# THE PETROLOGY, GEOCHEMISTRY AND GEOCHRONOLOGY OF THE FELSIC ALKALINE SUITE OF THE EASTERN YILGARN BLOCK, WESTERN AUSTRALIA.

VOLUME II

by

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Doctor of Philosophy

UNIVERSITY OF ADELAIDE

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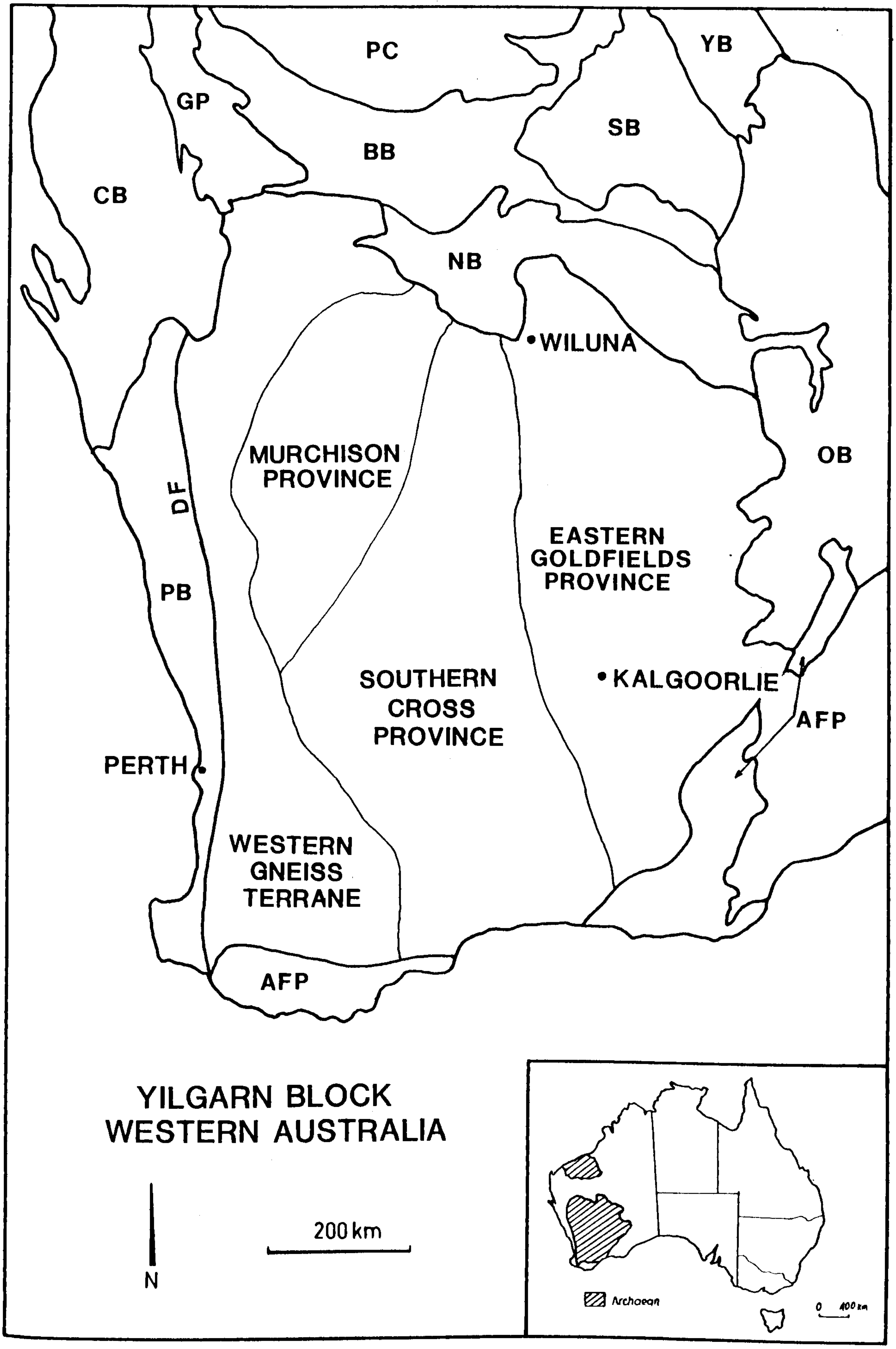



Figure 1.1 Major subdivisions of the Yilgarn Block, and surrounding geological provinces. PB = Perth Basin, DF = Darling Fault, AFP = Albany-Fraser Province, OB = Officer Basin, NB = Nabberu Basin, BB = Bangemall Basin, SB = Savory Basin, YB = Yeneena Basin, PC = Pilbara Craton, GP = Gascoyne Province, CB = Carnarvon Basin. (after Gee et al 1981, Myers & Hocking 1988).

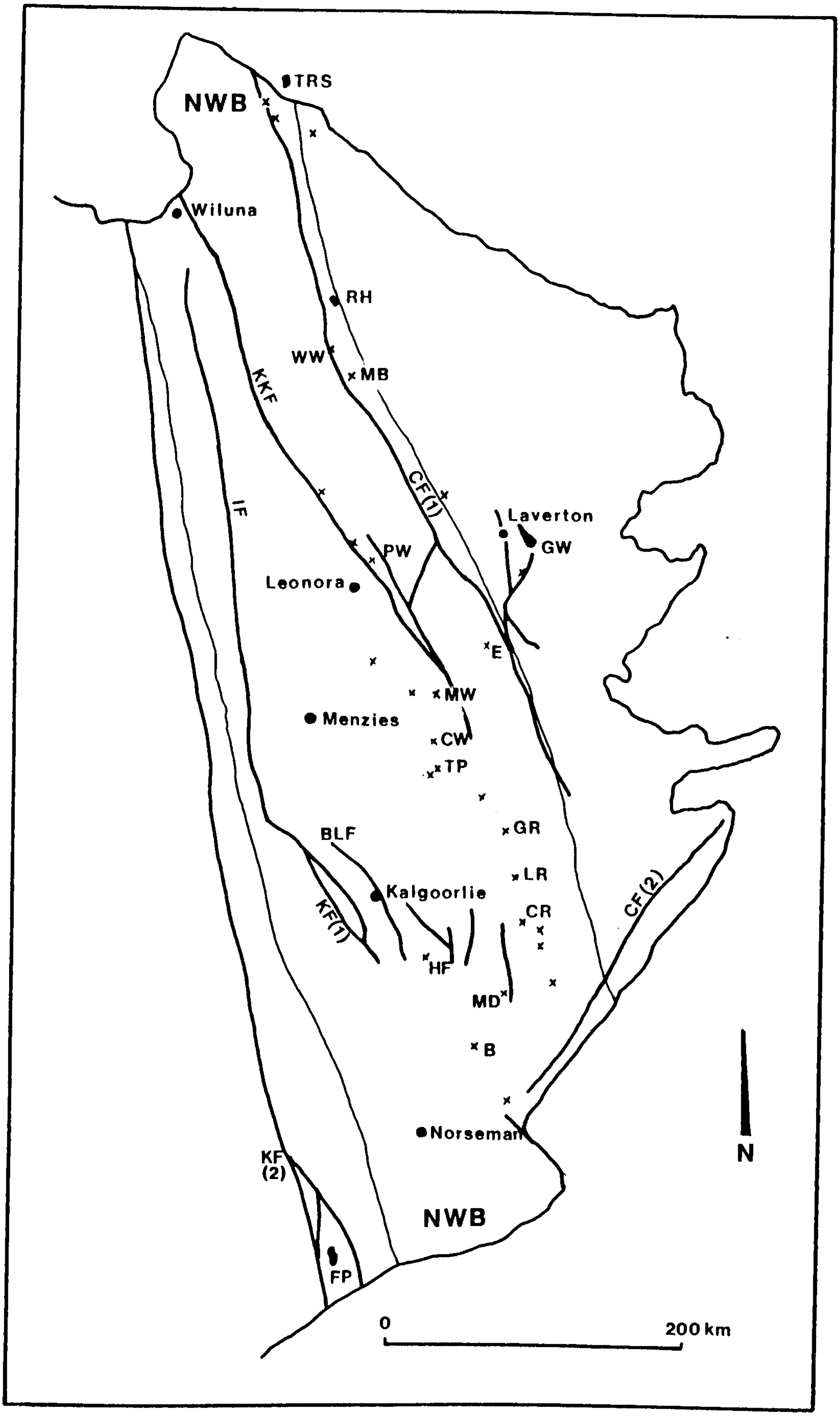



Figure 1.2 Distribution of the felsic alkaline suite, Eastern Goldfields Province. NWB = Norseman-Wiluna Belt, KKF = Keith-Kilkenny Fault, CF(1) = Celia Fault, CF(2) = Cundeelee Fault, IF = Ida Fault, BLF = Boulder-Lefroy Fault, KF(1) = Kununalling Fault, KF(2) = Koolyanobbing Fault. Felsic alkaline intrusions included in this study as follows: FP = Fitzgerald Peaks, B = Binneringie, MD = Madoonia Downs, HF = Hogan's Find, CR = Cardunia Rocks, LR = Lake Roe, GR = Gilgarna Rock, TP = Twin Peaks, CW = Cement Well, MW = McAuliffe Well, E = Eucalyptus, GW = Granite Well, PW = Pig Well, MB = Mt. Blackburn, WW = Woorana Well, RH = Red Hill, TRS = Teague Ring Structure.

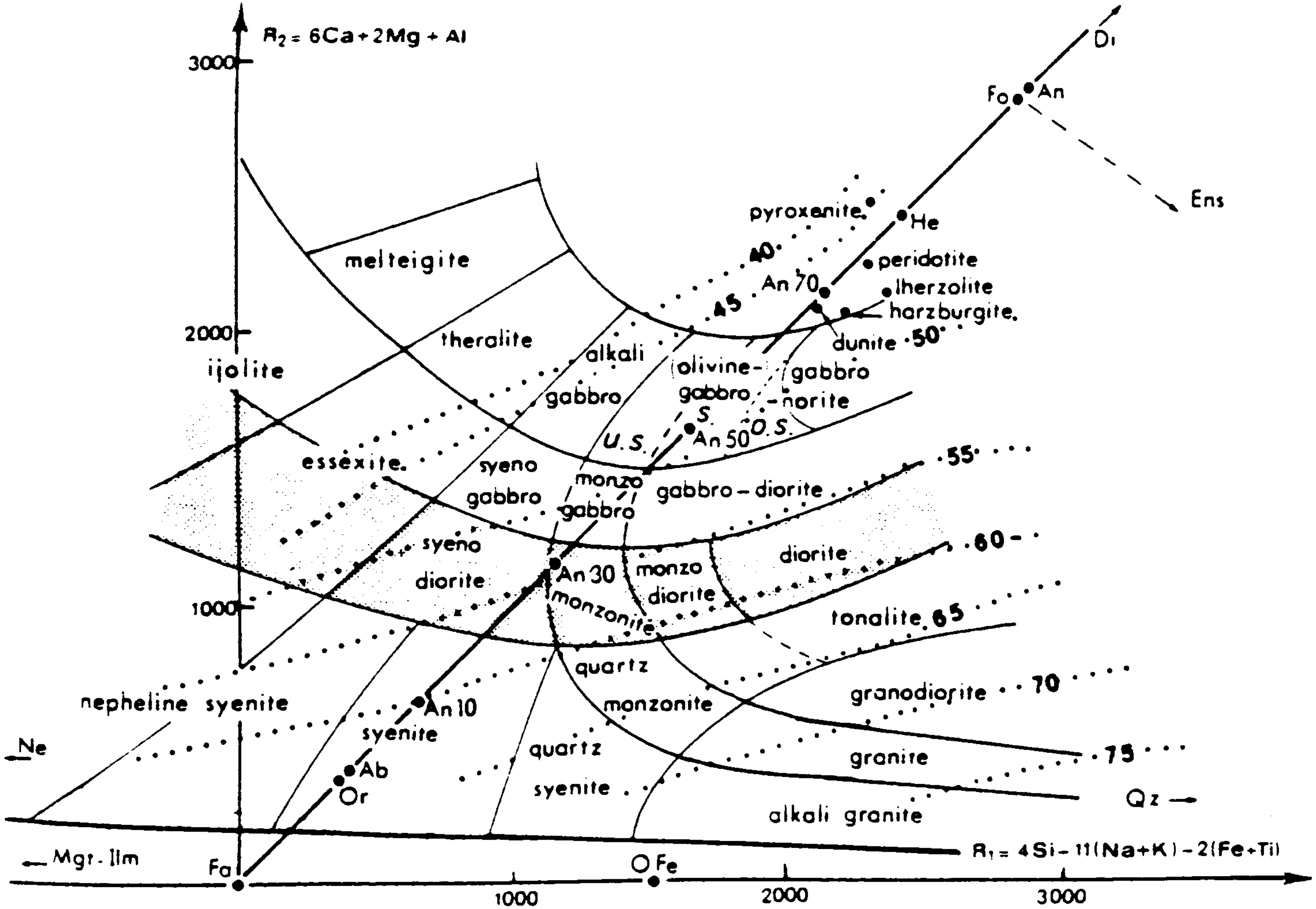



Figure 1.3 $R_1R_2$ geochemical classification scheme for the plutonic rock families. Thick solid line represents the critical line of silica saturation, with principal related minerals. Dashed lines represent weight percent silica contours. (after De La Roche et al 1980).
(* Transparent overlay for following $R_1R_2$ diagrams in pocket at rear of this volume).

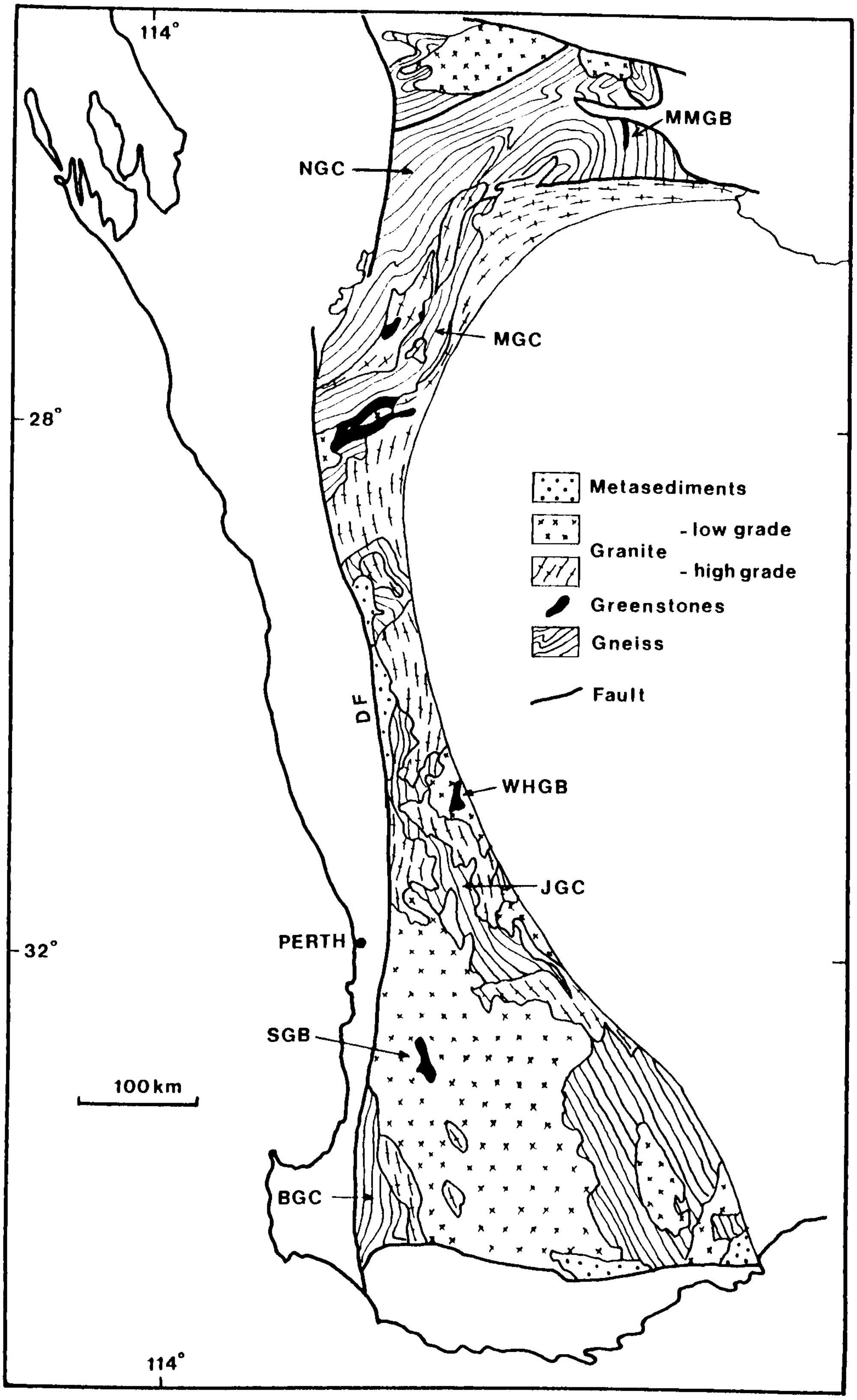



Figure 1.4 General geology of the Western Gneiss Terrane, Yilgarn Block. MMGB = Mount Maitland greenstone belt, NGC = Narryer Gneiss Complex, MGC = Murgoo Gneiss Complex, WHGB = Wongan Hills greenstone belt, JGC = Jimperding Gneiss Complex, SGB = Saddleback greenstone belt, BGC = Balingup Gneiss Complex, DF = Darling Fault. (after Myers 1990a).

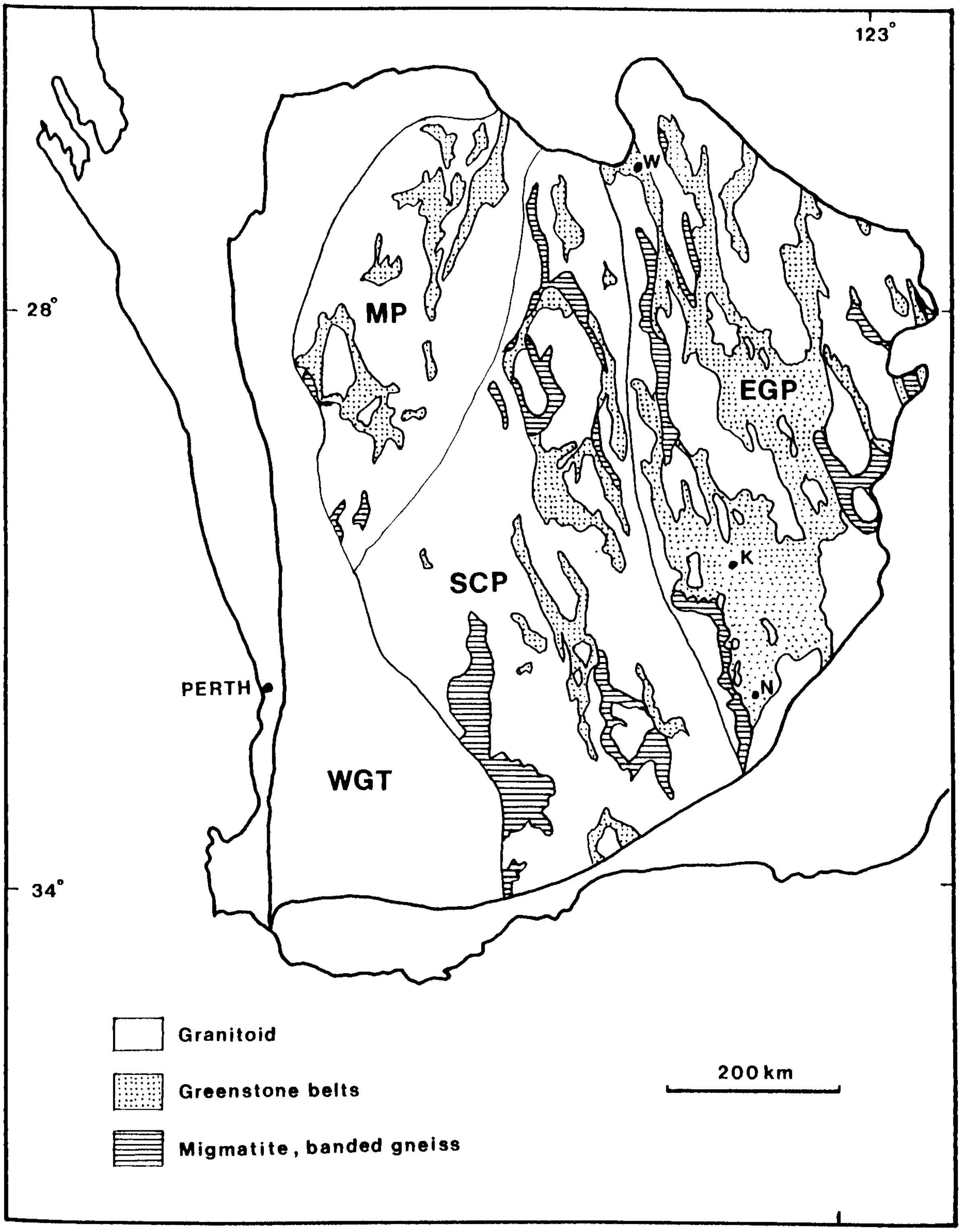



Figure 1.5 General geology of the granite-greenstone terranes, Yilgarn Block. EGP = Eastern Goldfields Province, SCP = Southern Cross Province, MP = Murchison Province, WGT = Western Gneiss Terrane, W = Wiluna, K = Kalgoorlie, N = Norseman. (after Gee et al 1981).

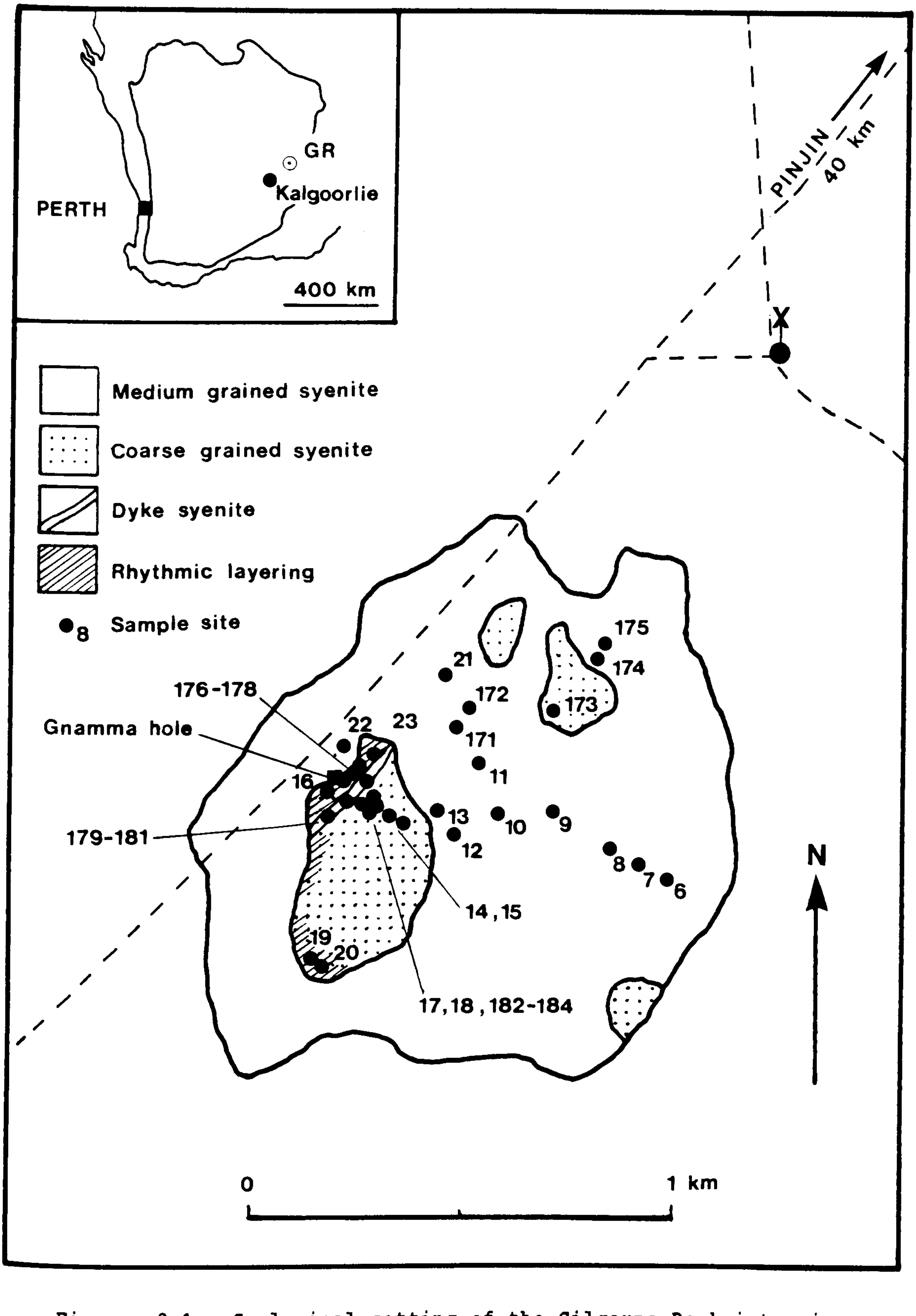



Figure 2.1 Geological setting of the Gilgarna Rock intrusion.

Figure 2.2

A. Contact region between coarse-grained syenite (low hummocks in foreground) and medium-grained syenite (tors in background), looking east from sample site 23, Gilgarna Rock.

B. Narrow tongue of coarse-grained syenite (under hammer) intruding medium-grained syenite, immediately east of sample site 23, Gilgarna Rock.

C. Xenoliths of medium-grained syenite within coarse grained syenite, 15m southwest of gnamma hole, Gilgarna Rock.

D. Rhythmic igneous layering displayed by alternating bands of alkali feldspar (anorthoclase, with minor oligoclase-albite), and alkali pyroxene (zoned augite/aegirine-augite), southern internal margin of main coarse-grained syenite outcrop, sample site 19, Gilgarna Rock.

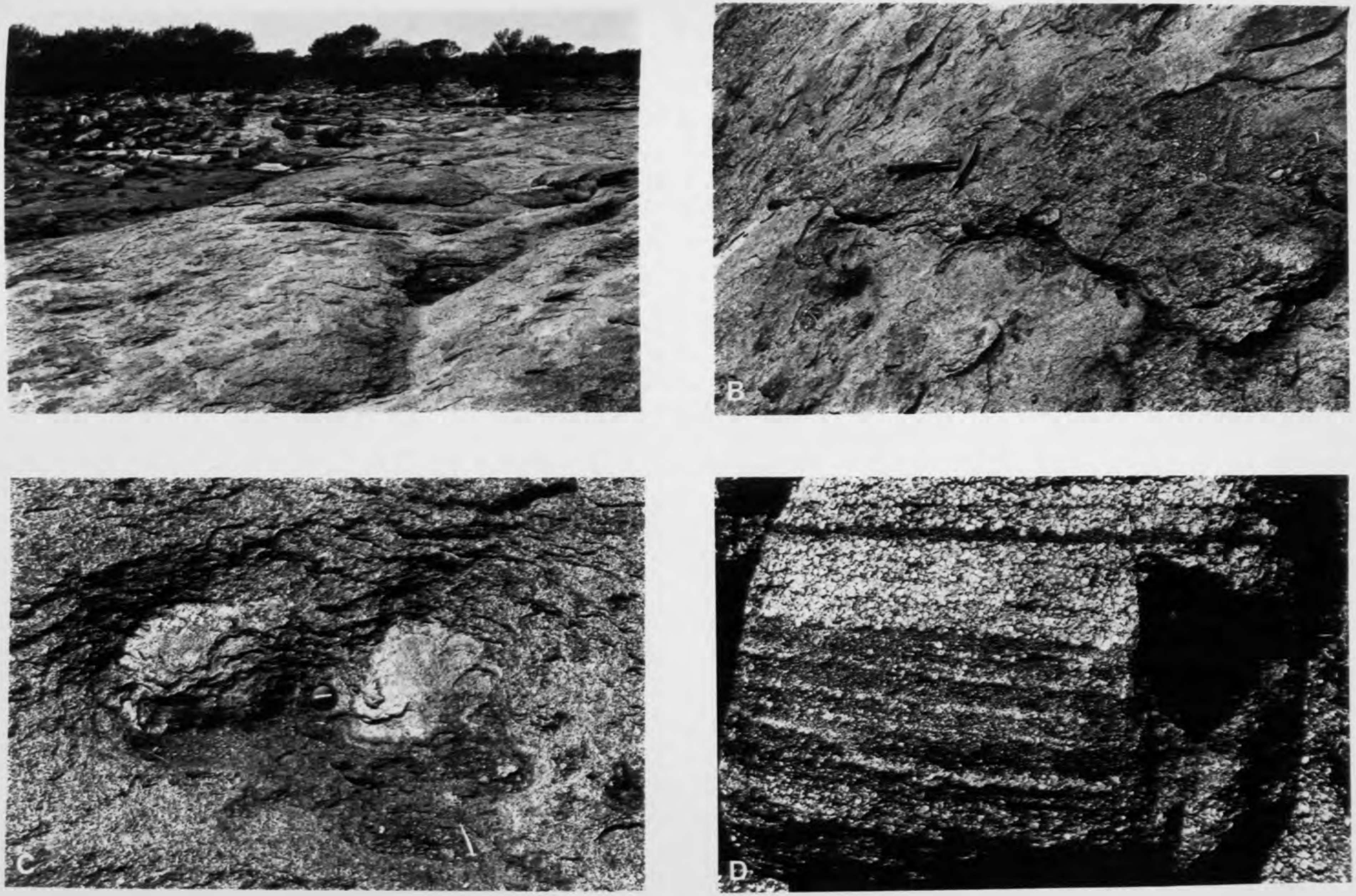

A
B
C
D

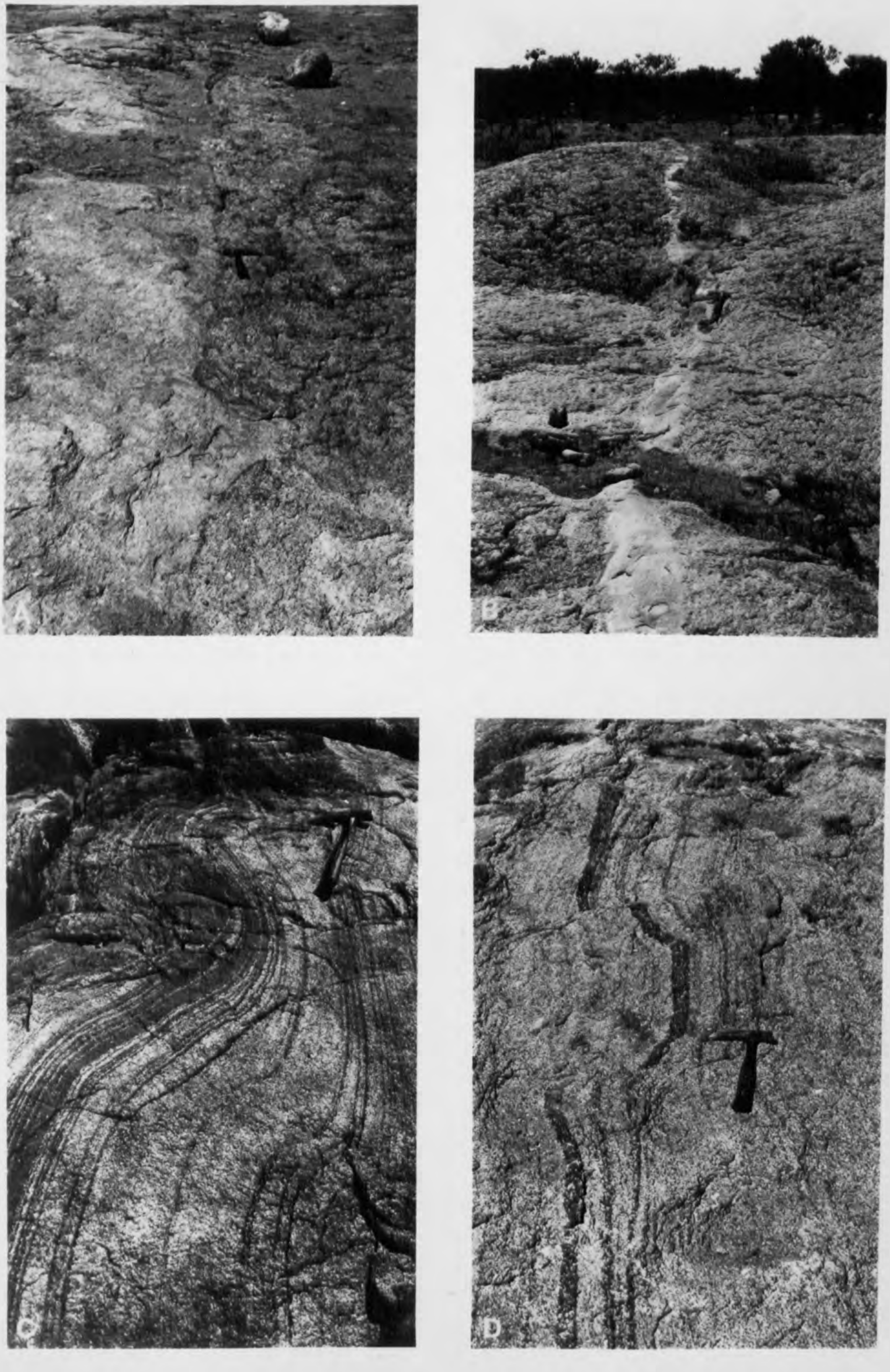
Figure 2.3

A. Sharp contact between medium-grained (left) and coarse-grained (right) syenite phases, immediately east of sample site 23, Gilgarna Rock.

B. North-east trending differentiate dyke intruding coarse-grained syenite, sample site 181, Gilgarna Rock.

C. Trough structure in rhythmic layered coarse-grained syenite, hammer point indicating facing direction towards contact with medium-grained syenite, vicinity of sample sites 19, 20, Gilgarna Rock.

D. Micro-faulted rhythmic layering, hammer point indicating facing direction towards contact with medium-grained syenite, 15m northeast of gnamma hole, Gilgarna Rock.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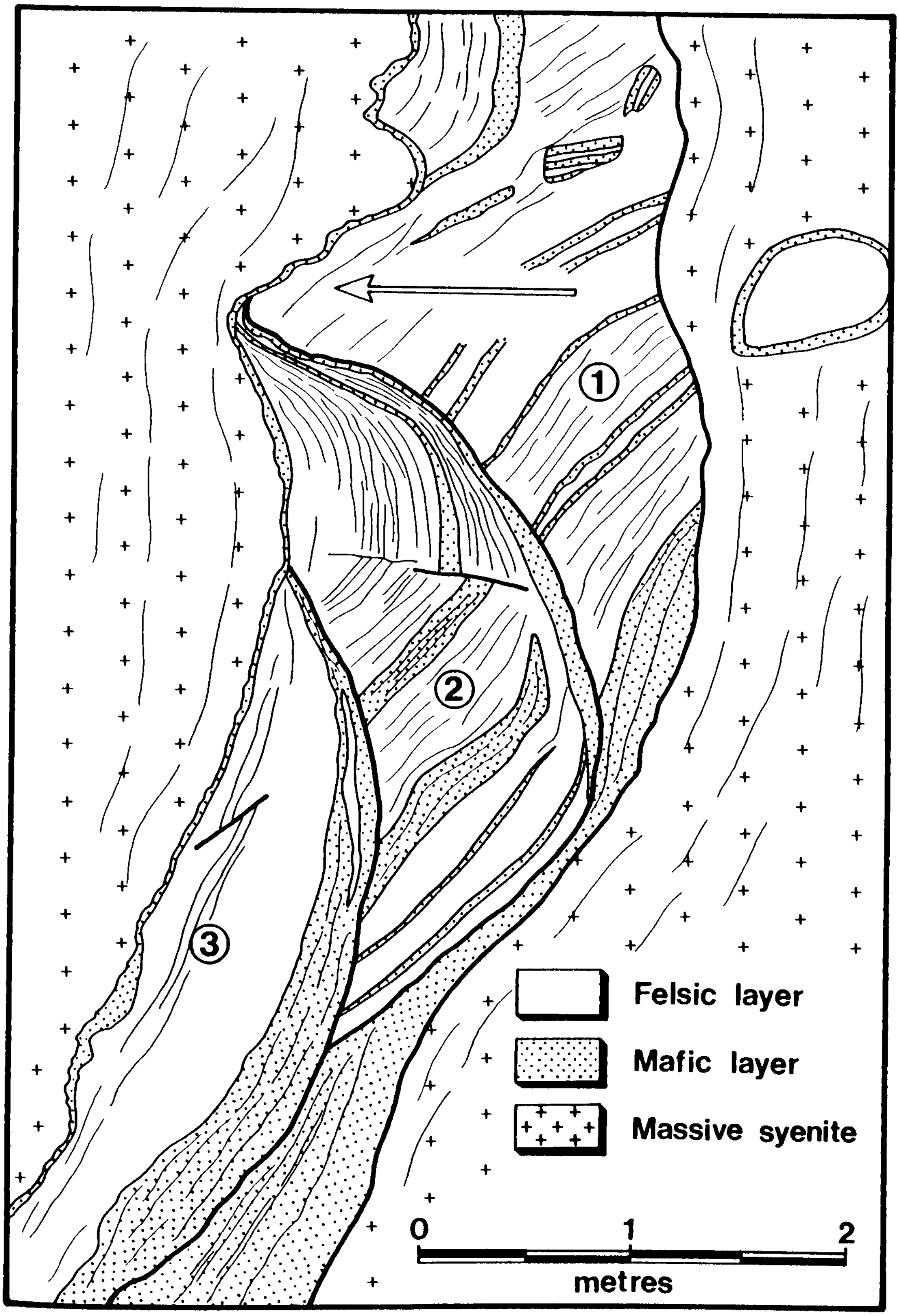



Figure 2.4 Sedimentary-style scour and fill structures within coarse-grained syenite, approaching the contact with medium-grained syenite, 25m northeast of gnamma hole, Gilgarna Rock. Arrow indicates facing direction. Zone 1 represents early layering subsequently modified by scours 2 and 3. Note disrupted blocks in zone 1, syn-crystallisation microfaults within zones 2 and 3, and orbicular structure within late-stage relatively massive syenite, which truncates the base of zone 1.

Figure 2.5

Note - for all stained slabs, yellow indicates alkali feldspar, pink indicates plagioclase feldspar. Scale in centimetres.

A. Slabbed and stained medium-grained syenite, sample 009, Gilgarna Rock. Note large zoned alkali feldspars.

B. Slabbed and stained coarse-grained syenite, sample 016, Gilgarna Rock.

C. Slabbed and stained granite, sample 029, Bulyairdie Rocks. Note relative abundance of plagioclase (albite).

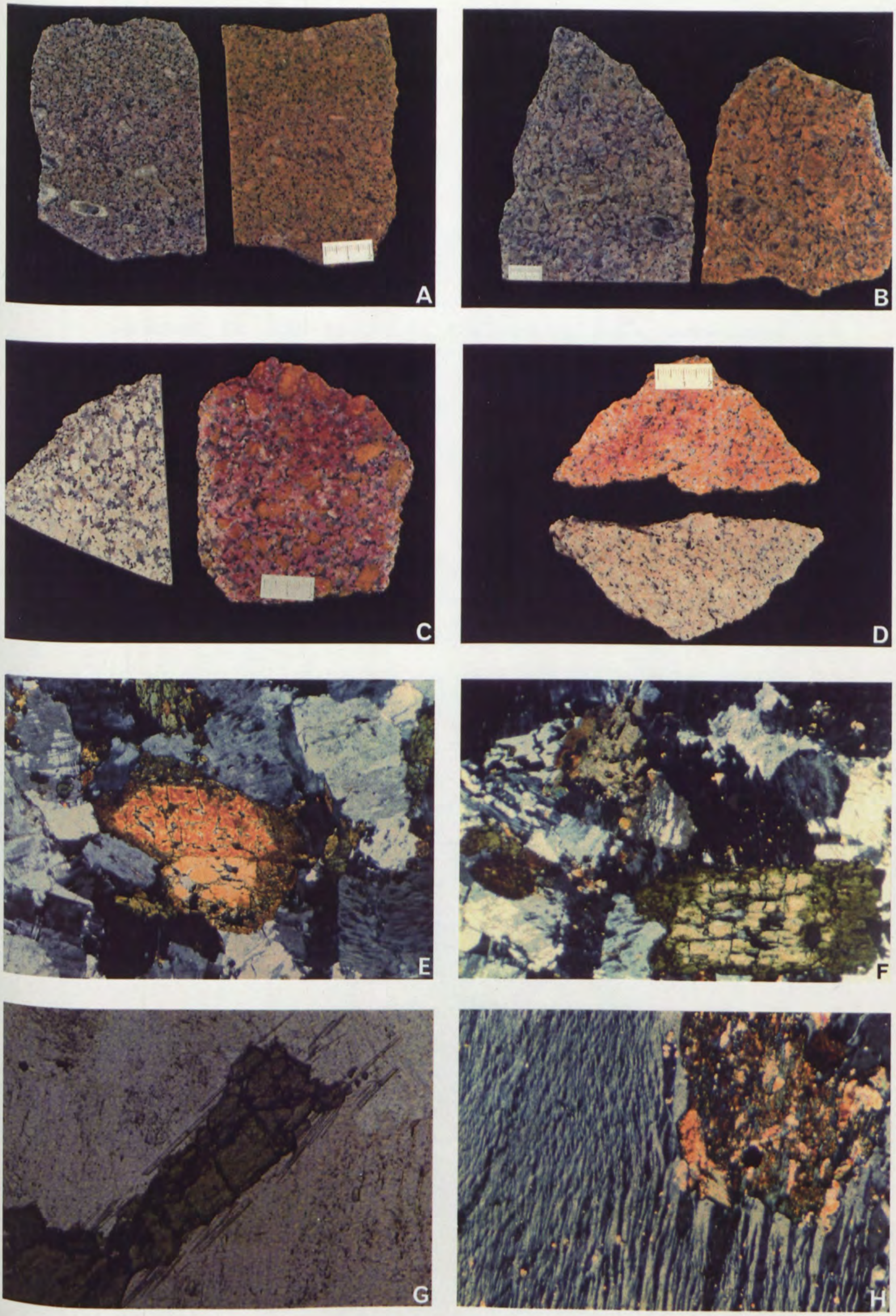
D. Slabbed and stained quartz monzonite, sample 039, Dingo Rock.

E. Aegirine-augite rimming augite, medium-grained syenite, sample 006, Gilgarna Rock. Background predominantly unmixed anorthoclase, note euhedral titanite middle centre right. Crossed polars (CP), field of view (FOV) = 3.9mm.

F. Aegirine-augite rimming and replacing augite, medium-grained syenite, sample 009, Gilgarna Rock. Note late interstitial calcite, top centre left. CP, FOV = 3.9mm.

G. Aegirine-augite rimmed and partly replaced by late stage uralitic magnesioriebeckitic amphibole needles, medium-grained syenite, sample 010, Gilgarna Rock. Plane-polarised light (PPL), FOV = 0.975mm.

H. Classic mesoperthitic alkali feldspar texture, coarse-grained syenite, sample 016, Gilgarna Rock. CP, FOV = 3.9mm.


A
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C
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F
G
H

Figure 2.6

A. Zoned anorthoclase, coarse-grained syenite, sample 173, Gilgarna Rock. Note consertal texture, top centre right. CP, FOV = 3.9mm.

B. Interlocking alkali feldspar mass exhibiting consertal textures, and minor late stage fleck calcite, medium-grained syenite, sample 022, Gilgarna Rock. CP, FOV = 3.9mm.

C. Typical unmixed anorthoclase textures, differentiate syenite, sample 023, Gilgarna Rock. Note late stage interstitial quartz and minor calcite, top and bottom left. CP, FOV = 3.9mm.

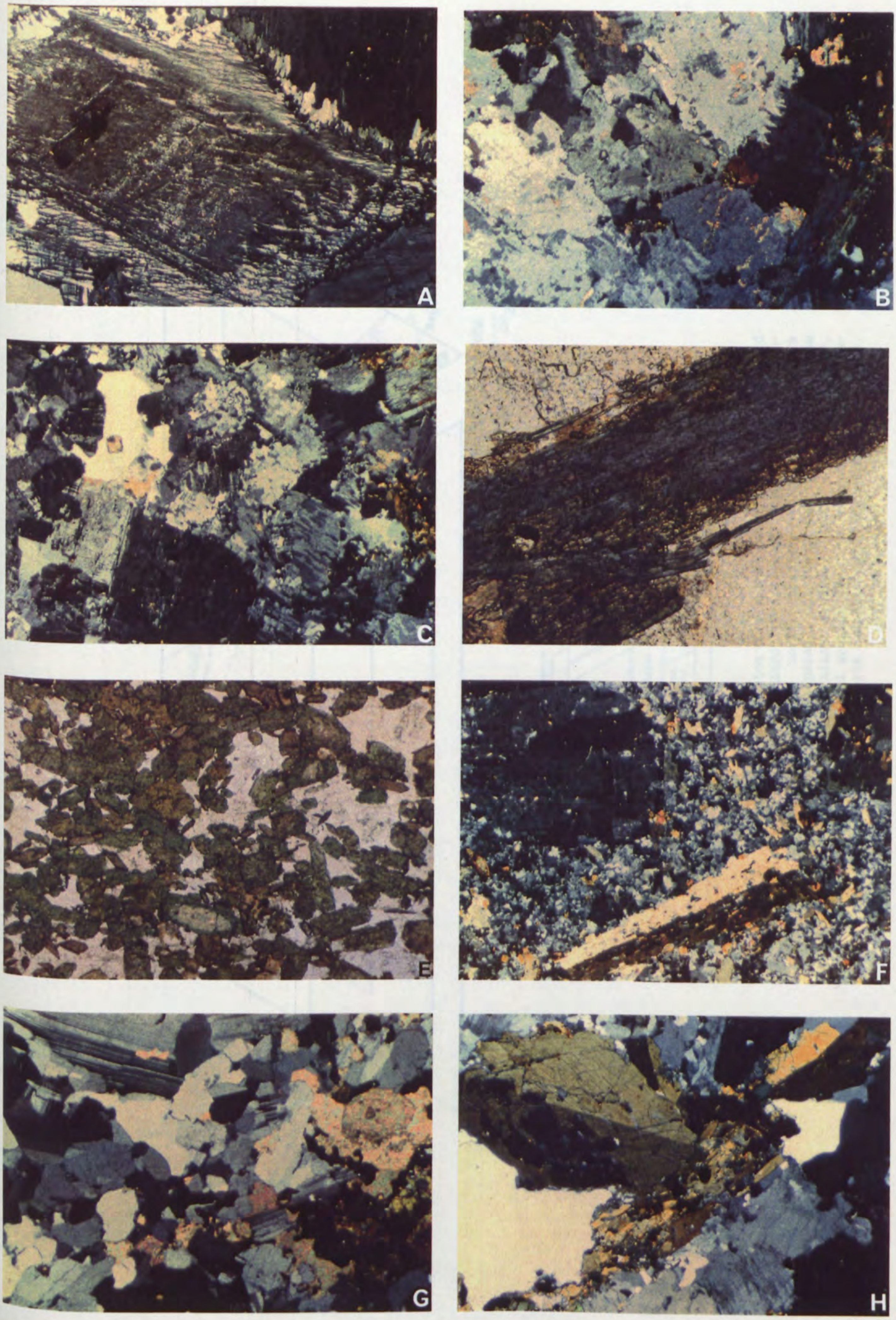
D. Magnesioriebeckite (dark blue-grey) replacing aegirine, medium-grained syenite, sample 175, Gilgarna Rock. PPL, FOV = 0.975mm.

E. Zoned augite/aegirine-augite within mafic layer of rhythmic layered syenite, sample 019, Gilgarna Rock. Note abundant brown titanite wedges throughout. PPL, FOV = 3.9mm.

F. Hornblende (centre bottom) and oligoclase (top left) phenocrysts within oligoclase-hornblende-microcline groundmass, porphyritic hornblende monzonite, sample 018, Gilgarna Rock. CP, FOV = 3.9mm.

G. Microcline-albite-quartz assemblage, alkali granite, sample 031, Cardunia Rocks. Note ragged aggregate of andradite, bottom right, and reasonably common calcite. CP, FOV = 3.9mm.

H. Large twinned hornblende-hastingsite exhibiting excellent 120° cleavage, within microcline-albite-quartz assemblage, quartz monzonite, sample 039, Dingo Rock. CP, FOV = 3.9mm.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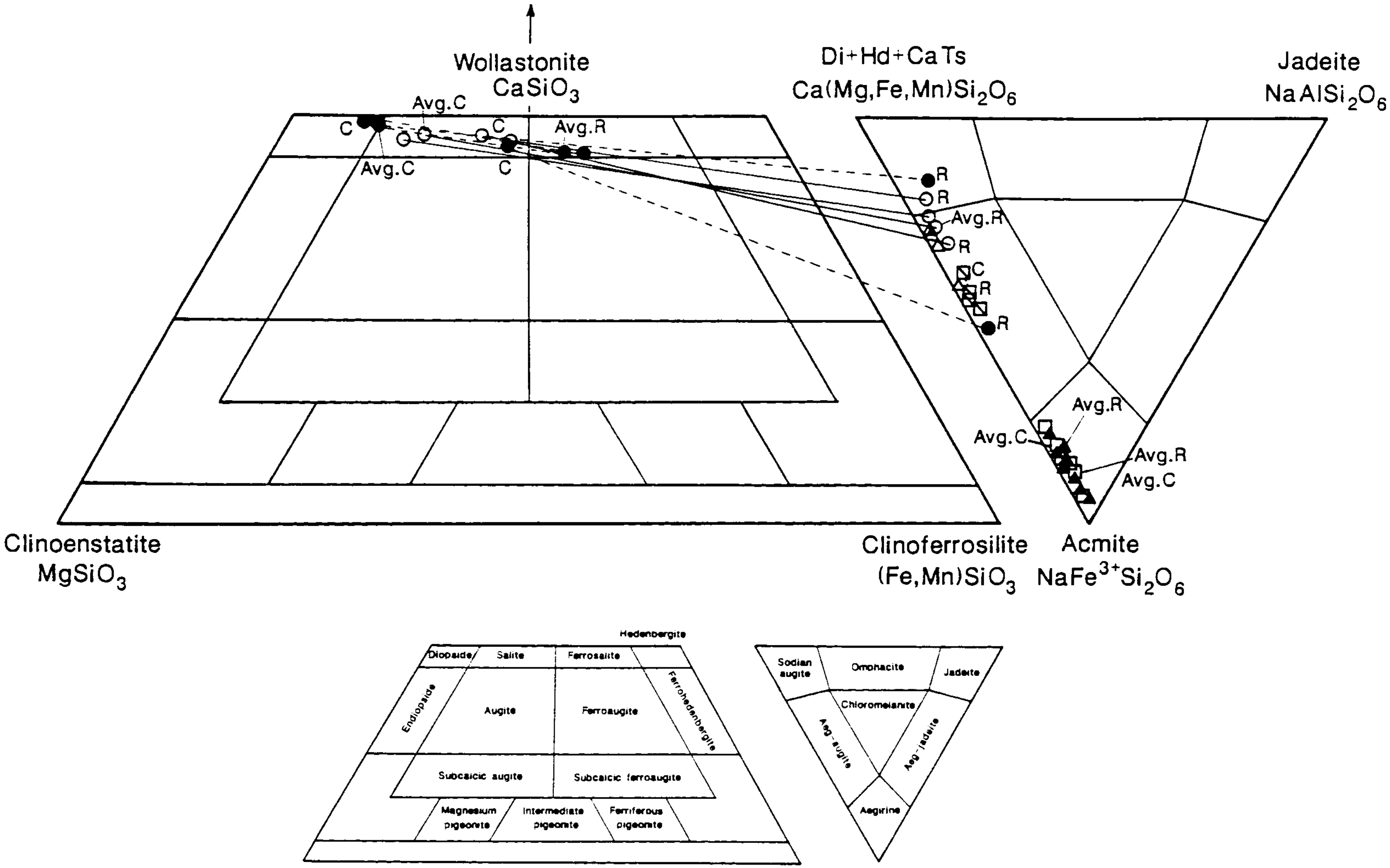



Figure 2.7 Pyroxene classification diagram. Gilgarna Rock samples - solid circles, medium-grained syenite 006; open circles, medium-grained syenite 009; solid triangles, coarse-grained syenite 016; lined open squares, differentiate syenite 179; open squares, medium-grained syenite, 021. Open triangles, Cardunia Rocks alkali granite 033. C = core, R = rim. Tie-lines link core and rim compositions from individual crystals.

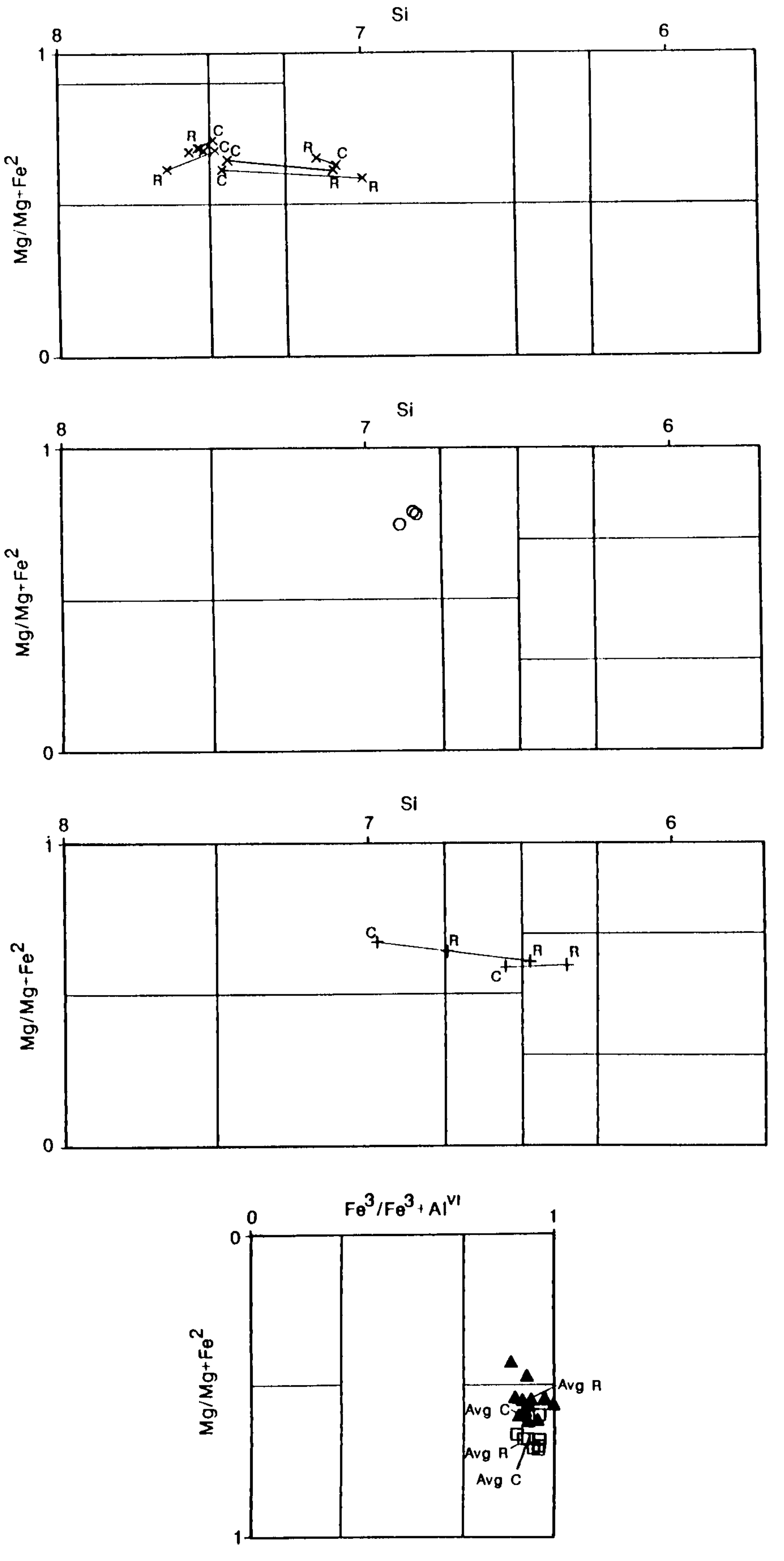
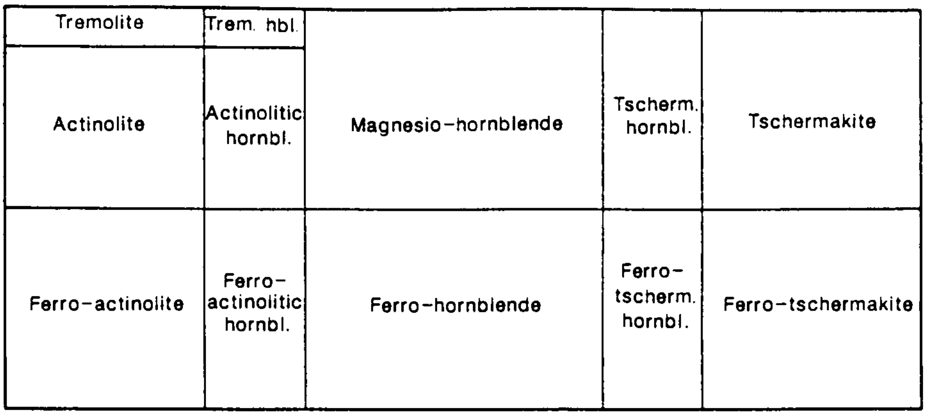
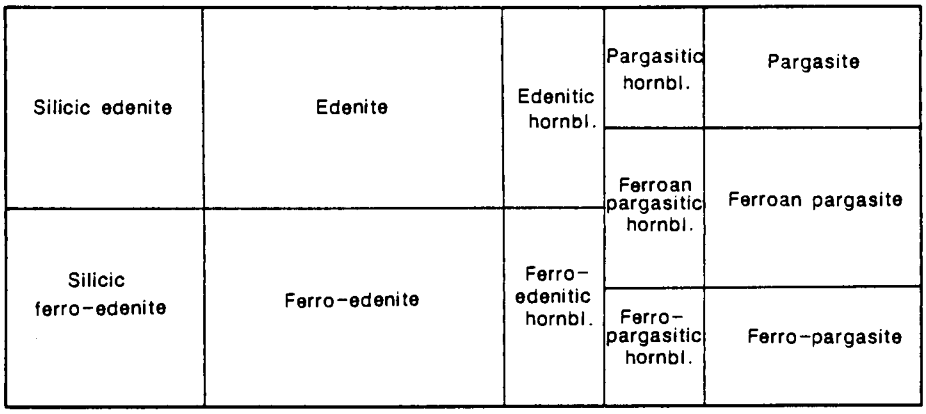
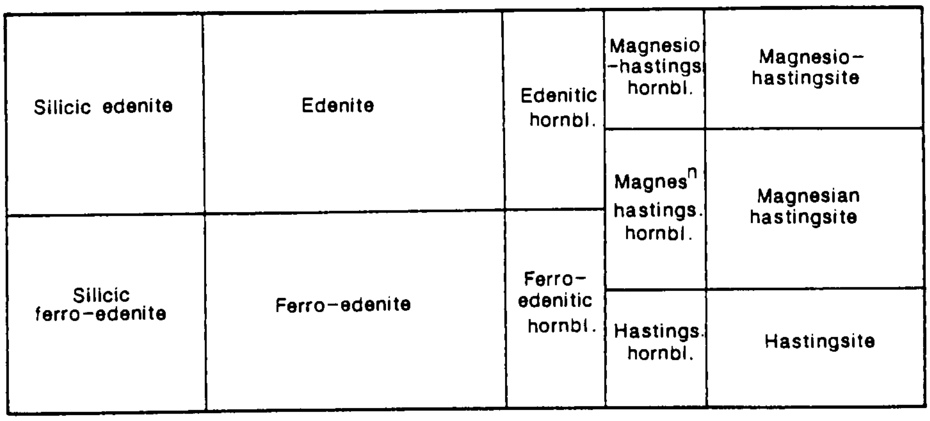



Figure 2.8 Amphibole classification diagram. Gilgarna Rock samples - open circles, medium-grained syenite 009; pluses, porphyritic hornblende monzonite 018; solid triangles, coarse-grained syenite 016; open squares, medium-grained syenite 021. Crosses, Bulyairdie Rocks granite 029. C = core, R = rim. Tie-lines link core and rim compositions from individual crystals. Classification key overleaf.


Tremolite
Trem. hbl.
Actinolite
Actinolitic hornbl.
Magnesio-hornblende
Tscherm. hornbl.
Tschermakite
Ferro-actinolite
Ferro-actinolitic hornbl.
Ferro-hornblende
Ferro-tscherm. hornbl.
Ferro-tschermakite


Silicic edenite
Edenite
Edenitic hornbl.
Pargasitic hornbl.
Pargasite
Ferroan pargasitic hornbl.
Ferroan pargasite
Silicic ferro-edenite
Ferro-edenite
Ferro-edenitic hornbl.
Ferro-pargasitic hornbl.
Ferro-pargasite


Silicic edenite
Edenite
Edenitic hornbl.
Magnesio-hastings hornbl.
Magnesio-hastingsite
Magnesn hastings. hornbl.
Magnesian hastingsite
Silicic ferro-edenite
Ferro-edenite
Ferro-edenitic hornbl.
Hastings. hornbl.
Hastingsite

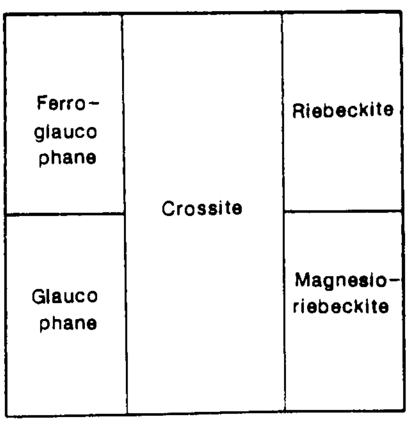

Ferro-glauco phane
Crossite
Riebeckite
Glauco phane
Magnesio-riebeckite

Figure 2.9 Whole rock major and trace element variation diagrams. Major element oxides in wt%, trace elements in p.p.m.

Gilgarna Rock samples - solid squares, medium-grained syenite (samples 6,7,8,9,10,11,12,21,22,171,172,174 & 175); open squares, coarse-grained syenite (samples 15,16,173,176,177, & 178); solid squares within circles, rhythmic layered syenite (samples 19,20); crosses, differentiate syenite (samples 23,179,180,181); open circles, porphyritic hornblende monzonite (samples 17,18,182,183,184).

Other Kurnalpi samples - solid triangles, including Claypan Dam granite (24), Yindi granites (25,27), Bulyairdie Rocks granite (28,29), Lake Roe syenite (30), Cardunia Rocks alkali granite (31,32,33,34,35), Dingo Rock granites (36,37,38,39,42,43).

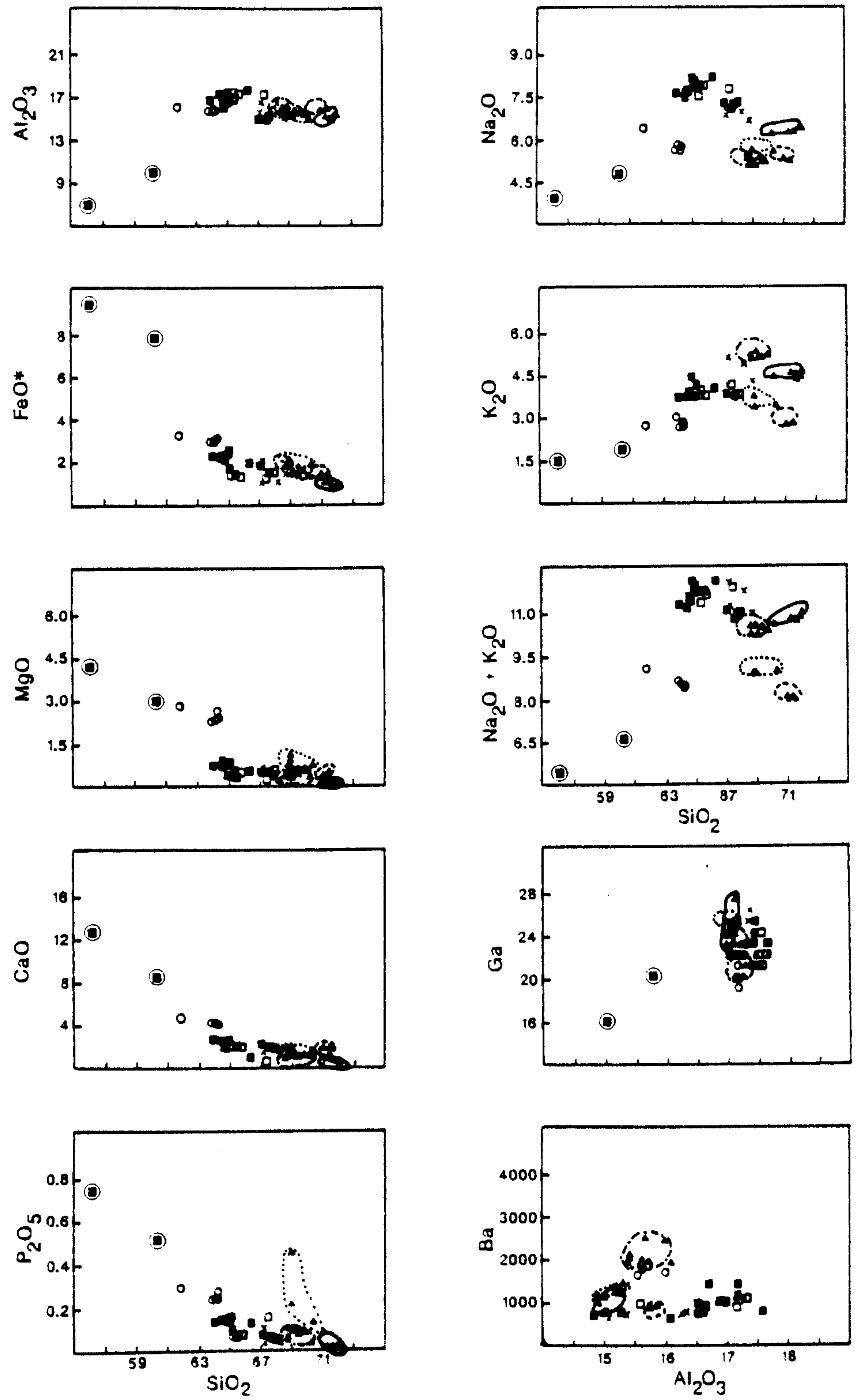
Groups outlined on overlay as follows:

........ Claypan/Bulyairdie group (CB)

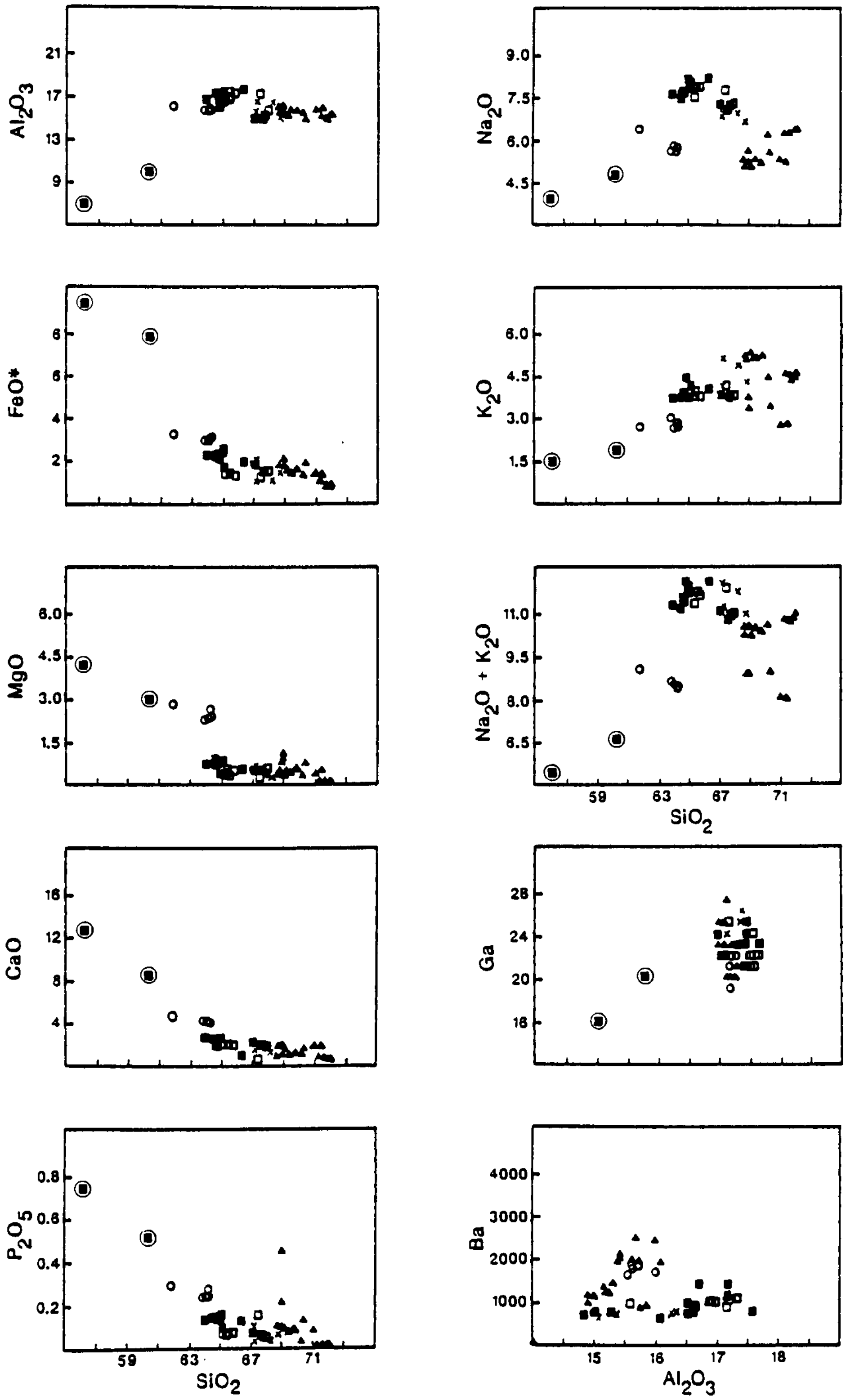
-------- Yindi group (Y)

________ Lake Roe/Cardunia group (RC)

._._._._ Dingo group (D)



Al2O3
21
17
13
9
Na2O
9.0
7.5
6.0
4.5
FeO*
8
6
4
2
K2O
6.0
4.5
3.0
1.5
MgO
6.0
4.5
3.0
1.5
Na2O + K2O
11.0
9.5
8.0
6.5
59
63
87
71
SiO2
CaO
16
12
8
4
Ga
28
24
20
16
P2O5
0.8
0.6
0.4
0.2
59
63
67
71
SiO2
Ba
4000
3000
2000
1000
15
16
17
18
Al2O3



Al2O3
21
17
13
9
Na2O
9.0
7.5
6.0
4.5
FeO*
8
6
4
2
K2O
6.0
4.5
3.0
1.5
MgO
6.0
4.5
3.0
1.5
Na2O + K2O
11.0
9.5
8.0
6.5
59
63
67
71
SiO2
CaO
16
12
8
4
Ga
28
24
20
16
P2O5
0.8
0.6
0.4
0.2
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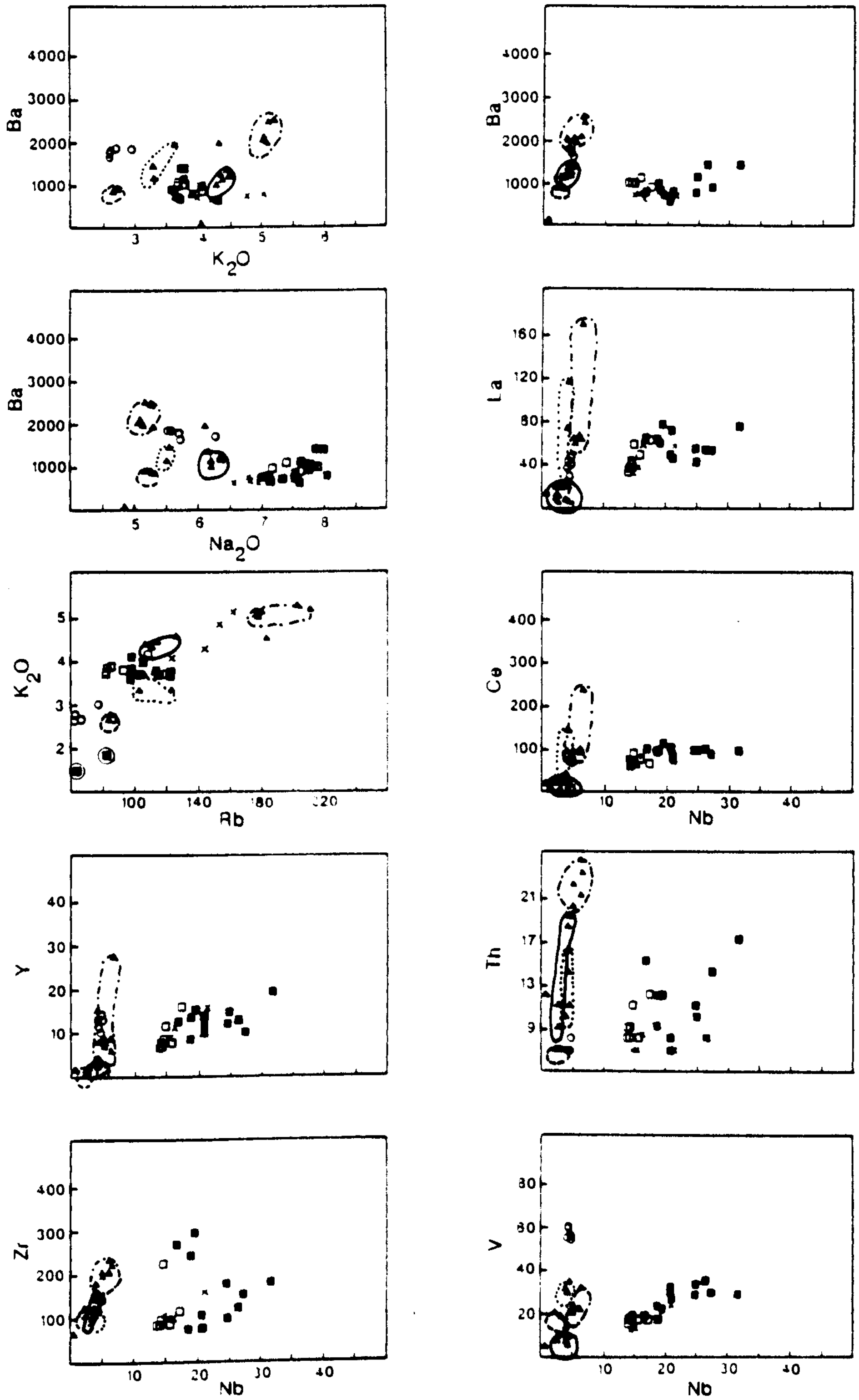
63
67
71
SiO2
Ba
4000
3000
2000
1000
15
16
17
18
Al2O3



Ba
4000
3000
2000
1000
3
4
5
6
K2O
Ba
4000
3000
2000
1000
Ba
4000
3000
2000
1000
5
6
7
8
Na2O
La
160
120
80
40
K2O
5
4
3
2
100
140
180
220
Rb
Ce
400
300
200
100
10
20
30
40
Nb
Y
40
30
20
10
Th
21
17
13
9
Zr
400
300
200
100
10
20
30
40
Nb
V
80
60
40
20
10
20
30
40
Nb

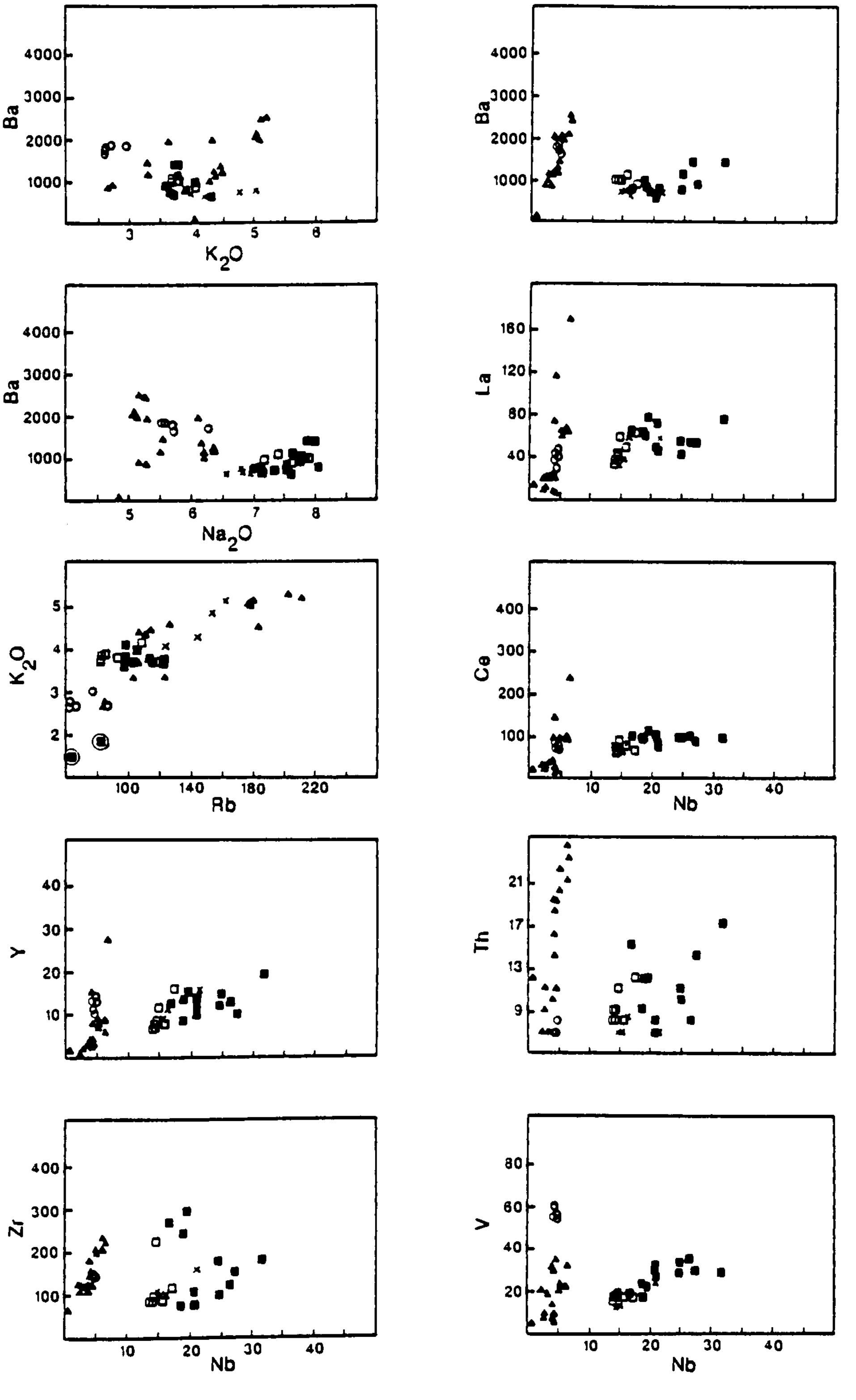
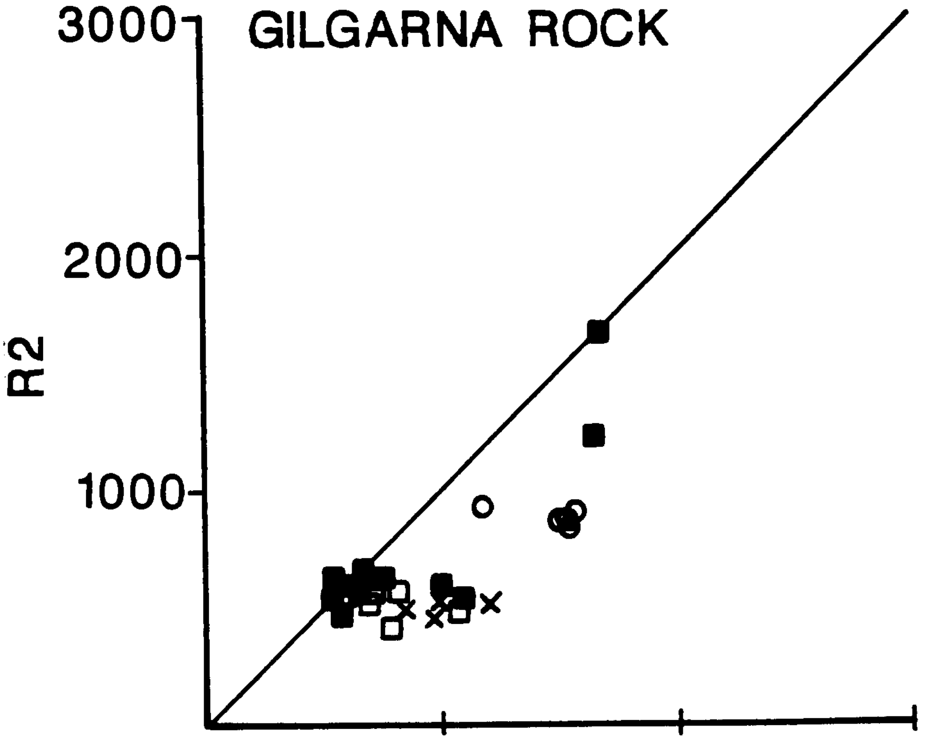
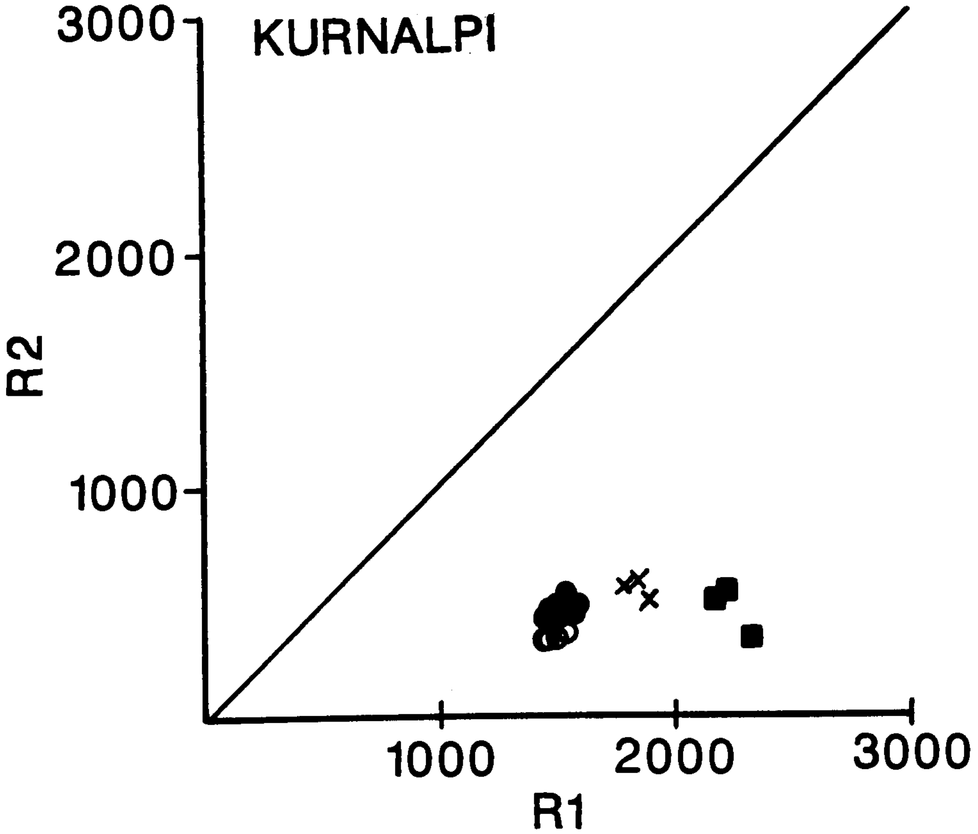

Ba
4000
3000
2000
1000
3
4
5
6
$K_2O$
Ba
4000
3000
2000
1000
Ba
4000
3000
2000
1000
5
6
7
8
$Na_2O$
La
160
120
80
40
$K_2O$
5
4
3
2
100
140
180
220
Rb
Ce
400
300
200
100
10
20
30
40
Nb
Y
40
30
20
10
Th
21
17
13
9
Zr
400
300
200
100
10
20
30
40
Nb
V
80
60
40
20
10
20
30
40
Nb

Figure 2.10 $R_1R_2$ geochemical classification diagrams. Gilgarna Rock sample symbols as in Fig. 2.9. Kurnalpi sample symbols as follows - crosses, Claypan Dam/Bulyairdie Rocks granites (24,28,29); solid squares, Yindi granites (25,26,27); open circles, Cardunia Rocks alkali granites (31,32,33,34,35); solid circles, Dingo Rock granites (36,37,38,39,40,41,42,43). Refer overlay in back pocket for key.


GILGARNA ROCK
3000
2000
1000
R2


KURNALPI
3000
2000
1000
R2
1000
2000
3000
R1

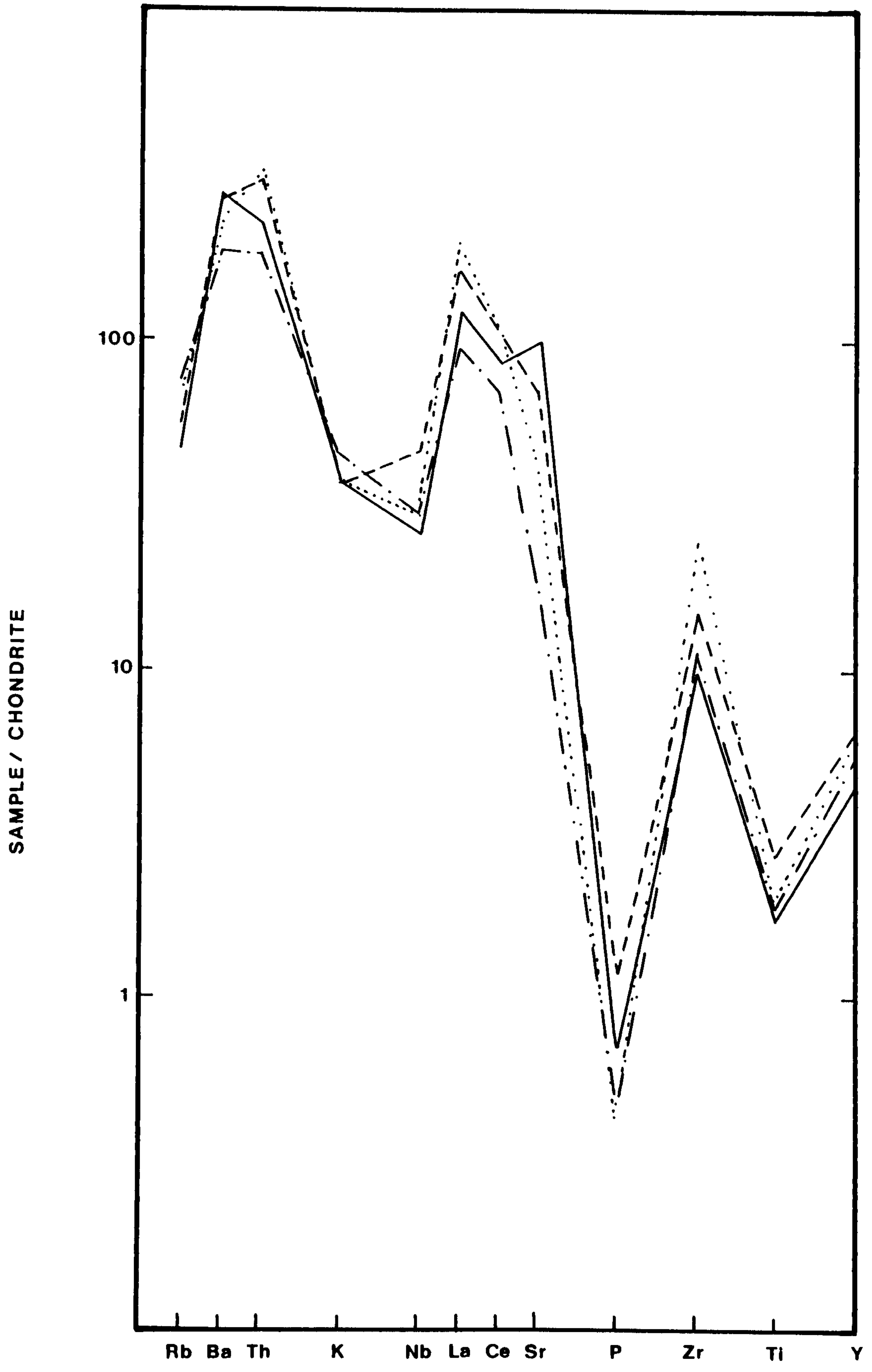



Figure 2.11 Chondrite-normalised hygromagmatophile (HYG) element spider plot, Gilgarna Rock. Solid line, coarse-grained syenite (average of 6 samples); dashed line, medium-grained syenite (average of 5 samples); dotted line, more evolved medium-grained syenite (average of 21,22,175); dash-dot line, differentiate syenite dyke (average of 4 samples). Normalising factors from Wood et al (1979).

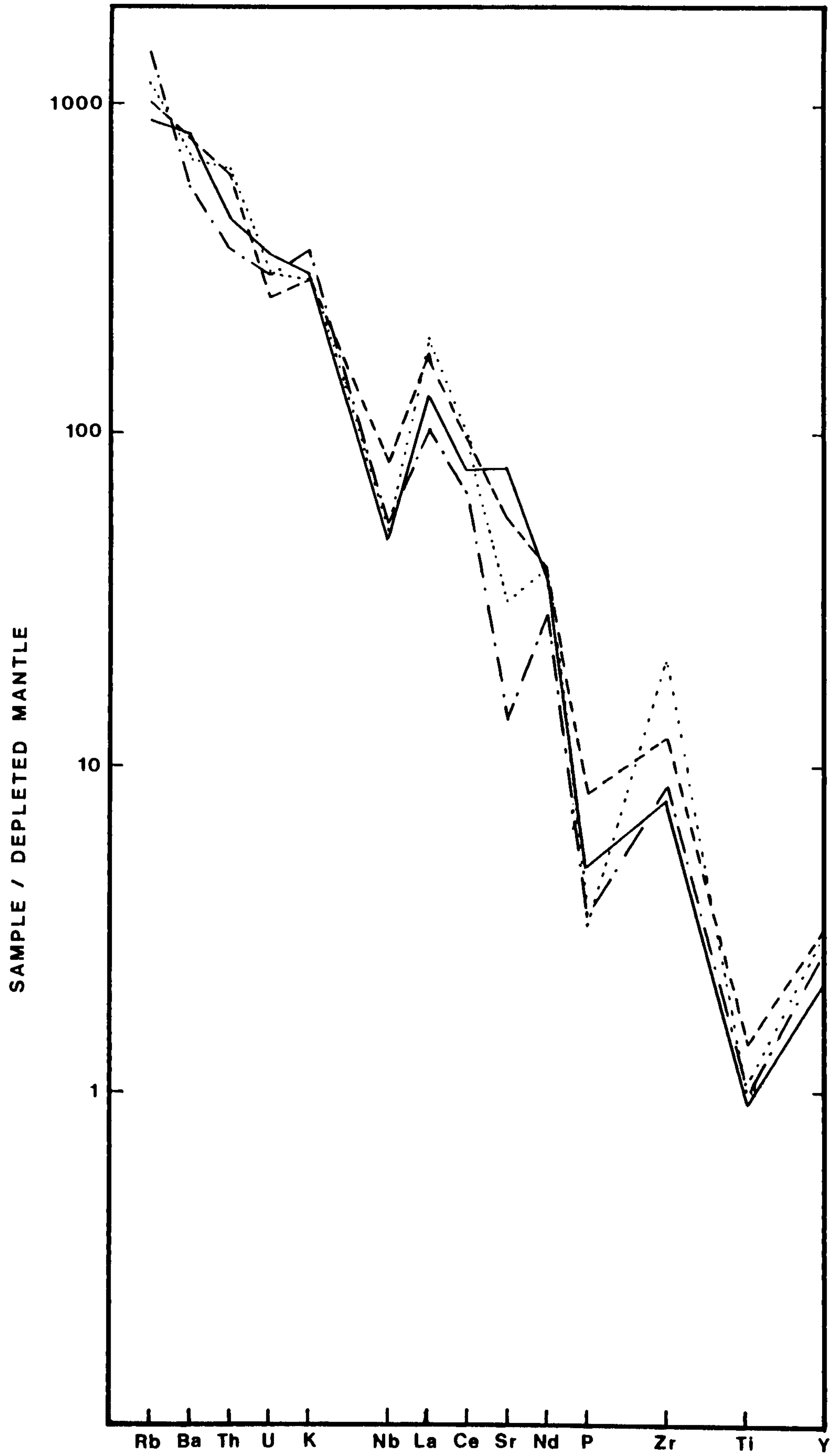



Figure 2.12 Depleted mantle source-normalised hygromagmatophile (HYG) element spider plot, Gilgarna Rock. Solid line, coarse-grained syenite (average of 6 samples); dashed line, medium-grained syenite (average of 5 samples); dotted line, more evolved medium-grained syenite (average of 21,22,175); dash-dot line, differentiate syenite dyke (average of 4 samples). Normalising factors from the N-type MORB mantle source of Wood et al (1979).

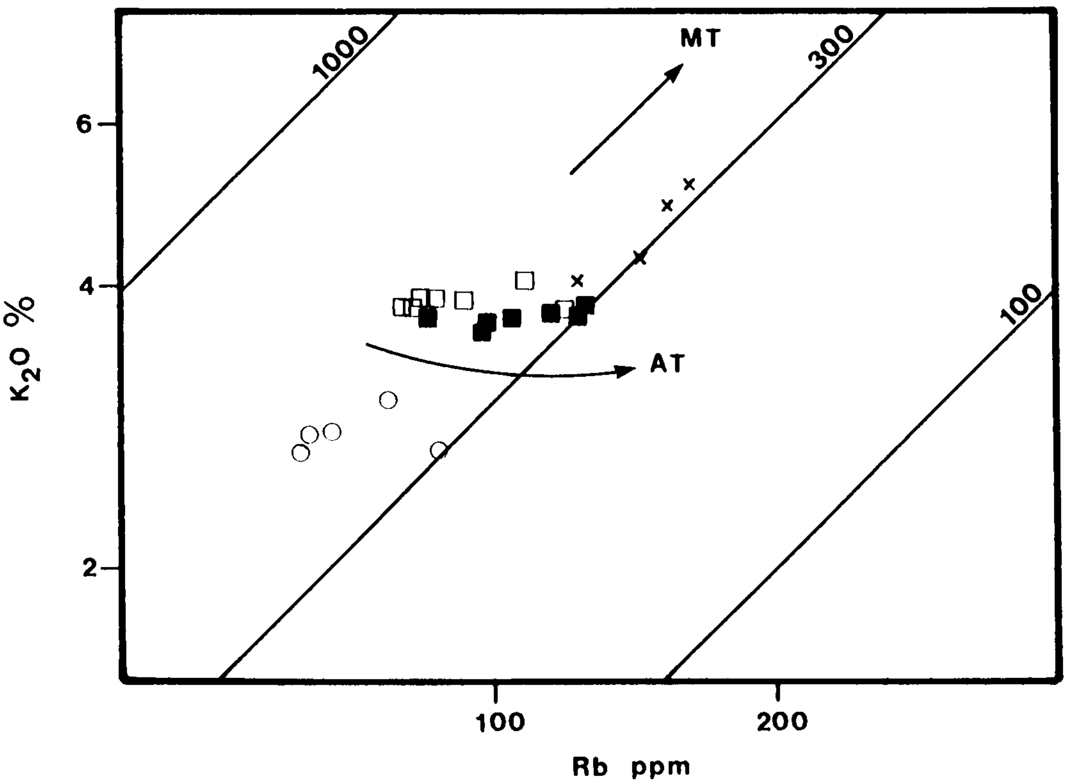



Figure 2.13 $K_2O$ vs. Rb variation diagram defining magmatic (MT) and autometasomatic (AT) trends. Gilgarna Rock samples - solid squares, medium-grained syenite; open squares, coarse-grained syenite; crosses, differentiate syenite; open circles, porphyritic hornblende monzonite.

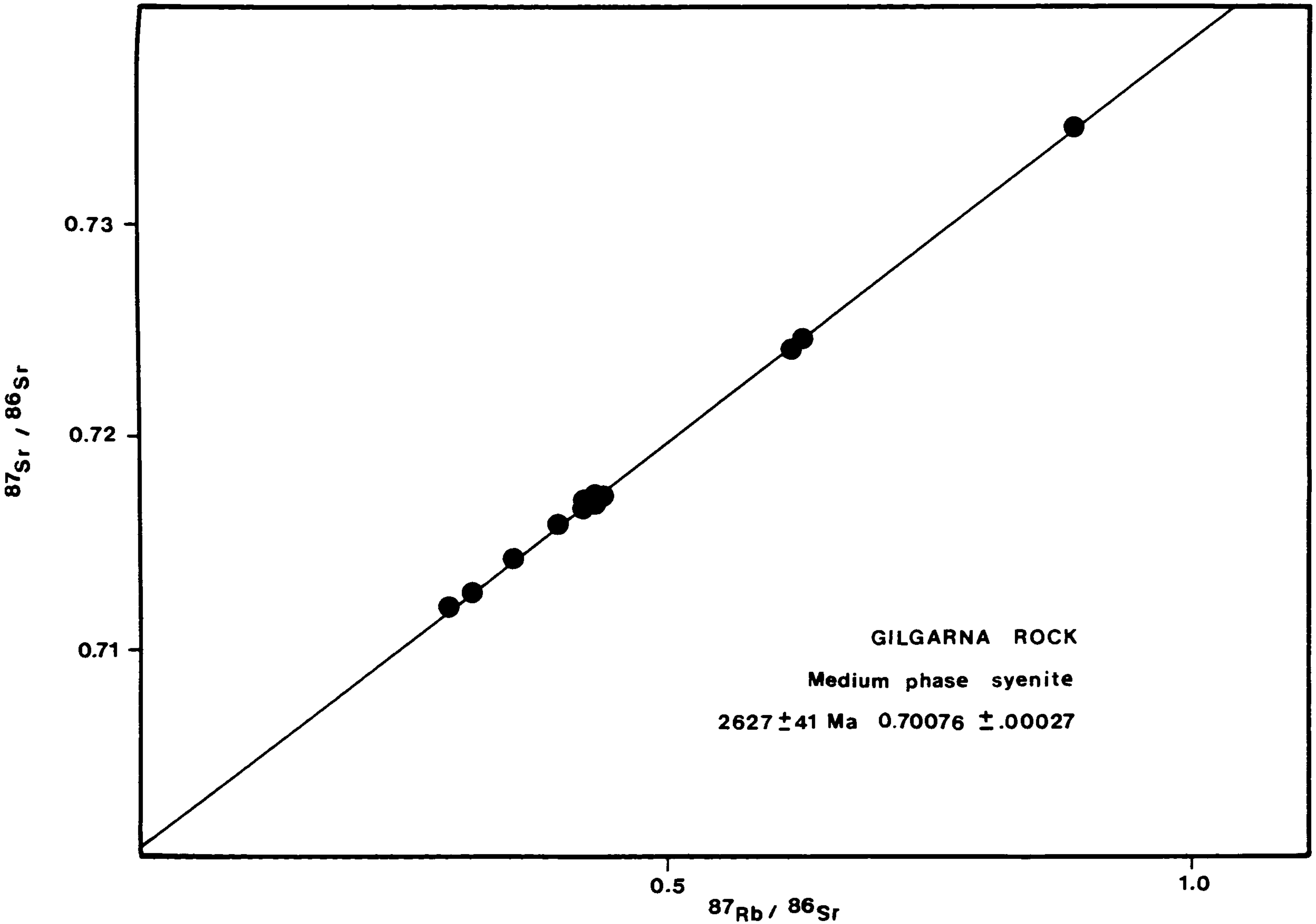



Figure 2.14 Rb-Sr isochron plot, Gilgarna Rock medium-grained syenite.

