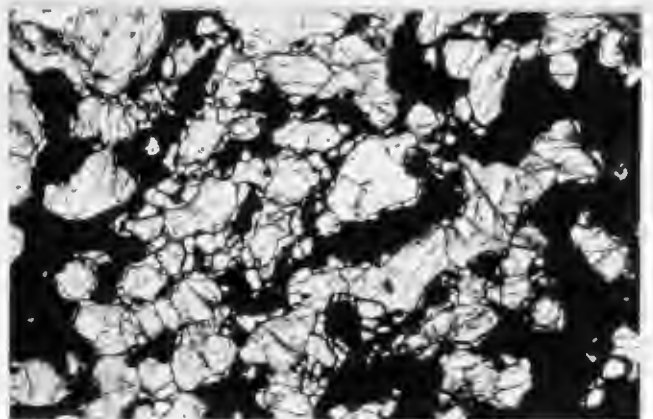
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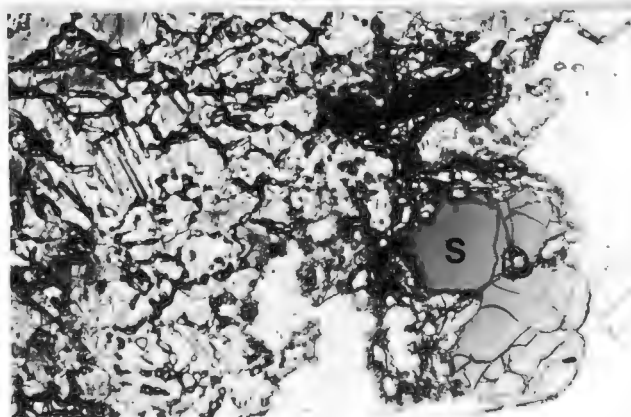


PLATE V-1.

V-1A: Grain boundary configuration of the coarse granular texture. Example is eclogite O2123. Garnet (GT), clinopyroxene (CPX).

V-1C: Grain boundary configurations of the mosaic granuloblastic texture. Example is eclogite O2093.

V-1E: Fine-scale banding in kyanite garnet granulite O2323. White areas are plag; elongate laths are ky; rest are cpx and gt. Note ky foliation is parallel to cpx banding.

V-1G: Cpx exsolution (white flashes) concentrated on either side of kink bands in opx of the 2 pyroxene granulite 42523. The large opx also has a thin continuous rim of cpx believed to be of an exsolution origin. White plag shows albite twinning.

V-1B: Grain boundary configurations of the granuloblastic texture. Example is eclogite O2-2.

V-1D: Garnet pyroxenite 12123. Large, strained cpx megacryst with exsolved gt lamella (center). Matrix is fine-grained recrystallised gt and cpx in a mosaic granuloblastic texture. Other relict cpx megacrysts can also be seen.

V-1F: Detail of sub-parallel ky laths in a plag-rich band of kyanite garnet granulite O2493. Gts have thin black rims and higher relief than cpx.

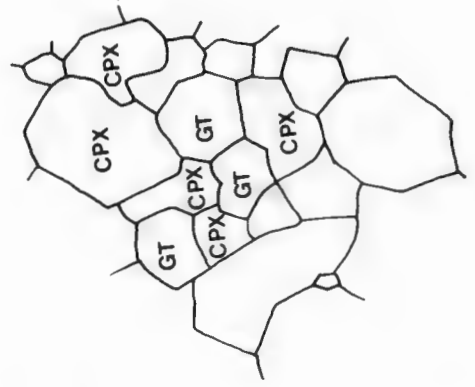
V-1H: Gt exsolved from cpx in pyroxenite O5023 forms a beautiful necklace texture. Fine scale spinel exsolution tablets occur with the cpx. The cpx is slightly schillerised.

PLATE V-1

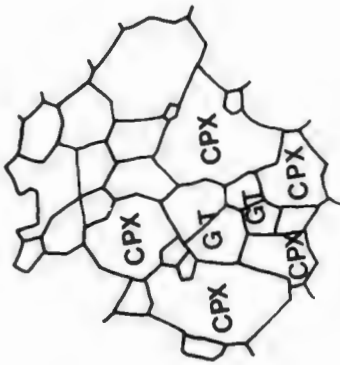
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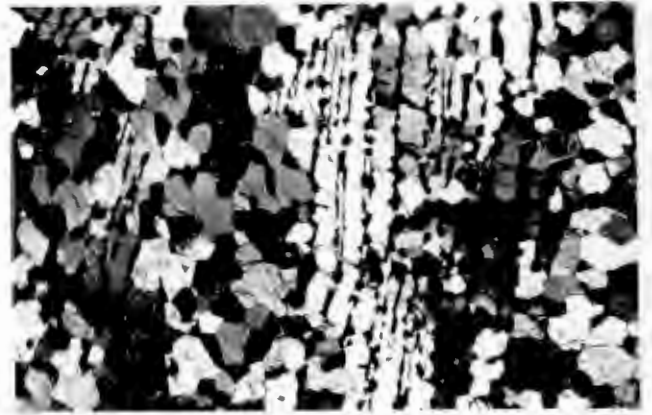
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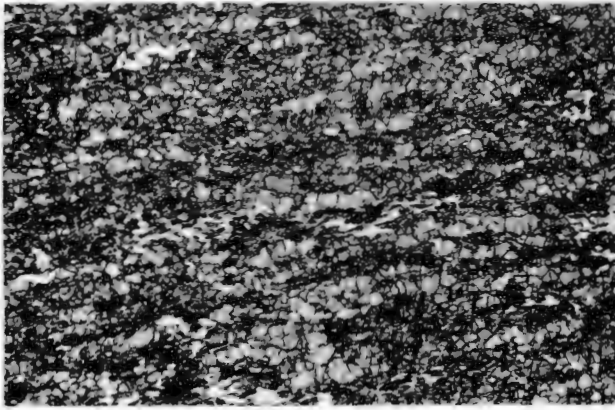
C



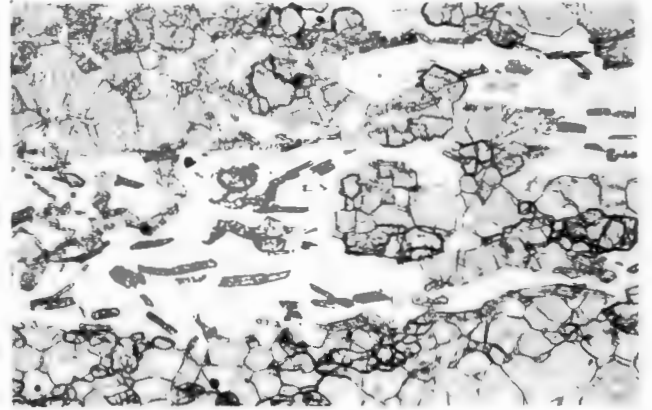
D



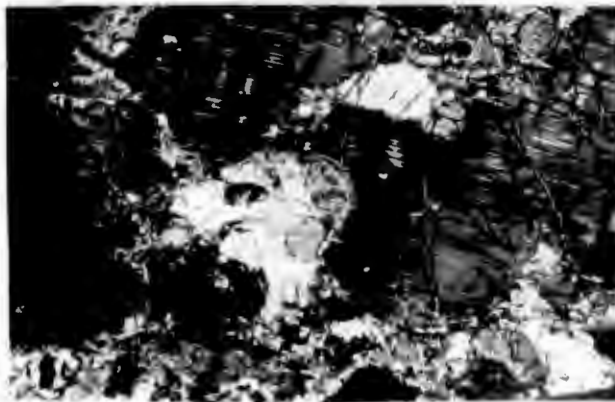
E



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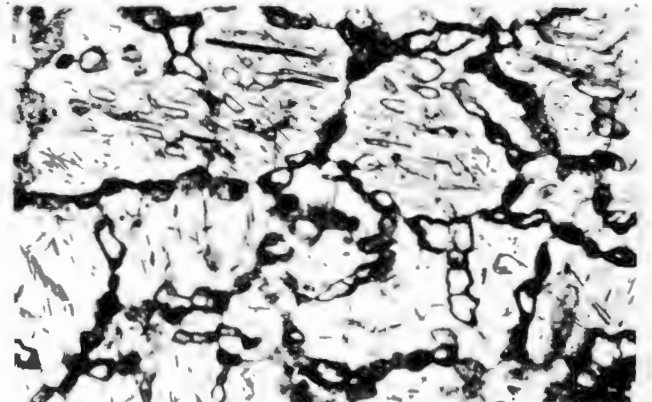


PLATE V-2.

V-2A: Spinel exsolution concentrated within opx of garnet pyroxenite PG-1. Anhedral spinel at grain triple junctions may also be of an exsolved origin.

V-2C: Coronite texture in a granulite xenolith from Matsoku. Photograph supplied by P.M. Jackson. Opx (center) reacts with plag (top and bottom right). At the opx-plag contact, a product assemblage of gt (outer), qtz (white) and cpx (inner) is formed.

V-2E: Relict opx in eclogite O2123. The opx has a highly irregular shape and is altered. Surrounding grains are gt (dark grey) and cpx (light grey to white).

V-2G: Drawing of reaction textures seen in kyanite garnet granulite O4-1. Al-rich opx or cpx is separated from matrix plag by corona-like intergrowths of cpx + ky (black). The reaction cpx has a higher Jad/Tsch ratio than the primary cpx.

V-2B: Rutile needles in gt of eclogite O9123. The rutile needles are arranged in triangular patterns. The highly schillerised cpx (left) is also probably due to minute rutile. Apatites are tiny high relief inclusions in cpx (lower left) and gt.

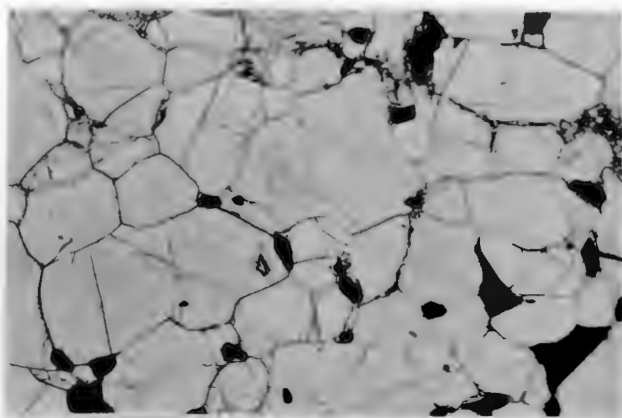
V-2D: The opx-plag reaction texture seen in the anorthosite xenolith 33023. All the black area is gt.

V-2F: Myriads of tiny qtz inclusions in gts (black) of garnet granulite 42303. Cpx and plag (twinned) occur with gt.

V-2H: Photo of the reaction textures in O4-1. The large roundish grains are primary cpx. Elongate ky is set in reaction cpx. The plag matrix is largely altered to natrolite.

PLATE V-2

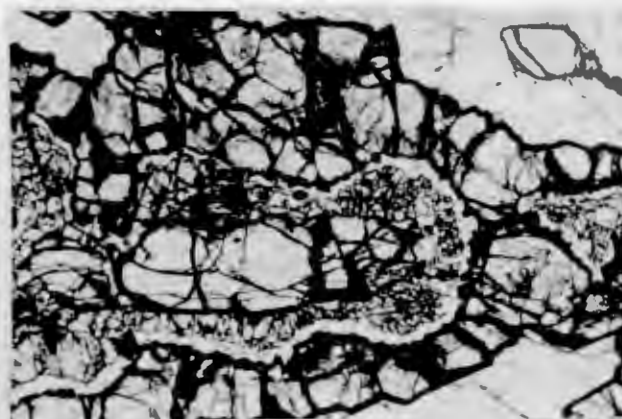
A



B



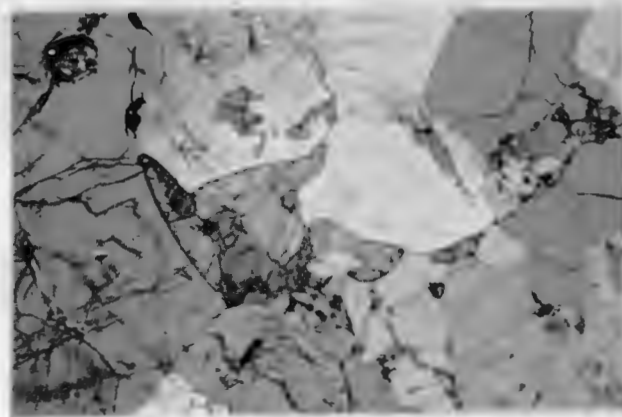
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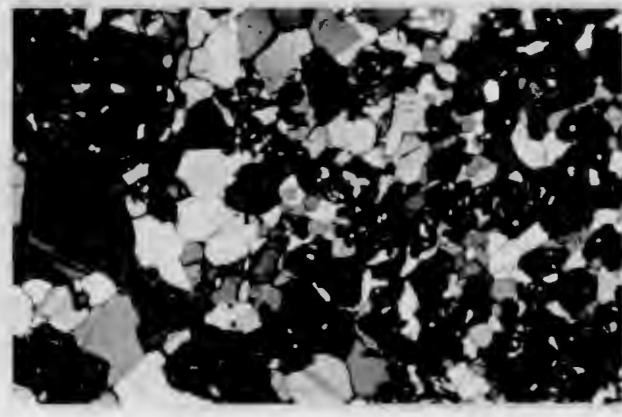
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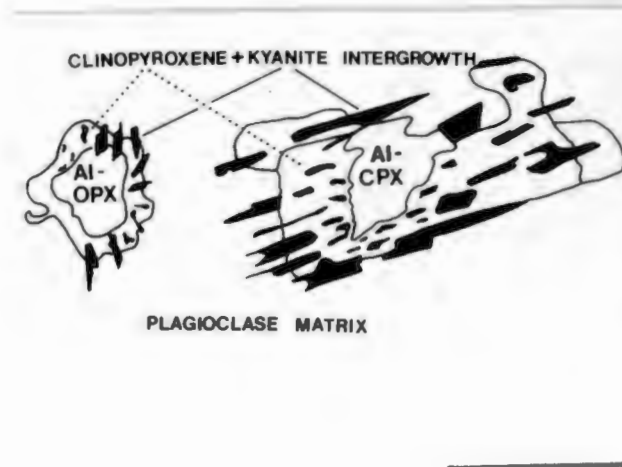
E



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G



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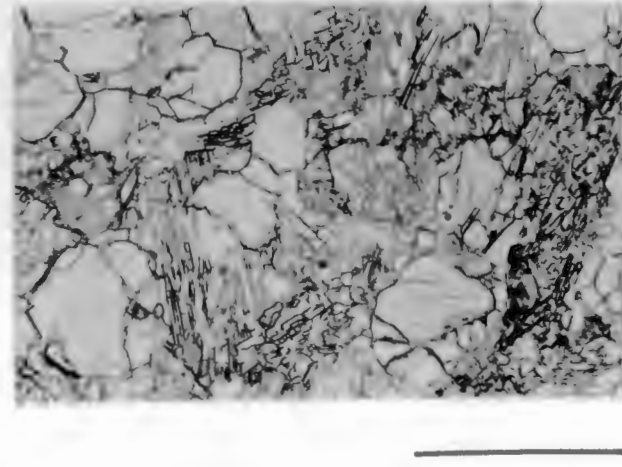


PLATE V-3.

V-3A: Drawing of a reaction texture seen in kyanite garnet granulite O2263. Gt and plag react to form cpx + ky intergrowths similar to that seen in O4-1 (Pl. V-2G).

V-3C: Drawing of reaction textures in kyanite garnet granulite 12133A. Note that at gt - plag contacts the assemblage cpx + ky is formed in a manner similar to that shown in Pl. V-3A,B. Continued breakdown of plag forms graphic to acicular intergrowths of qtz, ky and cpx.

V-3E: Another example of the reaction textures in 12133A. Gts are high relief idiomorphic grains. Plag is the low relief whitish material slightly altered. Note how the reaction product cpx + ky + qtz intergrowths are rooted against gt and extend into the plag.

V-3G: Kyanite eclogite O2463. Highly simplectised cpx (black) and gt occur in a granuloblastic texture. Tabular to elongate ky forms acicular intergrowths with qtz. Rare K-feldspar also occurs in the ky-qtz intergrowths.

V-3B: Photo of another part of O2263 where the $gt + plag = cpx + ky$ reaction is seen. On the upper margin of the gt (black) in the photo center is the cpx + ky intergrowth that separates gt from plag.

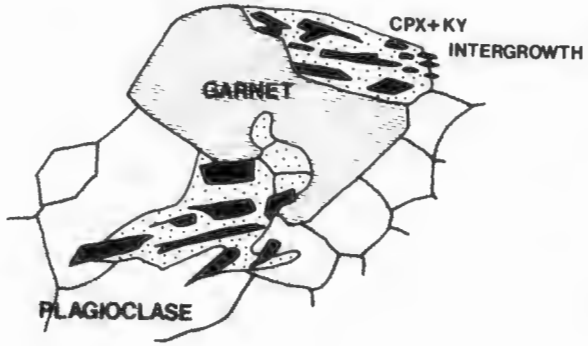
V-3D: The reaction area in 12133A on which most of the drawing in V-3C is based.

V-3F: Detail of the graphic nature of the ky + qtz + cpx intergrowths in 12133A. The ky and cpx are the high relief grains set in a white qtz matrix. Surrounds are plag and gt.

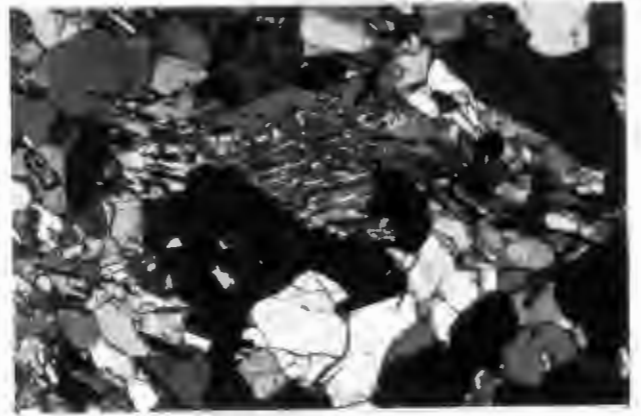
V-3H: Relict (?) plag and cpx worm-like forms in gt of garnet granulite 12133. Grey altered material is plag.

PLATE V-3

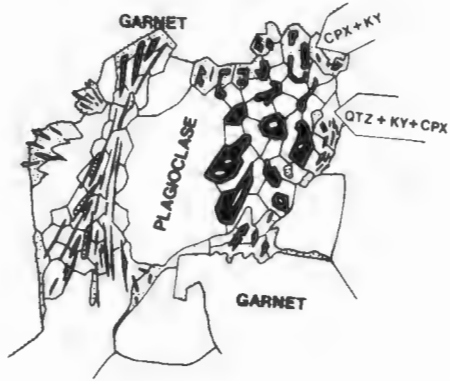
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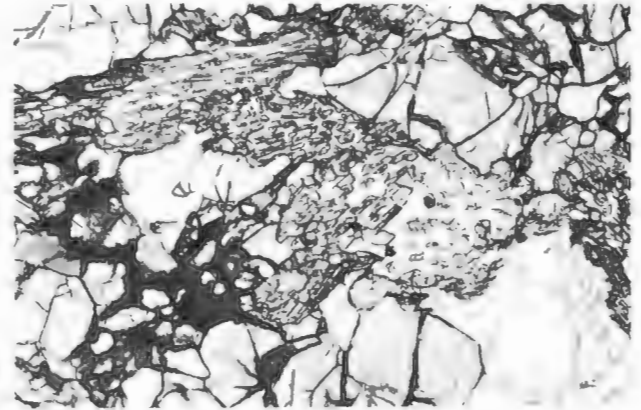
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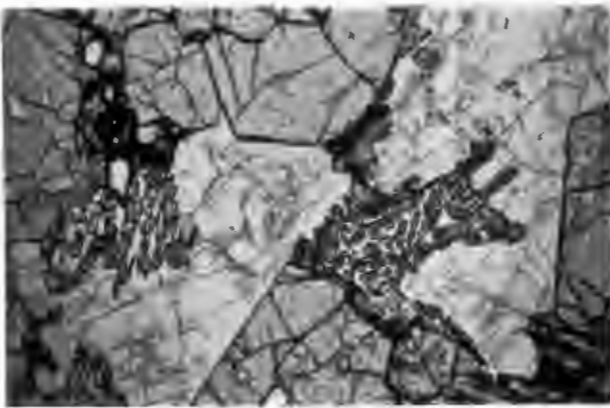
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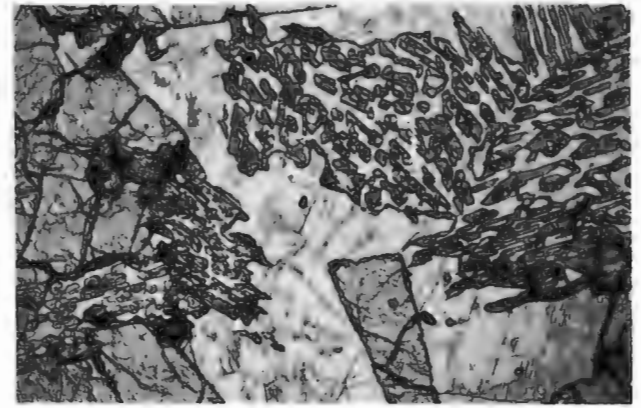
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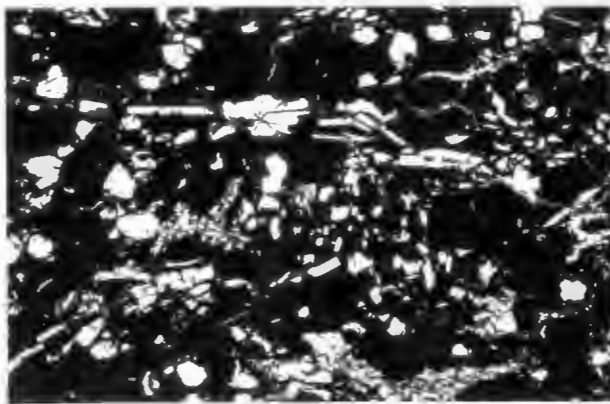
E



F



G



H

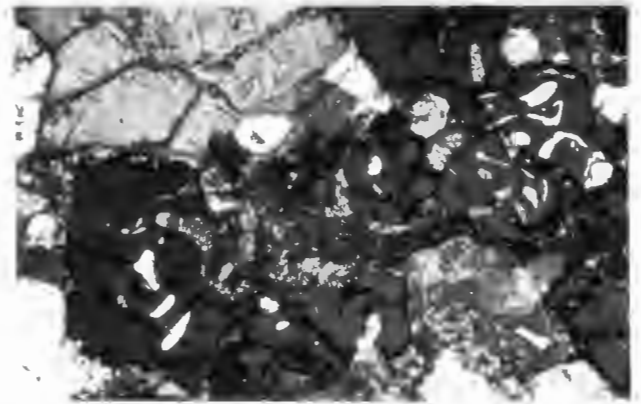


PLATE V-4.

V-4A: Ky laths and needles in gt (black). The ky are parallel to ky foliations elsewhere in this xenolith - kyanite garnet granulite 02323.

V-4C: Orbicular textures in garnet granulite 06043. Cpx (grey) surrounded by plag (whitish, altered) and garnet (high relief).

V-4E: Simplectisation of primary cpx (omphacite) in eclogites. The central clear white area is relict omphacite. Surrounding the omphacite is a fine-grained pyroxene relatively low in Na. This simplectite is typical of eclogite clinopyroxene.

V-4G: Cpx simplectisation and gt kelyphytisation in kyanite eclogites (example is 02453). Note how much finer-grained and optically less resolvable are the cpx symplectites of kyanite eclogites compared with those of eclogites (Pl. V-4E). Gt is the white grain in the photo center. Note that original grain boundaries are still visible.

V-4B: Scapolite in garnet granulite 06043. Note how in the top left part of this photo gt forms a rim (heart-shaped) about primary scapolite. Remainder of whitish matrix is plag. Gts are high relief with sub-idiomorphic shapes. Cpx are grey clear grains.

V-4D: Another example of the orbicular textures in 06043.

V-4F: Detail of the secondary cpx simplectite. The white areas are low-Na cpx and the dark areas appear to be sub-calcic with relatively high Mg.

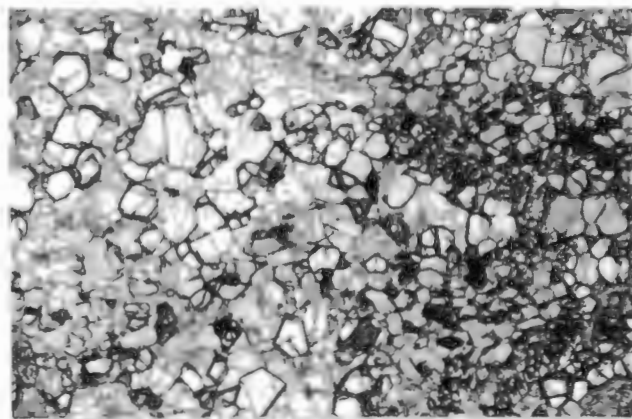
V-4H: Cpx simplectisation following cracks in primary cpx of eclogite 20093.

PLATE V-4

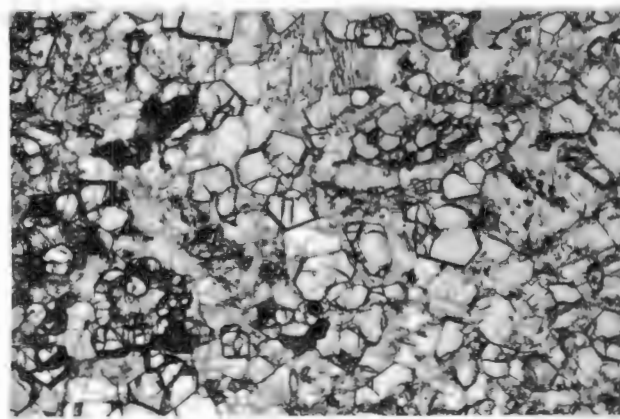
A



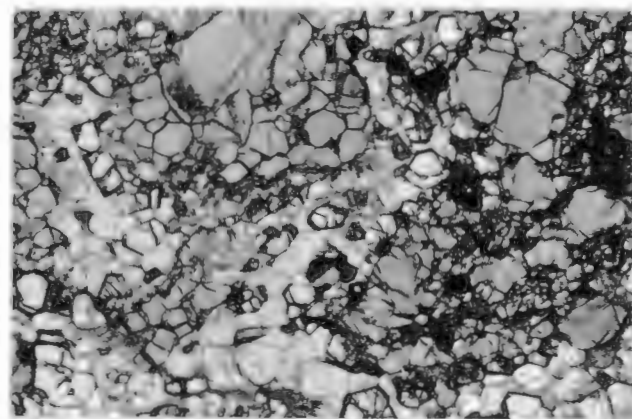
B



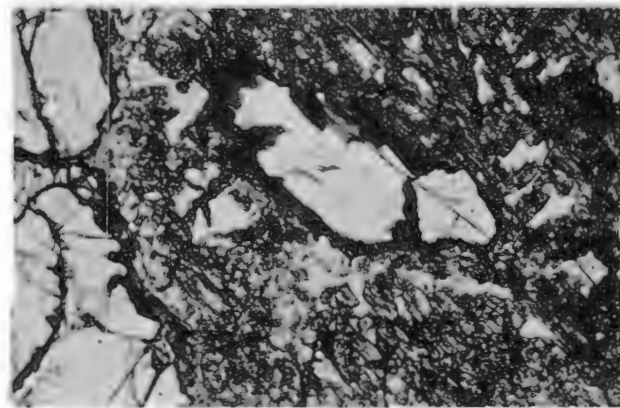
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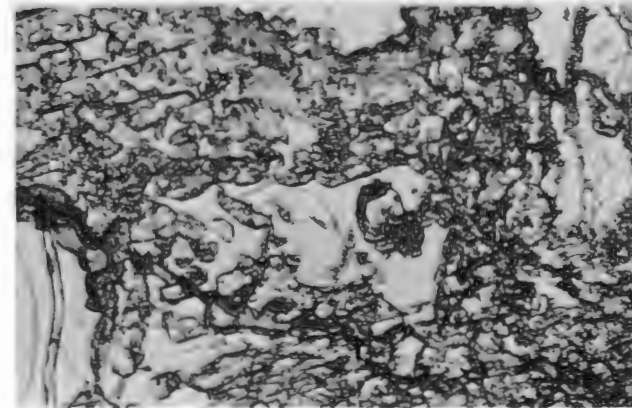
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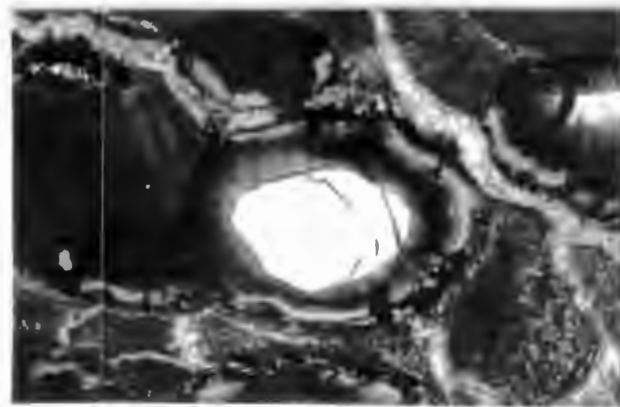
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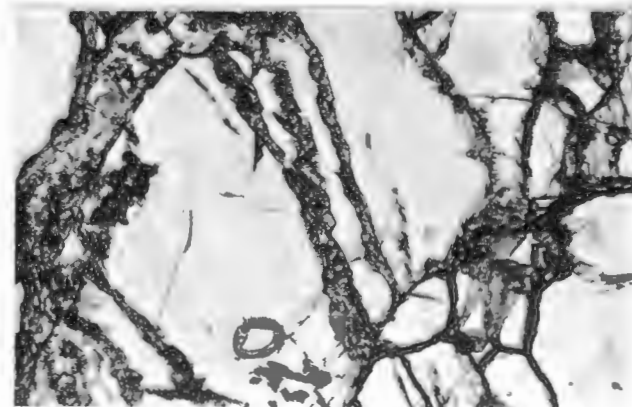


PLATE V-5.

V-5A: Secondary textures and minerals in eclogite O2023. Secondary clinopyroxene form compositionally zoned euhedral overgrowths on primary cpx that is simplectised. The overgrowth secondary cpx is studded with pleonaste (black) and has crystallised adjacent a large partially melted area. In this melt area a glass matrix contains euhedra and microlites of spinel (pleonaste), cpx, amph and olivine (? - now serpentinitised-chloritised). Rounded vesicles occur scattered in the melt area.

V-5C: Pitted garnets and ragged rutile reflect partial melting of these primary constituents in eclogite O2043.

V-5E: Relict gt in partial melt area of eclogite O2043. See Pl. V-5F.

V-5G: Detail of sector-zoned cpx (C) euhedra as well as spinel (black) and serpentine (S) in the secondary assemblage of O2043. Interstitial glass (M) is quenched melt.

V-5B: Dentate to highly irregular areas of mutual optical extinction in highly simplectised cpx of eclogite O2083. These are interpreted to reflect the mobility of primary grain boundaries during the simplectisation process.

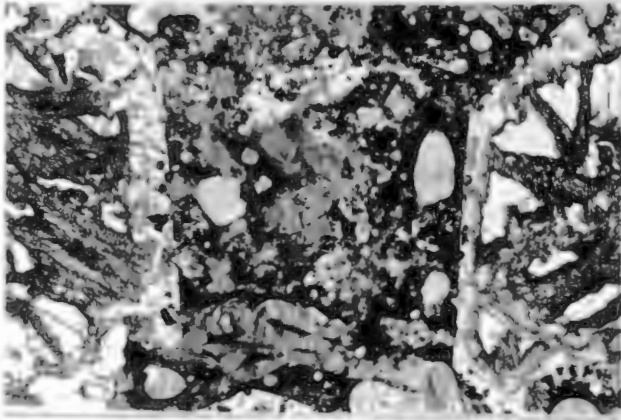
V-5D: Highly scalloped and pitted gt set in glass near the large melt patch shown in Pl. V-5A. This is a gt partial melting texture. Note the large vesicle filled with zeolites (to upper left of gt).

V-5F: The relict gt (G) occurring with euhedra of cpx (C), amph (A), phlogopite and spinel that have crystallised from the melt area in O2043. Serpentine (S) occurs in regular to irregular shapes. The dark brown interstitial material is glass containing quench or devitrification microlites.

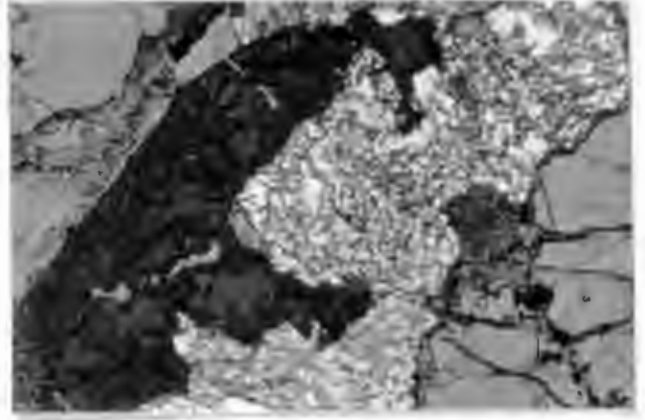
V-5H: As in Pl. V-5G. Cpx (C), amph (A) and phlogopite (P) secondary assemblages in O2043.

PLATE V-5

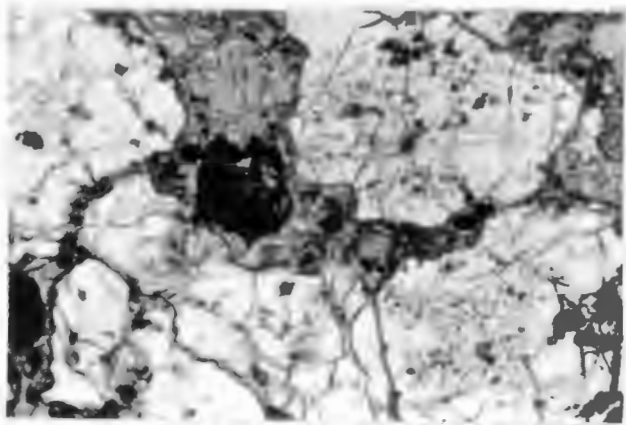
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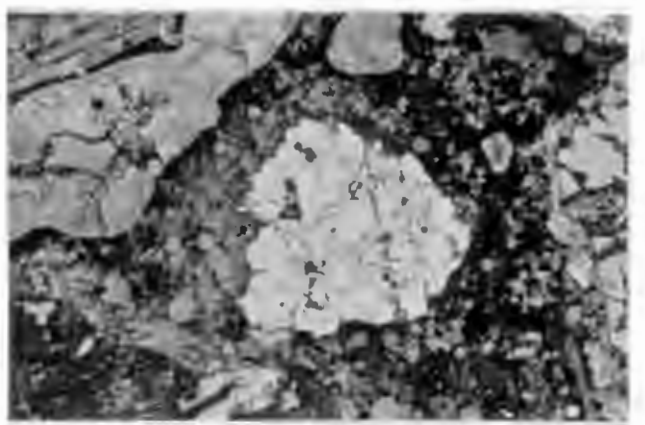
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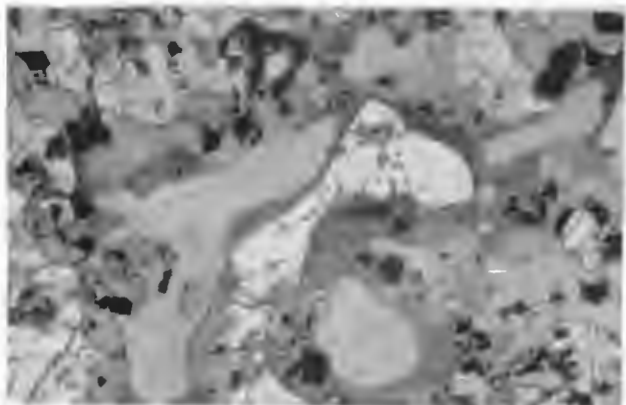
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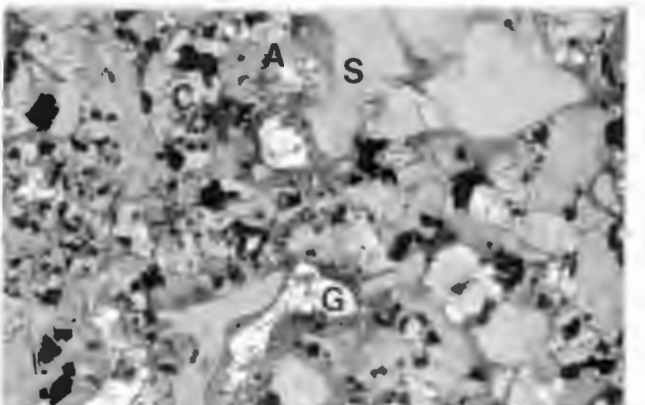
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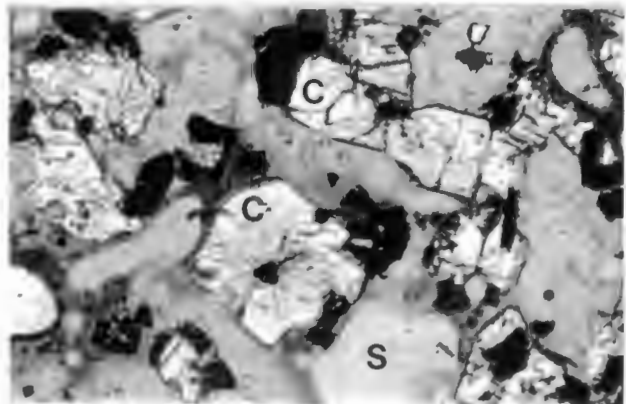
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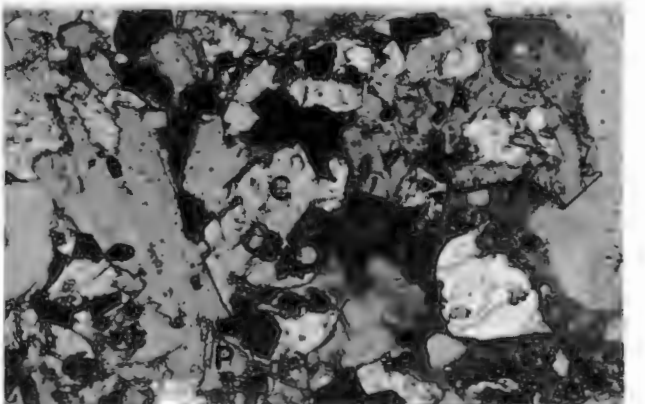


PLATE V-6.

V-6A: Primary metasomatic phlogopite in eclogite O2043. Embayed and indented grain boundaries are interpreted to indicate partial melting of this phlogopite. Note also scalloped gt shapes.

V-6C: Eclogite 42043 that has been amphibolitised. The black areas are highly symplectised primary cpx. A rare gt is set in amphibole at the top margin, right-hand side of the photo.

V-6E: Rutile (black) anhedral at triple grain junctions in eclogite O9123. Gt is whitish with rutile needle inclusions. Cpx is highly schillerized.

V-6G: Qtz (Q) interstitial to gt (G) elsewhere in kyanite eclogite O2143.

V-6B: Elongate quenched shapes of secondary olivine (?) now pseudomorphed. A large vesicle occurs to the left of these hoppers.

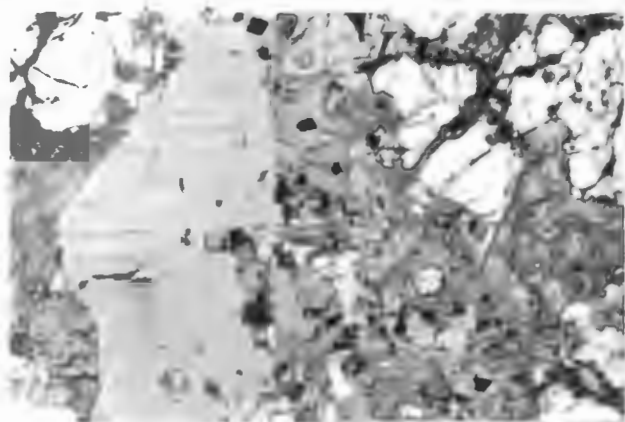
V-6D: Severely altered plagioclase forms the matrix to gt and cpx in garnet granulite O6-2. Note the streaky foliation and lineation produced by the alignment of slightly tabular cpx.

V-6F: Diablastic ky + Qtz intergrowths in kyanite eclogite O2143. Ky (K), cpx (C), Qtz (Q), gt (G).

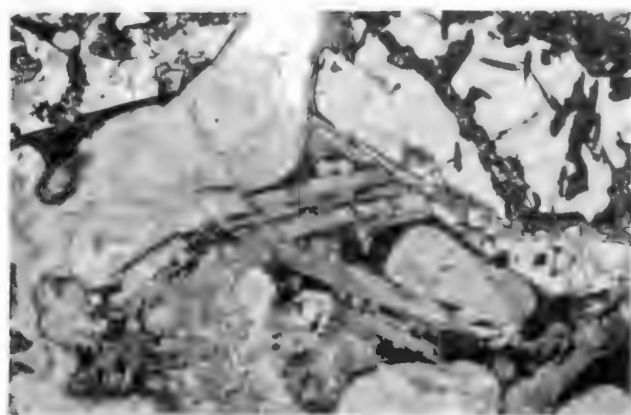
V-6H: Primary amphibole (A) in kyanite garnet granulite (?) O2363. Cpx is symplectised (black), ky are high relief elongate grains, P are areas of fine-grained anorthite that may originally have been scapolite.

PLATE V-6

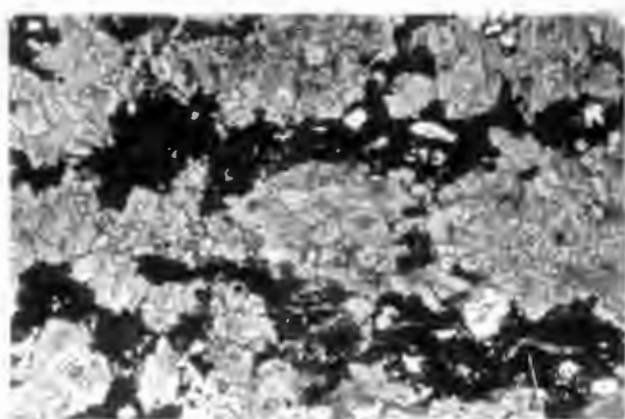
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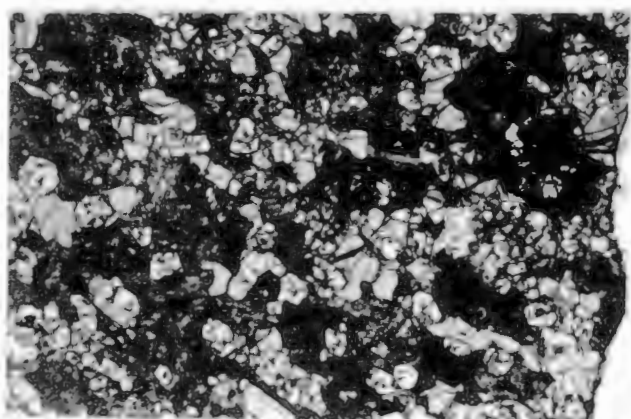
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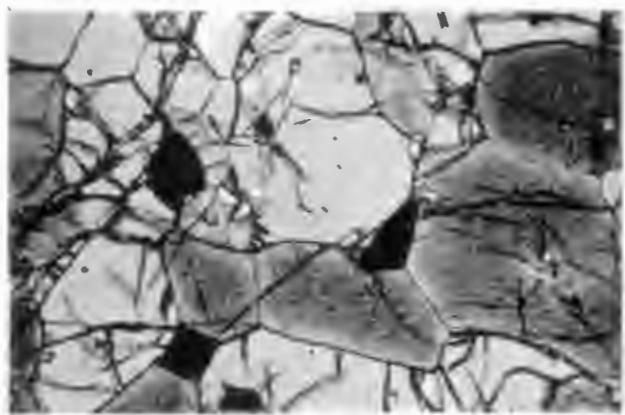
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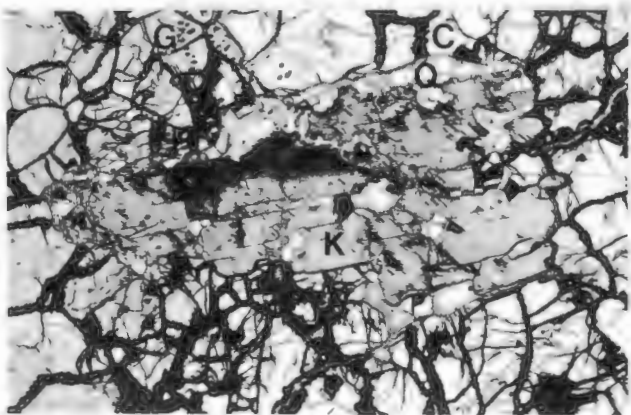
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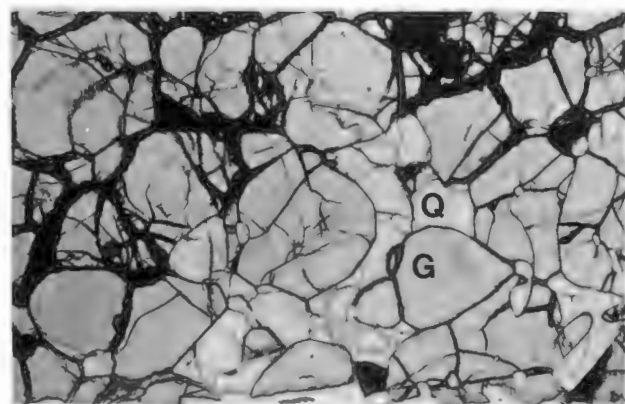
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G



H

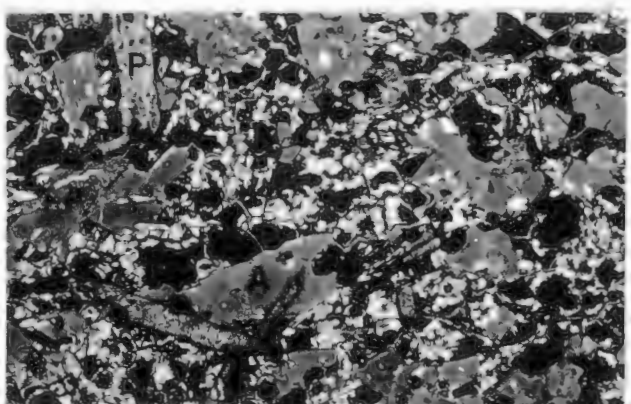


PLATE V-7.

V-7A: Skeletal secondary phlogopite containing trapped liquid pockets - in eclogite O2083.

V-7C: Partial melt area in kyanite eclogite 20373. Relict omphacite is set in simplectite cpx. The left area of the photo is the melt patch now seen to be mostly devitrified glass. Corundum (high relief tablets) are associated with the melt area.

V-7E: Euhedral (idiomorphic) gts in garnet granulite H5-2. Also seen are cpx, plag, apatite and primary amphibole (small dark grains in cpx - lower right).

V-7G: Retrograde amphibolitisation of garnet granulite O6-1. Note the more intense amphibolitisation on either side of the crack through this rock. This amphibole is green pleochroic and quite distinct from the deep brown primary amphibole seen in most granulites.

V-7B: A mineralogically zoned vein of a secondary assemblage (calcite, spinel, amphibole) developed along gt grain boundaries in eclogite 42163.

V-7D: Mineral banding in garnet granulite 42303. The central white band is mostly plagioclase. On either side are layers predominantly consisting of gt and cpx.

V-7F: Atoll-like gts growths in garnet granulite 11-1. Matrix is plag and minor cpx.

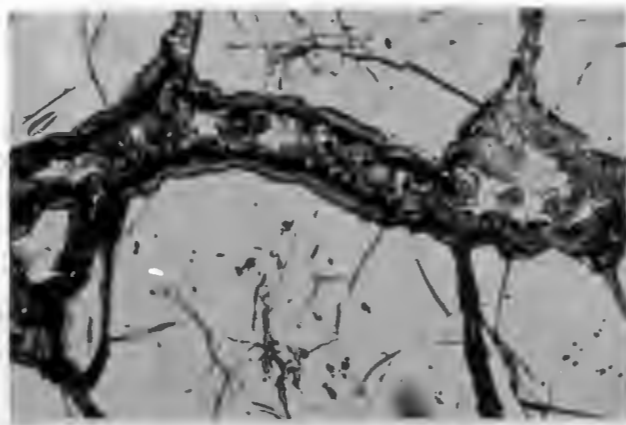
V-7H: Detail of the amphibolitisation in O6-1. Gts show tiny trails of material radiating into the gt from its contact with retrograde amphibole.

PLATE V-7

A



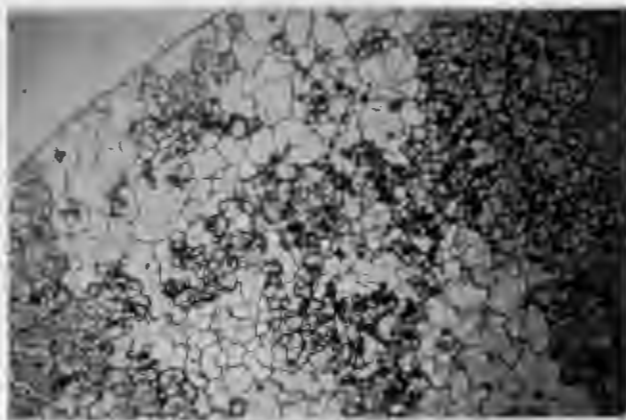
B



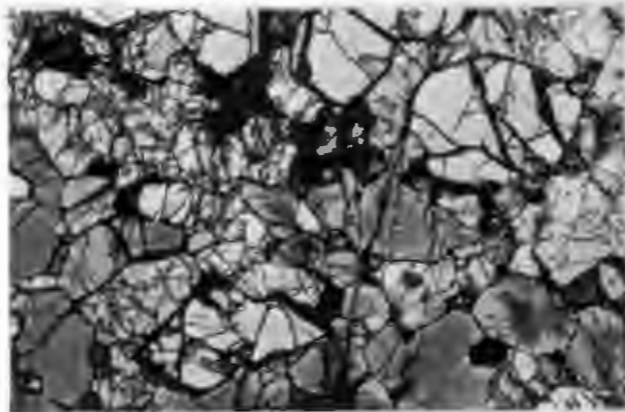
C



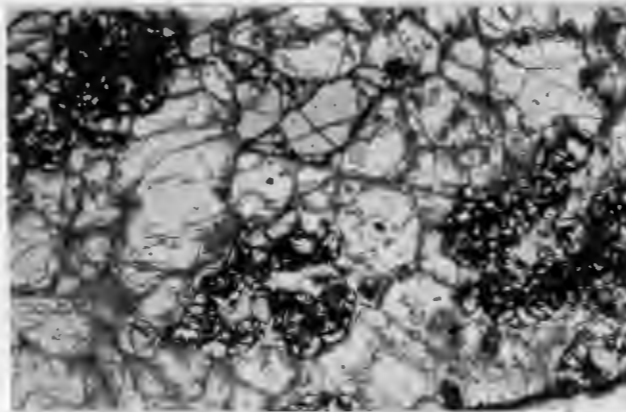
D



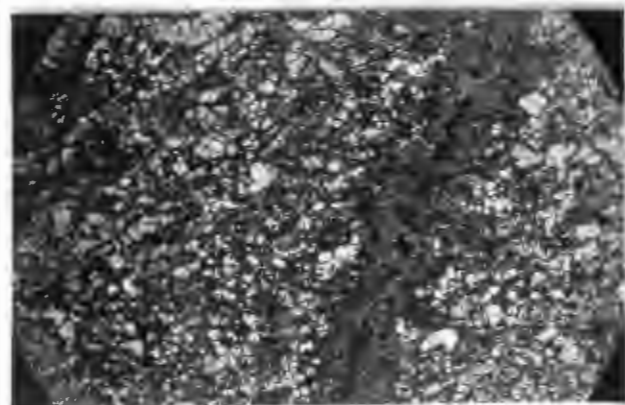
E



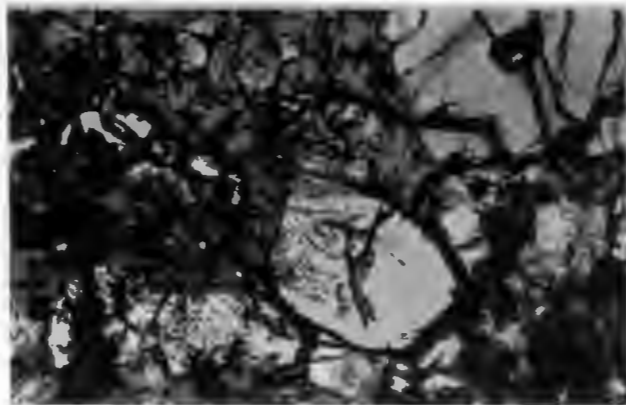
F



G



H



10

.5

PLATE V-8.

V-8A: Deformed albite twins in plagioclase of the anorthosite xenolith 33023.

V-8B: Rare albite twins with cross-cutting pericline twins in plagioclase of 33023. Note how the twins are broader at the grain edges. Albite and pericline twin combinations are the common products of mechanical deformation of plagioclase.

V-8C: Overall view of the anorthosite xenolith 33023.

V-8D: Anti-perthite of garnet granulite 07403.

V-8E: Primary rutile (R), apatite (A) and opaque (black) with secondary biotite (B) in garnet granulite 09133. P is plag, C is cpx.

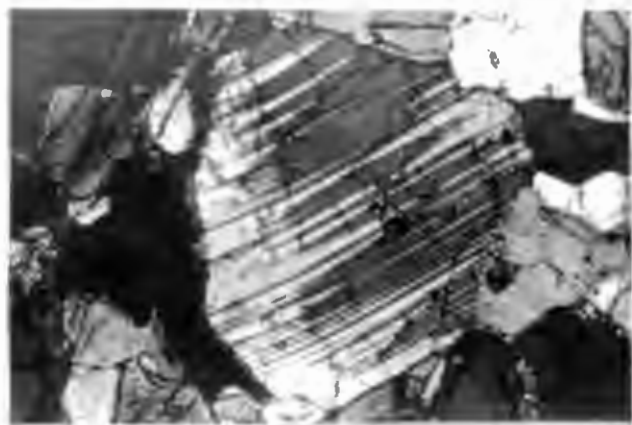
V-8F: Large primary scapolite (S) coexisting stably with plag (P), gt (G), cpx (C) in garnet granulite 07403. The scapolite, cpx and gt contain fine rutile needles.

V-8G: Clinopyroxene-rich band in kyanite garnet granulite 02243. The elongate grains are ky; white areas are plag.

V-8H: Reaction texture in kyanite garnet granulite 04-1. Rounded clear grains are primary Al-rich opx which are separated from plag (altered) by cpx + ky mantles.

PLATE V-8

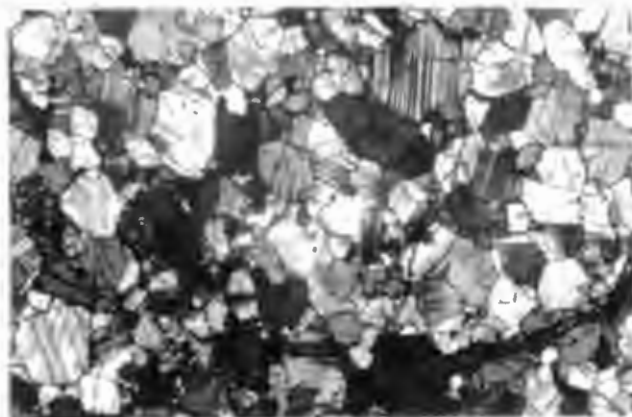
A



B



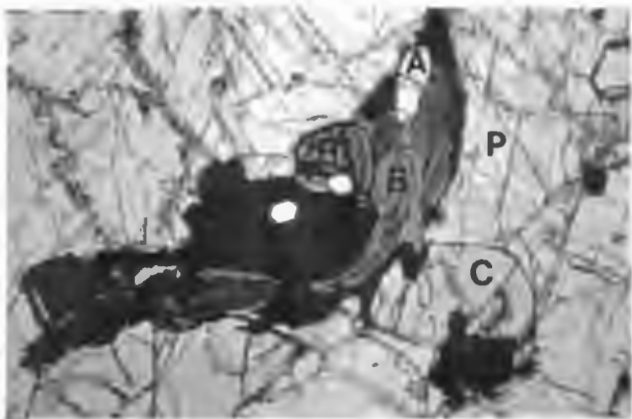
C



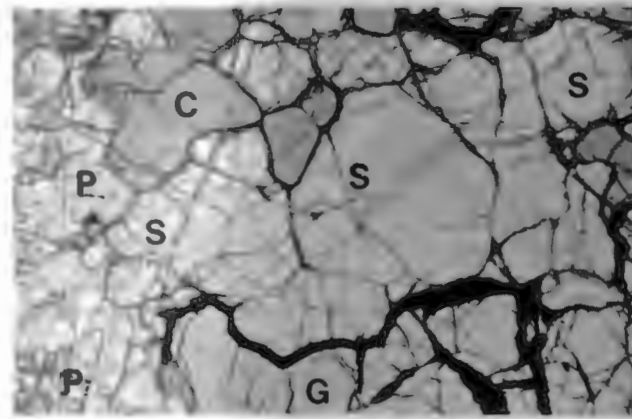
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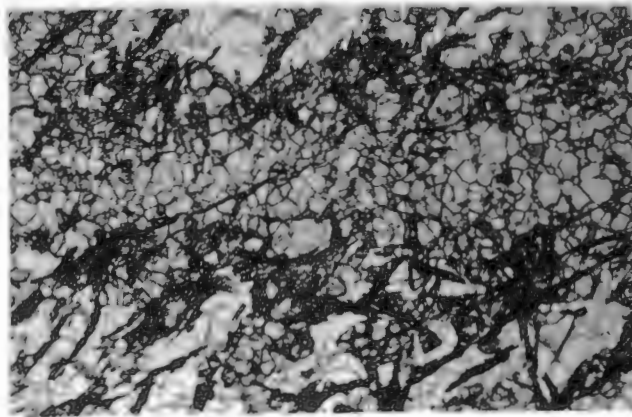
E



F



G



H

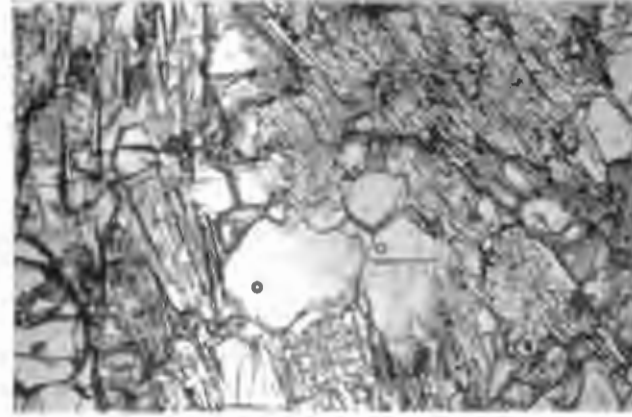


PLATE V-9.

V-9A: Reaction texture in kyanite garnet granulite O2263. G is gt, P is plag and C + K is the cpx + ky intergrowth.

V-9B: As in Pl. V-9A but under X-nicols.

V-9C: A different form of the reaction seen in Pl. V-9A,B. The ky + cpx intergrowths now have the forms of acicular growths. This is kyanite garnet granulite O2223.

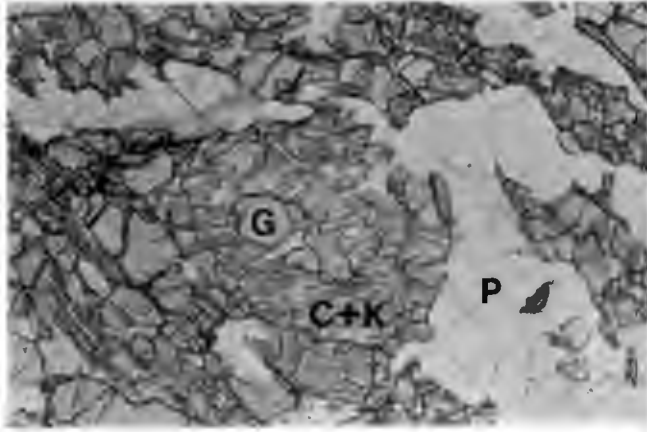
V-9D: The same intergrowth sheaves of cpx + ky as described in Pl. V-9C but now in kyanite garnet granulite O2243.

V-9E: Another view of the reaction textures in O2243.

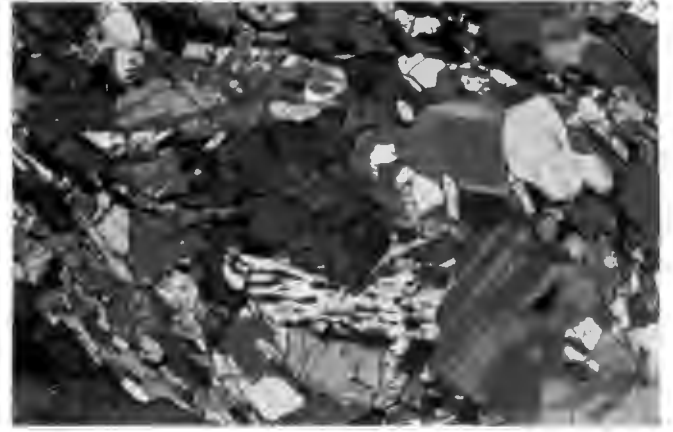
V-9F: In kyanite garnet granulite 12133A. Detail showing how the qtz (Q) + ky (K) graphic intergrowth areas, that result from plag breakdown, are separated from gt (G) by a thin band of cpx (C) + ky intergrowth. This latter cpx + ky band is believed to have formed in a reaction similar to that producing the reaction textures seen in Pls. V-9A to E.

PLATE V-9

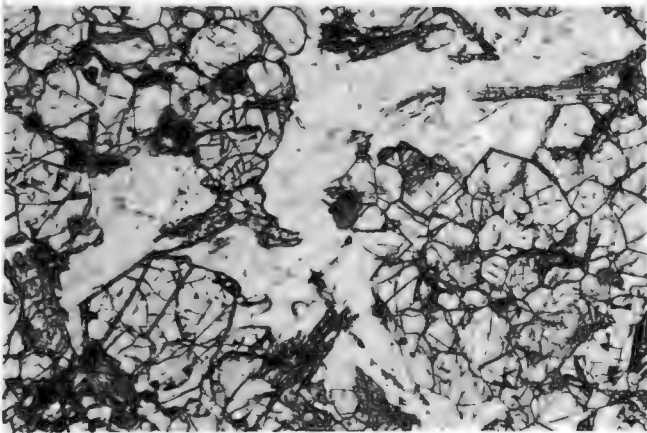
A



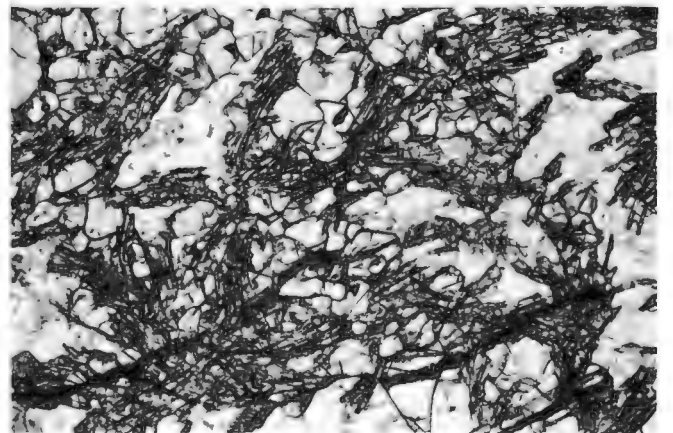
B



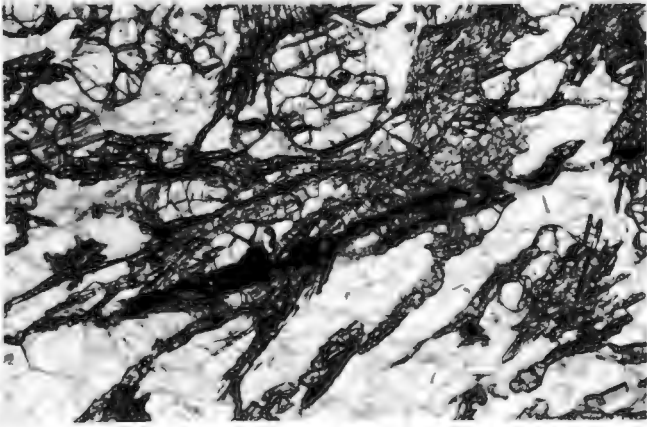
C



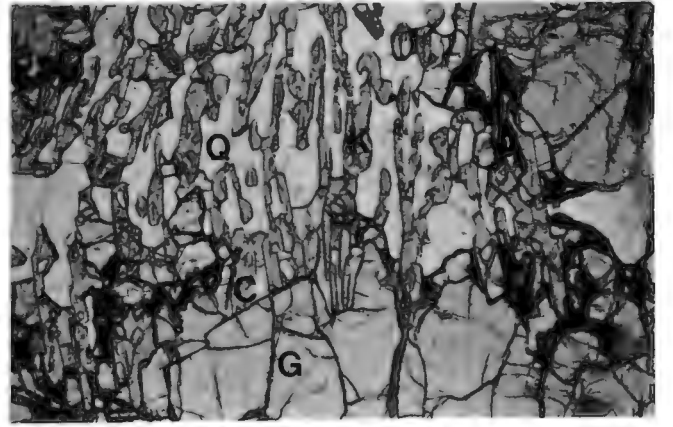
D



E



F



APPENDIX 6: FIGURES

Fig. II-1: Locality map showing the distribution of kimberlites in the central Cape Province. In APPENDIX 1 short descriptions are given for most of the kimberlites indicated on the map. In the locality map each kimberlite is given a number which corresponds to that in APPENDIX 1. To identify a kimberlite on the map follow this procedure: note in which of the three areas covered by Topo-cadastral map sheets 3022, 3024, 3122 the kimberlite in question occurs. Using the number indicated next to the locality and the Topo-sheet number find the description in APPENDIX 1.

The limits of magisterial districts about the larger towns (Britstown, De Aar, Victoria West, Prieska, Beaufort West) are also shown. The Hanover district is that to the SE of De Aar; Phillipstown district that to the NE of De Aar and Fraserburg district that to the SW of Loxton.

The inset map shows the geographical location of the study area. (Z = Zimbabwe, M = Maputo, S = Swaziland, L = Lesotho, R.S.A. = Republic of South Africa).

● KIMBERLEY

ORANGE RIVER

○ PRIESKA

22° E

23° E

24° E

25° E

30° S

31° S

32° S

● CARNARVON

TOPO-SHEET 3022

○ VOSBURG

○ BRITSTOWN

○ DE AAR

TOPO-SHEET 3024

○ LOXTON

○ VICTORIA WEST

TOPO-SHEET 3122

○ BEAUFORT WEST

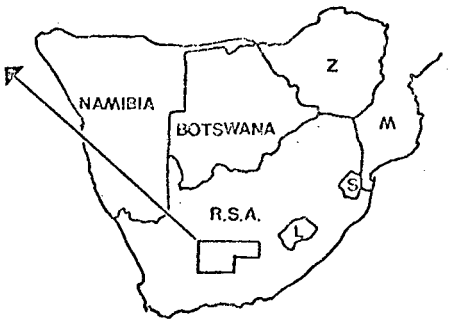
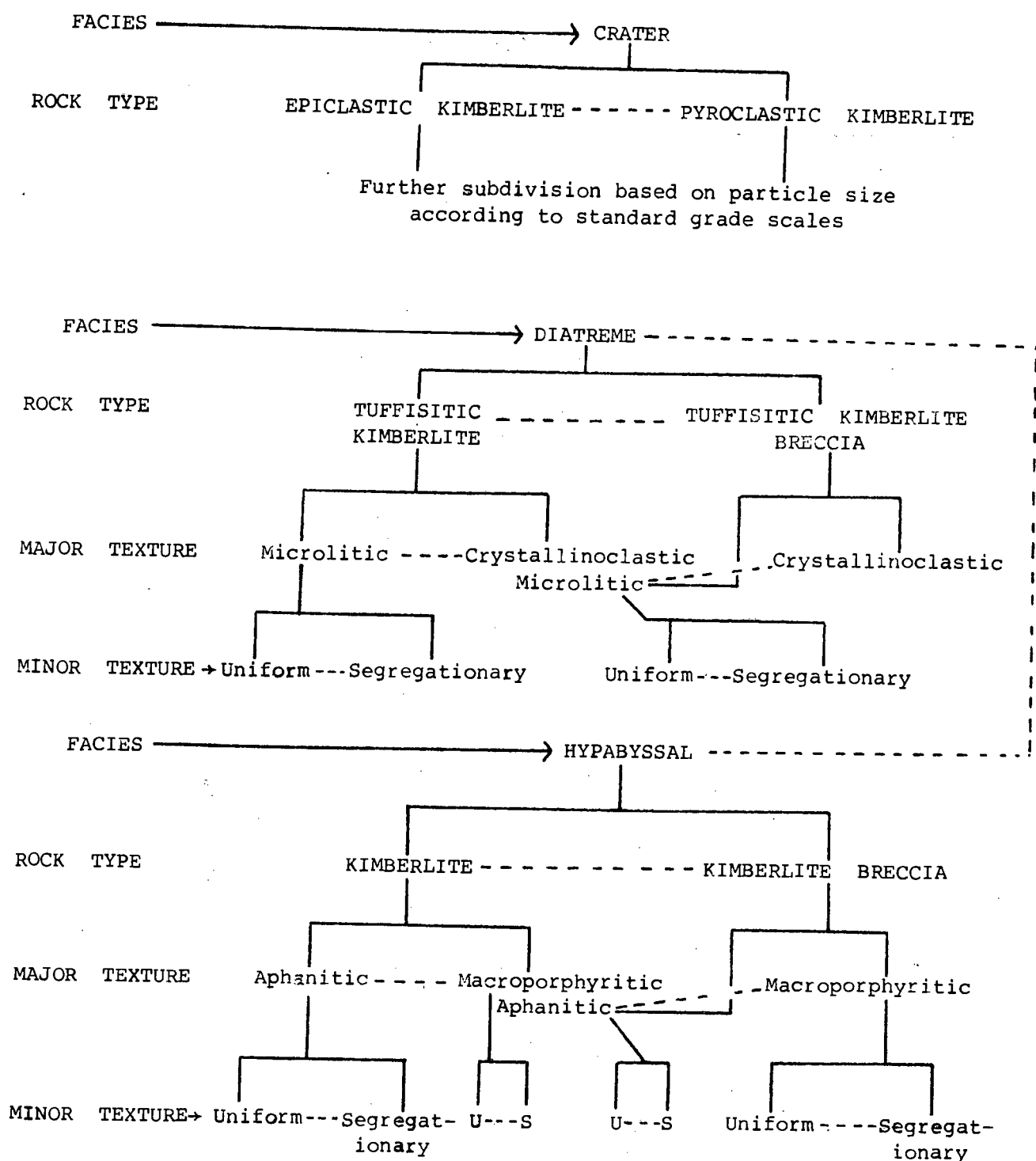


Fig. II-2: A textural-genetic classification of kimberlite rocks (reproduced from Clement and Skinner, 1979).



NOTE GRADATIONAL RELATIONSHIPS INDICATED BY DASHED LINES

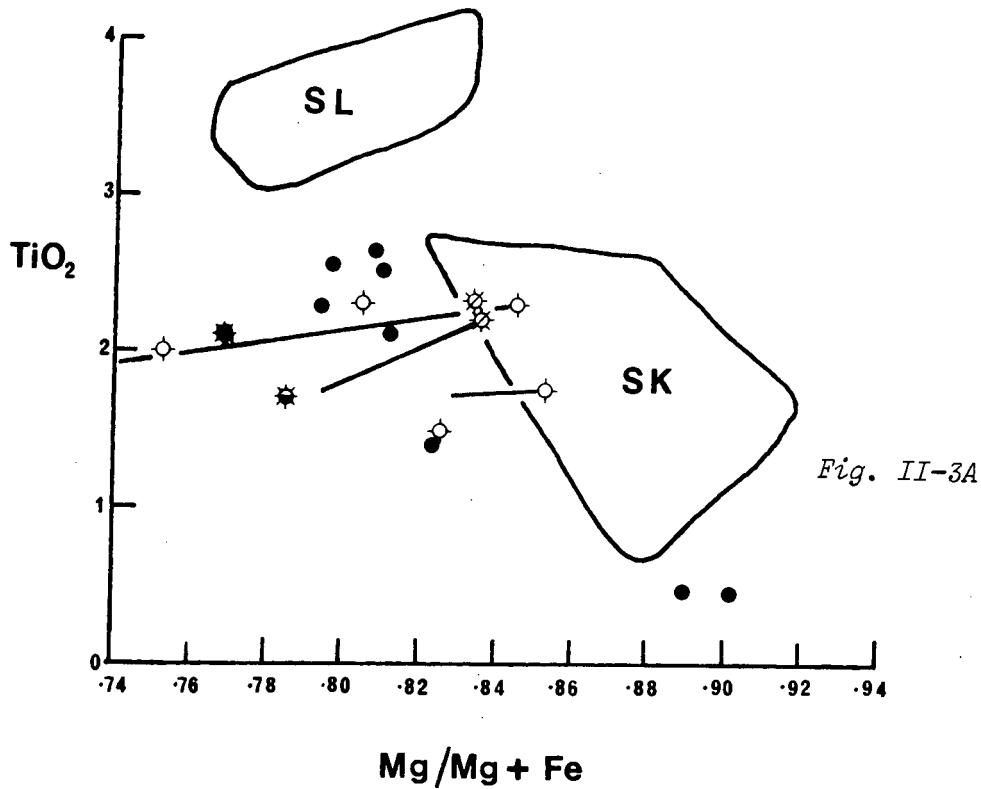


Fig. II-3A: TiO_2 (wt.%) vs. $Mg/Mg+Fe$ in groundmass phlogopite from the Melton Wold (08012) and Silvery Home (21012) kimberlites.

● - 08012; ○ - 21012 PK and zoning; ⊛ - 21012 DK, poikilitic and zoning; ⊠ - 21012 DK, interstitial. Fields are for phlogopites for Swartruggens lamprophyres (SL) and kimberlites (SK) - from Skinner + Scott, 1979.

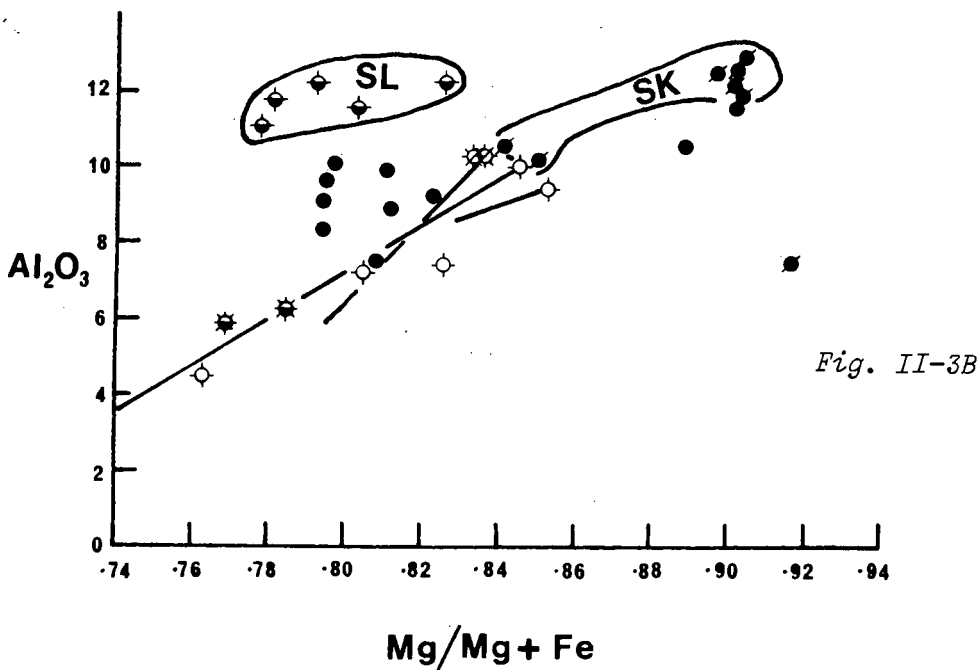


Fig. II-3B: Al_2O_3 (wt.%) vs. $Mg/Mg+Fe$ in groundmass phlogopites from the Melton Wold and Silvery Home kimberlites. Symbols as in Fig. II-3A. ◆ - Swartruggens lamprophyres; ● - Swartruggens kimberlites as in Fig. II-3A.

Fig. II-4: Ca-Mg-Fe variation for groundmass diopsides in the Silvery Home diopside kimberlite (●). Other data for diopsides in Swartruggens lamprophyres (SL) and kimberlites (SK), Premier (○) - from Skinner + Scott, 1979; Scott + Skinner, 1979.

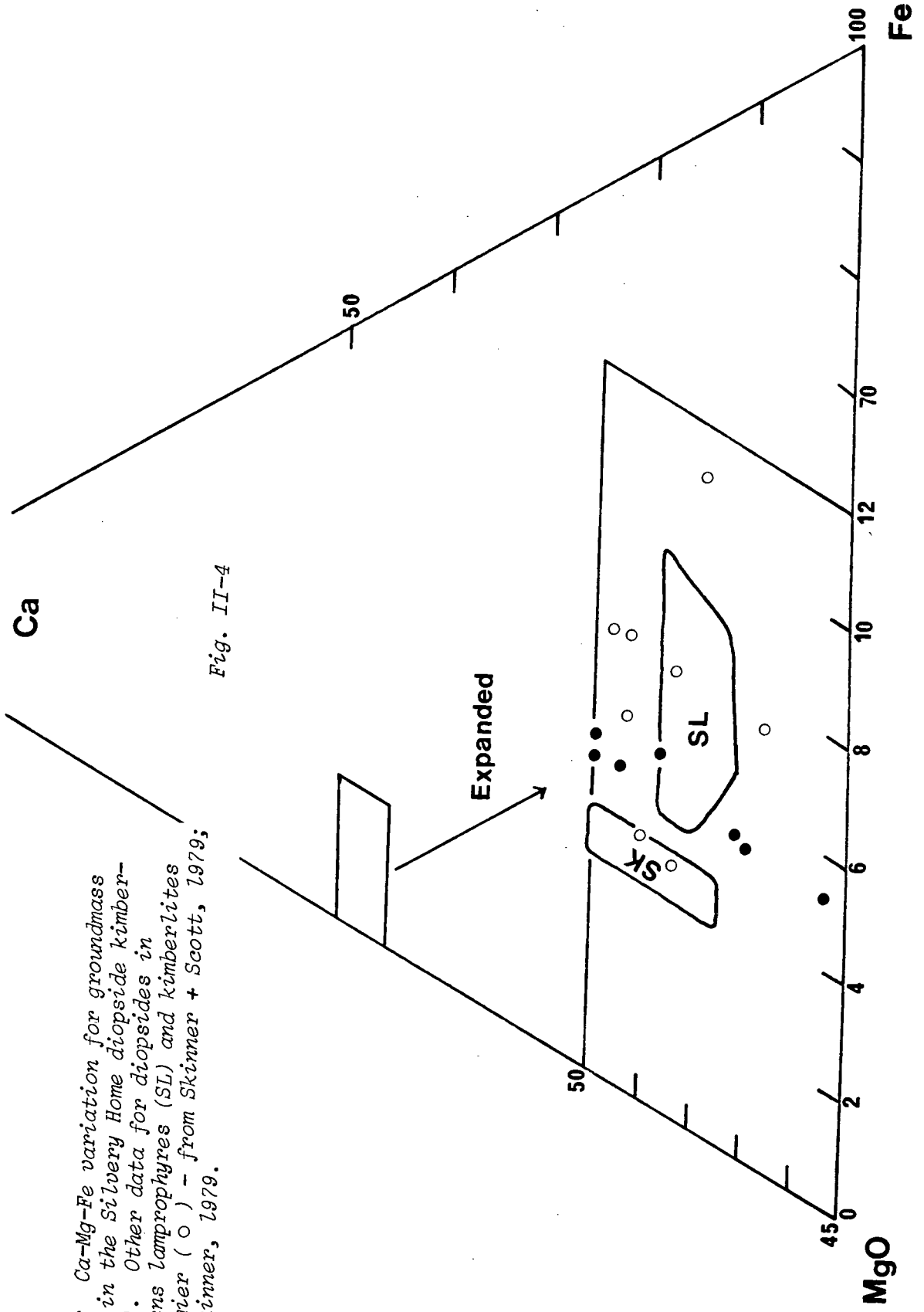


Fig. II-4

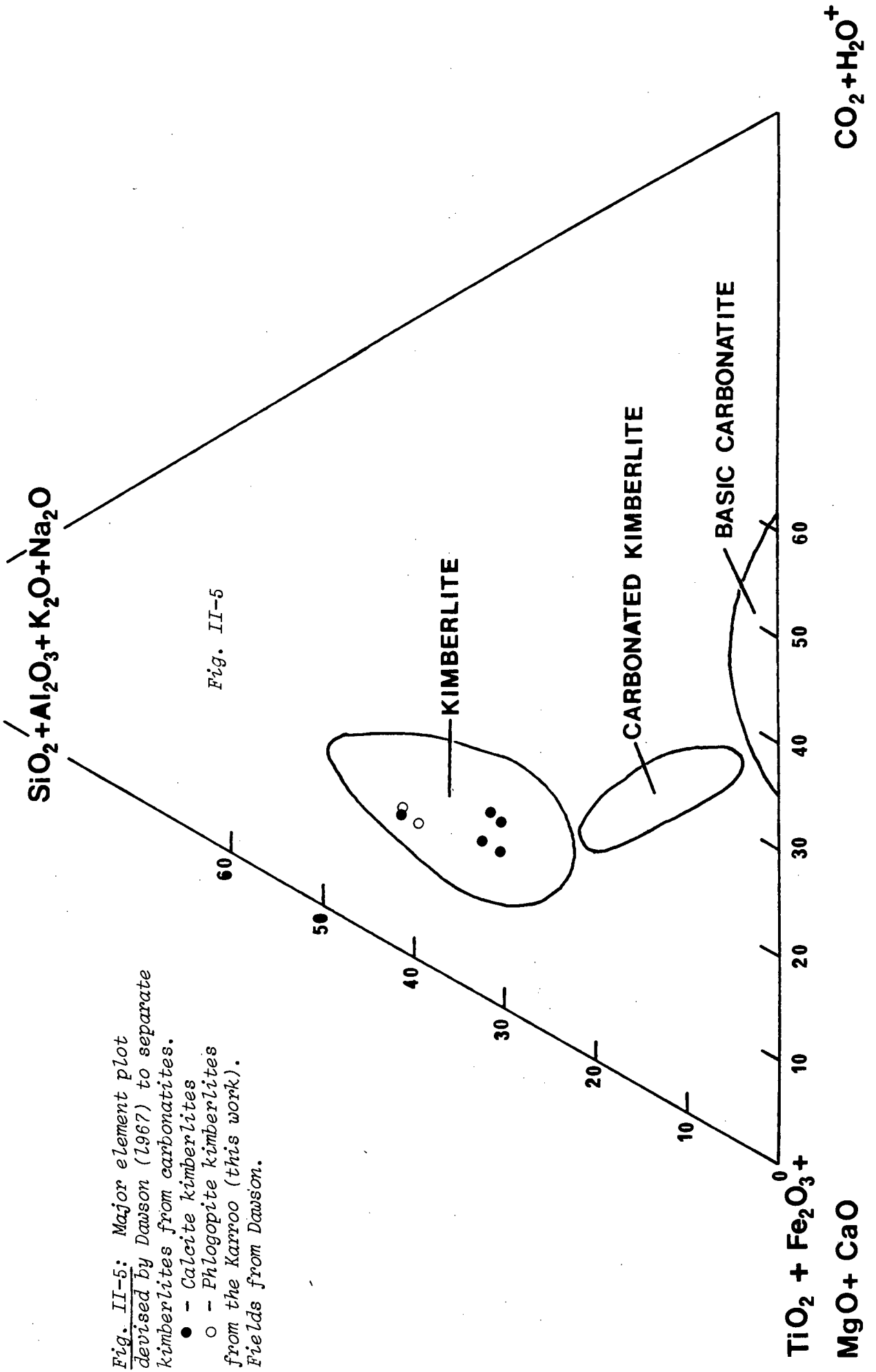


Fig. II-5

Fig. II-5: Major element plot devised by Dawson (1967) to separate kimberlites from carbonatites.

- - Calcite kimberlites
- - Phlogopite kimberlites from the Karroo (this work).

Fields from Dawson.

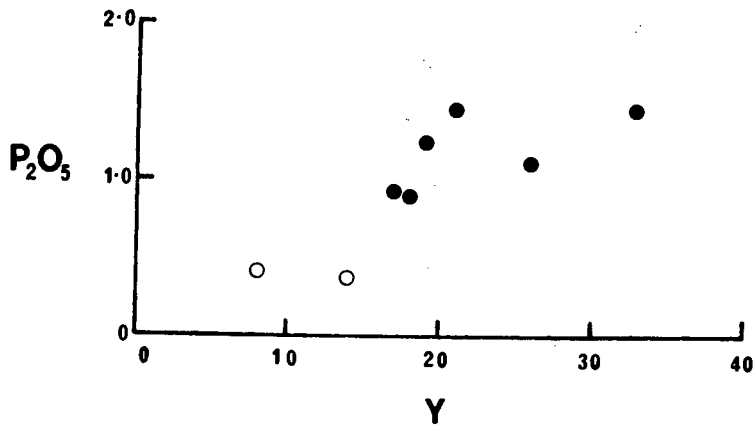


Fig. II-6A

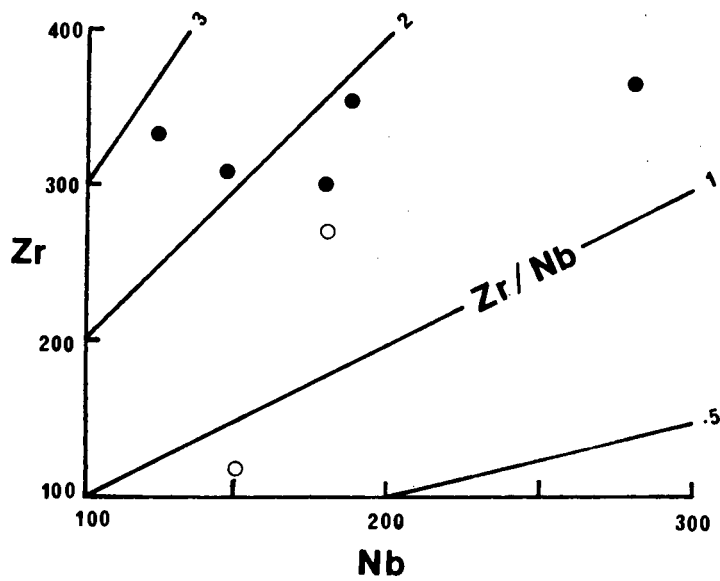


Fig. II-6B

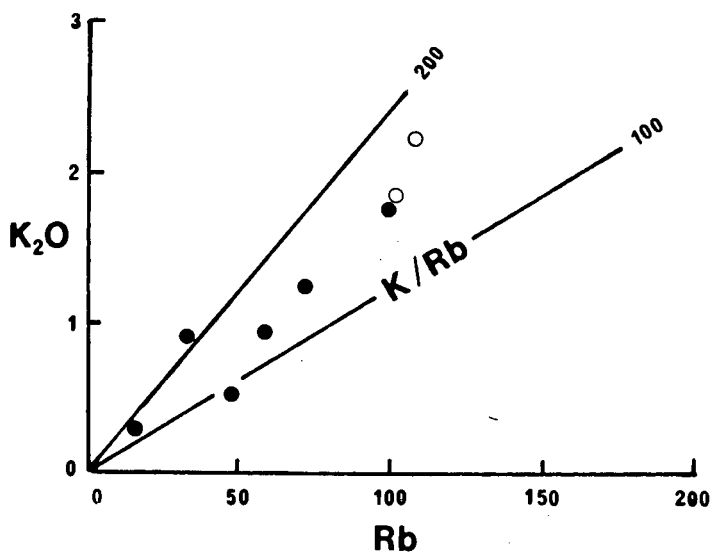


Fig. II-6C

Fig. II-6: Inter-element variation plots for Karroo kimberlite whole rock data. Symbols as in Fig. II-5. K_2O and P_2O_5 in wt.%; Zr, Nb, Y, Rb in ppm.