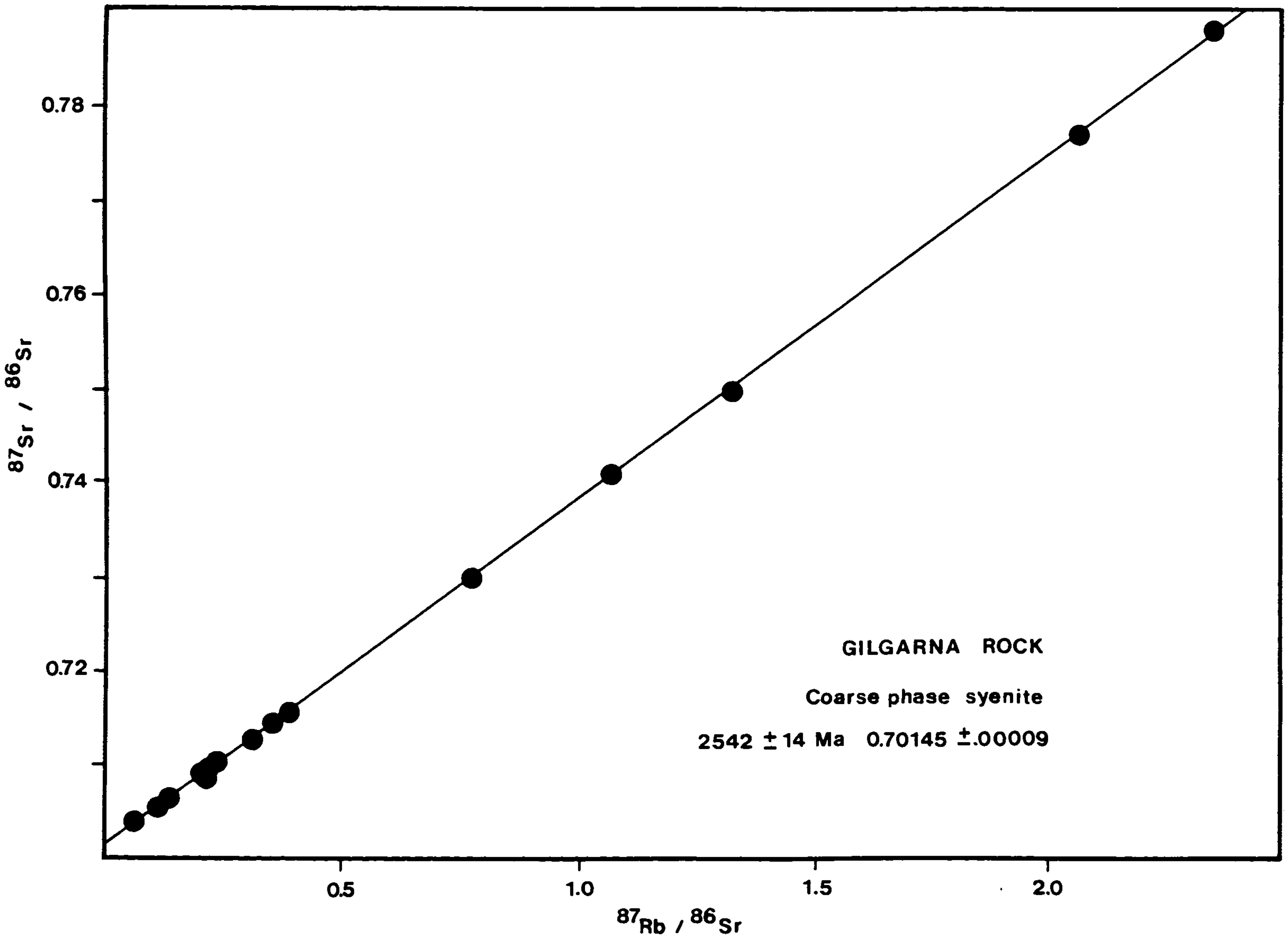



Figure 2.15 Rb-Sr isochron plot, Gilgarna Rock coarse-grained syenite.

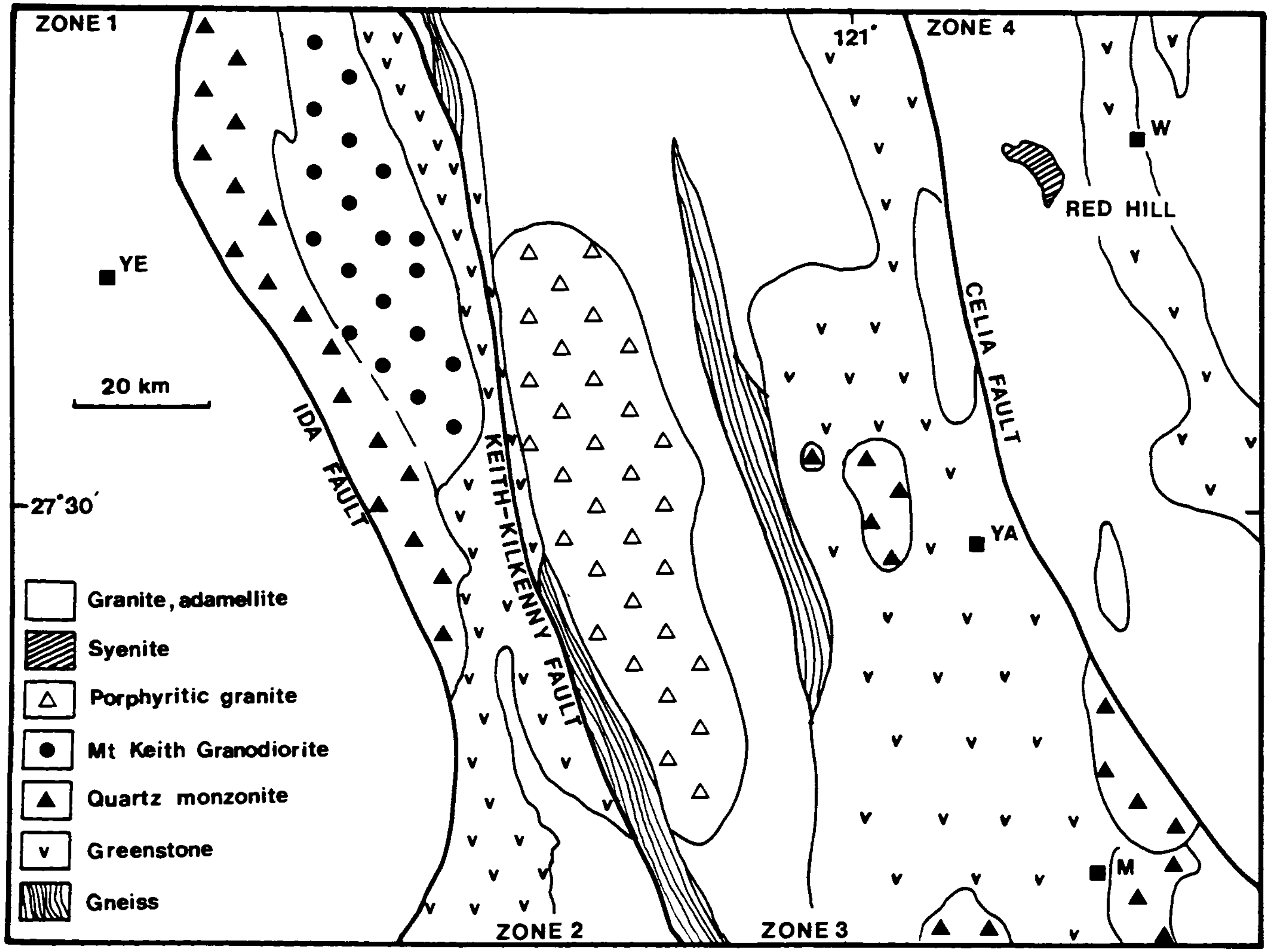



Figure 3.1 Regional geology of the Sir Samuel 1:250000 sheet area. YE = Yeelirrie, W = Wonganoo, YA = Yandal, M = Melrose. Tectonostratigraphic zones after Bunting & Williams (1979).

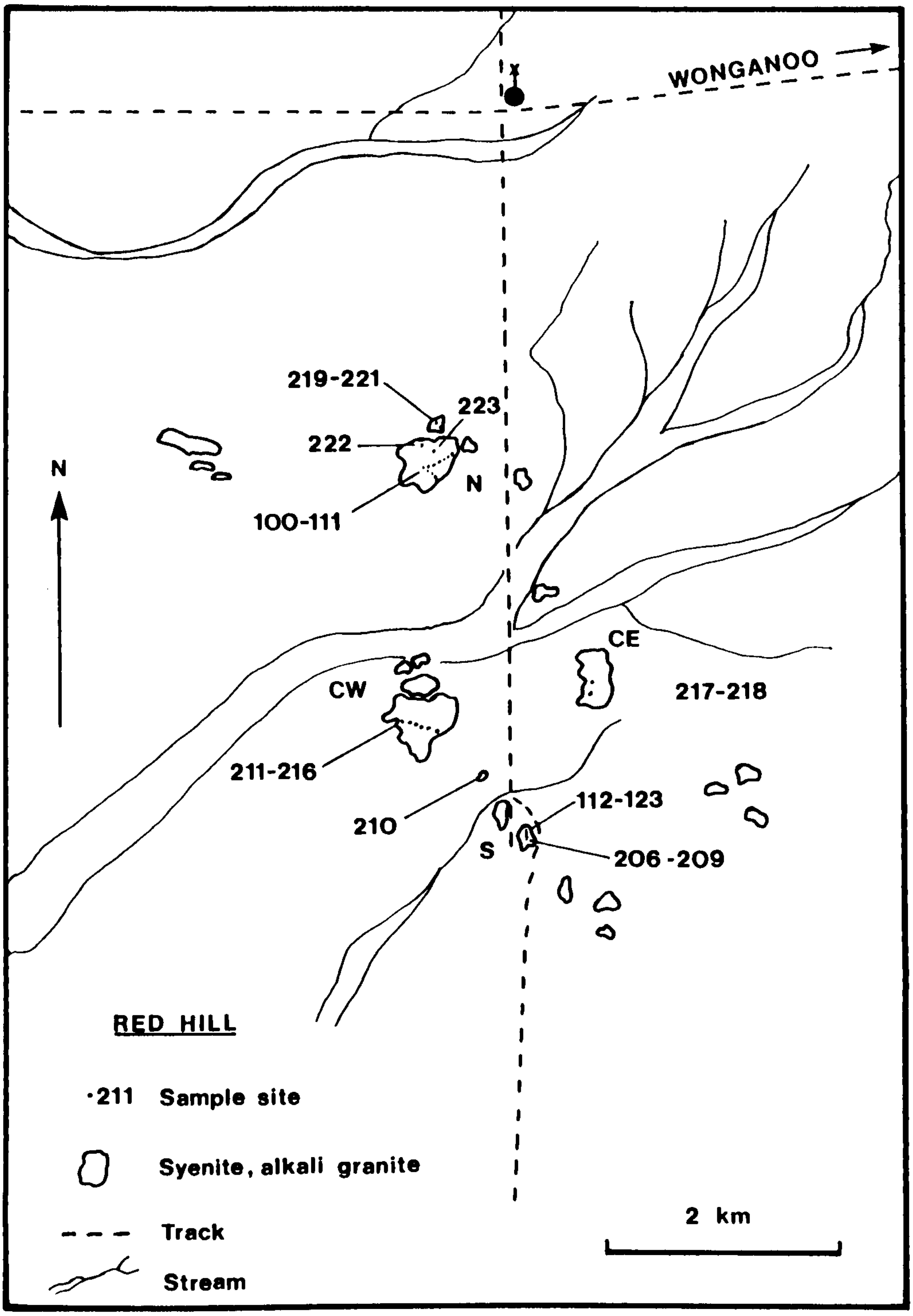



Figure 3.2 Geological setting of the Red Hill intrusion. N = north, CW = central west, CE = central east, S = south.

Figure 3.3

A. Woorana Well locality, granite hummocks (foreground) and syenite tors (background).

B. Red Hill south locality viewed from Red Hill north.

C. Alkali granite dyke intruding syenite, Red Hill south, vicinity sample site 120.

D. Coarse pegmatite (left) and alkali granite (middle) intruding syenite, Red Hill south. Note pyroxene prisms up to 4cm in length growing from the syenite into the granite dyke.

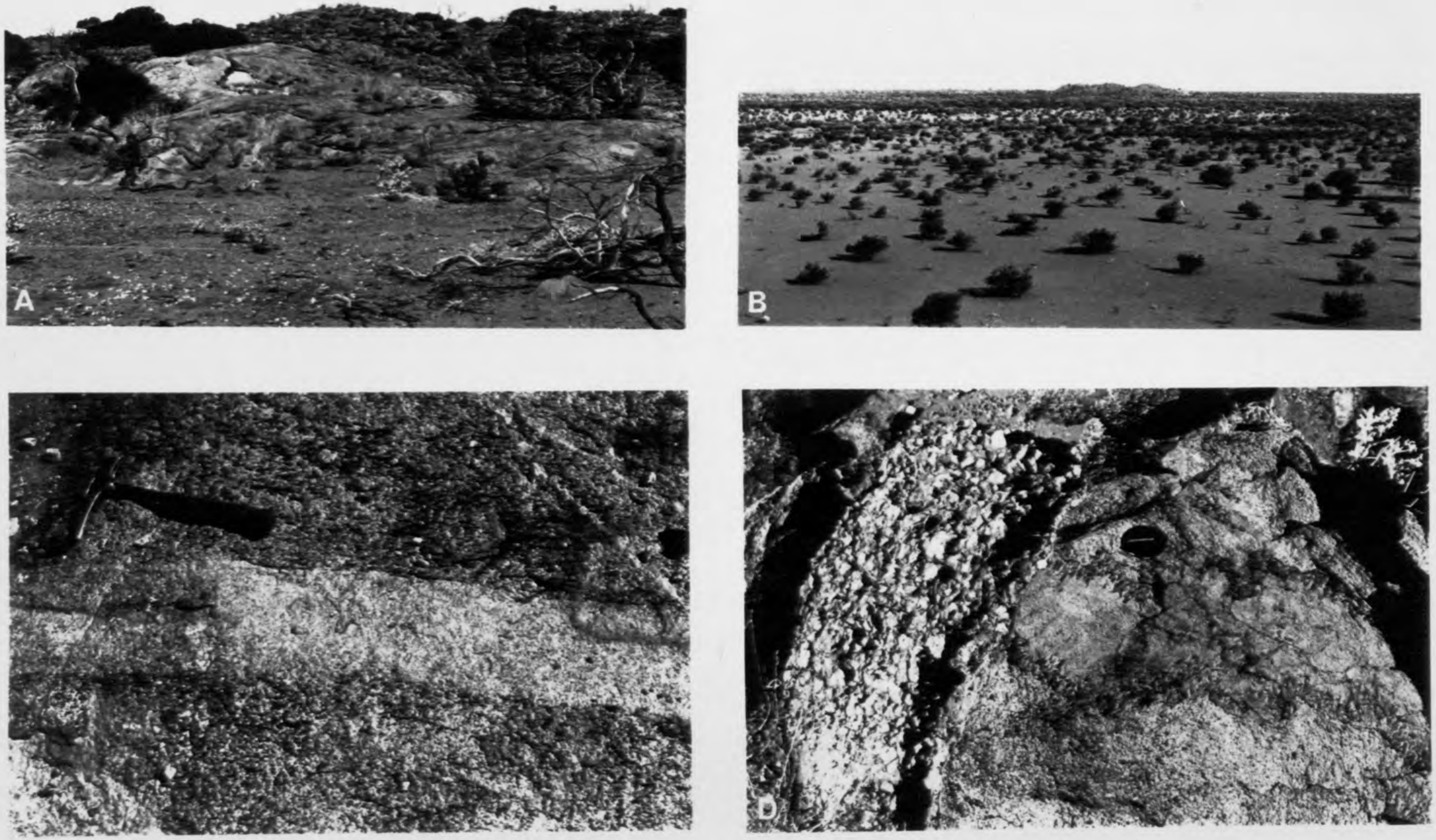

A
B
D

Figure 3.4

A. Alkali granite dyke (immediately left of small hammer) intruding syenite, Red Hill south, vicinity sample 120. Note two sets of late stage pegmatite, one subparallel to the alkali granite dyke, and the other parallel to the sledgehammer.

B. Syenite dyke (under hammer point) intruding biotite granite, Mt. Blackburn.

C. Alkali granite dyke intruding weathered syenite, Red Hill north.

D. Alkali granite dyke intruding coarse syenite, Red Hill south.


A
B
C
D

Figure 3.5

Note - for all stained slabs, yellow indicates alkali feldspar, pink indicates plagioclase feldspar. Scale in centimetres.

A. Slabbed and stained alkali granite, sample 097, Little Well.

B. Slabbed and stained alkali granite, sample 098, Woorana Well.

C. Slabbed and stained syenite, sample 099, Woorana Well.

D. Slabbed and stained Group 1 alkali granite, sample 109, Red Hill north.

E. Slabbed fine-grained alkali granite dyke intruding coarse-grained syenite, Red Hill south, vicinity sample site 206. Note aegirine-augite prisms growing into the fine-grained dyke.

F. Slabbed and stained Group 1 syenite, sample 120, Red Hill south.

G. Slabbed and stained Group 2 granite (quartz monzonite), sample 215, Red Hill central west.

H. Microcline-albite-quartz assemblage, alkali granite, sample 098, Woorana Well. CP, FOV = 3.9mm.

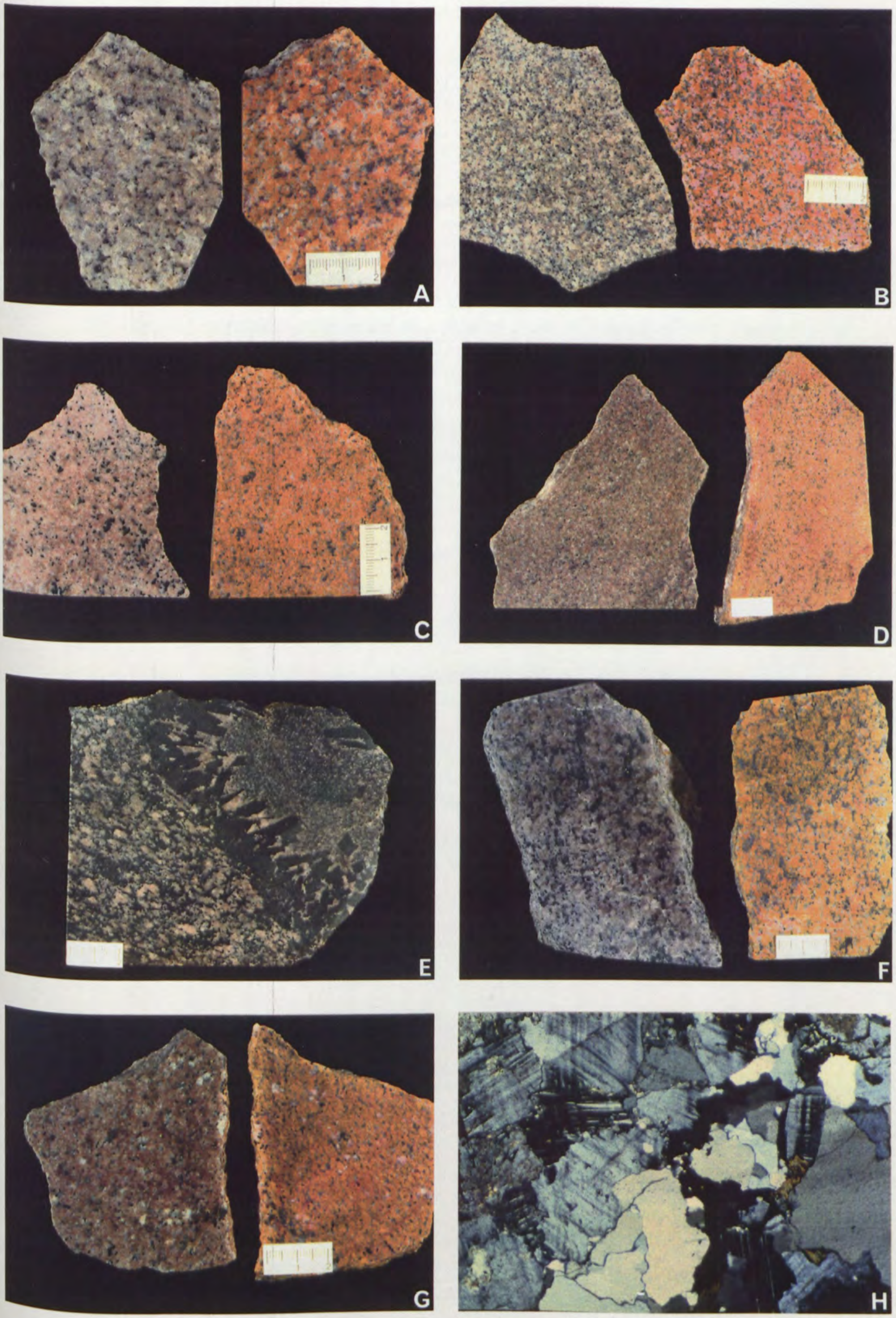

A
B
C
D
E
F
G
H

Figure 3.6

A. Albite-microcline dominant assemblage, with sodian ferrosalite-ferroaugite (left) and minor interstitial quartz (centre), syenite, sample 099, Woorana Well. CP, FOV = 3.9mm.

B. Typical two-feldspar Group 2 syenite petrographic texture, sample 101, Red Hill north. CP, FOV = 3.9mm.

C. Microcline-oligoclase dominant Group 1 alkali granite, sample 105, Red Hill north. Note interstitial quartz and ferroaugite (centre bottom). CP, FOV = 3.9mm.

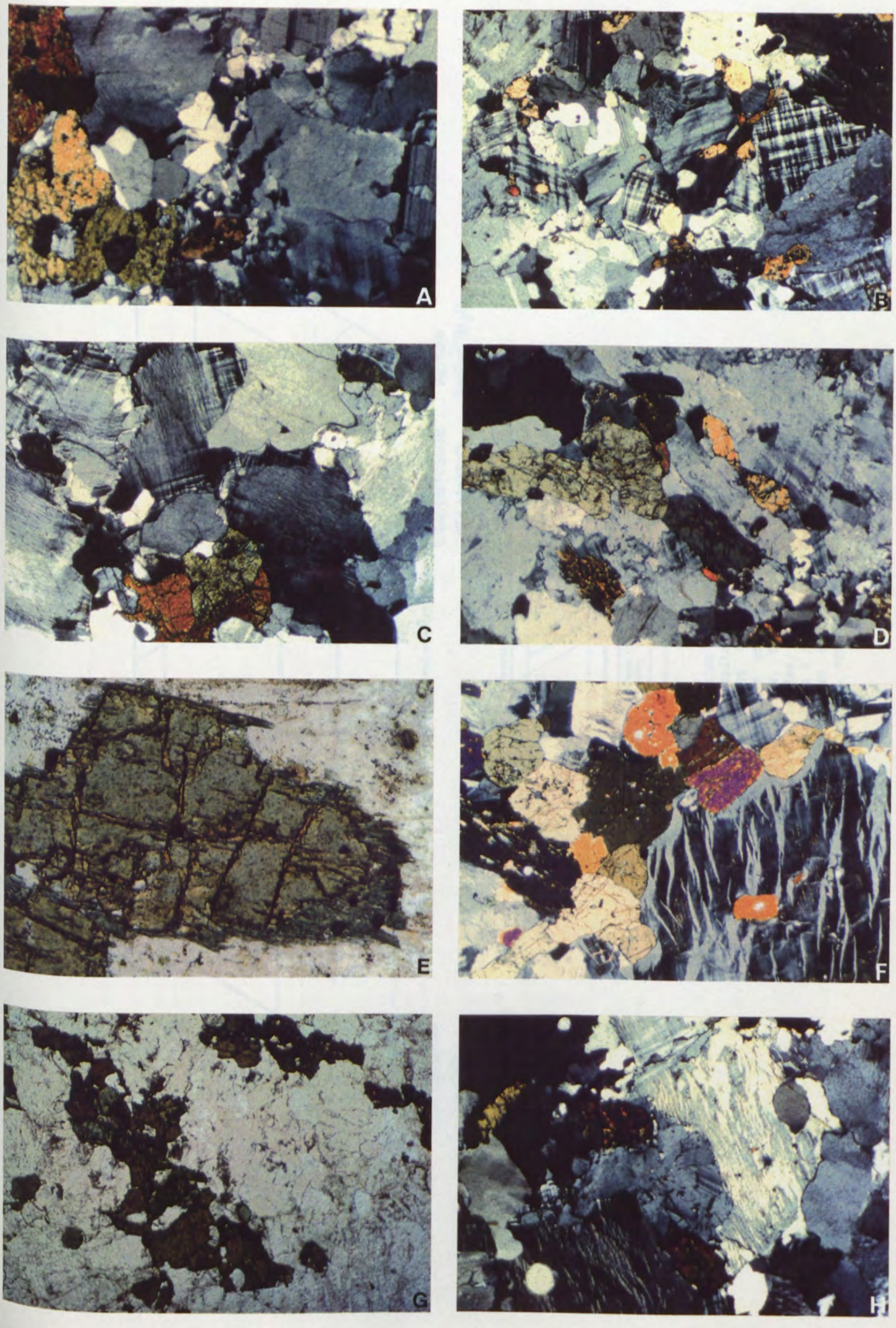
D. Typical alkali feldspar-dominant Group 1 alkali granite petrographic texture, sample 108, Red Hill north. Note characteristic low birefringent ferroaugite (centre). CP, FOV = 3.9mm.

E. Uralitic actinolite-edenitic hornblende needles rimming and partly replacing ferroaugite, Group 1 alkali granite, sample 109, Red Hill north. PPL, FOV = 0.975mm.

F. Typical Group 1 syenite petrographic texture, sample 112, Red Hill south. Note mesoperthitic alkali feldspar (right) and stubby aegirine-augite prisms (left). CP, FOV = 3.9mm.

G. Ragged andradite aggregates (dark brown), Group 2 syenite sample 119, Red Hill south. PPL, FOV = 3.9mm.

H. Typical microcline perthite-quartz assemblage, Group 2 alkali granite (to quartz syenite), sample 220, Red Hill north. Note minor salite to ferroaugite stubby prisms, centre top and bottom. CP, FOV = 3.9mm.


A
B
C
D
E
F
G
H

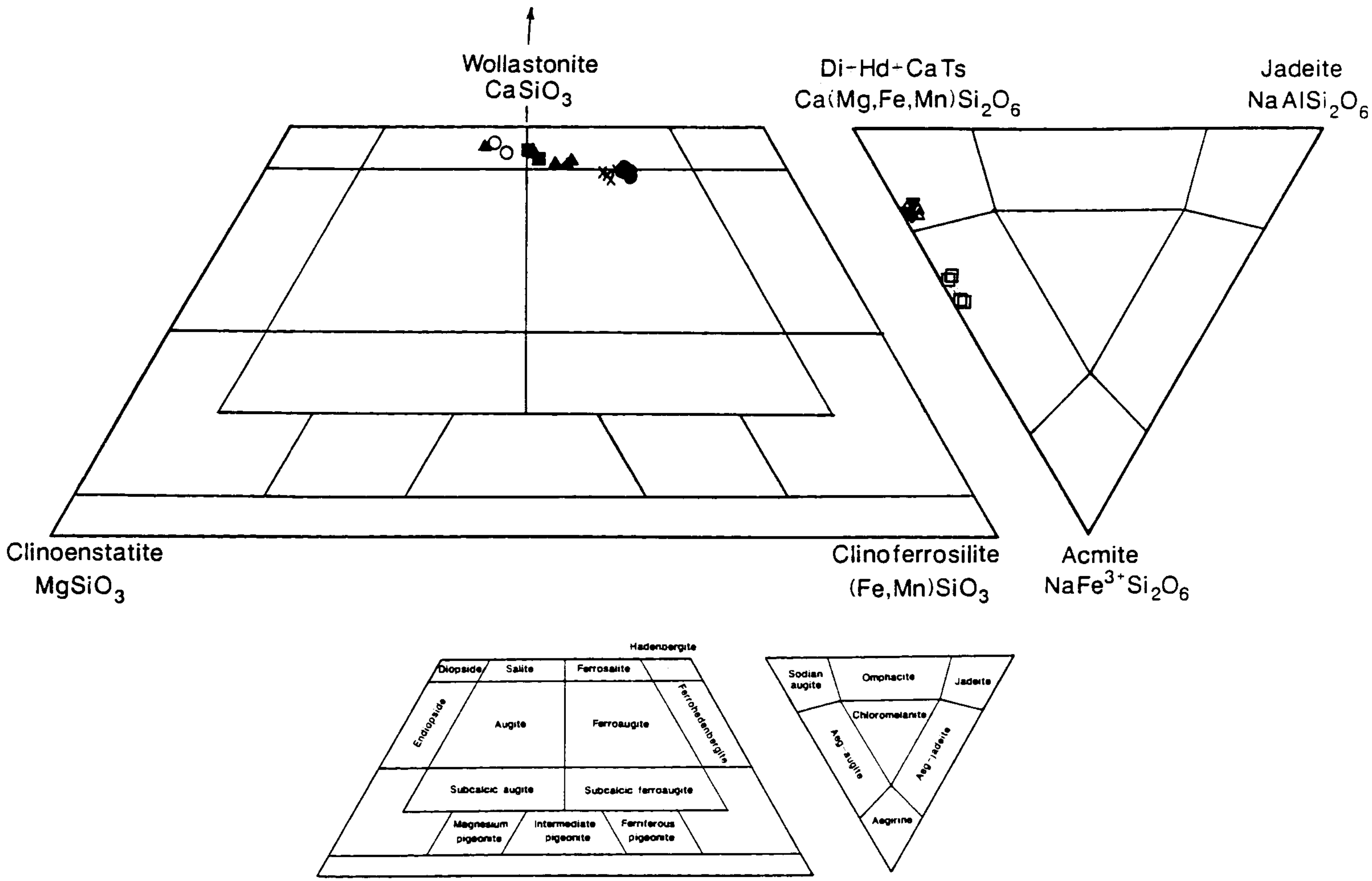



Figure 3.7 Pyroxene classification diagram. Red Hill samples - solid circles, Group 1 granite 105 (Red Hill north); open circles, Group 1 granite 109 (Red Hill north); inverted solid triangles, pyroxenes growing into dyke sample 113, (see Fig 3.5E); solid squares, Group 2 granite 212 (Red Hill central west); solid triangles, Group 2 syenite 119 (Red Hill south); open triangles, Group 1 syenite 120 (Red Hill south).
Other samples - open squares, alkali granite sample 097, Little Well; crosses, syenite sample 099, Woorana Well.

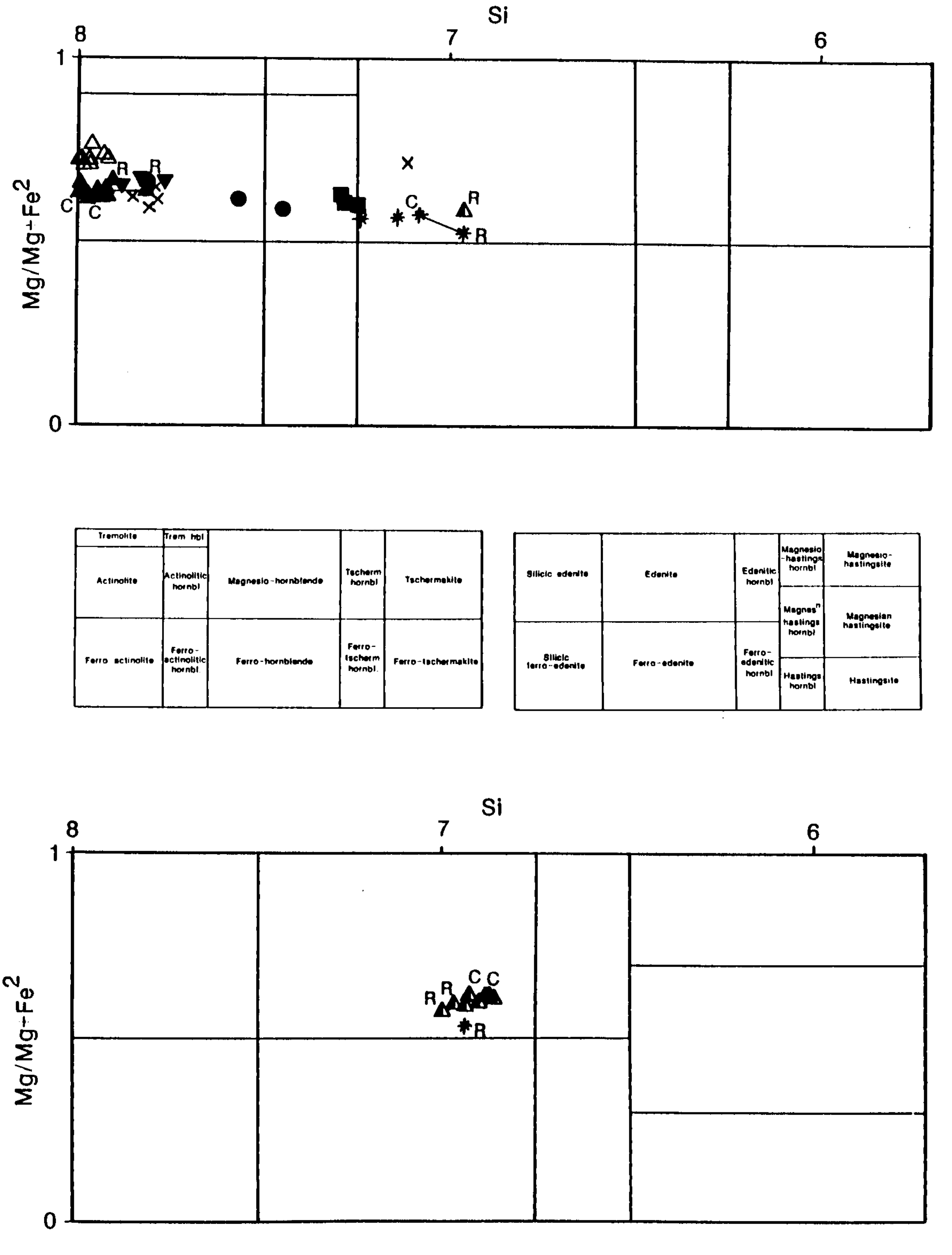
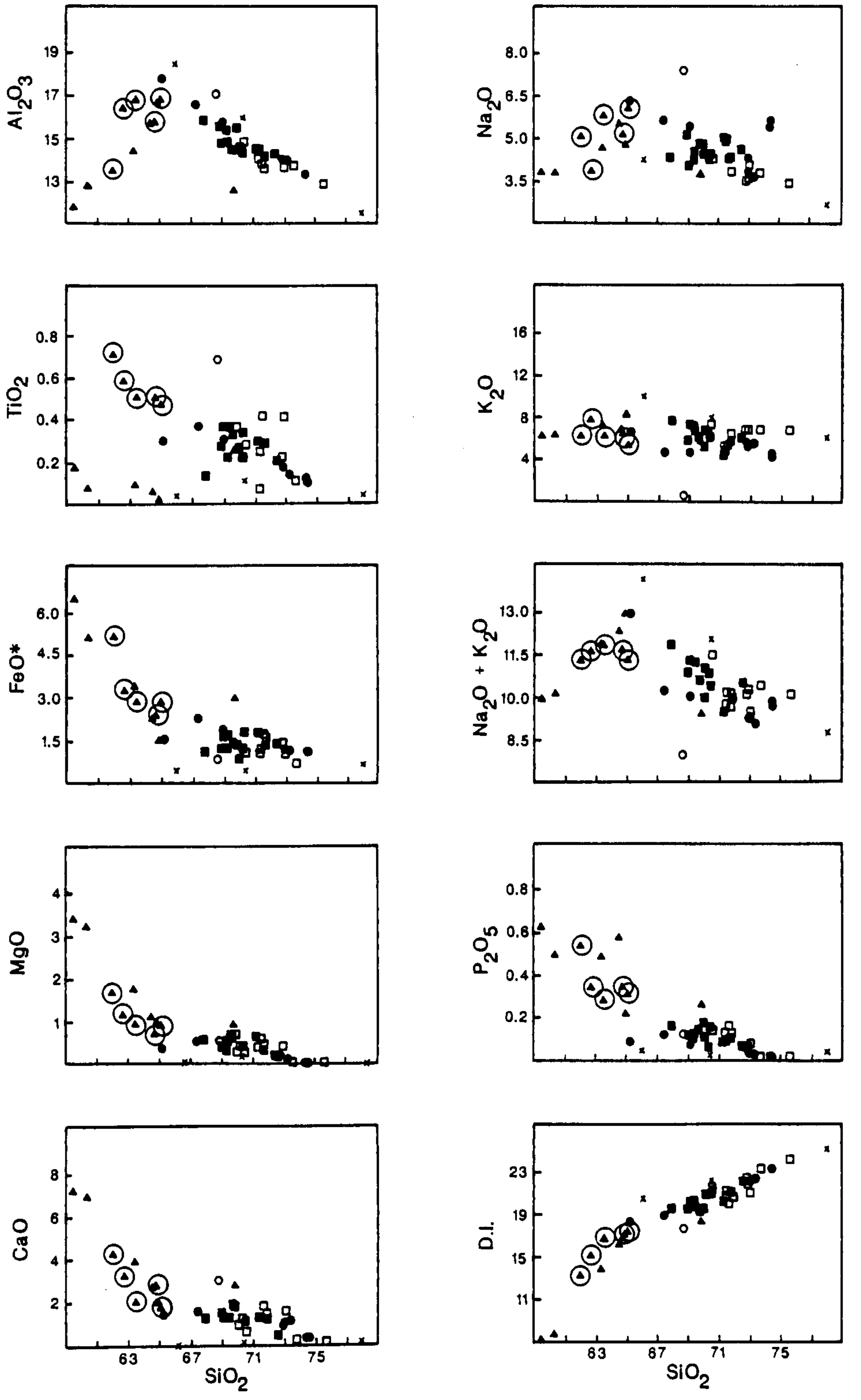



Figure 3.8 Amphibole classification diagram. Red Hill samples - half-solid triangles, Group 2 syenite 106 (Red Hill north); solid circles, Group 1 granite 109 (Red Hill north); inverted triangles, amphibole associated with pyroxene prisms from sample 113 (see Fig. 3.5E); solid squares, Group 2 granite 212 (Red Hill central west); solid triangles,Group 2 syenite 119 (Red Hill south); open triangles, Group 1 syenite 120 (Red Hill south). Other samples - asterisks, quartz monzonite sample 094, Andy Well; crosses, syenite sample 099, Woorana Well. C = core, R = rim, tie-line connects rim and core compositions from individual crystal.

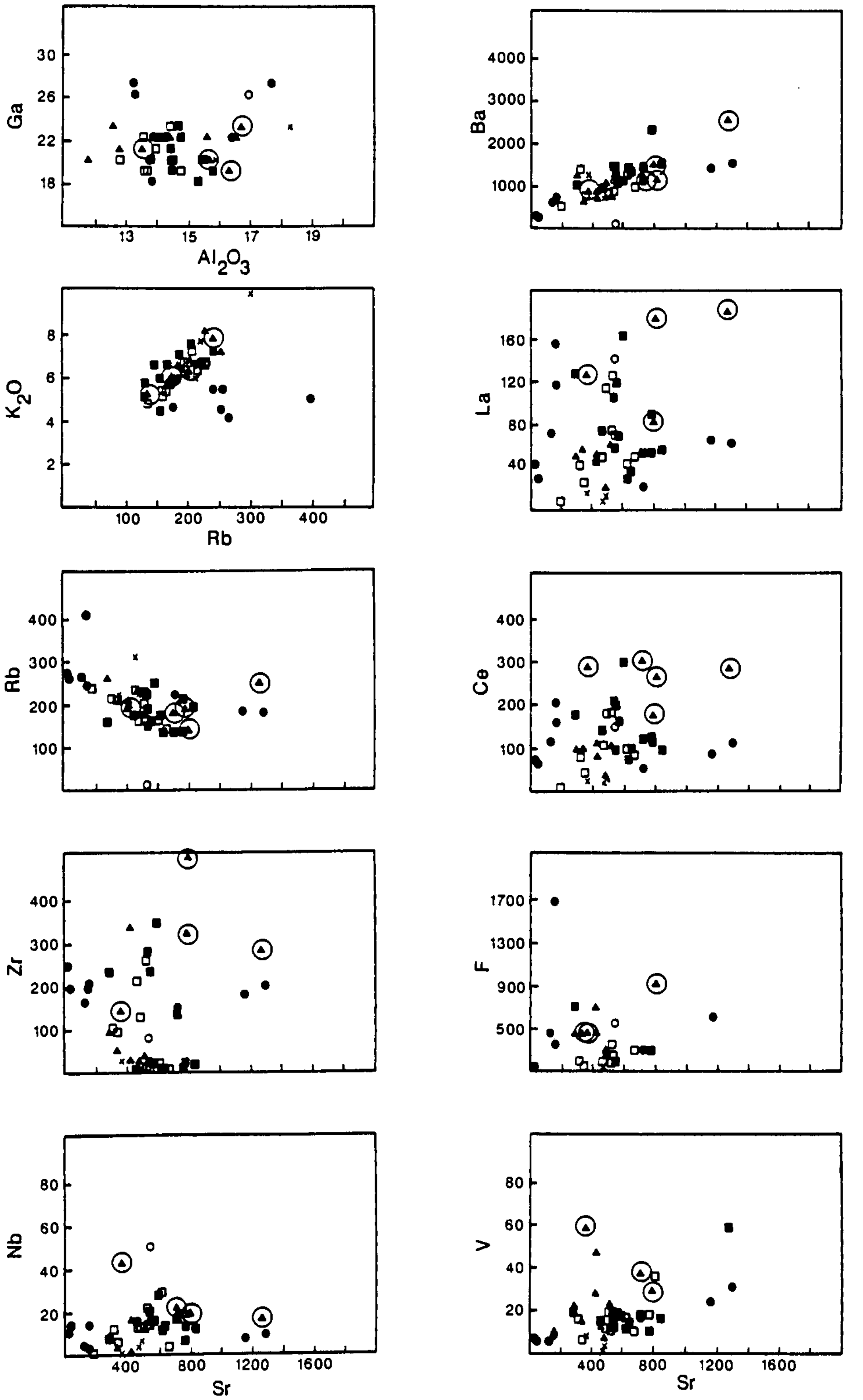
Figure 3.9 Whole rock major and trace element variation diagrams. Major element oxides in wt%, trace elements in p.p.m.

Red Hill samples - solid triangles, Group 1 syenites (samples 112,117,120,206 & 209); solid triangles within circle, Group 2 syenites (samples 101,106,119,208, & 222); open squares, Group 1 granites (samples 102,105,107,108,109,110,115,207 & 122); solid squares, Group 2 granites (samples 210,211,212,213,214,215,216,217,218,219,220,221 & 223); crosses, pegmatites 100,114 & 118.

Other Sir Samuel samples - solid circles, including Andy Well monzonite (93,94), Little Well alkali granite (95,96,97), Woorana Well alkali granite (98), Woorana Well syenite (99) and Wonganoo granite (224).

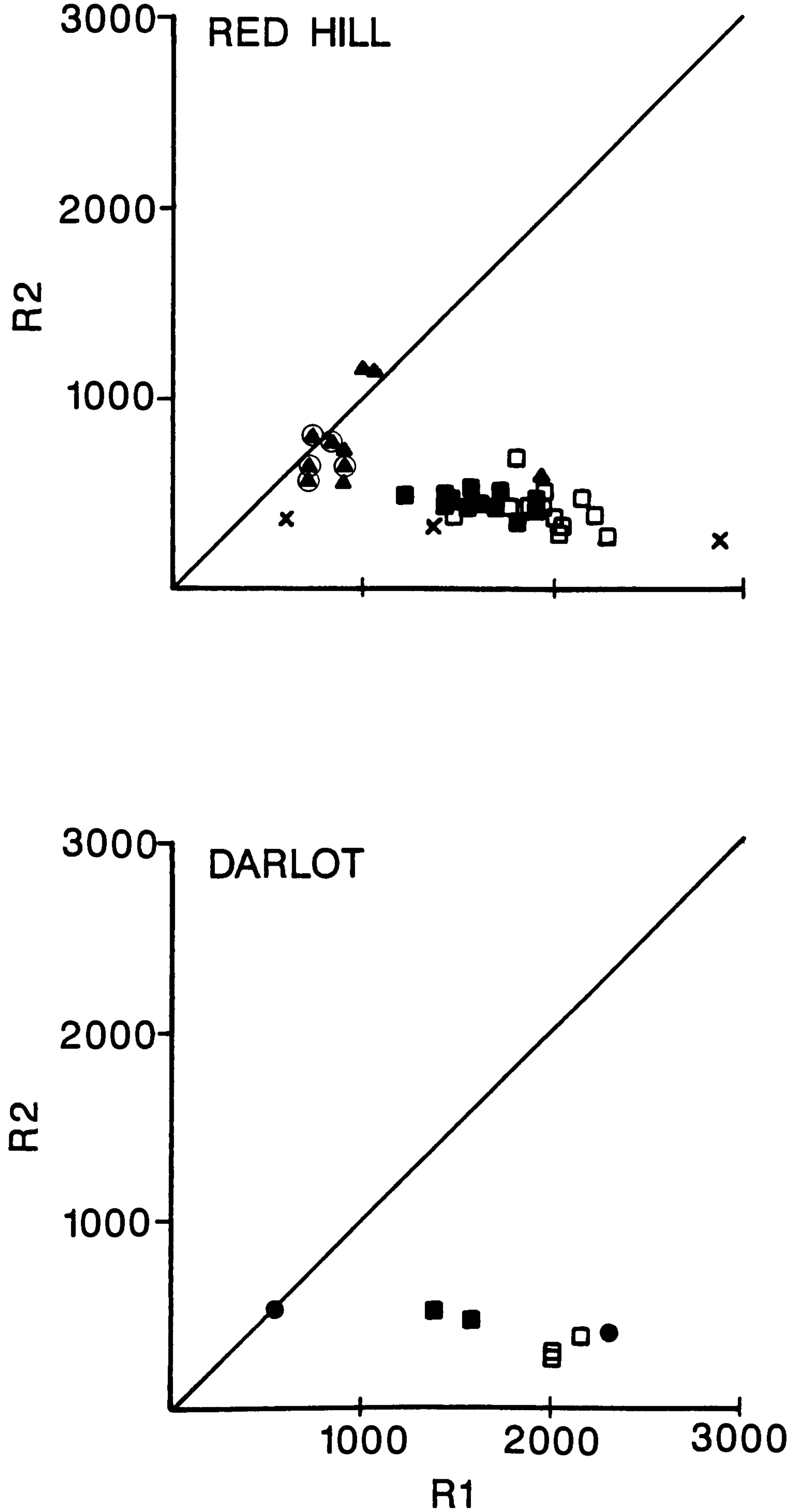


Al2O3
19
17
15
13
Na2O
8.0
6.5
5.0
3.5
TiO2
0.8
0.6
0.4
0.2
K2O
16
12
8
4
FeO*
6.0
4.5
3.0
1.5
Na2O + K2O
13.0
11.5
10.0
8.5
MgO
4
3
2
1
P2O5
0.8
0.6
0.4
0.2
CaO
8
6
4
2
D.I.
23
19
15
11
63
67
71
75
SiO2
63
67
71
75
SiO2



Ga
30
26
22
18
13
15
17
19
Al2O3
Ba
4000
3000
2000
1000
K2O
8
6
4
2
100
200
300
400
Rb
La
160
120
80
40
Rb
400
300
200
100
Ce
400
300
200
100
Zr
400
300
200
100
F
1700
1300
900
500
Nb
80
60
40
20
400
800
1200
1600
Sr
V
80
60
40
20
400
800
1200
1600
Sr

Figure 3.10 $R_1R_2$ geochemical classification diagrams. Red Hill samples - solid triangles, Group 1 syenites; solid triangles within circle, Group 2 syenites; open squares, Group 1 granites; solid squares, Group 2 granites; crosses, pegmatites.
Darlot (Sir Samuel) sample symbols as follows - solid squares, Andy Bore monzonite (93,94); open squares, Little Well alkali granite (95,96,97); solid circles, Woorana Well granite (98) and syenite (99). Refer overlay in back pocket for key.



RED HILL
3000
2000
1000
R2
DARLOT
3000
2000
1000
R2
1000
2000
3000
R1

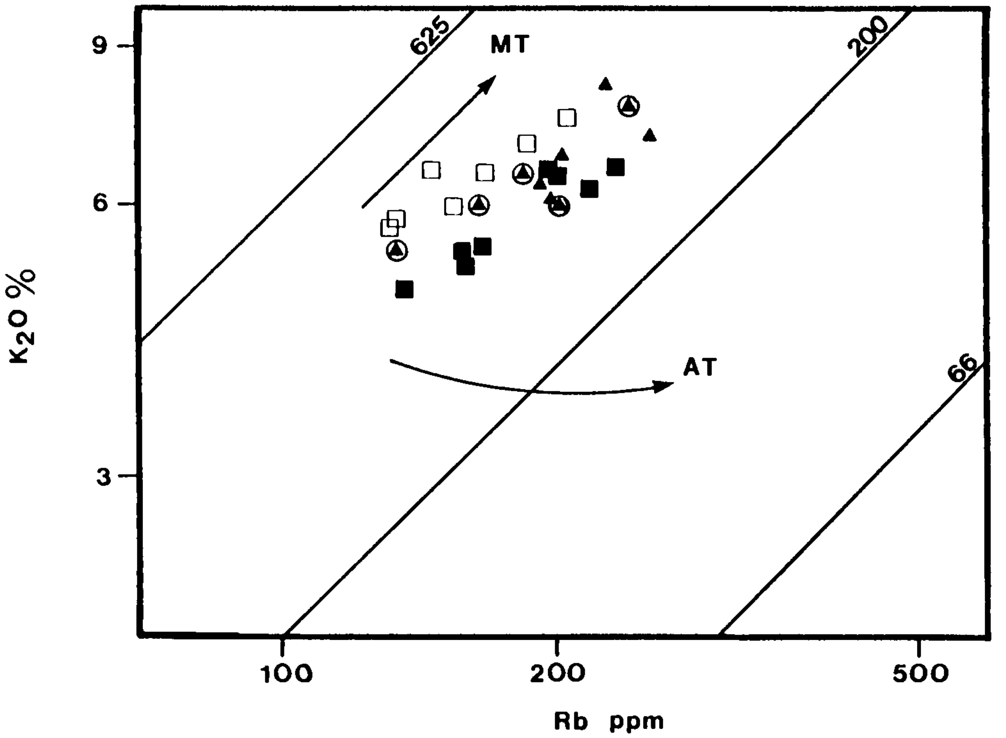



Figure 3.11 $K_2O$ vs. Rb variation diagram defining magmatic (MT) and autometasomatic (AT) trends, Red Hill. Symbols as follows - solid triangles, Group 1 syenites; solid triangles within circle, Group 2 syenites; solid squares, Group 1 granites; open squares, Group 2 granites.

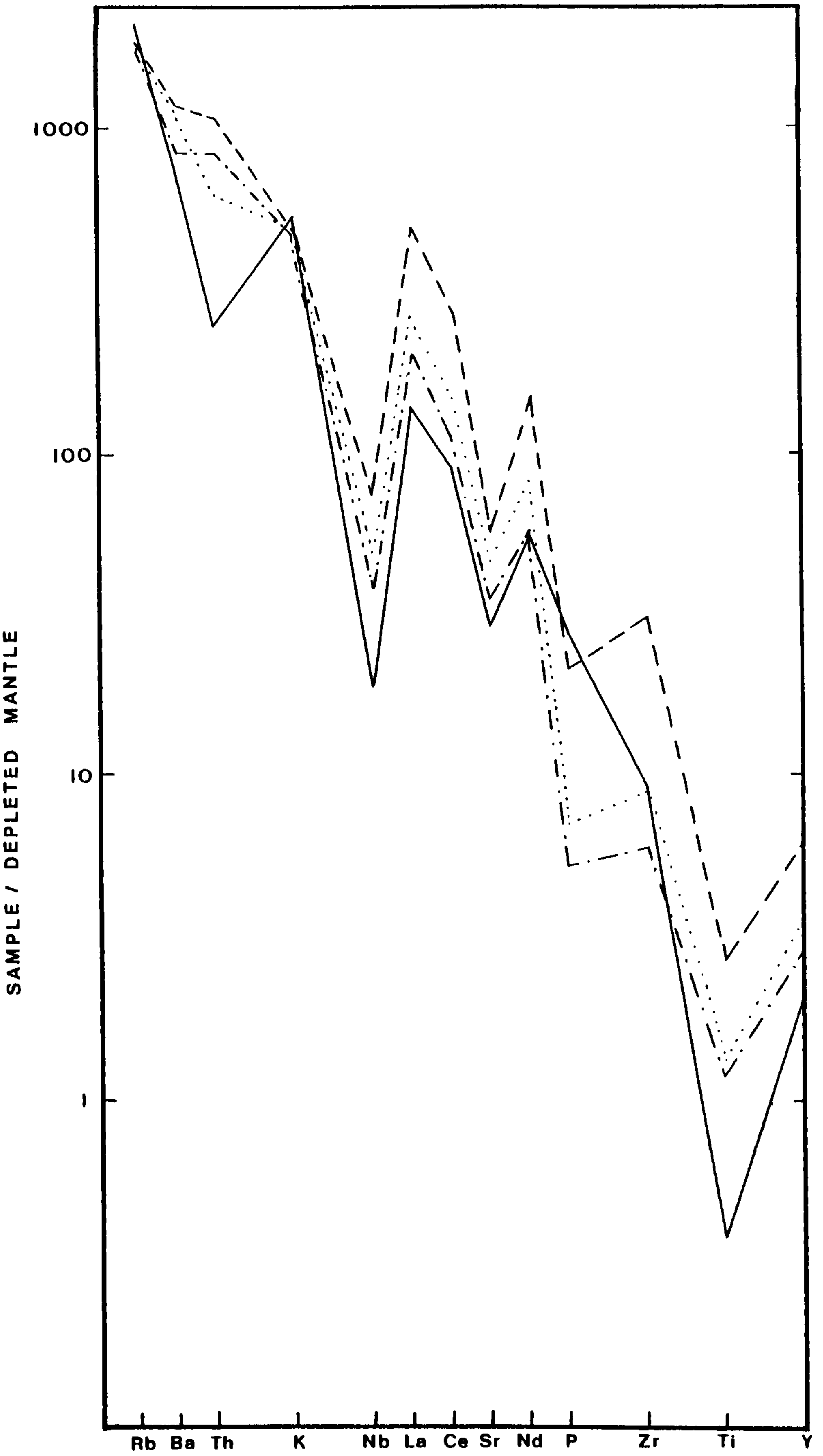



Figure 3.12 Depleted mantle source-normalised hygromagmatophile (HYG) element spider plot, Red Hill. Solid line, Group 1 syenites (average of 5); dashed line, Group 2 syenites (average of 5); dash-dot line, Group 1 granites (average of 9); dotted line, Group 2 granites (average of 13). Normalising factors from the N-type MORB mantle source of Wood et al (1979).

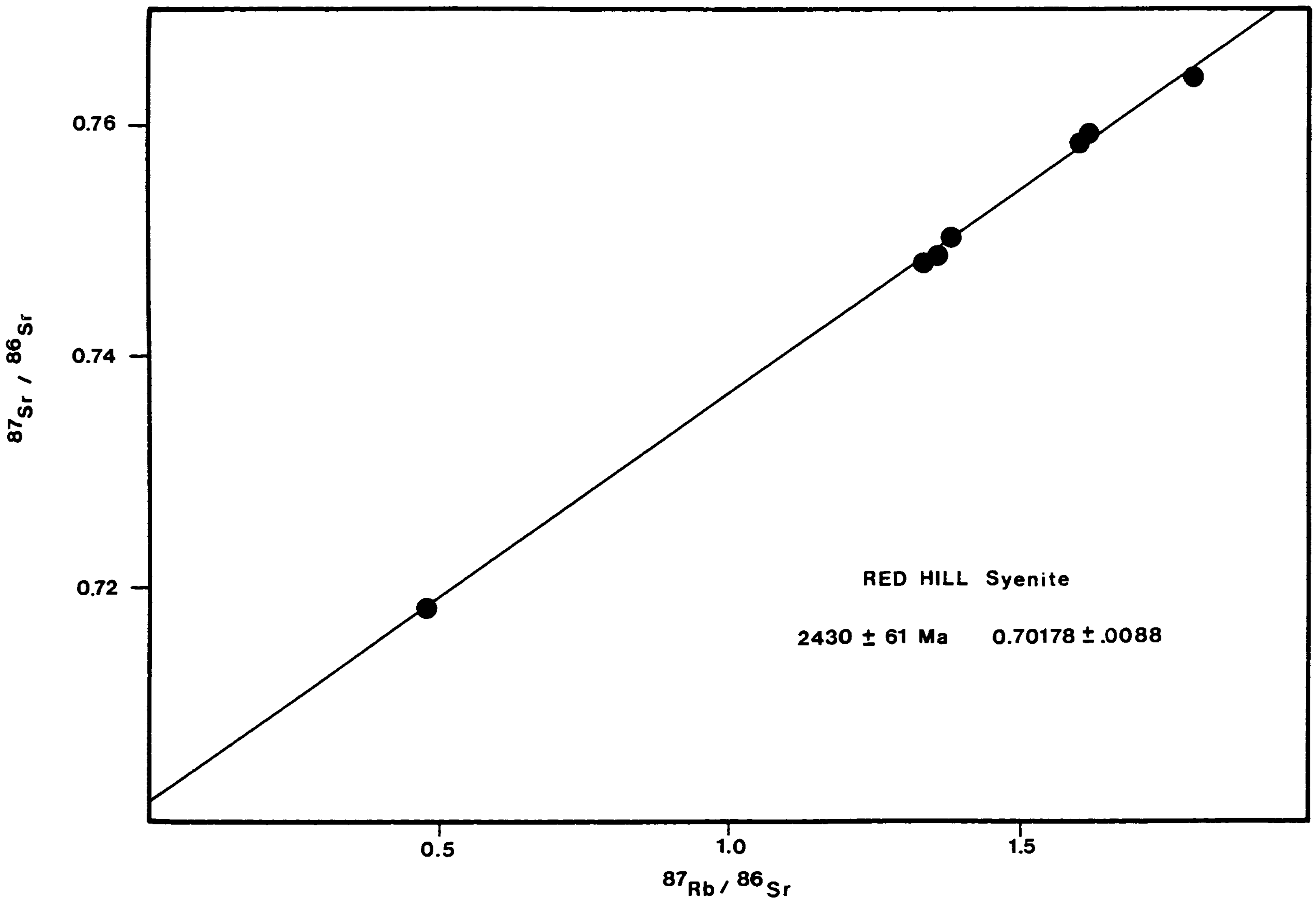



Figure 3.13 Rb-Sr isochron plot, Red Hill syenites.

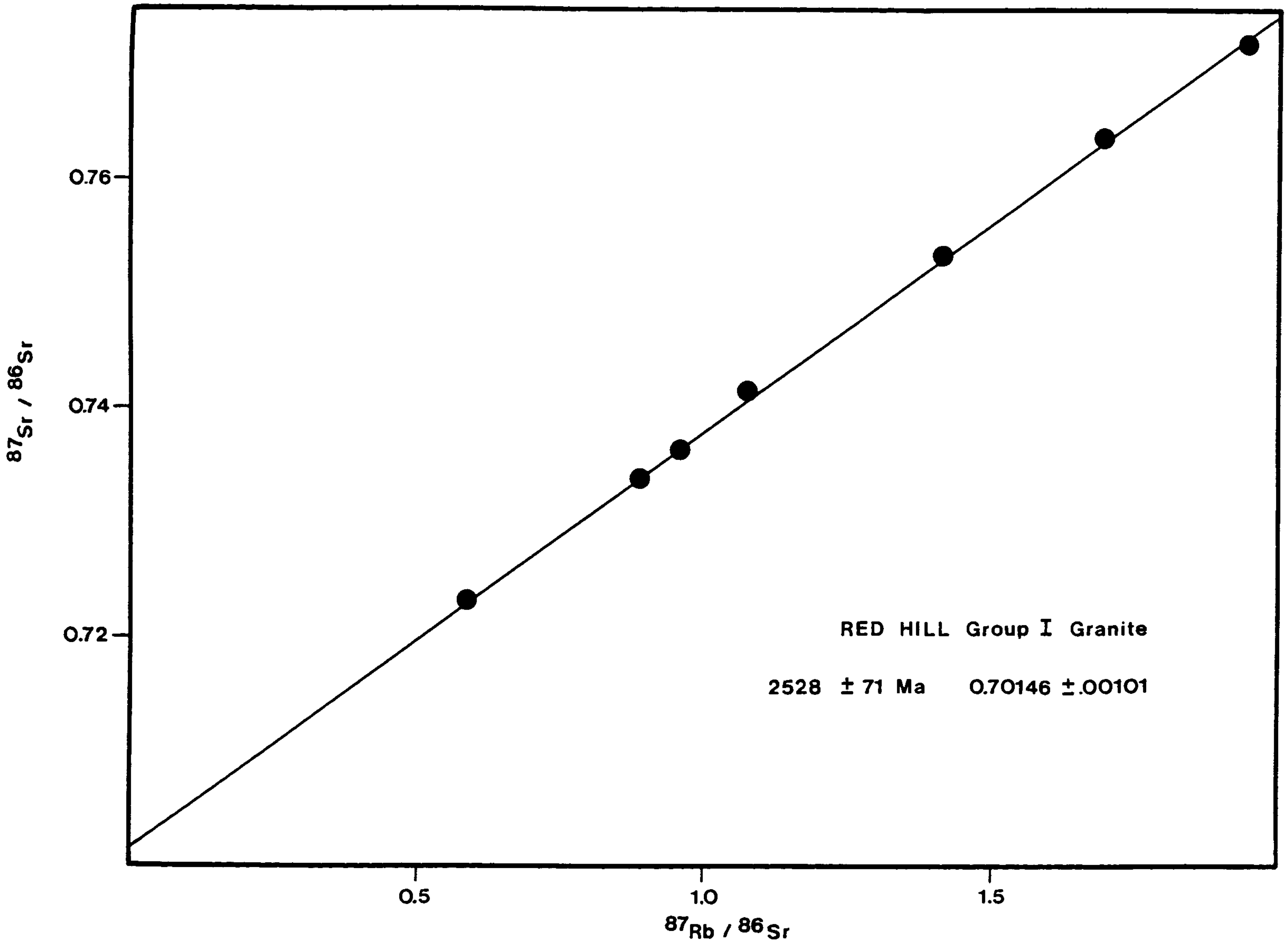



Figure 3.14 Rb-Sr isochron plot, Red Hill Group 1 granite.

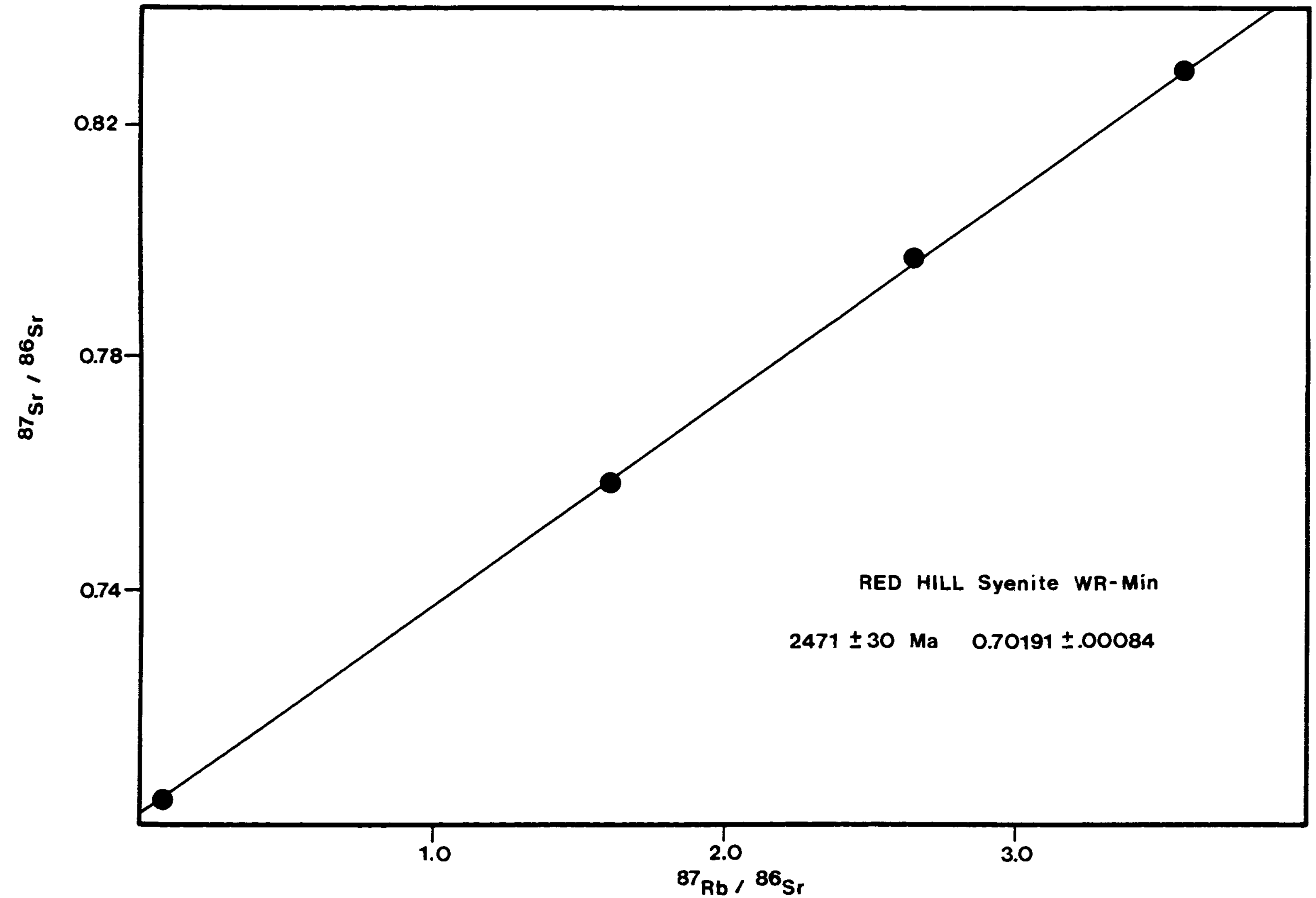



Figure 3.15 Rb-Sr whole rock-mineral isochron plot, Red Hill syenites.

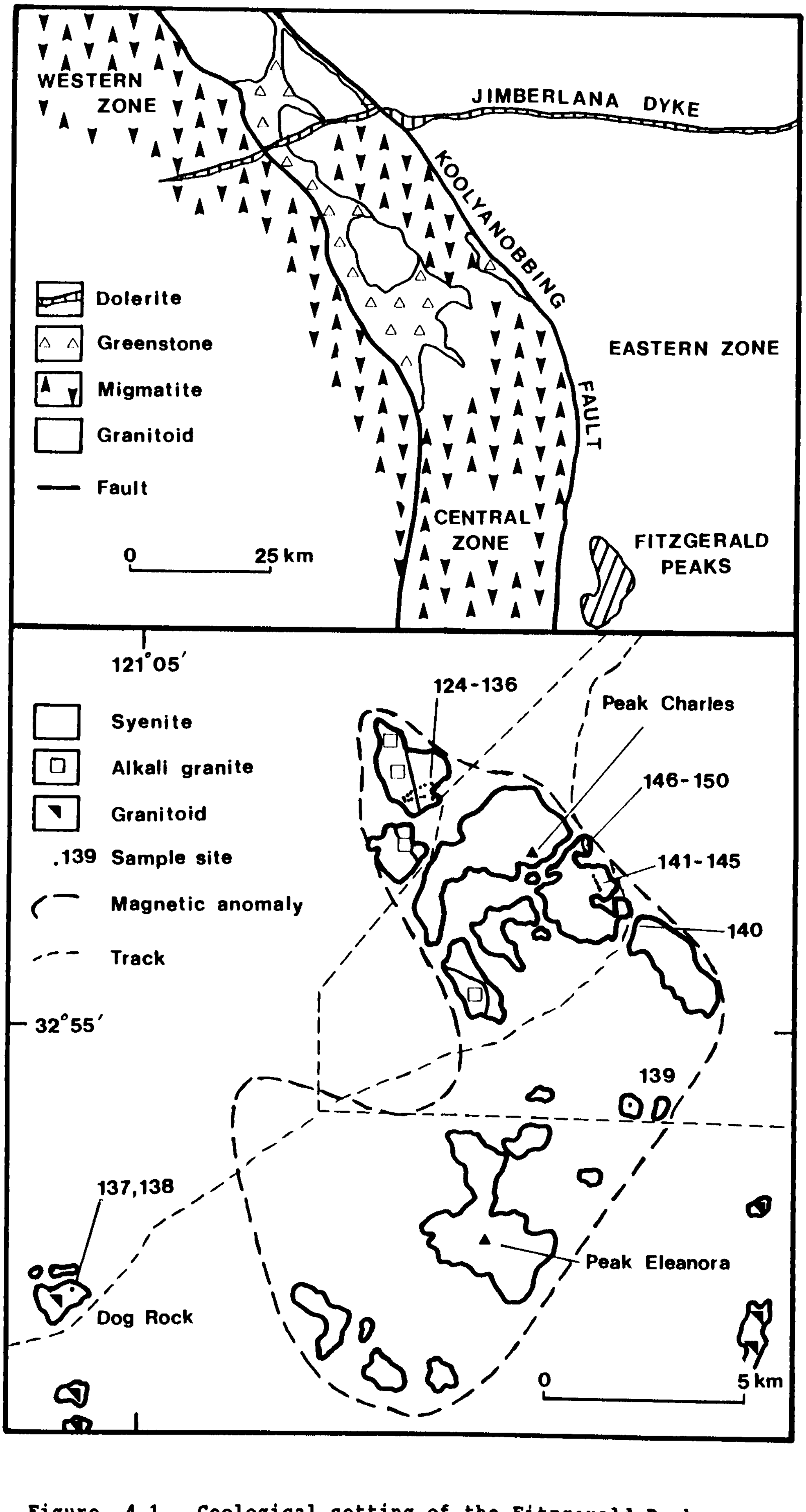



Figure 4.1 Geological setting of the Fitzgerald Peaks area.

Figure 4.2

Note - for all stained slabs, yellow indicates alkali feldspar, pink indicates plagioclase feldspar. Scale in centimetres.

A. Looking east towards Peak Charles, northern Fitzgerald Peaks intrusion.

B. Slabbed and stained Group 1 alkali granite, sample 125, northwestern Fitzgerald Peaks intrusion.

C. Slabbed and stained Group 1 syenite, sample 141, northeastern Fitzgerald Peaks intrusion.

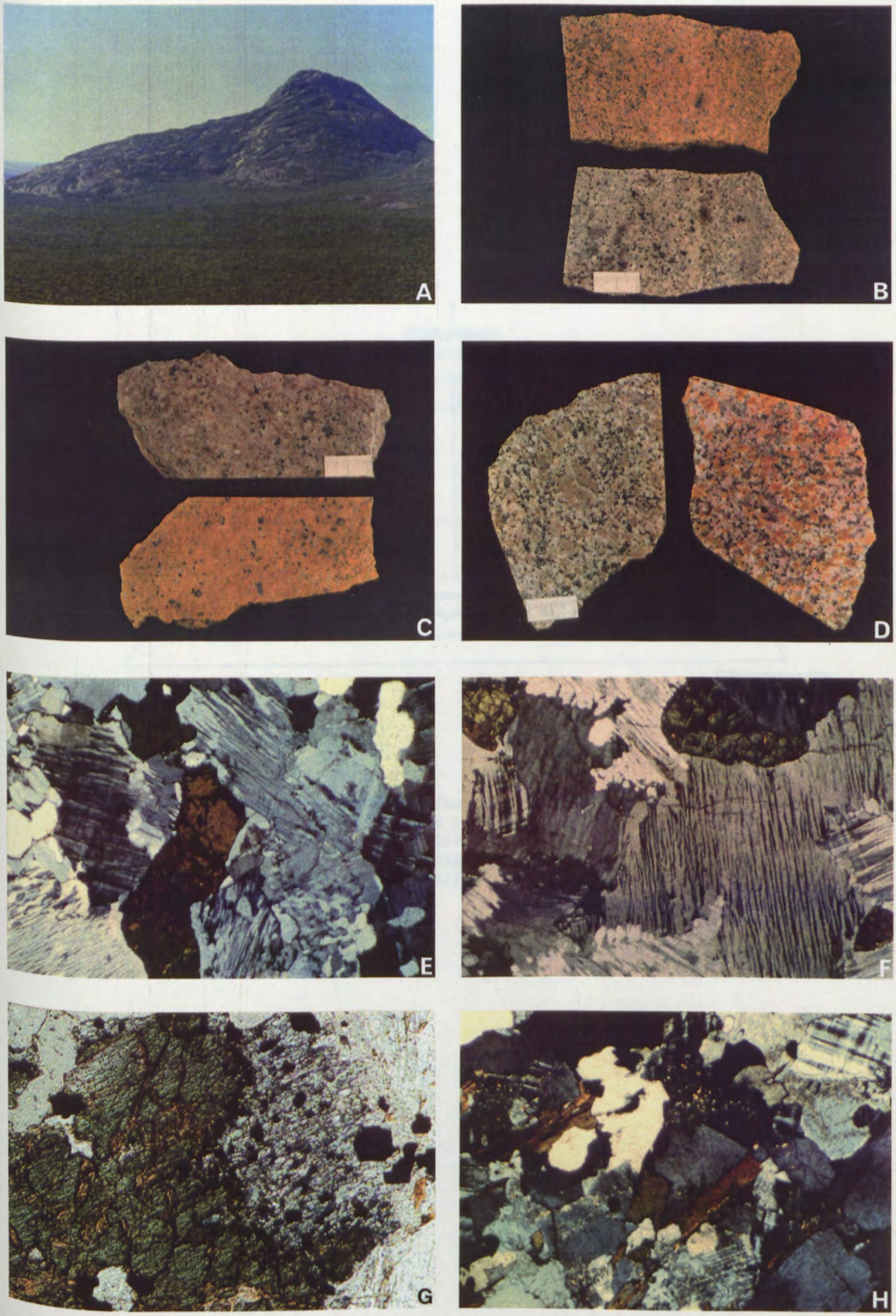
D. Slabbed and stained granite, sample 138, Dog Rock.

E. Typical microcline perthite-quartz assemblage, Group 1 alkali granite, sample 125, northwestern Fitzgerald Peaks intrusion. Note stubby aegirine-augite prisms, centre. CP, FOV = 3.9mm.

F. Classical consertal-textured mesoperthite to antiperthite, Group 1 syenite, sample 146, northeastern Fitzgerald Peaks intrusion. Note aegirine-augite prisms, centre top and centre left. CP, FOV = 3.9mm.

G. Pale blue-green uralitic actinolite with associated magnetite rimming, and in part replacing, characteristically green aegirine-augite, Group 1 syenite, sample 146, northeastern Fitzgerald Peaks intrusion. PPL, FOV = 0.975mm.

H. Typical batholithic granite assemblage, sample 137, Dog Rock. Oligoclase, centre bottom; microcline, top right; quartz, centre left; biotite, centre. CP, FOV = 3.9mm.


A
B
C
D
E
F
G
H

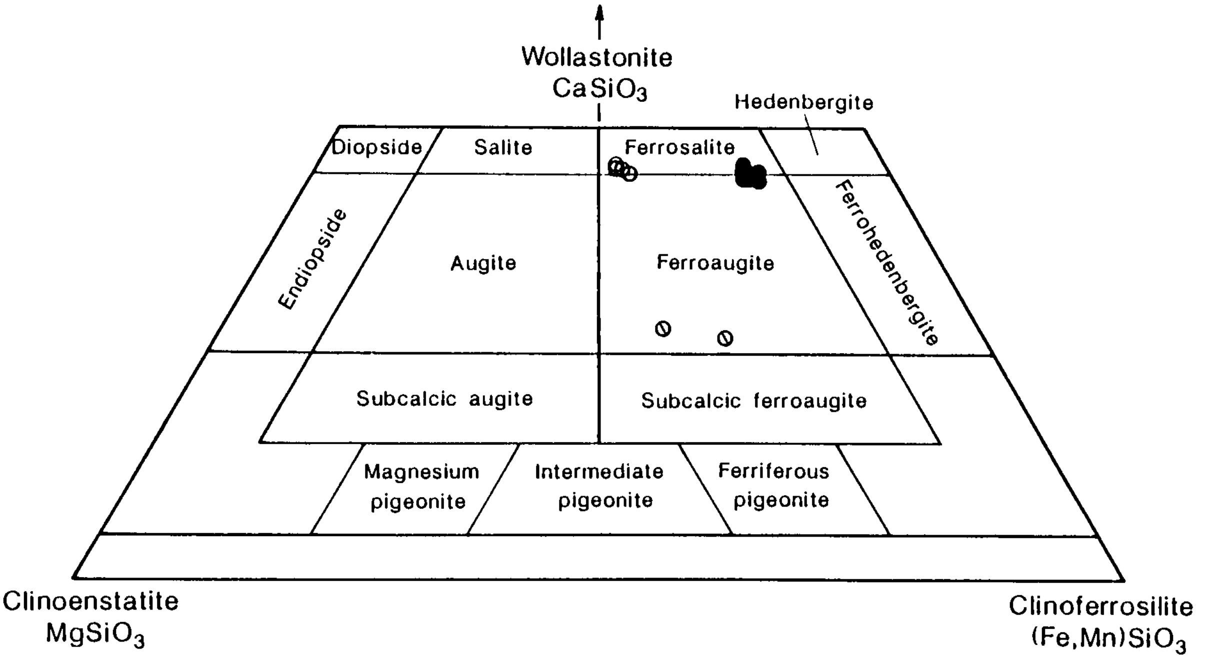



Figure 4.3 Pyroxene classification diagram. Fitzgerald Peaks samples - solid circles, Group 1 granite sample 125, Fitzgerald Peaks northwest; open circles, Group 2 syenite sample 145, Fitzgerald Peaks northeast, (line through circle indicates inclusion within amphibole).

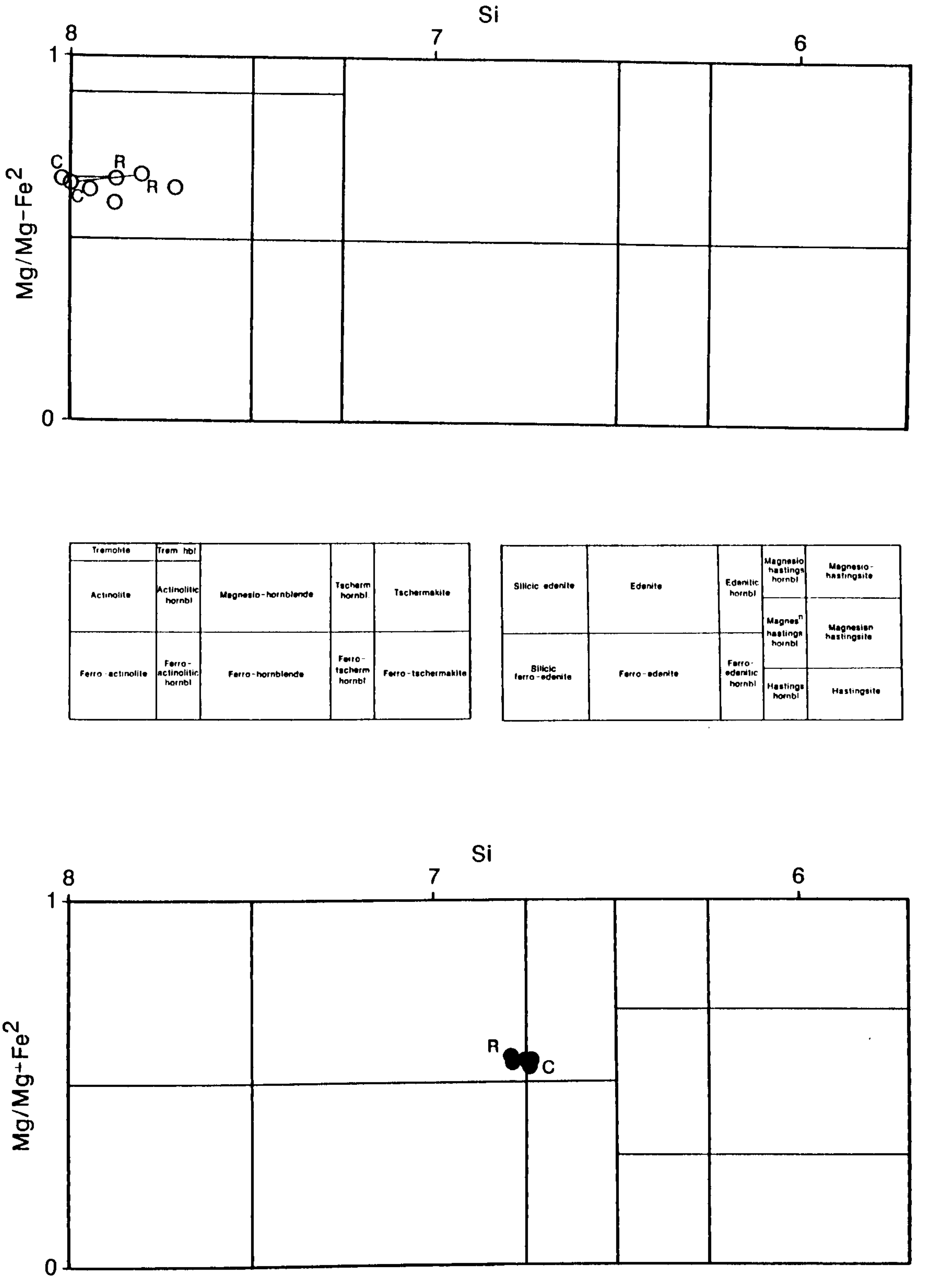



Figure 4.4 Amphibole classification diagram. Fitzgerald Peaks samples - open circles, Group 2 syenite sample 145, Fitzgerald Peaks northeast; solid circles, Group 2 granite sample 135, Fitzgerald Peaks northwest. C = core, R = rim, tie-lines connect rim and core compositions from individual crystal.

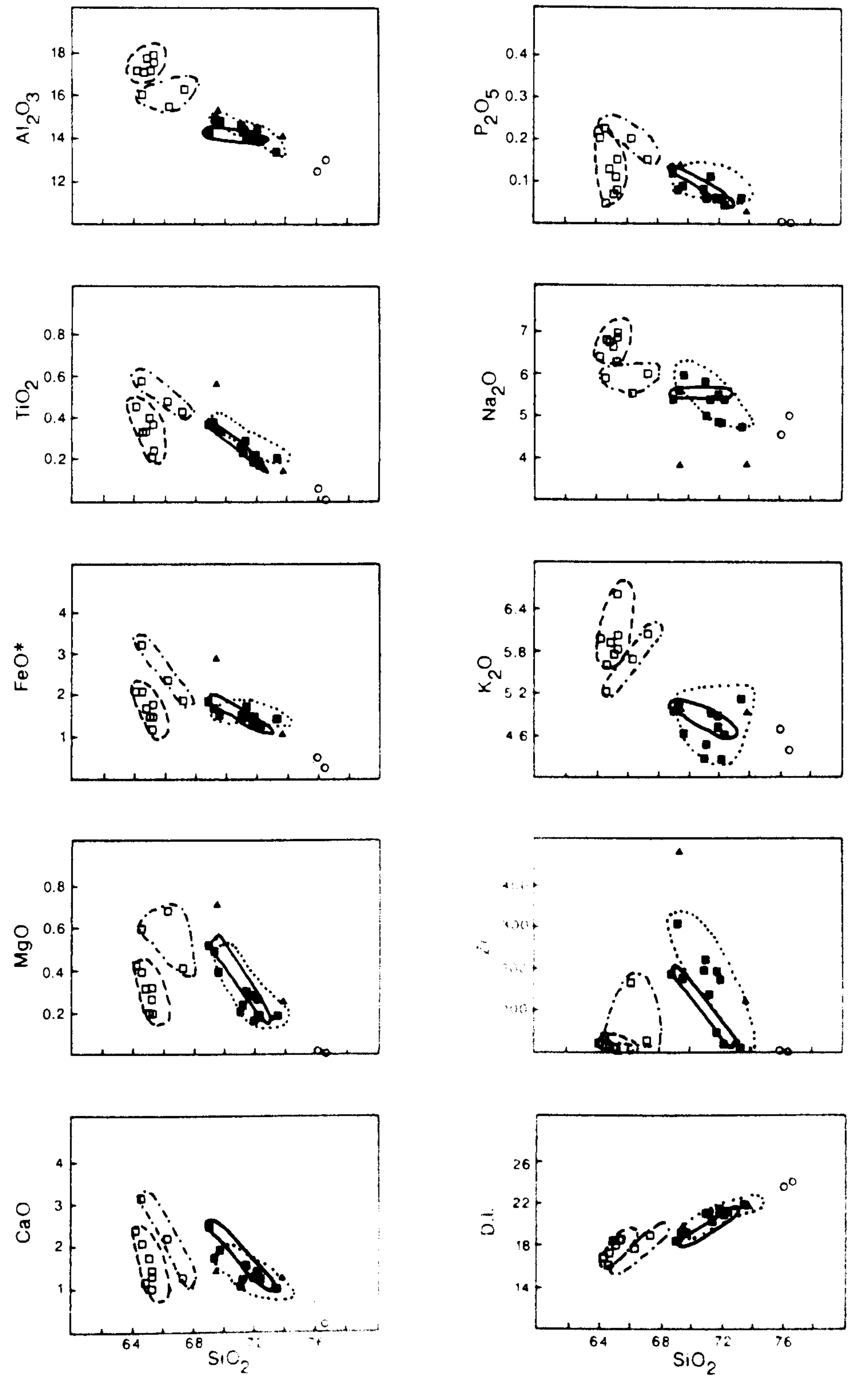
Figure 4.5 Whole rock major and trace element variation diagrams. Major element oxides in wt%, trace elements in p.p.m.

Fitzgerald Peaks samples - open squares, syenites (Group 1 samples 141,146A,146B,147,148,149,150; Group 2 samples 139,143,145); solid squares, alkali granites (Group 1 samples 124,125,127; Group 2 samples 126,128,129,133,135); open circles, coarse to very coarse grained pegmatites (samples 131,142).

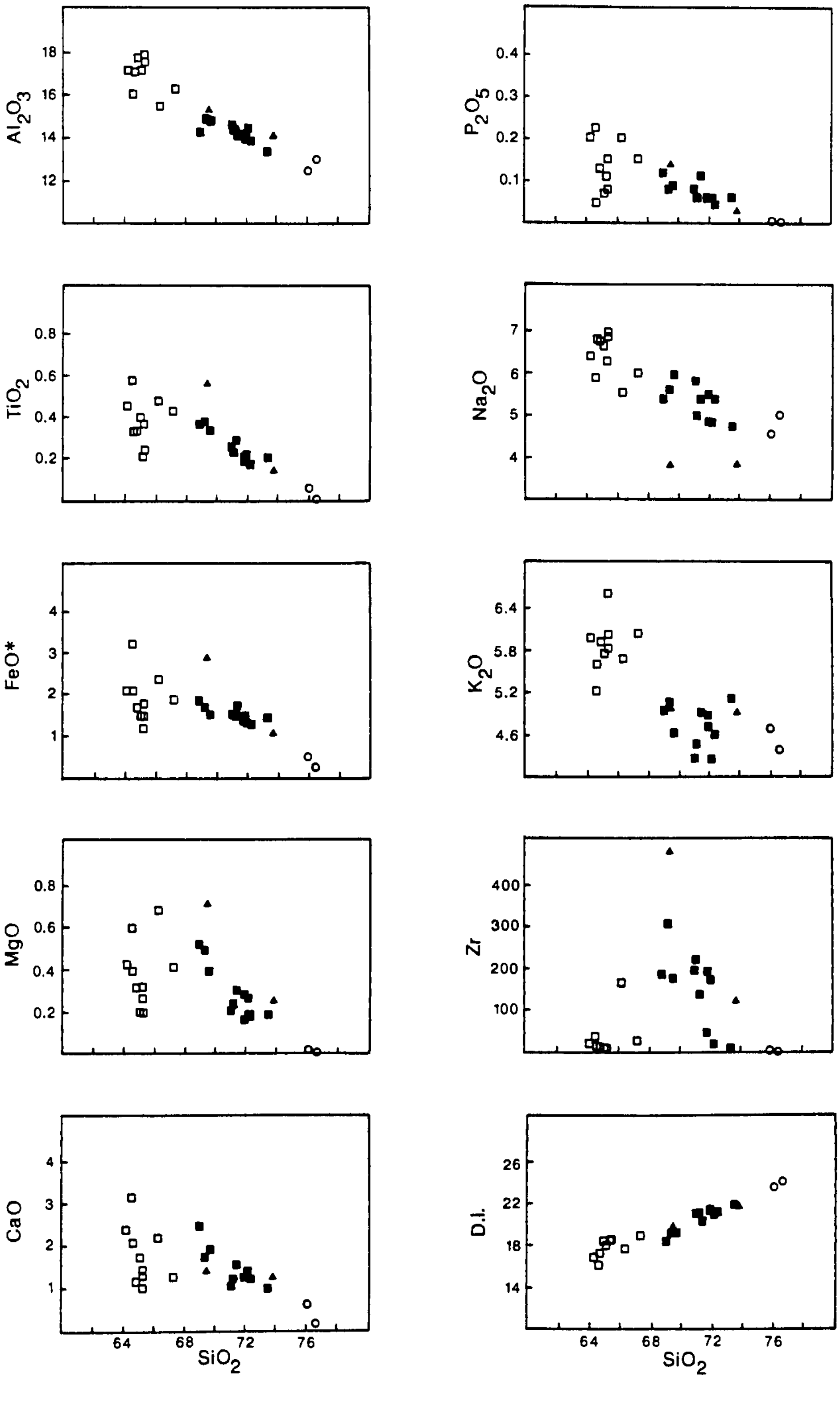
Other samples - solid triangles, Dog Rock granite (samples 137,138).

Groups outlined on overlay as follows -

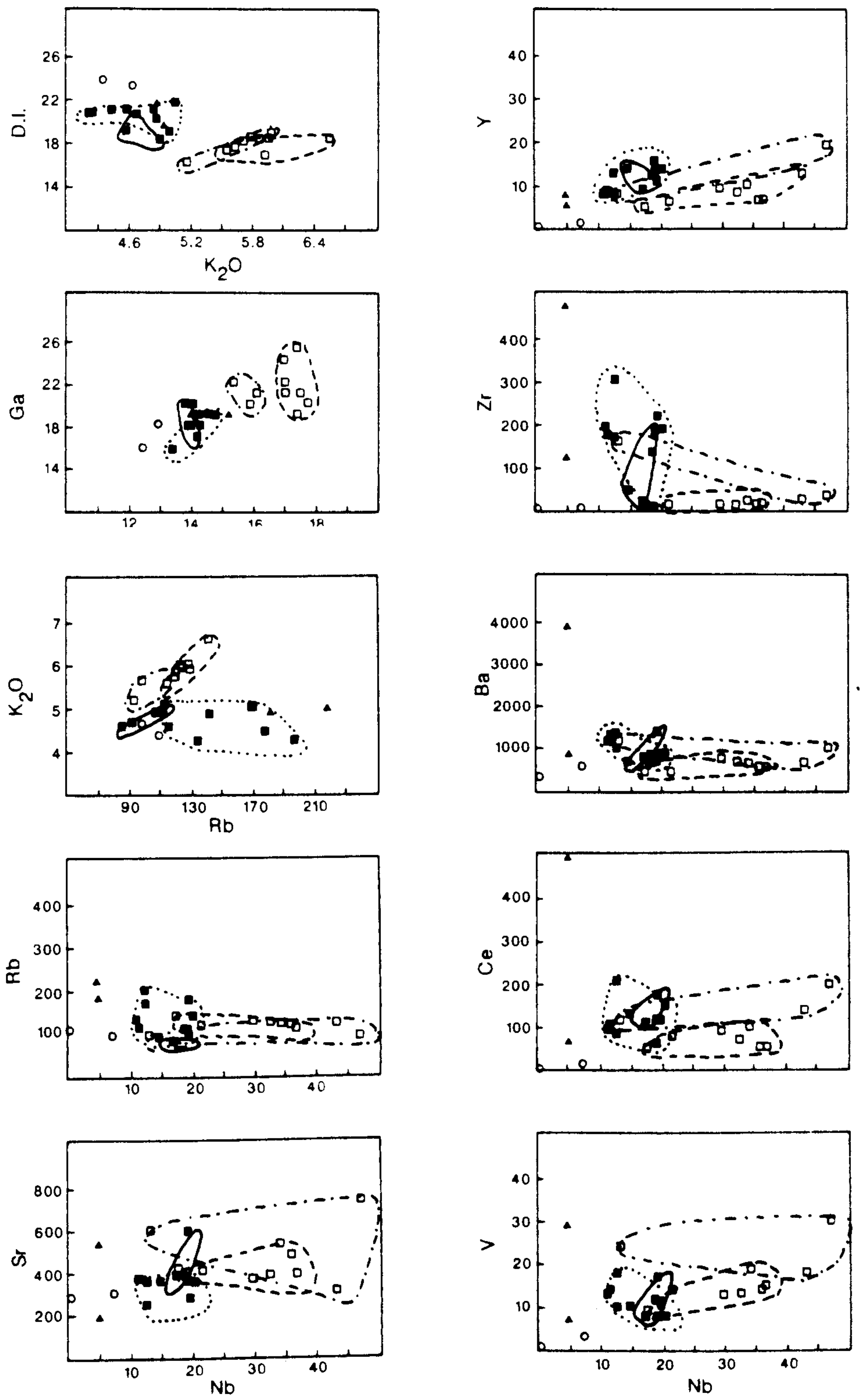
| | |
|---|---|
| ________ | Group 1 granite |
| ......... | Group 2 granite |
| --------- | Group 1 syenite |
| ._._._._ | Group 2 syenite |

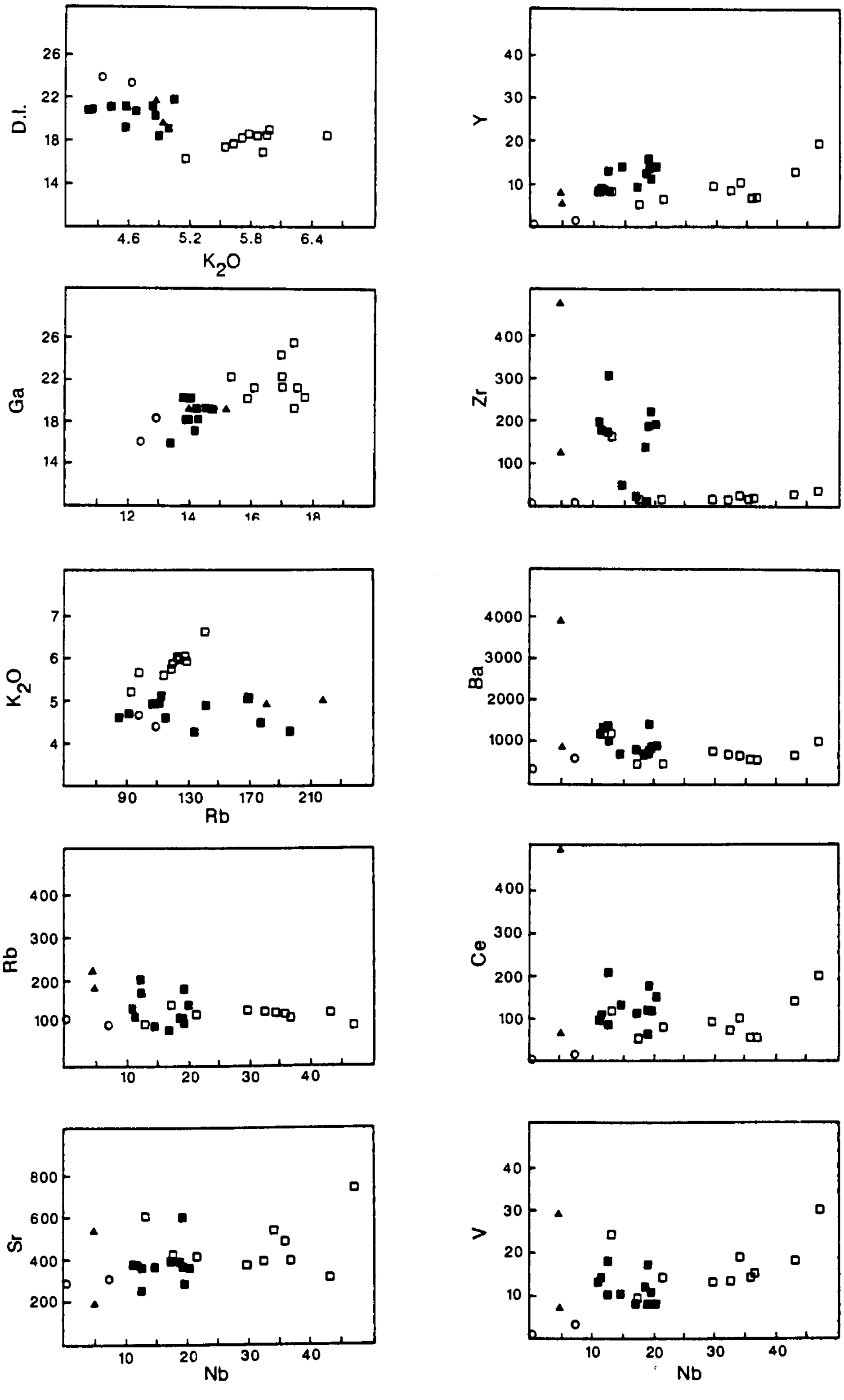


$Al_2O_3$
18
16
14
12
$P_2O_5$
0.4
0.3
0.2
0.1
$TiO_2$
0.8
0.6
0.4
0.2
$Na_2O$
7
6
5
4
FeO*
4
3
2
1
$K_2O$
6.4
5.8
5.2
4.6
MgO
0.8
0.6
0.4
0.2
CaO
4
3
2
1
D.I.
26
22
18
14
64
68
72
76
$SiO_2$



$Al_2O_3$
$P_2O_5$
$TiO_2$
$Na_2O$
FeO*
$K_2O$
MgO
Zr
CaO
D.I.
64
68
72
76
$SiO_2$


D.I.
K2O
4.6
5.2
5.8
6.4
Y
Ga
Zr
Ba
K2O
Rb
90
130
170
210
Ce
Rb
Sr
Nb
V
Nb
10
20
30
40


D.I.
K2O
Y
Ga
Zr
K2O
Rb
Ba
Rb
Ce
Sr
Nb
V
Nb

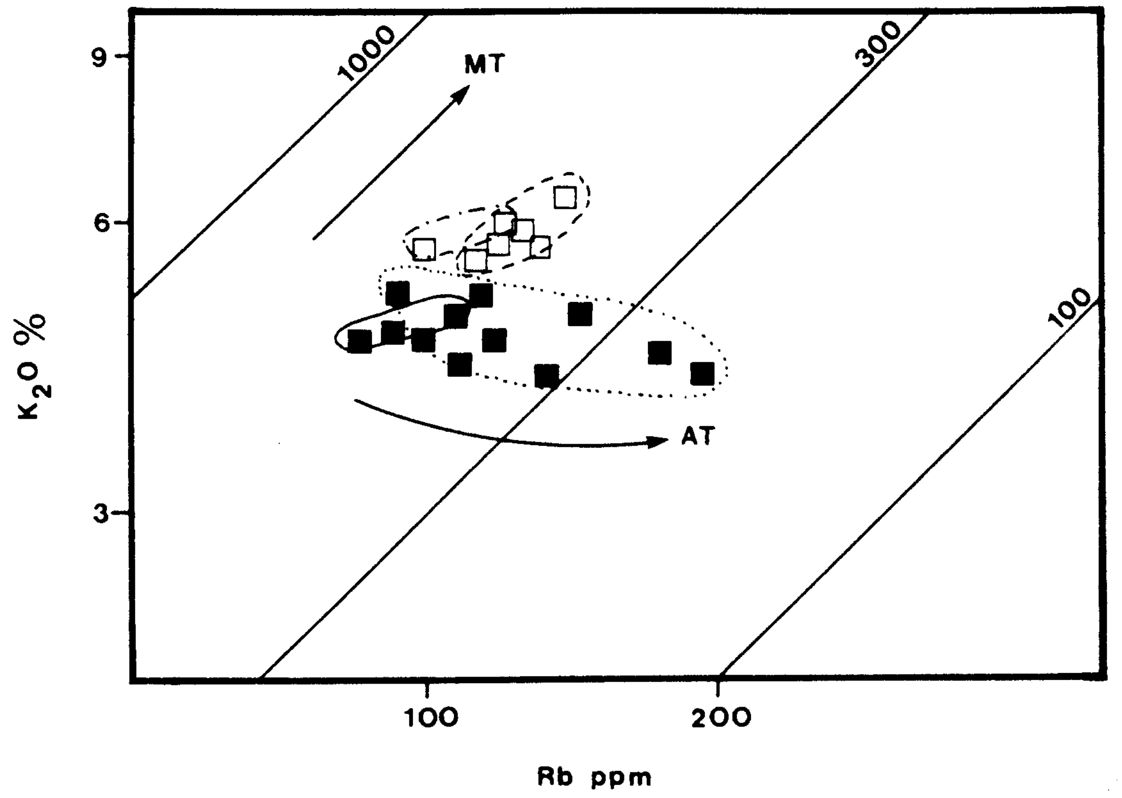



Figure 4.6 $K_2O$ vs. Rb variation diagram defining magmatic (MT) and autometasomatic (AT) trends, Fitzgerald Peaks. Symbols as follows - open squares, syenites; solid squares, granites.

Groups outlined as follows -

| | |
|---|---|
| ________ | Group 1 granite |
| ......... | Group 2 granite |
| --------- | Group 1 syenite |
| ._._._._ | Group 2 syenite |

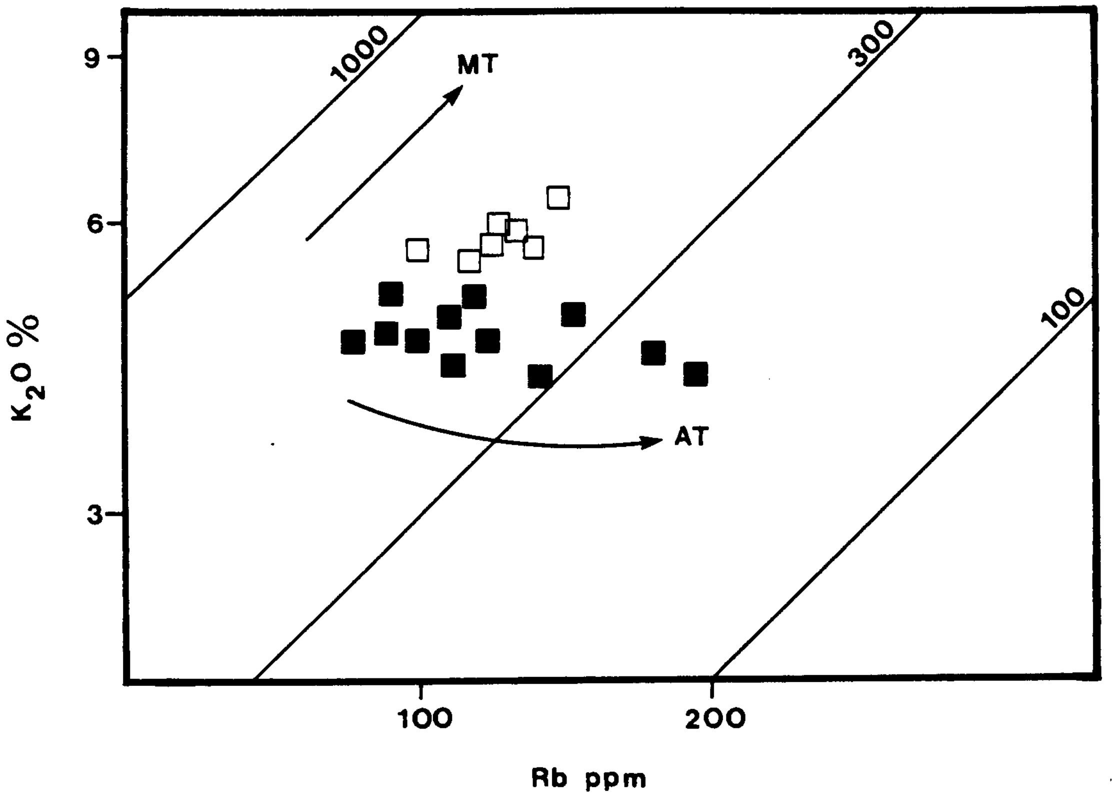



Figure 4.6 $K_2O$ vs. Rb variation diagram defining magmatic (MT) and autometasomatic (AT) trends, Fitzgerald Peaks. Symbols as follows - open squares, syenites; solid squares, granites.

Groups outlined as follows -

| | |
|---|---|
| ________ | Group 1 granite |
| ......... | Group 2 granite |
| --------- | Group 1 syenite |
| ._._._._ | Group 2 syenite |

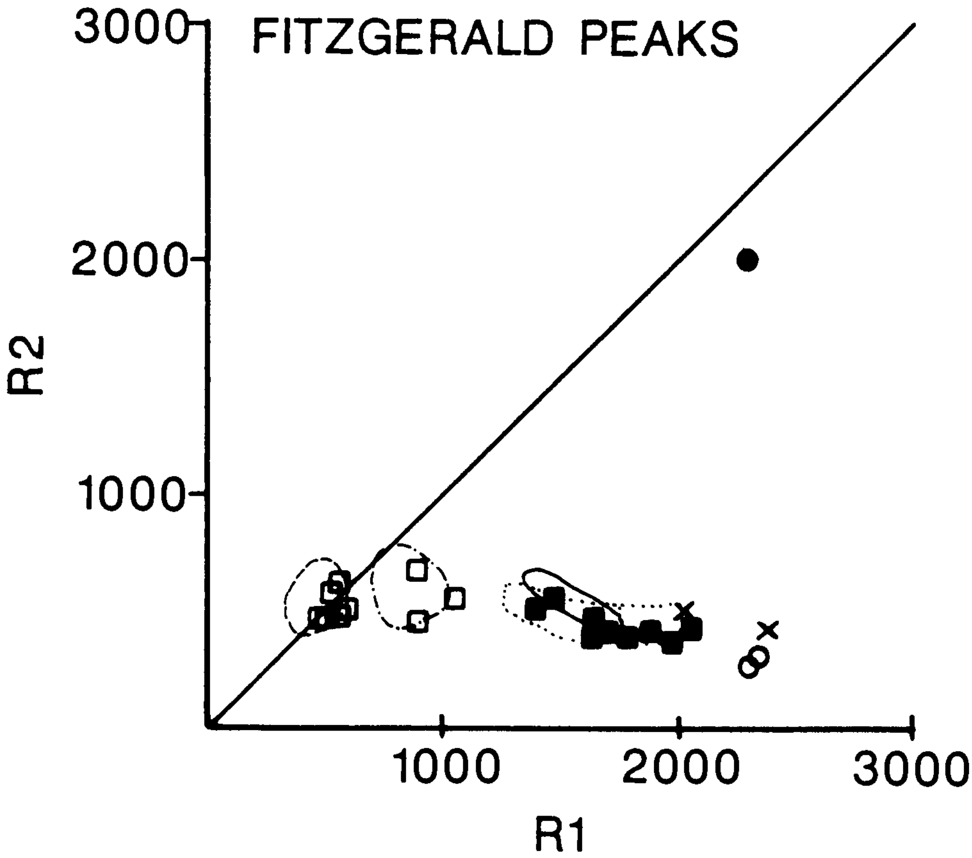
Figure 4.7 $R_1R_2$ geochemical classification diagrams.

Fitzgerald Peaks sample symbols as follows - open squares, syenites; solid squares, granites; open circles, pegmatites; crosses, Dog Rock granites; solid circle, norite, sample 140. Refer overlay in back pocket for key.

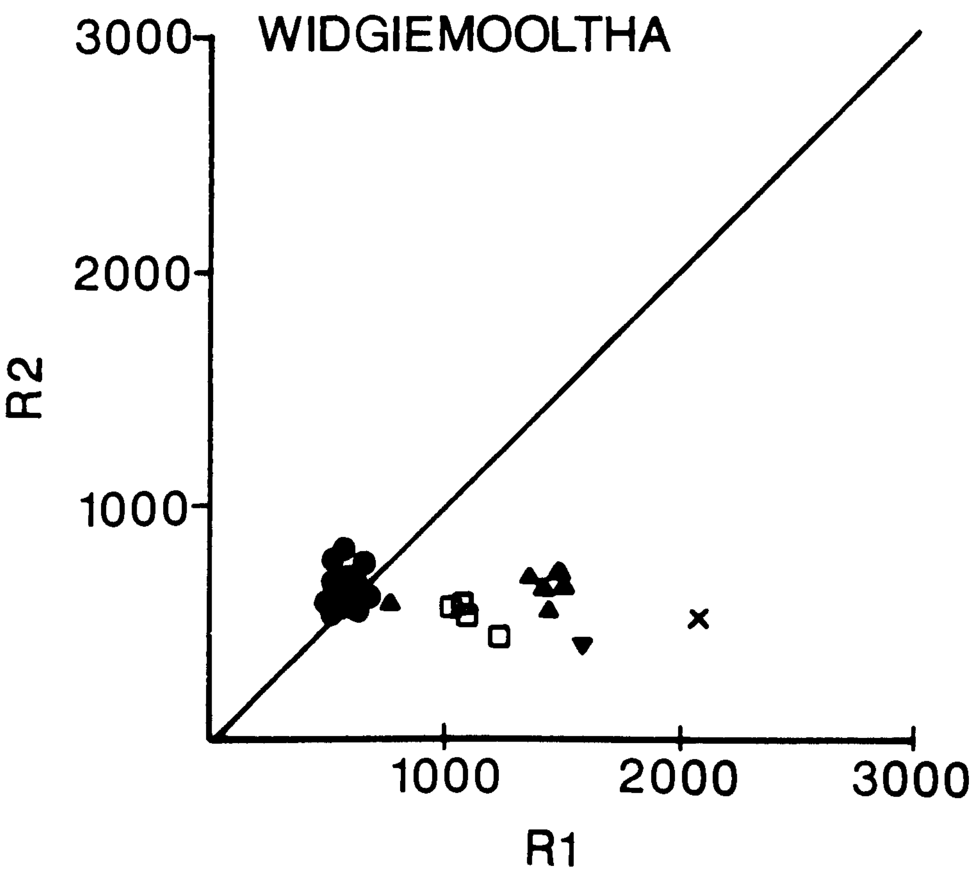
Groups outlined as follows -

| | |
|---|---|
| ________ | Group 1 granite |
| ......... | Group 2 granite |
| --------- | Group 1 syenite |
| ._._._._ | Group 2 syenite |

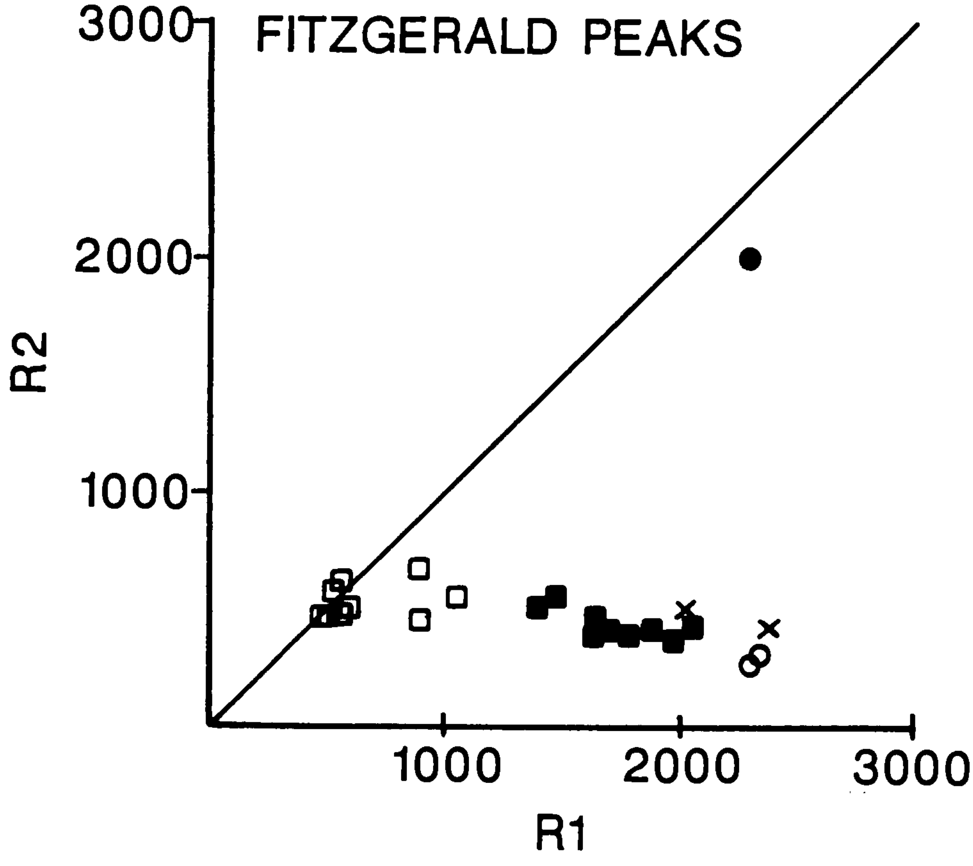
Widgiemooltha samples as follows - solid circles, Binneringie syenite; open squares, Erayinia Granitoid Complex; solid triangles, Madoonia Downs syenite to quartz monzonite; cross, regional granitoid 17km southeast of Binneringie homestead; solid inverted triangle, regional granitoid 9km southwest of Cowarna Downs homestead.

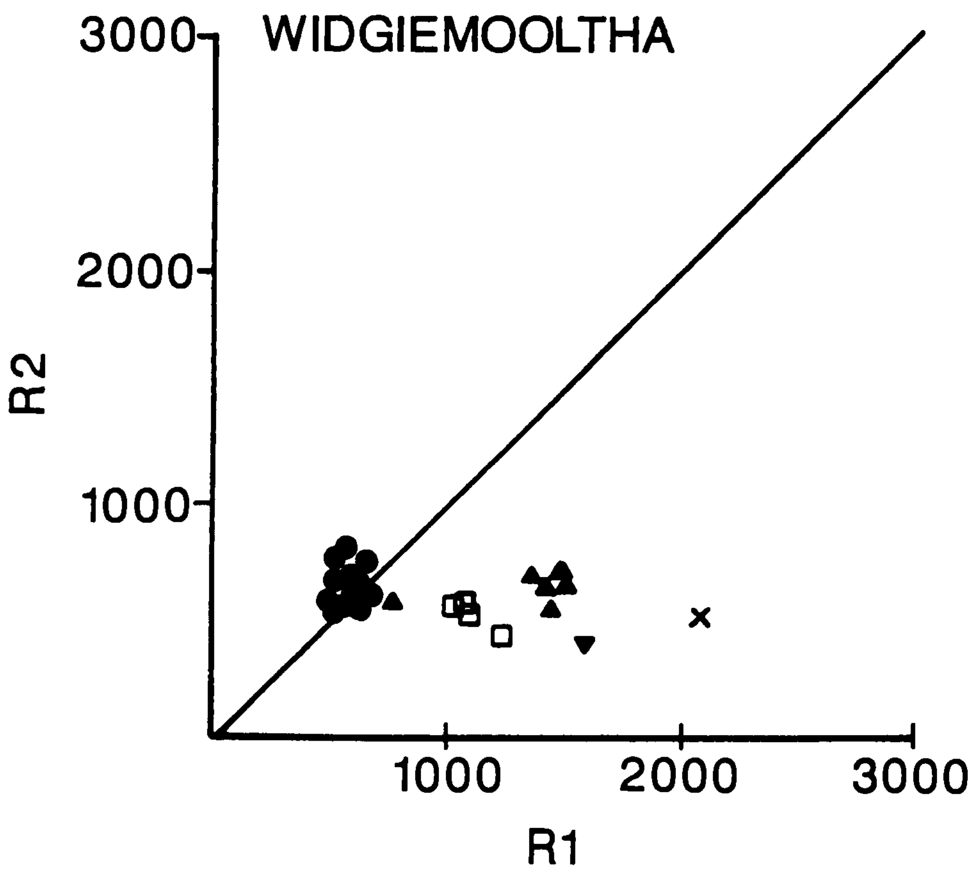


FITZGERALD PEAKS
3000
2000
1000
R2
1000
2000
3000
R1

WIDGIEMOOLTHA
3000
2000
1000
R2
1000
2000
3000
R1


FITZGERALD PEAKS
3000
2000
1000
R2
1000
2000
3000
R1


WIDGIEMOOLTHA
3000
2000
1000
R2
1000
2000
3000
R1

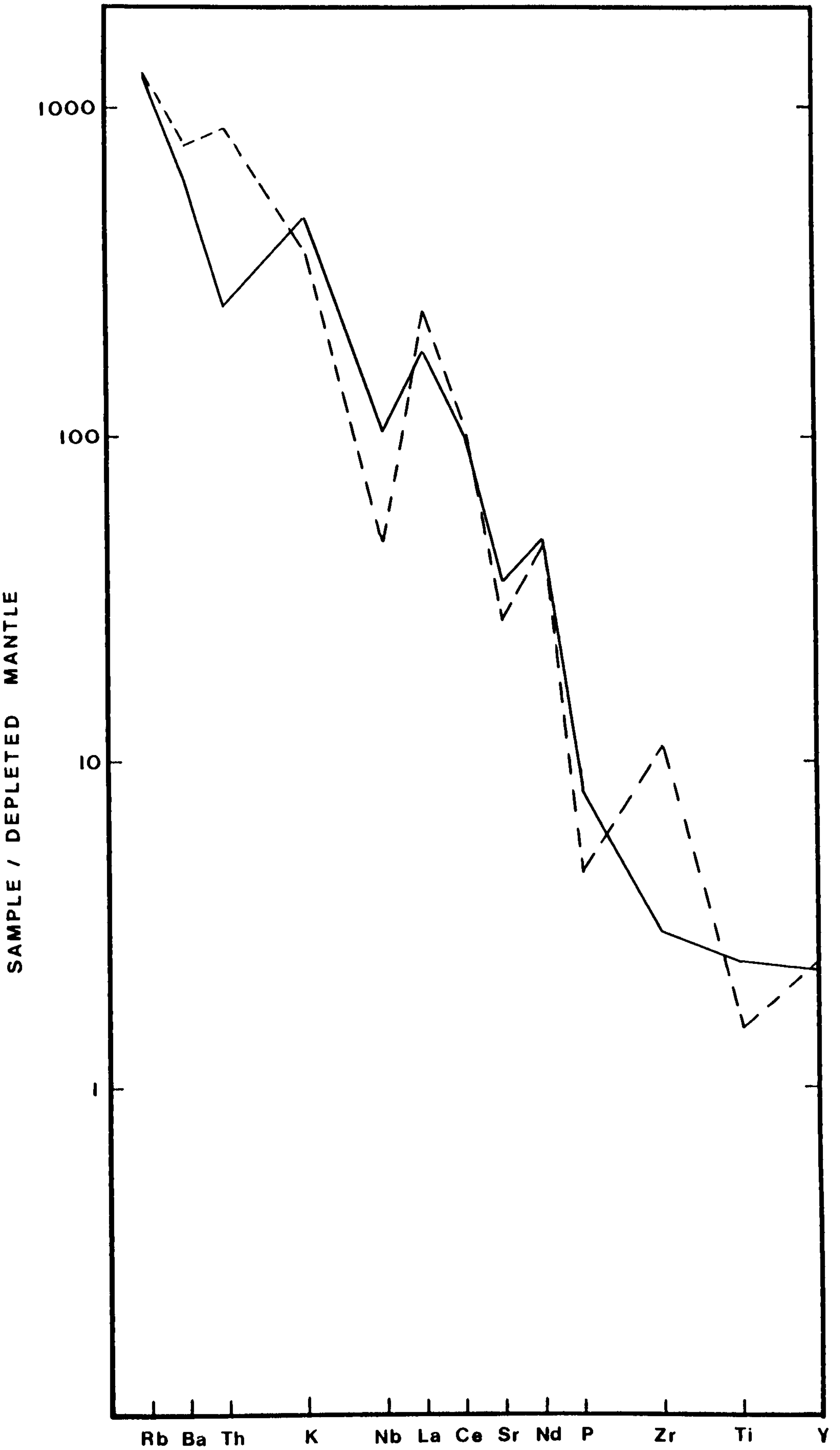



Figure 4.8 Depleted mantle source-normalised hygromagmatophile (HYG) element spider plot, Fitzgerald Peaks. Solid line, syenites (average of 10); dashed line, granites (average of 13). Normalising factors from the N-type MORB mantle source of Wood et al (1979).

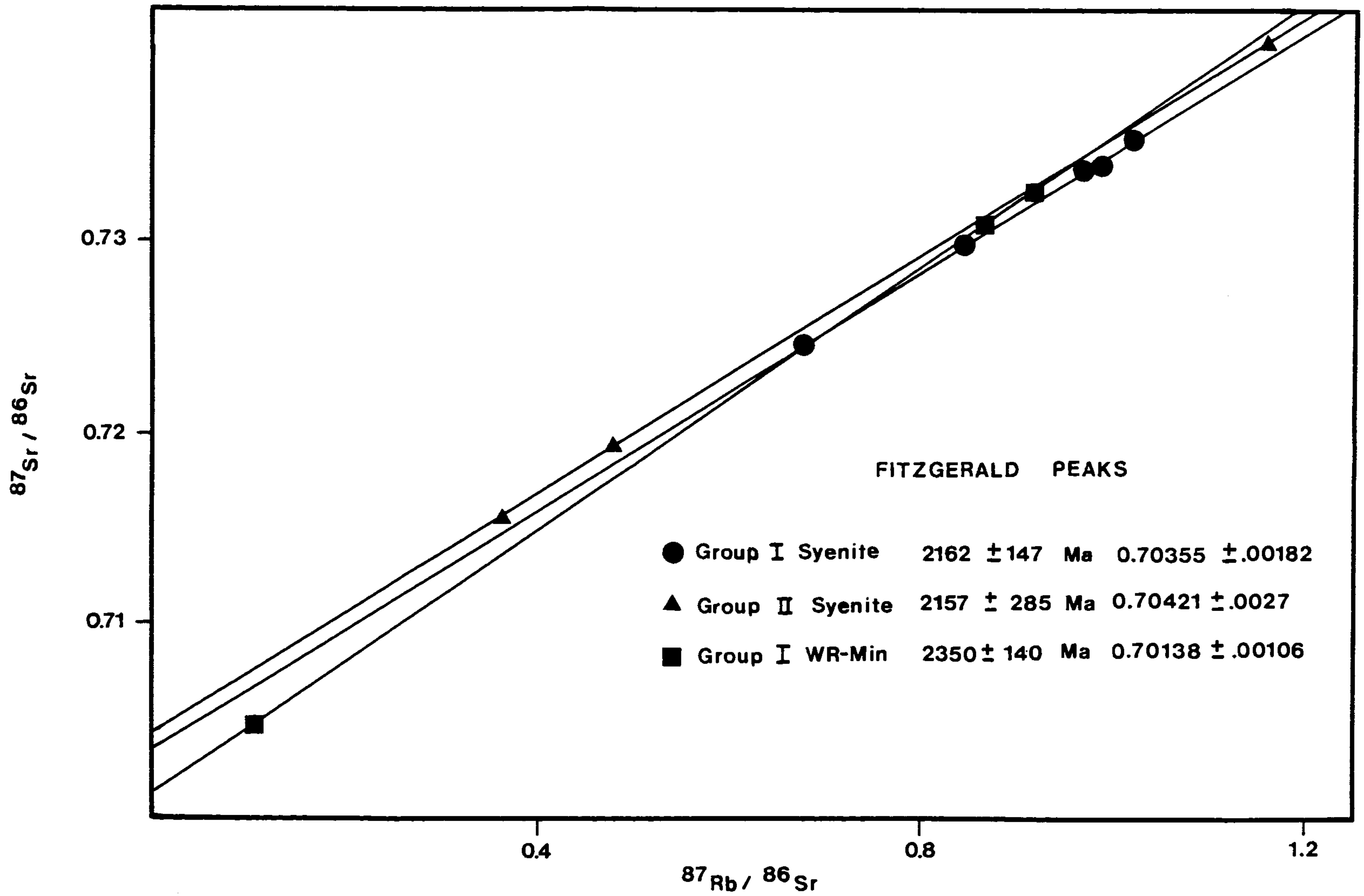



Figure 4.9 Rb-Sr isochron plot, Fitzgerald Peaks syenites.

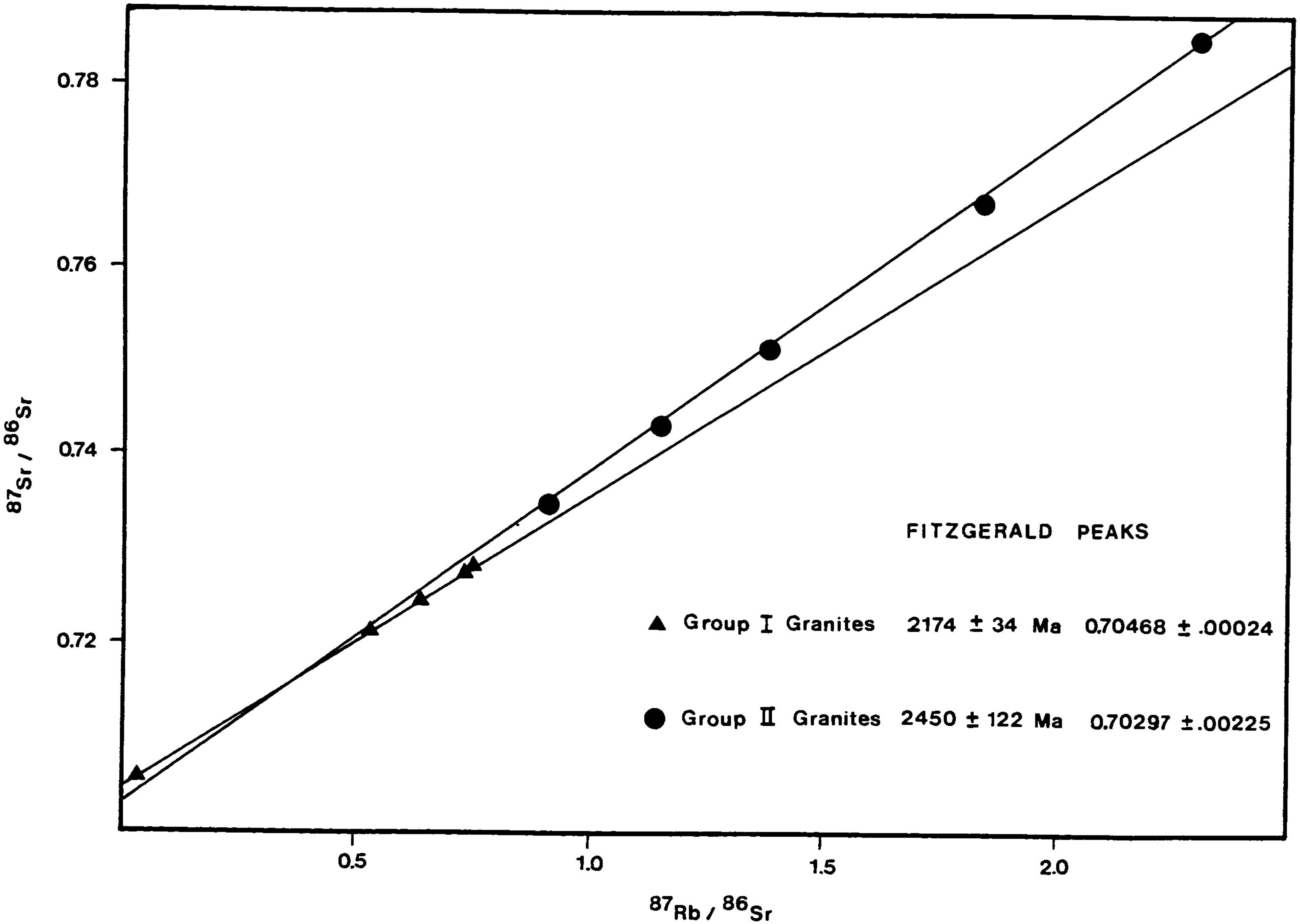



Figure 4.10 Rb-Sr isochron plot, Fitzgerald Peaks granites.

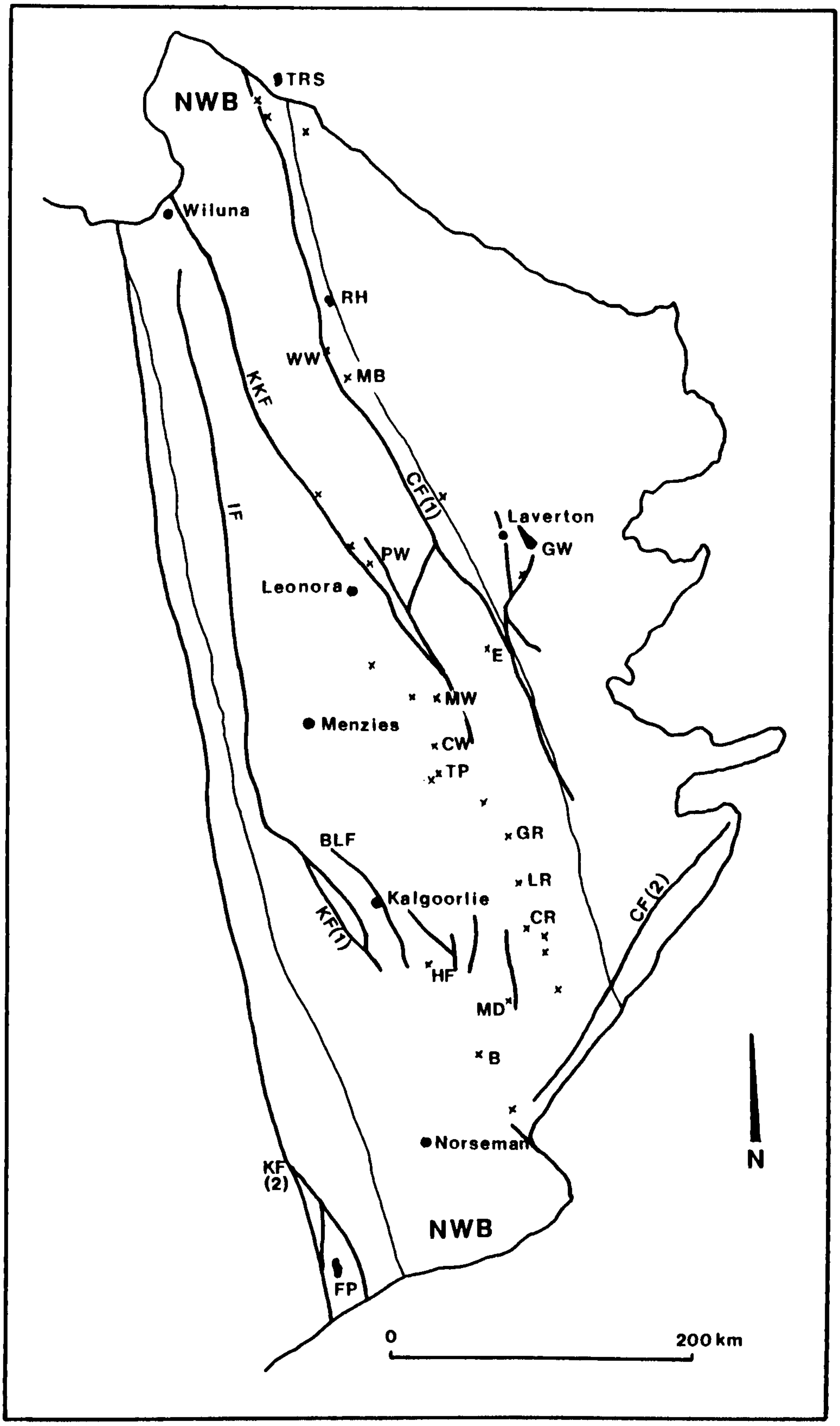



Figure 5.1 Distribution of the felsic alkaline suite, Eastern Goldfields Province. NWB = Norseman-Wiluna Belt, KKF = Keith-Kilkenny Fault, CF(1) = Celia Fault, CF(2) = Cundeelee Fault, IF = Ida Fault, BLF = Boulder-Lefroy Fault, KF(1) = Kunualling Fault, KF(2) = Koolyanobbing Fault. Felsic alkaline intrusions included in this study as follows: FP = Fitzgerald Peaks, B = Binneringie, MD = Madoonia Downs, HF = Hogan's Find, CR = Cardunia Rocks, LR = Lake Roe, GR = Gilgarna Rock, TP = Twin Peaks, CW = Cement Well, MW = McAuliffe Well, E = Eucalyptus, GW = Granite Well, PW = Pig Well, MB = Mt. Blackburn, WW = Woorana Well, RH = Red Hill, TRS = Teague Ring Structure.

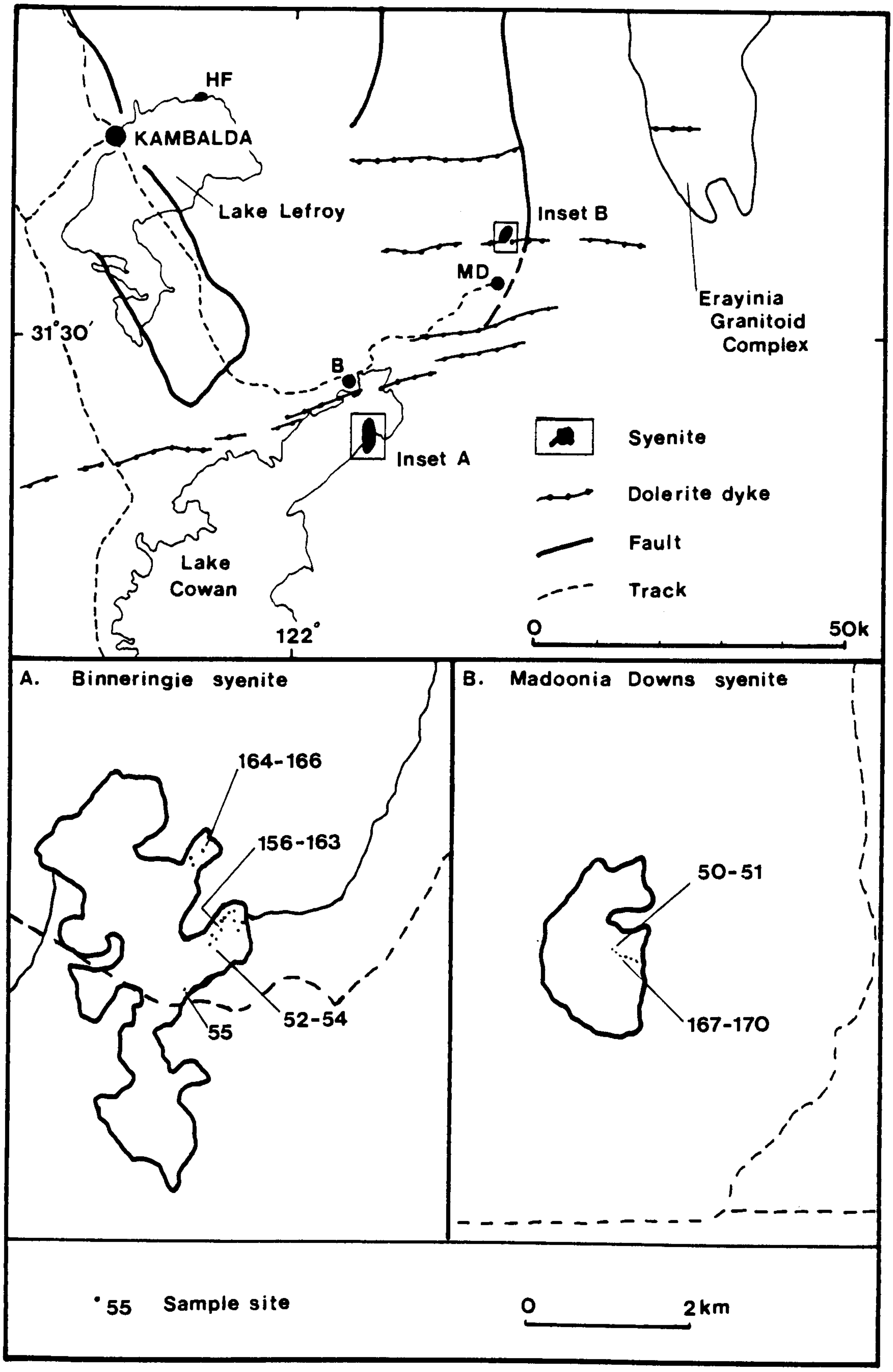



Figure 5.2.1 Regional geology and syenite localities, Widgiemooltha sheet. HF = Hogan's Find syenite, MD = Madoonia Downs homestead, B = Binneringie homestead.

Figure 5.2.2

Note - for all stained slabs, yellow indicates alkali feldspar, pink indicates plagioclase feldspar. Scale in centimetres.

A. Slabbed and stained lath-textured syenite, sample 052, 12km SSE Binneringie homestead.

B. Slabbed and stained relatively equigranular syenite, sample 161, 12km SSE Binneringie homestead.

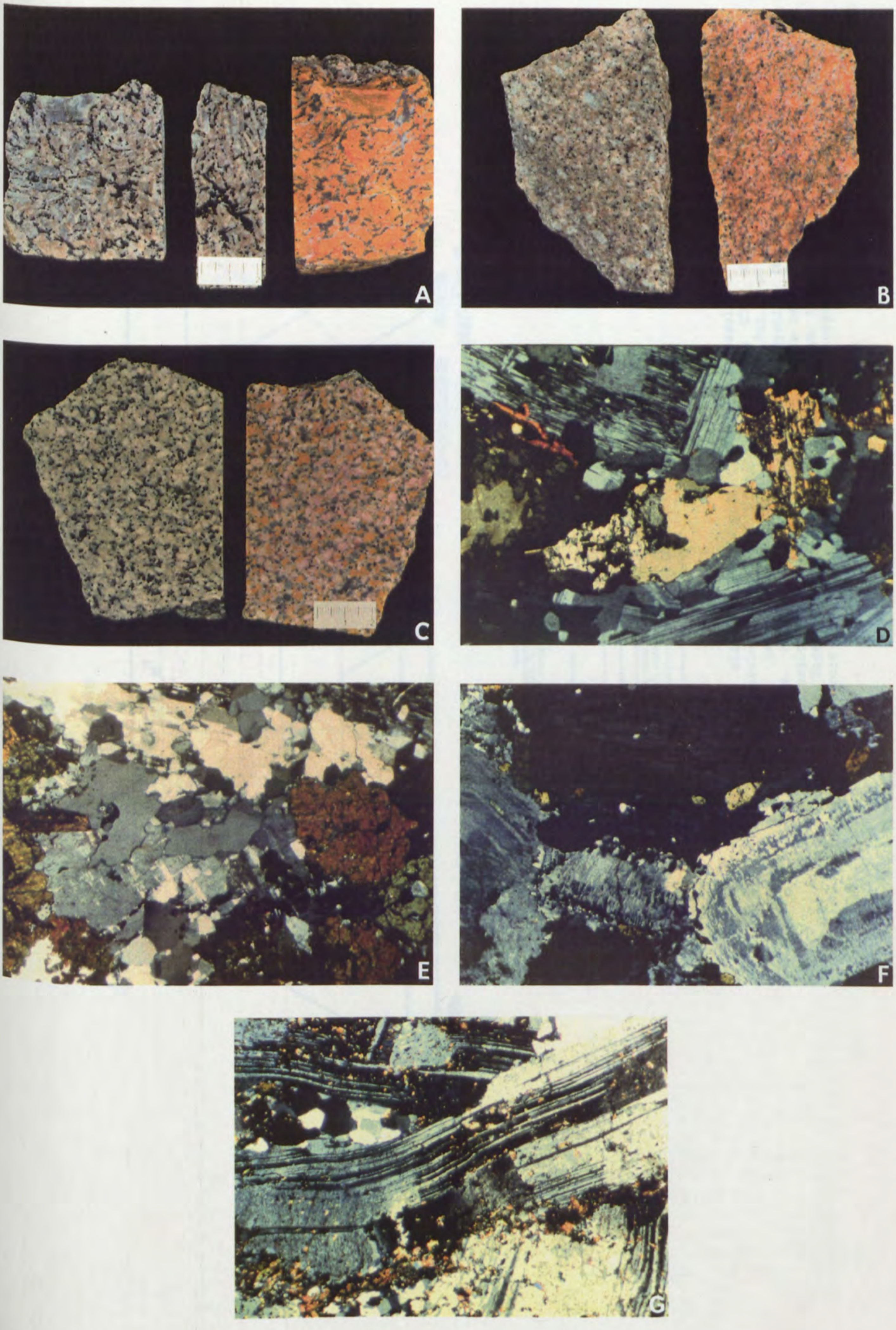
C. Slabbed and stained quartz monzonite, sample 167, 8km NNE Madoonia Downs homestead.

D. Albite-alkali feldspar-dominant assemblage, quartz monzonite, sample 051, 8km NNE Madoonia Downs homestead. Note hornblende, centre left and centre, and replacing ferroaugite, centre right. CP, FOV = 3.9mm.

E. Andradite-bearing (centre bottom, isotropic) lath-textured syenite, sample 052, 12km SSE Binneringie homestead. Note stubby salite to ferroaugite crystals, centre right and left; quartz exhibiting undulose extinction, centre left; large euhedral titanite, centre left; edge of alkali feldspar lath, top. CP, FOV = 3.9mm.

F. Superb zoned anorthoclase, relatively equigranular syenite, sample 166, 12km SSE Binneringie homestead. Consertal textures evident, bottom left. CP, FOV = 3.9mm.

G. Kinked oligoclase crystals, alkali granite, sample 058, 9km SW Cowarna Downs homestead. Note colourless mica alteration within, and particularly rimming, feldspar laths. CP, FOV = 3.9mm.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F
G

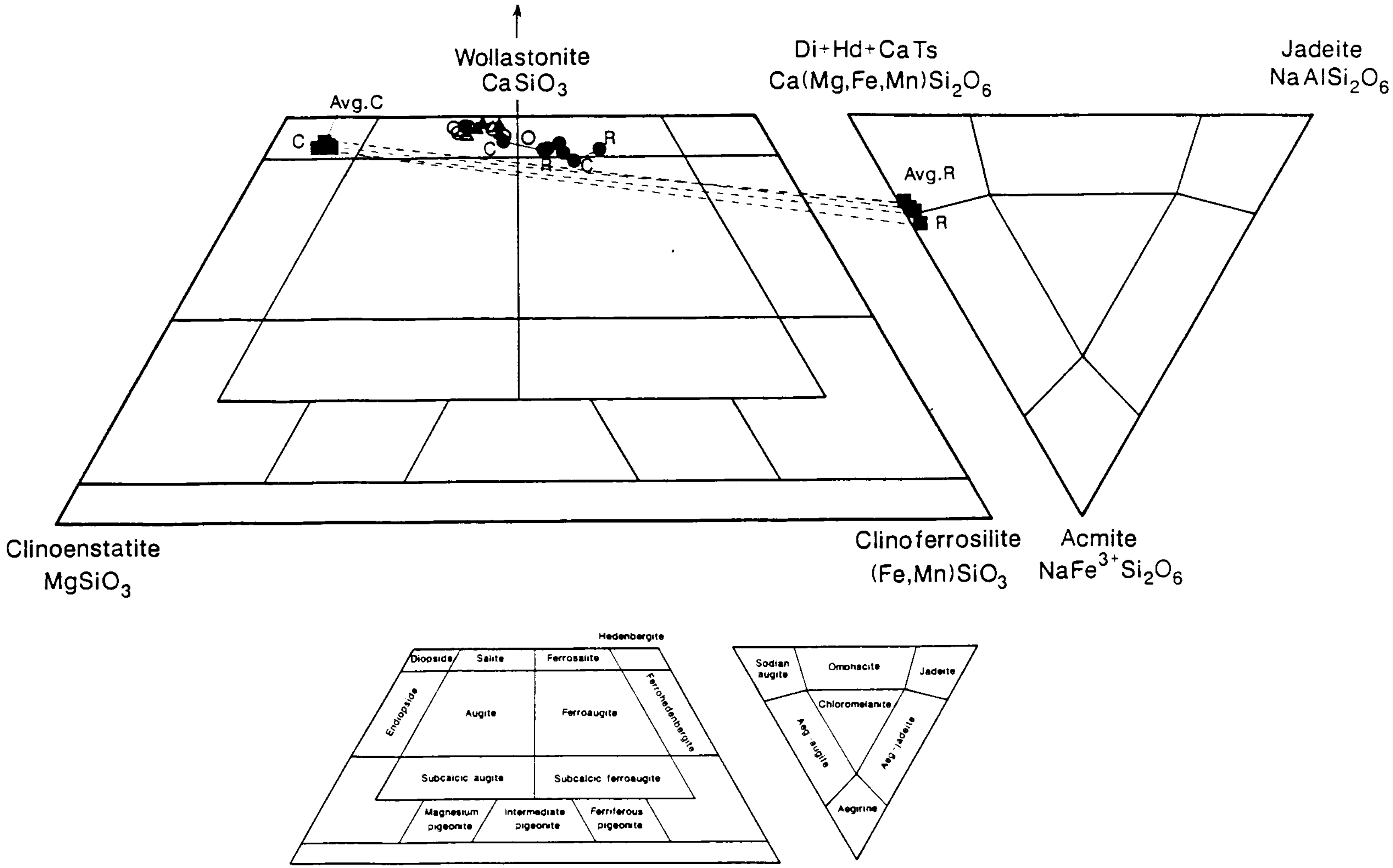



Figure 5.2.3 Pyroxene classification diagram. Widgiemooltha samples - solid circles, lath-textured Binneringie syenite 052; open circles, lath-textured Binneringie syenite 055; solid triangles, relatively equigranular Binneringie syenite 165; open triangles, Erayinia Granitoid Complex syenite 046; solid squares, Hogan's Find syenite 056. C = core R = rim, tie-lines connect core and rim compositions from individual crystals.

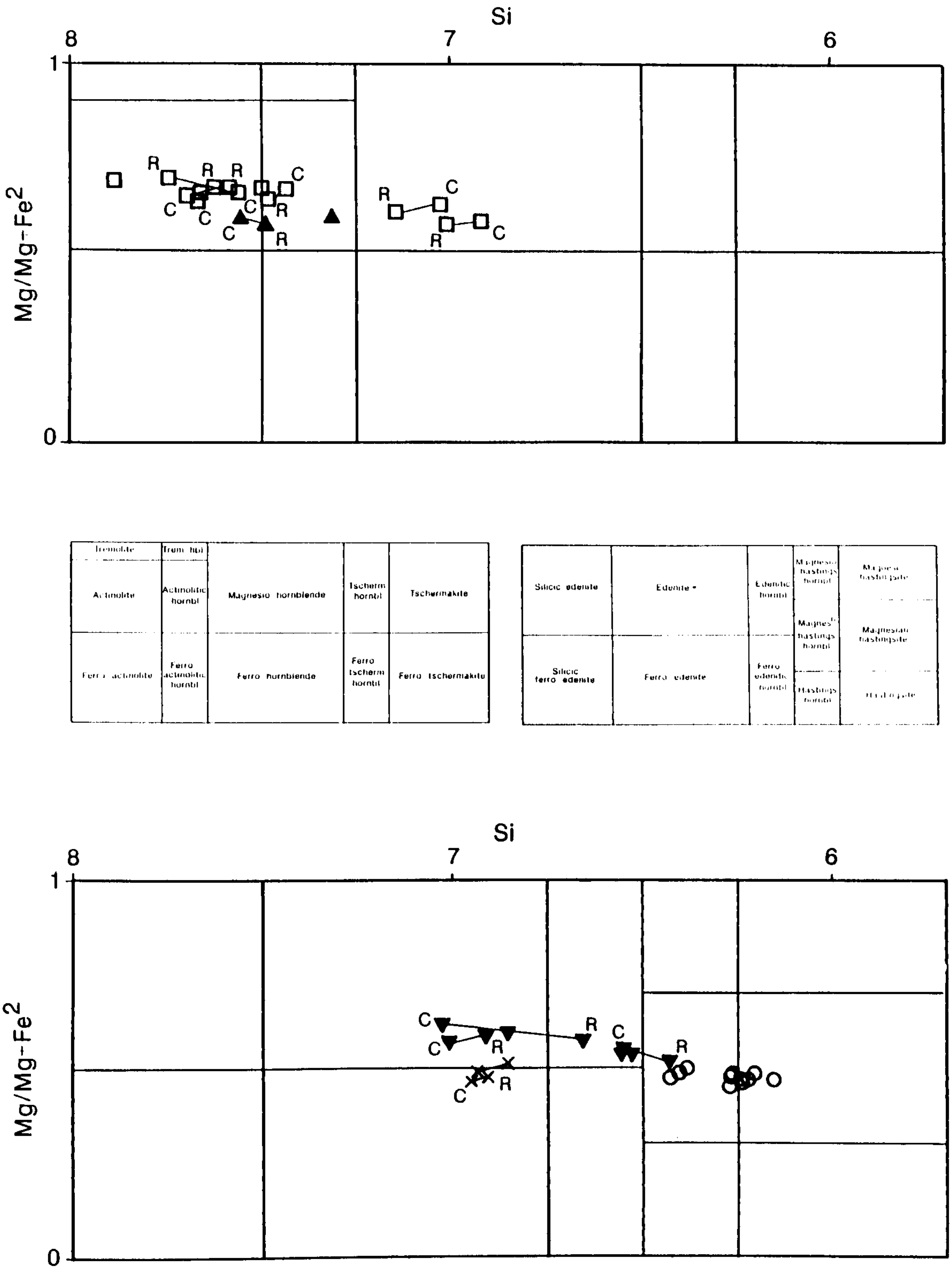
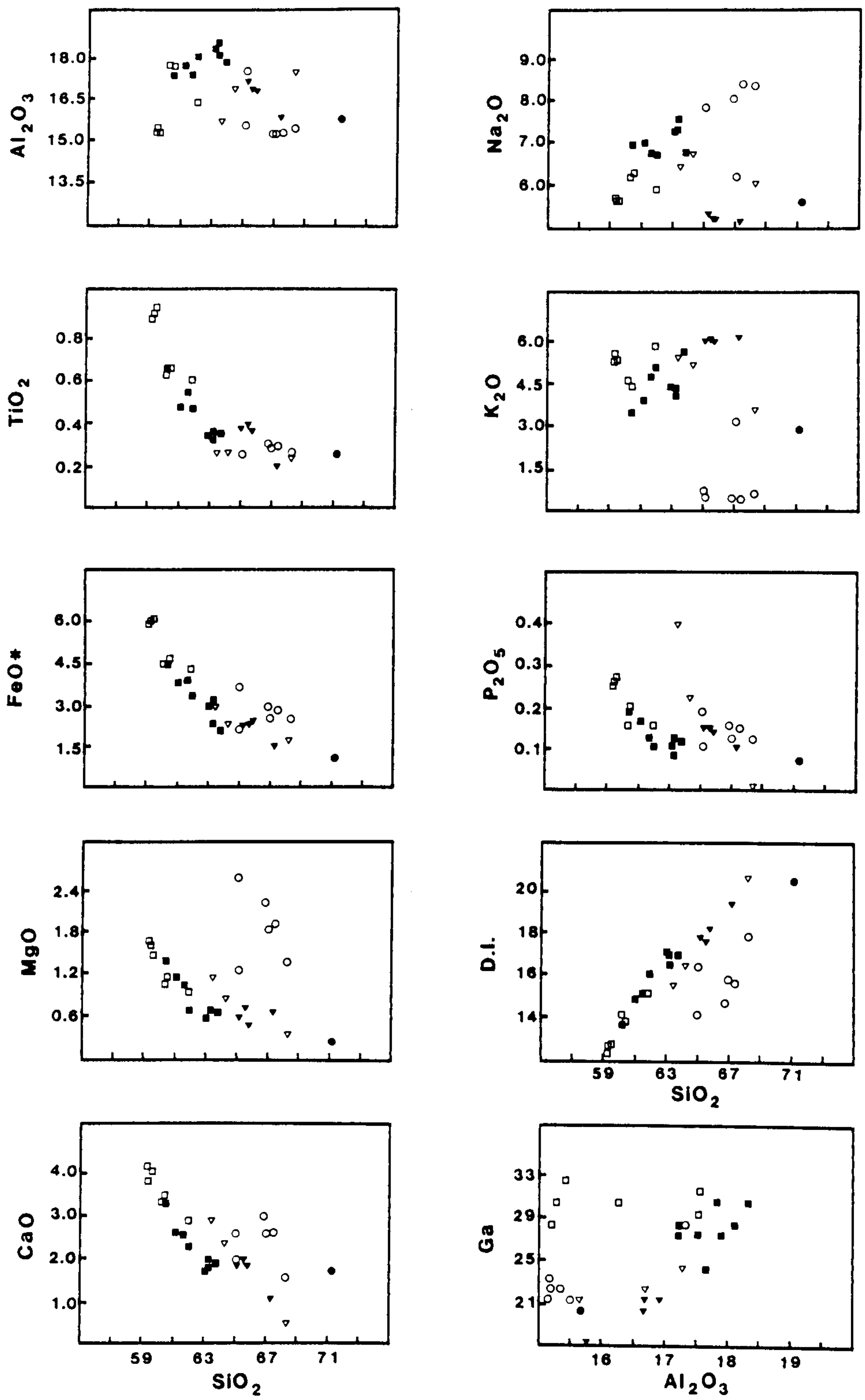


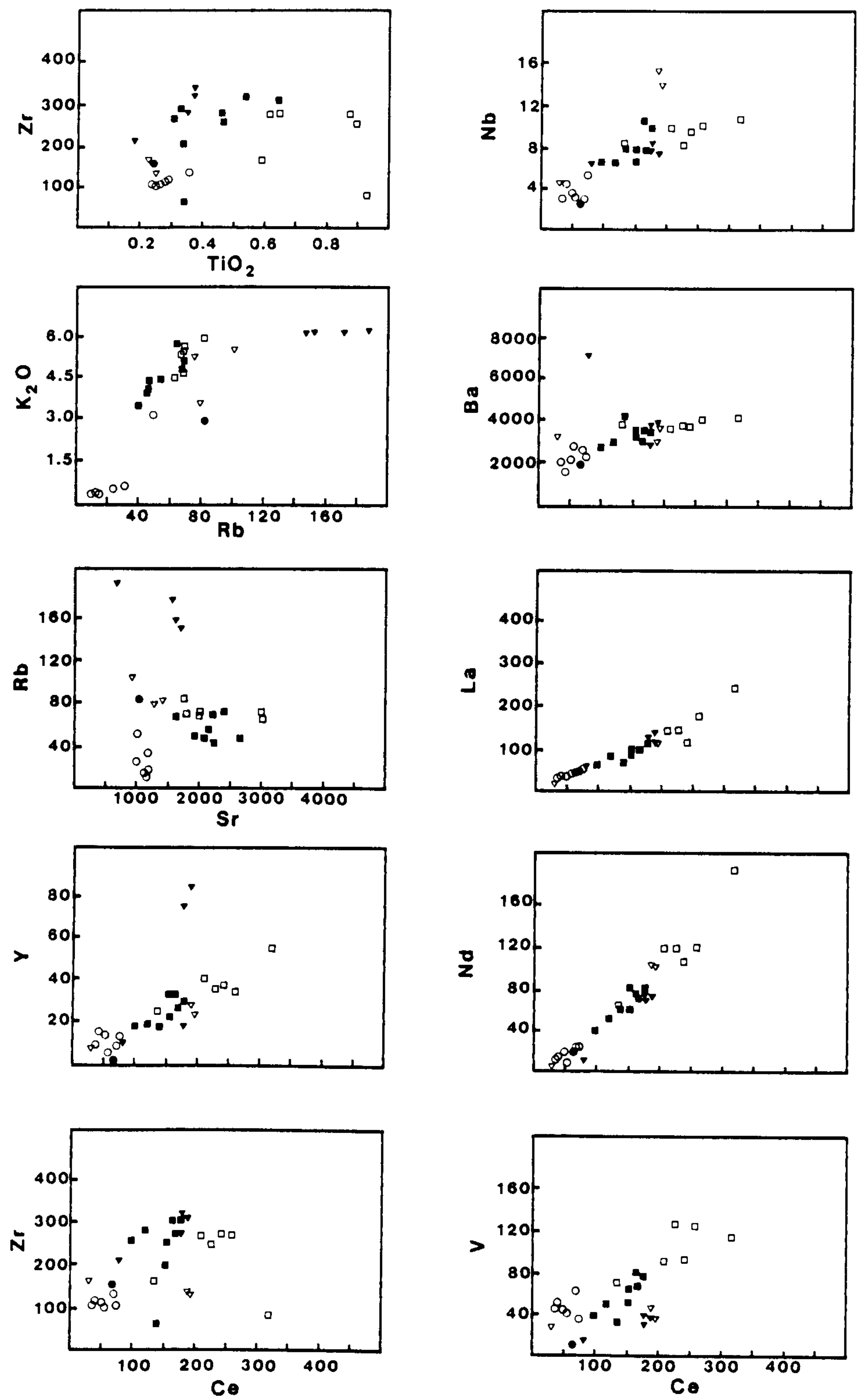

Figure 5.2.4 Amphibole classification diagram. Widgiemooltha samples - open squares, Madoonia Downs quartz monzonite 050; solid triangles, relatively equigranular Binneringie syenite 165; open circles, lath-textured Binneringie syenite 055; solid inverted triangles, Erayinia Granitoid Complex quartz monzonite 039; crosses, Erayinia Granitoid Complex syenite 046; C = core, R = rim, tie-lines connect rim and core compositions from individual crystal.

Figure 5.2.5 Whole rock major and trace element variation diagrams. Major element oxides in wt%, trace elements in p.p.m.

Widgiemooltha samples - open squares, lath-textured Binneringie syenites (samples 52,54,55,157,158,159); solid squares, relatively equigranular Binneringie syenites (samples 53,160A,160B,161,163,164,165,166); open circles, Madoonia Downs quartz monzonites to syenites (samples 50,51,167,168,169,170); solid inverted triangles, Erayinia Granitoid Complex granites to syenites (samples 45,46,47,49); open inverted triangles, Hogan's Find syenites (56,57) and Cowarna Downs regional granitoid (58); solid circle, regional granitoid southeast of Binneringie (155).



Al2O3
18.0
16.5
15.0
13.5
Na2O
9.0
8.0
7.0
6.0
TiO2
0.8
0.6
0.4
0.2
K2O
6.0
4.5
3.0
1.5
FeO*
6.0
4.5
3.0
1.5
P2O5
0.4
0.3
0.2
0.1
MgO
2.4
1.8
1.2
0.6
D.I.
20
18
16
14
59
63
67
71
SiO2
CaO
4.0
3.0
2.0
1.0
59
63
67
71
SiO2
Ga
33
29
25
21
16
17
18
19
Al2O3



Zr
400
300
200
100
0.2
0.4
0.6
0.8
$TiO_2$
Nb
16
12
8
4
$K_2O$
6.0
4.5
3.0
1.5
40
80
120
160
Rb
Ba
8000
6000
4000
2000
Rb
160
120
80
40
1000
2000
3000
4000
Sr
La
400
300
200
100
Y
80
60
40
20
Nd
160
120
80
40
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100
200
300
400
Ce

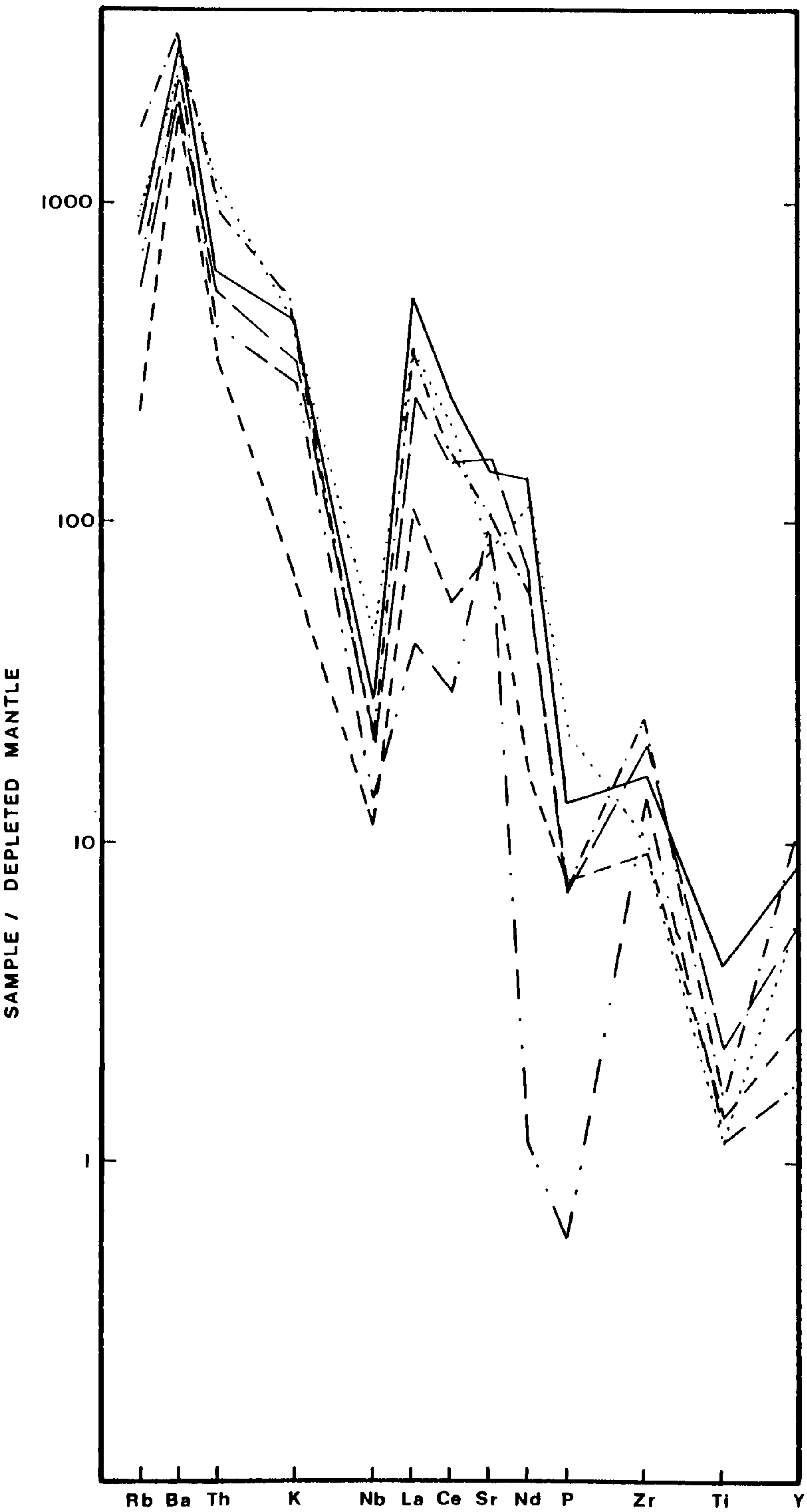



Figure 5.2.6 Depleted mantle source-normalised hygromagmatophile (HYG) element spider plot, Widgiemooltha. Solid line, lath-textured Binneringie syenites (average of 6); long-dashed line, equigranular Binneringie syenites (average of 8); short-dashed line, Madoonia Downs quartz monzonites/syenites (average of 6); dotted line, Hogan's Find syenites (average of 2); dash-dot line, Erayinia Granitoid Complex granites to syenites (average of 4); dash dash-dot dot line, regional batholithic granitoid (sample 58). Normalising factors from the N-type MORB mantle source of Wood et al (1979.

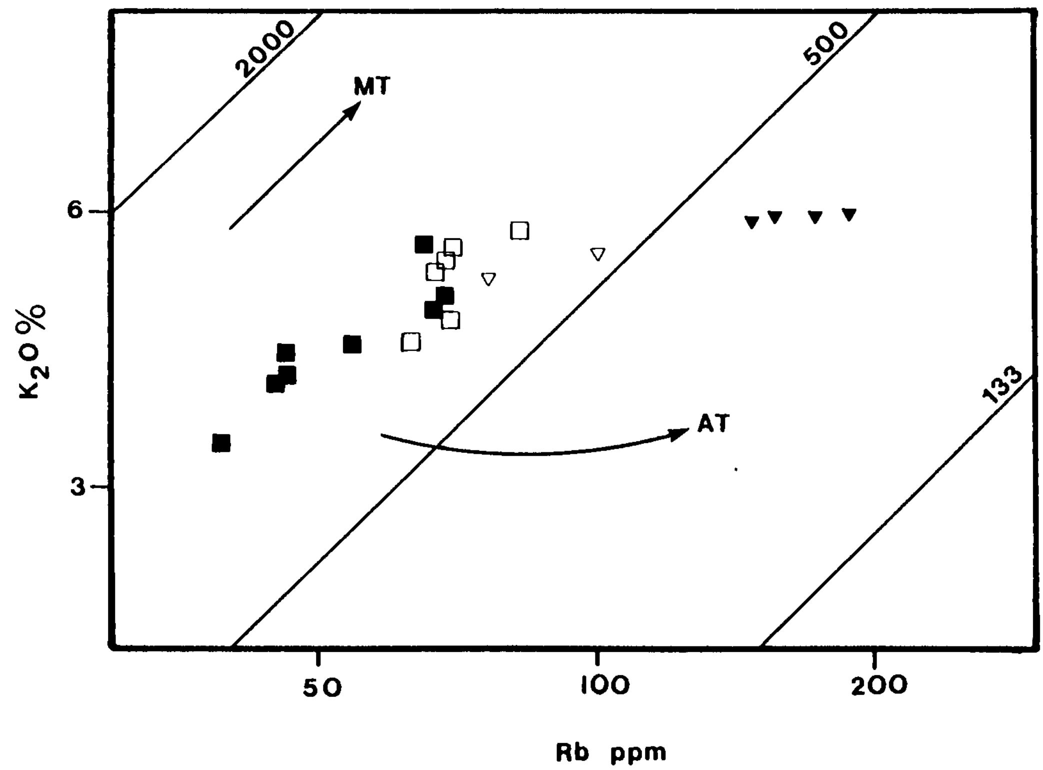



Figure 5.2.7 $K_2O$ vs. Rb variation diagram defining magmatic (MT) and autometasomatic (AT) trends, Widgiemooltha. Symbols as follows - open squares, lath-textured Binneringie syenites; solid squares, equigranular Binneringie syenites; open inverted triangles, Hogan's Find syenites; solid inverted triangles, Erayinia Granitoid Complex granites.

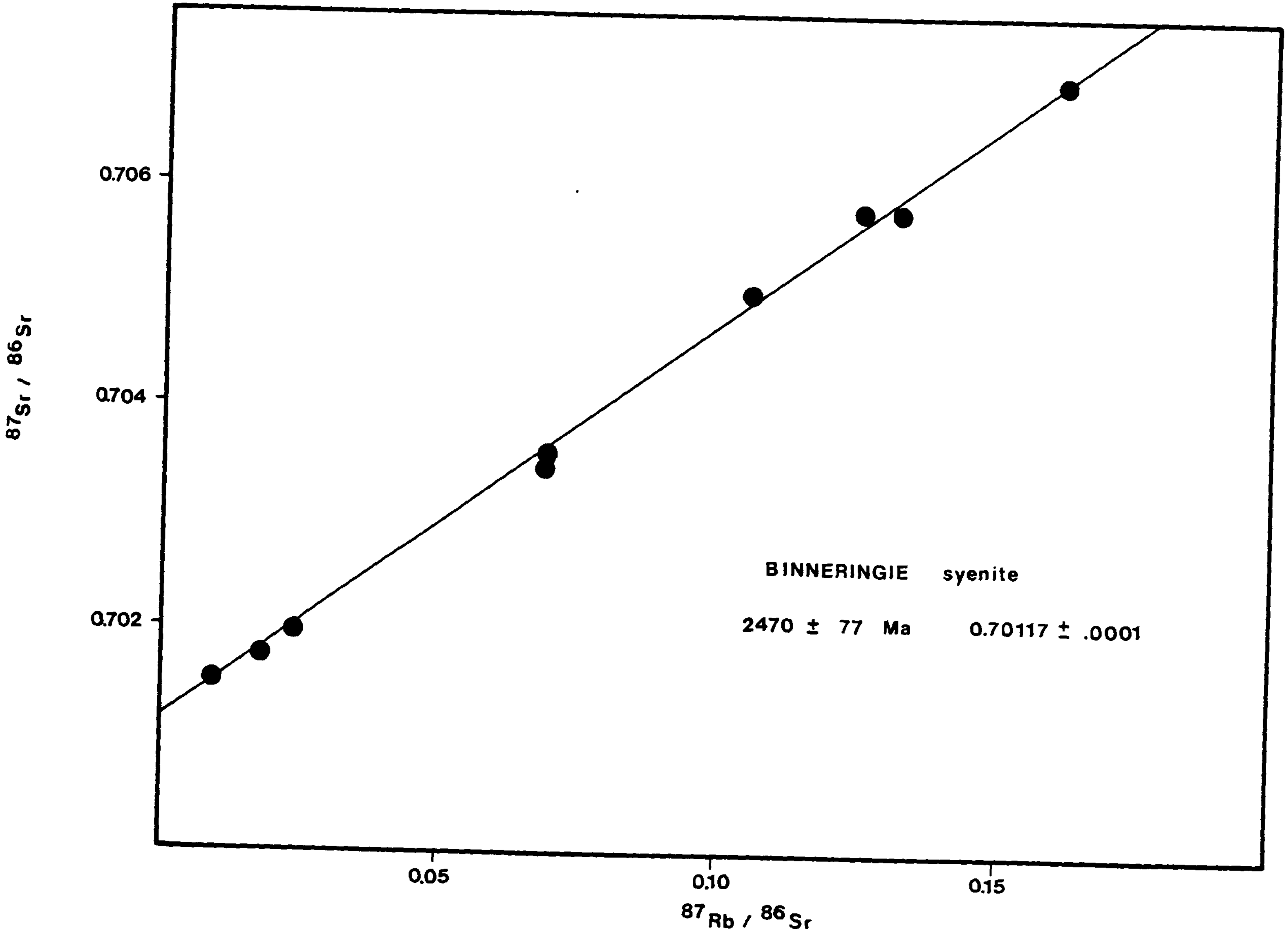



Figure 5.2.8 Rb-Sr isochron plot, Binneringie syenites.

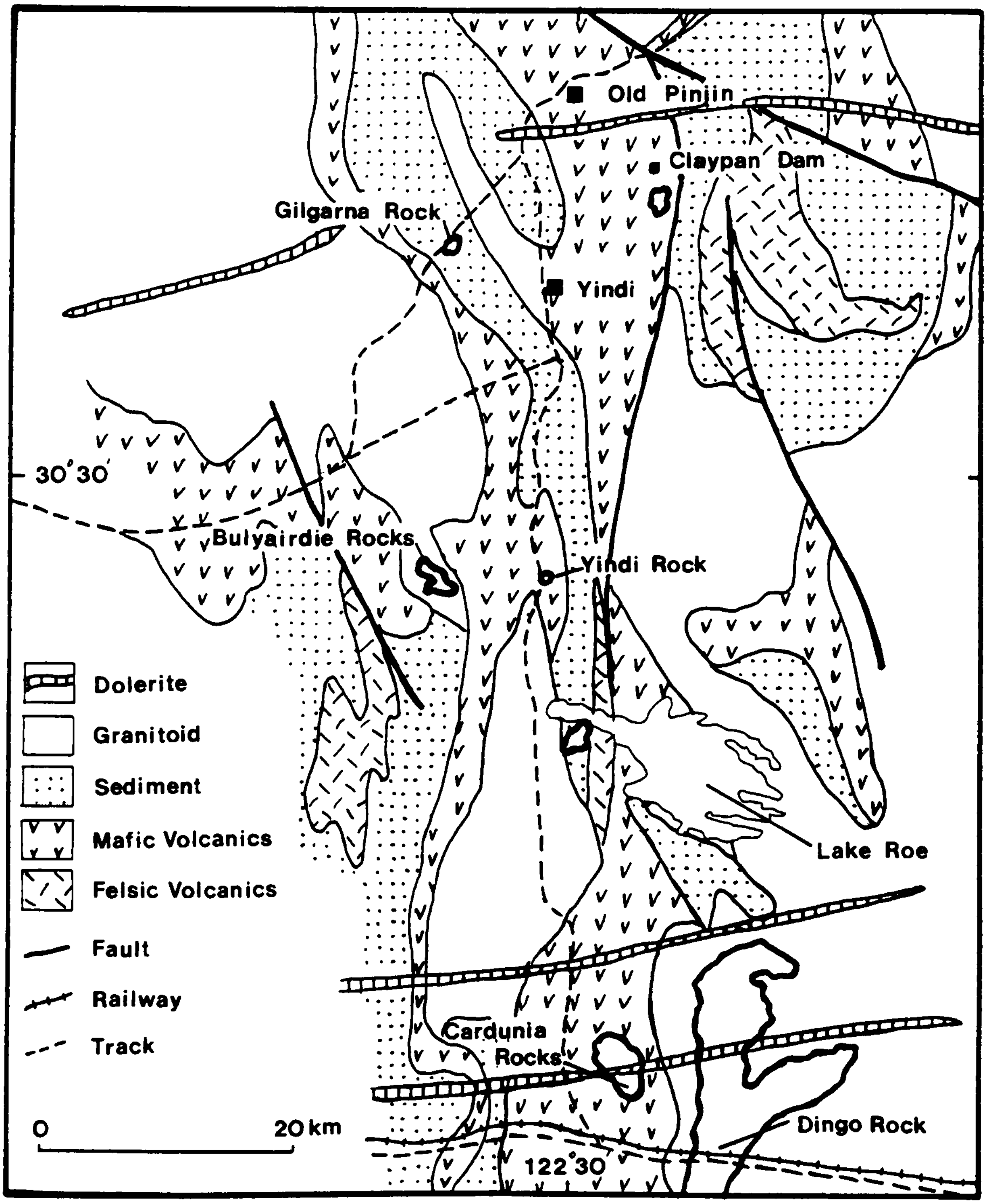



Figure 5.3.1 Regional geology and sampled localities, Kurnalpi sheet.

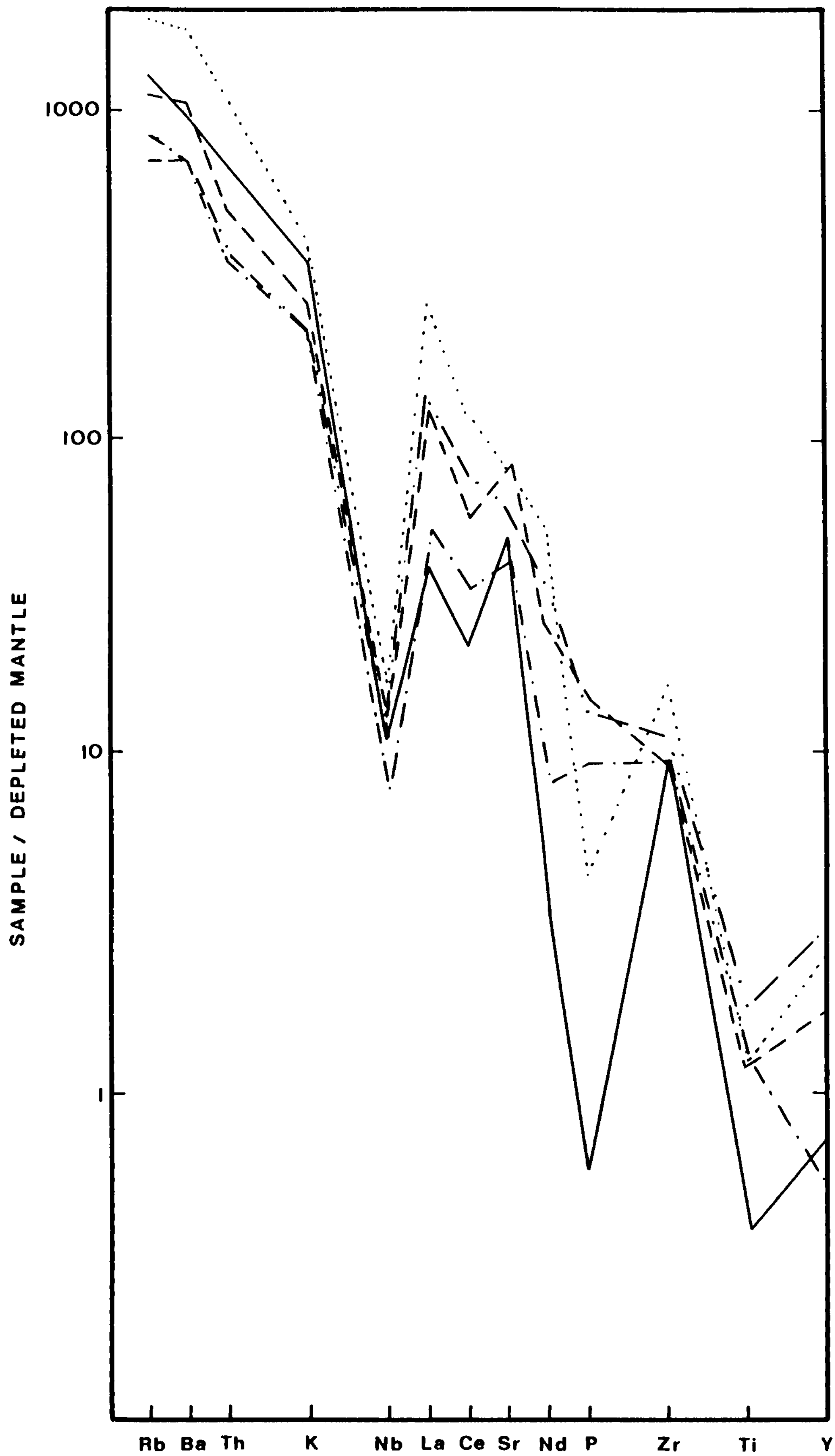



Figure 5.3.2 Depleted mantle source-normalised hygromagmatophile (HYG) element spider plot, Kurnalpi sheet. Solid line, Cardunia Rocks quartz syenites to alkali granites (average of 5); dotted line, Dingo Rock quartz monzonites (average of 6); dashed line, Bulyairdie Rocks granites (average of 2); dash-dot line, Yindi Rock granite (average of 3); dash-dash-dot line, Gilgarna Rock porphyritic monzodiorites (average of 5). Normalising factors from the N-type MORB mantle source of Wood et al (1979).

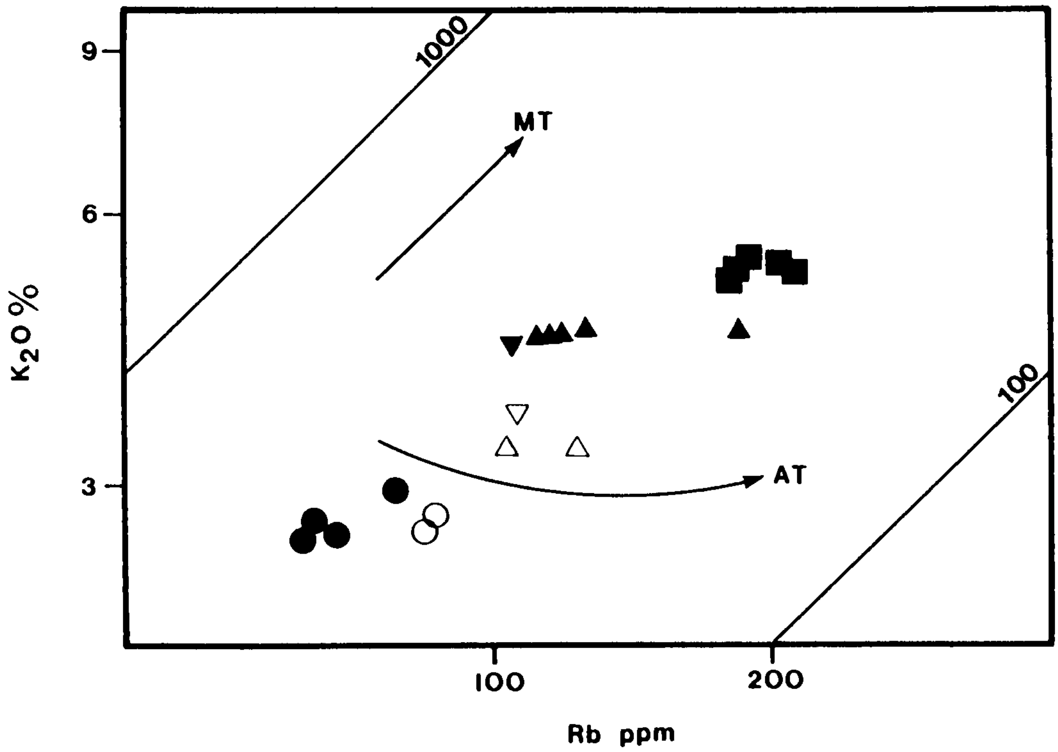



Figure 5.3.3 $K_2O$ vs. Rb variation diagram defining magmatic (MT) and autometasomatic (AT) trends, Kurnalpi. Symbols as follows - solid squares, Dingo Rock quartz monzonites; open inverted triangle, Claypan Dam granite; solid inverted triangle, Lake Roe syenite; open triangles, Bulyairdie Rocks granites; solid triangles, Cardunia Rocks quartz syenites to alkali granites; open circles, Yindi Rock granites; solid circles, Gilgarna Rock porphyritic monzodiorite.

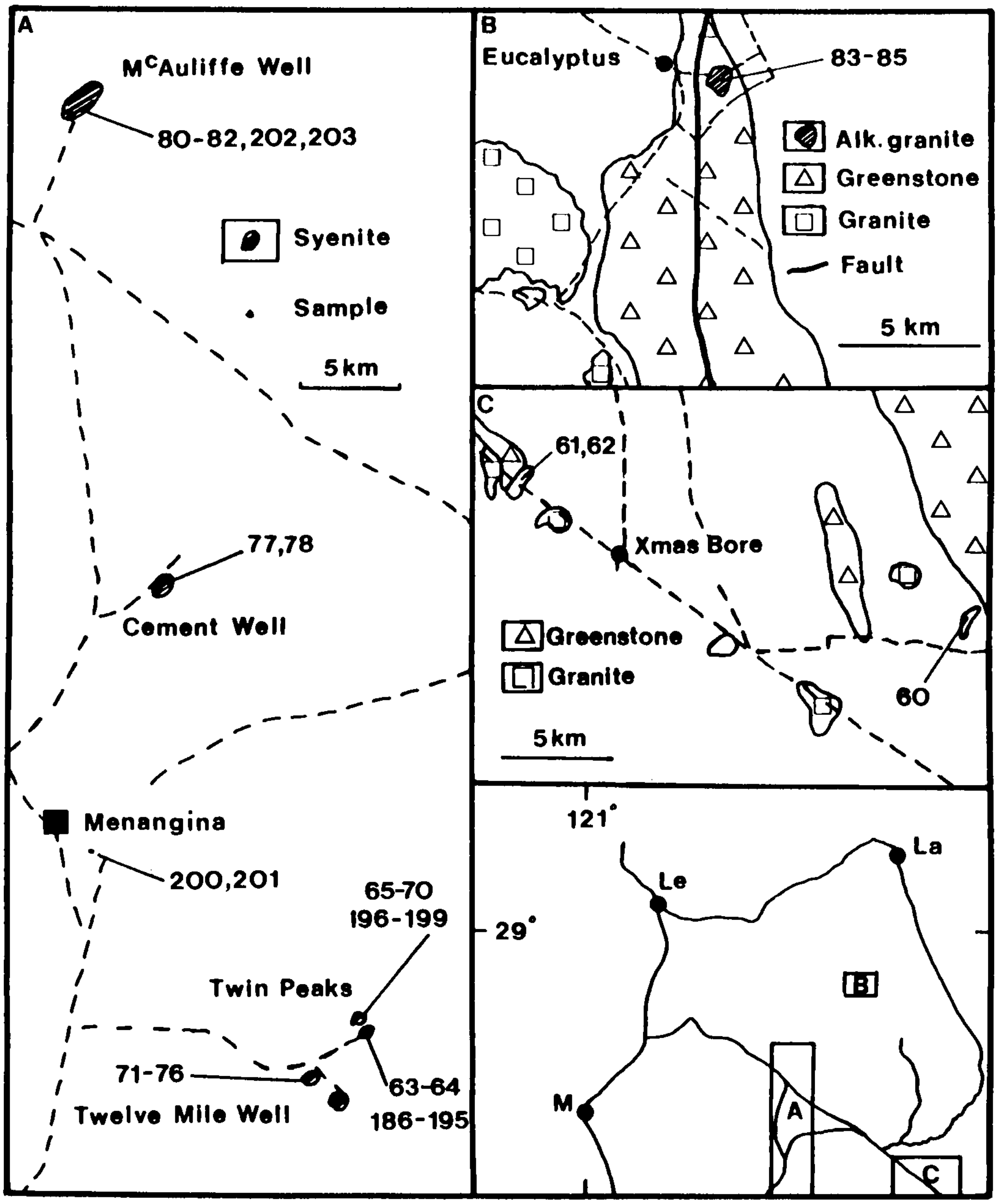



Figure 5.4.1 Regional geology and sampled localities, Edjudina sheet. M = Menzies, Le = Leonora, La = Laverton.

Figure 5.4.2

Note - for all stained slabs, yellow indicates alkali feldspar, pink indicates plagioclase feldspar. Scale in centimetres.

A. Monzonite dyke intruding layered syenite/monzodiorite, Twin Peaks south. (Lens cap sitting just above syenite/monzodiorite contact, with the syenite occupying the top right of the photo).

B. Heterogeneous syenite, in part epidotised, exhibiting abundant mafic schlieren and xenoliths, Twelve Mile Well.

C. Contact region between homogeneous syenite (top), and hornblende biotite granite (bottom), Cement Well.

D. Slabbed and stained layered syenite/monzodiorite, sample 064, Twin Peaks south.

E. Slabbed and stained homogeneous syenite, sample 077, Cement Well.

F. Slabbed and stained granite, sample 079, Cement Well.

G. Slabbed and stained alkali granite, sample 081, McAuliffe Well.

H. Slabbed and stained weathered alkali granite, sample 085, Eucalyptus. Vughs predominantly after weathered-out mafic minerals.


A
B
C
D
E
F
G
H

Figure 5.4.3

Note - for all stained slabs, yellow indicates alkali feldspar, pink indicates plagioclase feldspar. Scale in centimetres.

A. Slabbed and stained syenite, sample 088, Pig Well.

B. Slabbed and stained quartz monzonite, sample 094, Mt. MacDonald (Andy Well).

C. Oligoclase (top left) exhibiting strongly altered cores (right), and augite (bottom), monzodiorite, sample 187, Twin Peaks south. Note stubby apatite prism, bottom left. CP, FOV = 3.9mm.

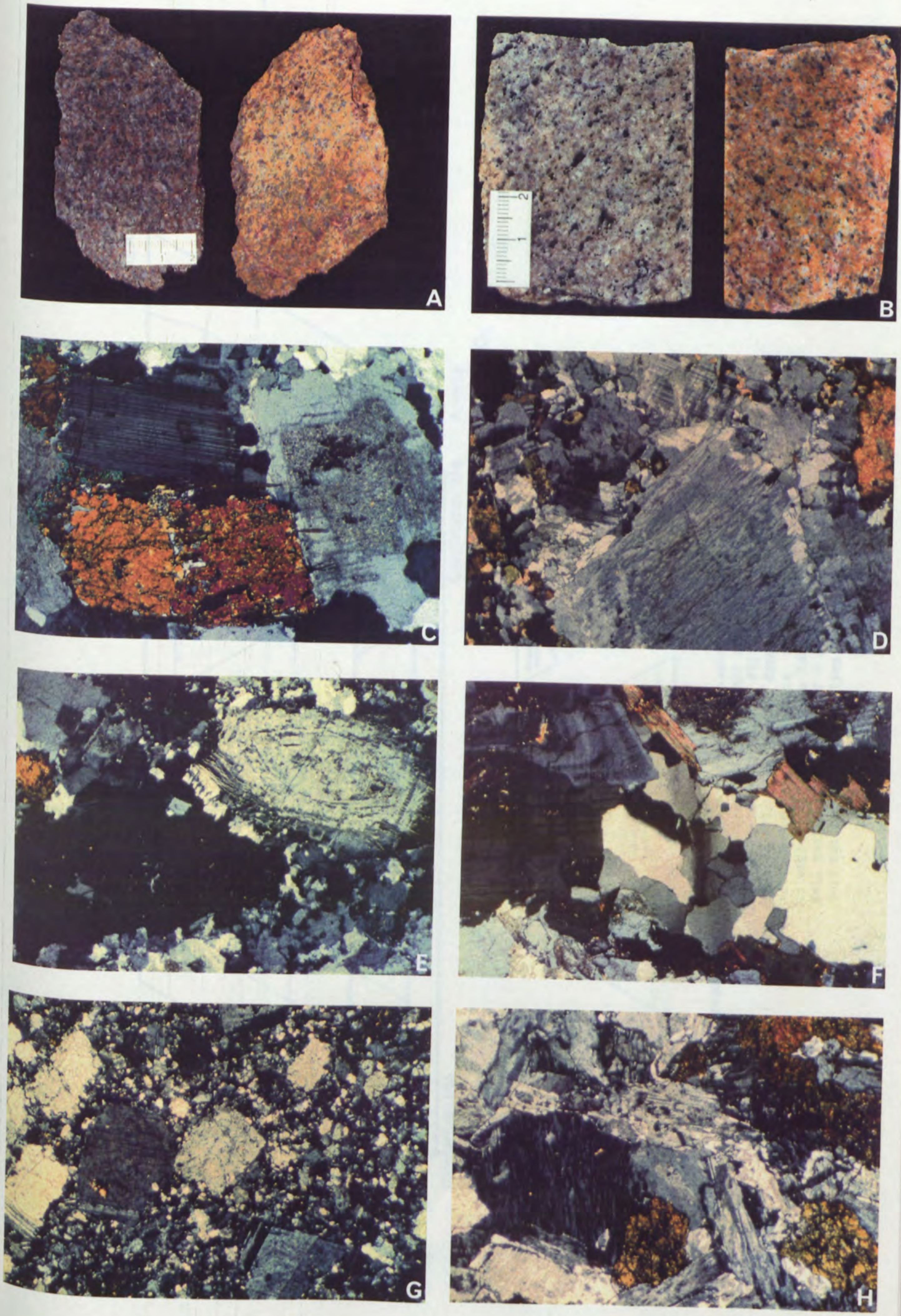
D. Alkali feldspar-dominant syenite, sample 077, Cement Well. Note zoned augite (core) / aegirine-augite (rim), top right, and minor interstitial quartz and calcite throughout. CP, FOV = 3.9mm.

E. Zoned plagioclase, top right, (albite cores gradually passing to oligoclase towards rims, then sudden Ca-rich zone (2.8%), and pure albite rims), quartz syenite, sample 203, McAuliffe Well, CP, FOV = 3.9mm.

F. Typical regional granite, sample 200, Menangina Rocks. Zoned calcic oligoclase (top left), abundant quartz (centre to bottom right), biotite (centre right). CP, FOV = 3.9mm.

G. Porphyritic alkali feldspar syenite, sample 085, Eucalyptus. Phenocrysts - albite and orthoclase, minor ex-mafics (?pyroxene); groundmass - albite, orthoclase, minor quartz. CP, FOV = 3.9mm.

H. Anorthoclase and aegirine-augite dominant syenite, sample 086, Pig Well. Note ubiquitous swapped margins on feldspars. CP, FOV = 3.9mm.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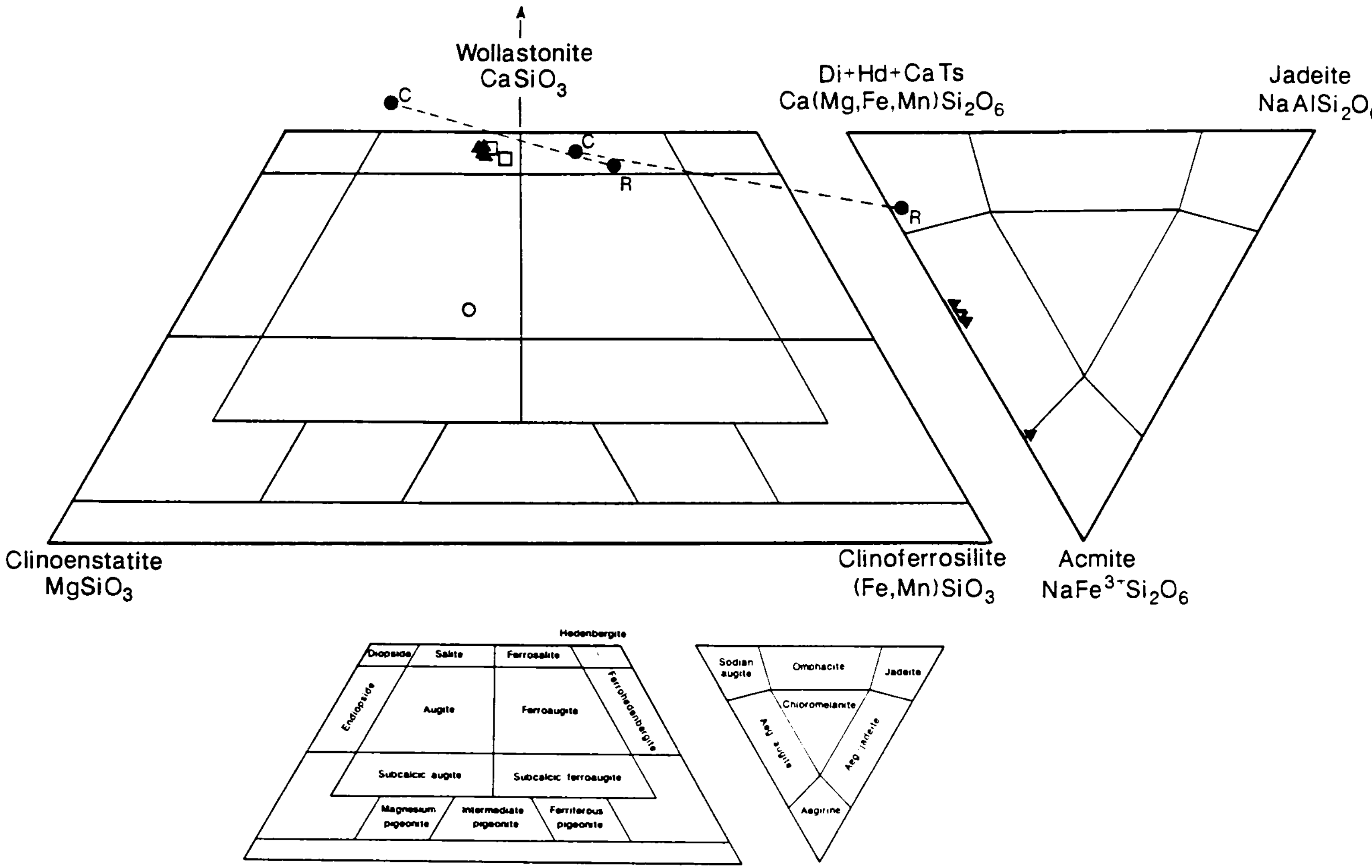



Figure 5.4.4 Pyroxene classification diagram. Edjudina sheet samples - solid triangles, Twin Peaks monzodiorite 067; open squares, Twelve Mile Well syenite 072; solid circles, Cement Well syenite 077; open circle, Cement Well syenite 078 (intergrown with hornblende). Leonora sheet samples - inverted open triangles, Pig Well syenite 090; inverted solid triangles, Pig Well quartz syenite 092. C = core R = rim, tie-lines connect core and rim compositions from individual crystals.

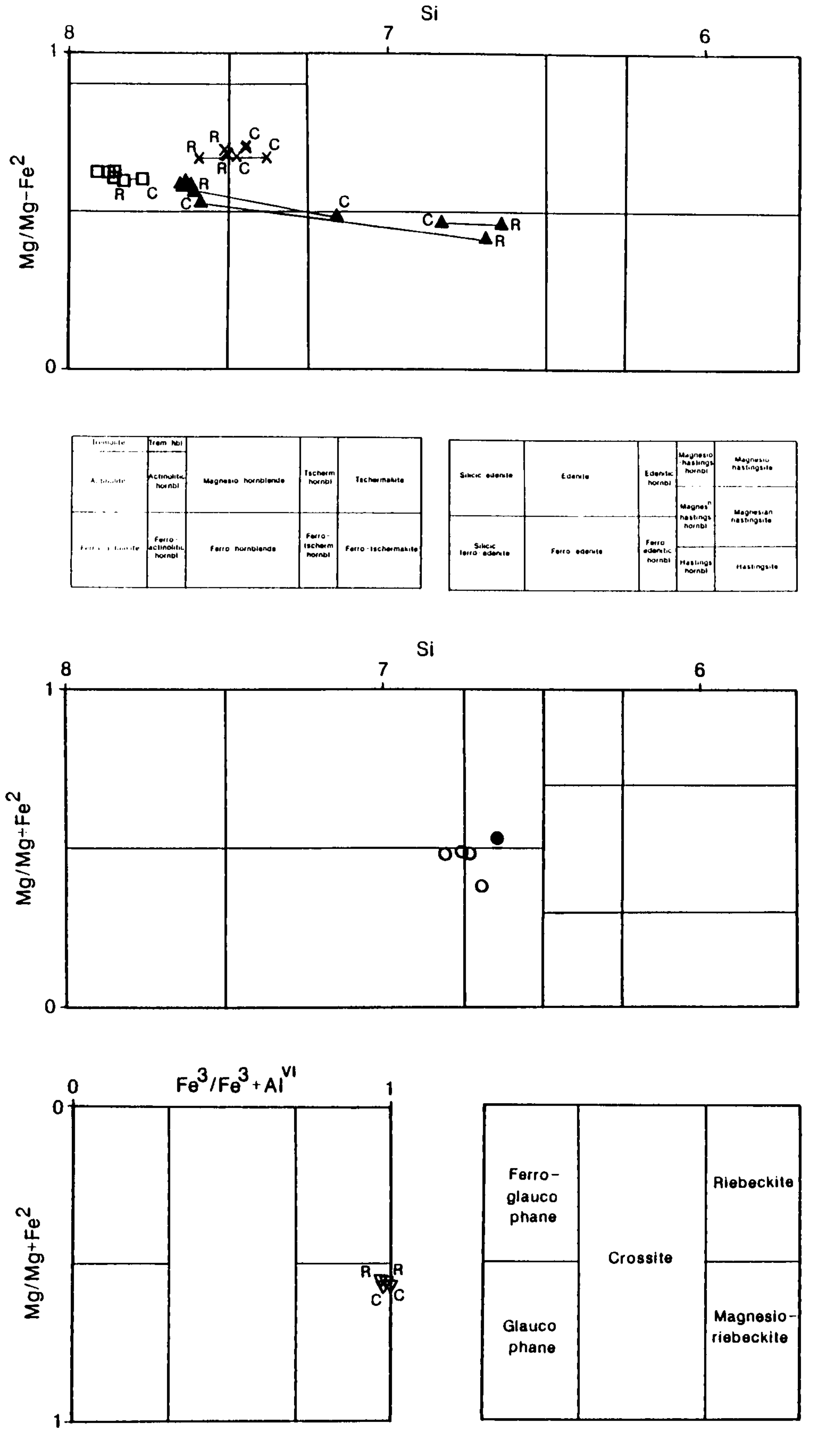


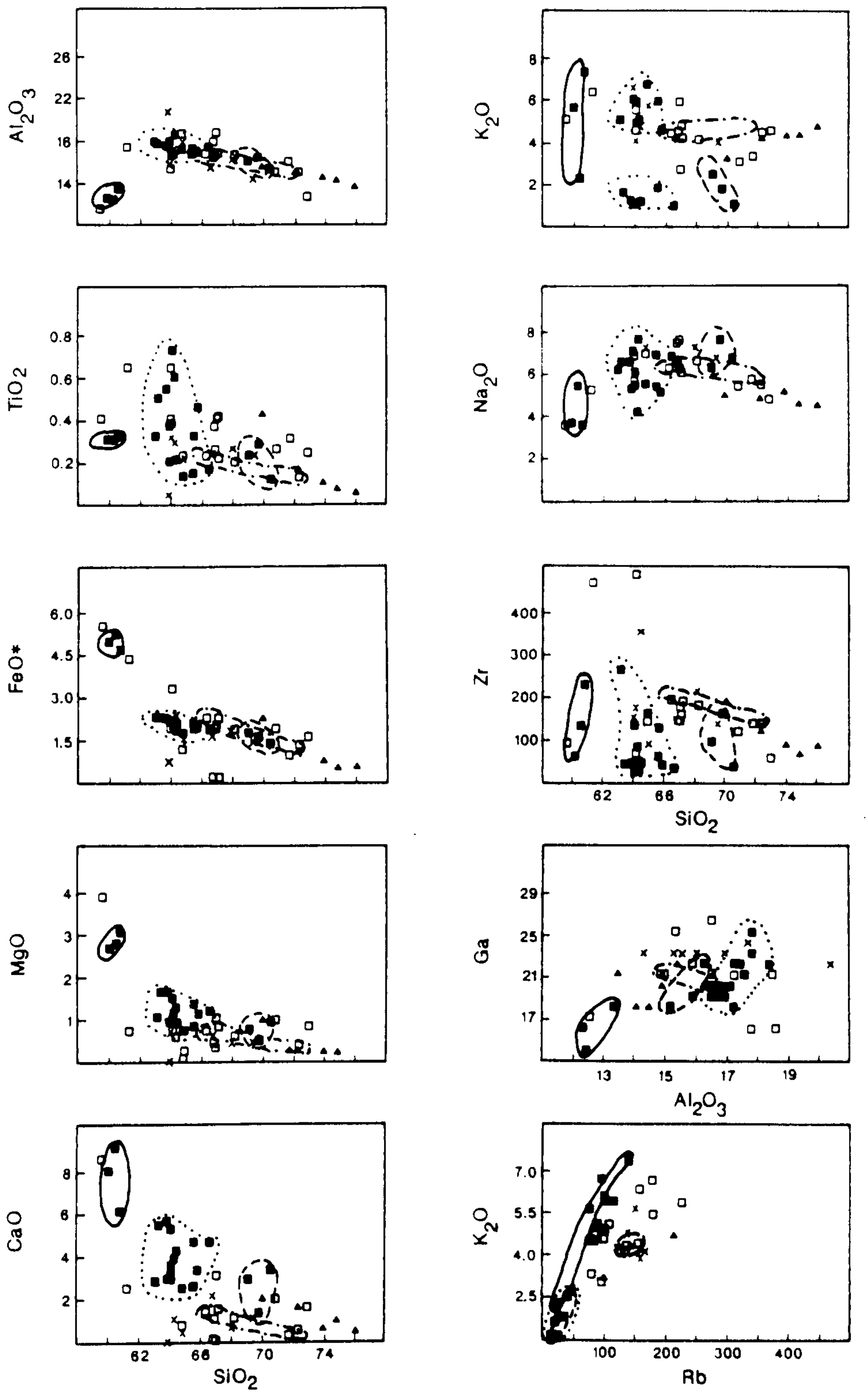

**Figure 5.4.5** **Amphibole classification diagram. Edjudina sheet samples - solid triangles, Twin Peaks monzodiorite 067; open squares, Twelve Mile Well syenite 072; solid circles, Cement Well syenite 077; open circles, Cement Well syenite 078; crosses, McAuliffe Well quartz syenite 203. Leonora sheet samples - inverted open triangles, Pig Well syenite 090. C = core, R = rim, tie-lines connect core and rim compositions from individual crystals.**

Figure 5.4.6 Whole rock major and trace element variation diagrams. Major element oxides in wt%, trace elements in p.p.m.

Edjudina samples - solid triangles, regional granitoids (samples 60,61,62,200,201); solid squares, Twin Peaks syenites (samples 70,186,188), monzonite/monzodiorites (samples 63,64,65,66,67,189,191,193,194,195,196,197,198,199), quartz monzodiorites (samples 69,187,190); open squares, Twelve Mile Well syenites and granites (samples 71,72,73,74), Cement Well syenites and granites (samples 77,78,79), McAuliffe Well quartz syenites (samples 80,81,82,203), Eucalyptus syenite (sample 85). Laverton samples - open squares, Granite Well syenite (samples 204,205). Leonora samples - crosses, Pig Well syenites (samples 86,87,88,89,90,91,92).