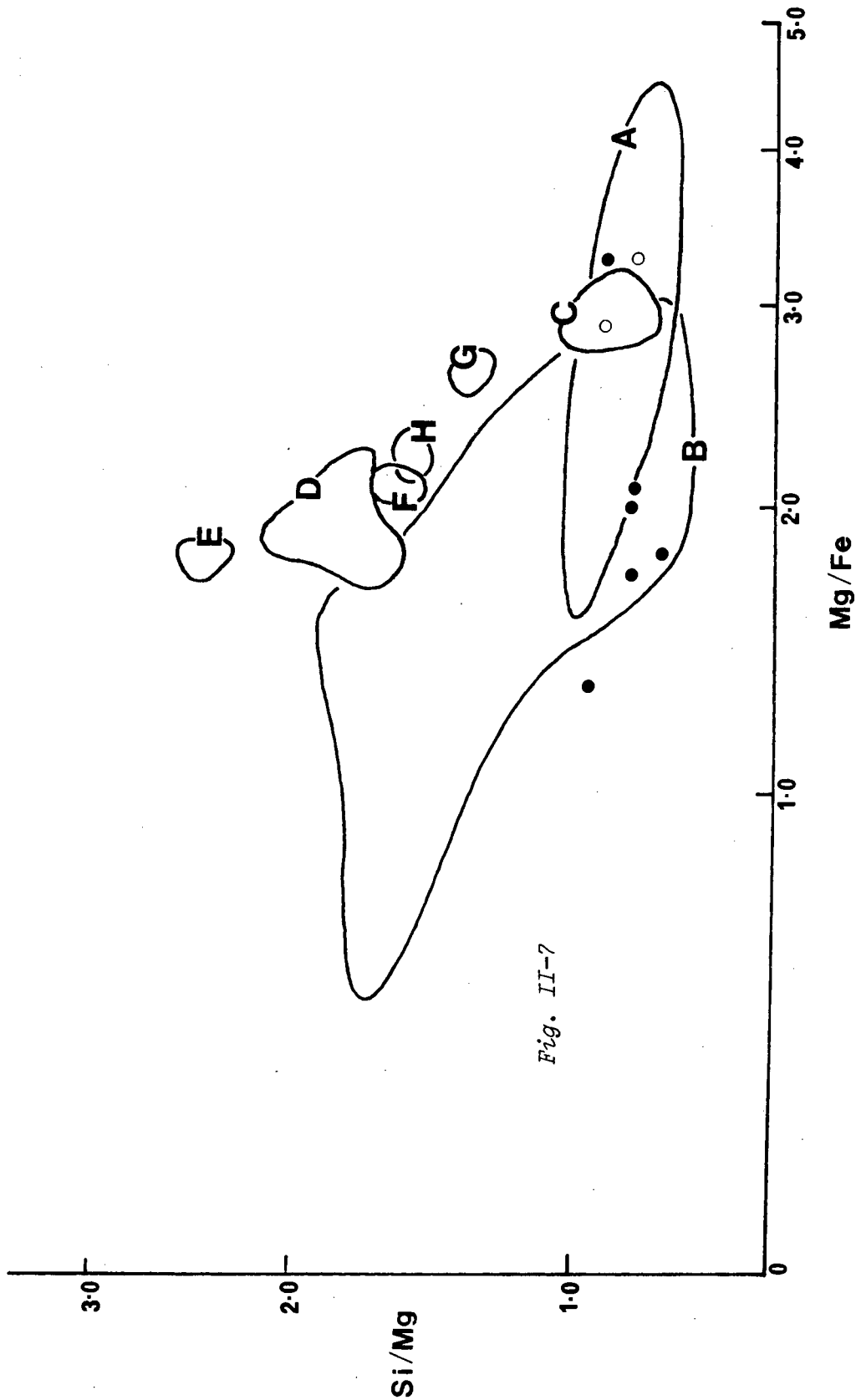


Fig. II-7

Fig. II-7: Si/Mg vs. Mg/Fe of Karroo kimberlite whole rock compositions. Fields are for data from Ilupin + Lutz (1971) for Russian kimberlites (A); Gurney + Ebrahim (1973) for Lesotho kimberlites (B); Fesq et al. (1976) for Bellsbank Main Fissure (C), Bellsbank Water Fissure (D), Ebenhaezer West (E), Ebenhaezer East (F), Koffiefontein (G), Premier Brown and Grey (H). Symbols for Karroo kimberlites as in Fig. II-5.

Fig. III-1

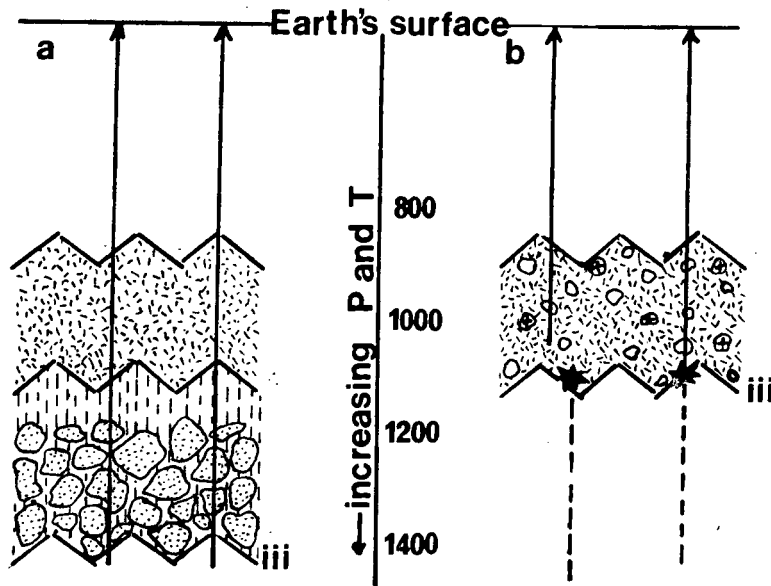


Fig. III-1: Reproduced from Gurney and Harte, 1980. Two models of the vertical mantle section sampled by kimberlites: a - after Boyd (1973) and Nixon and Boyd (1973); b - as proposed by Gurney and Harte (1980).

(stippled) - coarse peridotite, (cross-hatched) - high-T deformed peridotite,
 (circles with dots) - magma with megacrysts, (circles with crosses) - pyroxenite, (circles with squares) - eclogite,
 (star) - magmatic intrusions. Note in model (b) the megacrysts and deformed peridotites are associated with magmatic intrusions that may be the proto-kimberlite. Heavy arrows indicate paths of kimberlites. Dashed lines indicate the path of the postulated megacryst magma. iii) approximate lower limit of mantle sampling. (See Gurney and Harte, 1980 for details).

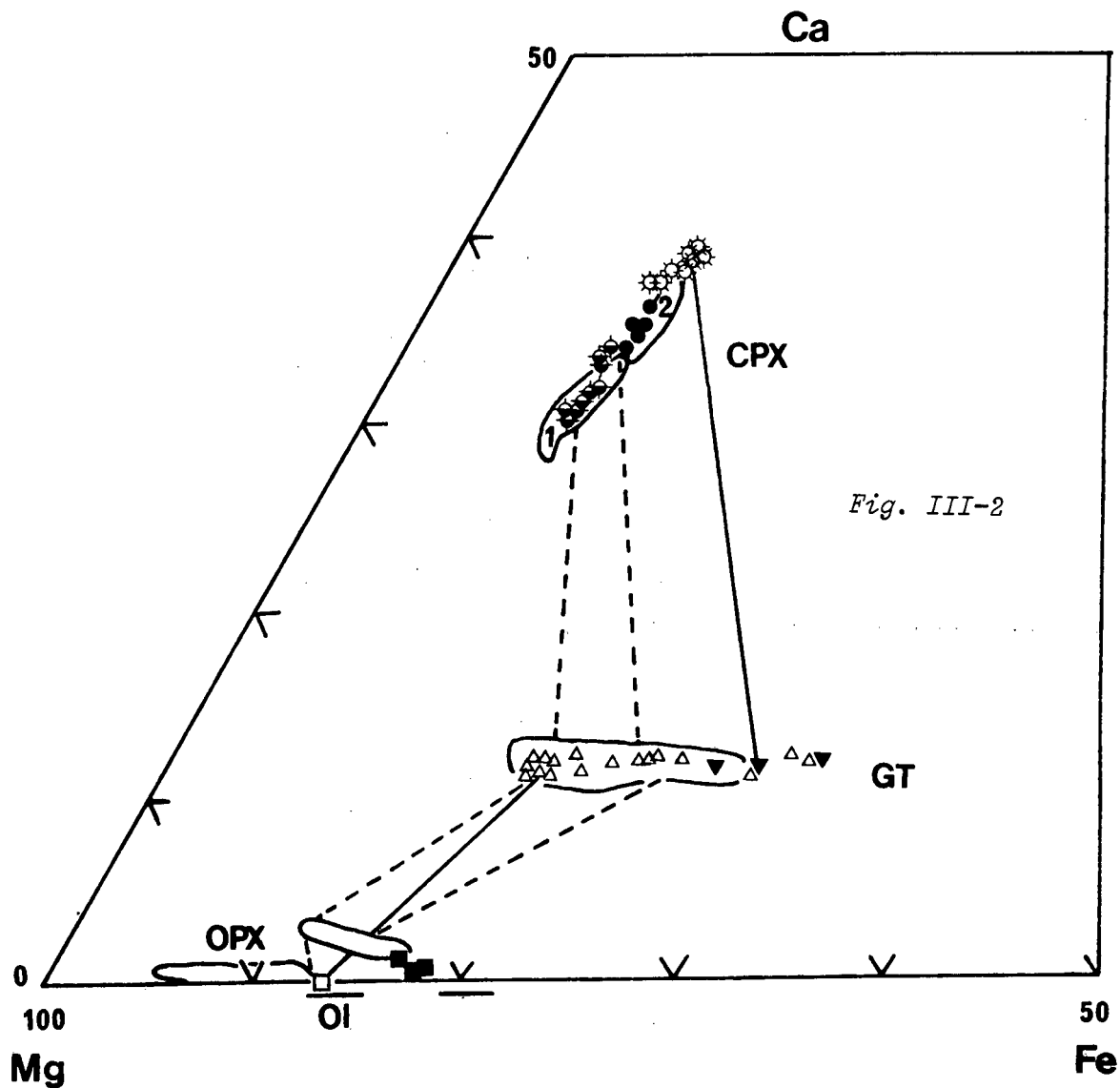


Fig. III-2

Fig. III-2: Ca-Mg-Fe variation diagram for silicate megacrysts from Lekkerfontein. Solid tie lines are for coexisting phases from this work; dashed tie lines and data fields are for the Monastery megacrysts: field 1 - Discrete; field 2 - Ilmenite association (Jakob, 1977).

- | | |
|---|--------------------------|
| Cpx: | Gt: |
| ◆ - Discrete | △ - Discrete |
| ● - Lamellar intergrowths with ilmenite | ▼ - Ilmenite association |
| ⊛ - Inclusions in ilmenite | |
| Opx: | Ol: |
| ■ - Inclusions in ilmenite | □ - Inclusion in gt. |

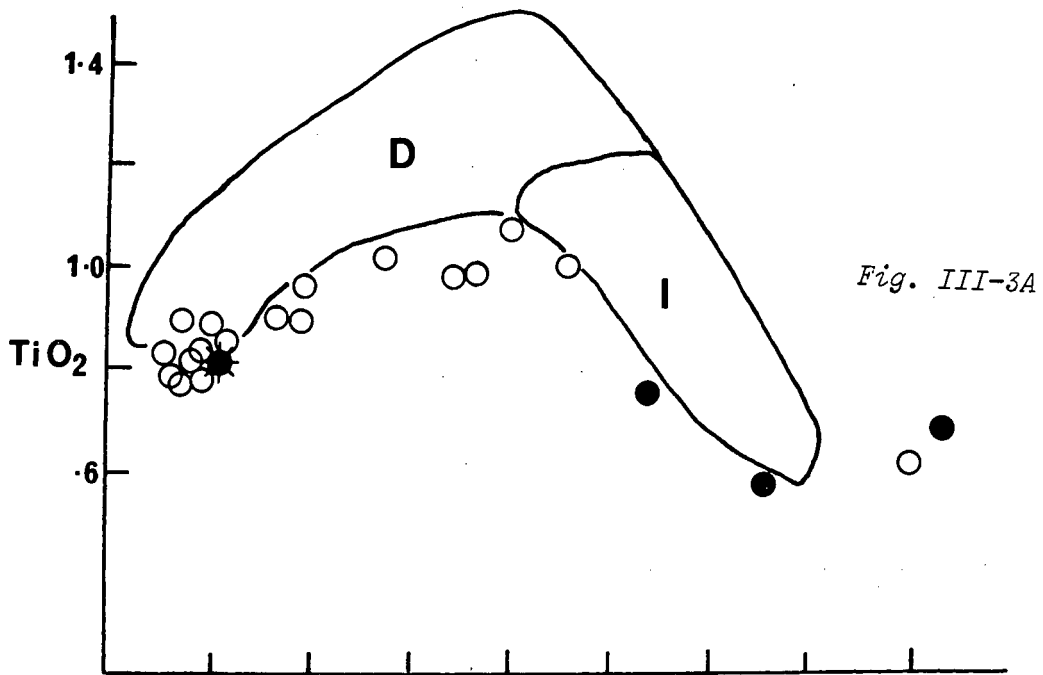


Fig. III-3A

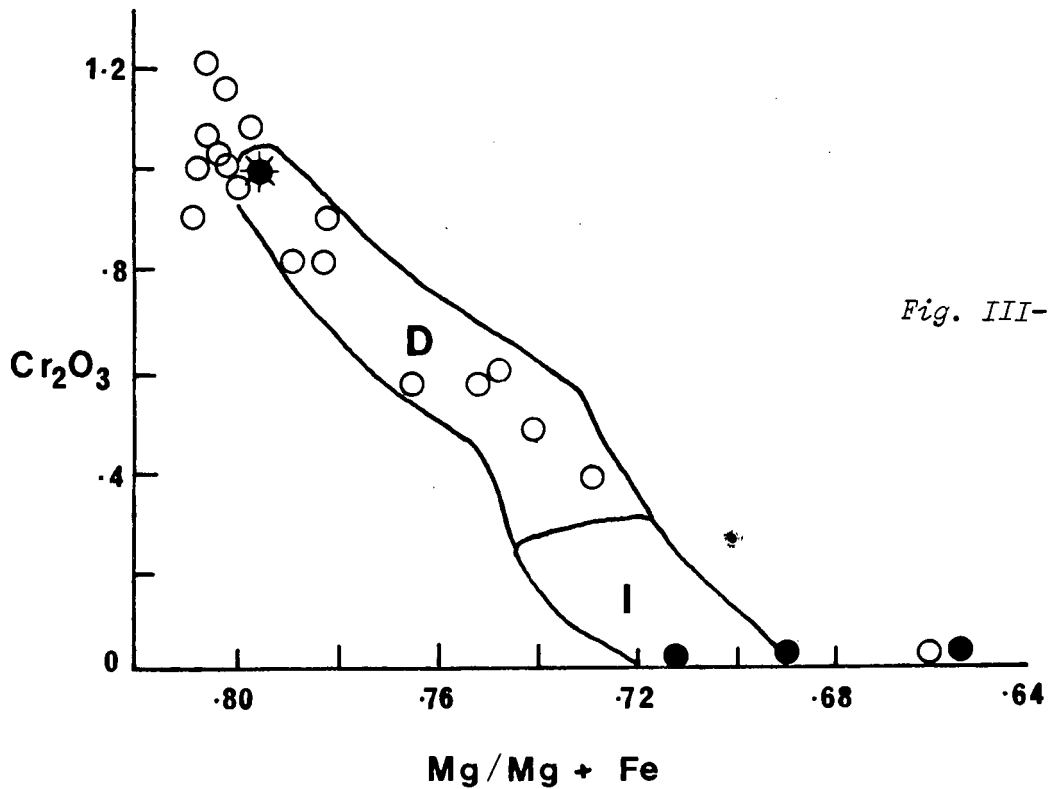


Fig. III-3B

Figs. III-3A: TiO_2 (wt.%) vs. $Mg/Mg+Fe$
-3B: Cr_2O_3 (wt.%) vs. $Mg/Mg+Fe$ in garnet
 megacrysts from Lekkerfontein.

○ - Discrete

★ - Garnet + olivine inclusion

● - Garnets in ilmenite association

Fields outlined are for data from Monastery (Jakob,
 1977): D = Discrete or silicate association

I = Ilmenite association.

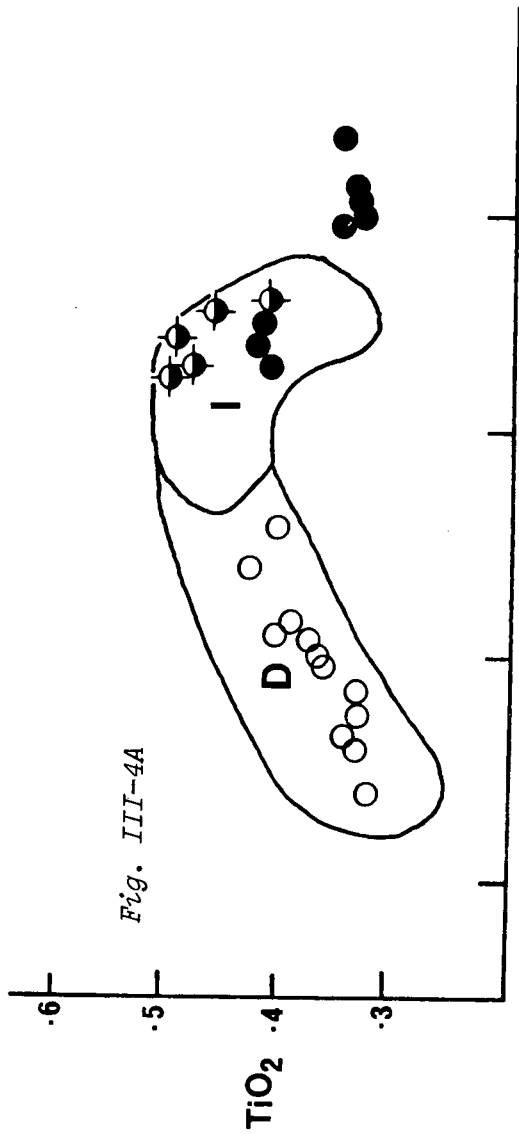


Fig. III-4A: TiO₂ (wt.%) vs. Mg/Mg+Fe in clinopyroxene megacrysts from Lekkerfontein

- - Discrete
- * - Lamellar + ilmenite
- - Inclusion in ilmenite.

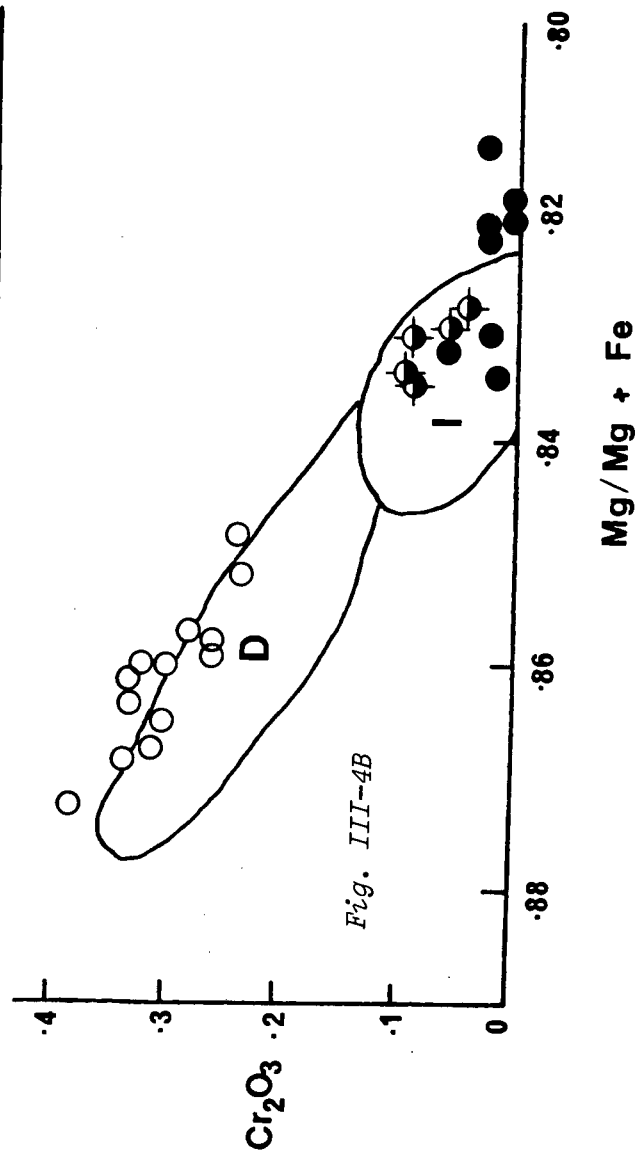


Fig. III-4B: Cr₂O₃ (wt.%) vs. Mg/Mg+Fe in clinopyroxene megacrysts from Lekkerfontein. Symbols as above. Fields D and I as in Fig. III-3.

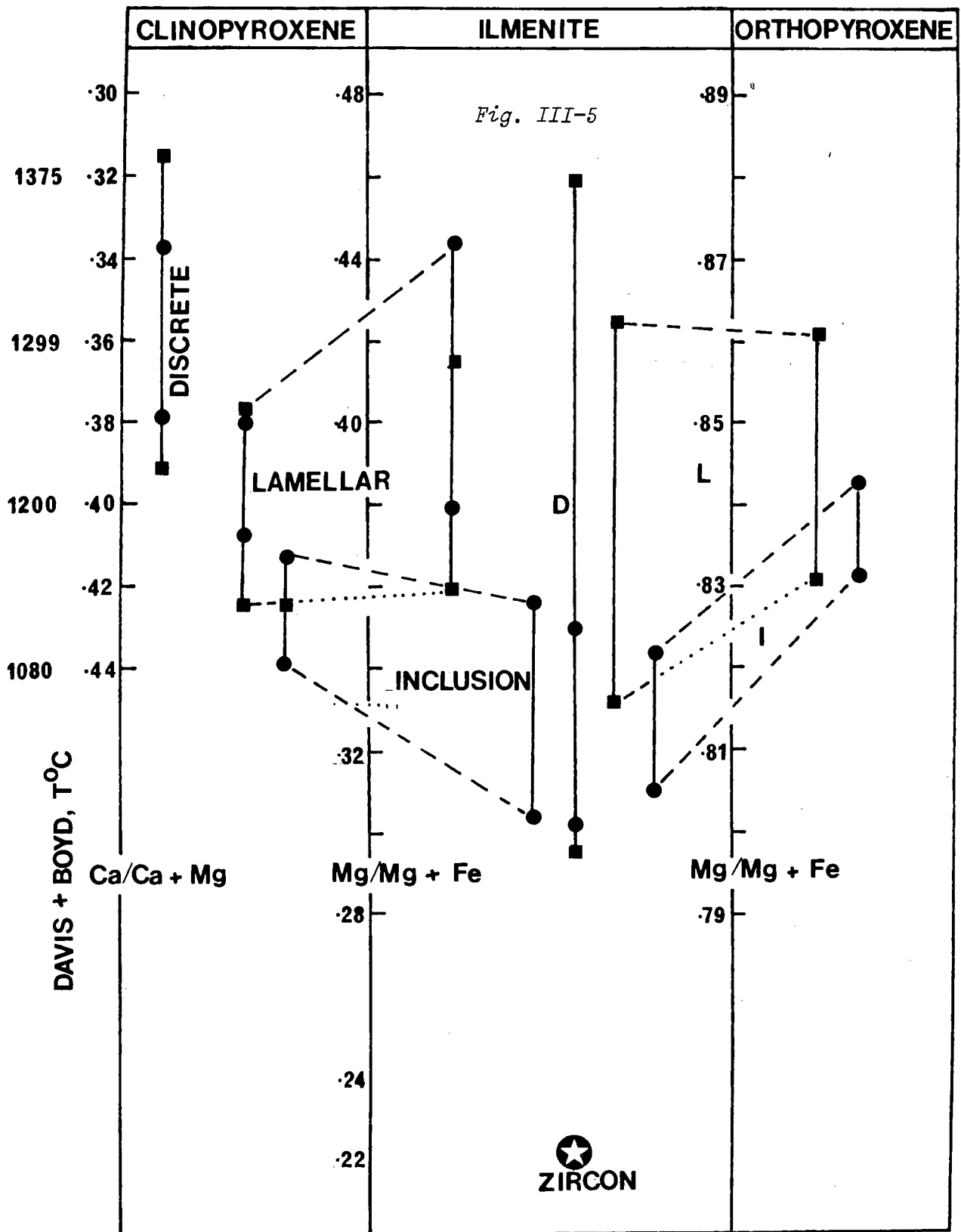


Fig. III-5: Diagram summarising the compositions of discrete and coexisting megacryst phases at Lekkerfontein (●) and comparing them with the data for megacrysts from Monastery (■) (Jakob, 1977). Lamellar (L) = lamellar intergrowths of pyroxenes with ilmenites; Inclusion (I) = inclusions of pyroxenes and zircon in ilmenite; Discrete (D) = discrete megacrysts. Lines (solid, dashed and dotted) show the limits in composition of each coexisting group.

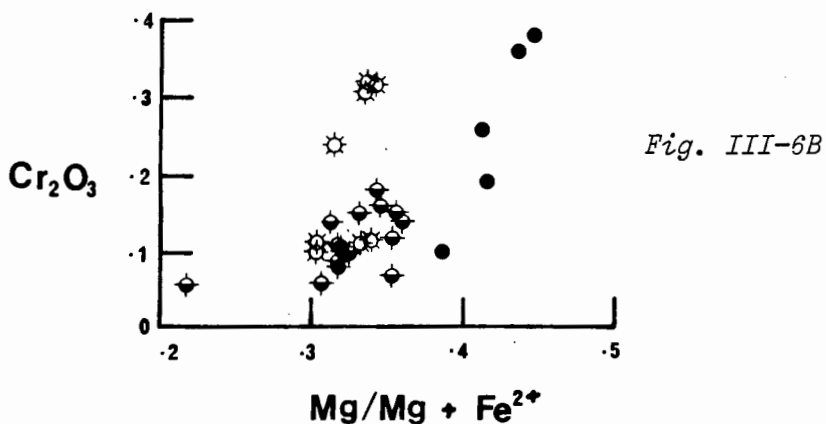
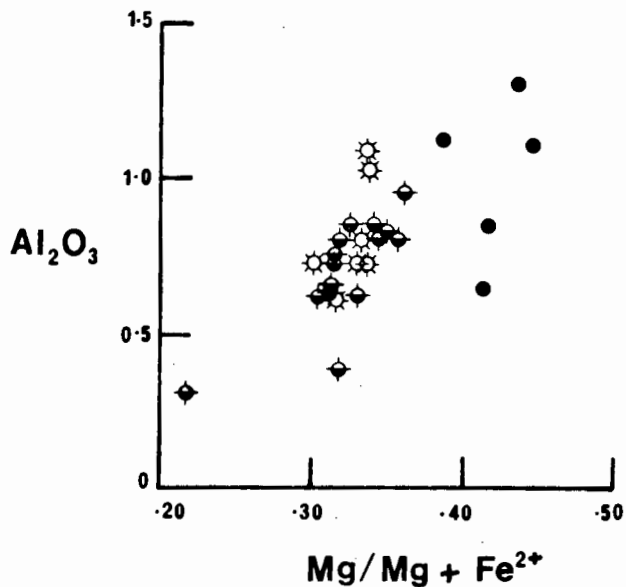


Fig. III-6A: Al_2O_3 (wt.%) vs. $Mg/Mg+Fe^{2+}$
 -6B: Cr_2O_3 (wt.%) vs. $Mg/Mg+Fe^{2+}$
 in ilmenite megacrysts from Lekkerfontein.
 ○ - Discrete; ● - Lamellar;
 ☆ - With inclusions.

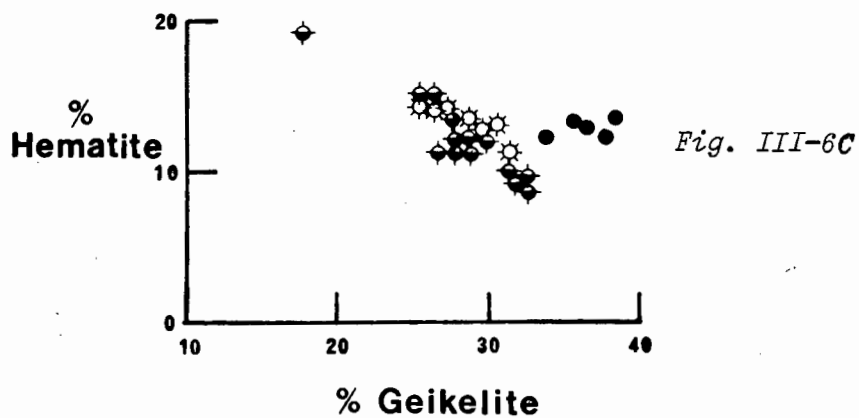


Fig. III-6C: % Hematite vs. % Geikelite
 in ilmenite megacrysts from Lekkerfontein.
 Symbols as in Fig. III-6A,B.

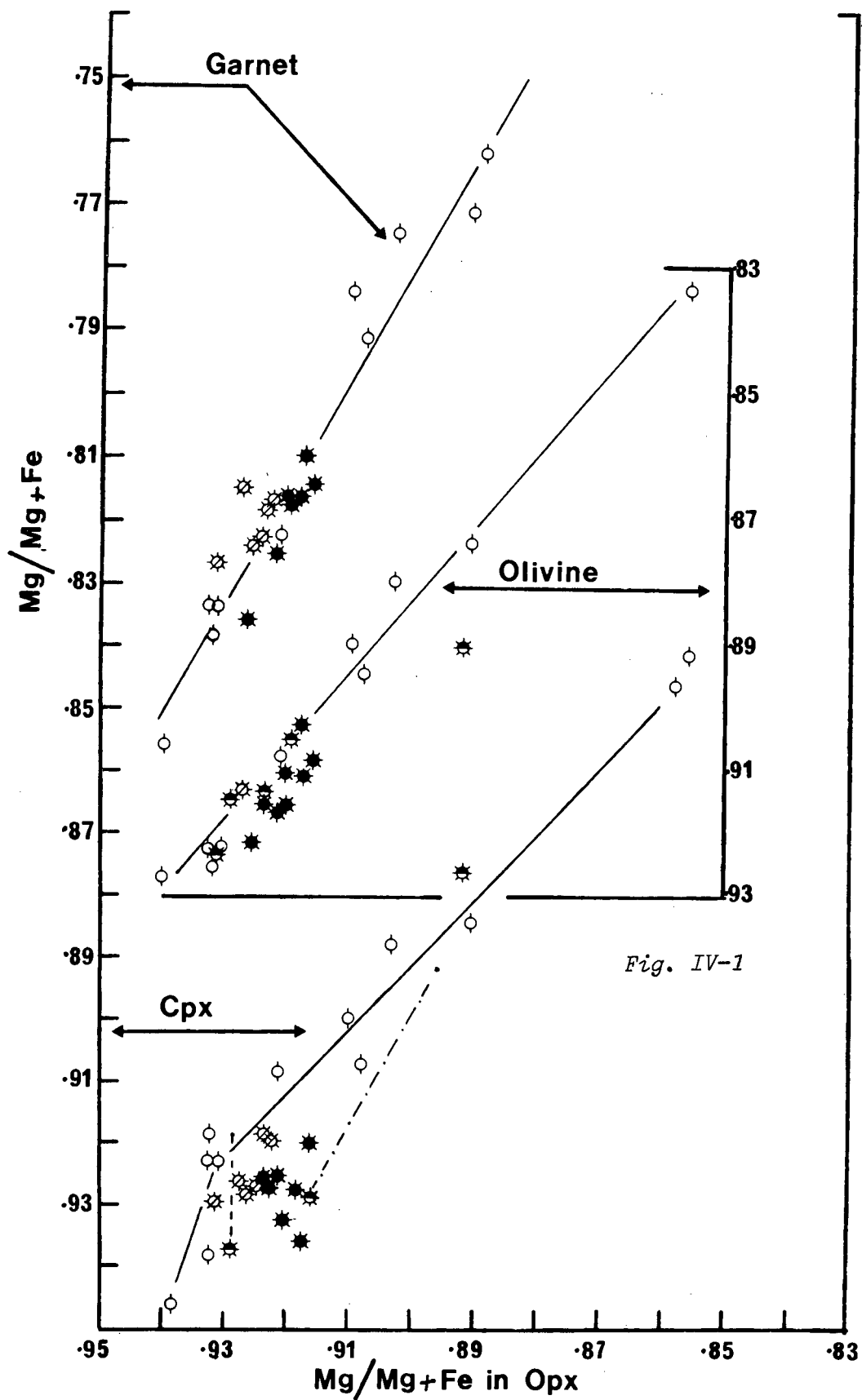


Fig. IV-1

Fig. IV-1: Mg, Fe equilibria in minerals from ultrabasics at Melton Wold and Hebron. Also shown are values for the Matsoku suite (Cox et al., 1973). * - Melton Wold garnet lherzolite, * - Hebron garnet lherzolite, * - Hebron lherzolite, --- neoblasts in Hebron porphyroclastic lherzolite 07103, \circ - Matsoku. --- joins primary (*) cpx to secondary cpx in 07063.

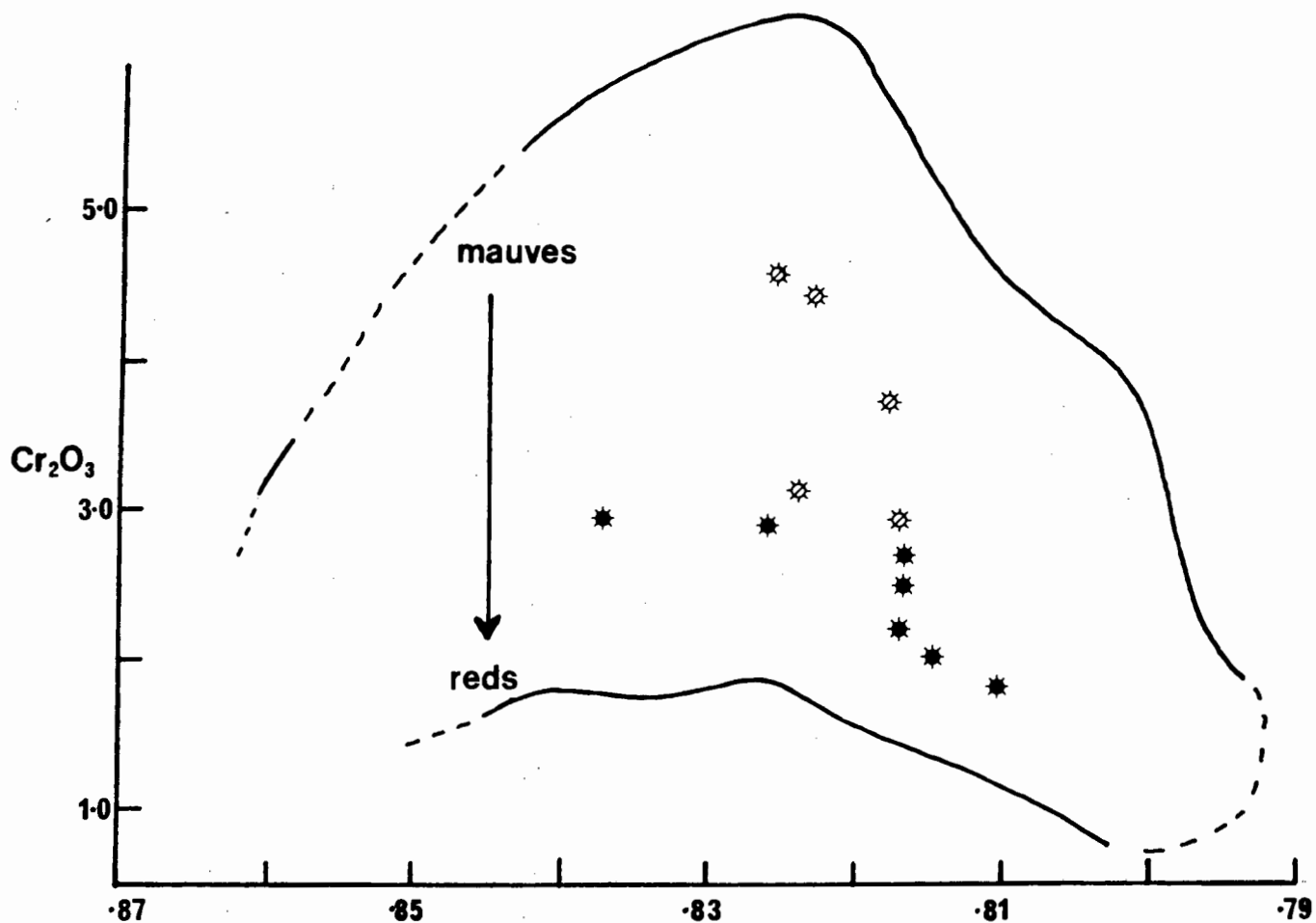


Fig. IV-2

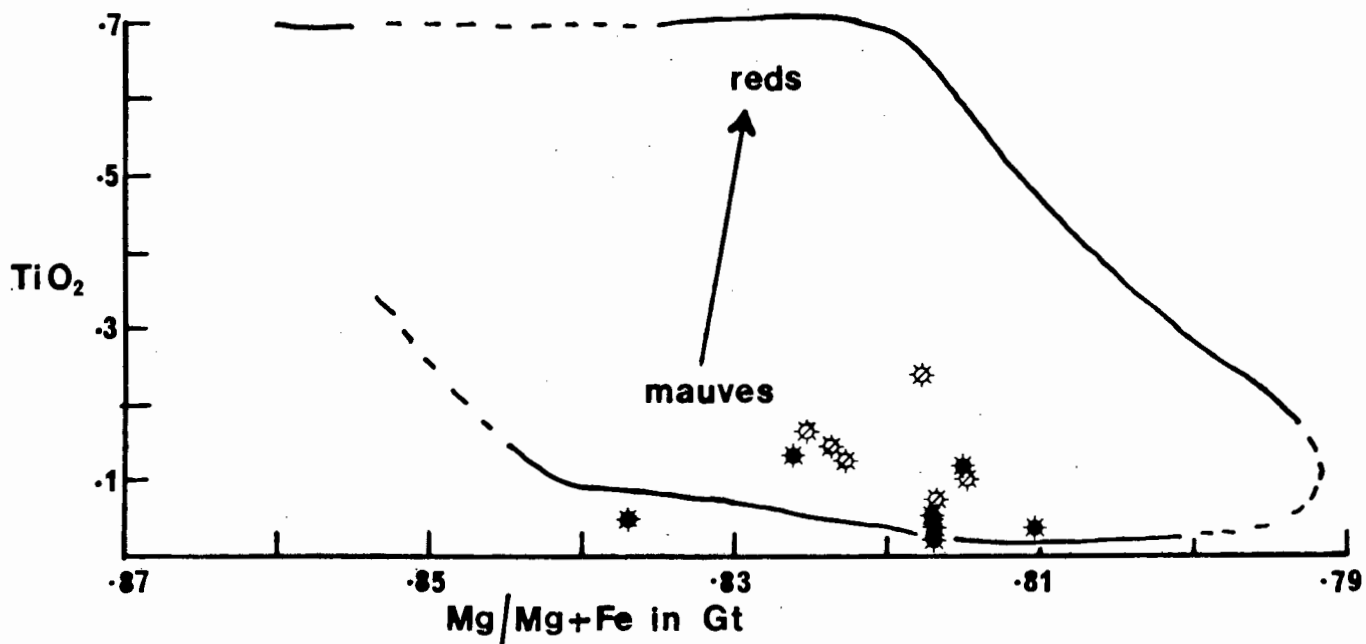


Fig. IV-2: Cr_2O_3 (wt.%) and TiO_2 (wt.%) variation with $\text{Mg}/\text{Mg}+\text{Fe}$ in garnets from the Melton Wold and Hebron peridotites. Also shown are the compositional fields occupied by garnets sampled from the heavy mineral concentrate at Melton Wold. These concentrate garnets change in colour as indicated (reds ← mauves). Symbols as in Fig. IV-1.

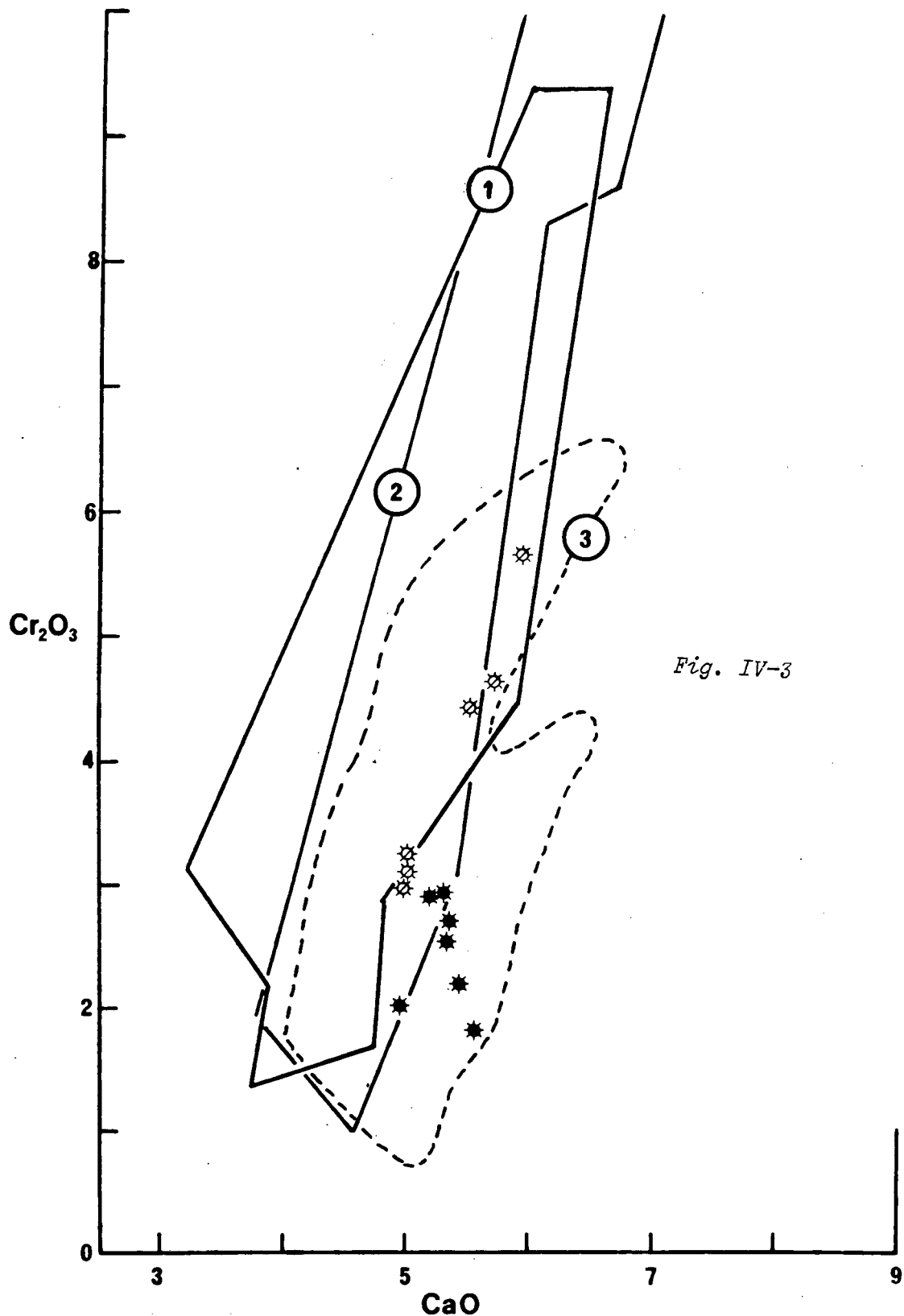


Fig. IV-3

Fig. IV-3: CaO (wt.%) vs. Cr₂O₃ (wt.%) variation for garnets from Hebron and Melton Wold peridotites. Their distribution is compared with the compositional fields of garnets from:

- 1 - Bultfontein peridotites (Lawless, 1979).
- 2 - Premier garnet lherzolites and Group 1 harzburgites (Danchin, 1979).
- 3 - Melton Wold concentrate (this work - analyses not given).

Symbols as in Fig. IV-1.

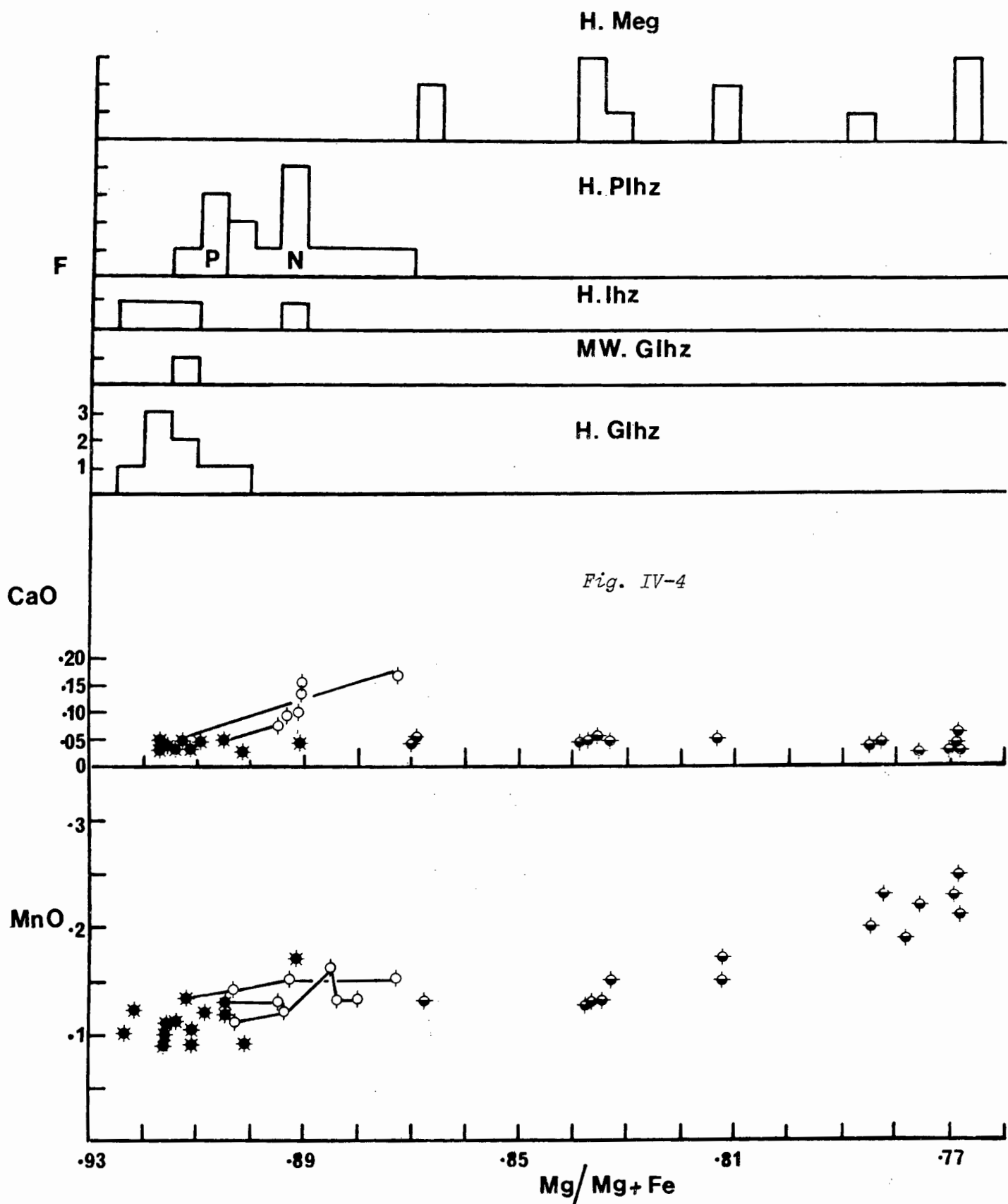


Fig. IV-4: Olivine compositions of Hebron (H) peridotites and megacrysts. MnO and Ca in wt.%. * - peridotites, \blacklozenge - megacrysts, \circ -neoblasts in 07103. Also given is a frequency (F) histogram of the Fo contents in different olivine types. Abbreviations are Glh - garnet lherzolite, lhz - lherzolite, Plh - porphyroclastic lherzolite 07103 (P = porphyroclast, n = neoblast), meg - megacryst. Because of severe alteration, only a single olivine from a Melton Wold (MW) garnet lherzolite was analysed.

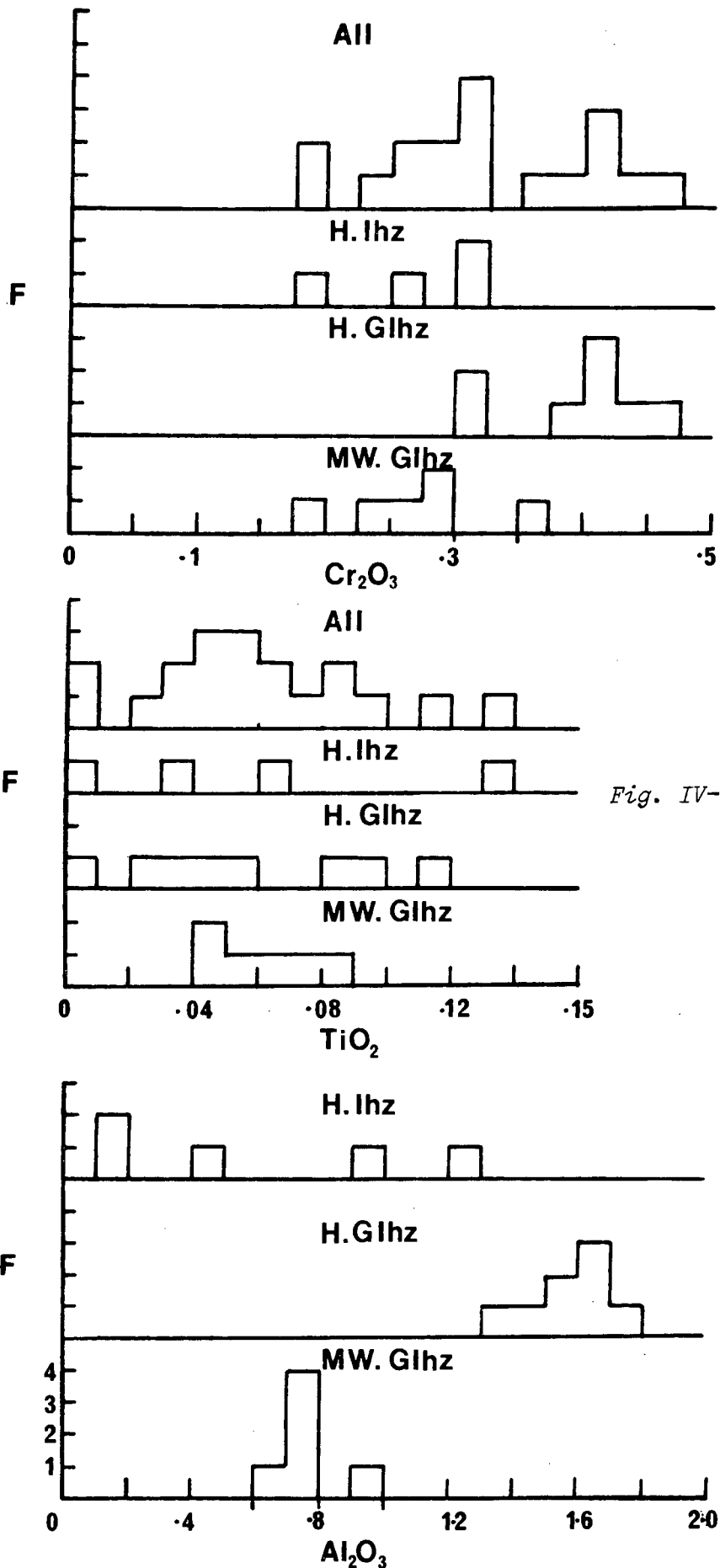


Fig. IV-5

Fig. IV-5: Orthopyroxene compositions. Frequency histograms showing the Al_2O_3 , TiO_2 , Cr_2O_3 , CaO and Na_2O contents (in wt.%) of orthopyroxenes in COARSE peridotites from Hebron and Melton Wold. Abbreviations as in Fig. IV-4; ALL - the total sample.

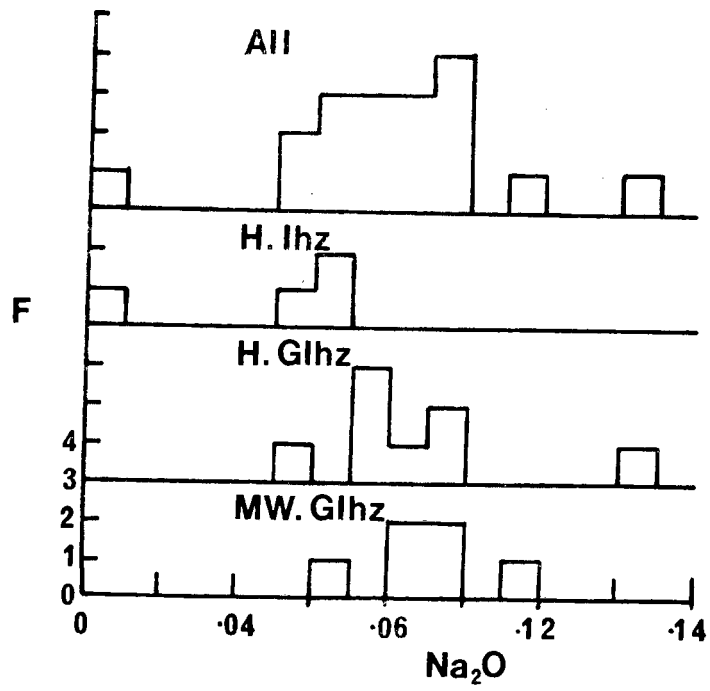
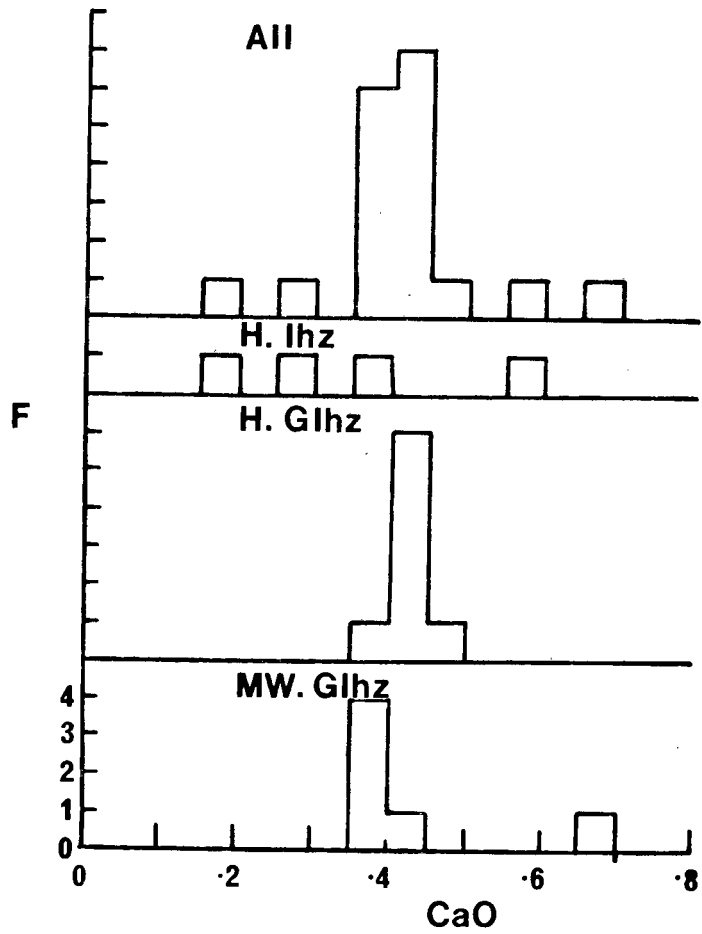


Fig. IV-5 (contd.)



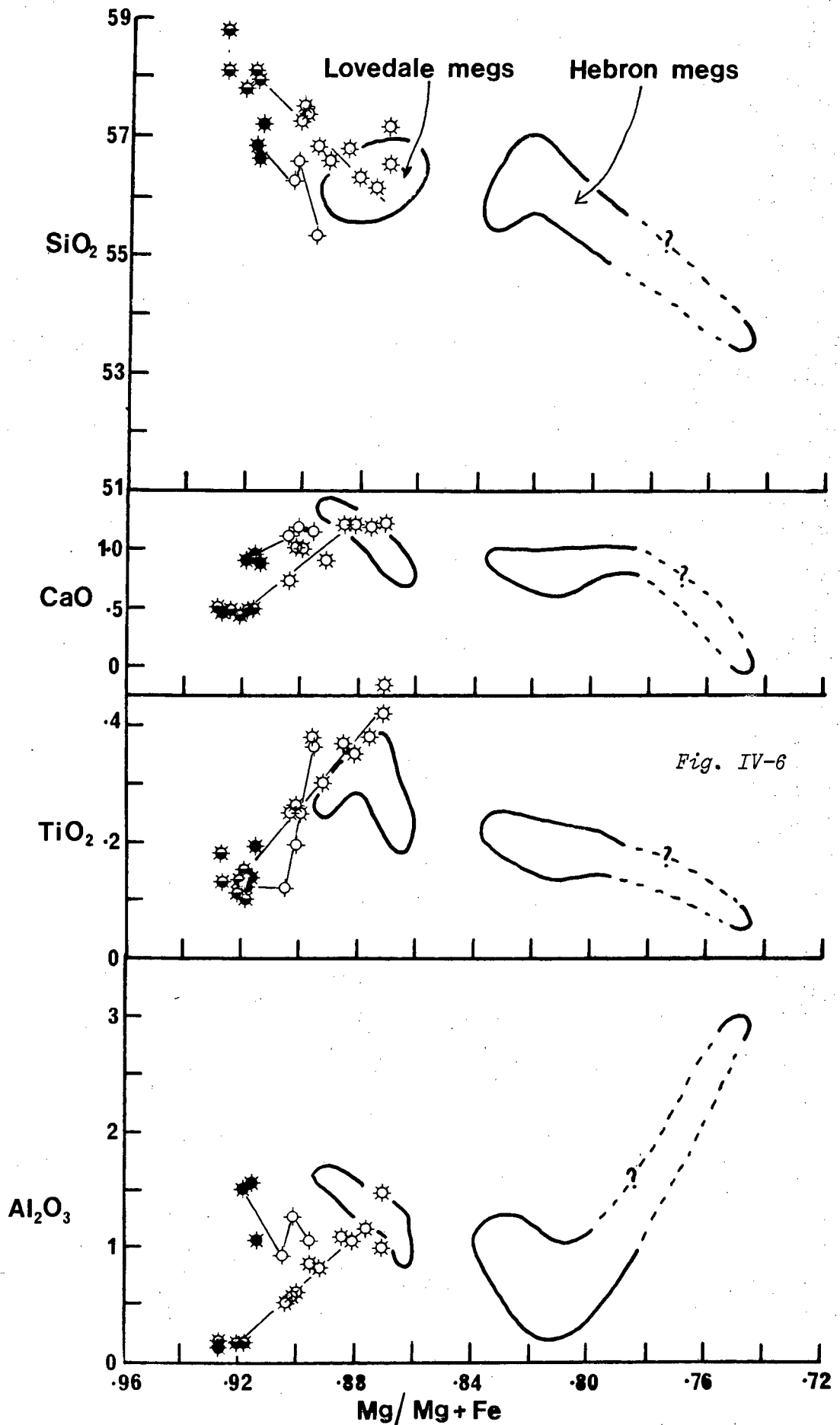


Fig. IV-6: Orthopyroxene compositions in the Hebron porphyroclastic therszolite 07103. SiO_2 , CaO , TiO_2 , Al_2O_3 in wt.%. \star - porphyroclasts, \star - neoblasts, \star - mantles replacing clinopyroxene porphyroclasts, \circ - neoblasts of recrystallised mantle. Also shown are the compositional fields for megacrysts (meg) at Hebron and Lovedale.

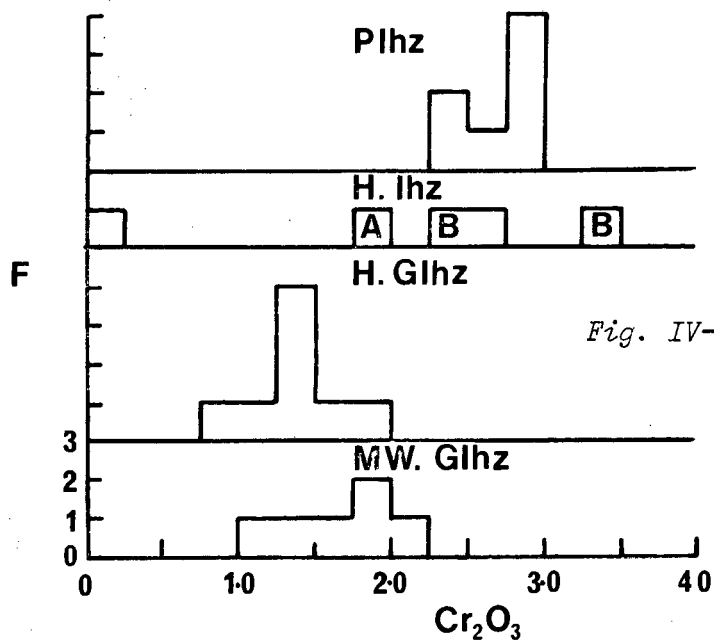
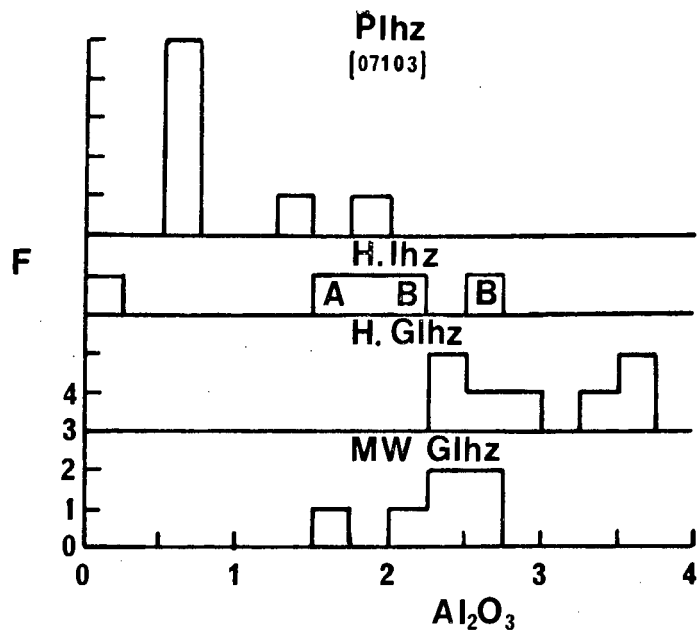


Fig. IV-7

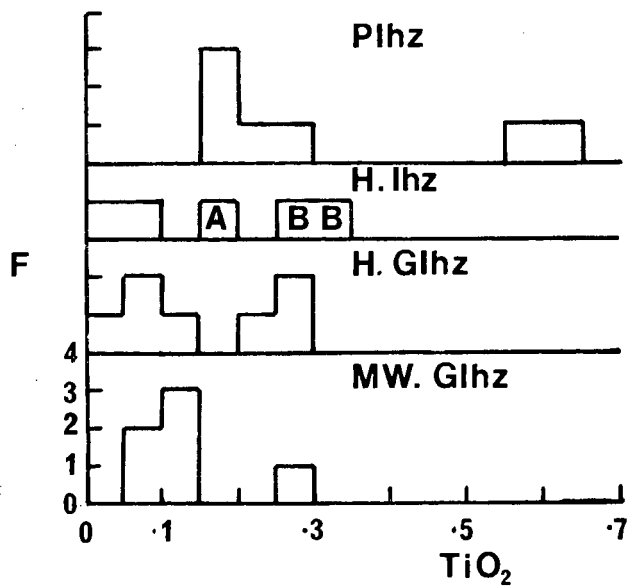


Fig. IV-7: Clinopyroxene compositions in coarse peridotites from Hebron and Melton Wold and in the porphyroclastic Iherzolite (07103) from Hebron. Al_2O_3 , Cr_2O_3 , TiO_2 , Na_2O in wt.%. Abbreviations as in Fig. IV-4; A - primary and B - secondary associations in 07063 - see text.

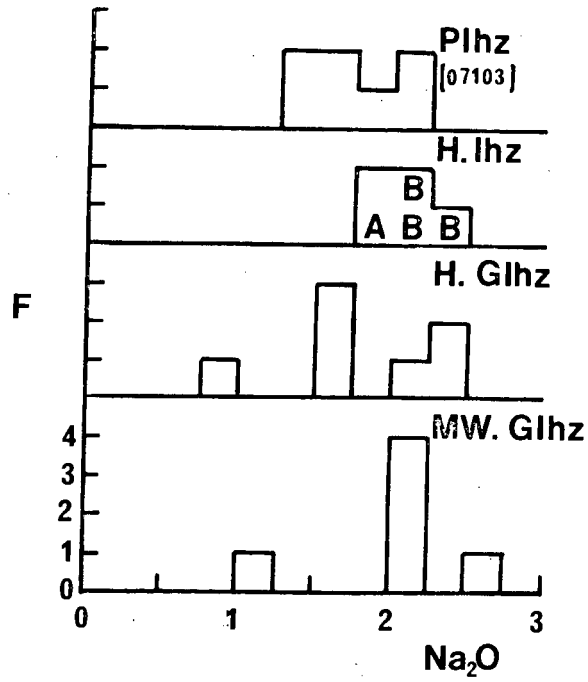
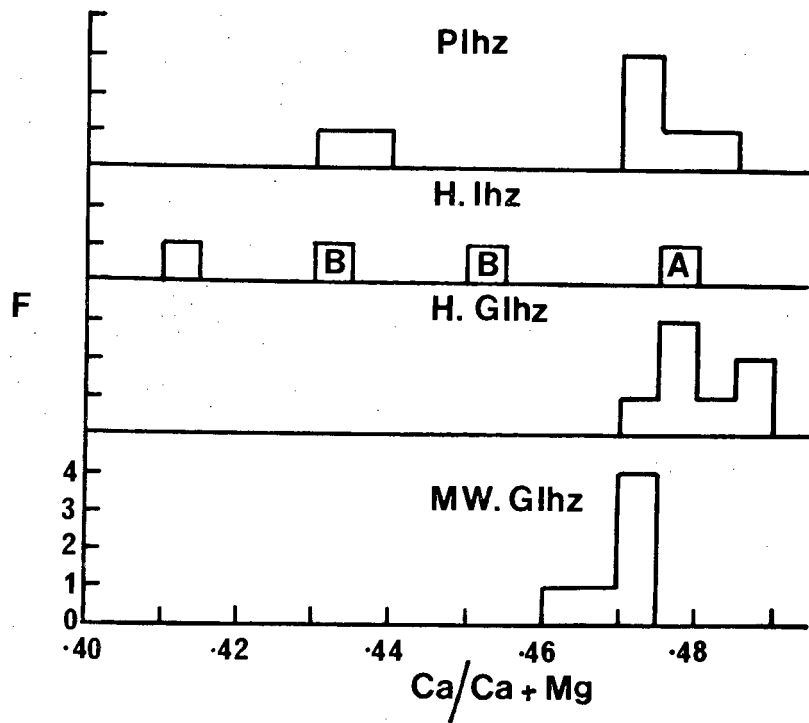


Fig. IV-7 (contd.)



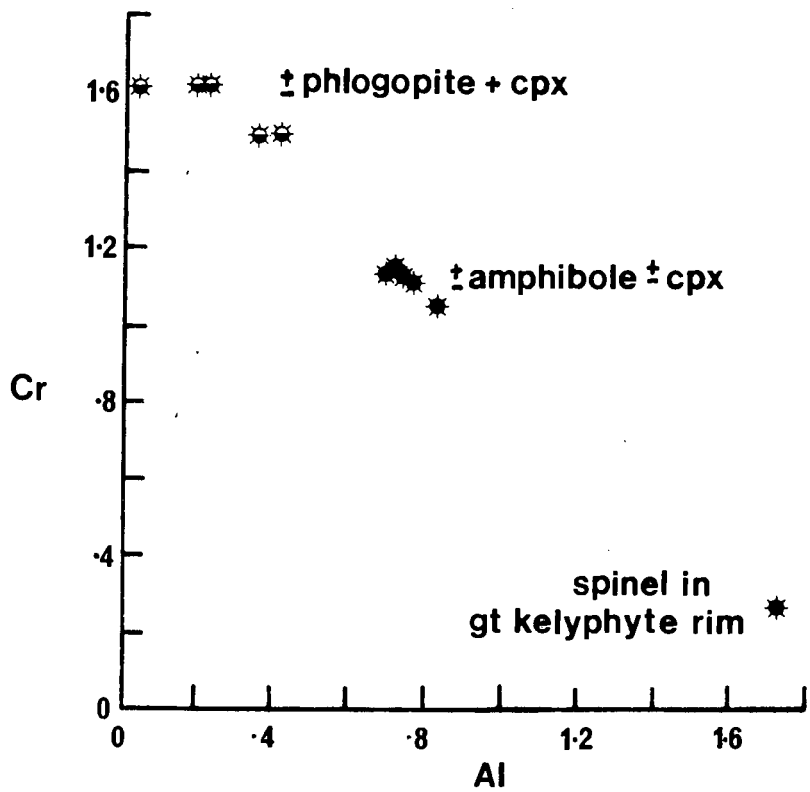


Fig. IV-8

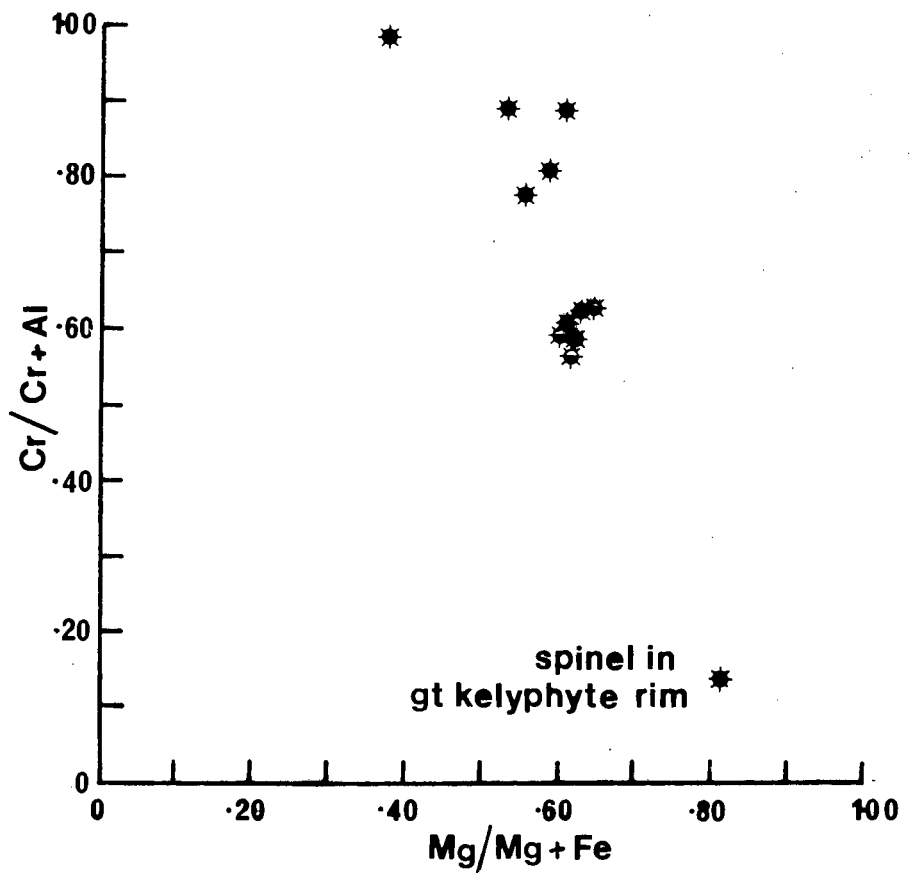


Fig. IV-8: Spinel compositions in Hebron peridotites. * - garnet lherzolites, ‡ - lherzolites. Mineral associations are shown. Data are atomic prop.

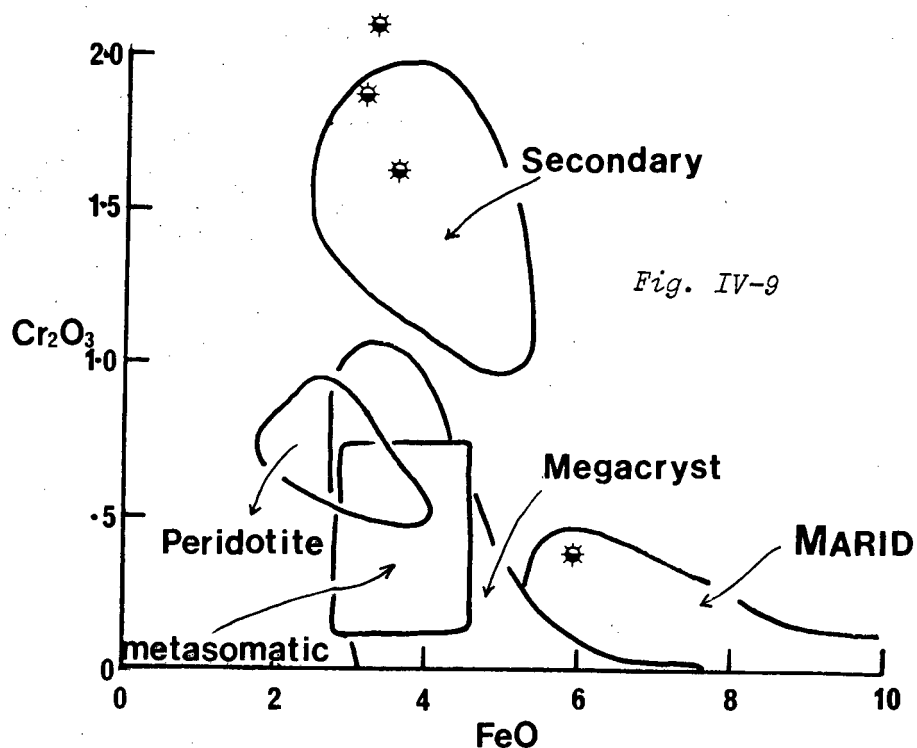


Fig. IV-9

| | <u>Hebron</u> | <u>Secondary</u> | <u>Primary</u> |
|---------------------------------------|-----------------------|------------------------|-----------------------|
| Mg/Mg+Fe av. | .94 - .88 (.92) | (after Carswell, 1975) | |
| TiO ₂ av. | 3.0 - 1.3 (2.80) | .5 - 1.5 (1.1) | .2 - .7 (.3) |
| Cr ₂ O ₃ av. | 2.1 - .4 (1.5) | 1.4 - 1.6 (1.5) | .6 - .9 (.7) |
| Al ₂ O ₃ av. | 12.3 - 18.0 (15.2) | 13.9 - 16.0 (14.9) | 12.2 - 13.2 (12.6) |

Fig. IV-9: Phlogopite compositions in Hebron lherzolites. Cr₂O₃ (wt.%) and FeO (wt.%) compositional fields for kimberlitic phlogopites are from Dawson and Smith (1977). The table summarises and compares data (wt.% and at. ratio) from Hebron with the primary and secondary metasomatic phlogopites described by Carswell (1975).

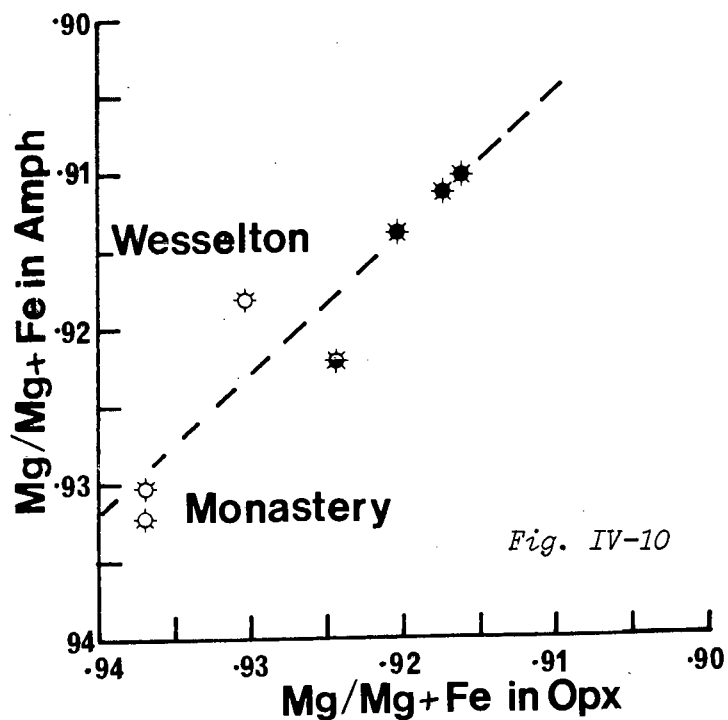


Fig. IV-10

| | <u>Range</u> | <u>Average</u> |
|--------------------------------|---------------|----------------|
| Mg/Mg+Fe | .92 - .91 | .91 |
| Ti ₂ O | .42 - .18 | .22 |
| Cr ₂ O ₃ | 2.40 - 1.53 | 2.02 |
| CaO | 11.10 - 9.85 | 10.58 |
| Al ₂ O ₃ | 10.87 - 13.14 | 12.37 |
| Na ₂ O | 4.31 - 2.48 | 3.43 |
| K ₂ O | 1.41 - 1.17 | 1.28 |

Fig. IV-10: Amphibole and orthopyroxene Fe/Mg equilibria in Hebron peridotites. Symbols as in Fig. IV-1; \odot - amphiboles in harzburgite from Wesselton (Boyd, 1971) and Monastery (Dawson and Smith, 1975). The table summarises the Hebron amphibole compositions. Ratios are atomic prop.; oxides are in wt.%.

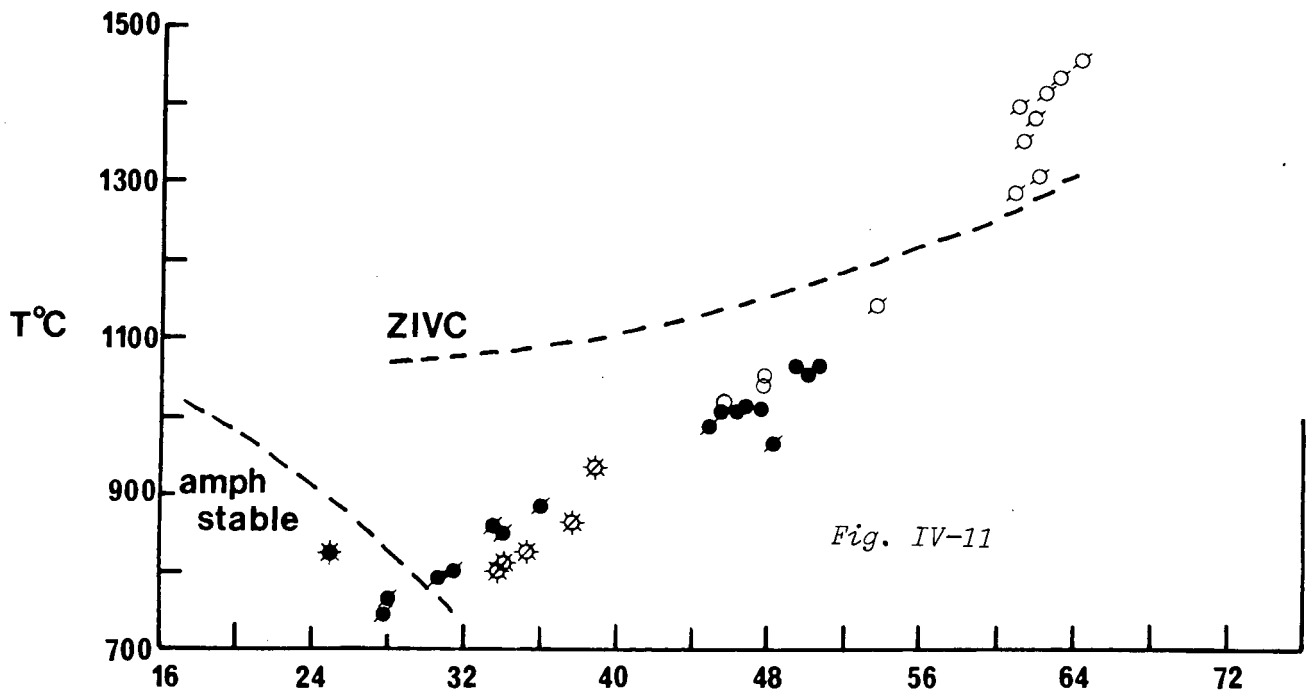


Fig. IV-11

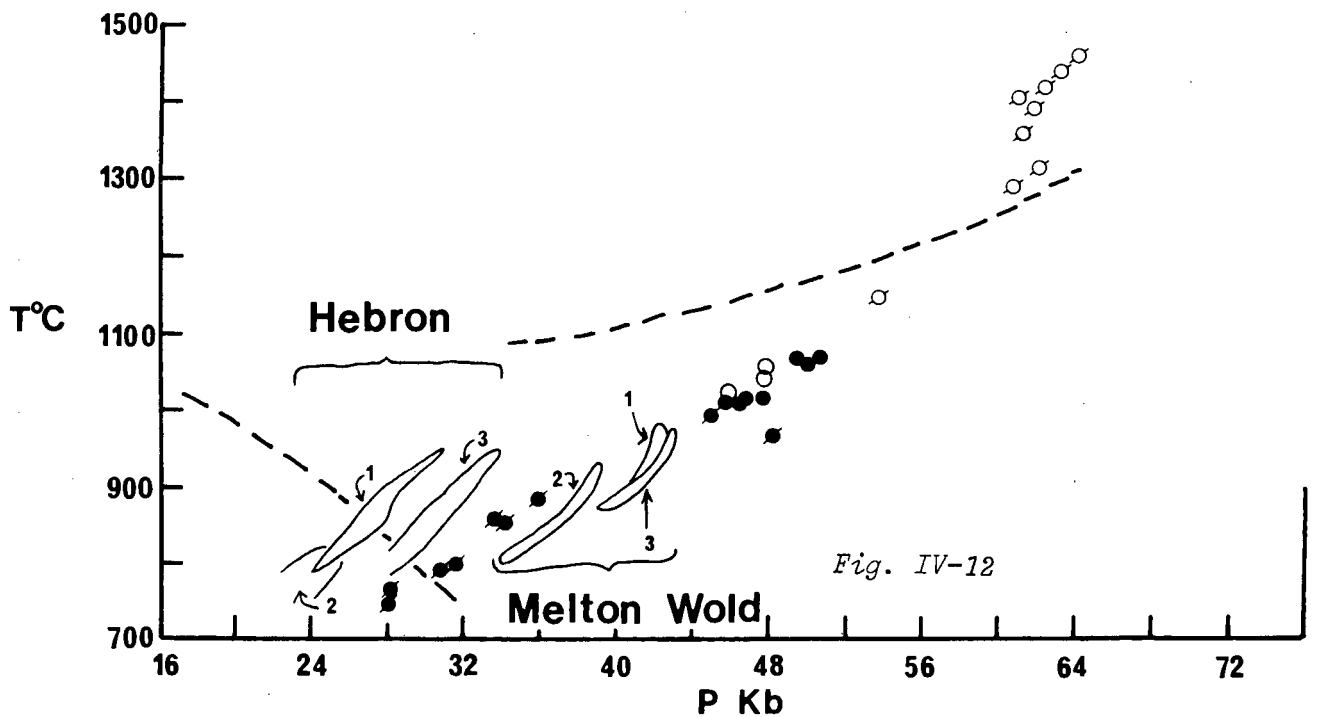


Fig. IV-12

Figs. IV-11, 12: Equilibration pressure and temperature estimates for coarse garnet lherzolites from Hebron and Melton Wold, using different calculation methods. Estimates are compared with those from Matsoku and Thaba Putsoa.

*Fig. IV-11: $T^{\circ}C$ (Lindsley and Dixon, 1976), Pkb (MacGregor, 1974).
 * - Hebron, * - Melton Wold, • - Matsoku coarse peridotites,
 ○ - Matsoku deformed peridotites, • - Thaba Putsoa coarse peridotites,
 ○ - Thaba Putsoa deformed peridotites. ZIVC approximates upper stability P,T of phlogopite (Egglar and Wendlandt, 1979); Amph - amphibole stability (Kushiro, 1968).*

*Fig. IV-12: Comparing the P,T arrays produced by using different combinations of the available geothermometers and geobarometers.
 1 - Wells (1977) av. $T^{\circ}C$ and MacGregor (1974) Pkb; 2 - as in Fig. IV-11; 3 - Wells (1977) av. $T^{\circ}C$ and Akella (1976) Pkb. The Matsoku and Thaba Putsoa data are as in Fig. IV-11. See also Tables IV-22, 23.*

Fig. V-1

Diagrammatic flowchart of the textural classification designed for mafic to intermediate xenoliths.

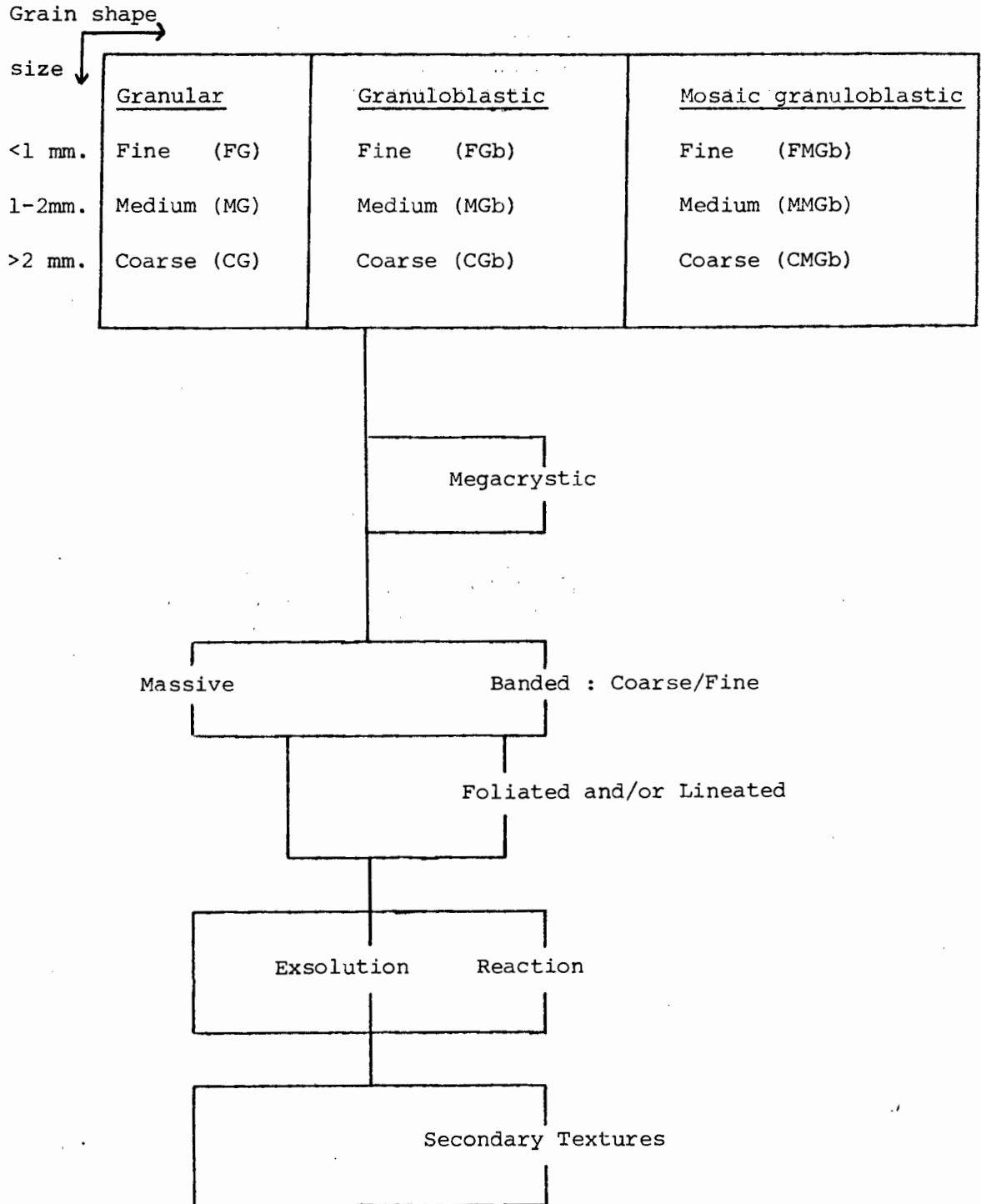


Fig. V-2A: Ca-Mg-Fe variation for garnets and clinopyroxene (cpx) in eclogite xenoliths.

Tie lines are shown

● - center of grain

○ - edge of grain

Fields show variation in individual xenoliths.

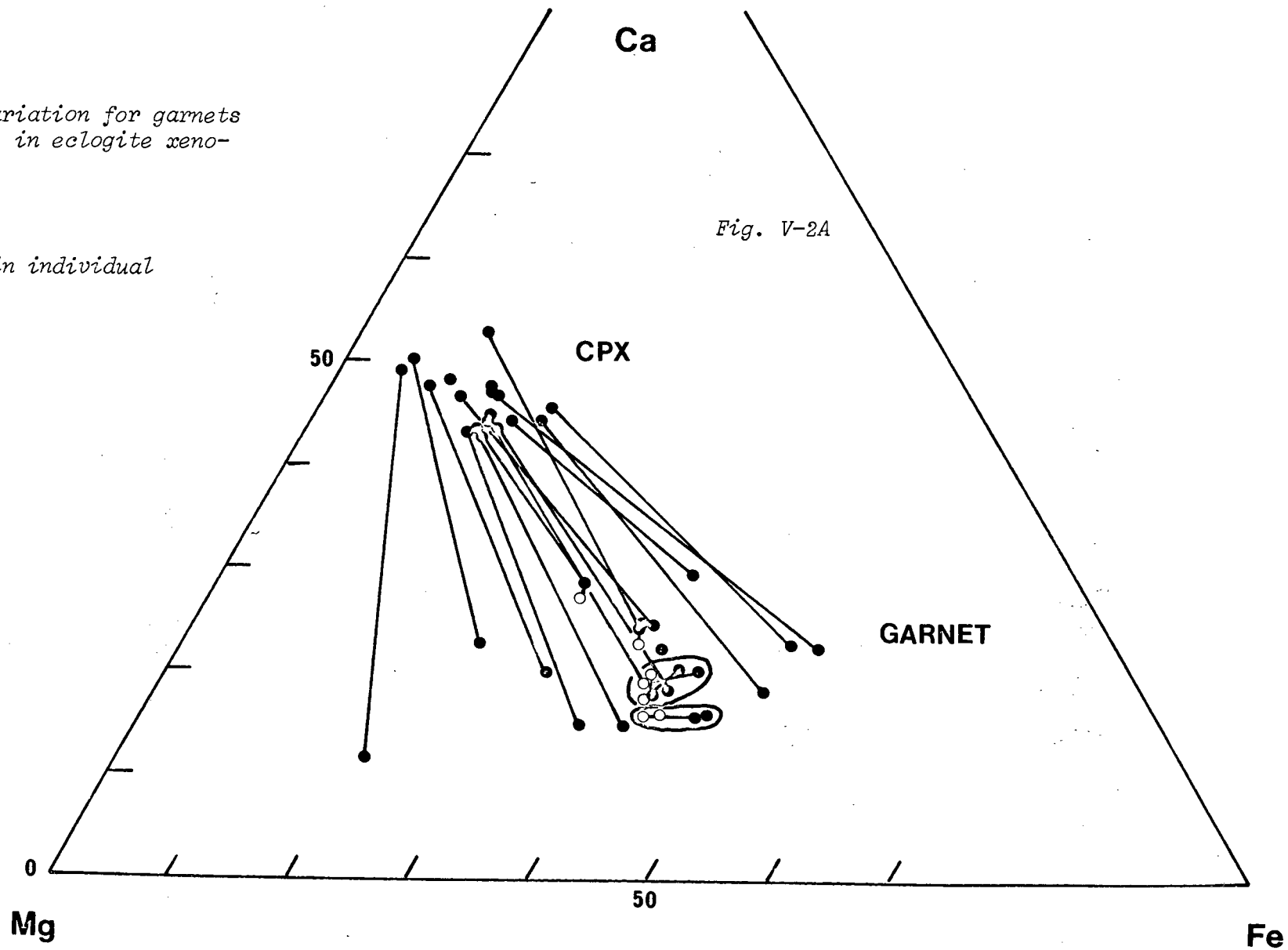


Fig. V-2B: Ca-Mg-Fe variation for garnets and clinopyroxene in kyanite eclogite xenoliths. Short tails indicate zoning towards grain edges.