Groups outlined on overlay as follows -

| | |
|---|---|
| _________ | Twin Peaks syenite |
| ......... | Twin Peaks monzonite/monzodiorite |
| --------- | Twin Peaks quartz monzodiorite |
| ._._._._ | McAuliffe Well quartz syenite |



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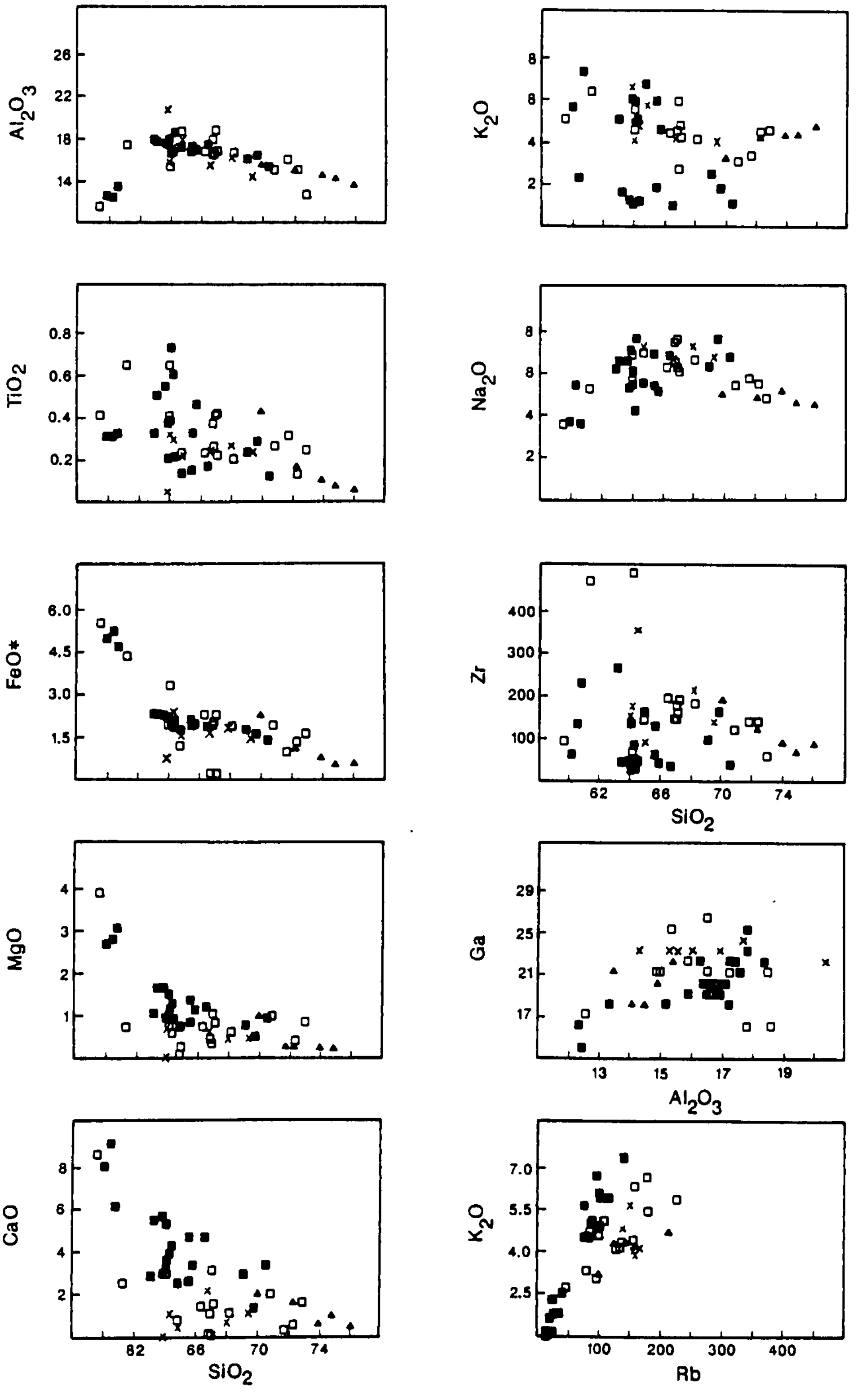
26
22
18
14
$K_2O$
8
6
4
2
$TiO_2$
0.8
0.6
0.4
0.2
$Na_2O$
8
6
4
2
FeO*
6.0
4.5
3.0
1.5
Zr
400
300
200
100
62
66
70
74
$SiO_2$
MgO
4
3
2
1
Ga
29
25
21
17
13
15
17
19
$Al_2O_3$
CaO
8
6
4
2
62
66
70
74
$SiO_2$
$K_2O$
7.0
5.5
4.0
2.5
100
200
300
400
Rb



$Al_2O_3$
26
22
18
14
$K_2O$
8
6
4
2
$TiO_2$
0.8
0.6
0.4
0.2
$Na_2O$
8
6
4
2
FeO*
6.0
4.5
3.0
1.5
Zr
400
300
200
100
62
66
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74
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MgO
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21
17
13
15
17
19
$Al_2O_3$
CaO
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6
4
2
82
66
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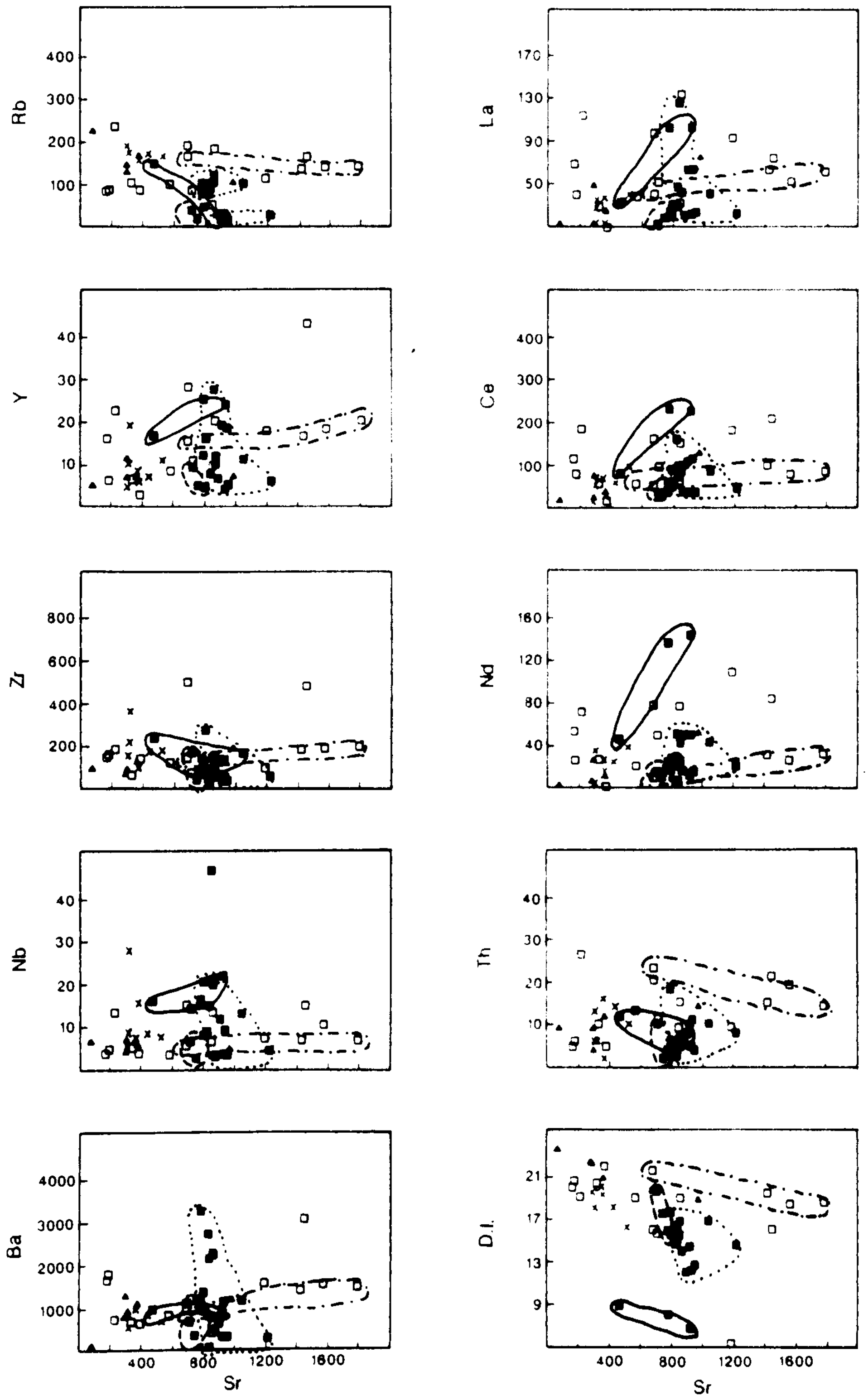
7.0
5.5
4.0
2.5
100
200
300
400
Rb


Rb
400
300
200
100
La
170
130
90
50
Y
40
30
20
10
Ce
400
300
200
100
Zr
800
600
400
200
Nd
160
120
80
40
Nb
40
30
20
10
Th
40
30
20
10
Ba
4000
3000
2000
1000
D.I.
21
17
13
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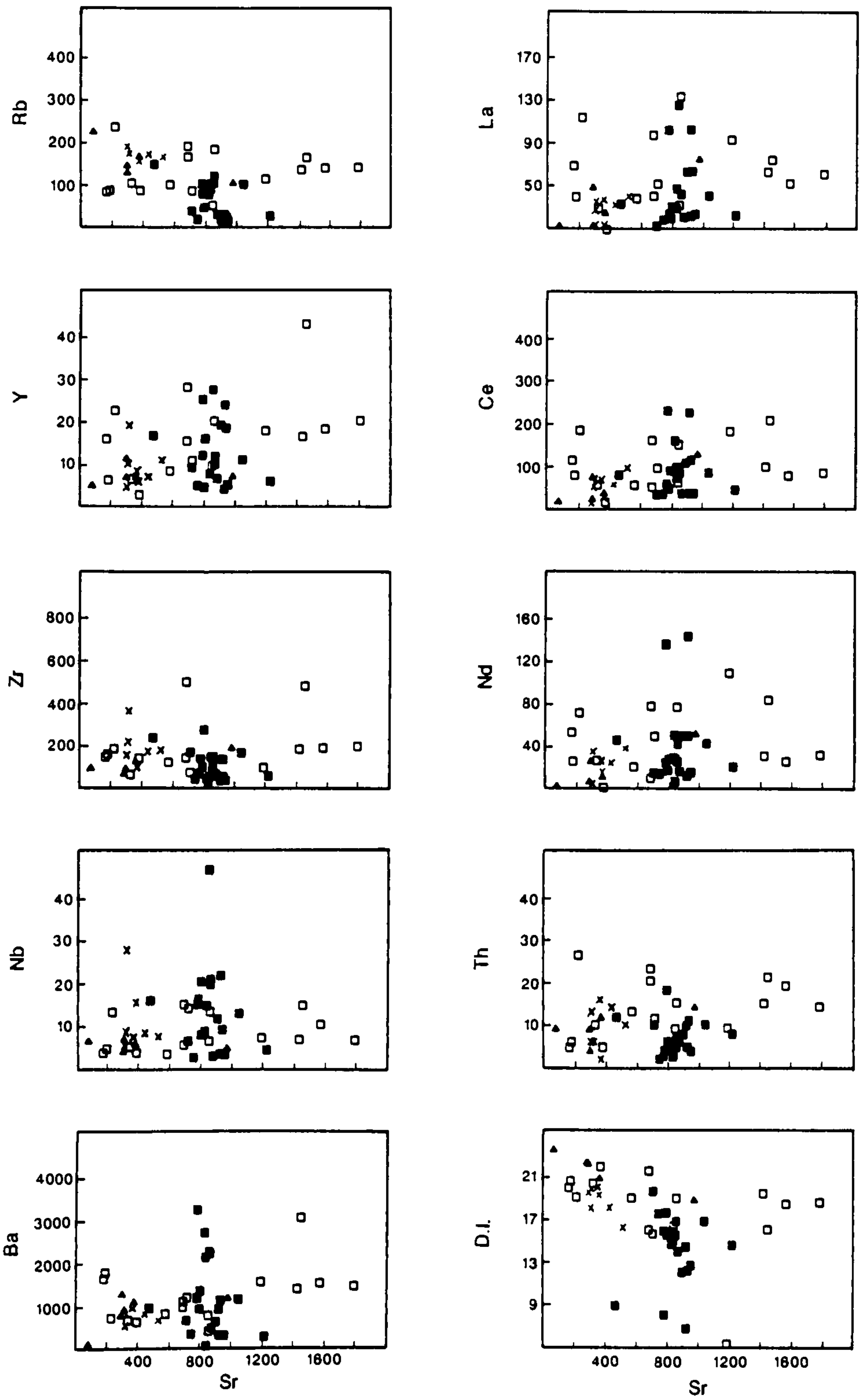
400
800
1200
1600
Sr
400
800
1200
1600
Sr



Rb
400
300
200
100
La
170
130
90
50
Y
40
30
20
10
Ce
400
300
200
100
Zr
800
600
400
200
Nd
160
120
80
40
Nb
40
30
20
10
Th
40
30
20
10
Ba
4000
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D.I.
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800
1200
1600
Sr
400
800
1200
1600
Sr

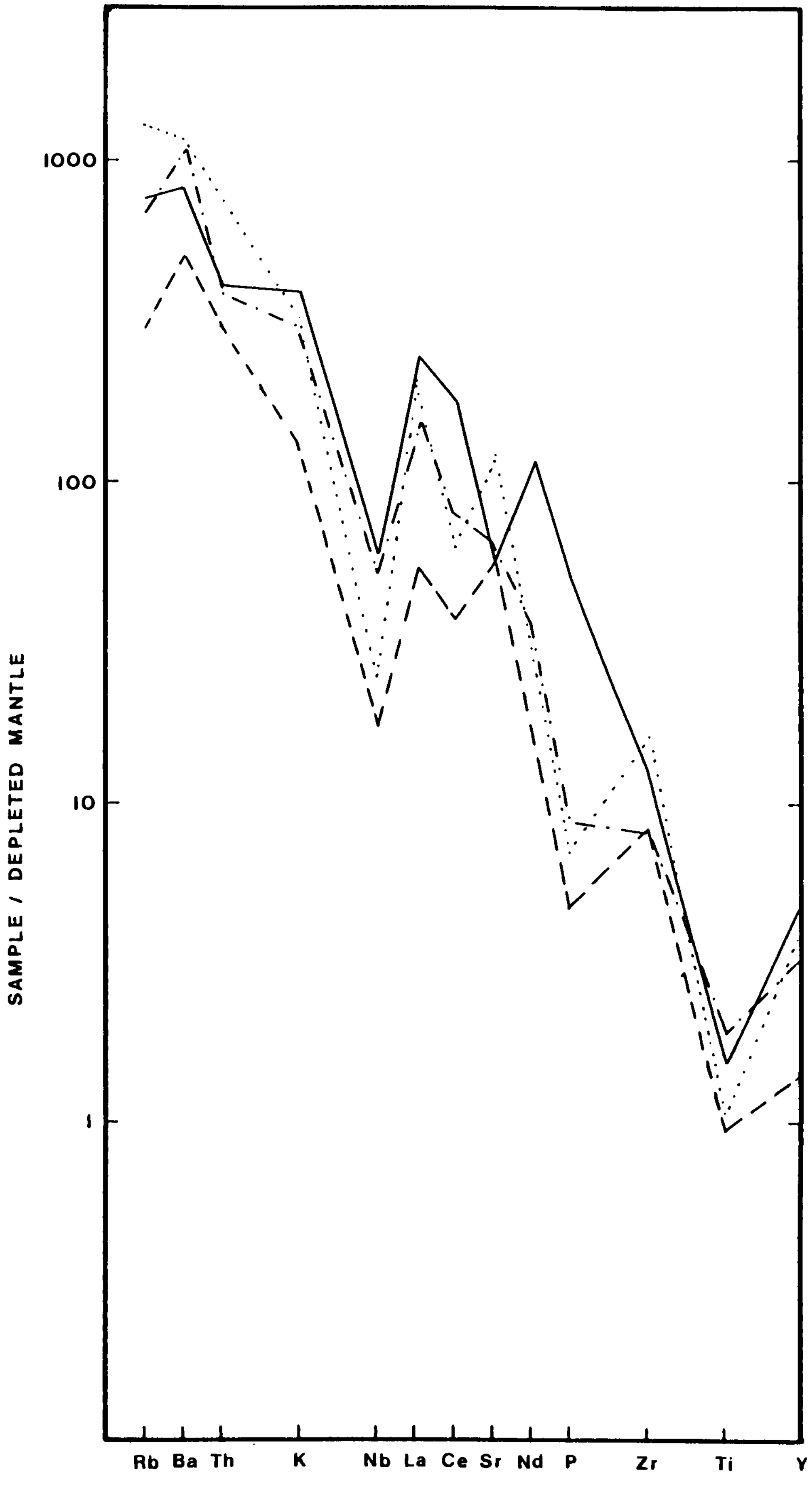



Figure 5.4.7 Depleted mantle source-normalised hygromagmatophile (HYG) element spider plot, Edjudina. Solid line, Twin Peaks syenites (average of 3); dash-dot line, Twin Peaks monzonite/monzodiorites (average of 14); dashed line, Twin Peaks quartz monzodiorites (average of 3); dotted line, McAuliffe Well quartz monzonites/syenites (average of 4). Normalising factors from the N-type MORB mantle source of Wood et al (1979).

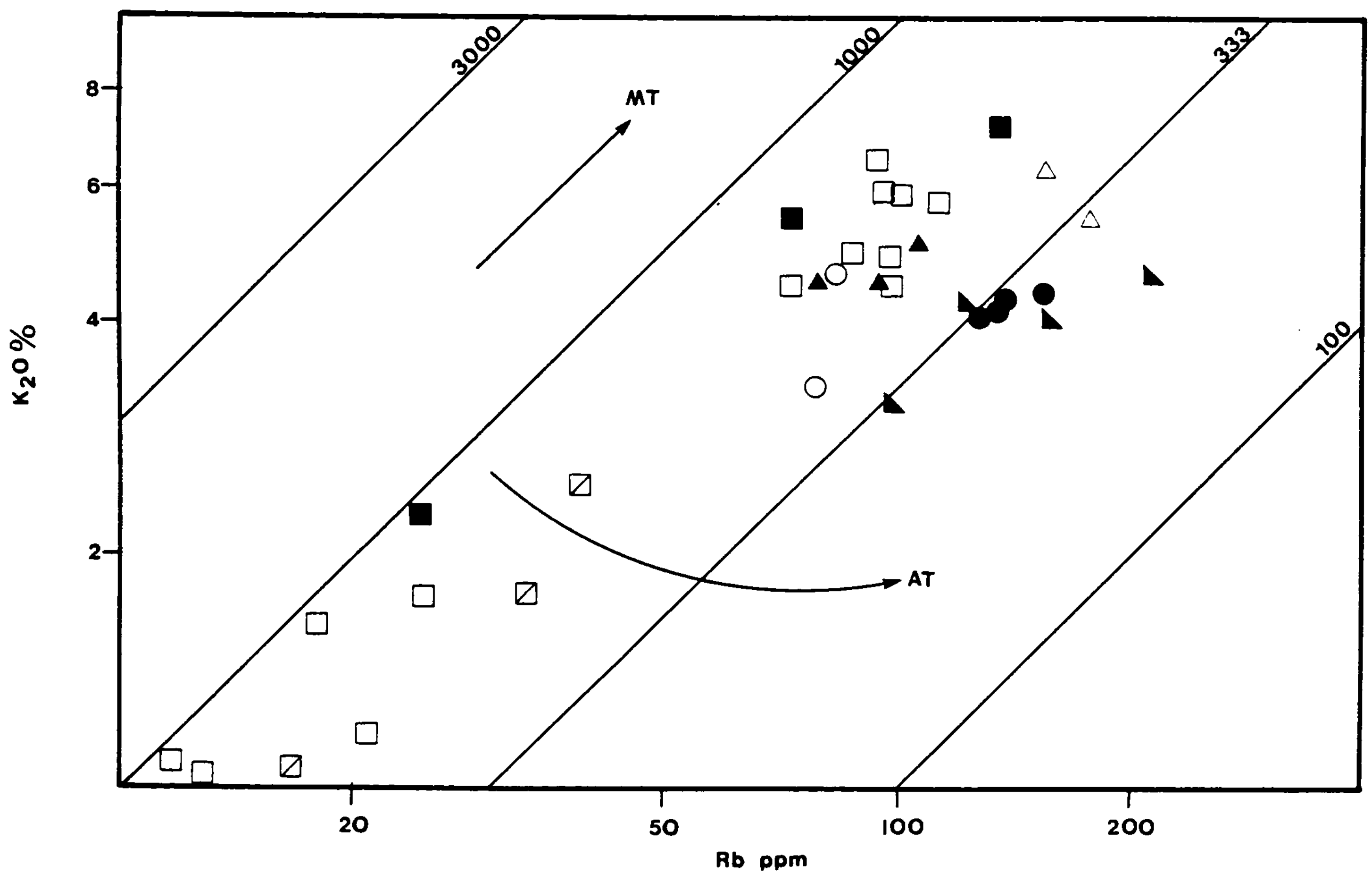



Figure 5.4.8 $K_2O$ vs. Rb variation diagram defining magmatic (MT) and autometasomatic (AT) trends, Edjudina. Symbols as follows - solid squares, Twin Peaks syenites; open squares, Twin Peaks monzonites/monzodiorites; diagonal-lined open squares; Twin Peaks quartz monzodiorites; solid triangles, Twelve Mile Well syenites; open triangles, Cement Well syenites; solid circles, McAuliffe Well quartz monzonites/syenites; open circles, Eucalyptus syenites; solid half-squares, regional granitoids.

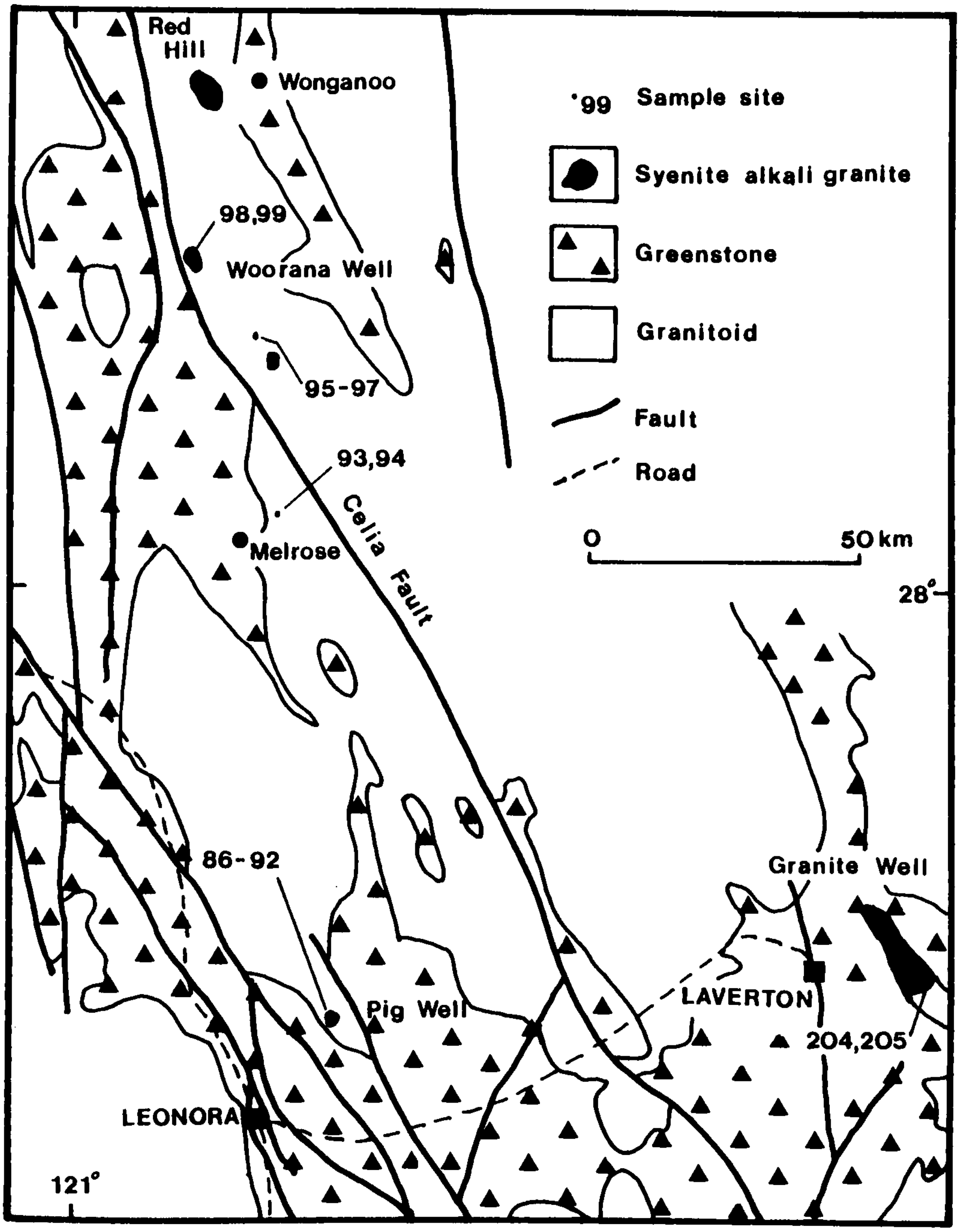



Figure 5.5.1 Regional geology and syenite localities, Leonora, Laverton and Sir Samuel sheets.

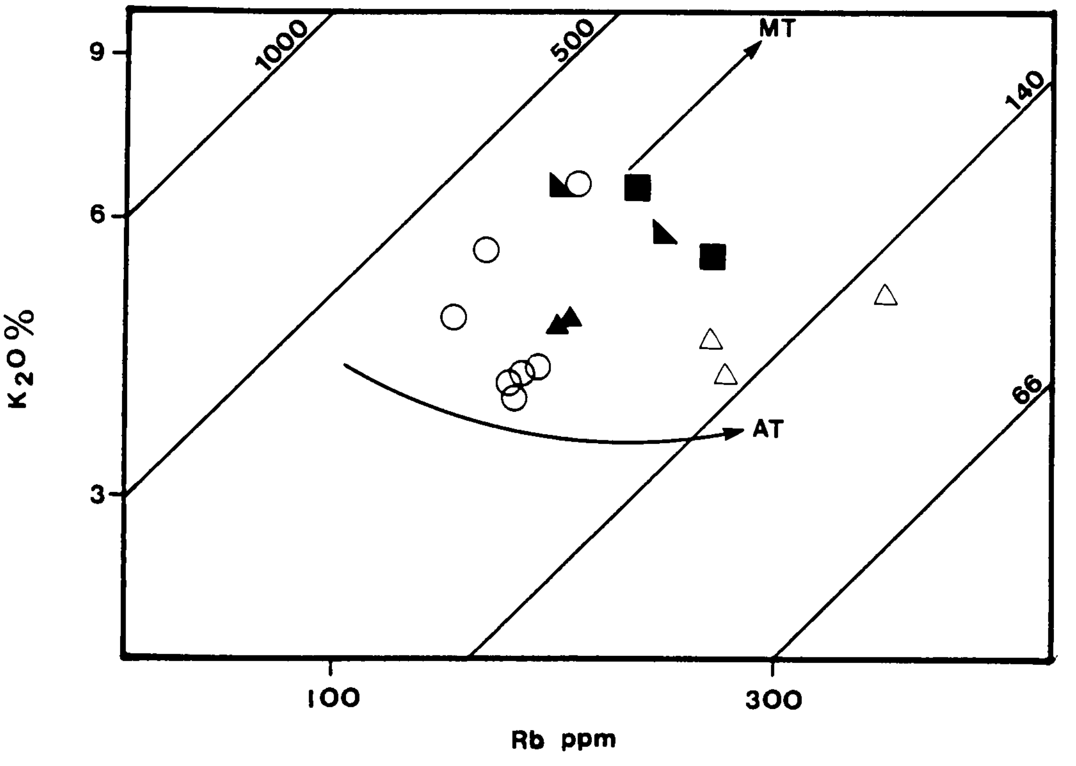



Figure 5.5.2 $K_2O$ vs. Rb variation diagram defining magmatic (MT) and autometasomatic (AT) trends, Leonora, Laverton and Sir Samuel. Symbols as follows - open circles, Pig Well syenites; solid half-squares, Granite Well syenites; solid triangles, Andy Well quartz monzonites; open triangles, Little Well alkali granites; solid squares, Woorana Well syenite and granite.

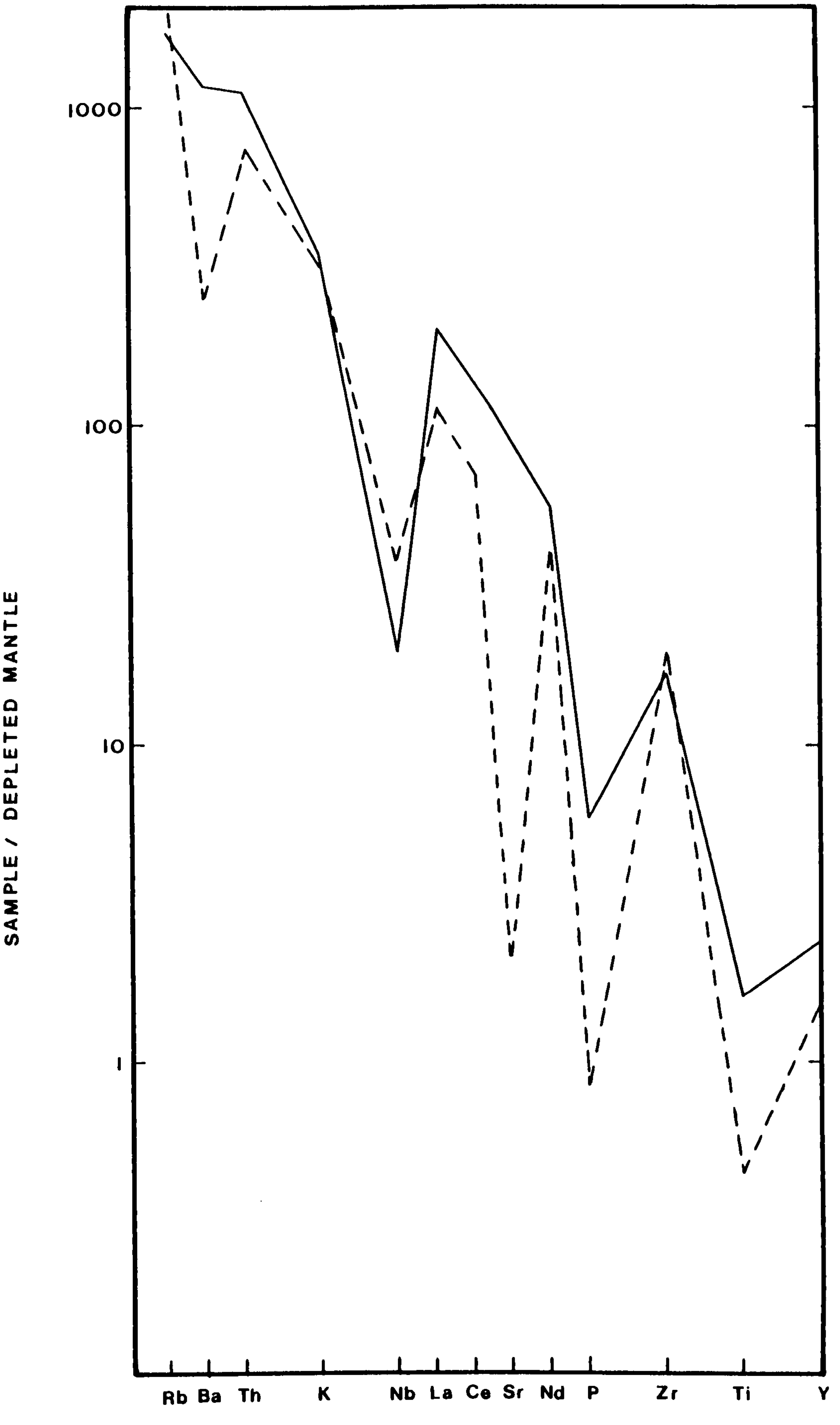



Figure 5.5.3 Depleted mantle source-normalised hygromagmatophile (HYG) element spider plot, Sir Samuel. Solid line, Andy Well quartz monzonites (average of 2); dashed line, Little Well alkali granites (average of 3). Normalising factors from the N-type MORB mantle source of Wood et al (1979).

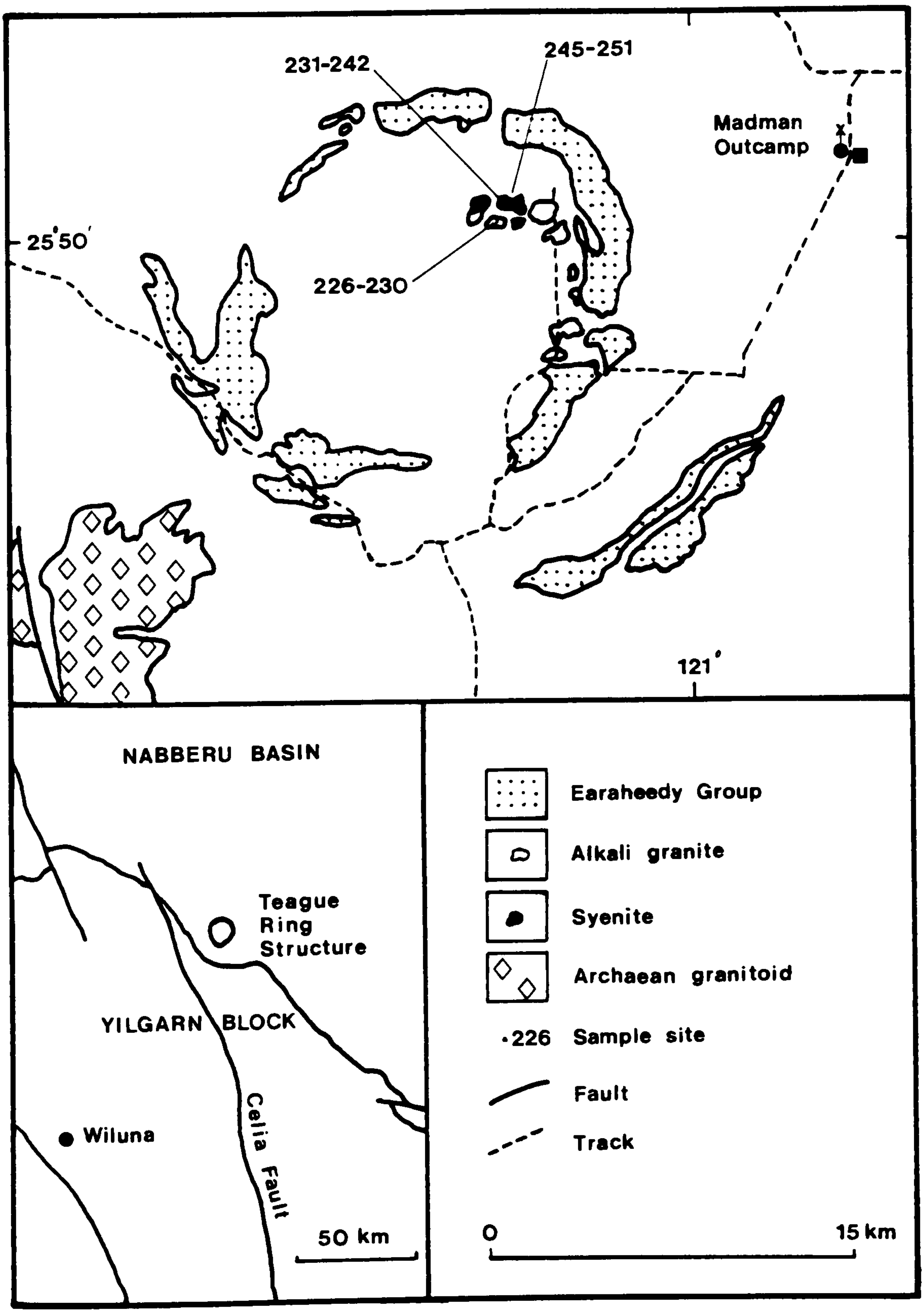



Figure 5.6.1 Geological setting of the Teague Ring Structure.

Figure 5.6.2

Note - for all stained slabs, yellow indicates alkali feldspar, pink indicates plagioclase feldspar. Scale in centimetres.

A. Rubbly alkali feldspar quartz syenite outcrop, central Teague Ring Structure, vicinity sample site 234.

B. Explosive-textured syenite outcrop, central Teague Ring Structure, vicinity sample site 252.

C. Fracture/breccia-textured syenite, central Teague Ring Structure, vicinity sample site 252.

D. Slabbed and stained alkali granite (sample 230, with scale), and alkali feldspar quartz syenite (samples 231,242), central Teague Ring Structure.

E. Slabbed and stained syenite, sample 252, central Teague Ring Structure.

F. Pseudotachylite vein comprising fine-grained quartz-feldspar-(opaque) assemblage, alkali granite, sample 228, central Teague Ring Structure. CP, FOV = 3.9mm.

G. Relict andradite displaying original euhedral outline, alkali feldspar quartz syenite, sample 234, central Teague Ring Structure. PPL, FOV = 3.9mm.

H. Deformation lamellae across the length of stubby aegirine-augite prisms (centre), syenite, sample 248, central Teague Ring Structure. Note mesoperthite (top right). CP, FOV = 3.9mm.


A
B
C
D
E
F
G
H

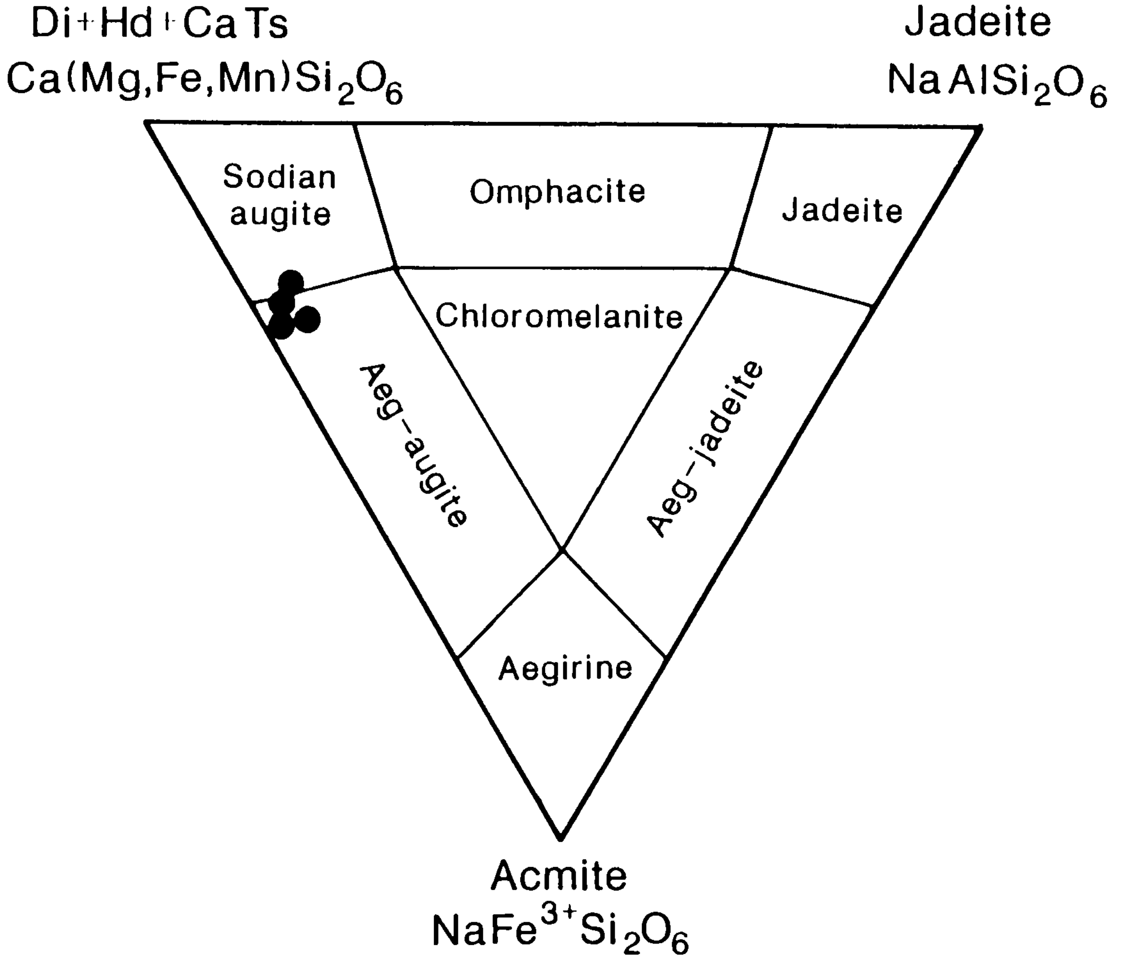



Figure 5.6.3 Pyroxene classification diagram, Teague Ring Structure. Solid circles, syenite 252.

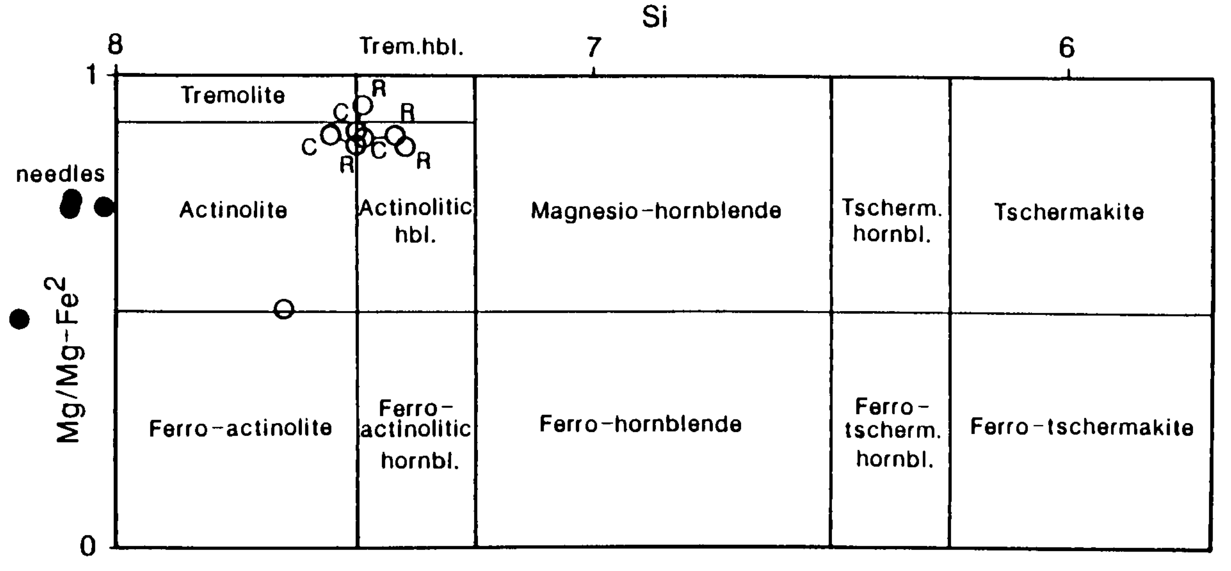
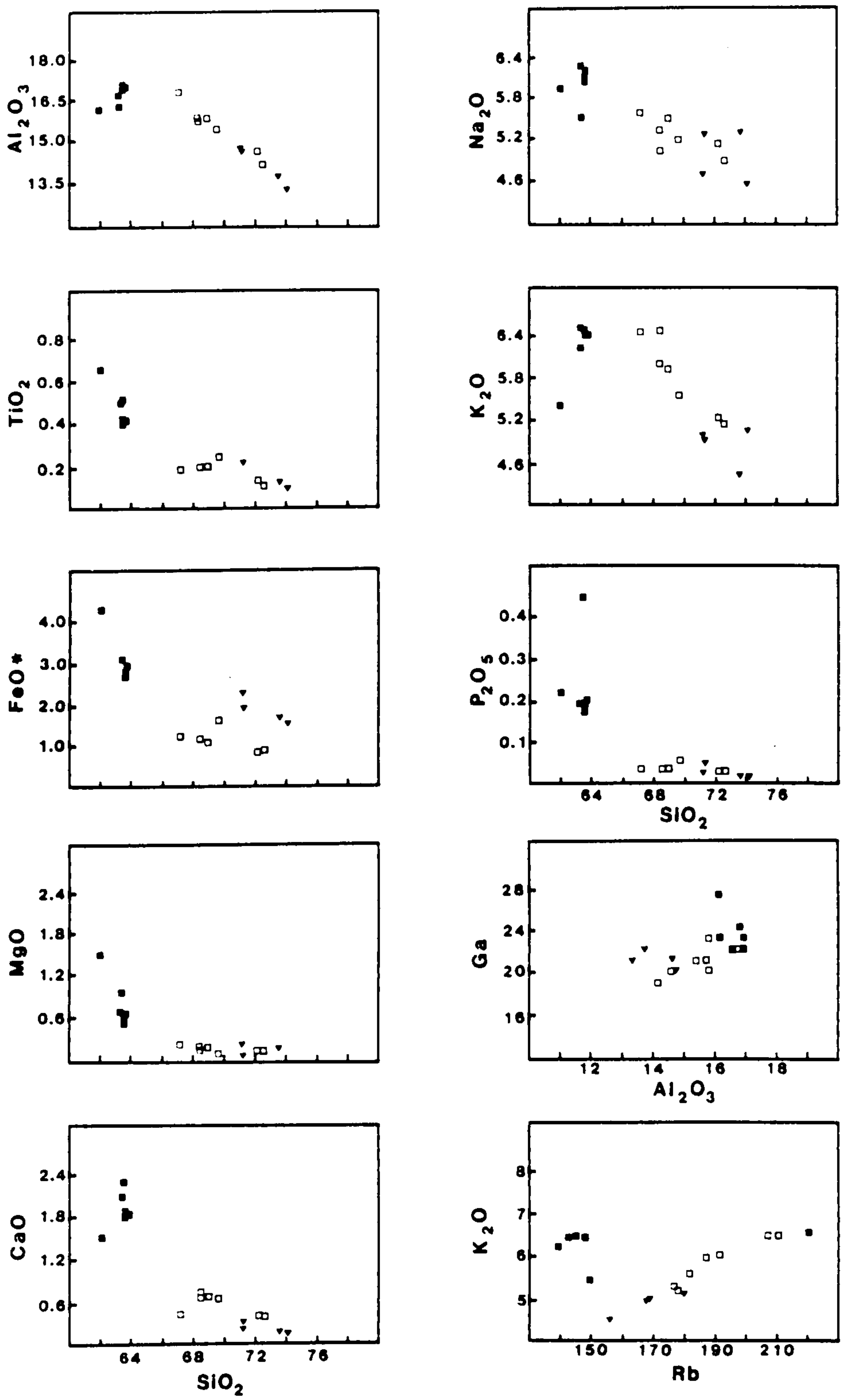


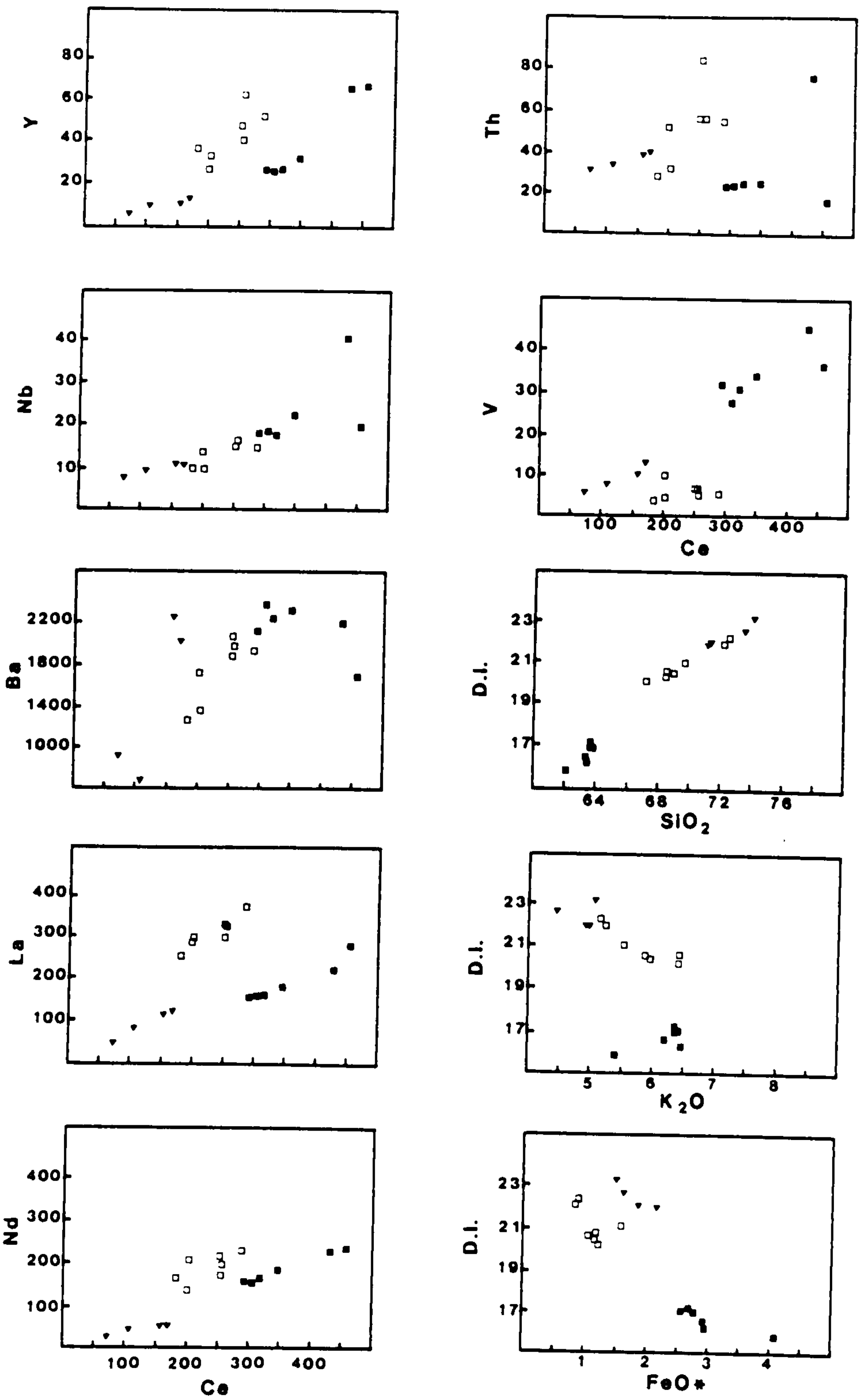

**Figure 5.6.4** Amphibole classification diagram, Teague Ring Structure. Solid circles, syenite 252 (non-stoichiometric needles); open circles, alkali feldspar quartz syenite 234. C = core, R = rim, tie-lines connect core and rim compositions from individual crystals.

Figure 5.6.5 Whole rock major and trace element variation diagrams, Teague Ring Structure. Major element oxides in wt%, trace elements in p.p.m.

Solid inverted triangles, alkali granite (samples 226,227,228,230); open squares, alkali feldspar quartz syenite (samples 231,232,234,236,239,240,242); solid squares, syenite (samples 059,245,247,248,249,251).



$Al_2O_3$
18.0
16.5
15.0
13.5
$Na_2O$
6.4
5.8
5.2
4.6
$TiO_2$
0.8
0.6
0.4
0.2
$K_2O$
6.4
5.8
5.2
4.6
FeO*
4.0
3.0
2.0
1.0
$P_2O_5$
0.4
0.3
0.2
0.1
64
68
72
76
$SiO_2$
MgO
2.4
1.8
1.2
0.6
Ga
28
24
20
16
12
14
16
18
$Al_2O_3$
CaO
2.4
1.8
1.2
0.6
64
68
72
76
$SiO_2$
$K_2O$
8
7
6
5
150
170
190
210
Rb


Y
80
60
40
20
Th
80
60
40
20
Nb
40
30
20
10
V
40
30
20
10
100 200 300 400
Ce
Ba
2200
1800
1400
1000
D.I.
23
21
19
17
64 68 72 76
SiO2
La
400
300
200
100
D.I.
23
21
19
17
5 6 7 8
K2O
Nd
400
300
200
100
100 200 300 400
Ce
D.I.
23
21
19
17
1 2 3 4
FeO*

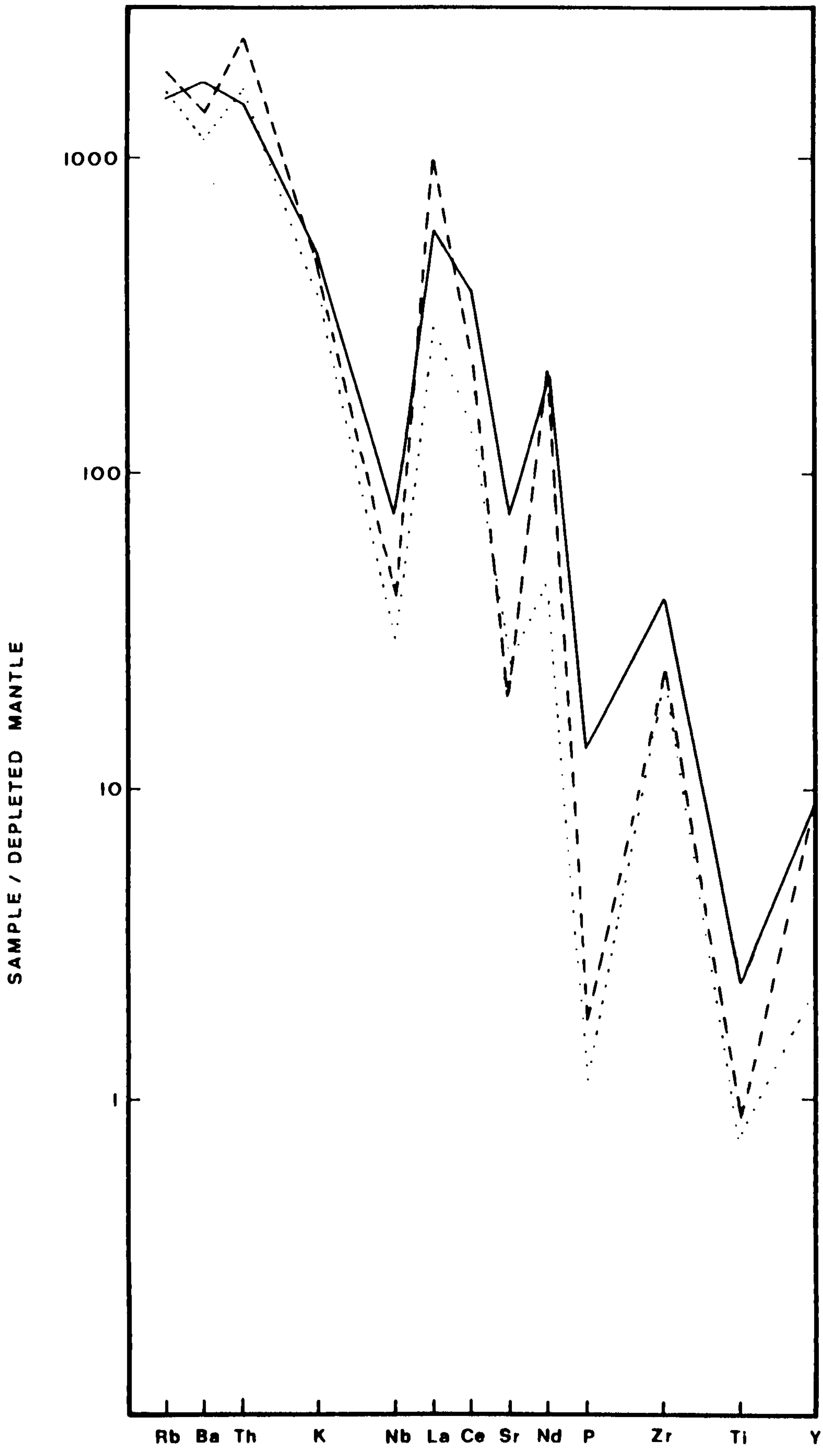



Figure 5.6.6 Depleted mantle source-normalised hygromagmatophile (HYG) element spider plot, Teague Ring Structure. Solid line, syenites (average of 5); dashed line, alkali feldspar quartz syenites (average of 7); dotted line, alkali granites, (average of 4). Normalising factors from the N-type MORB mantle source of Wood et al (1979).

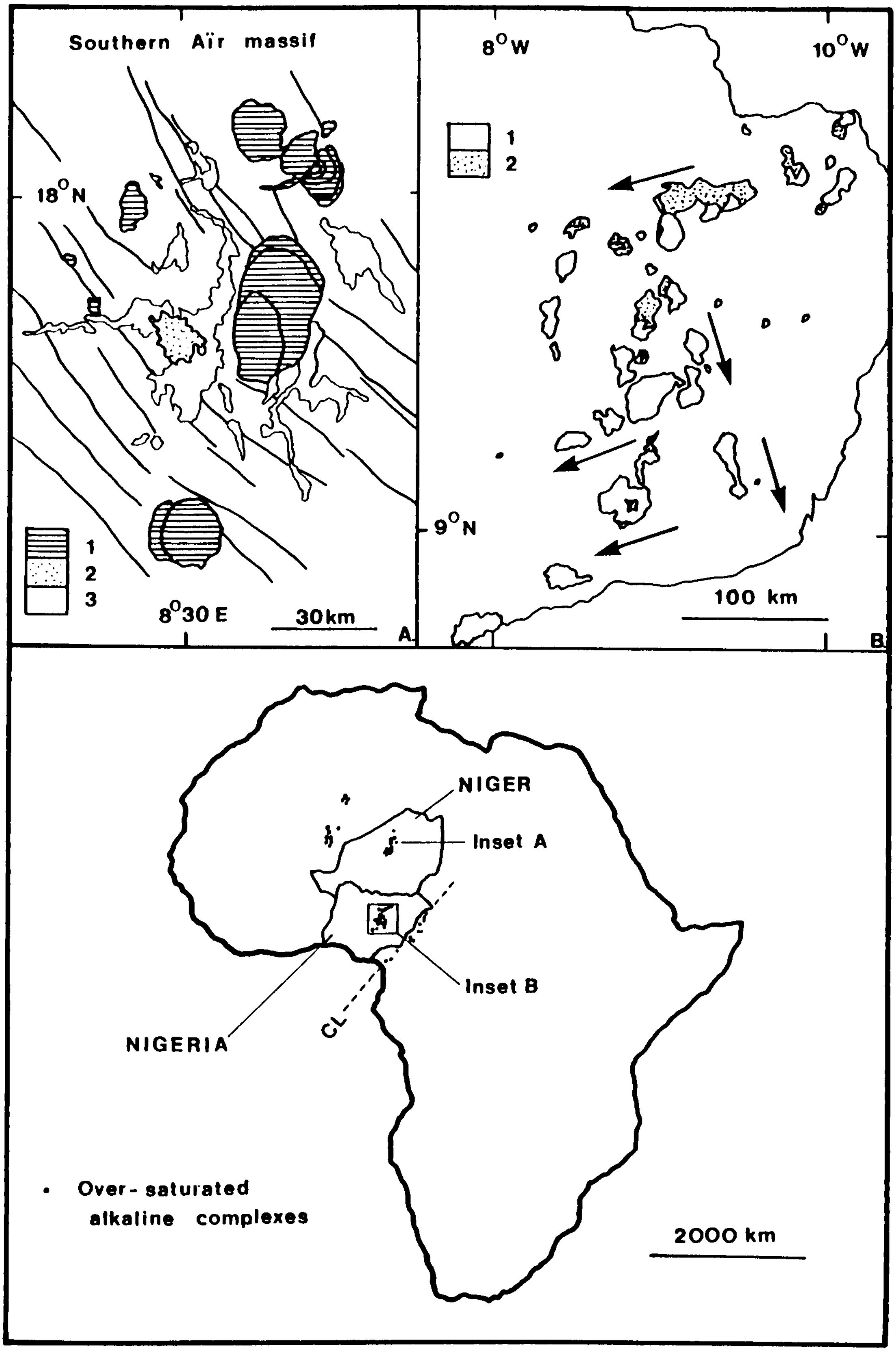



Figure 5.7.1 Geological setting of Phanerozoic Niger-Nigerian oversaturated felsic alkaline complexes. A. Structural pattern of the southern Air massif, showing the relationship between wrench faults and ring fractures. 1 = oversaturated ring complexes and plutons, 2 = Tertiary-Quatenary trachytes and phonolites, 3 = Quaternary olivine basalts. B. Migration of ages in the Nigerian Younger Granites province, progressively younger in direction of arrows. 1 = alkali granites and syenogranites, 2 = peralkaline granites and syenites. CL = Cameroon Line. (After Black et al 1985).

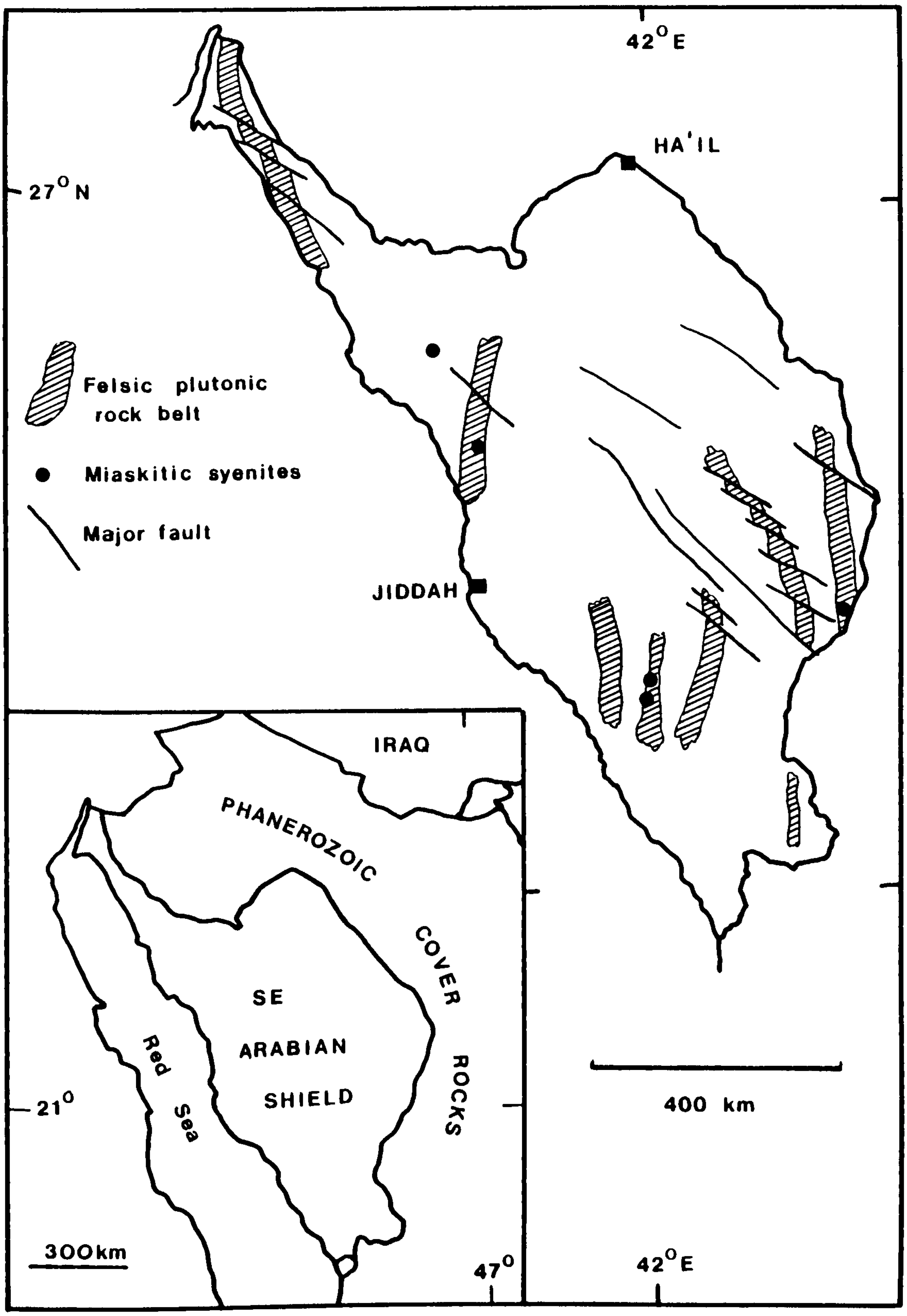



Figure 5.7.2 Geological setting of Arabian miaskitic syenite complexes. (After Ramsay 1986).

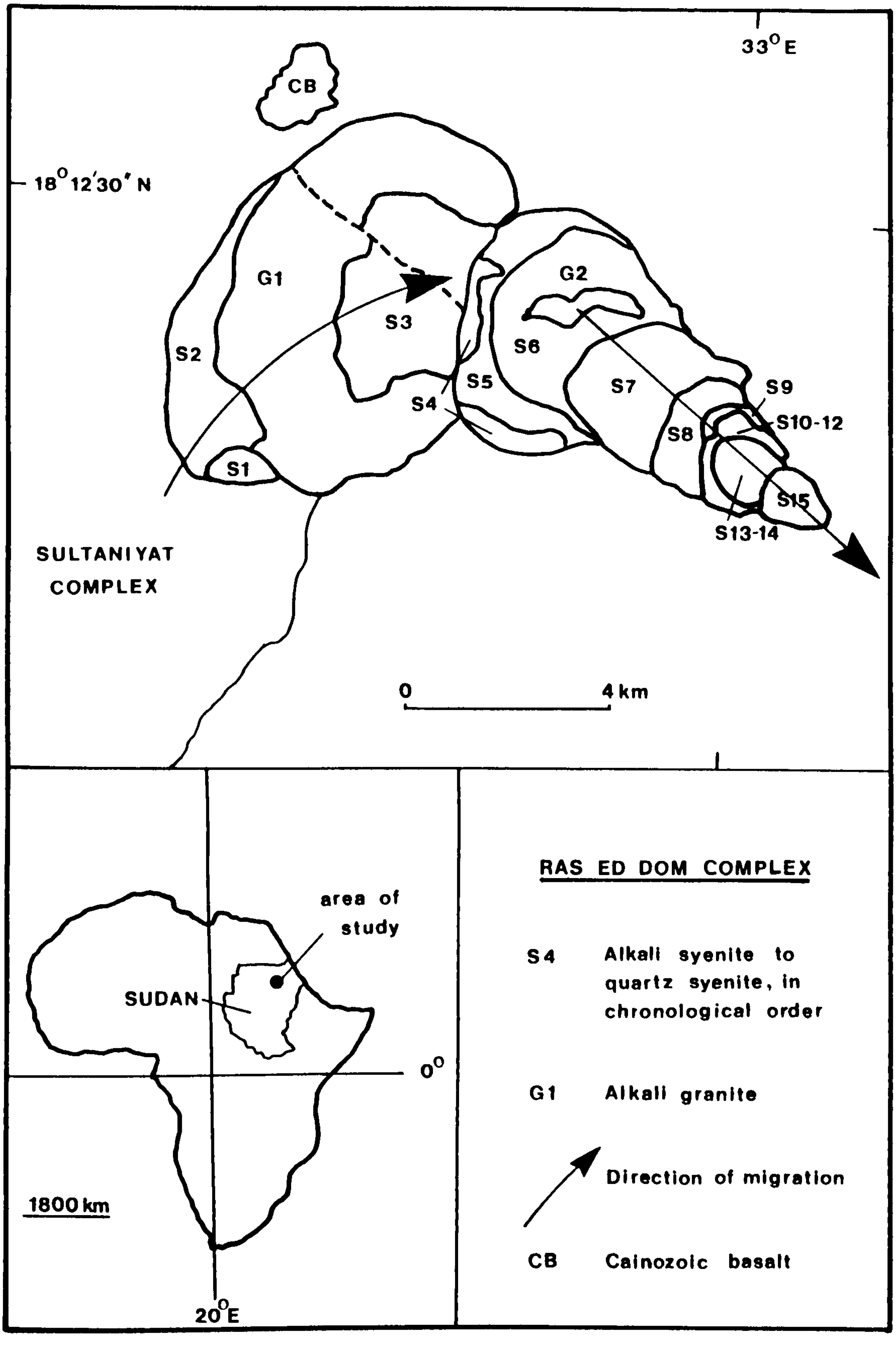



Figure 5.7.3 Geological setting of the Ras ed Dom ring complex, Sudan. Individual intrusions within the ring complex numbered in chronological order, arrows indicate direction of migration of igneous activity. (After O'Halloran 1985).

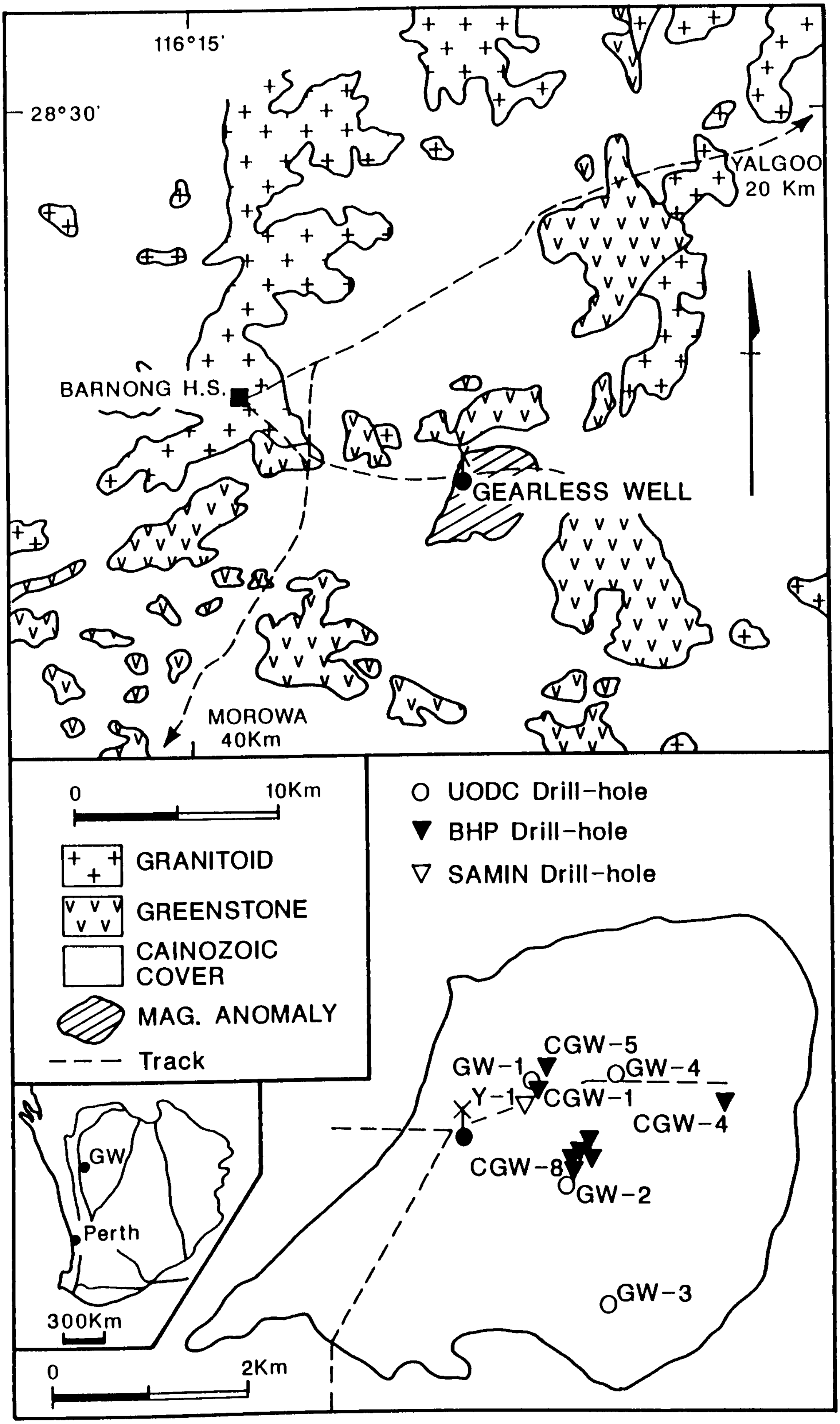



Figure 6.1 Geological setting of the Gearless Well trachyandesite intrusion, and drill hole location plan.

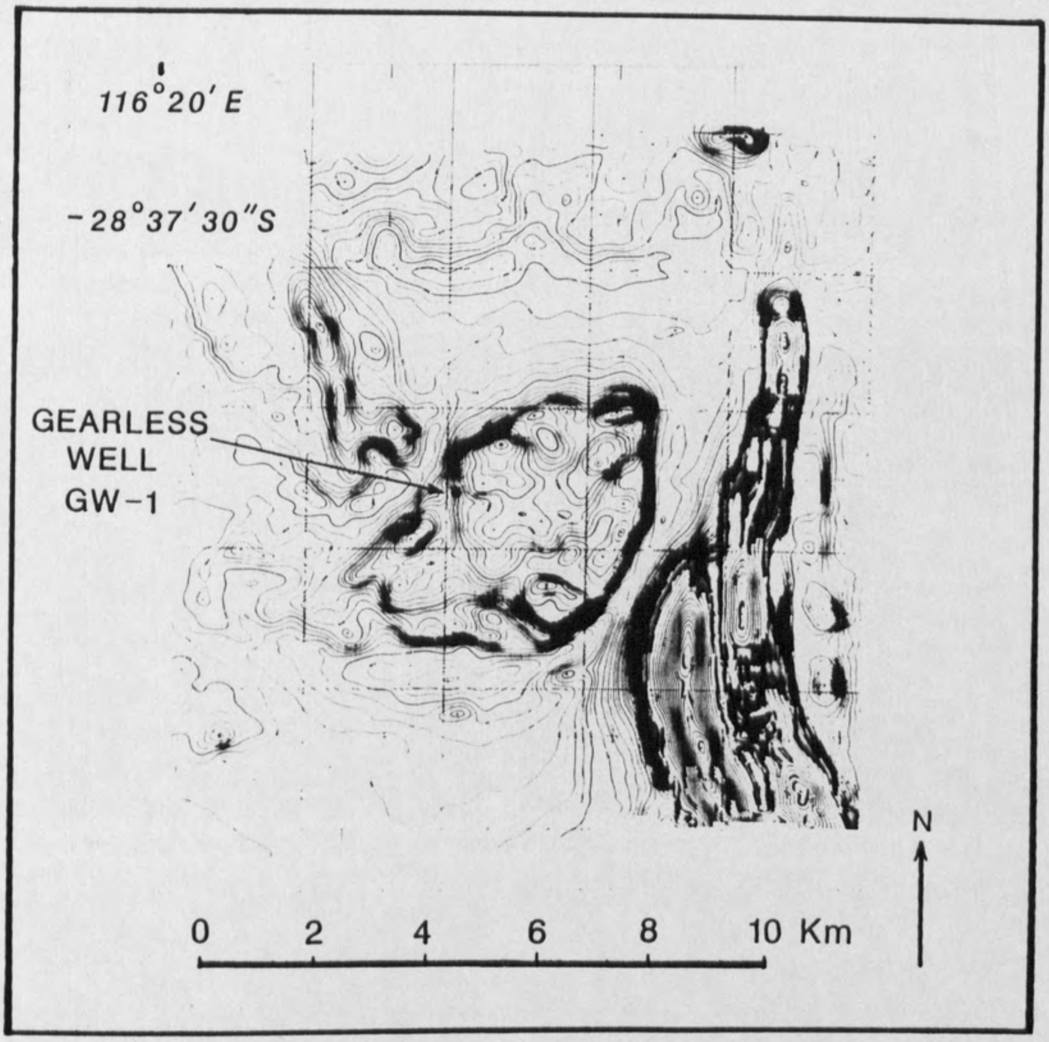



Figure 6.2 Aeromagnetic contour map of the Gearless Well area. Contour interval, 50 nT.

Figure 6.3

A. Typical porphyritic trachyandesite core from drill hole GW-1. Note well-defined agglomeratic texture in vicinity of carbonate veining, top right, and biotite commonly oriented parallel to core axis throughout. Scale in cms.

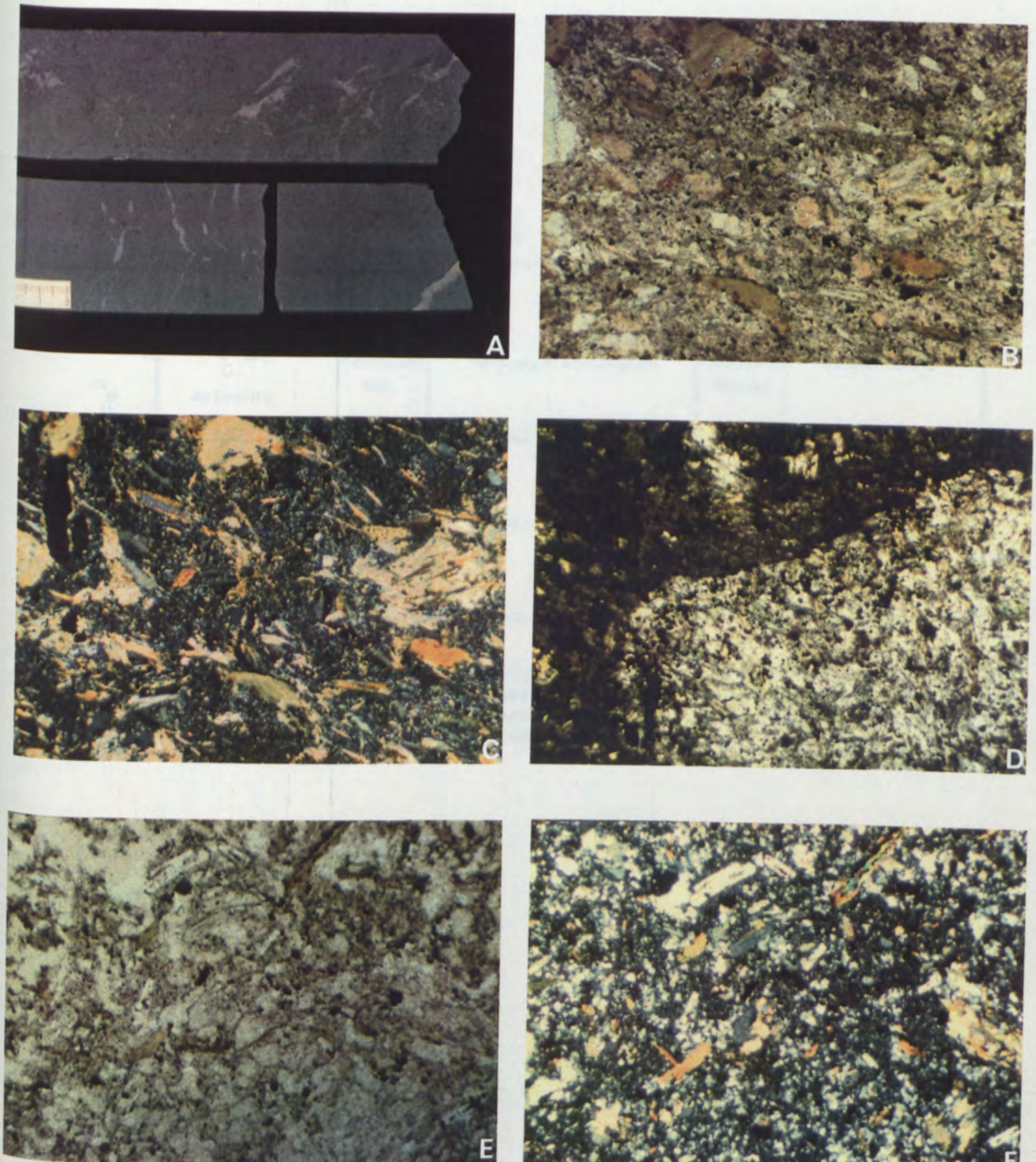
B. Typical petrographic character; sample 002, GW-1 trachyandesite. Phenocrysts - actinolite, pale green needles throughout; barian sanidine, stubby light pink-brown crystals, particularly in centre; biotite, olive green plates, centre top and bottom. Note common magnetite throughout groundmass. PPL, FOV = 3.9mm.

C. As above, crossed polars. Note large apatite prism in extinction, top left, and fine-grained nature of the sanidine-actinolite-magnetite-albite groundmass. CP, FOV = 3.9mm.

D. Sharp margin between subrounded agglomeratic fragment (bottom right) and matrix material (top left), GW-3 trachyandesite. Agglomeratic fragment displays generally finer grained phenocrysts and coarser grained groundmass. Both phases mineralogically identical. PPL, FOV = 3.9mm.

E. Groundmass-rich version of GW-1 trachyandesite, section normal to the direction of preferred orientation defined principally by biotite. PPL, FOV = 3.9mm.

F. As above, crossed polars. FOV = 3.9mm.


A
B
C
D
E
F

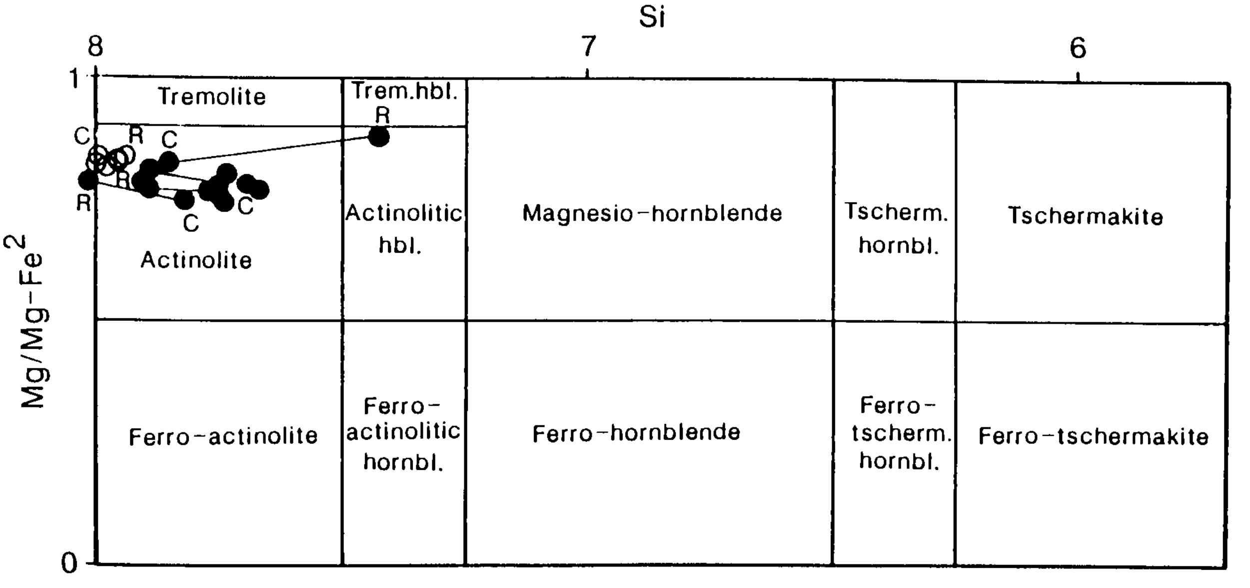



Figure 6.4 Amphibole classification diagram. Solid circles, GW-3 trachyandesite, sample 003; open circles, GW-1 trachyandesite, sample 004. C = core, R = rim, tie-lines connect core and rim compositions from individual crystals.

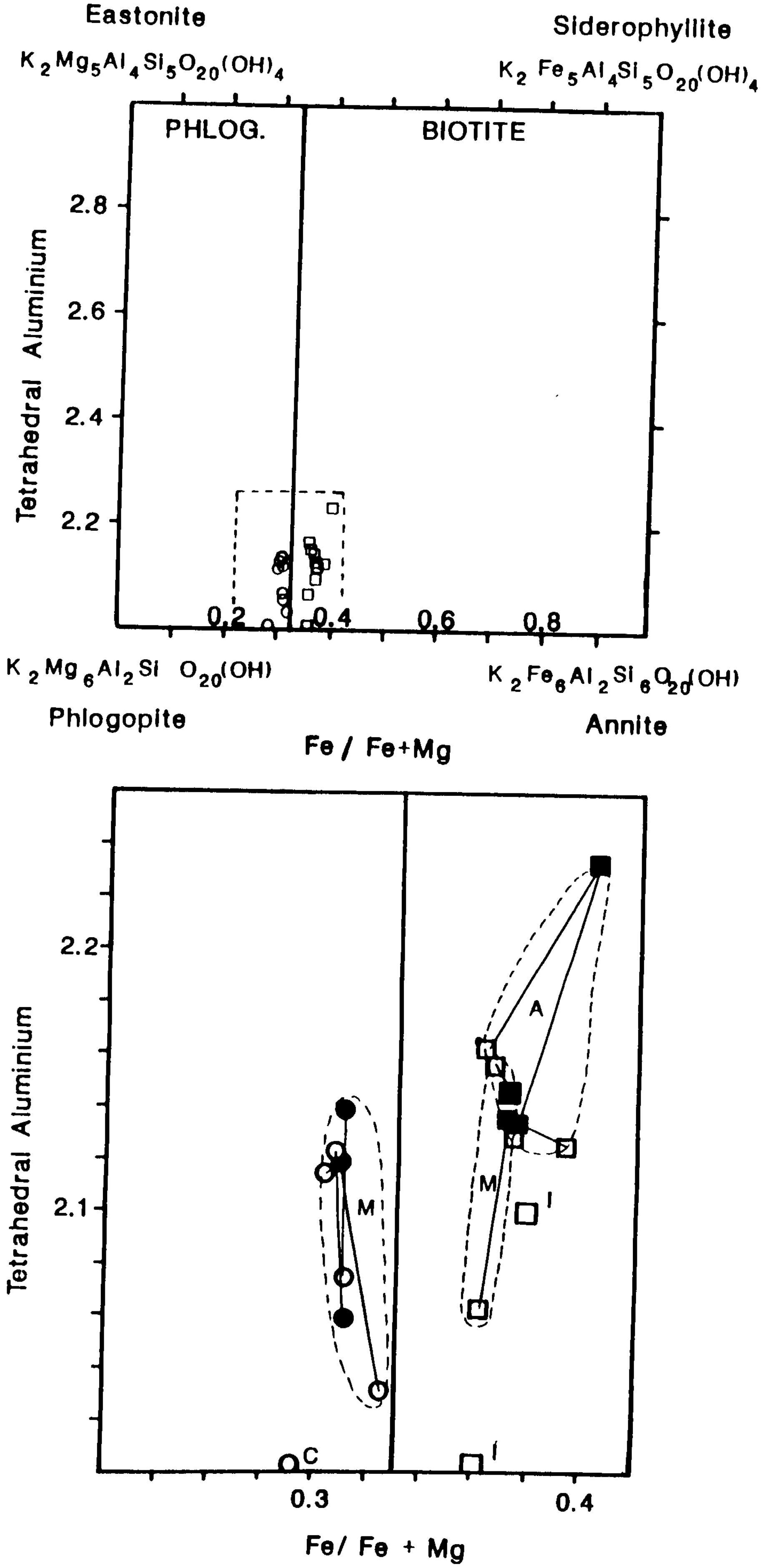



Figure 6.5 Biotite classification diagram. Biotite quadrilateral - open circles, GW-1 samples; open squares, GW-3 samples. Enlarged box - solid circles, GW-1 cores, sample 004; open circles, GW-1 rims, sample 004; solid squares, GW-3 cores, sample 003; open squares, GW-3 rims, sample 003. M = field of matrix biotites, A = field of agglomerate fragment biotites, I = inclusion within amphibole, C = biotite clot.

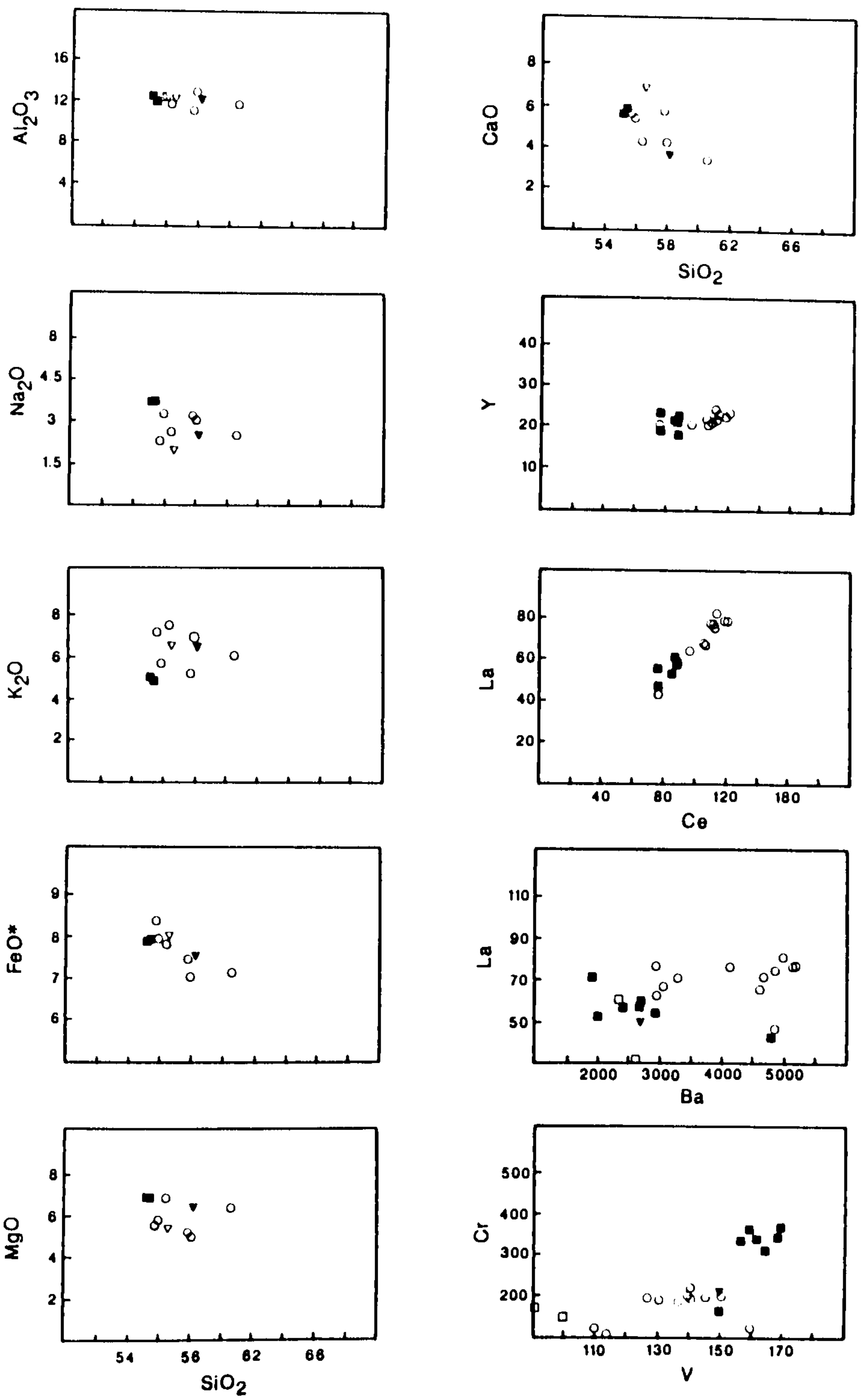



Figure 6.6 Whole rock major and trace element variation diagrams, Gearless Well trachyandesite. Major element oxides in wt%, trace elements in p.p.m. Open circles, GW-1 vicinity samples (including CGW-1, CGW-5 and Y-1 for some trace elements); solid squares, GW-3 samples; open squares, GW-4 samples; solid inverted triangle, GW-2 sample; open inverted triangle, CGW-4 sample.

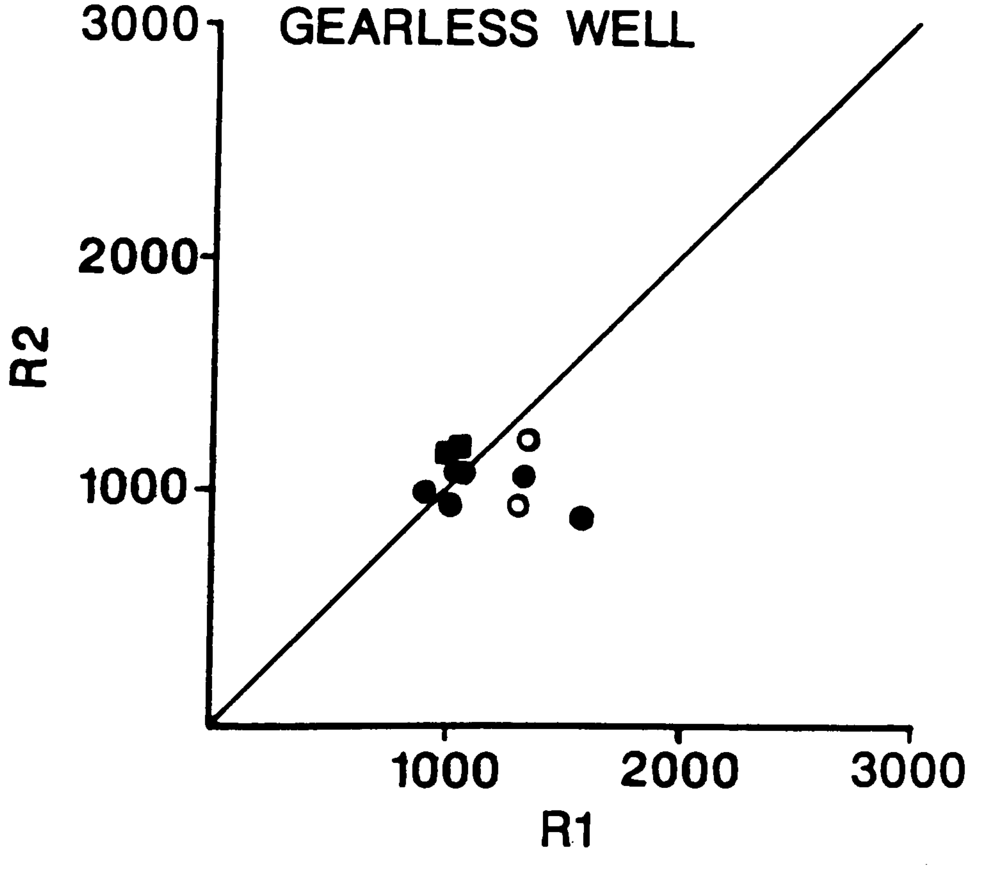



Figure 6.7 $R_1R_2$ geochemical classification diagram, Gearless Well. Solid squares, GW-3 samples; solid circles, GW-1 samples; open circles, CGW-4 samples. Refer overlay in back pocket for key.

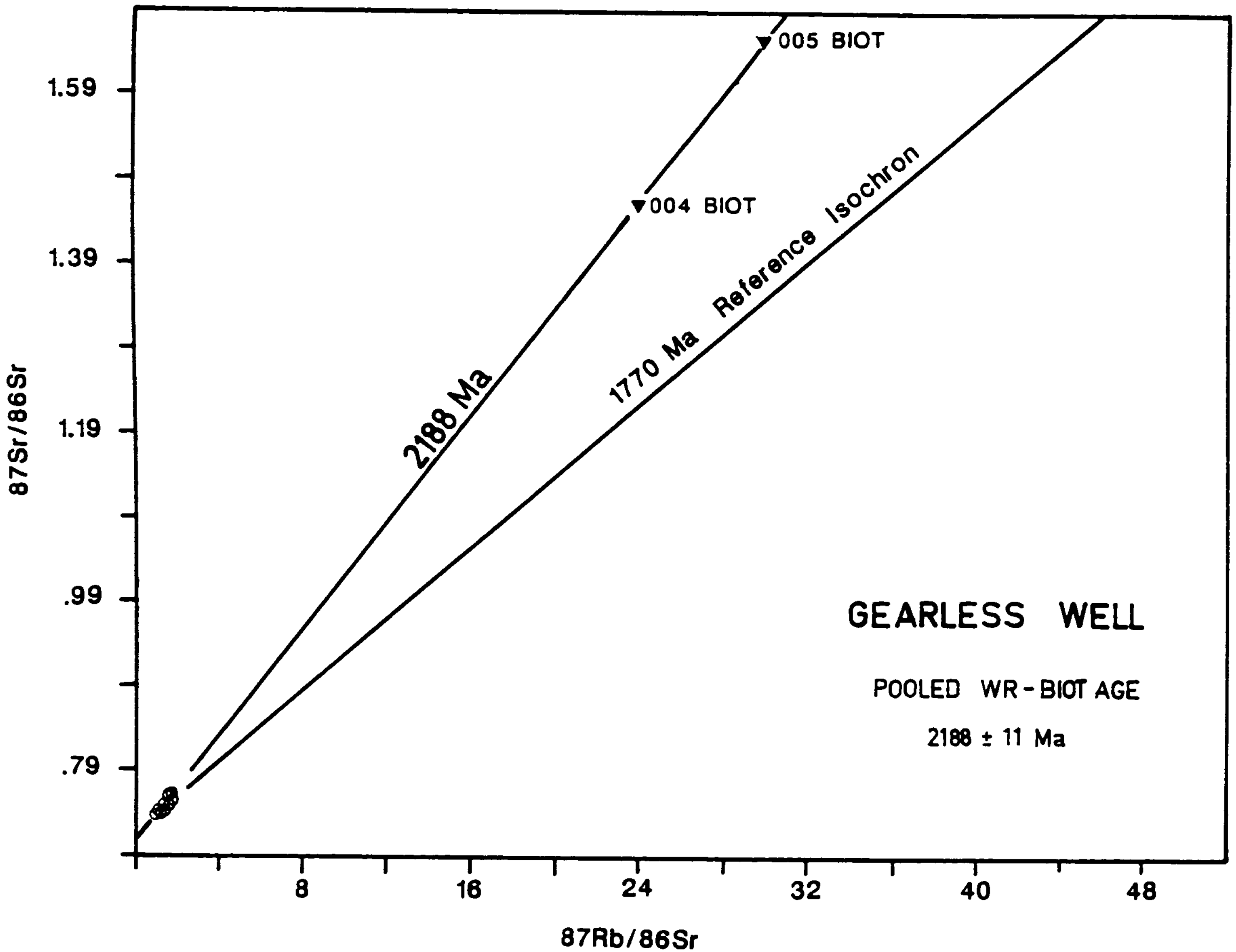



Figure 6.8 Rb-Sr isochron plot of Gearless Well samples. 1770 Ma reference isochron for seven of the eleven whole-rock samples (open circles), pooled whole rock-biotite age of 2188 Ma (biotites, solid inverted triangles).

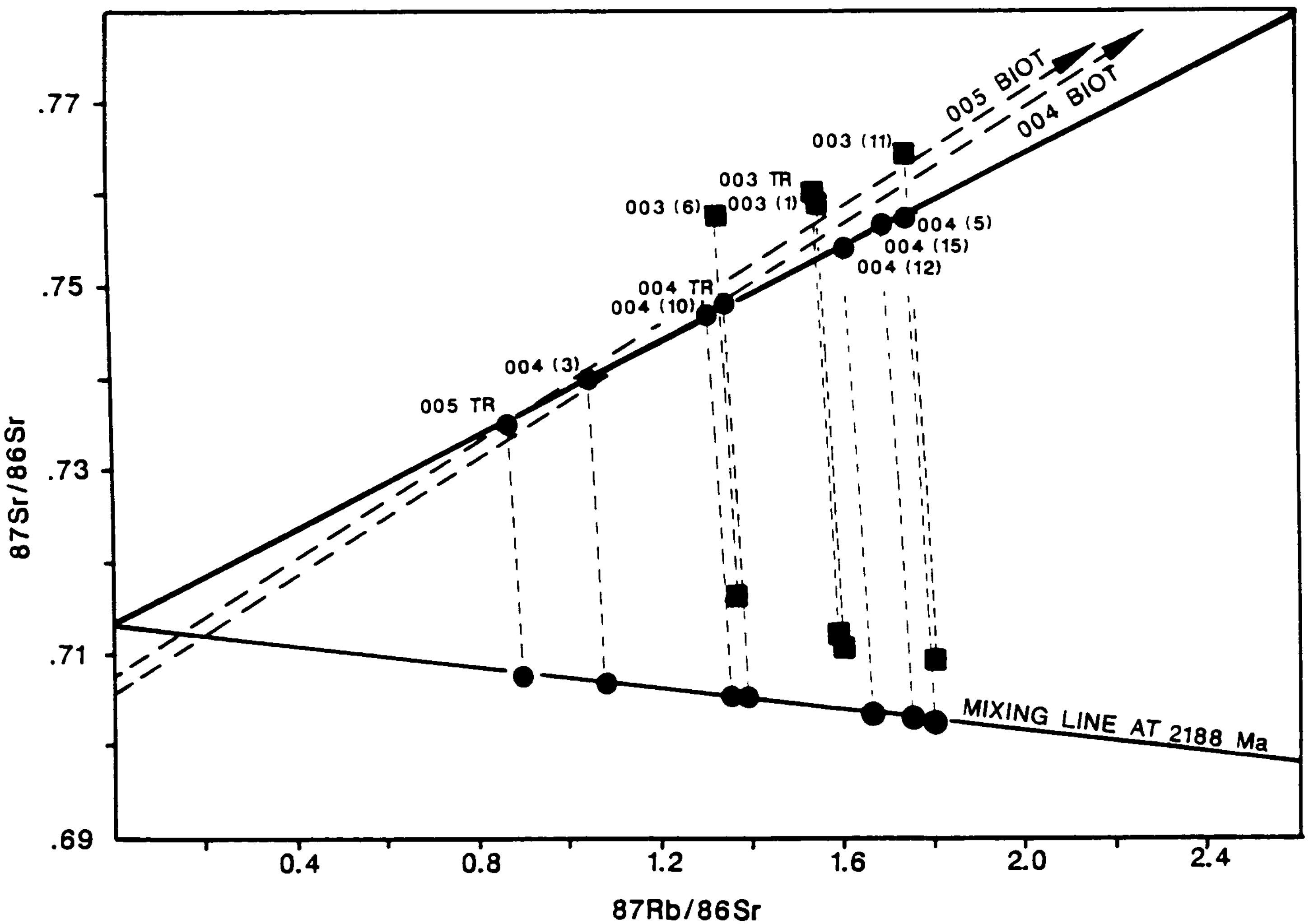



Figure 6.9 Rb-Sr isochron plot showing detail of whole-rock isotopics, with whole-rock data projected back to interpreted crystalisation age of 2188 Ma. Solid circles, GW-1 samples; solid squares, GW-3 samples.

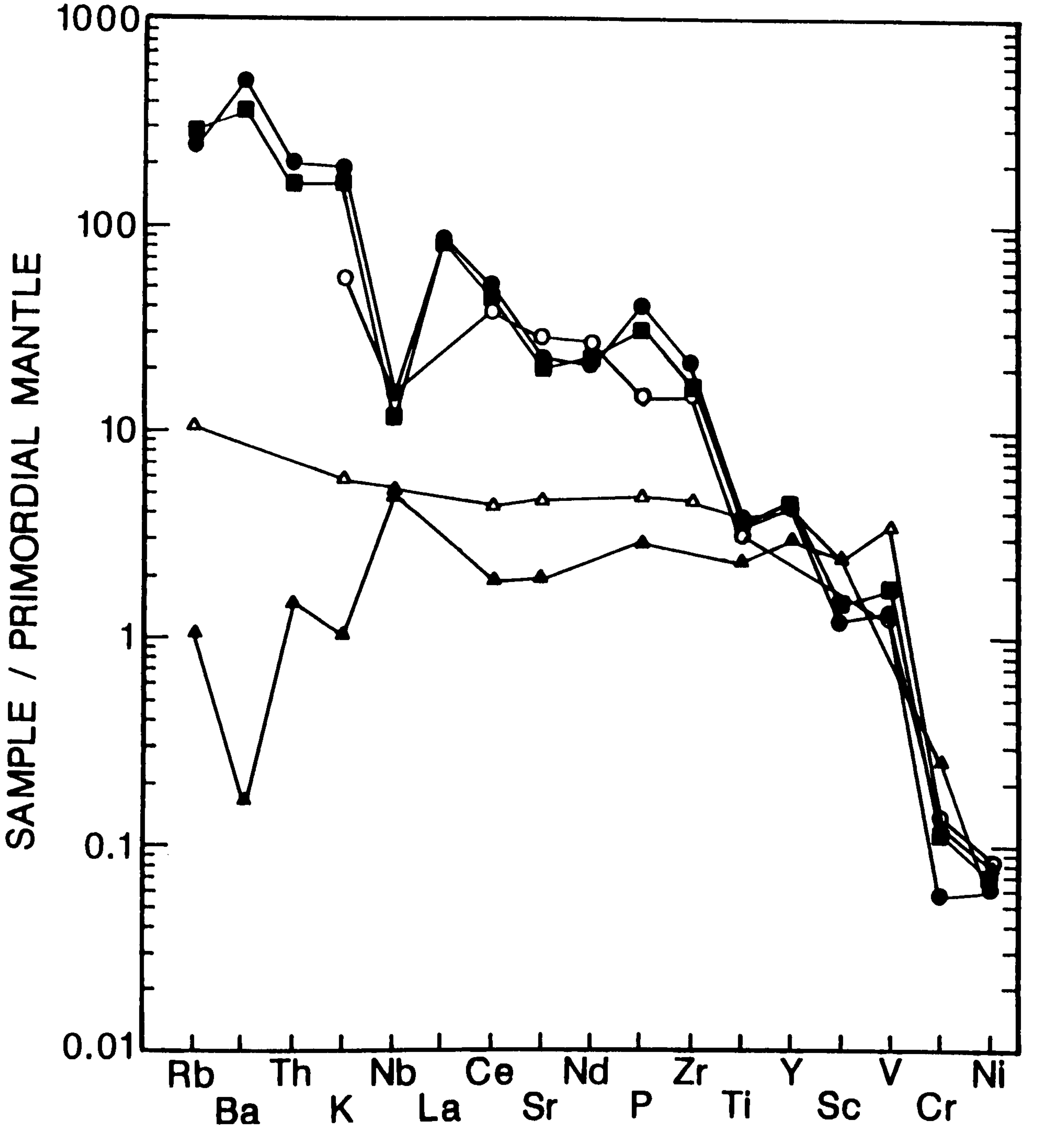



Figure 6.10 Primordial mantle-normalised hygromagmatophile (HYG) element spider plot, demonstrating similarity of Gearless Well samples to Canadian Archaean LILE-enriched trachyandesite, and the consistency of Ti, Y, Sc, V, Cr and Ni values of these samples with other Archaean mantle-derived magmas. Solid circles, GW-1 samples; solid squares, GW-3 samples; open circles, typical mantle-derived Canadian Archaean trachyandesite (Shirey & Hanson 1986); solid triangles, Archaean magnesian basalt, Munro Township, Ontario, Canada (Middlemost 1985); open triangles, average Eastern Goldfields Archaean tholeiite, W.A. (Giles & Hallberg 1982). Normalising factors from Wood et al (1979).

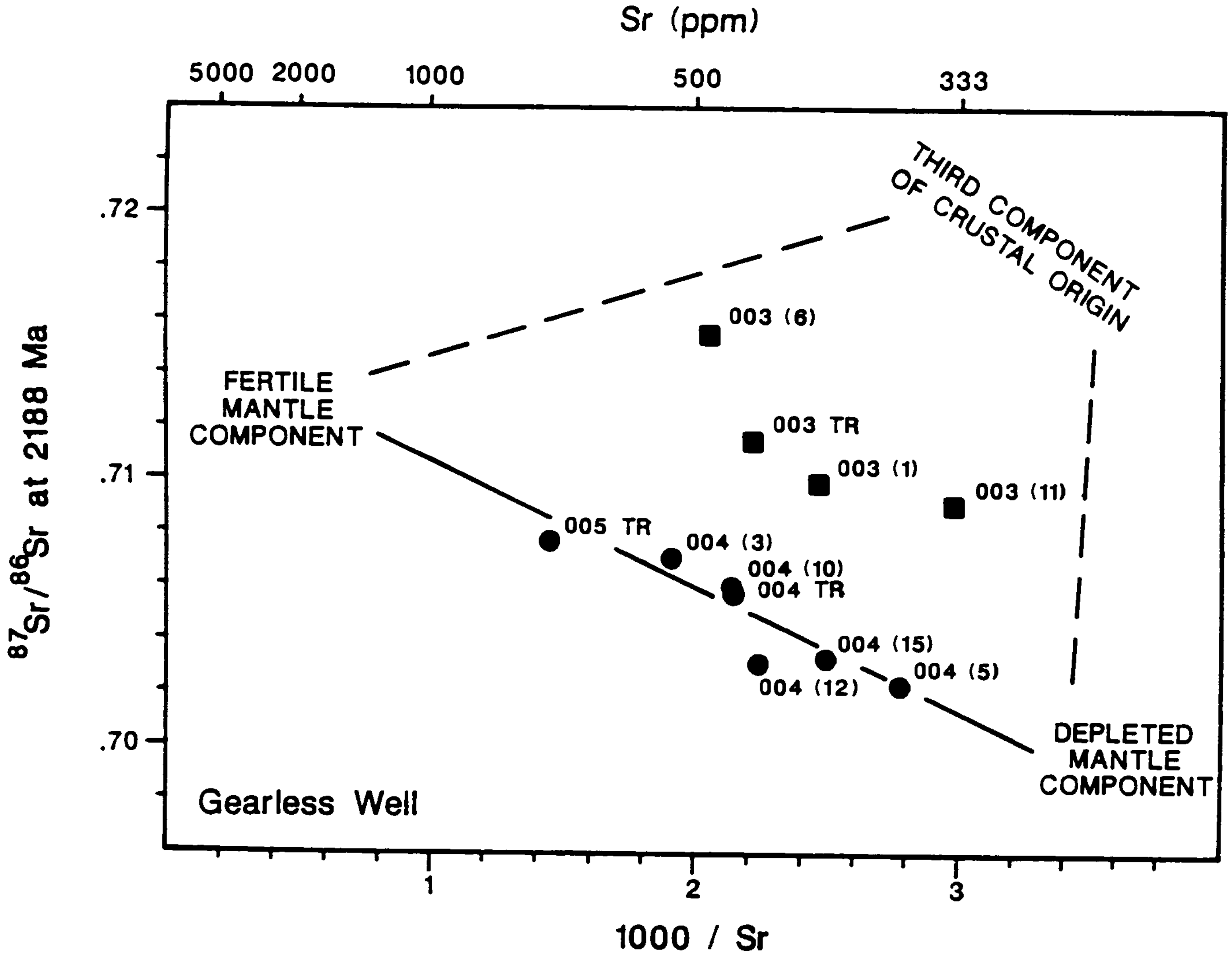



Figure 6.11 $^{87}Sr/^{86}Sr$ at 2188 Ma (time of interpreted crystallisation) versus Sr contents of the measured samples. Solid circles, GW-1 samples; solid squares, GW-3 samples. Depleted mantle component represents mantle from which previous partial melts have been removed. Fertile mantle component represents LILE-rich material injected into source region prior to melting. High radiogenic low Sr third component represents felsic crustal material, incorporated via interaction of fluid-charged magma with wall-rock during ascent through the crust.

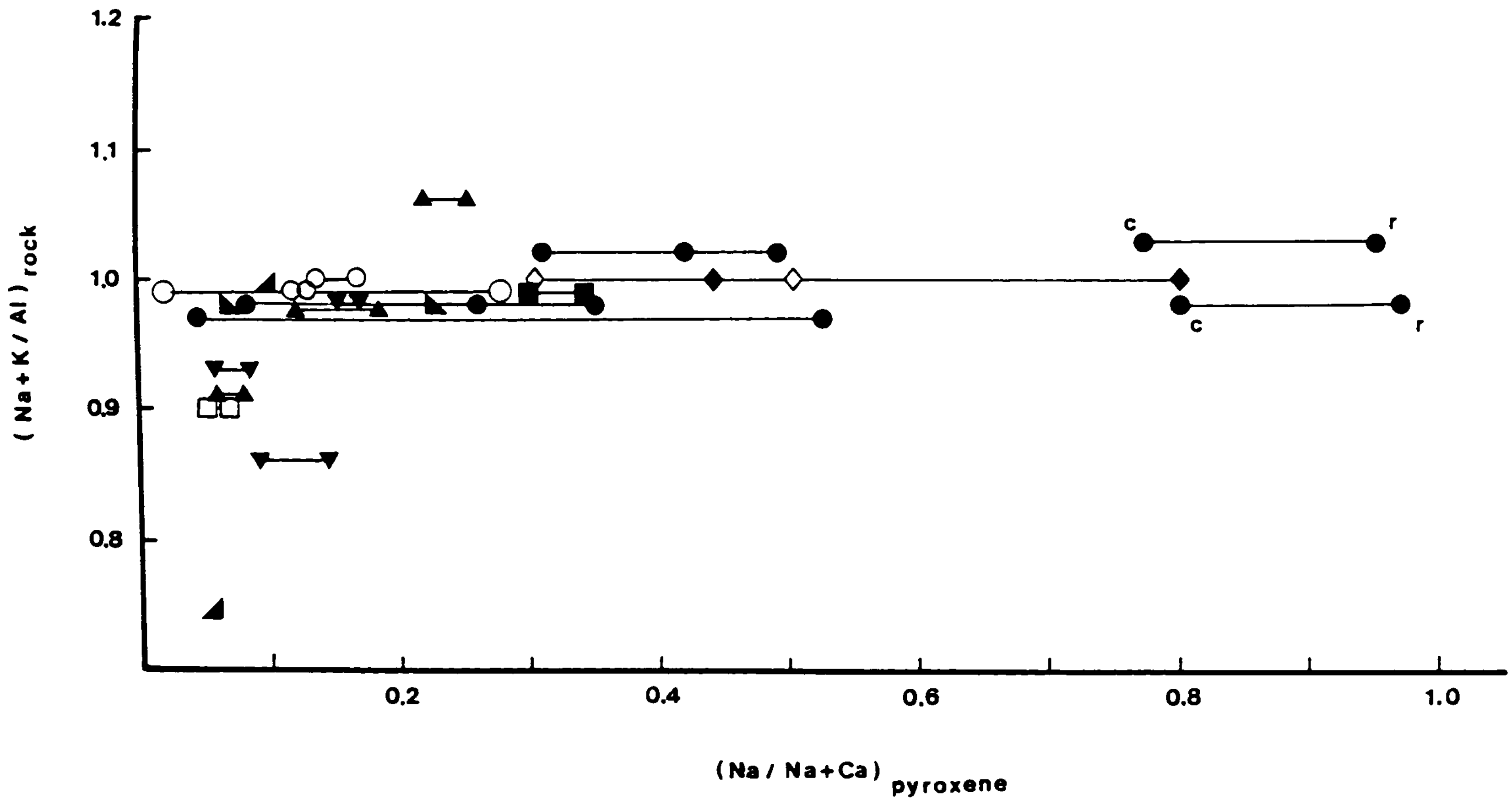



Figure 7.1 Agpaiitic index versus (Na/Na + Ca)$_{pyx}$, felsic alkaline suite, demonstrating lack of relationship between alkalinity of pyroxenes and agpaiicity. Solid circles, Gilgarna Rock syenites; solid triangles, Red Hill syenites and alkali granites; open circles, Fitzgerald Peaks syenites and alkali granites; open squares, Erayinia Granitoid Complex alkali granite; solid inverted triangles, Binneringie syenites; open diamonds, Cardunia Rocks alkali granite; solid half-squares (bottom right), Twin Peaks syenite; solid half-squares (bottom left), Cement Well syenite; solid diamonds, Pig Well syenite; solid squares, Teague Ring Structure syenite.

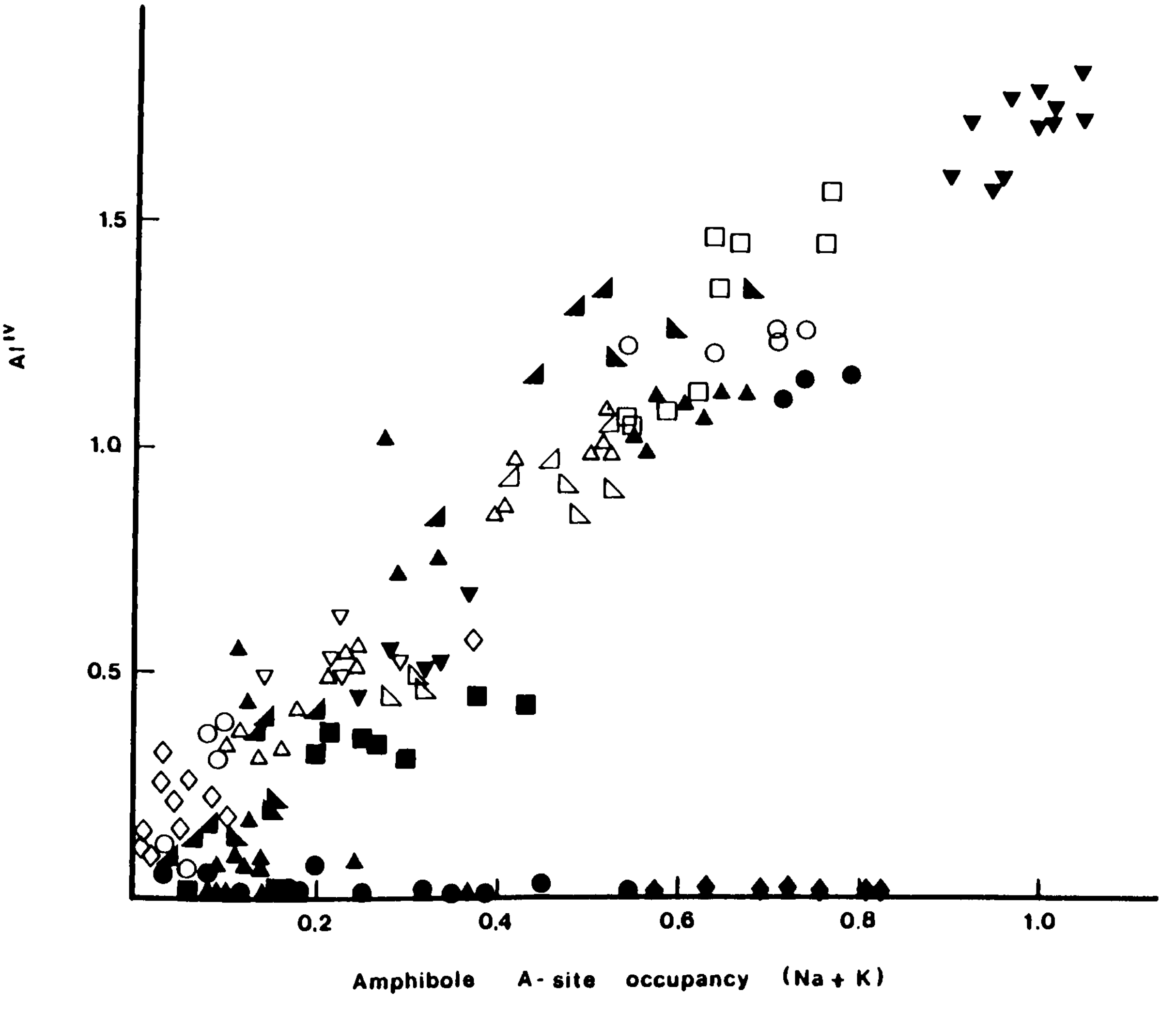



Figure 7.2 $Al^{IV}$ versus A-site occupancy, felsic alkaline suite amphiboles. Solid circles, Gilgarna Rock syenites; solid triangles, Red Hill syenites and alkali granites; open circles, Fitzgerald Peaks syenites and alkali granites; open squares, Erayinia Granitoid Complex alkali granite; open triangles, Madoonia Downs syenites to quartz monzonites; solid inverted triangles, Binneringie syenites; open diamonds, Cardunia Rocks alkali granite; open half-squares (bottom left), Bulyairdie Rocks granites; solid half-squares (bottom right), Twin Peaks syenite; solid half-squares (bottom left), Cement Well syenite; open inverted triangles, McAuliffe Well syenite; solid diamonds, Pig Well syenite; open half-squares (bottom right), Andy Well quartz monzonite; solid squares, Teague Ring Structure syenite. In general, the most alkaline primitive syenites from Gilgarna Rock, Red Hill, Pig Well and the Teague Ring Structure display low $Al^{IV}$ contents across a wide range of A-site occupancies.

Figure 7.3

Evolutionary scheme for the petrogenesis of the felsic alkaline suite.

A. Mantle up-welling, asthenospheric convection and intrusion into cooler lithosphere beneath primitive continental crust. Primitive crust believed to be broadly andesitic, generated above subduction zones, and subject to a complex pre-history of perhaps 700 Ma, prior to development of the greenstone sequences (Campbell & Hill 1988).

B. Rifting of the primitive crust in response to tension induced by asthenopheric convection, and generation of mantle-derived komatiitic and basaltic greenstone sequences in rift basins. Mantle convection cell moving closer to the base of the crust.

C. Continued greenstone production, melting of the basal crust in response to the proximity of the mantle thermal anomaly, and generation of granitic magmas and felsic volcanics.

D. Continued lower crustal anatexis, with major diapiric intrusion of resulting granitic magmas, and consequent intense basin-wide deformation. (Sediments shed from topographic highs overlying granite diapirs into inter-diapiric greenstone topographic lows, Campbell & Hill 1988). Later stage granitic magmas (generally more alkali-rich) as a result of the same long-lived thermal anomaly intruded into existing granitic bodies and greenstone sequences. Mantle convection cell moving away from the base of the crust towards the end of this period.

E. Gradual return of mantle convection cell towards the base of the crust during the Late Archaean, as a precursor to largely Proterozoic mafic-ultramafic dyke suite generation. Further restricted melting of the depleted granulitic lower crust, generation of the felsic alkaline magmas, and subsequent emplacement of the resultant magmas into the upper crust via major deep-seated conduits, largely related to marginal zones of the original rift basins. g = greenschist facies, a = amphibolite facies, gr = granulite facies.

(Aspects of this evolutionary scheme are drawn from a number of sources and bodies of opinion outlined in Chapter 1.7.4).

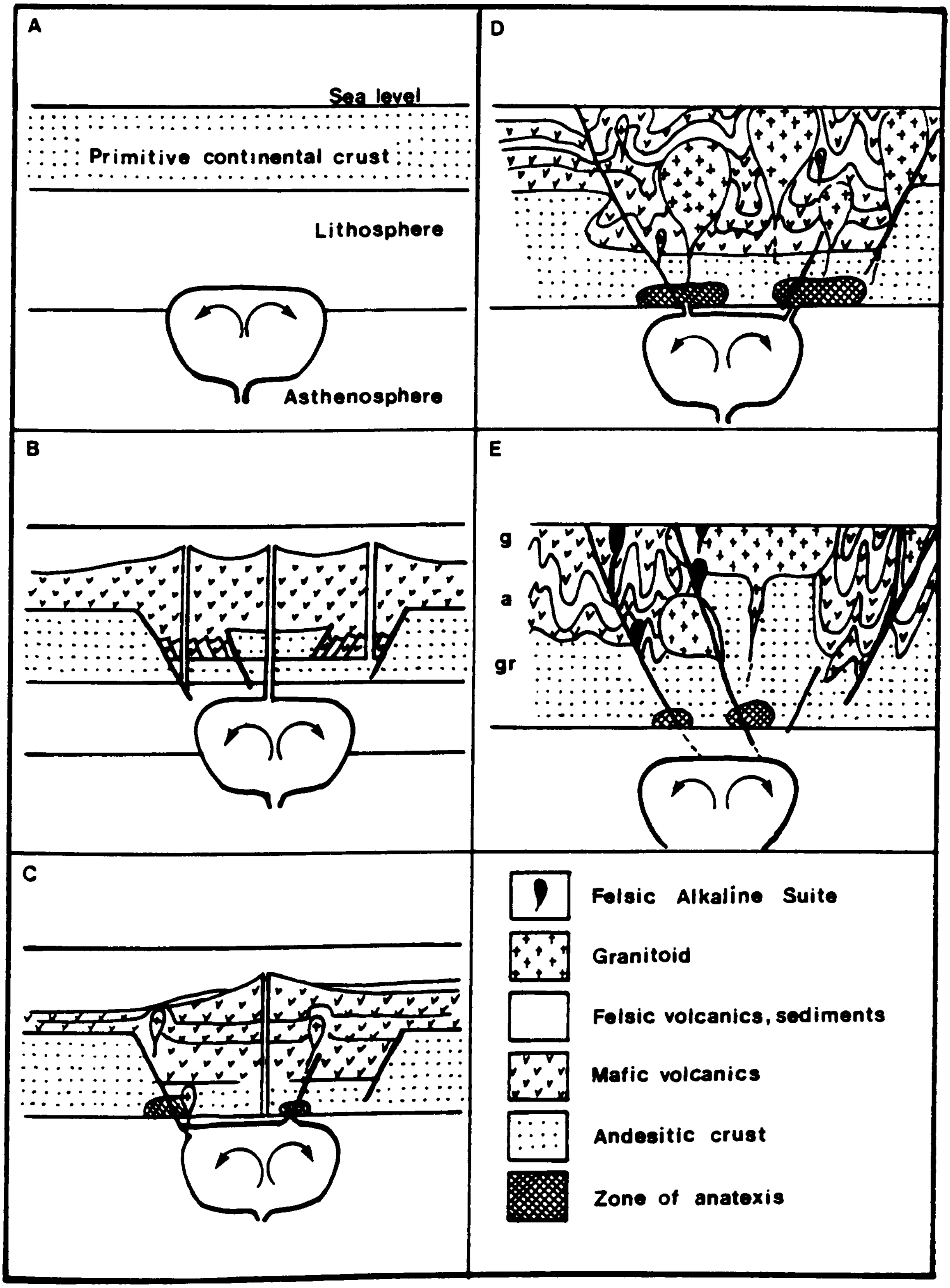

A
Sea level
Primitive continental crust
Lithosphere
Asthenosphere
B
C
D
E
g
a
gr
Felsic Alkaline Suite
Granitoid
Felsic volcanics, sediments
Mafic volcanics
Andesitic crust
Zone of anatexis

TABLE 1.1 : INTERPRETED YILGARN BLOCK GEOCHRONOLOGICAL FRAMEWORK

| REGION | AGE (Ga) GREENSTONE FORMATION | TECTONISM | GOLD MINLSN |
|---|---|---|---|
| Western Gneiss Terrane | | | |
| Mt. Narryer | 3.7-3.5 | 3.3, 3.1, 2.6 | |
| Jimperding | 3.25 | 3.2-2.5 | |
| Saddleback | 2.67-2.65 | 2.64 | |
| Balingup | 3.1 | 2.84-2.53 | |
| Gneiss/Granitoids | < 3.24 | > 2.63-2.55 | |
| Murchison Province | 3.0, 2.7 | 2.8-2.6 | 2.8-2.6 |
| Southern Cross Province | 3.0 | 2.7 | 2.7-2.63 |
| Eastern Goldfields Province | | | |
| northeastern section | 2.86-2.8 | ? | 2.73-2.66 |
| northern Nsman-Wiluna belt | 2.79-2.68 | 2.65 | 2.79-2.65 |
| southern Nsman-Wiluna belt | 2.74-2.66 | 2.66 | 2.73-2.66 |

- after the review of McNaughton & Dahl (1987).

**TABLE 2.1 : GILGARNA ROCK REPRESENTATIVE FELDSPAR ANALYSES**

| Sample | 006-6 | 006-6 | 006-12 | 006-12 | 009-3 | 009-3 | 009-3 | 009-3 | 016-9 | 016-9 | 016-9 | 016-9 | 016-9 | 016-9 | 016-9 | 018-1 | 018-3 | 179-2 | 179-2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| wt% | AP HOST | AP EXSN | AP HOST | AP EXSN | ZUA RIM | ZUA TOWARDS | ZUA CORE | ZUA CORE | ZUA | ZUA | ZUA RIM | ZUA TOWARDS | ZUA | ZUA CORE | ZUA CORE | PLAG | PLAG | PERTH HOST | PERTH EXSN |
| $SiO_2$ | 70.29 | 66.33 | 68.58 | 66.03 | 69.03 | 68.52 | 67.32 | 67.00 | 65.66 | 69.55 | 68.55 | 66.20 | 68.67 | 68.18 | 68.24 | 63.94 | 65.21 | 65.49 | 69.22 |
| $TiO_2$ | - | - | 0.14 | - | - | - | 0.19 | - | - | - | - | 0.22 | 0.18 | - | - | - | - | - | - |
| $Al_2O_3$ | 19.89 | 18.29 | 20.34 | 18.16 | 20.74 | 20.25 | 19.67 | 19.70 | 17.87 | 19.58 | 20.21 | 19.13 | 20.68 | 20.79 | 20.97 | 20.75 | 20.67 | 17.79 | 18.94 |
| FeO* | - | - | 0.42 | - | 0.26 | - | 0.25 | - | - | 0.25 | - | - | 0.22 | 0.18 | 0.21 | 0.22 | - | - | 0.29 |
| MgO | - | - | 0.14 | - | - | - | - | - | - | - | - | - | 0.15 | - | - | 0.50 | 0.46 | - | 0.22 |
| CaO | - | - | 0.85 | - | 1.02 | 0.59 | 0.32 | 0.23 | - | - | 0.39 | 0.15 | 0.90 | 1.22 | 1.15 | 2.05 | 1.77 | - | - |
| $Na_2O$ | 10.39 | - | 9.43 | 0.23 | 8.01 | 6.39 | 6.14 | 5.78 | - | 10.73 | 8.79 | 4.13 | 10.08 | 8.96 | 10.13 | 9.33 | 9.95 | 0.14 | 10.33 |
| $K_2O$ | 0.08 | 15.95 | 0.14 | 16.13 | 0.37 | 3.95 | 5.59 | 6.57 | 16.24 | 0.10 | 2.07 | 9.58 | 0.17 | 0.12 | 0.13 | 0.09 | 0.09 | 17.22 | 0.20 |
| Other | - | - | 0.23 | - | - | - | - | - | - | - | - | - | 0.27 | - | - | 0.26 | 0.06 | - | - |
| TOTAL | 100.65 | 100.57 | 100.27 | 100.55 | 99.43 | 99.70 | 99.48 | 99.28 | 99.77 | 100.21 | 100.01 | 99.41 | 101.32 | 99.45 | 100.83 | 97.14 | 98.21 | 100.64 | 99.20 |

Structural formulae on the basis of 32(O)

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Si | 12.090 | 12.117 | 11.900 | 12.096 | 12.005 | 12.035 | 11.983 | 11.986 | 12.127 | 12.071 | 11.981 | 11.980 | 11.822 | 11.900 | 11.812 | 11.557 | 11.642 | 12.075 | 12.129 |
| Ti | - | - | .018 | - | - | - | .026 | - | - | - | - | .118 | .024 | - | - | - | - | - | - |
| Al | 4.036 | 3.938 | 4.160 | 3.922 | 4.249 | 4.191 | 4.126 | 4.154 | 3.889 | 4.004 | 4.163 | 4.079 | 4.196 | 4.277 | 4.278 | 4.420 | 4.350 | 3.867 | 3.911 |
| $Fe^{2+}$ | - | - | .061 | - | .037 | - | .037 | - | - | .036 | - | - | .032 | .026 | .031 | .033 | - | - | .042 |
| Mg | - | - | .036 | - | - | - | - | - | - | - | - | - | .039 | - | - | .135 | .122 | - | .056 |
| Ca | - | - | .158 | - | .190 | .112 | .060 | .044 | - | - | .072 | .030 | .166 | .229 | .213 | .398 | .339 | - | - |
| Na | 3.467 | - | 3.172 | .080 | 2.698 | 2.176 | 2.119 | 2.005 | - | 3.610 | 2.980 | 1.450 | 3.363 | 3.032 | 3.401 | 3.268 | 3.442 | .049 | 3.508 |
| K | .017 | 3.717 | .031 | 3.769 | .082 | .886 | 1.269 | 1.500 | 3.826 | .022 | .461 | 2.212 | .038 | .028 | .028 | .022 | .021 | 4.051 | .044 |
| Other | - | - | .010 | - | - | - | - | - | - | - | - | - | .046 | - | - | .062 | .017 | - | - |

AP = Antiperthite, ZUA = Zoned unmixed anorthoclase, EXSN = Exsolution, PERTH = Perthite, FeO* = total iron

**TABLE 2.2 : GILGARNA ROCK REPRESENTATIVE PYROXENE ANALYSES**

| | 006-1 | 006-1 | 006-3 | 006-3 | 006-11 | 006-11 | 006 | 006 | 009-15 | 009-15 | 009-2 | 009-2 | 009-7 | 009-7 | 009 | 009 | 016-4 | 016-4 | 016-6 | 016-6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| wt% | RIM | CORE | RIM | CORE | RIM | CORE | AVG. RIM(11) | AVG. CORE(6)* | RIM | CORE | RIM | CORE | RIM | CORE | AVG. RIM(6) | AVG. CORE(7) | RIM | CORE | RIM | CORE |
| $SiO_2$ | 51.36 | 53.30 | 53.50 | 53.90 | 52.96 | 52.33 | 51.99 | 53.74 | 50.84 | 50.56 | 52.00 | 51.34 | 52.47 | 54.18 | 51.54 | 52.25 | 52.69 | 52.42 | 52.91 | 51.97 |
| $TiO_2$ | - | - | 0.16 | - | - | 0.15 | - | - | - | 0.22 | - | 0.15 | - | - | - | 0.07 | - | - | - | - |
| $Al_2O_3$ | 1.42 | 2.57 | 1.75 | 2.36 | 0.56 | 1.54 | 1.27 | 2.17 | 1.10 | 1.85 | 0.74 | 2.24 | 0.83 | 1.45 | 0.84 | 1.94 | 0.53 | 0.55 | 0.37 | 0.56 |
| $Fe_2O_3$ | 7.03 | 0.92 | 7.07 | 0.89 | 18.22 | 4.99 | 5.64 | 1.40 | 9.20 | 4.40 | 10.97 | 4.31 | 8.88 | - | 10.02 | 1.52 | 25.47 | 32.43 | 29.19 | 27.10 |
| FeO | 11.54 | 4.74 | 7.46 | 4.13 | 5.26 | 8.79 | 11.92 | 4.70 | 10.47 | 8.18 | 9.67 | 9.80 | 11.14 | 7.58 | 9.32 | 6.99 | 3.39 | - | 1.06 | 2.79 |
| MnO | 0.53 | - | 0.16 | - | 0.38 | 0.26 | 0.44 | 0.03 | 0.44 | 0.24 | 0.50 | 0.29 | 0.52 | - | 0.46 | 0.06 | - | 0.13 | 0.20 | - |
| MgO | 6.73 | 14.45 | 9.37 | 15.09 | 4.84 | 9.23 | 7.29 | 14.24 | 6.58 | 10.44 | 5.70 | 9.03 | 6.40 | 14.28 | 6.53 | 12.60 | 2.28 | 0.95 | 1.91 | 1.86 |
| CaO | 19.52 | 23.67 | 19.25 | 23.93 | 11.75 | 20.02 | 19.81 | 23.28 | 17.57 | 21.96 | 15.72 | 20.40 | 17.33 | 22.79 | 16.42 | 22.01 | 4.70 | 1.48 | 2.93 | 3.28 |
| $Na_2O$ | 2.61 | 0.63 | 3.27 | 0.59 | 7.28 | 2.49 | 2.47 | 0.92 | 3.37 | 1.18 | 4.68 | 1.99 | 3.76 | 0.48 | 4.13 | 1.11 | 10.68 | 12.79 | 11.83 | 11.18 |
| $K_2O$ | 0.07 | - | - | - | 0.08 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Other | - | - | - | - | 0.14 | - | - | - | 0.14 | 0.16 | - | - | - | - | - | - | - | - | - | - |
| TOTAL | 100.81 | 100.28 | 101.99 | 100.89 | 101.47 | 99.80 | 100.83 | 100.48 | 99.71 | 99.19 | 99.98 | 99.55 | 101.33 | 100.76 | 99.32 | 98.55 | 99.74 | 100.75 | 100.40 | 98.74 |

Structural formulae based on 6(O)
Cation total recalculated to 4

| | 006-1 RIM | 006-1 CORE | 006-3 RIM | 006-3 CORE | 006-11 RIM | 006-11 CORE | 006 AVG. RIM(11) | 006 AVG. CORE(6)* | 009-15 RIM | 009-15 CORE | 009-2 RIM | 009-2 CORE | 009-7 RIM | 009-7 CORE | 009 AVG. RIM(6) | 009 AVG. CORE(7) | 016-4 RIM | 016-4 CORE | 016-6 RIM | 016-6 CORE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Si | 1.965 | 1.954 | 1.976 | 1.958 | 1.995 | 1.982 | 1.982 | 1.968 | 1.966 | 1.930 | 1.999 | 1.957 | 1.993 | 1.989 | 1.990 | 1.969 | 2.018 | 1.995 | 2.010 | 2.012 |
| Ti | - | - | .004 | - | - | .004 | - | - | - | .006 | - | .004 | - | - | - | .002 | - | - | - | - |
| Al | .064 | .111 | .076 | .101 | .025 | .069 | .057 | .093 | .050 | .083 | .034 | .101 | .037 | .063 | .038 | .086 | .024 | .025 | .016 | .026 |
| $Fe^{3+}$ | .203 | .025 | .197 | .025 | .517 | .142 | .162 | .035 | .268 | .126 | .317 | .124 | .254 | - | .283 | .053 | .734 | .929 | .834 | .790 |
| $Fe^{2+}$ | .369 | .145 | .230 | .125 | .166 | .278 | .379 | .147 | .339 | .261 | .311 | .312 | .354 | .233 | .309 | .211 | .109 | - | .034 | .090 |
| Mn | .017 | - | .005 | - | .012 | .009 | .014 | .001 | .014 | .008 | .016 | .009 | .017 | - | .015 | .020 | - | .004 | .007 | - |
| Mg | .384 | .790 | .516 | .817 | .272 | .521 | .414 | .777 | .379 | .594 | .327 | .513 | .363 | .782 | .376 | .708 | .130 | .054 | .108 | .107 |
| Ca | .800 | .930 | .762 | .932 | .474 | .812 | .809 | .913 | .728 | .898 | .648 | .833 | .705 | .896 | .679 | .889 | .193 | .060 | .119 | .136 |
| Na | .194 | .045 | .234 | .042 | .532 | .183 | .183 | .065 | .253 | .088 | .349 | .147 | .277 | .034 | .309 | .081 | .793 | .944 | .871 | .839 |
| K | .003 | - | - | - | .004 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Other | - | - | - | - | .004 | - | - | - | .004 | .005 | - | - | - | - | - | - | - | - | - | - |

TABLE 2.2 cont...

| wt% | 016-11 | 016-11 | 016 | 016 | 021-2 | 021-2 | 021-16 | 021-16 | 021 | 021 | 179-2 | 179-2 | 179-3 | 179-3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RIM | CORE | AVG. RIM(6) | AVG. CORE(5) | RIM | CORE | RIM | CORE | AVG. RIM(4) | AVG. CORE(5) | RIM | CORE | RIM | CORE |
| $SiO_2$ | 53.05 | 53.23 | 52.65 | 52.31 | 51.52 | 52.06 | 52.04 | 51.96 | 51.81 | 51.89 | 52.30 | 52.07 | 52.68 | 52.01 |
| $TiO_2$ | - | - | 0.03 | - | - | 0.21 | 0.26 | 0.14 | 0.07 | 0.18 | - | - | - | - |
| $Al_2O_3$ | 0.56 | 0.67 | 0.81 | 0.55 | 0.56 | 0.70 | 0.63 | 0.52 | 0.67 | 0.59 | 0.41 | 0.49 | 0.33 | 0.35 |
| $Fe_2O_3$ | 29.38 | 29.80 | 28.95 | 30.35 | 30.88 | 27.80 | 27.15 | 24.81 | 28.90 | 26.85 | 10.10 | 9.13 | 12.07 | 8.91 |
| FeO | 0.17 | 2.79 | 1.09 | 1.19 | 0.62 | 1.54 | 1.55 | 2.39 | 1.28 | 1.49 | 11.77 | 11.90 | 10.62 | 14.72 |
| MnO | - | - | 0.03 | 0.06 | - | - | - | 0.16 | - | 0.03 | 0.59 | 0.62 | 0.56 | 0.66 |
| MgO | 1.84 | 0.37 | 2.23 | 1.21 | 0.67 | 1.76 | 1.90 | 2.91 | 1.27 | 2.35 | 5.59 | 5.94 | 5.14 | 4.56 |
| CaO | 3.95 | 0.69 | 2.97 | 2.11 | 1.08 | 2.47 | 3.11 | 5.59 | 2.11 | 3.85 | 15.42 | 16.07 | 13.19 | 15.90 |
| $Na_2O$ | 11.85 | 12.79 | 11.52 | 12.20 | 12.55 | 11.78 | 11.47 | 10.17 | 12.00 | 11.11 | 4.41 | 4.00 | 5.55 | 3.95 |
| $K_2O$ | - | - | - | - | - | - | - | 0.07 | - | - | - | - | - | - |
| Other | - | 0.15 | - | - | 0.26 | - | 0.06 | 0.12 | - | - | - | 0.15 | 0.18 | - |
| TOTAL | 100.80 | 100.49 | 100.28 | 99.98 | 98.14 | 98.32 | 98.17 | 98.84 | 98.11 | 98.34 | 100.59 | 100.37 | 100.32 | 101.06 |

Structural formulae based on 6(O)
Cation total recalculated to 4

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Si | 2.004 | 2.028 | 2.002 | 2.001 | 2.006 | 2.015 | 2.017 | 2.004 | 2.014 | 2.008 | 2.009 | 2.004 | 2.022 | 2.010 |
| Ti | - | - | .001 | - | - | .006 | .008 | .004 | .002 | .006 | - | - | - | - |
| Al | .025 | .030 | .036 | .025 | .026 | .032 | .029 | .024 | .031 | .027 | .019 | .022 | .015 | .016 |
| $Fe^{3+}$ | .835 | .855 | .807 | .878 | .905 | .810 | .792 | .720 | .841 | .780 | .292 | .265 | .349 | .259 |
| $Fe^{2+}$ | .005 | .089 | .056 | .034 | .020 | .050 | .050 | .077 | .046 | .050 | .378 | .383 | .341 | .476 |
| Mn | - | - | .001 | .002 | - | - | - | .005 | - | .001 | .019 | .020 | .018 | .022 |
| Mg | .104 | .021 | .126 | .069 | .039 | .101 | .110 | .167 | .074 | .136 | .320 | .341 | .294 | .263 |
| Ca | .160 | .028 | .121 | .087 | .045 | .102 | .129 | .231 | .088 | .160 | .635 | .663 | .542 | .658 |
| Na | .868 | .945 | .849 | .905 | .948 | .884 | .862 | .761 | .904 | .833 | .329 | .299 | .413 | .296 |
| K | - | - | - | - | - | - | - | .033 | - | - | - | - | - | - |
| Other | - | .005 | - | - | .011 | - | .004 | .004 | - | - | - | .005 | .006 | - |

* refers to number of analyses in average value

**TABLE 2.3 : GILGARNA ROCK REPRESENTATIVE AMPHIBOLE ANALYSES**

| wt% | 009-8 | 016-1 | 016-1 | 016-13 | 016-13 | 016 | 016 | 018-2 | 018-2 | 018-3 | 018-3 | 021-1 | 021-1 | 021-21 | 021-21 | 021 | 021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | REPL PYX | RIM | CORE | RIM | CORE | AVG. RIM(4) | AVG. CORE(9)* | RIM | CORE | RIM | CORE | RIM | CORE | RIM | CORE | AVG. RIM(3) | AVG. CORE(3) |
| $SiO_2$ | 46.86 | 55.36 | 54.88 | 57.66 | 54.66 | 53.02 | 53.87 | 42.21 | 46.13 | 41.27 | 42.26 | 54.09 | 54.47 | 54.22 | 53.61 | 54.11 | 54.06 |
| $TiO_2$ | 0.67 | - | - | - | - | - | - | 0.86 | 0.46 | 1.03 | 0.93 | - | - | - | - | - | - |
| $Al_2O_3$ | 8.30 | 0.81 | 0.87 | 0.85 | 0.60 | 0.65 | 0.77 | 9.32 | 5.78 | 9.85 | 8.47 | 0.31 | 0.40 | 0.84 | 0.43 | 0.64 | 0.56 |
| $Fe_2O_3$ | 0.67 | 12.72 | 10.29 | 16.36 | 5.56 | 12.57 | 10.70 | 2.73 | 4.14 | 4.14 | 2.97 | 8.76 | 7.62 | 9.72 | 11.95 | 8.94 | 10.09 |
| FeO | 9.11 | 12.40 | 11.99 | 9.08 | 17.95 | 11.98 | 12.19 | 11.62 | 13.35 | 13.35 | 14.33 | 8.82 | 9.77 | 10.06 | 9.13 | 9.81 | 9.53 |
| MnO | - | 0.19 | 0.21 | 13.61 | 0.23 | 0.30 | 0.28 | - | - | - | - | - | - | 0.13 | - | - | - |
| MgO | 15.46 | 9.18 | 10.35 | 9.48 | 7.77 | 8.41 | 9.67 | 11.78 | 13.60 | 11.15 | 11.26 | 12.26 | 12.40 | 11.02 | 10.94 | 11.63 | 11.46 |
| CaO | 11.57 | 0.58 | 1.64 | 1.44 | 1.94 | 0.89 | 1.51 | 11.33 | 11.26 | 11.08 | 11.50 | 1.59 | 2.32 | 1.24 | 0.85 | 1.52 | 1.40 |
| $Na_2O$ | 2.92 | 7.31 | 6.92 | 7.12 | 7.47 | 6.35 | 6.74 | 2.93 | 2.29 | 2.80 | 2.32 | 6.14 | 6.06 | 6.62 | 6.78 | 6.45 | 6.48 |
| $K_2O$ | 0.31 | 0.18 | 0.39 | 0.08 | 0.16 | 0.16 | 0.34 | 1.10 | 0.61 | 1.19 | 1.13 | 1.36 | 1.12 | 0.82 | 0.50 | 1.07 | 0.86 |
| Other | - | - | - | - | - | - | - | - | 0.12 | - | - | - | - | - | - | - | - |
| TOTAL | 96.06 | 98.73 | 97.55 | 100.60 | 97.27 | 94.36 | 96.09 | 95.37 | 95.85 | 95.85 | 95.17 | 93.34 | 94.15 | 94.67 | 94.19 | 94.17 | 94.43 |

Structural formulae on the basis of 23(O)
** Cation total recalculated to 13, exclusive of K, Na and Ca

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Si | 6.886 | 7.988 | 7.991 | 8.139 | 8.158 | 8.010 | 7.988 | 6.471 | 6.973 | 6.346 | 6.545 | 8.110 | 8.110 | 8.057 | 8.007 | 8.074 | 8.045 |
| Ti | .075 | - | - | - | - | - | - | .099 | .052 | .119 | .108 | - | - | - | - | - | - |
| $Al^{IV}$ | 1.114 | .012 | .009 | - | - | - | - | 1.529 | 1.027 | 1.654 | 1.455 | - | - | - | - | - | - |
| $Al^{VI}$ | .324 | .125 | .140 | .142 | .106 | .116 | .135 | .154 | .003 | .131 | .091 | .056 | .069 | .147 | .075 | .113 | .098 |
| $Fe^{3+}$ | .074 | 1.381 | 1.128 | 1.003 | .650 | 1.429 | 1.194 | .315 | .399 | .479 | .346 | .989 | .853 | 1.087 | 1.343 | 1.004 | 1.129 |
| $Fe^{2+}$ | 1.119 | 1.496 | 1.460 | 1.671 | 2.330 | 1.513 | 1.512 | 1.741 | 1.469 | 1.716 | 1.856 | 1.106 | 1.216 | 1.251 | 1.141 | 1.224 | 1.186 |
| Mn | - | .023 | .026 | .049 | .029 | .038 | .035 | - | - | - | - | - | - | .016 | - | - | - |
| Mg | 3.387 | 1.975 | 2.246 | 1.996 | 1.728 | 1.893 | 2.137 | 2.691 | 3.063 | 2.555 | 2.599 | 2.739 | 2.752 | 2.442 | 2.435 | 2.586 | 2.542 |
| Ca | 1.826 | .094 | .264 | .222 | .316 | .150 | .247 | 1.875 | 1.842 | 1.848 | 1.926 | .263 | .379 | .203 | .140 | .249 | .230 |
| $Na_A$ | .659 | .213 | .275 | .223 | .513 | .080 | .246 | .753 | .520 | .694 | .630 | .094 | .168 | .165 | .172 | .165 | .156 |
| $Na_B$ | .174 | 1.907 | 1.736 | 1.778 | 1.685 | 1.851 | 1.753 | .125 | .158 | .152 | .074 | 1.738 | 1.621 | 1.797 | 1.860 | 1.751 | 1.770 |
| K | .058 | .034 | .075 | .016 | .031 | .032 | .066 | .217 | .119 | .237 | .225 | .267 | .218 | .160 | .099 | .209 | .168 |
| Other | | - | - | - | - | - | - | - | .014 | - | - | - | - | - | - | - | - |

* refers to number of analyses in average value

** Excludes any Mn, $Fe^{2+}$ and Mg from the B site, eliminating any cummingtonite component.

## TABLE 2.4 : GILGARNA ROCK REPRESENTATIVE BIOTITE ANALYSES

| wt% | 006-8 RIM | 006-8 CORE | 006 AVG. (5)* | 009-9 RIM | 009-9 CORE | 009 AVG. (11) | 009 AVG. RIM(5) | 009 AVG. CORE(4) | 016-4 RIM | 016-4 TWDS CORE | 016-4 CORE | 016 AVG. RIM(4) | 016 AVG. CORE(3) | 018-2 CORE | 021 AVG. RIM(2) | 021 AVG. CORE(2) | 179-3 CORE | 179-4 CORE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 45.06 | 44.05 | 43.85 | 42.48 | 44.33 | 42.94 | 42.67 | 43.60 | 43.58 | 49.28 | 45.20 | 43.15 | 44.96 | 40.01 | 42.61 | 46.37 | 41.22 | 43.47 |
| $TiO_2$ | 0.54 | 0.37 | 0.37 | 0.12 | 0.60 | 0.35 | 0.32 | 0.46 | 0.41 | - | 0.41 | 0.37 | 0.30 | - | 1.14 | 0.58 | 0.23 | 0.17 |
| $Al_2O_3$ | 9.49 | 9.33 | 9.53 | 10.20 | 9.39 | 9.67 | 9.97 | 9.35 | 9.44 | 6.54 | 7.52 | 9.47 | 8.25 | 11.93 | 9.50 | 7.47 | 9.06 | 8.16 |
| FeO* | 11.97 | 11.75 | 12.11 | 12.17 | 11.06 | 11.31 | 11.66 | 10.91 | 9.78 | 4.85 | 7.01 | 10.64 | 8.08 | 10.29 | 8.75 | 5.56 | 14.30 | 11.63 |
| MnO | - | - | - | 0.23 | 0.19 | 0.21 | 0.28 | 0.11 | - | - | - | 0.14 | 0.04 | - | - | - | 0.39 | 0.30 |
| MgO | 17.94 | 17.62 | 17.60 | 18.28 | 18.28 | 18.13 | 18.16 | 18.25 | 19.41 | 21.20 | 19.61 | 18.73 | 19.60 | 18.60 | 19.05 | 20.05 | 16.39 | 17.77 |
| CaO | - | - | - | 0.14 | - | 0.01 | - | - | - | - | - | - | - | - | - | - | - | - |
| $Na_2O$ | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.68 | - | - | - | - |
| $K_2O$ | 9.53 | 10.07 | 9.82 | 9.99 | 9.73 | 9.87 | 9.86 | 9.82 | 9.93 | 9.91 | 9.87 | 9.82 | 9.90 | 9.85 | 9.76 | 9.77 | 10.70 | 10.83 |
| TOTAL | 94.53 | 93.19 | 93.28 | 93.61 | 93.58 | 92.49 | 92.92 | 92.50 | 92.55 | 91.78 | 89.62 | 92.32 | 91.13 | 91.36 | 90.81 | 89.80 | 92.29 | 92.33 |

Structural formulae on the basis of 22(O)

| | 006-8 RIM | 006-8 CORE | 006 AVG. (5)* | 009-9 RIM | 009-9 CORE | 009 AVG. (11) | 009 AVG. RIM(5) | 009 AVG. CORE(4) | 016-4 RIM | 016-4 TWDS CORE | 016-4 CORE | 016 AVG. RIM(4) | 016 AVG. CORE(3) | 018-2 CORE | 021 AVG. RIM(2) | 021 AVG. CORE(2) | 179-3 CORE | 179-4 CORE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Si | 6.585 | 6.563 | 6.530 | 6.344 | 6.544 | 6.450 | 6.396 | 6.520 | 6.482 | 7.128 | 6.825 | 6.467 | 6.717 | 6.097 | 6.431 | 6.911 | 6.370 | 6.596 |
| Ti | .059 | .041 | .041 | .014 | .067 | .040 | .036 | .051 | .046 | - | .047 | .042 | .034 | - | .129 | .065 | .027 | .019 |
| $Al^{IV}$ | 1.415 | 1.437 | 1.470 | 1.656 | 1.456 | 1.550 | 1.604 | 1.480 | 1.518 | 0.872 | 1.175 | 1.533 | 1.283 | 1.903 | 1.569 | 1.089 | 1.630 | 1.404 |
| $Al^{VI}$ | 0.220 | 0.202 | 0.203 | 0.139 | 0.178 | 0.162 | 0.156 | 0.170 | 0.137 | 0.243 | 0.163 | 0.140 | 0.169 | 0.239 | 0.121 | 0.225 | 0.020 | 0.056 |
| Fe(tot) | 1.463 | 1.464 | 1.508 | 1.520 | 1.365 | 1.420 | 1.461 | 1.365 | 1.217 | .587 | .885 | 1.335 | 1.008 | 1.311 | 1.394 | .694 | 1.848 | 1.476 |
| Mn | - | - | - | .029 | .024 | .027 | .035 | .014 | - | - | - | .017 | .006 | - | - | - | .051 | .038 |
| Mg | 3.908 | 3.912 | 3.906 | 4.069 | 4.022 | 4.058 | 4.053 | 4.068 | 4.304 | 4.570 | 4.414 | 4.175 | 4.364 | 4.224 | 4.287 | 4.454 | 3.776 | 4.018 |
| Ca | - | - | - | .022 | - | .002 | .004 | - | - | - | - | - | - | - | - | - | - | - |
| Na | - | - | - | - | - | - | - | - | - | - | - | - | - | .200 | .029 | - | - | - |
| K | 1.777 | 1.914 | 1.866 | 1.904 | 1.832 | 1.891 | 1.883 | 1.874 | 1.884 | 1.829 | 1.900 | 1.877 | 1.887 | 1.915 | 1.880 | 1.856 | 2.110 | 2.090 |
| Fe/Fe+Mg | 0.272 | 0.272 | 0.278 | 0.272 | 0.253 | 0.259 | 0.265 | 0.251 | 0.220 | 0.114 | 0.167 | 0.242 | 0.188 | 0.237 | 0.245 | 0.134 | 0.328 | 0.269 |

* refers to number of analyses in average value
FeO* = total iron

**TABLE 2.5 : GILGARNA ROCK REPRESENTATIVE TITANITE & APATITE ANALYSES**

| wt% | 006-2 | 006-2 | 009-18 | 009-18 | 016-13 | 016-13 | 021-23 | 021-23 | 179-1 | 179-1 |
|---|---|---|---|---|---|---|---|---|---|---|
| | TITANITE | | | | | | | | | |
| | RIM | CORE | RIM | CORE | RIM | CORE | RIM | CORE | RIM | CORE |
| $SiO_2$ | 31.62 | 30.92 | 29.22 | 29.36 | 30.60 | 30.09 | 29.39 | 29.65 | 31.42 | 30.36 |
| $TiO_2$ | 35.08 | 36.66 | 33.81 | 34.28 | 34.04 | 36.30 | 33.67 | 33.94 | 35.12 | 36.02 |
| $Al_2O_3$ | 1.64 | 1.40 | 1.25 | 1.28 | 1.56 | 1.39 | 1.82 | 1.81 | 0.88 | 1.25 |
| FeO* | 3.23 | 2.09 | 3.64 | 3.03 | 3.78 | 2.34 | 2.88 | 2.66 | 4.40 | 2.96 |
| MgO | - | - | - | 0.14 | 0.14 | - | - | - | - | - |
| CaO | 27.82 | 28.92 | 27.54 | 27.76 | 28.07 | 28.06 | 27.40 | 27.38 | 28.34 | 28.22 |
| $Na_2O$ | 0.40 | - | - | - | - | - | - | 0.20 | 0.31 | 0.17 |
| $P_2O_5$ | 0.26 | - | 0.20 | - | - | - | 0.15 | 0.32 | - | - |
| Other | 0.51 | 0.35 | 0.85 | 0.73 | 0.71 | 0.23 | 0.67 | 0.84 | 1.02 | 0.45 |
| TOTAL | 100.56 | 100.34 | 96.51 | 96.58 | 98.90 | 98.41 | 95.98 | 96.80 | 101.49 | 99.43 |

Structural formulae based on 18(O)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Si | 3.721 | 3.647 | 3.618 | 3.624 | 3.682 | 3.622 | 3.636 | 3.631 | 3.689 | 3.630 |
| Ti | 3.105 | 3.252 | 3.148 | 3.182 | 3.080 | 3.286 | 3.132 | 3.126 | 3.102 | 3.238 |
| Al | .227 | .194 | .183 | .186 | .221 | .198 | .265 | .261 | .122 | .177 |
| Fe(tot) | .318 | .207 | .377 | .313 | .380 | .236 | .298 | .273 | .432 | .296 |
| Mg | - | - | - | .025 | .024 | - | - | - | - | - |
| Ca | 3.508 | 3.655 | 3.654 | 3.671 | 3.619 | 3.619 | 3.631 | 3.592 | 3.566 | 3.616 |
| Na | .091 | - | - | - | - | - | - | .047 | .071 | .040 |
| P | .026 | - | .021 | - | - | - | .016 | .033 | - | - |
| Other | .048 | .033 | .084 | .056 | .066 | .022 | .066 | .082 | .093 | .043 |

| wt% | 006-13 | 006-13 | 009-17 | 018-4 | 018-4 | 021-20 | 021-20 | 179-7 | 179-7 |
|---|---|---|---|---|---|---|---|---|---|
| | APATITE | | | | | | | | |
| | RIM | CORE | CORE | RIM | CORE | RIM | CORE | RIM | CORE |
| $SiO_2$ | 0.73 | 0.63 | 0.74 | 0.76 | 0.69 | 0.35 | 0.38 | 0.95 | 1.86 |
| $Al_2O_3$ | 0.16 | 0.15 | - | 0.48 | 0.40 | - | - | - | - |
| MgO | - | - | - | 0.15 | 0.19 | - | - | - | - |
| CaO | 57.51 | 57.65 | 53.19 | 54.83 | 54.84 | 54.00 | 53.90 | 53.64 | 54.03 |
| $Na_2O$ | - | - | - | 0.58 | 0.38 | - | - | - | - |
| $K_2O$ | - | - | - | 0.12 | - | - | - | - | - |
| $P_2O_5$ | 41.77 | 41.93 | 39.09 | 38.46 | 38.99 | 40.29 | 40.22 | 39.72 | 38.16 |
| Other | - | - | 0.63 | 0.30 | - | - | - | - | 1.61 |
| TOTAL | 100.17 | 100.36 | 93.65 | 95.68 | 95.49 | 94.64 | 94.50 | 94.31 | 95.66 |

Structural formulae based on 25(O)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Si | .121 | .103 | .131 | .133 | .120 | .060 | .061 | .166 | .318 |
| Al | .030 | .030 | - | .099 | .082 | - | - | - | - |
| Mg | - | - | - | .039 | .050 | - | - | - | - |
| Ca | 10.149 | 10.156 | 9.996 | 10.191 | 10.198 | 10.057 | 10.051 | 10.016 | 9.933 |
| Na | - | - | - | .195 | .129 | - | - | - | - |
| K | - | - | - | .026 | - | - | - | - | - |
| P | 5.825 | 5.837 | 5.804 | 5.649 | 5.730 | 5.929 | 5.927 | 5.861 | 5.542 |
| Other | - | - | .081 | .037 | - | - | - | - | .199 |

TABLE 2.6 : GILGARNA ROCK WHOLE ROCK AND TRACE ELEMENT GEOCHEMISTRY

COARSE GRAINED SYENITE

| | 015 | 016 | 173 | 176 | 177 | 178 | 023 | 179 | 180 | 181 |
|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 65.39 | 65.74 | 67.40 | 65.11 | 65.37 | 65.44 | 68.16 | 68.71 | 67.16 | 67.11 |
| $TiO_2$ | 0.18 | 0.18 | 0.17 | 0.18 | 0.18 | 0.19 | 0.15 | 0.21 | 0.15 | 0.28 |
| $Al_2O_3$ | 17.33 | 17.19 | 17.15 | 16.88 | 16.85 | 16.97 | 16.27 | 15.09 | 16.35 | 15.38 |
| $Fe_2O_3$ | 1.25 | 1.00 | 1.23 | 1.24 | 1.60 | 1.40 | 1.10 | 1.38 | 1.26 | 1.68 |
| FeO | 0.36 | 0.45 | 0.15 | 0.31 | na | 0.16 | 0.09 | 0.21 | na | 0.51 |
| MnO | 0.03 | 0.03 | nd | 0.02 | nd | 0.02 | 0.05 | 0.03 | 0.01 | 0.04 |
| MgO | 0.52 | 0.50 | 0.28 | 0.35 | 0.39 | 0.36 | 0.29 | 0.37 | 0.14 | 0.59 |
| CaO | 2.03 | 1.95 | 0.65 | 2.01 | 2.07 | 2.02 | 1.19 | 1.99 | 1.47 | 2.28 |
| $Na_2O$ | 7.40 | 7.76 | 7.64 | 7.89 | 7.82 | 7.76 | 6.82 | 6.57 | 6.81 | 6.96 |
| $K_2O$ | 3.75 | 3.70 | 4.07 | 3.77 | 3.79 | 3.83 | 4.78 | 4.22 | 5.05 | 4.01 |
| $P_2O_5$ | 0.07 | 0.07 | 0.15 | 0.07 | 0.06 | 0.07 | 0.04 | 0.06 | 0.03 | 0.10 |
| LOI | 1.52 | 1.38 | 0.47 | 1.48 | 1.40 | 1.43 | 1.01 | 1.02 | 1.20 | 0.58 |
| TOTAL | 99.83 | 99.95 | 99.35 | 99.32 | 99.51 | 99.64 | 99.95 | 99.85 | 99.63 | 99.52 |
| Sc | 2 | 2.7 | 1.9 | 3.5 | 3.3 | 3 | 1.5 | 3 | 1.8 | 3.3 |
| V | 17 | 16 | 17 | 17 | 17 | 18 | 12 | 18 | 13 | 24 |
| Cr | 7 | <5 | <5 | <5 | <5 | <5 | <5 | 7 | <5 | 12 |
| Ni | 5 | 6 | 7 | 4 | 3 | 2 | 3 | 5 | 3 | 10 |
| Cu | 8 | 13 | 4 | 9 | 9 | 11 | 4 | 4 | 5 | 7 |
| Pb | 13 | 14 | 19 | 14 | 11 | 13 | 21 | 17 | 24 | 16 |
| Zn | 39 | 38 | 32 | 39 | 41 | 38 | 29 | 42 | 27 | 62 |
| Ga | 22 | 21 | 24 | 21 | 22 | 22 | 25 | 23 | 26 | 24 |
| Rb | 93 | 82 | 108 | 82 | 83 | 85 | 153 | 144 | 162 | 123 |
| Sr | 848 | 1136 | 839 | 1184 | 1086 | 1136 | 189 | 323 | 228 | 452 |
| Y | 8 | 6.6 | 15.9 | 7.8 | 7.6 | 8.5 | 8.6 | 11.7 | 8.5 | 15.5 |
| Zr | 84 | 84 | 112 | 84 | 85 | 95 | 102 | 97 | 96 | 157 |
| Nb | 15.7 | 13.8 | 17.3 | 13.9 | 14.2 | 14.3 | 14.6 | 16.2 | 15.4 | 21.2 |
| Ba | 1064 | 1010 | 860 | 987 | 983 | 969 | 703 | 599 | 720 | 669 |
| La | 47 | 34 | 61 | 37 | 43 | 40 | 32 | 57 | 36 | 56 |
| Ce | 77 | 71 | 63 | 62 | 68 | 73 | 62 | 81 | 63 | 96 |
| Nd | 34 | 27 | 45 | 32 | 31 | 33 | 25 | 36 | 31 | 50 |
| Th | 8 | 9 | 12 | 8 | 9 | 8 | 7 | 8 | 7 | 7 |
| U | 3 | 4 | na | na | na | na | 3 | na | na | na |
| F | 1475 | 950 | 950 | 950 | na | 1100 | 1700 | 1925 | na | 1725 |

Major elements wt.%, trace elements p.p.m.
na = no analysis , nd = not detected.

015-178 COARSE-GRAINED SYENITE, GNAMMA-HOLE LOCALITY
173 COARSE-GRAINED SYENITE, NORTH-EASTERN OUTCROP
023,179-181 MEDIUM-GRAINED DYKE,CUTTING COARSE PHASE (DIFFERENTIATE)

TABLE 2.6 cont...

MEDIUM GRAINED SYENITE

| | 022 | 006 | 007 | 008 | 009 | 010 | 011 | 012 | 013 | 171 |
|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 67.94 | 64.54 | 65.00 | 64.97 | 63.92 | 64.70 | 64.48 | 66.29 | 70.12 | 64.77 |
| $TiO_2$ | 0.20 | 0.29 | 0.31 | 0.29 | 0.28 | 0.27 | 0.28 | 0.25 | 0.30 | 0.26 |
| $Al_2O_3$ | 15.58 | 17.15 | 17.15 | 16.68 | 16.63 | 16.62 | 16.52 | 17.56 | 14.23 | 16.07 |
| $Fe_2O_3$ | 1.44 | 1.76 | 2.15 | 1.80 | 1.74 | 1.74 | 1.57 | 2.14 | 2.85 | 2.09 |
| FeO | 0.20 | 0.66 | 0.55 | 0.74 | 0.66 | 0.76 | 0.80 | na | na | 0.26 |
| MnO | 0.05 | 0.09 | 0.08 | 0.06 | 0.05 | 0.06 | 0.05 | 0.04 | 0.10 | 0.03 |
| MgO | 0.50 | 0.74 | 0.78 | 0.77 | 0.73 | 0.79 | 0.93 | 0.55 | 1.09 | 0.42 |
| CaO | 1.82 | 2.13 | 1.76 | 2.52 | 2.67 | 2.44 | 2.57 | 0.95 | 3.38 | 2.04 |
| $Na_2O$ | 7.18 | 7.62 | 7.86 | 7.98 | 7.54 | 7.56 | 7.35 | 8.03 | 6.46 | 7.62 |
| $K_2O$ | 3.69 | 3.78 | 3.78 | 3.72 | 3.60 | 3.71 | 3.66 | 3.93 | 0.81 | 4.32 |
| $P_2O_5$ | 0.05 | 0.14 | 0.15 | 0.15 | 0.13 | 0.14 | 0.14 | 0.12 | 0.08 | 0.13 |
| LOI | 1.48 | 0.42 | 0.42 | 0.62 | 1.38 | 0.51 | 1.54 | 0.34 | 0.47 | 1.35 |
| TOTAL | 100.13 | 99.32 | 99.98 | 100.29 | 99.33 | 99.30 | 99.88 | 100.20 | 99.88 | 99.36 |
| | | | | | | | | | | |
| Sc | 2.5 | 3.3 | 3.4 | 3 | 3.3 | 3.2 | 3.6 | 2.1 | 6.7 | 3.2 |
| V | 19 | 33 | 35 | 28 | 29 | 28 | 32 | 26 | 43 | 29 |
| Cr | 13 | 7 | 5 | 6 | 5 | 5 | <5 | 5 | 56 | <5 |
| Ni | 7 | 12 | 8 | 10 | 7 | 7 | 4 | 12 | 27 | 4 |
| Cu | 4 | 13 | 17 | 10 | 8 | 13 | 9 | 8 | 21 | 4 |
| Pb | 15 | 14 | 15 | 16 | 21 | 22 | 18 | 16 | 13 | 12 |
| Zn | 44 | 50 | 58 | 57 | 57 | 63 | 54 | 44 | 55 | 49 |
| Ga | 25 | 22 | 22 | 25 | 23 | 24 | 21 | 23 | 17 | 23 |
| Rb | 121 | 83 | 99 | 99 | 99 | 122 | 104 | 105 | 25.7 | 112 |
| Sr | 328 | 747 | 667 | 649 | 682 | 800 | 736 | 614 | 811 | 421 |
| Y | 11.5 | 14.6 | 12.8 | 19 | 10.1 | 12 | 11.4 | 13.6 | 11.4 | 10 |
| Zr | 220 | 98 | 118 | 176 | 148 | 175 | 106 | 76 | 91 | 103 |
| Nb | 14.6 | 24.8 | 26.3 | 31.6 | 27.2 | 24.6 | 20.9 | 21 | 4.5 | 20.7 |
| Ba | 934 | 1102 | 1369 | 1372 | 839 | 727 | 705 | 758 | 421 | 606 |
| La | 57 | 41 | 53 | 75 | 53 | 54 | 46 | 45 | 54 | 69 |
| Ce | 89 | 95 | 97 | 96 | 84 | 96 | 83 | 75 | 80 | 102 |
| Nd | 31 | 46 | 43 | 52 | 30 | 42 | 41 | 40 | 30 | 44 |
| Th | 11 | 10 | 8 | 17 | 14 | 11 | 8 | 5 | 6 | 7 |
| U | 2 | 2 | 3 | 4 | 2 | 3 | 2 | 2 | 3 | na |
| F | 800 | 450 | 600 | 1125 | 950 | 1250 | 1000 | na | na | 700 |

Major elements wt.%, trace elements p.p.m.
na = no analysis , nd = not detected.

022 COARSE GRAINED SYENITE
006-011 MEDIUM GRAINED SYENITE
012 MEDIUM HALF OF MED/COARSE CONTACT SAMPLE
013 MEDIUM SYENITE ADJACENT TO MAFIC XENOLITH
172 MEDIUM GRAINED SYENITE

TABLE 2.6 cont...

MEDIUM GRAINED SYENITE, MONZODIORITE PORPHYRY

| | 021 | 172 | 174 | 175 | 014 | 017 | 018 | 182 | 183 | 184 |
|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 67.53 | 65.03 | 67.03 | 67.70 | 59.39 | 64.21 | 61.84 | 64.24 | 64.08 | 63.83 |
| $TiO_2$ | 0.21 | 0.22 | 0.24 | 0.22 | 0.61 | 0.37 | 0.40 | 0.36 | 0.36 | 0.37 |
| $Al_2O_3$ | 15.01 | 16.49 | 14.83 | 15.28 | 15.80 | 15.73 | 15.99 | 15.63 | 15.55 | 15.62 |
| $Fe_2O_3$ | 1.54 | 1.64 | 1.80 | 1.48 | 7.20 | 3.35 | 1.54 | 3.38 | 3.28 | 3.28 |
| FeO | 0.15 | 0.26 | 0.19 | 0.20 | na | na | 1.87 | na | na | na |
| MnO | 0.04 | nd | 0.01 | 0.01 | 0.15 | 0.07 | 0.07 | 0.08 | 0.05 | 0.05 |
| MgO | 0.51 | 0.37 | 0.49 | 0.40 | 2.77 | 2.60 | 2.81 | 2.39 | 2.34 | 2.28 |
| CaO | 1.99 | 2.17 | 2.15 | 1.94 | 3.64 | 4.32 | 4.60 | 4.14 | 4.24 | 4.24 |
| $Na_2O$ | 7.03 | 7.76 | 7.15 | 7.13 | 7.17 | 5.58 | 6.27 | 5.71 | 5.73 | 5.54 |
| $K_2O$ | 3.65 | 4.06 | 3.73 | 3.68 | 2.22 | 2.73 | 2.64 | 2.64 | 2.65 | 2.97 |
| $P_2O_5$ | 0.06 | 0.09 | 0.07 | 0.05 | 0.22 | 0.27 | 0.29 | 0.24 | 0.24 | 0.23 |
| LOI | 1.68 | 1.23 | 1.77 | 1.57 | 0.53 | 0.59 | 0.79 | 0.58 | 0.51 | 0.62 |
| TOTAL | 99.39 | 99.32 | 99.45 | 99.66 | 99.68 | 99.80 | 99.11 | 99.48 | 99.00 | 99.03 |
| Sc | 2.6 | 3.6 | 3.3 | 3.4 | 12.4 | 8.6 | 8.7 | 8.7 | 8.4 | 9 |
| V | 19 | 23 | 22 | 17 | 105 | 58 | 59 | 54 | 55 | 53 |
| Cr | 11 | <5 | 7 | 5 | 120 | 110 | 107 | 95 | 99 | 98 |
| Ni | 7 | 7 | 3 | 7 | 64 | 42 | 47 | 47 | 41 | 41 |
| Cu | 3 | 5 | 3 | 2 | 19 | 15 | 13 | 8 | 13 | 11 |
| Pb | 15 | 10 | 13 | 14 | 15 | 19 | 16 | 16 | 18 | 16 |
| Zn | 49 | 37 | 52 | 52 | 154 | 70 | 76 | 69 | 70 | 68 |
| Ga | 22 | 21 | 24 | 22 | 22 | 22 | 22 | 19 | 21 | 21 |
| Rb | 115 | 97 | 113 | 122 | 65 | 63 | 87 | 67 | 62 | 77 |
| Sr | 529 | 566 | 400 | 400 | 894 | 537 | 1044 | 837 | 808 | 854 |
| Y | 12.5 | 8.5 | 15.2 | 14 | 26.6 | 10.4 | 11.3 | 13.3 | 13.3 | 14.3 |
| Zr | 262 | 73 | 289 | 238 | 164 | 145 | 142 | 146 | 142 | 143 |
| Nb | 16.6 | 18.6 | 19.4 | 18.8 | 8.8 | 4.5 | 4.3 | 4.1 | 4.7 | 4.6 |
| Ba | 769 | 940 | 672 | 758 | 734 | 1806 | 1650 | 1748 | 1598 | 1810 |
| La | 64 | 61 | 76 | 59 | 136 | 29 | 43 | 37 | 39 | 46 |
| Ce | 97 | 91 | 110 | 95 | 181 | 75 | 71 | 81 | 67 | 72 |
| Nd | 36 | 36 | 46 | 42 | 84 | 24 | 28 | 40 | 28 | 30 |
| Th | 15 | 9 | 12 | 12 | 12 | 7 | 7 | 7 | 8 | 8 |
| U | 4 | na | na | na | 19 | 4 | 3 | na | na | na |
| F | 800 | 1375 | 850 | 700 | na | na | 3375 | na | na | na |

Major elements wt.%, trace elements p.p.m.
na = no analysis , nd = not detected.

021 MEDIUM GRAINED SYENITE
172,174,175 MEDIUM GRAINED SYENITE SIMILAR TO 021 & 022
017-184 MONZODIORITE PORPHYRY, SOUTH GNAMMA-HOLE

TABLE 2.6 cont...

| | RHYTHMIC LAYERED SYENITE | |
|---|---|---|
| | 019 | 020 |
| $SiO_2$ | 56.09 | 60.24 |
| $TiO_2$ | 2.11 | 1.27 |
| $Al_2O_3$ | 7.04 | 10.02 |
| $Fe_2O_3$ | 10.30 | 8.61 |
| FeO | nd | nd |
| MnO | 0.36 | 0.35 |
| MgO | 4.14 | 2.97 |
| CaO | 12.54 | 8.44 |
| $Na_2O$ | 3.93 | 4.74 |
| $K_2O$ | 1.48 | 1.83 |
| $P_2O_5$ | 0.73 | 0.50 |
| LOI | 0.68 | 0.40 |
| TOTAL | 99.40 | 99.37 |
| | | |
| Sc | 17.7 | 11.4 |
| V | 165 | 114 |
| Cr | 45 | 31 |
| Ni | 34 | 26 |
| Cu | nd | nd |
| Pb | nd | nd |
| Zn | 296 | 216 |
| Ga | 16 | 20 |
| Rb | 64 | 83 |
| Sr | 250 | 373 |
| Y | 107 | 83 |
| Zr | 1387 | 1213 |
| Nb | 125 | 75 |
| Ba | 386 | 883 |
| La | 348 | 263 |
| Ce | 633 | 508 |
| Nd | 405 | 280 |
| Th | nd | nd |
| U | nd | nd |
| F | nd | nd |

Major elements wt.%, trace elements p.p.m.
na = no analysis , nd = not detected.

019 - MAFIC SCHLIEREN
020 - FELSIC SCHLIEREN

TABLE 2.7 : GILGARNA ROCK REE ANALYSES

| | 009 | 016 | 022 | 179 |
|---|---|---|---|---|
| ppm | | | | |
| Ce | 87.1 | 65.1 | 78.0 | 77.3 |
| Nd | 43.7 | 36.3 | 27.0 | 31.6 |
| Sm | 8.39 | 5.89 | 4.08 | 4.58 |
| Dy | nm | 1.42 | 1.59 | nm |
| Er | 0.88 | 0.71 | 0.84 | 0.74 |
| Yb | 0.75 | 0.48 | 0.71 | 0.58 |
| La/Yb | 71 | 71 | 80 | 99 |

nm = not measured

## TABLE 2.8 : GILGARNA ROCK CIPW NORMS

SYENITE

| | 006 | 007 | 008 | 009 | 010 | 011 | 012 | 013 | 015 | 016 |
|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 58.66 | 58.65 | 58.50 | 58.69 | 58.93 | 59.04 | 59.48 | 64.71 | 59.79 | 59.80 |
| $TiO_2$ | 0.20 | 0.21 | 0.20 | 0.19 | 0.18 | 0.19 | 0.17 | 0.21 | 0.12 | 0.12 |
| $Al_2O_3$ | 18.37 | 18.24 | 17.70 | 18.00 | 17.84 | 17.82 | 18.57 | 15.48 | 18.68 | 18.43 |
| $Fe_2O_3$ | 1.20 | 1.46 | 1.22 | 1.20 | 1.19 | 1.08 | 1.01 | 1.38 | 0.86 | 0.68 |
| FeO | 0.50 | 0.42 | 0.56 | 0.51 | 0.58 | 0.61 | 0.54 | 0.73 | 0.28 | 0.34 |
| MnO | 0.07 | 0.06 | 0.05 | 0.04 | 0.05 | 0.04 | 0.03 | 0.08 | 0.02 | 0.02 |
| MgO | 1.00 | 1.05 | 1.03 | 1.00 | 1.07 | 1.27 | 0.74 | 1.50 | 0.71 | 0.68 |
| CaO | 2.08 | 1.71 | 2.43 | 2.63 | 2.38 | 2.52 | 0.91 | 3.35 | 1.99 | 1.90 |
| $Na_2O$ | 13.43 | 13.75 | 13.93 | 13.42 | 13.35 | 13.05 | 13.97 | 11.56 | 13.12 | 13.68 |
| $K_2O$ | 4.38 | 4.35 | 4.27 | 4.22 | 4.32 | 4.27 | 4.49 | 0.95 | 4.38 | 4.29 |
| $P_2O_5$ | 0.11 | 0.11 | 0.11 | 0.10 | 0.11 | 0.11 | 0.09 | 0.06 | 0.05 | 0.05 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | | | | | | | | | | |
| Ap | 0.31 | 0.33 | 0.33 | 0.28 | 0.31 | 0.31 | 0.26 | 0.17 | 0.15 | 0.15 |
| Il | 0.55 | 0.59 | 0.55 | 0.53 | 0.51 | 0.53 | 0.47 | 0.57 | 0.34 | 0.34 |
| Mt | 1.58 | 1.14 | 1.55 | 1.50 | 1.87 | 1.96 | 1.71 | 2.51 | 0.75 | 1.04 |
| Or | 22 | 22 | 22 | 21 | 22 | 22 | 23 | 4.73 | 22 | 22 |
| Ab | 64 | 66 | 65 | 64 | 64 | 63 | 68 | 54 | 63 | 66 |
| An | 1.42 | 0.35 | - | 0.90 | 0.45 | 1.28 | 0.26 | 7.42 | 3.02 | 1.17 |
| Di | 4.54 | 4.79 | 4.93 | 4.53 | 4.85 | 5.77 | 3.25 | 6.67 | 3.24 | 3.11 |
| Hy | - | - | - | - | - | - | 0.03 | - | - | - |
| Ac | - | - | 2.13 | - | - | - | - | - | - | - |
| Q | 2.25 | 1.89 | 1.20 | 2.33 | 2.83 | 3.53 | 2.82 | 23 | 4.54 | 3.52 |
| Hm | 0.67 | 1.36 | - | 0.72 | 0.45 | 0.23 | 0.32 | 0.26 | 0.75 | 0.29 |
| Tn | - | - | - | - | - | - | - | - | - | - |
| Wo | 1.31 | 0.85 | 2.48 | 2.73 | 2.20 | 1.75 | - | 0.53 | 1.28 | 1.95 |
| Total | 99 | 100 | 100 | 99 | 99 | 100 | 100 | 100 | 100 | 100 |
| | | | | | | | | | | |
| A | 77 | 76 | 77 | 77 | 76 | 76 | 80 | 63 | 83 | 85 |
| M | 5.01 | 5.08 | 5.06 | 5.05 | 5.35 | 6.42 | 3.69 | 9.46 | 3.87 | 3.70 |
| F | 18 | 19 | 18 | 18 | 18 | 18 | 16 | 27 | 13 | 12 |
| Q | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 55 | 51 | 50 |
| M | 5.75 | 5.93 | 6.88 | 6.40 | 6.37 | 6.47 | 4.14 | 6.63 | 4.06 | 4.18 |
| L | 44 | 44 | 43 | 44 | 44 | 43 | 46 | 38 | 45 | 45 |
| PALI | 0.92 | 0.92 | 0.86 | 0.89 | 0.89 | 0.90 | 0.96 | 0.98 | 0.96 | 0.93 |
| PAKI | 1.03 | 1.01 | 0.97 | 1.02 | 1.01 | 1.03 | 1.01 | 1.24 | 1.07 | 1.03 |
| AI | 0.97 | 0.99 | 1.03 | 0.98 | 0.99 | 0.97 | 0.99 | 0.81 | 0.94 | 0.98 |
| PMI | 1.82 | 1.85 | 1.87 | 1.80 | 1.80 | 1.76 | 1.86 | 1.16 | 1.76 | 1.80 |

TABLE 2.8 cont...

SYENITE

| | 021 | 022 | 023 | 171 | 172 | 173 | 174 | 175 | 176 | 177 |
|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 62.58 | 62.27 | 62.28 | 59.47 | 59.52 | 61.25 | 62.11 | 62.46 | 59.62 | 59.70 |
| $TiO_2$ | 0.14 | 0.14 | 0.10 | 0.18 | 0.15 | 0.12 | 0.16 | 0.15 | 0.12 | 0.12 |
| $Al_2O_3$ | 16.39 | 16.83 | 17.51 | 17.38 | 17.79 | 18.37 | 16.19 | 16.61 | 18.22 | 18.14 |
| $Fe_2O_3$ | 1.07 | 0.99 | 0.76 | 1.44 | 1.13 | 0.84 | 1.26 | 1.03 | 0.85 | 0.77 |
| FeO | 0.12 | 0.15 | 0.07 | 0.20 | 0.20 | 0.11 | 0.15 | 0.15 | 0.24 | 0.41 |
| MnO | 0.03 | 0.04 | 0.04 | 0.02 | - | - | 0.01 | 0.01 | 0.02 | - |
| MgO | 0.70 | 0.68 | 0.39 | 0.57 | 0.50 | 0.38 | 0.68 | 0.55 | 0.48 | 0.53 |
| CaO | 1.97 | 1.79 | 1.16 | 2.01 | 2.13 | 0.63 | 2.14 | 1.92 | 1.97 | 2.03 |
| $Na_2O$ | 12.63 | 12.76 | 12.08 | 13.56 | 13.76 | 13.46 | 12.85 | 12.75 | 14.02 | 13.85 |
| $K_2O$ | 4.31 | 4.31 | 5.57 | 5.06 | 4.74 | 4.72 | 4.41 | 4.33 | 4.41 | 4.41 |
| $P_2O_5$ | 0.05 | 0.04 | 0.03 | 0.10 | 0.07 | 0.11 | 0.05 | 0.04 | 0.05 | 0.05 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | | | | | | | | | | |
| Ap | 0.13 | 0.11 | 0.09 | 0.28 | 0.20 | 0.33 | 0.15 | 0.11 | 0.15 | 0.13 |
| Il | 0.40 | 0.38 | 0.28 | 0.49 | 0.42 | 0.32 | 0.43 | 0.42 | 0.34 | 0.34 |
| Mt | 0.01 | 0.24 | 0.02 | 0.19 | 0.21 | - | - | 0.05 | 0.56 | 1.22 |
| Or | 22 | 22 | 28 | 26 | 24 | 24 | 22 | 22 | 23 | 23 |
| Ab | 58 | 60 | 57 | 59 | 63 | 65 | 56 | 59 | 67 | 66 |
| An | - | - | - | - | - | 0.50 | - | - | - | - |
| Di | 3.18 | 3.11 | 1.80 | 2.61 | 2.30 | 1.54 | 3.06 | 2.49 | 2.18 | 2.43 |
| Hy | - | - | - | - | - | 0.05 | - | - | - | - |
| Ac | 2.34 | 1.04 | 0.60 | 5.24 | 3.04 | - | 4.51 | 1.98 | 0.87 | 0.51 |
| Q | 11 | 9.81 | 8.77 | 2.66 | 2.43 | 6.41 | 9.50 | 10 | 2.42 | 2.85 |
| Hm | 0.74 | 0.93 | 0.89 | 0.17 | 0.46 | 1.24 | 0.27 | 0.78 | 0.57 | 0.12 |
| Tn | - | - | - | - | - | 0.01 | 0.03 | - | - | - |
| Wo | 2.51 | 2.22 | 1.53 | 2.69 | 3.22 | - | 2.87 | 2.76 | 3.00 | 3.03 |
| Total | 99 | 100 | 100 | 99 | 99 | 99 | 99 | 100 | 99 | 99 |
| | | | | | | | | | | |
| A | 82 | 83 | 88 | 80 | 83 | 87 | 80 | 83 | 85 | 84 |
| M | 3.91 | 3.80 | 2.20 | 2.81 | 2.59 | 2.07 | 3.61 | 3.06 | 2.55 | 2.83 |
| F | 14 | 14 | 9.94 | 17 | 15 | 11 | 16 | 14 | 12 | 13 |
| Q | 53 | 52 | 52 | 51 | 50 | 51 | 52 | 52 | 50 | 50 |
| M | 5.02 | 4.61 | 3.07 | 6.10 | 5.35 | 2.30 | 5.77 | 4.73 | 4.49 | 4.64 |
| L | 42 | 43 | 45 | 43 | 44 | 46 | 42 | 43 | 45 | 45 |
| PALI | 0.87 | 0.89 | 0.93 | 0.84 | 0.86 | 0.98 | 0.83 | 0.87 | 0.89 | 0.89 |
| PAKI | 0.97 | 0.99 | 0.99 | 0.93 | 0.96 | 1.01 | 0.94 | 0.97 | 0.99 | 0.99 |
| AI | 1.03 | 1.01 | 1.01 | 1.07 | 1.04 | 0.99 | 1.07 | 1.03 | 1.01 | 1.01 |
| PMI | 1.63 | 1.65 | 1.70 | 1.88 | 1.87 | 1.78 | 1.67 | 1.64 | 1.86 | 1.84 |

TABLE 2.8 cont...

| | SYENITE | | | | | | MONZODIORITE PORPHYRY | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 178 | 179 | 180 | 181 | 019 | 020 | 017 | 018 | 182 | 183 |
| $SiO_2$ | 59.78 | 63.18 | 61.60 | 61.46 | 53.77 | 57.02 | 58.93 | 56.91 | 59.20 | 59.21 |
| $TiO_2$ | 0.13 | 0.14 | 0.10 | 0.19 | 1.52 | 0.90 | 0.25 | 0.28 | 0.25 | 0.25 |
| $Al_2O_3$ | 18.27 | 16.35 | 17.68 | 16.60 | 7.95 | 11.18 | 17.01 | 17.34 | 16.98 | 16.93 |
| $Fe_2O_3$ | 0.96 | 0.95 | 0.61 | 1.16 | 5.20 | 4.29 | 1.04 | 1.07 | 1.05 | 1.03 |
| FeO | 0.12 | 0.16 | 0.32 | 0.39 | 2.75 | 2.27 | 1.57 | 1.44 | 1.59 | 1.55 |
| MnO | 0.02 | 0.02 | 0.01 | 0.03 | 0.29 | 0.28 | 0.05 | 0.05 | 0.06 | 0.04 |
| MgO | 0.49 | 0.51 | 0.19 | 0.81 | 5.92 | 4.19 | 3.56 | 3.86 | 3.28 | 3.22 |
| CaO | 1.98 | 1.96 | 1.45 | 2.24 | 12.88 | 8.56 | 4.25 | 4.54 | 4.08 | 4.20 |
| $Na_2O$ | 13.74 | 11.72 | 12.11 | 12.37 | 7.30 | 8.70 | 9.92 | 11.19 | 10.20 | 10.27 |
| $K_2O$ | 4.46 | 4.95 | 5.91 | 4.68 | 1.81 | 2.21 | 3.20 | 3.10 | 3.11 | 3.12 |
| $P_2O_5$ | 0.05 | 0.05 | 0.02 | 0.08 | 0.59 | 0.40 | 0.21 | 0.22 | 0.19 | 0.19 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | | | | | | | | | | |
| Ap | 0.15 | 0.13 | 0.07 | 0.22 | 1.55 | 1.07 | 0.60 | 0.64 | 0.53 | 0.53 |
| Il | 0.36 | 0.40 | 0.29 | 0.53 | 3.88 | 2.35 | 0.71 | 0.76 | 0.69 | 0.69 |
| Mt | 0.04 | 0.17 | 0.58 | 0.97 | 5.93 | 6.55 | 2.22 | 2.26 | 2.24 | 2.17 |
| Or | 23 | 25 | 30 | 24 | 8.44 | 11 | 16 | 16 | 16 | 16 |
| Ab | 66 | 54 | 57 | 57 | 27 | 39 | 48 | 54 | 49 | 49 |
| An | 0.17 | - | - | - | - | 0.64 | 9.94 | 7.72 | 9.35 | 8.97 |
| Di | 2.24 | 2.29 | 1.24 | 3.63 | 25 | 18 | 8.73 | 12 | 8.58 | 9.28 |
| Hy | - | - | - | - | - | - | 2.83 | 2.20 | 2.55 | 2.21 |
| Ac | - | 1.33 | 1.43 | 1.89 | 4.49 | - | - | - | - | - |
| Q | 3.07 | 12 | 6.85 | 8.58 | 9.85 | 12 | 10 | 4.16 | 10 | 10 |
| Hm | 1.39 | 0.81 | - | 0.36 | 1.33 | 1.36 | - | - | - | - |
| Tn | - | - | - | - | - | - | - | - | - | - |
| Wo | 2.92 | 2.91 | 2.40 | 2.75 | 12 | 7.09 | - | - | - | - |
| Total | 100 | 100 | 100 | 99 | 99 | 99 | 100 | 99 | 99 | 99 |
| | | | | | | | | | | |
| A | 85 | 84 | 88 | 79 | 26 | 34 | 57 | 58 | 58 | 58 |
| M | 2.64 | 2.87 | 1.04 | 4.23 | 20 | 16 | 18 | 18 | 16 | 16 |
| F | 13 | 14 | 10 | 17 | 55 | 50 | 25 | 23 | 26 | 25 |
| Q | 50 | 53 | 52 | 52 | 50 | 51 | 52 | 50 | 52 | 52 |
| M | 4.36 | 4.49 | 3.32 | 5.88 | 32 | 23 | 8.60 | 10 | 8.38 | 8.50 |
| L | 45 | 43 | 45 | 42 | 18 | 26 | 39 | 40 | 39 | 39 |
| PALI | 0.91 | 0.88 | 0.91 | 0.86 | 0.36 | 0.57 | 0.98 | 0.92 | 0.98 | 0.96 |
| PAKI | 1.00 | 0.98 | 0.98 | 0.97 | 0.87 | 1.02 | 1.30 | 1.21 | 1.28 | 1.27 |
| AI | 1.00 | 1.02 | 1.02 | 1.03 | 1.15 | 0.98 | 0.77 | 0.82 | 0.78 | 0.79 |
| PMI | 1.83 | 1.58 | 1.76 | 1.67 | 1.02 | 1.15 | 1.34 | 1.51 | 1.35 | 1.36 |

PALI = Peraluminous index $Al_2O_3$ / ( CaO + $Na_2O$ + $K_2O$ )
$>1$ = peraluminous, $<1$ = metaluminous

PAKI = Peralkaline index $Al_2O_3$ / ( $Na_2O$ + $K_2O$ )
$<1$ = peralkaline

AI = Agpaitic index ( $Na_2O$ + $K_2O$ ) / $Al_2O_3$
$>1$ = agpaitic

PMI = plumaskitic index 6 ( $Na_2O$ + $K_2O$ ) / $SiO_2$
$<1$ = plumaskitic, $>1$ = miaskitic

TABLE 2.9 : GILGARNA ROCK Rb, Sr AND ISOTOPE RATIO MEASUREMENTS

| Sample[1] | Rb(ppm) | Sr(ppm) | $^{87}Rb/^{86}Sr$ | $^{87}Sr/^{86}Sr$[2] |
|---|---|---|---|---|
| Coarse grained phase | | | | |
| 016S | 6 | 299 | 0.059 | 0.70364 |
| 016F | 56 | 1458 | 0.112 | 0.70547 |
| 016E | 39 | 942 | 0.121 | 0.70613 |
| 176 | 77 | 1103 | 0.203 | 0.70894 |
| 016 | 77 | 1077 | 0.206 | 0.70903 |
| 178 | 78 | 1047 | 0.216 | 0.70934 |
| 177 | 76 | 998 | 0.222 | 0.70950 |
| 015 | 85 | 815 | 0.303 | 0.71256 |
| 173 | 96 | 816 | 0.342 | 0.71400 |
| 016P | 66 | 507 | 0.378 | 0.71553 |
| 181 | 117 | 436 | 0.775 | 0.72988 |
| 022 | 114 | 311 | 1.061 | 0.74051 |
| 179 | 135 | 297 | 1.321 | 0.74966 |
| 180 | 152 | 215 | 2.061 | 0.77711 |
| 023 | 144 | 178 | 2.351 | 0.78835 |
| Medium grained phase | | | | |
| 010P | 13 | 155 | 0.247 | 0.70883 |
| 006R | 77 | 756 | 0.295 | 0.71203 |
| 006 | 78 | 716 | 0.315 | 0.71267 |
| 010F | 117 | 963 | 0.353 | 0.71424 |
| 009 | 91 | 665 | 0.398 | 0.71598 |
| 010R | 112 | 767 | 0.422 | 0.71692 |
| 011 | 98 | 674 | 0.422 | 0.71676 |
| 011D | 98 | 667 | 0.425 | 0.71680 |
| 010 | 113 | 760 | 0.429 | 0.71710 |
| 008 | 92 | 619 | 0.432 | 0.71705 |
| 021D | 108 | 503 | 0.623 | 0.72429 |
| 021 | 108 | 499 | 0.624 | 0.72460 |
| 175 | 112 | 365 | 0.893 | 0.73472 |

[1] S = Sphene, F = Alkali feldspar, E = Epidote, P = Pyroxene, R = Replicate measurement from same split, D = Duplicate sample.

[2] $^{87}Sr/^{86}Sr$ for E & A Sr std = 0.7080496 $\pm$ .0000096 (1 sigma).