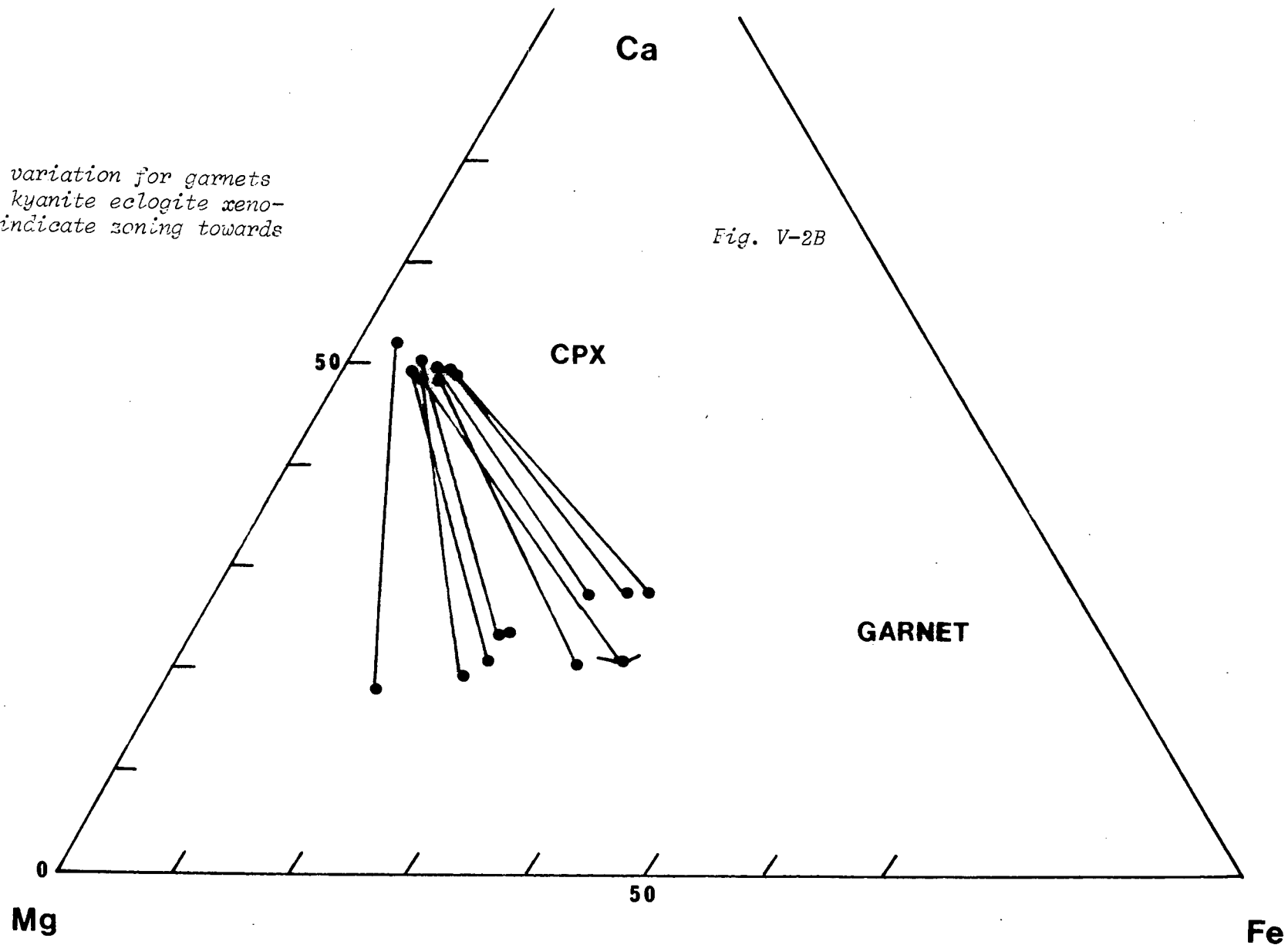


Fig. V-2B

Fig. V-2C: Ca-Mg-Fe variation for garnets and clinopyroxene in garnet granulite xenoliths.

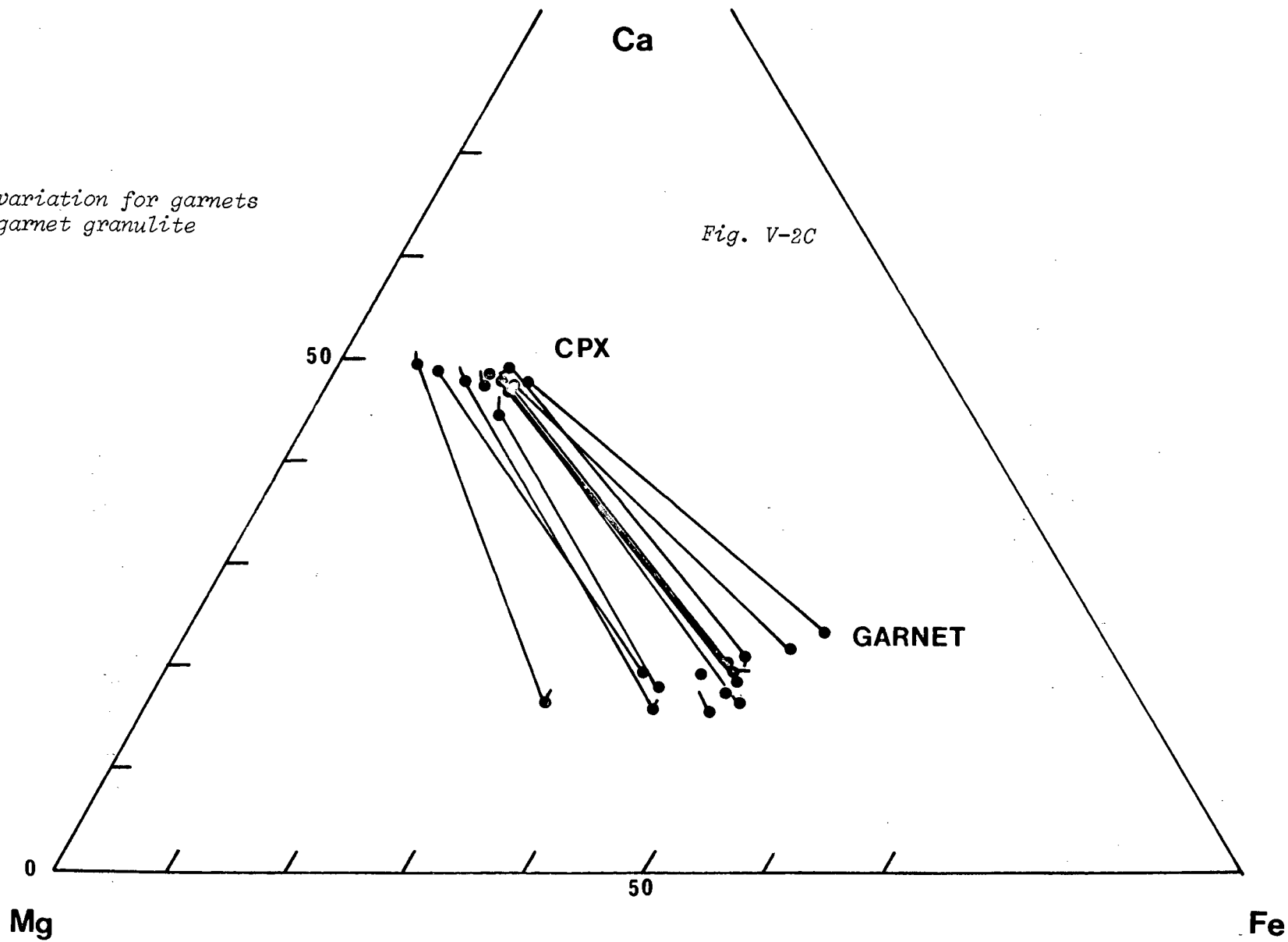


Fig. V-2C

Fig. V-2D: Ca-Mg-Fe variation for garnets and clinopyroxene in kyanite garnet granulites.

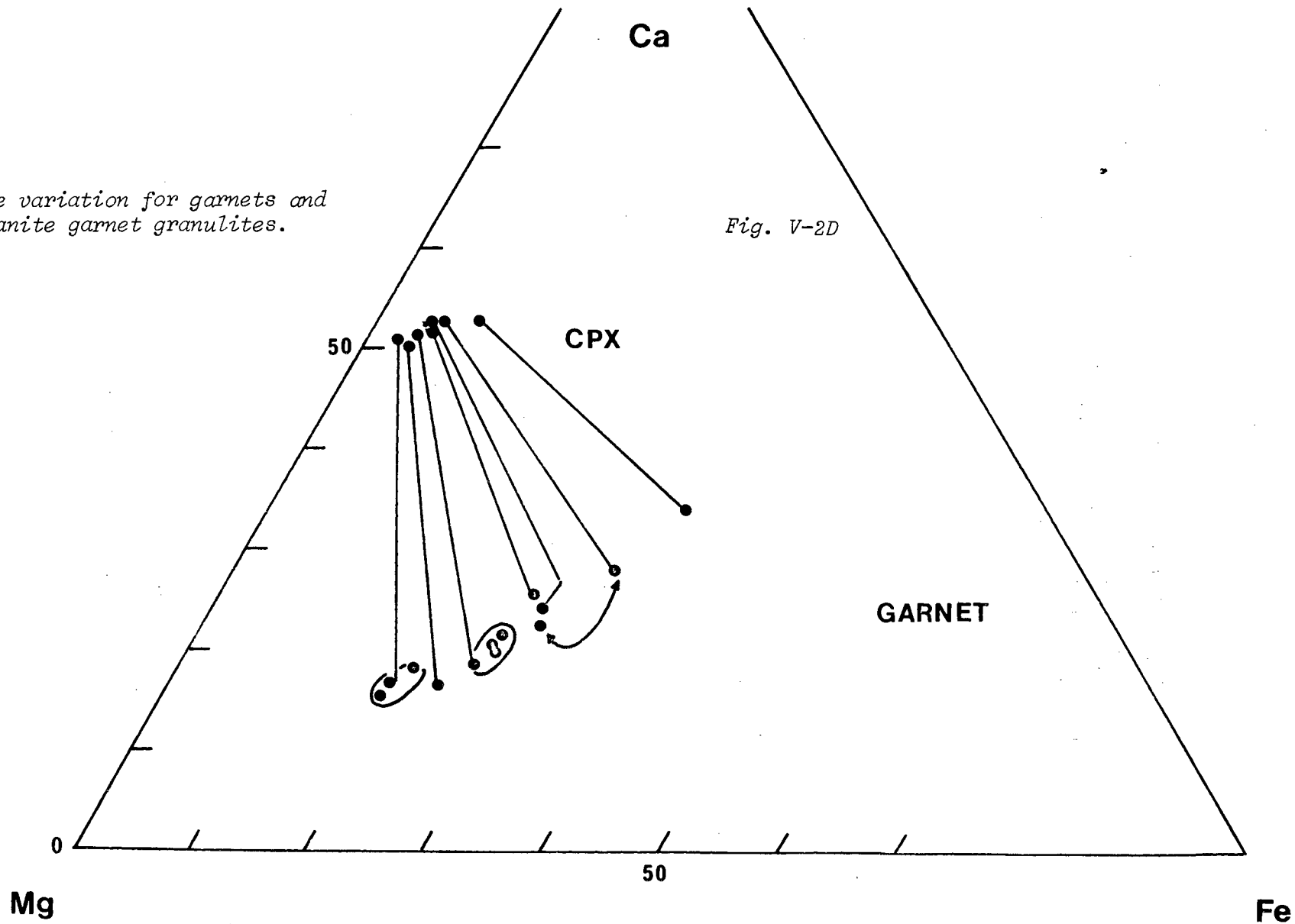
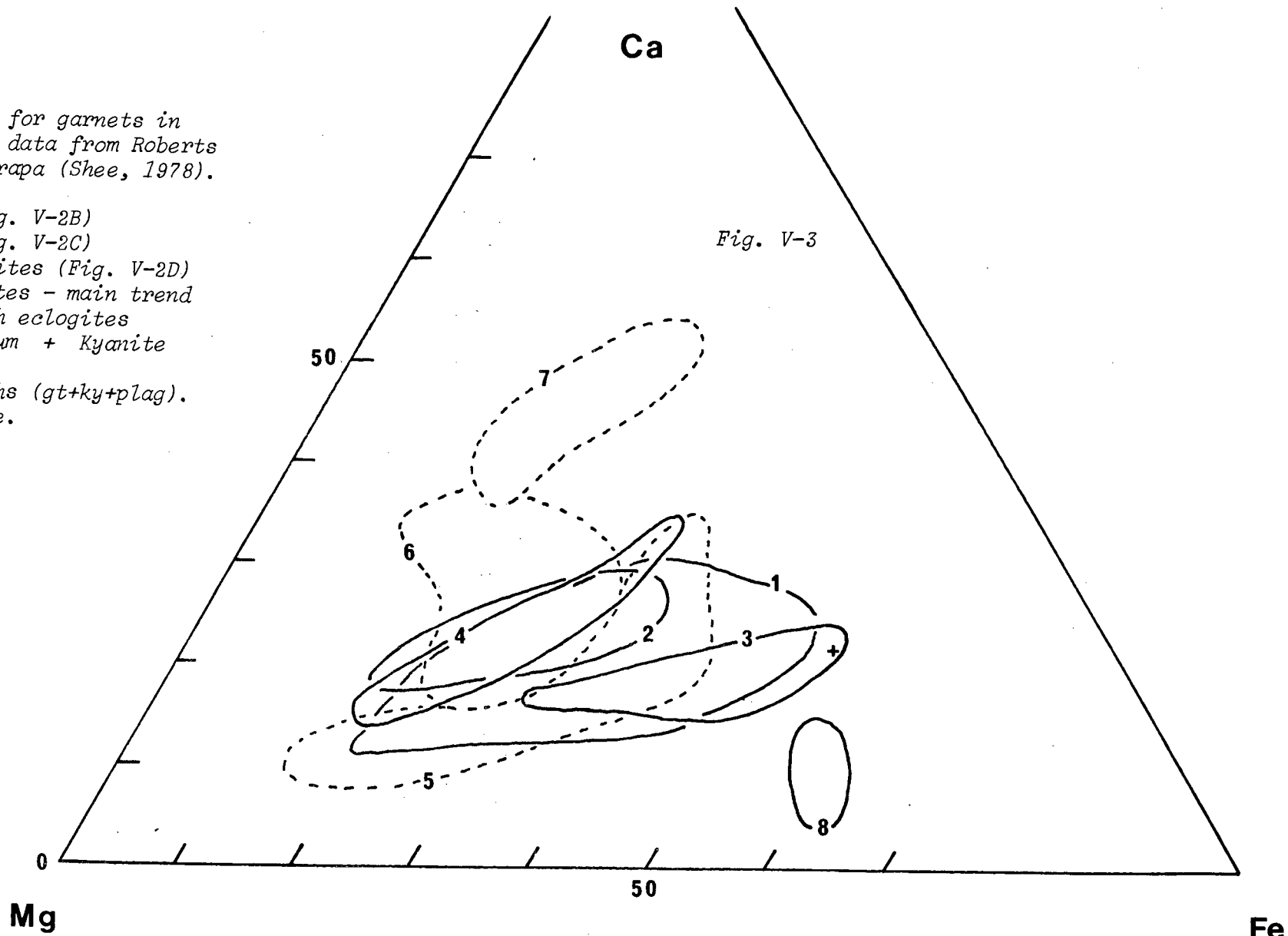


Fig. V-3: Summary Ca-Mg-Fe for garnets in xenoliths and compared with data from Roberts Victor (Hatton, 1978) and Orapa (Shee, 1978).

- 1 = Eclogites (Fig. V-2A)
- 2 = Kyanite eclogites (Fig. V-2B)
- 3 = Garnet granulites (Fig. V-2C)
- 4 = Kyanite garnet granulites (Fig. V-2D)
- 5 = Roberts Victor eclogites - main trend
- 6 = Roberts Victor Ca-rich eclogites
- 7 = Roberts Victor Corundum + Kyanite eclogites
- 8 = Orapa crustal xenoliths (gt+ky+plag).
- + = Orapa garnet granulite.



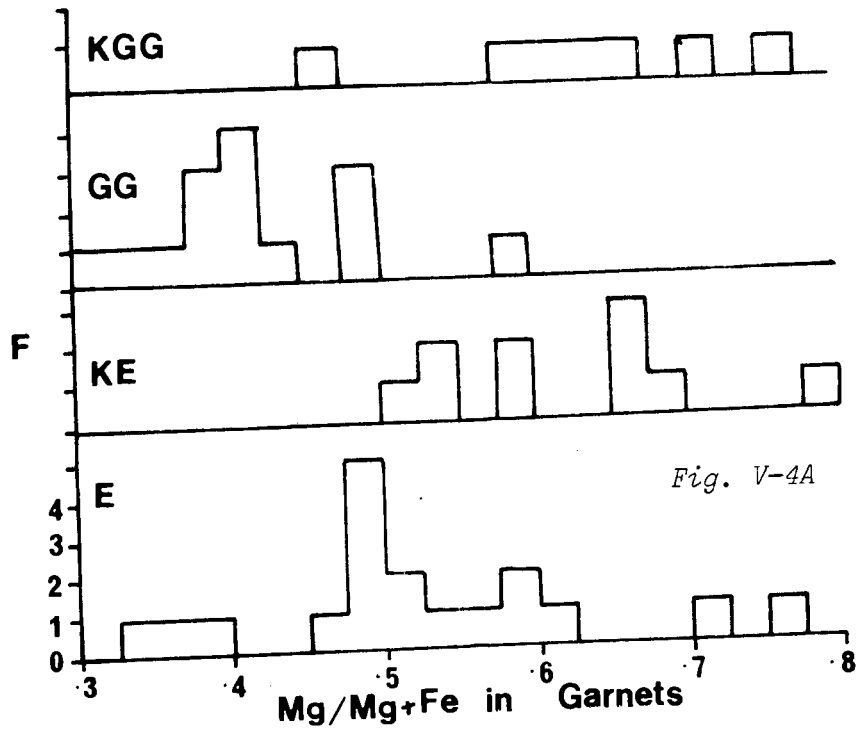


Fig. V-4A

Fig. V-4A: Frequency (F) histogram of garnet Mg/Mg+Fe ratio in xenoliths.

- E = Eclogite
- KE = Kyanite eclogite
- GG = Garnet granulite
- KGG = Kyanite garnet granulite.

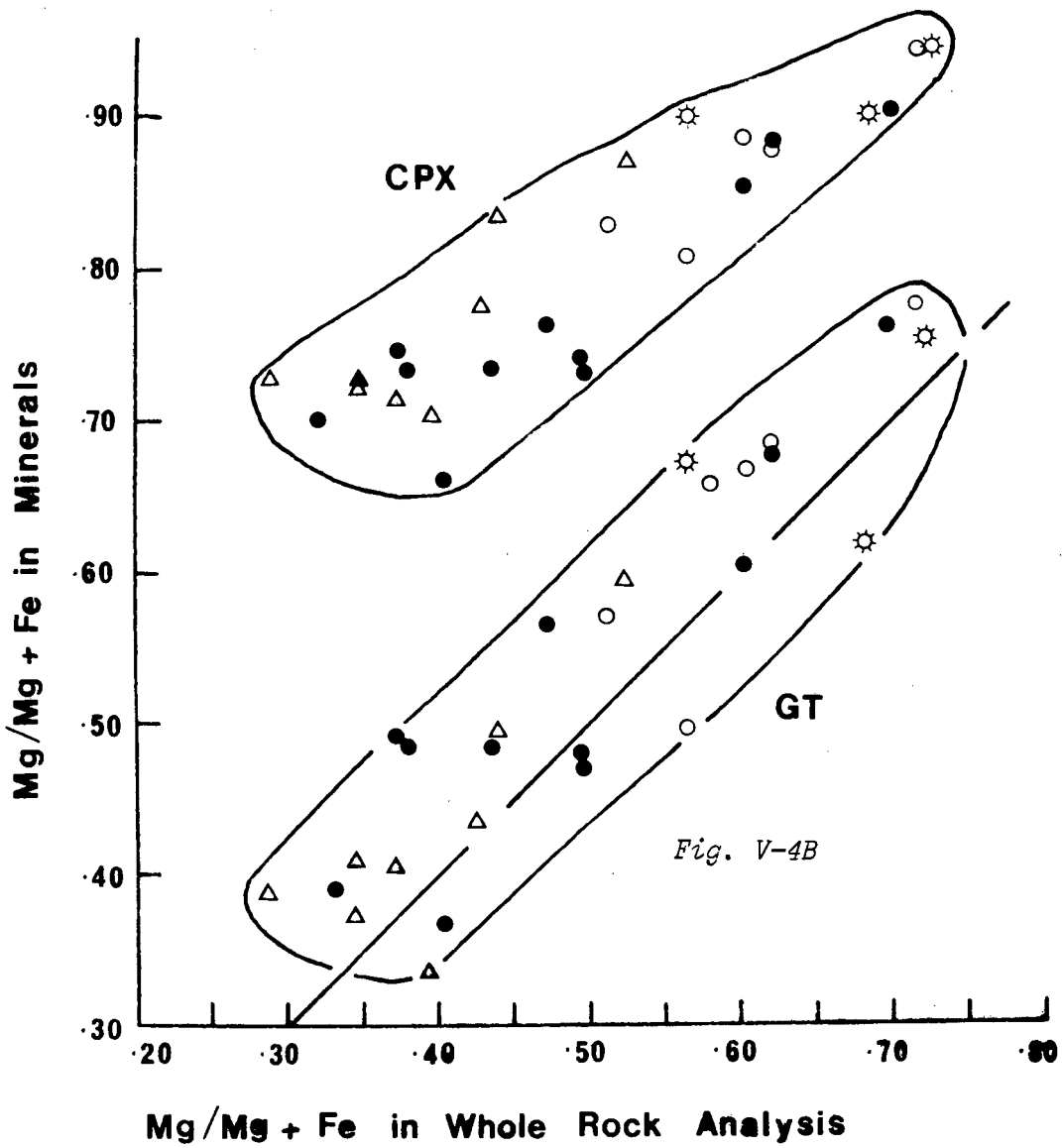


Fig. V-4B: Mg/Mg+Fe in garnet and clinopyroxene vs. xenolith whole rock Mg/mg+Fe (Fe from total Fe₂O₃).

- - Eclogites
- - Kyanite eclogites
- △ - Garnet granulites
- ☆ - Kyanite garnet granulites

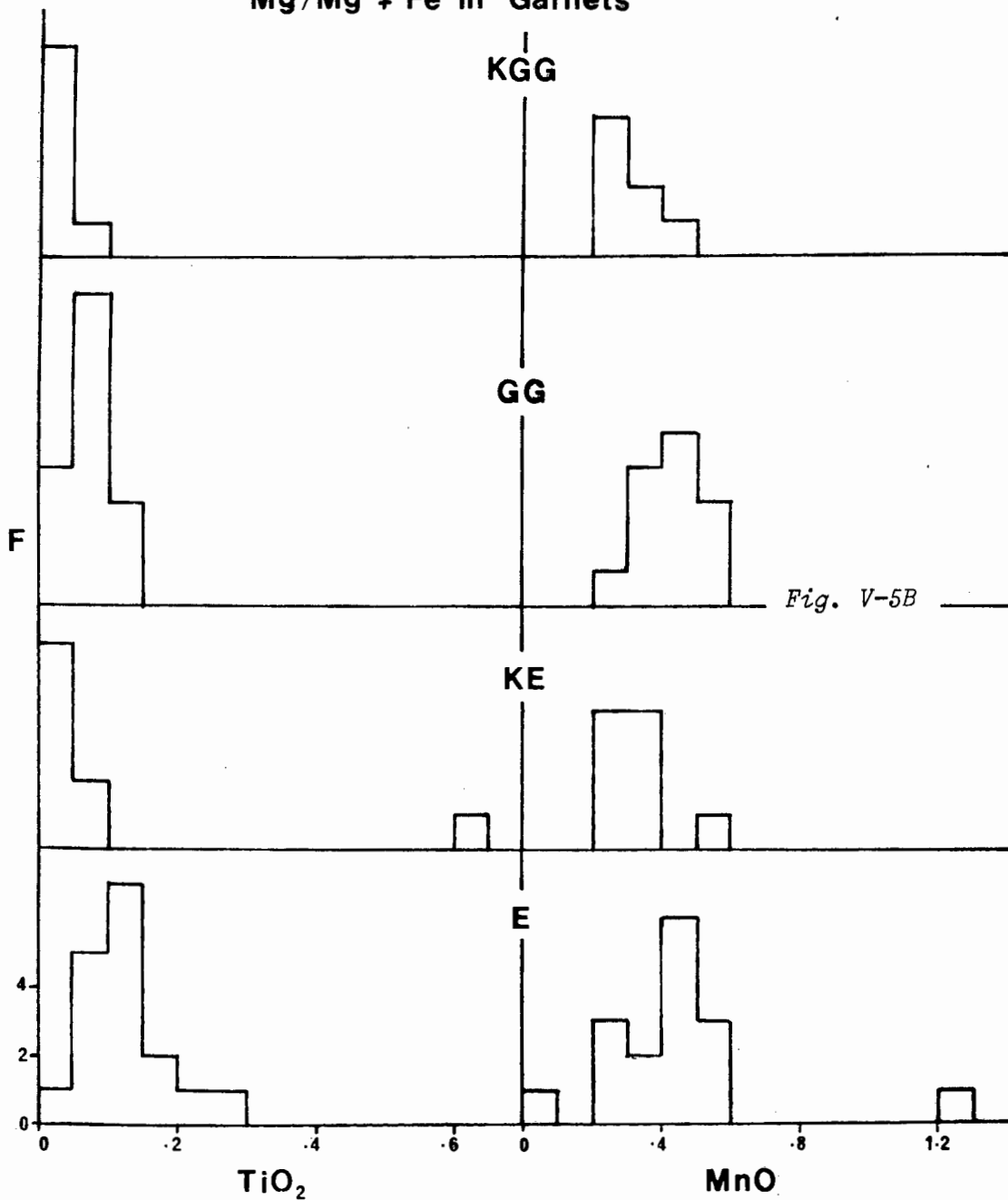
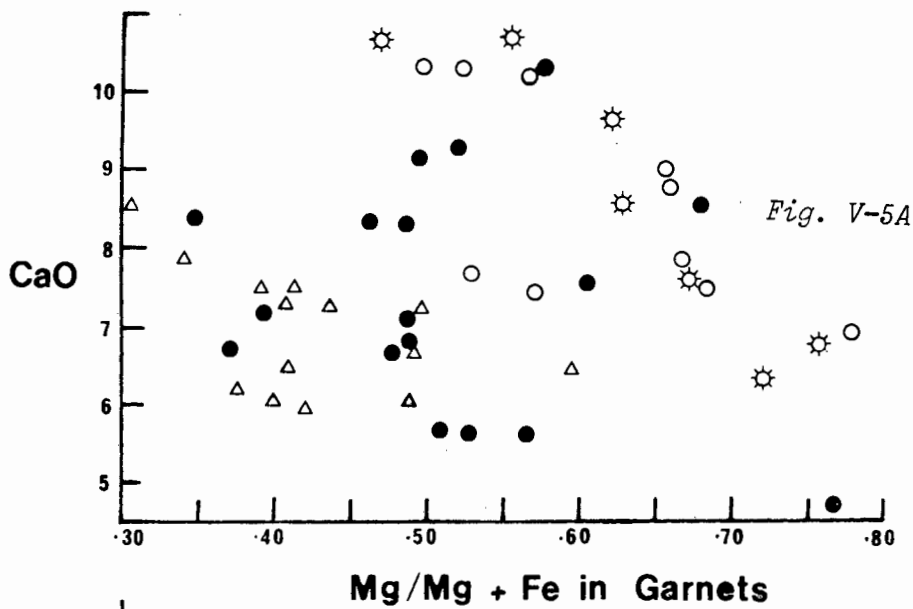


Fig. V-5A: CaO (wt.%) vs. Mg/Mg+Fe in garnets from xenoliths. Symbols as in Fig. V-4.

Fig. V-5B: Frequency (F) histogram of TiO₂(wt.%) and MnO (wt.%) contents in garnets of xenoliths. Abbreviations as in Fig. V-4.

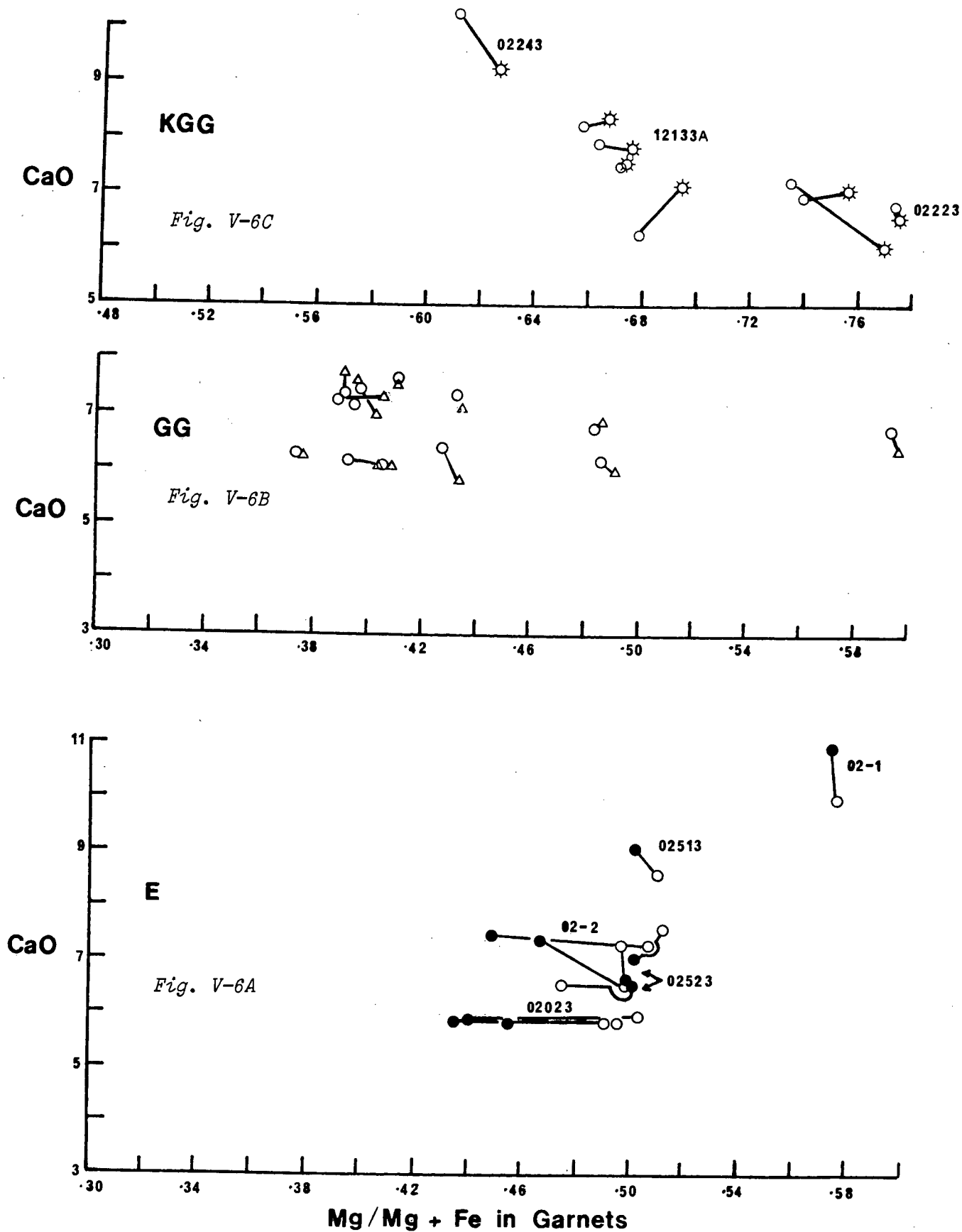


Fig. V-6: MgO, FeO, CaO zoning trends in garnets from xenoliths. Open circles are grain edges; others are cores.

- V-6C - Garnets from kyanite garnet granulites (KGG)*
- V-6B - Garnets from garnet granulites (GG)*
- V-6A - Garnets from partially melted eclogites (E).*

Different samples are identified by numbers.

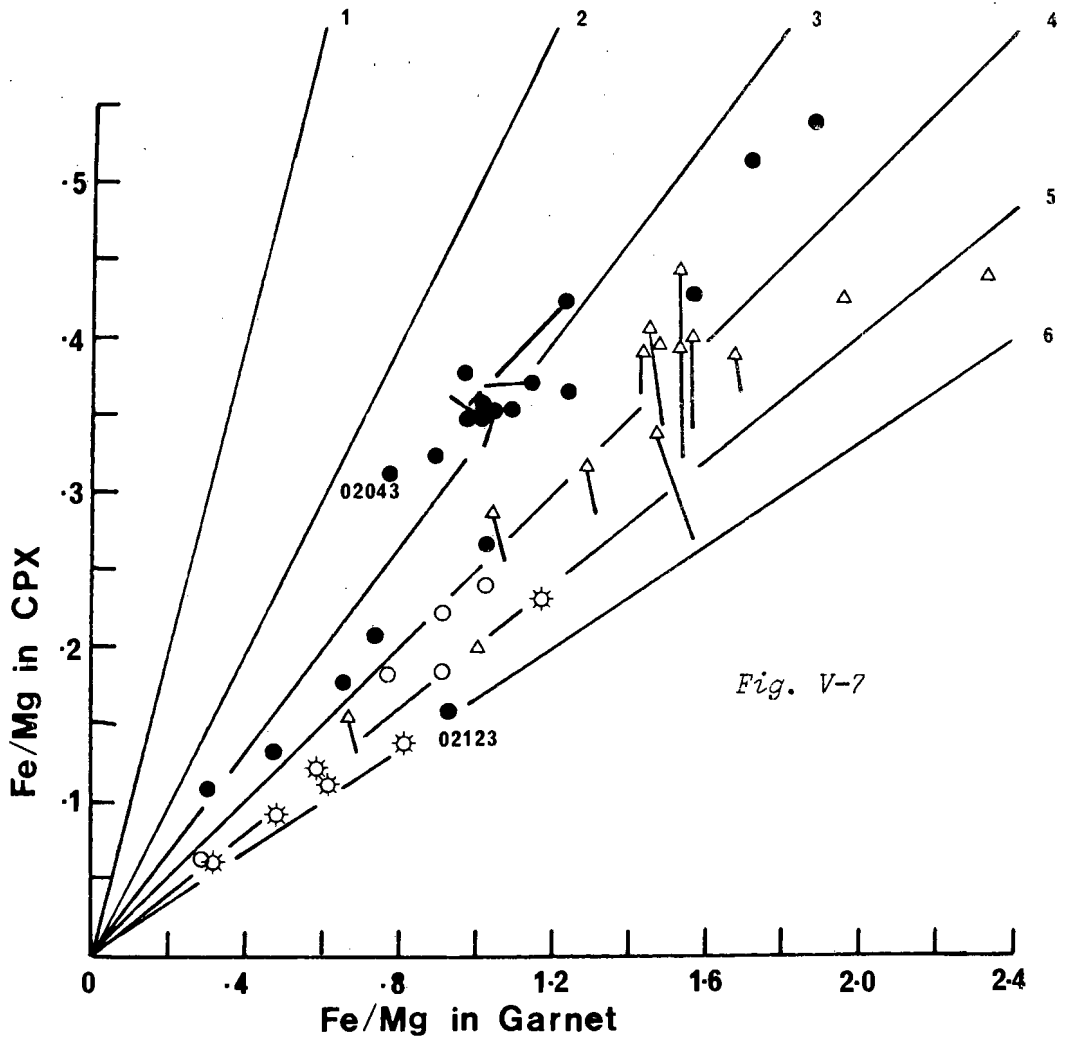


Fig. V-7: Fe/Mg in clinopyroxene vs. Fe/Mg in garnets of xenoliths. Radiating lines are constant values of $K_D = \frac{Gt (Fe/Mg)}{Cpx (Fe/Mg)}$. Tails from data points indicate zoning towards grain edges from cores. Symbols as in Fig. V-4.

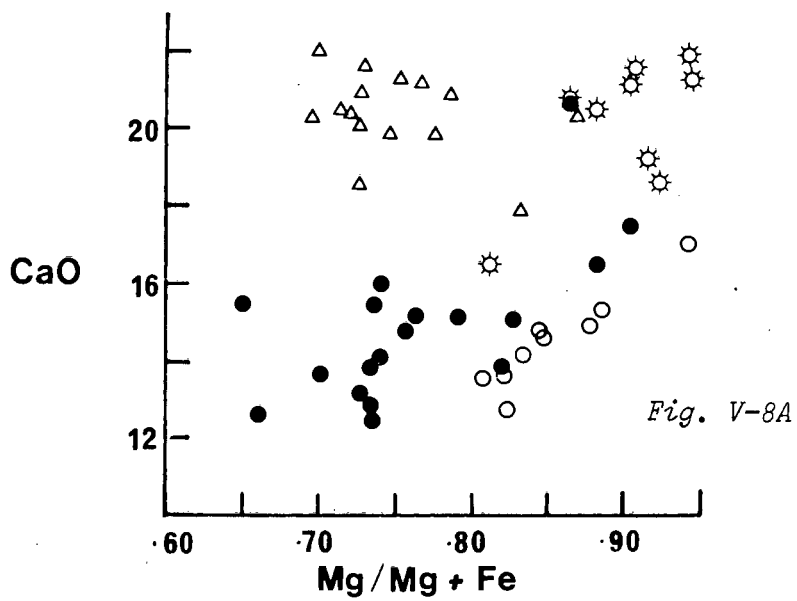
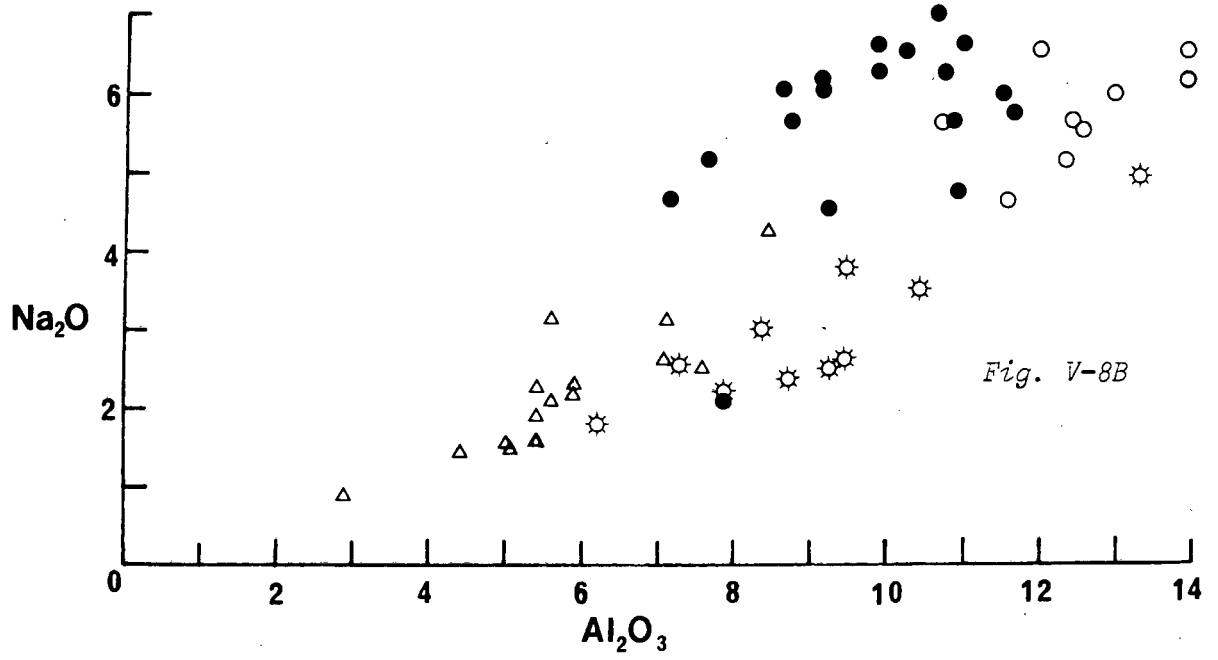


Fig. V-8B: Al_2O_3 (wt.%) vs. Na_2O (wt.%)
 V-8A: CaO (wt.%) vs. $Mg/Mg+Fe$ in clinopyroxenes from
 xenoliths. Symbols as in Fig. V-4.

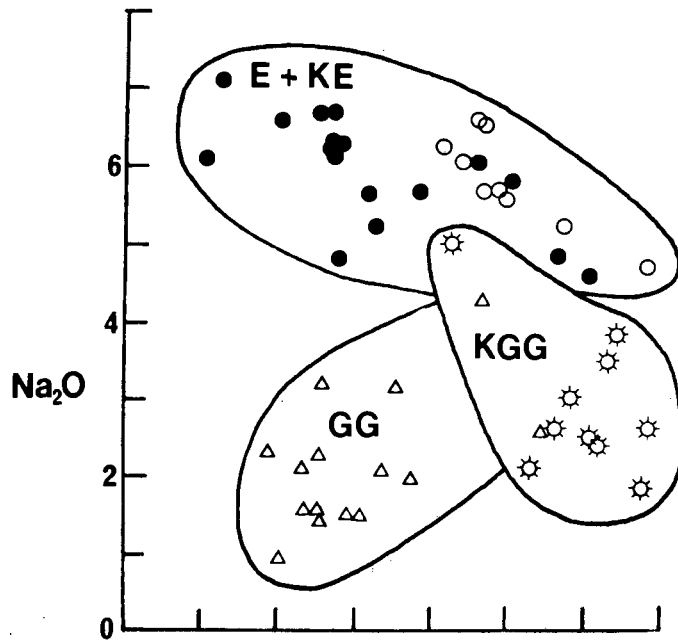


Fig. V-9B

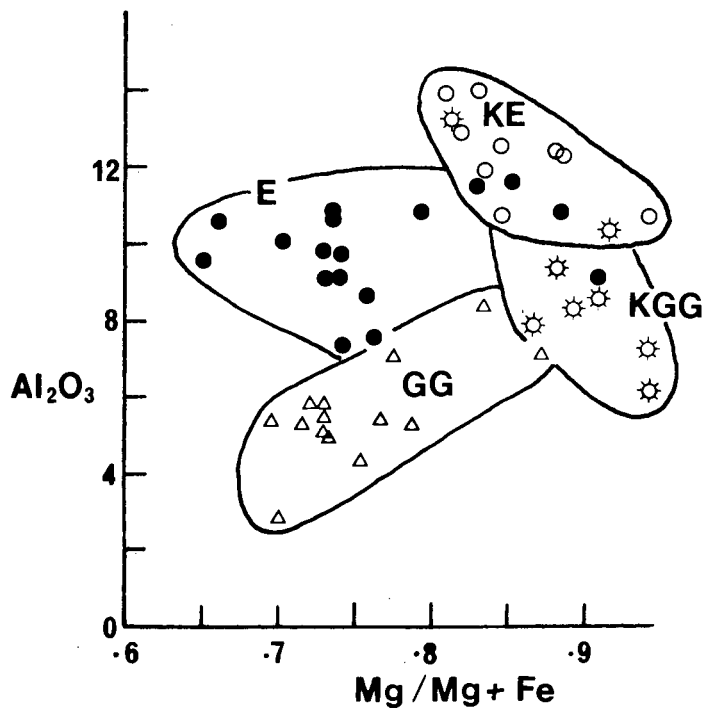


Fig. V-9A

Fig. V-9B: Na₂O (wt.%) vs. Mg/Mg+Fe
 V-9A: Al₂O₃ (wt.%) vs. Mg/Mg+Fe
 in clinopyroxenes from xenoliths.
 Symbols and abbreviations as in Fig. V-4.

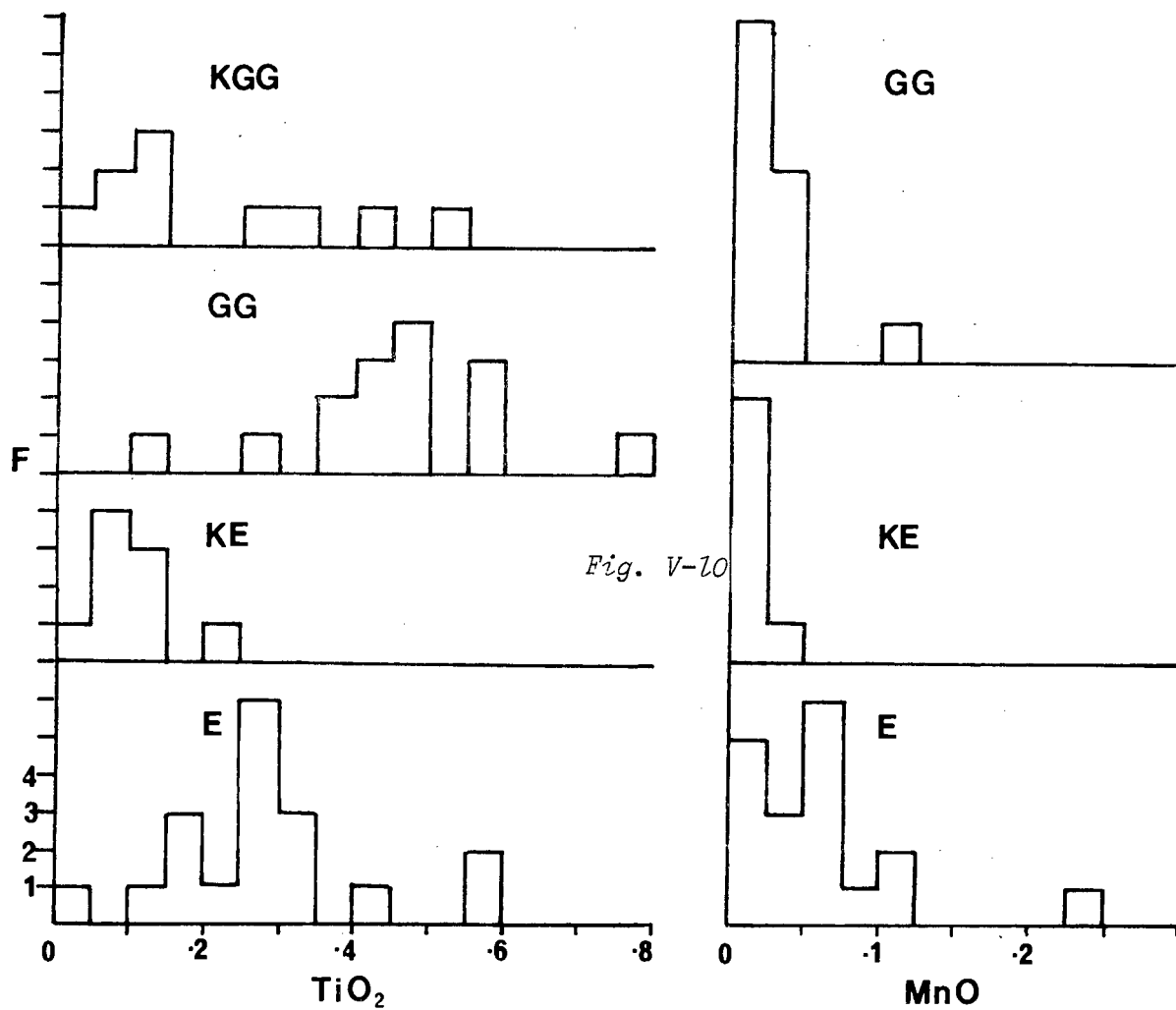


Fig. V-10: Frequency (F) histogram of TiO_2 (wt.%) and MnO (wt.%) contents in clinopyroxenes from the xenoliths. Abbreviations as in Fig. V-4.

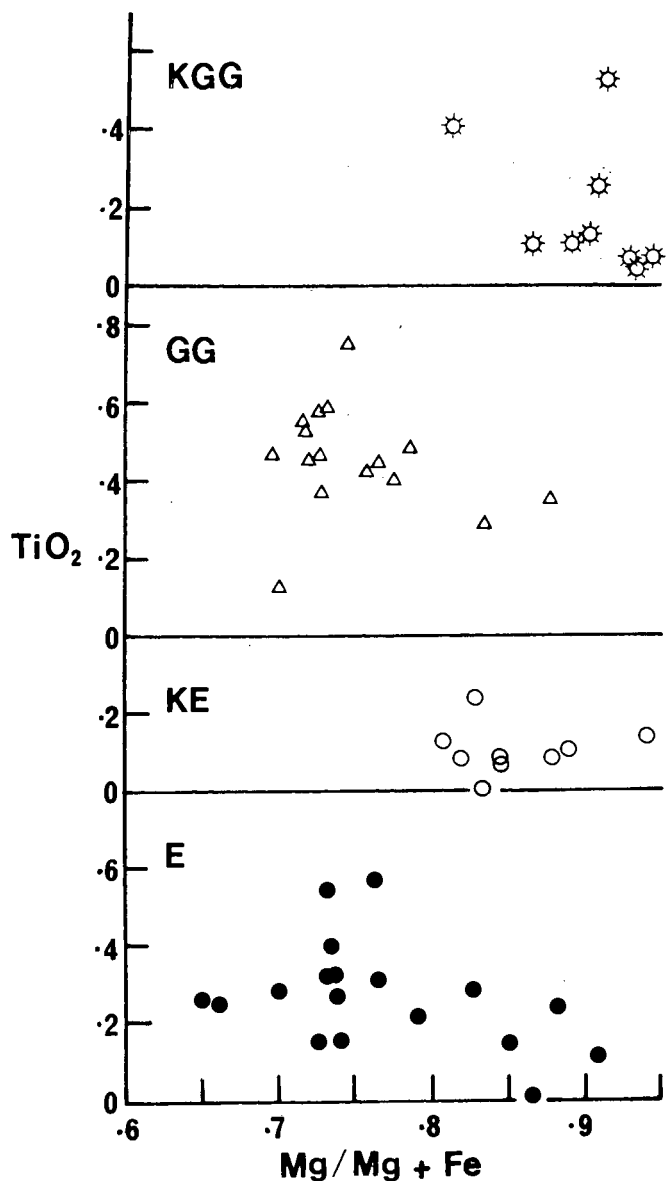


Fig. V-11

Fig. V-11: TiO_2 (wt.%) vs. $Mg/Mg+Fe$ in clinopyroxenes from the xenoliths. Abbreviations as in Fig. V-4.

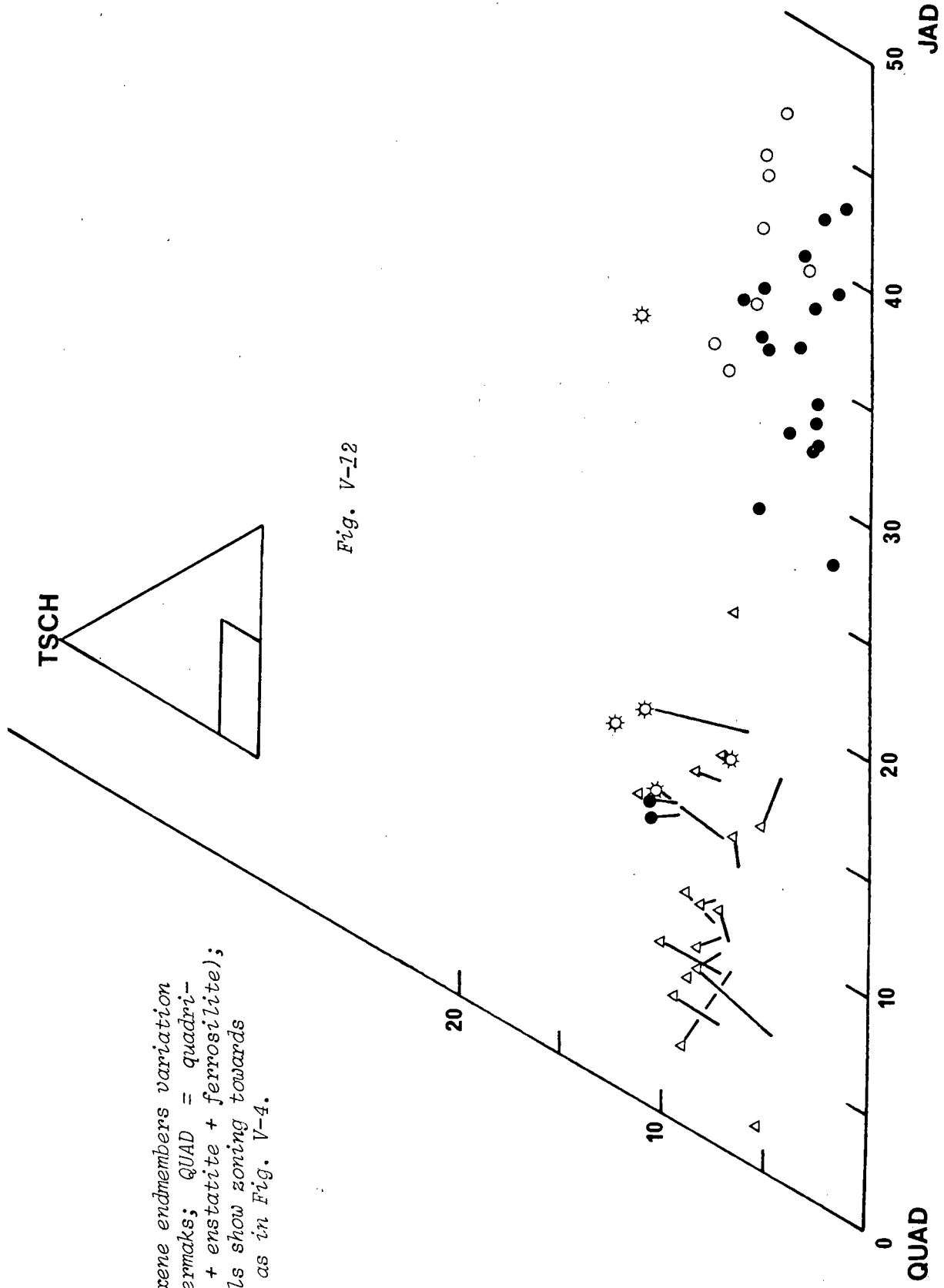


Fig. V-12: Clinopyroxene endmembers variation plot:- TSCH = tschermaks; QUAD = quadrilateral (wollastonite + enstatite + ferrosilite); JAD = jadeite. Tails show zoning towards grain edges. Symbols as in Fig. V-4.

Fig. V-12

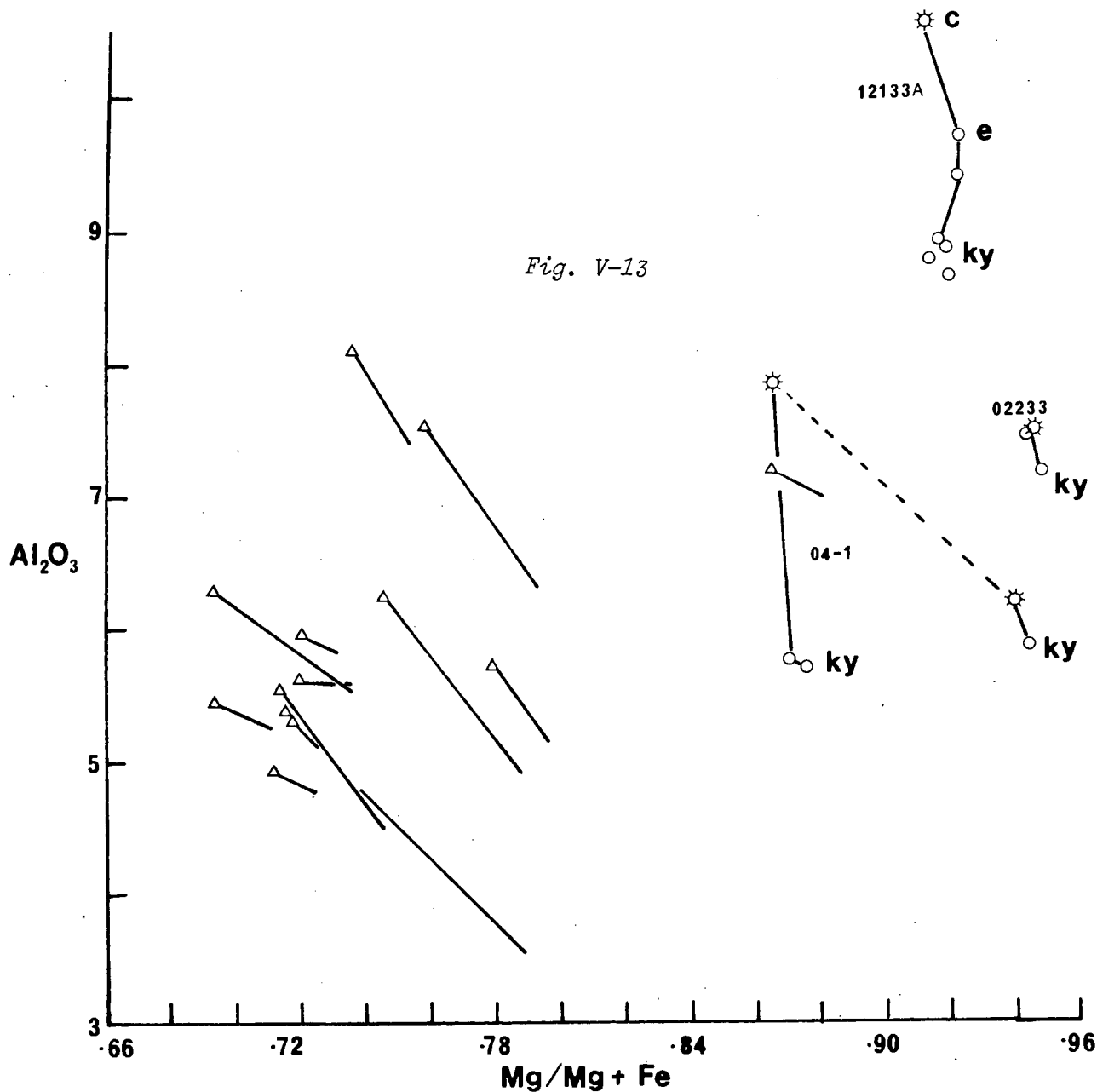


Fig. V-13: Al_2O_3 (wt.%) vs. Mg/Mg+Fe zoning (center to edge) trends in clinopyroxene from garnet granulites (GG Δ) and kyanite garnet granulites (KGG \star). For KGG, zoning is shown from center (c) to edge (e) and to clinopyroxene coexisting with kyanite (ky). Symbols as in Fig. V-4.

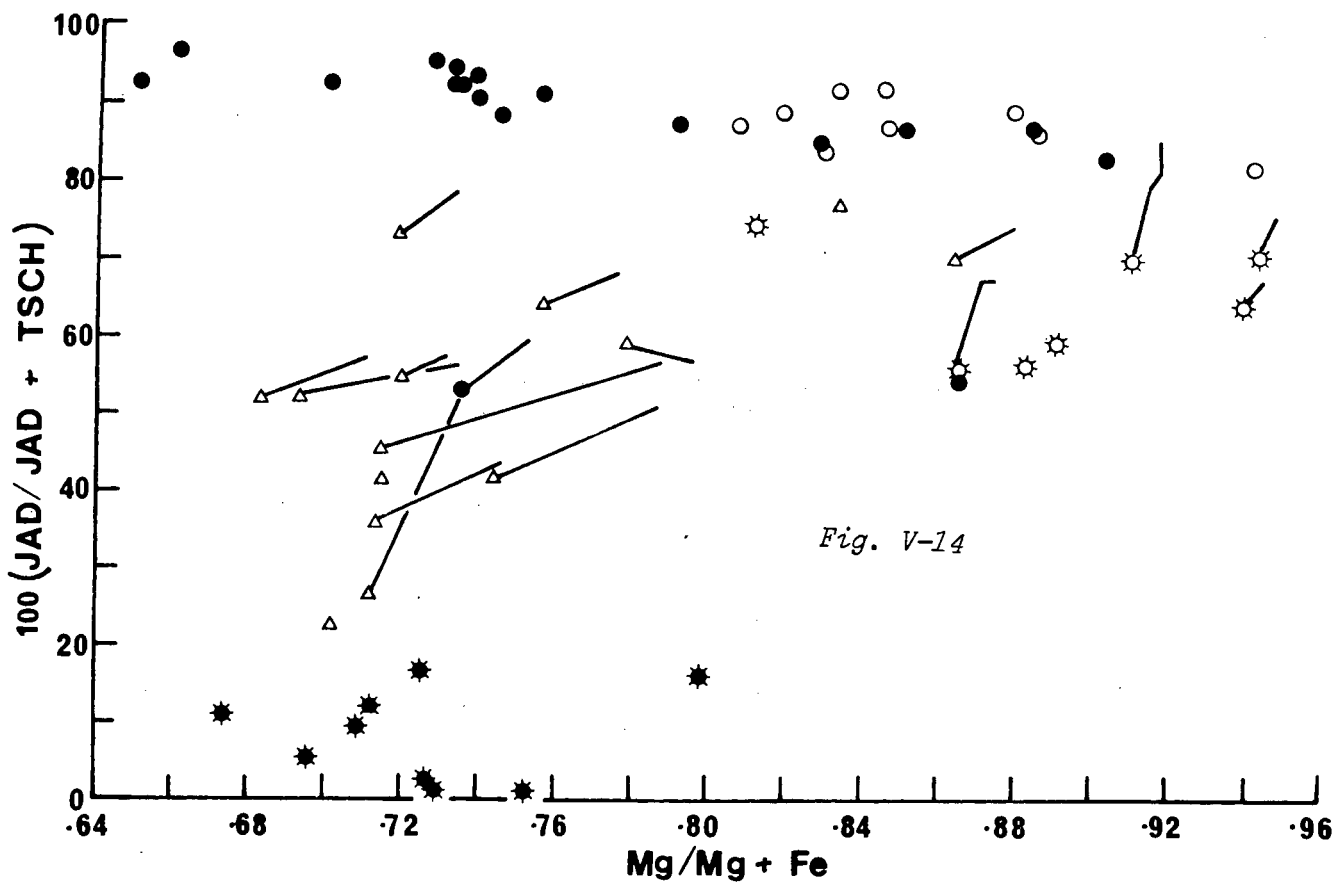


Fig. V-14

Fig. V-14: Change in the (Jad/Jad + Tsch) ratio of xenolith clinopyroxenes with changing clinopyroxene Mg/Mg+Fe ratio. This plot shows how granulite clinopyroxene edge compositions are zoned towards the Jad/Tsch ratios of eclogitic clinopyroxenes. Symbols as in Fig. V-4 and (*) = secondary clinopyroxenes in partially melted eclogites. Note the low jadeite content of these secondary pyroxenes.

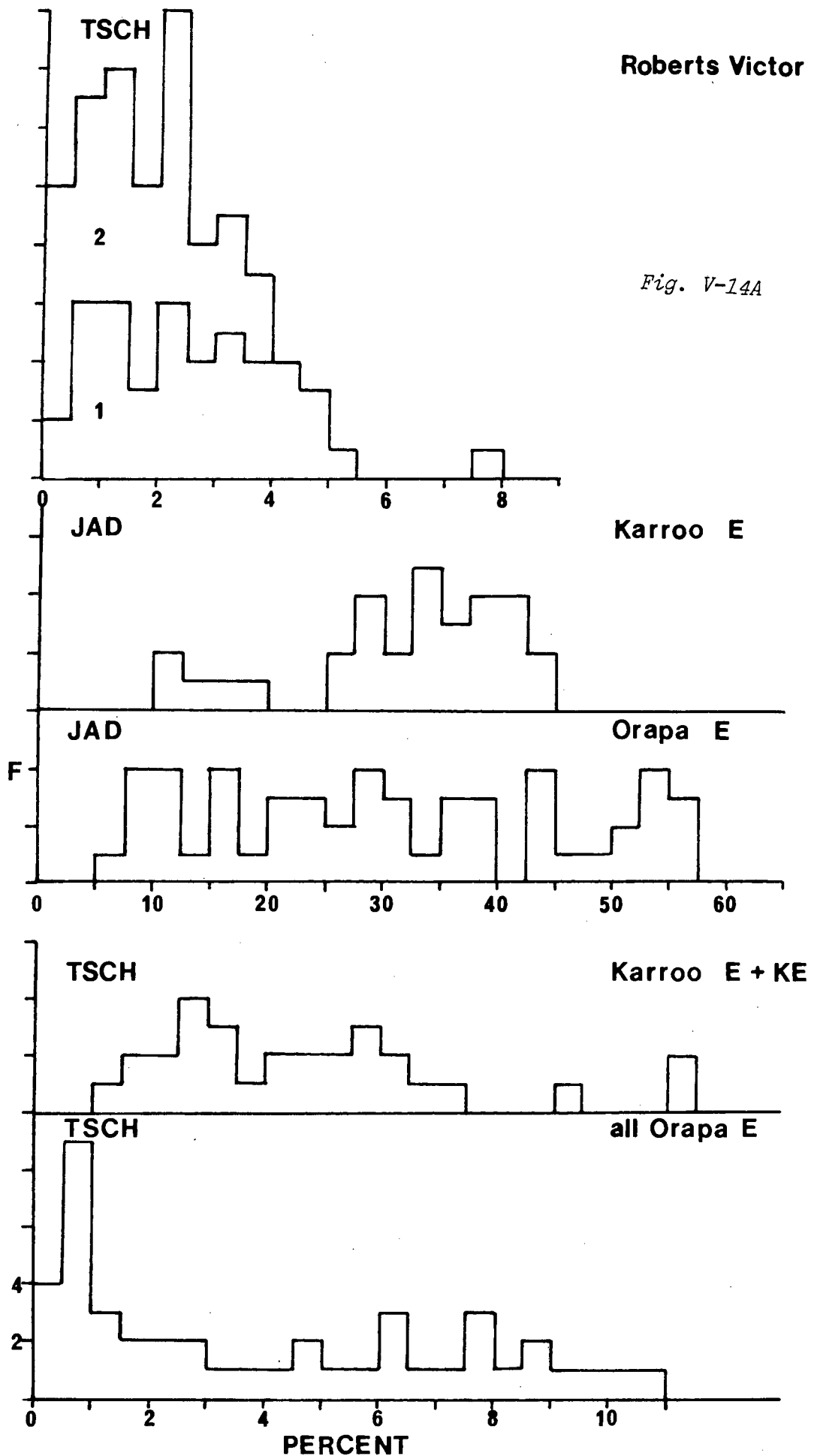


Fig. V-14A

Fig. V-14A: Comparing the tschermak (TSCH) and jadeite (JAD) contents of the clinopyroxenes of the Karroo eclogites (E) and kyanite eclogites (KE) with those from Orapa and Roberts Victor (type 1,2) (Shee, 1978; Hatton, 1978). F = frequency.

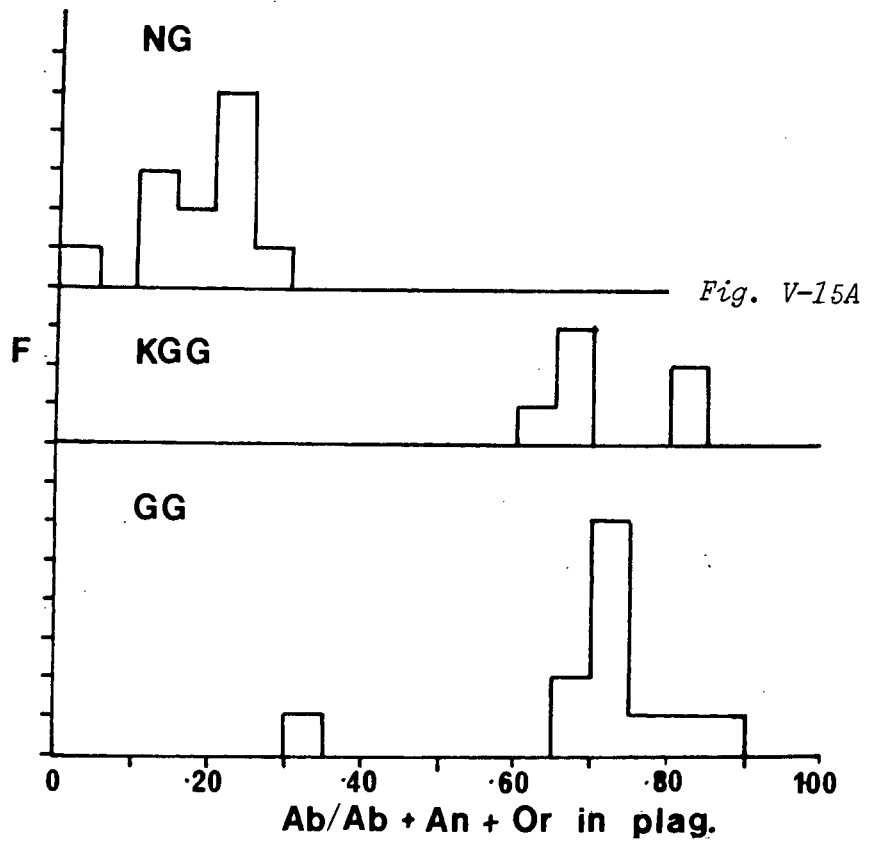


Fig. V-15A: Frequency histogram of $Ab/(Ab+An+Or)$ ratios in plagioclases of garnet granulites and kyanite garnet granulites. NG are data for Namaqua granulites (Jackson, 1976).

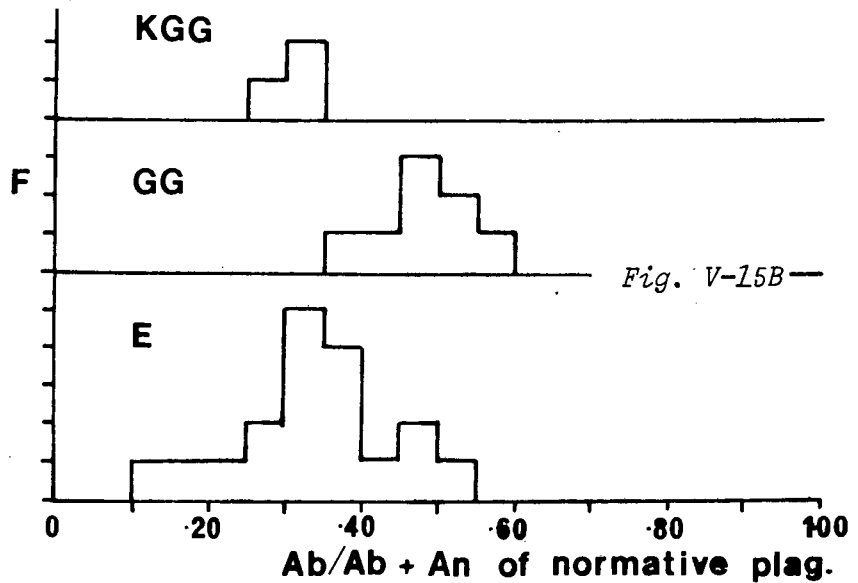
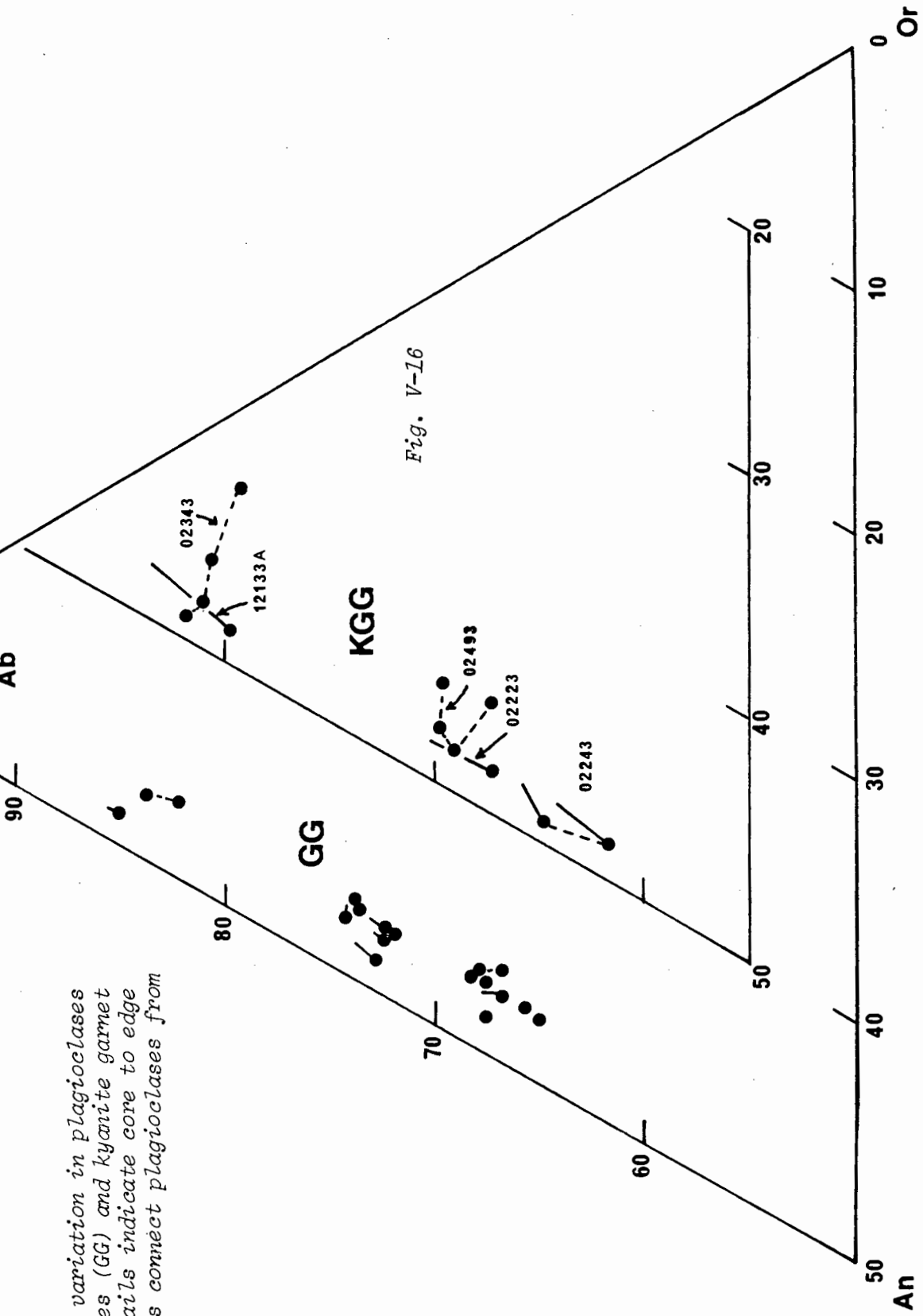


Fig. V-15B: Frequency histogram of normative $Ab/(Ab+An)$ ratios from xenolith bulk composition data. Abbreviations as in Fig. V-4.

Fig. V-16: Ab-An-Or variation in plagioclases from garnet granulites (GG) and kyanite garnet granulites (KGG). Tails indicate core to edge zoning. Dashed lines connect plagioclases from the same rock.



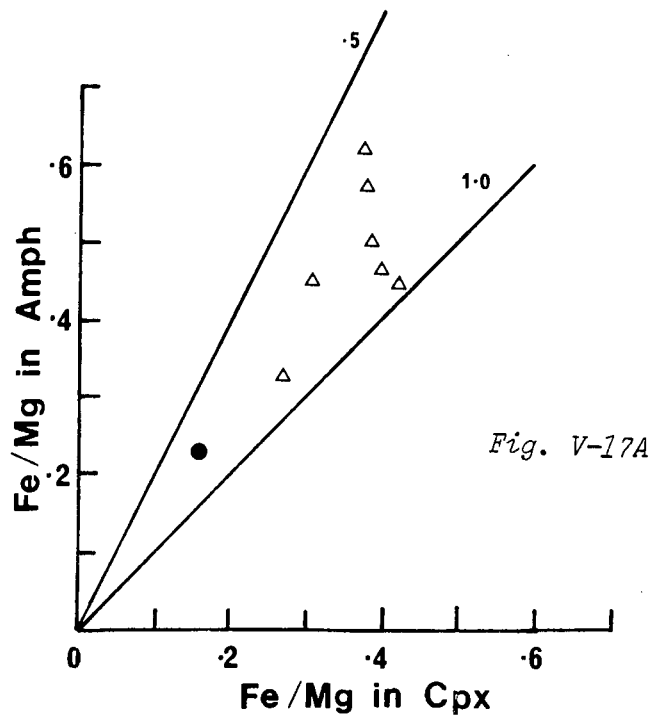


Fig. V-17A: Fe/Mg of amphibole vs. Fe/Mg of clinopyroxene in garnet granulites and an eclogite.

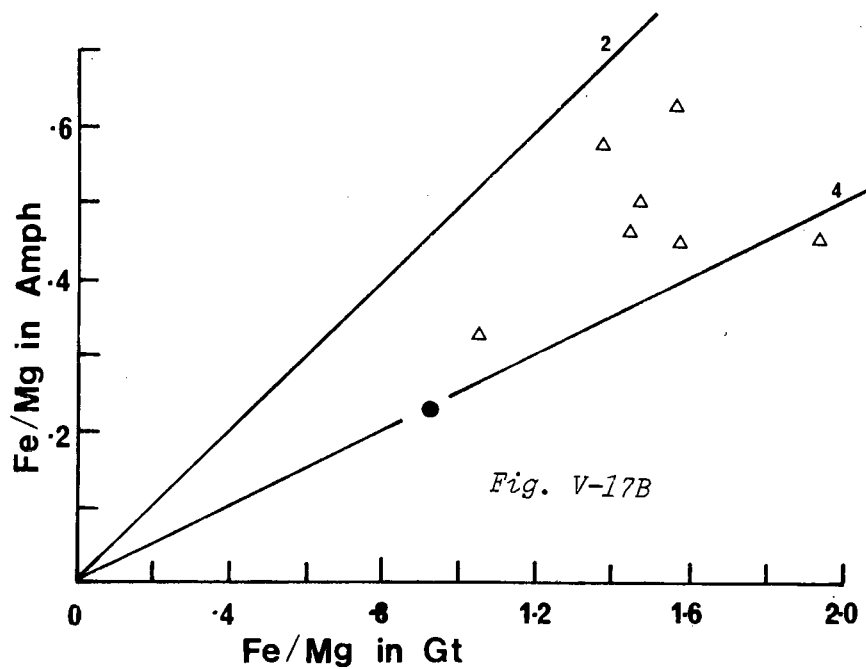


Fig. V-17B: Fe/Mg of amphibole vs. Fe/Mg of garnet in garnet granulites and an eclogite. Lines are values of constant

$$K_D = \frac{(Fe/Mg)_{Gt, Cpx}}{(Fe/Mg)_{Amph}}$$

Abbreviations as in Fig. V-4.

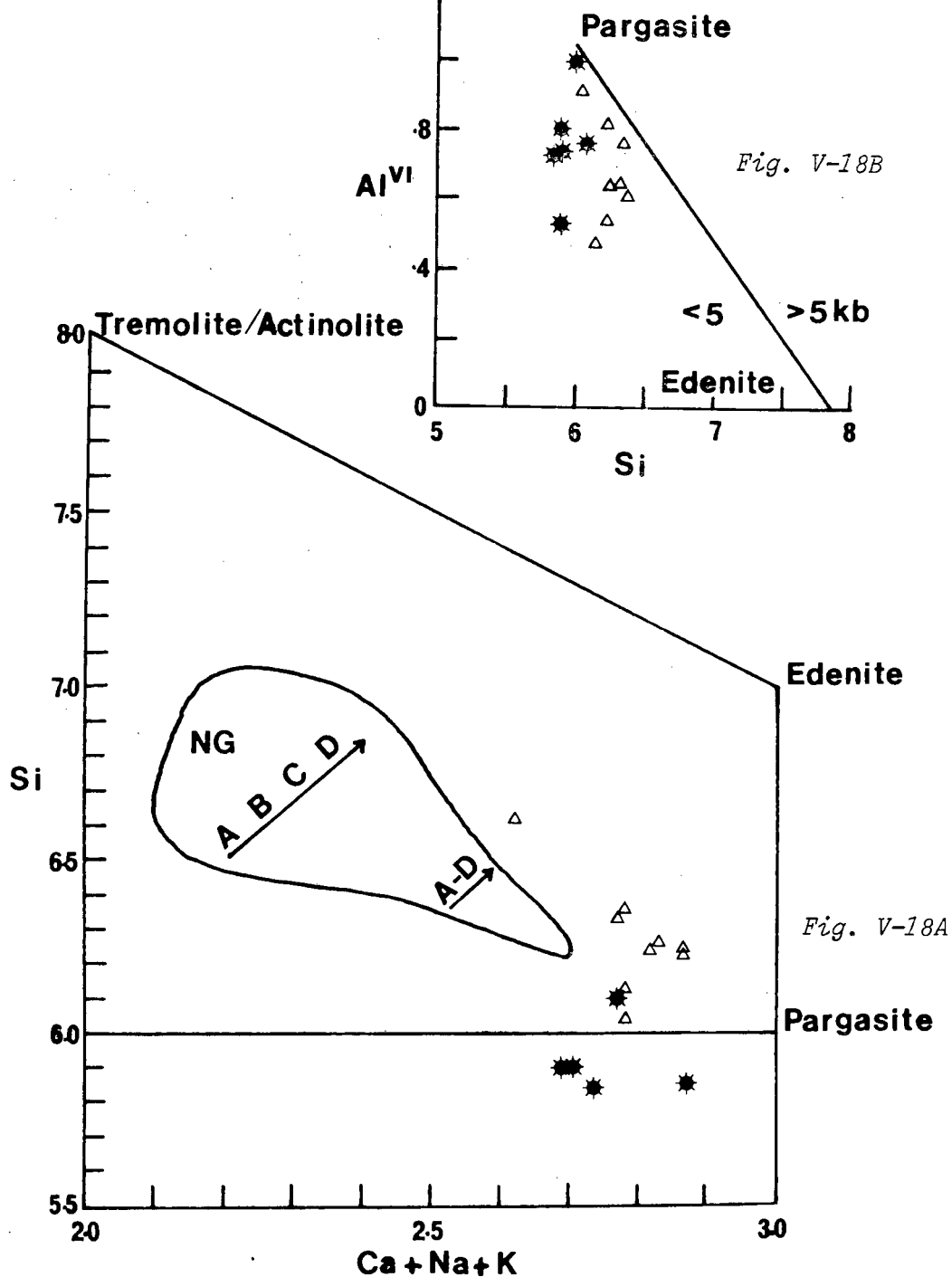


Fig. V-18A: Comparing the primary (Δ) and secondary (\star) amphiboles of the granulite and eclogite xenoliths respectively with those from two-pyroxene granulites in Namaqualand (after Fig. 30 in Jackson, 1976). A \rightarrow D is increasing metamorphic grade in the Namaqua metabasites.

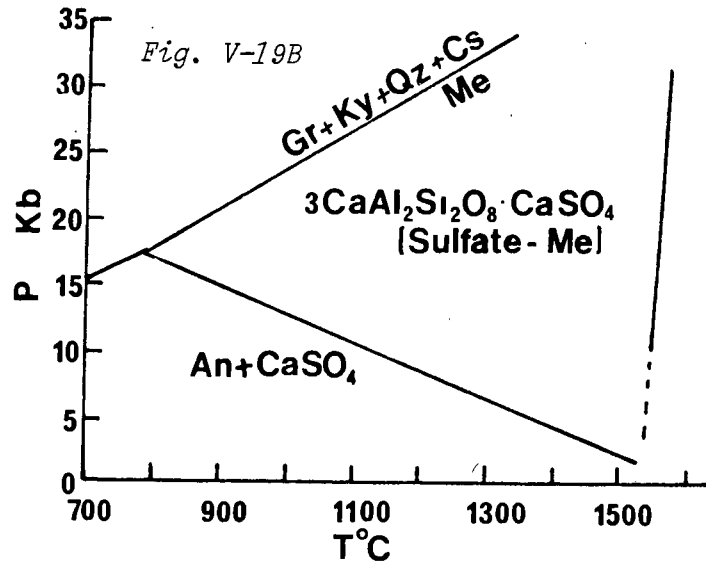
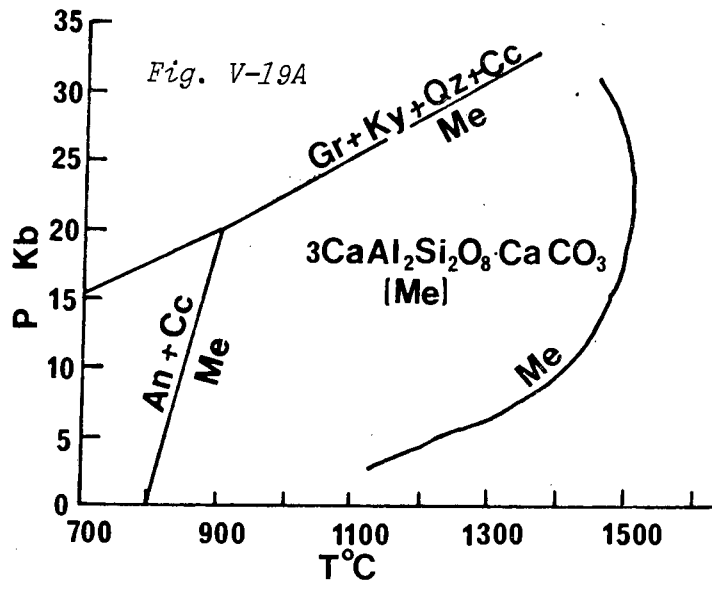


Fig. V-19A: Meionite
 V-19B: Sulfate-meionite. The stability fields of the carbonate and sulfate scapolite (meionite), after Figs. 8 and 9 of Goldsmith (1976).

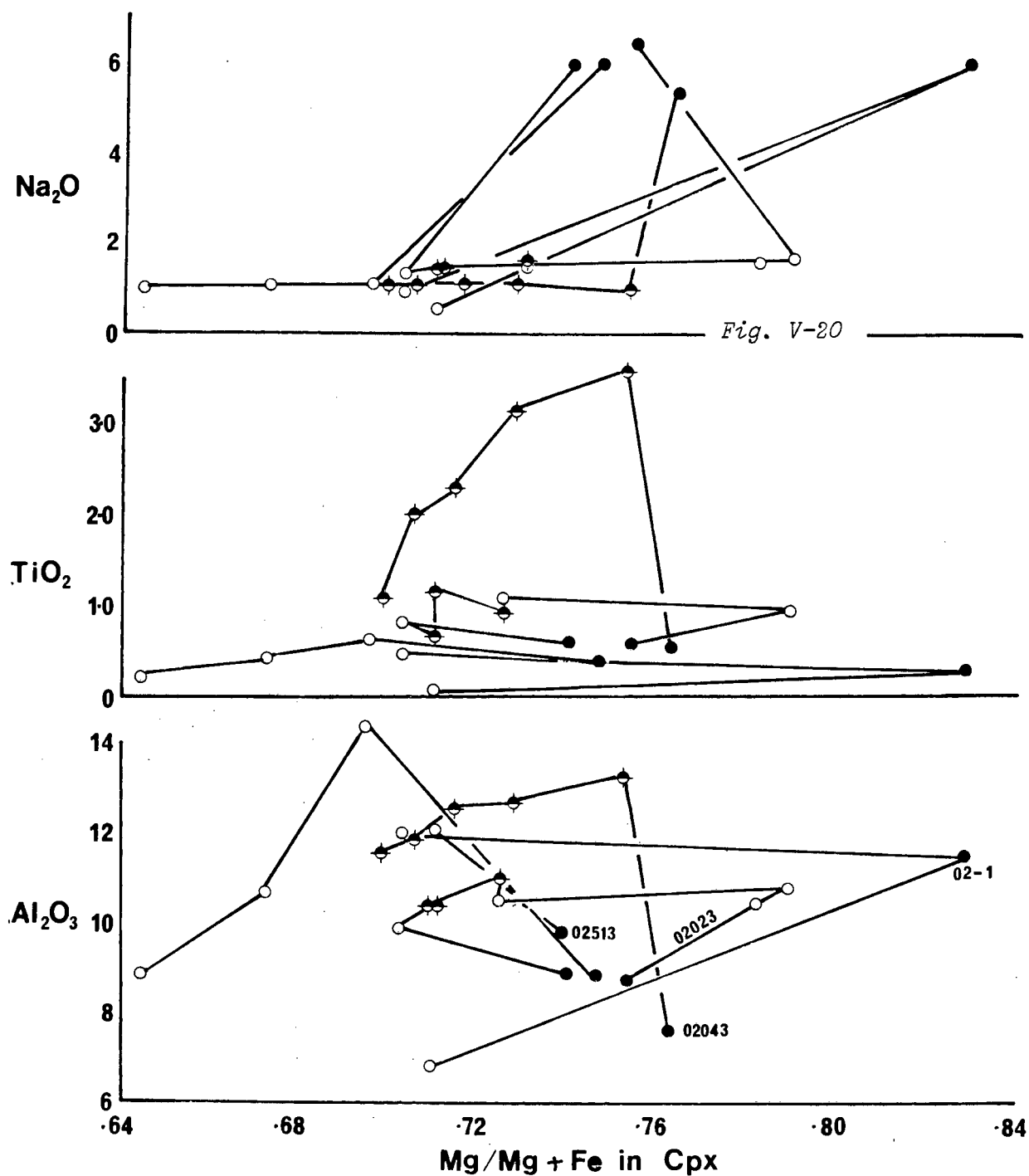


Fig. V-20: Variations (in wt.%) of Al_2O_3 , TiO_2 and Na_2O in secondary clinopyroxenes and their relation to the primary clinopyroxene of eclogites:-

● - primary clinopyroxene, ◆ - secondary clinopyroxene forming overgrowths on primary cpx, ○ - secondary clinopyroxene discrete in glass. Lines join clinopyroxenes of the same rock.

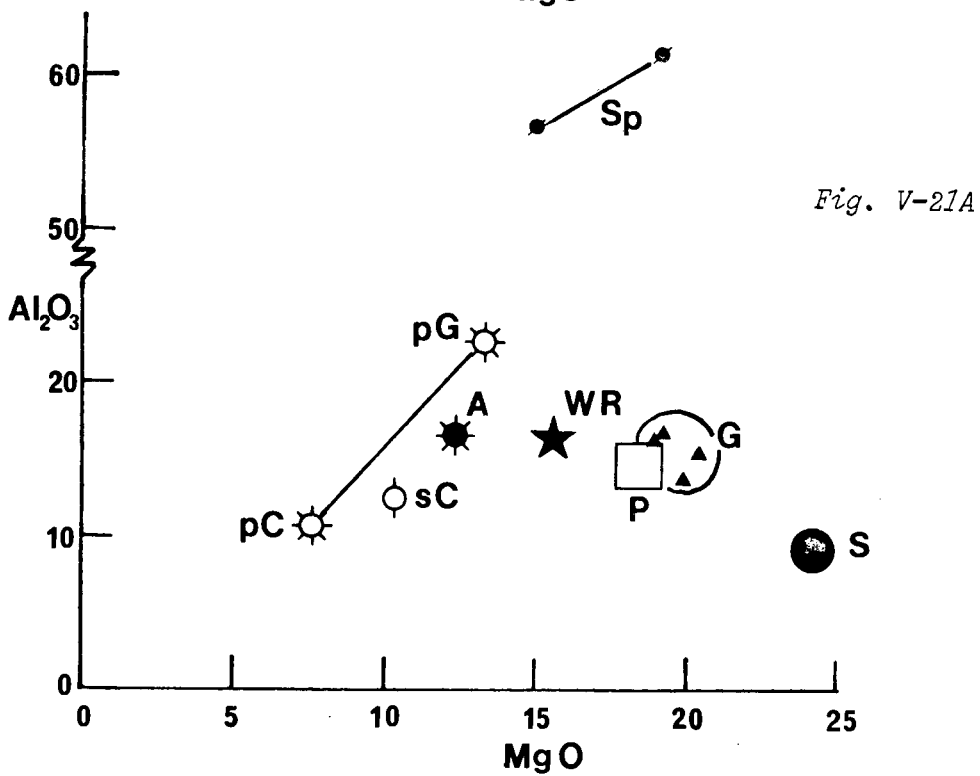
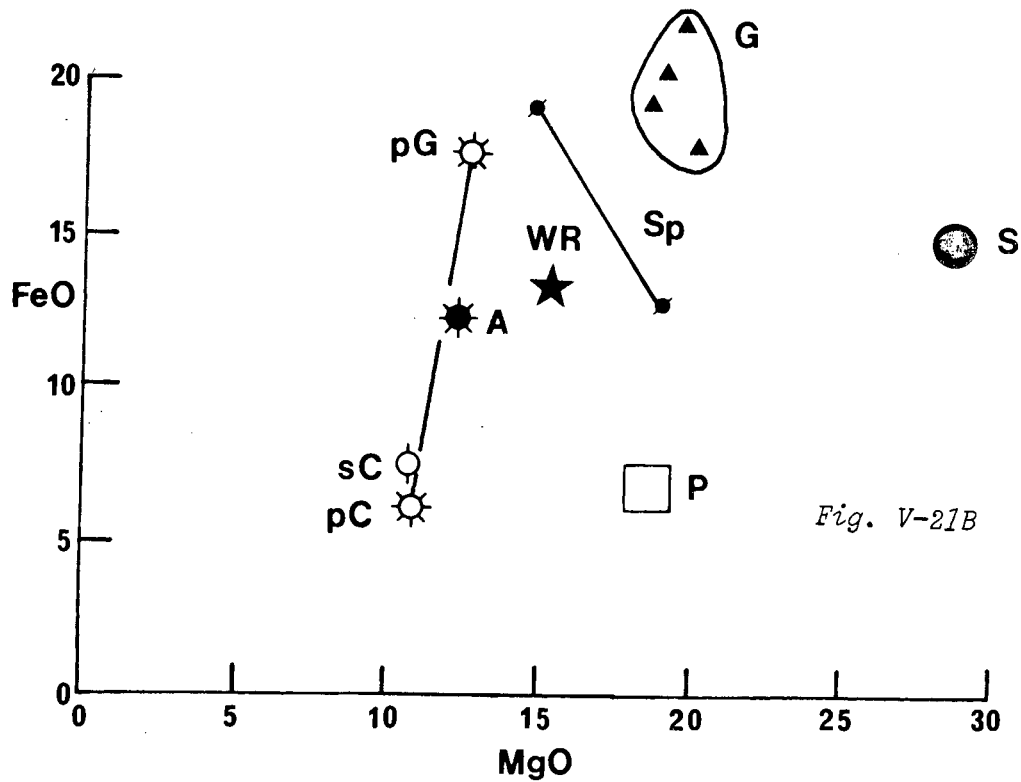


Fig. V-21B: FeO (wt.%) vs. MgO (wt.%)

V-21A: Al₂O₃(wt.%) vs. MgO (wt.%) of the primary and secondary phases in the partially melted eclogite 02043, compared with the whole rock composition of this xenolith.

- pG, pC - primary garnet and clinopyroxene. ☼
- sC - secondary clinopyroxene. ○
- A - secondary amphibole. ★
- Sp - secondary spinel ●
- S - secondary serpentine. ⊙
- P - phlogopite (primary and secondary). □
- G - secondary glass. ▲
- WR - whole rock data. ★

Fig. V-22A to H: Whole rock major element variation diagrams for the basic xenoliths. Data are in wt.% and are plotted against MgO selected to represent a differentiation index. Total iron as Fe_2O_3 .

- Eclogites from Lovedale) E
- Eclogites from other localities) E
- Kyanite eclogites KE
- △ Garnet granulites GG
- ☆ Kyanite garnet granulites KGG

Trends shown by dashed lines have been fitted by eye.

Fig. V-22I: The major element data plotted on a total alkali vs. silica diagram. Fields after Kuno (1968).

Symbols as above.

Fig. V-22J: Illustrating the more sodic and aluminous bulk rock composition of the granulites compared to the eclogites. Symbols as above.

Fig. V-22K: Frequency (F) histogram of whole rock Mg/Mg+Fe ratios (Fe = total Fe_2O_3). Av. = average. Abbreviations for the different groups as above.

Fig. V-22L: AF^*M diagram for the basic xenolith compositions. $A = Na_2O + K_2O$, $M = MgO$, $F^* = \text{total } Fe_2O_3$. Fe enrichment and calc alkaline indicate the two major trends seen in common igneous rocks on this type of diagram. Eclogites appear to be on a Fe enrichment trend while the kyanite eclogites and some garnet granulites may be of a calc alkaline nature.

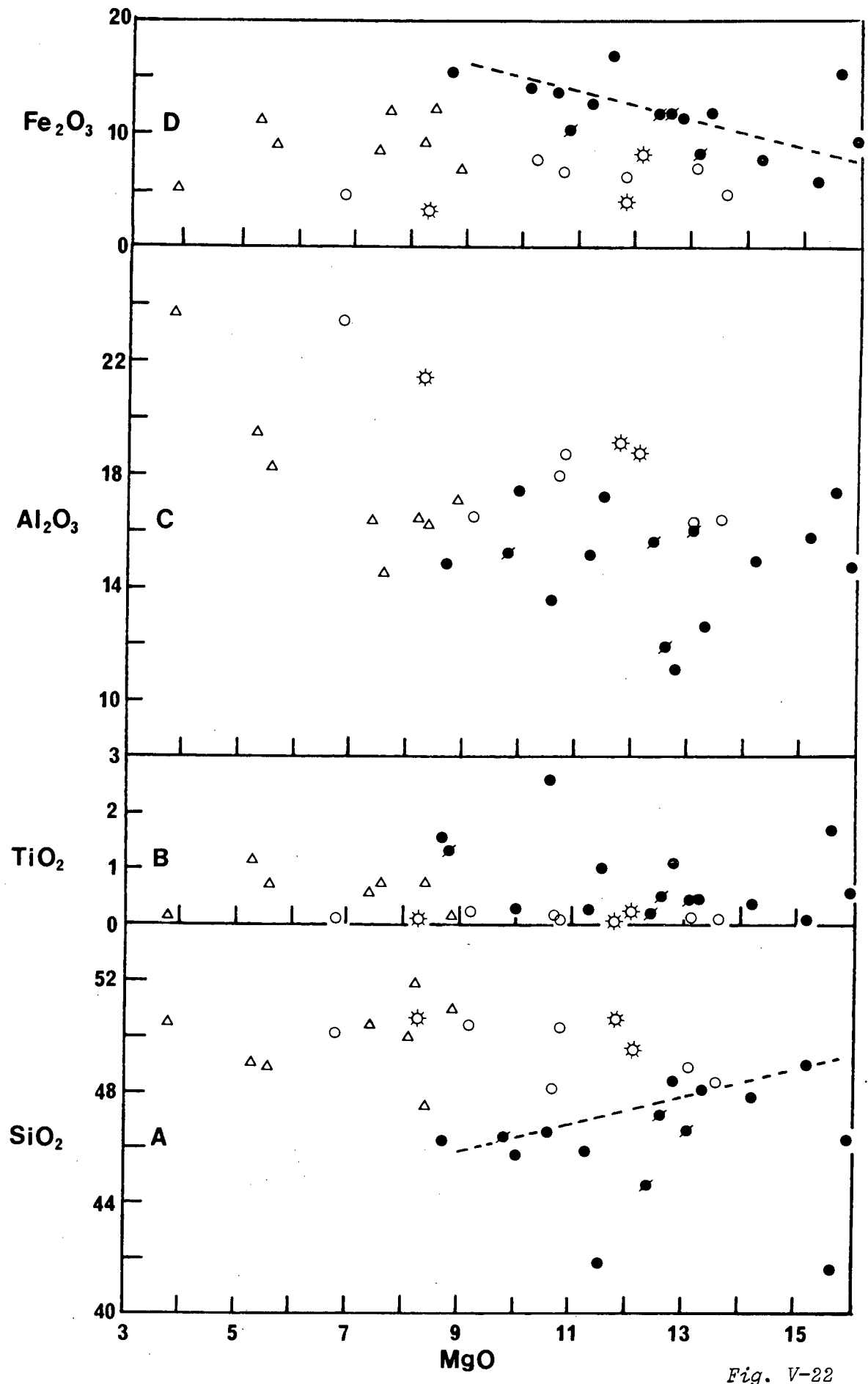


Fig. V-22

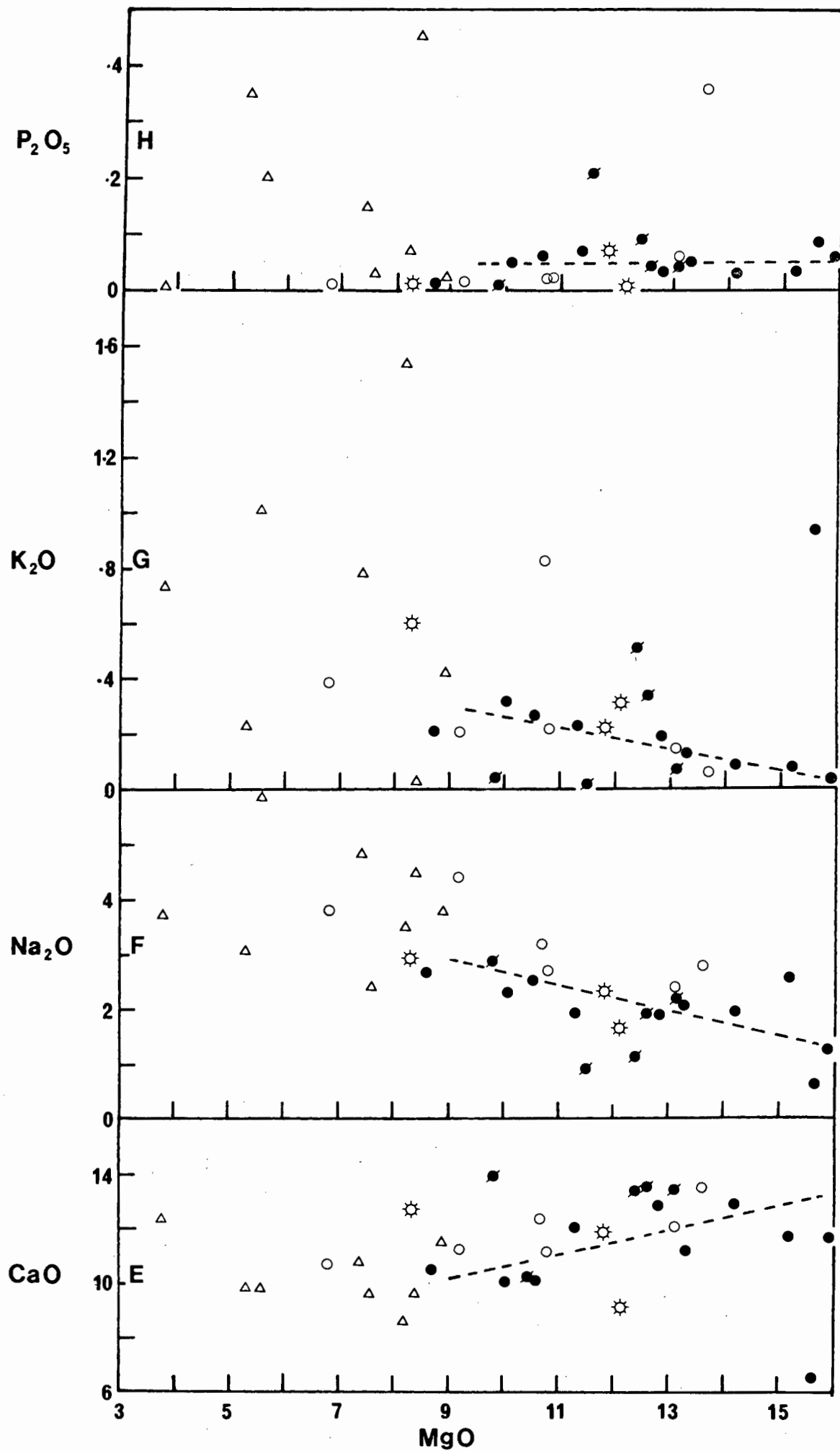


Fig. V-22 (contd.)

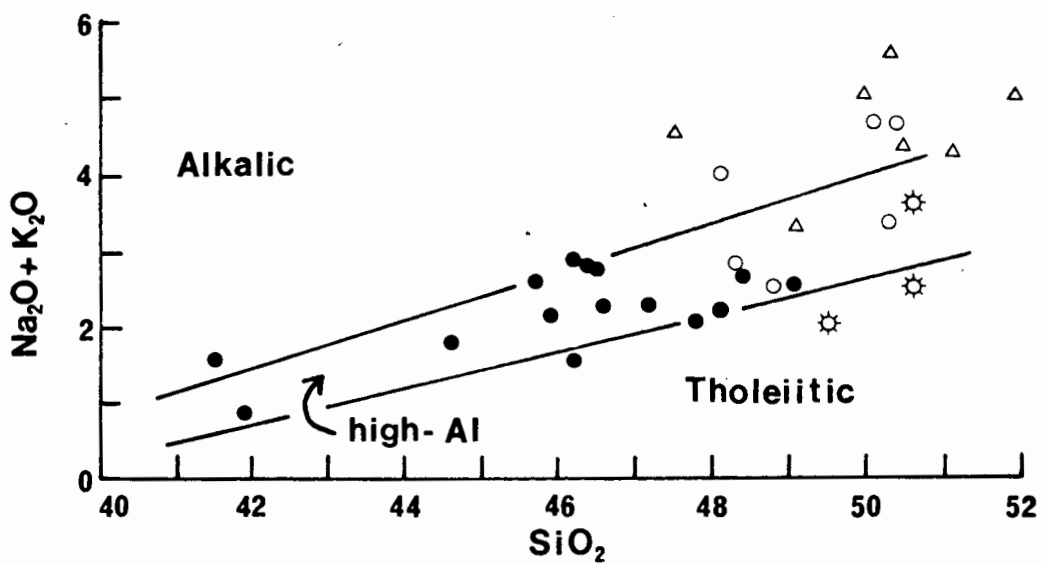
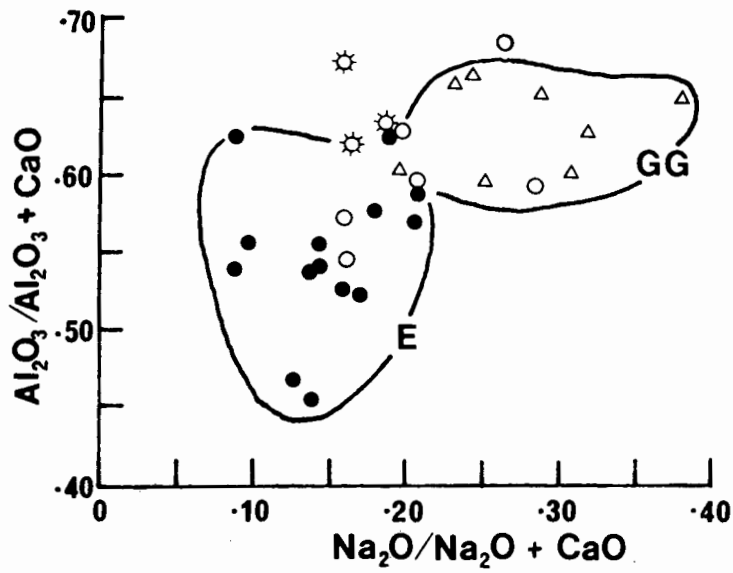
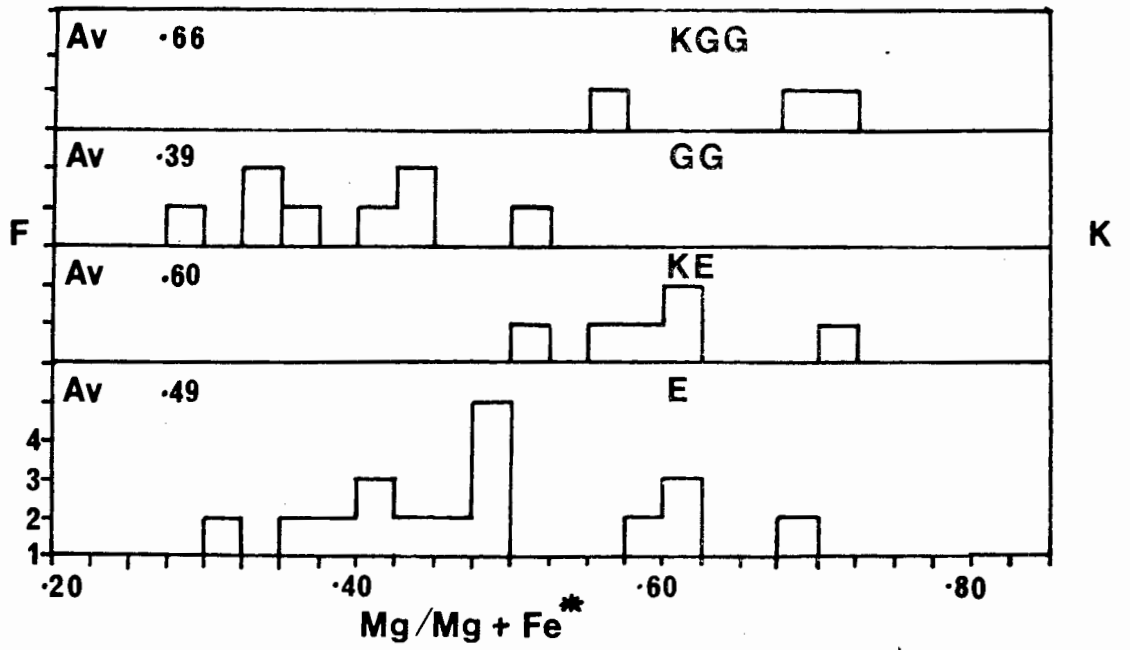


Fig.V-22 (contd.)

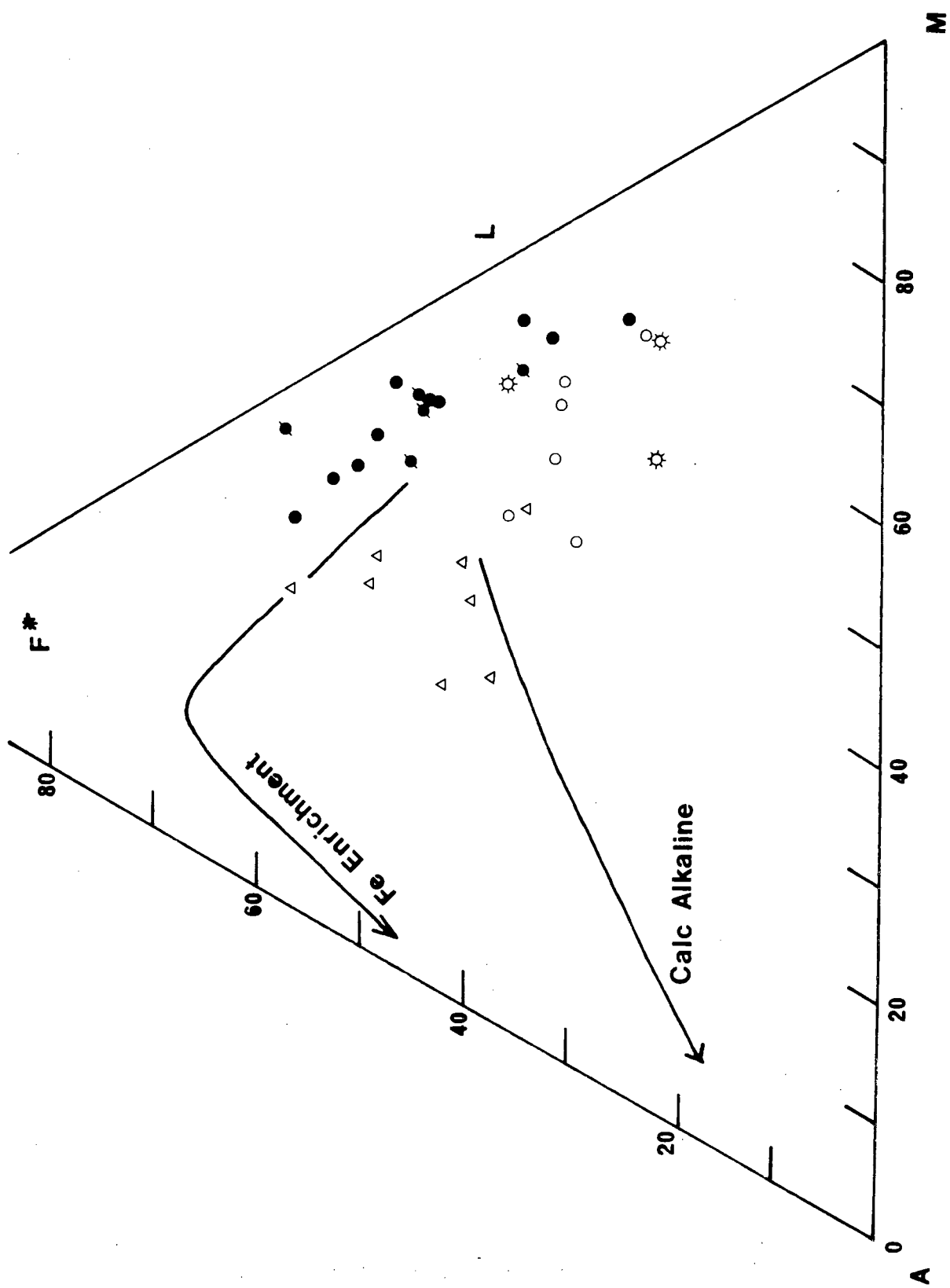


Fig. V-22 (contd.)

M

A

F*

L

Fe Enrichment

Calc Alkaline

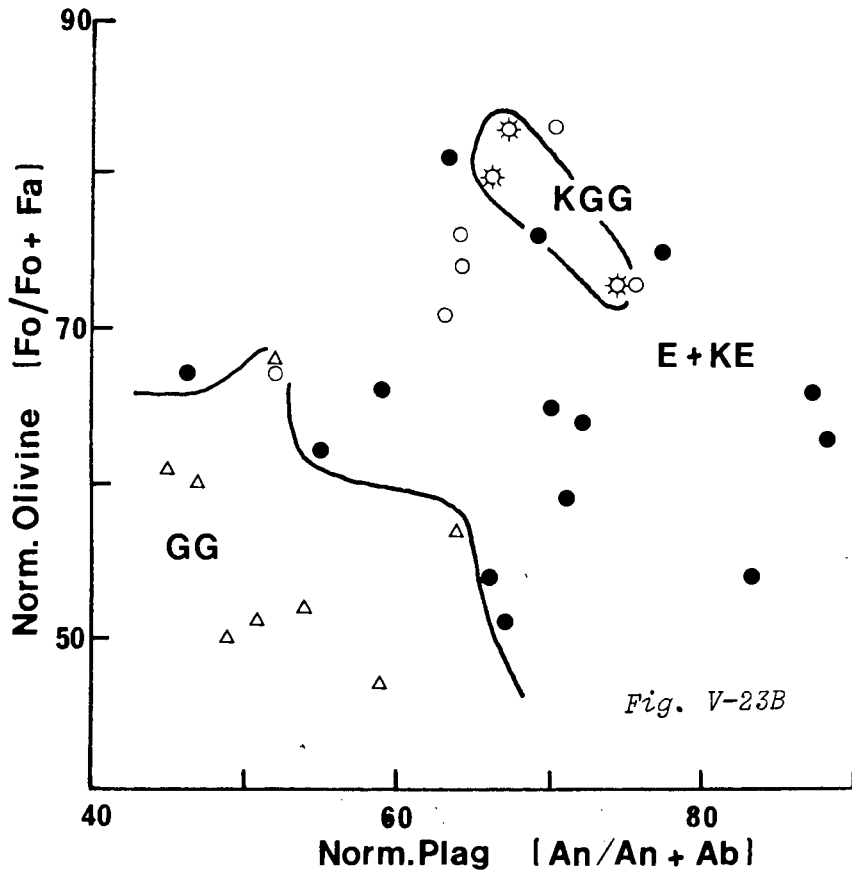
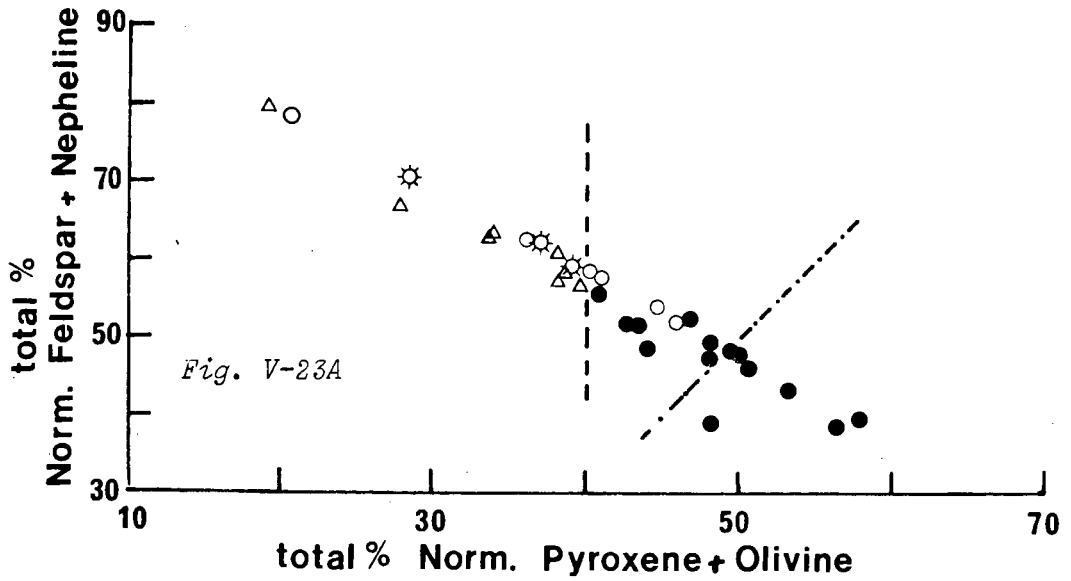


Fig. V-23A: Comparing the total normative mafic contents (pyroxene + olivine) of the basic xenoliths to their femic contents (feldspar + nepheline). The dashed line shows the cut-off between eclogites and granulites (note 2 kyanite eclogites plot in the granulite field). The other line (-·-·-) shows the similar cut-off for the Lesotho xenoliths (diagram after Griffin et al., 1979).

Fig. V-23B: Comparing normative olivine and plagioclase compositions of the basic xenoliths. Symbols and abbreviations as in Fig. V-22.

Fig. V-24A to K: Whole rock trace element variation diagrams for the basic xenoliths. Trace element data are given in ppm and are plotted against the differentiation index MgO (wt.%). Note in A,B the vertical scale is compressed.

Fig. V-24L: K_2O (wt.%) vs. Rb (ppm) for the basic xenoliths. Lines show constant values of the K/Rb ratio values indicated. Inset is a frequency (F) histogram to more clearly indicate the distribution of K/Rb ratios especially at low concentrations of K_2O and Rb.

Fig. V-24M: Frequency (F) histogram showing distribution of basic xenolith Zr/Nb ratios.

Fig. V-24N: Frequency (F) histogram showing distribution of basic xenolith Zr/Y ratios.

Fig. V-24 O: Illustrating the positive correlation between the whole rock V and Y contents of the basic xenoliths.

The symbols and group abbreviations are as in Fig. V-22.

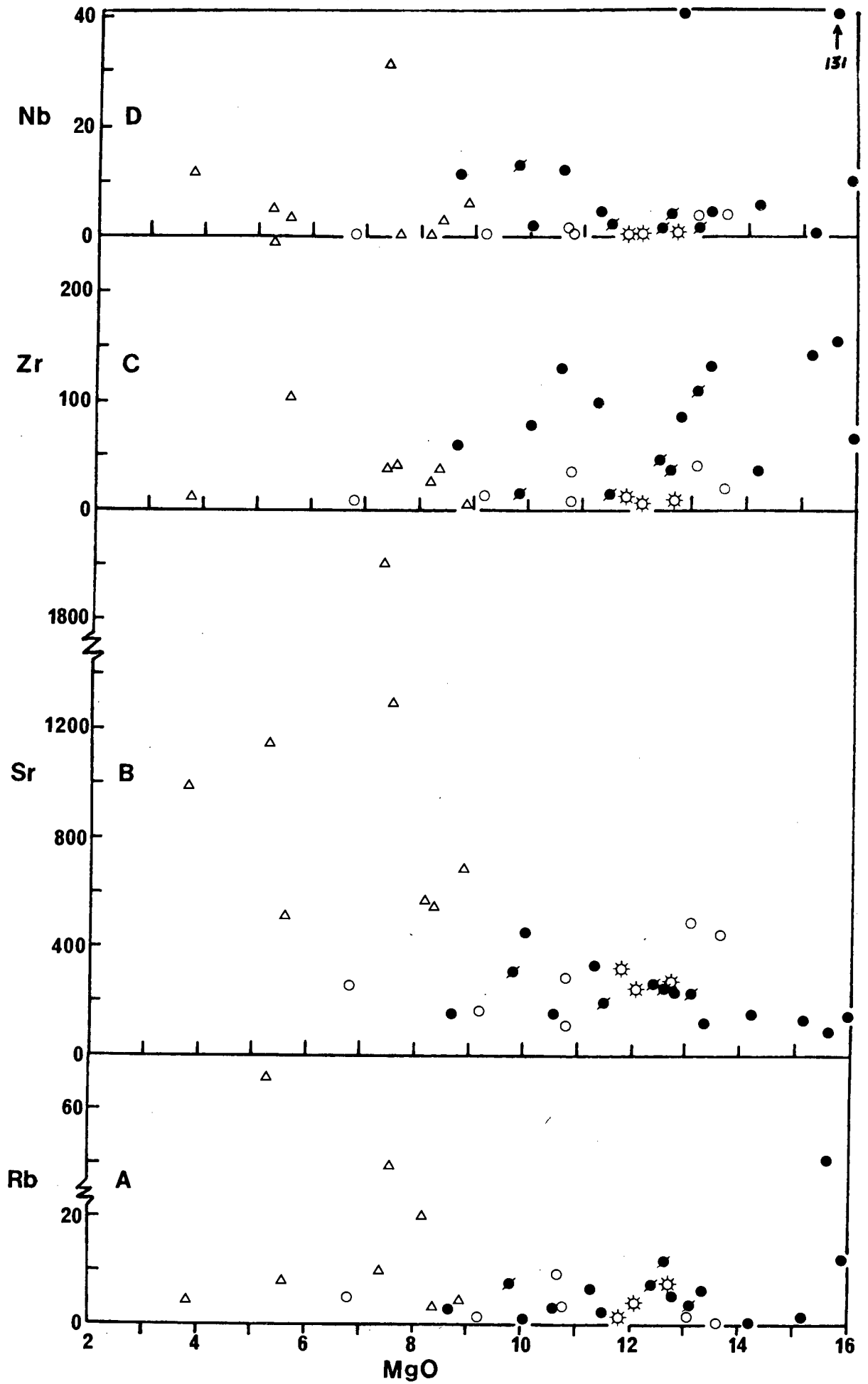


Fig. V-24

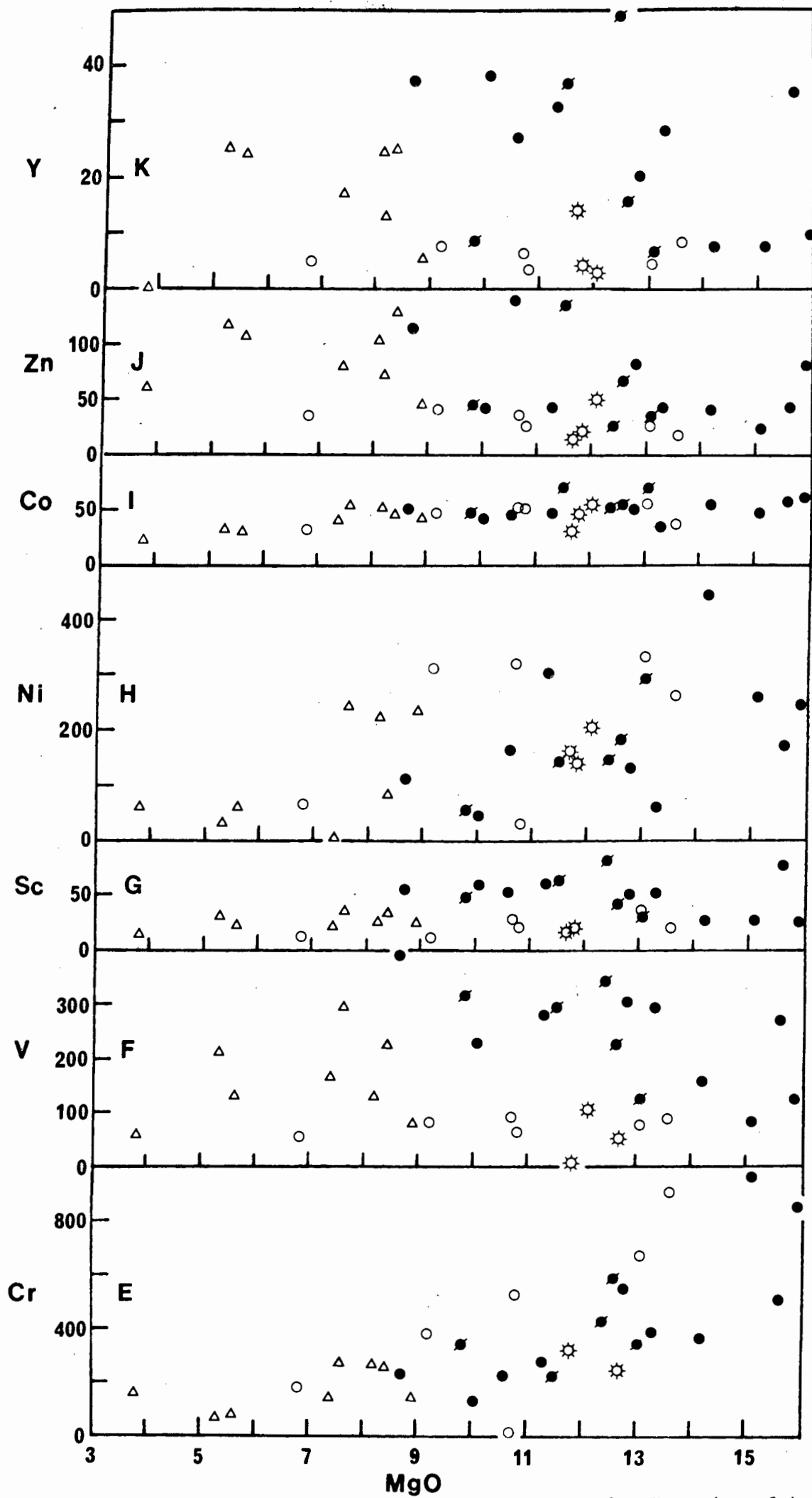
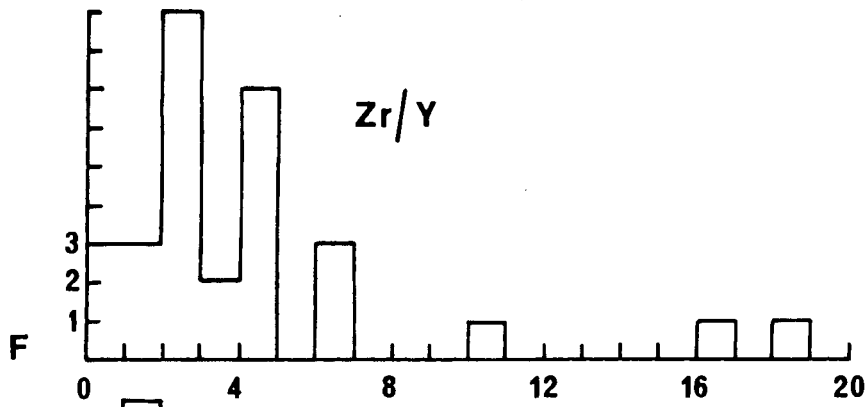
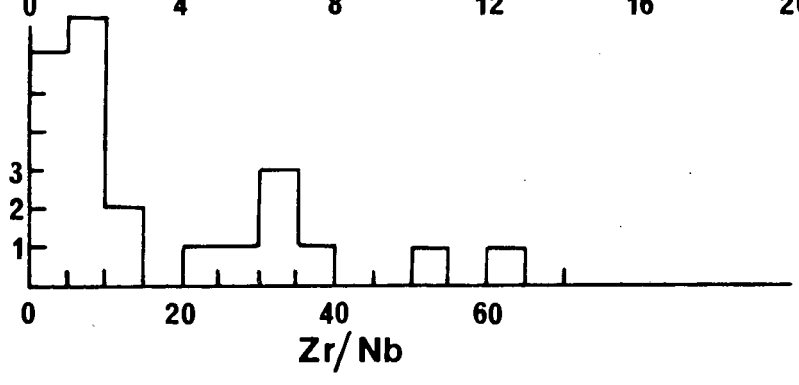


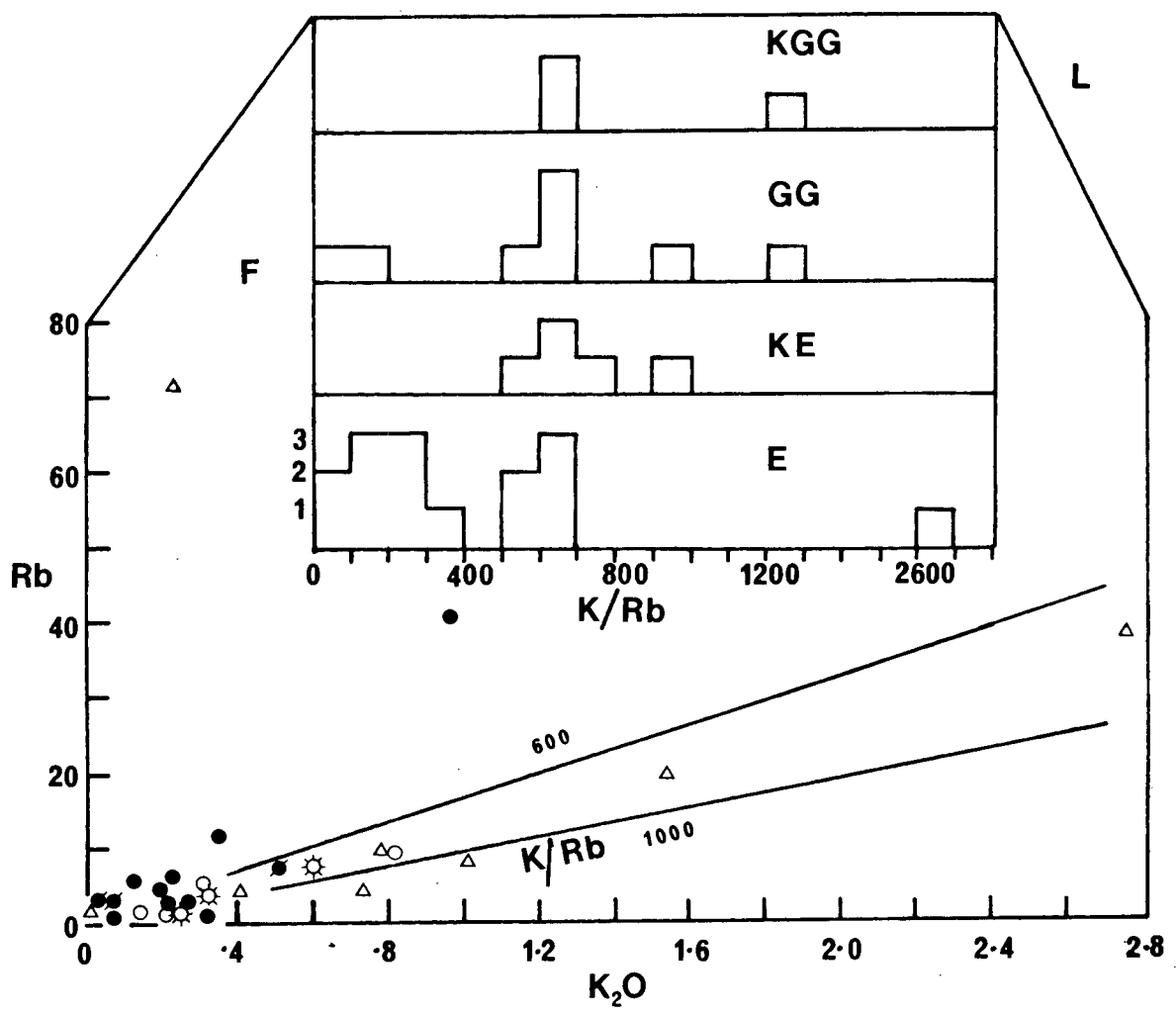
Fig. V-24 (contd.)



N



M



L

Fig. V-24 (contd.)

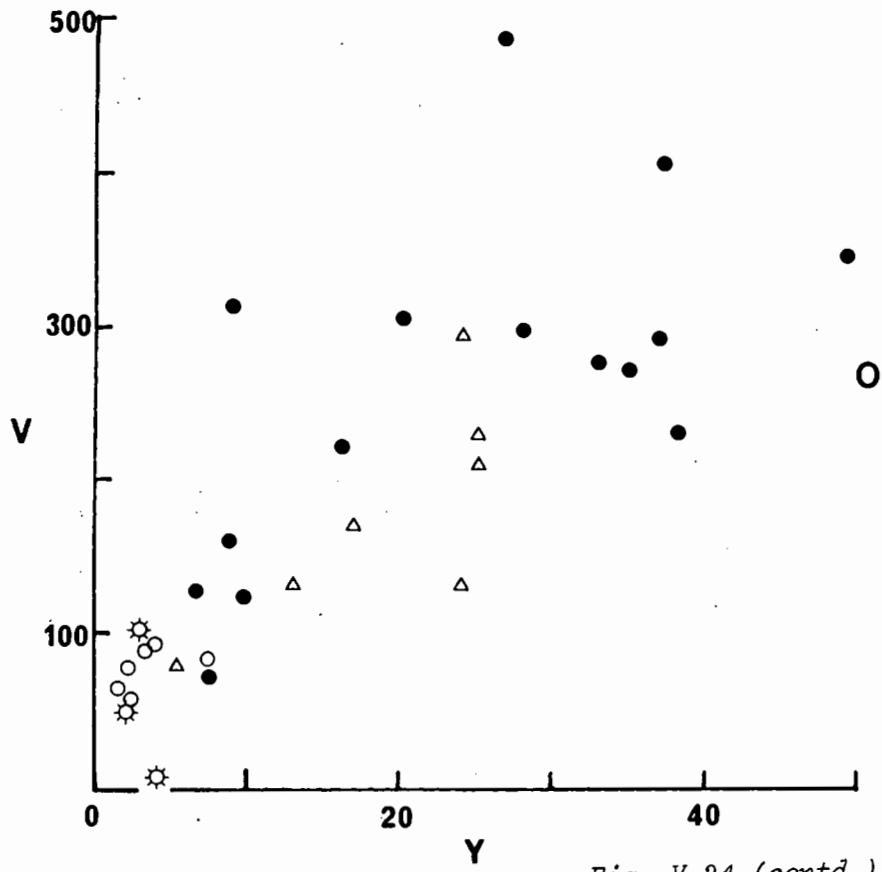


Fig. V-24 (contd.)

Fig. V-25: Major (SiO_2 to TiO_2 in wt.%) and trace (Zr to Cr in ppm) element variation diagrams plotted with MgO (wt.%) content as the differentiation index. The compositions of basic xenoliths are compared with other rock types to test simple petrogenetic models.

- E Eclogites from the Karroo pipes.
- KE Kyanite eclogites from the Karroo pipes.
- △ GG Garnet granulites from the Karroo pipes.
- △ GG Garnet granulites - Lesotho (Griffin et al., 1979).
- ★ GW Garnet websterites - Lesotho (Griffin et al., 1979).
- ◆ AM Average amphibolite from eastern Namaqualand (Geringer, 1979).
- ▲ AD Average andesite (Taylor, 1969).

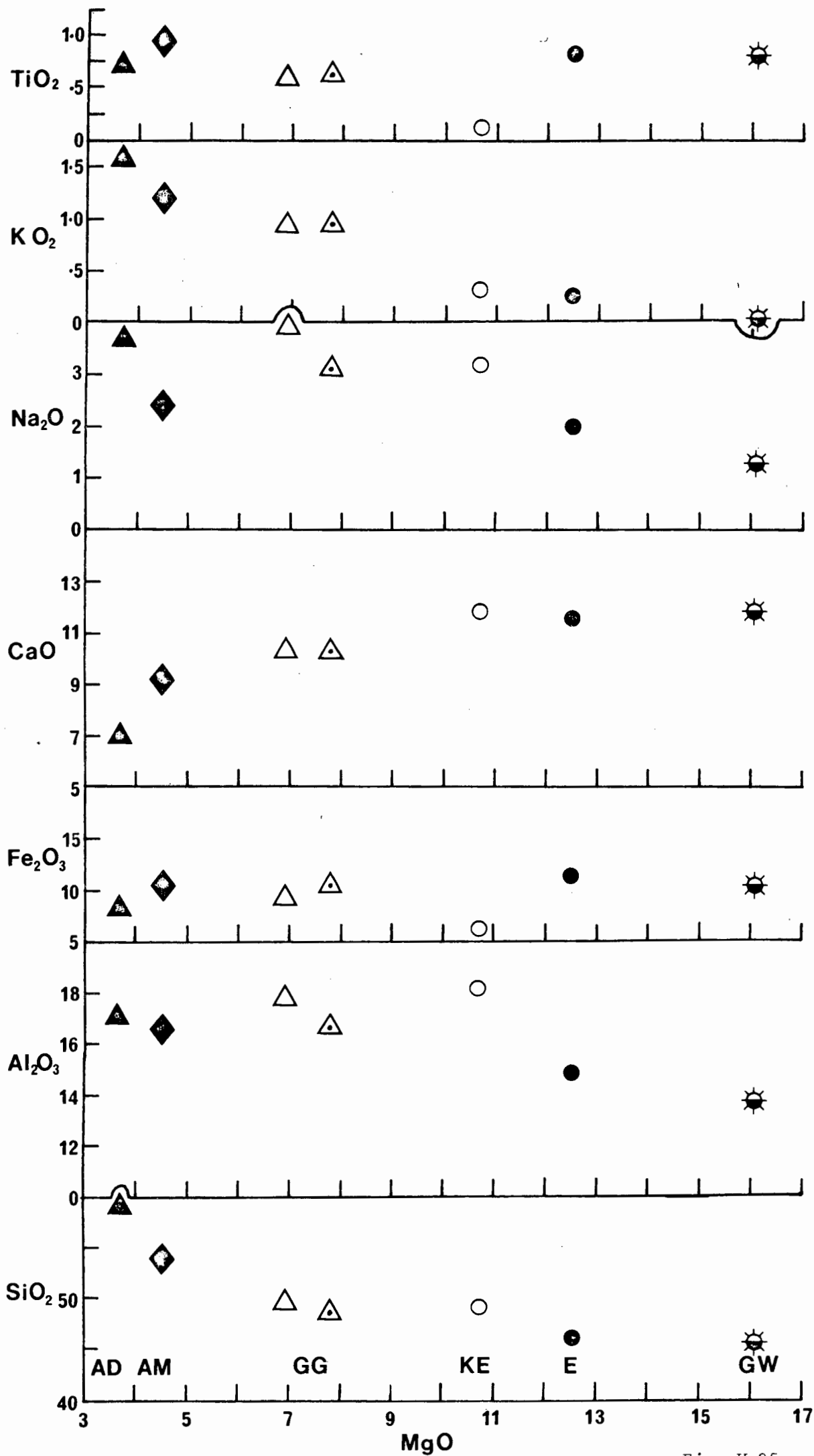


Fig. V-25

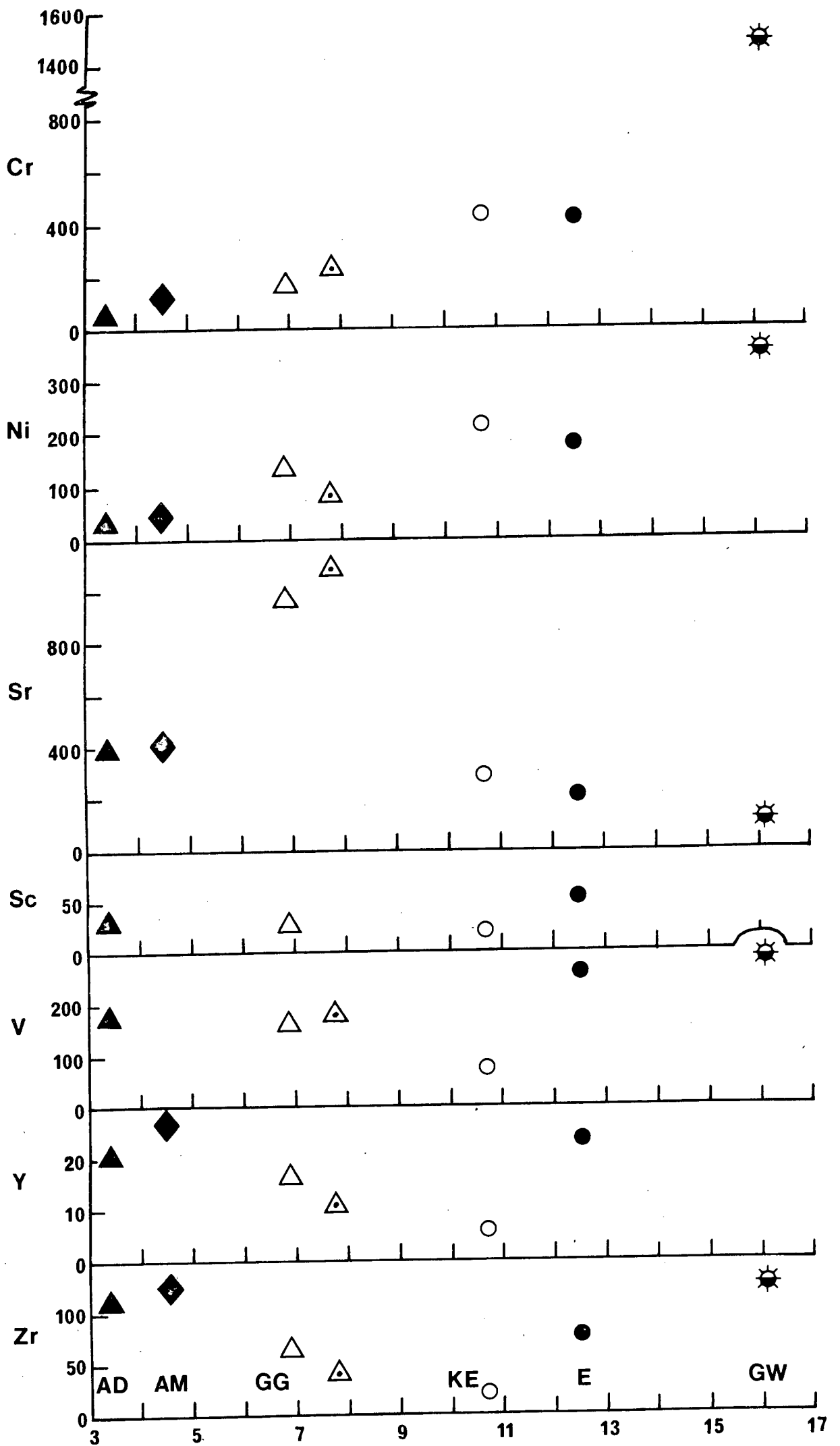


Fig. V-25 (contd.)

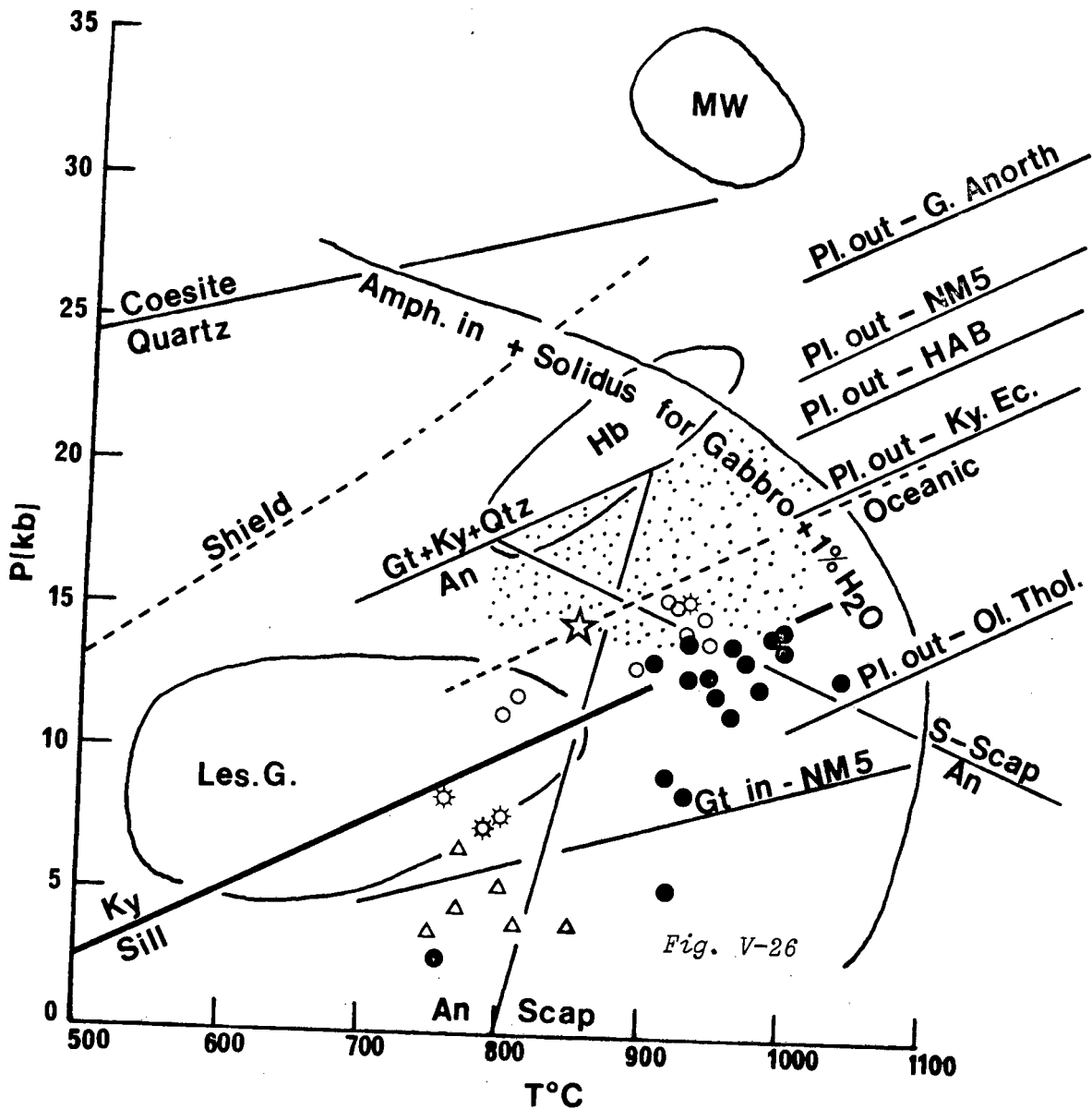
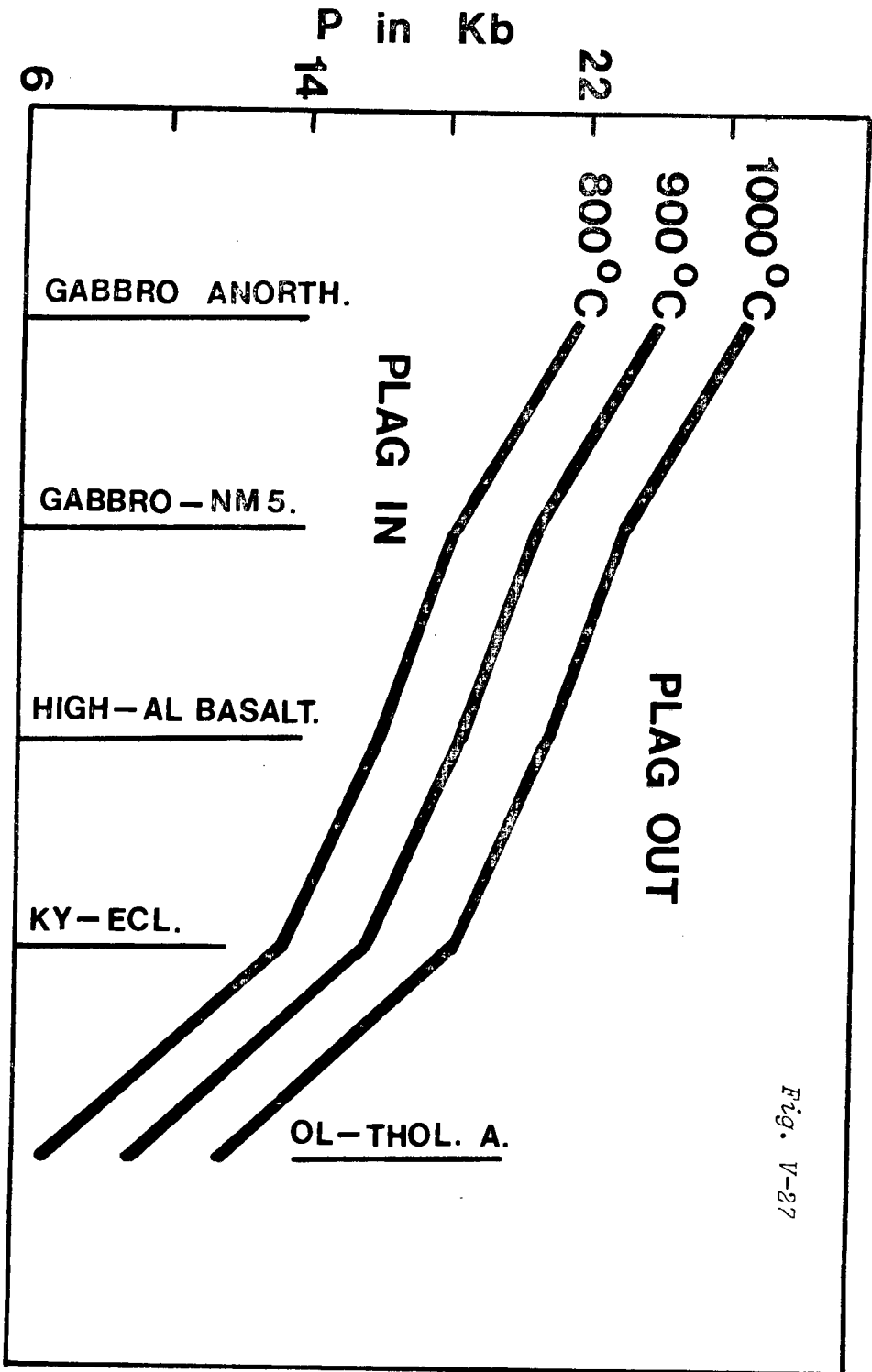


Fig. V-26: The estimated P,T regime of equilibration for the basic xenoliths from the Karroo pipes. ● - eclogite, ○ - kyanite eclogite, Δ - garnet granulite, ☆ - kyanite garnet granulite. The points are plotted using the geothermometer of Ellis and Green (1979) and the geobarometer of Currie and Curtis (1976) - for details see text). The dotted area is the preferred P,T regime. The following mineral reactions are used to independently constrain the xenolith P,T area:
 Amphibole (Amph.) stability and gabbro solidus - Wyllie (1971).
 Quartz - Coesite transition - Wyllie (1971).
 Scapolite (Scap) and sulfate scapolite (S-Scap) stability - Goldsmith (1976).
 Kyanite (Ky) - Sillimanite (Sill) transition - Richardson et al. (1968).
 The plagioclase-out (Pl. out) reactions in experimental runs on the following natural rocks: Olivine tholeiite A (Ol. Thol.), Kyanite eclogite (Ky. Ec.), High-Al basalt (HAB), gabbro (NMS) and gabbroic anorthosite (G. Anorth), as well as the garnet-in (Gt.-in) reaction in gabbro NMS are from Green and Ringwood (1967, 1972) and Green (1967). Also shown are oceanic and shield geotherms (Wyllie, 1971) and the equilibration fields for garnet granulites from Lesotho (Les. G. - from Griffin et al., 1979), ultrabasics from Hebron (Hb) and Melton Wold (MW) (from this work). ☆ is the invariant point of Hensen (1976) at 850°C, 14 kb (see Fig. V-28 and text).



BULK COMPOSITION

Fig. V-27: Illustrating the control of varying bulk composition on the stability of plagioclase at high P and T. This is a summary of the experimental data of Green and Ringwood (1967, 1972) and Green (1967) and is similar to that presented in Green and Ringwood (1972). Abbreviations as in Fig. V-26.

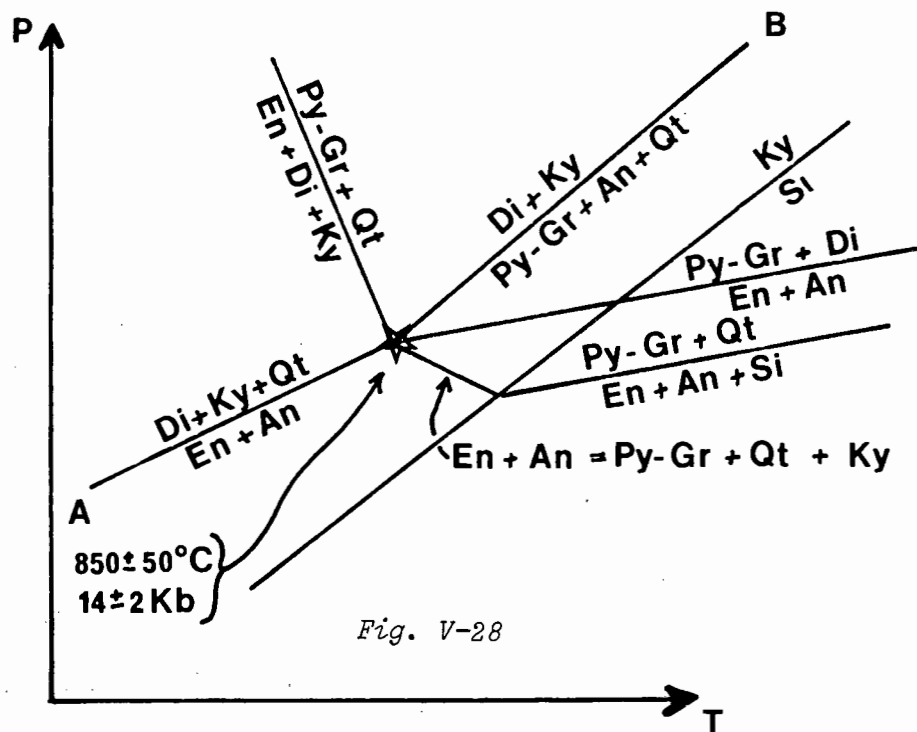


Fig. V-28

Fig. V-28: The hypothetical invariant point (☆) in the system $CaO-MgO-Al_2O_3-SiO_2$ studied by Hensen (1976). Reaction textures seen in certain kyanite garnet granulites are interpreted to indicate reactions A,B occurring when xenoliths cooled. Abbreviations are Py - pyrope, Gr - grossular, En - enstatite, Di - diopside, Ky - kyanite, Qtz - quartz, Si - sillimanite, An - anorthite.

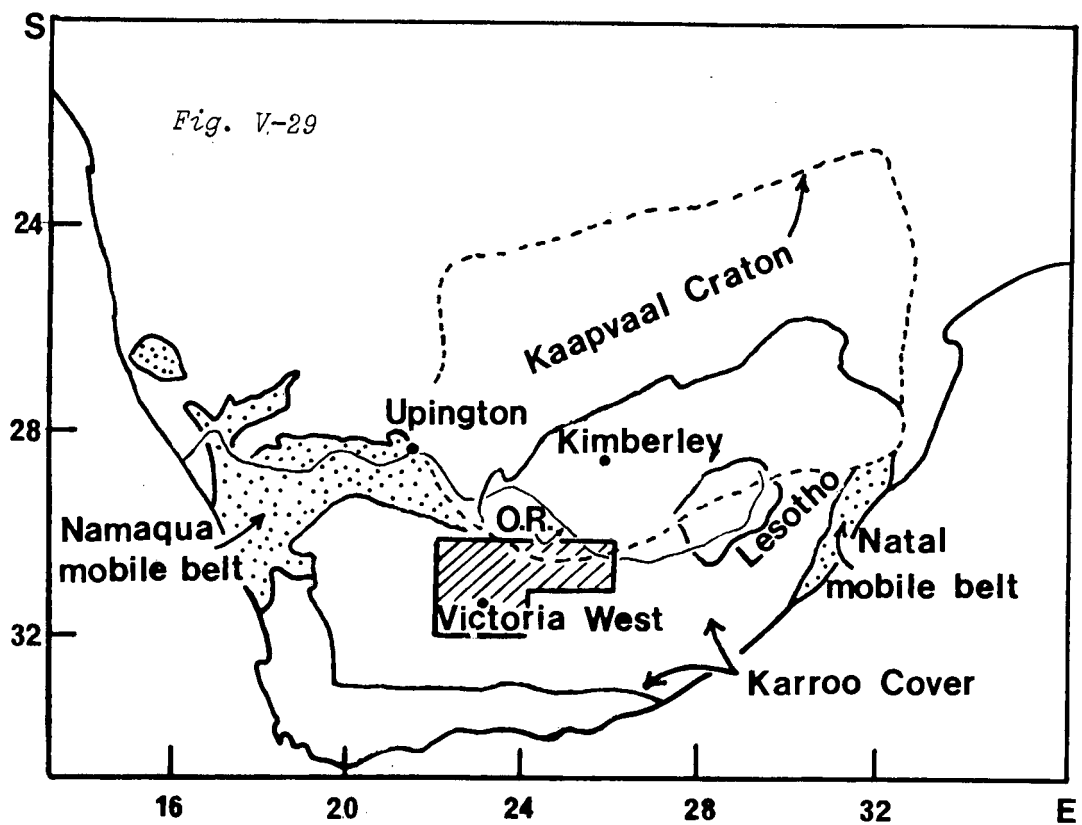


Fig. V-29: The study area (////) shown in relation to the Namaqua-Natal mobile belt and the Karroo sedimentary cover and situated to the south of the Kaapvaal craton (Kaapvaal craton limit shown by dashed line). O.R. - Orange river. Latitudes (S - south) and longitudes (E - east) are given.

APPENDIX 7: TABLES

LIST OF TABLES

- Table II-1. *Phlogopite compositions in kimberlites.*
II-2 *Diopside compositions in kimberlites.*
II-3 *Serpentine compositions in kimberlites.*
II-4 *Kimberlite whole rock analyses.*
II-5 *Comparing Karrco kimberlite whole rock data with kimberlites from elsewhere.*
- Table III-1 *Garnet megacryst compositions.*
III-2 *Clinopyroxene and orthopyroxene megacryst compositions.*
III-3 *Ilmenite megacryst compositions.*
- Table IV-1 *Literature guide.*
IV-2 *Peridotite textural classification.*
IV-3 *Summary of mineral compositions of peridotites from Hebron and Melton Wold.*
IV-4 *Garnet compositions of Hebron peridotites.*
IV-5 *Garnet compositions of Melton Wold peridotites.*
IV-6 *Olivine compositions of Hebron peridotites.*
IV-7 *Olivine compositions in the Hebron porphyroclastic lherzolite.*
IV-8 *Olivine megacryst compositions from Hebron.*
IV-9 *Orthopyroxene compositions of Hebron peridotites.*
IV-10 *Orthopyroxene compositions of the Hebron porphyroclastic lherzolite.*
IV-11 *Orthopyroxene megacryst compositions from Hebron.*
IV-12 *Orthopyroxene compositions of Melton Wold peridotites.*
IV-13 *Clinopyroxene compositions of Hebron peridotites.*
IV-14 *Clinopyroxene compositions of the Hebron porphyroclastic lherzolite.*
IV-15 *Clinopyroxene compositions of Melton Wold peridotites.*
IV-16 *Spinel compositions of Hebron peridotites.*
IV-17A *Spinel compositions of the Hebron porphyroclastic lherzolite.*
IV-17B *Ilmenite compositions of the Hebron porphyroclastic lherzolite.*
IV-18 *Phlogopite compositions of Hebron peridotites.*
IV-19 *Amphibole compositions of Hebron peridotites.*
IV-20 *Site occupancy in peridotite amphiboles.*
IV-21 *Ranges in mineral Mg/Mg+Fe ratios of peridotites.*
IV-22 *Estimates of peridotite equilibration temperatures.*
IV-23 *Estimates of peridotite equilibration pressures.*
IV-24 *Estimates of equilibration temperatures for the Hebron porphyroclastic lherzolite.*
- Table V-1 *Primary mineralogy of eclogitic xenoliths from Lovedale.*
V-2 *Summary of primary textures in eclogites and kyanite eclogites.*
V-3 *Primary mineralogy of eclogitic xenoliths from other localities.*
V-4 *Summary of textures in garnet granulites and kyanite garnet granulites.*
V-5 *Petrographic modes.*
V-6 *Primary mineralogy of garnet granulites and kyanite garnet granulites.*
V-7 *Garnet compositions of Lovedale eclogites.*
V-7A *Garnet compositions of other eclogites.*
V-8 *Garnet compositions of Lovedale kyanite eclogites.*

List of Tables (cont.)

- Table V-9 Garnet compositions of garnet granulites.
V-10 Garnet compositions of kyanite garnet granulites.
V-11 Clinopyroxene compositions of Lovedale eclogites.
V-11A Clinopyroxene compositions of other eclogites.
V-12 Clinopyroxene compositions of kyanite eclogites.
V-13 Clinopyroxene and orthopyroxene compositions of garnet granulites.
V-14 Clinopyroxene and orthopyroxene compositions of kyanite garnet granulites.
V-14A Garnet-clinopyroxene KD (Fe/Mg) values.
V-14B Clinopyroxene endmembers calculations.
V-15 Plagioclase compositions of garnet granulites.
V-16 Plagioclase compositions of kyanite garnet granulites.
V-17 Primary amphibole compositions of eclogites and granulites.
V-17A Amphibole site occupancy.
V-18 Kyanite compositions of eclogites and granulites.
V-19 Scapolite compositions of granulites.
V-20 Secondary clinopyroxene compositions of eclogites.
V-20A Secondary clinopyroxene endmember calculations.
V-21 Secondary amphibole compositions of eclogites.
V-21A Secondary amphibole site occupancy.
V-22 Secondary spinel compositions of eclogites.
V-23 Secondary and primary phlogopite compositions of eclogites.
V-24 Compositions of other secondary minerals in eclogites and granulites.
V-24A C.I.P.W. norms of glass analyses.
V-25 Whole rock compositions for eclogites, kyanite eclogites, garnet granulites and kyanite garnet granulites.
V-25A Whole rock compositions (V-25) expressed as volatile-free.
V-26 C.I.P.W. norms for the eclogitic and granulitic xenoliths.
V-27 Results of "MIXER" calculations.
V-28 Averaged whole rock compositions of basic xenoliths from the Karroo and Lesotho kimberlites.
V-29 Averaged xenolith bulk compositions compared with compositions of other rock types.
V-30 Crystal/Liquid distribution coefficients.
V-31 Estimates of the lower crustal composition beneath the study area.
V-32 Estimates of pressures and temperatures of equilibration for the basic xenoliths.

TABLE II-1
 ** MATRIX PHLOGOPITES IN KIMBERLITES **

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SiO2 | 41.27 | 41.26 | 41.07 | 40.86 | 39.93 | 40.11 | 39.91 | 39.33 | 40.73 | 40.17 |
| TiO2 | .45 | .48 | 1.43 | 2.14 | 2.54 | 2.65 | 2.54 | 2.55 | 2.29 | 2.30 |
| Al2O3 | 11.59 | 10.58 | 9.19 | 8.87 | 9.96 | 7.48 | 10.14 | 9.65 | 8.42 | 9.03 |
| Cr2O3 | .15 | .25 | .12 | .18 | .11 | ND | .05 | .02 | .12 | .08 |
| FEO | 5.41 | 6.34 | 7.81 | 10.15 | 10.00 | 10.31 | 10.50 | 10.68 | 11.06 | 10.89 |
| MNO | .06 | .05 | .07 | .06 | .06 | .07 | .07 | .11 | .08 | .07 |
| MGO | 27.83 | 28.51 | 25.58 | 24.54 | 23.91 | 24.33 | 23.19 | 23.46 | 23.96 | 23.52 |
| CaO | .25 | .04 | .15 | .05 | ND | .06 | .07 | .08 | ND | .15 |
| Na2O | .07 | .11 | .17 | .09 | .14 | .09 | .09 | .14 | .14 | .12 |
| K2O | 10.16 | 9.14 | 10.07 | 10.09 | 9.83 | 9.77 | 9.64 | 9.92 | 9.84 | 10.03 |
| TOTAL | 97.24 | 96.76 | 97.66 | 97.03 | 96.51 | 96.90 | 96.24 | 96.00 | 96.67 | 96.38 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| SI | 6.055 | 6.081 | 6.141 | 6.162 | 6.046 | 6.056 | 6.064 | 6.023 | 6.107 | 6.128 |
| TI | .050 | .053 | .161 | .243 | .289 | .301 | .290 | .294 | .262 | .264 |
| AL | 2.004 | 1.838 | 1.620 | 1.577 | 1.778 | 1.687 | 1.816 | 1.742 | 1.508 | 1.624 |
| CR | .017 | .029 | .014 | .021 | .013 | | .006 | .010 | .014 | .010 |
| FE2+ | .664 | .731 | 1.227 | 1.280 | 1.266 | 1.302 | 1.334 | 1.368 | 1.405 | 1.389 |
| MN | .007 | .006 | .009 | .008 | .008 | .009 | .012 | .014 | .010 | .012 |
| MG | 6.086 | 6.262 | 5.700 | 5.515 | 5.395 | 5.475 | 5.251 | 5.354 | 5.424 | 5.347 |
| CA | .039 | .006 | .024 | .008 | | .010 | .015 | .013 | | .025 |
| NA | .020 | .031 | .049 | .026 | .041 | .026 | .027 | .042 | .041 | .035 |
| K | 1.902 | 1.719 | 1.921 | 1.941 | 1.899 | 1.882 | 1.869 | 1.938 | 1.907 | 1.952 |
| SUM | 16.845 | 16.807 | 16.866 | 16.781 | 16.740 | 16.752 | 16.683 | 16.797 | 16.764 | 16.785 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-------------------|------------|-------------|
| 1 | PHL. 10,08012,PK. | 6 | PHL. 4, " |
| 2 | PHL. 11, " | 7 | PHL. 3, " |
| 3 | PHL. 8, " | 8 | PHL. 7, " |
| 4 | PHL. 9, " | 9 | PHL. 6, " |
| 5 | PHL. 5, " | 10 | PHL. 1, " |

TABLE II-1
 ** MATRIX PHLOGOPITES IN KINDERLITES **

| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SiO2 | 40.93 | 39.95 | 39.98 | 40.59 | 40.32 | 39.57 | 40.00 | 40.83 | 41.05 | 39.43 |
| TiO2 | 1.75 | 1.71 | 2.29 | 1.90 | 1.49 | 2.32 | 1.98 | 2.46 | 1.72 | 2.32 |
| Al2O3 | 9.37 | 8.58 | 7.96 | 3.47 | 7.35 | 7.33 | 4.49 | 10.18 | 5.98 | 10.28 |
| Cr2O3 | .26 | .17 | .23 | .08 | .24 | .12 | .07 | .16 | ND | .20 |
| FED | 7.97 | 7.36 | 8.13 | 15.54 | 9.79 | 11.02 | 14.47 | 8.71 | 12.03 | 8.74 |
| MNO | ND | .07 | .07 | .04 | .08 | .04 | .08 | .04 | .11 | .05 |
| MGO | 25.97 | 25.41 | 24.85 | 24.98 | 26.05 | 25.47 | 24.75 | 24.96 | 26.17 | 24.57 |
| CAO | ND | .06 | .04 | .05 | .07 | .04 | .04 | .05 | .10 | .07 |
| NA2O | .08 | ND | .07 | .10 | .07 | .06 | .11 | .08 | .14 | ND |
| K2O | 9.95 | 9.73 | 9.76 | 9.47 | 9.28 | 9.76 | 9.70 | 10.21 | 9.66 | 9.53 |
| TOTAL | 96.34 | 95.07 | 95.38 | 96.24 | 94.74 | 95.73 | 95.69 | 97.68 | 96.99 | 95.22 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| SI | 6.144 | 6.130 | 6.069 | 6.362 | 6.211 | 6.097 | 6.285 | 6.070 | 6.259 | 6.009 |
| TI | .198 | .197 | .261 | .224 | .173 | .269 | .234 | .275 | .197 | .266 |
| AL | 1.658 | 1.552 | 1.782 | .641 | 1.335 | 1.331 | .831 | 1.784 | 1.075 | 1.847 |
| CR | .031 | .021 | .028 | .010 | .029 | .015 | .009 | .019 | | .024 |
| FE2: | 1.001 | 1.201 | 1.032 | 2.037 | 1.261 | 1.420 | 1.901 | 1.083 | 1.534 | 1.114 |
| MN | | .009 | .009 | .008 | .010 | .005 | .011 | .005 | .014 | .006 |
| MG | 5.810 | 5.810 | 5.622 | 5.835 | 5.981 | 5.849 | 5.795 | 5.530 | 5.946 | 5.581 |
| CA | | .010 | .007 | .008 | .012 | .007 | .007 | .008 | .016 | .011 |
| NA | .023 | | .021 | .030 | .021 | .018 | .034 | .023 | .041 | |
| K | 1.906 | 1.905 | 1.890 | 1.894 | 1.824 | 1.919 | 1.944 | 1.937 | 1.879 | 1.853 |
| SUM | 16.778 | 16.844 | 16.720 | 17.050 | 16.857 | 16.929 | 17.050 | 16.733 | 16.965 | 16.720 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|---------------------------|------------|--------------------------|
| 11 | PHL. 2 CENTER, 21012, PK. | 16 | PHL. 1, " |
| 12 | PHL. 2 EDGE, " | 17 | PHL. 5, RED EDGE, " |
| 13 | PHL. 4 CENTER, " | 18 | PHL. 4 POIK., 21012, DX. |
| 14 | PHL. 4 EDGE (RED), " | 19 | PHL. 4 POIK. EDGE, " |
| 15 | PHL. 3 SMALL, " | 20 | PHL. 1 POIK., " |

TABLE II-1

** MATRIX PHLOGOPITES IN KIMBERLITES **

| | 21 | 22 |
|-------|-------|-------|
| SiO2 | 41.31 | 40.39 |
| TiO2 | 1.70 | 2.10 |
| Al2O3 | 6.21 | 5.97 |
| Cr2O3 | .05 | ND |
| FeO | 12.49 | 13.53 |
| MnO | .07 | .06 |
| MgO | 25.63 | 25.32 |
| CaO | .07 | .19 |
| Na2O | .12 | .10 |
| K2O | 9.73 | 9.10 |
| TOTAL | 97.38 | 96.78 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 23 | 23 |
|--------|--------|--------|
| SI | 6.279 | 6.205 |
| TI | .194 | .243 |
| AL | 1.113 | 1.081 |
| CR | .006 | |
| FE2+ | 1.588 | 1.738 |
| MN | .009 | .008 |
| MG | 5.806 | 5.797 |
| CA | .011 | .031 |
| NA | .035 | .030 |
| K | 1.887 | 1.783 |
| SUM | 16.928 | 16.918 |

*** SAMPLE DIRECTORY ***

| <u>SAMPLE NO.</u> | <u>DESCRIPTION</u> | <u>SAMPLE NO.</u> | <u>DESCRIPTION</u> |
|-------------------|----------------------|-------------------|--------------------|
| 21 | PHL. 2 INTERSTIT., " | | |
| 22 | PHL. 3 INTERSTIT., " | | |

TABLE II-2
 ** MATRIX DIOPSIDES IN KIMBERLITE 21012(DK) **

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-------|-------|-------|--------|--------|-------|-------|--------|
| SiO2 | 53.03 | 53.79 | 53.36 | 54.03 | 53.62 | 54.07 | 53.63 |
| TiO2 | .70 | .69 | 1.23 | 1.16 | 1.21 | 1.04 | 1.09 |
| Al2O3 | .86 | .27 | .49 | .48 | .44 | .62 | .58 |
| Cr2O3 | .23 | .25 | .42 | .35 | .32 | | .38 |
| FeO | 3.36 | 3.38 | 3.47 | 3.40 | 3.31 | 3.56 | 3.85 |
| MnO | .05 | .06 | .07 | | ND | .07 | .05 |
| MgO | 17.61 | 17.11 | 17.85 | 15.91 | 15.59 | 15.47 | 16.04 |
| CaO | 22.55 | 23.48 | 23.63 | 24.32 | 24.37 | 24.30 | 24.09 |
| Na2O | .39 | .34 | .45 | .46 | .46 | .38 | .43 |
| K2O | .06 | .05 | .05 | .07 | ND | .28 | .28 |
| TOTAL | 98.84 | 99.42 | 100.22 | 100.18 | 99.37 | 99.79 | 100.42 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
|--------|-------|-------|-------|-------|-------|-------|-------|
| SI | 1.957 | 1.976 | 1.951 | 1.975 | 1.976 | 1.984 | 1.963 |
| TI | .019 | .019 | .034 | .032 | .034 | .029 | .030 |
| AL | .037 | .012 | .021 | .021 | .019 | .027 | .025 |
| CR | .007 | .007 | .012 | .010 | .009 | | .011 |
| FE2+ | .104 | .104 | .106 | .104 | .102 | .107 | .118 |
| MN | .002 | .002 | .002 | | | .002 | .002 |
| HG | .969 | .937 | .929 | .867 | .856 | .846 | .875 |
| CA | .892 | .924 | .926 | .952 | .962 | .956 | .945 |
| NA | .028 | .024 | .032 | .033 | .033 | .027 | .031 |
| K | .003 | .002 | .002 | .003 | | .013 | .013 |
| SUM | 4.017 | 4.008 | 4.016 | 3.996 | 3.993 | 3.993 | 4.011 |

| | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|
| CA 45.40 | CA 47.04 | CA 47.21 | CA 49.53 | CA 50.11 | CA 50.00 | CA 48.76 |
| HG 49.32 | HG 47.68 | HG 47.38 | HG 45.07 | HG 44.58 | HG 44.28 | HG 45.16 |
| FE 5.28 | FE 5.29 | FE 5.41 | FE 5.40 | FE 5.31 | FE 5.72 | FE 6.08 |
| M: 90.33 | M: 90.02 | M: 89.75 | M: 89.29 | M: 89.35 | M: 88.56 | M: 88.13 |
| C: 47.93 | C: 49.66 | C: 49.91 | C: 52.36 | C: 52.92 | C: 53.04 | C: 51.92 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-------------|------------|-----------------|
| 1 | CPX. 4 | 6 | CPX. 2, IN PHL. |
| 2 | CPX. 5 | 7 | CPX. 3 |
| 3 | CPX. 1 | | |
| 4 | CPX. 6 | | |
| 5 | CPX. 7 | | |

TABLE II-3
 ** MATRIX PRIMARY SERPENTINE IN KIMBERLITES **

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SiO2 | 38.87 | 37.50 | 37.75 | 41.06 | 41.06 | 40.30 | 39.61 | 39.96 | 42.10 | 38.98 |
| TiO2 | .05 | .06 | .06 | ND | ND | .29 | ND | ND | ND | ND |
| Al2O3 | 1.17 | 1.10 | .78 | .35 | .35 | 6.38 | .23 | .53 | .22 | .48 |
| CR2O3 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| FeO | 6.79 | 5.23 | 7.04 | 5.07 | 4.82 | 7.87 | 5.77 | 3.60 | 3.02 | 3.58 |
| MnO | .10 | .09 | .10 | .13 | .06 | .06 | .09 | .05 | .06 | .12 |
| MgO | 39.24 | 37.81 | 37.80 | 36.64 | 39.06 | 33.00 | 39.18 | 39.09 | 38.50 | 41.68 |
| CaO | .05 | .05 | .09 | .08 | .14 | ND | .09 | .08 | ND | .05 |
| Na2O | .13 | .06 | .10 | .18 | .69 | .05 | ND | .13 | ND | .09 |
| K2O | .35 | .24 | .17 | .10 | .17 | 3.43 | | | | |
| TOTAL | 86.76 | 82.15 | 83.90 | 83.65 | 86.39 | 91.41 | 85.02 | 83.46 | 83.96 | 85.02 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|---------------------------------|------------|---------------------------|
| 1 | 1,00012 | 6 | 3. " , INTERSTIT. TO PHL. |
| 2 | 2, " " | 7 | MITCHELL (1978) |
| 3 | 3, " " | 8 | " " |
| 4 | 1,10012, INTERSTIT. TO CALCITE. | 9 | " " |
| 5 | 2, " " | 10 | " " |

TABLE II-4: KIMBERLITE WHOLE ROCK ANALYSES.
(MAJORS IN WT.%, TRACES IN PPM.)

| NO. | 02012 | 07012 | 09012 | 10012 | 30012 | 33012 | 08012 | 21012 |
|--------|--------|--------|-------|--------|--------|-------|--------|--------|
| TYPE | CK | | | | | | PK | |
| SI02 | 26.99 | 26.45 | 27.96 | 34.15 | 26.94 | 26.50 | 34.90 | 36.03 |
| TI02 | 2.96 | 3.50 | 3.39 | 1.22 | 2.92 | 4.17 | .93 | 1.55 |
| AL2O3 | 2.99 | 3.00 | 2.31 | 3.62 | 2.57 | 3.64 | 2.42 | 2.32 |
| FE2O3* | 10.27 | 11.64 | 10.45 | 7.40 | 12.75 | 14.44 | 8.42 | 9.11 |
| MNO | .17 | .17 | .16 | .16 | .22 | .21 | .14 | .13 |
| MGO | 24.31 | 23.43 | 25.49 | 28.12 | 26.93 | 22.21 | 31.94 | 30.38 |
| CAO | 12.41 | 13.05 | 11.90 | 8.03 | 11.19 | 12.10 | 5.56 | 4.15 |
| NA2O | .01 | .02 | .02 | .04 | .33 | .06 | .02 | .03 |
| K2O | .97 | .54 | .91 | 2.99 | .31 | 1.78 | 1.89 | 2.25 |
| P2O5 | .92 | .91 | 1.44 | 1.24 | 1.44 | 1.10 | .38 | .42 |
| H2O+ | 8.69 | 8.91 | 7.07 | 7.94 | 8.79 | | 9.53 | 10.58 |
| H2O- | .61 | .57 | .82 | .58 | .71 | .75 | .95 | .80 |
| CO2 | 8.90 | 8.30 | 7.33 | 4.54 | 5.67 | | 3.31 | 2.59 |
| TOTAL | 100.20 | 100.49 | 99.25 | 100.03 | 100.77 | 86.97 | 100.39 | 100.34 |
| RB | 58 | 48 | 34 | 71 | 16 | 101 | 101 | 107 |
| BA | 1527 | 793 | 1594 | 2691 | 1246 | 1696 | 2806 | 1613 |
| SR | 1240 | 881 | 1205 | 1937 | 987 | 1243 | 866 | 482 |
| ZR | 359 | 312 | 302 | 334 | 368 | 1327 | 117 | 271 |
| NB | 187 | 146 | 179 | 124 | 281 | 262 | 151 | 180 |
| CR | 896 | 723 | 992 | 1287 | 875 | 670 | 1396 | 1270 |
| V | 211 | 159 | 133 | 62 | 111 | 193 | 51 | 102 |
| SC | 19 | 15 | 20 | 28 | 20 | 22 | 12 | 12 |
| NI | 864 | 731 | 1069 | 1084 | 982 | 668 | 1517 | 1469 |
| CO | 83 | 92 | 90 | 78 | 93 | 106 | 97 | 98 |
| GA | 6.0 | 9.6 | 5.6 | 4.5 | 6.0 | 13.0 | 2.7 | 4.2 |
| Y | 17 | 18 | 21 | 19 | 33 | 26 | 14 | 8 |

FE2O3*=TOTAL FE AS FE2O3.