TABLE 2.10 : RESULTS OF Rb-Sr REGRESSION ANALYSES

| Regression | Samples | MSWD | Age (Ma) | IR | Model |
|---|---|---|---|---|---|
| Medium grained syenite -whole rocks | 11 | 0.72 | 2629 ± 43 | 0.70074 ± 0.00028 | 1 |
| Medium grained syenite -whole rocks + pyx, fsp | 13 | 2.51 | 2660 ± 37 | 0.70050 ± 0.00023 | 1 |
| Medium grained syenite -whole rocks + fsp | 12 | 0.68 | 2627 ± 41 | 0.70076 ± 0.00027 | 1 |
| Coarse grained syenite -whole rocks | 7 | 0.32 | 2546 ± 37 | 0.70141 ± 0.00017 | 1 |
| Differentiate dyke -whole rocks | 4 | 1.95 | 2551 ± 57 | 0.70121 ± 0.00106 | 1 |
| Combined coarse + dyke -whole rocks | 11 | 0.59 | 2543 ± 15 | 0.70142 ± 0.00013 | 1 |
| Combined coarse + dyke -whole rocks + mins | 15 | 0.86 | 2542 +14 | 0.70145 ± 0.00009 | 1 |

## TABLE 2.11 : GILGARNA ROCK U AND Pb ISOTOPE RATIO ANALYSES

| | Wt(mg) | Conc(ppm) | | Atomic ratios | | | | Apparent ages (Ma) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Pb | U | 206Pb/204Pb | 206Pb/238U | 207Pb/235U | 207Pb/206Pb | 206Pb/238U | 207Pb/235U | 207Pb/206Pb |
| Titanite honey brown | 40 | 13 | 5.7 | 57.776 | 0.6990 | 17.561 | 0.1822 | 3416 | 2966 | 2673 |
| Titanite red brown | 75 | 21 | 6.9 | 59.643 | 0.8982 | 22.473 | 0.1815 | 4131 | 3204 | 2666 |
| Titanite >250u dark | 48 | 21 | 11.6 | 76.415 | 0.5954 | 14.829 | 0.1806 | 3011 | 2804 | 2658 |
| Titanite >250u light | 21 | 10 | 6.4 | 73.662 | 0.5671 | 13.885 | 0.1776 | 2896 | 2741 | 2630 |
| Apatite A | 25 | 23 | 9 | 35.580 | 0.5108 | 13.481 | 0.1914 | 2660 | 2713 | 2754 |
| Apatite B | 39 | 30 | 13 | 41.270 | 0.5001 | 12.372 | 0.1794 | 2614 | 2633 | 2647 |

## TABLE 2.12 : Pb-Pb ISOCHRON REGRESSION ANALYSES

| Samples | $^{207}Pb/^{206}Pb$ age(Ma) | MSWD | Model | Comments |
|---|---|---|---|---|
| All (6) | 2623 ± 19 | 7.5 | 1 | Errors underestimated |
| | 2621 ± 53 | | 2 | |
| | 2625 ± 47 | | 3 | RECOMMENDED |
| All less Apat.B (5) | 2690 ± 20 | 1.66 | 1 | Errors underestimated |
| | 2601 ± 26 | | 2 | RECOMMENDED |
| | 2600 ± 32 | | 3 | |
| All less Apat. A (5) | 2669 ± 26 | 3.73 | 1 | Errors underestimated |
| | 2668 ± 51 | | 2 | RECOMMENDED |
| | 2656 ± 57 | | 3 | |

TABLE 3.1 : RED HILL REPRESENTATIVE FELDSPAR ANALYSES

| wt% | 105-2 MSP | 105-2 MSP | 106-2 PLAG | 106-7 PERTH HOST | 106-7 PERTH EXSN | 109-1 MICRO | 109-1 PLAG | 109-4 PLAG | 113B-2 PLAG | 113B-2 MICRO | 119-1 PLAG | 119-1 MICRO | 120-1 PERTH HOST | 120-1 PERTH EXSN | 120-2 PERTH HOST | 120-2 PERTH EXSN | 212-1 PLAG | 212-1 PERTH HOST | 212-1 PERTH EXSN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 65.21 | 69.27 | 67.75 | 64.61 | 68.08 | 65.63 | 69.27 | 66.21 | 69.52 | 65.75 | 69.12 | 64.90 | 65.63 | 69.27 | 65.89 | 69.11 | 68.39 | 65.61 | 68.45 |
| $Al_2O_3$ | 17.49 | 19.36 | 21.09 | 17.98 | 20.27 | 17.81 | 19.17 | 20.50 | 18.89 | 17.71 | 19.58 | 17.97 | 17.74 | 18.97 | 17.57 | 19.07 | 20.17 | 17.86 | 19.45 |
| FeO* | - | 0.19 | 0.19 | - | - | - | - | 0.23 | 0.46 | 0.26 | 0.22 | - | 0.24 | 0.40 | 0.24 | 0.39 | - | - | - |
| MnO | - | 0.15 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| MgO | - | - | - | - | - | - | 0.14 | - | 0.12 | - | 0.19 | - | - | - | - | 0.12 | 0.12 | - | - |
| CaO | - | 0.15 | 1.58 | - | 0.70 | - | - | 2.07 | - | - | - | - | - | - | - | - | 1.02 | - | 0.62 |
| $Na_2O$ | - | 9.76 | 8.36 | - | 9.37 | 0.68 | 10.60 | 8.67 | 10.36 | 0.20 | 11.74 | 0.47 | 0.39 | 11.12 | 0.27 | 10.87 | 10.03 | 0.12 | 9.84 |
| $K_2O$ | 17.49 | 0.19 | 0.21 | 15.90 | 0.11 | 16.03 | 0.07 | 0.34 | 0.19 | 17.37 | 0.06 | 15.98 | 16.60 | 0.19 | 16.69 | 0.12 | 0.09 | 17.55 | 0.15 |
| Other | - | 0.11 | - | - | 0.19 | - | 0.37 | - | - | - | - | - | - | - | - | - | - | - | - |
| TOTAL | 100.19 | 99.18 | 99.18 | 98.49 | 98.72 | 100.15 | 99.62 | 98.02 | 99.54 | 101.29 | 100.91 | 99.32 | 100.60 | 99.95 | 100.66 | 99.68 | 99.82 | 101.14 | 98.51 |

Structural formulae based on 8(O)

| | 105-2 MSP | 105-2 MSP | 106-2 PLAG | 106-7 PERTH HOST | 106-7 PERTH EXSN | 109-1 MICRO | 109-1 PLAG | 109-4 PLAG | 113B-2 PLAG | 113B-2 MICRO | 119-1 PLAG | 119-1 MICRO | 120-1 PERTH HOST | 120-1 PERTH EXSN | 120-2 PERTH HOST | 120-2 PERTH EXSN | 212-1 PLAG | 212-1 PERTH HOST | 212-1 PERTH EXSN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Si | 3.031 | 3.029 | 2.964 | 3.020 | 2.987 | 3.024 | 3.019 | 2.948 | 3.037 | 3.018 | 2.993 | 3.015 | 3.021 | 3.023 | 3.030 | 3.020 | 2.982 | 3.015 | 3.016 |
| Al | .958 | .998 | 1.087 | .991 | 1.048 | .967 | .985 | 1.076 | .972 | .958 | .999 | .984 | .963 | .976 | .952 | .982 | 1.036 | .967 | 1.010 |
| Fe(tot) | - | .007 | .007 | - | - | - | - | .008 | .017 | .010 | .008 | - | .009 | .015 | .009 | .014 | - | - | - |
| Mn | - | .006 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Mg | - | - | - | - | - | - | .009 | - | .008 | - | .012 | - | - | - | - | .008 | .008 | - | - |
| Ca | - | .007 | .007 | - | .033 | - | - | .099 | - | - | - | - | - | - | - | - | .048 | - | .029 |
| Na | - | .828 | .709 | - | .797 | .061 | .896 | .748 | .877 | .018 | .986 | .042 | .035 | .941 | .024 | .921 | .848 | .011 | .840 |
| K | 1.003 | .011 | .012 | .948 | .006 | .942 | .004 | .019 | .011 | 1.017 | .003 | .947 | .975 | .011 | .979 | .007 | .005 | 1.028 | .009 |
| Other | - | .004 | - | - | .006 | - | .010 | - | - | - | - | - | - | - | - | - | - | - | - |

MSP = Mesoperthite, EXSN = Exsolution, MICRO = Microcline, FeO* = total iron

## TABLE 3.2 : RED HILL REPRESENTATIVE PYROXENE ANALYSES

| wt% | 105-2 | 105-2 | 105-6 | 105-6 | 109-2 | 109-3 | 113-1 | 113-1 | 113-3 | 113-3 | 119-1 | 119-1 | 119-9 | 119-9 | 120-6 | 120-6 | 120-3 | 120-3 | 212-2 | 212-3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RIM | CORE | RIM | CORE | | | RIM | CORE | RIM | CORE | RIM | CORE | RIM | CORE | RIM | CORE | RIM | CORE | CORE | |
| $SiO_2$ | 51.09 | 51.02 | 51.08 | 50.52 | 53.61 | 52.96 | 52.60 | 52.18 | 52.96 | 53.23 | 51.25 | 51.57 | 53.43 | 52.26 | 53.03 | 52.94 | 53.63 | 52.69 | 52.42 | 52.68 |
| $Al_2O_3$ | 0.89 | 0.91 | 0.97 | 0.85 | 0.45 | 0.60 | 0.70 | 0.61 | 0.88 | 0.34 | 0.69 | 0.68 | 0.72 | 0.68 | 0.79 | 0.78 | 0.48 | 0.63 | 1.14 | 0.65 |
| $Fe_2O_3$ | 5.08 | 5.20 | 6.02 | 5.41 | - | 1.70 | 6.53 | 7.20 | 5.24 | 5.19 | 5.63 | 5.50 | 2.94 | 3.80 | 6.25 | 7.65 | 5.59 | 7.97 | 2.11 | 2.95 |
| FeO | 15.72 | 16.43 | 15.07 | 16.10 | 12.08 | 11.98 | 10.75 | 10.37 | 11.50 | 11.23 | 11.52 | 11.29 | 9.50 | 11.67 | 9.34 | 7.99 | 9.42 | 8.38 | 13.64 | 12.25 |
| MnO | 0.86 | 0.86 | 0.98 | 0.91 | 1.47 | 1.13 | 0.78 | 0.72 | 0.79 | 0.87 | 0.68 | 0.62 | 0.61 | 0.57 | 0.58 | 0.56 | 0.64 | 0.41 | 0.75 | 0.98 |
| MgO | 5.53 | 5.57 | 5.65 | 5.46 | 10.02 | 9.84 | 7.98 | 7.84 | 8.02 | 8.37 | 7.07 | 7.53 | 10.17 | 8.37 | 8.71 | 8.60 | 8.94 | 8.80 | 8.65 | 8.74 |
| CaO | 19.71 | 19.47 | 19.91 | 19.79 | 22.75 | 21.96 | 18.02 | 17.87 | 18.22 | 18.15 | 19.62 | 19.84 | 21.64 | 20.91 | 18.07 | 18.43 | 18.92 | 17.94 | 21.66 | 21.83 |
| $Na_2O$ | 2.03 | 1.91 | 2.04 | 1.79 | 0.75 | 0.98 | 3.03 | 3.11 | 2.89 | 2.89 | 2.45 | 2.35 | 1.71 | 1.84 | 3.19 | 3.41 | 2.99 | 3.35 | 1.10 | 1.34 |
| Other | 0.22 | - | 0.17 | - | - | - | - | - | - | - | - | 0.13 | - | - | - | - | 0.13 | 0.12 | - | - |
| TOTAL | 101.13 | 101.37 | 101.89 | 100.83 | 101.13 | 101.15 | 100.39 | 99.90 | 100.50 | 100.27 | 98.91 | 99.51 | 100.72 | 100.10 | 99.96 | 100.36 | 100.74 | 100.29 | 101.47 | 101.42 |

Structural formulae based on 6(O)
Cation total recalculated to 4

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Si | 1.978 | 1.975 | 1.964 | 1.969 | 2.018 | 1.998 | 2.003 | 1.998 | 2.012 | 2.025 | 1.994 | 1.991 | 2.005 | 1.998 | 2.010 | 1.999 | 2.017 | 1.993 | 1.985 | 1.993 |
| Al | .041 | .042 | .044 | .039 | .020 | .027 | .031 | .027 | .039 | .015 | .032 | .031 | .032 | .031 | .036 | .035 | .021 | .028 | .051 | .029 |
| $Fe^{3+}$ | .148 | .151 | .174 | .159 | - | .048 | .187 | .207 | .150 | .149 | .165 | .160 | .083 | .109 | .178 | .218 | .158 | .227 | .060 | .084 |
| $Fe^{2+}$ | .509 | .532 | .485 | .525 | .380 | .378 | .342 | .332 | .365 | .357 | .375 | .365 | .298 | .373 | .296 | .252 | .296 | .265 | .432 | .388 |
| Mn | .028 | .028 | .032 | .030 | .047 | .036 | .025 | .024 | .025 | .028 | .023 | .020 | .019 | .019 | .019 | .018 | .021 | .013 | .024 | .031 |
| Mg | .319 | .321 | .324 | .317 | .562 | .553 | .453 | .448 | .454 | .474 | .410 | .433 | .569 | .477 | .492 | .484 | .501 | .496 | .488 | .493 |
| Ca | .818 | .808 | .820 | .826 | .917 | .888 | .735 | .733 | .742 | .739 | .818 | .821 | .870 | .857 | .734 | .746 | .763 | .727 | .879 | .885 |
| Na | .152 | .143 | .152 | .136 | .055 | .072 | .224 | .231 | .213 | .213 | .184 | .176 | .124 | .136 | .235 | .250 | .218 | .246 | .081 | .098 |
| Other | .007 | - | .005 | - | - | - | - | - | - | - | - | .004 | - | - | - | - | .004 | .004 | - | - |

## TABLE 3.3 : RED HILL REPRESENTATIVE AMPHIBOLE ANALYSES

| wt% | 106-1 | 106-3 | 106-3 | 106-3 | 106-3 | 109-1 | 113B-3 | 113B-3 | 119-4 | 119-4 | 119-5 | 119-5 | 119-10 | 119-10 | 120-1 | 120-1 | 120-6 | 212-2 | 212-4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | RIM | CORE | RIM | CORE | REPL PYX | RIM | CORE | RIM NEEDLE | CORE | RIM | CORE | RIM | CORE | | | | RIM | |
| $SiO_2$ | 46.28 | 46.08 | 46.35 | 46.71 | 46.53 | 50.14 | 53.92 | 53.12 | 52.51 | 53.72 | 53.53 | 53.84 | 54.89 | 54.79 | 56.33 | 56.13 | 55.25 | 49.18 | 49.26 |
| $TiO_2$ | 0.59 | 0.28 | 0.50 | 0.32 | 0.40 | - | - | - | - | - | - | - | - | - | - | - | - | 0.13 | 0.14 |
| $Al_2O_3$ | 6.92 | 6.25 | 6.66 | 6.34 | 6.91 | 3.82 | 1.73 | 2.08 | 1.50 | 1.08 | 0.95 | 0.96 | 1.14 | 0.97 | 0.56 | 0.75 | 0.82 | 5.04 | 4.49 |
| $Fe_2O_3$ | 4.52 | 3.96 | 3.88 | 3.51 | 5.26 | 3.72 | 2.18 | 1.64 | 2.60 | - | - | 1.23 | 1.74 | 1.13 | 1.78 | 2.51 | 2.07 | 2.83 | 4.87 |
| FeO | 13.72 | 14.02 | 13.19 | 14.68 | 12.93 | 14.30 | 11.97 | 12.23 | 12.86 | 13.49 | 14.39 | 13.29 | 12.56 | 13.72 | 10.57 | 10.58 | 10.01 | 13.92 | 14.02 |
| MnO | 0.49 | 0.43 | 0.45 | 0.66 | 0.51 | 0.97 | 0.90 | 0.87 | 0.55 | 0.57 | 0.63 | 0.73 | 0.50 | 0.55 | 0.63 | 0.60 | 0.55 | 0.91 | 0.68 |
| MgO | 11.66 | 11.51 | 12.10 | 11.23 | 11.67 | 11.62 | 14.19 | 14.19 | 13.22 | 13.79 | 13.76 | 13.91 | 14.63 | 13.98 | 16.21 | 15.59 | 16.07 | 12.10 | 11.83 |
| CaO | 10.90 | 10.89 | 10.87 | 11.12 | 10.95 | 11.67 | 10.39 | 10.65 | 10.16 | 11.14 | 11.37 | 10.78 | 10.82 | 10.94 | 10.78 | 10.25 | 10.46 | 11.84 | 11.01 |
| $Na_2O$ | 2.11 | 1.94 | 2.11 | 1.76 | 1.81 | 0.64 | 1.52 | 1.58 | 1.43 | 0.92 | 0.95 | 1.33 | 1.34 | 1.18 | 1.51 | 1.50 | 1.67 | 1.02 | 1.40 |
| $K_2O$ | 1.26 | 1.24 | 1.26 | 1.22 | 1.31 | 0.27 | 0.57 | 0.60 | 0.41 | 0.27 | 0.23 | 0.28 | 0.31 | 0.24 | 0.29 | 0.40 | 0.31 | 0.54 | 0.87 |
| Other | - | - | - | - | 0.07 | - | - | - | 0.14 | - | - | - | - | - | - | - | - | - | - |
| TOTAL | 98.46 | 96.60 | 97.37 | 97.55 | 98.36 | 97.15 | 97.37 | 96.96 | 95.38 | 94.99 | 95.81 | 96.35 | 97.92 | 97.50 | 98.66 | 98.30 | 97.22 | 97.50 | 98.57 |

Structural formulae on the basis of 23(O)
*Cation total recalculated to 13, exclusive of K, Na and Ca

| | 106-1 | 106-3 | 106-3 | 106-3 | 106-3 | 109-1 | 113B-3 | 113B-3 | 119-4 | 119-4 | 119-5 | 119-5 | 119-10 | 119-10 | 120-1 | 120-1 | 120-6 | 212-2 | 212-4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Si | 6.872 | 6.974 | 6.931 | 7.010 | 6.898 | 7.446 | 7.829 | 7.766 | 7.821 | 7.988 | 7.940 | 7.921 | 7.906 | 7.954 | 7.972 | 7.976 | 7.930 | 7.283 | 7.257 |
| Ti | .066 | .032 | .056 | .036 | .044 | - | - | - | - | - | - | - | - | - | - | - | - | .014 | .016 |
| $Al^{IV}$ | 1.128 | 1.026 | 1.069 | .990 | 1.102 | .554 | .171 | .234 | .179 | .012 | .060 | .079 | .094 | .046 | .028 | .024 | .070 | .717 | .743 |
| $Al^{VI}$ | .082 | .090 | .104 | .130 | .106 | .114 | .126 | .124 | .085 | .178 | .106 | .087 | .098 | .120 | .065 | .101 | .069 | .163 | .036 |
| $Fe^{3+}$ | .505 | .451 | .437 | .396 | .587 | .416 | .238 | .180 | .292 | - | - | .136 | .188 | .124 | .190 | .268 | .224 | .315 | .539 |
| $Fe^{2+}$ | 1.704 | 1.774 | 1.649 | 1.842 | 1.604 | 1.776 | 1.454 | 1.496 | 1.602 | 1.677 | 1.784 | 1.635 | 1.513 | 1.665 | 1.250 | 1.256 | 1.202 | 1.724 | 1.727 |
| Mn | .061 | .055 | .057 | .083 | .064 | .122 | .111 | .108 | .069 | .072 | .080 | .091 | .061 | .067 | .076 | .073 | .067 | .114 | .084 |
| Mg | 2.580 | 2.597 | 2.697 | 2.512 | 2.579 | 2.572 | 3.071 | 3.092 | 2.934 | 3.057 | 3.042 | 3.051 | 3.140 | 3.024 | 3.419 | 3.302 | 3.439 | 3.670 | 2.598 |
| Ca | 1.757 | 1.786 | 1.762 | 1.806 | 1.766 | 1.876 | 1.627 | 1.676 | 1.633 | 1.745 | 1.807 | 1.705 | 1.678 | 1.708 | 1.642 | 1.572 | 1.617 | 1.895 | 1.762 |
| $Na_A$ | .374 | .028 | .381 | .324 | .295 | .065 | .057 | .126 | .049 | .010 | .081 | .086 | .056 | .041 | .059 | - | .084 | .191 | .168 |
| $Na_B$ | .243 | .214 | .239 | .194 | .234 | .124 | .374 | .324 | .367 | .255 | .181 | .295 | .322 | .292 | .358 | .415 | .383 | .105 | .238 |
| K | .242 | .242 | .244 | .235 | .252 | .051 | .106 | .113 | .079 | .052 | .042 | .054 | .058 | .044 | .053 | .074 | .157 | .102 | .165 |
| Other | - | - | - | - | .016 | - | - | - | .017 | - | - | - | - | - | - | - | - | - | - |

* excludes any Mn, $Fe^{2+}$ and Mg from the B site, eliminating any cummingtonite component

TABLE 3.4 : RED HILL REPRESENTATIVE GARNET ANALYSES

| wt% | 119-8 | 119-8 |
|---|---|---|
| $SiO_2$ | 34.91 | 35.32 |
| $TiO_2$ | 1.67 | 1.42 |
| $Al_2O_3$ | 2.05 | 1.93 |
| $Fe_2O_3$ | 25.57 | 27.06 |
| FeO | 1.15 | 0.60 |
| MnO | 0.32 | 0.22 |
| MgO | 0.18 | 0.12 |
| CaO | 32.35 | 32.63 |
| $Na_2O$ | - | 0.15 |
| Other | - | 0.14 |
| TOTAL | 98.20 | 99.60 |

Structural formulae on the basis of 24(O)
Cation totals recalculated to 16

| | | |
|---|---|---|
| Si | 5.943 | 5.933 |
| Ti | .213 | .179 |
| Al | .412 | .383 |
| $Fe^{3+}$ | 3.276 | 3.420 |
| $Fe^{2+}$ | .164 | .084 |
| Mn | .046 | .031 |
| Mg | .045 | .030 |
| Ca | 5.901 | 5.873 |
| Na | - | .047 |
| Other | - | .019 |

## TABLE 3.5 : RED HILL REPRESENTATIVE TITANITE ANALYSES

| wt% | 105-1 | 105-1 | 106-1 | 106-1 | 109-1 | 109-1 | 113B-3 | 113B-3 | 113B-3 | 119-2 | 119-2 | 119-9 | 119-9 | 120-4 | 212-5 | 212-5 | 212-5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RIM | CORE | RIM | CORE | RIM | CORE | RIM | TWDS CORE | CORE | RIM | CORE | ALT | ALT | | ALT RIM | RIM | CORE |
| $SiO_2$ | 30.64 | 29.88 | 30.68 | 31.53 | 30.30 | 30.47 | 20.74 | 30.66 | 31.04 | 29.65 | 29.94 | 36.02 | 36.46 | 30.49 | 35.64 | 30.08 | 29.94 |
| $TiO_2$ | 34.36 | 34.89 | 32.11 | 31.43 | 35.76 | 36.78 | 64.44 | 39.16 | 39.04 | 32.67 | 33.79 | 0.32 | 0.65 | 36.80 | 32.74 | 37.01 | 36.75 |
| $Al_2O_3$ | 1.70 | 1.00 | 3.53 | 2.08 | 1.63 | 0.38 | 0.75 | - | 0.13 | 0.98 | 0.89 | 2.06 | 2.03 | 0.39 | 1.67 | 1.25 | 0.93 |
| FeO* | 4.50 | 4.26 | 2.94 | 3.24 | 2.38 | 2.89 | 3.98 | 1.58 | 1.44 | 4.11 | 2.83 | 25.63 | 25.39 | 2.77 | 1.74 | 2.50 | 2.29 |
| MnO | - | 0.16 | - | - | 0.26 | 0.27 | - | - | - | - | - | 0.17 | - | 0.21 | 0.22 | 0.22 | - |
| MgO | - | - | - | - | - | - | - | - | - | 0.11 | - | 0.15 | 0.20 | - | - | - | - |
| CaO | 28.52 | 27.85 | 28.78 | 24.44 | 27.66 | 28.30 | 1.37 | 28.45 | 28.55 | 27.25 | 27.62 | 33.59 | 33.63 | 28.93 | 17.43 | 27.77 | 27.66 |
| $Na_2O$ | - | - | - | 0.23 | - | - | 0.29 | - | 0.26 | 0.25 | - | 0.21 | 0.13 | 0.18 | 0.92 | - | - |
| $K_2O$ | - | - | 0.07 | - | - | - | 0.14 | - | - | - | - | - | - | - | 0.30 | - | - |
| $P_2O_5$ | - | - | 0.16 | 0.51 | - | - | 0.49 | - | - | - | - | - | - | - | - | - | - |
| Other | 0.26 | 0.66 | - | 0.37 | 0.57 | 0.57 | 1.38 | 0.26 | 1.19 | 0.49 | 0.39 | - | - | 0.38 | 0.35 | 0.17 | 0.34 |
| TOTAL | 99.98 | 98.70 | 98.27 | 93.83 | 98.56 | 99.66 | 93.58 | 100.11 | 101.65 | 95.51 | 95.46 | 98.15 | 98.49 | 100.15 | 91.01 | 99.00 | 97.91 |

Structural formulae based on 18(O)

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Si | 3.662 | 3.627 | 3.692 | 3.919 | 3.641 | 3.632 | 2.503 | 3.615 | 3.591 | 3.711 | 3.725 | 4.833 | 4.854 | 3.632 | 4.416 | 3.602 | 3.623 |
| Ti | 3.089 | 3.184 | 2.906 | 2.938 | 3.232 | 3.297 | 5.848 | 3.473 | 3.396 | 3.076 | 3.161 | .033 | .065 | 3.296 | 3.050 | 3.334 | 3.344 |
| Al | .240 | .143 | .501 | .305 | .232 | .053 | .106 | - | .018 | .145 | .130 | .326 | .319 | .055 | .244 | .177 | .133 |
| Fe(tot) | .449 | .432 | .296 | .337 | .239 | .288 | .402 | .156 | .139 | .430 | .294 | 2.876 | 2.828 | .276 | .180 | .251 | .214 |
| Mn | - | .017 | - | - | .026 | .027 | - | - | - | - | - | .019 | - | .021 | .023 | .023 | - |
| Mg | - | - | - | - | - | - | - | - | - | .021 | - | .030 | .040 | - | - | - | - |
| Ca | 3.653 | 3.621 | 3.710 | 3.255 | 3.562 | 3.614 | .177 | 3.595 | 3.538 | 3.654 | 3.682 | 4.829 | 4.798 | 3.691 | 2.313 | 3.564 | 3.586 |
| Na | - | - | - | .055 | - | - | .068 | - | .058 | .062 | - | .054 | .034 | .042 | .221 | - | - |
| K | - | - | .011 | - | - | - | .022 | - | - | - | - | - | - | - | .047 | - | - |
| P | - | - | .016 | .058 | - | - | .050 | - | - | - | - | - | - | - | - | - | - |
| Other | .025 | .063 | - | .350 | .537 | .494 | .117 | .022 | .099 | .049 | .038 | - | - | .036 | .035 | .016 | .033 |

FeO* = total iron, ALT = altered

TABLE 3.6 : RED HILL REPRESENTATIVE APATITE ANALYSES

| wt% | 105-1 RIM | 105-1 CORE | 106-6 RIM | 106-6 CORE | 119-2 RIM | 119-2 CORE | 120-7 RIM | 120-7 CORE | 212-6 RIM | 212-6 CORE |
|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 1.70 | 1.80 | 0.37 | 0.26 | 1.17 | 1.99 | 0.97 | 1.26 | 1.55 | 1.70 |
| $Al_2O_3$ | - | - | - | - | 0.12 | 0.15 | 0.19 | 0.17 | 0.14 | - |
| CaO | 53.39 | 53.12 | 55.76 | 55.72 | 53.94 | 53.36 | 55.77 | 56.23 | 54.70 | 54.17 |
| $Na_2O$ | - | - | - | 0.16 | - | 0.40 | 0.32 | 0.29 | - | - |
| $P_2O_5$ | 38.05 | 38.24 | 40.72 | 40.78 | 41.36 | 37.77 | 41.59 | 40.81 | 39.90 | 39.34 |
| Other | 1.36 | 1.51 | 0.29 | 0.19 | - | 1.31 | 0.25 | 0.43 | 0.90 | 0.33 |
| TOTAL | 94.50 | 94.67 | 97.14 | 97.11 | 96.59 | 94.98 | 99.09 | 99.19 | 97.19 | 95.54 |

Structural formulae based on 25(O)

| | 105-1 RIM | 105-1 CORE | 106-6 RIM | 106-6 CORE | 119-2 RIM | 119-2 CORE | 120-7 RIM | 120-7 CORE | 212-6 RIM | 212-6 CORE |
|---|---|---|---|---|---|---|---|---|---|---|
| Si | .297 | .313 | .063 | .044 | .198 | .344 | .161 | .099 | .261 | .293 |
| Al | - | - | - | - | .025 | .031 | .036 | .034 | .028 | - |
| Ca | 9.965 | 9.877 | 10.167 | 10.144 | 9.768 | 9.888 | 9.896 | 10.113 | 9.898 | 10.000 |
| Na | - | - | - | .052 | - | .135 | .101 | .092 | - | - |
| P | 5.612 | 5.617 | 5.866 | 5.866 | 5.919 | 5.531 | 5.832 | 5.876 | 5.705 | 5.738 |
| Other | .177 | .198 | .040 | .023 | - | .163 | .029 | .050 | .116 | .046 |

**TABLE 3.7 : RED HILL WHOLE ROCK AND TRACE ELEMENT GEOCHEMISTRY**

| | 100 | 114 | 118 | 103 | 102 | 105 | 107 | 108 | 109 | 110 |
|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 78.59 | 66.01 | 70.39 | 68.63 | 72.83 | 71.40 | 71.76 | 71.56 | 72.95 | 71.35 |
| $TiO_2$ | 0.03 | 0.03 | 0.10 | 0.66 | 0.20 | 0.23 | 0.27 | 0.40 | 0.39 | 0.06 |
| $Al_2O_3$ | 11.50 | 18.25 | 15.90 | 16.92 | 13.99 | 13.97 | 13.58 | 13.82 | 13.62 | 14.43 |
| $Fe_2O_3$ | 0.76 | 0.40 | 0.49 | 0.68 | 1.30 | 0.91 | 1.78 | 1.55 | 0.85 | 0.89 |
| FeO | na | 0.10 | na | 0.26 | 0.19 | 0.38 | na | 0.32 | 0.28 | 0.29 |
| MnO | nd | nd | 0.01 | 0.06 | 0.07 | 0.07 | 0.08 | 0.10 | 0.03 | 0.09 |
| MgO | nd | nd | nd | 0.59 | 0.34 | 0.25 | 0.50 | 0.62 | 0.40 | 0.38 |
| CaO | 0.14 | 0.08 | 0.14 | 2.92 | 0.81 | 1.31 | 1.41 | 1.76 | 1.55 | 1.38 |
| $Na_2O$ | 2.65 | 4.26 | 4.34 | 7.27 | 3.57 | 4.94 | 3.80 | 4.25 | 4.00 | 4.85 |
| $K_2O$ | 5.97 | 9.74 | 7.54 | 0.67 | 6.60 | 5.10 | 6.22 | 5.35 | 5.38 | 4.81 |
| $P_2O_5$ | 0.04 | 0.05 | 0.03 | 0.12 | 0.07 | 0.09 | 0.12 | 0.16 | 0.08 | 0.13 |
| LOI | 0.28 | 0.33 | 0.26 | 0.32 | 0.25 | 0.18 | 0.59 | 0.33 | 0.67 | 0.32 |
| TOTAL | 99.96 | 99.24 | 99.19 | 99.10 | 100.22 | 98.83 | 100.11 | 100.23 | 100.20 | 98.97 |
| Sc | 0.3 | nd | nd | 8.6 | 1.1 | 1.1 | 1.9 | 3.9 | 2.8 | 1.4 |
| V | 7 | 0.6 | 3 | 16 | 10 | 11 | 17 | 19 | 16 | 10 |
| Cr | <5 | <5 | <5 | <5 | <5 | <5 | 10 | <5 | <5 | <5 |
| Ni | 3 | 3 | 4 | 4 | 3 | 4 | 7 | 8 | 5 | 8 |
| Cu | 6 | 5 | 3 | 4 | 3 | 3 | 3 | 4 | 4 | 4 |
| Pb | 17 | 13 | 14 | 26 | 26 | 12 | 22 | 25 | 26 | 14 |
| Zn | 9 | 8 | 8 | 48 | 62 | 49 | 66 | 69 | 34 | 44 |
| Ga | 14 | 23 | 20 | 26 | 21 | 21 | 22 | 20 | 19 | 23 |
| Rb | 213 | 301 | 221 | 12.6 | 196 | 160 | 215 | 159 | 163 | 136 |
| Sr | 356 | 466 | 478 | 536 | 521 | 482 | 534 | 519 | 614 | 664 |
| Y | 0.7 | 0.9 | 4.5 | 13 | 19.4 | 12.4 | 17.4 | 24.6 | 15.2 | 5.2 |
| Zr | 27.2 | 17.2 | 8.8 | 79 | 255 | 129 | 8.7 | 12.3 | 19.2 | 4.6 |
| Nb | 0.4 | 3.5 | 5.6 | 48.6 | 13.2 | 11.9 | 13.9 | 20.5 | 27.9 | 3.9 |
| Ba | 1217 | 730 | 887 | 102 | 865 | 832 | 1158 | 1428 | 1248 | 957 |
| La | 15 | 9 | 12 | 138 | 122 | 111 | 68 | 72 | 41 | 47 |
| Ce | 25 | 22 | 34 | 145 | 188 | 178 | 145 | 181 | 97 | 82 |
| Nd | 1.8 | 7 | 17 | 209 | 81 | 62 | 77 | 87 | 60 | 25 |
| Th | 7 | 8 | 7 | 43 | 54 | 11 | 8 | 9 | 8 | 3 |
| F | na | 150 | na | 550 | 200 | 250 | na | 350 | na | 300 |

Major elements wt.%, trace elements p.p.m.
na = no analysis , nd = not detected

100,114 PEGMATITE, RED HILL NORTH
118 PEGMATITE, RED HILL SOUTH
103 SYENITE/ALBITITE?, RED HILL NORTH
102-110 GROUP 1 GRANITES, RED HILL NORTH

TABLE 3.7 cont...

| | 115 | 122 | 207 | 210 | 211 | 212 | 213 | 214 | 215 | 216 |
|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 73.65 | 70.46 | 75.59 | 69.94 | 70.27 | 68.91 | 69.99 | 67.83 | 69.29 | 69.64 |
| $TiO_2$ | 0.10 | 0.26 | nd | 0.34 | 0.21 | 0.26 | 0.25 | 0.12 | 0.21 | 0.31 |
| $Al_2O_3$ | 13.69 | 14.79 | 12.80 | 14.48 | 14.56 | 15.53 | 15.44 | 15.78 | 15.33 | 14.46 |
| $Fe_2O_3$ | 0.61 | 1.10 | 0.28 | 0.97 | 1.11 | 1.30 | 0.95 | 1.23 | 1.36 | 1.60 |
| FeO | 0.13 | 0.12 | na | 0.46 | 0.25 | na | na | na | na | na |
| MnO | 0.01 | 0.06 | 0.02 | 0.08 | 0.03 | 0.09 | 0.05 | 0.08 | 0.04 | 0.06 |
| MgO | 0.03 | 0.32 | nd | 0.66 | 0.44 | 0.53 | 0.31 | 0.55 | 0.32 | 0.63 |
| CaO | 0.20 | 0.62 | 0.05 | 1.77 | 1.22 | 1.44 | 0.89 | 1.25 | 1.22 | 1.91 |
| $Na_2O$ | 3.75 | 4.30 | 3.39 | 4.76 | 4.24 | 5.08 | 4.37 | 4.30 | 4.19 | 4.75 |
| $K_2O$ | 6.56 | 7.07 | 6.60 | 5.13 | 6.50 | 5.66 | 6.53 | 7.43 | 6.93 | 5.70 |
| $P_2O_5$ | 0.01 | 0.15 | 0.02 | 0.18 | 0.07 | 0.13 | 0.11 | 0.16 | 0.10 | 0.15 |
| LOI | 0.29 | 0.31 | 0.20 | 0.37 | 0.84 | 0.41 | 0.41 | 0.33 | 0.38 | 0.63 |
| TOTAL | 99.03 | 99.55 | 98.95 | 99.15 | 99.73 | 99.33 | 99.29 | 99.03 | 99.37 | 99.83 |
| Sc | nd | 1.5 | 0.6 | 3.1 | 2.3 | 4.2 | 3.6 | 3.9 | 2.9 | 2.7 |
| V | 6 | 15 | nd | 17 | 14 | 14 | 11 | 10 | 15 | 17 |
| Cr | <5 | 5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| Ni | 2 | 5 | 5 | 9 | 5 | 12 | 2 | 9 | 3 | 5 |
| Cu | 4 | 6 | 4 | 5 | 4 | 5 | 11 | 5 | 5 | 4 |
| Pb | 20 | 11 | 5 | 17 | 21 | 22 | 20 | 29 | 27 | 17 |
| Zn | 13 | 45 | 4 | 53 | 36 | 46 | 35 | 52 | 31 | 55 |
| Ga | 19 | 19 | 20 | 19 | 20 | 20 | 20 | 19 | 18 | 21 |
| Rb | 200 | 207 | 231 | 132 | 146 | 132 | 168 | 205 | 186 | 132 |
| Sr | 336 | 308 | 183 | 768 | 536 | 639 | 622 | 772 | 834 | 714 |
| Y | 5.8 | 8.1 | 0.6 | 9.6 | 13.9 | 16.5 | 9.4 | 10.1 | 10.6 | 9.9 |
| Zr | 94 | 104 | 1.3 | 11.1 | 25.8 | 10.5 | 8.8 | 19 | 18.8 | 134 |
| Nb | 5.9 | 11.5 | 0.6 | 12.7 | 15.4 | 12.6 | 11.3 | 6.3 | 11.6 | 16.2 |
| Ba | 723 | 1383 | 508 | 1460 | 1208 | 1314 | 1396 | 2245 | 1485 | 1405 |
| La | 25 | 40 | 7 | 52 | 56 | 35 | 28 | 87 | 55 | 51 |
| Ce | 44 | 80 | 9 | 123 | 94 | 98 | 74 | 115 | 94 | 120 |
| Nd | 16 | 33 | 3 | 66 | 51 | 50 | 43 | 42 | 39 | 70 |
| Th | 29 | 11 | nd | 6 | 6 | 5 | 5 | 9 | 9 | 8 |
| F | 150 | 200 | na | 300 | 200 | na | na | na | na | na |

Major elements wt.%, trace elements p.p.m.
na = no analysis , nd = not detected

115-207 GROUP 1 GRANITE, RED HILL SOUTH
210 GROUP 2 GRANITE, RED HILL SOUTH/CTRAL WEST
211-216 GROUP 2 GRANITE, RED HILL CTRAL WEST

TABLE 3.7 cont...

| | 217 | 218 | 219 | 220 | 221 | 223 | 101 | 104 | 106 | 111 |
|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 72.43 | 70.37 | 68.99 | 69.37 | 71.71 | 71.21 | 62.65 | 72.70 | 65.02 | 69.74 |
| $TiO_2$ | 0.19 | 0.32 | 0.35 | 0.35 | 0.27 | 0.28 | 0.56 | 0.20 | 0.45 | 0.24 |
| $Al_2O_3$ | 14.26 | 14.29 | 14.72 | 14.76 | 14.03 | 14.45 | 16.30 | 14.04 | 16.68 | 12.58 |
| $Fe_2O_3$ | 1.52 | 1.92 | 1.76 | 1.48 | 1.50 | 1.53 | 3.52 | 1.10 | 2.19 | 3.27 |
| FeO | na | na | na | 0.31 | na | 0.40 | na | 0.26 | 0.80 | na |
| MnO | 0.03 | 0.06 | 0.05 | 0.05 | 0.09 | 0.03 | 0.07 | 0.02 | 0.09 | 0.12 |
| MgO | 0.21 | 0.42 | 0.42 | 0.56 | 0.35 | 0.63 | 1.12 | 0.19 | 0.90 | 0.90 |
| CaO | 0.42 | 1.15 | 1.27 | 1.24 | 1.23 | 1.31 | 3.18 | 0.60 | 1.79 | 2.67 |
| $Na_2O$ | 4.49 | 4.36 | 4.02 | 4.49 | 4.27 | 4.93 | 3.87 | 3.50 | 6.00 | 3.72 |
| $K_2O$ | 5.88 | 5.93 | 7.13 | 6.62 | 5.63 | 4.45 | 7.68 | 6.53 | 5.21 | 5.61 |
| $P_2O_5$ | 0.07 | 0.16 | 0.12 | 0.12 | 0.11 | 0.09 | 0.34 | 0.07 | 0.31 | 0.26 |
| LOI | 0.34 | 0.35 | 0.37 | 0.30 | 0.30 | 0.32 | 0.27 | 0.41 | 0.41 | 0.32 |
| TOTAL | 99.85 | 99.33 | 99.19 | 99.65 | 99.48 | 99.62 | 99.55 | 99.61 | 99.85 | 99.42 |
| Sc | 1.5 | 3 | 2.3 | 2.1 | 3.2 | 3 | 3.1 | 1.9 | 3.4 | 2.8 |
| V | 11 | 18 | 17 | 19 | 14 | 18 | 57 | 12 | 35 | 22 |
| Cr | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| Ni | 3 | 6 | 11 | 4 | 6 | 3 | 6 | 5 | 5 | 10 |
| Cu | 4 | 6 | 3 | 5 | 5 | 16 | 54 | 4 | 75 | 2 |
| Pb | 19 | 15 | 30 | 23 | 26 | 33 | 22 | 28 | 28 | 13 |
| Zn | 36 | 65 | 99 | 73 | 57 | 64 | 60 | 32 | 104 | 113 |
| Ga | 22 | 22 | 23 | 22 | 22 | 20 | 19 | 22 | 23 | 23 |
| Rb | 182 | 155 | 240 | 222 | 171 | 155 | 240 | 227 | 134 | 168 |
| Sr | 546 | 562 | 590 | 526 | 449 | 280 | 1266 | 456 | 803 | 508 |
| Y | 17.6 | 14.1 | 26.9 | 20.6 | 15.4 | 10.6 | 30.4 | 14.8 | 25.9 | 9.5 |
| Zr | 232 | 21.7 | 341 | 277 | 5.7 | 232 | 278 | 210 | 492 | 39.9 |
| Nb | 15.4 | 15.5 | 26.6 | 19.8 | 15.1 | 7.5 | 16.6 | 12.7 | 18.4 | 12.5 |
| Ba | 1060 | 1197 | 1088 | 1422 | 913 | 1007 | 2471 | 1047 | 1137 | 766 |
| La | 116 | 67 | 158 | 103 | 72 | 125 | 180 | 47 | 174 | 60 |
| Ce | 194 | 159 | 293 | 203 | 139 | 174 | 281 | 107 | 260 | 101 |
| Nd | 87 | 87 | 154 | 98 | 64 | 57 | 109 | 42 | 105 | 52 |
| Th | 24 | 6 | 19 | 12 | 6 | 45 | 20 | 23 | 34 | 4 |
| F | na | na | na | 250 | na | 700 | na | 200 | 900 | na |

Major elements wt.%, trace elements p.p.m.
na = no analysis , nd = not detected

217-218 GROUP 2 GRANITE, RED HILL CTRAL EAST
219-223 GROUP 2 GRANITE, RED HILL NORTH
101,106 GROUP 2 SYENITE, RED HILL NORTH
104,111 ?SYENITE, RED HILL NORTH

TABLE 3.7 cont...

| | 112 | 117 | 119 | 120 | 206 | 208 | 209 | 222 | 224 |
|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 59.42 | 60.30 | 64.70 | 63.31 | 64.45 | 61.96 | 64.87 | 63.46 | 72.81 |
| $TiO_2$ | 0.16 | 0.07 | 0.49 | 0.08 | 0.05 | 0.69 | 0.02 | 0.49 | 0.21 |
| $Al_2O_3$ | 11.78 | 12.79 | 15.67 | 14.42 | 15.61 | 13.52 | 16.54 | 16.69 | 13.81 |
| $Fe_2O_3$ | 4.18 | 3.27 | 2.60 | 2.73 | 1.85 | 4.43 | 0.97 | 3.15 | 0.86 |
| FeO | 2.55 | 2.06 | na | 0.82 | 0.56 | 1.05 | 0.58 | na | 0.58 |
| MnO | 0.29 | 0.27 | 0.12 | 0.13 | 0.09 | 0.17 | 0.09 | 0.09 | 0.02 |
| MgO | 3.32 | 3.16 | 0.70 | 1.73 | 1.11 | 1.69 | 0.94 | 0.92 | 0.27 |
| CaO | 7.09 | 6.86 | 2.69 | 3.79 | 2.60 | 4.17 | 1.92 | 1.97 | 0.95 |
| $Na_2O$ | 3.82 | 3.78 | 5.12 | 4.67 | 5.49 | 5.07 | 4.75 | 5.73 | 3.78 |
| $K_2O$ | 6.07 | 6.26 | 6.46 | 7.06 | 6.72 | 6.13 | 8.07 | 5.96 | 5.35 |
| $P_2O_5$ | 0.62 | 0.49 | 0.34 | 0.48 | 0.57 | 0.53 | 0.22 | 0.28 | 0.05 |
| LOI | 0.47 | 0.40 | 0.30 | 0.34 | 0.37 | 0.40 | 0.34 | 0.27 | 0.55 |
| TOTAL | 99.76 | 99.71 | 99.19 | 99.56 | 99.47 | 99.80 | 99.31 | 99.02 | 99.24 |
| Sc | 5 | 4.6 | 3 | 2.5 | 2.1 | 4.6 | 2.6 | 4.2 | 1.1 |
| V | 46 | 27 | 28 | 21 | 14 | 57 | 7 | 36 | 10 |
| Cr | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| Ni | 5 | 2 | 13 | 7 | 3 | 10 | 3 | 8 | 2 |
| Cu | 5 | 3 | 3 | 3 | 3 | 3 | 4 | 16 | 4 |
| Pb | 9 | 15 | 13 | 6 | 7 | 5 | 20 | 33 | 46 |
| Zn | 190 | 170 | 128 | 103 | 68 | 151 | 52 | 110 | 54 |
| Ga | 20 | 21 | 20 | 22 | 22 | 21 | 22 | 23 | 20 |
| Rb | 198 | 192 | 184 | 253 | 204 | 201 | 227 | 174 | 239 |
| Sr | 418 | 417 | 786 | 282 | 330 | 356 | 475 | 712 | 154 |
| Y | 10.2 | 10.5 | 23.2 | 9.5 | 9 | 24.4 | 3.2 | 27.1 | 3.6 |
| Zr | 332 | 29.2 | 317 | 95 | 51 | 142 | 25.1 | 515 | 203 |
| Nb | 16 | 1.4 | 18 | 7.7 | 3.6 | 41.2 | 0.7 | 21.1 | 3.1 |
| Ba | 741 | 848 | 1478 | 1254 | 633 | 859 | 1073 | 1245 | 730 |
| La | 48 | 45 | 81 | 49 | 55 | 123 | 21 | 210 | 114 |
| Ce | 111 | 81 | 175 | 97 | 99 | 284 | 36 | 299 | 156 |
| Nd | 73 | 42 | 103 | 52 | 53 | 184 | 15 | 135 | 59 |
| Th | 10 | 3 | 17 | 5 | 3 | 4 | 4 | 34 | 60 |
| F | 700 | 450 | na | 450 | 450 | 450 | 300 | na | 350 |

Major elements wt.%, trace elements p.p.m.
na = no analysis , nd = not detected

112,117,120,206,209 GROUP 1 SYENITE, RED HILL SOUTH
119,208,222 GROUP 2 SYENITE, RED HILL NORTH
224 GRANITOID, 7.5 km WEST WONGANOO

TABLE 3.8 : RED HILL REE ANALYSES

| | 105 | 120 |
|---|---|---|
| ppm | | |
| Ce | 156.0 | 81.0 |
| Nd | 64.9 | 41.7 |
| Sm | 10.1 | 6.67 |
| Dy | nm | 1.40 |
| Er | 1.13 | 0.64 |
| Yb | 0.43 | 0.65 |
| La/Yb | 258 | 75 |

nm = not measured

TABLE 3.9 : RED HILL CIPW NORMS

SYENITE

| | 101 | 104 | 106 | 111 | 112 | 117 | 119 | 120 | 206 | 208 |
|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 58.06 | 68.24 | 59.53 | 65.59 | 55.45 | 56.02 | 59.81 | 58.44 | 59.15 | 57.45 |
| $TiO_2$ | 0.39 | 0.14 | 0.31 | 0.17 | 0.11 | 0.05 | 0.34 | 0.06 | 0.03 | 0.48 |
| $Al_2O_3$ | 17.80 | 15.53 | 18.00 | 13.94 | 12.95 | 14.00 | 17.08 | 15.69 | 16.89 | 14.78 |
| $Fe_2O_3$ | 1.47 | 0.78 | 1.51 | 1.39 | 2.94 | 2.29 | 1.09 | 1.90 | 1.28 | 3.09 |
| FeO | 1.21 | 0.20 | 0.61 | 1.14 | 1.99 | 1.60 | 0.89 | 0.63 | 0.43 | 0.81 |
| MnO | 0.05 | 0.02 | 0.07 | 0.10 | 0.23 | 0.21 | 0.09 | 0.10 | 0.07 | 0.13 |
| MgO | 1.55 | 0.27 | 1.23 | 1.26 | 4.62 | 4.38 | 0.96 | 2.38 | 1.52 | 2.34 |
| CaO | 3.16 | 0.60 | 1.76 | 2.69 | 7.09 | 6.83 | 2.67 | 3.75 | 2.56 | 4.14 |
| $Na_2O$ | 6.95 | 6.36 | 10.65 | 6.78 | 6.92 | 6.82 | 9.19 | 8.36 | 9.77 | 9.11 |
| $K_2O$ | 9.08 | 7.81 | 6.09 | 6.73 | 7.22 | 7.42 | 7.62 | 8.32 | 7.87 | 7.25 |
| $P_2O_5$ | 0.27 | 0.06 | 0.24 | 0.21 | 0.49 | 0.38 | 0.27 | 0.37 | 0.44 | 0.41 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | | | | | | | | | | |
| Ap | 0.74 | 0.15 | 0.68 | 0.57 | 1.33 | 1.05 | 0.74 | 1.04 | 1.24 | 1.15 |
| Il | 1.05 | 0.38 | 0.85 | 0.45 | 0.30 | 0.13 | 0.92 | 0.15 | 0.09 | 1.29 |
| Mt | 3.04 | 0.33 | 1.58 | 2.83 | 3.55 | 4.18 | 2.26 | 1.89 | 1.09 | 1.92 |
| Or | 45 | 39 | 31 | 33 | 35 | 36 | 38 | 41 | 39 | 36 |
| Ab | 32 | 30 | 51 | 31 | 26 | 30 | 43 | 34 | 43 | 35 |
| An | 4.37 | 2.51 | 3.17 | 1.05 | - | - | 0.68 | - | - | - |
| Di | 7.38 | - | 3.31 | 6.94 | 25 | 22 | 4.69 | 11 | 7.57 | 10 |
| Hy | - | 0.31 | 0.59 | - | - | - | - | - | - | - |
| Ac | - | - | - | - | 4.80 | 0.94 | - | 4.03 | 3.14 | 6.48 |
| C | - | 0.60 | - | - | - | - | - | - | - | - |
| Q | 5.00 | 26 | 6.66 | 22 | 2.20 | 2.37 | 6.42 | 3.94 | 3.72 | 4.43 |
| Hm | - | 0.88 | 1.11 | - | - | - | - | - | - | 0.81 |
| Wo | 0.29 | - | - | 1.01 | 0.85 | 2.18 | 2.12 | 1.08 | 0.21 | 2.29 |
| Total | 99 | 100 | 100 | 99 | 99 | 99 | 99 | 99 | 99 | 99 |
| | | | | | | | | | | |
| A | 70 | 86 | 73 | 67 | 48 | 53 | 76 | 68 | 77 | 59 |
| M | 6.75 | 1.62 | 5.86 | 6.49 | 16 | 17 | 4.61 | 9.99 | 6.96 | 8.96 |
| F | 24 | 13 | 21 | 26 | 35 | 30 | 19 | 22 | 16 | 32 |
| Q | 50 | 56 | 51 | 55 | 50 | 50 | 51 | 51 | 51 | 50 |
| M | 7.94 | 1.58 | 5.45 | 6.99 | 19 | 17 | 6.55 | 10 | 6.62 | 14 |
| L | 42 | 43 | 44 | 38 | 31 | 34 | 43 | 39 | 43 | 36 |
| PALI | 0.93 | 1.05 | 0.97 | 0.86 | 0.61 | 0.66 | 0.88 | 0.77 | 0.84 | 0.72 |
| PAKI | 1.11 | 1.10 | 1.07 | 1.03 | 0.92 | 0.98 | 1.02 | 0.94 | 0.96 | 0.90 |
| AI | 0.90 | 0.91 | 0.93 | 0.97 | 1.09 | 1.02 | 0.98 | 1.06 | 1.04 | 1.11 |
| PMI | 1.66 | 1.25 | 1.69 | 1.24 | 1.53 | 1.53 | 1.69 | 1.71 | 1.79 | 1.71 |

TABLE 3.9 cont...

| | SYENITES | | GRANITES | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 209 | 222 | 100 | 114 | 118 | 103 | 102 | 105 | 107 | 108 |
| $SiO_2$ | 59.61 | 58.42 | 74.34 | 60.71 | 65.29 | 63.02 | 67.78 | 66.70 | 66.99 | 66.46 |
| $TiO_2$ | 0.01 | 0.34 | 0.02 | 0.02 | 0.07 | 0.45 | 0.14 | 0.16 | 0.19 | 0.28 |
| $Al_2O_3$ | 17.92 | 18.11 | 12.82 | 19.78 | 17.38 | 18.31 | 15.34 | 15.38 | 14.94 | 15.13 |
| $Fe_2O_3$ | 0.67 | 1.31 | 0.38 | 0.28 | 0.24 | 0.47 | 0.91 | 0.64 | 0.87 | 1.08 |
| FeO | 0.45 | 1.08 | 0.20 | 0.08 | 0.13 | 0.20 | 0.15 | 0.30 | 0.46 | 0.25 |
| MnO | 0.07 | 0.07 | - | - | 0.01 | 0.05 | 0.06 | 0.06 | 0.06 | 0.08 |
| MgO | 1.29 | 1.26 | - | - | - | 0.81 | 0.47 | 0.35 | 0.70 | 0.86 |
| CaO | 1.89 | 1.95 | 0.14 | 0.08 | 0.14 | 2.87 | 0.81 | 1.31 | 1.41 | 1.76 |
| $Na_2O$ | 8.46 | 10.24 | 4.86 | 7.59 | 7.80 | 12.94 | 6.45 | 8.95 | 6.87 | 7.65 |
| $K_2O$ | 9.46 | 7.00 | 7.21 | 11.43 | 8.92 | 0.78 | 7.84 | 6.08 | 7.41 | 6.34 |
| $P_2O_5$ | 0.17 | 0.22 | 0.03 | 0.04 | 0.02 | 0.09 | 0.06 | 0.07 | 0.09 | 0.13 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | | | | | | | | | | |
| Ap | 0.48 | 0.61 | 0.09 | 0.11 | 0.07 | 0.26 | 0.15 | 0.20 | 0.26 | 0.35 |
| Il | 0.04 | 0.93 | 0.06 | 0.06 | 0.19 | 0.68 | 0.38 | 0.44 | 0.51 | 0.76 |
| Mt | 1.40 | 2.74 | 0.73 | 0.24 | 0.27 | - | 0.26 | 0.79 | 1.40 | 0.20 |
| Or | 47 | 35 | 35 | 57 | 44 | 3.95 | 39 | 30 | 37 | 32 |
| Ab | 40 | 48 | 22 | 36 | 37 | 62 | 30 | 42 | 32 | 36 |
| An | 0.01 | 2.19 | 0.43 | 0.07 | 0.50 | 12 | 2.63 | 0.86 | 1.63 | 2.82 |
| Di | 6.41 | 5.06 | - | - | - | 0.98 | 0.83 | 1.54 | 3.08 | 3.81 |
| Hy | - | 0.31 | - | - | - | 0.71 | 0.34 | - | - | - |
| Ac | - | - | - | - | - | - | - | - | - | - |
| C | - | - | 1.02 | 1.36 | 0.83 | - | - | - | - | - |
| Q | 3.04 | 3.53 | 40 | 3.94 | 16 | 18 | 25 | 21 | 23 | 23 |
| Hm | - | - | 0.03 | 0.24 | 0.16 | 0.68 | 1.13 | 0.37 | 0.29 | 1.41 |
| Tn | - | - | - | - | - | 0.74 | - | - | - | - |
| Wo | 0.32 | - | - | - | - | - | - | 1.38 | 0.48 | 0.25 |
| Total | 99 | 99 | 100 | 99 | 99 | 99 | 100 | 99 | 100 | 100 |
| | | | | | | | | | | |
| A | 83 | 73 | 91 | 96 | 96 | 83 | 84 | 86 | 80 | 78 |
| M | 6.10 | 5.71 | - | - | - | 6.18 | 2.80 | 2.14 | 4.00 | 5.06 |
| F | 11 | 22 | 8.90 | 3.75 | 4.37 | 11 | 13 | 12 | 16 | 17 |
| Q | 50 | 50 | 58 | 51 | 54 | 54 | 56 | 55 | 55 | 55 |
| M | 4.79 | 6.37 | 0.69 | 0.52 | 0.57 | 2.07 | 2.15 | 2.85 | 3.70 | 4.12 |
| L | 45 | 44 | 41 | 49 | 46 | 44 | 42 | 42 | 41 | 41 |
| PALI | 0.90 | 0.94 | 1.05 | 1.04 | 1.03 | 1.10 | 1.02 | 0.94 | 0.95 | 0.96 |
| PAKI | 1.00 | 1.05 | 1.06 | 1.04 | 1.04 | 1.33 | 1.07 | 1.02 | 1.05 | 1.08 |
| AI | 1.00 | 0.95 | 0.94 | 0.96 | 0.96 | 0.75 | 0.93 | 0.98 | 0.96 | 0.93 |
| PMI | 1.80 | 1.77 | 0.97 | 1.88 | 1.54 | 1.31 | 1.27 | 1.35 | 1.28 | 1.26 |

TABLE 3.9 cont...

| | GRANITES | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 109 | 110 | 115 | 122 | 207 | 210 | 211 | 212 | 213 | 214 |
| $SiO_2$ | 68.09 | 66.64 | 69.26 | 65.44 | 71.32 | 65.20 | 65.56 | 63.78 | 65.11 | 63.00 |
| $TiO_2$ | 0.27 | 0.04 | 0.07 | 0.18 | - | 0.24 | 0.15 | 0.18 | 0.17 | 0.08 |
| $Al_2O_3$ | 14.98 | 15.88 | 15.17 | 16.18 | 14.24 | 15.91 | 16.01 | 16.94 | 16.92 | 17.27 |
| $Fe_2O_3$ | 0.60 | 0.63 | 0.43 | 0.77 | 0.14 | 0.68 | 0.78 | 0.64 | 0.46 | 0.60 |
| FeO | 0.22 | 0.23 | 0.10 | 0.09 | 0.07 | 0.36 | 0.20 | 0.34 | 0.25 | 0.32 |
| MnO | 0.02 | 0.07 | 0.01 | 0.05 | 0.02 | 0.06 | 0.02 | 0.07 | 0.04 | 0.06 |
| MgO | 0.56 | 0.53 | 0.04 | 0.44 | - | 0.92 | 0.61 | 0.73 | 0.43 | 0.76 |
| CaO | 1.55 | 1.38 | 0.20 | 0.62 | 0.05 | 1.77 | 1.22 | 1.43 | 0.88 | 1.24 |
| $Na_2O$ | 7.25 | 8.78 | 6.84 | 7.74 | 6.21 | 8.61 | 7.66 | 9.12 | 7.89 | 7.74 |
| $K_2O$ | 6.40 | 5.73 | 7.87 | 8.38 | 7.94 | 6.11 | 7.73 | 6.68 | 7.75 | 8.80 |
| $P_2O_5$ | 0.06 | 0.10 | 0.01 | 0.12 | 0.02 | 0.14 | 0.05 | 0.10 | 0.09 | 0.13 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | | | | | | | | | | |
| Ap | 0.18 | 0.28 | 0.02 | 0.33 | 0.04 | 0.39 | 0.15 | 0.28 | 0.24 | 0.35 |
| Il | 0.66 | 0.11 | 0.19 | 0.38 | - | 0.64 | 0.40 | 0.49 | 0.48 | 0.23 |
| Mt | - | 1.06 | 0.16 | - | 0.28 | 0.76 | 0.30 | 0.94 | 0.46 | 1.23 |
| Or | 32 | 28 | 39 | 42 | 39 | 30 | 39 | 33 | 39 | 44 |
| Ab | 34 | 41 | 32 | 36 | 29 | 40 | 36 | 43 | 37 | 36 |
| An | 3.33 | 3.42 | 0.93 | 0.18 | 0.12 | 2.96 | 1.54 | 2.85 | 3.21 | 1.83 |
| Di | 2.47 | 2.28 | - | 1.52 | - | 4.05 | 2.72 | 3.08 | 0.43 | 2.94 |
| Hy | - | 0.02 | 0.05 | 0.12 | 0.02 | - | - | 0.05 | 0.40 | 0.12 |
| Ac | - | - | - | - | - | - | - | - | - | - |
| C | - | - | 0.16 | - | 0.08 | - | - | - | - | - |
| Q | 26 | 22 | 26 | 18 | 31 | 19 | 19 | 15 | 18 | 12 |
| Hm | 0.85 | 0.16 | 0.50 | 1.10 | - | 0.45 | 0.91 | 0.26 | 0.35 | 0.01 |
| Tn | 0.10 | - | - | 0.14 | - | - | - | - | - | - |
| Wo | 0.39 | - | - | - | - | 0.04 | 0.43 | - | - | - |
| Total | 100 | 99 | 99 | 99 | 99 | 99 | 100 | 99 | 99 | 99 |
| | | | | | | | | | | |
| A | 85 | 85 | 92 | 87 | 97 | 82 | 85 | 84 | 89 | 86 |
| M | 3.63 | 3.36 | 0.27 | 2.46 | - | 5.46 | 3.48 | 4.17 | 2.53 | 4.03 |
| F | 11 | 11 | 7.25 | 10 | 3.01 | 13 | 12 | 11 | 8.57 | 9.99 |
| Q | 56 | 55 | 56 | 54 | 57 | 54 | 54 | 53 | 54 | 53 |
| M | 2.69 | 2.29 | 0.79 | 2.17 | 0.26 | 3.68 | 2.99 | 3.11 | 1.59 | 2.88 |
| L | 41 | 43 | 43 | 44 | 43 | 42 | 43 | 44 | 44 | 44 |
| PALI | 0.99 | 1.00 | 1.02 | 0.97 | 1.00 | 0.97 | 0.96 | 0.98 | 1.02 | 0.97 |
| PAKI | 1.10 | 1.10 | 1.03 | 1.00 | 1.01 | 1.08 | 1.04 | 1.07 | 1.08 | 1.04 |
| AI | 0.91 | 0.91 | 0.97 | 1.00 | 0.99 | 0.92 | 0.96 | 0.93 | 0.92 | 0.96 |
| PMI | 1.20 | 1.31 | 1.27 | 1.48 | 1.19 | 1.35 | 1.41 | 1.49 | 1.44 | 1.58 |

TABLE 3.9 cont...

| | GRANITES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 215 | 216 | 217 | 218 | 219 | 220 | 221 | 223 | 224 |
| $SiO_2$ | 64.46 | 64.57 | 67.27 | 65.73 | 64.46 | 64.32 | 66.95 | 66.18 | 68.68 |
| $TiO_2$ | 0.15 | 0.21 | 0.13 | 0.22 | 0.25 | 0.24 | 0.19 | 0.20 | 0.15 |
| $Al_2O_3$ | 16.81 | 15.80 | 15.61 | 15.73 | 16.20 | 16.13 | 15.43 | 15.83 | 15.35 |
| $Fe_2O_3$ | 0.67 | 0.78 | 0.75 | 0.95 | 0.87 | 1.03 | 0.74 | 1.07 | 0.61 |
| FeO | 0.35 | 0.41 | 0.39 | 0.50 | 0.46 | 0.24 | 0.39 | 0.31 | 0.46 |
| MnO | 0.03 | 0.05 | 0.02 | 0.05 | 0.04 | 0.04 | 0.07 | 0.02 | 0.02 |
| MgO | 0.44 | 0.87 | 0.29 | 0.58 | 0.58 | 0.77 | 0.49 | 0.87 | 0.38 |
| CaO | 1.21 | 1.90 | 0.42 | 1.15 | 1.27 | 1.23 | 1.23 | 1.30 | 0.96 |
| $Na_2O$ | 7.57 | 8.54 | 8.09 | 7.90 | 7.27 | 8.07 | 7.72 | 8.88 | 6.92 |
| $K_2O$ | 8.23 | 6.75 | 6.97 | 7.06 | 8.50 | 7.83 | 6.71 | 5.27 | 6.44 |
| $P_2O_5$ | 0.08 | 0.12 | 0.05 | 0.13 | 0.09 | 0.09 | 0.09 | 0.07 | 0.04 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | | | | | | | | | |
| Ap | 0.22 | 0.33 | 0.15 | 0.35 | 0.26 | 0.26 | 0.24 | 0.20 | 0.11 |
| Il | 0.40 | 0.59 | 0.36 | 0.61 | 0.66 | 0.66 | 0.51 | 0.53 | 0.40 |
| Mt | 0.99 | 1.02 | 1.19 | 1.34 | 1.05 | 0.15 | 1.12 | 0.58 | 1.26 |
| Or | 41 | 34 | 35 | 35 | 42 | 39 | 33 | 26 | 32 |
| Ab | 35 | 40 | 38 | 37 | 34 | 38 | 36 | 42 | 32 |
| An | 2.53 | 1.28 | 1.38 | 1.88 | 1.06 | 0.57 | 2.48 | 4.19 | 4.39 |
| Di | 1.97 | 3.88 | 0.22 | 2.45 | 2.58 | 3.44 | 2.15 | 1.54 | - |
| Hy | - | - | 0.29 | 0.03 | - | - | - | 0.63 | 0.46 |
| Ac | - | - | - | - | - | - | - | - | - |
| C | - | - | - | - | - | - | - | - | 0.40 |
| Q | 16 | 17 | 23 | 20 | 16 | 16 | 23 | 23 | 28 |
| Hm | 0.27 | 0.42 | 0.25 | 0.42 | 0.51 | 1.38 | 0.28 | 1.14 | - |
| Tn | - | - | - | - | - | - | - | - | - |
| Wo | 0.27 | 1.19 | - | - | 0.64 | 0.38 | 0.19 | - | - |
| Total | 99 | 100 | 100 | 99 | 99 | 100 | 99 | 100 | 99 |
| | | | | | | | | | |
| A | 86 | 81 | 84 | 80 | 82 | 82 | 83 | 77 | 83 |
| M | 2.47 | 4.90 | 1.71 | 3.27 | 3.10 | 4.11 | 2.94 | 5.20 | 2.47 |
| F | 12 | 14 | 14 | 17 | 14 | 14 | 14 | 17 | 14 |
| Q | 54 | 54 | 55 | 54 | 54 | 53 | 55 | 55 | 56 |
| M | 2.63 | 4.34 | 1.89 | 3.40 | 3.66 | 3.92 | 2.86 | 3.11 | 1.70 |
| L | 44 | 42 | 43 | 42 | 43 | 43 | 42 | 42 | 42 |
| PALI | 0.99 | 0.92 | 1.01 | 0.98 | 0.95 | 0.94 | 0.99 | 1.02 | 1.07 |
| PAKI | 1.06 | 1.03 | 1.04 | 1.05 | 1.03 | 1.01 | 1.07 | 1.12 | 1.15 |
| AI | 0.94 | 0.97 | 0.96 | 0.95 | 0.97 | 0.99 | 0.94 | 0.89 | 0.87 |
| PMI | 1.47 | 1.42 | 1.34 | 1.37 | 1.47 | 1.48 | 1.29 | 1.28 | 1.17 |

PALI = Peraluminous index $Al_2O_3$ / ( CaO + $Na_2O$ + $K_2O$ )
>1 = peraluminous, <1 = metaluminous

PAKI = Peralkaline index $Al_2O_3$ / ( $Na_2O$ + $K_2O$ )
<1 = peralkaline

AI = Agpaitic index ( $Na_2O$ + $K_2O$ ) / $Al_2O_3$
>1 = agpaitic

PMI = plumaskitic index 6 ( $Na_2O$ + $K_2O$ ) / $SiO_2$
<1 = plumaskitic, >1 = miaskitic

## TABLE 3.10 : RED HILL Rb, Sr AND ISOTOPE RATIO MEASUREMENTS

| Sample[1] | Rb(ppm) | Sr(ppm) | $^{87}Rb/^{86}Sr$ | $^{87}Sr/^{86}Sr$[2] |
|---|---|---|---|---|
| Syenites | | | | |
| 120P | 2 | 104 | 0.059 | 0.70407 |
| 106 | 123 | 755 | 0.473 | 0.71837 |
| 117 | 176 | 385 | 1.328 | 0.74817 |
| 112 | 185 | 399 | 1.350 | 0.74841 |
| 209 | 216 | 456 | 1.377 | 0.75064 |
| 120R | 200 | 363 | 1.601 | 0.75866 |
| 208 | 189 | 344 | 1.602 | 0.75860 |
| 206 | 195 | 316 | 1.801 | 0.76428 |
| 120 | 236 | 261 | 2.640 | 0.79632 |
| 120F | 299 | 246 | 3.563 | 0.82971 |
| Granites | | | | |
| 105P | 2 | 78 | 0.096 | 0.71033 |
| 210 | 134 | 748 | 0.520 | 0.71914 |
| 110 | 127 | 621 | 0.592 | 0.72312 |
| 211 | 141 | 519 | 0.789 | 0.73009 |
| 108 | 151 | 494 | 0.886 | 0.73342 |
| 105 | 151 | 460 | 0.951 | 0.73622 |
| 102 | 185 | 500 | 1.076 | 0.74143 |
| 105F | 221 | 567 | 1.132 | 0.74232 |
| 220 | 212 | 507 | 1.215 | 0.74529 |
| 104 | 214 | 439 | 1.413 | 0.75323 |
| 223 | 150 | 271 | 1.607 | 0.76078 |
| 115 | 189 | 325 | 1.695 | 0.76358 |
| 122 | 196 | 293 | 1.941 | 0.77180 |

1 F = Alkali feldspar, P = Pyroxene, R = Replicate measurement from same split.

2 $^{87}Sr/^{86}Sr$ for E & A std = 0.7080496 $\pm$ 0.0000096 (1 sigma).

## TABLE 4.1 : FITZGERALD PEAKS REPRESENTATIVE FELDSPAR ANALYSES

| wt% | 125-1 | 125-3 | 125-3 | 125-4 | 125-4 | 125-5 | 131-1 | 131-1 | 131-3 | 135-6 | 135-6 | 145-3 | 145-4 | 145-4 | 137-1 | 137-2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLAG | PERTH HOST | PERTH EXSN | PERTH HOST | PERTH EXSN | PLAG | PERTH HOST | PERTH EXSN | PLAG | PERTH HOST | PERTH EXSN | PLAG | PERTH HOST | PERTH EXSN | PLAG | MICRO |
| $SiO_2$ | 69.66 | 66.09 | 69.66 | 65.70 | 68.33 | 69.02 | 65.70 | 68.57 | 68.44 | 65.60 | 67.28 | 68.77 | 65.42 | 69.56 | 60.83 | 62.23 |
| $TiO_2$ | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.63 |
| $Al_2O_3$ | 19.30 | 17.83 | 18.96 | 17.74 | 19.14 | 19.20 | 17.82 | 19.22 | 19.27 | 17.87 | 20.48 | 19.82 | 17.65 | 19.40 | 22.81 | 18.53 |
| FeO* | 0.21 | - | 0.13 | - | 0.33 | 0.26 | - | 0.36 | 0.34 | - | - | 0.23 | - | 0.18 | - | - |
| MnO | - | - | - | - | 0.14 | - | - | - | - | - | - | - | - | - | - | - |
| MgO | 0.14 | - | - | - | 0.14 | 0.11 | - | 0.14 | - | - | - | 0.13 | - | 0.13 | 0.57 | 0.21 |
| CaO | 0.20 | - | - | - | 0.43 | 0.26 | - | 0.30 | 0.57 | - | 1.56 | 0.63 | - | - | 4.27 | - |
| $Na_2O$ | 10.50 | - | 10.34 | - | 10.44 | 10.36 | - | 10.56 | 10.23 | - | 9.96 | 10.26 | - | 10.08 | 9.00 | 0.52 |
| $K_2O$ | 0.12 | 17.60 | 0.10 | 17.54 | 0.14 | 0.16 | 17.55 | 0.33 | 0.13 | 17.32 | 0.14 | 0.10 | 17.46 | 0.09 | 0.30 | 15.25 |
| Other | 0.07 | - | 0.05 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| TOTAL | 100.20 | 101.52 | 99.24 | 100.98 | 99.09 | 99.37 | 101.07 | 99.48 | 98.98 | 100.79 | 99.42 | 99.94 | 100.53 | 99.44 | 97.78 | 97.37 |

Structural formulae based on 8(O)

| | 125-1 | 125-3 | 125-3 | 125-4 | 125-4 | 125-5 | 131-1 | 131-1 | 131-3 | 135-6 | 135-6 | 145-3 | 145-4 | 145-4 | 137-1 | 137-2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Si | 3.024 | 3.023 | 3.045 | 3.022 | 3.007 | 3.021 | 3.019 | 3.008 | 3.011 | 3.019 | 2.955 | 2.996 | 3.022 | 3.031 | 2.760 | 2.951 |
| Ti | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | .022 |
| Al | .987 | .961 | .977 | .961 | .993 | .990 | .965 | .993 | .999 | .969 | 1.060 | 1.017 | .961 | .996 | 1.220 | 1.036 |
| Fe(tot) | .008 | - | .005 | - | .012 | .010 | .013 | .013 | .013 | - | - | .008 | - | .007 | - | - |
| Mn | - | - | - | - | .005 | - | - | - | - | - | - | - | - | - | - | - |
| Mg | .009 | - | - | - | .009 | .007 | - | .009 | - | - | - | .009 | - | .009 | .038 | .015 |
| Ca | .009 | - | - | - | .020 | .012 | - | .014 | .027 | - | .073 | .029 | - | - | .208 | - |
| Na | .884 | - | .876 | - | .891 | .879 | - | .898 | .873 | - | .848 | .867 | - | .852 | .792 | .048 |
| K | .007 | 1.027 | .006 | 1.029 | - | .009 | 1.029 | .018 | .007 | 1.017 | .008 | .006 | 1.029 | .005 | .018 | .922 |
| Other | .006 | - | .004 | - | - | - | - | - | - | - | - | - | - | - | - | - |

FeO* = total iron

## TABLE 4.2 : FITZGERALD PEAKS REPRESENTATIVE PYROXENE ANALYSES

| | 125-1 | 125-1 | 125-2 | 125-2 | 125-5 | 125-5 | 125-1 | 125-1 | 125-6 | 125-6 | 145-1 | 145-2 | 145-3 | 145-3 | 145-6 | 145-6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| wt% | RIM | CORE | RIM | CORE | RIM | CORE | RIM | CORE | RIM | CORE | BLEB | BLEB | RIM | CORE | RIM | CORE |
| $SiO_2$ | 50.82 | 49.84 | 51.04 | 51.26 | 49.87 | 51.31 | 51.28 | 51.24 | 51.42 | 50.98 | 53.36 | 54.74 | 52.78 | 52.83 | 53.22 | 51.98 |
| $TiO_2$ | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.12 |
| $Al_2O_3$ | 0.63 | 0.72 | 0.58 | 0.47 | 0.58 | 0.54 | 0.61 | 0.72 | 0.71 | 0.52 | 0.19 | 0.17 | 0.78 | 0.75 | 0.69 | 0.81 |
| $Fe_2O_3$ | 5.50 | 6.40 | 6.17 | 5.39 | 7.13 | 5.87 | 4.83 | 4.87 | 4.31 | 4.97 | - | - | 3.20 | 3.55 | 2.63 | 3.37 |
| FeO | 18.39 | 16.65 | 17.15 | 17.84 | 16.94 | 17.90 | 18.46 | 18.37 | 18.70 | 17.61 | 24.87 | 22.89 | 13.34 | 14.00 | 14.04 | 13.52 |
| MnO | 0.90 | 1.09 | 1.21 | 0.94 | 0.98 | 0.96 | 0.89 | 0.94 | 0.86 | 0.94 | 1.51 | 0.31 | 0.46 | 0.49 | 0.52 | 0.33 |
| MgO | 4.15 | 4.31 | 4.49 | 4.29 | 4.14 | 4.30 | 4.24 | 4.40 | 4.53 | 4.40 | 7.47 | 9.51 | 8.29 | 8.22 | 8.38 | 8.03 |
| CaO | 19.55 | 19.67 | 19.75 | 19.96 | 19.73 | 19.67 | 19.94 | 20.17 | 20.03 | 20.42 | 11.42 | 12.15 | 20.84 | 20.66 | 20.97 | 20.49 |
| $Na_2O$ | 1.95 | 1.93 | 2.02 | 2.00 | 1.95 | 2.07 | 1.91 | 1.78 | 1.77 | 1.81 | 0.54 | 0.48 | 1.69 | 1.63 | 1.57 | 1.69 |
| Other | - | 0.14 | - | - | 0.12 | - | 0.14 | - | - | - | 0.16 | - | - | - | - | - |
| TOTAL | 101.89 | 100.75 | 102.41 | 102.15 | 101.44 | 102.62 | 102.30 | 102.49 | 102.33 | 101.65 | 99.52 | 100.25 | 101.38 | 102.13 | 102.02 | 100.34 |

Structural formulae on the basis of 6(O)
Cation total recalculated to 4

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Si | 1.979 | 1.960 | 1.973 | 1.986 | 1.954 | 1.980 | 1.985 | 1.980 | 1.987 | 1.984 | 2.090 | 2.094 | 1.999 | 2.009 | 2.005 | 1.993 |
| Ti | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | .003 |
| Al | .029 | .034 | .027 | .022 | .027 | .025 | .028 | .033 | .033 | .024 | .009 | .008 | .035 | .034 | .031 | .037 |
| $Fe^{3+}$ | .161 | .189 | .180 | .157 | .210 | .171 | .141 | .142 | .125 | .146 | - | - | .091 | - | .075 | .097 |
| $Fe^{2+}$ | .599 | .548 | .554 | .578 | .555 | .578 | .598 | .593 | .604 | .573 | .815 | .732 | .423 | .547 | .442 | .433 |
| Mn | .030 | .036 | .040 | .031 | .033 | .031 | .029 | .031 | .028 | .031 | .050 | .010 | .015 | .016 | .017 | .011 |
| Mg | .241 | .253 | .259 | .248 | .242 | .247 | .245 | .253 | .261 | .255 | .436 | .542 | .468 | .466 | .470 | .459 |
| Ca | .815 | .829 | .818 | .828 | .828 | .813 | .827 | .835 | .830 | .851 | .479 | .498 | .846 | .842 | .846 | .842 |
| Na | .147 | .147 | .151 | .151 | .148 | .155 | .144 | .134 | .132 | .137 | .041 | .036 | .124 | .120 | .115 | .126 |
| Other | - | .004 | - | - | .004 | - | .004 | - | - | - | .005 | - | - | - | - | - |

TABLE 4.3 : FITZGERALD PEAK REPRESENTATIVE AMPHIBOLE ANALYSES

| | 135-3 | 135-3 | 135-3 | 135-3 | 145-1 | 145-1 | 145-2 | 145-2 |
|---|---|---|---|---|---|---|---|---|
| wt% | RIM | CORE | RIM | CORE | RIM | CORE | RIM | CORE |
| $SiO_2$ | 44.65 | 44.18 | 44.99 | 44.82 | 54.62 | 55.70 | 53.21 | 55.68 |
| $TiO_2$ | 0.37 | 0.29 | 0.43 | 0.52 | - | - | - | - |
| $Al_2O_3$ | 6.91 | 7.24 | 7.01 | 7.11 | 1.23 | 0.52 | 2.43 | 0.65 |
| $Fe_2O_3$ | 5.20 | 4.82 | 6.09 | 5.37 | 0.65 | 0.72 | 2.03 | - |
| FeO | 14.88 | 15.34 | 14.16 | 14.90 | 13.19 | 13.11 | 12.19 | 13.85 |
| MnO | 0.85 | 0.75 | 0.85 | 0.76 | 0.58 | 0.58 | 0.53 | 0.43 |
| MgO | 10.31 | 10.22 | 10.38 | 10.59 | 14.79 | 14.65 | 14.47 | 14.89 |
| CaO | 11.12 | 11.06 | 11.04 | 11.03 | 12.07 | 11.81 | 11.82 | 12.32 |
| $Na_2O$ | 1.69 | 2.01 | 1.42 | 2.03 | 0.47 | 0.32 | 0.70 | 0.24 |
| $K_2O$ | 1.45 | 1.53 | 1.49 | 1.54 | 0.18 | 0.08 | 0.30 | 0.06 |
| Other | - | - | - | - | 0.17 | - | - | 0.14 |
| TOTAL | 97.43 | 97.43 | 97.86 | 98.67 | 97.96 | 97.49 | 97.68 | 98.27 |

Structural formulae on the basis of 23(O)
*Cation total recalculated to 13, exclusive of K, Na and Ca

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Si | 6.786 | 6.737 | 6.786 | 6.735 | 7.878 | 8.033 | 7.702 | 7.989 |
| Ti | .042 | .033 | .049 | .059 | - | - | - | - |
| $Al^{IV}$ | 1.214 | 1.263 | 1.214 | 1.259 | .122 | - | .298 | .011 |
| $Al^{VI}$ | .025 | .039 | .032 | - | .087 | .089 | .117 | .099 |
| $Fe^{3+}$ | .595 | .552 | .691 | .607 | .071 | .078 | .222 | - |
| $Fe^{2+}$ | 1.892 | 1.956 | 1.787 | 1.872 | 1.591 | 1.582 | 1.476 | 1.661 |
| Mn | .110 | .096 | .108 | .097 | .071 | .071 | .065 | .053 |
| Mg | 2.336 | 2.324 | 2.333 | 2.372 | 3.180 | 3.148 | 3.121 | 3.185 |
| Ca | 1.839 | 1.833 | 1.816 | 1.804 | 1.867 | 1.828 | 1.844 | 1.894 |
| $Na_A$ | .344 | .436 | .239 | .404 | - | - | .042 | - |
| $Na_B$ | .161 | .167 | .184 | .196 | .132 | .090 | .156 | .067 |
| K | .287 | .302 | .292 | .300 | .033 | .015 | .056 | .012 |
| Other | - | - | - | - | .019 | - | - | .016 |

* Excludes any Mn, $Fe^{2+}$ and Mg from the B site, eliminating any cummingtonite component

TABLE 4.4 : FITZGERALD PEAKS REPRESENTATIVE BIOTITE ANALYSES

| wt% | 135-1 | 135-4 | 137-1 | 137-2 |
|---|---|---|---|---|
| $SiO_2$ | 39.57 | 38.67 | 34.12 | 34.24 |
| $TiO_2$ | 1.86 | 0.77 | 3.80 | 3.80 |
| $Al_2O_3$ | 12.24 | 11.86 | 14.72 | 14.87 |
| FeO* | 13.18 | 14.71 | 22.54 | 23.34 |
| MnO | 0.52 | 0.40 | - | - |
| MgO | 15.27 | 15.61 | 7.78 | 7.38 |
| $Na_2O$ | - | - | 0.88 | 0.78 |
| $K_2O$ | 10.36 | 9.98 | 9.14 | 9.10 |
| Other | - | - | 0.16 | 0.12 |
| TOTAL | 93.00 | 92.00 | 93.14 | 94.63 |

Structural formulae on the basis of 22(O)

| | | | | |
|---|---|---|---|---|
| Si | 6.029 | 6.003 | 5.475 | 8.863 |
| Ti | .213 | .090 | .458 | .935 |
| Al | 2.197 | 2.169 | 2.784 | 4.536 |
| Fe(tot) | 1.679 | 1.909 | 3.025 | 5.054 |
| Mn | .067 | - | - | - |
| Mg | 3.467 | 3.611 | 1.861 | 2.848 |
| Na | - | - | .274 | .392 |
| K | 2.014 | 1.976 | 1.871 | 3.007 |
| Other | - | - | .044 | .053 |

FeO* = total iron

TABLE 4.5 : FITZGERALD PEAKS REPRESENTATIVE TITANITE ANALYSES

| | 125-2 | 125-2 | 125-3 | 125-3 | 131-1 | 131-3 | 135-1 | 135-1 | 145-2 | 145-2 |
|---|---|---|---|---|---|---|---|---|---|---|
| wt% | RIM | CORE | RIM | CORE | ALT RIM | ALT CORE | RIM | CORE | RIM | CORE |
| $SiO_2$ | 30.60 | 30.76 | 30.75 | 30.79 | 3.51 | 3.73 | 31.20 | 31.28 | 30.22 | 30.16 |
| $TiO_2$ | 34.50 | 36.24 | 33.65 | 40.28 | 65.89 | 59.63 | 38.53 | 39.09 | 37.45 | 36.83 |
| $Al_2O_3$ | 1.43 | 0.70 | 1.49 | 0.16 | 1.00 | 1.01 | 1.42 | 0.80 | 0.79 | 0.90 |
| FeO* | 3.98 | 3.90 | 4.26 | 1.86 | 15.72 | 15.51 | 1.39 | 1.40 | 2.46 | 2.75 |
| MgO | - | - | - | - | 0.16 | - | - | - | - | - |
| CaO | 29.07 | 29.35 | 28.45 | 29.54 | 0.27 | 0.21 | 29.54 | 29.55 | 27.86 | 28.41 |
| $Na_2O$ | - | - | - | 0.15 | 0.22 | 0.14 | - | - | - | - |
| $K_2O$ | - | - | - | - | 0.09 | 0.07 | - | - | - | - |
| $P_2O_5$ | - | - | 0.19 | - | 3.65 | 3.29 | - | - | - | - |
| Other | 0.19 | 0.15 | 0.29 | - | 0.93 | 1.08 | - | - | 0.57 | 0.58 |
| TOTAL | 99.77 | 101.10 | 99.08 | 102.78 | 91.44 | 84.67 | 102.08 | 102.12 | 99.35 | 99.63 |

Structural formulae on the basis of 18(O)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Si | 3.665 | 3.635 | 3.701 | 3.557 | .480 | .557 | 3.607 | 3.618 | 3.609 | 3.602 |
| Ti | 3.107 | 3.220 | 3.045 | 3.500 | 6.786 | 6.694 | 3.350 | 3.401 | 3.362 | 3.307 |
| Al | .202 | .098 | .211 | .022 | .162 | .177 | .194 | .110 | .111 | .127 |
| Fe(tot) | .398 | .385 | .429 | .180 | 1.801 | 1.936 | .135 | .135 | .246 | .275 |
| Mg | - | - | - | - | .032 | - | - | - | - | - |
| Ca | 3.729 | 3.716 | 3.669 | 3.657 | .039 | .034 | 3.659 | 3.662 | 3.564 | 3.634 |
| Na | - | - | - | .033 | .057 | .042 | - | - | - | - |
| K | - | - | - | - | .016 | .014 | - | - | - | - |
| P | - | - | - | - | .423 | .415 | - | - | - | - |
| Other | .018 | .013 | .044 | - | .104 | .171 | - | - | .054 | .045 |

FeO* = total iron; ALT = altered

TABLE 4.6 : FITZGERALD PEAKS REPRESENTATIVE APATITE ANALYSES

| | 135-2 | 135-2 | 145-4 | 145-4 | 137-1 | 137-1 |
|---|---|---|---|---|---|---|
| wt% | RIM | CORE | RIM | CORE | RIM | CORE |
| $SiO_2$ | 1.05 | 1.17 | 0.71 | 0.71 | 0.72 | 0.55 |
| $Al_2O_3$ | 0.16 | 0.16 | nd | nd | 0.55 | 0.41 |
| MgO | nd | nd | nd | nd | 0.20 | 0.18 |
| CaO | 54.70 | 54.93 | 55.90 | 55.78 | 55.32 | 55.40 |
| $Na_2O$ | nd | nd | nd | nd | 0.30 | 0.41 |
| $P_2O_5$ | 40.07 | 40.35 | 41.73 | 41.63 | 38.55 | 39.22 |
| Other | nd | 0.21 | nd | nd | nd | nd |
| TOTAL | 95.98 | 96.82 | 98.34 | 98.12 | 95.64 | 96.17 |

Structural formulae on the basis of 25(O)

| | | | | | | |
|---|---|---|---|---|---|---|
| Si | .181 | .199 | .119 | .118 | .126 | .095 |
| Al | .032 | .031 | - | - | .113 | .083 |
| Mg | - | - | - | - | .051 | .045 |
| Ca | 10.049 | 10.001 | 10.006 | 10.008 | 10.299 | 10.244 |
| Na | - | - | - | - | .102 | .137 |
| P | 5.817 | 5.805 | 5.903 | 5.902 | 5.671 | 5.731 |
| Other | - | .028 | - | - | - | - |

**TABLE 4.7 : FITZGERALD PEAKS WHOLE ROCK AND TRACE ELEMENT GEOCHEMISTRY**

| | GRANITES | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 124 | 125 | 126 | 127 | 128 | 129 | 130 | 131 | 132 | 133 |
| $SiO_2$ | 71.94 | 72.36 | 73.47 | 68.97 | 69.31 | 69.65 | 71.41 | 76.60 | 71.07 | 71.88 |
| $TiO_2$ | 0.20 | 0.17 | 0.20 | 0.36 | 0.37 | 0.33 | 0.28 | nd | 0.25 | 0.19 |
| $Al_2O_3$ | 14.07 | 13.86 | 13.38 | 14.21 | 14.79 | 14.73 | 14.06 | 12.97 | 14.55 | 13.99 |
| $Fe_2O_3$ | 1.59 | 0.99 | 1.53 | 2.00 | 1.05 | 1.67 | 1.85 | 0.15 | 1.64 | 1.50 |
| FeO | na | 0.36 | na | na | 0.70 | na | na | 0.10 | na | na |
| MnO | 0.03 | 0.03 | 0.05 | 0.04 | 0.03 | 0.02 | 0.07 | nd | 0.03 | 0.03 |
| MgO | 0.28 | 0.17 | 0.18 | 0.51 | 0.49 | 0.39 | 0.30 | nd | 0.21 | 0.16 |
| CaO | 1.28 | 1.21 | 0.99 | 2.44 | 1.72 | 1.89 | 1.54 | 0.16 | 1.06 | 1.26 |
| $Na_2O$ | 5.49 | 5.38 | 4.74 | 5.37 | 5.60 | 5.95 | 5.39 | 4.97 | 5.80 | 4.85 |
| $K_2O$ | 4.69 | 4.59 | 5.08 | 4.92 | 5.02 | 4.60 | 4.90 | 4.36 | 4.26 | 4.86 |
| $P_2O_5$ | 0.06 | 0.05 | 0.06 | 0.12 | 0.08 | 0.09 | 0.11 | nd | 0.08 | 0.06 |
| LOI | 0.22 | 0.17 | 0.26 | 0.62 | 0.28 | 0.52 | 0.08 | 0.14 | 0.32 | 0.56 |
| TOTAL | 99.83 | 99.34 | 99.92 | 99.54 | 99.44 | 99.82 | 99.98 | 99.46 | 99.27 | 99.34 |
| | | | | | | | | | | |
| Sc | 2.4 | 2 | 2.4 | 3.9 | 2.8 | 2.7 | 2 | 0.2 | 2.1 | 2.3 |
| V | 10 | 8 | 8 | 17 | 18 | 14 | 12 | 1 | 13 | 8 |
| Cr | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| Ni | 3 | 3 | 4 | 5 | 6 | 4 | 5 | 1 | 3 | 3 |
| Cu | 4 | 4 | 3 | 3 | 6 | 4 | 3 | 5 | 5 | 21 |
| Pb | 7 | 5 | 13 | 10 | 18 | 17 | 9 | 7 | 30 | 31 |
| Zn | 46 | 36 | 47 | 58 | 47 | 42 | 54 | 6 | 52 | 39 |
| Ga | 20 | 20 | 16 | 17 | 19 | 19 | 18 | 18 | 19 | 18 |
| Rb | 93 | 86 | 114 | 108 | 171 | 117 | 113 | 110 | 135 | 144 |
| Sr | 359 | 390 | 368 | 592 | 362 | 374 | 382 | 285 | 369 | 359 |
| Y | 13.9 | 9.6 | 16 | 13.5 | 13.1 | 8.4 | 12.8 | 0.30 | 8.1 | 14.1 |
| Zr | 47 | 22 | 9.6 | 184 | 299 | 174 | 133 | 1.1 | 193 | 188 |
| Nb | 14.7 | 17.1 | 19 | 19.1 | 12.6 | 11.5 | 18.7 | 0.2 | 11.2 | 20.3 |
| Ba | 733 | 819 | 804 | 1407 | 1364 | 1307 | 759 | 359 | 1178 | 908 |
| La | 89 | 80 | 57 | 94 | 169 | 64 | 67 | 5 | 69 | 113 |
| Ce | 130 | 111 | 63 | 175 | 205 | 108 | 118 | 3 | 94 | 147 |
| Nd | 49 | 45 | 45 | 70 | 53 | 31 | 41 | nd | 27 | 37 |
| Th | 20 | 5 | 30 | 16 | 11 | 12 | 11 | 2 | 24 | 26 |
| F | na | 700 | na | na | 350 | na | na | 150 | na | na |

Major elements wt.%, trace elements p.p.m.
na = no analysis , nd = not detected

124,125,127 GROUP 1 GRANITES, FITZGERALD PEAKS WEST
126,128-133 GROUP 2 GRANITES, FITZGERALD PEAKS WEST

TABLE 4.7 cont...

| | GRANITES | | | | | NORITE |
|---|---|---|---|---|---|---|
| | 135 | 136 | 137 | 138 | 142 | 140 |
| $SiO_2$ | 71.22 | 72.13 | 69.47 | 73.83 | 76.08 | 46.23 |
| $TiO_2$ | 0.23 | 0.20 | 0.55 | 0.14 | 0.06 | 0.37 |
| $Al_2O_3$ | 14.32 | 14.26 | 15.23 | 14.02 | 12.45 | 7.28 |
| $Fe_2O_3$ | 1.18 | 1.44 | 3.12 | 0.67 | 0.55 | 11.41 |
| FeO | 0.40 | na | na | 0.47 | na | na |
| MnO | 0.03 | 0.02 | 0.06 | 0.02 | nd | 0.16 |
| MgO | 0.23 | 0.27 | 0.70 | 0.25 | 0.02 | 25.62 |
| CaO | 1.19 | 1.38 | 1.39 | 1.21 | 0.62 | 5.64 |
| $Na_2O$ | 4.99 | 4.86 | 3.82 | 3.85 | 4.56 | 1.11 |
| $K_2O$ | 4.45 | 4.24 | 4.97 | 4.90 | 4.66 | 0.43 |
| $P_2O_5$ | 0.06 | 0.06 | 0.14 | 0.03 | nd | 0.04 |
| LOI | 0.65 | 0.67 | 0.54 | 0.43 | 0.50 | 2.08 |
| TOTAL | 98.96 | 99.53 | 99.43 | 99.81 | 99.48 | 99.80 |
| Sc | 2.1 | 3.2 | 3.4 | 2.6 | 0.8 | 22.6 |
| V | 11 | 10 | 29 | 7 | 3 | 131 |
| Cr | <5 | <5 | <5 | 5 | <5 | 3551 |
| Ni | 4 | 1 | 7 | 1 | 4 | 1208 |
| Cu | 3 | 3 | 15 | 4 | 3 | 58 |
| Pb | 37 | 37 | 45 | 44 | 8 | 3 |
| Zn | 53 | 43 | 65 | 31 | 10 | 76 |
| Ga | 18 | 19 | 19 | 19 | 16 | 10 |
| Rb | 179 | 197 | 219 | 183 | 99 | 10.9 |
| Sr | 280 | 250 | 523 | 193 | 304 | 90 |
| Y | 11.1 | 8.4 | 7.9 | 5.4 | 1.5 | 8.7 |
| Zr | 216 | 170 | 465 | 121 | 3.4 | 38.2 |
| Nb | 19.5 | 12.6 | 4.7 | 5 | 7.1 | 1.6 |
| Ba | 890 | 1009 | 3826 | 897 | 598 | 143 |
| La | 85 | 59 | 633 | 43 | 10 | 10 |
| Ce | 117 | 84 | 492 | 66 | 15 | 8 |
| Nd | 32 | 24 | 236 | 13 | 3 | 5 |
| Th | 33 | 33 | 62 | 28 | 2 | nd |
| F | 550 | na | na | 300 | na | na |

Major elements wt.%, trace elements p.p.m.
na = no analysis , nd = not detected

135,136 GROUP 2 GRANITE, FITZGERALD PEAKS WEST
137,138 GRANITE, DOG ROCK
142 GROUP 2 GRANITE, FITZGERALD PEAKS EAST
140 NORITE DYKE, FITZ PEAKS EAST

TABLE 4.7 cont...

| | SYENITES | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 139 | 141 | 143 | 145 | 146A | 146B | 147 | 148 | 149 | 150 |
| $SiO_2$ | 64.58 | 65.29 | 67.29 | 66.27 | 65.32 | 64.85 | 64.65 | 64.22 | 65.12 | 65.33 |
| $TiO_2$ | 0.57 | 0.21 | 0.42 | 0.47 | 0.36 | 0.33 | 0.33 | 0.45 | 0.39 | 0.24 |
| $Al_2O_3$ | 15.91 | 17.41 | 16.13 | 15.39 | 17.77 | 17.53 | 16.98 | 17.03 | 17.01 | 17.39 |
| $Fe_2O_3$ | 2.12 | 1.00 | 2.04 | 1.42 | 1.61 | 1.82 | 2.27 | 1.35 | 1.18 | 1.95 |
| FeO | 1.20 | 0.27 | na | 1.00 | na | na | na | 0.83 | 0.41 | na |
| MnO | 0.11 | 0.02 | 0.03 | 0.02 | 0.01 | 0.04 | 0.06 | 0.05 | 0.04 | 0.04 |
| MgO | 0.59 | 0.26 | 0.41 | 0.67 | 0.32 | 0.31 | 0.39 | 0.42 | 0.20 | 0.20 |
| CaO | 3.10 | 1.41 | 1.24 | 2.16 | 1.01 | 1.17 | 2.04 | 2.34 | 1.71 | 1.28 |
| $Na_2O$ | 5.89 | 6.26 | 5.97 | 5.53 | 6.82 | 6.73 | 6.79 | 6.38 | 6.60 | 6.91 |
| $K_2O$ | 5.19 | 6.55 | 6.00 | 5.65 | 5.97 | 5.89 | 5.57 | 5.94 | 5.73 | 5.80 |
| $P_2O_5$ | 0.22 | 0.11 | 0.15 | 0.20 | 0.08 | 0.13 | 0.05 | 0.20 | 0.07 | 0.15 |
| LOI | 0.39 | 0.74 | 0.29 | 0.83 | 0.45 | 0.54 | 0.72 | 0.59 | 0.69 | 0.22 |
| TOTAL | 99.87 | 99.52 | 99.98 | 99.61 | 99.73 | 99.34 | 99.83 | 99.79 | 99.15 | 99.50 |
| Sc | 5 | 1.9 | 2.4 | 3.3 | 2.2 | 2.4 | 2.6 | 2.7 | 2.6 | 1.7 |
| V | 30 | 9 | 18 | 24 | 13 | 13 | 15 | 19 | 14 | 14 |
| Cr | <5 | <5 | <5 | 7 | <5 | <5 | <5 | <5 | <5 | <5 |
| Ni | 9 | 1 | 3 | 4 | 2 | 4 | 3 | 3 | 2 | 5 |
| Cu | 4 | 5 | 3 | 17 | 2 | 3 | 4 | 4 | 5 | 4 |
| Pb | 9 | 10 | 4 | 7 | 5 | 5 | 3 | 8 | 8 | 4 |
| Zn | 92 | 24 | 38 | 49 | 34 | 36 | 47 | 48 | 32 | 33 |
| Ga | 20 | 19 | 21 | 22 | 20 | 21 | 24 | 21 | 22 | 25 |
| Rb | 94 | 142 | 124 | 100 | 129 | 130 | 116 | 125 | 121 | 121 |
| Sr | 726 | 419 | 310 | 589 | 383 | 375 | 393 | 531 | 473 | 408 |
| Y | 19.6 | 5.2 | 12.7 | 8.5 | 8.4 | 9.5 | 6.9 | 10.4 | 6.9 | 6.5 |
| Zr | 35.2 | 11.9 | 28.6 | 166 | 13.4 | 14.5 | 19.7 | 22.1 | 15.3 | 11.5 |
| Nb | 47 | 17.4 | 43 | 13.1 | 32.4 | 29.6 | 36.6 | 34.1 | 35.8 | 21.4 |
| Ba | 992 | 531 | 688 | 1202 | 715 | 757 | 596 | 707 | 619 | 497 |
| La | 121 | 31 | 65 | 82 | 41 | 50 | 36 | 53 | 34 | 55 |
| Ce | 196 | 52 | 137 | 115 | 73 | 91 | 54 | 101 | 56 | 80 |
| Nd | 85 | 26 | 55 | 35 | 30 | 43 | 23 | 46 | 26 | 38 |
| Th | 14 | 3 | 4 | 7 | 4 | 4 | 3 | 4 | 4 | 3 |
| F | 350 | 150 | na | 350 | na | na | na | 350 | 250 | na |

Major elements wt.%, trace elements p.p.m.
na = no analysis , nd = not detected

139 GROUP 2 SYENITE, FITZGERALD PEAKS CTRAL
143,145 GROUP 2 SYENITE, FITZGERALD PEAKS EAST
141,146A-150 GROUP 1 SYENITE, FITZGERALD PEAKS EAST

TABLE 4.8 : FITZGERALD PEAKS CIPW NORMS

| | GRANITES | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 124 | 125 | 126 | 127 | 128 | 129 | 130 | 131 | 132 | 133 |
| $SiO_2$ | 66.33 | 67.13 | 68.20 | 63.96 | 63.99 | 64.05 | 65.73 | 71.28 | 65.82 | 67.16 |
| $TiO_2$ | 0.14 | 0.12 | 0.14 | 0.25 | 0.26 | 0.23 | 0.19 | - | 0.17 | 0.13 |
| $Al_2O_3$ | 15.29 | 15.16 | 14.63 | 15.53 | 16.09 | 15.97 | 15.25 | 14.23 | 15.88 | 15.41 |
| $Fe_2O_3$ | 0.66 | 0.69 | 0.64 | 0.84 | 0.73 | 0.69 | 0.77 | 0.11 | 0.69 | 0.63 |
| FeO | 0.54 | 0.28 | 0.53 | 0.69 | 0.54 | 0.57 | 0.63 | 0.08 | 0.57 | 0.52 |
| MnO | 0.02 | 0.02 | 0.04 | 0.03 | 0.02 | 0.02 | 0.05 | - | 0.02 | 0.02 |
| MgO | 0.38 | 0.24 | 0.25 | 0.71 | 0.67 | 0.53 | 0.41 | - | 0.29 | 0.22 |
| CaO | 1.26 | 1.20 | 0.98 | 2.43 | 1.70 | 1.86 | 1.52 | 0.16 | 1.05 | 1.26 |
| $Na_2O$ | 9.81 | 9.68 | 8.53 | 9.65 | 10.02 | 10.61 | 9.61 | 8.97 | 10.42 | 8.79 |
| $K_2O$ | 5.52 | 5.44 | 6.01 | 5.82 | 5.91 | 5.39 | 5.75 | 5.18 | 5.03 | 5.80 |
| $P_2O_5$ | 0.05 | 0.04 | 0.05 | 0.09 | 0.06 | 0.07 | 0.09 | - | 0.06 | 0.05 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | | | | | | | | | | |
| Ap | 0.13 | 0.11 | 0.13 | 0.26 | 0.18 | 0.20 | 0.24 | - | 0.18 | 0.13 |
| Il | 0.38 | 0.32 | 0.38 | 0.68 | 0.70 | 0.63 | 0.53 | - | 0.47 | 0.36 |
| Mt | 1.30 | 0.77 | 1.33 | 1.74 | 1.28 | 1.39 | 1.38 | 0.22 | 1.43 | 1.31 |
| Or | 28 | 27 | 30 | 29 | 30 | 27 | 29 | 26 | 25 | 29 |
| Ab | 46 | 46 | 40 | 45 | 47 | 50 | 45 | 42 | 49 | 41 |
| An | - | 0.09 | 0.23 | 0.16 | 0.40 | - | - | 0.18 | 1.10 | 2.04 |
| Di | 2.18 | 1.05 | 1.52 | 3.35 | 3.01 | 2.51 | 2.49 | 0.10 | 1.58 | 1.36 |
| Hy | - | - | - | - | - | - | - | - | - | - |
| Ac | 0.16 | - | - | - | - | 0.13 | 0.46 | - | - | - |
| C | - | - | - | - | - | - | - | - | - | - |
| Q | 20 | 22 | 25 | 16 | 15 | 15 | 19 | 31 | 19 | 23 |
| Hm | - | 0.46 | - | - | 0.16 | - | - | - | - | - |
| Wo | 1.43 | 1.84 | 1.04 | 3.09 | 1.75 | 2.49 | 1.67 | 0.20 | 0.76 | 0.95 |
| Total | 100 | 99 | 100 | 99 | 99 | 100 | 100 | 99 | 99 | 99 |
| | | | | | | | | | | |
| A | 83 | 86 | 84 | 79 | 82 | 82 | 81 | 97 | 83 | 84 |
| M | 2.29 | 1.46 | 1.54 | 3.92 | 3.78 | 3.05 | 2.37 | - | 1.74 | 1.39 |
| F | 14 | 13 | 15 | 17 | 14 | 15 | 16 | 2.78 | 15 | 14 |
| Q | 55 | 55 | 56 | 54 | 53 | 53 | 54 | 57 | 54 | 55 |
| M | 3.34 | 2.78 | 2.75 | 5.43 | 4.35 | 4.39 | 3.98 | 0.32 | 2.89 | 2.62 |
| L | 42 | 42 | 42 | 41 | 42 | 42 | 42 | 43 | 43 | 42 |
| PALI | 0.92 | 0.93 | 0.94 | 0.87 | 0.91 | 0.89 | 0.90 | 0.99 | 0.96 | 0.97 |
| PAKI | 1.00 | 1.00 | 1.01 | 1.00 | 1.01 | 1.00 | 0.99 | 1.01 | 1.03 | 1.06 |
| AI | 1.00 | 1.00 | 0.99 | 1.00 | 0.99 | 1.00 | 1.01 | 0.99 | 0.97 | 0.95 |
| PMI | 1.39 | 1.35 | 1.28 | 1.45 | 1.49 | 1.50 | 1.40 | 1.19 | 1.41 | 1.30 |

TABLE 4.8 cont...

| | GRANITES | | | | |
|---|---|---|---|---|---|
| | 135 | 136 | 137 | 138 | 142 |
| $SiO_2$ | 66.85 | 67.38 | 65.02 | 69.15 | 71.29 |
| $TiO_2$ | 0.16 | 0.14 | 0.39 | 0.10 | 0.04 |
| $Al_2O_3$ | 15.84 | 15.70 | 16.80 | 15.47 | 13.75 |
| $Fe_2O_3$ | 0.83 | 0.61 | 1.32 | 0.47 | 0.23 |
| FeO | 0.31 | 0.50 | 1.09 | 0.37 | 0.19 |
| MnO | 0.02 | 0.02 | 0.05 | 0.02 | - |
| MgO | 0.32 | 0.38 | 0.98 | 0.35 | 0.03 |
| CaO | 1.20 | 1.38 | 1.39 | 1.21 | 0.62 |
| $Na_2O$ | 9.08 | 8.80 | 6.93 | 6.98 | 8.28 |
| $K_2O$ | 5.33 | 5.05 | 5.93 | 5.86 | 5.57 |
| $P_2O_5$ | 0.05 | 0.05 | 0.11 | 0.02 | - |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | | | | | |
| Ap | 0.13 | 0.13 | 0.31 | 0.07 | - |
| Il | 0.44 | 0.38 | 1.04 | 0.27 | 0.11 |
| Mt | 0.73 | 1.26 | 2.69 | 0.98 | 0.27 |
| Or | 26 | 25 | 29 | 29 | 28 |
| Ab | 42 | 41 | 32 | 33 | 38 |
| An | 3.55 | 4.61 | 5.92 | 5.81 | - |
| Di | 1.42 | 1.64 | - | - | 0.44 |
| Hy | - | 0.08 | 1.21 | 0.46 | - |
| Ac | - | - | - | - | 0.41 |
| C | - | - | 2.73 | 0.53 | - |
| Q | 23 | 25 | 24 | 30 | 31 |
| Hm | 0.69 | - | - | - | - |
| Wo | 0.17 | - | - | - | 1.05 |
| Total | 99 | 99 | 99 | 100 | 99 |
| | | | | | |
| A | 83 | 83 | 68 | 86 | 94 |
| M | 2.02 | 2.46 | 5.40 | 2.45 | 0.20 |
| F | 15 | 15 | 27 | 12 | 6.18 |
| Q | 55 | 56 | 55 | 57 | 57 |
| M | 2.45 | 2.29 | 4.09 | 1.31 | 1.18 |
| L | 42 | 42 | 41 | 42 | 42 |
| PALI | 1.01 | 1.03 | 1.18 | 1.10 | 0.95 |
| PAKI | 1.10 | 1.13 | 1.31 | 1.21 | 0.99 |
| AI | 0.91 | 0.88 | 0.77 | 0.83 | 1.01 |
| PMI | 1.29 | 1.23 | 1.19 | 1.11 | 1.17 |

TABLE 4.8 cont...

| | SYENITES | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 139 | 141 | 143 | 145 | 146A | 146B | 147 | 148 | 149 | 150 |
| $SiO_2$ | 59.31 | 59.66 | 61.38 | 61.31 | 59.21 | 59.12 | 58.83 | 58.58 | 59.73 | 59.26 |
| $TiO_2$ | 0.39 | 0.14 | 0.29 | 0.32 | 0.24 | 0.23 | 0.22 | 0.31 | 0.27 | 0.16 |
| $Al_2O_3$ | 17.22 | 18.74 | 17.34 | 16.78 | 18.98 | 18.84 | 18.21 | 18.31 | 18.39 | 18.59 |
| $Fe_2O_3$ | 1.47 | 0.69 | 0.84 | 0.99 | 0.66 | 0.75 | 0.93 | 0.93 | 0.81 | 0.80 |
| FeO | 0.92 | 0.21 | 0.69 | 0.77 | 0.54 | 0.62 | 0.77 | 0.63 | 0.31 | 0.66 |
| MnO | 0.09 | 0.02 | 0.02 | 0.02 | 0.01 | 0.03 | 0.05 | 0.04 | 0.03 | 0.03 |
| MgO | 0.81 | 0.35 | 0.56 | 0.92 | 0.43 | 0.42 | 0.53 | 0.57 | 0.27 | 0.27 |
| CaO | 3.05 | 1.38 | 1.21 | 2.15 | 0.98 | 1.15 | 1.98 | 2.29 | 1.68 | 1.24 |
| $Na_2O$ | 10.50 | 11.08 | 10.56 | 9.92 | 11.98 | 11.90 | 11.98 | 11.28 | 11.73 | 12.16 |
| $K_2O$ | 6.08 | 7.64 | 6.98 | 6.67 | 6.91 | 6.85 | 6.47 | 6.91 | 6.71 | 6.71 |
| $P_2O_5$ | 0.17 | 0.08 | 0.12 | 0.16 | 0.06 | 0.10 | 0.04 | 0.15 | 0.05 | 0.11 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | | | | | | | | | | |
| Ap | 0.48 | 0.24 | 0.33 | 0.44 | 0.18 | 0.28 | 0.11 | 0.44 | 0.15 | 0.33 |
| Il | 1.08 | 0.40 | 0.80 | 0.89 | 0.68 | 0.63 | 0.63 | 0.85 | 0.74 | 0.46 |
| Mt | 2.58 | 0.33 | 1.35 | 1.94 | 1.31 | 1.59 | 1.48 | 1.54 | 0.33 | 1.11 |
| Or | 31 | 39 | 35 | 33 | 35 | 35 | 33 | 35 | 34 | 34 |
| Ab | 50 | 53 | 49 | 47 | 58 | 57 | 57 | 54 | 56 | 57 |
| An | 1.63 | 0.06 | - | 0.48 | 0.24 | 0.23 | - | 0.31 | - | - |
| Di | 3.62 | 1.61 | 2.96 | 4.13 | 1.97 | 2.10 | 3.38 | 2.59 | 1.24 | 2.28 |
| Hy | - | - | - | - | - | - | - | - | - | - |
| Ac | - | - | 0.86 | - | - | - | 1.02 | - | 0.22 | 1.17 |
| C | - | - | - | - | - | - | - | - | - | - |
| Q | 6.19 | 2.08 | 7.95 | 9.36 | 1.31 | 1.51 | 1.15 | 1.47 | 2.85 | 1.48 |
| Hm | 0.34 | 0.78 | - | 0.09 | 0.07 | - | - | 0.29 | 0.88 | - |
| Wo | 3.43 | 1.86 | 0.74 | 1.81 | 0.85 | 0.99 | 2.45 | 2.96 | 2.79 | 1.10 |
| Total | 100 | 99 | 100 | 99 | 100 | 99 | 100 | 100 | 99 | 99 |
| | | | | | | | | | | |
| A | 73 | 89 | 82 | 77 | 86 | 84 | 81 | 82 | 87 | 84 |
| M | 3.87 | 1.80 | 2.80 | 4.64 | 2.15 | 2.07 | 2.55 | 2.79 | 1.40 | 1.33 |
| F | 23 | 9.56 | 15 | 18 | 12 | 14 | 17 | 15 | 12 | 14 |
| Q | 51 | 50 | 52 | 52 | 50 | 50 | 50 | 50 | 50 | 50 |
| M | 7.50 | 3.24 | 4.33 | 5.78 | 3.48 | 3.77 | 5.55 | 5.49 | 4.07 | 3.85 |
| L | 42 | 47 | 44 | 42 | 47 | 46 | 45 | 45 | 46 | 46 |
| PALI | 0.88 | 0.93 | 0.92 | 0.90 | 0.96 | 0.95 | 0.89 | 0.89 | 0.91 | 0.92 |
| PAKI | 1.04 | 1.00 | 0.99 | 1.01 | 1.00 | 1.00 | 0.99 | 1.01 | 1.00 | 0.99 |
| AI | 0.96 | 1.00 | 1.01 | 0.99 | 1.00 | 1.00 | 1.01 | 0.99 | 1.00 | 1.01 |
| PMI | 1.68 | 1.88 | 1.72 | 1.62 | 1.92 | 1.90 | 1.88 | 1.86 | 1.85 | 1.91 |

PALI = Peraluminous index $Al_2O_3$ / ( $CaO + Na_2O + K_2O$ )
>1 = peraluminous, <1 = metaluminous
PAKI = Peralkaline index $Al_2O_3$ / ( $Na_2O + K_2O$ )
<1 = peralkaline
AI = Agpaitic index ( $Na_2O + K_2O$ ) / $Al_2O_3$
>1 = agpaitic
PMI = plumaskitic index 6 ( $Na_2O + K_2O$ ) / $SiO_2$
<1 = plumaskitic, >1 = miaskitic

TABLE 4.9 : FITZGERALD PEAKS Rb, Sr AND ISOTOPE RATIO MEASUREMENTS

| Sample[1] | Rb (ppm) | Sr (ppm) | $^{87}Rb/^{86}Sr$ | $^{87}Sr/^{86}Sr$[2] |
|---|---|---|---|---|
| Granites | | | | |
| 125P | 1.1 | 88 | 0.037 | 0.70582 |
| 127 | 102 | 559 | 0.526 | 0.72130 |
| 125 | 80 | 366 | 0.637 | 0.72452 |
| 125F | 81 | 319 | 0.735 | 0.70582 |
| 124 | 87 | 336 | 0.751 | 0.72830 |
| 129 | 110 | 353 | 0.901 | 0.73510 |
| 142 | 92 | 282 | 0.946 | 0.73226 |
| 131 | 100 | 260 | 1.120 | 0.73859 |
| 133 | 133 | 338 | 1.141 | 0.74314 |
| 128 | 161 | 340 | 1.371 | 0.75130 |
| 135 | 166 | 263 | 1.833 | 0.76724 |
| 136 | 185 | 235 | 2.294 | 0.78517 |
| Syenites | | | | |
| 150P | 2.8 | 77 | 0.102 | 0.70485 |
| 139 | 87 | 694 | 0.362 | 0.71538 |
| 145 | 92 | 555 | 0.479 | 0.71923 |
| 148 | 117 | 502 | 0.678 | 0.72459 |
| 147 | 108 | 373 | 0.843 | 0.72988 |
| 150 | 114 | 382 | 0.863 | 0.73070 |
| 150F | 124 | 392 | 0.919 | 0.73253 |
| 146A | 120 | 360 | 0.970 | 0.73400 |
| 141 | 133 | 392 | 0.988 | 0.73398 |
| 146B | 121 | 344 | 1.020 | 0.73533 |
| 143 | 118 | 296 | 1.162 | 0.74032 |

[1] F = Alkali feldspar, P= Pyroxene.

[2] $^{87}Sr/^{86}Sr$ for E & A std = 0.7080496 $\pm$ 0.0000096 (1 sigma).

TABLE 4.10 : RESULTS OF Rb-Sr REGRESSION ANALYSES

| Regression | Samples | MSWD | Age (Ma) | IR | Model |
|---|---|---|---|---|---|
| Granites | | | | | |
| Combined granites -whole rocks | 10 | 112 | 2519 ± 171 | 0.70074 ± 0.00306 | 3 |
| Combined granites -whole rocks - 131,142 | 8 | 14 | 2496 ± 65 | 0.70187 ± 0.00117 | 3 |
| Group 1 granites -whole rocks | 3 | 2.79 | 2143 ± 1006 | 0.70499 ± 0.00890 | 2 |
| Group 1 granite (125) -whole rock + mins | 3 | 0.20 | 2165 ± 147 | 0.70467 ± 0.00096 | 1 |
| Group 1 granites -whole rocks + mins | 5 | 1.23 | 2174 ± 32 | 0.70468 ± 0.00024 | 1 |
| Group 2 granites -whole rocks | 5 | 6.23 | 2450 ± 122 | 0.70297 ± 0.00225 | 2 |
| Syenites | | | | | |
| Combined syenites -whole rocks | 9 | 7.05 | 2120 ± 75 | 0.70426 ± 0.00090 | 3 |
| Group 1 syenites -whole rocks | 6 | 3.18 | 2162 ± 147 | 0.70355 ± 0.00182 | 2 |
| Group 1 syenite (150) -whole rock + mins | 3 | 0.17 | 2350 ± 140 | 0.70138 ± 0.00106 | 1 |
| Group 1 syenites -whole rocks + mins | 8 | 7.08 | 2329 ± 36 | 0.70143 ± 0.00023 | 2 |
| Group 2 syenites -whole rocks | 3 | 3.20 | 2157 ± 285 | 0.70421 ± 0.00270 | 3 |

Group 1 granites - 124, 125, 127.
Group 2 granites - 128, 129, 133, 135, 136.
Group 1 syenites - 141, 146A, 146B, 147, 148, 150.
Group 2 syenites - 139, 143, 145.

**TABLE 5.2.1 : WIDGIEMOOLTHA REPRESENTATIVE FELDSPAR ANALYSES**

| | 052-2 | 052-2 | 055-3 | 055-3 | 055-3 | 165-4 | 165-2 | 050-8 | 050-8 | 050-8 | 056-1 | 056-1 | 056-1 | 056-1 | 056-1 | 056-5 | 046-3 | 046-12 | 046-12 | 046-12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| wt% | MSP K | MSP NA | ZONED NA | ZONED NA | ZONED K | ANTIP NA | EXS K | PLAG RIM | PLAG TWDSCRE | PLAG CORE | ZONED RIM | ZONED K | ZONED NA | ZONED CORE | ZONED RIM | ZONED CORE | PERTH HOST | PERTH HOST | EXS NA | PLAG |
| $SiO_2$ | 65.02 | 69.25 | 68.75 | 67.31 | 64.27 | 69.09 | 64.82 | 69.35 | 69.19 | 69.00 | 67.13 | 63.85 | 69.36 | 67.50 | 65.35 | 67.16 | 65.45 | 65.27 | 68.41 | 67.04 |
| $TiO_2$ | - | - | - | - | 0.43 | - | 0.36 | - | - | - | 0.22 | 0.41 | - | - | - | - | 0.17 | 0.14 | - | - |
| $Al_2O_3$ | 18.24 | 19.25 | 20.03 | 20.58 | 18.12 | 19.88 | 18.22 | 20.08 | 20.00 | 20.06 | 19.27 | 18.32 | 19.37 | 20.49 | 18.27 | 20.45 | 17.92 | 18.11 | 19.39 | 20.64 |
| FeO* | - | 0.16 | 0.11 | 0.14 | - | - | - | 0.19 | - | - | - | - | 0.26 | 0.16 | - | 0.17 | - | - | - | - |
| MgO | - | 0.15 | - | - | - | 0.16 | - | - | - | - | - | - | 0.11 | 0.16 | - | - | - | - | 0.20 | 0.10 |
| CaO | - | - | 0.76 | 1.56 | - | 0.72 | - | 0.29 | 0.23 | 0.20 | - | - | - | 0.97 | - | 1.11 | - | - | 0.28 | 1.79 |
| $Na_2O$ | 0.32 | 10.99 | 10.67 | 9.77 | 0.86 | 10.06 | 0.45 | 11.07 | 10.74 | 10.74 | 7.05 | 0.66 | 11.23 | 10.41 | 0.39 | 10.31 | - | 0.43 | 10.14 | 9.60 |
| $K_2O$ | 16.48 | 0.10 | 0.18 | 0.19 | 14.60 | 0.08 | 16.60 | 0.10 | 0.08 | 0.09 | 6.14 | 15.60 | 0.25 | 0.22 | 16.36 | 0.27 | 17.12 | 16.58 | 0.19 | 0.13 |
| Other | - | 0.07 | 0.25 | - | - | 0.06 | - | 0.37 | 0.06 | - | - | - | 0.07 | 0.40 | - | 0.15 | - | - | - | - |
| TOTAL | 100.06 | 99.97 | 100.75 | 99.55 | 98.28 | 100.05 | 100.45 | 101.45 | 100.30 | 100.09 | 99.81 | 98.84 | 100.65 | 100.31 | 100.37 | 99.62 | 100.66 | 100.53 | 98.61 | 99.30 |

Structural formulae on the basis of 8(O)

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Si | 3.005 | 3.017 | 2.980 | 2.953 | 3.004 | 3.002 | 2.990 | 2.983 | 3.001 | 2.997 | 2.993 | 2.982 | 3.009 | 2.943 | 3.008 | 2.948 | 3.014 | 3.005 | 3.013 | 2.946 |
| Ti | - | - | - | - | .015 | - | .013 | - | - | - | .008 | .014 | - | - | - | - | .006 | .005 | - | - |
| Al | .994 | .988 | 1.023 | 1.064 | .998 | 1.018 | .991 | 1.018 | 1.022 | 1.027 | 1.013 | 1.009 | .990 | 1.053 | .991 | 1.063 | .972 | .983 | 1.006 | 1.069 |
| Fe(tot) | - | .006 | .004 | .005 | - | - | - | .007 | - | - | - | - | .009 | .006 | - | .006 | - | - | - | - |
| Mg | .010 | - | - | - | .011 | - | - | - | - | - | - | - | .007 | .011 | - | - | - | - | .013 | .007 |
| Ca | - | - | .035 | .073 | - | .034 | - | .013 | .011 | .012 | - | - | - | .045 | - | .052 | - | - | .013 | .085 |
| Na | .028 | .929 | .897 | .831 | .061 | .848 | .040 | .923 | .904 | .904 | .610 | .060 | .945 | .880 | .034 | .878 | - | .038 | .866 | .818 |
| K | .971 | .006 | .010 | .011 | .871 | .004 | .977 | .006 | .004 | .005 | .349 | .929 | .014 | .012 | .961 | .015 | 1.006 | .974 | .010 | .007 |
| Other | - | .005 | .009 | - | - | .004 | - | .012 | .005 | - | - | - | .003 | .016 | - | .007 | - | - | - | - |

FeO* = total iron; PERTH = perthite; ANTIP = antiperthite; MSP = mesoperthite; EXS = exsolution.

## TABLE 5.2.2 : WIDGIEMOOLTHA REPRESENTATIVE PYROXENE ANALYSES

| | 052-1 | 052-1 | 052-2 | 052-2 | 052-6 | 052-6 | 052-8 | 052-8 | 055-3 | 055-3 |
|---|---|---|---|---|---|---|---|---|---|---|
| wt% | RIM | CORE | RIM | CORE | RIM | CORE | RIM | CORE | RIM | CORE |
| $SiO_2$ | 51.85 | 52.08 | 52.49 | 51.99 | 52.31 | 52.65 | 52.31 | 51.90 | 52.15 | 51.76 |
| $TiO_2$ | - | - | - | - | - | - | - | 0.40 | 0.22 | 0.36 |
| $Al_2O_3$ | 0.62 | 0.42 | 0.54 | 0.59 | 0.97 | 1.15 | 0.74 | 2.07 | 1.50 | 1.75 |
| $Fe_2O_3$ | 4.98 | 5.42 | 4.39 | 5.60 | 4.11 | 2.54 | 4.87 | 4.63 | 2.82 | 2.20 |
| FeO | 14.54 | 12.85 | 13.19 | 11.63 | 12.55 | 9.00 | 12.32 | 9.58 | 8.33 | 9.08 |
| MnO | 1.02 | 0.74 | 0.82 | 0.66 | 0.62 | 0.63 | 0.65 | 0.48 | 0.67 | 0.69 |
| MgO | 6.00 | 6.79 | 7.32 | 7.70 | 7.66 | 10.65 | 6.99 | 9.08 | 10.80 | 10.31 |
| CaO | 20.38 | 19.16 | 20.80 | 20.22 | 20.10 | 22.69 | 19.14 | 20.88 | 22.13 | 21.95 |
| $Na_2O$ | 2.08 | 2.59 | 1.90 | 2.21 | 2.15 | 1.13 | 2.71 | 2.03 | 1.24 | 1.29 |
| $K_2O$ | - | - | 0.08 | - | - | - | - | - | - | - |
| Other | - | - | - | - | - | - | - | - | 0.36 | 0.18 |
| TOTAL | 101.47 | 100.05 | 101.53 | 100.60 | 100.47 | 100.44 | 99.73 | 101.05 | 100.22 | 99.57 |

Structural formulae on the basis of 6(O)
Cation total recalculated to 4

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Si | 1.991 | 2.009 | 1.997 | 1.988 | 1.999 | 1.980 | 2.014 | 1.951 | 1.963 | 1.964 |
| Ti | - | - | - | - | - | - | - | .011 | .006 | .010 |
| Al | .028 | .019 | .024 | .027 | .044 | .051 | .034 | .092 | .067 | .010 |
| $Fe^{3+}$ | .144 | .157 | .126 | .161 | .118 | .072 | .141 | .131 | .080 | .063 |
| $Fe^{2+}$ | .467 | .415 | .420 | .372 | .401 | .283 | .397 | .301 | .263 | .288 |
| Mn | .033 | .024 | .026 | .021 | .436 | .597 | .401 | .509 | .021 | .022 |
| Mg | .344 | .391 | .415 | .439 | .436 | .597 | .401 | .509 | .606 | .583 |
| Ca | .839 | .792 | .848 | .828 | .823 | .914 | .790 | .841 | .892 | .892 |
| Na | .155 | .194 | .140 | .164 | .159 | .083 | .203 | .148 | .091 | .094 |
| K | - | - | .004 | - | - | - | - | - | - | - |
| Other | - | - | - | - | - | - | - | - | .011 | .006 |

TABLE 5.2.2 cont...

| wt% | 055-4 RIM | 055-4 CORE | 055-2 RIM | 055-2 CORE | 165-2 RIM | 165-2 CORE | 165-7 RIM | 165-7 CORE | 056-1 RIM | 056-1 CORE |
|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 52.34 | 51.58 | 51.53 | 51.04 | 52.30 | 53.22 | 53.39 | 53.70 | 53.26 | 55.13 |
| $TiO_2$ | - | - | 0.36 | 0.22 | - | - | - | - | - | - |
| $Al_2O_3$ | 1.13 | 1.45 | 2.21 | 1.57 | 0.65 | 0.38 | 0.82 | 0.85 | 0.29 | 1.14 |
| $Fe_2O_3$ | 3.99 | 4.09 | 3.03 | 4.28 | 1.90 | 0.09 | 1.84 | 1.20 | 5.42 | - |
| FeO | 9.73 | 10.87 | 8.65 | 8.48 | 10.92 | 11.69 | 11.35 | 10.62 | 12.27 | 3.38 |
| MnO | 0.87 | 0.78 | 0.78 | 0.84 | 1.19 | 1.26 | 1.07 | 1.01 | 0.55 | - |
| MgO | 9.04 | 8.17 | 10.08 | 9.32 | 9.37 | 10.01 | 9.51 | 10.34 | 7.05 | 16.98 |
| CaO | 21.15 | 20.66 | 22.14 | 21.43 | 22.71 | 22.97 | 22.35 | 22.90 | 18.52 | 22.97 |
| $Na_2O$ | 1.89 | 1.94 | 1.28 | 1.69 | 1.00 | 0.74 | 1.25 | 1.04 | 3.14 | 0.37 |
| $K_2O$ | - | - | 0.09 | - | - | - | - | - | - | - |
| Other | - | - | 0.21 | - | 0.16 | - | - | 0.12 | - | 0.23 |
| TOTAL | 100.14 | 99.54 | 100.36 | 98.87 | 100.20 | 100.36 | 101.58 | 101.78 | 100.50 | 100.20 |

Structural formulae on the basis of 6(O)
Cation total recalculated to 4

| | 055-4 RIM | 055-4 CORE | 055-2 RIM | 055-2 CORE | 165-2 RIM | 165-2 CORE | 165-7 RIM | 165-7 CORE | 056-1 RIM | 056-1 CORE |
|---|---|---|---|---|---|---|---|---|---|---|
| Si | 1.987 | 1.980 | 1.943 | 1.959 | 1.993 | 2.017 | 2.002 | 2.000 | 2.032 | 1.997 |
| Ti | - | - | .010 | .006 | - | - | - | - | - | - |
| Al | .051 | .066 | .098 | .072 | .029 | .017 | .036 | .037 | .013 | .049 |
| $Fe^{3+}$ | .114 | .118 | .086 | .124 | .054 | .003 | .052 | .034 | .156 | - |
| $Fe^{2+}$ | .309 | .349 | .273 | .272 | .348 | .371 | .356 | .331 | .391 | .102 |
| Mn | .028 | .026 | .025 | .027 | .038 | .041 | .034 | .032 | .018 | - |
| Mg | .512 | .467 | .567 | .533 | .532 | .566 | .532 | .574 | .401 | .917 |
| Ca | .861 | .850 | .894 | .881 | .927 | .933 | .898 | .914 | .757 | .891 |
| Na | .139 | .144 | .094 | .126 | .074 | .054 | .091 | .075 | .232 | .026 |
| K | - | - | .004 | - | - | - | - | - | - | - |
| Other | - | - | .006 | - | .005 | - | - | .004 | - | .007 |

TABLE 5.2.2 cont...

| wt% | 056-2 RIM | 056-2 CORE | 056-3 RIM | 056-3 CORE | 056 AVG RIM *(11) | 056 AVG CORE (6) | 046-2 RIM | 046-2 CORE | 046-6 RIM | 046-6 CORE |
|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 53.69 | 54.88 | 53.08 | 55.39 | 53.21 | 55.28 | 53.25 | 53.97 | 53.29 | 53.26 |
| $TiO_2$ | - | 0.14 | - | - | - | 0.02 | - | - | - | - |
| $Al_2O_3$ | 0.28 | 1.36 | 0.43 | 0.59 | 0.34 | 0.81 | 0.73 | 0.64 | 0.51 | 0.69 |
| $Fe_2O_3$ | 7.22 | - | 6.34 | - | 5.44 | - | 1.13 | - | 0.71 | 0.52 |
| FeO | 10.37 | 3.95 | 11.07 | 3.18 | 11.22 | 3.59 | 11.04 | 11.58 | 12.78 | 11.54 |
| MnO | 0.35 | - | 0.48 | - | 0.48 | - | 0.62 | 0.61 | 0.57 | 0.68 |
| MgO | 7.35 | 16.90 | 7.15 | 17.60 | 7.59 | 16.92 | 10.64 | 10.85 | 9.83 | 10.34 |
| CaO | 17.77 | 23.00 | 18.37 | 23.06 | 18.80 | 22.91 | 22.62 | 22.95 | 22.76 | 22.55 |
| $Na_2O$ | 3.80 | 0.31 | 3.37 | 0.29 | 3.09 | 0.45 | 0.88 | 0.71 | 0.79 | 0.89 |
| $K_2O$ | - | - | - | - | - | - | - | - | - | - |
| Other | - | 0.14 | - | 0.14 | - | 0.19 | - | - | 0.17 | - |
| TOTAL | 100.83 | 100.68 | 100.29 | 100.25 | 100.17 | 100.17 | 100.91 | 101.31 | 101.41 | 100.47 |

Structural formulae on the basis of 6(O)
Cation total recalculated to 4

| | 056-2 RIM | 056-2 CORE | 056-3 RIM | 056-3 CORE | 056 AVG RIM | 056 AVG CORE | 046-2 RIM | 046-2 CORE | 046-6 RIM | 046-6 CORE |
|---|---|---|---|---|---|---|---|---|---|---|
| Si | 2.030 | 1.984 | 2.024 | 2.004 | 2.028 | 2.007 | 2.000 | 2.015 | 2.005 | 2.010 |
| Ti | - | .004 | - | - | - | .001 | - | - | - | - |
| Al | .013 | .058 | .019 | .025 | .015 | .035 | .033 | .029 | .023 | .031 |
| $Fe^{3+}$ | .206 | - | .182 | - | .157 | - | .032 | - | .020 | .015 |
| $Fe^{2+}$ | .328 | .119 | .353 | .096 | .357 | .109 | .347 | .361 | .402 | .364 |
| Mn | .011 | - | .016 | - | .016 | - | .020 | .019 | .018 | .022 |
| Mg | .414 | .911 | .406 | .949 | .431 | .916 | .595 | .604 | .551 | .582 |
| Ca | .720 | .891 | .751 | .894 | .768 | .891 | .910 | .918 | .917 | .912 |
| Na | .279 | .022 | .249 | .020 | .228 | .032 | .064 | .052 | .058 | .065 |
| K | - | - | - | - | - | - | - | - | - | - |
| Other | - | .004 | - | .004 | - | .005 | - | - | .005 | - |

* Refers to number of analyses in average value

## TABLE 5.2.3 : WIDGIEMOOLTHA REPRESENTATIVE AMPHIBOLE ANALYSES

| wt% | 055-4 | 055-5 | 165-1 | 165-3 RIM | 165-3 CORE | 050-1 RIM | 050-1 CORE | 050-2 RIM | 050-2 TWDS CORE | 050-2 CORE BLEB | 050-10 RIM | 050-10 CORE | 046-1 RIM | 046-1 CORE | 046-2 RIM | 046-2 CORE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 40.90 | 39.55 | 49.70 | 49.97 | 50.53 | 52.83 | 52.39 | 46.45 | 46.03 | 54.41 | 52.49 | 52.23 | 45.63 | 45.11 | 45.54 | 45.36 |
| $TiO_2$ | 0.28 | 0.28 | - | - | - | - | - | 0.28 | 0.44 | - | 0.24 | - | 0.25 | 0.27 | - | 0.29 |
| $Al_2O_3$ | 9.66 | 10.97 | 4.35 | 3.74 | 3.31 | 2.70 | 2.58 | 6.85 | 7.57 | 1.13 | 2.89 | 2.84 | 6.35 | 6.30 | 6.64 | 6.30 |
| $Fe_2O_3$ | 5.28 | 5.27 | 2.70 | 0.86 | 1.00 | 2.14 | 1.82 | 2.06 | - | - | - | - | - | - | - | - |
| FeO | 15.64 | 16.39 | 14.86 | 15.78 | 15.23 | 12.52 | 13.85 | 15.10 | 17.21 | 12.44 | 14.60 | 14.18 | 21.67 | 21.53 | 21.42 | 21.48 |
| MnO | 0.98 | 0.99 | 1.16 | 1.09 | 0.92 | 0.17 | 0.19 | - | 0.15 | 0.25 | 0.36 | 0.17 | 0.58 | 0.61 | 0.61 | 0.61 |
| MgO | 8.66 | 8.16 | 12.10 | 11.84 | 12.28 | 14.58 | 13.60 | 11.58 | 11.18 | 15.34 | 14.32 | 13.84 | 9.13 | 9.55 | 9.33 | 8.97 |
| CaO | 10.86 | 11.32 | 12.08 | 12.02 | 12.16 | 11.59 | 12.08 | 11.68 | 11.38 | 12.95 | 11.87 | 11.98 | 10.81 | 11.40 | 11.72 | 11.42 |
| $Na_2O$ | 2.26 | 2.29 | 1.12 | 1.06 | 0.74 | 0.90 | 0.52 | 1.51 | 1.75 | - | 1.00 | 0.69 | 1.60 | 1.52 | 1.52 | 1.29 |
| $K_2O$ | 1.70 | 2.06 | 0.67 | 0.46 | 0.40 | 0.29 | 0.23 | 0.78 | 0.81 | 0.06 | 0.24 | 0.22 | 1.28 | 1.21 | 1.25 | 1.30 |
| Other | - | 0.25 | - | - | - | - | - | 0.17 | - | 0.35 | - | - | - | - | - | - |
| TOTAL | 96.22 | 97.53 | 98.74 | 96.82 | 96.57 | 97.72 | 97.26 | 96.46 | 96.52 | 96.93 | 98.01 | 96.15 | 97.30 | 97.50 | 98.03 | 97.02 |

Structural formulae on the basis of 23(O)
*Cation total recalculated to 13, exclusive of K, Na and Ca

| | 055-4 | 055-5 | 165-1 | 165-3 RIM | 165-3 CORE | 050-1 RIM | 050-1 CORE | 050-2 RIM | 050-2 TWDS CORE | 050-2 CORE BLEB | 050-10 RIM | 050-10 CORE | 046-1 RIM | 046-1 CORE | 046-2 RIM | 046-2 CORE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Si | 6.384 | 6.155 | 7.318 | 7.486 | 7.550 | 7.621 | 7.668 | 7.007 | 6.920 | 7.895 | 7.588 | 7.698 | 6.937 | 6.860 | 6.908 | 6.950 |
| Ti | .033 | .033 | - | - | - | - | - | .031 | .050 | - | .026 | - | .028 | .030 | - | .033 |
| $Al^{IV}$ | 1.616 | 1.845 | .682 | .514 | .450 | .379 | .332 | .993 | 1.080 | .105 | .412 | .302 | 1.063 | 1.128 | 1.092 | 1.050 |
| $Al^{VI}$ | .162 | .168 | .072 | .146 | .133 | .082 | .113 | .226 | .262 | .089 | .080 | .191 | .075 | - | .095 | .089 |
| $Fe^{3+}$ | .620 | .617 | .299 | .097 | .112 | .233 | .201 | .233 | .341 | - | .236 | .077 | .568 | .587 | .425 | .433 |
| $Fe^{2+}$ | 2.042 | 2.134 | 1.830 | 1.977 | 1.903 | 1.517 | 1.696 | 1.905 | 1.822 | 1.510 | 1.529 | 1.671 | 2.187 | 2.150 | 2.292 | 2.319 |
| Mn | .130 | .130 | .144 | .138 | .117 | .021 | .024 | - | .019 | .031 | .044 | .021 | .075 | .079 | .078 | .080 |
| Mg | 2.014 | 1.892 | 2.655 | 2.643 | 2.734 | 3.147 | 2.966 | 2.604 | 2.505 | 3.318 | 3.085 | 3.040 | 2.067 | 2.165 | 2.110 | 2.047 |
| Ca | 1.846 | 1.919 | 1.921 | 1.934 | 1.952 | 1.809 | 1.905 | 1.900 | 1.840 | 2.013 | 1.850 | 1.896 | 1.787 | 1.886 | 1.925 | 1.896 |
| $Na_A$ | .542 | .621 | .243 | .243 | .168 | .062 | .054 | .345 | .355 | - | .131 | .092 | .288 | .342 | .377 | .283 |
| $Na_B$ | .154 | .081 | .079 | .066 | .048 | .191 | .095 | .100 | .160 | - | .151 | .104 | .213 | .114 | .075 | .104 |
| K | .344 | .417 | .127 | .089 | .076 | .054 | .044 | .150 | .157 | .012 | .045 | .041 | .250 | .238 | .243 | .256 |
| Other | - | .026 | - | - | - | - | - | .018 | - | .041 | - | - | - | - | - | - |

* Excludes any Mn, $Fe^{2+}$ and Mg from the B site, eliminating any cummingtonite component

TABLE 5.2.4 : WIDGIEMOOLTHA REPRESENTATIVE GARNET ANALYSES

| | 052-1 | 052-1 | 052-1 |
|---|---|---|---|
| wt% | | ** | |
| $SiO_2$ | 34.48 | 35.56 | 35.59 |
| $TiO_2$ | 0.34 | 0.37 | 0.34 |
| $Al_2O_3$ | 1.47 | 1.41 | 1.38 |
| $Fe_2O_3$ | - | 30.80 | - |
| FeO | 26.74 | .08 | 27.80 |
| MnO | 1.46 | 1.29 | 1.29 |
| MgO | - | - | - |
| CaO | 31.32 | 32.19 | 32.47 |
| $Na_2O$ | 2.92 | 0.29 | - |
| $K_2O$ | 0.22 | - | - |
| $P_2O_5$ | - | - | - |
| Other | - | - | - |
| TOTAL | 98.95 | 101.97 | 98.87 |

Structural formulae on the basis of 24 (O)

| | | ** | |
|---|---|---|---|
| Si | 6.259 | 5.892 | 6.409 |
| Ti | .047 | .043 | .046 |
| Al | .315 | .269 | .293 |
| $Fe^{3+}$ | - | 3.840 | - |
| $Fe^{2+}$ | 4.059 | .012 | 4.187 |
| Mn | .225 | .197 | .198 |
| Mg | - | - | - |
| Ca | 6.092 | 5.763 | 6.264 |
| Na | 1.029 | .095 | - |
| K | .051 | - | - |
| P | - | - | - |
| Other | - | - | - |

** cation total recalculated to 16, recalculation for other analyses inapplicable. FeO = total iron for all other analyses.

052 - Lake Cowan syenite, Widgiemooltha

**TABLE 5.2.5 : WIDGIEMOOLTHA WHOLE ROCK AND TRACE ELEMENT GEOCHEMISTRY**

| | 045 | 046 | 047 | 049 | 050 | 051 | 167 | 168 | 169 | 170 |
|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 65.84 | 65.22 | 65.60 | 67.33 | 65.08 | 66.90 | 67.07 | 65.15 | 68.33 | 67.51 |
| $TiO_2$ | 0.35 | 0.37 | 0.37 | 0.18 | 0.36 | 0.29 | 0.27 | 0.24 | 0.25 | 0.28 |
| $Al_2O_3$ | 16.67 | 16.92 | 16.69 | 15.75 | 15.49 | 15.15 | 15.14 | 17.35 | 15.33 | 15.18 |
| $Fe_2O_3$ | 2.00 | 1.97 | 2.41 | 1.52 | 1.51 | 3.03 | 2.52 | 2.27 | 2.53 | 1.22 |
| FeO | 0.43 | 0.35 | na | na | 2.03 | na | na | na | na | 1.51 |
| MnO | 0.08 | 0.04 | 0.06 | 0.04 | 0.07 | 0.06 | 0.04 | 0.02 | 0.02 | 0.02 |
| MgO | 0.45 | 0.58 | 0.72 | 0.66 | 2.53 | 2.18 | 1.82 | 1.24 | 1.36 | 1.89 |
| CaO | 1.74 | 1.78 | 1.85 | 0.93 | 2.49 | 2.91 | 2.51 | 1.81 | 1.50 | 2.53 |
| $Na_2O$ | 5.22 | 5.35 | 5.21 | 5.16 | 7.77 | 7.99 | 6.21 | 9.70 | 8.28 | 8.31 |
| $K_2O$ | 5.94 | 5.89 | 5.98 | 6.05 | 0.61 | 0.30 | 3.05 | 0.36 | 0.52 | 0.33 |
| $P_2O_5$ | 0.13 | 0.14 | 0.14 | 0.10 | 0.18 | 0.15 | 0.12 | 0.10 | 0.12 | 0.14 |
| LOI | 0.37 | 0.45 | 0.49 | 1.28 | 1.03 | 0.36 | 0.55 | 0.69 | 0.63 | 0.69 |
| TOTAL | 99.22 | 99.06 | 99.51 | 98.97 | 99.13 | 99.30 | 99.28 | 98.92 | 98.85 | 99.60 |
| Sc | 3.4 | 3.4 | 4.2 | 2.3 | 8.8 | 7.1 | 6.8 | 5.3 | 5.9 | 7.3 |
| V | 27 | 34 | 36 | 13 | 59 | 47 | 42 | 33 | 39 | 42 |
| Cr | 5 | 7 | <5 | <5 | 161 | 124 | 113 | 97 | 108 | 119 |
| Ni | 8 | 10 | 8 | 9 | 43 | 40 | 37 | 22 | 29 | 42 |
| Cu | 5 | 10 | 8 | 4 | 5 | 4 | 3 | 8 | 5 | 3 |
| Pb | 33 | 34 | 33 | 38 | 12 | 16 | 12 | 23 | 32 | 9 |
| Zn | 67 | 65 | 75 | 37 | 62 | 55 | 49 | 38 | 44 | 52 |
| Ga | 20 | 21 | 21 | 17 | 21 | 23 | 21 | 28 | 22 | 22 |
| Rb | 173 | 148 | 154 | 189 | 30.6 | 14.2 | 49 | 12.4 | 23.5 | 8.8 |
| Sr | 1564 | 1695 | 1627 | 653 | 1167 | 1169 | 1005 | 1109 | 983 | 1142 |
| Y | 17.4 | 82 | 73 | 10.2 | 8.4 | 15.3 | 9 | 12.9 | 5.7 | 13.5 |
| Zr | 265 | 303 | 311 | 200 | 126 | 111 | 97 | 99 | 96 | 103 |
| Nb | 7.5 | 7.1 | 7.8 | 6.1 | 2.8 | 4.3 | 2.9 | 5.1 | 3 | 3.4 |
| Ba | 2811 | 3825 | 3743 | 6995 | 2642 | 1657 | 2054 | 2330 | 2813 | 2203 |
| La | 114 | 127 | 117 | 51 | 40 | 27 | 23 | 46 | 36 | 29 |
| Ce | 177 | 188 | 177 | 79 | 69 | 38 | 34 | 73 | 54 | 49 |
| Nd | 64 | 69 | 70 | 7 | 20 | 11 | 9 | 21 | 5 | 16 |
| Th | 21 | 20 | 21 | 14 | 6 | 9 | 5 | 7 | 6 | 6 |
| F | 300 | 500 | na | 850 | 650 | na | na | na | na | 700 |

Major elements wt.% , trace elements p.p.m.
na = no analysis , nd = not detected.

ERAYINIA GRANITOID COMPLEX
045-047 ALKALI FELDSPAR SYENITE, 4.5 km SOUTH ERAYINIA HILL
049 ALKALI FELDSPAR SYENITE, 1 km NORTH DOG LAKE TURNOFF

MADOONIA DOWNS INTRUSION
050-170 SYENITE, 8 km NORTH-NORTH-EAST MADOONIA DOWNS H.S.(aband)

TABLE 5.2.5 cont...

| | 052 | 053 | 054 | 055 | 155 | 156 | 157 | 158 | 159 | 160A |
|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 61.91 | 63.28 | 60.44 | 60.27 | 71.28 | 46.97 | 59.52 | 59.36 | 59.29 | 60.36 |
| $TiO_2$ | 0.59 | 0.34 | 0.65 | 0.62 | 0.24 | 1.32 | 0.93 | 0.90 | 0.88 | 0.65 |
| $Al_2O_3$ | 16.26 | 17.91 | 17.55 | 17.58 | 15.65 | 13.66 | 15.19 | 15.40 | 15.26 | 17.24 |
| $Fe_2O_3$ | 4.50 | 2.56 | 4.92 | 3.26 | 0.67 | 16.02 | 6.48 | 6.41 | 4.21 | 4.71 |
| FeO | na | 0.63 | na | 1.31 | 0.36 | na | na | na | 1.91 | na |
| MnO | 0.12 | 0.11 | 0.18 | 0.12 | 0.01 | 0.33 | 0.15 | 0.13 | 0.13 | 0.11 |
| MgO | 0.93 | 0.67 | 1.16 | 1.05 | 0.26 | 5.77 | 1.46 | 1.59 | 1.62 | 1.38 |
| CaO | 2.82 | 1.69 | 3.37 | 3.23 | 1.60 | 8.64 | 3.95 | 3.72 | 4.05 | 3.21 |
| $Na_2O$ | 5.91 | 7.28 | 6.28 | 6.20 | 5.61 | 4.64 | 5.65 | 5.63 | 5.69 | 6.92 |
| $K_2O$ | 5.70 | 3.98 | 4.35 | 4.55 | 2.84 | 1.35 | 5.25 | 5.44 | 5.19 | 3.39 |
| $P_2O_5$ | 0.15 | 0.12 | 0.19 | 0.15 | 0.07 | 0.14 | 0.26 | 0.25 | 0.24 | 0.18 |
| LOI | 0.17 | 0.47 | 0.24 | 0.42 | 0.47 | 0.50 | 0.16 | 0.26 | 0.42 | 0.60 |
| TOTAL | 99.06 | 99.04 | 99.33 | 98.76 | 99.06 | 99.31 | 99.00 | 99.07 | 98.88 | 98.76 |
| Sc | 5.1 | 4.4 | 7.3 | 6.3 | 2 | 46 | 8.2 | 8.1 | 7.9 | 8.1 |
| V | 67 | 49 | 88 | 85 | 10 | 367 | 109 | 119 | 118 | 76 |
| Cr | <5 | 15 | 9 | 5 | <5 | 30 | 5 | 5 | 7 | 26 |
| Ni | 7 | 9 | 16 | 12 | 11 | 123 | 46 | 16 | 28 | 43 |
| Cu | 4 | 4 | 15 | 16 | 2 | 17 | 8 | 17 | 35 | 13 |
| Pb | 19 | 25 | 23 | 26 | 37 | 10 | 18 | 21 | 22 | 18 |
| Zn | 112 | 69 | 121 | 113 | 42 | 244 | 147 | 156 | 159 | 117 |
| Ga | 30 | 27 | 29 | 31 | 20 | 21 | 28 | 32 | 30 | 27 |
| Rb | 82 | 45.6 | 63 | 69 | 82 | 10.5 | 68 | 69 | 67 | 39.7 |
| Sr | 1749 | 2647 | 3111 | 3018 | 1021 | 1642 | 1797 | 2001 | 1991 | 2227 |
| Y | 25.3 | 33 | 37.5 | 40.2 | 2 | 32.4 | 54 | 35.1 | 34.3 | 32.9 |
| Zr | 155 | 192 | 265 | 261 | 147 | 91 | 75 | 241 | 263 | 296 |
| Nb | 8 | 6.3 | 9 | 9.4 | 2.5 | 4.8 | 10.3 | 7.8 | 9.6 | 10 |
| Ba | 3870 | 3526 | 3692 | 3646 | 1959 | 339 | 4117 | 3771 | 4082 | 3073 |
| La | 67 | 91 | 106 | 135 | 39 | 35 | 233 | 135 | 167 | 90 |
| Ce | 134 | 152 | 241 | 209 | 63 | 42 | 319 | 228 | 260 | 163 |
| Nd | 58 | 77 | 101 | 112 | 15 | 11 | 185 | 114 | 115 | 71 |
| Th | 12 | 11 | 14 | 17 | 10 | 3 | 13 | 10 | 14 | 10 |
| F | na | 250 | na | 350 | 450 | na | na | na | 550 | na |

Major elements wt.%, trace elements p.p.m.
na = no analysis , nd = not detected.

BINNERINGIE INTRUSION
- 052 - LATH SYENITE
- 053 - LIGHT PINK EVEN-GRAINED SYENITE
- 054-055 GREY-WHITE SYENITE (SIMILAR TO LATH SYENITE)
- 156 - MAFIC XENOLITH FROM LATH SYENITE
- 157-159 LATH SYENITE
- 160A- EVEN GRAINED SYENITE

155 - EQUIGRANULAR GRANITOID, SOUTH OF BLUE DAM

TABLE 5.2.5 cont...

| | 160B | 161 | 163 | 164 | 165 | 166 | 056 | 057 | 058 |
|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 61.12 | 63.09 | 63.78 | 61.60 | 63.24 | 61.94 | 64.31 | 63.49 | 68.37 |
| $TiO_2$ | 0.47 | 0.33 | 0.34 | 0.54 | 0.31 | 0.46 | 0.25 | 0.25 | 0.23 |
| $Al_2O_3$ | 17.54 | 18.13 | 17.67 | 17.22 | 18.34 | 17.84 | 16.70 | 15.63 | 17.28 |
| $Fe_2O_3$ | 3.95 | 3.05 | 2.06 | 4.06 | 2.38 | 2.40 | 2.38 | 2.33 | 1.71 |
| FeO | na | na | na | na | na | 0.94 | na | 0.66 | na |
| MnO | 0.09 | 0.06 | 0.07 | 0.11 | 0.08 | 0.08 | 0.08 | 0.12 | 0.04 |
| MgO | 1.13 | 0.56 | 0.66 | 1.04 | 0.69 | 0.67 | 0.85 | 1.12 | 0.35 |
| CaO | 2.53 | 1.62 | 1.79 | 2.48 | 1.89 | 2.20 | 2.30 | 2.79 | 0.42 |
| $Na_2O$ | 6.99 | 7.24 | 6.78 | 6.75 | 7.54 | 6.71 | 6.70 | 6.43 | 6.04 |
| $K_2O$ | 3.86 | 4.30 | 5.52 | 4.68 | 4.25 | 4.97 | 5.07 | 5.36 | 3.49 |
| $P_2O_5$ | 0.16 | 0.10 | 0.11 | 0.12 | 0.08 | 0.10 | 0.21 | 0.38 | 0.01 |
| LOI | 0.68 | 0.46 | 0.32 | 0.30 | 0.43 | 0.44 | 0.33 | 0.53 | 1.06 |
| TOTAL | 98.51 | 98.92 | 99.09 | 98.89 | 99.22 | 98.75 | 99.18 | 99.09 | 99.00 |
| | | | | | | | | | |
| Sc | 5.7 | 4 | 3.9 | 5.3 | 3.3 | 4.4 | 3.5 | 3.2 | 3.1 |
| V | 60 | 46 | 31 | 72 | 36 | 63 | 33 | 43 | 24 |
| Cr | 17 | 9 | 9 | 13 | <5 | 8 | 11 | 9 | 8 |
| Ni | 30 | 17 | 7 | 11 | 12 | 10 | 11 | 22 | 7 |
| Cu | 12 | 7 | 7 | 9 | 18 | 10 | 3 | 3 | 5 |
| Pb | 22 | 22 | 22 | 27 | 21 | 29 | 21 | 36 | 28 |
| Zn | 97 | 78 | 63 | 93 | 62 | 91 | 64 | 95 | 41 |
| Ga | 27 | 28 | 24 | 28 | 30 | 30 | 22 | 21 | 24 |
| Rb | 45 | 54 | 65 | 67 | 46 | 69 | 76 | 101 | 79 |
| Sr | 2077 | 2137 | 1624 | 2204 | 1921 | 2380 | 1265 | 911 | 1413 |
| Y | 21.7 | 19.1 | 17.6 | 30 | 17.6 | 26.6 | 23.3 | 27.5 | 7.5 |
| Zr | 244 | 273 | 54 | 301 | 249 | 264 | 122 | 124 | 152 |
| Nb | 7.6 | 6.2 | 7.6 | 9.4 | 6.4 | 7.5 | 13.4 | 14.6 | 4.3 |
| Ba | 3250 | 2998 | 4193 | 3460 | 2718 | 3539 | 3685 | 2988 | 3225 |
| La | 82 | 77 | 65 | 106 | 59 | 91 | 106 | 111 | 13 |
| Ce | 153 | 118 | 136 | 176 | 96 | 168 | 193 | 188 | 28 |
| Nd | 56 | 47 | 56 | 77 | 35 | 67 | 96 | 98 | 1 |
| Th | 10 | 11 | 8 | 16 | 7 | 13 | 24 | 23 | 8 |
| F | na | na | na | na | na | 450 | na | 400 | na |

Major elements wt.%, trace elements p.p.m.
na = no analysis , nd = not detected.

BINNERINGIE INTRUSION
160B-166 EVEN-GRAINED SYENITE

HOGAN'S FIND INTRUSION
056-057 ALKALI FELDSPAR SYENITE, 10.7 km SOUTH CARNILYA HILL

058 - MONZODIORITE/ALKALI GRANITE, 8 km SOUTH EAST RANDALLS

TABLE 5.2.6 : WIDGIEMOOLTHA CIPW NORMS

| | 052 | 054 | 055 | 157 | 158 | 159 | 053 | 155 | 160A | 160B |
|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 57.06 | 55.47 | 55.76 | 55.24 | 55.03 | 55.20 | 57.89 | 66.39 | 55.66 | 56.37 |
| $TiO_2$ | 0.41 | 0.45 | 0.43 | 0.65 | 0.63 | 0.61 | 0.23 | 0.17 | 0.45 | 0.32 |
| $Al_2O_3$ | 17.66 | 18.98 | 19.17 | 16.61 | 16.83 | 16.75 | 19.31 | 17.18 | 18.73 | 19.07 |
| $Fe_2O_3$ | 2.19 | 2.38 | 2.27 | 3.17 | 3.13 | 2.95 | 1.76 | 0.47 | 2.29 | 1.92 |
| FeO | 1.16 | 1.26 | 1.01 | 1.68 | 1.66 | 1.49 | 0.48 | 0.28 | 1.21 | 1.02 |
| MnO | 0.09 | 0.14 | 0.09 | 0.12 | 0.10 | 0.10 | 0.08 | 0.01 | 0.09 | 0.07 |
| MgO | 1.28 | 1.59 | 1.45 | 2.02 | 2.20 | 2.25 | 0.91 | 0.36 | 1.90 | 1.55 |
| CaO | 2.78 | 3.32 | 3.20 | 3.93 | 3.70 | 4.04 | 1.66 | 1.60 | 3.17 | 2.50 |
| $Na_2O$ | 10.56 | 11.18 | 11.13 | 10.17 | 10.11 | 10.26 | 12.92 | 10.12 | 12.37 | 12.50 |
| $K_2O$ | 6.70 | 5.09 | 5.37 | 6.22 | 6.43 | 6.16 | 4.65 | 3.37 | 3.99 | 4.55 |
| $P_2O_5$ | 0.12 | 0.15 | 0.12 | 0.20 | 0.20 | 0.19 | 0.09 | 0.05 | 0.14 | 0.12 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | | | | | | | | | | |
| Ap | 0.33 | 0.41 | 0.33 | 0.56 | 0.54 | 0.52 | 0.26 | 0.15 | 0.39 | 0.35 |
| Il | 1.11 | 1.22 | 1.17 | 1.74 | 1.68 | 1.65 | 0.65 | 0.45 | 1.22 | 0.89 |
| Mt | 3.50 | 3.96 | 2.81 | 4.70 | 4.66 | 4.00 | 1.41 | 0.50 | 3.53 | 3.19 |
| Or | 33 | 25 | 27 | 31 | 32 | 30 | 24 | 17 | 20 | 23 |
| Ab | 50 | 53 | 52 | 47 | 46 | 47 | 62 | 47 | 58 | 59 |
| An | 1.00 | 6.75 | 6.66 | 0.55 | 0.70 | 0.79 | 4.42 | 7.50 | 5.93 | 5.05 |
| Di | 5.68 | 7.07 | 6.43 | 8.86 | 9.65 | 9.87 | 2.86 | - | 7.80 | 5.76 |
| Hy | - | - | - | - | - | - | 0.34 | 0.43 | 0.17 | 0.32 |
| Ol | - | - | - | - | - | - | - | - | - | - |
| Ne | - | - | - | - | 0.38 | 0.27 | - | - | - | - |
| Ac | - | - | - | - | - | - | - | - | - | - |
| C | - | - | - | - | - | - | - | 1.22 | - | - |
| Q | 1.30 | 0.69 | 0.52 | 0.38 | - | - | 2.09 | 24 | 0.61 | 0.40 |
| Hm | 0.72 | 0.68 | 1.31 | 1.24 | 1.22 | 1.42 | 1.60 | 0.33 | 0.85 | 0.57 |
| Wo | 2.30 | 0.27 | 0.46 | 2.99 | 2.11 | 2.70 | - | - | - | - |
| Total | 99 | 99 | 99 | 99 | 99 | 99 | 99 | 99 | 99 | 98 |
| | | | | | | | | | | |
| A | 66 | 62 | 64 | 56 | 56 | 57 | 73 | 86 | 61 | 66 |
| M | 5.30 | 6.72 | 6.27 | 7.46 | 8.04 | 8.49 | 4.35 | 2.65 | 8.15 | 6.90 |
| F | 29 | 32 | 29 | 37 | 36 | 35 | 23 | 11 | 31 | 27 |
| Q | 49 | 49 | 49 | 48 | 48 | 48 | 50 | 55 | 49 | 49 |
| M | 9.45 | 9.69 | 8.89 | 14 | 14 | 14 | 5.30 | 1.36 | 9.75 | 7.81 |
| L | 42 | 42 | 42 | 38 | 39 | 39 | 45 | 43 | 42 | 43 |
| PALI | 0.88 | 0.97 | 0.97 | 0.82 | 0.83 | 0.82 | 1.00 | 1.14 | 0.96 | 0.98 |
| PAKI | 1.02 | 1.17 | 1.16 | 1.01 | 1.02 | 1.02 | 1.10 | 1.27 | 1.15 | 1.12 |
| AI | 0.98 | 0.86 | 0.86 | 0.99 | 0.98 | 0.98 | 0.91 | 0.79 | 0.87 | 0.89 |
| PMI | 1.82 | 1.76 | 1.78 | 1.78 | 1.80 | 1.79 | 1.82 | 1.22 | 1.76 | 1.82 |

TABLE 5.2.6 cont...

| | 161 | 163 | 164 | 165 | 166 | 056 | 057 | 058 | 156 |
|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 57.68 | 58.10 | 56.50 | 57.37 | 56.95 | 58.71 | 58.36 | 63.61 | 44.10 |
| $TiO_2$ | 0.23 | 0.23 | 0.37 | 0.21 | 0.32 | 0.17 | 0.17 | 0.16 | 0.93 |
| $Al_2O_3$ | 19.53 | 18.98 | 18.61 | 19.61 | 19.33 | 17.97 | 16.93 | 18.95 | 15.12 |
| $Fe_2O_3$ | 1.47 | 0.99 | 1.96 | 1.14 | 1.66 | 1.15 | 1.61 | 0.84 | 5.66 |
| FeO | 0.78 | 0.52 | 1.04 | 0.60 | 0.72 | 0.61 | 0.51 | 0.44 | 6.99 |
| MnO | 0.05 | 0.05 | 0.09 | 0.06 | 0.06 | 0.06 | 0.09 | 0.03 | 0.26 |
| MgO | 0.76 | 0.90 | 1.42 | 0.93 | 0.92 | 1.16 | 1.55 | 0.49 | 8.08 |
| CaO | 1.59 | 1.75 | 2.44 | 1.84 | 2.17 | 2.25 | 2.74 | 0.41 | 8.69 |
| $Na_2O$ | 12.83 | 11.97 | 12.00 | 13.26 | 11.96 | 11.86 | 11.46 | 10.91 | 8.44 |
| $K_2O$ | 5.02 | 6.42 | 5.47 | 4.92 | 5.83 | 5.91 | 6.28 | 4.15 | 1.62 |
| $P_2O_5$ | 0.08 | 0.08 | 0.09 | 0.06 | 0.08 | 0.16 | 0.29 | 0.01 | 0.11 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | | | | | | | | | |
| Ap | 0.22 | 0.24 | 0.26 | 0.17 | 0.22 | 0.46 | 0.83 | 0.02 | 0.30 |
| Il | 0.63 | 0.64 | 1.02 | 0.59 | 0.87 | 0.47 | 0.47 | 0.43 | 2.44 |
| Mt | 2.52 | 1.46 | 3.14 | 1.92 | 1.96 | 2.09 | 1.67 | 1.29 | 11 |
| Or | 25 | 33 | 27 | 25 | 29 | 30 | 31 | 20 | 7.74 |
| Ab | 61 | 57 | 56 | 62 | 56 | 56 | 50 | 50 | 25 |
| An | 4.28 | 1.48 | 2.85 | 3.64 | 3.87 | 0.53 | - | 1.97 | 12 |
| Di | 2.79 | 4.05 | 6.36 | 4.24 | 4.12 | 5.20 | 7.02 | - | 25 |
| Hy | 0.18 | - | - | - | - | - | - | 0.56 | - |
| Ol | - | - | - | - | - | - | - | - | 8.88 |
| Ne | - | - | 0.25 | 0.72 | 0.19 | - | - | - | 7.17 |
| Ac | - | - | - | - | - | - | 3.37 | - | - |
| C | - | - | - | - | - | - | - | 5.57 | - |
| Q | 1.18 | 0.14 | - | - | - | 2.37 | 2.29 | 18 | - |
| Hm | 0.40 | 0.44 | 0.66 | 0.34 | 1.05 | 0.22 | - | 0.29 | - |
| Wo | - | 0.89 | 0.61 | 0.19 | 0.74 | 1.52 | 1.42 | - | - |
| Total | 99 | 99 | 99 | 99 | 99 | 99 | 99 | 99 | 99 |
| | | | | | | | | | |
| A | 75 | 81 | 67 | 78 | 73 | 77 | 73 | 81 | 20 |
| M | 3.62 | 4.33 | 6.13 | 4.56 | 4.20 | 5.57 | 6.99 | 2.97 | 20 |
| F | 22 | 15 | 27 | 17 | 23 | 17 | 20 | 16 | 60 |
| Q | 49 | 49 | 49 | 49 | 49 | 50 | 50 | 54 | 45 |
| M | 5.08 | 5.06 | 8.45 | 5.13 | 6.41 | 6.17 | 8.08 | 2.16 | 30 |
| L | 46 | 46 | 43 | 46 | 45 | 44 | 42 | 44 | 25 |
| PALI | 1.01 | 0.94 | 0.93 | 0.98 | 0.97 | 0.90 | 0.83 | 1.23 | 0.81 |
| PAKI | 1.09 | 1.03 | 1.07 | 1.08 | 1.09 | 1.01 | 0.95 | 1.26 | 1.50 |
| AI | 0.91 | 0.97 | 0.94 | 0.93 | 0.92 | 0.99 | 1.05 | 0.79 | 0.67 |
| PMI | 1.86 | 1.90 | 1.86 | 1.90 | 1.88 | 1.82 | 1.82 | 1.42 | 1.37 |

TABLE 5.2.6 cont...

| | 050 | 051 | 167 | 168 | 169 | 170 | 045 | 046 | 047 | 049 |
|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 59.75 | 60.84 | 61.70 | 58.77 | 62.57 | 61.39 | 60.94 | 60.38 | 60.52 | 62.90 |
| $TiO_2$ | 0.25 | 0.20 | 0.19 | 0.16 | 0.17 | 0.19 | 0.24 | 0.26 | 0.26 | 0.13 |
| $Al_2O_3$ | 16.76 | 16.23 | 16.41 | 18.44 | 16.55 | 16.27 | 18.18 | 18.46 | 18.15 | 17.34 |
| $Fe_2O_3$ | 1.04 | 0.93 | 0.78 | 0.69 | 0.79 | 0.83 | 1.39 | 1.37 | 1.34 | 0.85 |
| FeO | 1.56 | 1.41 | 1.18 | 1.05 | 1.19 | 1.15 | 0.33 | 0.27 | 0.41 | 0.26 |
| MnO | 0.05 | 0.05 | 0.03 | 0.02 | 0.02 | 0.02 | 0.06 | 0.03 | 0.05 | 0.03 |
| MgO | 3.46 | 2.96 | 2.50 | 1.67 | 1.86 | 2.56 | 0.62 | 0.80 | 0.99 | 0.92 |
| CaO | 2.45 | 2.83 | 2.47 | 1.75 | 1.47 | 2.46 | 1.73 | 1.77 | 1.83 | 0.93 |
| $Na_2O$ | 13.83 | 14.09 | 11.07 | 16.97 | 14.70 | 14.64 | 9.37 | 9.60 | 9.32 | 9.35 |
| $K_2O$ | 0.71 | 0.35 | 3.58 | 0.41 | 0.60 | 0.38 | 7.02 | 6.95 | 7.04 | 7.21 |
| $P_2O_5$ | 0.14 | 0.12 | 0.09 | 0.08 | 0.09 | 0.11 | 0.10 | 0.11 | 0.11 | 0.08 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | | | | | | | | | | |
| Ap | 0.41 | 0.33 | 0.27 | 0.22 | 0.27 | 0.31 | 0.28 | 0.31 | 0.31 | 0.22 |
| Il | 0.70 | 0.56 | 0.52 | 0.46 | 0.48 | 0.54 | 0.66 | 0.70 | 0.70 | 0.35 |
| Mt | 2.26 | 2.00 | 1.66 | 1.50 | 1.69 | 1.79 | 0.64 | 0.19 | 0.85 | 0.71 |
| Or | 3.69 | 1.78 | 18 | 2.14 | 3.10 | 1.96 | 35 | 35 | 35 | 36 |
| Ab | 68 | 68 | 53 | 83 | 71 | 71 | 44 | 45 | 44 | 44 |
| An | 5.77 | 4.62 | 4.48 | 2.76 | 3.21 | 3.20 | 4.48 | 4.78 | 4.49 | 1.97 |
| Di | 5.01 | 7.80 | 6.36 | 4.88 | 3.08 | 7.46 | 2.77 | 2.82 | 3.37 | 1.82 |
| Hy | 3.76 | 2.32 | 1.95 | 1.31 | 2.06 | 1.70 | - | 0.20 | 0.28 | 0.61 |
| Ol | - | - | - | - | - | - | - | - | - | - |
| Ne | - | - | - | - | - | - | - | - | - | - |
| Ac | - | - | - | - | - | - | - | - | - | - |
| C | - | - | - | - | - | - | - | - | - | - |
| Q | 9.56 | 11 | 13 | 2.52 | 14 | 11 | 9.40 | 7.99 | 8.59 | 12 |
| Hm | - | - | - | - | - | - | 1.56 | 1.85 | 1.35 | 0.75 |
| Wo | - | - | - | - | - | - | 0.09 | - | - | - |
| Total | 99 | 99 | 99 | 99 | 99 | 99 | 99 | 99 | 99 | 99 |
| | | | | | | | | | | |
| A | 57 | 60 | 67 | 73 | 68 | 64 | 78 | 78 | 77 | 83 |
| M | 17 | 16 | 13 | 8.97 | 10 | 14 | 3.15 | 4.04 | 4.94 | 4.87 |
| F | 25 | 24 | 20 | 18 | 22 | 21 | 19 | 18 | 18 | 12 |
| Q | 52 | 52 | 53 | 50 | 53 | 53 | 52 | 51 | 52 | 53 |
| M | 7.25 | 7.47 | 6.16 | 5.06 | 4.57 | 6.75 | 4.20 | 4.17 | 4.64 | 2.90 |
| L | 41 | 40 | 41 | 45 | 42 | 41 | 44 | 44 | 44 | 44 |
| PALI | 0.99 | 0.94 | 0.96 | 0.96 | 0.99 | 0.93 | 1.00 | 1.01 | 1.00 | 0.99 |
| PAKI | 1.15 | 1.12 | 1.12 | 1.06 | 1.08 | 1.08 | 1.11 | 1.12 | 1.11 | 1.05 |
| AI | 0.87 | 0.89 | 0.89 | 0.94 | 0.92 | 0.92 | 0.90 | 0.90 | 0.90 | 0.95 |
| PMI | 1.46 | 1.42 | 1.43 | 1.78 | 1.47 | 1.47 | 1.61 | 1.65 | 1.62 | 1.58 |

PALI = Peraluminous index $Al_2O_3$ / ( CaO + $Na_2O$ + $K_2O$ )
$>1$ = peraluminous, $<1$ = metaluminous

PAKI = Peralkaline index $Al_2O_3$ / ( $Na_2O$ + $K_2O$ )
$<1$ = peralkaline

AI = Agpaitic index ( $Na_2O$ + $K_2O$ ) / $Al_2O_3$
$>1$ = agpaitic

PMI = plumaskitic index 6 ( $Na_2O$ + $K_2O$ ) / $SiO_2$
$<1$ = plumaskitic, $>1$ = miaskitic

## TABLE 5.2.7 : BINNERINGIE Rb, Sr AND ISOTOPE RATIO MEASUREMENTS

| Sample[1] | Rb (ppm) | Sr (ppm) | $^{87}Rb/^{86}Sr$ | $^{87}Sr/^{86}Sr$[2] |
|---|---|---|---|---|
| 052S | 1.0 | 358 | 0.008 | 0.70158 |
| 163P | 1.7 | 288 | 0.017 | 0.71080 |
| 052P | 3.2 | 398 | 0.023 | 0.70198 |
| 165 | 45 | 1894 | 0.068 | 0.70358 |
| 055 | 66 | 2749 | 0.069 | 0.70343 |
| 157 | 68 | 1867 | 0.105 | 0.70500 |
| 163 | 66 | 1649 | 0.115 | 0.70599 |
| 163F | 78 | 1814 | 0.125 | 0.70578 |
| 052 | 74 | 1628 | 0.131 | 0.70578 |
| 052F | 87 | 1546 | 0.162 | 0.70694 |

1 S = Titanite, P = Pyroxene, F = Feldspar.

2 $^{87}Sr/^{86}Sr$ for E & A std = 0.7080496 ± 0.0000096 (1 sigma).

## TABLE 5.2.8 : RESULTS OF Rb-Sr REGRESSION ANALYSES

| Regression | Samples | MSWD | Age (Ma) | IR | Model |
|---|---|---|---|---|---|
| Combined syenites -whole rocks + minerals | 9 | 2.50 | 2470 ± 77 | 0.70117 ± 0.00010 | 1 |
| Lath phase syenite -whole rocks + minerals | 6 | 2.89 | 2445 ± 104 | 0.70118 ± 0.00014 | 1 |
| Lath phase syenite (052) -whole rock + minerals | 4 | 1.27 | 2428 ± 164 | 0.70122 ± 0.00024 | 1 |

## TABLE 5.3.1 : KURNALPI REPRESENTATIVE FELDSPAR ANALYSES

| wt% | 024-2 | 024-2 | 024-2 | 024-2 | 024-2 | 029-1 | 029-10 | 029-10 | 029-5 | 029-5 | 033-1 | 033-2 | 033-4 | 039-2 | 039-2 | 039-2 | 039-2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ZONED RIM | TWDS CORE | CORE | MYRMEKITE RIM | MYRMEKITE CORE | PLAG | MSP NA | MSP K | PLAG | PLAG | PERTH HOST | EXS NA | PLAG RIM | PLAG CORE | PLAG | MICRO | PLAG |
| $SiO_2$ | 65.95 | 65.92 | 64.17 | 68.95 | 66.38 | 68.93 | 68.78 | 64.51 | 65.57 | 65.58 | 68.86 | 65.20 | 69.00 | 65.40 | 69.08 | 67.88 | 68.89 |
| $TiO_2$ | 0.15 | - | - | - | - | - | 0.10 | 0.35 | - | - | - | - | 0.15 | - | - | - | - |
| $Al_2O_3$ | 22.40 | 22.73 | 23.60 | 20.40 | 22.05 | 19.37 | 19.39 | 18.01 | 20.55 | 20.98 | 18.85 | 17.85 | 18.93 | 18.44 | 19.83 | 20.78 | 20.05 |
| FeO* | - | - | - | - | - | - | 0.17 | - | 0.13 | 0.11 | 0.30 | - | 0.32 | - | - | - | - |
| MnO | - | - | - | - | - | - | - | - | - | - | 0.14 | - | - | - | - | - | - |
| MgO | - | - | - | - | - | - | - | - | - | - | 0.18 | - | 0.14 | - | - | - | - |
| CaO | 3.08 | 3.24 | 4.40 | 0.51 | 2.39 | 0.26 | 0.21 | - | 1.81 | 2.08 | - | - | - | - | 0.31 | 1.08 | 0.59 |
| $Na_2O$ | 8.72 | 7.80 | 7.68 | 9.34 | 8.99 | 11.34 | 10.80 | 0.28 | 9.70 | 10.24 | 11.24 | 0.11 | 11.11 | 0.15 | 10.46 | 10.13 | 10.77 |
| $K_2O$ | 0.18 | 0.15 | 0.19 | 0.06 | 0.14 | 0.14 | 0.14 | 15.56 | 0.14 | 0.20 | 0.13 | 16.94 | 0.10 | 15.26 | 0.08 | 0.13 | 0.08 |
| Other | - | - | - | 0.05 | - | - | 0.11 | - | - | 0.12 | 0.07 | - | - | - | - | - | - |
| TOTAL | 100.48 | 99.84 | 100.04 | 99.31 | 99.95 | 100.04 | 99.70 | 98.71 | 97.90 | 99.31 | 99.77 | 100.10 | 99.75 | 99.25 | 99.76 | 100.00 | 100.38 |

Structural formulae on the basis of 8(O)

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Si | 2.874 | 2.879 | 2.815 | 3.004 | 2.900 | 3.006 | 3.006 | 3.008 | 3.930 | 2.901 | 3.016 | 3.017 | 3.016 | 3.020 | 3.008 | 2.959 | 2.990 |
| Ti | .005 | - | - | - | - | - | .003 | .012 | - | - | - | - | .005 | - | - | - | - |
| Al | 1.150 | 1.170 | 1.220 | 1.048 | 1.035 | .995 | .999 | .990 | 1.083 | 1.094 | .973 | .974 | .976 | 1.003 | 1.018 | 1.067 | 1.025 |
| Fe(tot) | - | - | - | - | - | - | .006 | - | .005 | .006 | .011 | - | .012 | - | - | - | - |
| Mn | - | - | - | - | - | - | - | - | - | - | .005 | - | - | - | - | - | - |
| Mg | - | - | - | - | - | - | - | - | - | - | .012 | - | .009 | - | - | - | - |
| Ca | .144 | .152 | .207 | .024 | .112 | .012 | .010 | - | .087 | .099 | - | - | - | - | .015 | .051 | .027 |
| Na | .737 | .660 | .653 | .789 | .761 | .959 | .915 | .025 | .840 | .879 | .955 | .010 | .942 | .014 | .883 | .856 | .906 |
| K | .010 | .009 | .011 | .004 | .008 | .008 | .008 | .925 | .008 | .012 | .007 | 1.000 | .006 | .899 | .004 | .007 | .005 |
| Other | - | - | - | .004 | - | - | .004 | - | - | .004 | .005 | - | - | - | - | - | - |

FeO* = total iron; MSP = mesoperthite; PERTH = perthite;
EXS = exsolution; MICRO = microcline.

TABLE 5.3.2 : KURNALPI REPRESENTATIVE PYROXENE ANALYSES

| | 033-3 | 033-3 | 033-6 | 033-6 | 033-7 | 033-7 |
|---|---|---|---|---|---|---|
| wt% | RIM | CORE | RIM | CORE | RIM | CORE |
| $SiO_2$ | 52.91 | 53.29 | 51.70 | 51.46 | 53.48 | 52.32 |
| $TiO_2$ | - | - | - | - | - | - |
| $Al_2O_3$ | 0.70 | 0.57 | 0.55 | 0.77 | 0.53 | 0.44 |
| $Fe_2O_3$ | 10.42 | 7.84 | 14.56 | 13.25 | 14.81 | 13.58 |
| FeO | 7.08 | 8.27 | 9.74 | 9.93 | 8.33 | 10.47 |
| MnO | 0.96 | 0.78 | 0.85 | 0.77 | 0.97 | 0.87 |
| MgO | 7.46 | 7.99 | 4.05 | 4.58 | 4.97 | 4.04 |
| CaO | 15.90 | 16.81 | 12.57 | 13.22 | 11.84 | 12.26 |
| $Na_2O$ | 4.66 | 4.08 | 6.02 | 5.55 | 6.60 | 6.11 |
| $K_2O$ | - | - | - | - | - | - |
| TOTAL | 100.09 | 99.63 | 100.04 | 99.53 | 101.53 | 100.09 |

Structural formulae on the basis of 6(O)
Cation total recalculated to 4

| | | | | | | |
|---|---|---|---|---|---|---|
| Si | 2.006 | 2.024 | 2.001 | 1.998 | 2.019 | 2.021 |
| Ti | - | - | - | - | - | - |
| Al | .031 | .026 | .025 | .035 | .024 | .020 |
| $Fe^{3+}$ | .298 | .234 | .424 | .387 | .421 | .395 |
| $Fe^{2+}$ | .225 | .255 | .315 | .322 | .263 | .338 |
| Mn | .031 | .025 | .028 | .025 | .031 | .028 |
| Mg | .422 | .452 | .234 | .265 | .280 | .233 |
| Ca | .646 | .684 | .521 | .550 | .479 | .608 |
| Na | .342 | .300 | .452 | .418 | .483 | .457 |
| K | - | - | - | - | - | - |

## TABLE 5.3.3 : KURNALPI REPRESENTATIVE AMPHIBOLE ANALYSES

| | 029-1 | 029-1 | 029-7 | 029-7 | 039-1 | 039-1 | 039-3 | 039-3 |
|---|---|---|---|---|---|---|---|---|
| wt% | | | RIM | CORE | RIM | CORE | RIM | CORE |
| $SiO_2$ | 51.26 | 51.24 | 50.12 | 50.47 | 43.52 | 43.26 | 42.22 | 43.39 |
| $TiO_2$ | 0.26 | 0.25 | 0.32 | 0.24 | - | - | - | - |
| $Al_2O_3$ | 3.34 | 3.10 | 3.30 | 3.47 | 9.63 | 8.85 | 9.91 | 9.44 |
| $Fe_2O_3$ | 2.39 | 1.89 | 1.69 | 2.34 | 6.14 | 6.29 | 5.57 | 4.99 |
| FeO | 11.96 | 12.21 | 11.66 | 10.95 | 14.74 | 14.58 | 15.49 | 14.87 |
| MnO | 0.39 | 0.47 | 0.35 | 0.37 | 0.45 | 0.52 | 0.52 | 0.48 |
| MgO | 14.08 | 14.00 | 13.99 | 14.40 | 9.67 | 9.90 | 9.32 | 10.11 |
| CaO | 10.89 | 11.07 | 10.78 | 10.89 | 11.35 | 11.42 | 11.62 | 11.42 |
| $Na_2O$ | 1.67 | 1.47 | 1.64 | 1.58 | 1.67 | 1.65 | 1.77 | 1.96 |
| $K_2O$ | 0.54 | 0.47 | 0.45 | 0.53 | 1.45 | 1.42 | 1.54 | 1.55 |
| Other | 0.14 | 0.11 | - | 0.10 | - | - | - | - |
| TOTAL | 96.92 | 96.28 | 94.30 | 95.33 | 98.63 | 97.89 | 97.97 | 98.21 |

Structural formulae on the basis of 23(O)
*Cation total recalculated to 13, exclusive of K, Na and Ca

| | 029-1 | 029-1 | 029-7 | 029-7 | 039-1 | 039-1 | 039-3 | 039-3 |
|---|---|---|---|---|---|---|---|---|
| Si | 7.519 | 7.565 | 7.539 | 7.498 | 6.532 | 6.554 | 6.428 | 6.545 |
| Ti | .029 | .027 | .036 | .027 | - | - | - | - |
| $Al^{IV}$ | .481 | .435 | .461 | .502 | 1.468 | 1.446 | 1.572 | 1.455 |
| $Al^{VI}$ | .096 | .104 | .124 | .106 | .235 | .134 | .207 | .224 |
| $Fe^{3+}$ | .264 | .210 | .191 | .261 | .694 | .717 | .639 | .566 |
| $Fe^{2+}$ | 1.467 | 1.507 | 1.467 | 1.359 | 1.850 | 1.847 | 1.973 | 1.876 |
| Mn | .049 | .058 | .045 | .047 | .058 | .067 | .066 | .061 |
| Mg | 3.079 | 3.080 | 3.137 | 3.188 | 2.163 | 2.235 | 2.115 | 2.273 |
| Ca | 1.723 | 1.761 | 1.746 | 1.745 | 1.858 | 1.888 | 1.926 | 1.873 |
| $Na_A$ | .201 | .185 | .227 | .204 | .354 | .382 | .459 | .455 |
| $Na_B$ | .277 | .239 | .255 | .255 | .142 | .112 | .074 | .127 |
| K | .102 | .090 | .086 | .100 | .282 | .279 | .304 | .302 |
| Other | .016 | .013 | - | .012 | - | - | - | - |

* Excludes any Mn, $Fe^{2+}$ and Mg from the B site, eliminating any cummingtonite component

TABLE 5.3.4 : KURNALPI WHOLE ROCK AND TRACE ELEMENT GEOCHEMISTRY

| | 024 | 025 | 026 | 027 | 028 | 029 | 030 | 031 | 032 | 033 |
|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 68.92 | 71.00 | 75.23 | 71.43 | 68.93 | 70.32 | 70.18 | 71.59 | 71.99 | 71.92 |
| $TiO_2$ | 0.41 | 0.27 | 0.03 | 0.27 | 0.26 | 0.22 | 0.16 | 0.05 | 0.07 | 0.07 |
| $Al_2O_3$ | 16.06 | 15.74 | 14.00 | 15.84 | 15.31 | 14.90 | 15.39 | 15.01 | 15.21 | 15.25 |
| $Fe_2O_3$ | 1.20 | 0.97 | 0.20 | 1.54 | 1.66 | 1.50 | 1.18 | 0.68 | 1.02 | 0.66 |
| FeO | 1.07 | 0.60 | 0.20 | na | 0.56 | 0.56 | 0.27 | 0.19 | na | 0.17 |
| MnO | 0.05 | 0.02 | 0.02 | nd | 0.05 | 0.03 | 0.02 | 0.01 | 0.04 | 0.03 |
| MgO | 0.95 | 0.43 | 0.01 | 0.52 | 1.03 | 0.80 | 0.35 | 0.03 | 0.06 | 0.04 |
| CaO | 1.95 | 1.82 | 0.66 | 1.82 | 1.88 | 1.54 | 1.07 | 0.73 | 0.56 | 0.61 |
| $Na_2O$ | 5.14 | 5.29 | 4.85 | 5.18 | 5.54 | 5.52 | 6.10 | 6.20 | 6.34 | 6.36 |
| $K_2O$ | 3.64 | 2.69 | 4.06 | 2.76 | 3.30 | 3.32 | 4.33 | 4.39 | 4.50 | 4.38 |
| $P_2O_5$ | 0.21 | 0.08 | nd | 0.27 | 0.44 | 0.13 | 0.03 | 0.01 | 0.01 | 0.01 |
| LOI | 0.68 | 0.52 | 0.44 | 0.54 | 0.59 | 0.56 | 0.23 | 0.57 | 0.40 | 0.50 |
| TOTAL | 100.28 | 99.42 | 99.70 | 99.98 | 99.55 | 99.40 | 99.31 | 99.45 | 100.20 | 99.99 |
| | | | | | | | | | | |
| Sc | 3.6 | 3 | 1.7 | 3.1 | 4.5 | 4 | 1.3 | nd | 0.6 | 0.2 |
| V | 30 | 19 | 5 | 21 | 35 | 31 | 14 | 10 | 10 | 8 |
| Cr | <5 | 6 | <5 | <5 | 31 | 28 | 7 | <5 | <5 | <5 |
| Ni | 4 | 3 | 3 | 4 | 18 | 14 | 3 | 2 | 2 | 2 |
| Cu | 8 | 8 | 6 | 8 | 4 | 3 | 4 | 3 | 2 | 3 |
| Pb | 23 | 17 | 33 | 18 | 19 | 22 | 21 | 19 | 15 | 18 |
| Zn | 64 | 52 | 11 | 52 | 60 | 52 | 42 | 39 | 46 | 41 |
| Ga | 21 | 23 | 30 | 22 | 25 | 25 | 27 | 22 | 25 | 23 |
| Rb | 105 | 84 | 170 | 85 | 103 | 123 | 106 | 113 | 126 | 114 |
| Sr | 1193 | 559 | 80 | 551 | 1164 | 968 | 1132 | 732 | 782 | 680 |
| Y | 7.9 | 3.5 | 1.8 | 0.9 | 10.6 | 4.4 | 14.8 | 2.7 | 3.4 | 3.1 |
| Zr | 179 | 120 | 63 | 120 | 122 | 112 | 137 | 120 | 155 | 123 |
| Nb | 4.1 | 3.2 | 0.6 | 2.2 | 4.5 | 3.8 | 3.9 | 2.7 | 4.3 | 4.1 |
| Ba | 1897 | 822 | 85 | 870 | 1414 | 1120 | 1931 | 1112 | 1173 | 1181 |
| La | 115 | 21 | 14 | 10 | 44 | 26 | 73 | 20 | 6 | 6 |
| Ce | 139 | 36 | 18 | 28 | 67 | 42 | 95 | 31 | 20 | 15 |
| Nd | 68 | 9 | 7 | 7 | 33 | 13 | 39 | 5 | 1 | 2 |
| Th | 16 | 7 | 12 | 7 | 11 | 10 | 19 | 11 | 19 | 14 |
| U | 2 | 4 | 3 | 2 | 2 | 2 | 4 | 6 | 8 | 2 |
| F | 900 | 600 | 200 | na | 850 | 650 | 250 | 200 | na | 250 |

Major elements wt.%, trace elements p.p.m.
na = no analysis , nd = not detected

024 - GRANITE, 17 km ENE GILGARNA
025,027 - GRANITE, YINDI ROCK
026 - ALKALI FELDSPAR GRANITE (APLITE), YINDI ROCK
028,029 - PORPHYRITIC HORNBLENDE GRANITE, BULYAIRDIE ROCKS
030 - QUARTZ MONZONITE/SYENITE, ROADSIDE WEST MARGIN LAKE ROE
031-033 QUARTZ SYENITE/ALKALI GRANITE, CARDUNIA ROCKS

TABLE 5.3.4 cont...

| | 034 | 035 | 036 | 037 | 038 | 039 | 041 | 042 | 043 |
|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 71.65 | 71.30 | 69.78 | 68.67 | 69.08 | 69.16 | 49.83 | 68.59 | 68.97 |
| $TiO_2$ | 0.06 | 0.08 | 0.24 | 0.24 | 0.22 | 0.25 | 0.95 | 0.27 | 0.25 |
| $Al_2O_3$ | 14.90 | 15.16 | 15.62 | 15.42 | 15.67 | 15.42 | 13.88 | 15.98 | 15.66 |
| $Fe_2O_3$ | 0.93 | 1.16 | 1.26 | 1.80 | 1.71 | 1.42 | 13.25 | 1.96 | 1.58 |
| FeO | na | na | 0.44 | na | na | 0.32 | na | na | 0.32 |
| MnO | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.25 | 0.04 | 0.06 |
| MgO | 0.08 | 0.12 | 0.53 | 0.52 | 0.42 | 0.50 | 6.76 | 0.40 | 0.42 |
| CaO | 0.74 | 0.80 | 1.19 | 1.83 | 1.15 | 1.46 | 6.98 | 0.81 | 1.08 |
| $Na_2O$ | 6.22 | 6.17 | 5.13 | 5.08 | 5.31 | 5.06 | 4.55 | 5.26 | 5.16 |
| $K_2O$ | 4.31 | 4.47 | 5.10 | 5.05 | 5.06 | 4.99 | 2.02 | 5.11 | 5.22 |
| $P_2O_5$ | nd | 0.01 | 0.08 | 0.09 | 0.08 | 0.08 | 0.07 | 0.10 | 0.09 |
| LOI | 0.55 | 0.43 | 0.43 | 0.80 | 0.40 | 0.56 | 0.87 | 0.52 | 0.48 |
| TOTAL | 99.45 | 99.73 | 99.83 | 99.50 | 99.13 | 99.26 | 99.35 | 99.03 | 99.27 |
| Sc | 0.6 | 0.6 | 2.9 | 3.2 | 2.8 | 2.1 | 43.8 | 3.1 | 2.9 |
| V | 8 | 6 | 23 | 22 | 21 | 22 | 283 | 32 | 22 |
| Cr | <5 | <5 | 5 | 5 | 9 | 6 | 162 | <5 | 9 |
| Ni | 1 | 3 | 11 | 9 | 11 | 8 | 70 | 12 | 8 |
| Cu | 2 | 3 | 8 | 5 | 9 | 10 | 60 | 8 | 9 |
| Pb | 19 | 31 | 36 | 32 | 34 | 34 | 17 | 31 | 34 |
| Zn | 40 | 45 | 61 | 55 | 59 | 58 | 220 | 70 | 54 |
| Ga | 23 | 22 | 21 | 20 | 21 | 20 | 17 | 20 | 20 |
| Rb | 110 | 183 | 180 | 177 | 179 | 178 | 151 | 211 | 202 |
| Sr | 689 | 504 | 1049 | 1080 | 1057 | 1060 | 650 | 1064 | 1080 |
| Y | 2.2 | 4.2 | 7.7 | 6.1 | 9.3 | 7.1 | 17.1 | 27.2 | 8.8 |
| Zr | 111 | 142 | 200 | 201 | 194 | 201 | 78 | 219 | 231 |
| Nb | 2.6 | 4.2 | 5.1 | 6.2 | 5 | 5 | 3.3 | 6.4 | 6.1 |
| Ba | 972 | 1309 | 1922 | 2042 | 1904 | 1981 | 325 | 2393 | 2449 |
| La | 10 | 20 | 59 | 63 | 58 | 63 | 22 | 167 | 66 |
| Ce | 23 | 23 | 90 | 90 | 90 | 92 | 37 | 231 | 98 |
| Nd | 4 | 3 | 27 | 27 | 23 | 31 | 13 | 130 | 29 |
| Th | 9 | 18 | 22 | 21 | 22 | 20 | 6 | 23 | 24 |
| U | 3 | 2 | 3 | 5 | 4 | na | na | na | na |
| F | na | na | 300 | na | na | 750 | na | na | 550 |

Major elements wt.%, trace elements p.p.m.
na = no analysis , nd = not detected

034-035 QUARTZ SYENITE/ALKALI GRANITE, CARDUNIA ROCKS
036-039 ALKALI FELDSPAR GRANITE/ADAMELLITE, DINGO ROCK
041 - MAFIC XENOLITH, DINGO ROCK
042 - ALKALI FELDSPAR GRANITE/QUARTZ SYENITE, DINGO ROCK
043 - ALKALI FELDSPAR GRANITE/QUARTZ SYENITE, 7.5 KM E KARONIE-TRANSLINE

TABLE 5.3.5 : KURNALPI CIPW NORMS

| | 036 | 037 | 038 | 039 | 042 | 043 | 041 | 031 | 032 | 033 |
|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 64.44 | 63.84 | 64.19 | 64.36 | 63.82 | 64.08 | 46.45 | 66.02 | 65.72 | 65.84 |
| $TiO_2$ | 0.17 | 0.17 | 0.16 | 0.17 | 0.19 | 0.17 | 0.67 | 0.03 | 0.05 | 0.05 |
| $Al_2O_3$ | 17.00 | 16.89 | 17.14 | 16.91 | 17.52 | 17.15 | 15.25 | 16.31 | 16.36 | 16.45 |
| $Fe_2O_3$ | 0.88 | 0.98 | 0.88 | 0.99 | 1.07 | 1.10 | 4.65 | 0.47 | 0.54 | 0.45 |
| FeO | 0.34 | 0.34 | 0.31 | 0.25 | 0.37 | 0.25 | 5.74 | 0.15 | 0.19 | 0.13 |
| MnO | 0.02 | 0.02 | 0.01 | 0.02 | 0.03 | 0.05 | 0.20 | 0.01 | 0.03 | 0.02 |
| MgO | 0.73 | 0.72 | 0.65 | 0.69 | 0.55 | 0.58 | 9.39 | 0.04 | 0.08 | 0.05 |
| CaO | 1.17 | 1.82 | 1.14 | 1.46 | 0.80 | 1.07 | 6.97 | 0.72 | 0.55 | 0.60 |
| $Na_2O$ | 9.19 | 9.16 | 9.51 | 9.14 | 9.49 | 9.29 | 8.22 | 11.08 | 11.23 | 11.29 |
| $K_2O$ | 6.01 | 5.99 | 5.95 | 5.93 | 6.07 | 6.18 | 2.40 | 5.16 | 5.24 | 5.11 |
| $P_2O_5$ | 0.06 | 0.07 | 0.05 | 0.06 | 0.08 | 0.07 | 0.05 | 0.01 | 0.01 | 0.01 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | | | | | | | | | | |
| Ap | 0.18 | 0.20 | 0.15 | 0.18 | 0.22 | 0.20 | 0.15 | 0.02 | 0.02 | 0.02 |
| Il | 0.46 | 0.45 | 0.44 | 0.48 | 0.51 | 0.48 | 1.75 | 0.10 | 0.13 | 0.13 |
| Mt | 0.83 | 0.83 | 0.66 | 0.41 | 0.90 | 0.51 | 9.29 | 0.50 | 0.73 | 0.45 |
| Or | 30 | 30 | 30 | 30 | 30 | 31 | 12 | 26 | 27 | 26 |
| Ab | 44 | 43 | 45 | 43 | 45 | 44 | 30 | 53 | 53 | 54 |
| An | 4.56 | 4.36 | 4.20 | 4.61 | 3.35 | 4.20 | 11 | 0.18 | - | 0.12 |
| Di | 0.75 | 3.21 | 0.98 | 1.92 | - | 0.52 | 19 | 0.19 | 0.37 | 0.25 |
| Hy | 0.67 | - | 0.51 | 0.31 | 0.66 | 0.56 | - | - | - | - |
| Ac | - | - | - | - | - | - | - | - | 0.46 | - |
| Ol | - | - | - | - | - | - | 13 | - | - | - |
| Ne | - | - | - | - | - | - | 3.76 | - | - | - |
| C | - | - | - | - | 1.12 | - | - | - | - | - |
| Q | 188 | 166 | 177 | 177 | 166 | 177 | -- | 188 | 177 | 188 |
| Hm | 0.70 | 0.84 | 0.83 | 1.15 | 0.91 | 1.24 | - | 0.34 | 0.13 | 0.36 |
| Wo | - | 0.22 | - | - | - | - | - | 1.32 | 0.96 | 1.07 |
| Total | 100 | 99 | 99 | 99 | 99 | 99 | 99 | 99 | 100 | 100 |
| | | | | | | | | | | |
| A | 81 | 80 | 82 | 81 | 80 | 81 | 23 | 92 | 90 | 92 |
| M | 4.21 | 4.11 | 3.72 | 4.01 | 3.09 | 3.26 | 24 | 0.26 | 0.50 | 0.34 |
| F | 15 | 16 | 14 | 15 | 17 | 16 | 52 | 8.18 | 9.38 | 7.73 |
| Q | 54 | 54 | 54 | 54 | 54 | 54 | 47 | 54 | 54 | 54 |
| M | 2.54 | 3.65 | 2.52 | 2.97 | 2.52 | 2.62 | 27 | 1.57 | 1.77 | 1.49 |
| L | 44 | 43 | 44 | 43 | 44 | 44 | 26 | 44 | 44 | 45 |
| PALI | 1.04 | 1.00 | 1.03 | 1.02 | 1.07 | 1.04 | 0.87 | 0.96 | 0.96 | 0.97 |
| PAKI | 1.12 | 1.12 | 1.11 | 1.12 | 1.13 | 1.11 | 1.43 | 1.00 | 0.99 | 1.00 |
| AI | 0.89 | 0.90 | 0.90 | 0.89 | 0.89 | 0.90 | 0.70 | 1.00 | 1.01 | 1.00 |
| PMI | 1.42 | 1.42 | 1.45 | 1.41 | 1.46 | 1.45 | 1.37 | 1.48 | 1.50 | 1.50 |

TABLE 5.3.5 cont...

| | 034 | 035 | 024 | 025 | 026 | 027 | 028 | 029 | 030 |
|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 66.06 | 65.48 | 63.65 | 66.15 | 70.05 | 66.09 | 63.94 | 65.37 | 64.62 |
| $TiO_2$ | 0.04 | 0.06 | 0.28 | 0.19 | 0.02 | 0.19 | 0.18 | 0.15 | 0.11 |
| $Al_2O_3$ | 16.19 | 16.41 | 17.48 | 17.28 | 15.36 | 17.28 | 16.74 | 16.32 | 16.70 |
| $Fe_2O_3$ | 0.51 | 0.63 | 0.83 | 0.68 | 0.14 | 0.64 | 1.16 | 1.05 | 0.82 |
| FeO | 0.18 | 0.22 | 0.83 | 0.47 | 0.16 | 0.53 | 0.43 | 0.44 | 0.21 |
| MnO | 0.02 | 0.02 | 0.04 | 0.02 | 0.02 | - | 0.04 | 0.02 | 0.02 |
| MgO | 0.11 | 0.16 | 1.31 | 0.60 | 0.01 | 0.72 | 1.42 | 1.11 | 0.48 |
| CaO | 0.73 | 0.78 | 1.93 | 1.82 | 0.66 | 1.80 | 1.87 | 1.54 | 1.05 |
| $Na_2O$ | 11.11 | 10.99 | 9.20 | 9.55 | 8.76 | 9.29 | 9.96 | 9.95 | 10.89 |
| $K_2O$ | 5.06 | 5.24 | 4.29 | 3.19 | 4.83 | 3.25 | 3.91 | 3.94 | 5.09 |
| $P_2O_5$ | - | 0.01 | 0.16 | 0.06 | - | 0.21 | 0.34 | 0.10 | 0.02 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | | | | | | | | | |
| Ap | - | 0.02 | 0.46 | 0.17 | - | 0.58 | 0.97 | 0.29 | 0.07 |
| Il | 0.11 | 0.15 | 0.78 | 0.51 | 0.06 | 0.50 | 0.50 | 0.42 | 0.30 |
| Mt | 0.63 | 0.76 | 1.76 | 1.22 | 0.29 | 1.33 | 1.23 | 1.28 | 0.47 |
| Or | 26 | 26 | 22 | 16 | 24 | 16 | 20 | 20 | 26 |
| Ab | 53 | 52 | 44 | 45 | 41 | 43 | 47 | 47 | 52 |
| An | 0.03 | 0.46 | 8.38 | 8.50 | 3.26 | 7.18 | 6.52 | 6.10 | 1.83 |
| Di | 0.49 | 0.74 | - | - | - | - | - | 0.69 | 2.15 |
| Hy | - | - | 1.72 | 0.70 | 0.09 | 0.86 | 1.70 | 1.14 | - |
| Ac | - | - | - | - | - | - | - | - | - |
| Ol | - | - | - | - | - | - | - | - | - |
| Ne | - | - | - | - | - | - | - | - | - |
| C | - | - | 1.25 | 2.02 | 0.86 | 3.30 | 0.50 | - | - |
| Q | 18 | 17 | 20 | 26 | 30 | 26 | 20 | 22 | 16 |
| Hm | 0.30 | 0.39 | - | 0.13 | - | - | 0.83 | 0.63 | 0.86 |
| Wo | 1.29 | 1.09 | - | - | - | - | - | - | 0.36 |
| Total | 99 | 100 | 100 | 99 | 100 | 100 | 99 | 99 | 99 |
| | | | | | | | | | |
| A | 90 | 88 | 72 | 79 | 95 | 78 | 72 | 75 | 84 |
| M | 0.69 | 1.00 | 7.83 | 4.27 | 0.11 | 5.11 | 8.39 | 6.74 | 2.83 |
| F | 8.92 | 11 | 20 | 17 | 4.52 | 17 | 20 | 19 | 13 |
| Q | 54 | 54 | 54 | 56 | 57 | 56 | 54 | 55 | 54 |
| M | 1.80 | 2.08 | 3.20 | 2.02 | 0.34 | 2.07 | 3.21 | 3.04 | 2.73 |
| L | 44 | 44 | 42 | 42 | 43 | 42 | 42 | 42 | 44 |
| PALI | 0.96 | 0.96 | 1.13 | 1.19 | 1.08 | 1.20 | 1.06 | 1.06 | 0.98 |
| PAKI | 1.00 | 1.01 | 1.30 | 1.36 | 1.13 | 1.38 | 1.21 | 1.17 | 1.05 |
| AI | 1.00 | 0.99 | 0.77 | 0.74 | 0.88 | 0.73 | 0.83 | 0.85 | 0.96 |
| PMI | 1.47 | 1.49 | 1.27 | 1.16 | 1.16 | 1.14 | 1.30 | 1.28 | 1.48 |

PALI = Peraluminous index $Al_2O_3$ / ( CaO + $Na_2O$ + $K_2O$ )
>1 = peraluminous, <1 = metaluminous

PAKI = Peralkaline index $Al_2O_3$ / ( $Na_2O$ + $K_2O$ )
<1 = peralkaline

AI = Agpaitic index ( $Na_2O$ + $K_2O$ ) / $Al_2O_3$
>1 = agpaitic

PMI = plumaskitic index 6 ( $Na_2O$ + $K_2O$ ) / $SiO_2$
<1 = plumaskitic, >1 = miaskitic

TABLE 5.4.1 : EDJUDINA REPRESENTATIVE FELDSPAR ANALYSES

| | 061-1 | 061-5 | 067-2 | 067-2 | 072-4 | 072-8 | 077-1 | 077-5 |
|---|---|---|---|---|---|---|---|---|
| wt% | PLAG | KSP | PLAG | PLAG | PLAG | KSP | PERTH EXS | PERTH HOST |
| $SiO_2$ | 68.18 | 65.96 | 65.90 | 66.09 | 69.83 | 64.86 | 69.26 | 65.73 |
| $Al_2O_3$ | 20.17 | 18.01 | 21.45 | 21.35 | 19.29 | 17.86 | 19.39 | 17.86 |
| FeO* | - | - | - | - | - | - | - | - |
| MnO | - | - | - | - | - | - | - | - |
| MgO | 0.12 | - | 0.12 | - | 0.10 | - | 0.09 | - |
| CaO | 1.08 | - | 2.77 | 2.71 | - | - | 0.19 | - |
| $Na_2O$ | 9.78 | 0.43 | 9.24 | 9.18 | 10.22 | 0.23 | 10.41 | - |
| $K_2O$ | 0.08 | 16.91 | 0.14 | 0.16 | 0.15 | 17.38 | 0.12 | 16.86 |
| Other | 0.07 | - | 0.05 | - | - | - | - | - |
| TOTAL | 99.48 | 101.31 | 99.67 | 99.49 | 99.59 | 100.33 | 99.46 | 100.45 |

Structural formulae on the basis of 8(O)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Si | 2.982 | 3.016 | 2.898 | 2.908 | 3.038 | 3.006 | 3.023 | 3.026 |
| Al | 1.040 | .971 | 1.112 | 1.107 | .989 | .975 | .997 | .969 |
| Fe(tot) | - | - | - | - | - | - | - | - |
| Mn | - | - | - | - | - | - | - | - |
| Mg | .008 | - | .008 | - | .006 | - | .006 | - |
| Ca | .051 | - | .131 | .128 | - | - | .009 | - |
| Na | .829 | .038 | .788 | .783 | .863 | .020 | .881 | - |
| K | .005 | .987 | .008 | .009 | .008 | 1.028 | .007 | .990 |
| Other | .005 | - | .004 | - | - | - | - | - |

TABLE 5.4.1 cont...

| wt% | 078-1 | 078-2 | 203-1 | 203-1 | 203-1 | 203-1 | 203-1 | 203-1 |
|---|---|---|---|---|---|---|---|---|
| | KSP | PLAG BLEB | PERTH HOST | PERTH EXS | ZONED RIM......... | | ...TOWARDS | CORE |
| $SiO_2$ | 65.25 | 67.74 | 66.26 | 69.55 | 68.22 | 66.12 | 67.69 | 67.66 |
| $Al_2O_3$ | 17.69 | 20.31 | 18.17 | 19.19 | 20.31 | 21.71 | 20.44 | 20.15 |
| FeO* | - | - | - | 0.20 | - | - | 0.20 | - |
| MnO | - | - | - | - | - | - | 0.12 | - |
| MgO | - | - | - | - | 0.10 | - | 0.14 | 0.12 |
| CaO | 0.38 | 1.21 | - | 0.07 | 0.83 | 2.83 | 1.46 | 1.32 |
| $Na_2O$ | 0.32 | 9.54 | 0.30 | 10.42 | 9.99 | 8.94 | 9.82 | 9.95 |
| $K_2O$ | 16.54 | 0.17 | 17.15 | 0.14 | 0.14 | 0.08 | 0.11 | 0.14 |
| Other | - | - | - | - | - | - | - | - |
| TOTAL | 100.18 | 98.97 | 101.88 | 99.57 | 99.59 | 99.68 | 99.98 | 99.34 |

Structural formula based on 8(O)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Si | 3.017 | 2.977 | 3.014 | 3.033 | 2.980 | 2.900 | 2.957 | 2.970 |
| Al | .964 | 1.052 | .974 | .986 | 1.045 | 1.123 | 1.052 | 1.043 |
| Fe(tot) | - | - | - | .007 | - | - | .007 | - |
| Mn | - | - | - | - | - | - | .004 | - |
| Mg | - | - | - | - | .006 | - | .009 | .008 |
| Ca | .019 | .057 | - | .003 | .039 | .133 | .068 | .062 |
| Na | .029 | .813 | .026 | .881 | .846 | .760 | .831 | .847 |
| K | .975 | .010 | .995 | .008 | .008 | .005 | .006 | .008 |
| Other | - | - | - | - | - | - | - | - |

TABLE 5.4.1 cont...

| wt% | 203-1 ZONED CORE | 203-8 PERTH HOST | 203-8 PERTH EXS | 200-2 PLAG | 200-4 MICRO | 200-5 PLAG RIM | 200-5 PLAG CORE |
|---|---|---|---|---|---|---|---|
| $SiO_2$ | 69.27 | 66.02 | 68.58 | 65.07 | 64.97 | 64.90 | 63.28 |
| $Al_2O_3$ | 19.66 | 18.35 | 19.51 | 21.72 | 17.92 | 21.07 | 21.74 |
| FeO* | - | - | 0.26 | 0.17 | - | - | - |
| MnO | - | - | - | - | - | - | - |
| MgO | 0.15 | - | - | 0.18 | - | 0.11 | 0.09 |
| CaO | 1.17 | - | 0.28 | 3.38 | - | 2.38 | 3.93 |
| $Na_2O$ | 8.58 | 2.09 | 9.78 | 8.69 | 0.33 | 9.37 | 8.40 |
| $K_2O$ | 0.15 | 13.92 | 1.06 | 0.26 | 16.65 | 0.20 | 0.13 |
| Other | - | - | - | 0.12 | - | 0.13 | - |
| TOTAL | 98.98 | 100.38 | 99.47 | 99.59 | 99.87 | 98.16 | 97.57 |

Structural formulae based on 8(O)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Si | 3.025 | 3.012 | 3.009 | 2.871 | 3.012 | 2.898 | 2.851 |
| Al | 1.012 | .986 | 1.009 | 1.130 | .979 | 1.109 | 1.154 |
| Fe(tot) | - | - | .010 | .006 | - | - | - |
| Mn | - | - | - | - | - | - | - |
| Mg | .010 | - | - | .012 | - | .007 | .006 |
| Ca | .055 | - | .013 | .160 | - | .114 | .190 |
| Na | .726 | .185 | .832 | .744 | .030 | .812 | .734 |
| K | .009 | .810 | .059 | .015 | .985 | .012 | .008 |
| Other | - | - | - | .004 | - | .005 | - |

FeO* = total iron; PERTH = perthite; EXS = exsolution; MICRO = microcline.