H2O+, CO2 WERE DETERMINED BY GAS CHROMATOGRAPHY.

TYPE=KIMBERLITE TYPE WHERE: CK=CALCITE KIMBERLITE.

: PK=PHLOGOPITE KIMBERLITE.

NOTE THAT THE PK VARIETY OF 21012 WAS ANALYSED(SEE II.3).

BLANK=NOT ANALYSED.

TABLE II-5: COMPARING THE COMPOSITIONS OF THE KARROO KIMBERLITES WITH OTHER KIMBERLITES.
(MAJORS IN WT.%, TRACES IN PPM.)

| | SA.K | LES.K | RUS.K | BAS.K | MIC.K | KARROO CK | KARROO PK |
|--------|-------|-------|-------|-------|-------|-----------|-----------|
| SI02 | 36.36 | 33.21 | 27.64 | 35.2 | 31.1 | 26-34 | 35-36 |
| TI02 | .98 | 1.97 | 1.65 | 2.32 | 2.03 | 1.2-4.2 | .93-1.6 |
| AL203 | 5.13 | 4.45 | 3.17 | 4.90 | 4.9 | 2.3-3.6 | 2.3-2.4 |
| FE203* | 8.57 | 10.59 | 8.46 | 10.89 | 11.67 | 7.4-14.4 | 8.4-9.1 |
| MNO | .16 | .17 | .13 | .11 | .10 | .16-.21 | .14-.13 |
| MGO | 17.43 | 22.78 | 24.31 | 27.9 | 23.9 | 22-28 | 30-32 |
| CAO | 11.16 | 9.36 | 14.13 | 7.6 | 10.6 | 8.0-13.1 | 4.2-5.6 |
| NA2O | .42 | .19 | .23 | .32 | .31 | .01-.33 | .02-.03 |
| K2O | 1.52 | .79 | .79 | .98 | 2.1 | .54-3.0 | 1.9-2.3 |
| P2O5 | .55 | .65 | .55 | .72 | .66 | .91-1.4 | .38-.42 |
| H2O+ | | 8.04 | 7.89 | 7.4 | 7.1 | 7.9-8.9 | 9.5-10.6 |
| CO2 | | 4.58 | 10.84 | 3.3 | 5.9 | 4.5-8.9 | 3.3-2.6 |
| RB | | 21 | | | | 16-101 | 101-107 |
| BA | | 740 | | | | 793-2691 | 1613-2806 |
| SR | | 445 | 200 | | | 881-1205 | 482-886 |
| ZR | | 450 | 200 | | | 302-1327 | 117-271 |
| NB | | 240 | 70 | | | 124-262 | 151-180 |
| CR | 1505 | 1160 | 1500 | | | 670-1287 | 1270-1396 |
| V | | 120 | 170 | | | 62-211 | 51-102 |
| SC | | 24 | 15 | | | 15-28 | 12 |
| NI | | | 450 | | | 668-1084 | 1469-1517 |
| CO | | 77 | 40 | | | 78-106 | 97-98 |
| GA | | 9 | | | | 4.5-13 | 2.7-4.2 |
| Y | | | | | | 17-26 | 8-14 |

MAJOR ELEMENT DATA FOR: SA.K (AVERAGE SOUTH AFRICAN KIMBERLITE)
 LES.K (" LESOTHO ")
 RUS.K (" YAKUTIA ")
 BAS.K (" *BASALTIC* ")
 MIC.K (" *MICACEOUS* ")

ARE FROM GURNEY+EBRAHIM(1973).

TRACE ELEMENT DATA ARE FROM DAWSON(1967) , KABLE ET AL., 1975 AND GURNEY+EBRAHIM(1973).

RANGES FOR KARROO PIPES FROM TABLE II-4.

FE203*=AS IN TABLE II-4.

TABLE III-1
 ** GARNET MECACRYSTS-LEKKERFONTEIN **

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 11 |
|-------|-------|-------|-------|-------|-------|--------|-------|-------|--------|-------|
| SiO2 | 41.77 | 41.52 | 41.62 | 41.64 | 41.44 | 41.61 | 41.66 | 41.54 | 41.58 | 41.53 |
| TiO2 | .83 | .90 | .79 | .78 | .83 | .84 | .79 | .89 | .85 | .82 |
| Al2O3 | 21.87 | 21.13 | 21.87 | 21.74 | 21.64 | 21.83 | 21.86 | 21.57 | 21.61 | 21.28 |
| Cr2O3 | 1.22 | 1.35 | 1.00 | 1.08 | 1.03 | 1.15 | 1.01 | .97 | 1.00 | .99 |
| FeO | 8.49 | 8.62 | 8.64 | 8.83 | 8.78 | 9.11 | 9.03 | 8.81 | 9.24 | 9.16 |
| MnO | .21 | .22 | .19 | .23 | .23 | .23 | .21 | .25 | .22 | .24 |
| MgO | 20.27 | 20.51 | 20.52 | 20.70 | 21.12 | 20.73 | 20.53 | 19.69 | 20.49 | 20.18 |
| CaO | 4.54 | 4.90 | 4.39 | 4.68 | 4.42 | 4.93 | 4.79 | 4.68 | 4.76 | 4.46 |
| Na2O | .09 | .09 | .08 | .06 | .08 | .07 | .06 | .08 | .06 | .08 |
| K2O | | | | | | | | | | |
| TOTAL | 99.29 | 99.24 | 99.10 | 99.94 | 99.57 | 100.50 | 99.94 | 98.48 | 100.09 | 98.75 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------|
| OXYGEN | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| SI | 2.995 | 2.990 | 2.990 | 2.974 | 2.970 | 2.963 | 2.970 | 3.008 | 2.974 | 3.004 |
| TJ | .045 | .049 | .043 | .042 | .045 | .045 | .042 | .048 | .046 | .045 |
| AL | 1.847 | 1.793 | 1.852 | 1.847 | 1.828 | 1.832 | 1.842 | 1.841 | 1.822 | 1.814 |
| CR | .069 | .077 | .057 | .061 | .058 | .065 | .057 | .056 | .061 | .057 |
| FE2+ | .509 | .519 | .519 | .527 | .526 | .543 | .540 | .534 | .553 | .554 |
| MN | .013 | .013 | .012 | .014 | .014 | .014 | .013 | .015 | .013 | .015 |
| MG | 2.166 | 2.201 | 2.197 | 2.203 | 2.256 | 2.200 | 2.187 | 2.125 | 2.184 | 2.175 |
| CA | .349 | .378 | .338 | .358 | .339 | .376 | .367 | .363 | .380 | .346 |
| NA | .013 | .013 | .011 | .008 | .011 | .010 | .008 | .011 | .008 | .011 |
| K | | | | | | | | | | |
| SUM | 8.007 | 8.033 | 8.018 | 8.035 | 8.048 | 8.048 | 8.034 | 8.001 | 8.042 | 8.021 |
| CA 11.53 | CA 12.20 | CA 11.07 | CA 11.59 | CA 10.87 | CA 12.06 | CA 11.86 | CA 12.02 | CA 12.20 | CA 11.24 | |
| MG 71.63 | MG 71.04 | MG 71.94 | MG 71.33 | MG 72.27 | MG 70.54 | MG 70.69 | MG 70.32 | MG 70.07 | MG 70.74 | |
| FE 16.84 | FE 16.76 | FE 17.00 | FE 17.07 | FE 16.86 | FE 17.40 | FE 17.45 | FE 17.66 | FE 17.73 | FE 18.02 | |
| M: 80.97 | M: 80.92 | M: 80.89 | M: 80.69 | M: 81.09 | M: 80.22 | M: 80.20 | M: 79.93 | M: 79.80 | M: 79.70 | |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-------------|------------|----------------|
| 1 | D.GT2 | 6 | D.GT12 |
| 2 | D.GT9 | 7 | D.GT10 |
| 3 | D.GT21 | 8 | D.GT3 |
| 4 | D.GT8 | 9 | D.GT13 |
| 5 | D.GT22 | 10 | D.GT26+1.DL1,2 |

TABLE III-1
 ** GARNET MEGACRYSTS-LEKKERFONTEIN **

| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|-------|-------|--------|-------|--------|-------|-------|-------|-------|-------|-------|
| SiO2 | 41.35 | 41.64 | 41.24 | 41.18 | 41.13 | 40.90 | 41.02 | 40.86 | 40.70 | 40.50 |
| TiO2 | .91 | .89 | 1.03 | .98 | 1.00 | 1.08 | 1.01 | .77 | .58 | .62 |
| Al2O3 | 21.54 | 21.76 | 21.96 | 21.61 | 21.48 | 21.47 | 21.50 | 21.95 | 22.34 | 21.95 |
| Cr2O3 | .91 | .82 | .57 | .57 | .61 | .48 | .39 | ND | .04 | ND |
| FeO | 7.52 | 7.94 | 10.42 | 11.26 | 11.42 | 11.61 | 12.08 | 12.51 | 13.75 | 14.95 |
| MnO | .28 | .24 | .29 | .26 | .26 | .27 | .28 | .32 | .36 | .39 |
| MgO | 19.82 | 20.07 | 19.18 | 19.14 | 19.10 | 19.71 | 18.29 | 17.29 | 17.23 | 16.37 |
| CaO | 4.91 | 4.66 | 4.72 | 4.92 | 4.10 | 4.87 | 4.72 | 4.51 | 4.45 | 4.71 |
| Na2O | .08 | .07 | .09 | .09 | .10 | .13 | .11 | .07 | .08 | .12 |
| K2O | | | | | | | | | | |
| TOTAL | 79.32 | 100.09 | 79.40 | 100.01 | 99.20 | 79.52 | 79.40 | 98.30 | 79.53 | 99.63 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SI | 2.984 | 2.982 | 2.980 | 2.973 | 2.988 | 2.972 | 2.987 | 3.006 | 2.975 | 2.979 |
| TI | .049 | .048 | .056 | .053 | .055 | .059 | .055 | .043 | .032 | .034 |
| AL | 1.632 | 1.637 | 1.662 | 1.639 | 1.639 | 1.639 | 1.845 | 1.903 | 1.925 | 1.903 |
| CR | .052 | .046 | .033 | .033 | .035 | .028 | .022 | | .002 | |
| FE2+ | .574 | .595 | .630 | .680 | .694 | .706 | .736 | .770 | .841 | .920 |
| MN | .017 | .015 | .018 | .016 | .016 | .017 | .017 | .020 | .022 | .024 |
| MG | 2.131 | 2.142 | 2.066 | 2.059 | 2.068 | 2.026 | 1.985 | 1.896 | 1.877 | 1.794 |
| CA | .380 | .358 | .366 | .381 | .319 | .379 | .368 | .356 | .349 | .370 |
| NA | .011 | .010 | .013 | .013 | .014 | .018 | .016 | .010 | .011 | .017 |
| K | | | | | | | | | | |
| SUM | 8.031 | 8.033 | 8.023 | 8.045 | 8.027 | 8.044 | 8.032 | 8.004 | 8.035 | 8.043 |

| | | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| CA 12.30 | CA 11.55 | CA 11.94 | CA 12.20 | CA 10.36 | CA 12.19 | CA 11.92 | CA 11.77 | CA 11.37 | CA 12.01 |
| MG 69.08 | MG 69.21 | MG 67.49 | MG 66.01 | MG 67.12 | MG 65.13 | MG 64.26 | MG 62.75 | MG 61.22 | MG 58.18 |
| FE 10.62 | FE 19.24 | FE 20.57 | FE 21.79 | FE 22.52 | FE 22.68 | FE 23.82 | FE 25.48 | FE 27.41 | FE 29.81 |

M: 78.77 M: 78.25 M: 76.64 M: 75.18 M: 74.88 M: 74.17 M: 72.96 M: 71.12 M: 69.07 M: 66.12

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-------------|------------|--------------|
| 11 | D.GT7 | 16 | D.GT20 |
| 12 | D.GT14 | 17 | D.GT19 |
| 13 | D.GT4 | 18 | D.GT1+I.ILM1 |
| 14 | D.GT6 | 19 | D.GT17 |
| 15 | D.GT11 | 20 | D.GT24 |

TABLE III-1

** GARNET MEGACRYSTIS-LEKKERFONTEIN **

| | 21 | 22 | 23 |
|-------|--------|--------|-------|
| SiO2 | 40.70 | 41.27 | 41.19 |
| TiO2 | .69 | .69 | .59 |
| Al2O3 | 21.94 | 22.03 | 22.29 |
| Cr2O3 | ND | .06 | .05 |
| FeO | 15.47 | 13.92 | 13.57 |
| MnO | .42 | .33 | .33 |
| MgO | 16.43 | 17.27 | 17.29 |
| CaO | 4.80 | 4.82 | 4.42 |
| Na2O | .09 | .06 | .05 |
| K2O | | | |
| TOTAL | 100.57 | 100.25 | 99.77 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 12 | 12 | 12 |
|--------|-------|-------|-------|
| SI | 2.973 | 2.997 | 2.997 |
| TI | .039 | .039 | .032 |
| AL | 1.889 | 1.885 | 1.912 |
| CR | | .003 | .003 |
| FE2+ | .945 | .845 | .826 |
| MN | .026 | .020 | .020 |
| MG | 1.789 | 1.869 | 1.875 |
| CA | .376 | .359 | .345 |
| NA | .013 | .008 | .007 |
| K | | | |
| SUM | 8.050 | 8.025 | 8.017 |

CA 12.08 CA 11.69 CA 11.32

MG 57.52 MG 60.80 MG 61.57

FE 30.39 FE 27.50 FE 27.12

M: 65.43 M: 68.86 M: 69.42

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|----------------|------------|-------------|
| 21 | D.GT5+I.ILM5 | | |
| 22 | I.GT4B IN ILM4 | | |
| 23 | I.GT4C IN ILM4 | | |

TABLE III-2
 ** CLINDPYROXENE+ORTHOPYROXENE MEGACRYSTS-LEKKERFONTEIN **

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SiO2 | 54.51 | 55.21 | 55.08 | 54.48 | 54.31 | 54.99 | 54.52 | 54.71 | 54.65 | 54.50 |
| TiO2 | .32 | .33 | .35 | .33 | .33 | .36 | .36 | .36 | .40 | .39 |
| Al2O3 | 2.75 | 2.71 | 2.73 | 2.71 | 2.64 | 2.72 | 2.64 | 2.75 | 2.69 | 2.74 |
| Cr2O3 | .39 | .35 | .32 | .31 | .34 | .34 | .33 | .31 | .27 | .29 |
| FeO | 5.17 | 5.35 | 5.33 | 5.54 | 5.46 | 5.56 | 5.56 | 5.52 | 5.43 | 5.58 |
| MnO | .11 | .10 | .11 | .10 | .12 | .12 | .12 | .12 | .11 | .13 |
| MgO | 19.95 | 19.76 | 19.54 | 19.98 | 19.34 | 19.47 | 19.33 | 19.17 | 18.57 | 18.88 |
| CaO | 14.26 | 14.09 | 14.06 | 14.13 | 15.23 | 13.95 | 15.26 | 13.96 | 14.92 | 15.45 |
| Na2O | 1.62 | 1.56 | 1.61 | 1.56 | 1.57 | 1.64 | 1.59 | 1.67 | 1.70 | 1.67 |
| K2O | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| TOTAL | 99.10 | 99.49 | 99.15 | 99.16 | 99.36 | 99.17 | 99.73 | 98.59 | 98.77 | 99.65 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SI | 1.972 | 1.986 | 1.988 | 1.972 | 1.969 | 1.987 | 1.969 | 1.989 | 1.988 | 1.971 |
| TI | .009 | .009 | .010 | .009 | .009 | .010 | .010 | .010 | .011 | .011 |
| AL | .117 | .115 | .116 | .116 | .113 | .116 | .112 | .118 | .115 | .117 |
| CR | .011 | .010 | .009 | .009 | .010 | .010 | .009 | .009 | .008 | .008 |
| FE2+ | .156 | .161 | .161 | .168 | .166 | .168 | .168 | .168 | .165 | .169 |
| MN | .003 | .003 | .003 | .003 | .004 | .004 | .004 | .004 | .003 | .004 |
| MG | 1.076 | 1.060 | 1.051 | 1.078 | 1.045 | 1.048 | 1.041 | 1.038 | 1.007 | 1.010 |
| CA | .553 | .543 | .544 | .548 | .592 | .540 | .591 | .544 | .582 | .599 |
| NA | .114 | .109 | .113 | .109 | .110 | .115 | .111 | .118 | .120 | .117 |
| K | | | | | | | | | | |
| SUM | 4.012 | 3.997 | 3.996 | 4.012 | 4.017 | 3.998 | 4.016 | 3.997 | 4.000 | 4.015 |

| | | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| CA 30.97 | CA 30.80 | CA 30.97 | CA 30.56 | CA 32.83 | CA 30.75 | CA 32.83 | CA 31.07 | CA 33.17 | CA 33.54 |
| Mg 60.26 | Mg 60.07 | Mg 59.87 | Mg 60.09 | Mg 57.98 | Mg 59.69 | Mg 57.84 | Mg 59.34 | Mg 57.41 | Mg 57.01 |
| FE 8.76 | FE 9.13 | FE 9.16 | FE 9.35 | FE 9.19 | FE 9.57 | FE 9.34 | FE 9.59 | FE 9.42 | FE 9.45 |
| M: 87.30 | M: 86.81 | M: 86.72 | M: 86.54 | M: 86.32 | M: 86.19 | M: 86.10 | M: 86.09 | M: 85.90 | M: 85.77 |
| C: 33.95 | C: 33.89 | C: 34.10 | C: 33.71 | C: 36.15 | C: 34.00 | C: 36.21 | C: 34.36 | C: 36.61 | C: 37.04 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-------------|------------|-------------|
| 1 | D.CPX12 | 6 | D.CPX2 |
| 2 | D.CPX1 | 7 | D.CPX8 |
| 3 | D.CPX4 | 8 | D.CPX9 |
| 4 | D.CPX13 | 9 | D.CPX3 |
| 5 | D.CPX10 | 10 | D.CPX6 |

TABLE III-2
 ** CLINOPYROXENE+ORTHOPIYROXENE MEGACRYSTS-LEKKERFONTEIN **

| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|-------|-------|-------|--------|-------|--------|--------|--------|-------|-------|-------|
| SiO2 | 53.93 | 54.39 | 54.32 | 54.60 | 55.28 | 54.61 | 54.63 | 54.21 | 54.02 | 53.78 |
| TiO2 | .43 | .40 | .50 | .47 | .48 | .45 | .40 | .41 | .30 | .43 |
| Al2O3 | 2.73 | 2.70 | 2.69 | 2.62 | 2.67 | 2.70 | 2.64 | 2.57 | 2.63 | 2.36 |
| Cr2O3 | .24 | .25 | .09 | .10 | .09 | .06 | .05 | ND | ND | .07 |
| FeO | 5.71 | 5.94 | 6.51 | 6.47 | 6.56 | 6.57 | 6.41 | 6.13 | 6.24 | 6.08 |
| MnO | .12 | .09 | .09 | .12 | .11 | .08 | .10 | .10 | .14 | .12 |
| MgO | 18.46 | 18.61 | 18.53 | 18.26 | 18.10 | 17.98 | 17.33 | 17.39 | 17.49 | 16.90 |
| CaO | 15.58 | 15.59 | 16.38 | 15.49 | 15.78 | 16.15 | 16.51 | 17.34 | 17.04 | 16.83 |
| Na2O | 1.76 | 1.68 | 1.83 | 1.78 | 1.82 | 1.86 | 1.90 | 1.78 | 1.79 | 1.91 |
| K2O | .07 | ND | ND | .04 | ND | .05 | .04 | ND | ND | ND |
| TOTAL | 99.03 | 99.68 | 100.96 | 99.95 | 100.91 | 100.51 | 100.01 | 99.98 | 99.77 | 98.50 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SI | 1.968 | 1.971 | 1.955 | 1.977 | 1.982 | 1.971 | 1.982 | 1.971 | 1.968 | 1.982 |
| TI | .012 | .011 | .014 | .013 | .013 | .012 | .011 | .011 | .010 | .012 |
| AL | .117 | .115 | .114 | .112 | .113 | .115 | .113 | .110 | .113 | .103 |
| CR | .007 | .007 | .003 | .003 | .003 | .002 | .001 | | | .002 |
| FE2+ | .174 | .180 | .196 | .196 | .197 | .193 | .194 | .186 | .190 | .187 |
| MN | .004 | .003 | .003 | .004 | .003 | .002 | .003 | .003 | .004 | .004 |
| MG | 1.004 | 1.005 | .994 | .985 | .967 | .967 | .937 | .942 | .950 | .929 |
| CA | .609 | .605 | .632 | .601 | .606 | .625 | .642 | .675 | .665 | .665 |
| NA | .125 | .118 | .128 | .125 | .127 | .130 | .134 | .125 | .126 | .137 |
| K | .003 | | | .002 | | .002 | .002 | | | |
| SUM | 4.022 | 4.017 | 4.038 | 4.017 | 4.011 | 4.025 | 4.018 | 4.026 | 4.028 | 4.022 |
| CA | 34.08 | 33.81 | 34.68 | 33.72 | 34.25 | 34.89 | 36.19 | 37.44 | 36.85 | 37.33 |
| MG | 56.17 | 56.14 | 54.56 | 55.29 | 54.64 | 54.03 | 52.84 | 52.23 | 52.61 | 52.14 |
| FE | 9.75 | 10.05 | 10.76 | 10.99 | 11.11 | 11.08 | 10.97 | 10.33 | 10.53 | 10.53 |
| M: | 85.21 | 84.81 | 83.53 | 83.41 | 83.10 | 82.98 | 82.81 | 83.49 | 83.32 | 83.20 |
| C: | 37.76 | 37.59 | 38.86 | 37.88 | 38.53 | 39.24 | 40.65 | 41.76 | 41.19 | 41.72 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-------------|------------|---------------|
| 11 | D.CPX11 | 16 | L.CPX5 |
| 12 | D.CPX7 | 17 | L.CPX4 |
| 13 | L.CPX1 | 18 | I.CPX7D+ILH7A |
| 14 | L.CPX3 | 19 | I.CPX7E+ILH7A |
| 15 | L.CPX2 | 20 | I.CPX1B+ILH1A |

TABLE III-2
 ** CLINOPYROXENE+ORTHOPYROXENE MEGACRYSTS--LEKKERFONTEIN **

| | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|-------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SiO2 | 54.24 | 53.93 | 53.98 | 54.01 | 53.82 | 54.28 | 54.76 | 53.45 | 55.90 | 55.69 |
| TiO2 | .42 | .36 | .33 | .34 | .35 | .34 | .35 | .35 | .17 | .23 |
| Al2O3 | 2.50 | 2.55 | 2.47 | 2.45 | 2.49 | 2.46 | 2.47 | 2.53 | .94 | 1.04 |
| Cr2O3 | ND | ND | .04 | ND | .04 | ND | ND | .04 | ND | .04 |
| FeO | 6.29 | 6.34 | 6.40 | 6.47 | 6.38 | 6.36 | 6.36 | 6.48 | 10.72 | 10.10 |
| MnO | .09 | .13 | .10 | .10 | .13 | .10 | .14 | .11 | .13 | .14 |
| MgO | 17.32 | 16.58 | 16.70 | 16.76 | 16.36 | 16.19 | 16.12 | 15.85 | 30.55 | 30.47 |
| CaO | 17.18 | 16.98 | 17.55 | 17.52 | 17.40 | 17.54 | 17.45 | 17.11 | .83 | .97 |
| Na2O | 1.81 | 1.95 | 1.81 | 1.78 | 1.93 | 1.85 | 1.76 | 1.97 | .17 | .16 |
| K2O | .08 | .07 | ND | ND | ND | ND | ND | ND | ND | ND |
| TOTAL | 100.04 | 98.92 | 99.40 | 99.48 | 98.92 | 99.15 | 99.44 | 97.91 | 99.48 | 98.87 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SI | 1.971 | 1.983 | 1.978 | 1.977 | 1.981 | 1.991 | 2.000 | 1.988 | 1.979 | 1.979 |
| TI | .011 | .010 | .009 | .009 | .010 | .009 | .010 | .010 | .005 | .006 |
| AL | .111 | .111 | .107 | .106 | .108 | .106 | .106 | .111 | .039 | .044 |
| CR | | | .001 | | .001 | | | .001 | | .002 |
| FE2+ | .191 | .195 | .196 | .198 | .196 | .195 | .194 | .202 | .317 | .300 |
| MN | .003 | .004 | .003 | .003 | .004 | .003 | .004 | .003 | .004 | .004 |
| MG | .938 | .908 | .912 | .914 | .898 | .885 | .877 | .878 | 1.612 | 1.614 |
| CA | .669 | .669 | .689 | .687 | .686 | .689 | .683 | .682 | .033 | .037 |
| NA | .128 | .139 | .129 | .126 | .138 | .132 | .125 | .142 | .012 | .011 |
| K | .004 | .003 | | | | | | | | |
| SUM | 4.027 | 4.023 | 4.024 | 4.024 | 4.024 | 4.012 | 4.000 | 4.018 | 4.002 | 3.998 |
| CA | 37.20 | 37.74 | 38.34 | 38.19 | 38.55 | 38.96 | 38.92 | 38.70 | 1.70 | 1.89 |
| MG | 52.17 | 51.26 | 50.75 | 50.81 | 50.42 | 50.02 | 50.01 | 49.86 | 82.13 | 82.72 |
| FE | 10.63 | 11.00 | 10.91 | 11.01 | 11.03 | 11.03 | 11.07 | 11.44 | 16.17 | 15.39 |
| M: | 83.07 | 82.33 | 82.30 | 82.19 | 82.05 | 81.94 | 81.87 | 81.34 | 83.55 | 84.32 |
| C: | 41.63 | 42.41 | 43.04 | 42.91 | 43.33 | 43.79 | 43.77 | 43.70 | 2.03 | 2.24 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|---------------------|------------|-----------------|
| 21 | I.CPX7C+ILM7A | 26 | I.CPX3B+ILM3A |
| 22 | I.CPX14B+ILM14A | 27 | I.CPX6B+ILM6A |
| 23 | I.CPX9C+ILM9A | 28 | I.CPX5B+ILM5A |
| 24 | I.CPX9B+ILM9A | 29 | I.OPX8B+ILM8A |
| 25 | I.CPX4D+ILM4A+I.GT4 | 30 | I.OPX12B+ILM12A |

TABLE III-2

** CLINDPYROXENE+ORTHO PYROXENE NEGACRYSTS-LEKKERFONTEIN **

| | |
|-------|-------|
| | 31 |
| SI02 | 55.29 |
| TI02 | .17 |
| AL2O3 | .93 |
| CR2O3 | ND |
| FE0 | 11.02 |
| MNO | .14 |
| MGO | 30.35 |
| CA0 | .89 |
| NA2O | .17 |
| K2O | ND |
| TOTAL | 98.98 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| | |
|--------|-------|
| OXYGEN | 6 |
| SI | 1.972 |
| TI | .00 |
| AL | .039 |
| CR | |
| FE2+ | .329 |
| MN | .004 |
| MG | 1.614 |
| CA | .034 |
| NA | .012 |
| K | |
| SUM | 4.009 |

CA 1.72
 MG 81.64
 FE 16.64

M: 83.07
 C: 2.06

*** SAMPLE DIRECTORY ***

| <u>SAMPLE NO.</u> | <u>DESCRIPTION</u> | <u>SAMPLE NO.</u> | <u>DESCRIPTION</u> |
|-------------------|--------------------|-------------------|--------------------|
| 31 | I.OPX2B+ILM2A | | |

TABLE III-3
 ** ILMENITE MEGACRYSTS-LEKKERFONTEIN **

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|--------|-------|-------|--------|--------|-------|-------|-------|-------|--------|
| SiO2 | | | | | | | | | | |
| TiO2 | 49.31 | 48.97 | 48.98 | 49.47 | 49.21 | 49.81 | 50.10 | 50.25 | 49.63 | 49.41 |
| Al2O3 | 1.10 | 1.31 | .85 | 1.13 | .65 | .76 | .81 | .83 | .83 | .85 |
| Cr2O3 | .38 | .36 | .19 | .10 | .26 | .14 | .17 | .12 | .16 | .18 |
| FeO | 38.83 | 37.91 | 38.79 | 39.83 | 39.55 | 38.45 | 37.86 | 38.48 | 39.22 | 42.10 |
| MnO | .15 | .16 | .21 | .19 | .14 | .18 | .15 | .18 | | |
| MgO | 11.05 | 10.71 | 10.25 | 9.60 | 10.20 | 9.02 | 9.01 | 8.91 | 8.64 | 8.54 |
| CaO | | | | | | | | | | |
| Na2O | | | | | | | | | | |
| K2O | | | | | | | | | | |
| TOTAL | 100.82 | 99.42 | 99.27 | 100.32 | 100.01 | 98.56 | 98.10 | 98.77 | 98.48 | 101.08 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SI | | | | | | | | | | |
| TI | .886 | .898 | .896 | .898 | .896 | .917 | .925 | .923 | .918 | .899 |
| AL | .031 | .037 | .024 | .032 | .019 | .028 | .023 | .024 | .024 | .024 |
| CR | .007 | .007 | .004 | .002 | .005 | .003 | .003 | .002 | .003 | .003 |
| FE2+ | .775 | .766 | .789 | .884 | .881 | .787 | .777 | .786 | .807 | .852 |
| MN | .003 | .003 | .004 | .004 | .003 | .004 | .003 | .004 | | |
| MG | .393 | .386 | .372 | .345 | .368 | .329 | .330 | .324 | .317 | .308 |
| CA | | | | | | | | | | |
| NA | | | | | | | | | | |
| K | | | | | | | | | | |
| SUM | 2.095 | 2.088 | 2.090 | 2.085 | 2.092 | 2.068 | 2.062 | 2.064 | 2.068 | 2.087 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-----------------|------------|----------------------|
| 1 | L. ILM2+L. CPX2 | 6 | ILM7B+I. CPX7C, D, E |
| 2 | L. ILM3+L. CPX3 | 7 | ILM1A+I. CPX12 |
| 3 | L. ILM5+L. CPX5 | 8 | ILM7A+I. CPX7C, D, E |
| 4 | L. ILM4+L. CPX4 | 9 | ILM12A+I. CPX12B |
| 5 | L. ILM1+L. CPX1 | 10 | ILM10A+PHL |

TABLE III-3
 ** JLMENITE MEGACRYSTS-LEKKERFONTEIN **

| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|-------|--------|-------|-------|--------|-------|-------|-------|-------|-------|-------|
| SiO2 | | | | | | | | | | |
| TiO2 | 49.21 | 48.46 | 47.53 | 48.77 | 47.66 | 48.44 | 48.51 | 48.19 | 47.92 | 43.80 |
| Al2O3 | .63 | .85 | .81 | .39 | .73 | .75 | .67 | .69 | .64 | .31 |
| Cr2O3 | .15 | .10 | .10 | .08 | .09 | .11 | .09 | .14 | .06 | .06 |
| FeO | 42.52 | 40.38 | 40.97 | 43.79 | 41.14 | 41.41 | 41.00 | 41.36 | 40.99 | 49.60 |
| MnO | | .17 | .15 | | .15 | .15 | .17 | .17 | .13 | |
| K2O | 8.19 | 7.89 | 7.64 | 7.86 | 7.63 | 7.67 | 7.66 | 7.57 | 7.35 | 4.85 |
| CaO | | | | | | | | | | |
| Na2O | | | | | | | | | | |
| K2O | | | | | | | | | | |
| TOTAL | 100.70 | 97.85 | 97.20 | 100.89 | 97.40 | 98.53 | 98.10 | 98.12 | 97.14 | 98.62 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Si | | | | | | | | | | |
| Ti | .902 | .910 | .903 | .898 | .904 | .907 | .911 | .907 | .911 | .858 |
| Al | .018 | .025 | .024 | .011 | .022 | .022 | .020 | .020 | .019 | .010 |
| Cr | .003 | .002 | .002 | .002 | .002 | .002 | .002 | .003 | .001 | .001 |
| Fe2+ | .867 | .843 | .865 | .897 | .867 | .862 | .856 | .866 | .867 | 1.020 |
| Mn | | .004 | .003 | | .003 | .003 | .004 | .004 | .004 | |
| K | .298 | .294 | .287 | .287 | .287 | .285 | .285 | .282 | .277 | .188 |
| Ca | | | | | | | | | | |
| Na | | | | | | | | | | |
| K | | | | | | | | | | |
| SUM | 2.087 | 2.077 | 2.084 | 2.095 | 2.085 | 2.081 | 2.078 | 2.082 | 2.079 | 2.137 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|------------------------|------------|---------------|
| 11 | ILM14A+I.CPX14B | 16 | ILM6A+I.CPX6B |
| 12 | ILM4A+I.GT4B,C+I.CPX4D | 17 | ILM3A+I.CPX3B |
| 13 | ILM9A+I.CPX9B,C | 18 | ILM2A+I.OPX2B |
| 14 | ILM11A+PHL | 19 | ILM5A+I.CPX5B |
| 15 | ILM8A+I.OPX8B | 20 | ILM15+ZIRCON |

TABLE III-3
 ** ILMENITE MEGACRYSTS-LEKKERFONTEIN **

| | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|-------|--------|--------|--------|--------|--------|--------|--------|--------|-------|--------|
| SiO2 | | | | | | | | | | |
| TiO2 | 50.13 | 48.99 | 49.13 | 49.28 | 49.28 | 48.74 | 48.50 | 48.27 | 48.07 | 48.11 |
| Al2O3 | .83 | .73 | .78 | 1.04 | 1.04 | 1.08 | .80 | .63 | .74 | .63 |
| Cr2O3 | .12 | .32 | .11 | .32 | .32 | .11 | ND | .21 | .10 | .24 |
| FeO | 40.85 | 41.77 | 41.76 | 41.94 | 41.94 | 42.00 | 42.92 | 43.88 | 43.24 | 44.35 |
| MnO | | | | | | | | | | |
| MgO | 8.88 | 8.40 | 8.41 | 8.39 | 8.39 | 8.23 | 8.11 | 7.68 | 7.60 | 7.63 |
| CaO | | | | | | | | | | |
| Na2O | | | | | | | | | | |
| K2O | | | | | | | | | | |
| TOTAL | 100.81 | 100.21 | 100.19 | 100.97 | 100.97 | 100.16 | 100.35 | 100.67 | 99.75 | 101.03 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SI | | | | | | | | | | |
| Ti | .909 | .900 | .902 | .897 | .897 | .896 | .894 | .892 | .895 | .889 |
| Al | .024 | .021 | .022 | .030 | .030 | .031 | .023 | .018 | .022 | .018 |
| Cr | .002 | .006 | .002 | .006 | .006 | .002 | | .004 | .002 | .005 |
| Fe2+ | .824 | .853 | .853 | .849 | .849 | .859 | .880 | .902 | .895 | .910 |
| Mn | | | | | | | | | | |
| Mg | .319 | .306 | .306 | .303 | .303 | .300 | .296 | .281 | .280 | .279 |
| Ca | | | | | | | | | | |
| Na | | | | | | | | | | |
| K | | | | | | | | | | |
| SUM | 2.078 | 2.086 | 2.086 | 2.085 | 2.085 | 2.087 | 2.094 | 2.097 | 2.094 | 2.100 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-------------|------------|-------------|
| 21 | D.ILM1 | 26 | D.ILM4 |
| 22 | D.ILM6 | 27 | D.ILM2 |
| 23 | D.ILM3 | 28 | D.ILM7 |
| 24 | D.ILM11 | 29 | D.ILM5 |
| 25 | D.ILM12 | 30 | D.ILM10 |

TABLE III-3
 ** ILMENITE MEGACRYSTS-LEKKERFONTEIN **

| | 31 | 32 | 33 | 34 |
|-------|--------|--------|-------|-------|
| SI02 | | | | |
| TiO2 | 47.57 | 47.48 | 48.01 | 46.48 |
| AL2O3 | .74 | .68 | | |
| CR2O3 | .11 | .10 | .07 | .11 |
| FE0 | 44.59 | 45.02 | 41.23 | 43.61 |
| MNO | | | .19 | .24 |
| MGO | 7.25 | 7.22 | 8.51 | 7.38 |
| CAO | | | | |
| NA2O | | | | |
| K2O | | | | |
| TOTAL | 100.26 | 100.50 | 98.01 | 97.82 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 3 | 3 | 3 | 3 |
|--------|-------|-------|-------|-------|
| SI | | | | |
| TI | .086 | .084 | .096 | .091 |
| AL | .022 | .020 | | |
| CR | .002 | .002 | .001 | .002 |
| FE2+ | .724 | .732 | .865 | .929 |
| MN | | | .004 | .005 |
| MG | .268 | .266 | .318 | .280 |
| CA | | | | |
| NA | | | | |
| K | | | | |
| SUM | 2.102 | 2.105 | 2.094 | 2.108 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|--------------------|------------|-------------|
| 31 | D. ILM9, POLYXTAL. | | |
| 32 | D. ILM8, POLYXTAL. | | |
| 33 | 1. ILM1 IN D. GT1 | | |
| 34 | 1. ILM5 IN D. GTS | | |

TABLE IV-1: A REFERENCE GUIDE TO RECENT CONFERENCES, SYMPOSIA, BOOKS AND THESES WHERE DESCRIPTIONS CAN BE FOUND OF PERIDOTITE SUITES AT THE FOLLOWING KIMBERLITES.

LESOTHO

LETSENG-LA-TERAE

MOTHAE, THABA PUTSOA, SOLANE
MATSOKU

KAO

PIPE 200
SEKAMENG

BOTSWANA

DK9 IN THE ORAPA FIELD

SOUTH AFRICA

MONASTERY
BULTFONTEIN

FRANK SMITH
EAST GRIQUALAND
GIBEON IN NAMIBIA
PREMIER
ROBERTS VICTOR

ANGOLA

SOMACUANZA, CAMUTUE,
ARTUR DE PAIVA

U.S.A.

MONTANA
COLORADO+WYOMING

U.S.S.R.

UDACHNAYA
VARIOUS KIMBERLITES

BLOOMER+NIXON, 1973-*1
LOCKE (IN PREP., LEEDS UNIVERSITY)
NIXON+BOYD, 1973, -*1
COX+GURNEY+HARTE, 1973-*1
HARTE+GURNEY+COX, 1975-*2
GURNEY+HARTE+COX, 1975-*2
NIXON+BOYD, 1973-*1
MACGREGOR, 1979-*4
CARSWELL ET AL., 1979-*4
NIXON+BOYD, 1973-*1

SHEE, 1978-*7

WHITELOCK, 1973-*1
DAWSON ET AL., 1975-*3
LAWLESS, 1978-*7
LAWLESS ET AL., 1979-*4
BOYD, 1975-*3
NIXON+BOYD, 1979-*5
MACGREGOR, 1975-*2
DANCHIN, 1979-*4
HATTON, 1978-*7

DANCHIN+BOYD, 1975-*3

HEARN+BOYD, 1975-*2
MCCALLUM ET AL., 1979-*5

POKHILENKO, 1979-*5
SOBOLEV, 1977-*6

REFERENCES:

- *1 =LESOTHO KIMBERLITES. ED. NIXON(1973)
- *2 =PROCEEDINGS OF THE FIRST KIMBERLITE CONFERENCE (CAPE TOWN)
ED. AHRENS ET AL. (1975), PHY.CHEM.EARTH VOL.9
- *3 =1ST KIMBERLITE SYMPOSIUM, CAMBRIDGE(1975)
- *4 =PROCEEDINGS OF THE SECOND KIMBERLITE CONFERENCE(SANTA FE)

ED. BOYD+MEYER(1979),A.G.U.

- *5 =2ND KIMBERLITE SYMPOSIUM,CAMBRIDGE(1979)
- *6 =DEEP-SEATED INCLUSIONS IN KIMBERLITES AND THE PROBLEM OF THE COMPOSITION OF THE UPPER MANTLE. SOBOLEV(1977)
- *7 =THESES SUBMITTED TO THE DEPT. OF GEOCHEMISTRY, UNIVERSITY OF CAPE TOWN,(1978)

Table IV-2: Summary of peridotite textural classification (reproduced from Harte, 1977).

| Rock Type | Porphyro-clasts | Grain Size | Grain Boundaries | Equant | Bibliography |
|------------------------|---|---|--|--|--|
| Coarse | Absent | Average grain size greater than 2.0 mm | Variable. Often largely straight or smoothly curving but may be less regular | Equant | Boullier and Nicolas, 1973, Plates 19A, 19B Boullier and Nicolas, 1975, Fig. 1A. Cox et al. 1973, Plates 26A, 26B Harte et al. 1975, Figs. 1, 2 Mercier and Nicolas, 1975, Figs. 1, 14A, 14B Boullier and Nicolas, 1973, Plate 20A Boullier and Nicolas, 1975, Fig. 1B |
| Porphyro-clastic | Present. More than 10% of olivine occurs as porphyro-clasts | Two major populations: one represented by relicts, the other by finer-grained matrix | Irregular in porphyro-clasts, straight in neoblasts | (Neither disrupted nor laminated) Disrupted Fluidal Laminated and disrupted | Boullier and Nicolas, 1973, Plate 20B Boullier and Nicolas, 1975, Figs. 1C, 2A Mercier and Nicolas, 1975, Fig. 4 Cox et al. 1973, Plate 27A Harte et al. 1975, Figs. 5, 6 Boullier (pers. comm.) Dawson (pers. comm.), Fig. 1A this paper |
| Mosaic-porphyr-clastic | Present. Less than 10% of olivine occurs as porphyro-clasts | Two major populations: one represented by relicts, the other by finer-grained matrix | Irregular in porphyro-clasts, straight in neoblasts | (Neither disrupted nor laminated) Fluidal Laminated and disrupted | Boullier and Nicolas, 1973, Plate 21A Boullier and Nicolas, 1975, Fig. 2B Poirier and Nicolas, 1975, Fig. 13 Boullier and Nicolas, 1973, Plate 21B Boullier and Nicolas, 1975, Figs. 2C, 3A Dawson et al. 1975, Fig. 1B, this paper |
| Granulo-elastic | Absent or rare for all mineral species | Small size range for each mineral species (excepting rare porphyro-clasts). Grain size generally less than 2.0 mm | Straight or smoothly curving, bounding grains of polygonal or tabular shape | Equant Tabular | Cox et al. 1973, Plate 27B Harte et al. 1975, Fig. 9 Mercier and Nicolas, 1975, Fig. 6B Harte et al. 1975, Fig. 8 Mercier and Nicolas, 1975, Fig. 6A |

TABLE IV-3: SUMMARY MINERAL CHEMISTRY DATA FOR PERIDOTITES FROM HEBRON (HEB) AND MELTON WOLD (MW) -SEE TABLES IV-4,15. RANGES AND AVERAGES ARE GIVEN.

| | (MG/MG+FE) *100 | TIO2 WT.% | CR2O3 WT.% | CAO WT.% | AL2O3 WT.% | (CA/CA+MG) *100 |
|----------------------|--------------------|--------------|---------------|-------------|---------------|--------------------|
| GARNET | | | | | | |
| GLHZ (MW) | 82.6-81.5 | .24-.07 | 5.69-2.97 | 5.93-4.94 | | |
| | 82.1 | .17 | 4.10 | 5.34 | | |
| GLHZ (HEB) | 83.7-81.0 | .13-.03 | 2.90-.40 | 6.10-4.93 | | |
| | 82.2 | .06 | 2.45 | 5.38 | | |
| ORTHOPYROXENE | | | | | | |
| GLHZ (MW) | 93.2-92.3 | .08-.04 | .35-.18 | .67-.36 | .94-.67 | |
| | 92.6 | .06 | .27 | .44 | .75 | |
| GLHZ (HEB) | 92.6-91.6 | .11-.02 | .47-.32 | .46-.36 | 1.70-1.37 | |
| | 92.1 | .06 | .39 | .41 | 1.58 | |
| PORP (HEB) | | | | | | |
| PORP-A | 92.4-91.8 | .18-.10 | .22-.18 | .49-.46 | .17-.15 | |
| | 92.1 | .13 | .21 | .48 | .16 | |
| NEOB-A | 90.4-87.1 | .47-.25 | .40-.19 | 1.21-.73 | 1.49-.51 | |
| | 88.8 | .32 | .25 | 1.05 | .91 | |
| RIMS-B | 91.8-91.5 | .19-.13 | .74-.58 | .95-.91 | 1.54-1.05 | |
| | 91.6 | .15 | .67 | .93 | 1.36 | |
| NEOB-B | 90.5-89.6 | .37-.12 | .72-.59 | 1.17-1.11 | 1.27-.93 | |
| | 90.1 | .23 | .65 | 1.14 | 1.09 | |
| CLINOPYROXENE | | | | | | |
| GLHZ (MW) | 93.0-91.9 | .27-.06 | 2.16-1.07 | | 2.68-1.68 | 47.4-46.1 |
| | 92.5 | .12 | 1.63 | | 2.27 | 47.0 |
| GLHZ (HEB) | 93.6-92.0 | .25-.04 | 1.75-.93 | | 3.54-1.98 | 47.8-47.0 |
| | 92.7 | .16 | 1.40 | | 3.03 | 47.9 |
| LHZ (HEB) | | | | | | |
| TYPE A | 93.7 | .16 | 1.89 | | 1.42 | 47.9 |
| TYPE B | 93.9-91.9 | .34-.09 | 3.50-2.20 | | 2.72-1.98 | 45.2-41.9 |
| | 92.6 | .22 | 2.74 | | 2.25 | 43.5 |
| PORP (HEB) | 92.9-89.1 | .61-.16 | 2.74-1.95 | | 1.99-.59 | 48.1-43.6 |
| | 91.7 | .31 | 2.43 | | .91 | 46.5 |
| OLIVINE | | | | | | |
| GLHZ (HEB) | 92.2-90.1 | | | | | |
| | 91.3 | | | | | |
| LHZ (HEB) | 92.4-89.1 | | | | | |
| | 91.1 | | | | | |
| PORP (HEB) | | | | | | |
| PORP | 91.3-90.5 | | | | | |
| | 90.7 | | | | | |
| NEOB | 90.4-87.3 | | | | | |
| | 88.9 | | | | | |

.....
:WHERE :
:GLHZ = GARNET LHERZOLITE :
:LHZ = LHERZOLITE :
:PORP = PORPHYROCLAST(IC) :
:NEOB = NEOBLAST(IC) :
.....

TABLE IV-4
GARNETS**COARSE PERIDOTITES - HEBRON**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 11 |
|-------|--------|-------|-------|-------|--------|--------|--------|--------|--------|--------|
| SiO2 | 41.66 | 41.47 | 41.31 | 41.62 | 41.77 | 41.78 | 42.00 | 41.83 | 42.31 | 42.03 |
| TiO2 | .13 | .05 | .04 | .06 | .05 | ND | .04 | ND | .04 | .11 |
| Al2O3 | 22.23 | 22.46 | 22.44 | 22.48 | 22.12 | 22.51 | 22.58 | 22.81 | 22.44 | 22.74 |
| Cr2O3 | 2.90 | 2.24 | 2.21 | 2.26 | 2.94 | 2.52 | 2.73 | 1.82 | 2.44 | 2.03 |
| FeO | 7.54 | 7.81 | 7.73 | 7.90 | 7.18 | 7.97 | 7.87 | 8.10 | 6.88 | 8.19 |
| MnO | .36 | .41 | .38 | .45 | .40 | .41 | .36 | .45 | .30 | .39 |
| MgO | 20.10 | 19.57 | 19.51 | 19.63 | 20.62 | 20.00 | 19.68 | 19.43 | 19.72 | 20.20 |
| CaO | 5.22 | 5.38 | 5.29 | 5.47 | 5.26 | 5.25 | 5.32 | 5.54 | 6.10 | 4.93 |
| Na2O | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| K2O | | | | | | | | | | |
| TOTAL | 100.15 | 99.40 | 98.92 | 99.83 | 100.55 | 100.66 | 100.59 | 100.00 | 100.44 | 100.82 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------|
| SI | 2.968 | 2.976 | 2.977 | 2.975 | 2.974 | 2.977 | 2.980 | 2.984 | 2.996 | 2.974 |
| TI | .007 | .003 | .002 | .003 | .003 | | .002 | | .002 | .006 |
| AL | 1.867 | 1.900 | 1.906 | 1.894 | 1.848 | 1.882 | 1.888 | 1.918 | 1.873 | 1.911 |
| CR | .163 | .127 | .126 | .128 | .165 | .141 | .153 | .103 | .137 | .113 |
| FE2+ | .449 | .469 | .466 | .472 | .426 | .473 | .467 | .483 | .407 | .484 |
| MN | .022 | .025 | .023 | .027 | .024 | .025 | .022 | .027 | .018 | .023 |
| MG | 2.134 | 2.093 | 2.095 | 2.091 | 2.178 | 2.114 | 2.081 | 2.066 | 2.102 | 2.128 |
| CA | .399 | .414 | .408 | .419 | .399 | .399 | .404 | .423 | .463 | .373 |
| NA | | | | | | | | | | |
| K | | | | | | | | | | |
| SUM | 8.010 | 8.008 | 8.006 | 8.011 | 8.018 | 8.012 | 7.998 | 8.006 | 7.998 | 8.011 |
| CA 13.36 | CA 13.90 | CA 13.75 | CA 14.05 | CA 13.30 | CA 13.36 | CA 13.70 | CA 14.25 | CA 15.57 | CA 12.51 | |
| MG 71.57 | MG 70.34 | MG 70.56 | MG 70.12 | MG 72.53 | MG 70.80 | MG 70.48 | MG 69.50 | MG 70.72 | MG 71.29 | |
| FE 15.07 | FE 15.75 | FE 15.69 | FE 15.84 | FE 14.17 | FE 15.83 | FE 15.82 | FE 16.26 | FE 13.71 | FE 16.28 | |
| M: 82.61 | M: 81.70 | M: 81.81 | M: 81.58 | M: 83.65 | M: 81.72 | M: 81.67 | M: 81.04 | M: 83.76 | M: 81.48 | |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-------------------------|------------|-------------------------------|
| 1 | 07033 | 6 | 07143 |
| 2 | 07073.AV. | 7 | 07163 |
| 3 | 07073.GT2 WITH SP4 | 8 | 07173 |
| 4 | 07073.GT1 WITH SP2+ANPH | 9 | 07173, HIGH CR, CA, MG GARNET |
| 5 | 07083 | 10 | 07183 |

TABLE IV-5
GARNETS**COARSE PERIDOTITES - MELTON MOLD**

| | 1 | 2 | 3 | 4 | 5 | 6 |
|-------|-------|-------|--------|--------|--------|--------|
| SiO2 | 41.60 | 41.50 | 41.50 | 41.90 | 41.40 | 41.30 |
| TiO2 | .24 | .14 | .12 | .07 | .16 | .10 |
| Al2O3 | 21.40 | 21.60 | 20.60 | 21.90 | 20.70 | 19.80 |
| Cr2O3 | 3.75 | 3.13 | 4.43 | 2.97 | 4.61 | 5.69 |
| FeO | 8.01 | 7.76 | 7.61 | 8.00 | 7.41 | 70.74 |
| MnO | .34 | .31 | .33 | .35 | .33 | .30 |
| MgO | 20.20 | 20.40 | 19.90 | 20.10 | 19.80 | 19.10 |
| CaO | .41 | 4.97 | 5.50 | 4.94 | 5.67 | 5.93 |
| Na2O | .05 | ND | .05 | .05 | ND | .05 |
| K2O | | | | | | |
| TOTAL | 96.00 | 79.94 | 100.04 | 100.28 | 100.11 | 163.01 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 12 | 12 | 12 | 12 | 12 | 12 |
|--------|-------|-------|-------|-------|-------|-------|
| SI | 3.055 | 2.975 | 2.980 | 2.905 | 2.971 | 2.265 |
| TI | .013 | .008 | .006 | .004 | .009 | .004 |
| AL | 1.852 | 1.820 | 1.744 | 1.839 | 1.751 | 1.280 |
| CR | .218 | .177 | .252 | .167 | .262 | .247 |
| FE2+ | .492 | .464 | .457 | .477 | .445 | 3.245 |
| MN | .021 | .019 | .020 | .021 | .020 | .014 |
| MG | 2.211 | 2.174 | 2.130 | 2.134 | 2.118 | 1.561 |
| CA | .032 | .382 | .423 | .377 | .438 | .349 |
| NA | .007 | | .007 | .007 | | .005 |
| K | | | | | | |
| SUM | 7.901 | 8.020 | 8.019 | 8.011 | 8.014 | 8.970 |

CA 1.18 CA 12.66 CA 14.96 CA 12.62 CA 14.58 CA 6.76
 MG 80.83 MG 71.98 MG 70.76 MG 71.43 MG 70.59 MG 30.29
 FE 17.99 FE 15.36 FE 15.18 FE 15.95 FE 14.82 FE 62.95

M: 81.80 M: 82.41 M: 82.33 M: 81.74 M: 82.64 M: 32.48

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-------------|------------|-------------|
| 1 | 08053 | 6 | 08123 |
| 2 | 08063 | | |
| 3 | 08073 | | |
| 4 | 08083 | | |
| 5 | 08113 | | |

TABLE IV-6
OLIVINES**COARSE PERIDOTITES - HEBRON**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|-------|-------|-------|-------|--------|--------|--------|-------|-------|--------|
| SiO2 | 40.76 | 40.43 | 40.60 | 40.48 | 41.03 | 40.77 | 40.79 | 40.11 | 40.65 | 41.06 |
| TiO2 | ND | | | ND | ND | ND | ND | ND | | ND |
| Al2O3 | | | | | ND | | | | | |
| Cr2O3 | | | | | ND | | | | | ND |
| FeO | 6.19 | 8.23 | 8.20 | 7.63 | 8.77 | 8.79 | 8.71 | 8.84 | 7.43 | 8.43 |
| MnO | .09 | .10 | .10 | .12 | .09 | .09 | .10 | .12 | .10 | .11 |
| MgO | 50.43 | 50.32 | 50.29 | 50.89 | 50.93 | 50.39 | 50.09 | 49.67 | 50.94 | 50.49 |
| CaO | ND | | .04 | | ND | ND | ND | .04 | | ND |
| Na2O | | | | | ND | | | | | |
| K2O | | | | | | | | | | |
| NiO | .36 | .35 | | .41 | | | .38 | | | .39 |
| TOTAL | 99.85 | 99.47 | 99.23 | 99.34 | 100.87 | 100.06 | 100.09 | 98.77 | 99.12 | 100.51 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SI | .995 | .992 | .996 | .991 | .992 | .994 | .995 | .992 | .994 | .996 |
| TI | | | | | | | | | | |
| AL | | | | | | | | | | |
| CR | | | | | | | | | | |
| FE2+ | .167 | .169 | .168 | .156 | .177 | .179 | .178 | .183 | .152 | .171 |
| MN | .002 | .002 | .002 | .002 | .002 | .002 | .002 | .003 | .002 | .002 |
| MG | 1.834 | 1.839 | 1.838 | 1.856 | 1.835 | 1.831 | 1.822 | 1.830 | 1.857 | 1.826 |
| CA | | | .001 | | | | | .001 | | |
| NA | | | | | | | | | | |
| K | | | | | | | | | | |
| NI | .007 | .007 | | .000 | | | .007 | | | .000 |
| SUM | 3.005 | 3.008 | 3.004 | 3.008 | 3.008 | 3.006 | 3.005 | 3.008 | 3.006 | 3.003 |

FO 91.65 FO 91.59 FO 91.62 FO 92.21 FO 91.19 FO 91.08 FO 91.11 FO 90.92 FO 92.43 FO 91.43
FA 8.35 FA 8.41 FA 8.38 FA 7.79 FA 8.01 FA 8.92 FA 8.89 FA 9.08 FA 7.57 FA 8.57

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|---------------|------------|---------------|
| 1 | 07033,GT.LHZ. | 6 | 07163,GT.LHZ. |
| 2 | 07053,GT.LHZ. | 7 | 07173,GT.LHZ. |
| 3 | 07073,GT.LHZ. | 8 | 07183,GT.LHZ. |
| 4 | 07093,GT.LHZ. | 9 | 07023,LHZ. |
| 5 | 07143,GT.LHZ. | 10 | 07043,LHZ. |

TABLE IV-6
 OLIVINES**COARSE PERIDOTITES - HEBRON**

| | 11 | 12 |
|-------|--------|--------|
| SiO2 | 40.83 | 40.42 |
| TiO2 | ND | ND |
| Al2O3 | ND | |
| Cr2O3 | ND | |
| FeO | 8.39 | 10.67 |
| MnO | .11 | .17 |
| MgO | 50.68 | 48.74 |
| CaO | ND | .04 |
| Na2O | | |
| K2O | | |
| H2O | .35 | .34 |
| TOTAL | 100.40 | 100.35 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 4 | 4 |
|--------|-------|-------|
| SI | .792 | .793 |
| TI | | |
| AL | | |
| CR | | |
| FE2+ | .170 | .219 |
| MN | .002 | .004 |
| MG | 1.835 | 1.784 |
| CA | | .001 |
| NA | | |
| K | | |
| NI | .007 | .007 |
| SUM | 3.000 | 3.007 |

FO 91.50 FO 89.06
 FA 8.50 FA 10.94

*** SAMPLE DIRECTORY ***

| <u>SAMPLE NO.</u> | <u>DESCRIPTION</u> | <u>SAMPLE NO.</u> | <u>DESCRIPTION</u> |
|-------------------|--------------------|-------------------|--------------------|
| 11 | 07063.LHZ. | | |
| 12 | 07093.LHZ. | | |

TABLE IV-7
OLIVINES**PORPHYROCLASTIC LHERZOLITE - HEBRON**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SiO2 | 40.59 | 40.13 | 39.96 | 40.75 | 40.94 | 40.75 | 40.58 | 40.72 | 40.67 | 40.44 |
| TiO2 | ND | | | ND | | | ND | ND | | |
| Al2O3 | | ND | ND | | | | | | | |
| Cr2O3 | ND | .04 | ND | | | | ND | | | |
| FeO | 8.60 | 10.40 | 12.20 | 7.23 | 9.26 | 7.23 | 10.25 | 9.35 | 7.48 | 11.62 |
| MnO | .13 | .15 | .15 | .13 | .15 | .12 | .13 | .11 | .11 | .13 |
| MgO | 50.32 | 48.53 | 46.87 | 49.55 | 49.58 | 49.60 | 48.70 | 49.18 | 49.67 | 47.62 |
| CaO | .04 | .02 | .16 | .04 | | | .07 | | | |
| Na2O | | | | | | | | | | |
| K2O | | | | | | | | | | |
| NiO | .39 | .36 | .32 | | | | | | | |
| TOTAL | 100.02 | 99.71 | 99.70 | 99.71 | 99.93 | 99.70 | 99.95 | 99.37 | 99.93 | 99.81 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SI | .991 | .992 | .996 | .999 | 1.001 | .997 | .997 | 1.001 | .996 | 1.001 |
| TI | | | | | | | | | | |
| AL | | | | | | | | | | |
| CR | | .001 | | | | | | | | |
| FE2+ | .176 | .215 | .254 | .189 | .189 | .189 | .211 | .192 | .194 | .240 |
| MN | .003 | .003 | .003 | .003 | .003 | .002 | .003 | .002 | .002 | .003 |
| MG | 1.831 | 1.787 | 1.749 | 1.810 | 1.806 | 1.811 | 1.790 | 1.802 | 1.812 | 1.756 |
| CA | .001 | .002 | .004 | .001 | | | .002 | | | |
| NA | | | | | | | | | | |
| K | | | | | | | | | | |
| NI | .002 | .007 | .006 | | | | | | | |
| SUM | 3.009 | 3.008 | 3.004 | 3.001 | 2.999 | 3.001 | 3.003 | 2.998 | 3.004 | 2.999 |

FO 91.25 FO 89.27 FO 87.25 FO 90.54 FO 90.51 FO 90.54 FO 89.48 FO 90.36 FO 90.33 FO 87.96
 FA 8.75 FA 10.73 FA 12.75 FA 7.46 FA 9.49 FA 9.46 FA 10.52 FA 9.64 FA 7.67 FA 12.04

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-------------------------|------------|--------------------------|
| 1 | 07103, PORP.1 | 6 | 07103B, PORP.3-EDGE |
| 2 | 07103, NEOB.2 IN PORP.1 | 7 | 07103B, NEOB.2 IN PORP.1 |
| 3 | 07103, NEOB.3 IN PORP.1 | 8 | 07103B, NEOB.5 IN PORP.3 |
| 4 | 07103B, PORP.1 | 9 | 07103B, NEOB.6 IN PORP.3 |
| 5 | 07103B, PORP.3-CENTER | 10 | 07103B, NEOB.7 IN PORP.3 |

TABLE IV-7
OLIVINES**PORPHYROCLASTIC LHERZOLITE - HEBRON**

| | 11 | 12 | 13 |
|-------|-------|-------|-------|
| SiO2 | 40.32 | 40.11 | 40.71 |
| TiO2 | ND | ND | |
| Al2O3 | | | |
| Cr2O3 | | ND | |
| FeO | 10.21 | 11.16 | 10.89 |
| MnO | .12 | .13 | .11 |
| MgO | 48.52 | 47.53 | 47.05 |
| CaO | | | |
| Na2O | | | |
| K2O | | | |
| TOTAL | 99.18 | 98.95 | 98.81 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 4 | 4 | 4 |
|--------|-------|-------|-------|
| SI | .998 | .799 | 1.013 |
| TI | | | |
| AL | | | |
| CR | | | |
| FE2+ | .211 | .233 | .227 |
| MN | .003 | .003 | .003 |
| MG | 1.790 | 1.765 | 1.744 |
| CA | | | |
| NA | | | |
| K | | | |
| SUM | 3.002 | 3.000 | 2.987 |

FO 89.44 FO 88.36 FO 88.50
FA 10.56 FA 11.64 FA 11.50

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-----------------------------|------------|-------------|
| 11 | 07103B, NEOB. 8 IN PORP. 3 | | |
| 12 | 07103B, NEOB. 9 IN PORP. 3 | | |
| 13 | 07103B, NEOB. 10 IN PORP. 3 | | |

TABLE IV-8
OLIVINES**NEGACRYSTS - HEERON**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|--------|--------|-------|-------|-------|--------|-------|-------|--------|-------|
| SI02 | 39.83 | 39.81 | 39.47 | 39.33 | 39.19 | 39.46 | 38.85 | 38.78 | 38.57 | 38.43 |
| TI02 | | | | | | ND | | | | |
| AL2O3 | | | | | | | | | | |
| CR2O3 | | | | | ND | | | | | |
| FE0 | 12.72 | 12.77 | 15.41 | 15.47 | 15.72 | 16.00 | 17.52 | 17.51 | 20.15 | 20.12 |
| MNO | .12 | .13 | .13 | .13 | .13 | .15 | .17 | .15 | .20 | .23 |
| MGO | 47.56 | 47.42 | 44.75 | 44.65 | 44.68 | 44.67 | 42.85 | 42.64 | 41.34 | 40.69 |
| CAO | .04 | .05 | .04 | .04 | .05 | .04 | ND | .05 | ND | .04 |
| NA2O | | | | | | | | | | |
| K2O | | | | | | | | | | |
| TOTAL | 100.27 | 100.18 | 99.80 | 99.62 | 99.78 | 100.33 | 79.40 | 99.13 | 100.27 | 99.51 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SI | .988 | .988 | .995 | .994 | .990 | .992 | .994 | .995 | .970 | .975 |
| TI | | | | | | | | | | |
| AL | | | | | | | | | | |
| CR | | | | | | | | | | |
| FE2+ | .264 | .265 | .325 | .327 | .332 | .337 | .375 | .376 | .433 | .435 |
| MN | .003 | .003 | .003 | .003 | .003 | .003 | .004 | .003 | .004 | .005 |
| MG | 1.757 | 1.754 | 1.681 | 1.682 | 1.683 | 1.674 | 1.634 | 1.630 | 1.582 | 1.569 |
| CA | .001 | .001 | .001 | .001 | .001 | .001 | | .001 | | .001 |
| NA | | | | | | | | | | |
| K | | | | | | | | | | |
| SUM | 3.012 | 3.012 | 3.005 | 3.006 | 3.010 | 3.007 | 3.006 | 3.005 | 3.010 | 3.005 |

| | | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| FO 86.95 | FO 86.87 | FO 83.81 | FO 83.72 | FO 83.51 | FO 83.26 | FO 81.34 | FO 81.27 | FO 78.52 | FO 78.28 |
| FA 13.05 | FA 13.13 | FA 16.19 | FA 16.28 | FA 16.49 | FA 16.74 | FA 18.66 | FA 18.73 | FA 21.48 | FA 21.72 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-------------|------------|-------------|
| 1 | OL.9 | 6 | OL.10 |
| 2 | OL.8 | 7 | OL.3A |
| 3 | OL.7 | 8 | OL.3 |
| 4 | OL.4 | 9 | OL.14 |
| 5 | OL.1 | 10 | OL.6 |

TABLE IV-8
OLIVINES**MEGACRYSTS - HEBRON**

| | 11 | 12 | 13 | 14 | 15 |
|-------|--------|--------|-------|-------|--------|
| SiO2 | 38.49 | 38.51 | 38.22 | 38.08 | 38.41 |
| TiO2 | | | | | |
| Al2O3 | | | | | |
| Cr2O3 | | | | | |
| FeO | 20.98 | 21.59 | 21.36 | 21.38 | 21.58 |
| MnO | .22 | .23 | .25 | .19 | .21 |
| MgO | 40.88 | 40.51 | 39.91 | 39.89 | 40.13 |
| CaO | ND | ND | .04 | .06 | ND |
| Na2O | | | | | |
| K2O | | | | | |
| TOTAL | 100.58 | 100.85 | 99.78 | 99.60 | 100.34 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 4 | 4 | 4 | 4 | 4 |
|--------|-------|-------|-------|-------|-------|
| SI | .789 | .790 | .792 | .791 | .792 |
| TI | | | | | |
| AL | | | | | |
| CR | | | | | |
| FE2+ | .451 | .464 | .464 | .465 | .466 |
| MN | .005 | .005 | .005 | .004 | .005 |
| MG | 1.566 | 1.551 | 1.545 | 1.547 | 1.545 |
| CA | | | .001 | .002 | |
| NA | | | | | |
| K | | | | | |
| SUM | 3.011 | 3.010 | 3.008 | 3.009 | 3.008 |

FO 77.64 FO 76.98 FO 76.90 FO 76.88 FO 76.82
 FA 22.36 FA 23.02 FA 23.10 FA 23.12 FA 23.18

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-------------|------------|-------------|
| 11 | OL.13 | | |
| 12 | OL.11 | | |
| 13 | OL.5 | | |
| 14 | OL.2 | | |
| 15 | OL.12 | | |

TABLE IV-9
ORTHOPYROXENES**COARSE PERIDOTITES - HEBRON**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|--------|-------|-------|--------|--------|-------|--------|-------|-------|--------|
| SiO2 | 56.76 | 57.04 | 56.86 | 57.62 | 57.32 | 57.07 | 57.36 | 57.06 | 57.43 | 57.16 |
| TiO2 | .11 | .09 | ND | .05 | ND | .04 | ND | .08 | ND | ND |
| Al2O3 | 1.69 | 1.37 | 1.59 | 1.56 | 1.64 | 1.62 | 1.70 | 1.49 | .92 | 1.22 |
| Cr2O3 | .43 | .40 | .35 | .47 | .40 | .04 | .32 | .32 | .30 | .31 |
| FeO | 5.39 | 5.13 | 5.32 | 4.98 | 5.49 | 5.35 | 5.57 | 5.63 | 4.62 | 5.22 |
| MnO | .11 | .11 | .10 | .10 | .12 | .11 | .13 | .13 | .12 | .11 |
| MgO | 35.78 | 34.74 | 34.58 | 35.07 | 34.57 | 34.81 | 34.74 | 34.56 | 35.72 | 35.83 |
| CaO | .41 | .40 | .40 | .46 | .41 | .43 | .36 | .41 | .19 | .35 |
| Na2O | .05 | .09 | .07 | .09 | .07 | .08 | .07 | .13 | ND | .06 |
| K2O | | | | | | | | | | |
| TOTAL | 100.73 | 99.37 | 99.28 | 100.40 | 100.03 | 99.55 | 100.26 | 99.81 | 99.32 | 100.27 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
|--------|-------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| SI | 1.939 | 1.969 | 1.966 | 1.967 | 1.968 | 1.967 | 1.965 | 1.966 | 1.977 | 1.958 |
| TI | .003 | .002 | | .001 | | .001 | | .002 | | |
| AL | .068 | .056 | .065 | .063 | .064 | .066 | .069 | .061 | .037 | .049 |
| CR | .012 | .011 | .010 | .013 | .011 | .001 | .009 | .009 | .008 | .008 |
| FE2+ | .154 | .148 | .154 | .142 | .158 | .154 | .160 | .162 | .133 | .150 |
| MN | .003 | .003 | .003 | .003 | .003 | .003 | .004 | .004 | .003 | .003 |
| MG | 1.822 | 1.788 | 1.782 | 1.785 | 1.769 | 1.780 | 1.774 | 1.775 | 1.833 | 1.829 |
| CA | .015 | .015 | .015 | .017 | .015 | .016 | .013 | .015 | .007 | .013 |
| NA | .003 | .006 | .005 | .006 | .005 | .005 | .005 | .007 | | .004 |
| K | | | | | | | | | | |
| SUM | 4.020 | 3.998 | 3.999 | 3.997 | 3.995 | 4.001 | 3.998 | 4.002 | 4.000 | 4.015 |
| CA | .75 | CA .76 | CA .76 | CA .87 | CA .78 | CA .81 | CA .68 | CA .78 | CA .36 | CA .65 |
| MG | 91.51 | MG 91.65 | MG 91.35 | MG 91.82 | MG 91.10 | MG 91.31 | MG 91.12 | MG 90.91 | MG 92.90 | MG 91.85 |
| FE | 7.74 | FE 7.59 | FE 7.89 | FE 7.32 | FE 8.12 | FE 7.88 | FE 8.20 | FE 8.31 | FE 6.74 | FE 7.51 |
| M: | 92.21 | M: 92.35 | M: 92.05 | M: 92.62 | M: 91.82 | M: 92.06 | M: 91.75 | M: 91.62 | M: 93.23 | M: 92.44 |
| C: | .82 | C: .82 | C: .82 | C: .93 | C: .85 | C: .88 | C: .74 | C: .85 | C: .38 | C: .70 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|---------------|------------|---------------|
| 1 | 07033,GT.LHZ. | 6 | 07163,GT.LHZ. |
| 2 | 07053,GT.LHZ. | 7 | 07173,GT.LHZ. |
| 3 | 07073,GT.LHZ. | 8 | 07183,GT.LHZ. |
| 4 | 07083,GT.LHZ. | 9 | 07023,LHZ. |
| 5 | 07143,GT.LHZ. | 10 | 07043,LHZ. |

TABLE IV-9
 ORTHOPYROXENES**COARSE PERIDOTITES - HEBRON**

| | 11 | 12 |
|-------|-------|-------|
| SiO2 | 57.32 | 57.97 |
| TiO2 | .06 | .13 |
| Al2O3 | .44 | .04 |
| Cr2O3 | .25 | .14 |
| FeO | 4.90 | 7.24 |
| MnO | .12 | ND |
| MgO | 35.82 | 33.53 |
| CaO | .27 | .50 |
| Na2O | .05 | .06 |
| K2O | ND | ND |
| TOTAL | 99.24 | 99.75 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 |
|--------|-------|-------|
| SI | 1.980 | 2.009 |
| TI | .002 | .003 |
| AL | .018 | .002 |
| CR | .007 | .005 |
| FE2+ | .142 | .210 |
| MN | .004 | |
| MG | 1.844 | 1.732 |
| CA | .010 | .022 |
| NA | .003 | .004 |
| K | | |
| SUM | 4.008 | 3.987 |

CA .50 CA 1.10
 MG 92.41 MG 88.21
 FE 7.09 FE 10.69

H: 92.87 H: 89.19
 C: .54 C: 1.23

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-------------|------------|-------------|
| 11 | 07063, LHZ. | | |
| 12 | 07093, LHZ. | | |

TABLE IV-10
ORTHOPYROXENES**PORPHYROCLASTIC LHERZOLITE - NEBRO**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|--------|-------|--------|--------|-------|-------|-------|-------|-------|-------|
| SiO2 | 58.85 | 58.06 | 57.20 | 56.54 | 56.97 | 56.08 | 57.82 | 58.00 | 58.13 | 58.21 |
| TiO2 | .18 | .13 | .42 | .47 | .26 | .37 | .11 | .15 | .10 | .13 |
| Al2O3 | .17 | .15 | .74 | 1.49 | .56 | 1.09 | .15 | .17 | .16 | .15 |
| CR2O3 | .21 | .22 | .28 | .26 | .22 | .40 | .22 | .21 | .18 | .20 |
| FeO | 5.22 | 5.16 | 8.45 | 8.38 | 6.48 | 7.36 | 5.34 | 5.57 | 5.51 | 5.39 |
| MnO | ND | .12 | ND | ND | .14 | .14 | .13 | .15 | .15 | .13 |
| MgO | 35.44 | 34.90 | 32.16 | 31.66 | 33.30 | 31.73 | 34.92 | 34.77 | 34.69 | 35.16 |
| CaO | .48 | .48 | .98 | 1.21 | 1.01 | 1.17 | .49 | .49 | .49 | .46 |
| Na2O | .08 | .07 | .14 | .20 | .14 | .15 | .08 | .10 | .09 | .07 |
| K2O | ND | | | | | | | | | |
| TOTAL | 100.65 | 99.29 | 100.58 | 100.22 | 99.08 | 98.49 | 99.26 | 99.61 | 99.50 | 99.90 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SI | 2.003 | 2.004 | 1.981 | 1.968 | 1.988 | 1.972 | 1.999 | 2.000 | 2.005 | 1.999 |
| TI | .005 | .003 | .011 | .012 | .007 | .010 | .003 | .004 | .003 | .003 |
| AL | .007 | .006 | .038 | .061 | .023 | .045 | .006 | .007 | .007 | .006 |
| CR | .006 | .006 | .008 | .007 | .006 | .011 | .006 | .006 | .005 | .005 |
| FE2+ | .149 | .149 | .245 | .244 | .187 | .217 | .154 | .161 | .159 | .155 |
| MN | | .004 | | | .004 | .004 | .004 | .004 | .004 | .004 |
| MG | 1.797 | 1.795 | 1.660 | 1.642 | 1.732 | 1.668 | 1.799 | 1.787 | 1.783 | 1.800 |
| CA | .018 | .018 | .036 | .045 | .038 | .044 | .018 | .018 | .018 | .017 |
| NA | .005 | .005 | .007 | .013 | .007 | .010 | .005 | .007 | .006 | .005 |
| K | | | | | | | | | | |
| SUM | 3.989 | 3.987 | 3.989 | 3.993 | 3.996 | 3.989 | 3.995 | 3.993 | 3.998 | 3.994 |

| | | | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------|
| CA .89 | CA .76 | CA 1.87 | CA 2.34 | CA 1.93 | CA 2.29 | CA .72 | CA .92 | CA .92 | CA .92 | CA .86 |
| MG 91.54 | MG 91.50 | MG 85.52 | MG 85.03 | MG 88.42 | MG 86.45 | MG 91.25 | MG 90.91 | MG 90.77 | MG 91.29 | |
| FE 7.57 | FE 7.59 | FE 12.61 | FE 12.63 | FE 9.66 | FE 11.25 | FE 7.83 | FE 8.17 | FE 8.11 | FE 7.85 | |
| H: 92.37 | N: 92.34 | M: 87.15 | H: 87.07 | M: 90.16 | H: 88.48 | M: 92.10 | M: 91.75 | M: 91.82 | M: 92.00 | |
| C: .96 | C: .78 | C: 2.14 | C: 2.67 | C: 2.13 | C: 2.58 | C: 1.00 | C: 1.00 | C: 1.01 | C: .73 | |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|---------------------------|------------|---------------------------|
| 1 | 07103, PORP.1 | 6 | 07103, NEOB.14 IN PORP.12 |
| 2 | 07103, PORP.12 | 7 | 07103B, PORP.1 CENTER |
| 3 | 07103, NEOB.2 IN PORP.1 | 8 | 07103B, PORP.1 EDGE |
| 4 | 07103, NEOB.3 IN PORP.1 | 9 | 07103B, PORP.6 |
| 5 | 07103, NEOB.13 IN PORP.12 | 10 | 07103B, PORP.19 |

TABLE IV-10
 ORTHOPYROXENES**PORPHYROCLASTIC LHERZOLITE - HEBRON**

| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SiO2 | 58.10 | 56.32 | 57.37 | 57.45 | 56.14 | 56.85 | 56.64 | 56.65 | 57.18 | 56.86 |
| TiO2 | .13 | .35 | .25 | .25 | .38 | .38 | .30 | .14 | .19 | .13 |
| Al2O3 | .16 | 1.05 | .59 | .51 | 1.16 | .85 | .82 | 1.54 | 1.05 | 1.50 |
| Cr2O3 | .20 | .19 | .23 | .26 | .19 | .27 | .17 | .58 | .68 | .74 |
| FeO | 5.43 | 7.72 | 6.58 | 6.39 | 8.07 | 6.72 | 7.15 | 5.51 | 5.61 | 5.37 |
| MnO | .14 | .16 | .15 | .14 | .15 | .14 | .16 | .15 | .15 | .14 |
| MgO | 34.98 | 32.81 | 33.32 | 33.69 | 31.89 | 32.39 | 33.00 | 33.61 | 33.83 | 33.76 |
| CaO | .48 | 1.20 | 1.00 | .73 | 1.18 | 1.16 | .89 | .95 | .91 | .93 |
| Na2O | .08 | .14 | .10 | .12 | ND | .15 | .10 | .15 | .13 | .15 |
| K2O | | ND | | | | | | | | |
| TOTAL | 99.70 | 99.15 | 99.59 | 99.54 | 99.17 | 98.91 | 99.24 | 99.28 | 99.73 | 99.58 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SI | 2.000 | 1.976 | 1.991 | 1.992 | 1.972 | 1.989 | 1.979 | 1.966 | 1.976 | 1.966 |
| Ti | .003 | .009 | .007 | .007 | .010 | .010 | .008 | .004 | .005 | .003 |
| AL | .006 | .043 | .024 | .021 | .048 | .035 | .034 | .063 | .043 | .061 |
| CR | .005 | .005 | .006 | .007 | .005 | .007 | .005 | .016 | .019 | .020 |
| FE2+ | .156 | .227 | .191 | .185 | .237 | .197 | .209 | .160 | .162 | .155 |
| MN | .004 | .005 | .004 | .004 | .004 | .004 | .005 | .004 | .004 | .004 |
| Mg | 1.795 | 1.674 | 1.723 | 1.741 | 1.670 | 1.689 | 1.718 | 1.738 | 1.742 | 1.740 |
| CA | .018 | .045 | .037 | .027 | .044 | .043 | .033 | .035 | .034 | .034 |
| NA | .005 | .010 | .007 | .008 | | .010 | .007 | .010 | .009 | .010 |
| K | | | | | | | | | | |
| SUM | 3.993 | 3.995 | 3.991 | 3.992 | 3.992 | 3.985 | 3.997 | 3.996 | 3.993 | 3.995 |

CA .90 CA 2.32 CA 1.91 CA 1.39 CA 2.28 CA 2.25 CA 1.70 CA 1.83 CA 1.74 CA 1.79
 MG 91.16 MG 86.04 MG 88.31 MG 87.13 MG 85.57 MG 87.55 MG 87.63 MG 87.90 MG 87.90 MG 90.17
 FE 7.94 FE 11.64 FE 9.79 FE 9.49 FE 12.15 FE 10.19 FE 10.67 FE 8.27 FE 8.37 FE 8.05

M: 91.99 M: 88.88 M: 90.02 M: 90.38 M: 87.57 M: 87.57 M: 89.15 M: 91.58 M: 91.49 M: 91.01
 C: .98 C: 2.62 C: 2.11 C: 1.53 C: 2.59 C: 2.51 C: 1.90 C: 1.99 C: 1.90 C: 1.94

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-------------------------|------------|--------------------------------|
| 11 | 07103B,AV.PORP.OPX | 16 | 07103B,NEOB.8 IN PORP.6 |
| 12 | 07103B,NEOB.3 IN PORP.1 | 17 | 07103B,NEOB.20 IN PORP.19 |
| 13 | 07103B,NEOB.4 IN PORP.1 | 18 | 07103B,RIM OPX.9 IN CPX.1 |
| 14 | 07103B,NEOB.5 IN PORP.1 | 19 | 07103B,RIM OPX.10 IN CPX.2 |
| 15 | 07103B,NEOB.7 IN PORP.6 | 20 | 07103B,RIM OPX.15 AND REXTALD. |

TABLE IV-10
 ORTHOPYROXENES**PORPHYROCLASTIC LHERZOLITE - HEBRON**

| | 21 | 22 | 23 |
|-------|-------|-------|-------|
| SiO2 | 55.32 | 56.46 | 56.59 |
| TiO2 | .37 | .12 | .19 |
| Al2O3 | 1.06 | .73 | 1.27 |
| Cr2O3 | .59 | .72 | .63 |
| FeO | 6.90 | 6.28 | 6.43 |
| MnO | .15 | .14 | .13 |
| MgO | 32.80 | 33.39 | 33.05 |
| CaO | 1.13 | 1.11 | 1.17 |
| Na2O | .16 | .16 | .17 |
| K2O | | | |
| TOTAL | 98.33 | 99.31 | 99.63 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 |
|--------|-------|-------|-------|
| SI | 1.954 | 1.969 | 1.967 |
| TI | .010 | .003 | .005 |
| AL | .044 | .038 | .052 |
| CR | .016 | .020 | .017 |
| FE2+ | .261 | .183 | .187 |
| MN | .004 | .004 | .004 |
| MG | 1.727 | 1.735 | 1.712 |
| CA | .043 | .041 | .044 |
| NA | .011 | .011 | .011 |
| K | | | |
| SUM | 4.011 | 4.005 | 3.999 |

CA 2.17 CA 2.12 CA 2.24
 MG 87.63 MG 88.54 MG 88.13
 FE 10.20 FE 9.34 FE 9.62

M: 89.58 M: 90.45 M: 90.16
 C: 2.42 C: 2.33 C: 2.48

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|------------------------------|------------|-------------|
| 21 | 07103B,NEOB.16 IN RIM OPX.15 | | |
| 22 | 07103B,NEOB.17 IN RIM OPX.15 | | |
| 23 | 07103B,NEOB.18 IN RIM OPX.15 | | |

TABLE IV-11
ORTHOPYROXENES**MEGACRYSTS-HEBRON**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|-------|--------|--------|--------|-------|--------|--------|--------|--------|--------|
| SiO2 | 56.02 | 56.08 | 55.72 | 55.94 | 55.98 | 56.11 | 55.84 | 56.91 | 56.16 | 56.21 |
| TiO2 | .22 | .21 | .22 | .20 | .20 | .24 | .21 | .18 | .19 | .15 |
| Al2O3 | 1.02 | .74 | 1.19 | .78 | .78 | 1.11 | 1.20 | .68 | .61 | .27 |
| CR2O3 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| FeO | 10.79 | 11.02 | 11.10 | 11.16 | 11.01 | 11.20 | 11.20 | 11.71 | 12.10 | 12.40 |
| MnO | .13 | .13 | .14 | .14 | .14 | .13 | .13 | .13 | .15 | .16 |
| MgO | 30.43 | 30.88 | 30.75 | 30.93 | 30.49 | 30.37 | 30.37 | 30.59 | 30.23 | 30.52 |
| CaO | .91 | .88 | .91 | .87 | .86 | .90 | .90 | .83 | .84 | .69 |
| Na2O | .15 | .15 | .17 | .16 | .13 | .16 | .16 | .16 | .10 | .06 |
| K2O | | | | | | | | | | |
| TOTAL | 79.68 | 100.30 | 100.21 | 100.19 | 99.60 | 100.23 | 100.02 | 101.20 | 100.41 | 100.47 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
|--------|-------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| SI | 1.980 | 1.972 | 1.964 | 1.972 | 1.982 | 1.976 | 1.971 | 1.987 | 1.982 | 1.985 |
| TI | .006 | .006 | .006 | .005 | .005 | .006 | .006 | .005 | .005 | .004 |
| AL | .042 | .039 | .049 | .032 | .033 | .046 | .050 | .028 | .025 | .011 |
| CR | | | | | | | | | | |
| FE2+ | .319 | .324 | .327 | .329 | .326 | .330 | .331 | .342 | .357 | .366 |
| MN | .004 | .004 | .004 | .004 | .004 | .004 | .004 | .004 | .004 | .005 |
| MG | 1.603 | 1.619 | 1.615 | 1.625 | 1.609 | 1.594 | 1.598 | 1.592 | 1.590 | 1.606 |
| CA | .034 | .033 | .034 | .033 | .033 | .034 | .034 | .031 | .032 | .026 |
| NA | .010 | .010 | .012 | .011 | .009 | .011 | .011 | .011 | .007 | .004 |
| K | | | | | | | | | | |
| SUM | 3.998 | 4.007 | 4.011 | 4.012 | 4.001 | 4.000 | 4.004 | 3.999 | 4.003 | 4.000 |
| CA | 1.76 | CA 1.68 | CA 1.74 | CA 1.65 | CA 1.66 | CA 1.73 | CA 1.73 | CA 1.58 | CA 1.61 | CA 1.31 |
| MG | 81.93 | MG 81.92 | MG 81.71 | MG 81.79 | MG 81.77 | MG 81.42 | MG 81.42 | MG 81.02 | MG 80.35 | MG 80.37 |
| FE | 16.30 | FE 16.40 | FE 16.55 | FE 16.56 | FE 16.57 | FE 16.85 | FE 16.85 | FE 17.40 | FE 18.05 | FE 18.32 |
| M: | 83.40 | M: 83.32 | M: 83.16 | M: 83.16 | M: 83.15 | M: 82.85 | M: 82.85 | M: 82.32 | M: 81.66 | M: 81.43 |
| C: | 2.10 | C: 2.01 | C: 2.08 | C: 1.98 | C: 1.99 | C: 2.09 | C: 2.09 | C: 1.91 | C: 1.96 | C: 1.60 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-------------|------------|----------------------|
| 1 | OPX.8 | 6 | OPX.9 |
| 2 | OPX.15 | 7 | OPX.13 |
| 3 | OPX.6 | 8 | OPX.18 |
| 4 | OPX.11 | 9 | OPX.5 |
| 5 | OPX.16 | 10 | OPX.3 DIFFERENT SPOT |

TABLE IV-11
ORTHOPYROXENES**HEGACRYSTS-HEBRON**

| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|-------|--------|--------|--------|-------|--------|-------|-------|-------|--------|--------|
| SI02 | 56.64 | 55.82 | 55.77 | 55.79 | 55.94 | 55.29 | 55.23 | 55.54 | 53.78 | 53.59 |
| TIO2 | .16 | .18 | .21 | .18 | .19 | .17 | .17 | .17 | .06 | .07 |
| AL2O3 | .27 | .76 | .76 | .82 | .77 | .76 | .82 | .82 | 2.92 | 2.86 |
| CR2O3 | ND | ND | ND | ND | ND | ND | ND | ND | .05 | ND |
| FE0 | 12.39 | 12.53 | 12.48 | 12.49 | 12.65 | 13.04 | 13.35 | 13.43 | 16.22 | 16.15 |
| MNO | .14 | .16 | .15 | .15 | .16 | .17 | .17 | .18 | .23 | .27 |
| MGO | 30.27 | 30.03 | 29.73 | 29.32 | 29.41 | 28.87 | 28.99 | 28.51 | 27.01 | 27.21 |
| CAO | .69 | .88 | .90 | .96 | .91 | .93 | .93 | .95 | .39 | .30 |
| NA2O | .10 | .11 | .12 | .12 | .15 | .16 | .15 | .18 | ND | ND |
| K2O | | | | | | | | | | |
| TOTAL | 100.67 | 100.48 | 100.13 | 99.84 | 100.17 | 99.53 | 99.02 | 99.81 | 100.67 | 100.47 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SI | 1.994 | 1.974 | 1.978 | 1.984 | 1.984 | 1.976 | 1.974 | 1.985 | 1.929 | 1.924 |
| Ti | .004 | .005 | .006 | .005 | .005 | .005 | .005 | .005 | .002 | .002 |
| AL | .011 | .032 | .032 | .034 | .032 | .041 | .035 | .035 | .123 | .121 |
| CR | | | | | | | | | .001 | |
| FE21 | .365 | .371 | .370 | .371 | .375 | .390 | .399 | .401 | .486 | .485 |
| MN | .004 | .005 | .005 | .005 | .005 | .005 | .005 | .005 | .007 | .008 |
| MG | 1.588 | 1.583 | 1.572 | 1.554 | 1.554 | 1.540 | 1.545 | 1.518 | 1.444 | 1.457 |
| CA | .026 | .033 | .034 | .037 | .035 | .036 | .036 | .036 | .015 | .012 |
| NA | .007 | .008 | .008 | .008 | .010 | .011 | .010 | .012 | | |
| K | | | | | | | | | | |
| SUM | 4.000 | 4.009 | 4.004 | 3.998 | 4.000 | 4.004 | 4.009 | 3.999 | 4.002 | 4.012 |

| | | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| CA 1.32 | CA 1.68 | CA 1.73 | CA 1.36 | CA 1.76 | CA 1.81 | CA 1.80 | CA 1.86 | CA .77 | CA .59 |
| MG 80.25 | MG 79.67 | MG 79.53 | MG 79.20 | MG 79.14 | MG 79.33 | MG 78.03 | MG 77.62 | MG 74.22 | MG 74.57 |
| FE 18.43 | FE 18.65 | FE 18.74 | FE 18.93 | FE 19.10 | FE 19.85 | FE 20.17 | FE 20.52 | FE 25.01 | FE 24.84 |

| | | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| H: 81.32 | H: 81.03 | H: 80.93 | H: 80.71 | H: 80.56 | H: 79.78 | H: 79.46 | H: 79.09 | H: 74.79 | H: 75.01 |
| C: 1.61 | C: 2.06 | C: 2.13 | C: 2.30 | C: 2.18 | C: 2.26 | C: 2.25 | C: 2.34 | C: 1.03 | C: .79 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-------------|------------|----------------------|
| 11 | OPX.3 | 16 | OPX.14 |
| 12 | OPX.17 | 17 | OPX.12 |
| 13 | OPX.10 | 18 | OPX.7 |
| 14 | OPX.2 | 19 | OPX.1 |
| 15 | OPX.4 | 20 | OPX.1 DIFFERENT SPOT |

TABLE IV-12
ORTHOPYROXENES**CDARSE PERIDOTITES - NELTON WOLD**

| | 1 | 2 | 3 | 4 | 5 | 6 |
|-------|--------|--------|--------|--------|--------|--------|
| SiO2 | 58.20 | 58.30 | 57.90 | 58.40 | 58.10 | 58.01 |
| TiO2 | .08 | .06 | .05 | .04 | .07 | .04 |
| Al2O3 | .71 | .71 | .74 | .72 | .67 | .71 |
| Cr2O3 | .26 | .24 | .28 | .18 | .28 | .35 |
| FeO | 5.29 | 5.07 | 5.16 | 5.32 | 4.73 | 5.01 |
| MnO | .09 | .08 | .10 | .10 | .07 | .08 |
| MgO | 35.80 | 35.70 | 35.50 | 35.60 | 36.10 | 35.90 |
| CaO | .39 | .38 | .67 | .43 | .36 | .38 |
| Na2O | .11 | .08 | .08 | .06 | .09 | .09 |
| K2O | ND | ND | ND | ND | ND | ND |
| TOTAL | 100.94 | 100.63 | 100.69 | 100.86 | 100.48 | 100.58 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 | 6 | 6 | 6 |
|--------|-------|-------|-------|-------|-------|-------|
| SI | 1.979 | 1.985 | 1.974 | 1.986 | 1.979 | 1.977 |
| TI | .002 | .002 | .001 | .001 | .002 | .001 |
| AL | .028 | .028 | .038 | .029 | .027 | .029 |
| CR | .007 | .006 | .008 | .005 | .008 | .009 |
| FE2+ | .150 | .144 | .147 | .151 | .135 | .143 |
| MN | .003 | .002 | .003 | .003 | .002 | .002 |
| MG | 1.814 | 1.811 | 1.804 | 1.804 | 1.833 | 1.824 |
| CA | .014 | .014 | .024 | .016 | .013 | .014 |
| NA | .007 | .005 | .005 | .004 | .006 | .006 |
| K | | | | | | |
| SiH | 4.005 | 3.999 | 4.005 | 3.999 | 4.005 | 4.001 |

| | | | | | |
|----------|----------|----------|----------|----------|----------|
| CA .72 | CA .70 | CA 1.24 | CA .79 | CA .66 | CA .70 |
| MG 91.68 | MG 91.97 | MG 91.31 | MG 91.53 | MG 92.53 | MG 92.09 |
| FE 7.60 | FE 7.33 | FE 7.45 | FE 7.68 | FE 6.80 | FE 7.21 |
| H: 92.34 | H: 92.62 | H: 92.46 | H: 92.26 | H: 93.15 | H: 92.74 |
| C: .78 | C: .76 | C: 1.34 | C: .86 | C: .71 | C: .76 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|---------------|------------|---------------|
| 1 | 08053,GT.LHZ. | 6 | 08123,GT.LHZ. |
| 2 | 08063,GT.LHZ. | | |
| 3 | 08073,GT.LHZ. | | |
| 4 | 08083,GT.LHZ. | | |
| 5 | 08113,GT.LHZ. | | |

TABLE IV-13
CLINOPYROXENES**COARSE PERIDOTITES - HERRON**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|-------|-------|-------|--------|-------|--------|--------|--------|-------|--------|
| SiO2 | 52.97 | 53.47 | 53.56 | 54.27 | 54.30 | 54.34 | 54.34 | 54.71 | 53.87 | 54.77 |
| TiO2 | .25 | .22 | .06 | .04 | .06 | .25 | .12 | .07 | .16 | .25 |
| Al2O3 | 3.54 | 3.37 | 2.37 | 2.73 | 2.81 | 2.22 | 3.52 | 1.98 | 1.42 | 2.04 |
| Cr2O3 | 1.75 | 1.67 | 1.19 | 1.29 | 1.37 | .93 | 1.39 | 3.50 | 1.09 | 2.20 |
| FeO | 2.26 | 2.29 | 2.17 | 2.26 | 2.30 | 2.10 | 2.48 | 2.15 | 2.00 | 2.69 |
| MnO | .09 | .06 | .09 | .09 | .09 | .06 | .09 | .12 | .10 | .12 |
| MgO | 16.18 | 16.00 | 16.90 | 16.26 | 16.06 | 17.29 | 16.09 | 18.41 | 16.82 | 17.09 |
| CaO | 19.99 | 20.24 | 22.01 | 21.57 | 21.11 | 21.88 | 20.23 | 18.44 | 21.50 | 19.61 |
| Na2O | 2.13 | 2.47 | 1.50 | 1.70 | 1.63 | .95 | 2.34 | 2.07 | 1.81 | 2.39 |
| K2O | | ND | ND | ND | ND | | | | | ND |
| NiO | | .05 | | | | | | | | |
| TOTAL | 99.16 | 99.85 | 99.86 | 100.22 | 99.74 | 100.02 | 100.60 | 101.47 | 99.57 | 101.17 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------|
| SI | 1.935 | 1.943 | 1.948 | 1.962 | 1.969 | 1.964 | 1.955 | 1.950 | 1.967 | 1.964 |
| TI | .007 | .006 | .002 | .001 | .002 | .007 | .003 | .002 | .004 | .007 |
| AL | .152 | .144 | .102 | .116 | .120 | .095 | .149 | .083 | .061 | .086 |
| CR | .051 | .048 | .034 | .037 | .039 | .027 | .040 | .099 | .055 | .062 |
| FE2+ | .069 | .070 | .066 | .068 | .070 | .063 | .075 | .064 | .061 | .081 |
| MN | .003 | .002 | .003 | .003 | .003 | .002 | .003 | .004 | .003 | .004 |
| MG | .881 | .866 | .916 | .876 | .868 | .931 | .863 | .978 | .915 | .913 |
| CA | .783 | .798 | .858 | .836 | .820 | .847 | .780 | .704 | .841 | .754 |
| NA | .151 | .174 | .106 | .119 | .115 | .067 | .163 | .143 | .120 | .166 |
| K | | | | | | | | | | |
| NI | | .001 | | | | | | | | |
| SUM | 4.032 | 4.042 | 4.035 | 4.020 | 4.007 | 4.002 | 4.029 | 4.028 | 4.035 | 4.038 |
| CA 45.17 | CA 45.71 | CA 46.62 | CA 46.94 | CA 46.66 | CA 46.00 | CA 45.41 | CA 40.33 | CA 46.29 | CA 43.12 | |
| MG 50.85 | MG 50.26 | MG 49.79 | MG 49.22 | MG 49.37 | MG 50.56 | MG 50.24 | MG 56.00 | MG 50.36 | MG 52.27 | |
| FE 3.99 | FE 4.04 | FE 3.59 | FE 3.84 | FE 3.97 | FE 3.45 | FE 4.35 | FE 3.67 | FE 3.36 | FE 4.62 | |
| M: 92.73 | M: 92.57 | M: 93.28 | M: 92.76 | M: 92.56 | M: 93.62 | M: 92.04 | M: 93.85 | M: 93.74 | M: 91.83 | |
| C: 47.84 | C: 47.63 | C: 48.36 | C: 48.82 | C: 48.59 | C: 47.64 | C: 47.48 | C: 41.87 | C: 47.89 | C: 45.21 | |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|--------------------------|------------|------------------------------|
| 1 | 07033,GT.LHZ. | 6 | 07173,GT.LHZ.,+AKPH,SP,GT |
| 2 | 07053,GT.LHZ. | 7 | 07183,GT.LHZ. |
| 3 | 07073,GT.LHZ.,CPX.3+SP.5 | 8 | 07023,LHZ.,+SP,PHL |
| 4 | 07143,GT.LHZ. | 9 | 07063,LHZ.,CPX.3,RELICT CORE |
| 5 | 07163,GT.LHZ. | 10 | 07063,LHZ.,CPX.1+SP.1,PHL.1 |

TABLE IV-13
CLINOPYROXENES**COARSE PERIDOTITES - HEDRON**

| | 11 | 12 |
|-------|-------|-------|
| SiO2 | 53.32 | 53.92 |
| TiO2 | .34 | 1.67 |
| Al2O3 | 2.72 | .21 |
| Cr2O3 | 2.52 | .08 |
| FeO | 2.64 | 3.89 |
| MnO | ND | ND |
| MgO | 17.08 | 15.19 |
| CaO | 18.25 | 22.25 |
| Na2O | 2.04 | 1.72 |
| K2O | ND | ND |
| TOTAL | 98.93 | 98.86 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 |
|--------|-------|-------|
| Si | 1.949 | 1.995 |
| Ti | .087 | .046 |
| Al | .117 | .009 |
| Cr | .073 | .002 |
| Fe2+ | .081 | .118 |
| Mn | | |
| Mg | .930 | .838 |
| Ca | .715 | .882 |
| Na | .145 | .123 |
| K | | |
| SUM | 4.019 | 4.015 |

CA 41.41 CA 48.01
MG 53.91 MG 45.59
FE 4.68 FE 6.40

H: 92.02 H: 87.69
C: 43.45 C: 51.29

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-----------------------------|------------|-------------|
| 11 | 07063, LHZ., CPX. 4+SP, PHL | | |
| 12 | 07093, LHZ. | | |

TABLE IV-14
CLINOPYROXENES**PORPHYROCLASTIC LHERZOLITE - HEBRON**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-------|-------|-------|--------|-------|-------|-------|--------|
| SiO2 | 55.15 | 54.77 | 55.51 | 54.61 | 54.64 | 54.77 | 54.09 |
| TiO2 | .21 | .57 | .27 | .16 | .18 | .17 | .61 |
| Al2O3 | .61 | 1.32 | .54 | .60 | .59 | .61 | 1.99 |
| Cr2O3 | 2.57 | 2.11 | 1.98 | 2.94 | 2.65 | 2.00 | 1.75 |
| FeO | 2.31 | 3.57 | 2.38 | 2.22 | 2.40 | 2.26 | 3.75 |
| MnO | ND | ND | ND | .14 | .10 | .12 | .14 |
| MgO | 16.32 | 17.30 | 16.72 | 16.29 | 16.44 | 16.33 | 17.26 |
| CaO | 21.02 | 18.80 | 21.42 | 20.45 | 20.48 | 20.19 | 18.56 |
| Na2O | 1.59 | 1.47 | 1.47 | 2.07 | 1.83 | 2.00 | 1.67 |
| K2O | ND | ND | ND | ND | ND | | |
| TOTAL | 99.80 | 99.93 | 100.41 | 99.49 | 99.32 | 99.25 | 100.02 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
|--------|-------|-------|-------|-------|-------|-------|-------|
| SI | 2.005 | 1.985 | 2.004 | 1.996 | 1.998 | 2.003 | 1.962 |
| TI | .006 | .016 | .007 | .004 | .005 | .005 | .017 |
| AL | .026 | .056 | .027 | .026 | .025 | .026 | .085 |
| CR | .074 | .060 | .057 | .085 | .077 | .081 | .056 |
| FE2+ | .070 | .108 | .072 | .068 | .073 | .069 | .114 |
| MN | | | | .004 | .003 | .004 | .004 |
| MG | .884 | .934 | .900 | .887 | .896 | .890 | .933 |
| CA | .819 | .730 | .829 | .801 | .803 | .791 | .721 |
| NA | .112 | .103 | .103 | .147 | .130 | .142 | .117 |
| K | | | | | | | |
| SUM | 3.996 | 3.993 | 3.999 | 4.018 | 4.011 | 4.010 | 4.010 |

CA 46.18 CA 41.18 CA 46.03 CA 45.61 CA 45.29 CA 45.20 CA 40.80
 MG 49.86 MG 52.71 MG 49.98 MG 50.53 MG 50.57 MG 50.85 MG 52.77
 FE 3.96 FE 6.10 FE 3.99 FE 3.86 FE 4.14 FE 3.95 FE 6.43

M: 92.64 M: 89.62 M: 92.60 M: 92.90 M: 92.43 M: 92.79 M: 89.13
 C: 48.08 C: 43.86 C: 47.95 C: 47.44 C: 47.25 C: 47.06 C: 43.60

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|--------------------------------|------------|--------------------------------|
| 1 | 07103, LHZ., CPX.1 | 6 | 07103B, LHZ., CPX.3+OPX RIM |
| 2 | 07103, LHZ., CPX.2 | 7 | 07103B, LHZ., CPX.4+OPX.15 RIM |
| 3 | 07103, LHZ., CPX.3 | | |
| 4 | 07103B, LHZ., CPX.1+OPX.9 RIM | | |
| 5 | 07103B, LHZ., CPX.2+OPX.10 RIM | | |

TABLE IV-15
CLINOPYROXENES**COARSE PERIDOTITES - MELTON WOLD**

| | 1 | 2 | 3 | 4 | 5 | 6 |
|-------|--------|--------|-------|--------|--------|--------|
| SiO2 | 55.00 | 55.10 | 54.70 | 55.70 | 55.70 | 55.00 |
| TiO2 | .27 | .11 | .06 | .11 | .12 | .06 |
| Al2O3 | 2.68 | 2.56 | 1.68 | 2.31 | 2.06 | 2.31 |
| Cr2O3 | 1.96 | 1.61 | 1.07 | 1.33 | 1.64 | 2.16 |
| FeO | 2.48 | 2.21 | 2.47 | 2.56 | 2.20 | 2.30 |
| MnO | .07 | .05 | .09 | .08 | .07 | .09 |
| MgO | 15.70 | 16.10 | 17.60 | 16.40 | 16.30 | 16.10 |
| CaO | 19.50 | 20.10 | 21.00 | 20.10 | 20.40 | 19.90 |
| Na2O | 2.59 | 2.20 | 1.18 | 2.01 | 2.22 | 2.17 |
| K2O | ND | ND | ND | ND | ND | ND |
| TOTAL | 100.26 | 100.05 | 99.86 | 100.61 | 100.72 | 100.10 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 | 6 | 6 | 6 |
|--------|-------|-------|-------|-------|-------|-------|
| SI | 1.983 | 1.987 | 1.980 | 1.997 | 1.997 | 1.986 |
| TI | .007 | .003 | .002 | .003 | .003 | .002 |
| AL | .114 | .109 | .072 | .098 | .087 | .093 |
| CR | .056 | .046 | .031 | .038 | .046 | .062 |
| FE2+ | .075 | .067 | .075 | .077 | .066 | .069 |
| MN | .002 | .002 | .003 | .002 | .002 | .003 |
| MG | .844 | .865 | .949 | .876 | .871 | .866 |
| CA | .753 | .777 | .815 | .772 | .784 | .776 |
| NA | .181 | .154 | .083 | .140 | .154 | .152 |
| K | | | | | | |
| SUM | 4.016 | 4.010 | 4.009 | 4.003 | 4.011 | 4.009 |

| | | | | | |
|----------|----------|----------|----------|----------|----------|
| CA 45.06 | CA 45.46 | CA 44.30 | CA 44.76 | CA 45.55 | CA 45.14 |
| Mg 50.46 | Mg 50.64 | Mg 51.64 | Mg 50.79 | Mg 50.62 | Mg 50.79 |
| FE 4.47 | FE 3.90 | FE 4.07 | FE 4.45 | FE 3.83 | FE 4.07 |

| | | | | | |
|----------|----------|----------|----------|----------|----------|
| M: 91.86 | M: 92.85 | M: 92.70 | M: 91.95 | M: 92.96 | M: 92.58 |
| C: 47.17 | C: 47.30 | C: 46.17 | C: 46.84 | C: 47.36 | C: 47.05 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|---------------|------------|---------------|
| 1 | 08053,GT.LHZ. | 6 | 08123,GT.LHZ. |
| 2 | 08063,GT.LHZ. | | |
| 3 | 08073,GT.LHZ. | | |
| 4 | 08083,GT.LHZ. | | |
| 5 | 08113,GT.LHZ. | | |

TABLE IV-16
SPINELS**COARSE PERIDOTITES -HEBRON**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SiO2 | | | | | | | | | | |
| TiO2 | .68 | .31 | .25 | .30 | .32 | .24 | .22 | .19 | .12 | ND |
| Al2O3 | 18.86 | 20.79 | 20.53 | 20.80 | 20.79 | 20.26 | 18.82 | 19.98 | 22.73 | 56.36 |
| Cr2O3 | 46.23 | 45.19 | 44.96 | 45.63 | 45.27 | 44.15 | 46.54 | 46.01 | 43.58 | 12.76 |
| FeO | 18.91 | 19.56 | 19.02 | 19.92 | 19.48 | 18.73 | 18.23 | 20.03 | 19.42 | 8.70 |
| MnO | .42 | .60 | .58 | .62 | .59 | .57 | .70 | .65 | .57 | |
| MgO | 13.58 | 13.12 | 13.05 | 12.98 | 13.16 | 12.93 | 13.65 | 13.04 | 13.33 | 21.88 |
| CaO | | | | | | | | | | |
| Na2O | | | | | | | | | | |
| K2O | | | | | | | | | | |
| TOTAL | 98.88 | 99.67 | 98.39 | 99.65 | 99.61 | 96.88 | 98.16 | 99.90 | 99.75 | 99.91 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Si | | | | | | | | | | |
| Ti | .021 | .007 | .006 | .007 | .008 | .006 | .005 | .005 | .003 | |
| Al | .706 | .770 | .769 | .771 | .770 | .771 | .710 | .742 | .833 | 1.715 |
| Cr | 1.161 | 1.123 | 1.130 | 1.120 | 1.124 | 1.126 | 1.178 | 1.147 | 1.071 | .265 |
| Fe2+ | .502 | .517 | .506 | .524 | .512 | .505 | .488 | .528 | .505 | .188 |
| Mn | .011 | .016 | .016 | .017 | .016 | .016 | .019 | .017 | .015 | |
| Mg | .643 | .614 | .618 | .609 | .616 | .622 | .651 | .613 | .618 | .842 |
| Ca | | | | | | | | | | |
| Na | | | | | | | | | | |
| K | | | | | | | | | | |
| SUM | 3.045 | 3.046 | 3.044 | 3.047 | 3.045 | 3.046 | 3.051 | 3.051 | 3.045 | 3.010 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-------------------------|------------|-----------------------------------|
| 1 | 07033,GT.LHZ.,DISCRETE | 6 | 07073,SP.5 IN CPX.4 |
| 2 | 07073,GT.LHZ.,AV. | 7 | 07083,GT.LHZ.,DISCRETE |
| 3 | 07073,SP.4 IN GT.2 | 8 | 07143,GT.LHZ.,DISCRETE |
| 4 | 07073,SP.2 IN GT.1+AMPH | 9 | 07173,GT.LHZ.,IN CPX+AMPH |
| 5 | 07073,SP.3 IN GT.1+AMPH | 10 | 07183,GT.LHZ.,IN GT KELYPHYTE RIM |

TABLE IV-16
SPINELS**COARSE PERIDOTITES -HEBRON**

| | 11 | 12 | 13 | 14 | 15 |
|-------|--------|-------|-------|-------|-------|
| SI02 | | | | | |
| TIO2 | .06 | .58 | 1.09 | .98 | 1.51 |
| AL2O3 | 10.72 | 8.99 | 4.62 | 5.01 | .60 |
| CR2O3 | 56.79 | 56.93 | 59.96 | 60.96 | 58.03 |
| FE0 | 21.22 | 19.38 | 21.79 | 18.91 | 31.52 |
| MNO | .72 | .71 | .71 | .73 | .05 |
| HGO | 11.24 | 11.84 | 10.39 | 12.09 | 7.51 |
| CAO | | .04 | | | |
| NA2O | | | | | |
| K2O | | | | | |
| TOTAL | 100.75 | 98.47 | 98.56 | 98.68 | 99.22 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 4 | 4 | 4 | 4 | 4 |
|--------|-------|-------|-------|-------|-------|
| SI | | | | | |
| TI | .001 | .015 | .028 | .025 | .041 |
| AL | .416 | .357 | .189 | .202 | .026 |
| CR | 1.478 | 1.516 | 1.646 | 1.647 | 1.672 |
| FE2+ | .584 | .546 | .633 | .540 | .761 |
| MN | .020 | .020 | .021 | .021 | .002 |
| MG | .551 | .594 | .538 | .616 | .408 |
| CA | | .001 | | | |
| NA | | | | | |
| K | | | | | |
| SUM | 3.051 | 3.049 | 3.054 | 3.051 | 3.110 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|---------------------------------|------------|-------------|
| 11 | 07023, LHZ., SP+PHL+CPX | | |
| 12 | 07043, LHZ., IN OLIVINE | | |
| 13 | 07063, LHZ., SP.1+CPX.1+PHL.1 | | |
| 14 | 07063, SP.2+PHL.2 IN CPX.3 EDGE | | |
| 15 | 07093, LHZ., DISCRETE | | |

TABLE IV-17A
 SPINEL-PORPHYROCLASTIC LHERZOLITE - HEBRON

| | 1 | 2 | 3 |
|-------|-------|-------|-------|
| SiO2 | | | |
| TiO2 | 5.45 | 3.27 | 3.51 |
| Al2O3 | 9.46 | 8.88 | 11.86 |
| Cr2O3 | 43.49 | 42.95 | 42.07 |
| FeO | 25.21 | 22.90 | 23.48 |
| MnO | .41 | .47 | .62 |
| MgO | 12.25 | 11.56 | 11.62 |
| CaO | | | |
| Na2O | | | |
| K2O | | | |
| TOTAL | 96.27 | 90.03 | 93.15 |

ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS

| OXYGEN | 4 | 4 | 4 |
|--------|-------|-------|-------|
| SI | | | |
| TI | .141 | .071 | .093 |
| AL | .384 | .386 | .492 |
| CR | 1.184 | 1.254 | 1.171 |
| FE2+ | .726 | .707 | .691 |
| MN | .012 | .015 | .018 |
| MG | .629 | .636 | .618 |
| CA | | | |
| NA | | | |
| K | | | |
| SUM | 3.075 | 3.089 | 3.076 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-------------------------|------------|-------------|
| 1 | 07103, SP.1 IN OPX RIM | | |
| 2 | 07103, SP.2 IN OPX RIM | | |
| 3 | 07103B, SP.1 IN OPX RIM | | |

TABLE IV-17B
ILMENITE AS IN TABLE IV-17A

| | 1 | 2 | 3 | 4 | 5 |
|-------|-------|-------|-------|--------|--------|
| SiO2 | ND | | | | |
| TiO2 | 55.86 | 56.19 | 55.23 | 56.46 | 54.08 |
| Al2O3 | | | | | ND |
| Cr2O3 | 2.40 | 2.46 | 2.99 | 5.87 | 8.92 |
| FeO | 27.70 | 27.95 | 26.26 | 25.63 | 25.90 |
| MnO | .21 | ND | ND | .25 | .23 |
| H2O | 13.09 | 13.13 | 12.87 | 12.20 | 11.63 |
| CaO | | | | | |
| Na2O | | | | | |
| K2O | | | | | |
| TOTAL | 99.27 | 99.74 | 98.36 | 100.41 | 100.77 |

ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS

| OXYGEN | 3 | 3 | 3 | 3 | 3 |
|--------|-------|-------|-------|-------|-------|
| SI | | | | | |
| TI | .971 | .972 | .981 | .967 | .931 |
| AL | | | | | |
| CR | .044 | .045 | .055 | .106 | .161 |
| FE2+ | .536 | .538 | .510 | .488 | .496 |
| MN | .004 | | | .005 | .004 |
| MG | .451 | .450 | .445 | .414 | .397 |
| CA | | | | | |
| NA | | | | | |
| K | | | | | |
| SUM | 2.006 | 2.005 | 1.991 | 1.980 | 1.989 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|--------------------------|------------|-------------|
| 1 | 07103B, DISCRETE ILM | | |
| 2 | 07103B, ILM1A, DISCRETE | | |
| 3 | 07103B, ILM, 2A, NEAR 1A | | |
| 4 | 07103, ILM, 2 IN OPX RIM | | |
| 5 | 07103, ILM, 3 IN OPX RIM | | |

TABLE IV-18
PHLOGOPITES** COARSE LHERZOLITES - HEBRON**

| | 1 | 2 | 3 | 4 |
|-------|-------|-------|-------|-------|
| SiO2 | 38.39 | 38.77 | 39.50 | 40.48 |
| TiO2 | .19 | 2.02 | 1.32 | 3.10 |
| Al2O3 | 17.98 | 15.63 | 15.09 | 12.25 |
| Cr2O3 | 1.66 | 2.13 | 1.87 | .44 |
| FeO | 3.55 | 3.28 | 3.05 | 5.90 |
| MnO | ND | .07 | .07 | ND |
| H2O | 23.28 | 23.63 | 24.68 | 25.20 |
| CaO | .04 | .06 | ND | .07 |
| Na2O | .36 | .40 | .94 | .16 |
| K2O | 10.08 | 9.13 | 8.96 | 9.40 |
| TOTAL | 95.54 | 95.12 | 95.51 | 97.01 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 23 | 23 | 23 | 23 |
|--------|--------|--------|--------|--------|
| SI | 5.685 | 5.752 | 5.826 | 5.948 |
| TI | .021 | .225 | .146 | .343 |
| AL | 3.138 | 2.733 | 2.623 | 2.122 |
| CR | .194 | .250 | .220 | .051 |
| FE2+ | .440 | .407 | .376 | .725 |
| MN | | .009 | .009 | |
| HG | 5.138 | 5.225 | 5.425 | 5.510 |
| CA | .006 | .010 | | .011 |
| NA | .103 | .115 | .269 | .046 |
| K | 1.904 | 1.728 | 1.686 | 1.762 |
| SUM | 16.631 | 16.453 | 16.583 | 16.527 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|--------------------------------------|------------|-------------|
| 1 | 07043, DISCRETE | | |
| 2 | 07063, PHL. 1, +CPX. 1 +SP. 1 | | |
| 3 | 07063, PHL. 2, +SP. 2 IN CPX. 3 EDGE | | |
| 4 | 07093, DISCRETE | | |

TABLE IV-19
 AMPHIROLES**COARSE PERIDOTITES - HEBRON AND OTHERS**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SiO2 | 44.69 | 45.22 | 45.40 | 44.95 | 45.50 | 45.70 | 44.50 | 54.29 | 55.60 | 54.92 |
| TiO2 | .19 | .11 | .42 | .18 | ND | ND | ND | .59 | .80 | .57 |
| Al2O3 | 12.26 | 13.14 | 11.71 | 10.87 | 11.10 | 11.10 | 11.10 | 1.24 | .44 | 1.70 |
| Cr2O3 | 2.18 | 1.98 | 1.53 | 2.40 | 1.67 | 2.10 | 2.30 | .06 | .15 | .89 |
| FeO | 3.32 | 3.41 | 3.34 | 3.00 | 3.18 | 2.64 | 2.73 | 4.31 | 4.52 | 2.31 |
| MnO | .06 | .06 | .07 | .06 | .06 | .18 | .18 | .07 | ND | ND |
| MgO | 19.79 | 19.61 | 18.96 | 19.88 | 20.22 | 20.20 | 20.40 | 21.16 | 21.43 | 22.52 |
| CaO | 10.37 | 11.10 | 9.85 | 11.00 | 10.60 | 11.10 | 10.00 | 7.12 | 5.01 | 6.70 |
| Na2O | 3.29 | 2.48 | 4.31 | 3.64 | 3.79 | 3.20 | 3.26 | 3.24 | 4.04 | 3.84 |
| K2O | 1.41 | 1.17 | 1.20 | 1.34 | .60 | 1.34 | 1.34 | 4.72 | 4.88 | 4.61 |
| NiO | | | | | .10 | .35 | .35 | | | |
| TOTAL | 97.56 | 98.28 | 96.79 | 97.32 | 96.83 | 97.92 | 96.97 | 96.80 | 96.96 | 98.07 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| SI | 6.367 | 6.367 | 6.504 | 6.438 | 6.502 | 6.483 | 6.394 | 7.770 | 7.913 | 7.677 |
| TI | .020 | .012 | .045 | .019 | | | | .064 | .094 | .060 |
| AL | 2.059 | 2.181 | 1.977 | 1.835 | 1.870 | 1.856 | 1.880 | .209 | .074 | .281 |
| CR | .246 | .220 | .173 | .272 | .189 | .236 | .261 | .007 | .017 | .099 |
| FE2+ | .396 | .402 | .400 | .359 | .380 | .313 | .328 | .516 | .538 | .271 |
| MN | .007 | .007 | .008 | .007 | .007 | .022 | .022 | .008 | | |
| MG | 4.282 | 4.115 | 4.048 | 4.243 | 4.306 | 4.271 | 4.368 | 4.513 | 4.545 | 4.704 |
| CA | 1.583 | 1.675 | 1.512 | 1.688 | 1.623 | 1.687 | 1.663 | 1.092 | .764 | 1.006 |
| NA | .909 | .677 | 1.197 | 1.011 | 1.050 | .880 | .908 | .899 | 1.115 | 1.044 |
| K | .256 | .210 | .219 | .245 | .109 | .243 | .246 | .862 | .886 | .824 |
| NI | | | | | .011 | .040 | .040 | | | |
| SUM | 16.044 | 15.865 | 16.084 | 16.117 | 16.048 | 16.031 | 16.111 | 15.939 | 15.948 | 15.987 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-----------------------------|------------|----------------------------------|
| 1 | 07073,GT.LHZ. | 6 | IN HTZ,BD1368,DAWSON+SMITH(1975) |
| 2 | 07173,GT.LHZ. | 7 | IN HTZ,BD1368,DAWSON+SMITH(1975) |
| 3 | 07183,GT.LHZ. | 8 | K-RICHTERITE,TYPE A,ERLANK(1973) |
| 4 | 07043,LHZ. | 9 | K-RICHTERITE,TYPE B,ERLANK(1973) |
| 5 | IN HTZ,WESSELTON-BOYD(1971) | 10 | K-RICHTERITE,TYPE C,ERLANK(1973) |

TABLE IV-20: SITE OCCUPANCY IN PERIDOTITE AMPHIBOLES
(SEE TABLE IV-19), BASED ON 23 OXYGENS AND
AFTER PAPIKE ET AL., 1974.

| SAMPLE NO. | 07073 | 07173 | 07183 | 07043 | RICHTERITE |
|------------|-------|-------|-------|-------|------------|
| SI | 6.37 | 6.37 | 6.50 | 6.44 | 7.47 |
| AL-IV | 1.63 | 1.63 | 1.50 | 1.56 | .53 |
| TETR. | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 |
| AL-VI | .43 | .55 | .48 | .28 | .13 |
| TI | .02 | .01 | .05 | .02 | .01 |
| MG | 3.92 | 3.84 | 3.93 | 3.07 | 4.45 |
| FE | .37 | .37 | .36 | .35 | .28 |
| MN | .01 | .01 | .01 | .01 | |
| CR | .25 | .22 | .17 | .27 | .13 |
| M1,2,3 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| MG | .28 | .28 | .12 | .17 | .20 |
| FE | .03 | .03 | .04 | .14 | .01 |
| CA | 1.58 | 1.68 | 1.51 | 1.69 | 1.04 |
| NA | .11 | .01 | .33 | | .75 |
| M4 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| NA | .80 | .67 | .87 | 1.01 | .58 |
| K | .26 | .21 | .22 | .25 | .42 |
| A | 1.06 | .88 | 1.09 | 1.26 | 1.00 |

WHERE SITES ARE TETR. =TETRAHEDRAL
M1,2,3,4=OCTAHEDRAL
A =12-FOLD ALKALI SITE

CALCULATION OF ENDMEMBERS

| | | | | | |
|---------|---------|------|------|------|------------|
| A | 54.9 | 51.8 | 54.5 | 61.8 | 61.4 |
| B | 42.5 | 47.9 | 37.5 | 38.2 | 16.0 |
| C | 2.6 | .3 | 8.0 | | 22.6 |
| %OTHERS | 54.9 | 51.8 | 54.5 | 61.8 | 61.4 |
| %QUAD | 45.1 | 48.2 | 45.5 | 38.2 | 38.6 |
| NAME | EDENITE | | | | RICHTERITE |

WHERE
A = (NA+K) IN A SITE
B = (AL-IV)*0.5 IN TETR. SITE
C = (NA IN M4 SITE)*0.5
OTHERS=A+B+C
QUAD =100-OTHERS

RICHTERITE IS FROM ERLANK+RICKARD(1977, TABLE 1, NO.1)

TABLE IV-21: RANGES IN 100*(MG/MG+FE) RATIOS OF MINERALS FROM LHERZOLITE XENOLITHS AT THE FOLLOWING KIMBERLITE LOCALITIES.

| | COARSE TEXTURE ----- | DEFORMED TEXTURE ----- |
|--------------------------------|-------------------------|---------------------------|
| GARNETS ----- | | |
| MATSOKU | 69.8-85.6 | 83.4-78.4 |
| BULTFONTEIN | 78.1-85.0 | 86.6-80.9 |
| THABA PUTSOA | 83.0-85.9 | 85.6-72.2 |
| PREMIER | 82.8-86.7 | 86.0-81.1 |
| HEBRON | 81.0-83.7 | |
| MELTON WOLD | 81.5-82.6 | |
| OLIVINES ----- | | |
| MATSOKU | 83.4-92.3 | 92.6-89.0 |
| BULTFONTEIN | 89.3-93.4 | 94.6-89.0 |
| THABA PUTSOA | 91.9-93.6 | 91.8-84.2 |
| HEBRON | 89.1-92.4 | 91.3-87.3 (07103) |
| ORTHOPYROXENES ----- | | |
| MATSOKU | 85.8-94.0 | 93.2-91.0 |
| BULTFONTEIN | 90.8-94.3 | 95.2-91.9 |
| THABA PUTSOA | 93.2-94.2 | 92.8-87.2 |
| PREMIER | 92.7-94.0 | 93.3-89.9 |
| HEBRON | 89.2-93.2 | 92.4-87.1 (07103) |
| MELTON WOLD | 92.3-93.2 | |
| CLINOPYROXENES ----- | | |
| MATSOKU | 84.2-92.3 | 91.9-90.9 |
| BULTFONTEIN | 88.6-94.0 | 94.9-87.9 |
| THABA PUTSOA | 93.2-95.4 | 92.2-86.1 |
| PREMIER | 91.0-95.4 | 93.0-88.4 |
| HEBRON | 92.0-93.7 | 92.9-89.1 (07103) |
| MELTON WOLD | 91.9-93.0 | |

TABLE IV-22: EQUILIBRIUM TEMPERATURE (CELCIUS) ESTIMATES FOR PERIDOTITE XENOLITHS FROM HEBRON AND MELTON WOLD.

| SAMPLE NO. | (1) C/C+M | (2) L+D | (3) WELL | (4) WELL | (5) AV. WELL | (6) D+B | (6) W+B | (7) E+G LN KD | (8) X CA/GT |
|-------------|--------------|------------|-------------|-------------|--------------------|------------|------------|---------------------|----------------|
| HEBRON | | | | | | | | | |
| 07033 | 47.04 | 825 | 882 | 872 | 877 | 973 | 1000 | .9887 | .1326 |
| 07053 | 47.63 | OCL | 790 | 779 | 784 | 951 | 918 | NO GARNET | |
| 07073 | 48.36 | OCL | 788 | 782 | 785 | 923 | 914 | 1.135 | .1380 |
| 07143 | 48.82 | OCL | 821 | 814 | 818 | 904 | 943 | 1.059 | .1325 |
| 07163 | 48.59 | OCL | 886 | 878 | 882 | 914 | 1003 | 1.023 | .1358 |
| 07173 | 47.64 | OCL | 950 | 951 | 951 | 950 | 1050 | 1.240 | .1411 |
| 07183 | 47.48 | OCL | 856 | 845 | 851 | 956 | 972 | 1.212 | .1240 |
| 07063 | 47.89 | OCL | 761 | 757 | 759 | 941 | 889 | NO GARNET | |
| 07093 | 51.29 | OCL | 1060 | 1061 | 1061 | OCL | 1138 | NO GARNET | |
| MELTON WOLD | | | | | | | | | |
| 08053 | 47.15 | 810 | 880 | 869 | 874 | 969 | 1001 | .9208 | .1258 |
| 08063 | 47.29 | 800 | 984 | 992 | 999 | 964 | 1013 | 1.013 | .1257 |
| 08073 | 46.12 | 937 | 984 | 979 | 982 | 1007 | 1093 | .9997 | .1397 |
| 08083 | 46.79 | 865 | 941 | 931 | 936 | 982 | 1054 | .9333 | .1253 |
| 08113 | 47.36 | OCL | 878 | 869 | 873 | 961 | 1004 | 1.020 | .1450 |
| 08123 | 47.05 | 825 | 914 | 905 | 910 | 973 | 1034 | 1.046 | .1526 |

WHERE

- C/C+MG = 100 * (CA/CA+MG) MOLE % IN CLINOPYROXENE
- (1) = LINDSLEY+DIXON, 1976: 20 KB DATA : FOR CPX WITH C/C+MG > 47 < 47.5 USING A COMBINATION OF 20 AND 15 KB DATA. THE TEMPERATURES ARE UNCORRECTED FOR PRESSURE EFFECTS. TEMPERATURES WERE ESTIMATED GRAPHICALLY.
- (2) = WELLS, 1977: AL IS ASSUMED TO BE EQUALLY DIVIDED BETWEEN THE M1 OCTAHEDRAL AND THE TETRAHEDRAL SITES: M2=CA+NA+MN/2, M1=TI+CR+MN/2+AL/2, FE AND MG ARE RANDOMLY DISTRIBUTED BETWEEN THE M1 AND M2 SITES AND THE ACTIVITIES OF MgSiO3 IN THE PYROXENES ARE CALCULATED ACCORDING TO EQ. 24, 25 OF WOOD+BANNO, 1973. ALL FE IS ASSUMED DIVALENT.
- (3) = WELLS, 1977: WHERE CHARGE BALANCING IN THE FOLLOWING ORDER IS ASSUMED - NATIALSiO6, NACRSi2O6, M2+CRALSiO6, NAALSiO6, M2+AL2SiO6. THE REMAINING ASSUMPTIONS ARE AS IN (2).
- (4) = AVERAGE WELLS, 1977 CALCULATED AS AVERAGE OF (3) AND (2).
- (5) = DAVIS+BOYD, 1966: THE FOLLOWING EQ. WAS FITTED TO THE 30 KB DATA. TEMPERATURE (CELCIUS) = 1173.551 + (2871.756 * C) - (7011.628 * C * C), WHERE C = CA/CA+MG MOLE RATIO OF CLINOPYROXENE.
- (6) = WOOD+BANNO, 1973: THE TEMPERATURE IS THE AVERAGE AFTER ASSIGNING ELEMENTS TO SITES AS OUTLINED IN (1) AND (2).
- (7) = ELLIS+GREEN, 1979:
$$KD = \frac{FE/MG (GT)}{FE/MG (CPX)}$$
- (8) =
$$X CA/GT = \text{MOLE FRACTION IN GARNET} = \frac{CA}{CA+MG+FE+MN}$$
- OCL = OUTSIDE THE EXPERIMENTAL LIMITS OF LINDSLEY+DIXON, 1976.

TABLE IV-23: EQUILIBRIUM PRESSURE (KB) ESTIMATES FOR PERIDOTITES FROM HEBRON AND MELTON WOLD.

| SAMPLE NO. | MACGREGOR | | | WOOD | | WOOD AKELLA | | WT % AL2O3 IN OPX |
|-------------|------------|------------|------------|------------|------------|-------------|------------|----------------------|
| | T=1 P=1 | T=4 P=2 | T=5 P=3 | T=1 P=4 | T=4 P=5 | T=4 P=6 | T=4 P=7 | |
| HEBRON | | | | | | | | |
| 07033 | 25 | 28 | 33 | 17 | 20 | 23 | 30 | 1.69 |
| 07073 | | 24 | 32 | | 16 | 17 | 28 | 1.59 |
| 07143 | | 25 | 30 | | 17 | 18 | 28 | 1.64 |
| 07163 | | 29 | 31 | | 20 | 22 | 32 | 1.64 |
| 07173 | | 31 | 32 | | 23 | 24 | 34 | 1.70 |
| 07183 | | 28 | 33 | | 21 | 21 | 31 | 1.49 |
| MELTON WOLD | | | | | | | | |
| 08053 | 34 | 39 | 45 | 26 | 30 | 32 | 39 | .71 |
| 08063 | 34 | 40 | 45 | 26 | 31 | 34 | 40 | .71 |
| 08073 | 39 | 42 | 43 | 29 | 31 | 31 | 43 | .94 |
| 08083 | 38 | 43 | 46 | 30 | 34 | 35 | 43 | .72 |
| 08113 | 33 | 40 | 43 | 24 | 39 | 32 | 39 | .67 |
| 08123 | 35 | 41 | 45 | 24 | 29 | 31 | 41 | .71 |

WHERE

T1,4,5
P1,2,3

=TEMPERATURE ESTIMATES AS IN TABLE IV-22.
=PRESSURES ESTIMATED AT T1,4,5 USING THE AL2O3 WT. % CONTENT OF ORTHOPYROXENES COEXISTING WITH GARNET AS OUTLINED BY MACGREGOR, 1974. AL2O3 WT. % ISOPLETHS BETWEEN 0.5-1.5 WT.% WERE CALCULATED BY FRASER (PERS.COMM.) FROM MACGREGOR'S DATA

P4,5

=PRESSURES ESTIMATED AT T1,4 USING EQ.12 OF WOOD, 1974. FE AND CR CORRECTIONS ARE APPLIED AND AL IS ASSUMED TO BE EQUALLY DIVIDED BETWEEN THE M1 AND TETRAHEDRAL SITES IN ORTHOPYROXENE (SEE TABLE IV-22, (2)).

P6

=PRESSURES ESTIMATED USING WOOD'S (1974) METHOD, CALCULATING THE AMOUNT OF AL IN THE OPX M1 SITE AFTER CHARGE BALANCING IN THE ORDER OUTLINED IN TABLE IV-22, (3).

P7

=PRESSURES ESTIMATED FROM THE ISOPLETH DATA OF AKELLA, 1976 IN THE SYSTEM CMAS. AL2O3 ISOPLETHS <1.4 WT.% WERE GRAPHICALLY EXTRAPOLATED.

TABLE IV-24: TEMPERATURES CALCULATED FOR CLINOPYROXENES
IN THE PORPHYROCLASTIC LHERZOLITE (D7103)
FROM HEBRON.

| CA/CA+MG AT.% CPX | L+D 1 | D+B 2 | AVERAGE WELLS 3 |
|----------------------|----------|----------|-----------------------|
| .4808 | OCL | 933 | |
| .4795 | OCL | 938 | |
| .4744 | OCL | 958 | 848 |
| .4725 | 800 | 965 | 885 |
| .4706 | 825 | 972 | |
| .4386 | 1100 | 1084 | |
| .4360 | 1115 | 1092 | 1079 |

TEMPS IN CELCIUS WHERE

1-LINDSLEY+DIXON(1976), 20KB EXPERIMENTAL DATA,
ASSUMPTIONS AS IN TABLE IV-22.

2-DAVIS+BOYD(1966), AS IN TABLE IV-22.

3-AVERAGE WELLS(1977), AS IN TABLE IV-22.

TABLE V-1: PRIMARY MINERALOGY OF ECLOGITIC XENOLITHS FROM LOVEDALE

| NO. | GT | CPX | RUT | AP | AMPH | OPX | KY | QTZ | K-SP | PHL(1) |
|-------------------|----|-----|-----|----|------|-----|----|-----|------|--------|
| ECLOGITES | | | | | | | | | | |
| 02023 | * | * | | | | | | | | * |
| 02-1 | * | * | | | | | | | | |
| 02063 | * | * | | | | | | | | |
| 02073 | * | * | | | | | | | | |
| 02233 | * | * | | | | | | | | |
| 02313 | * | * | | | | | | | | |
| 02353 | * | * | | | | | | | | |
| 02423 | * | * | | | | | | | | |
| 02443 | * | * | | | | | | | | |
| 02483 | * | * | | | | | | | | |
| 02513 | * | * | | | | | | | | |
| 02523 | * | * | | | | | | | | |
| 02-2 | * | * | * | | | | | | | |
| 02083 | * | * | * | | | | | | | * |
| 02093 | * | * | * | | | | | | | * |
| 02103 | * | * | * | | | | | | | * |
| 02433 | * | * | * | | | | | | | |
| 02203 | * | * | * | | | | | | | |
| 02413 | * | * | * | * | | | | | | |
| 02043 | * | * | * | | | | | | | * |
| 02123 | * | * | | | * | * | | | | |
| KYANITE ECLOGITES | | | | | | | | | | |
| 02173 | * | * | | | | | * | | | |
| 02403 | * | * | | | | | * | | | |
| 02473 | * | * | | | | | * | | | |
| 02503 | * | * | | | | | * | | | |
| 02133 | * | * | * | | | | * | | | |
| 02143 | * | * | | | | | * | * | | |
| 02153 | * | * | | | | | * | * | | |
| 02213 | * | * | | | | | * | * | | |
| 02333 | * | * | | | | | * | * | | |
| 02453 | * | * | | | | | * | * | * | |
| 02463 | * | * | | | | | * | * | * | |

WHERE

- (1) = PRIMARY METASOMATIC PHLOGOPITE SUSPECTED
- GT = GARNET
- CPX = CLINOPYROXENE
- RUT = RUTILE
- AP = APATITE
- AMPH = AMPHIBOLE
- OPX = ORTHOPYROXENE
- KY = KYANITE
- QTZ = QUARTZ
- K-SP = K-FELDSPAR
- PHL = PHLOGOPITE
- * = MINERAL PRESENT IN THIN SECTION
- BLANK = MINERAL ABSENT

TABLE V-2: SUMMARY OF PRIMARY TEXTURES IN ECLOGITES AND KYANITE ECLOGITES FROM LOVEDALE (LOVE), ROODEKRAAL (ROOD), JACHTFONTEIN (JACH) AND MARKT (MARK)

| TEXTURE | LOVE | | ROOD | | JACH | | MARK |
|----------------------|------|-------|------|-------|------|-------|------|
| | EC | KY EC | EC | KY EC | EC | KY EC | EC |
| CG | 3 | | | | | | |
| MG | | | | | | | 1 |
| CGB | 12 | 3 | 3 | 1 | 6 | | 3 |
| MGB | 2 | | 2 | | | | |
| CMGB | 2 | 1 | | | | | 1 |
| MMGB | 2 | 6 | 1 | | 2 | 1 | |
| FMGB | | 1 | | 1 | | | 1 |
| C BAND | 11 | 1 | 2 | 1 | 7 | | 1 |
| F BAND | 1 | 5 | 1 | 1 | 1 | | |
| MASSIVE | 9 | 5 | 3 | | | 1 | 5 |
| FOLIATION | | 6 | | 1 | | 1 | |
| GLASS IN | 3 | | | | | 1 | |
| SECONDARY ASSEMBLAGE | | | | | | | |
| N = | 21 | 11 | 6 | 2 | 8 | 1 | 6 |
| TOTAL= | 55 | | | | | | |

WHERE

EC = ECLOGITE
 KY EC = KYANITE ECLOGITE
 CG = COARSE - GRAINED GRANULAR TEXTURE
 MG = MEDIUM - " " "
 CGB = COARSE - " GRANULOBLASTIC TEXTURE
 MGB = MEDIUM - " " "
 CMGB = COARSE - " MOSAIC GRANULOBLASTIC TEXTURE
 MMGB = MEDIUM = " " " "
 FMGB = FINE - " " " "
 C BAND = COARSE BANDING (SEE TEXT)
 F BAND = FINE BANDING "

TABLE V-3: PRIMARY MINERALOGY OF ECLOGITIC XENOLITHS FROM
 ROODEKRAAL, JACHTFONTEIN, MARKT, LEUWEFONTEIN,
 SWEETPUT, LEYFONTEIN, UINTJIESBERG AND LEKKERFONTEIN.

| LOCALITY+NO. | GT | CPX | RUT | AP | KY | QTZ | K-SP |
|---------------|----|-----|-----|----|----|-----|------|
| ROODEKRAAL | * | * | | | | | |
| 42043 | * | * | | | | | |
| 42543 | * | * | | | | | |
| 42073 | * | * | * | | | | |
| 42163 | * | * | * | | | | |
| 42533 | * | * | * | * | | | |
| 42203 | * | * | * | | | * | |
| 42213 | * | * | * | | * | * | |
| 42313 | * | * | * | | * | * | |
| JACHTFONTEIN | | | | | | | |
| 20093 | * | * | * | | | | |
| 20113 | * | * | * | | | | |
| 20163 | * | * | * | | | | |
| 20223 | * | * | * | | | | |
| 20253 | * | * | * | | | | |
| 20263 | * | * | * | | | | |
| 20273 | * | * | * | | | | |
| 20323 | * | * | * | | | | |
| 20373 | * | * | | | * | | |
| MARKT | | | | | | | |
| 10043 | * | * | | | | | |
| 10053 | * | * | | | | | |
| 10063 | * | * | * | | | | * |
| 12093 | * | * | | | | | |
| 12113 | * | * | | | | | |
| 12123 | * | * | * | | | | |
| LEKKERFONTEIN | | | | | | | |
| 33043 | * | ? | | | | | |
| 33103 | * | ? | | | | | |
| LEUWEFONTEIN | | | | | | | |
| 26043 | * | * | * | | | | |
| SWEETPUT | | | | | | | |
| 03-1 | * | * | * | | | | |
| LEYFONTEIN | | | | | | | |
| 01-1 | * | * | | | | | |
| UINTJIESBERG | | | | | | | |
| 09123 | * | * | * | * | | | |

WHERE MINERAL ABBREVIATIONS ARE AS IN TABLE V-1.
 ?=CPX SUSPECTED BUT NOW TOTALLY REPLACED BY CALCITE.

TABLE V-4: TEXTURES OF THE GARNET GRANULITES (GT GRAN) AND KYANITE GARNET GRANULITES (KY GT GRAN).

| TEXTURE | GT GRAN | KY GT GRAN |
|---------------------------------|---------|------------|
| CG | 3 | |
| MG | 1 | |
| CGB | | 2 |
| MGB | 10 | 2 |
| FGB | 2 | 2 |
| MMGB | | 2 |
| FMGB | | 2 |
| COARSE BANDING | 5 | 5 |
| FINE BANDING | 1 | 2 |
| MASSIVE | 10 | 3 |
| FOLIATIONS | 5 | 6 |
| EXSOLUTION | 1 | |
| REACTION TEXTURES (SEE TEXT) | 2 | 7 |
| N = | 16 | 10 |
| TOTAL=26 | | |

FOR TEXTURAL ABBREVIATIONS SEE TABLE V-2

ALSO, FGB = FINE-GRAINED GRANULOBlastic TEXTURE

TABLE V-5: PETROGRAPHIC MODES FOR SOME TYPICAL GARNET GRANULITES.

| NO. | GT | CPX | PLAG | RUT | AP | SCAP | AMPH | OPAQ | OPX |
|-------|------|------|------|-----|-----|------|------|------|-----|
| H5-1 | 43.6 | 17.3 | 35.8 | 1.4 | 1.3 | | | | |
| H5-2 | 36.5 | 30.8 | 18.8 | 2.6 | .8 | .6 | 9.9 | | |
| D6-2 | 15.9 | 21.0 | 56.5 | .2 | 1.6 | | 2.4 | 2.4 | |
| 07403 | 29.4 | 13.5 | 43.4 | .8 | .8 | 9.5 | 1.4 | 1.1 | |
| 11-1 | 13.7 | 11.8 | 72.8 | .2 | .2 | | | 1.3 | |
| 12133 | 22.4 | 32.4 | 45.0 | .2 | | | | | |
| 25023 | 20.0 | 24.0 | 55.9 | .1 | | | | | |
| 30-1 | 18.9 | 39.3 | 41.8 | | | | | | |
| 33023 | .7 | 5.9 | 65.4 | | .1 | | 24.1 | | 3.8 |

WHERE MINERAL ABBREVIATIONS ARE AS TABLE V-1

ALSO PLAG = PLAGIOCLASE

SCAP = SCAPOLITE

OPAQ = OPAQUE OXIDE

MODES WERE CALCULATED ON POINT COUNTS >500<1000

FOR LOCALITY CODE SEE TABLE V-6

TABLE V-6: PRIMARY MINERALOGY OF GARNET GRANULITES AND KYANITE
GARNET GRANULITES FROM DIFFERENT LOCALITIES.

| NO. | GT | CPX | PLAG | RUT | AP | SCAP | KY | QTZ | OPAQ | OPX | AMPH | REACTION |
|---------------------------|----|-----|------|-----|----|------|----|-----|------|-----|------|----------|
| GARNET GRANULITES | | | | | | | | | | | | |
| 30-1 | * | * | * | | | | | | | | | |
| 06-1 | * | * | * | * | | | | | | | | |
| 12133 | * | * | * | * | | | | | | | | |
| 25023 | * | * | * | * | | | | | | | | |
| 07413 | * | * | * | * | | | | | | | | |
| 33013 | * | * | * | | | | | | * | | | |
| 06043 | * | * | * | * | | * | | | | | | |
| 42303 | * | * | * | * | | | | * | | | | #1,4 |
| 11-1 | * | * | * | * | * | | | | * | | | |
| H5-1 | * | * | * | * | * | | | | | | * | |
| 33023 | * | * | * | | * | | | | | * | * | #1,2 |
| H5-2 | * | * | * | * | * | * | | | | | * | |
| 06-2 | * | * | * | * | * | | | | * | | * | |
| 09153 | * | * | * | * | * | | | | * | | * | |
| 07403 | * | * | * | * | * | * | | | * | | * | |
| 09133 | * | * | * | * | * | * | | | * | | * | |
| KYANITE GARNET GRANULITES | | | | | | | | | | | | |
| 02223 | * | * | * | | | | * | | | | | #9 |
| 02243 | * | * | * | | | | * | | | | | #9 |
| 02273 | * | * | * | | | | * | | | | | #9 |
| 02323 | * | * | * | | | | * | | | | | #9 |
| 02343 | * | * | * | | | | * | | | | | #9 |
| 02493 | * | * | * | | | | * | | | | | |
| 02263 | * | * | * | | | * | * | | | | | #9 |
| 02363 | * | * | ? | | | ? | * | | | | * | |
| 12133A | * | * | * | * | | | * | * | | | | #9,10 |
| 04-1 | * | * | * | * | | * | * | | | * | | #6,7,8 |

LOCALITY CODE

02=LOVEDALE

04=VETLAAGTE

06=CORDAATSKUIL

H5=HEBRON NO.1

07=HEBRON NO.2

09=UINTJIESBERG

11=KALKPUT

12=MARKT NO.2

25=WINDHOEK, SOUTH BLOW

30=GOEDEHOOP, GHII

33=LEKKERFONTEIN

42=ROODEKRAAL

REACTION=# IDENTIFIES THE REACTIONS DISCUSSED IN V.2.1.6 (SEE
TEXT)

MINERAL ABBREVIATIONS ARE AS IN TABLES V-1,4

? =MINERAL IDENTIFICATION NOT POSITIVE

TABLE V-7
GARNETS ** ECLOGITES - LOVEDALE **

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|-------|-------|-------|--------|-------|--------|--------|--------|--------|--------|
| SiO2 | 39.89 | 39.78 | 39.91 | 39.35 | 39.17 | 39.94 | 39.56 | 39.33 | 39.08 | 39.21 |
| TiO2 | .11 | .13 | .12 | .20 | .17 | .14 | .21 | .17 | .18 | .17 |
| Al2O3 | 22.81 | 22.87 | 22.86 | 22.55 | 22.74 | 22.84 | 22.65 | 22.71 | 22.36 | 22.53 |
| Cr2O3 | .07 | .08 | .08 | ND | ND | ND | ND | ND | .06 | .05 |
| FeO | 14.78 | 14.63 | 14.67 | 17.66 | 19.10 | 19.86 | 19.61 | 19.73 | 22.27 | 20.65 |
| MnO | .25 | .28 | .27 | .57 | .60 | .55 | .57 | .56 | .61 | .80 |
| MgO | 11.12 | 11.10 | 11.13 | 10.74 | 10.60 | 9.74 | 10.92 | 10.48 | 7.83 | 11.43 |
| CaO | 10.90 | 9.95 | 10.27 | 6.66 | 7.26 | 7.36 | 6.52 | 7.07 | 5.38 | 5.96 |
| Na2O | .07 | .05 | .05 | .10 | .07 | .07 | .09 | .08 | .06 | .06 |
| K2O | | | | | | | | | | |
| TOTAL | 79.91 | 78.87 | 79.26 | 100.04 | 99.72 | 100.41 | 100.08 | 100.16 | 100.33 | 100.26 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SI | 2.965 | 2.983 | 2.977 | 2.963 | 2.957 | 2.991 | 2.970 | 2.962 | 2.965 | 2.958 |
| TI | .006 | .007 | .007 | .011 | .010 | .008 | .012 | .010 | .010 | .010 |
| AL | 2.003 | 2.022 | 2.015 | 2.002 | 2.024 | 2.021 | 2.007 | 2.016 | 1.999 | 1.998 |
| CR | .004 | .005 | .005 | | | | | | .004 | .003 |
| FE2+ | .921 | .918 | .918 | 1.238 | 1.206 | 1.247 | 1.233 | 1.243 | 1.413 | 1.262 |
| MN | .016 | .018 | .017 | .036 | .038 | .035 | .036 | .036 | .039 | .051 |
| MG | 1.235 | 1.241 | 1.241 | 1.228 | 1.193 | 1.090 | 1.224 | 1.176 | 1.111 | 1.282 |
| CA | .870 | .800 | .823 | .537 | .587 | .592 | .525 | .570 | .478 | .480 |
| NA | .010 | .007 | .007 | .015 | .010 | .010 | .013 | .012 | .007 | .009 |
| K | | | | | | | | | | |
| SUM | 8.030 | 8.000 | 8.010 | 8.631 | 8.026 | 7.995 | 8.021 | 8.026 | 8.028 | 8.044 |

| | | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| CA 28.76 | CA 27.03 | CA 27.61 | CA 17.89 | CA 19.67 | CA 20.22 | CA 17.61 | CA 19.88 | CA 15.92 | CA 15.89 |
| MG 40.81 | MG 41.94 | MG 41.61 | MG 40.88 | MG 39.94 | MG 37.21 | MG 41.03 | MG 39.35 | MG 37.02 | MG 42.39 |
| FE 30.44 | FE 31.02 | FE 30.78 | FE 41.23 | FE 40.39 | FE 42.58 | FE 41.35 | FE 41.57 | FE 47.06 | FE 41.72 |
| M: 57.28 | M: 57.48 | M: 57.48 | M: 49.79 | M: 49.72 | M: 46.64 | M: 49.81 | M: 48.63 | M: 44.63 | M: 50.39 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|------------------|------------|-------------------|
| 1 | 02-1,GT.2 CENTER | 6 | 02-2,GT.2 CENTER |
| 2 | 02-1,GT.2 EDGE | 7 | 02-2,GT.2 EDGE |
| 3 | 02-1,AV. OF 3 | 8 | 02-2,AV. OF 6 |
| 4 | 02-2,GT.1 CENTER | 9 | 02023,GT.4 CENTER |
| 5 | 02-2,GT.1 EDGE | 10 | 02023,GT.4 EDGE |

TABLE V-7
GARNETS ** ECLOGITES - LOVEDALE **

| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|-------|--------|--------|--------|--------|--------|--------|--------|-------|--------|-------|
| SI02 | 38.98 | 40.15 | 39.39 | 39.48 | 40.35 | 39.60 | 39.36 | 39.96 | 38.84 | 38.98 |
| TI02 | .17 | .26 | .17 | .18 | .22 | .15 | .14 | .06 | .11 | .25 |
| AL2O3 | 22.47 | 22.85 | 22.47 | 22.66 | 22.92 | 22.86 | 22.95 | 23.02 | 22.39 | 22.35 |
| CR2O3 | .08 | .05 | .08 | .05 | .05 | ND | ND | .10 | ND | .09 |
| FE0 | 22.01 | 19.80 | 21.68 | 20.26 | 17.91 | 19.32 | 18.47 | 15.38 | 23.10 | 20.21 |
| MNO | .67 | .58 | .60 | .59 | .51 | .47 | .36 | .30 | .46 | .49 |
| MGO | 10.07 | 12.05 | 10.17 | 11.17 | 13.17 | 12.05 | 10.11 | 13.22 | 8.30 | 10.36 |
| CAO | 5.93 | 5.51 | 5.85 | 5.84 | 5.63 | 5.67 | 7.24 | 7.57 | 7.16 | 6.71 |
| NA2O | .04 | .07 | .06 | .05 | .09 | .06 | .04 | ND | .04 | .04 |
| K2O | | | | | | | | | | |
| TOTAL | 100.42 | 101.32 | 100.47 | 100.22 | 100.85 | 100.19 | 100.70 | 99.63 | 100.43 | 99.48 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SI | 2.953 | 2.972 | 2.973 | 2.968 | 2.975 | 2.961 | 2.946 | 2.964 | 2.964 | 2.962 |
| TI | .010 | .014 | .010 | .010 | .012 | .008 | .008 | .003 | .006 | .014 |
| AL | 2.006 | 1.993 | 1.999 | 2.002 | 1.992 | 2.015 | 2.025 | 2.013 | 2.014 | 2.002 |
| CR | .005 | .003 | .005 | .003 | .003 | | | .006 | | .005 |
| FE2+ | 1.394 | 1.226 | 1.369 | 1.274 | 1.104 | 1.208 | 1.156 | .954 | 1.474 | 1.284 |
| MN | .043 | .036 | .038 | .038 | .032 | .030 | .023 | .019 | .030 | .032 |
| MG | 1.137 | 1.329 | 1.144 | 1.251 | 1.447 | 1.343 | 1.128 | 1.461 | .944 | 1.173 |
| CA | .481 | .437 | .473 | .470 | .445 | .454 | .741 | .602 | .585 | .546 |
| NA | .006 | .010 | .009 | .007 | .013 | .009 | .006 | | .006 | .006 |
| K | | | | | | | | | | |
| SUM | 8.035 | 8.021 | 8.020 | 8.023 | 8.022 | 8.028 | 8.035 | 8.025 | 8.025 | 8.024 |
| CA | 15.98 | 14.61 | 15.85 | 15.70 | 14.84 | 15.12 | 24.50 | 19.94 | 19.49 | 18.19 |
| MG | 37.74 | 44.43 | 38.32 | 41.78 | 48.30 | 44.68 | 37.28 | 48.44 | 31.43 | 39.06 |
| FE | 46.29 | 40.97 | 45.84 | 42.52 | 36.86 | 40.20 | 38.22 | 31.62 | 49.88 | 42.76 |
| H: | 44.91 | 52.03 | 45.53 | 49.56 | 56.72 | 52.64 | 49.38 | 60.50 | 39.03 | 47.74 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|----------------------|------------|----------------|
| 11 | 02023,GT.2 ADJ. CPX9 | 16 | 02063,AV. OF 3 |
| 12 | 02023,GT.3 EDGE | 17 | 02073,AV. OF 3 |
| 13 | 02023,GT.7 CENTER | 18 | 02083,AV. OF 4 |
| 14 | 02023,GT.7 EDGE | 19 | 02093,AV. OF 5 |
| 15 | 02043,AV. OF 2 | 20 | 02103,AV. OF 3 |

TABLE V-7
GARNETS ** ECLOGITES - LOVEDALE **

| | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|-------|--------|--------|--------|-------|-------|--------|--------|--------|--------|--------|
| SiO2 | 40.00 | 41.97 | 39.87 | 40.48 | 38.19 | 39.33 | 39.19 | 39.72 | 39.58 | 39.66 |
| TiO2 | .09 | ND | .08 | .09 | .12 | .14 | .06 | .14 | .17 | .14 |
| Al2O3 | 22.69 | 23.86 | 22.15 | 23.37 | 21.67 | 22.68 | 22.71 | 22.63 | 22.50 | 22.57 |
| Cr2O3 | ND | .12 | ND | .05 | ND | ND | ND | .11 | .05 | .08 |
| FeO | 17.42 | 18.29 | 24.58 | 11.94 | 23.46 | 20.46 | 19.95 | 18.22 | 19.21 | 19.78 |
| MnO | .42 | .23 | .07 | .23 | .54 | .44 | 1.25 | .48 | .48 | .47 |
| MgO | 10.52 | 19.18 | 8.05 | 14.15 | 7.06 | 9.25 | 11.61 | 10.27 | 10.63 | 10.46 |
| CaO | 9.26 | 4.71 | 6.72 | 8.64 | 8.35 | 8.33 | 5.74 | 9.06 | 8.55 | 8.26 |
| Na2O | ND | .06 | .06 | .05 | .04 | .07 | .04 | .06 | ND | .04 |
| K2O | | | | | | | | | | |
| TOTAL | 100.44 | 100.43 | 100.00 | 99.00 | 99.46 | 100.72 | 100.57 | 100.69 | 100.20 | 101.46 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------|
| SI | 2.985 | 2.984 | 2.980 | 2.979 | 2.966 | 2.964 | 2.941 | 2.970 | 2.970 | 2.957 |
| TI | .005 | | .005 | .005 | .007 | .008 | .003 | .008 | .010 | .008 |
| AL | 1.996 | 2.000 | 1.991 | 2.027 | 1.984 | 2.014 | 2.009 | 1.994 | 1.990 | 1.983 |
| CR | | .007 | | .003 | | | | .007 | .003 | .005 |
| FE2+ | 1.087 | .611 | 1.568 | .735 | 1.524 | 1.289 | 1.252 | 1.139 | 1.147 | 1.233 |
| MN | .027 | .014 | .005 | .014 | .036 | .028 | .079 | .030 | .031 | .030 |
| MG | 1.170 | 2.032 | .915 | 1.552 | .817 | 1.039 | 1.299 | 1.144 | 1.109 | 1.162 |
| CA | .740 | .359 | .549 | .681 | .695 | .673 | .462 | .726 | .687 | .668 |
| NA | | .008 | .009 | .007 | .006 | .010 | .006 | .009 | | .004 |
| K | | | | | | | | | | |
| SUM | 8.012 | 8.016 | 8.023 | 8.004 | 8.037 | 8.026 | 8.053 | 8.027 | 8.026 | 8.044 |
| CA 24.70 | CA 11.95 | CA 18.11 | CA 22.95 | CA 22.89 | CA 22.41 | CA 15.32 | CA 24.12 | CA 22.77 | CA 21.60 | |
| MG 39.03 | MG 67.69 | MG 30.18 | MG 52.29 | MG 26.92 | MG 34.62 | MG 43.11 | MG 38.03 | MG 39.38 | MG 38.04 | |
| FE 36.27 | FE 20.36 | FE 51.71 | FE 24.76 | FE 50.19 | FE 42.97 | FE 41.57 | FE 37.88 | FE 37.85 | FE 40.37 | |
| M: 51.83 | M: 76.88 | M: 36.85 | M: 67.86 | M: 34.91 | M: 44.62 | M: 50.91 | M: 50.11 | M: 50.99 | M: 48.52 | |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-----------------|------------|---------------------|
| 21 | 02123, AV. OF 2 | 26 | 02443, AV. OF 2 |
| 22 | 02233, AV. OF 2 | 27 | 02483, AV. OF 2 |
| 23 | 02413, AV. OF 2 | 28 | 02513, GT. 3 CENTER |
| 24 | 02423, AV. OF 2 | 29 | 02513, GT. 3 EDGE |
| 25 | 02433, AV. OF 3 | 30 | 02513, AV. OF 4 |

TABLE V-7
GARNETS ** ECLOGITES - LOVEDALE **

| | 31 | 32 | 33 | 34 | 35 |
|-------|--------|-------|--------|--------|--------|
| SiO2 | 40.01 | 39.44 | 39.87 | 39.79 | 39.72 |
| TiO2 | .12 | .08 | .17 | .22 | .14 |
| Al2O3 | 22.75 | 22.67 | 22.66 | 22.80 | 22.71 |
| Cr2O3 | ND | .04 | .04 | .04 | .04 |
| FeO | 19.51 | 20.36 | 19.03 | 18.34 | 19.58 |
| MnO | .51 | .57 | .54 | .52 | .53 |
| MgO | 10.94 | 10.11 | 10.74 | 10.79 | 10.55 |
| CaO | 6.51 | 6.53 | 7.00 | 7.55 | 6.81 |
| Na2O | .08 | .04 | .04 | .05 | .05 |
| K2O | | | | | |
| TOTAL | 100.45 | 99.84 | 100.09 | 100.10 | 100.12 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 12 | 12 | 12 | 12 | 12 |
|--------|-------|-------|-------|-------|-------|
| SI | 2.990 | 2.981 | 2.990 | 2.979 | 2.984 |
| TI | .007 | .005 | .010 | .012 | .008 |
| AL | 2.004 | 2.020 | 2.003 | 2.012 | 2.011 |
| CR | | .002 | .002 | .002 | .002 |
| FE2+ | 1.220 | 1.287 | 1.193 | 1.148 | 1.230 |
| MN | .032 | .036 | .034 | .033 | .034 |
| MG | 1.219 | 1.139 | 1.200 | 1.204 | 1.181 |
| CA | .521 | .529 | .562 | .686 | .547 |
| NA | .012 | .006 | .006 | .007 | .007 |
| K | | | | | |
| SUM | 8.006 | 8.006 | 8.001 | 8.005 | 8.005 |

CA 17.62 CA 17.90 CA 19.03 CA 20.48 CA 18.50
 MG 41.18 MG 38.54 MG 40.60 MG 40.70 MG 39.92
 FE 41.21 FE 43.56 FE 40.37 FE 39.82 FE 41.58

N: 49.98 N: 46.95 N: 50.14 N: 51.18 N: 48.98

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-------------------|------------|-------------|
| 31 | 02523,GT.1 CENTER | | |
| 32 | 02523,GT.1 EDGE | | |
| 33 | 02523,GT.3 CENTER | | |
| 34 | 02523,GT.3 EDGE | | |
| 35 | 02523,AV. OF 5 | | |

TABLE V-7A
GARNETS ** ECLOGITES-DIFFERENT LOCALITIES **

| | 1 | 2 | 3 |
|-------|--------|--------|--------|
| SiO2 | 39.39 | 40.44 | 46.11 |
| TiO2 | .11 | .18 | .17 |
| Al2O3 | 22.61 | 23.20 | 23.12 |
| Cr2O3 | ND | .08 | .08 |
| FeO | 20.17 | 14.80 | 14.72 |
| MnO | .35 | .36 | .39 |
| MgO | 10.91 | 11.58 | 11.66 |
| CaO | 6.76 | 10.13 | 10.02 |
| Na2O | ND | .05 | .05 |
| K2O | | | |
| TOTAL | 100.32 | 100.82 | 100.32 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 12 | 12 | 12 |
|--------|-------|-------|-------|
| SI | 2.961 | 2.975 | 2.967 |
| TI | .006 | .010 | .009 |
| AL | 2.004 | 2.012 | 2.016 |
| CR | | .005 | .005 |
| FE2+ | 1.268 | .911 | .910 |
| MN | .022 | .022 | .024 |
| MG | 1.222 | 1.270 | 1.285 |
| CA | .545 | .799 | .794 |
| NA | | .007 | .007 |
| K | | | |
| SUM | 8.031 | 8.010 | 8.018 |

CA 17.94 CA 26.81 CA 26.56
 MG 40.27 MG 42.62 MG 42.99
 FE 41.78 FE 30.57 FE 30.45

H: 49.08 H: 58.23 H: 58.53

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-------------------------------|------------|-------------|
| 1 | 09123, AV. OF 4, UINTJIESBERG | | |
| 2 | 12093, GT. 1 CENTER, MARKT | | |
| 3 | 12093, GT. 1 EDGE, MARKT | | |

TABLE V-8
GARNETS ** KYANITE ECLOGITES - LOVEDALE **

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|-------|-------|-------|--------|-------|--------|-------|-------|-------|-------|
| SiO2 | 40.03 | 41.09 | 39.54 | 39.92 | 39.92 | 40.33 | 40.20 | 39.41 | 39.63 | 39.37 |
| TiO2 | .07 | .04 | .05 | .04 | ND | .61 | ND | ND | ND | ND |
| Al2O3 | 23.07 | 23.41 | 22.73 | 22.99 | 23.04 | 23.38 | 23.11 | 22.97 | 23.12 | 23.01 |
| Cr2O3 | .05 | .06 | .04 | .06 | .05 | .13 | .14 | .08 | .09 | .09 |
| FeO | 16.33 | 12.81 | 17.39 | 16.39 | 15.07 | 12.88 | 12.47 | 18.13 | 16.70 | 17.84 |
| MnO | .30 | .20 | .38 | .39 | .34 | .28 | .24 | .57 | .41 | .53 |
| MgO | 12.21 | 14.40 | 9.57 | 10.09 | 11.03 | 13.54 | 13.50 | 10.38 | 11.47 | 10.89 |
| CaO | 7.45 | 7.94 | 10.25 | 10.28 | 10.22 | 9.02 | 8.80 | 7.82 | 7.76 | 7.43 |
| Na2O | .04 | ND | ND | .04 | ND | ND | ND | ND | ND | .04 |
| K2O | | | | | | | | | | |
| TOTAL | 99.55 | 99.96 | 99.98 | 100.20 | 99.72 | 100.19 | 98.50 | 99.40 | 99.22 | 99.21 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------|
| SI | 2.981 | 2.996 | 2.974 | 2.980 | 2.976 | 2.952 | 2.984 | 2.973 | 2.972 | 2.969 |
| TI | .004 | .002 | .003 | .002 | | .034 | | | | |
| AL | 2.025 | 2.012 | 2.015 | 2.023 | 2.024 | 2.017 | 2.022 | 2.043 | 2.044 | 2.045 |
| CR | .003 | .003 | .002 | .004 | .003 | .008 | .008 | .005 | .005 | .005 |
| FE2+ | 1.017 | .781 | 1.094 | 1.023 | .940 | .788 | .774 | 1.144 | 1.047 | 1.125 |
| MN | .019 | .012 | .024 | .025 | .021 | .017 | .015 | .036 | .026 | .034 |
| MG | 1.355 | 1.565 | 1.073 | 1.123 | 1.225 | 1.477 | 1.493 | 1.167 | 1.202 | 1.224 |
| CA | .594 | .620 | .826 | .822 | .816 | .707 | .700 | .632 | .624 | .600 |
| NA | .006 | | | .006 | | | | | | .006 |
| K | | | | | | | | | | |
| SUM | 8.004 | 7.994 | 8.016 | 8.007 | 8.010 | 8.003 | 8.000 | 8.005 | 8.005 | 8.008 |
| CA 20.04 | CA 20.91 | CA 27.60 | CA 27.70 | CA 27.38 | CA 23.80 | CA 23.59 | CA 21.48 | CA 21.12 | CA 20.36 | |
| MG 45.68 | MG 52.75 | MG 35.85 | MG 37.82 | MG 41.10 | MG 49.68 | MG 50.33 | MG 39.65 | MG 43.41 | MG 41.58 | |
| FE 34.28 | FE 26.33 | FE 36.55 | FE 34.48 | FE 31.51 | FE 26.52 | FE 26.09 | FE 38.87 | FE 35.47 | FE 38.15 | |
| M: 57.13 | M: 66.70 | M: 49.51 | M: 52.31 | M: 56.60 | M: 65.20 | M: 65.86 | M: 50.50 | M: 55.03 | M: 52.10 | |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-----------------|------------|-----------------|
| 1 | 02133, AV. OF 4 | 6 | 02403. |
| 2 | 02143, AV. OF 7 | 7 | 02453, AV. OF 2 |
| 3 | 02153, AV. OF 4 | 8 | 02463, GT. 1 |
| 4 | 02173, AV. OF 2 | 9 | 02463, GT. 2 |
| 5 | 02213, AV. OF 2 | 10 | 02463, GT. 3 |

TABLE V-8
 CARNETS ** KYANITE ECLOGITES - LOVEDALE **

| | 11 | 12 | 13 |
|-------|-------|-------|--------|
| SI02 | 39.47 | 41.16 | 41.21 |
| TIO2 | ND | ND | ND |
| AL2O3 | 23.04 | 23.59 | 23.71 |
| CR2O3 | .08 | .15 | .10 |
| FE0 | 17.55 | 9.11 | 12.73 |
| MNO | .50 | .40 | .28 |
| MGO | 10.91 | 17.83 | 15.30 |
| CAO | 7.67 | 6.97 | 7.47 |
| HA2O | ND | ND | .05 |
| K2O | | | ND |
| TOTAL | 99.26 | 99.26 | 100.89 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 12 | 12 | 12 |
|--------|-------|-------|-------|
| SI | 2.972 | 2.971 | 2.975 |
| TI | | | |
| AL | 2.045 | 2.007 | 2.017 |
| CR | .005 | .009 | .006 |
| FE2+ | 1.105 | .550 | .768 |
| HN | .032 | .024 | .017 |
| MG | 1.224 | 1.918 | 1.646 |
| CA | .619 | .539 | .578 |
| NA | | | .007 |
| K | | | |
| SUM | 8.005 | 8.021 | 8.016 |

CA 20.99 CA 17.93 CA 19.31
 MG 41.53 MG 63.78 MG 55.01
 FE 37.49 FE 18.29 FE 25.68
 N: 52.56 N: 77.72 N: 68.17

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-----------------|------------|-------------|
| 11 | 02463, AV. OF 3 | | |
| 12 | 02473, AV. OF 2 | | |
| 13 | 02503, AV. OF 3 | | |

TABLE V-9
GARNETS ** GARNET GRANULITES - DIFFERENT LOCALITIES **

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|--------|--------|-------|--------|--------|--------|--------|--------|--------|--------|
| SiO2 | 39.75 | 39.21 | 39.11 | 39.21 | 39.11 | 39.16 | 39.62 | 39.88 | 39.75 | 39.12 |
| TiO2 | ND | ND | ND | .07 | .07 | .07 | .07 | .06 | .07 | .07 |
| Al2O3 | 21.82 | 22.24 | 21.74 | 21.71 | 21.80 | 21.76 | 22.35 | 22.34 | 22.34 | 21.99 |
| Cr2O3 | ND | ND | ND | ND | ND | ND | ND | .05 | ND | .08 |
| FeO | 22.84 | 23.02 | 22.09 | 22.40 | 22.56 | 22.48 | 20.61 | 20.65 | 20.63 | 23.10 |
| MnO | .55 | .53 | .54 | .43 | .44 | .43 | .32 | .34 | .33 | .40 |
| MgO | 8.40 | 8.43 | 8.47 | 8.78 | 8.88 | 8.79 | 11.16 | 10.94 | 11.05 | 8.85 |
| CaO | 7.59 | 7.17 | 7.28 | 7.49 | 7.62 | 7.55 | 5.93 | 6.12 | 6.03 | 7.29 |
| K2O | .05 | .04 | .04 | ND | ND | ND | .05 | .04 | .04 | .05 |
| K2O | | | | ND | | | | | | |
| TOTAL | 100.04 | 100.68 | 99.31 | 100.12 | 100.52 | 100.27 | 100.13 | 100.42 | 100.27 | 100.95 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SI | 2.973 | 2.982 | 3.006 | 2.994 | 2.979 | 2.988 | 2.982 | 2.994 | 2.988 | 2.971 |
| TI | | | | .004 | .004 | .004 | .004 | .003 | .004 | .004 |
| AL | 1.973 | 1.994 | 1.970 | 1.954 | 1.957 | 1.957 | 1.983 | 1.977 | 1.979 | 1.968 |
| CR | | | | | | | | .003 | | .005 |
| FE2+ | 1.466 | 1.464 | 1.420 | 1.431 | 1.437 | 1.434 | 1.297 | 1.296 | 1.297 | 1.467 |
| MN | .036 | .034 | .035 | .028 | .028 | .028 | .020 | .022 | .021 | .026 |
| MG | .961 | .956 | .978 | .999 | 1.008 | .999 | 1.252 | 1.224 | 1.238 | 1.002 |
| CA | .624 | .584 | .600 | .613 | .622 | .617 | .478 | .492 | .486 | .593 |
| NA | .007 | .006 | .006 | | | | .007 | .006 | .006 | .007 |
| K | | | | | | | | | | |
| SUM | 8.842 | 8.622 | 8.616 | 8.626 | 8.640 | 8.631 | 8.625 | 8.616 | 8.620 | 8.643 |

| | | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| CA 20.46 | CA 19.45 | CA 20.05 | CA 20.14 | CA 20.28 | CA 20.23 | CA 19.80 | CA 16.34 | CA 16.08 | CA 19.37 |
| Mg 31.49 | Mg 31.81 | Mg 32.45 | Mg 32.84 | Mg 32.87 | Mg 32.76 | Mg 41.35 | Mg 40.63 | Mg 40.98 | Mg 32.71 |
| Fe 48.05 | Fe 48.74 | Fe 47.49 | Fe 47.02 | Fe 46.86 | Fe 47.01 | Fe 42.85 | Fe 43.03 | Fe 42.94 | Fe 47.91 |
| K: 39.59 | M: 39.49 | N: 40.59 | H: 41.12 | H: 41.23 | M: 41.07 | M: 49.11 | M: 48.56 | H: 48.84 | H: 40.57 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-----------------------------------|------------|----------------------------|
| 1 | 06023, CORDAATSKUIL, GT. 2 CENTER | 6 | 06043, AV. |
| 2 | 06023, GT. 2 EDGE | 7 | H5-1, HEBRON, GT. 1 CENTER |
| 3 | 06023, AV. OF 4 | 8 | H5-1, GT. 1 EDGE |
| 4 | 06043, GT. 1 CENTER | 9 | H5-1, AV. |
| 5 | 06043, GT. 1 EDGE | 10 | H5-2, GT. 1 CENTER |

TABLE V-9
GARNETS ** GARNET GRANULITES - DIFFERENT LOCALITIES **

| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|-------|--------|--------|-------|--------|--------|-------|-------|-------|--------|--------|
| SiO2 | 39.00 | 39.06 | 38.80 | 39.11 | 38.95 | 38.32 | 37.46 | 37.89 | 39.50 | 39.25 |
| TiO2 | .04 | .05 | .17 | .12 | .14 | .09 | .06 | .08 | .13 | .11 |
| Al2O3 | 22.40 | 22.19 | 21.80 | 21.90 | 21.85 | 21.93 | 22.16 | 22.04 | 22.55 | 22.62 |
| Cr2O3 | .06 | .07 | ND | .04 | ND | .04 | .05 | .05 | .04 | ND |
| FeO | 23.45 | 23.27 | 22.73 | 23.04 | 22.88 | 23.45 | 23.86 | 23.65 | 20.04 | 19.90 |
| MnO | .35 | .38 | .43 | .47 | .45 | .46 | .46 | .46 | .35 | .36 |
| MgO | 8.38 | 8.61 | 8.18 | 8.29 | 8.23 | 8.90 | 8.66 | 8.78 | 11.00 | 11.05 |
| CaO | 7.24 | 7.26 | 7.72 | 7.36 | 7.54 | 6.83 | 6.13 | 6.08 | 6.72 | 6.78 |
| Na2O | ND | ND | ND | ND | ND | .04 | ND | ND | ND | ND |
| K2O | | | | | | | | | | |
| TOTAL | 100.94 | 100.92 | 99.86 | 100.34 | 100.08 | 99.26 | 98.86 | 99.06 | 100.34 | 100.11 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SI | 2.964 | 2.968 | 2.979 | 2.988 | 2.984 | 2.960 | 2.917 | 2.939 | 2.967 | 2.955 |
| TI | .002 | .003 | .010 | .007 | .008 | .005 | .004 | .005 | .007 | .006 |
| AL | 2.006 | 1.987 | 1.973 | 1.972 | 1.973 | 1.997 | 2.034 | 2.015 | 1.996 | 2.007 |
| CR | .004 | .004 | | .002 | | .002 | .003 | .003 | .002 | |
| FE2+ | 1.490 | 1.479 | 1.460 | 1.472 | 1.466 | 1.515 | 1.554 | 1.534 | 1.259 | 1.253 |
| MN | .023 | .024 | .028 | .030 | .029 | .030 | .030 | .030 | .022 | .023 |
| MG | .949 | .975 | .936 | .944 | .940 | 1.024 | 1.005 | 1.015 | 1.231 | 1.240 |
| CA | .590 | .591 | .635 | .602 | .619 | .499 | .512 | .505 | .541 | .547 |
| NA | | | | | | .006 | | | | |
| K | | | | | | | | | | |
| SUM | 8.030 | 8.036 | 8.024 | 8.019 | 8.022 | 8.038 | 8.062 | 8.050 | 8.027 | 8.035 |
| CA | 19.46 | 19.41 | 20.96 | 19.96 | 20.46 | 16.43 | 16.66 | 16.54 | 17.84 | 17.99 |
| MG | 31.33 | 32.02 | 30.88 | 31.27 | 31.07 | 33.72 | 32.73 | 33.23 | 40.62 | 40.79 |
| FE | 49.20 | 48.57 | 48.16 | 48.77 | 48.47 | 49.86 | 50.61 | 50.23 | 41.53 | 41.22 |
| M: | 38.91 | 39.74 | 39.07 | 39.07 | 39.06 | 40.35 | 39.28 | 39.82 | 49.45 | 49.74 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-------------------|------------|--------------------------------|
| 11 | H5-2,GT.1 EDGE | 16 | 07413,GT.1 CENTER |
| 12 | H5-2,AV. | 17 | 07413,GT.1 EDGE |
| 13 | 07403,GT.1 CENTER | 18 | 07413,AV. |
| 14 | 07403,GT.1 EDGE | 19 | 09123,UINTJIESBERG,GT.1 CENTER |
| 15 | 07403,AV. | 20 | 09123,GT.1 EDGE |

TABLE V-9
GARNETS ** GARNET GRANULITES - DIFFERENT LOCALITIES **

| | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|
| SiO2 | 38.63 | 38.49 | 38.68 | 38.70 | 38.15 | 39.48 | 39.39 | 39.58 | 39.49 | 40.30 |
| TiO2 | .06 | .06 | .06 | .09 | .06 | ND | .08 | .10 | .09 | ND |
| Al2O3 | 21.97 | 21.86 | 22.05 | 22.02 | 21.41 | 22.46 | 22.50 | 22.15 | 22.32 | 23.25 |
| Cr2O3 | .04 | .07 | .05 | .04 | ND | ND | .06 | .05 | .05 | ND |
| FeO | 23.30 | 23.36 | 22.88 | 23.00 | 25.69 | 19.61 | 21.56 | 21.35 | 21.45 | 16.51 |
| MnO | .44 | .46 | .43 | .53 | .40 | .37 | .35 | .37 | .36 | .24 |
| MgO | 9.04 | 8.95 | 9.35 | 8.93 | 6.22 | 10.88 | 9.40 | 9.14 | 9.27 | 13.78 |
| CaO | 6.03 | 6.13 | 5.98 | 6.46 | 8.62 | 7.28 | 7.12 | 7.35 | 7.23 | 6.34 |
| Na2O | ND | ND | ND | ND | ND | ND | .04 | .05 | .04 | ND |
| K2O | | | | | | | | | | |
| TOTAL | 99.54 | 99.41 | 99.51 | 99.78 | 100.59 | 100.14 | 100.50 | 100.14 | 100.30 | 100.49 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SI | 2.970 | 2.967 | 2.968 | 2.969 | 2.961 | 2.971 | 2.977 | 3.001 | 2.990 | 2.964 |
| TI | .003 | .003 | .003 | .005 | .004 | | .005 | .006 | .005 | |
| AL | 1.991 | 1.986 | 1.995 | 1.991 | 1.959 | 1.992 | 2.005 | 1.980 | 1.992 | 2.016 |
| CR | .002 | .004 | .003 | .002 | | | .004 | .003 | .003 | |
| FE2+ | 1.498 | 1.506 | 1.468 | 1.475 | 1.668 | 1.234 | 1.363 | 1.354 | 1.358 | 1.016 |
| MN | .029 | .030 | .028 | .034 | .026 | .024 | .022 | .024 | .023 | .015 |
| MG | 1.036 | 1.028 | 1.069 | 1.021 | .719 | 1.220 | 1.059 | 1.033 | 1.046 | 1.511 |
| CA | .497 | .506 | .492 | .531 | .717 | .587 | .577 | .597 | .587 | .500 |
| NA | | | | | | | .006 | .007 | .006 | |
| K | | | | | | | | | | |
| SUM | 8.032 | 8.036 | 8.032 | 8.030 | 8.058 | 8.032 | 8.017 | 8.005 | 8.010 | 8.026 |
| CA | 16.39 | 16.65 | 16.23 | 17.54 | 23.10 | 19.30 | 19.23 | 20.01 | 19.61 | 16.51 |
| MG | 34.18 | 33.82 | 35.30 | 33.72 | 23.18 | 40.12 | 35.31 | 34.61 | 34.97 | 49.92 |
| FE | 49.43 | 49.53 | 48.47 | 48.74 | 53.72 | 40.58 | 45.45 | 45.37 | 45.41 | 33.56 |
| H: | 40.88 | 40.57 | 42.14 | 40.89 | 30.14 | 49.72 | 43.72 | 43.27 | 43.51 | 59.00 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-------------------------|------------|------------------------------------|
| 21 | 09133, GT.2 CENTER | 26 | 12133, MARKT, AV. OF 3 |
| 22 | 09133, GT.2 EDGE | 27 | 25023, WINDHOEK SOUTH, GT.1 CENTER |
| 23 | 09133, AV. OF 5 | 28 | 25023, GT.1 EDGE |
| 24 | 09153, AV. OF 4 | 29 | 25023, AV. |
| 25 | 11-1, KALKPUT, AV. OF 2 | 30 | 30-1, GOEDEHOOP, GT.1 CENTER |

TABLE V-9
GARNETS ** GARNET GRANULITES - DIFFERENT LOCALITIES **

| | 31 | 32 | 33 | 34 | 35 | 36 |
|-------|--------|--------|--------|--------|--------|--------|
| SiO2 | 40.48 | 40.39 | 38.88 | 39.01 | 38.94 | 38.63 |
| TiO2 | ND | ND | .07 | .05 | .06 | ND |
| Al2O3 | 23.27 | 23.36 | 22.07 | 21.86 | 21.96 | 22.07 |
| Cr2O3 | ND | ND | ND | .08 | .05 | ND |
| FeO | 16.36 | 16.43 | 24.59 | 24.37 | 24.49 | 23.99 |
| MnO | .25 | .24 | .55 | .53 | .54 | .52 |
| MgO | 13.37 | 13.58 | 8.33 | 8.16 | 8.24 | 6.92 |
| CaO | 6.73 | 6.53 | 6.22 | 6.26 | 6.24 | 7.90 |
| Na2O | ND | ND | ND | ND | ND | ND |
| K2O | | | | | | |
| TOTAL | 100.53 | 100.60 | 100.75 | 100.35 | 100.54 | 100.08 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 12 | 12 | 12 | 12 | 12 | 12 |
|--------|-------|-------|-------|-------|-------|-------|
| SI | 2.976 | 2.967 | 2.971 | 2.990 | 2.980 | 2.979 |
| TI | | | .004 | .003 | .003 | |
| AL | 2.016 | 2.023 | 1.988 | 1.975 | 1.981 | 2.006 |
| CR | | | | .005 | .003 | |
| FE2+ | 1.006 | 1.009 | 1.571 | 1.562 | 1.567 | 1.547 |
| MN | .016 | .015 | .036 | .034 | .035 | .034 |
| MG | 1.465 | 1.487 | .949 | .932 | .940 | .795 |
| CA | .530 | .514 | .569 | .514 | .512 | .653 |
| NA | | | | | | |
| K | | | | | | |
| SUM | 8.014 | 8.020 | 8.032 | 8.020 | 8.026 | 8.018 |

| | | | | | |
|----------|----------|----------|----------|----------|----------|
| CA 17.67 | CA 17.08 | CA 16.81 | CA 17.09 | CA 16.95 | CA 21.79 |
| Mg 48.81 | Mg 49.39 | Mg 31.31 | Mg 30.98 | Mg 31.14 | Mg 26.55 |
| FE 33.52 | FE 33.53 | FE 51.87 | FE 51.93 | FE 51.91 | FE 51.65 |
| M: 59.29 | M: 59.56 | M: 37.64 | M: 37.37 | M: 37.49 | M: 33.95 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|---------------------------------|------------|----------------|
| 31 | 30-1,GT.1 EDGE | 36 | 33023,AV. OF 2 |
| 32 | 30-1,AV. | | |
| 33 | 33013,LEKKERFONTEIN,GT.1 CENTER | | |
| 34 | 33013,GT.1 EDGE | | |
| 35 | 33013,AV. | | |

TABLE V-10
GARNETS ** KYANITE GARNET GRANULITES - DIFFERENT LOCALITIES **

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|--------|--------|--------|--------|--------|--------|-------|--------|--------|--------|
| SiO2 | 41.55 | 41.88 | 41.53 | 41.66 | 41.52 | 41.96 | 41.70 | 41.82 | 40.63 | 40.87 |
| TiO2 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Al2O3 | 24.05 | 23.68 | 24.30 | 24.19 | 24.05 | 24.18 | 22.75 | 23.82 | 23.46 | 23.53 |
| Cr2O3 | ND | ND | .05 | ND | ND | ND | ND | ND | .07 | .07 |
| FeO | 11.50 | 9.63 | 9.64 | 9.71 | 10.56 | 9.84 | 10.66 | 10.88 | 13.92 | 14.05 |
| MnO | .28 | .21 | .23 | .27 | .35 | .30 | .35 | .29 | .39 | .40 |
| MgO | 16.68 | 18.51 | 18.39 | 18.19 | 16.76 | 17.20 | 16.97 | 17.51 | 13.08 | 12.42 |
| CaO | 6.29 | 6.63 | 6.83 | 6.88 | 7.28 | 7.12 | 6.98 | 6.83 | 9.23 | 10.32 |
| Na2O | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| K2O | | | | | | | | | | |
| TOTAL | 100.38 | 100.43 | 101.09 | 100.13 | 100.55 | 100.63 | 99.44 | 100.38 | 100.82 | 101.69 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SI | 2.994 | 2.980 | 2.947 | 2.974 | 2.974 | 2.989 | 3.021 | 2.989 | 2.969 | 2.970 |
| TI | | | | | | | | | | |
| AL | 2.036 | 1.983 | 2.033 | 2.035 | 2.031 | 2.030 | 1.943 | 2.007 | 2.021 | 2.016 |
| CR | | | .003 | | | | | | .005 | .004 |
| FE2+ | .691 | .574 | .572 | .580 | .633 | .586 | .646 | .663 | .851 | .854 |
| MN | .017 | .013 | .014 | .016 | .021 | .018 | .021 | .018 | .024 | .025 |
| MG | 1.785 | 1.967 | 1.945 | 1.935 | 1.789 | 1.826 | 1.832 | 1.865 | 1.424 | 1.345 |
| CA | .484 | .507 | .519 | .465 | .559 | .543 | .542 | .523 | .723 | .804 |
| NA | | | | | | | | | | |
| K | | | | | | | | | | |
| SUM | 7.998 | 8.027 | 8.036 | 8.008 | 8.010 | 7.996 | 8.008 | 8.007 | 8.018 | 8.021 |

| | | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| CA 16.35 | CA 16.62 | CA 17.10 | CA 15.61 | CA 18.75 | CA 18.39 | CA 17.94 | CA 17.49 | CA 24.11 | CA 26.76 |
| MG 60.31 | MG 64.54 | MG 64.05 | MG 64.94 | MG 60.83 | MG 61.78 | MG 60.67 | MG 62.36 | MG 47.52 | MG 44.80 |
| FE 23.33 | FE 18.84 | FE 18.84 | FE 19.45 | FE 21.22 | FE 19.83 | FE 21.38 | FE 20.15 | FE 28.38 | FE 28.44 |
| H: 72.10 | H: 77.40 | H: 77.27 | H: 76.95 | H: 73.88 | H: 75.78 | H: 73.94 | H: 75.58 | H: 62.61 | H: 61.17 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|---------------------------------|------------|--------------------|
| 1 | 04-1, VETLAAGTE, GT WITH CPX-KY | 6 | 02223, GT.3 CENTER |
| 2 | 02223, LOVEDALE, GT.1 CENTER | 7 | 02223, GT.3 EDGE |
| 3 | 02223, GT.1 EDGE | 8 | 02223, AV. |
| 4 | 02223, GT.2 CENTER | 9 | 02243, GT.1 CENTER |
| 5 | 02223, GT.2 EDGE | 10 | 02243, GT.1 EDGE |

TABLE V-10
GARNETS ** KYANITE GARNET GRANULITES - DIFFERENT LOCALITIES **

| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|-------|--------|--------|--------|--------|--------|--------|--------|-------|-------|-------|
| SiO2 | 40.75 | 40.80 | 39.19 | 40.09 | 40.61 | 40.59 | 40.78 | 40.64 | 40.52 | 40.30 |
| TiO2 | ND | ND | .08 | ND | ND | .06 | ND | ND | ND | ND |
| Al2O3 | 23.49 | 23.50 | 22.41 | 23.02 | 23.47 | 23.57 | 23.62 | 23.45 | 23.47 | 23.37 |
| Cr2O3 | .08 | .12 | ND | .08 | .06 | .04 | ND | ND | ND | ND |
| FeO | 13.98 | 13.13 | 17.98 | 15.73 | 14.43 | 12.82 | 13.31 | 12.50 | 12.95 | 12.59 |
| MnO | .39 | .32 | .23 | .41 | .30 | .20 | .23 | .22 | .22 | .21 |
| MgO | 12.75 | 13.07 | 0.27 | 10.93 | 13.58 | 14.41 | 14.34 | 14.64 | 14.31 | 14.59 |
| CaO | 9.77 | 9.85 | 12.72 | 10.66 | 8.60 | 8.39 | 8.24 | 7.89 | 7.91 | 7.56 |
| Na2O | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| K2O | | | | | | | | | | |
| TOTAL | 101.23 | 100.83 | 100.00 | 100.95 | 101.00 | 100.10 | 100.58 | 99.38 | 99.42 | 98.65 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| SI | 2.970 | 2.974 | 2.966 | 2.965 | 2.961 | 2.963 | 2.967 | 2.979 | 2.976 | 2.976 |
| TI | | | .005 | | | .003 | | | | |
| AL | 2.018 | 2.019 | 1.999 | 2.007 | 2.017 | 2.028 | 2.026 | 2.026 | 2.032 | 2.034 |
| CR | .005 | .007 | | .005 | .003 | .002 | | | | |
| FE2+ | .852 | .800 | 1.081 | .973 | .890 | .783 | .810 | .766 | .795 | .778 |
| MN | .024 | .020 | .015 | .026 | .019 | .012 | .014 | .014 | .014 | .013 |
| MG | 1.385 | 1.420 | .933 | 1.265 | 1.475 | 1.568 | 1.555 | 1.599 | 1.566 | 1.606 |
| CA | .763 | .769 | 1.031 | .945 | .672 | .656 | .642 | .620 | .622 | .598 |
| NA | | | | | | | | | | |
| K | | | | | | | | | | |
| SUM | 8.019 | 8.012 | 8.031 | 8.028 | 8.029 | 8.019 | 8.019 | 8.007 | 8.008 | 8.007 |
| CA 25.43 | CA 25.73 | CA 33.87 | CA 27.95 | CA 22.19 | CA 21.83 | CA 21.36 | CA 20.76 | CA 20.86 | CA 20.06 | CA 20.06 |
| MG 46.16 | MG 47.49 | MG 30.63 | MG 39.86 | MG 48.74 | MG 52.14 | MG 51.71 | MG 53.57 | MG 52.49 | MG 53.06 | MG 53.06 |
| FE 28.40 | FE 26.77 | FE 35.50 | FE 32.19 | FE 29.06 | FE 26.03 | FE 26.93 | FE 25.67 | FE 26.65 | FE 26.08 | FE 26.08 |
| H: 61.91 | H: 63.95 | H: 46.32 | H: 55.32 | H: 62.65 | H: 66.70 | H: 65.75 | H: 67.61 | H: 66.32 | H: 67.37 | H: 67.37 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|---------------------------------|------------|----------------------------|
| 11 | 02243, AV. | 16 | 12133A, MARKT, GT.1 CENTER |
| 12 | 02243, GT.4 IN CPX BAND | 17 | 12133A, GT.1 EDGE |
| 13 | 02343, AV. OF 2 | 18 | 12133A, GT.2 CENTER |
| 14 | 02493, AV. OF 2 IN PLAG BAND | 19 | 12133A, GT.2 EDGE |
| 15 | 02493, AV. OF 2 IN CPX, GT BAND | 20 | 12133A, GT.3 CENTER |

TABLE V-10
GARNETS ** KYANITE GARNET GRANULITES - DIFFERENT LOCALITIES **

| | 21 | 22 | 23 | 24 |
|--------------------------------|-------|--------|-------|-------|
| SiO ₂ | 40.31 | 41.24 | 41.02 | 40.67 |
| TiO ₂ | ND | ND | ND | ND |
| Al ₂ O ₃ | 23.48 | 23.88 | 23.81 | 23.58 |
| Cr ₂ O ₃ | ND | ND | ND | ND |
| FeO | 12.68 | 12.06 | 12.99 | 12.74 |
| MnO | .22 | .20 | .23 | .22 |
| MgO | 14.52 | 15.39 | 15.47 | 14.74 |
| CaO | 7.51 | 7.19 | 6.28 | 7.62 |
| Na ₂ O | ND | ND | ND | ND |
| K ₂ O | | | | |
| TOTAL | 98.75 | 100.00 | 99.83 | 99.61 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 12 | 12 | 12 | 12 |
|------------------|-------|-------|-------|-------|
| SI | 2.974 | 2.988 | 2.983 | 2.975 |
| TI | | | | |
| AL | 2.042 | 2.039 | 2.041 | 2.033 |
| CR | | | | |
| FE ²⁺ | .782 | .731 | .790 | .779 |
| MN | .014 | .012 | .014 | .014 |
| MG | 1.597 | 1.662 | 1.677 | 1.607 |
| CA | .594 | .558 | .489 | .597 |
| NA | | | | |
| K | | | | |
| SUM | 8.005 | 7.993 | 7.996 | 8.008 |

CA 19.97 CA 18.92 CA 16.55 CA 20.02
 MG 53.71 MG 56.32 MG 56.72 MG 53.86
 FE 26.32 FE 24.77 FE 26.73 FE 26.12

H: 67.11 H: 69.46 H: 67.97 H: 67.34

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|----------------------|------------|-------------|
| 21 | 12133A, GT. 3 EDGE | | |
| 22 | 12133A, GT. 4 CENTER | | |
| 23 | 12133A, GT. 4 EDGE | | |
| 24 | 12133A, AV. | | |

TABLE V-11
CPX + OPX ** ECLOGITES-LOVEDALE **

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| SI02 | 53.85 | 55.08 | 55.25 | 54.91 | 55.27 | 54.93 | 54.69 | 54.77 | 54.40 | 54.63 |
| TI02 | .29 | .40 | .35 | .41 | .39 | .43 | .55 | .48 | .58 | .57 |
| AL2O3 | 11.49 | 10.95 | 11.01 | 10.68 | 11.05 | 11.07 | 9.08 | 9.51 | 9.11 | 8.74 |
| CR2O3 | .07 | ND | ND | ND | ND | .04 | .07 | .07 | .05 | .09 |
| FE0 | 3.45 | 5.73 | 5.63 | 5.82 | 5.71 | 5.78 | 6.48 | 7.02 | 6.39 | 6.41 |
| MNO | ND | .06 | .04 | .07 | .07 | .07 | .07 | .06 | .09 | .07 |
| MGO | 9.33 | 8.86 | 8.83 | 9.12 | 8.65 | 8.84 | 9.94 | 9.32 | 9.96 | 10.39 |
| CAO | 15.23 | 13.29 | 13.17 | 13.59 | 13.23 | 13.17 | 13.93 | 13.12 | 14.08 | 14.24 |
| HA2O | 6.05 | 6.71 | 6.69 | 6.48 | 6.87 | 6.79 | 6.23 | 6.50 | 6.02 | 5.93 |
| K2O | ND | ND | ND | ND | | | ND | ND | | |
| TOTAL | 99.79 | 101.12 | 101.00 | 101.12 | 101.26 | 101.12 | 101.05 | 100.87 | 100.68 | 101.06 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SI | 1.929 | 1.956 | 1.961 | 1.953 | 1.959 | 1.951 | 1.958 | 1.964 | 1.954 | 1.956 |
| TI | .008 | .011 | .009 | .011 | .010 | .011 | .015 | .013 | .016 | .015 |
| AL | .485 | .458 | .461 | .448 | .462 | .464 | .383 | .482 | .386 | .369 |
| CR | .002 | | | | | .001 | .002 | .002 | .001 | .003 |
| FE2+ | .103 | .170 | .167 | .173 | .169 | .172 | .194 | .211 | .192 | .192 |
| MN | | .002 | .001 | .002 | .002 | .002 | .002 | .002 | .003 | .002 |
| MG | .498 | .469 | .467 | .483 | .457 | .468 | .530 | .498 | .533 | .554 |
| CA | .584 | .506 | .501 | .518 | .503 | .501 | .534 | .504 | .542 | .546 |
| NA | .420 | .462 | .460 | .447 | .472 | .468 | .432 | .452 | .419 | .412 |
| K | | | | | | | | | | |
| SUM | 4.031 | 4.035 | 4.029 | 4.036 | 4.035 | 4.039 | 4.051 | 4.048 | 4.046 | 4.049 |
| CA | 49.29 | 44.17 | 44.13 | 44.10 | 44.52 | 43.93 | 42.45 | 41.57 | 42.77 | 42.28 |
| MG | 42.00 | 40.96 | 41.15 | 41.16 | 40.48 | 41.02 | 42.13 | 41.07 | 42.09 | 42.07 |
| FE | 8.71 | 14.87 | 14.72 | 14.74 | 15.00 | 15.05 | 15.41 | 17.36 | 15.15 | 14.85 |
| H: | 82.82 | 73.37 | 73.65 | 73.63 | 72.97 | 73.16 | 73.22 | 70.29 | 73.53 | 74.26 |
| C: | 53.99 | 51.89 | 51.75 | 51.72 | 52.37 | 51.72 | 50.19 | 50.30 | 50.41 | 49.66 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|--------------------|------------|-------------------|
| 1 | 02-1, AV. OF 4 | 6 | 02-2, CPX.2 EDGE |
| 2 | 02-2, AV. OF 4 | 7 | 02023, AV. OF 4 |
| 3 | 02-2, CPX.1 CENTER | 8 | 02023, CPX.9 |
| 4 | 02-2, CPX.1 EDGE | 9 | 02023, CPX.3 EDGE |
| 5 | 02-2, CPX.2 CENTER | 10 | 02023, CPX.7 EDGE |

TABLE V-11
CPX + OPX ** ECLOGITES-LOVEDALE **

| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|-------|-------|--------|--------|--------|--------|-------|-------|-------|-------|--------|
| SiO2 | 54.16 | 54.99 | 55.18 | 55.55 | 55.19 | 53.77 | 52.69 | 56.55 | 54.43 | 55.09 |
| TiO2 | .57 | .31 | .22 | .15 | .28 | .27 | ND | ND | .12 | .29 |
| Al2O3 | 7.64 | 8.71 | 10.84 | 11.63 | 10.16 | 7.11 | 7.95 | 9.21 | 9.15 | 10.62 |
| Cr2O3 | .09 | .04 | ND | .17 | .05 | .13 | .30 | ND | .22 | .05 |
| FeO | 6.85 | 6.01 | 4.67 | 3.17 | 6.69 | 6.59 | 3.59 | .04 | 2.25 | 6.96 |
| MnO | .07 | .06 | .04 | .04 | .05 | .06 | .11 | ND | ND | .08 |
| MgO | 10.90 | 10.45 | 9.94 | 10.11 | 8.77 | 10.46 | 12.86 | 22.29 | 11.74 | 7.59 |
| CaO | 15.24 | 14.02 | 15.11 | 15.14 | 13.71 | 15.96 | 20.75 | 2.00 | 17.50 | 12.76 |
| Na2O | 5.21 | 5.72 | 5.68 | 5.78 | 6.58 | 4.67 | 2.10 | .12 | 4.55 | 7.08 |
| K2O | ND | ND | | | ND | ND | ND | .30 | ND | |
| TOTAL | 99.94 | 101.12 | 101.71 | 101.74 | 101.49 | 99.83 | 99.67 | 98.64 | 99.99 | 100.42 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------|
| SI | 1.963 | 1.964 | 1.944 | 1.942 | 1.964 | 1.974 | 1.895 | 2.054 | 1.943 | 1.979 |
| TI | .016 | .008 | .006 | .004 | .007 | .007 | | | .003 | .007 |
| AL | .326 | .367 | .450 | .479 | .426 | .388 | .337 | .394 | .385 | .450 |
| CR | .003 | .001 | | .005 | .001 | .004 | .009 | | .006 | .001 |
| FE2+ | .183 | .180 | .138 | .093 | .199 | .202 | .109 | .001 | .067 | .209 |
| MN | .002 | .002 | .001 | .001 | .002 | .002 | .003 | | | .002 |
| MG | .589 | .556 | .522 | .527 | .465 | .572 | .697 | 1.206 | .625 | .406 |
| CA | .592 | .567 | .570 | .567 | .523 | .528 | .809 | .070 | .570 | .489 |
| NA | .366 | .396 | .388 | .392 | .454 | .332 | .148 | .008 | .315 | .493 |
| K | | | | | | | | .010 | | |
| SUM | 4.040 | 4.042 | 4.019 | 4.008 | 4.042 | 4.030 | 4.007 | 3.761 | 4.015 | 4.034 |
| CA 43.39 | CA 43.53 | CA 46.38 | CA 47.80 | CA 44.04 | CA 44.77 | CA 50.07 | CA 6.05 | CA 49.18 | CA 44.27 | |
| MG 43.16 | MG 42.69 | MG 42.43 | MG 44.39 | MG 39.18 | MG 40.81 | MG 43.16 | MG 93.85 | MG 45.89 | MG 36.80 | |
| FE 13.44 | FE 13.78 | FE 11.19 | FE 7.81 | FE 16.77 | FE 14.43 | FE 6.76 | FE .09 | FE 4.94 | FE 18.94 | |
| H: 76.25 | H: 75.60 | H: 79.14 | H: 85.04 | H: 70.02 | H: 73.88 | H: 86.46 | H: 99.90 | H: 90.27 | H: 66.02 | |
| C: 50.13 | C: 50.49 | C: 52.22 | C: 51.85 | C: 52.92 | C: 52.31 | C: 53.71 | C: 6.06 | C: 51.73 | C: 54.61 | |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-----------------|------------|-------------------|
| 11 | 02043, | 16 | 02103. |
| 12 | 02063, AV, OF 3 | 17 | 02123. |
| 13 | 02073, AV, OF 4 | 18 | 02123, RELICT OPX |
| 14 | 02083, AV, OF 2 | 19 | 02233, AV OF 2 |
| 15 | 02093, AV, OF 2 | 20 | 02413, AV, OF 2 |

TABLE V-11
CPX + OPX ** ECLOGITES-LOVEDALE **

| | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
|-------|--------|-------|--------|-------|-------|-------|-------|-------|
| SiO2 | 54.70 | 53.31 | 54.84 | 54.83 | 53.74 | 54.14 | 53.66 | 53.90 |
| TiO2 | .25 | .26 | .32 | .15 | .32 | .26 | .37 | .15 |
| Al2O3 | 10.86 | 8.62 | 10.71 | 9.82 | 9.12 | 9.14 | 9.07 | 9.79 |
| Cr2O3 | .84 | ND | ND | ND | ND | ND | .84 | .05 |
| FeO | 2.45 | 7.82 | 5.46 | 5.95 | 5.91 | 5.59 | 5.71 | 5.69 |
| MnO | ND | .04 | ND | .13 | ND | ND | ND | .25 |
| MgO | 10.41 | 8.15 | 8.42 | 8.90 | 9.18 | 9.02 | 9.31 | 9.84 |
| CaO | 16.51 | 14.71 | 13.98 | 13.22 | 15.48 | 15.25 | 15.34 | 14.87 |
| Na2O | 4.81 | 6.06 | 6.27 | 6.70 | 6.07 | 6.27 | 5.89 | 6.32 |
| K2O | ND | ND | ND | ND | ND | ND | ND | ND |
| TOTAL | 100.09 | 99.00 | 100.06 | 99.74 | 99.90 | 99.75 | 99.43 | 99.26 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
|----------|----------|----------|----------|----------|----------|----------|----------|-------|
| SI | 1.942 | 1.967 | 1.966 | 1.978 | 1.951 | 1.964 | 1.954 | 1.960 |
| TI | .007 | .007 | .009 | .004 | .009 | .007 | .010 | .004 |
| AL | .454 | .375 | .453 | .418 | .390 | .391 | .389 | .420 |
| CR | .001 | | | | | | .001 | .001 |
| FE2+ | .073 | .241 | .164 | .188 | .179 | .170 | .174 | .171 |
| MN | | .001 | | .004 | | | | .008 |
| MG | .551 | .448 | .450 | .479 | .497 | .480 | .505 | .490 |
| CA | .628 | .581 | .537 | .511 | .602 | .593 | .598 | .548 |
| NA | .331 | .434 | .436 | .469 | .427 | .441 | .416 | .446 |
| K | | | | | | | | |
| SUM | 3.990 | 4.056 | 4.016 | 4.043 | 4.059 | 4.055 | 4.049 | 4.049 |
| CA 50.18 | CA 45.76 | CA 46.67 | CA 43.71 | CA 47.11 | CA 47.42 | CA 46.85 | CA 45.26 | |
| MG 44.01 | MG 35.26 | MG 39.10 | MG 40.93 | MG 38.86 | MG 39.01 | MG 39.54 | MG 40.45 | |
| FE 5.81 | FE 18.99 | FE 14.23 | FE 15.36 | FE 14.04 | FE 13.57 | FE 13.61 | FE 14.29 | |
| H: 88.33 | H: 65.00 | H: 73.32 | H: 72.72 | H: 73.46 | H: 74.20 | H: 74.40 | H: 73.90 | |
| C: 53.28 | C: 56.48 | C: 54.42 | C: 51.64 | C: 54.80 | C: 54.86 | C: 54.23 | C: 52.81 | |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-----------------|------------|---------------------|
| 21 | 02423, AV. OF 2 | 26 | 92513, CPX.3 CENTER |
| 22 | 02433, | 27 | 02513, CPX.3 EDGE |
| 23 | 02443, AV. OF 2 | 28 | 02523, AV. OF 2 |
| 24 | 02483, AV. OF 2 | | |
| 25 | 02513, AV. OF 5 | | |

TABLE U-11A
CLINOPYROXENES **ECLOGITES-DIFFERENT LOCALITIES **

| | 1 | 2 | 3 | 4 | 5 |
|-------|-------|-------|-------|-------|-------|
| SiO2 | 50.20 | 50.91 | 50.55 | 53.08 | 53.59 |
| TiO2 | .04 | .60 | .75 | .22 | .24 |
| Al2O3 | 8.10 | 7.43 | 7.60 | 5.90 | 6.18 |
| Cr2O3 | ND | ND | ND | ND | .15 |
| FeO | 7.00 | 6.48 | 6.69 | 4.38 | 4.27 |
| MnO | .04 | ND | ND | ND | .11 |
| MgO | 10.90 | 11.09 | 11.06 | 12.61 | 12.54 |
| CaO | 19.58 | 20.09 | 19.89 | 18.99 | 18.91 |
| Na2O | 2.53 | 2.44 | 2.51 | 3.23 | 3.13 |
| K2O | ND | ND | ND | ND | ND |
| TOTAL | 99.21 | 99.07 | 99.08 | 99.28 | 99.13 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 | 6 | 6 |
|--------|-------|-------|-------|-------|-------|
| SI | 1.064 | 1.089 | 1.078 | 1.965 | 1.957 |
| TI | .023 | .017 | .021 | .006 | .007 |
| AL | .355 | .325 | .333 | .254 | .266 |
| CR | | | | | .004 |
| FE2+ | .217 | .201 | .208 | .134 | .130 |
| MN | .001 | | | | .003 |
| MG | .603 | .613 | .612 | .685 | .682 |
| CA | .779 | .799 | .792 | .742 | .740 |
| NA | .182 | .176 | .181 | .228 | .222 |
| K | | | | | |
| SUM | 4.026 | 4.020 | 4.025 | 4.016 | 4.012 |

CA 48.70 CA 49.52 CA 49.12 CA 47.54 CA 47.65
 MG 37.71 MG 38.02 MG 37.99 MG 43.90 MG 43.95
 FE 13.59 FE 12.47 FE 12.89 FE 8.56 FE 8.40

H: 73.51 H: 75.31 H: 74.66 H: 83.69 H: 83.96
 C: 56.36 C: 56.57 C: 56.39 C: 51.99 C: 52.02

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|---------------------|------------|-------------|
| 1 | 09123, CPX.2 CENTER | | |
| 2 | 09123, CPX.2 EDGE | | |
| 3 | 09123, AV. | | |
| 4 | 12093, CPX.1 CENTER | | |
| 5 | 12093, CPX.1 EDGE | | |

TABLE V-12
CLINOPYROXENES ** KYANITE ECLOGITES - LOVEDALE **

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|--------|--------|--------|-------|--------|--------|-------|-------|--------|-------|
| SiO2 | 55.76 | 55.60 | 55.33 | 54.74 | 54.82 | 55.91 | 54.67 | 54.85 | 55.74 | 52.86 |
| TiO2 | .24 | .18 | .12 | .08 | .08 | ND | .06 | .14 | .09 | .09 |
| Al2O3 | 13.94 | 12.26 | 13.93 | 12.88 | 12.49 | 11.93 | 10.70 | 11.46 | 12.37 | 6.36 |
| Cr2O3 | .06 | .10 | .04 | .07 | .09 | .10 | ND | .18 | .15 | .12 |
| FeO | 3.04 | 2.35 | 3.52 | 3.33 | 2.97 | 3.17 | 3.10 | 1.18 | 2.31 | 3.98 |
| MnO | ND | ND | .04 | ND | ND | .07 | ND | .04 | ND | ND |
| MgO | 8.26 | 10.15 | 8.26 | 8.48 | 9.15 | 8.94 | 9.48 | 10.51 | 9.41 | 11.94 |
| CaO | 12.88 | 15.44 | 13.61 | 13.94 | 14.80 | 14.18 | 14.91 | 16.99 | 14.90 | 18.66 |
| Na2O | 6.56 | 5.24 | 6.23 | 6.06 | 5.60 | 6.62 | 5.72 | 4.72 | 5.71 | 2.53 |
| K2O | ND | ND | ND | ND | ND | ND | ND | | ND | .05 |
| TOTAL | 100.78 | 101.28 | 101.69 | 99.61 | 100.04 | 100.95 | 98.70 | 99.27 | 100.71 | 98.54 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SI | 1.949 | 1.941 | 1.936 | 1.947 | 1.942 | 1.965 | 1.968 | 1.927 | 1.954 | 1.930 |
| TI | .006 | .003 | .003 | .002 | .002 | | .002 | .004 | .002 | .002 |
| AL | .574 | .504 | .575 | .548 | .521 | .494 | .454 | .482 | .511 | .360 |
| CR | .002 | .003 | .001 | .002 | .002 | .003 | | .005 | .004 | .003 |
| FE2+ | .089 | .069 | .103 | .099 | .088 | .093 | .093 | .035 | .068 | .119 |
| MN | | | .001 | | | .002 | | .001 | | |
| MG | .430 | .528 | .431 | .449 | .483 | .468 | .509 | .559 | .492 | .650 |
| CA | .482 | .577 | .510 | .531 | .562 | .534 | .575 | .649 | .560 | .730 |
| NA | .445 | .355 | .423 | .418 | .385 | .451 | .399 | .326 | .388 | .179 |
| K | | | | | | | | | | .002 |
| SUM | 3.979 | 3.981 | 3.984 | 3.989 | 3.987 | 4.012 | 4.003 | 3.989 | 3.988 | 3.977 |

| | | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| CA 48.17 | CA 49.19 | CA 48.88 | CA 49.20 | CA 49.59 | CA 48.75 | CA 48.86 | CA 52.23 | CA 50.81 | CA 48.71 |
| Mg 42.96 | Mg 44.97 | Mg 41.26 | Mg 41.63 | Mg 42.64 | Mg 42.75 | Mg 43.21 | Mg 44.94 | Mg 43.93 | Mg 43.35 |
| FE 8.87 | FE 5.84 | FE 9.87 | FE 9.17 | FE 7.77 | FE 8.51 | FE 7.93 | FE 2.83 | FE 6.05 | FE 7.95 |
| M: 82.88 | M: 88.50 | M: 80.70 | M: 81.94 | M: 84.59 | M: 83.40 | M: 84.49 | M: 94.07 | M: 87.89 | M: 84.51 |
| C: 52.85 | C: 52.24 | C: 54.23 | C: 54.17 | C: 53.77 | C: 53.28 | C: 53.07 | C: 53.75 | C: 53.24 | C: 52.91 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-----------------|------------|-------------------|
| 1 | 02133, AV. OF 4 | 6 | 02363, |
| 2 | 02143, AV. OF 4 | 7 | 02463, AV. OF 2 |
| 3 | 02153, AV. OF 3 | 8 | 02473, AV. OF 3 |
| 4 | 02173, AV. OF 3 | 9 | 02503, AV. OF 3 |
| 5 | 02213, AV. OF 4 | 10 | 02213, TURKID CPX |

TABLE V-13
CPX+OPX ** GARNET GRANULITES - DIFFERENT LOCALITIES **

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SiO2 | 50.66 | 51.29 | 51.08 | 50.99 | 51.25 | 51.13 | 51.67 | 51.99 | 51.83 | 50.80 |
| TiO2 | .53 | .39 | .45 | .50 | .58 | .58 | .51 | .41 | .46 | .51 |
| Al2O3 | 6.29 | 5.53 | 5.86 | 5.96 | 5.83 | 5.89 | 5.71 | 5.13 | 5.42 | 6.23 |
| Cr2O3 | ND | ND | ND | .04 | ND | .04 | .06 | .06 | .06 | .07 |
| FeO | 8.61 | 7.44 | 8.01 | 7.94 | 7.55 | 7.74 | 6.35 | 5.79 | 6.87 | 7.21 |
| MnO | ND | ND | ND | .04 | .04 | .04 | .05 | .05 | .05 | ND |
| MgO | 10.91 | 11.65 | 11.62 | 11.44 | 11.55 | 11.50 | 12.53 | 12.69 | 12.61 | 11.83 |
| CaO | 20.03 | 20.53 | 20.42 | 20.03 | 20.17 | 20.10 | 20.51 | 21.40 | 20.95 | 20.93 |
| Na2O | 2.12 | 2.17 | 2.18 | 2.28 | 2.34 | 2.31 | 1.92 | 1.98 | 1.95 | 2.22 |
| K2O | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| TOTAL | 99.21 | 99.06 | 99.69 | 99.31 | 99.35 | 99.34 | 99.32 | 99.51 | 99.41 | 99.83 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------|
| SI | 1.896 | 1.915 | 1.900 | 1.902 | 1.908 | 1.905 | 1.912 | 1.921 | 1.917 | 1.885 |
| TI | .015 | .011 | .013 | .016 | .016 | .016 | .014 | .011 | .013 | .014 |
| AL | .278 | .243 | .257 | .262 | .256 | .259 | .249 | .223 | .236 | .272 |
| CR | | | | .001 | | .001 | .002 | .002 | .002 | .002 |
| FE2+ | .270 | .232 | .249 | .240 | .235 | .241 | .197 | .179 | .188 | .224 |
| NN | | | | .001 | .001 | .001 | .002 | .002 | .002 | |
| MG | .609 | .648 | .644 | .636 | .641 | .639 | .691 | .699 | .695 | .654 |
| CA | .803 | .821 | .814 | .801 | .805 | .803 | .813 | .847 | .830 | .832 |
| NA | .154 | .157 | .157 | .165 | .169 | .167 | .138 | .142 | .140 | .160 |
| K | | | | | | | | | | |
| SUM | 4.027 | 4.031 | 4.037 | 4.033 | 4.032 | 4.032 | 4.018 | 4.026 | 4.022 | 4.044 |
| CA 47.78 | CA 48.26 | CA 47.67 | CA 47.53 | CA 47.88 | CA 47.70 | CA 47.82 | CA 49.12 | CA 48.47 | CA 48.66 | |
| MG 36.19 | MG 38.09 | MG 37.73 | MG 37.76 | MG 38.13 | MG 37.96 | MG 40.63 | MG 40.51 | MG 40.57 | MG 38.25 | |
| FE 16.03 | FE 13.65 | FE 14.60 | FE 14.71 | FE 13.99 | FE 14.34 | FE 11.55 | FE 10.37 | FE 10.96 | FE 13.08 | |
| M: 69.31 | M: 73.62 | M: 72.11 | M: 71.97 | M: 73.16 | M: 72.59 | M: 77.86 | M: 79.62 | M: 78.73 | M: 74.51 | |
| C: 56.90 | C: 55.89 | C: 55.82 | C: 55.73 | C: 55.67 | C: 55.69 | C: 54.86 | C: 54.80 | C: 54.43 | C: 55.99 | |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|---------------------|------------|--------------------|
| 1 | 06023, CPX.2 CENTER | 6 | 06043, AV. |
| 2 | 06023, CPX.2 EDGE | 7 | H5-1, CPX.1 CENTER |
| 3 | 06023, AV. OF 4 | 8 | H5-1, CPX.1 EDGE |
| 4 | 06043, CPX.1 CENTER | 9 | H5-1, AV. |
| 5 | 06043, CPX.1 EDGE | 10 | H5-2, CPX.1 CENTER |

TABLE V-13
 CPX+OPX ** GARNET GRANULITES - DIFFERENT LOCALITIES **

| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|-------|-------|-------|--------|--------|--------|-------|-------|-------|-------|-------|
| SiO2 | 51.97 | 51.32 | 50.79 | 51.72 | 51.25 | 50.96 | 52.21 | 51.58 | 50.67 | 51.39 |
| TiO2 | .37 | .44 | .66 | .51 | .58 | .52 | .31 | .42 | .45 | .41 |
| Al2O3 | 4.90 | 5.56 | 5.55 | 4.48 | 5.01 | 5.31 | 3.52 | 4.41 | 4.93 | 4.78 |
| Cr2O3 | .06 | .06 | .04 | ND | ND | .06 | .05 | .05 | ND | ND |
| FeO | 6.20 | 6.71 | 8.27 | 7.69 | 7.98 | 8.32 | 6.29 | 7.31 | 9.26 | 8.69 |
| MnO | ND | ND | .06 | ND | .04 | .07 | ND | .05 | .05 | .05 |
| MgO | 12.89 | 12.36 | 11.54 | 12.66 | 12.10 | 11.83 | 13.23 | 12.53 | 12.83 | 12.00 |
| CaO | 21.46 | 21.19 | 21.72 | 21.73 | 21.73 | 20.92 | 21.98 | 21.45 | 19.77 | 21.02 |
| Na2O | 1.93 | 2.08 | 1.57 | 1.33 | 1.45 | 1.54 | 1.45 | 1.50 | 1.40 | 1.57 |
| K2O | ND | ND | ND | ND | | | ND | ND | | |
| TOTAL | 99.81 | 99.75 | 100.21 | 100.18 | 100.17 | 99.53 | 99.68 | 99.31 | 99.57 | 99.31 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------|
| SI | 1.919 | 1.901 | 1.888 | 1.915 | 1.902 | 1.902 | 1.944 | 1.923 | 1.895 | 1.920 |
| TI | .010 | .012 | .010 | .014 | .016 | .015 | .009 | .012 | .013 | .012 |
| AL | .213 | .243 | .243 | .196 | .219 | .234 | .154 | .194 | .207 | .211 |
| CR | .002 | .002 | .001 | | | .002 | .001 | .001 | | |
| FE2+ | .191 | .208 | .257 | .238 | .248 | .260 | .196 | .220 | .290 | .253 |
| MN | | | .002 | | .001 | .002 | | .002 | .002 | .002 |
| MG | .709 | .692 | .639 | .699 | .669 | .658 | .734 | .696 | .715 | .668 |
| CA | .849 | .841 | .865 | .862 | .864 | .837 | .877 | .857 | .800 | .842 |
| NA | .138 | .149 | .113 | .095 | .104 | .111 | .105 | .108 | .102 | .114 |
| K | | | | | | | | | | |
| SUM | 4.033 | 4.039 | 4.028 | 4.021 | 4.024 | 4.021 | 4.022 | 4.022 | 4.034 | 4.020 |
| CA 48.54 | CA 48.58 | CA 49.11 | CA 47.93 | CA 48.52 | CA 47.69 | CA 48.53 | CA 48.11 | CA 44.34 | CA 47.75 | |
| MG 40.52 | MG 39.41 | MG 36.29 | MG 38.84 | MG 37.58 | MG 37.51 | MG 40.63 | MG 39.89 | MG 39.62 | MG 37.91 | |
| FE 10.95 | FE 12.01 | FE 14.60 | FE 13.24 | FE 13.91 | FE 14.80 | FE 10.84 | FE 12.80 | FE 16.05 | FE 14.34 | |
| H: 78.73 | H: 76.65 | H: 71.32 | H: 74.58 | H: 72.99 | H: 71.70 | H: 78.94 | H: 75.34 | H: 71.17 | H: 72.55 | |
| C: 54.58 | C: 55.21 | C: 57.50 | C: 55.24 | C: 56.35 | C: 55.97 | C: 54.43 | C: 55.17 | C: 52.81 | C: 55.74 | |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|---------------------|------------|---------------------|
| 11 | HS-2, CPX.1 EDGE | 16 | 07413, CPX.1 CENTER |
| 12 | HS-2, AV. | 17 | 07413, CPX.1 EDGE |
| 13 | 07403, CPX.1 CENTER | 18 | 07413, AV. |
| 14 | 07403, CPX.1 EDGE | 19 | 09133, CPX.2 CENTER |
| 15 | 07403, AV. | 20 | 09133, CPX.2 EDGE |

TABLE V-13
CPX+OPX ** GARNET GRANULITES - DIFFERENT LOCALITIES **

| | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|
| SiO2 | 51.08 | 50.44 | 50.61 | 50.55 | 50.79 | 51.63 | 51.09 | 52.77 | 52.32 | 53.06 |
| TiO2 | .46 | .55 | .55 | .55 | .49 | .43 | .46 | .28 | .40 | .35 |
| Al2O3 | 5.08 | 5.37 | 5.41 | 5.36 | 5.46 | 5.26 | 5.37 | 8.42 | 7.51 | 7.01 |
| Cr2O3 | ND | .04 | .05 | .04 | ND | ND | ND | .07 | .05 | ND |
| FeO | 8.09 | 8.42 | 8.43 | 8.37 | 8.99 | 8.30 | 8.71 | 4.00 | 6.49 | 6.01 |
| MnO | .04 | .05 | .05 | .05 | .06 | .04 | .05 | ND | .04 | ND |
| MgO | 12.01 | 11.87 | 11.75 | 11.87 | 10.89 | 11.50 | 11.14 | 11.24 | 11.44 | 11.87 |
| CaO | 20.93 | 20.52 | 20.55 | 20.55 | 20.32 | 20.49 | 20.38 | 17.98 | 17.36 | 17.69 |
| Na2O | 1.52 | 1.67 | 1.58 | 1.59 | 2.30 | 2.21 | 2.27 | 4.27 | 3.17 | 3.18 |
| K2O | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| TOTAL | 99.16 | 98.94 | 98.99 | 98.94 | 99.33 | 99.89 | 99.50 | 99.07 | 100.89 | 101.21 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------|
| SI | 1.912 | 1.896 | 1.900 | 1.899 | 1.907 | 1.919 | 1.912 | 1.925 | 1.902 | 1.910 |
| TI | .013 | .016 | .016 | .016 | .014 | .012 | .013 | .008 | .013 | .010 |
| AL | .221 | .238 | .239 | .237 | .242 | .230 | .237 | .362 | .322 | .279 |
| CR | | .001 | .001 | .001 | | | | .002 | .001 | |
| FE2+ | .253 | .265 | .265 | .263 | .282 | .258 | .273 | .122 | .197 | .182 |
| MN | .001 | .002 | .002 | .002 | .002 | .001 | .002 | | .001 | |
| MG | .670 | .665 | .657 | .654 | .609 | .637 | .621 | .611 | .620 | .640 |
| CA | .839 | .826 | .827 | .827 | .810 | .816 | .817 | .763 | .754 | .763 |
| NA | .110 | .122 | .115 | .116 | .167 | .159 | .165 | .302 | .225 | .223 |
| K | | | | | | | | | | |
| SUM | 4.020 | 4.030 | 4.022 | 4.025 | 4.042 | 4.034 | 4.040 | 4.036 | 4.036 | 4.035 |
| CA 47.62 | CA 47.06 | CA 47.27 | CA 47.14 | CA 47.83 | CA 47.69 | CA 47.76 | CA 48.94 | CA 48.00 | CA 48.15 | |
| MG 38.01 | MG 37.86 | MG 37.59 | MG 37.87 | MG 35.65 | MG 37.23 | MG 36.31 | MG 42.56 | MG 39.45 | MG 40.38 | |
| FE 14.37 | FE 15.07 | FE 15.14 | FE 14.99 | FE 16.52 | FE 15.08 | FE 15.93 | FE 8.50 | FE 12.56 | FE 11.47 | |
| M: 72.57 | M: 71.53 | M: 71.30 | M: 71.65 | M: 68.34 | M: 71.17 | M: 69.50 | M: 83.35 | M: 75.85 | M: 77.87 | |
| C: 55.61 | C: 55.42 | C: 55.70 | C: 55.45 | C: 57.29 | C: 56.16 | C: 56.81 | C: 53.49 | C: 54.89 | C: 54.39 | |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|---------------------|------------|---------------------|
| 21 | 09133, AV. OF 4 | 26 | 11-1, CPX.2 EDGE |
| 22 | 09153, CPX.2 CENTER | 27 | 11-1, AV. OF 3 |
| 23 | 09153, CPX.2 EDGE | 28 | 12133, AV. OF 2 |
| 24 | 09153, AV. OF 3 | 29 | 25023, CPX.1 CENTER |
| 25 | 11-1, CPX.2 CENTER | 30 | 25023, CPX.1 EDGE |

TABLE V-13
 CPX+OPX ** GARNET GRANULITES - DIFFERENT LOCALITIES **

| | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
|-------|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|
| SiO2 | 53.14 | 53.53 | 53.18 | 53.35 | 52.03 | 52.44 | 52.23 | 51.31 | 52.87 | 52.75 |
| TiO2 | .40 | .34 | .35 | .35 | .41 | .31 | .36 | .12 | .09 | ND |
| Al2O3 | 7.11 | 7.23 | 7.93 | 7.43 | 5.61 | 5.57 | 5.59 | 2.92 | 1.84 | 2.01 |
| Cr2O3 | ND | .07 | .04 | .05 | .20 | .21 | .20 | .04 | ND | ND |
| FeO | 6.02 | 3.65 | 3.11 | 3.38 | 7.83 | 7.36 | 7.59 | 9.32 | 20.78 | 21.40 |
| MnO | ND | ND | ND | ND | .06 | ND | .05 | .13 | .13 | .14 |
| MgO | 11.74 | 12.98 | 12.80 | 12.89 | 11.28 | 11.30 | 11.33 | 12.31 | 23.08 | 22.36 |
| CaO | 19.65 | 20.39 | 20.48 | 20.43 | 18.53 | 18.63 | 18.98 | 21.95 | .38 | .31 |
| Na2O | 3.15 | 2.67 | 2.56 | 2.61 | 3.21 | 3.13 | 3.17 | .92 | ND | ND |
| K2O | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| TOTAL | 101.28 | 100.89 | 99.58 | 100.22 | 99.17 | 99.07 | 99.11 | 99.03 | 99.22 | 99.05 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------|
| SI | 1.919 | 1.920 | 1.928 | 1.924 | 1.936 | 1.947 | 1.942 | 1.940 | 1.965 | 1.968 |
| TI | .011 | .009 | .010 | .009 | .011 | .009 | .010 | .003 | .003 | |
| AL | .363 | .306 | .300 | .303 | .246 | .244 | .245 | .130 | .081 | .088 |
| CR | | .002 | .001 | .001 | .006 | .006 | .006 | .001 | | |
| FE2+ | .182 | .169 | .094 | .102 | .244 | .229 | .236 | .295 | .646 | .668 |
| MN | | | | | .002 | | .002 | .004 | .004 | .004 |
| MG | .632 | .694 | .692 | .693 | .626 | .630 | .628 | .694 | 1.278 | 1.243 |
| CA | .760 | .784 | .796 | .789 | .739 | .741 | .740 | .889 | .015 | .012 |
| NA | .221 | .186 | .180 | .183 | .232 | .225 | .229 | .067 | | |
| K | | | | | | | | | | |
| SUM | 4.029 | 4.010 | 4.002 | 4.006 | 4.042 | 4.032 | 4.037 | 4.025 | 3.993 | 3.987 |
| CA 48.31 | CA 49.38 | CA 50.31 | CA 49.83 | CA 45.95 | CA 46.34 | CA 46.15 | CA 47.36 | CA .78 | CA .64 | |
| MG 40.14 | MG 43.72 | MG 43.73 | MG 43.73 | MG 38.90 | MG 39.37 | MG 39.14 | MG 36.94 | MG 65.72 | MG 64.64 | |
| FE 11.55 | FE 6.90 | FE 5.96 | FE 6.44 | FE 15.15 | FE 14.29 | FE 14.71 | FE 15.70 | FE 33.30 | FE 34.72 | |
| M: 77.65 | M: 86.37 | M: 88.00 | M: 87.17 | M: 71.97 | M: 73.37 | M: 72.68 | M: 70.18 | M: 66.43 | M: 65.06 | |
| C: 54.62 | C: 53.04 | C: 53.50 | C: 53.26 | C: 54.15 | C: 54.87 | C: 54.11 | C: 56.18 | C: 1.17 | C: .99 | |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|---------------------|------------|-------------------------------------|
| 31 | 25023, AV. OF 3 | 36 | 33013, CPX.1 EDGE |
| 32 | 30-1, CPX.1 CENTER | 37 | 33013, AV. |
| 33 | 30-1, CPX.1 EDGE | 38 | 33023, AV. OF 2 |
| 34 | 30-1, AV. | 39 | 33023, OPX.1, NEAR GT |
| 35 | 33013, CPX.1 CENTER | 40 | 33023, OPX.2, 1/2 WAY TO OPX CENTER |

TABLE V-13
 CPX+OPX ** GARNET GRANULITES - DIFFERENT LOCALITIES **

| | |
|-------|--------|
| | 41 |
| SiO2 | 52.35 |
| TiO2 | ND |
| Al2O3 | 1.85 |
| Cr2O3 | ND |
| FeO | 22.75 |
| MnO | .13 |
| MgO | 22.75 |
| CaO | .31 |
| Na2O | ND |
| K2O | ND |
| TOTAL | 160.21 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| | |
|------------------|-------|
| OXYGEN | 6 |
| Si | 1.946 |
| Ti | |
| Al | .081 |
| Cr | |
| Fe ²⁺ | .707 |
| Mn | .004 |
| Mg | 1.260 |
| Ca | .012 |
| Na | |
| K | |
| SUM | 4.013 |
| CA | .62 |
| Mg | 63.66 |
| FE | 35.72 |
| Mn | 64.05 |
| C | .97 |

**** SAMPLE DIRECTORY ****

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|---------------------|------------|-------------|
| 41 | 33023, OPX.3 CENTER | | |

TABLE U-14
 CPX, OPX ** KYANITE GARNET GRANULITES - DIFFERENT LOCALITIES **

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SiO2 | 52.09 | 52.93 | 52.75 | 52.99 | 53.61 | 53.76 | 52.96 | 53.59 | 52.73 | 52.94 |
| TiO2 | .10 | .07 | .05 | | .04 | ND | ND | ND | .00 | .00 |
| Al2O3 | 7.85 | 5.99 | 5.75 | 5.69 | 6.19 | 5.81 | 4.95 | 4.47 | 6.19 | 5.89 |
| Cr2O3 | .30 | .24 | .04 | ND | ND | ND | .18 | .09 | .21 | .19 |
| FeO | 3.59 | 3.59 | 3.59 | 3.49 | 1.66 | 1.60 | 11.70 | 12.00 | 3.45 | 3.46 |
| MnO | .11 | .07 | .10 | .08 | ND | ND | .19 | .18 | .06 | .08 |
| MgO | 12.86 | 13.59 | 13.53 | 13.75 | 14.48 | 14.97 | 29.27 | 29.27 | 13.45 | 13.60 |
| CaO | 20.75 | 20.74 | 21.02 | 20.89 | 21.97 | 21.43 | .12 | .21 | 21.10 | 21.14 |
| Na2O | 2.10 | 1.95 | 1.99 | 2.00 | 1.78 | 1.83 | ND | ND | 1.91 | 1.95 |
| K2O | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| TOTAL | 99.76 | 99.18 | 98.83 | 98.93 | 99.77 | 99.46 | 99.40 | 99.92 | 99.19 | 99.34 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SI | 1.893 | 1.933 | 1.936 | 1.940 | 1.932 | 1.940 | 1.885 | 1.899 | 1.927 | 1.932 |
| TI | .003 | .002 | .001 | | .001 | | | | .002 | .002 |
| AL | .336 | .258 | .249 | .246 | .263 | .247 | .208 | .187 | .267 | .253 |
| CR | .009 | .007 | .001 | | | | .005 | .003 | .006 | .005 |
| FE2+ | .109 | .110 | .110 | .107 | .050 | .040 | .348 | .358 | .105 | .106 |
| MN | .003 | .002 | .003 | .002 | | | .006 | .005 | .002 | .002 |
| MG | .696 | .740 | .740 | .750 | .778 | .885 | 1.552 | 1.546 | .732 | .740 |
| CA | .808 | .812 | .827 | .819 | .848 | .829 | .005 | .008 | .826 | .827 |
| NA | .148 | .138 | .142 | .142 | .124 | .128 | | | .135 | .138 |
| K | | | | | | | | | | |
| SUM | 4.006 | 4.002 | 4.009 | 4.008 | 3.998 | 4.000 | 4.009 | 4.007 | 4.003 | 4.006 |

| | | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| CA 50.07 | CA 48.86 | CA 49.30 | CA 48.88 | CA 50.62 | CA 49.26 | CA .24 | CA .42 | CA 49.65 | CA 49.44 |
| MG 43.16 | MG 44.53 | MG 44.13 | MG 44.75 | MG 46.40 | MG 47.07 | MG 81.48 | MG 80.86 | MG 44.02 | MG 44.24 |
| FE 6.76 | FE 6.60 | FE 6.57 | FE 6.37 | FE 2.99 | FE 2.97 | FE 18.28 | FE 18.73 | FE 6.34 | FE 6.32 |
| H: 86.46 | M: 87.09 | M: 87.04 | M: 87.53 | H: 93.96 | M: 94.34 | M: 81.68 | M: 81.20 | M: 87.42 | M: 87.51 |
| C: 53.71 | C: 52.32 | C: 52.76 | C: 52.21 | C: 52.17 | C: 50.72 | C: .29 | C: .51 | C: 53.01 | C: 52.78 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-------------------------|------------|--------------------------|
| 1 | 04-1, CORE CPX.1 CENTER | 6 | 04-1, CPX.3A OF CPX-KY |
| 2 | 04-1, CORE CPX.1 EDGE | 7 | 04-1, CORE OPX.1 CENTER |
| 3 | 04-1, CPX.1A OF CPX-KY | 8 | 04-1, CORE OPX.1 EDGE |
| 4 | 04-1, CPX.1B OF CPX-KY | 9 | 04-1, CPX.2A-KY OF OPX.1 |
| 5 | 04-1, CORE CPX.3 | 10 | 04-1, CPX.2B-KY OF OPX.1 |

TABLE V-14
 CPX,OPX ** KYANITE GARNET GRANULITES - DIFFERENT LOCALITIES **

| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|
| SI02 | 53.45 | 54.33 | 54.20 | 54.05 | 54.12 | 54.72 | 52.52 | 52.51 | 52.47 | 52.46 |
| TI02 | ND | ND | .07 | .09 | .08 | ND | .13 | .26 | .41 | .07 |
| AL2O3 | 4.51 | 3.57 | 7.26 | 7.24 | 7.25 | 7.16 | 9.16 | 8.67 | 13.25 | 9.39 |
| CR2O3 | .16 | .10 | .08 | .04 | .06 | | .07 | .10 | .07 | .19 |
| FE0 | 12.11 | 12.30 | 1.47 | 1.47 | 1.47 | 1.40 | 2.41 | 2.29 | 3.62 | 2.91 |
| MNO | .21 | .17 | ND | ND | ND | ND | .05 | ND | .07 | ND |
| MG0 | 29.00 | 28.89 | 13.91 | 13.59 | 13.75 | 14.00 | 12.35 | 12.75 | 8.78 | 12.13 |
| CA0 | .16 | .14 | 21.40 | 21.34 | 21.37 | 20.65 | 21.20 | 21.53 | 16.55 | 21.32 |
| Mg2O | ND | ND | 2.50 | 2.59 | 2.57 | 2.73 | 2.52 | 2.38 | 5.00 | 2.66 |
| K2O | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| TOTAL | 99.64 | 99.53 | 100.92 | 100.44 | 100.70 | 100.79 | 100.42 | 100.52 | 100.25 | 101.15 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
|--------|-------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| SI | 1.900 | 1.932 | 1.927 | 1.931 | 1.928 | 1.942 | 1.885 | 1.885 | 1.876 | 1.876 |
| TI | | | .002 | .002 | .002 | | .004 | .007 | .011 | .002 |
| AL | .189 | .150 | .304 | .305 | .305 | .299 | .368 | .357 | .558 | .396 |
| CR | .004 | .003 | .002 | .001 | .002 | | .002 | .003 | .002 | .005 |
| FE2+ | .360 | .366 | .044 | .044 | .044 | .042 | .072 | .069 | .108 | .087 |
| IR | .006 | .005 | | | | | .002 | | .002 | |
| MG | 1.536 | 1.531 | .737 | .723 | .730 | .745 | .661 | .682 | .468 | .646 |
| CA | .006 | .005 | .815 | .817 | .816 | .785 | .815 | .828 | .634 | .817 |
| NA | | | .172 | .179 | .178 | .188 | .175 | .166 | .347 | .184 |
| K | | | | | | | | | | |
| SUM | 4.004 | 3.992 | 4.004 | 4.004 | 4.005 | 4.002 | 4.004 | 4.007 | 4.006 | 4.014 |
| CA | .32 | CA .28 | CA 51.08 | CA 51.56 | CA 51.32 | CA 49.97 | CA 52.66 | CA 52.45 | CA 52.39 | CA 52.69 |
| MG | 80.76 | MG 80.49 | MG 46.18 | MG 45.67 | MG 45.93 | MG 47.39 | MG 42.67 | MG 43.20 | MG 38.66 | MG 41.70 |
| FE | 18.92 | FE 19.23 | FE 2.74 | FE 2.77 | FE 2.76 | FE 2.64 | FE 4.67 | FE 4.35 | FE 8.94 | FE 5.61 |
| N: | 81.02 | N: 80.72 | N: 94.40 | N: 94.28 | N: 94.34 | N: 94.72 | N: 90.13 | N: 90.84 | N: 81.21 | N: 88.13 |
| C: | .40 | C: .35 | C: 52.52 | C: 53.03 | C: 52.77 | C: 51.33 | C: 55.24 | C: 54.83 | C: 57.54 | C: 55.82 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|------------------------|------------|----------------------------|
| 11 | 04-1,CORE OPX.2 CENTER | 16 | 02223,CPX.1A-KY |
| 12 | 04-1,CORE OPX.2 EDGE | 17 | 02243,AV. CPX IN FLAG BAND |
| 13 | 02223,CPX.1 CENTER | 18 | 02243,AV. CPX IN CPX BAND |
| 14 | 02223,CPX.1 EDGE | 19 | 02343,AV. OF 2 |
| 15 | 02223,AV. | 20 | 02493,AV. CPX IN FLAG BAND |

TABLE V-14
CPX, OPX % Kyanite Garnet Granulites - Different Localities %

| | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
|-------|--------|-------|-------|-------|-------|-------|-------|-------|
| SiO2 | 52.37 | 52.26 | 51.77 | 53.44 | 54.63 | 53.67 | 53.48 | 53.16 |
| TiO2 | .11 | .52 | .41 | .34 | .12 | .30 | .23 | .35 |
| Al2O3 | 8.32 | | 9.71 | 9.45 | 8.68 | 8.68 | 8.93 | 8.78 |
| Cr2O3 | .26 | 10.35 | | ND | ND | ND | ND | ND |
| FeO | 2.59 | 1.91 | 1.67 | 1.79 | 1.90 | 1.91 | 2.01 | 2.07 |
| MnO | ND | | | ND | | | | |
| MgO | 12.05 | 11.49 | 11.71 | 11.68 | 11.87 | 12.08 | 12.01 | 12.09 |
| CaO | 21.51 | 19.19 | 19.06 | 18.55 | 18.20 | 18.78 | 18.75 | 19.35 |
| Na2O | 3.08 | 3.52 | 3.69 | 3.85 | 4.11 | 3.77 | 3.64 | 3.38 |
| K2O | ND | ND | ND | ND | ND | ND | ND | ND |
| TOTAL | 100.24 | 99.25 | 98.23 | 99.13 | 99.73 | 99.21 | 99.07 | 99.28 |

% Atomic Proportions Based on Selected No. of Oxygens %

| Oxygen | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
|------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Si | 1.893 | 1.956 | 1.890 | 1.924 | 1.952 | 1.934 | 1.929 | 1.928 |
| Ti | .003 | .015 | .011 | .009 | .003 | .008 | .006 | .010 |
| Al | .354 | | .418 | .401 | .374 | .369 | .300 | .374 |
| Cr | .007 | .306 | | | | | | |
| Fe ²⁺ | .078 | .066 | .057 | .054 | .057 | .058 | .061 | .063 |
| Mn | | | | | | | | |
| Mg | .649 | .641 | .637 | .627 | .632 | .649 | .646 | .651 |
| Ca | .833 | .770 | .746 | .716 | .697 | .725 | .725 | .749 |
| Na | .210 | .256 | .261 | .269 | .285 | .263 | .255 | .237 |
| K | | | | | | | | |
| SUM | 4.029 | 4.004 | 4.021 | 4.001 | 4.000 | 4.006 | 4.002 | 4.002 |
| CA | 53.39 | 52.34 | 51.78 | 51.25 | 50.29 | 50.66 | 50.64 | 51.22 |
| Mg | 41.60 | 43.59 | 44.25 | 44.89 | 45.62 | 45.32 | 45.12 | 44.51 |
| FE | 5.02 | 4.07 | 3.97 | 3.86 | 4.10 | 4.02 | 4.24 | 4.28 |
| H: | 89.24 | 91.47 | 91.78 | 92.08 | 91.76 | 91.85 | 91.41 | 91.23 |
| C: | 56.21 | 54.56 | 53.92 | 53.31 | 52.43 | 52.78 | 52.88 | 53.58 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|----------------------------|------------|--------------------|
| 21 | 02493, AV. CPX IN CPX BAND | 26 | 12133A, CPX, 4A-KY |
| 22 | 12133A, CPX, 3 CENTER | 27 | 12133A, CPX, 5A-KY |
| 23 | 12133A, CPX, 3 EDGE | 28 | 12133A, CPX, 6A-KY |
| 24 | 12133A, CPX, 2 | | |
| 25 | 12133A, CPX, 1A-KY | | |

TABLE V-14A

GARNET AND CLINOPYROXENE KD'S (FE/MG): ECLOGITES+GRANULITES.

| SAMPLE NO. | CENTER | EDGE | AVERAGE |
|---------------------------|------------|------------|---------|
| ECLOGITES | | | |
| 02023* | 2.91 | 2.56, 2.94 | |
| 02-1 | | 2.94 | |
| 02-2 | 2.82, 3.09 | 2.82, 2.79 | |
| 02043* | | | 2.46 |
| 02063 | | | 2.77 |
| 02073 | | | 3.88 |
| 02083 | | | 3.70 |
| 02093 | | | 3.65 |
| 02103 | | | 3.10 |
| 02123 | | | 5.94 |
| 02233 | | | 2.80 |
| 02413 | | | 3.33 |
| 02423 | | | 3.57 |
| 02433 | | | 3.46 |
| 02443 | | | 3.41 |
| 02483 | | | 2.56 |
| 02513* | 2.86 | 2.79 | |
| 02523* | | | 2.95 |
| KYANITE ECLOGITES | | | |
| 02133 | | | 3.63 |
| 02143 | | | 3.82 |
| 02153 | | | 4.27 |
| 02173 | | | 4.13 |
| 02213 | | | 4.21 |
| 02463 | | | 4.94 |
| 02473 | | | 4.58 |
| 02503 | | | 3.38 |
| GARNET GRANULITES | | | |
| 06023 | 3.44 | 4.28 | |
| 06043 | 3.67 | 3.91 | |
| H5-1 | 3.63 | 4.13 | |
| H5-2 | 4.28 | 5.83 | |
| 07403 | 3.87 | 4.58 | |
| 07413 | 3.74 | 5.79 | |
| 09123 | 2.84 | 3.08 | |
| 09133 | 3.56 | 3.87 | |
| 09153 | | | 3.65 |
| 11-1 | | | 5.27 |
| 12133 | | | 5.07 |
| 25023 | 4.05 | 4.61 | |
| 30-1 | 4.28 | 5.06 | |
| 33013 | 4.25 | 4.60 | |
| 33023 | | | 4.58 |
| KYANITE GARNET GRANULITES | | | |

2.

| | | | |
|--------------|------|------|------|
| 02223 | 5.02 | 5.81 | |
| 02243 | | | 5.64 |
| 02343 | 5.02 | | |
| 02493 (PLAG) | | | 5.99 |
| 02493 (CPX) | | | 4.96 |
| 12133A | 5.18 | 5.47 | |

WHERE

$$KD = \frac{\text{(FE/MG) IN GARNET}}{\text{(FE/MG) IN CLINOPYROXENE}}$$

TABLE V-14B: CLINOPYROXENE ENDMEMBERS (FOR METHOD SEE APPENDIX).

| SAMPLE NO. | TSCH | JAD | ACM | PSJ | WO+ENS+FS | JAD/JAD+TSCH(1) |
|---|-------|-------|-------|------|-----------|-----------------|
| ECLOGITES | | | | | | |
| 02-1 | 6.02 | 34.48 | 5.83 | | 53.68 | 85.14 |
| 02-2 | 3.14 | 37.28 | 6.66 | | 52.92 | 92.23 |
| 02023 | 2.51 | 30.81 | 9.31 | | 57.28 | 92.47 |
| 02063 | 2.64 | 29.27 | 8.09 | | 60.00 | 91.73 |
| 02073 | 4.86 | 34.05 | 3.70 | | 57.39 | 87.51 |
| 02083 | 5.33 | 36.64 | 2.07 | | 55.95 | 87.30 |
| 02093 | 2.73 | 34.62 | 8.09 | | 54.56 | 92.69 |
| 02103 | 1.82 | 25.89 | 5.94 | | 66.35 | 93.43 |
| 02123 | 10.70 | 12.88 | 1.78 | | 74.64 | 54.62 |
| 02233 | 5.27 | 27.05 | 3.71 | | 63.96 | 83.69 |
| 02413 | 1.33 | 40.10 | 6.75 | | 51.83 | 96.79 |
| 02423 | 4.69 | 32.38 | 7.54 | | 55.38 | 87.35 |
| 02433 | 2.40 | 29.85 | 10.17 | | 57.58 | 92.56 |
| 02443 | 2.44 | 41.80 | .78 | | 54.98 | 94.48 |
| 02483 | 1.69 | 35.94 | 8.18 | | 54.19 | 95.51 |
| 02513 | 3.68 | 28.52 | 10.76 | | 57.04 | 88.57 |
| 02523 | 3.36 | 32.52 | 9.16 | | 54.95 | 90.64 |
| 12093 | 3.14 | 19.23 | 2.85 | | 74.79 | 85.96 |
| 09123C | 10.88 | 12.42 | 5.10 | | 71.61 | 53.30 |
| 09123E | 9.14 | 13.31 | 3.69 | | 73.86 | 59.29 |
| KYANITE ECLOGITES | | | | | | |
| 02133 | 4.46 | 44.15 | | 3.87 | 47.52 | 84.65 |
| 02143 | 5.64 | 35.24 | | 3.67 | 55.53 | 86.23 |
| 02153 | 6.06 | 42.01 | | 2.98 | 48.96 | 87.39 |
| 02173 | 5.08 | 41.63 | | 1.99 | 51.29 | 89.12 |
| 02213 | 5.62 | 38.35 | | 2.39 | 53.69 | 87.22 |
| 02363 | 3.44 | 41.73 | 2.67 | | 52.17 | 92.38 |
| 02463 | 2.99 | 39.38 | .50 | | 57.23 | 92.93 |
| 02473 | 6.90 | 32.60 | | 1.80 | 58.70 | 82.53 |
| 02503 | 4.38 | 38.61 | | 3.48 | 53.53 | 89.81 |
| GARNET GRANULITES, C= CENTER, E= EDGE OF EACH CLINOPYROXENE | | | | | | |
| 06023C | 8.56 | 9.62 | 5.19 | | 76.63 | 52.92 |
| E | 7.73 | 9.93 | 5.93 | | 77.89 | 56.23 |
| 06043C | 7.82 | 9.44 | 6.29 | | 76.45 | 54.69 |
| E | 7.24 | 9.91 | 6.20 | | 76.64 | 57.78 |
| H5-1C | 7.21 | 10.03 | 3.41 | | 79.36 | 58.18 |
| E | 6.54 | 8.56 | 5.10 | | 79.89 | 56.69 |
| H5-2C | 9.04 | 6.45 | 7.88 | | 76.63 | 41.64 |
| E | 6.77 | 6.96 | 6.20 | | 80.08 | 50.69 |
| 07403C | 9.16 | 5.08 | 5.76 | | 80.00 | 35.67 |
| E | 6.89 | 5.24 | 3.98 | | 83.90 | 43.20 |
| 07413C | 8.06 | 6.80 | 3.98 | | 81.17 | 45.76 |
| E | 4.55 | 5.91 | 4.26 | | 85.27 | 56.50 |
| 09133C | 8.91 | 3.20 | 6.69 | | 83.04 | 26.42 |
| E | 6.60 | 7.28 | 3.79 | | 82.33 | 52.45 |
| 09153C | 8.42 | 6.03 | 5.65 | | 79.90 | 41.73 |
| E | 8.13 | 6.87 | 4.26 | | 80.74 | 45.80 |
| 11-1C | 7.44 | 7.91 | 7.82 | | 76.84 | 51.53 |
| E | 6.49 | 8.66 | 6.30 | | 77.34 | 57.16 |
| 12133C | 6.27 | 21.33 | 6.92 | | 65.48 | 77.28 |

| | | | | | | |
|---|-------|-------|------|-----|-------|-------|
| 25023C | 8.06 | 14.52 | 6.83 | | 70.59 | 64.30 |
| E | 6.53 | 14.07 | 6.17 | | 73.23 | 68.30 |
| 30-1C | 6.99 | 16.34 | 1.97 | | 74.70 | 70.04 |
| E | 6.19 | 17.66 | .30 | | 75.85 | 74.05 |
| 33013C | 4.99 | 13.73 | 8.09 | | 73.19 | 73.34 |
| E | 4.20 | 15.46 | 6.01 | | 74.33 | 78.64 |
| 33023 | 5.51 | 1.64 | 4.83 | | 88.01 | 22.94 |
| KYANITE GARNET GRANULITES, NO'S 1-28 (TABLE V-14) | | | | | | |
| 04-1C, 1 | 10.33 | 13.60 | 1.09 | | 74.98 | 56.83 |
| " E, 2 | 6.49 | 13.47 | .30 | | 79.74 | 67.48 |
| " +KY , 3 | 6.23 | 12.25 | 1.78 | | 79.74 | 66.29 |
| " +KY , 4 | 5.93 | 12.46 | 1.58 | | 80.02 | 67.75 |
| " C, 5 | 6.70 | 12.40 | | .50 | 80.40 | 64.92 |
| " E, 6 | 6.00 | 12.70 | .10 | | 81.20 | 67.91 |
| 02223, 15 | 6.85 | 16.57 | .09 | | 75.50 | 70.75 |
| " +KY , 16 | 5.78 | 18.25 | .50 | | 75.47 | 75.95 |
| 02243, 17 | 11.04 | 16.52 | .90 | | 71.54 | 59.94 |
| " , 18 | 10.69 | 14.95 | 1.49 | | 72.87 | 58.31 |
| 02343, 19 | 11.20 | 32.90 | 1.49 | | 54.41 | 74.60 |
| 02493, 20 | 11.97 | 15.40 | 2.65 | | 69.99 | 56.27 |
| " , 21 | 9.99 | 14.63 | 5.47 | | 69.85 | 59.42 |
| 12133AC, 22 | 10.03 | 23.75 | .70 | | 65.52 | 70.31 |
| " E, 23 | 8.81 | 21.54 | 3.90 | | 65.64 | 70.97 |
| " +KY , 24 | 5.50 | 28.37 | .01 | | 67.03 | 86.31 |
| " +KY , 25 | 6.75 | 25.10 | .01 | | 68.15 | 81.36 |
| " +KY , 26 | 6.47 | 24.90 | .50 | | 68.13 | 79.38 |
| " +KY , 27 | 6.97 | 23.31 | .30 | | 69.42 | 76.98 |

WHERE

TSCH=CALCIUM TSCHERMACK'S

JAD =JADEITE

ACM =ACMITE

PSJ =PSUEDO-JADEITE OR ESKOLA'S MOLECULE

WO+ENS+FS=QUAD=QUADRILATERAL ENDMEMBERS WOLLASTONITE,
ENSTATITE, FERROSILITE.

(1) = 100*(JAD/JAD+TSCH)

TABLE V-15
PLAGIOCLASE ** GARNET GRANULITES **

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|--------|--------|--------|--------|--------|-------|-------|-------|--------|--------|
| SiO2 | 62.16 | 62.08 | 61.43 | 62.03 | 60.00 | 63.51 | 59.01 | 63.95 | 59.60 | 61.28 |
| TiO2 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Al2O3 | 24.14 | 24.02 | 24.93 | 24.67 | 25.60 | 19.17 | 25.41 | 19.29 | 25.54 | 24.41 |
| CR2O3 | | ND | | ND | | ND | ND | ND | ND | ND |
| FeO | .05 | .04 | .04 | .04 | ND | ND | ND | ND | ND | .04 |
| MnO | | ND | | | ND | ND | ND | ND | ND | ND |
| MgO | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CaO | 5.33 | 5.06 | 5.43 | 5.24 | 7.06 | .12 | 6.93 | .12 | 6.91 | 5.43 |
| Na2O | 8.41 | 9.01 | 8.45 | 8.69 | 7.70 | 1.50 | 7.74 | 1.17 | 7.75 | 8.68 |
| K2O | .50 | .63 | .26 | .28 | .45 | 14.74 | .51 | 14.78 | .47 | .47 |
| TOTAL | 100.61 | 100.89 | 100.59 | 100.98 | 100.87 | 99.69 | 99.66 | 99.36 | 100.34 | 100.37 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| SI | 2.744 | 2.740 | 2.712 | 2.727 | 2.657 | 2.955 | 2.648 | 2.961 | 2.654 | 2.718 |
| TI | | | | | | | | | | |
| AL | 1.256 | 1.249 | 1.297 | 1.278 | 1.336 | 1.051 | 1.344 | 1.053 | 1.341 | 1.276 |
| CR | | | | | | | | | | |
| FE2+ | .002 | .001 | .001 | .001 | | | | | | .001 |
| MN | | | | | | | | | | |
| MG | | | | | | | | | | |
| CA | .252 | .239 | .257 | .247 | .335 | .006 | .333 | .006 | .330 | .258 |
| NA | .720 | .771 | .723 | .741 | .661 | .135 | .674 | .105 | .669 | .747 |
| K | .028 | .035 | .015 | .016 | .025 | .875 | .029 | .873 | .028 | .027 |
| SUM | 5.062 | 5.038 | 5.008 | 5.012 | 5.018 | 5.024 | 5.031 | 5.001 | 5.024 | 5.029 |
| | AN 25.21 | AN 22.88 | AN 25.82 | AN 24.60 | AN 32.79 | AN .59 | AN 32.17 | AN .60 | AN 32.11 | AN 25.03 |
| | AB 71.98 | AB 73.73 | AB 72.71 | AB 73.03 | AB 64.72 | AB 13.32 | AB 65.01 | AB 19.67 | AB 65.16 | AB 72.39 |
| | OR 2.82 | OR 3.39 | OR 1.47 | OR 1.57 | OR 2.49 | OR 86.10 | OR 2.82 | OR 88.72 | OR 2.71 | OR 2.58 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|---------------------|------------|---------------------------|
| 1 | 06023, RELICT PLAG | 6 | 07403, K-SPAR.1 IN PLAG.1 |
| 2 | 06043, RELICT PLAG | 7 | 07403, PLAG.2 |
| 3 | H5-2, PLAG.1 CENTER | 8 | 07403, K-SPAR.2 IN PLAG.2 |
| 4 | H5-2, PLAG.1 EDGE | 9 | 07403, PLAG AV. OF 3 |
| 5 | 07403, PLAG.1 | 10 | 07413, PLAG.1 CENTER |

TABLE V-15
PLAGIOCLASE ** GARNET GRANULITES **

| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|-------|--------|-------|--------|-------|--------|-------|--------|--------|--------|--------|
| SiO2 | 61.11 | 60.57 | 61.39 | 61.09 | 61.21 | 59.99 | 62.07 | 62.10 | 62.19 | 64.19 |
| TiO2 | ND | ND | | | | ND | ND | ND | ND | ND |
| Al2O3 | 24.39 | 24.31 | 25.10 | 24.60 | 25.19 | 24.67 | 24.14 | 23.76 | 23.91 | 22.47 |
| Cr2O3 | ND | ND | | | | ND | ND | ND | ND | ND |
| FeO | .85 | .85 | | | | | ND | ND | ND | ND |
| MnO | ND | ND | | | | | ND | ND | ND | |
| MgO | ND | ND | | | | | ND | ND | ND | |
| CaO | 5.34 | 5.34 | 6.10 | 6.01 | 6.02 | 5.99 | 5.46 | 5.24 | 5.26 | 3.19 |
| Na2O | 8.68 | 8.66 | 7.40 | 7.54 | 7.55 | 7.66 | 8.77 | 8.83 | 8.66 | 10.29 |
| K2O | .47 | .50 | .47 | .46 | .48 | .61 | .45 | .46 | .46 | .59 |
| TOTAL | 100.09 | 99.48 | 100.54 | 99.90 | 100.45 | 98.94 | 100.96 | 100.46 | 100.75 | 100.76 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| SI | 2.718 | 2.712 | 2.709 | 2.714 | 2.705 | 2.698 | 2.735 | 2.748 | 2.745 | 2.823 |
| TI | | | | | | | | | | |
| AL | 1.279 | 1.283 | 1.310 | 1.299 | 1.312 | 1.303 | 1.254 | 1.239 | 1.244 | 1.165 |
| CR | | | | | | | | | | |
| FE2+ | .002 | .002 | | | | | | | | |
| MN | | | | | | | | | | |
| MG | | | | | | | | | | |
| CA | .254 | .256 | .288 | .286 | .285 | .289 | .258 | .248 | .249 | .156 |
| NA | .748 | .752 | .633 | .650 | .647 | .668 | .749 | .758 | .758 | .877 |
| K | .027 | .029 | .026 | .026 | .027 | .035 | .025 | .026 | .026 | .033 |
| SUM | 5.030 | 5.036 | 4.966 | 4.974 | 4.976 | 4.999 | 5.024 | 5.023 | 5.024 | 5.050 |
| | AN 24.71 | AN 24.71 | AN 30.42 | AN 29.75 | AN 29.72 | AN 29.11 | AN 24.97 | AN 24.07 | AN 24.08 | AN 14.17 |
| | AB 72.70 | AB 72.53 | AB 66.79 | AB 67.54 | AB 67.46 | AB 67.36 | AB 72.58 | AB 73.41 | AB 73.41 | AB 82.71 |
| | OR 2.59 | OR 2.76 | OR 2.79 | OR 2.71 | OR 2.82 | OR 3.53 | OR 2.45 | OR 2.52 | OR 2.51 | OR 3.12 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-----------------------|------------|----------------------|
| 11 | 07413, PLAG. 2 EDGE | 16 | 09153, AV. OF 2 |
| 12 | 07413, AV. OF 5 | 17 | 11-1, PLAG. 1 CENTER |
| 13 | 09133, PLAG. 4 CENTER | 18 | 11-1, PLAG. 1 EDGE |
| 14 | 09133, PLAG. 4 EDGE | 19 | 11-1, AV. OF 3 |
| 15 | 09133, AV. OF 5 | 20 | 12133, AV. OF 3 |

TABLE U-15
PLAGIOCLASE ** GARNET GRANULITES **

| | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
|-------|--------|--------|--------|--------|--------|--------|--------|--------|
| SiO2 | 63.53 | 62.34 | 62.61 | 62.50 | 64.56 | 64.61 | 64.58 | 50.45 |
| TiO2 | ND | ND | ND | ND | ND | ND | ND | ND |
| Al2O3 | 23.17 | 24.16 | 24.09 | 24.17 | 22.52 | 22.51 | 22.51 | 31.75 |
| Cr2O3 | ND | | | | ND | ND | ND | ND |
| FeO | ND | ND | ND | ND | ND | ND | ND | ND |
| MnO | ND | | | | ND | ND | ND | ND |
| MgO | ND | | | | ND | ND | ND | ND |
| CaO | 3.97 | 4.99 | 4.91 | 4.95 | 2.96 | 2.92 | 2.94 | 14.29 |
| Na2O | 9.54 | 8.76 | 8.79 | 8.83 | 10.32 | 10.45 | 10.39 | 3.61 |
| K2O | .49 | .56 | .53 | .53 | .25 | .26 | .25 | .20 |
| TOTAL | 100.75 | 100.83 | 100.95 | 101.00 | 100.66 | 100.80 | 100.71 | 100.45 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|
| SI | 2.794 | 2.746 | 2.753 | 2.748 | 2.833 | 2.832 | 2.833 | 2.292 |
| TI | | | | | | | | |
| AL | 1.201 | 1.254 | 1.248 | 1.253 | 1.165 | 1.163 | 1.164 | 1.701 |
| CR | | | | | | | | |
| FE2+ | | | | | | | | |
| MN | | | | | | | | |
| MG | | | | | | | | |
| CA | .187 | .236 | .231 | .233 | .139 | .137 | .138 | .696 |
| NA | .814 | .748 | .749 | .753 | .878 | .888 | .883 | .318 |
| K | .027 | .031 | .030 | .030 | .014 | .015 | .014 | .016 |
| SUM | 5.025 | 5.016 | 5.012 | 5.017 | 5.031 | 5.037 | 5.033 | 5.024 |
| AN | 18.20 | 23.20 | 22.89 | 22.96 | 13.50 | 13.19 | 13.35 | 67.55 |
| AB | 77.13 | 73.70 | 74.16 | 74.11 | 85.15 | 85.41 | 85.30 | 30.88 |
| OR | 2.67 | 3.10 | 2.94 | 2.93 | 1.36 | 1.40 | 1.35 | 1.58 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|----------------------|------------|--------------------|
| 21 | 25023, AV. OF 2 | 26 | 33013, PLAG.1 EDGE |
| 22 | 30-1, PLAG.1 CENTER | 27 | 33013, AV. |
| 23 | 30-1, PLAG.1 EDGE | 28 | 33023. |
| 24 | 30-1, AV. OF 3 | | |
| 25 | 33013, PLAG.1 CENTER | | |

TABLE V-16
PLAGIOCLASE ** KYANITE GARNET GRANULITES **

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|--------|--------|-------|-------|--------|--------|--------|-------|--------|--------|
| SiO2 | 59.53 | 60.36 | 59.45 | 59.91 | 59.45 | 59.94 | 60.90 | 59.20 | 59.39 | 62.08 |
| TiO2 | ND | | | | | | | | | |
| Al2O3 | 26.63 | 25.51 | 25.21 | 25.36 | 26.38 | 25.85 | 25.80 | 24.81 | 25.71 | 22.83 |
| Cr2O3 | ND | | | | | | | | | |
| FeO | ND | | | | | | | | | .39 |
| MnO | ND | | | | | | | | | |
| MgO | ND | | | | | | | | | |
| CaO | 6.84 | 6.42 | 6.09 | 6.25 | 7.84 | 7.29 | 7.15 | 6.85 | 7.28 | 3.76 |
| Na2O | 7.49 | 7.74 | 8.37 | 8.66 | 7.27 | 7.65 | 7.48 | 7.72 | 7.53 | 10.81 |
| K2O | .34 | .31 | .32 | .32 | .28 | .31 | .17 | .33 | .27 | .81 |
| TOTAL | 100.89 | 100.34 | 99.44 | 99.90 | 101.22 | 101.02 | 100.60 | 98.91 | 100.18 | 100.68 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| SI | 2.631 | 2.677 | 2.667 | 2.672 | 2.625 | 2.649 | 2.657 | 2.671 | 2.617 | 2.761 |
| TI | | | | | | | | | | |
| AL | 1.387 | 1.333 | 1.333 | 1.333 | 1.373 | 1.347 | 1.347 | 1.320 | 1.351 | 1.197 |
| CR | | | | | | | | | | |
| FE2+ | | | | | | | | | | .815 |
| MR | | | | | | | | | | |
| MG | | | | | | | | | | |
| CA | .324 | .305 | .293 | .299 | .371 | .345 | .339 | .331 | .348 | .179 |
| NA | .642 | .666 | .728 | .697 | .622 | .654 | .642 | .675 | .651 | .932 |
| K | .019 | .018 | .018 | .018 | .016 | .017 | .016 | .019 | .015 | .046 |
| SUM | 5.006 | 4.998 | 5.039 | 5.019 | 5.007 | 5.013 | 4.995 | 5.016 | 5.011 | 5.130 |
| | AN 32.89 | AN 30.87 | AN 28.17 | AN 29.46 | AN 36.76 | AN 33.96 | AN 34.23 | AN 32.29 | AN 34.29 | AN 15.48 |
| | AB 65.17 | AB 67.35 | AB 70.07 | AB 68.75 | AB 61.68 | AB 64.32 | AB 64.80 | AB 65.86 | AB 64.19 | AB 80.55 |
| | OR 1.95 | OR 1.77 | OR 1.76 | OR 1.80 | OR 1.56 | OR 1.72 | OR .97 | OR 1.85 | OR 1.51 | OR 3.97 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|----------------------|------------|----------------------|
| 1 | 84-1. | 6 | 02243, PLAG.1 EDGE |
| 2 | 02223, PLAG.1 CENTER | 7 | 02243, PLAG.2 CENTER |
| 3 | 02223, PLAG.1 EDGE | 8 | 02243, PLAG.2 EDGE |
| 4 | 02223, AV. | 9 | 02243, AV. |
| 5 | 02243, PLAG.1 CENTER | 10 | 02343, PLAG.4 IN GT |

TABLE V-16
PLAGIOCLASE ** KYANITE GARNET GRANULITES **

| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|-------|--------|--------|--------|--------|--------|--------|-------|--------|-------|
| SI02 | 61.79 | 62.37 | 60.71 | 60.96 | 60.86 | 63.32 | 64.23 | 63.67 | 42.35 |
| TI02 | ND | ND | ND | ND | ND | | | | ND |
| AL2O3 | 23.31 | 22.94 | 24.83 | 24.61 | 24.61 | 23.36 | 22.43 | 22.97 | 35.97 |
| CR2O3 | | ND | | | ND | | | | ND |
| FE0 | .05 | .11 | ND | ND | ND | ND | ND | ND | .35 |
| MNO | | | ND | | ND | | | | ND |
| MGO | | | ND | | ND | | | | ND |
| CAO | 4.28 | 3.85 | 6.49 | 5.74 | 6.05 | 4.06 | 3.67 | 3.58 | 17.85 |
| NA2O | 10.59 | 10.86 | 8.47 | 8.42 | 8.24 | 9.56 | 9.87 | 9.64 | 1.19 |
| K2O | .17 | .41 | .33 | .72 | .63 | .27 | .33 | .36 | .67 |
| TOTAL | 100.26 | 100.56 | 100.89 | 100.48 | 100.45 | 100.54 | 99.94 | 100.17 | 98.46 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| SI | 2.749 | 2.767 | 2.687 | 2.706 | 2.702 | 2.780 | 2.836 | 2.809 | 2.000 |
| TI | | | | | | | | | |
| AL | 1.222 | 1.200 | 1.295 | 1.267 | 1.288 | 1.213 | 1.167 | 1.194 | 2.002 |
| CR | | | | | | | | | |
| FE2+ | .082 | .084 | | | | | | | .014 |
| MN | | | | | | | | | |
| MG | | | | | | | | | |
| CA | .284 | .183 | .388 | .273 | .288 | .172 | .145 | .169 | .903 |
| NA | .914 | .934 | .729 | .725 | .789 | .811 | .845 | .825 | .109 |
| K | .010 | .023 | .019 | .041 | .036 | .015 | .019 | .017 | .040 |
| SUM | 5.101 | 5.112 | 5.839 | 5.833 | 5.826 | 5.819 | 5.812 | 5.815 | 5.072 |
| | AN 18.10 | AN 16.05 | AN 29.17 | AN 26.29 | AN 27.87 | AN 18.82 | AN 14.40 | AN 16.74 | AN 95.81 |
| | AB 81.04 | AB 81.92 | AB 69.06 | AB 69.78 | AB 68.68 | AB 79.69 | AB 83.76 | AB 81.59 | AB 10.35 |
| | OR .86 | OR 2.03 | OR 1.77 | OR 3.93 | OR 3.45 | OR 1.49 | OR 1.84 | OR 1.67 | OR 3.84 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|---------------------|------------|-----------------------------|
| 11 | 02343, PLAG+KYANITE | 16 | 12133A, PLAG.2 CENTER |
| 12 | 02343, AV. OF 4 | 17 | 12133A, PLAG.2 EDGE |
| 13 | 02493, PLAG.3 EDGE | 18 | 12133A, AV. OF 3 |
| 14 | 02493, PLAG.5 EDGE | 19 | 02363, PLAG IN ALTERED AREA |
| 15 | 02493, AV. OF 4 | | |

TABLE V-17
PRIMARY AMPHIBOLES ** ECLOGITES + GRANULITES **

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SiO2 | 41.48 | 47.14 | 41.99 | 43.81 | 42.52 | 40.61 | 41.58 | 42.94 | 42.10 |
| TiO2 | 1.65 | .07 | 1.68 | 1.35 | 1.13 | 2.25 | 1.98 | 1.94 | .87 |
| Al2O3 | 16.90 | 16.12 | 13.64 | 14.25 | 13.63 | 13.24 | 12.95 | 12.85 | 14.85 |
| Cr2O3 | .09 | .06 | ND | .07 | .09 | .15 | .06 | .04 | ND |
| FeO | 5.95 | 6.34 | 11.17 | 8.34 | 11.88 | 13.35 | 12.48 | 10.77 | 10.28 |
| MnO | ND | .10 | ND | ND | ND | .04 | ND | ND | .04 |
| MgO | 14.41 | 14.37 | 12.47 | 14.20 | 13.54 | 11.95 | 12.12 | 12.74 | 12.82 |
| CaO | 12.81 | 8.69 | 11.86 | 12.12 | 11.51 | 11.83 | 11.52 | 11.55 | 12.06 |
| Na2O | 2.57 | 4.49 | 2.66 | 2.88 | 2.53 | 1.57 | 1.87 | 1.75 | 1.87 |
| K2O | .96 | .51 | 2.80 | 1.83 | 1.56 | 2.12 | 2.19 | 2.26 | 2.24 |
| TOTAL | 96.85 | 97.89 | 96.91 | 97.99 | 97.62 | 97.31 | 96.78 | 96.86 | 97.15 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| SI | 6.643 | 6.621 | 6.248 | 6.338 | 6.261 | 6.129 | 6.243 | 6.368 | 6.219 |
| TI | .181 | .007 | .186 | .147 | .125 | .254 | .224 | .216 | .897 |
| AL | 2.902 | 2.669 | 2.392 | 2.427 | 2.366 | 2.344 | 2.292 | 2.246 | 2.536 |
| CR | .018 | .007 | .008 | .008 | .010 | .018 | .007 | .005 | |
| FE2+ | .725 | .745 | 1.390 | 1.008 | 1.364 | 1.677 | 1.567 | 1.336 | 1.270 |
| MN | | .012 | | | | .005 | | | .005 |
| MG | 3.129 | 3.088 | 2.765 | 3.958 | 2.971 | 2.675 | 2.712 | 2.916 | 2.623 |
| CA | 1.875 | 1.388 | 1.891 | 1.976 | 1.816 | 1.904 | 1.853 | 1.835 | 1.989 |
| NA | .726 | 1.223 | .594 | .560 | .722 | .457 | .544 | .503 | .536 |
| K | .178 | .091 | .388 | .337 | .293 | .406 | .428 | .428 | .422 |
| SUM | 15.772 | 15.691 | 15.854 | 15.754 | 15.933 | 15.868 | 15.866 | 15.756 | 15.869 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|----------------------|------------|----------------------|
| 1 | 02123, ECLOGITE | 6 | 07403, GT. GRANULITE |
| 2 | 02363, KY. ECLOGITE | 7 | 09133, GT. GRANULITE |
| 3 | 06023, GT. GRANULITE | 8 | 09153, GT. GRANULITE |
| 4 | H5-1, GT. GRANULITE | 9 | 33023, GT. GRANULITE |
| 5 | H5-2, GT. GRANULITE | | |

TABLE V-17A: SITE OCCUPANCY IN AMPHIBOLES FROM ECLOGITES AND GRANULITES, BASED ON 23 OXYGENS (AFTER PAPIKE ET AL., 1974).

| TABLE =3 V-17 | 4 | 5 | 6 | 7 | 8 | 9 | 1 | 2 | |
|------------------|---------|------|-------|-------|-------|-------|-------|-------|----------------|
| 06023 | H5-1 | H5-2 | 07403 | 09133 | 09153 | 33023 | 02123 | 02363 | |
| SI | 6.25 | 6.33 | 6.26 | 6.13 | 6.24 | 6.37 | 6.22 | 6.04 | 6.62 |
| AL-IV | 1.75 | 1.67 | 1.74 | 1.87 | 1.76 | 1.63 | 1.78 | 1.96 | 1.38 |
| TETR. | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 |
| AL-VI | 0.64 | .76 | .63 | .47 | .54 | .61 | .81 | .95 | 1.29 |
| TI | .19 | .15 | .13 | .25 | .22 | .22 | .10 | .18 | .01 |
| MG | 2.76 | 3.06 | 2.90 | 2.61 | 2.68 | 2.82 | 2.82 | 3.13 | 2.95 |
| FE | 1.39 | 1.01 | 1.33 | 1.64 | 1.55 | 1.34 | 1.27 | .73 | .73 |
| MN | | | | .01 | | | | .01 | |
| CR | | .01 | .01 | .02 | .01 | .01 | | .01 | .01 |
| M1,2,3 | 4.98 | 4.99 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| MG | | | .07 | .06 | .03 | | | | .06 |
| FE | | | .03 | .04 | .02 | | | | .01 |
| CA | 1.89 | 1.88 | 1.82 | 1.90 | 1.85 | 1.84 | 1.91 | 1.88 | 1.31 |
| NA | .11 | .12 | .08 | | .10 | .16 | .09 | .12 | .62 |
| M4 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| NA | .49 | .44 | .64 | .46 | .45 | .34 | .45 | .60 | .60 |
| K | .38 | .33 | .29 | .41 | .42 | .43 | .42 | .18 | .09 |
| A | .87 | .77 | .93 | .87 | .87 | .77 | .87 | .78 | .69 |
| A | 48.2 | 46.3 | 50.6 | 48.0 | 48.3 | 46.0 | 48.2 | 42.8 | 40.8 |
| B | 48.8 | 50.0 | 47.2 | 52.0 | 50.0 | 49.0 | 49.4 | 53.8 | 40.8 |
| C | 3.0 | 3.7 | 2.2 | | 2.7 | 5.0 | 2.4 | 3.4 | 18.4 |
| %OTHERS | 48.8 | 50.0 | 50.6 | 52.0 | 50.0 | 49.0 | 49.4 | 53.8 | 40.8 |
| %QUAD | 51.2 | 50.0 | 49.4 | 48.0 | 50.0 | 51.0 | 50.6 | 46.2 | 59.2 |
| NAME | EDENITE | | | | | | | | PARG- ASITE |

WHERE A, B, C, OTHERS, QUAD ARE AS IN TABLE IV-20.
SITES ARE TETR=TETRAHEDRAL, M1, 2, 3, 4=OCTAHEDRAL, A=12-FOLD
ALKALI.

TABLE V-18
 KYANITES ** ECLOGITES + GRANULITES **

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|--------|--------|--------|--------|--------|-------|--------|--------|-------|--------|
| SiO2 | 36.89 | 37.13 | 36.92 | 36.95 | 36.92 | 35.72 | 36.57 | 36.51 | 35.40 | 38.66 |
| TiO2 | .05 | ND | ND | ND | ND | .64 | | | ND | ND |
| Al2O3 | 63.04 | 63.40 | 63.33 | 63.89 | 63.79 | 63.42 | 63.71 | 63.85 | 63.80 | 61.61 |
| Cr2O3 | .09 | .15 | .07 | .11 | .09 | .32 | .28 | | ND | |
| FeO | .37 | .30 | .42 | .38 | .36 | .29 | .28 | .29 | .36 | .29 |
| MnO | ND | | ND | | | | | | | |
| MgO | ND | ND | ND | ND | ND | .04 | | | ND | |
| CaO | ND | ND | ND | ND | ND | ND | | ND | .15 | .12 |
| Na2O | ND | | ND | ND | | | | | | |
| K2O | | | | | | | | | | |
| TOTAL | 100.41 | 101.04 | 100.82 | 101.40 | 101.23 | 99.75 | 100.84 | 100.68 | 99.76 | 100.69 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| SI | 3.965 | 3.974 | 3.962 | 3.943 | 3.946 | 3.877 | 3.925 | 3.922 | 3.845 | 4.143 |
| TI | .004 | | | | | .003 | | | | |
| AL | 8.006 | 7.998 | 8.012 | 8.037 | 8.036 | 8.114 | 8.069 | 8.084 | 8.168 | 7.782 |
| CR | .008 | .013 | .006 | .009 | .008 | .027 | .024 | | | |
| FE2+ | .033 | .027 | .038 | .034 | .032 | .018 | .025 | .026 | .033 | .026 |
| MN | | | | | | | | | | |
| MG | | | | | | .006 | | | | |
| CA | | | | | | | | | .017 | .014 |
| NA | | | | | | | | | | |
| K | | | | | | | | | | |
| SUM | 12.025 | 12.018 | 12.027 | 12.033 | 12.031 | 12.040 | 12.033 | 12.036 | 12.069 | 11.965 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|---------------------|------------|-------------------------|
| 1 | 02133, KY, ECLOGITE | 6 | 02463, " |
| 2 | 02143, " | 7 | 02453, " |
| 3 | 02153, " | 8 | 02463, " |
| 4 | 02173, " | 9 | 02243, KY, GT GRANULITE |
| 5 | 02213, " | 10 | 02343, " |

TABLE V-18
 KYANITES ** ECLOGITES + GRANULITES **

| | 11 | 12 |
|-------|--------|--------|
| SiO2 | 36.95 | 36.43 |
| TiO2 | ND | ND |
| Al2O3 | 63.90 | 63.86 |
| Cr2O3 | ND | ND |
| FeO | .33 | .19 |
| MnO | | |
| MgO | ND | ND |
| CaO | ND | ND |
| Na2O | | |
| K2O | | |
| TOTAL | 101.24 | 100.54 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 20 | 28 |
|--------|--------|--------|
| SI | 3.947 | 3.917 |
| TI | | |
| AL | 8.046 | 8.094 |
| CR | | |
| FE2+ | .029 | .017 |
| HR | | |
| MG | | |
| CA | | |
| NA | | |
| K | | |
| SUM | 12.029 | 12.035 |

*** SAMPLE DIRECTORY ***

| <u>SAMPLE NO.</u> | <u>DESCRIPTION</u> | <u>SAMPLE NO.</u> | <u>DESCRIPTION</u> |
|-------------------|--------------------|-------------------|--------------------|
| 11 | 02493, | | |
| 12 | 12133A, | | |

TABLE V-19: PRIMARY SCAPOLITE IN GRANULITES.

| | H5-2 | 06043 | 07403 | A | B |
|-------|----------------------------------|-------|-------|-------|-------|
| | ----- | ----- | ----- | -- | -- |
| SI02 | 47.50 | 48.49 | 47.60 | 47.52 | 43.21 |
| TI02 | ND | .06 | ND | ND | <.10 |
| AL2O3 | 24.92 | 24.65 | 25.83 | 25.21 | 27.75 |
| CR2O3 | ND | ND | ND | ND | |
| FE0 | .09 | .05 | .11 | .30 | .32 |
| MNO | | ND | ND | .02 | |
| MGO | .02 | .02 | .05 | .14 | .22 |
| CAO | 14.68 | 14.54 | 16.10 | 15.48 | 18.27 |
| NA2O | 4.93 | 5.27 | 4.35 | 4.52 | 2.66 |
| K2O | .19 | .27 | .25 | .10 | .24 |
| SO3 | 2.30 | | 4.40 | 4.17 | 5.58 |
| TOTAL | 93.63 | 93.35 | 93.69 | 97.46 | 98.35 |
| +H2O | | | | .30 | |
| +CO2 | | | | 2.16 | 1.86 |
| | ATOMIC PROPORTIONS TO 12 (SI+AL) | | | | |
| SI | 7.415 | 7.504 | 7.319 | 7.382 | 6.830 |
| AL | 4.585 | 4.496 | 4.681 | 4.618 | 5.170 |
| TI | | .007 | | | |
| FE | .012 | .007 | .014 | .039 | .043 |
| MN | | | | .003 | |
| MG | .005 | .005 | .011 | .033 | .052 |
| CAO | 2.456 | 2.411 | 2.653 | 2.577 | 3.094 |
| NA | 1.491 | 1.581 | 1.297 | 1.360 | .815 |
| K | .038 | .054 | .049 | .020 | .048 |
| %ME. | 61.79 | 59.78 | 66.55 | 65.77 | 78.70 |

WHERE

A=SCAPOLITE FROM GT+AMPH+CPX+PLAG. GNEISS, GHANA (VON KNORRING+KENNEDY, 1958).

B=SCAPOLITE FROM DELEGATE TWO-PYROXENE GRANULITE (R18) (LOVERING+WHITE, 1969).

%ME.=%MEIONITE ENDMEMBER CALCULATED AS 100(CA+MG+FE+MN+TI/NA+K+CA+MG+FE+MN+TI) AT. PROP.

TABLE V-20
SECONDARY CLINOPYROXENES ** ECLOGITES **

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|--------|-------|-------|--------|-------|--------|--------|-------|-------|-------|
| SiO2 | 47.40 | 46.93 | 46.65 | 47.55 | 46.82 | 46.50 | 49.48 | 42.33 | 44.10 | 42.89 |
| TiO2 | 1.08 | .81 | .67 | .93 | 1.16 | .49 | .09 | 3.67 | 2.81 | 3.16 |
| Al2O3 | 10.52 | 9.98 | 10.42 | 11.05 | 10.45 | 12.01 | 6.85 | 13.27 | 11.86 | 12.67 |
| Cr2O3 | .04 | .04 | ND | ND | ND | | | .06 | ND | ND |
| FeO | 8.24 | 8.58 | 8.53 | 7.82 | 8.42 | 8.14 | 8.84 | 6.39 | 7.98 | 7.14 |
| MnO | .27 | .30 | .24 | .16 | .22 | .14 | .24 | .15 | .27 | .20 |
| MgO | 12.22 | 11.39 | 11.83 | 11.54 | 11.55 | 10.86 | 12.15 | 10.95 | 10.74 | 10.70 |
| CaO | 19.89 | 20.51 | 18.33 | 19.67 | 19.52 | 21.45 | 22.35 | 20.72 | 20.44 | 20.39 |
| Na2O | 1.43 | 1.30 | 1.37 | 1.49 | 1.34 | .92 | .55 | .96 | 1.10 | 1.13 |
| K2O | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| TOTAL | 101.10 | 99.85 | 98.08 | 100.24 | 99.52 | 100.53 | 100.56 | 98.51 | 98.53 | 98.30 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SI | 1.744 | 1.755 | 1.764 | 1.756 | 1.750 | 1.723 | 1.839 | 1.601 | 1.674 | 1.629 |
| TI | .030 | .023 | .019 | .026 | .033 | .014 | .003 | .104 | .057 | .090 |
| AL | .456 | .440 | .464 | .481 | .460 | .524 | .300 | .592 | .531 | .567 |
| CR | .001 | .001 | | | | | | .002 | | |
| FE2+ | .253 | .268 | .270 | .242 | .263 | .252 | .275 | .202 | .253 | .227 |
| MN | .008 | .010 | .008 | .005 | .007 | .004 | .008 | .005 | .009 | .006 |
| MG | .670 | .635 | .667 | .635 | .643 | .600 | .673 | .617 | .607 | .606 |
| CA | .784 | .822 | .743 | .778 | .782 | .851 | .890 | .840 | .831 | .830 |
| NA | .102 | .094 | .100 | .107 | .097 | .066 | .040 | .070 | .081 | .083 |
| K | | | | | | | | | | |
| SUM | 4.049 | 4.049 | 4.035 | 4.031 | 4.036 | 4.035 | 4.028 | 4.033 | 4.044 | 4.039 |

| | | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| CA 45.92 | CA 47.64 | CA 44.23 | CA 47.03 | CA 46.30 | CA 49.99 | CA 48.43 | CA 50.61 | CA 49.13 | CA 49.92 |
| MG 39.24 | MG 36.80 | MG 39.70 | MG 38.38 | MG 38.11 | MG 35.20 | MG 36.62 | MG 37.20 | MG 35.90 | MG 36.44 |
| FE 14.85 | FE 15.56 | FE 16.07 | FE 14.59 | FE 15.59 | FE 14.81 | FE 14.95 | FE 12.18 | FE 14.97 | FE 13.64 |

| | | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| N: 72.55 | N: 70.29 | N: 71.19 | N: 72.45 | N: 70.97 | N: 70.39 | N: 71.61 | N: 75.33 | N: 70.57 | N: 72.76 |
| C: 53.92 | C: 56.42 | C: 52.70 | C: 55.07 | C: 54.86 | C: 58.68 | C: 56.94 | C: 57.64 | C: 57.78 | C: 57.81 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-------------------------|------------|-------------------------------|
| 1 | 02023, OVERGROWTH CPX.3 | 6 | 02-1, CPX.1 ADJ. CALCITE BLOB |
| 2 | 02023, " CPX.10 | 7 | 02-1, CPX.2 |
| 3 | 02023, IN GLASS, CPX A | 8 | 02043, CPX.A1 CENTER |
| 4 | 02023, " ,CPX.1C | 9 | 02043, CPX.A1 EDGE |
| 5 | 02023, " ,TINY CPX | 10 | 02043, CPX.B CENTER |

TABLE U-20
SECONDARY CLINOPYROXENES ** ECLOGITES **

| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SiO2 | 45.11 | 44.61 | 49.87 | 44.79 | 47.09 | 48.21 | 46.01 | 52.86 | 53.33 |
| TiO2 | 1.10 | 2.30 | .42 | .64 | .42 | .23 | .72 | .09 | .18 |
| Al2O3 | 11.61 | 12.65 | 8.22 | 14.34 | 10.72 | 8.97 | 12.18 | 8.36 | 11.53 |
| Cr2O3 | .07 | .05 | ND | ND | ND | ND | ND | .12 | .17 |
| FeO | 8.39 | 7.71 | 6.85 | 7.56 | 9.28 | 10.88 | 8.11 | 3.90 | 2.47 |
| MnO | .32 | .21 | .18 | .15 | .30 | .41 | .20 | ND | ND |
| MgO | 10.91 | 10.83 | 15.14 | 9.70 | 10.72 | 11.06 | 11.15 | 11.94 | 9.97 |
| CaO | 20.50 | 20.73 | 17.93 | 21.05 | 19.82 | 18.82 | 19.12 | 18.66 | 16.08 |
| Na2O | 1.04 | 1.11 | 1.23 | 1.09 | 1.04 | 1.00 | 1.34 | 2.53 | 5.20 |
| K2O | ND | ND | ND | ND | ND | ND | ND | .05 | .18 |
| TOTAL | 99.07 | 99.61 | 99.89 | 99.37 | 99.43 | 99.60 | 98.87 | 98.54 | 99.05 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SI | 1.702 | 1.651 | 1.827 | 1.675 | 1.765 | 1.811 | 1.725 | 1.930 | 1.918 |
| TI | .031 | .065 | .012 | .018 | .012 | .006 | .020 | .002 | .005 |
| AL | .516 | .559 | .355 | .632 | .474 | .397 | .538 | .360 | .489 |
| CR | .002 | .001 | | | | | | .003 | .005 |
| FE2+ | .265 | .242 | .210 | .236 | .291 | .342 | .254 | .119 | .074 |
| MN | .010 | .007 | .006 | .005 | .010 | .013 | .006 | | |
| HG | .613 | .605 | .827 | .541 | .599 | .619 | .623 | .650 | .534 |
| CA | .829 | .833 | .704 | .843 | .796 | .758 | .768 | .730 | .620 |
| NA | .076 | .081 | .087 | .079 | .076 | .073 | .097 | .177 | .363 |
| K | | | | | | | | .002 | .005 |
| SUM | 4.046 | 4.045 | 4.028 | 4.031 | 4.024 | 4.021 | 4.034 | 3.977 | 4.014 |

| | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| CA 48.55 | CA 49.58 | CA 40.44 | CA 52.05 | CA 47.22 | CA 44.08 | CA 46.68 | CA 48.71 | CA 50.45 |
| HG 35.94 | HG 36.03 | HG 47.49 | HG 33.36 | HG 35.52 | HG 36.03 | HG 37.86 | HG 43.35 | HG 43.50 |
| FE 15.51 | FE 14.39 | FE 12.00 | FE 14.59 | FE 17.26 | FE 19.89 | FE 15.45 | FE 7.95 | FE 6.05 |
| N: 69.85 | N: 71.45 | N: 79.73 | N: 69.57 | N: 67.30 | N: 64.43 | N: 71.01 | N: 84.51 | N: 87.79 |
| C: 57.46 | C: 57.92 | C: 45.99 | C: 60.94 | C: 57.07 | C: 55.02 | C: 55.22 | C: 52.91 | C: 53.69 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|---------------------------------|------------|--------------------------|
| 11 | 02043, CPX, N EDGE | 16 | 02513, * CPX, 7, IN MELT |
| 12 | 02043, CPX, C | 17 | 02523, IN GLASS |
| 13 | 02423, OVERGROWTH CPX | 18 | 02213, FINE SIMPLECTITE |
| 14 | 02513, * CPX, 5 ADJ. CPX | 19 | 02453, * |
| 15 | 02513, *CPX, 6, 1 2 WAY TO MELT | | |

TABLE V-20A: ENDMEMBERS FOR SECONDARY CLINOPYROXENES (NO'S REFER TO ANALYSES IN TABLE V-20. SEE ALSO TABLE V-14B).

| | TSCH | JAD | ACM | QUAD | 100 (JAD/JAD+TSCH) |
|----------|-------|------|-------|-------|--------------------|
| 02023,1 | 21.14 | .47 | 9.07 | 69.32 | 2.17 |
| " ,2 | 20.80 | 8.81 | 70.40 | | |
| " ,3 | 20.70 | 2.85 | 6.68 | 69.75 | 12.10 |
| " ,4 | 20.89 | 4.31 | 5.94 | 68.85 | 17.10 |
| 02-1,6 | 25.07 | | 6.29 | 68.84 | |
| " ,7 | 15.22 | | 3.85 | 80.92 | |
| 02043,8 | 28.18 | .19 | 6.49 | 65.14 | .67 |
| " ,9 | 25.35 | | 7.63 | 67.01 | |
| " ,10 | 26.62 | .47 | 7.39 | 65.51 | 1.73 |
| " ,11 | 25.12 | | 7.15 | 67.73 | |
| " ,12 | 26.70 | | 7.60 | 65.68 | |
| 02423,13 | 15.52 | 3.18 | 5.20 | 76.10 | 17.01 |
| 02513,14 | 29.45 | 1.73 | 5.85 | 62.97 | 5.55 |
| " ,15 | 21.62 | 2.71 | 4.65 | 71.01 | 11.14 |
| " ,16 | 17.87 | 3.03 | 4.10 | 75.00 | 14.50 |
| 02523,17 | 24.36 | 2.67 | 6.59 | 66.38 | 9.88 |

TABLE V-21
SECONDARY AMPHIBOLES ** ECLOGITES **

| | 1 | 2 | 3 | 4 | 5 |
|-------|-------|-------|-------|-------|-------|
| SI02 | 38.65 | 39.85 | 39.26 | 39.14 | 41.74 |
| TIO2 | 1.40 | 2.21 | 2.37 | 4.24 | .96 |
| AL2O3 | 16.52 | 16.32 | 16.38 | 14.89 | 15.36 |
| CR2O3 | .06 | .09 | ND | .06 | .04 |
| FE0 | 12.25 | 11.83 | 12.29 | 13.45 | 11.63 |
| MNO | .25 | .31 | .30 | .31 | .24 |
| MGO | 11.69 | 12.55 | 11.99 | 10.98 | 13.62 |
| CAO | 10.48 | 10.65 | 11.14 | 9.20 | 9.81 |
| NA2O | 3.00 | 2.52 | 2.07 | 3.67 | 3.62 |
| K2O | 1.50 | 1.49 | 1.88 | .81 | 1.18 |
| TOTAL | 96.00 | 97.81 | 97.70 | 96.75 | 98.12 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 23 | 23 | 23 | 23 | 23 |
|--------|--------|--------|--------|--------|--------|
| SI | 5.850 | 5.889 | 5.840 | 5.889 | 6.112 |
| TI | .159 | .246 | .265 | .400 | .106 |
| AL | 2.947 | 2.843 | 2.872 | 2.641 | 2.651 |
| CR | .007 | .011 | | .007 | .005 |
| FE2+ | 1.551 | 1.462 | 1.529 | 1.692 | 1.424 |
| MN | .032 | .039 | .038 | .040 | .038 |
| MG | 2.682 | 2.764 | 2.658 | 2.462 | 2.972 |
| CA | 1.700 | 1.686 | 1.776 | 1.483 | 1.539 |
| NA | .880 | .722 | .597 | 1.071 | 1.028 |
| K | .290 | .279 | .357 | .155 | .205 |
| SUM | 16.098 | 15.940 | 15.934 | 15.920 | 16.071 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-------------------------|------------|-------------|
| 1 | 02023, EUBEDRAL IN MELT | | |
| 2 | 02043, " , CENTER | | |
| 3 | 02043, " , EDGE | | |
| 4 | 02413, IN GT. KELYPHYTE | | |
| 5 | 02523, IN MELT | | |

TABLE V-21A: SITE OCCUPANCY IN SECONDARY AMPHIBOLES
(SEE ALSO TABLE V-17A).

| TABLE= | 1 | 2 | 3 | 4 | 5 |
|---------|---------|-------|-------|-------|-------|
| V-20 | 02023 | 02043 | 02043 | 02413 | 02523 |
| S1 | 5.85 | 5.89 | 5.84 | 5.89 | 6.11 |
| AL-IV | 2.15 | 2.11 | 2.16 | 2.11 | 1.89 |
| TETR. | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 |
| AL-VI | .80 | .73 | .71 | .53 | .76 |
| TI | .16 | .25 | .27 | .48 | .11 |
| MG | 2.53 | 2.60 | 2.53 | 2.34 | 2.77 |
| FE | 1.47 | 1.37 | 1.45 | 1.60 | 1.32 |
| MN | .03 | .04 | .04 | .04 | .03 |
| CR | .01 | .01 | | .01 | .01 |
| M1,2,3 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| MG | .15 | .16 | .13 | .12 | .21 |
| FE | .08 | .09 | .08 | .09 | .10 |
| CA | 1.70 | 1.69 | 1.78 | 1.48 | 1.54 |
| NA | .07 | .06 | .06 | .31 | .15 |
| M4 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| NA | .81 | .66 | .54 | .76 | .88 |
| K | .29 | .28 | .36 | .16 | .21 |
| A | 1.10 | .94 | .90 | .92 | 1.09 |
| A | 49.8 | 46.4 | 45.8 | 43.2 | 51.7 |
| B | 48.6 | 52.1 | 53.7 | 49.5 | 44.8 |
| C | 1.6 | 1.5 | 1.5 | 7.3 | 3.5 |
| %OTHERS | 49.8 | 52.1 | 53.7 | 49.5 | 51.7 |
| %QUAD | 50.2 | 47.9 | 46.3 | 50.5 | 48.3 |
| NAME | EDENITE | | | | |

TABLE V-22
SECONDARY SPINELS ** ECLOGITES **

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|-------|-------|-------|-------|--------|-------|--------|-------|-------|-------|
| SiO2 | | | | | | | | | |
| TiO2 | .35 | .55 | .61 | .58 | .73 | .61 | .25 | .29 | .27 |
| Al2O3 | 55.40 | 56.01 | 61.15 | 57.60 | 61.13 | 57.21 | 60.64 | 58.10 | 55.29 |
| Cr2O3 | .31 | .08 | ND | | | ND | ND | .21 | ND |
| FeO | 27.28 | 26.41 | 18.24 | 26.92 | 18.57 | 27.87 | 20.31 | 24.82 | 29.51 |
| MnO | .26 | .21 | .17 | .53 | .19 | .36 | .18 | .18 | .22 |
| MgO | 14.70 | 14.99 | 19.10 | 14.93 | 19.12 | 14.84 | 17.16 | 14.37 | 13.54 |
| CaO | | | | | | | | .08 | |
| Na2O | | | | | | | | | |
| K2O | | | | | | | | | |
| TOTAL | 98.30 | 98.25 | 99.29 | 100.56 | 99.74 | 100.90 | 98.55 | 98.05 | 98.84 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SI | | | | | | | | | |
| Ti | .007 | .011 | .012 | .012 | .014 | .012 | .005 | .006 | .006 |
| AL | 1.017 | 1.027 | 1.005 | 1.036 | 1.079 | 1.025 | 1.902 | 1.079 | 1.020 |
| CR | .007 | .002 | | | | | | .005 | |
| FE2+ | .635 | .611 | .399 | .609 | .405 | .631 | .452 | .569 | .607 |
| MN | .006 | .005 | .004 | .012 | .004 | .008 | .004 | .004 | .005 |
| MG | .609 | .618 | .745 | .602 | .743 | .599 | .681 | .507 | .564 |
| CA | | | | | | | | .002 | |
| NA | | | | | | | | | |
| K | | | | | | | | | |
| SUM | 3.081 | 3.074 | 3.045 | 3.070 | 3.046 | 3.075 | 3.044 | 3.052 | 3.004 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|------------------------------|------------|---------------------------|
| 1 | 02023, SP.1 WITH CPX IN MELT | 6 | 02043, SP.4 IN MELT |
| 2 | 02023, SP.2 | 7 | 02423, SP.1 WITH SEC AMPH |
| 3 | 02043, SP.1 IN AMPH | 8 | 02513, SP. IN CPX RIM |
| 4 | 02043, SP.2 IN SERP | 9 | 02523, SP IN AMPH |
| 5 | 02043, SP.3 IN CPX | | |

TABLE V-23
PRIMARY(P)+SECONDARY PHLOGOPITES**ECLOGITES**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SI02 | 39.83 | 38.37 | 38.45 | 38.32 | 38.78 | 37.60 | 37.43 | 35.70 |
| TIO2 | 5.16 | 5.63 | 5.63 | 5.76 | 5.77 | 5.50 | 3.27 | 1.43 |
| AL2O3 | 14.57 | 14.97 | 15.81 | 15.02 | 15.68 | 16.18 | 14.78 | 20.06 |
| CR2O3 | .74 | 1.46 | .23 | .27 | .29 | .21 | .06 | ND |
| FE0 | 5.79 | 5.65 | 6.46 | 6.43 | 6.40 | 6.82 | 11.94 | 10.80 |
| MNO | ND | .05 | .05 | .04 | ND | ND | .07 | .05 |
| K2O | 19.29 | 18.76 | 18.33 | 18.72 | 18.78 | 18.39 | 16.54 | 16.67 |
| CAO | ND | ND | ND | ND | ND | .05 | ND | 1.00 |
| NA2O | .19 | .16 | .26 | .22 | .26 | .34 | .30 | .96 |
| K2O | 9.81 | 9.83 | 9.64 | 9.62 | 9.61 | 9.30 | 9.61 | 9.45 |
| TOTAL | 94.62 | 94.89 | 94.89 | 94.43 | 95.62 | 94.41 | 94.04 | 96.13 |

** ATOMIC PROPORTIONS BASED ON SELECTED NO. OF OXYGENS **

| OXYGEN | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| SI | 5.630 | 5.533 | 5.536 | 5.551 | 5.537 | 5.450 | 5.596 | 5.202 |
| TI | .560 | .611 | .610 | .628 | .620 | .600 | .370 | .157 |
| AL | 2.477 | 2.544 | 2.683 | 2.585 | 2.639 | 2.764 | 2.605 | 3.445 |
| CR | .004 | .166 | .026 | .031 | .033 | .024 | .007 | |
| FE2+ | .698 | .681 | .778 | .779 | .764 | .827 | 1.493 | 1.316 |
| MN | | .006 | .006 | .005 | | | .009 | .006 |
| MG | 4.147 | 4.032 | 3.933 | 4.041 | 3.996 | 3.973 | 3.685 | 3.620 |
| CA | | | | | | .008 | | .156 |
| NA | .053 | .045 | .073 | .062 | .072 | .096 | .007 | .271 |
| K | 1.805 | 1.808 | 1.771 | 1.778 | 1.751 | 1.720 | 1.833 | 1.757 |
| SUM | 15.459 | 15.428 | 15.421 | 15.444 | 15.419 | 15.464 | 15.688 | 15.932 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-----------------------------------|------------|---------------------|
| 1 | 02043,PHL.1 CENTER,LARGE PLATE(P) | 6 | 02043,PHL.4 EDGE ," |
| 2 | 02043,PHL.1 EDGE, *(P) | 7 | 02103,PHL |
| 3 | 02043,PHL.2 CENTER, *(P) | 8 | 02513,PHL |
| 4 | 02043,PHL.2 EDGE, *(P) | | |
| 5 | 02043,PHL.3 CENTER,CRUMDMASS | | |

TABLE V-24
OTHER SECONDARY MINERALS ** ECLOGITES + GRANULITES **

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SiO2 | 30.19 | 32.45 | 37.56 | 31.92 | 30.49 | 31.70 | 31.08 | 31.50 | 39.71 | 41.52 |
| TiO2 | .20 | .55 | .70 | .94 | 1.38 | 1.03 | 1.30 | 1.24 | .25 | .18 |
| Al2O3 | 13.00 | 13.69 | 15.33 | 15.13 | 14.02 | 14.79 | 13.54 | 12.03 | 16.81 | 17.59 |
| CR2O3 | | | | ND | ND | ND | ND | ND | ND | ND |
| FeO | 22.70 | 11.46 | 10.05 | 11.25 | 16.59 | 17.76 | 15.53 | 18.90 | 14.61 | 12.40 |
| MnO | .43 | .40 | .31 | .25 | .44 | .44 | .44 | .41 | .26 | .22 |
| MgO | 15.90 | 19.79 | 9.77 | 19.12 | 16.27 | 16.25 | 17.63 | 17.18 | 8.57 | 7.66 |
| CaO | 1.34 | 6.63 | 7.52 | 4.58 | 5.61 | 3.79 | 5.00 | 3.93 | 1.53 | 2.49 |
| Na2O | .16 | .36 | 1.32 | .25 | .33 | .31 | .26 | .20 | .76 | 1.79 |
| K2O | .15 | .11 | 1.11 | .13 | 1.21 | 1.24 | 1.22 | 1.14 | 4.69 | 4.60 |
| TOTAL | 84.87 | 85.44 | 83.67 | 83.59 | 86.37 | 87.32 | 86.81 | 86.63 | 87.42 | 88.46 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-----------------|------------|-----------------|
| 1 | 02023, GLASS. 1 | 6 | 02043, GLASS. 2 |
| 2 | 02023, GLASS. 2 | 7 | 02043, GLASS. 3 |
| 3 | 02023, GLASS. 3 | 8 | 02043, GLASS. 4 |
| 4 | 02023, GLASS. 4 | 9 | 02513, GLASS. 1 |
| 5 | 02043, GLASS. 1 | 10 | 02513, GLASS. 2 |

TABLE V-24
OTHER SECONDARY MINERALS ** ECLOGITES + GRANULITES **

| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SiO2 | 31.99 | 43.47 | 37.31 | 37.84 | 53.18 | 51.94 | 47.09 | 52.46 |
| TiO2 | .06 | ND | .09 | .10 | | | ND | ND |
| Al2O3 | 11.40 | 18.73 | 9.84 | 10.06 | 24.63 | 24.57 | 28.18 | 27.29 |
| Cr2O3 | ND | ND | ND | ND | | | | ND |
| FeO | 25.91 | ND | 12.68 | 10.61 | | | ND | ND |
| MnO | .30 | ND | .09 | ND | | | | ND |
| MgO | 17.42 | 9.35 | 24.40 | 25.18 | | | ND | ND |
| CaO | .18 | .37 | .45 | .55 | .57 | .54 | .17 | .08 |
| Na2O | .22 | 1.38 | .16 | .14 | 13.26 | 13.87 | 15.52 | 16.27 |
| K2O | .05 | .77 | .18 | .22 | .12 | .07 | .09 | .09 |
| TOTAL | 87.56 | 74.11 | 85.22 | 84.72 | 91.76 | 90.99 | 91.12 | 96.26 |

*** SAMPLE DIRECTORY ***

| SAMPLE NO. | DESCRIPTION | SAMPLE NO. | DESCRIPTION |
|------------|-----------------------------------|------------|------------------|
| 11 | 02023, CHLORITE-SERPENTINE LATHES | 16 | 02453, ANALCITE |
| 12 | 02023, BA-ZEOLITE | 17 | 06023, NATROLITE |
| 13 | 02043, SERPENTINE-REGULAR | 18 | 11-1, NATROLITE |
| 14 | 02043, SERPENTINE-IRREGULAR | | |
| 15 | 02453, ANALCITE | | |

TABLE V-24A: C.I.P.W. NORMS OF GLASS ANALYSES IN TABLE V-24 (SEE ALSO TABLE V-26). CALCULATED VOLATILE-FREE AND $Fe^{3+}/Fe^{2+} = .20$

| TABLE | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| V-24 | | | | | | | | | | |
| OR | 1.11 | | 7.78 | 1.11 | | 2.78 | | 6.67 | 31.69 | 30.58 |
| PLAG.AB | 1.57 | | 13.10 | 2.62 | | | | | 9.43 | 13.10 |
| .AN | 7.78 | 35.58 | 38.92 | 27.24 | 20.02 | 21.41 | 26.97 | 22.52 | 8.90 | 13.90 |
| LE | | .44 | | | 6.54 | 7.85 | 6.54 | .87 | | |
| NE | | 1.99 | | | .57 | 1.70 | 1.42 | 1.14 | 2.27 | |
| CO | 12.14 | 2.14 | | 7.14 | 7.00 | 6.02 | 3.57 | 3.77 | 8.26 | 5.81 |
| DIOP.WO | | | 2.32 | | | | | | | |
| .ENS | | | 1.40 | | | | | | | |
| .FS | | | .79 | | | | | | | |
| WO | | 2.01 | | | 5.10 | | .70 | | | |
| HYP.ENS | 17.30 | | | 7.80 | | | | | 3.8 | |
| .FS | 13.59 | | | 2.38 | | | | | 3.70 | |
| OL.FO | 20.72 | 39.06 | 19.32 | 34.44 | 32.76 | 32.48 | 35.42 | 34.58 | 14.28 | 15.12 |
| .FA | 17.95 | 14.08 | 11.63 | 11.42 | 20.06 | 20.86 | 17.75 | 22.03 | 14.89 | 15.10 |
| MT | 7.19 | 3.71 | 3.25 | 3.71 | 5.10 | 5.57 | 4.87 | 4.18 | 4.41 | 3.71 |
| IL | .46 | 1.22 | 1.52 | 2.12 | 3.04 | 2.28 | 2.89 | 2.74 | .61 | .41 |

WHERE LE=LEUCITE

TABLE V-25: WHOLE ROCK ANALYSES-ECLOGITES+GRANULITES.

| | 02-2 | 02023 | 02043 | 02083 | 02093 | 02103 | 02233 | 02413 | 02423 | 02513 |
|-------|--------|-------|-------|--------|--------|--------|--------|-------|--------|-------|
| SiO2 | 45.62 | 46.35 | 40.58 | 44.77 | 45.92 | 47.59 | 48.92 | 45.37 | 47.01 | 44.72 |
| TiO2 | .25 | .44 | 1.63 | .51 | 1.52 | 1.09 | .67 | 2.49 | .36 | .27 |
| Al2O3 | 16.68 | 12.17 | 16.89 | 14.22 | 14.75 | 10.84 | 15.63 | 13.21 | 14.64 | 14.67 |
| Fe2O3 | 14.14 | 11.28 | 14.82 | 8.86 | 15.06 | 11.20 | 5.65 | 13.24 | 7.46 | 12.48 |
| MnO | .34 | .24 | .34 | .15 | .25 | .18 | .11 | .17 | .14 | .28 |
| MgO | 9.98 | 12.86 | 15.24 | 15.42 | 8.61 | 12.61 | 15.12 | 10.35 | 13.99 | 11.04 |
| CaO | 9.99 | 10.82 | 6.29 | 11.32 | 10.43 | 12.63 | 11.63 | 9.93 | 12.67 | 11.73 |
| Na2O | 2.33 | 2.02 | .62 | 1.23 | 2.72 | 1.93 | 2.55 | 2.49 | 1.99 | 1.92 |
| K2O | .32 | .13 | .94 | .34 | .21 | .20 | .08 | .25 | .08 | .23 |
| P2O5 | .05 | .05 | .08 | .06 | .01 | .03 | .03 | .06 | .03 | .07 |
| H2O+ | 1.15 | 2.87 | 2.20 | 3.47 | .81 | 1.71 | .89 | 1.79 | 1.51 | 2.33 |
| H2O- | | | | | | | .11 | .44 | .24 | |
| TOTAL | 100.82 | 99.23 | 99.63 | 100.35 | 100.29 | 100.01 | 100.79 | 99.79 | 100.12 | 99.74 |
| RB | 1.0 | 5.9 | 40 | 12 | 2.9 | 5.1 | 1.2 | 3.1 | 1.1 | 6.4 |
| BA | 1723 | 6078 | 925 | 1178 | 1722 | 311 | 516 | 5362 | 620 | 5457 |
| SR | 455 | 117 | 92 | 140 | 146 | 223 | 139 | 154 | 155 | 321 |
| ZR | 78 | 109 | 148 | 63 | 60 | 84 | 14 | 126 | 34 | 95 |
| NB | 2.8 | 4.2 | 128 | 9.8 | 11 | 39 | 12 | 12 | 5.5 | 4.5 |
| CR | 134 | 372 | 497 | 825 | 236 | 545 | 759 | 217 | 367 | 273 |
| V | 230 | 287 | 267 | 121 | 403 | 300 | 73 | 475 | 157 | 272 |
| SC | 68 | 52 | 76 | 24 | 55 | 50 | 27 | 51 | 26 | 59 |
| NI | 47 | 59 | 167 | 239 | 110 | 131 | 261 | 161 | 443 | 257 |
| CO | 42 | 35 | 57 | 59 | 51 | 52 | 47 | 47 | 55 | 46 |
| ZN | 42 | 42 | 41 | 78 | 114 | 83 | 23 | 137 | 39 | 43 |
| CU | ND | 6.1 | 25 | 28 | 12 | 7.0 | 16 | 12 | 3.5 | 3.5 |
| | | | | | 0 | | | | | |
| Y | 38 | 27 | 34 | 9.6 | 37 | 20 | 7.5 | 26 | 8.5 | 32 |

SAMPLE INDEX:

| | |
|-------|---------------------|
| 02-2 | : LOVEDALE ECLOGITE |
| 02023 | : LOVEDALE ECLOGITE |
| 02043 | : LOVEDALE ECLOGITE |
| 02083 | : LOVEDALE ECLOGITE |
| 02093 | : LOVEDALE ECLOGITE |
| 02103 | : LOVEDALE ECLOGITE |
| 02233 | : LOVEDALE ECLOGITE |
| 02413 | : LOVEDALE ECLOGITE |
| 02423 | : LOVEDALE ECLOGITE |
| 02513 | : LOVEDALE ECLOGITE |

TABLE V-25:WHOLE ROCK ANALYSES-ECLOGITES+GRANULITES.

| | 10043 | 12093 | 20253 | 20263 | 02133 | 02143 | 02153 | 02453 | 02473 | 02503 |
|-------|--------|--------|--------|-------|--------|--------|--------|--------|--------|--------|
| SiO2 | 46.94 | 44.04 | 46.67 | 45.49 | 50.11 | 50.30 | 49.43 | 46.54 | 47.79 | 47.80 |
| TiO2 | .50 | .20 | .39 | 1.29 | .22 | .07 | .10 | .13 | .10 | .12 |
| Al2O3 | 11.87 | 15.44 | 16.03 | 14.92 | 16.43 | 18.67 | 23.10 | 17.31 | 16.27 | 15.82 |
| Fe2O3 | 11.66 | 11.43 | 8.12 | 10.21 | 7.62 | 6.08 | 4.48 | 6.52 | 4.72 | 6.84 |
| MnO | .19 | .26 | .12 | .16 | .13 | .11 | .06 | .11 | .09 | .13 |
| MgO | 12.51 | 12.27 | 13.08 | 7.64 | 9.18 | 10.77 | 6.69 | 10.37 | 13.51 | 12.82 |
| CaO | 13.47 | 13.20 | 13.42 | 13.64 | 11.09 | 11.15 | 10.54 | 11.84 | 13.40 | 11.85 |
| Na2O | 1.93 | 1.24 | 2.19 | 2.75 | 4.38 | 2.67 | 3.78 | 3.11 | 2.73 | 2.36 |
| K2O | .37 | .51 | .07 | .64 | .21 | .21 | .39 | .79 | .06 | .15 |
| P2O5 | .06 | .09 | .04 | .91 | .03 | .02 | .01 | .02 | .36 | .06 |
| H2O+ | .80 | 1.29 | .60 | 1.06 | .76 | .89 | 1.32 | 3.24 | 1.09 | 1.97 |
| H2O- | .15 | .20 | .06 | .14 | .11 | | .12 | .30 | .06 | .35 |
| TOTAL | 100.45 | 100.17 | 100.79 | 99.31 | 100.27 | 100.94 | 100.02 | 100.36 | 100.18 | 100.27 |
| RB | 12 | 7.3 | 3.6 | 7.8 | 1.8 | 3.4 | 5.0 | 9.6 | ND | 1.7 |
| BA | 321 | 748 | 134 | 267 | 1278 | 548 | 4932 | 1486 | 1679 | 6299 |
| SR | 244 | 268 | 235 | 296 | 163 | 105 | 255 | 272 | 446 | 484 |
| Zr | 36 | 45 | 11 | 16 | 15 | 0.8 | 9.5 | 35 | 17 | 36 |
| Nb | 4.0 | 12 | 12 | 13 | 12 | 12 | 12 | 12 | 4.8 | 3.7 |
| Cr | 592 | 430 | 345 | 339 | 382 | 527 | 186 | 876 | 896 | 657 |
| V | 223 | 339 | 127 | 310 | 84 | 66 | 56 | 88 | 93 | 76 |
| Sc | 44 | 83 | 31 | 46 | 22 | 21 | 14 | 25 | 22 | 34 |
| Ni | 185 | 148 | 297 | 58 | 310 | 323 | 67 | 313 | 262 | 328 |
| Co | 55 | 53 | 70 | 47 | 49 | 52 | 32 | 49 | 38 | 54 |
| Zn | 68 | 26 | 35 | 44 | 43 | 26 | 35 | 36 | 19 | 29 |
| Cu | 73 | 12 | 111 | 5.1 | 34 | 6.5 | 39 | 8.5 | 14 | 6.5 |
| Y | 16 | 48 | 6.6 | 8.7 | 7.5 | 3.1 | 4.8 | 5.6 | 8.5 | 4.7 |

SAMPLE INDEX:

10043 : HARKT ECLOGITE
 12093 : HARKT ECLOGITE
 20253 : JACHTFORTEIN ECLOGITE
 20263 : JACHTFORTEIN ECLOGITE
 02133 : LOVEDALE KYANITE ECLOGITE
 02143 : LOVEDALE KYANITE ECLOGITE
 02153 : LOVEDALE KYANITE ECLOGITE
 02453 : LOVEDALE KYANITE ECLOGITE
 02473 : LOVEDALE KYANITE ECLOGITE
 02503 : LOVEDALE KYANITE ECLOGITE

TABLE V-25:WHOLE ROCK ANALYSES:ECLOGITES+GRANULITES.

| | 06043 | 07403 | 09123 | 09153 | 12133 | 30-1 | 25023 | 33013 | 33023 | 02223 |
|--------------------------------|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|
| SiO ₂ | 46.43 | 47.85 | 42.17 | 47.44 | 51.66 | 50.44 | 49.22 | 50.81 | 50.21 | 50.42 |
| TiO ₂ | .76 | 1.14 | 1.01 | .75 | .39 | .16 | .56 | .72 | .19 | .03 |
| Al ₂ O ₃ | 18.13 | 17.00 | 17.27 | 16.19 | 16.27 | 16.86 | 16.07 | 14.51 | 23.75 | 18.98 |
| Fe ₂ O ₃ | 9.11 | 11.09 | 16.89 | 12.24 | 9.07 | 6.92 | 8.40 | 12.22 | 4.98 | 3.94 |
| HNO | .17 | .16 | .30 | .22 | .12 | .11 | .14 | .21 | .05 | .09 |
| MgO | 5.58 | 5.17 | 11.54 | 8.37 | 8.19 | 8.80 | 7.26 | 7.60 | 3.77 | 11.79 |
| CaO | 9.68 | 9.54 | 10.22 | 9.65 | 8.61 | 11.36 | 10.62 | 9.59 | 12.14 | 11.71 |
| Na ₂ O | 5.86 | 3.04 | .99 | 4.52 | 3.47 | 3.80 | 4.74 | 2.36 | 3.64 | 2.33 |
| K ₂ O | 1.00 | .23 | .01 | .03 | 1.53 | .41 | .78 | 2.75 | .74 | .24 |
| P ₂ O ₅ | .20 | .34 | .22 | .46 | .07 | .02 | .15 | .03 | .00 | .07 |
| H ₂ O ⁺ | 1.59 | .91 | .01 | .92 | .88 | 1.85 | 2.20 | .73 | .82 | .75 |
| H ₂ O ⁻ | .08 | .07 | .06 | .12 | .13 | .01 | .03 | .01 | .06 | .23 |
| TOTAL | 100.59 | 98.54 | 100.69 | 100.91 | 100.39 | 100.74 | 100.17 | 100.73 | 100.35 | 100.58 |
| RB | 8.3 | 76 | 2.9 | 3.2 | 20 | 4.8 | 10 | 39 | 4.9 | 1.6 |
| BA | 4.2 | 1191 | 267 | 692 | 782 | 2353 | 1721 | 1953 | 614 | 581 |
| SR | 514 | 1123 | 198 | 545 | 570 | 674 | 1994 | 1298 | 969 | 311 |
| ZR | 104 | 244 | 15 | 39 | 26 | 5.0 | 39 | 46 | 14 | 12 |
| NB | 3.5 | 4.9 | 2.3 | 3.1 | 12 | 7.0 | 30 | 12 | 12 | 12 |
| CR | 92 | 70 | 222 | 293 | 271 | 152 | 152 | 284 | 170 | 320 |
| V | 134 | 206 | 294 | 230 | 133 | 80 | 168 | 297 | 63 | 7 |
| SC | 24 | 30 | 63 | 33 | 26 | 25 | 21 | 36 | 15 | 20 |
| MI | 57 | 31 | 149 | 84 | 222 | 239 | 12 | 245 | 63 | 145 |
| CD | 33 | 33 | 72 | 45 | 52 | 44 | 41 | 53 | 23 | 46 |
| ZN | 108 | 115 | 137 | 129 | 72 | 45 | 78 | 108 | 61 | 22 |
| CU | 12 | 19 | 255 | 9.8 | 48 | 25 | 48 | 59 | 12 | 27 |
| Y | 24 | 24 | 37 | 25 | 13 | 5.4 | 17 | 24 | | 4.0 |

SAMPLE INDEX:

| | |
|-------|-------------------------------|
| 06043 | : CORDAATSKUIL GT GRANULITE |
| 07403 | : HEDRON GT GRANULITE |
| 09123 | : UINTJIESBERG ECLOGITE |
| 09153 | : UINTJIESBERG GT GRANULITE |
| 12133 | : MARKT GT GRANULITE |
| 30-1 | : GOEDEHOOP GT GRANULITE |
| 25023 | : WINDHOEK SOUTH GT GRANULITE |
| 33013 | : LEKKERFONTEIN GT GRANULITE |
| 33023 | : LEKKERFONTEIN GT GRANULITE |
| 02223 | : LOVEDALE KY GT GRANULITE |

TABLE V-25: WHOLE ROCK ANALYSES: ECLOGITES+GRANULITES.

| | 02243 | 12133A |
|-------|-------|--------|
| SiO2 | 50.02 | 49.73 |
| TiO2 | .03 | .25 |
| Al2O3 | 21.12 | 18.79 |
| Fe2O3 | 3.28 | 8.19 |
| MnO | .07 | .11 |
| MgO | 8.21 | 12.17 |
| CaO | 12.54 | 9.13 |
| Na2O | 2.92 | 1.72 |
| K2O | .57 | .33 |
| P2O5 | .01 | .00 |
| H2O+ | 1.07 | .50 |
| H2O- | .12 | .01 |
| TOTAL | 79.98 | 100.84 |
| RB | 7.6 | 4.3 |
| BA | 3026 | 1079 |
| SR | 261 | 242 |
| ZR | 8.3 | 5.8 |
| NB | 12 | 12 |
| NO | | |
| CR | 246 | 1026 |
| V | 52 | 104 |
| SC | 18 | |
| NI | 165 | 209 |
| CO | 32 | 55 |
| ZN | 14 | 50 |
| CU | 14 | 5.0 |
| Y | 2.1 | 2.9 |

SAMPLE INDEX:

02243 : LOVEDALE KY GT GRANULITE
 12133A : MARKT KY GT GRANULITE

TABLE V-25A:VOLATILE-FREE WHOLE ROCK ANALYSES.

| | 02-2 | 02023 | 02043 | 02083 | 02093 | 02103 | 02233 | 02413 | 02423 | 02513 |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SiO2 | 45.76 | 48.10 | 41.65 | 46.21 | 46.16 | 49.41 | 49.02 | 46.51 | 47.79 | 45.91 |
| TiO2 | .25 | .45 | 1.67 | .53 | 1.53 | 1.11 | .07 | 2.55 | .36 | .27 |
| Al2O3 | 16.73 | 12.63 | 17.34 | 14.68 | 14.83 | 11.03 | 15.66 | 13.54 | 14.08 | 15.06 |
| Fe2O3 | 14.18 | 11.70 | 15.21 | 9.15 | 15.14 | 11.39 | 5.66 | 13.57 | 7.58 | 12.81 |
| MnO | .34 | .25 | .35 | .15 | .25 | .16 | .11 | .17 | .14 | .28 |
| Na2O | 10.01 | 13.34 | 15.64 | 15.92 | 8.86 | 12.83 | 15.15 | 10.61 | 14.22 | 11.33 |
| CaO | 10.02 | 11.23 | 6.46 | 11.69 | 10.49 | 12.85 | 11.65 | 10.08 | 12.88 | 12.04 |
| MgO | 2.34 | 2.10 | .64 | 1.27 | 2.73 | 1.96 | 2.56 | 2.55 | 2.02 | 1.97 |
| K2O | .32 | .13 | .96 | .35 | .21 | .20 | .08 | .26 | .08 | .23 |
| P2O5 | .05 | .05 | .08 | .06 | .01 | .03 | .03 | .06 | .03 | .07 |
| RD | 1.0 | 6.1 | 41 | 12 | 2.9 | 5.2 | 1.2 | 3.2 | 1.1 | 6.6 |
| BA | 1728 | 6308 | 949 | 1216 | 1731 | 316 | 517 | 5496 | 630 | 5602 |
| SR | 456 | 121 | 74 | 145 | 147 | 227 | 139 | 158 | 158 | 330 |
| ZR | 78 | 113 | 152 | 65 | 60 | 65 | 140 | 129 | 36 | 98 |
| HB | 2.0 | 4.3 | 131 | 10 | 11 | 40 | 12 | 12 | 5.6 | 4.6 |
| CK | 174 | 386 | 510 | 852 | 237 | 554 | 961 | 222 | 373 | 280 |
| V | 231 | 298 | 274 | 125 | 405 | 305 | 73 | 487 | 160 | 279 |
| SC | 60 | 54 | 78 | 25 | 55 | 51 | 27 | 52 | 26 | 61 |
| NI | 47 | 61 | 171 | 247 | 111 | 133 | 262 | 165 | 450 | 305 |
| CO | 42 | 36 | 59 | 61 | 51 | 53 | 47 | 48 | 56 | 47 |
| ZN | 42 | 44 | 42 | 81 | 115 | 84 | 23 | 140 | 40 | 44 |
| CU | | 6.3 | 26 | 29 | 12 | 7.1 | 16 | 12 | 3.6 | 3.6 |
| Y | 38 | 28 | 35 | 7.9 | 37 | 20 | 7.5 | 27 | 8.6 | 33 |

SAMPLE INDEX:

| | |
|-------|------|
| 02-2 | : EC |
| 02023 | : EC |
| 02043 | : EC |
| 02083 | : EC |
| 02093 | : EC |
| 02103 | : EC |
| 02233 | : EC |
| 02413 | : EC |
| 02423 | : EC |
| 02513 | : EC |

TABLE V-25A: VOLATILE-FREE WHOLE ROCK ANALYSES.

| | 10043 | 12093 | 20253 | 20263 | 02133 | 02143 | 02153 | 02453 | 02473 | 02503 |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SiO2 | 47.17 | 44.63 | 46.61 | 46.35 | 50.41 | 50.27 | 50.14 | 48.11 | 48.26 | 48.80 |
| TiO2 | .50 | .20 | .38 | 1.31 | .22 | .07 | .10 | .13 | .10 | .12 |
| Al2O3 | 11.93 | 15.65 | 16.01 | 15.20 | 16.53 | 18.67 | 23.43 | 17.89 | 16.43 | 16.15 |
| Fe2O3 | 11.71 | 11.58 | 8.11 | 10.40 | 7.67 | 6.08 | 4.54 | 6.74 | 4.77 | 6.98 |
| MnO | .19 | .26 | 11.98 | .16 | .13 | .11 | .06 | .11 | .09 | .13 |
| MgO | 12.57 | 12.43 | 13.86 | 9.82 | 9.23 | 10.76 | 6.79 | 10.72 | 13.64 | 13.09 |
| CaO | 13.53 | 13.38 | 13.40 | 13.90 | 11.16 | 11.14 | 10.69 | 12.24 | 13.53 | 12.10 |
| Na2O | 1.94 | 1.26 | 2.18 | 2.81 | 4.40 | 2.67 | 3.93 | 3.21 | 2.76 | 2.41 |
| K2O | .37 | .51 | .07 | .04 | .21 | .21 | .39 | .82 | .06 | .15 |
| P2O5 | .06 | .09 | .04 | .01 | .03 | .02 | .01 | .02 | .36 | .06 |
| RB | 12 | 7.4 | 3.6 | 7.9 | 1.8 | 3.4 | 5.1 | 9.9 | ND | 1.7 |
| BA | 322 | 758 | 134 | 272 | 1286 | 548 | 5003 | 1536 | 1695 | 6422 |
| SR | 245 | 271 | 235 | 302 | 164 | 105 | 259 | 281 | 450 | 494 |
| ZR | 36 | 46 | 110 | 16 | 15 | 8.8 | 9.6 | 36 | 17 | 31 |
| NB | 4.0 | 12 | 12 | 13 | 12 | 12 | 12 | 12 | 4.8 | 3.8 |
| CR | 595 | 436 | 345 | 345 | 384 | 527 | 189 | 9.6 | 905 | 671 |
| V | 224 | 344 | 127 | 316 | 85 | 66 | 57 | 91 | 94 | 78 |
| SC | 44 | 84 | 31 | 47 | 22 | 21 | 14 | 26 | 22 | 35 |
| NI | 186 | 150 | 297 | 59 | 312 | 32 | 68 | 323 | 265 | 335 |
| CO | 55 | 54 | 70 | 48 | 49 | 52 | 32 | 51 | 38 | 55 |
| ZN | 68 | 26 | 35 | 45 | 43 | 28 | 36 | 37 | 19 | 30 |
| CU | 73 | 12 | 111 | 5.2 | 34 | 6.5 | 40 | 8.8 | 14 | 6.6 |
| Y | 16 | 49 | 6.6 | 8.9 | 7.5 | 3.1 | 4.9 | 5.8 | 8.6 | 4.8 |

SAMPLE INDEX:

10043 : EC
 12093 : EC
 20253 : EC
 20263 : EC
 02133 : KY EC
 02143 : KY EC
 02153 : KY EC
 02453 : KY EC
 02473 : KY EC
 02503 : KY EC

TABLE V-25A: VOLATILE-FREE WHOLE ROCK ANALYSES.

| | 06043 | 07403 | 09123 | 09153 | 12133 | 30-1 | 25023 | 33013 | 33023 | 02223 |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SiO2 | 48.96 | 49.05 | 41.91 | 47.58 | 51.98 | 51.01 | 50.25 | 50.00 | 50.48 | 50.62 |
| TiO2 | .76 | 1.17 | 1.00 | .75 | .39 | .16 | 00.57 | .72 | .19 | .03 |
| Al2O3 | 18.33 | 19.47 | 17.16 | 16.21 | 16.37 | 17.05 | 16.41 | 14.51 | 23.88 | 19.06 |
| Fe2O3 | 9.21 | 11.37 | 16.79 | 12.25 | 9.12 | 7.00 | 8.57 | 12.22 | 5.01 | 3.96 |
| H2O | .17 | .16 | .30 | .22 | .12 | .11 | .14 | .21 | .05 | .09 |
| K2O | 5.64 | 5.30 | 11.47 | 8.38 | 8.24 | 8.90 | 7.41 | 7.60 | 3.79 | 11.84 |
| CaO | 9.78 | 9.78 | 10.16 | 9.66 | 8.66 | 11.47 | 10.84 | 9.58 | 12.21 | 11.76 |
| Na2O | 5.92 | 3.11 | .98 | 4.53 | 3.49 | 3.84 | 4.84 | 2.36 | 3.66 | 2.34 |
| K2O | 1.01 | .23 | .01 | .03 | 1.54 | .41 | .79 | 2.75 | .74 | .24 |
| P2O5 | .20 | .35 | .22 | .46 | .07 | .02 | .15 | .03 | .00 | .07 |
| RB | 8.4 | 72 | 2.9 | 3.2 | 20 | 4.7 | 10 | 39 | 4.9 | 1.6 |
| BA | 4.2 | 1221 | 265 | 693 | 786 | 2390 | 1757 | 1953 | 617 | 583 |
| GR | 519 | 1151 | 197 | 546 | 574 | 682 | 2036 | 1298 | 994 | 312 |
| ZR | 105 | 250 | 15 | 39 | 26 | 5.1 | 39 | 40 | 14 | 12 |
| NB | 3.5 | 5.0 | 2.2 | 3.1 | 12 | 7.1 | 31 | 12 | 12 | 12 |
| MO | | | | | | | | | | |
| CR | 93 | 72 | 221 | 273 | 273 | 154 | 155 | 284 | 171 | 322 |
| V | 135 | 211 | 292 | 230 | 134 | 81 | 171 | 297 | 63 | 7.0 |
| SC | 24 | 31 | 63 | 33 | 26 | 25 | 21 | 36 | 15 | 20 |
| NI | 58 | 32 | 148 | 84 | 223 | 241 | 12 | 245 | 63 | 146 |
| CO | 33 | 34 | 72 | 45 | 52 | 44 | 42 | 53 | 23 | 46 |
| ZN | 109 | 118 | 136 | 129 | 72 | 46 | 80 | 108 | 61 | 22 |
| CU | 12 | 19 | 253 | 9.1 | 48 | 25 | 49 | 59 | 12 | 27 |
| Y | 24 | 25 | 37 | 25 | 13 | 5.5 | 17 | 24 | ND | 4.0 |

SAMPLE INDEX:

06043 : GT GRN
07403 : GT GRN
09123 : EC
09153 : GT GRN
12133 : GT GRN
30-1 : GT GRN
25023 : GT GRN
33013 : GT GRN
33023 : GT GRN
02223 : KY GT GRN

TABLE V-25A: VOLATILE-FREE WHOLE ROCK ANALYSES.

| | 02243 | 12133A |
|-------|-------|--------|
| SiO2 | 50.63 | 49.52 |
| TiO2 | .03 | .25 |
| Al2O3 | 21.38 | 18.71 |
| Fe2O3 | 3.32 | 8.15 |
| MnO | .07 | .11 |
| MgO | 8.31 | 12.12 |
| CaO | 12.67 | 9.09 |
| Na2O | 2.96 | 1.71 |
| K2O | .60 | .32 |
| P2O5 | .01 | .00 |
| RB | 7.7 | 4.2 |
| BA | 3063 | 1074 |
| GR | 264 | 241 |
| ZR | 8.4 | 5.8 |
| NB | 12 | 12 |
| CR | 249 | 1022 |
| V | 53 | 104 |
| SC | 18 | |
| NI | 167 | 200 |
| CO | 32 | 55 |
| ZN | 14 | 50 |
| CU | 14 | 5.0 |
| Y | 2.1 | 2.9 |

SAMPLE INDEX:

02243 : KY GT GRN
 12133A : KY GT GRN

TABLE V-26: C.I.P.W. NORMS FOR ECLOGITES AND GRANULITES
CALCULATED ANHYDROUS AND ASSUMING FE2O3/FeO=0.15.

| SAMPLE NO. | 02-2 | 02023 | 02043 | 02083 | 02093 | 02103 | 02233 | 02413 |
|---------------|-----------|-------|-------|-------|-------|-------|-------|-------|
| OR | 1.95 | 083 | 5.73 | 2.13 | 1.24 | 1.24 | .53 | 1.54 |
| PLAG AB | 18.54 | 17.85 | 5.42 | 10.92 | 21.18 | 16.84 | 19.00 | 21.92 |
| .AN | 34.61 | 24.93 | 34.95 | 33.53 | 27.91 | 20.84 | 31.26 | 24.99 |
| NE | .82 | | | | 1.27 | | 1.40 | |
| CO | | | 2.54 | | | | | |
| DIOP.WO | 6.41 | 12.96 | | 10.19 | 10.32 | 18.10 | 11.12 | 10.74 |
| .ENS | 3.48 | 8.25 | | 7.18 | 5.39 | 11.74 | 8.31 | 6.54 |
| .FS | 2.71 | 3.88 | | 2.14 | 4.63 | 5.13 | 1.71 | 3.60 |
| HYP .ENS | | 3.24 | 8.38 | 1.71 | | 1.48 | | 1.23 |
| OL .FO | | 1.52 | 3.99 | .51 | | .65 | | .68 |
| .FA | 15.26 | 15.47 | 21.62 | 21.77 | 11.53 | 13.36 | 20.76 | 13.30 |
| MT | 2.48 | 2.04 | 2.64 | 1.59 | 2.64 | 1.99 | .99 | 2.36 |
| ILM | .44 | .89 | 3.21 | 1.01 | 2.94 | 2.13 | .13 | 4.92 |
| AP | .14 | .12 | .19 | .17 | .02 | .07 | .07 | .14 |
| NORM PLAG: AN | 66 | 59 | 87 | 77 | 67 | 46 | 63 | 55 |
| NORM OL : FO | 54 | 66 | 66 | 75 | 51 | 67 | -81 | 62 |
| ROCK TYPE: | ECLOGITES | | | | | | | |

| SAMPLE NO. | 02423 | 02513 | 10043 | 12093 | 20253 | 20263 | 02133 | 02143 |
|---------------|-----------|-------|-------|-------|--------------|-------|-------|-------|
| OR | .53 | 1.48 | 2.25 | 3.13 | .06 | .24 | 1.30 | 1.30 |
| PLAG.AB | 14.55 | 13.55 | 11.03 | 5.22 | 11.51 | 11.48 | 24.76 | 22.76 |
| .AN | 31.48 | 31.89 | 22.99 | 36.12 | 34.03 | 29.06 | 24.82 | 38.46 |
| NE | 1.40 | 1.47 | 1.78 | 3.01 | 2.99 | 3.85 | 6.74 | 6.94 |
| DIOP.WO | 13.64 | 11.68 | 18.55 | 12.61 | 13.62 | 16.90 | 12.82 | 7.09 |
| .ENS | 9.71 | 6.86 | 11.66 | 7.79 | 9.41 | 10.56 | 12.82 | 7.09 |
| .FS | 2.73 | 4.25 | 5.74 | 4.08 | 3.10 | 5.31 | 3.70 | 1.54 |
| HYP .ENS | | 5.30 | | | | | | |
| .FS | | 1.65 | | | | | | |
| OL .FO | 18.18 | 15.19 | 14.01 | 16.16 | 16.30 | 9.91 | 10.44 | 11.70 |
| .FA | 5.62 | 10.36 | 7.60 | 9.32 | 5.92 | 5.50 | 5.14 | 4.01 |
| MT | 1.32 | 2.23 | 2.04 | 2.03 | 1.42 | 1.81 | 1.33 | 1.06 |
| ILM | .70 | .55 | .97 | .38 | .74 | 2.45 | .42 | .15 |
| AP | .07 | .19 | .17 | .17 | .05 | .02 | .07 | .05 |
| NORM PLAG: AN | 69 | 71 | 70 | 88 | 75 | 72 | 52 | 65 |
| NORM OL : FO | 76 | 59 | 65 | 63 | 73 | 64 | 67 | 74 |
| ROCK TYPE: | ECLOGITES | | | | KY.ECLOGITES | | | |

TABLE V-26 (CONT'D)

| SAMPLE NO. | 02153 | 02453 | 02473 | 02503 | 06043 | 07403 | 09123 | 09153 |
|------------|-------------|-------|-------|-------|-------------------|-------|-------|----------|
| OR | 2.36 | 4.90 | .41 | .95 | 5.97 | 1.48 | 25.71 | |
| PLAG.AB | 27.72 | 12.21 | 14.27 | 19.13 | 19.21 | 26.65 | 8.55 | 25.71 |
| .AN | 45.74 | 32.16 | 32.34 | 32.96 | 20.14 | 38.85 | 43.00 | 24.28 |
| NE | 2.63 | 8.19 | 5.01 | .77 | 17.14 | 7.11 | | |
| DIOP.WO | 3.10 | 12.10 | 13.64 | 11.28 | 11.42 | 3.30 | 2.78 | 9.19 |
| .ENS | 2.10 | 8.24 | 10.29 | 7.98 | 5.94 | 1.67 | 1.15 | 3.82 |
| .FS | .76 | 2.82 | 1.96 | 2.33 | 5.15 | 1.67 | 1.15 | 3.82 |
| HYP .ENS | | 6.82 | 4.73 | | | | | |
| .FS | | 7.14 | 3.59 | | | | | |
| OL .FO | 10.41 | 13.04 | 16.70 | 17.39 | 5.89 | 3.46 | 15.93 | 11.17 |
| .FA | 4.17 | 4.93 | 3.51 | 5.60 | 5.54 | 3.98 | 13.33 | 9.32 |
| MT | .78 | 1.17 | .83 | 1.22 | 1.68 | 1.99 | 2.94 | 2.12 |
| ILM | .19 | .27 | .19 | .25 | 1.46 | 2.24 | 1.96 | 1.44 |
| AP | .02 | .05 | .88 | .14 | .50 | .83 | .54 | .83 |
| NORM PLAG: | AN 63 | 75 | 70 | 64 | 51 | 59 | 83 | 49 |
| NORM OL : | FO 71 | 73 | 83 | 76 | 51 | 47 | 54 | 55 |
| ROCK TYPE: | KY ECLOGITE | | | | GT GRANULITE.ECL. | | | GT GRAN. |

| SAMPLE NO. | 12133 | 30-1 | 25023 | 33013 | 33023 | 02223 | 02243 | 12133A |
|------------|--------------|-------|-------|-------|-----------------|-------|-------|--------|
| OR | 9.22 | 2.48 | 4.78 | 16.41 | 4.43 | 1.42 | 3.55 | 2.01 |
| PLAG.AB | 27.79 | 25.63 | 22.87 | 17.74 | 25.33 | 19.89 | 22.59 | 14.55 |
| .AN | 24.59 | 28.18 | 20.82 | 21.11 | 46.67 | 40.91 | 43.41 | 42.38 |
| NE | | 3.85 | 9.93 | 1.30 | 3.15 | | 1.33 | |
| DIOP.WO | 7.63 | 12.12 | 13.52 | 11.14 | 5.89 | 7.17 | 8.21 | 1.26 |
| .ENS | 4.56 | 7.90 | 8.04 | 5.88 | 3.33 | 5.43 | 6.08 | .85 |
| .FS | 2.67 | 3.38 | 4.78 | 4.91 | 2.32 | 1.01 | 1.34 | .31 |
| HYP .ENS | .99 | | | | | 8.37 | | 20.15 |
| .FS | .58 | | | | | 1.56 | | 7.20 |
| OL .FO | 10.59 | 10.08 | 7.40 | 9.28 | 4.30 | 11.07 | 10.30 | 6.56 |
| .FA | 6.83 | 4.75 | 4.85 | 8.54 | 3.30 | 2.27 | 2.50 | 2.58 |
| MT | 1.58 | 1.22 | 1.49 | 2.13 | .87 | .64 | .58 | 1.48 |
| ILM | .74 | .30 | 1.10 | 1.39 | .38 | .06 | .08 | .49 |
| AP | .17 | .05 | .36 | .07 | | .17 | .02 | |
| NORM PLAG: | AN 45 | 54 | 47 | 54 | 64 | 67 | 66 | 74 |
| NORM OL : | FO 61 | 68 | 60 | 52 | 57 | 83 | 80 | 72 |
| ROCK TYPE: | GT GRANULITE | | | | KY GT GRANULITE | | | |

3.

OR=ORTHOCLASE, PLAG=PLAGIOCLASE, AB=ALBITE, AN=ANORTHITE, NE=
NEPHELINE, CO=CORUNDUM, DIOP=DIOPSIDE, ENS=ENSTATITE, FS=FERROSILITE
HYP=HYPERSTHENE, FO=FORSTERITE, FA=FAYALITE, OL=OLIVINE, MT=MAGNETITE
ILM=ILMENITE, AP=APATITE, KY=KYANITE, GT=GARNET, GRAN=GRANULITE, ECL=
ECLOGITE, NORM=NORMATIVE.

TABLE V-27: CALCULATING CHEMICAL MODES FROM BULK ROCK AND MINERAL DATA USING THE METHOD OF BYRAN ET AL., 1969.

| SAMPLE NO. | 02233 | | 02143 | | 02093 | | 02043 | |
|---|-------|-------|---------------|-------|-------------------|-------|---------------|------|
| | OBS | CALC | OBS | CALC | OBS | CALC | OBS | CALC |
| SI02 | 49.30 | 48.88 | 50.58 | 50.89 | 46.87 | 47.27 | 42.29 | 42.8 |
| TI02 | .07 | .07 | .07 | .07 | 1.55 | 1.56 | 1.70 | 1.7 |
| AL203 | 15.75 | 15.56 | 18.78 | 18.89 | 15.06 | 15.38 | 17.60 | 18.5 |
| FE0 | 5.12 | 5.76 | 5.50 | 5.73 | 13.83 | 13.79 | 13.90 | 12.9 |
| MNO | .11 | .09 | .11 | .08 | .25 | .29 | .36 | .3 |
| MGO | 15.24 | 14.99 | 10.83 | 10.65 | 8.79 | 8.44 | 15.88 | 14.5 |
| CA0 | 11.72 | 11.91 | 11.21 | 11.41 | 10.65 | 10.65 | 6.56 | 5.7 |
| NA20 | 2.57 | 2.59 | 2.69 | 2.95 | 2.77 | 3.62 | .65 | .9 |
| K20 | .08 | .01 | .21 | .01 | .21 | .01 | .97 | 2.6 |
| SD | | .65 | | .24 | | .39 | | 4.1 |
| MODE | | | | | | | | |
| GARNET | | 43.72 | | 34.27 | 41.01 | 43.83 | | 58.3 |
| CLINOPYROXENE | | 56.28 | | 50.28 | 57.58 | 54.81 | | 16.4 |
| RUTILE | | | | | 1.41 | 1.36 | | .1 |
| PHLOGOPITE | | | | | | | | 25.0 |
| KYANITE | | | | 6.26 | | | | |
| QUARTZ | | | | 3.19 | | | | |
| CPX ALTERATION: V. FRESH---- | | | FRESH----- | | MOD. ALTERED | | BAD. ALTERED. | |
| SAMPLE NO: | 02023 | | 07403 | | 06043 | | 33013 | |
| | OBS | CALC | OBS | CALC | OBS | CALC | OBS | CALC |
| SI02 | 48.67 | 48.84 | 49.62 | 49.52 | 49.42 | 51.99 | 50.62 | 51.0 |
| TI02 | .46 | 1.03 | 1.18 | 1.02 | .77 | .17 | .73 | .1 |
| AL203 | 12.78 | 13.34 | 19.69 | 19.66 | 18.50 | 18.66 | 14.69 | 15.3 |
| FE0 | 10.65 | 09.78 | 10.35 | 10.46 | 8.36 | 9.15 | 11.13 | 11.1 |
| MNO | .25 | .16 | .16 | .16 | .17 | .15 | .21 | .2 |
| MGO | 13.34 | 10.44 | 5.36 | 5.35 | 5.69 | 5.74 | 11.13 | 11.1 |
| CA0 | 11.36 | 9.85 | 9.89 | 9.99 | 9.87 | 9.70 | 9.70 | 10.5 |
| NA20 | 2.12 | 3.99 | 3.15 | 3.69 | 5.98 | 4.43 | 2.39 | 4.0 |
| K20 | .13 | 1.92 | .23 | .28 | 1.02 | .27 | 2.78 | .0 |
| SD | | 7.00 | | .35 | | 7.63 | | 1.6 |
| MODE | | | | | | | | |
| GARNET | | 18.95 | 29.40 | 32.58 | | 31.80 | | 32.6 |
| CLINOPYROXENE | | 62.35 | 13.60 | 18.70 | | 25.59 | | 41.5 |
| PLAGIOCLASE | | | 43.40 | 42.90 | | 42.61 | | 25.8 |
| PHLOGOPITE | | 18.70 | | | | | | |
| AMPHIBOLE | | | 1.40 | 3.00 | | | | |
| SCAPOLITE | | | 9.50 | .88 | | | | |
| ILMENITE | | | 1.10 | 1.93 | | | | |
| CPX ALTERATION: BAD. ALTERED | | | V. FRESH----- | | | | | |
| PLAG ALTERATION: | | | V. FRESH----- | | BAD. ALTERED----- | | | |
| SD=SUM OF SQUARED DIFFERENCES BETWEEN 'OBS' AND 'CALC' COMPOSITION | | | | | | | | |
| 'MIXER' IS A COMPUTER GENERATED, LEAST SQUARES APPROXIMATION ROUTINE | | | | | | | | |
| WRITTEN BY BYRAN ET AL., 1969. | | | | | | | | |
| CPX=CLINOPYROXENE, PLAG=PLAGIOCLASE, CALC=CALCULATED BULK COMPOSITION | | | | | | | | |
| , OBS=OBSERVED BULK COMPOSITION, V.=VERY, BAD=BADLY | | | | | | | | |

2.

NOTE THAT THE SD VALUES SHOWN IN THIS TABLE ARE THOSE THAT RESULTED WHEN MIXING CALCULATIONS WERE PERFORMED ON ALKALI-FREE DATA. BULK ROCK FE DATA IS QUOTED AS FEO TO MATCH THE MINERAL DATA. ALL COMPOSITIONS WERE RECALCULATED ANHYDROUS.

TABLE V-28: AVERAGED BULK COMPOSITIONS FOR BASIC XENOLITHS FROM THE KARROO AND LESOTHO KIMBERLITES.

| | EC(3) | KY EC(3) | GT GR(3) | GT GR(1) | KY GT GR(3) | GT WS(2) |
|-------|-----------|-----------|-----------|-----------|-------------|----------|
| N= | 15 | 6 | 8 | 18 | 3 | 5 |
| SI02 | 46.14 | 49.33 | 49.93 | 48.99 | 50.25 | 45.7 |
| R | 41.9-49.1 | 48.1-50.4 | 47.5-52.0 | 43.8-61.3 | 49.5-61.3 | |
| TI02 | .81 | .12 | .59 | .87 | .10 | .8 |
| R | .07-2.6 | .07-2.2 | .16-1.2 | .06-3.3 | .03-.25 | |
| AL2O3 | 14.82 | 18.18 | 17.78 | 16.56 | 19.72 | 13.8 |
| R | 11.0-17.3 | 16.1-23.4 | 14.5-23.9 | 12.1-24.4 | 18.7-21.4 | |
| FE2O3 | 11.66 | 6.13 | 9.34 | 10.56 | 5.14 | 10.4 |
| R | 5.7-16.7 | 4.5-7.7 | 5.0-12.2 | 4.0-20.0 | 3.3-8.2 | |
| MGO | 12.47 | 10.71 | 6.91 | 7.84 | 10.76 | 16.1 |
| R | 8.7-15.9 | 6.8-13.1 | 3.8-8.9 | 2.5-10.3 | 8.3-12.1 | |
| CAO | 11.58 | 11.81 | 10.25 | 10.27 | 11.18 | 11.9 |
| R | 6.5-13.5 | 10.7-13.5 | 8.7-12.2 | 8.2-12.7 | 9.1-12.7 | |
| NA2O | 1.95 | 3.21 | 3.97 | 3.12 | 2.34 | 1.3 |
| R | .6-2.8 | 2.4-4.4 | 2.4-5.9 | 1.3-5.0 | 1.7-5.0 | |
| K2O | .25 | .31 | .93 | .96 | .39 | .02 |
| R | .01-.96 | .06-.82 | .03-2.8 | .18-2.1 | .24-.60 | |
| | | | P.P.M. | | | |
| RB | 8 | 4 | 20 | 18 | 5 | |
| R | 1-41 | ND-10 | 3-72 | 2-52 | 2-8 | |
| SR | 215 | 292 | 975 | 1091 | 272 | 127 |
| R | 94-456 | 105-494 | 519-2036 | 232-3556 | 241-312 | |
| ZR | 79 | 20 | 65 | 40 | 9 | 128 |
| R | 52-152 | 9-31 | 5-250 | 3-137 | 6-12 | |
| Y | 24 | 6 | 17 | 11 | 3 | |
| R | 7-49 | 3-9 | ND-25 | 4-27 | 2-4 | |
| CR | 430 | 445 | 185 | 245 | 531 | 1521 |
| R | 134-961 | 10-671 | 72-284 | 36-247 | 249-1022 | |
| NI | 186 | 222 | 136 | 81 | 173 | 368 |
| R | 47-450 | 32-335 | ND-245 | 32-156 | 146-208 | |
| V | 263 | 79 | 165 | 181 | 55 | 297 |
| R | 73-405 | 57-94 | 63-297 | 2-425 | 7-104 | |
| CO | 53 | 46 | 41 | 76 | 44 | |
| R | 36-72 | 32-55 | 23-53 | 23-156 | 32-55 | |
| ZN | 64 | 32 | 90 | 90 | 29 | 94 |
| R | 23-150 | 19-43 | 46-129 | 27-235 | 14-50 | |
| SC | 51 | 23 | 26 | | 19 | |
| R | 25-78 | 14-35 | 15-36 | | 18-20 | |

R=RANGE

(1)=AVERAGE GARNET GRANULITE, LESOTHO (GRIFFIN ET AL., 1979 AND ROGERS, 1978).

(2)=AVERAGE GARNET WEBSTERITE, LESOTHO (GRIFFIN ET AL., 1979)

(3)=EC IS ECLOGITE; KY EC IS KYANITE ECLOGITE; GT GR IS GARNET GRANULITE; KY GT GR IS KYANITE GARNET GRANULITE -XENOLITHS FROM THE KARROO KIMBERLITES (THIS WORK).

TABLE V-29: AVERAGED XENOLITH BULK COMPOSITIONS COMPARED WITH COMPOSITIONS OF OTHER ROCK TYPES.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|-------|------|------|------|------|------|------|------|------|------|------|------|
| SI02 | 46.1 | 46.9 | 49.3 | 50.3 | 49.3 | 49.9 | 50.6 | 53.5 | 55.6 | 54.0 | 59.5 |
| TI02 | .8 | | .1 | | .8 | | 1.1 | | 1.0 | .9 | .7 |
| AL2O3 | 14.8 | 13.2 | 18.2 | 17.0 | 16.9 | 16.8 | 15.6 | 22.5 | 17.3 | 16.6 | 17.2 |
| FE2O3 | 11.7 | 11.2 | 6.1 | 7.6 | 10.2 | 11.4 | 11.6 | 4.7 | 9.0 | 10.7 | 6.8 |
| MGO | 12.5 | 14.6 | 10.7 | 7.8 | 7.6 | 7.6 | 7.7 | 2.1 | 4.6 | 4.5 | 3.4 |
| CAO | 11.6 | 10.2 | 11.8 | 11.4 | 10.3 | 9.3 | 9.7 | 9.9 | 7.8 | 9.3 | 7.0 |
| NA2O | 2.0 | 1.7 | 3.2 | 2.8 | 3.4 | 2.9 | 2.4 | 3.7 | 2.6 | 2.4 | 3.7 |
| K2O | .3 | | .3 | | 1.1 | | 1.0 | | 2.2 | 1.2 | 1.6 |

P.P.M.

| | | | | | | | | | | | |
|----|-----|--|-----|--|------|--|--|--|--|-----|-----|
| ZR | 79 | | 20 | | 27 | | | | | 126 | 110 |
| Y | 24 | | 6 | | 14 | | | | | 28 | 21 |
| SR | 215 | | 292 | | 1045 | | | | | 401 | 385 |
| CR | 430 | | 445 | | 221 | | | | | 139 | 56 |
| NI | 186 | | 222 | | 103 | | | | | 44 | 18 |
| SC | 51 | | 23 | | 26 | | | | | | 30 |
| V | 263 | | 79 | | 175 | | | | | | 175 |
| ZN | 64 | | 32 | | 90 | | | | | | |
| CO | 53 | | 46 | | 62 | | | | | | 24 |

1. AVERAGE ECLOGITE FROM THE KARROO KIMBERLITES (TABLE V-28)
2. OLIVINE THOLEIITE A (GREEN AND RINGWOOD, 1967)
3. AVERAGE KYANITE ECLOGITE FROM THE KARROO KIMBERLITES (TABLE V-28)
4. HIGH-ALUMINA BASALT (GREEN, 1967)
5. AVERAGE (WEIGHTED) GARNET GRANULITE FROM THE KARROO AND LESOTHO KIMBERLITES
6. OLIVINE GABBRO NMS (GREEN AND RINGWOOD, 1972)
7. AVERAGE GABBRO (IN APPENDIX 2 OF COX ET AL., 1979)
8. GABBROIC ANORTHOSITE (GREEN, 1967)
9. DIORITE (REID, 1978)
10. AVERAGE (N=29) AMPHIBOLITE , EASTERN NAMAQUALAND (GERINGER, 1980)
11. AVERAGE ANDESITE (TAYLOR, 1969)

TABLE V-30: CRYSTAL/LIQUID DISTRIBUTION COEFFICIENTS (D).

| MINERAL ELEMENT | OL | CPX | PLAG | AMPH | GT |
|--------------------|----------|---------|---------|---------|---------|
| SR | <<1 | <<1 | >1 | <1 | <<1 |
| RANGE | .01-.003 | .07-.17 | 1-7 | .02-.7 | .02 |
| V | <<1 | 1 | <<1 | >>1 | 1 |
| RANGE | .02-1.0 | .7-1.7 | .04 | | .01-2.6 |
| Y | <<1 | <1 | <<1 | >1 | >1 |
| RANGE | .01-.13 | .2-1.5 | .01-.20 | 1-3 | 1-11 |
| ZR | <<1 | <<1 | <<1 | 1 | 1 |
| RANGE | .01 | .03-.3 | .01-.03 | .5-1.5 | .02-2.4 |
| NB | <<1 | <<1 | <<1 | 1 | <<1 |
| RANGE | .01-.05 | .01-.10 | .01-.03 | .8-1.3 | .03-1.0 |
| CR | <1 | >>1 | <<1 | >>1 | >>1 |
| RANGE | .7 | 4-13 | .05 | | 17 |
| NI | >>1 | >1 | <<1 | >1 | <1 |
| RANGE | 7-17(A) | 1.4-4 | .02-.09 | 1-7 | .2-1.0 |
| CO | >1 | 1 | <<1 | >1 | >1 |
| RANGE | 2-4 | .5-1.3 | .03-.05 | | .4-6.0 |
| SC | <<1 | >1 | <<1 | >>1 | >>1 |
| RANGE | .1-.3 | 2.4-5.0 | .01-.26 | | 2.6-6.5 |
| TI | <<1 | | <<1 | >1 | <<1 |
| RANGE | .02-.10 | | .05 | 1.5-3.0 | .3-.5 |

RANGES IN D'S WHERE GIVEN ARE FROM LE ROEX'S (1980) COMPILATION OF PUBLISHED AND UNPUBLISHED D VALUES.

(A)=CALCULATED FROM HART AND DAVIES (1978) WHERE $D(NI) = (124/NGO) - .9$
 >=GREATER THAN, >>=MUCH GREATER THAN AND VISA VERSA.

TABLE V-31: ESTIMATED MAJOR ELEMENT COMPOSITIONS OF LOWER AND AVERAGE CONTINENTAL CRUST.

| | 1 | 2 | 3 | 4 | 5 |
|--------|------|------|------|------|------|
| SI02 | 55.5 | 56.3 | 54.8 | 57.6 | 60.2 |
| TI02 | .8 | 1.1 | 1.3 | 1.0 | 1.0 |
| AL203 | 14.7 | 17.1 | 15.5 | 15.4 | 15.6 |
| FE203* | 7.9 | 8.8 | 11.3 | 8.4 | 7.9 |
| MGO | 5.7 | 5.0 | 4.4 | 3.7 | 3.9 |
| CAO | 10.4 | 5.5 | 7.4 | 5.6 | 5.8 |
| NA2O | 3.9 | 2.1 | 2.1 | 3.7 | 3.2 |
| K2O | .8 | 1.4 | 1.7 | .8 | 2.5 |

*=TOTAL FE AS FE2O3 , DATA IN WT.%. .

- 1 - LOWER CRUST BENEATH THE KARROO KIMBERLITES (THIS WORK).
 - 2 - LOWER CRUST BENEATH THE BOURNAC PIPE, MASSIF CENTRAL, FRANCE.
 - 3 - FRASER RANGE GRANULITES, AUSTRALIA.
 - 4 - ARCHEAN ANDESITES FROM THE CANADIAN SHIELD.
 - 5 - AVERAGE CONTINENTAL CRUST.
- DATA FOR NO'S. 2-5 ARE FROM TABLE 2 OF DUPUY ET AL., 1980.

TABLE V-32: ESTIMATES OF TEMPERATURES AND PRESSURES OF
EQUILIBRIUM FOR ECLOGITIC AND GRANULITIC XENOLITHS.

| SAMPLE NO. | TEMP. (C)* | PRESSURE (KB)* |
|------------------|-------------|----------------|
| ----- | | |
| GT GRANULITES | | |
| ----- | | |
| 06023 | 810 | 3.8 |
| 06043 | 850 | 3.8 |
| 12133 | 770 | 6.6 |
| 25023 | 800 | 5.3 |
| 30-1 | 750 | 3.6 |
| 33013 | 770 | 4.4 |
| KY GT GRANULITES | | |
| ----- | | |
| 02223 | 710 | 1.8 |
| 02243 | 790 | 7.3 |
| 02493 | 800 | 7.7 |
| 12133A | 760 | 8.4 |
| 02343 | 930 | 15.4 |
| ECLOGITES | | |
| ----- | | |
| 02-1 | 990 | 14.2 |
| 02-2 | 995 | 14.4 |
| 02023 | 980 | 12.4 |
| 02063 | 960 | 11.4 |
| 02073 | 930 | 12.8 |
| 02083 | 900 | 13.1 |
| 02093 | 900 | 13.2 |
| 02103 | 930 | 8.6 |
| 02123 | 755 | 2.6 |
| 02233 | 915 | 9.2 |
| 02413 | 930 | 14.0 |
| 02423 | 945 | 12.7 |
| 02433 | 950 | 12.1 |
| 02443 | 960 | 13.9 |
| 02483 | 1000 | 13.7 |
| 02513 | 1040 | 12.8 |
| 02523 | 970 | 13.2 |
| 09123 | 920 | 5.1 |
| KY ECLOGITES | | |
| ----- | | |
| 02133 | 915 | 15.4 |
| 02143 | 895 | 13.0 |
| 02153 | 920 | 15.2 |
| 02173 | 940 | 14.9 |
| 02213 | 930 | 14.0 |
| 02463 | 810 | 12.0 |
| 02473 | 800 | 11.2 |
| 02503 | 945 | 13.9 |

*THE METHOD USED TO ESTIMATE THE P, T CO-ORDINATES
IS FULLY DESCRIBED IN V.6.1. NOTE THAT THE PRESSURE
ESTIMATES ARE MINIMUM VALUES ONLY.