TABLE 5.4.2 : EDJUDINA REPRESENTATIVE PYROXENE ANALYSES

| | 067-1 | 067-1 | 067-3 | 067-3 | 072-1 | 072-1 | 077-1 | 077-1 | 077-12 | 077-12 |
|---|---|---|---|---|---|---|---|---|---|---|
| wt% | RIM | CORE | RIM | CORE | RIM | CORE | RIM | CORE | RIM | CORE |
| $SiO_2$ | 53.12 | 53.06 | 53.45 | 53.24 | 53.60 | 53.58 | 51.64 | 50.05 | 49.99 | 52.57 |
| $TiO_2$ | - | - | - | - | - | - | - | 0.41 | 0.13 | 0.18 |
| $Al_2O_3$ | 0.85 | 0.74 | 0.49 | 0.73 | 0.38 | 0.34 | 0.60 | 1.85 | 1.59 | 2.04 |
| $Fe_2O_3$ | 0.28 | - | - | 0.59 | 1.78 | 1.29 | 5.57 | 4.65 | 5.16 | 2.26 |
| FeO | 12.08 | 12.76 | 12.64 | 12.01 | 12.47 | 11.86 | 19.18 | 13.79 | 15.06 | 8.65 |
| MnO | 0.58 | 0.65 | 0.53 | 0.62 | 0.15 | 0.26 | 0.77 | 0.54 | 0.70 | 0.29 |
| MgO | 10.29 | 10.11 | 10.23 | 10.46 | 9.24 | 9.86 | 3.60 | 6.73 | 5.67 | 11.37 |
| CaO | 22.55 | 22.16 | 22.91 | 22.76 | 21.11 | 22.19 | 17.33 | 21.57 | 19.69 | 22.76 |
| $Na_2O$ | 0.78 | 0.75 | 0.68 | 0.69 | 1.72 | 1.29 | 2.84 | 1.36 | 1.90 | 1.01 |
| $K_2O$ | - | - | - | - | - | - | - | - | - | - |
| Other | - | - | - | - | 0.15 | - | - | - | - | - |
| TOTAL | 100.53 | 100.23 | 100.93 | 101.10 | 100.60 | 100.67 | 101.53 | 100.95 | 99.89 | 101.13 |

Structural formulae on the basis of 6(O)
Cation total recalculated to 4

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Si | 2.006 | 2.013 | 2.014 | 2.001 | 2.027 | 2.021 | 2.012 | 1.929 | 1.955 | 1.955 |
| Ti | - | - | - | - | - | - | - | .012 | .004 | .005 |
| Al | .038 | .033 | .022 | .032 | .017 | .015 | .028 | .084 | .074 | .089 |
| $Fe^{3+}$ | .008 | - | - | .017 | .051 | .037 | .163 | .135 | .152 | .063 |
| $Fe^{2+}$ | .382 | .405 | .398 | .378 | .394 | .374 | .625 | .444 | .493 | .269 |
| Mn | .018 | .021 | .017 | .020 | .005 | .008 | .025 | .018 | .023 | .009 |
| Mg | .579 | .572 | .575 | .586 | .521 | .554 | .209 | .386 | .331 | .630 |
| Ca | .912 | .901 | .925 | .917 | .855 | .897 | .723 | .891 | .825 | .907 |
| Na | .057 | .055 | .049 | .051 | .126 | .094 | .215 | .101 | .144 | .073 |
| K | - | - | - | - | - | - | - | - | - | - |
| Other | - | - | - | - | .005 | - | - | - | - | - |

**TABLE 5.4.3 : EDJUDINA REPRESENTATIVE AMPHIBOLE ANALYSES**

| wt% | 067-1 | 067-1 | 067-4 | 067-4 | 067-7 | 067-7 | 072-1 | 072-1 | 072-4 | 072-5 | 077-3 | 078-1 | 078-1 | 203-3 | 203-3 | 203-4 | 203-4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RIM | CORE | RIM | CORE | RIM | CORE | RIM | CORE | RIM | CORE | BLEB | | | RIM | CORE | RIM | CORE |
| $SiO_2$ | 43.88 | 44.67 | 52.06 | 52.06 | 43.21 | 51.15 | 53.88 | 53.89 | 53.75 | 53.06 | 43.53 | 45.40 | 44.53 | 51.53 | 51.83 | 51.79 | 51.19 |
| $TiO_2$ | - | - | - | - | - | - | - | - | - | - | 0.99 | 0.28 | - | - | 0.48 | 0.40 | 0.48 |
| $Al_2O_3$ | 8.69 | 7.52 | 3.05 | 3.24 | 8.08 | 3.17 | 1.35 | 1.34 | 1.45 | 1.81 | 8.56 | 6.94 | 8.00 | 3.59 | 3.36 | 3.52 | 3.28 |
| $Fe_2O_3$ | 5.77 | 4.93 | - | - | 5.75 | 0.99 | 1.33 | 1.19 | 0.87 | 1.93 | 2.85 | 5.55 | 4.92 | 3.76 | 2.83 | 3.33 | 2.64 |
| FeO | 17.22 | 17.29 | 16.14 | 16.47 | 18.34 | 17.69 | 14.67 | 14.78 | 15.68 | 15.23 | 15.61 | 17.23 | 16.63 | 11.02 | 11.69 | 11.12 | 12.07 |
| MnO | 0.58 | 0.53 | 0.68 | 0.56 | 0.71 | 0.60 | 0.18 | 0.22 | 0.25 | 0.23 | 0.39 | 1.11 | 1.02 | 0.68 | 0.88 | 0.80 | 0.53 |
| MgO | 8.38 | 8.63 | 12.65 | 12.55 | 7.37 | 11.25 | 13.44 | 13.51 | 13.28 | 12.84 | 10.22 | 8.99 | 8.91 | 14.27 | 14.34 | 14.02 | 13.84 |
| CaO | 11.78 | 11.64 | 12.54 | 12.47 | 11.59 | 12.34 | 11.56 | 11.68 | 12.13 | 11.53 | 11.65 | 11.67 | 11.79 | 11.15 | 11.29 | 11.17 | 11.15 |
| $Na_2O$ | 1.23 | 1.11 | 0.45 | 0.44 | 1.00 | 0.64 | 0.64 | 0.66 | 0.51 | 0.79 | 1.92 | 1.24 | 1.31 | 1.42 | 1.59 | 1.10 | 1.25 |
| $K_2O$ | 1.05 | 0.86 | 0.17 | 0.21 | 1.09 | 0.27 | 0.19 | 0.21 | 0.24 | 0.22 | 0.87 | 1.31 | 1.34 | 0.42 | 0.46 | 0.41 | 0.51 |
| Other | - | - | 0.12 | - | - | - | - | - | - | - | - | - | 0.23 | - | - | - | - |
| TOTAL | 98.58 | 97.18 | 97.87 | 98.00 | 97.14 | 98.11 | 97.24 | 97.48 | 98.16 | 97.64 | 96.60 | 99.73 | 98.67 | 97.84 | 98.75 | 97.65 | 96.94 |

Structural formulae on the basis of 23(O)
*Cation total recalculated to 13, exclusive of K, Na and Ca

| | 067-1 | 067-1 | 067-4 | 067-4 | 067-7 | 067-7 | 072-1 | 072-1 | 072-4 | 072-5 | 077-3 | 078-1 | 078-1 | 203-3 | 203-3 | 203-4 | 203-4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Si | 6.644 | 6.831 | 7.648 | 7.640 | 6.688 | 7.582 | 7.877 | 7.868 | 7.831 | 7.775 | 6.648 | 6.806 | 6.734 | 7.457 | 7.471 | 7.512 | 7.512 |
| Ti | - | - | - | - | - | - | - | - | - | - | .114 | .032 | - | - | .052 | .043 | .053 |
| $Al^{IV}$ | 1.356 | 1.169 | .352 | .360 | 1.312 | .418 | .123 | .132 | .169 | .225 | 1.352 | 1.194 | 1.266 | .543 | .529 | .488 | .488 |
| $Al^{VI}$ | .195 | .187 | .176 | .200 | .163 | .135 | .109 | .099 | .079 | .088 | .188 | .031 | .160 | .068 | .042 | .115 | .080 |
| $Fe^{3+}$ | .657 | .567 | - | - | .670 | .111 | .147 | .131 | .095 | .213 | .328 | .627 | .559 | .409 | .307 | .363 | .292 |
| $Fe^{2+}$ | 2.181 | 2.212 | 1.983 | 2.022 | 2.374 | 2.194 | 1.793 | 1.804 | 1.910 | 1.867 | 1.994 | 2.160 | 2.103 | 1.333 | 1.410 | 1.349 | 1.481 |
| Mn | .074 | .068 | .084 | .069 | .094 | .075 | .022 | .027 | .031 | .028 | .050 | .141 | .131 | .083 | .107 | .098 | .065 |
| Mg | 1.892 | 1.966 | 2.770 | 2.746 | 1.700 | 2.485 | 2.930 | 2.884 | 2.884 | 2.804 | 2.327 | 2.009 | 2.009 | 3.076 | 3.081 | 3.031 | 3.028 |
| Ca | 1.944 | 1.936 | 1.973 | 1.961 | 1.955 | 1.965 | 1.818 | 1.834 | 1.898 | 1.820 | 1.922 | 1.905 | 1.938 | 1.747 | 1.758 | 1.753 | 1.767 |
| $Na_A$ | .310 | .106 | - | .124 | .261 | .148 | .002 | .020 | .045 | .047 | .497 | .271 | .327 | .148 | .207 | .064 | .124 |
| $Na_B$ | .056 | .064 | .129 | .002 | .045 | .035 | .182 | .166 | .102 | .180 | .078 | .095 | .062 | .253 | .242 | .247 | .233 |
| K | .206 | .335 | .032 | .039 | .219 | .051 | .036 | .039 | .044 | .041 | .170 | .255 | .262 | .079 | .086 | .077 | .096 |
| Other | - | - | .014 | - | - | - | - | - | - | - | - | - | .037 | - | - | - | - |

* Excludes any Mn, $Fe^{2+}$ and Mg from the B site, eliminating any cummingtonite component

TABLE 5.4.4 : EDJUDINA WHOLE ROCK AND TRACE ELEMENT GEOCHEMISTRY

| | 060 | 061 | 062 | 063 | 064 | 186 | 187 | 188 | 189 | 190 |
|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 73.87 | 74.75 | 69.94 | 65.45 | 64.78 | 60.40 | 70.43 | 60.01 | 63.88 | 69.05 |
| $TiO_2$ | 0.09 | 0.06 | 0.41 | 0.14 | 0.13 | 0.30 | 0.11 | 0.30 | 0.36 | 0.22 |
| $Al_2O_3$ | 14.41 | 13.99 | 15.32 | 16.59 | 16.97 | 12.30 | 15.12 | 12.40 | 17.15 | 15.84 |
| $Fe_2O_3$ | 0.65 | 0.42 | 1.88 | 1.01 | 1.94 | 5.68 | 1.54 | 5.41 | 2.46 | 1.92 |
| FeO | 0.19 | 0.17 | 0.54 | 1.16 | na | na | na | na | na | na |
| MnO | 0.06 | 0.03 | 0.04 | 0.11 | 0.06 | 0.14 | 0.05 | 0.20 | 0.07 | 0.06 |
| MgO | 0.24 | 0.20 | 0.98 | 1.35 | 0.77 | 2.78 | 0.91 | 2.64 | 0.94 | 0.77 |
| CaO | 0.62 | 0.97 | 2.01 | 4.60 | 2.51 | 9.02 | 3.31 | 7.96 | 2.93 | 2.85 |
| $Na_2O$ | 5.09 | 4.43 | 4.88 | 6.76 | 5.43 | 5.39 | 6.58 | 3.67 | 5.24 | 6.14 |
| $K_2O$ | 4.17 | 4.20 | 3.12 | 1.74 | 6.60 | 2.24 | 1.05 | 5.53 | 5.92 | 2.45 |
| $P_2O_5$ | 0.01 | 0.01 | 0.26 | 0.14 | 0.28 | 1.10 | 0.08 | 1.04 | 0.11 | 0.07 |
| LOI | 0.58 | 0.60 | 0.68 | 0.24 | 0.13 | 0.38 | 0.37 | 0.40 | 0.31 | 0.40 |
| TOTAL | 99.98 | 99.84 | 100.06 | 99.29 | 99.59 | 99.72 | 99.54 | 99.53 | 99.37 | 99.76 |
| Sc | 2.3 | 1.3 | 3.6 | 7.1 | 1.5 | 5.5 | 4.4 | 5.6 | 5.1 | 4.1 |
| V | 6 | 4 | 34 | 28 | 19 | 62 | 18 | 55 | 34 | 26 |
| Cr | <5 | <5 | 14 | 19 | <5 | <5 | 13 | <5 | 9 | 8 |
| Ni | 6 | nd | 9 | 11 | 2 | 7 | 9 | 9 | 8 | 6 |
| Cu | 13 | 5 | 7 | 14 | 8 | 18 | 60 | 12 | 38 | 11 |
| Pb | 22 | 22 | 23 | 12 | 9 | 7 | 10 | 7 | 17 | 13 |
| Zn | 17 | 25 | 65 | 48 | 32 | 99 | 35 | 108 | 45 | 40 |
| Ga | 18 | 18 | 22 | 20 | 20 | 16 | 18 | 14 | 18 | 19 |
| Rb | 121 | 138 | 98 | 24.9 | 93 | 24.1 | 16.7 | 73 | 96 | 39 |
| Sr | 288 | 287 | 967 | 867 | 1036 | 914 | 740 | 771 | 770 | 785 |
| Y | 11.1 | 6.7 | 6.8 | 6.1 | 10.4 | 22.8 | 4.6 | 24.2 | 11.4 | 4.3 |
| Zr | 85 | 66 | 185 | 59 | 158 | 130 | 38 | 62 | 130 | 94 |
| Nb | 7 | 3.9 | 4.8 | 3.1 | 12.8 | 21.7 | 2.8 | 16.2 | 15.3 | 7.8 |
| Ba | 1242 | 801 | 1197 | 481 | 1114 | 900 | 336 | 1172 | 3147 | 924 |
| La | 48 | 13 | 74 | 21 | 41 | 101 | 18 | 101 | 23 | 21 |
| Ce | 69 | 19 | 124 | 34 | 81 | 221 | 33 | 222 | 55 | 45 |
| Nd | 25 | 6 | 50 | 15 | 40 | 139 | 12 | 132 | 23 | 17 |
| Th | 9 | 4 | 14 | 6 | 10 | 10 | 2 | 3 | 4 | 6 |
| F | 250 | 250 | 950 | 350 | na | na | na | na | na | na |

Major elements wt.%, trace elements p.p.m.
na = no analysis , nd = not detected

061 - GRANITE DYKE, 12 km SOUTH-SOUTH-WEST EDJUDINA MINING CENTRE
062 - PORPHYRITIC GRANITE, 12 km SOUTH-SOUTH-WEST EDJUDINA MINING CENTRE
063 - MONZODIORITE, TWIN PEAKS SOUTH
064 - MONZONITE EXHIBITING MAFIC/FELSIC SCHLIEREN, TWIN PEAKS SOUTH
186,188 - SYENITE, TWIN PEAKS SOUTH
187 - QUARTZ MONZODIORITE, TWIN PEAKS SOUTH
189 - MONZONITE, TWIN PEAKS SOUTH
190 - QUARTZ MONZODIORITE, TWIN PEAKS SOUTH

TABLE 5.4.4 cont...

| | 191 | 193 | 194 | 195 | 065 | 066 | 067 | 069 | 070 | 196 |
|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 65.51 | 64.10 | 64.15 | 64.23 | 63.76 | 63.26 | 64.37 | 69.67 | 60.69 | 63.05 |
| $TiO_2$ | 0.31 | 0.37 | 0.71 | 0.59 | 0.53 | 0.49 | 0.21 | 0.27 | 0.31 | 0.31 |
| $Al_2O_3$ | 17.03 | 16.73 | 16.28 | 16.43 | 17.36 | 17.51 | 18.28 | 16.23 | 13.28 | 17.74 |
| $Fe_2O_3$ | 1.48 | 2.22 | 2.30 | 2.31 | 1.35 | 2.53 | 2.05 | 1.77 | 5.08 | 1.67 |
| FeO | 0.60 | na | na | na | 1.03 | na | na | na | na | 0.80 |
| MnO | 0.05 | 0.06 | 0.10 | 0.10 | 0.09 | 0.09 | 0.06 | 0.02 | 0.10 | 0.05 |
| MgO | 0.84 | 1.00 | 1.15 | 1.29 | 1.66 | 1.65 | 0.94 | 0.49 | 3.02 | 1.07 |
| CaO | 2.56 | 3.17 | 3.56 | 3.85 | 5.59 | 5.40 | 4.19 | 1.36 | 6.08 | 2.78 |
| $Na_2O$ | 5.31 | 5.34 | 5.99 | 4.14 | 6.49 | 6.48 | 7.52 | 7.46 | 3.51 | 6.07 |
| $K_2O$ | 5.79 | 5.82 | 4.84 | 4.97 | 1.13 | 1.60 | 1.16 | 1.77 | 7.16 | 4.92 |
| $P_2O_5$ | 0.10 | 0.13 | 0.13 | 0.15 | 0.17 | 0.18 | 0.15 | 0.09 | 0.36 | 0.10 |
| LOI | 0.48 | 0.55 | 0.47 | 0.43 | 0.56 | 0.40 | 0.32 | 0.28 | 0.22 | 0.50 |
| TOTAL | 100.05 | 99.47 | 99.67 | 98.48 | 99.73 | 99.58 | 99.24 | 99.40 | 99.80 | 99.06 |
| Sc | 3.4 | 4.7 | 5.1 | 6.5 | 11.4 | 10.7 | 6.4 | 2.6 | 11.5 | 5 |
| V | 26 | 31 | 33 | 35 | 40 | 40 | 27 | 22 | 70 | 38 |
| Cr | 9 | 8 | 6 | 15 | 20 | 21 | 17 | <5 | <5 | 15 |
| Ni | 8 | 6 | 13 | 15 | 13 | 16 | 11 | 4 | 14 | 9 |
| Cu | 18 | 18 | 13 | 16 | 40 | 49 | 6 | 33 | 14 | 91 |
| Pb | 47 | 78 | 27 | 9 | 12 | 14 | 14 | 14 | 15 | 18 |
| Zn | 43 | 44 | 61 | 64 | 55 | 53 | 43 | 43 | 59 | 56 |
| Ga | 20 | 19 | 20 | 19 | 22 | 21 | 22 | 22 | 18 | 25 |
| Rb | 113 | 98 | 97 | 87 | 11.7 | 18 | 21 | 33.3 | 137 | 86 |
| Sr | 849 | 853 | 834 | 827 | 893 | 924 | 1211 | 704 | 461 | 790 |
| Y | 9.9 | 10.9 | 26.6 | 19.4 | 18.4 | 17.7 | 5.4 | 8.7 | 16.1 | 15.3 |
| Zr | 126 | 81 | 50 | 27.5 | 47 | 42.2 | 46.2 | 159 | 226 | 260 |
| Nb | 19.6 | 20.7 | 46 | 14.5 | 11.5 | 9.2 | 4.2 | 6.2 | 16 | 20.2 |
| Ba | 2182 | 2151 | 1799 | 2118 | 606 | 1096 | 269 | 636 | 947 | 1308 |
| La | 42 | 43 | 61 | 47 | 63 | 63 | 22 | 13 | 33 | 30 |
| Ce | 75 | 79 | 124 | 94 | 104 | 109 | 43 | 31 | 76 | 85 |
| Nd | 25 | 40 | 68 | 49 | 48 | 47 | 19 | 13 | 44 | 26 |
| Th | 7 | 5 | 6 | 3 | 8 | 11 | 8 | 10 | 12 | 18 |
| F | 250 | na | na | na | 450 | na | na | na | na | 250 |

Major elements wt.%, trace elements p.p.m.
na = no analysis , nd = not detected

191-195 MONZONITE, TWIN PEAKS SOUTH
065-067 MONZODIORITE, TWIN PEAKS NORTH
069- QUARTZ MONZODIORITE, LAYERED FELSIC/MAFIC TWIN PEAKS NORTH
070- SYENODIORITE, LAYERED FELSIC/MAFIC TWIN PEAKS NORTH
196- MONZODIORITE, TWIN PEAKS NORTH

TABLE 5.4.4 cont...

| | 197 | 198 | 199 | 071 | 072 | 073 | 074 | 075 | 076 | 077 |
|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 65.74 | 66.50 | 63.99 | 72.85 | 59.52 | 64.04 | 66.98 | 69.31 | 58.24 | 64.07 |
| $TiO_2$ | 0.45 | 0.16 | 0.20 | 0.23 | 0.40 | 0.63 | 0.39 | 0.03 | 0.34 | 0.39 |
| $Al_2O_3$ | 16.84 | 17.22 | 17.72 | 12.52 | 11.41 | 16.85 | 16.49 | 17.11 | 8.22 | 15.29 |
| $Fe_2O_3$ | 2.06 | 2.04 | 2.43 | 1.79 | 2.65 | 2.17 | 2.19 | 0.24 | 4.62 | 2.44 |
| FeO | na | na | na | na | 3.01 | na | na | na | na | 1.06 |
| MnO | 0.05 | 0.09 | 0.09 | 0.05 | 0.13 | 0.05 | 0.05 | 0.01 | 0.08 | 0.08 |
| MgO | 1.13 | 1.19 | 1.49 | 0.83 | 3.84 | 1.01 | 1.03 | nd | 8.33 | 0.76 |
| CaO | 3.28 | 4.64 | 5.26 | 1.58 | 8.55 | 2.97 | 3.04 | 0.05 | 13.51 | 3.30 |
| $Na_2O$ | 5.04 | 6.72 | 6.95 | 4.68 | 3.57 | 6.80 | 6.17 | 4.96 | 3.36 | 5.54 |
| $K_2O$ | 4.45 | 1.01 | 1.05 | 4.48 | 5.02 | 4.46 | 2.63 | 8.26 | 3.18 | 5.36 |
| $P_2O_5$ | 0.11 | 0.11 | 0.14 | 0.17 | 0.59 | 0.17 | 0.13 | 0.01 | 0.22 | 0.21 |
| LOI | 0.44 | 0.48 | 0.38 | 0.20 | 0.70 | 0.30 | 0.27 | 0.13 | 0.12 | 1.04 |
| TOTAL | 99.57 | 100.14 | 99.69 | 99.38 | 99.38 | 99.44 | 99.37 | 100.11 | 100.21 | 99.53 |
| | | | | | | | | | | |
| Sc | 7.6 | 8.1 | 9.9 | 2.9 | 12 | 3.9 | 5.9 | nd | 28.2 | 4 |
| V | 40 | 34 | 43 | 22 | 117 | 44 | 41 | 1 | 83 | 51 |
| Cr | 16 | 19 | 19 | 15 | 31 | 6 | 14 | <5 | 178 | <5 |
| Ni | 12 | 14 | 14 | 8 | 36 | 11 | 10 | 2 | 46 | 6 |
| Cu | 11 | 20 | 14 | 17 | 116 | 22 | 16 | 12 | 9 | 12 |
| Pb | 18 | 12 | 13 | 12 | 6 | 6 | 15 | 7 | 3 | 24 |
| Zn | 44 | 45 | 50 | 43 | 45 | 32 | 52 | 3 | 44 | 91 |
| Ga | 19 | 22 | 23 | 17 | 13 | 19 | 21 | 22 | 13 | 25 |
| Rb | 73 | 12.7 | 13.4 | 97 | 107 | 79 | 45.8 | 183 | 54 | 179 |
| Sr | 820 | 913 | 942 | 324 | 1183 | 708 | 844 | 170 | 661 | 678 |
| Y | 7.4 | 3.6 | 4.5 | 6.5 | 17.2 | 10.4 | 9.3 | nd | 7.4 | 27.2 |
| Zr | 41 | 33 | 28.2 | 54 | 90 | 66 | 140 | 10.9 | 46.5 | 482 |
| Nb | 8.5 | 3.3 | 3.5 | 5.3 | 6.9 | 14.2 | 6.5 | 2.3 | 1.7 | 15 |
| Ba | 2624 | 304 | 296 | 683 | 1531 | 1147 | 776 | 489 | 936 | 966 |
| La | 29 | 22 | 23 | 30 | 91 | 51 | 32 | 7 | 37 | 96 |
| Ce | 153 | 34 | 33 | 54 | 177 | 91 | 61 | 11 | 77 | 154 |
| Nd | 28 | 11 | 14 | 26 | 105 | 48 | 26 | 1 | 42 | 74 |
| Th | 4 | 5 | 4 | 10 | 9 | 11 | 9 | 3 | 3 | 20 |
| F | na | na | na | na | 550 | na | na | na | na | 1275 |

Major elements wt.%, trace elements p.p.m.
na = no analysis , nd = not detected

197-199 MONZODIORITE, TWIN PEAKS NORTH
071- SYENITE, COMPLEX EASTERN MARGIN TWELVE MILE WELL
072,073 - COARSE SYENITE TWELVE MILE WELL
074 - SYENITE, WESTERN MARGIN TWELVE MILE WELL
075 - PEGMATITE TWELVE MILE WELL
076 - DOLERITE TWELVE MILE WELL
077 - SYENITE CEMENT WELL

TABLE 5.4.4 cont...

| | 078 | 079 | 080 | 081 | 082 | 203 | 200 | 201 | 083 | 084 | 085 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 61.27 | 70.77 | 68.13 | 67.10 | 72.30 | 66.33 | 72.21 | 75.98 | 66.99 | 71.66 | 66.83 |
| $TiO_2$ | 0.63 | 0.25 | 0.19 | 0.21 | 0.12 | 0.22 | 0.16 | 0.04 | 0.40 | 0.30 | 0.36 |
| $Al_2O_3$ | 17.16 | 14.88 | 16.45 | 16.56 | 14.92 | 16.63 | 14.86 | 13.39 | 18.54 | 15.81 | 17.74 |
| $Fe_2O_3$ | 2.95 | 2.10 | 2.08 | 1.91 | 1.45 | 2.01 | 0.90 | 0.52 | 0.27 | 1.08 | 0.21 |
| FeO | 1.59 | na | na | 0.54 | na | 0.41 | 0.27 | 0.06 | na | na | 0.04 |
| MnO | 0.10 | 0.04 | 0.09 | 0.08 | 0.05 | 0.04 | nd | 0.01 | 0.04 | 0.01 | 0.10 |
| MgO | 0.75 | 0.98 | 0.60 | 0.82 | 0.41 | 0.73 | 0.26 | nd | nd | 0.28 | 0.47 |
| CaO | 2.49 | 1.94 | 1.13 | 1.53 | 0.63 | 1.38 | 1.56 | 0.51 | 0.12 | 0.34 | 0.21 |
| $Na_2O$ | 5.21 | 5.33 | 6.44 | 5.97 | 5.39 | 6.18 | 4.71 | 4.39 | 7.45 | 5.61 | 7.30 |
| $K_2O$ | 6.22 | 2.98 | 4.02 | 4.06 | 4.34 | 4.26 | 4.08 | 4.63 | 4.62 | 3.24 | 4.41 |
| $P_2O_5$ | 0.29 | 0.09 | 0.10 | 0.11 | 0.02 | 0.14 | 0.04 | nd | 0.02 | 0.01 | 0.03 |
| LOI | 0.56 | 0.53 | 0.38 | 0.52 | 0.42 | 0.46 | 0.70 | 0.35 | 0.80 | 0.98 | 1.01 |
| TOTAL | 99.22 | 99.89 | 99.60 | 99.42 | 100.04 | 98.80 | 99.75 | 99.88 | 99.24 | 99.31 | 98.70 |
| | | | | | | | | | | | |
| Sc | 4.3 | 4.6 | 2.5 | 3.6 | 1.7 | 3.9 | 1.9 | 1.1 | 1.6 | 1 | 1.3 |
| V | 63 | 32 | 32 | 35 | 20 | 40 | 10 | 4 | 19 | 33 | 23 |
| Cr | <5 | 20 | 13 | 20 | 9 | 16 | <5 | <5 | <5 | <5 | <5 |
| Ni | 6 | 15 | 9 | 15 | 9 | 11 | 4 | 1 | 21 | 18 | 203 |
| Cu | 10 | 9 | 4 | 9 | 35 | 7 | 6 | 7 | 11 | 37 | 19 |
| Pb | 20 | 23 | 25 | 27 | 29 | 26 | 26 | 29 | 4 | 4 | 5 |
| Zn | 83 | 51 | 38 | 46 | 28 | 11 | 4 | 1 | 9 | 28 | 17 |
| Ga | 21 | 21 | 20 | 19 | 21 | 20 | 20 | 21 | 16 | 22 | 16 |
| Rb | 155 | 95 | 127 | 132 | 155 | 135 | 158 | 212 | 83 | 79 | 80 |
| Sr | 1447 | 565 | 1418 | 1565 | 679 | 1785 | 363 | 70 | 174 | 376 | 164 |
| Y | 41.8 | 8.3 | 15.8 | 17.5 | 14.8 | 19.2 | 6.6 | 5 | 6 | 2.7 | 15.6 |
| Zr | 461 | 116 | 177 | 185 | 134 | 190 | 119 | 86 | 154 | 136 | 143 |
| Nb | 14.7 | 3.8 | 6.8 | 10 | 5.4 | 6.7 | 5.9 | 6.5 | 4.9 | 4.1 | 4.1 |
| Ba | 2991 | 805 | 1375 | 1489 | 1074 | 1423 | 1066 | 122 | 1742 | 650 | 1618 |
| La | 74 | 38 | 63 | 52 | 40 | 61 | 25 | 13 | 40 | 10 | 68 |
| Ce | 204 | 52 | 98 | 77 | 49 | 82 | 33 | 14 | 76 | 14 | 109 |
| Nd | 81 | 20 | 29 | 24 | 8 | 31 | 10 | 1 | 25 | 0.6 | 51 |
| Th | 21 | 13 | 15 | 19 | 23 | 14 | 12 | 9 | 6 | 5 | 5 |
| F | 1050 | na | na | 450 | na | 450 | 550 | 250 | na | na | 250 |

Major elements wt.%, trace elements p.p.m.
na = no analysis , nd = not detected

078 - SYENITE, CEMENT WELL
079 - GRANITE, CEMENT WELL
080-203 SYENITE, McAULIFFE WELL
200 - GRANODIORITE, MENANGINA ROCKS
201 - LEUCO-DYKE, MENANGINA ROCKS
083-085 WEATHERED SYENITE, EUCALYPTUS DAM

TABLE 5.4.5 : EDJUDINA CIPW NORMS

| | 060 | 061 | 062 | 063 | 064 | 186 | 187 | 188 | 189 |
|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 68.51 | 69.82 | 65.07 | 59.87 | 59.11 | 55.87 | 64.77 | 56.03 | 58.68 |
| $TiO_2$ | 0.06 | 0.04 | 0.29 | 0.10 | 0.09 | 0.21 | 0.08 | 0.21 | 0.25 |
| $Al_2O_3$ | 15.75 | 15.40 | 16.80 | 17.89 | 18.25 | 13.41 | 16.39 | 13.64 | 18.56 |
| $Fe_2O_3$ | 0.45 | 0.30 | 1.32 | 0.70 | 0.60 | 1.78 | 0.48 | 1.71 | 0.77 |
| FeO | 0.15 | 0.13 | 0.42 | 0.89 | 0.90 | 2.69 | 0.73 | 2.58 | 1.16 |
| MnO | 0.05 | 0.02 | 0.03 | 0.09 | 0.05 | 0.11 | 0.04 | 0.16 | 0.05 |
| MgO | 0.33 | 0.28 | 1.36 | 1.84 | 1.05 | 3.83 | 1.25 | 3.67 | 1.29 |
| CaO | 0.61 | 0.97 | 2.00 | 4.51 | 2.45 | 8.93 | 3.26 | 7.96 | 2.88 |
| $Na_2O$ | 9.15 | 8.03 | 8.80 | 11.99 | 9.61 | 9.67 | 11.72 | 6.63 | 9.34 |
| $K_2O$ | 4.93 | 5.00 | 3.70 | 2.03 | 7.68 | 2.64 | 1.23 | 6.58 | 6.94 |
| $P_2O_5$ | 0.01 | 0.01 | 0.20 | 0.11 | 0.22 | 0.86 | 0.06 | 0.82 | 0.09 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | | | | | | | | | |
| Ap | 0.02 | 0.02 | 0.57 | 0.31 | 0.61 | 2.36 | 0.18 | 2.23 | 0.24 |
| Il | 0.17 | 0.11 | 0.78 | 0.26 | 0.25 | 0.56 | 0.21 | 0.56 | 0.68 |
| Mt | 0.55 | 0.48 | 0.69 | 1.46 | 1.26 | 3.63 | 1.01 | 3.47 | 1.61 |
| Or | 25 | 25 | 19 | 10 | 39 | 13 | 6.18 | 32 | 35 |
| Ab | 43 | 38 | 41 | 57 | 46 | 45 | 56 | 30 | 44 |
| An | 3.00 | 4.78 | 8.30 | 9.72 | 2.40 | 2.70 | 8.66 | 1.03 | 5.76 |
| Di | - | - | - | 10 | 6.93 | 23 | 6.24 | 22 | 6.91 |
| Hy | 0.39 | 0.33 | 1.61 | - | - | - | 0.29 | - | 0.30 |
| Ol | - | - | - | - | - | - | - | - | - |
| Ne | - | - | - | - | - | - | - | - | - |
| Ac | - | - | - | - | - | - | - | - | - |
| C | 0.86 | 0.81 | 1.79 | - | - | - | - | - | - |
| Q | 27 | 31 | 25 | 9.97 | 3.32 | 5.67 | 21 | 4.43 | 4.46 |
| Hm | 0.27 | 0.09 | 1.41 | - | - | - | - | - | - |
| Ru | - | - | - | - | - | - | - | - | - |
| Wo | - | - | - | 0.06 | 0.01 | 2.91 | - | 2.10 | - |
| Total | 100 | 100 | 100 | 99 | 99 | 99 | 99 | 98 | 99 |
| | | | | | | | | | |
| A | 89 | 91 | 69 | 70 | 80 | 46 | 74 | 52 | 75 |
| M | 2.31 | 2.11 | 8.44 | 11 | 5.15 | 17 | 8.88 | 15 | 6.33 |
| F | 8.76 | 6.73 | 23 | 19 | 14 | 38 | 17 | 34 | 18 |
| Q | 56 | 57 | 55 | 52 | 51 | 51 | 55 | 50 | 51 |
| M | 1.07 | 0.75 | 3.44 | 6.78 | 4.96 | 18 | 4.22 | 16 | 5.86 |
| L | 43 | 43 | 41 | 41 | 45 | 32 | 41 | 33 | 44 |
| PALI | 1.07 | 1.10 | 1.16 | 0.97 | 0.92 | 0.63 | 1.01 | 0.64 | 0.97 |
| PAKI | 1.12 | 1.18 | 1.34 | 1.28 | 1.06 | 1.09 | 1.27 | 1.03 | 1.14 |
| AI | 0.89 | 0.85 | 0.74 | 0.78 | 0.95 | 0.92 | 0.79 | 0.97 | 0.88 |
| PMI | 1.23 | 1.12 | 1.15 | 1.41 | 1.76 | 1.32 | 1.20 | 1.42 | 1.67 |

TABLE 5.4.5 cont...

| | 190 | 191 | 193 | 194 | 195 | 065 | 066 | 067 |
|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 63.44 | 59.98 | 58.91 | 58.67 | 60.24 | 58.38 | 57.77 | 58.56 |
| $TiO_2$ | 0.15 | 0.21 | 0.25 | 0.49 | 0.41 | 0.36 | 0.34 | 0.14 |
| $Al_2O_3$ | 17.15 | 18.38 | 18.12 | 17.55 | 18.16 | 18.73 | 18.85 | 19.60 |
| $Fe_2O_3$ | 0.60 | 1.02 | 0.69 | 0.71 | 0.73 | 0.93 | 0.78 | 0.63 |
| FeO | 0.90 | 0.46 | 1.04 | 1.07 | 1.11 | 0.79 | 1.18 | 0.95 |
| MnO | 0.05 | 0.04 | 0.05 | 0.08 | 0.08 | 0.07 | 0.07 | 0.05 |
| MgO | 1.05 | 1.15 | 1.37 | 1.57 | 1.80 | 2.27 | 2.25 | 1.27 |
| CaO | 2.80 | 2.51 | 3.12 | 3.49 | 3.87 | 5.49 | 5.28 | 4.08 |
| $Na_2O$ | 10.93 | 9.42 | 9.52 | 10.63 | 7.53 | 11.52 | 11.48 | 13.26 |
| $K_2O$ | 2.87 | 6.76 | 6.82 | 5.64 | 5.94 | 1.33 | 1.87 | 1.34 |
| $P_2O_5$ | 0.05 | 0.08 | 0.10 | 0.10 | 0.12 | 0.13 | 0.14 | 0.12 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | | | | | | | | |
| Ap | 0.15 | 0.22 | 0.28 | 0.28 | 0.33 | 0.37 | 0.39 | 0.33 |
| Il | 0.42 | 0.59 | 0.70 | 1.34 | 1.12 | 1.00 | 0.93 | 0.40 |
| Mt | 1.26 | 1.20 | 1.45 | 1.50 | 1.52 | 1.94 | 1.65 | 1.34 |
| Or | 15 | 34 | 34 | 28 | 29 | 6.64 | 9.44 | 6.84 |
| Ab | 52 | 45 | 45 | 50 | 35 | 54 | 55 | 64 |
| An | 8.47 | 5.54 | 4.48 | 3.23 | 12 | 15 | 14 | 13 |
| Di | 4.51 | 5.16 | 8.06 | 8.26 | 5.75 | 10 | 10 | 6.07 |
| Hy | 0.57 | - | - | - | 0.98 | - | 0.54 | 0.48 |
| Ol | - | - | - | - | - | - | - | - |
| Ne | - | - | - | - | - | - | - | - |
| Ac | - | - | - | - | - | - | - | - |
| C | - | - | - | - | - | - | - | - |
| Q | 18 | 7.43 | 4.55 | 4.38 | 12 | 10 | 7.81 | 7.23 |
| Hm | - | 0.65 | - | - | - | - | - | - |
| Ru | - | - | - | - | - | - | - | - |
| Wo | - | 0.29 | 0.43 | 1.69 | - | 0.06 | - | - |
| Total | 100 | 100 | 99 | 100 | 98 | 100 | 99 | 99 |
| | | | | | | | | |
| A | 75 | 78 | 76 | 75 | 70 | 65 | 64 | 73 |
| M | 6.70 | 5.92 | 6.84 | 7.91 | 9.95 | 14 | 13 | 7.90 |
| F | 19 | 16 | 17 | 18 | 20 | 21 | 22 | 19 |
| Q | 54 | 51 | 51 | 50 | 53 | 52 | 51 | 51 |
| M | 4.00 | 5.08 | 6.36 | 7.79 | 5.86 | 7.97 | 7.82 | 4.94 |
| L | 42 | 44 | 43 | 42 | 41 | 40 | 41 | 44 |
| PALI | 1.03 | 0.98 | 0.93 | 0.89 | 1.05 | 1.02 | 1.01 | 1.05 |
| PAKI | 1.24 | 1.14 | 1.11 | 1.08 | 1.35 | 1.46 | 1.41 | 1.34 |
| AI | 0.80 | 0.88 | 0.90 | 0.93 | 0.74 | 0.69 | 0.71 | 0.74 |
| PMI | 1.31 | 1.62 | 1.66 | 1.66 | 1.34 | 1.32 | 1.39 | 1.50 |

TABLE 5.4.5 cont...

| | 069 | 070 | 196 | 197 | 198 | 199 | 071 | 072 |
|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 63.63 | 56.07 | 57.92 | 60.62 | 60.53 | 58.19 | 67.95 | 55.84 |
| $TiO_2$ | 0.18 | 0.21 | 0.21 | 0.31 | 0.11 | 0.14 | 0.16 | 0.28 |
| $Al_2O_3$ | 17.47 | 14.46 | 19.20 | 18.30 | 18.47 | 19.00 | 13.77 | 12.61 |
| $Fe_2O_3$ | 0.55 | 1.59 | 1.15 | 0.64 | 0.63 | 0.75 | 0.56 | 1.87 |
| FeO | 0.82 | 2.40 | 0.61 | 0.97 | 0.95 | 1.13 | 0.85 | 2.36 |
| MnO | 0.02 | 0.08 | 0.04 | 0.04 | 0.07 | 0.07 | 0.04 | 0.10 |
| MgO | 0.67 | 4.16 | 1.47 | 1.55 | 1.61 | 2.02 | 1.15 | 5.37 |
| CaO | 1.33 | 6.02 | 2.73 | 3.24 | 4.52 | 5.13 | 1.58 | 8.59 |
| $Na_2O$ | 13.21 | 6.29 | 10.82 | 9.01 | 11.86 | 12.26 | 8.46 | 6.49 |
| $K_2O$ | 2.06 | 8.44 | 5.77 | 5.24 | 1.17 | 1.21 | 5.33 | 6.01 |
| $P_2O_5$ | 0.07 | 0.28 | 0.08 | 0.09 | 0.08 | 0.11 | 0.13 | 0.47 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | | | | | | | | |
| Ap | 0.20 | 0.78 | 0.22 | 0.24 | 0.24 | 0.31 | 0.37 | 1.27 |
| Il | 0.52 | 0.58 | 0.59 | 0.86 | 0.30 | 0.38 | 0.44 | 0.74 |
| Mt | 1.17 | 2.70 | 1.85 | 1.35 | 1.34 | 1.59 | 1.11 | 3.77 |
| Or | 11 | 42 | 29 | 26 | 5.95 | 6.17 | 26 | 29 |
| Ab | 64 | 28 | 51 | 43 | 57 | 59 | 39 | 30 |
| An | 5.66 | - | 6.58 | 10 | 14 | 14 | - | 0.28 |
| Di | 0.46 | 24 | 5.82 | 4.68 | 7.29 | 9.60 | 5.76 | 28 |
| Hy | 1.04 | 0.24 | 0.20 | 0.99 | 0.62 | 0.59 | 0.29 | - |
| Ol | - | - | - | - | - | - | - | - |
| Ne | - | - | - | - | - | - | - | - |
| Ac | - | 1.12 | - | - | - | - | 0.12 | - |
| C | - | - | - | - | - | - | - | - |
| Q | 16 | 0.88 | 3.03 | 12 | 13 | 8.09 | 25 | 4.03 |
| Hm | - | - | 0.40 | - | - | - | - | - |
| Ru | - | - | - | - | - | - | - | - |
| Wo | - | - | - | - | - | - | - | 2.29 |
| Total | 99 | 99 | 99 | 99 | 100 | 100 | 99 | 99 |
| | | | | | | | | |
| A | 79 | 55 | 75 | 74 | 69 | 66 | 76 | 47 |
| M | 4.20 | 16 | 7.27 | 8.75 | 11 | 12 | 6.93 | 21 |
| F | 17 | 29 | 18 | 18 | 20 | 22 | 17 | 32 |
| Q | 54 | 49 | 50 | 53 | 53 | 52 | 56 | 50 |
| M | 2.30 | 16 | 5.85 | 4.90 | 5.41 | 6.96 | 4.32 | 20 |
| L | 44 | 35 | 44 | 43 | 41 | 41 | 40 | 30 |
| PALI | 1.05 | 0.70 | 0.99 | 1.05 | 1.05 | 1.02 | 0.90 | 0.60 |
| PAKI | 1.14 | 0.98 | 1.16 | 1.28 | 1.42 | 1.41 | 1.00 | 1.01 |
| AI | 0.87 | 1.02 | 0.86 | 0.78 | 0.71 | 0.71 | 1.00 | 0.99 |
| PMI | 1.44 | 1.58 | 1.72 | 1.41 | 1.29 | 1.39 | 1.22 | 1.34 |

TABLE 5.4.5 cont...

| | 073 | 074 | 075 | 076 | 200 | 201 | 077 | 078 |
|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 58.24 | 61.54 | 63.05 | 53.03 | 67.38 | 70.87 | 59.55 | 56.91 |
| $TiO_2$ | 0.43 | 0.27 | 0.02 | 0.23 | 0.11 | 0.03 | 0.27 | 0.44 |
| $Al_2O_3$ | 18.06 | 17.85 | 18.34 | 8.82 | 16.34 | 14.73 | 16.75 | 18.78 |
| $Fe_2O_3$ | 0.67 | 0.68 | 0.07 | 1.43 | 0.63 | 0.37 | 1.71 | 2.06 |
| FeO | 1.01 | 1.03 | 0.11 | 2.15 | 0.21 | 0.05 | 0.82 | 1.24 |
| MnO | 0.04 | 0.04 | 0.01 | 0.06 | - | 0.01 | 0.06 | 0.08 |
| MgO | 1.37 | 1.41 | - | 11.31 | 0.36 | - | 1.05 | 1.04 |
| CaO | 2.89 | 2.99 | 0.05 | 13.18 | 1.56 | 0.51 | 3.29 | 2.48 |
| $Na_2O$ | 11.99 | 11.00 | 8.75 | 5.92 | 8.52 | 7.93 | 9.98 | 9.38 |
| $K_2O$ | 5.17 | 3.09 | 9.58 | 3.69 | 4.86 | 5.51 | 6.36 | 7.38 |
| $P_2O_5$ | 0.13 | 0.10 | 0.01 | 0.17 | 0.03 | - | 0.16 | 0.23 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | | | | | | | | |
| Ap | 0.37 | 0.29 | 0.02 | 0.46 | 0.09 | - | 0.46 | 0.63 |
| Il | 1.19 | 0.74 | 0.06 | 0.61 | 0.31 | 0.08 | 0.74 | 1.19 |
| Mt | 1.41 | 1.44 | 0.16 | 1.27 | 0.41 | 0.11 | 2.57 | 3.63 |
| Or | 26 | 16 | 49 | 18 | 24 | 27 | 32 | 37 |
| Ab | 57 | 52 | 42 | 21 | 40 | 37 | 47 | 44 |
| An | 2.28 | 9.54 | 0.01 | - | 7.42 | 2.52 | 1.02 | 5.04 |
| Di | 7.31 | 4.13 | 0.14 | 54 | 0.11 | -0.00 | 4.69 | 4.61 |
| Hy | - | 1.05 | 0.02 | - | 0.40 | - | - | - |
| Ol | - | - | - | 0.12 | - | - | - | - |
| Ne | - | - | - | 1.05 | - | - | - | - |
| Ac | - | - | - | 3.16 | - | - | - | - |
| C | - | - | - | - | - | 0.48 | - | - |
| Q | 2.16 | 14 | 8.75 | - | 26 | 32 | 6.76 | 2.67 |
| Hm | - | - | - | - | 0.62 | 0.45 | 0.68 | 0.45 |
| Ru | - | - | - | - | - | - | - | - |
| Wo | 1.21 | - | - | - | - | 0.00 | 3.66 | 0.10 |
| Total | 99 | 99 | 100 | 100 | 100 | 100 | 99 | 99 |
| | | | | | | | | |
| A | 77 | 72 | 98 | 33 | 85 | 93 | 71 | 67 |
| M | 6.88 | 8.39 | - | 42 | 2.52 | - | 4.93 | 4.40 |
| F | 16 | 20 | 1.97 | 26 | 12 | 6.61 | 24 | 29 |
| Q | 50 | 53 | 52 | 49 | 56 | 57 | 51 | 49 |
| M | 6.88 | 4.60 | 0.28 | 31 | 1.45 | 0.55 | 8.13 | 7.70 |
| L | 43 | 42 | 48 | 20 | 43 | 43 | 41 | 43 |
| PALI | 0.90 | 1.05 | 1.00 | 0.39 | 1.09 | 1.06 | 0.85 | 0.98 |
| PAKI | 1.05 | 1.27 | 1.00 | 0.92 | 1.22 | 1.10 | 1.03 | 1.12 |
| AI | 0.95 | 0.79 | 1.00 | 1.09 | 0.82 | 0.91 | 0.98 | 0.89 |
| PMI | 1.77 | 1.37 | 1.75 | 1.09 | 1.19 | 1.14 | 1.65 | 1.77 |

TABLE 5.4.5 cont...

| | 079 | 080 | 081 | 082 | 203 | 083 | 084 | 085 |
|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 65.53 | 62.39 | 61.87 | 66.65 | 61.36 | 60.97 | 66.85 | 61.31 |
| $TiO_2$ | 0.17 | 0.13 | 0.14 | 0.08 | 0.15 | 0.27 | 0.21 | 0.25 |
| $Al_2O_3$ | 16.24 | 17.75 | 18.00 | 16.21 | 18.13 | 19.89 | 17.39 | 19.18 |
| $Fe_2O_3$ | 0.95 | 1.00 | 1.33 | 0.71 | 1.40 | 0.13 | 0.53 | 0.14 |
| FeO | 0.63 | 0.53 | 0.42 | 0.37 | 0.32 | 0.07 | 0.28 | 0.03 |
| MnO | 0.03 | 0.07 | 0.06 | 0.04 | 0.03 | 0.03 | 0.01 | 0.08 |
| MgO | 1.35 | 0.82 | 1.13 | 0.56 | 1.01 | - | 0.39 | 0.64 |
| CaO | 1.92 | 1.10 | 1.51 | 0.62 | 1.37 | 0.12 | 0.34 | 0.20 |
| $Na_2O$ | 9.57 | 11.43 | 10.68 | 9.63 | 11.09 | 13.15 | 10.15 | 12.98 |
| $K_2O$ | 3.52 | 4.70 | 4.78 | 5.11 | 5.03 | 5.37 | 3.85 | 5.17 |
| $P_2O_5$ | 0.07 | 0.08 | 0.09 | 0.02 | 0.11 | 0.02 | 0.01 | 0.02 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | | | | | | | | |
| Ap | 0.20 | 0.22 | 0.24 | 0.04 | 0.31 | 0.04 | 0.02 | 0.07 |
| Il | 0.48 | 0.36 | 0.40 | 0.23 | 0.42 | 0.27 | 0.56 | 0.30 |
| Mt | 2.00 | 2.00 | 1.41 | 1.39 | 0.82 | - | 0.33 | - |
| Or | 18 | 24 | 24 | 26 | 25 | 27 | 19 | 26 |
| Ab | 46 | 55 | 51 | 46 | 53 | 63 | 47 | 62 |
| An | 7.93 | 4.13 | 6.46 | 2.99 | 5.07 | 0.46 | 1.58 | 0.84 |
| Di | 1.06 | 0.74 | 0.45 | - | 0.83 | - | - | - |
| Hy | 1.35 | 0.79 | 1.24 | 0.67 | 0.98 | - | 0.45 | 0.78 |
| Ol | - | - | - | - | - | - | - | - |
| Ne | - | - | - | - | - | - | - | - |
| Ac | - | - | - | - | - | - | - | - |
| C | - | - | - | 0.53 | - | 2.22 | 4.91 | 1.31 |
| Q | 23 | 13 | 13 | 23 | 11 | 5.75 | 25 | 6.49 |
| Hm | - | 0.09 | 0.96 | 0.07 | 1.46 | 0.19 | 0.52 | 0.21 |
| Ru | - | - | - | - | - | 0.25 | - | 0.20 |
| Wo | - | - | - | - | - | - | - | - |
| Total | 100 | 100 | 99 | 100 | 99 | 99 | 99 | 99 |
| | | | | | | | | |
| A | 72 | 78 | 74 | 83 | 76 | 98 | 86 | 94 |
| M | 8.43 | 4.49 | 6.07 | 3.49 | 5.28 | - | 2.71 | 3.77 |
| F | 20 | 17 | 20 | 14 | 19 | 2.41 | 12 | 2.20 |
| Q | 55 | 53 | 53 | 55 | 52 | 51 | 56 | 51 |
| M | 3.43 | 3.10 | 3.49 | 1.86 | 3.52 | 0.45 | 1.49 | 0.88 |
| L | 41 | 44 | 44 | 43 | 44 | 48 | 43 | 48 |
| PALI | 1.08 | 1.03 | 1.06 | 1.06 | 1.04 | 1.07 | 1.21 | 1.05 |
| PAKI | 1.24 | 1.10 | 1.16 | 1.10 | 1.12 | 1.07 | 1.24 | 1.06 |
| AI | 0.81 | 0.91 | 0.86 | 0.91 | 0.89 | 0.93 | 0.81 | 0.95 |
| PMI | 1.20 | 1.55 | 1.50 | 1.33 | 1.58 | 1.82 | 1.26 | 1.78 |

PALI = Peraluminous index $Al_2O_3$ / ( CaO + $Na_2O$ + $K_2O$ )
>1 = peraluminous, <1 = metaluminous

PAKI = Peralkaline index $Al_2O_3$ / ( $Na_2O$ + $K_2O$ )
<1 = peralkaline

AI = Agpaitic index ( $Na_2O$ + $K_2O$ ) / $Al_2O_3$
>1 = agpaitic

PMI = plumaskitic index 6 ( $Na_2O$ + $K_2O$ ) / $SiO_2$
<1 = plumaskitic, >1 = miaskitic

## TABLE 5.5.1 : LEONORA & SIR SAMUEL REPRESENTATIVE FELDSPAR ANALYSES

| | 090-1 | 090-2 | 092-1 | 092-3 | 092-3 | 092-3 | 094-3 | 094-3 | 094-7 | 097-2 | 097-3 | 099-1 | 099-8 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| wt% | ZONED RIM | PLAG | PLAG | PLAG | PERTH MICRO | EXS PLAG | MICRO | PLAG | PLAG | MICRO | PLAG | PLAG | MICRO |
| $SiO_2$ | 65.78 | 65.29 | 69.42 | 69.36 | 65.44 | 69.66 | 64.44 | 65.52 | 66.54 | 65.76 | 69.42 | 69.60 | 65.71 |
| $Al_2O_3$ | 17.93 | 21.85 | 18.72 | 19.73 | 17.82 | 19.08 | 17.84 | 20.79 | 20.21 | 17.40 | 19.04 | 19.56 | 17.93 |
| FeO* | - | - | 0.55 | 0.17 | - | 0.14 | - | - | 0.18 | - | 0.34 | 0.23 | - |
| MnO | - | - | - | - | - | - | - | 0.15 | - | - | 0.12 | 0.14 | - |
| MgO | - | 0.23 | - | 0.10 | - | - | - | 0.16 | - | - | 0.09 | 0.14 | - |
| CaO | - | 3.03 | - | 0.65 | - | - | - | 2.23 | 1.59 | - | - | 0.20 | - |
| $Na_2O$ | 0.16 | 8.94 | 10.37 | 9.73 | - | 10.15 | 0.31 | 9.35 | 9.52 | - | 9.35 | 10.31 | 0.32 |
| $K_2O$ | 17.24 | 0.27 | 0.06 | 0.12 | 17.22 | 0.11 | 16.45 | 0.11 | 0.15 | 17.25 | 0.18 | 0.22 | 17.31 |
| Other | - | - | - | 0.07 | - | - | - | - | - | - | - | 0.06 | - |
| TOTAL | 101.11 | 99.61 | 99.12 | 99.93 | 100.48 | 99.14 | 99.04 | 98.31 | 98.19 | 100.41 | 98.54 | 100.46 | 101.27 |
| | Structural formulae on the basis of 8(O) | | | | | | | | | | | | |
| Si | 3.017 | 2.876 | 3.043 | 3.014 | 3.020 | 3.044 | 3.011 | 2.917 | 2.958 | 3.036 | 3.048 | 3.016 | 3.013 |
| Al | .969 | 1.134 | .967 | 1.011 | .969 | .983 | .982 | 1.091 | 1.059 | .947 | .985 | .999 | .969 |
| Fe(tot) | - | - | .020 | .006 | - | .005 | - | - | .007 | - | .012 | .008 | - |
| Mn | - | - | - | - | - | - | - | .006 | - | - | .004 | .005 | - |
| Mg | - | .015 | - | .007 | - | - | - | .011 | - | - | .006 | .009 | - |
| Ca | - | .143 | - | .038 | - | - | - | .107 | .076 | - | - | .009 | - |
| Na | .015 | .764 | .881 | .820 | - | .860 | .028 | .867 | .820 | - | .796 | .866 | .029 |
| K | 1.009 | .015 | .003 | .007 | 1.014 | .006 | .980 | .006 | .008 | 1.016 | .010 | .012 | 1.013 |
| Other | - | - | - | .006 | - | - | - | - | - | - | - | .004 | - |

FeO* = total iron; PERTH = perthite; EXS = exsolution; MICRO = microcline.

## TABLE 5.5.2 : LEONORA & SIR SAMUEL REPRESENTATIVE PYROXENE ANALYSES

| | 090-2 | 090-2 | 092-1 | 092-3 | 092-3 | 097-1 | 097-1 | 097-4 | 097-4 | 099-1 | 099-1 | 099-2 | 099-2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| wt% | RIM | CORE | | RIM | CORE | RIM | CORE | RIM | CORE | RIM | CORE | RIM | CORE |
| $SiO_2$ | 53.19 | 53.50 | 52.93 | 53.70 | 53.34 | 51.98 | 51.69 | 52.31 | 51.86 | 52.08 | 51.92 | 51.79 | 51.87 |
| $TiO_2$ | - | 0.17 | 0.16 | 0.31 | 0.30 | - | - | - | - | - | - | - | - |
| $Al_2O_3$ | 0.32 | 0.32 | 0.24 | 0.42 | 0.27 | 0.65 | 0.51 | 0.36 | 0.50 | 0.67 | 0.71 | 0.70 | 0.60 |
| $Fe_2O_3$ | 13.15 | 12.40 | 23.46 | 13.19 | 11.03 | 9.41 | 12.26 | 9.08 | 10.50 | 4.03 | 5.69 | 5.33 | 6.28 |
| FeO | 9.96 | 9.99 | 6.30 | 8.68 | 8.69 | 17.68 | 14.85 | 17.90 | 17.21 | 15.57 | 14.75 | 15.06 | 14.72 |
| MnO | 0.27 | 0.35 | 0.29 | 0.44 | 0.49 | 0.74 | 0.91 | 0.82 | 0.93 | 0.64 | 0.69 | 0.76 | 0.64 |
| MgO | 5.29 | 5.43 | 2.53 | 5.81 | 6.38 | 2.60 | 2.76 | 2.38 | 2.42 | 6.21 | 6.19 | 6.09 | 5.85 |
| CaO | 12.09 | 12.10 | 4.33 | 11.73 | 13.19 | 12.19 | 10.87 | 10.80 | 12.42 | 19.43 | 19.42 | 19.02 | 19.47 |
| $Na_2O$ | 6.14 | 6.17 | 10.09 | 6.47 | 5.74 | 5.06 | 5.87 | 5.55 | 5.10 | 2.18 | 2.32 | 2.35 | 2.42 |
| $K_2O$ | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Other | - | 0.16 | - | 0.17 | - | - | 0.15 | - | - | - | - | - | - |
| TOTAL | 100.41 | 100.59 | 100.33 | 100.92 | 99.43 | 100.31 | 99.87 | 99.20 | 100.94 | 100.81 | 101.69 | 101.10 | 101.85 |

Structural formulae on the basis of 6(O)
Cation total recalculated to 4

| | 090-2 | 090-2 | 092-1 | 092-3 | 092-3 | 097-1 | 097-1 | 097-4 | 097-4 | 099-1 | 099-1 | 099-2 | 099-2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Si | 2.031 | 2.036 | 2.027 | 2.029 | 2.039 | 2.038 | 2.028 | 2.069 | 2.027 | 2.008 | 1.988 | 1.995 | 1.986 |
| Ti | - | .005 | .005 | .009 | .009 | - | - | - | - | - | - | - | - |
| Al | .014 | .014 | .011 | .019 | .012 | .030 | .023 | .017 | .023 | .030 | .032 | .032 | .027 |
| $Fe^{3+}$ | .378 | .355 | .676 | .375 | .318 | .278 | .362 | .270 | .309 | .117 | .164 | .154 | .181 |
| $Fe^{2+}$ | .318 | .318 | .202 | .274 | .278 | .580 | .487 | .592 | .563 | .502 | .472 | .485 | .471 |
| Mn | .009 | .011 | .009 | .014 | .016 | .025 | .030 | .027 | .031 | .021 | .023 | .025 | .021 |
| Mg | .301 | .308 | .144 | .327 | .363 | .152 | .161 | .141 | .141 | .357 | .353 | .349 | .334 |
| Ca | .495 | .493 | .178 | .475 | .540 | .512 | .457 | .458 | .520 | .803 | .796 | .785 | .799 |
| Na | .455 | .455 | .749 | .474 | .425 | .385 | .446 | .426 | .386 | .163 | .172 | .175 | .180 |
| K | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Other | - | .005 | - | .005 | - | - | .005 | - | - | - | - | - | - |

**TABLE 5.5.3 : LEONORA & SIR SAMUEL REPRESENTATIVE AMPHIBOLE ANALYSES**

| | 090-2 | 090-3 | 090-6 | 090-6 | 092-1 | 092-5 | 094-1 | 094-1 | 097-5 | 097-5 | 097-5 | 097-5 | 099-9 | 099-10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| wt% | REPL PYX | NEEDLE | RIM | CORE | REPL PYX | | RIM | CORE | RIM | CORE | CORE | RIM | | |
| $SiO_2$ | 56.37 | 56.99 | 54.96 | 54.55 | 56.97 | 57.40 | 45.72 | 47.49 | 55.85 | 56.23 | 56.65 | 55.62 | 53.13 | 54.41 |
| $TiO_2$ | - | - | 0.12 | - | - | 0.24 | 0.25 | 0.34 | - | - | - | - | - | - |
| $Al_2O_3$ | 0.94 | 0.64 | 0.29 | - | 0.18 | - | 6.54 | 5.47 | 1.43 | 1.30 | 1.66 | 1.28 | 1.88 | 1.48 |
| $Fe_2O_3$ | - | - | 16.17 | 17.23 | 0.87 | - | - | - | - | - | - | - | - | - |
| FeO | 8.30 | 10.28 | 11.69 | 11.29 | 8.73 | 10.54 | 19.22 | 18.54 | 32.57 | 29.46 | 28.17 | 28.88 | 15.61 | 14.88 |
| MnO | 0.30 | 0.29 | 0.18 | - | 0.56 | 0.35 | 0.93 | 0.98 | 0.88 | 0.84 | 0.61 | 0.81 | 0.80 | 0.86 |
| MgO | 16.89 | 16.15 | 8.04 | 7.95 | 16.12 | 14.92 | 10.21 | 11.16 | 2.98 | 4.23 | 4.64 | 3.96 | 13.09 | 13.92 |
| CaO | 5.35 | 10.94 | - | - | 4.93 | 3.15 | 11.29 | 11.34 | - | - | - | - | 12.05 | 12.38 |
| $Na_2O$ | 5.60 | 1.49 | 6.54 | 6.31 | 5.18 | 6.96 | 1.49 | 1.43 | 1.76 | 2.38 | 2.52 | 2.64 | 0.61 | 0.53 |
| $K_2O$ | 1.76 | 0.26 | 0.14 | - | 1.87 | 1.96 | 1.15 | 0.80 | - | - | - | - | 0.38 | 0.25 |
| TOTAL | 95.51 | 97.04 | 98.13 | 97.34 | 95.40 | 95.52 | 96.80 | 97.55 | 95.47 | 94.44 | 94.25 | 93.19 | 97.55 | 98.71 |

Structural formulae on the basis of 23(O)
*Cation total recalculated to 13, exclusive of K, Na and Ca

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Si | 8.152 | 8.123 | 7.985 | 7.985 | 8.262 | 8.362 | 6.941 | 7.082 | 8.071 | 8.175 | 8.220 | 8.229 | 7.797 | 7.853 |
| Ti | - | - | .013 | - | - | .027 | .029 | .039 | - | - | - | - | - | - |
| $Al^{IV}$ | - | - | .015 | - | - | - | 1.059 | .918 | - | - | - | - | .203 | .147 |
| $Al^{VI}$ | .159 | .108 | .036 | - | .032 | - | .112 | .043 | .243 | .223 | .283 | .223 | .324 | .252 |
| $Fe^{3+}$ | - | - | 1.768 | 1.898 | .095 | - | .454 | .513 | 2.648 | 2.337 | 2.178 | 2.171 | .040 | .016 |
| $Fe^{2+}$ | 1.004 | 1.225 | 1.420 | 1.382 | 1.058 | 1.285 | 1.986 | 1.800 | 1.288 | 1.245 | 1.241 | 1.403 | 1.876 | 1.780 |
| Mn | .036 | .035 | .022 | - | .068 | .044 | .119 | .123 | .108 | .103 | .075 | .101 | .099 | .105 |
| Mg | 3.640 | 3.432 | 1.740 | 1.734 | 3.484 | 3.239 | 2.301 | 2.482 | .642 | .916 | 1.004 | .873 | 2.864 | 2.994 |
| Ca | .828 | 1.671 | - | - | .768 | .491 | 1.858 | 1.837 | - | - | - | - | 1.896 | 1.916 |
| $Na_A$ | .400 | .083 | - | - | .227 | .458 | .301 | .257 | - | - | - | - | .070 | .063 |
| $Na_B$ | 1.172 | .329 | 1.929 | 1.882 | 1.232 | 1.509 | .142 | .163 | .528 | .713 | .749 | .803 | .174 | .147 |
| K | .324 | .048 | .026 | - | .347 | .364 | .226 | .154 | - | - | - | - | .072 | .046 |

* Excludes any Mn, $Fe^{2+}$ and Mg from the B site, eliminating any cummingtonite component

TABLE 5.5.4 : LEONORA, LAVERTON AND SIR SAMUEL
WHOLE ROCK & TRACE ELEMENT GEOCHEMISTRY

| | 086 | 087 | 088 | 089 | 090 | 091 | 092 | 204 | 205 |
|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 64.86 | 64.30 | 63.88 | 68.02 | 64.03 | 69.38 | 66.72 | 64.80 | 66.90 |
| $TiO_2$ | 0.21 | 0.28 | 0.04 | 0.25 | 0.30 | 0.22 | 0.23 | 0.22 | 0.25 |
| $Al_2O_3$ | 17.63 | 16.84 | 20.33 | 15.92 | 15.51 | 14.25 | 15.24 | 18.41 | 16.39 |
| $Fe_2O_3$ | 1.78 | 2.62 | 0.70 | 2.05 | 1.99 | 1.69 | 1.45 | 1.28 | 1.68 |
| FeO | na | na | 0.09 | na | 0.32 | na | 0.35 | na | 0.41 |
| MnO | 0.09 | 0.09 | 0.02 | 0.04 | 0.04 | 0.04 | 0.02 | 0.04 | 0.06 |
| MgO | 0.26 | 0.62 | 0.04 | 0.52 | 0.74 | 0.49 | 0.60 | 0.08 | 0.38 |
| CaO | 0.56 | 1.12 | 0.07 | 0.68 | 2.99 | 1.15 | 2.14 | 0.80 | 1.11 |
| $Na_2O$ | 7.11 | 7.52 | 6.57 | 7.15 | 6.88 | 6.58 | 6.59 | 6.86 | 6.38 |
| $K_2O$ | 5.53 | 4.69 | 6.43 | 4.04 | 3.96 | 3.85 | 4.02 | 6.55 | 5.74 |
| $P_2O_5$ | 0.07 | 0.08 | 0.01 | 0.09 | 0.16 | 0.08 | 0.08 | 0.02 | 0.09 |
| LOI | 0.52 | 0.50 | 0.83 | 0.54 | 2.14 | 0.38 | 1.41 | 0.61 | 0.43 |
| TOTAL | 98.61 | 98.64 | 99.01 | 99.29 | 99.05 | 98.09 | 98.85 | 99.66 | 99.81 |
| Sc | 1.4 | 2.6 | nd | 2.2 | 3.9 | 1.8 | 2.7 | 1.2 | 2 |
| V | 25 | 35 | 20 | 32 | 48 | 29 | 27 | 22 | 24 |
| Cr | <5 | 5 | <5 | 10 | 9 | 5 | 5 | <5 | <5 |
| Ni | 6 | 8 | 10 | 8 | 9 | 8 | 7 | 1 | 6 |
| Cu | 12 | 9 | 46 | 14 | 29 | 16 | 18 | 5 | 4 |
| Pb | 5 | 13 | 31 | 14 | 23 | 9 | 18 | 26 | 22 |
| Zn | 34 | 53 | 19 | 49 | 65 | 44 | 48 | 1 | 6 |
| Ga | 24 | 23 | 22 | 23 | 23 | 23 | 23 | 21 | 26 |
| Rb | 148 | 136 | 181 | 165 | 154 | 158 | 162 | 175 | 224 |
| Sr | 366 | 308 | 294 | 302 | 517 | 354 | 430 | 851 | 215 |
| Y | 5.8 | 18.5 | 4.5 | 9.9 | 10.6 | 8.3 | 6.7 | 19.1 | 22 |
| Zr | 89 | 349 | 149 | 206 | 171 | 133 | 157 | 140 | 174 |
| Nb | 15.4 | 27.6 | 5.5 | 8.3 | 7.5 | 7.1 | 8.3 | 13.1 | 13.4 |
| Ba | 638 | 574 | 888 | 898 | 668 | 950 | 818 | 428 | 743 |
| La | 11 | 28 | 12 | 36 | 41 | 37 | 33 | 132 | 113 |
| Ce | 27 | 51 | 16 | 64 | 90 | 61 | 54 | 145 | 177 |
| Nd | 14 | 34 | 2 | 26 | 36 | 25 | 23 | 75 | 68 |
| Th | 2 | 6 | 6 | 13 | 10 | 16 | 14 | 15 | 26 |
| F | na | na | 250 | na | 900 | na | 750 | na | 1450 |

Major elements wt.%, trace elements p.p.m.
na = no analysis , nd = not detected

086-088 SYENITE PORPHYRY, PIG WELL
089,090 MEDIUM GRAINED SYENITE, PIG WELL
091,092 LEUCOSYENITE, PIG WELL
204 GRANITOID, GRANITE WELL 15 km ENE LAVERTON
205 SYENITE, GRANITE WELL 15 km ENE LAVERTON

TABLE 5.5.4 cont...

| | 093 | 094 | 095 | 096 | 097 | 098 | 099 | 224 |
|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 67.36 | 69.05 | 72.86 | 74.39 | 74.37 | 73.26 | 65.18 | 72.81 |
| $TiO_2$ | 0.35 | 0.29 | 0.16 | 0.09 | 0.11 | 0.13 | 0.28 | 0.21 |
| $Al_2O_3$ | 16.44 | 15.62 | 13.90 | 13.28 | 13.24 | 13.84 | 17.67 | 13.81 |
| $Fe_2O_3$ | 2.49 | 1.53 | 1.11 | 1.12 | 1.20 | 0.66 | 1.20 | 0.86 |
| FeO | na | 0.45 | 0.16 | 0.11 | na | 0.57 | 0.44 | 0.58 |
| MnO | 0.03 | 0.02 | 0.06 | nd | nd | nd | 0.03 | 0.02 |
| MgO | 0.52 | 0.49 | 0.15 | nd | nd | 0.13 | 0.38 | 0.27 |
| CaO | 1.54 | 1.29 | 0.88 | 0.22 | 0.31 | 1.07 | 1.41 | 0.95 |
| $Na_2O$ | 5.55 | 5.34 | 4.26 | 5.53 | 5.30 | 3.61 | 6.27 | 3.78 |
| $K_2O$ | 4.56 | 4.57 | 4.95 | 4.09 | 4.44 | 5.37 | 6.52 | 5.35 |
| $P_2O_5$ | 0.12 | 0.08 | 0.04 | 0.01 | 0.02 | 0.03 | 0.09 | 0.05 |
| LOI | 0.41 | 0.50 | 0.49 | 0.29 | 0.26 | 0.75 | 0.23 | 0.55 |
| TOTAL | 99.37 | 99.22 | 99.01 | 99.14 | 99.23 | 99.43 | 99.69 | 99.24 |
| | | | | | | | | |
| Sc | 2.3 | 2 | 0.1 | nd | nd | 1 | 1.9 | 1.1 |
| V | 30 | 23 | 8 | 7 | 6 | 5 | 16 | 10 |
| Cr | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| Ni | 4 | 4 | 4 | 4 | nd | 3 | 7 | 2 |
| Cu | 32 | 7 | 6 | 3 | 3 | 3 | 3 | 4 |
| Pb | 33 | 32 | 63 | 8 | 13 | 43 | 16 | 46 |
| Zn | 66 | 52 | 81 | 39 | 46 | 37 | 39 | 54 |
| Ga | 22 | 20 | 22 | 26 | 27 | 18 | 27 | 20 |
| Rb | 175 | 176 | 397 | 265 | 253 | 255 | 214 | 239 |
| Sr | 1288 | 1154 | 151 | 21.5 | 38 | 121 | 717 | 154 |
| Y | 12.8 | 7.2 | 18.3 | 7.4 | 5.3 | 3.1 | 7.8 | 3.6 |
| Zr | 198 | 177 | 192 | 245 | 192 | 162 | 143 | 203 |
| Nb | 9 | 6.7 | 14 | 10.6 | 13.4 | 4.4 | 17.9 | 3.1 |
| Ba | 1478 | 1372 | 734 | 296 | 281 | 621 | 1097 | 730 |
| La | 61 | 64 | 151 | 42 | 28 | 69 | 21 | 114 |
| Ce | 110 | 84 | 197 | 69 | 65 | 114 | 53 | 156 |
| Nd | 39 | 31 | 75 | 39 | 31 | 37 | 32 | 59 |
| Th | 20 | 25 | 71 | 3 | 26 | 63 | 5 | 60 |
| F | na | 600 | 1650 | 150 | na | 450 | 300 | 350 |

Major elements wt.%, trace elements p.p.m.
na = no analysis , nd = not detected

093,094 MONZONITE, ANDY'S BORE 9 km NORTH EAST MELROSE
095- ALKALI GRANITOID, 1 km SOUTH EAST LITTLE WELL
096,097 ALKALI GRANITOID, 1 km EAST LITTLE WELL
098- ALKALI GRANITOID, 2.9 km NORTH WOORANA WELL
099- SYENITE, 2.9 km NORTH WOORANA WELL
224- GRANITE, 7.5 km WEST WONGANOO

TABLE 5.5.5 : LEONORA, LAVERTON & SIR SAMUEL CIPW NORMS

| | 086 | 087 | 088 | 089 | 090 | 091 | 092 | 204 |
|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 59.40 | 58.83 | 58.31 | 62.26 | 59.75 | 64.58 | 62.12 | 58.72 |
| $TiO_2$ | 0.14 | 0.19 | 0.03 | 0.17 | 0.21 | 0.15 | 0.16 | 0.15 |
| $Al_2O_3$ | 19.03 | 18.15 | 21.87 | 17.18 | 17.06 | 15.63 | 16.72 | 19.66 |
| $Fe_2O_3$ | 0.86 | 1.26 | 0.48 | 0.99 | 1.40 | 0.83 | 1.02 | 0.61 |
| FeO | 0.45 | 0.67 | 0.07 | 0.52 | 0.25 | 0.44 | 0.27 | 0.32 |
| MnO | 0.07 | 0.07 | 0.02 | 0.03 | 0.03 | 0.03 | 0.02 | 0.03 |
| MgO | 0.35 | 0.85 | 0.05 | 0.71 | 1.03 | 0.68 | 0.83 | 0.11 |
| CaO | 0.55 | 1.10 | 0.07 | 0.66 | 2.99 | 1.14 | 2.13 | 0.77 |
| $Na_2O$ | 12.63 | 13.34 | 11.62 | 12.69 | 12.45 | 11.88 | 11.89 | 12.05 |
| $K_2O$ | 6.46 | 5.47 | 7.48 | 4.72 | 4.71 | 4.57 | 4.78 | 7.57 |
| $P_2O_5$ | 0.05 | 0.06 | 0.01 | 0.07 | 0.12 | 0.06 | 0.06 | 0.02 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | | | | | | | | |
| Ap | 0.15 | 0.18 | 0.02 | 0.20 | 0.35 | 0.18 | 0.18 | 0.04 |
| Il | 0.40 | 0.53 | 0.07 | 0.47 | 0.59 | 0.42 | 0.44 | 0.42 |
| Mt | 1.61 | 1.27 | 0.24 | 1.60 | 0.28 | 0.02 | 0.54 | 0.88 |
| Or | 33 | 28 | 37 | 24 | 24 | 23 | 24 | 39 |
| Ab | 60 | 61 | 55 | 60 | 59 | 52 | 56 | 56 |
| An | - | - | 0.28 | - | - | - | 0.12 | 0.10 |
| Di | 1.60 | 4.39 | - | 2.47 | 4.62 | 4.24 | 3.73 | 0.50 |
| Hy | - | 0.10 | 0.06 | 0.20 | - | - | - | - |
| Ne | - | - | - | - | - | - | - | 1.33 |
| Ac | 0.27 | 2.78 | - | 0.96 | 0.44 | 3.40 | - | - |
| C | - | - | 4.87 | - | - | - | - | - |
| Q | 1.51 | 1.05 | 0.90 | 9.87 | 4.97 | 15 | 10.00 | - |
| Hm | 0.05 | - | 0.53 | - | 1.68 | - | 1.09 | 0.30 |
| Ru | - | - | - | - | - | - | - | - |
| Wo | 0.21 | - | - | - | 3.68 | 0.09 | 2.46 | 1.33 |
| Total | 99 | 99 | 99 | 99 | 99 | 98 | 99 | 100 |
| | | | | | | | | |
| A | 85 | 78 | 93 | 80 | 77 | 81 | 81 | 90 |
| M | 1.75 | 3.94 | 0.29 | 3.72 | 5.24 | 3.83 | 4.55 | 0.54 |
| F | 13 | 18 | 6.24 | 16 | 18 | 15 | 15 | 9.55 |
| Q | 50 | 50 | 50 | 52 | 51 | 54 | 52 | 49 |
| M | 3.11 | 5.46 | 0.87 | 3.79 | 6.89 | 4.11 | 5.04 | 2.53 |
| L | 47 | 45 | 49 | 44 | 42 | 42 | 43 | 48 |
| PALI | 0.97 | 0.91 | 1.14 | 0.95 | 0.85 | 0.89 | 0.89 | 0.96 |
| PAKI | 1.00 | 0.96 | 1.14 | 0.99 | 0.99 | 0.95 | 1.00 | 1.00 |
| AI | 1.00 | 1.04 | 0.87 | 1.01 | 1.01 | 1.05 | 1.00 | 1.00 |
| PMI | 1.93 | 1.92 | 1.97 | 1.68 | 1.72 | 1.53 | 1.61 | 2.01 |

TABLE 5.5.5 cont...

| | 205 | 093 | 094 | 095 | 096 | 097 | 098 | 099 |
|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 61.06 | 62.29 | 64.18 | 68.64 | 69.37 | 69.31 | 69.19 | 59.19 |
| $TiO_2$ | 0.17 | 0.24 | 0.20 | 0.11 | 0.06 | 0.08 | 0.09 | 0.19 |
| $Al_2O_3$ | 17.63 | 17.92 | 17.11 | 15.44 | 14.60 | 14.54 | 15.41 | 18.91 |
| $Fe_2O_3$ | 1.15 | 1.21 | 1.07 | 0.79 | 0.79 | 0.59 | 0.47 | 0.82 |
| FeO | 0.31 | 0.64 | 0.35 | 0.13 | 0.09 | 0.31 | 0.45 | 0.33 |
| MnO | 0.05 | 0.02 | 0.02 | 0.05 | - | - | - | 0.02 |
| MgO | 0.52 | 0.72 | 0.68 | 0.21 | - | - | 0.18 | 0.51 |
| CaO | 1.08 | 1.53 | 1.29 | 0.88 | 0.22 | 0.31 | 1.09 | 1.37 |
| $Na_2O$ | 11.28 | 9.95 | 9.62 | 7.78 | 10.01 | 9.57 | 6.62 | 11.04 |
| $K_2O$ | 6.68 | 5.38 | 5.42 | 5.94 | 4.86 | 5.28 | 6.47 | 7.55 |
| $P_2O_5$ | 0.07 | 0.09 | 0.06 | 0.03 | 0.01 | 0.02 | 0.02 | 0.07 |
| TOTAL | 00.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | | | | | | | | |
| Ap | 0.20 | 0.26 | 0.18 | 0.09 | 0.02 | 0.04 | 0.07 | 0.20 |
| Il | 0.47 | 0.67 | 0.55 | 0.30 | 0.17 | 0.21 | 0.25 | 0.53 |
| Mt | 0.80 | 1.78 | 0.68 | 0.25 | 0.09 | 0.58 | 0.97 | 0.71 |
| Or | 34 | 27 | 27 | 29 | 24 | 26 | 32 | 38 |
| Ab | 52 | 47 | 45 | 36 | 46 | 43 | 31 | 53 |
| An | - | 6.53 | 5.21 | 4.11 | - | - | 5.17 | 0.82 |
| Di | 2.34 | 0.34 | 0.65 | - | - | 0.37 | - | 2.34 |
| Hy | - | 0.77 | 0.63 | 0.25 | - | - | 0.32 | - |
| Ne | - | - | - | - | - | - | - | - |
| Ac | 1.42 | - | - | - | 1.13 | 1.28 | - | - |
| C | - | - | - | 0.09 | - | - | 0.41 | - |
| Q | 6.61 | 14 | 18 | 27 | 27 | 27 | 29 | 1.65 |
| Hm | 0.65 | 0.53 | 1.07 | 0.95 | 0.67 | - | - | 0.71 |
| Ru | - | - | - | - | - | - | - | - |
| Wo | 0.95 | - | - | - | 0.43 | 0.39 | - | 1.23 |
| Total | 100 | 99 | 99 | 99 | 99 | 99 | 99 | 100 |
| | | | | | | | | |
| A | 82 | 75 | 79 | 86 | 88 | 88 | 86 | 86 |
| M | 2.57 | 3.88 | 3.91 | 1.40 | - | - | 1.25 | 2.54 |
| F | 15 | 21 | 17 | 13 | 12 | 12 | 13 | 12 |
| Q | 51 | 53 | 54 | 56 | 56 | 56 | 56 | 50 |
| M | 4.20 | 3.39 | 2.79 | 1.47 | 1.55 | 1.63 | 1.23 | 3.74 |
| L | 45 | 44 | 43 | 43 | 42 | 42 | 42 | 46 |
| PALI | 0.93 | 1.06 | 1.05 | 1.06 | 0.97 | 0.96 | 1.09 | 0.95 |
| PAKI | 0.98 | 1.17 | 1.14 | 1.12 | 0.98 | 0.98 | 1.18 | 1.02 |
| AI | 1.02 | 0.86 | 0.88 | 0.89 | 1.02 | 1.02 | 0.85 | 0.98 |
| PMI | 1.77 | 1.48 | 1.41 | 1.20 | 1.29 | 1.29 | 1.14 | 1.88 |

PALI = Peraluminous index $Al_2O_3 / ( CaO + Na_2O + K_2O )$
$>1$ = peraluminous, $<1$ = metaluminous

PAKI = Peralkaline index $Al_2O_3 / ( Na_2O + K_2O )$
$<1$ = peralkaline

AI = Agpaitic index $( Na_2O + K_2O ) / Al_2O_3$
$>1$ = agpaitic

PMI = plumaskitic index $6 ( Na_2O + K_2O ) / SiO_2$
$<1$ = plumaskitic, $>1$ = miaskitic

TABLE 5.6.1 : TEAGUE RING STRUCTURE REPRESENTATIVE FELDSPAR ANALYSES

| | 228-2 | 228-4 | 234-1 | 234-1 | 234-2 | 234-2 | 252-3 | 252-3 |
|---|---|---|---|---|---|---|---|---|
| wt% | PLAG | KSP | PERTH HOST | PERTH EXS | PLAG RIM | PLAG CORE | PERTH HOST | PERTH EXS |
| $SiO_2$ | 66.62 | 62.38 | 63.58 | 67.02 | 65.22 | 67.44 | 65.11 | 69.15 |
| $Al_2O_3$ | 19.24 | 17.57 | 17.88 | 19.38 | 20.34 | 19.50 | 17.97 | 18.99 |
| FeO* | - | - | - | 0.23 | 0.74 | - | - | 0.26 |
| MnO | - | - | - | - | - | - | - | 0.11 |
| MgO | 0.55 | 0.22 | 0.33 | 0.45 | 0.55 | 0.46 | - | - |
| CaO | - | - | - | - | 0.08 | - | - | - |
| $Na_2O$ | 11.85 | 0.58 | 2.64 | 11.07 | 8.39 | 10.46 | 0.26 | 10.55 |
| $K_2O$ | - | 15.72 | 12.85 | 0.07 | 0.78 | - | 16.87 | 0.14 |
| Other | 0.21 | - | - | - | - | 0.16 | - | 0.06 |
| TOTAL | 98.47 | 96.47 | 97.28 | 98.22 | 96.10 | 98.02 | 100.21 | 99.26 |
| | Structural formulae on the basis of 8(O) | | | | | | | |
| Si | 2.963 | 2.993 | 2.992 | 2.969 | 2.955 | 2.988 | 3.011 | 3.030 |
| Al | 1.008 | .994 | .992 | 1.012 | 1.086 | 1.018 | .979 | .980 |
| Fe(tot) | - | - | - | .009 | .028 | - | - | .009 |
| Mn | - | - | - | - | - | - | - | .007 |
| Mg | .037 | .016 | .023 | .030 | .037 | .030 | - | - |
| Ca | - | - | - | - | .004 | - | - | - |
| Na | 1.022 | .054 | .241 | 1.005 | .737 | .898 | .024 | .897 |
| K | - | .962 | .771 | .004 | .045 | - | .995 | .008 |
| Other | .010 | - | - | - | - | .005 | - | .004 |

FeO* = total iron; PERTH = perthite; EXS = exsolution; MICRO = microcline.

TABLE 5.6.2 : TEAGUE RING STRUCTURE REPRESENTATIVE PYROXENE ANALYSES

| | 252-3 | 252-3 | 252-4 | 252-4 |
|---|---|---|---|---|
| wt% | RIM | CORE | RIM | CORE |
| $SiO_2$ | 51.87 | 51.88 | 50.84 | 50.36 |
| $TiO_2$ | - | - | - | 0.22 |
| $Al_2O_3$ | 0.79 | 0.44 | 1.33 | 1.52 |
| $Fe_2O_3$ | 7.68 | 8.52 | 9.88 | 10.03 |
| FeO | 15.94 | 16.16 | 14.57 | 13.34 |
| MnO | 0.61 | 0.62 | 0.58 | 0.62 |
| MgO | 4.03 | 3.86 | 3.52 | 4.21 |
| CaO | 15.90 | 15.23 | 15.02 | 16.18 |
| $Na_2O$ | 3.86 | 4.07 | 4.34 | 3.93 |
| $K_2O$ | - | - | - | - |
| Other | - | - | - | - |
| TOTAL | 100.68 | 100.78 | 100.08 | 100.41 |

Structural formulae on the basis of 6(O)
Cation total recalculated to 4

| | | | | |
|---|---|---|---|---|
| Si | 2.015 | 2.019 | 1.989 | 1.960 |
| Ti | - | - | - | .006 |
| Al | .036 | .020 | .061 | .070 |
| $Fe^{3+}$ | .225 | .250 | .291 | .294 |
| $Fe^{2+}$ | .518 | .526 | .477 | .434 |
| Mn | .020 | .020 | .019 | .021 |
| Mg | .233 | .224 | .205 | .244 |
| Ca | .662 | .635 | .629 | .675 |
| Na | .291 | .307 | .329 | .296 |
| K | - | - | - | - |
| Other | - | - | - | - |

TABLE 5.6.3 : TEAGUE RING STRUCTURE REPRESENTATIVE AMPHIBOLE ANALYSES

| wt% | 234-2 RIM | 234-2 CORE | 234-3 RIM | 234-3 CORE | 234-3 BLEB | 252-2 FINE NEEDLE | 252-3 NEEDLE | 252-3 FINE NEEDLE | 252-4 NEEDLE ADJ PYX |
|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 51.71 | 51.62 | 52.88 | 52.73 | 50.90 | 58.59 | 56.44 | 55.52 | 56.58 |
| $TiO_2$ | 0.44 | 0.17 | 0.55 | 0.17 | 0.14 | 0.18 | - | - | - |
| $Al_2O_3$ | 2.12 | 1.86 | 2.11 | 2.06 | 1.73 | 4.10 | 0.28 | 0.26 | 0.40 |
| $Fe_2O_3$ | 4.08 | 3.11 | 5.56 | 5.61 | - | - | - | - | - |
| FeO | 7.81 | 7.82 | 4.28 | 6.65 | 19.51 | 24.88 | 10.46 | 10.97 | 11.30 |
| MnO | - | - | 0.13 | 0.55 | 0.52 | 0.22 | 0.39 | 0.50 | 0.42 |
| MgO | 17.12 | 17.46 | 18.94 | 17.37 | 11.15 | 5.14 | 16.40 | 15.80 | 16.58 |
| CaO | 9.34 | 9.62 | 9.11 | 9.56 | 12.09 | 1.09 | 12.11 | 11.91 | 12.32 |
| $Na_2O$ | 2.39 | 2.18 | 2.75 | 2.58 | 1.11 | 1.02 | 0.45 | 0.35 | 0.50 |
| $K_2O$ | 0.29 | 0.16 | 0.37 | 0.28 | 0.15 | 0.34 | - | - | 0.08 |
| Other | - | - | - | - | 0.12 | 0.59 | - | - | 0.13 |
| TOTAL | 95.30 | 94.00 | 96.68 | 97.56 | 97.42 | 96.15 | 96.53 | 95.31 | 98.31 |

Structural formulae on the basis of 23(O)
*Cation total recalculated to 13, exclusive of K, Na and Ca

| | 234-2 RIM | 234-2 CORE | 234-3 RIM | 234-3 CORE | 234-3 BLEB | 252-2 FINE NEEDLE | 252-3 NEEDLE | 252-3 FINE NEEDLE | 252-4 NEEDLE ADJ PYX |
|---|---|---|---|---|---|---|---|---|---|
| Si | 7.498 | 7.554 | 7.481 | 7.499 | 7.647 | 8.208 | 8.098 | 8.095 | 8.020 |
| Ti | .048 | .019 | .059 | .018 | .016 | .019 | - | - | - |
| $Al^{IV}$ | .362 | .321 | .352 | .345 | .307 | - | - | - | - |
| $Al^{VI}$ | - | - | - | - | - | .677 | .047 | .044 | .066 |
| $Fe^{3+}$ | .782 | .736 | .836 | .803 | .066 | 1.758 | - | - | - |
| $Fe^{2+}$ | .610 | .562 | .262 | .587 | 2.384 | 1.158 | 1.255 | 1.338 | 1.339 |
| Mn | - | - | .016 | .066 | .066 | .026 | .048 | .062 | .051 |
| Mg | 3.700 | 3.808 | 3.994 | 3.682 | 2.497 | 1.074 | 3.508 | 3.434 | 3.502 |
| Ca | 1.480 | 1.537 | 1.410 | 1.487 | 1.949 | .172 | 1.861 | 1.861 | 1.871 |
| $Na_A$ | .165 | .169 | .182 | .212 | .272 | - | - | - | .009 |
| $Na_B$ | .520 | .463 | .590 | .513 | .051 | .291 | .125 | .099 | .129 |
| K | .054 | .031 | .068 | .052 | .029 | .064 | - | - | .014 |
| Other | - | - | - | - | .015 | .079 | - | - | .014 |

* Excludes any Mn, $Fe^{2+}$ and Mg from the B site, eliminating any cummingtonite component

**TABLE 5.6.4 : TEAGUE RING STRUCTURE**
**WHOLE ROCK AND TRACE ELEMENT GEOCHEMISTRY**

| | 059 | 226 | 227 | 228 | 230 | 231 | 232 | 234 | 236 |
|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 63.34 | 73.71 | 71.30 | 74.24 | 71.36 | 68.51 | 69.03 | 67.22 | 68.55 |
| $TiO_2$ | 0.50 | 0.11 | 0.20 | 0.08 | 0.20 | 0.19 | 0.19 | 0.18 | 0.19 |
| $Al_2O_3$ | 16.20 | 13.72 | 14.71 | 13.29 | 14.60 | 15.81 | 15.79 | 16.72 | 15.69 |
| $Fe_2O_3$ | 3.29 | 1.76 | 2.40 | 1.10 | 2.03 | 1.02 | 1.14 | 1.32 | 1.27 |
| FeO | na | na | na | 0.48 | na | 0.20 | na | na | na |
| MnO | 0.11 | nd | 0.01 | 0.01 | 0.02 | 0.09 | 0.04 | 0.02 | 0.05 |
| MgO | 0.97 | 0.20 | 0.23 | 0.08 | 0.10 | 0.22 | 0.22 | 0.26 | 0.19 |
| CaO | 2.27 | 0.15 | 0.23 | 0.13 | 0.27 | 0.71 | 0.65 | 0.41 | 0.63 |
| $Na_2O$ | 5.47 | 5.25 | 4.70 | 4.54 | 5.22 | 5.29 | 5.46 | 5.55 | 5.02 |
| $K_2O$ | 6.46 | 4.42 | 4.95 | 5.03 | 4.89 | 5.95 | 5.88 | 6.40 | 6.42 |
| $P_2O_5$ | 0.43 | 0.01 | 0.02 | 0.01 | 0.04 | 0.03 | 0.03 | 0.03 | 0.03 |
| LOI | 0.48 | 0.49 | 0.59 | 0.49 | 0.62 | 0.95 | 0.87 | 0.92 | 0.97 |
| TOTAL | 99.52 | 99.82 | 99.33 | 99.48 | 99.34 | 98.97 | 99.30 | 99.01 | 98.99 |
| Sc | 2.1 | 0.9 | 1.2 | 0.2 | 1.6 | 1 | 1.2 | nd | 0.8 |
| V | 34 | 7 | 12 | 5 | 9 | 6 | 5 | 6 | 5 |
| Cr | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| Ni | 15 | 2 | 2 | 2 | 1 | 14 | 8 | 4 | 11 |
| Cu | 19 | 4 | 3 | 4 | 3 | 3 | 4 | 4 | 3 |
| Pb | 16 | 15 | 20 | 14 | 18 | 12 | 16 | 26 | 14 |
| Zn | 82 | 9 | 14 | 7 | 14 | 54 | 43 | 72 | 51 |
| Ga | 23 | 22 | 20 | 21 | 21 | 20 | 23 | 22 | 21 |
| Rb | 221 | 156 | 169 | 180 | 168 | 192 | 187 | 211 | 208 |
| Sr | 303 | 308 | 390 | 293 | 394 | 292 | 312 | 267 | 284 |
| Y | 65 | 9.5 | 12.6 | 6 | 10.5 | 47 | 51 | 40 | 61 |
| Zr | 129 | 280 | 297 | 214 | 295 | 311 | 282 | 71 | 300 |
| Nb | 18.8 | 8.5 | 9.9 | 6.7 | 10.1 | 14.2 | 13.9 | 15.7 | 15.4 |
| Ba | 1638 | 671 | 1961 | 892 | 2185 | 1830 | 1877 | 2015 | 1923 |
| La | 272 | 82 | 121 | 49 | 113 | 323 | 364 | 294 | 321 |
| Ce | 459 | 105 | 169 | 70 | 155 | 254 | 289 | 255 | 256 |
| Nd | 228 | 39 | 50 | 24 | 47 | 206 | 222 | 166 | 190 |
| Th | 15 | 31 | 37 | 28 | 36 | 53 | 52 | 80 | 53 |
| U | 2 | na | na | na | na | na | na | na | na |
| F | na | na | na | 150 | na | 200 | na | na | na |

Major elements wt.%, trace elements p.p.m.
na = no analysis , nd = not detected

059 SYENITE, SAMPLE COURTESY METALSEX
226-230 WEATHERED JOINTED ALKALI GRANITE
231-236 QUARTZ SYENITE

TABLE 5.6.4 cont...

| | 239 | 240 | 242 | 245 | 247 | 248 | 249 | 251 |
|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 69.72 | 72.71 | 72.30 | 61.98 | 63.30 | 63.62 | 63.54 | 63.55 |
| $TiO_2$ | 0.23 | 0.10 | 0.12 | 0.64 | 0.49 | 0.41 | 0.40 | 0.41 |
| $Al_2O_3$ | 15.37 | 14.15 | 14.62 | 16.12 | 16.62 | 16.86 | 16.80 | 16.95 |
| $Fe_2O_3$ | 1.74 | 0.94 | 0.44 | 4.20 | 3.27 | 2.12 | 3.01 | 2.89 |
| FeO | na | na | 0.41 | 0.34 | na | 0.89 | na | na |
| MnO | 0.04 | 0.03 | 0.03 | 0.12 | 0.09 | 0.08 | 0.07 | 0.07 |
| MgO | 0.12 | 0.16 | 0.16 | 1.49 | 0.70 | 0.65 | 0.54 | 0.60 |
| CaO | 0.63 | 0.36 | 0.39 | 1.49 | 2.06 | 1.81 | 1.77 | 1.84 |
| $Na_2O$ | 5.16 | 4.89 | 5.12 | 5.88 | 6.19 | 6.11 | 6.04 | 6.01 |
| $K_2O$ | 5.52 | 5.11 | 5.22 | 5.37 | 6.17 | 6.37 | 6.38 | 6.41 |
| $P_2O_5$ | 0.05 | 0.02 | 0.02 | 0.21 | 0.18 | 0.19 | 0.17 | 0.18 |
| LOI | 0.51 | 0.70 | 0.88 | 1.11 | 0.46 | 0.50 | 0.49 | 0.49 |
| TOTAL | 99.09 | 99.16 | 99.70 | 98.95 | 99.53 | 99.62 | 99.19 | 99.38 |
| Sc | 1.3 | nd | 0.8 | 2.1 | 2.3 | 2.2 | 2.8 | 2.5 |
| V | 9 | 3 | 4 | 43 | 32 | 30 | 29 | 26 |
| Cr | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| Ni | 3 | 3 | 5 | 13 | 9 | 5 | 7 | 8 |
| Cu | 3 | 4 | 4 | nd | 3 | 4 | 4 | 4 |
| Pb | 22 | 9 | 9 | 12 | 13 | 8 | 10 | 10 |
| Zn | 32 | 21 | 26 | 207 | 88 | 67 | 70 | 72 |
| Ga | 21 | 19 | 20 | 27 | 22 | 22 | 24 | 23 |
| Rb | 182 | 178 | 177 | 149 | 139 | 148 | 142 | 145 |
| Sr | 589 | 133 | 142 | 651 | 1187 | 1142 | 1177 | 1279 |
| Y | 26.9 | 36 | 33 | 64 | 31 | 26 | 26.4 | 25.6 |
| Zr | 359 | 248 | 177 | 1907 | 211 | 230 | 169 | 189 |
| Nb | 12.8 | 9.1 | 8.8 | 39 | 21.4 | 17.4 | 16.9 | 17.6 |
| Ba | 1668 | 1231 | 1328 | 2132 | 2251 | 2063 | 2187 | 2307 |
| La | 285 | 250 | 292 | 217 | 177 | 153 | 160 | 155 |
| Ce | 200 | 182 | 202 | 433 | 349 | 294 | 320 | 307 |
| Nd | 131 | 159 | 200 | 220 | 178 | 148 | 160 | 147 |
| Th | 49 | 26 | 30 | 72 | 23 | 22 | 23 | 22 |
| U | na | na | na | na | na | na | na | na |
| F | na | na | 200 | 300 | na | 200 | na | na |

Major elements wt.%, trace elements p.p.m.
na = no analysis , nd = not detected.

239-242 QUARTZ SYENITE
245-251 SYENITE

TABLE 5.6.5 : TEAGUE RING STRUCTURE CIPW NORMS

| | 059 | 226 | 227 | 228 | 230 | 231 | 232 | 234 |
|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 58.30 | 68.46 | 66.78 | 69.59 | 66.58 | 63.87 | 63.99 | 62.29 |
| $TiO_2$ | 0.34 | 0.08 | 0.14 | 0.06 | 0.14 | 0.13 | 0.13 | 0.12 |
| $Al_2O_3$ | 17.57 | 15.02 | 16.24 | 14.68 | 16.05 | 17.37 | 17.25 | 18.27 |
| $Fe_2O_3$ | 1.60 | 0.86 | 1.18 | 0.78 | 1.00 | 0.72 | 0.56 | 0.64 |
| FeO | 0.85 | 0.46 | 0.63 | 0.38 | 0.53 | 0.16 | 0.29 | 0.34 |
| MnO | 0.09 | - | 0.01 | 0.01 | 0.02 | 0.07 | 0.03 | 0.02 |
| MgO | 1.33 | 0.28 | 0.32 | 0.11 | 0.14 | 0.31 | 0.30 | 0.36 |
| CaO | 2.24 | 0.15 | 0.23 | 0.13 | 0.27 | 0.71 | 0.65 | 0.40 |
| $Na_2O$ | 9.77 | 9.46 | 8.54 | 8.25 | 9.44 | 9.56 | 9.82 | 9.97 |
| $K_2O$ | 7.58 | 5.23 | 5.92 | 6.01 | 5.82 | 7.08 | 6.95 | 7.57 |
| $P_2O_5$ | 0.33 | 0.01 | 0.02 | 0.01 | 0.03 | 0.02 | 0.02 | 0.02 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | | | | | | | | |
| Ap | 0.93 | 0.02 | 0.04 | 0.02 | 0.09 | 0.07 | 0.07 | 0.07 |
| Il | 0.94 | 0.21 | 0.38 | 0.15 | 0.38 | 0.36 | 0.36 | 0.34 |
| Mt | 2.44 | 1.59 | 2.02 | 1.36 | 1.68 | 0.39 | 0.82 | 0.98 |
| Or | 38 | 26 | 29 | 30 | 29 | 35 | 35 | 38 |
| Ab | 46 | 45 | 40 | 39 | 44 | 45 | 47 | 47 |
| An | 0.56 | 0.68 | 1.00 | 0.58 | 1.07 | 1.82 | 1.22 | 1.84 |
| Di | 5.93 | - | - | - | - | 1.37 | 1.36 | - |
| Ne | - | - | - | - | - | - | - | - |
| Hy | - | 0.33 | 0.37 | 0.13 | 0.16 | - | - | 0.43 |
| Ac | - | - | - | - | - | - | - | - |
| C | - | 0.10 | 2.49 | 0.34 | 0.66 | - | - | 0.00 |
| Q | 3.37 | 26 | 24 | 28 | 22 | 14 | 14 | 9.38 |
| Hm | 0.61 | 0.15 | 0.28 | 0.17 | 0.27 | 0.76 | 0.24 | 0.26 |
| Ru | - | - | - | - | - | - | - | - |
| Wo | 0.50 | - | - | - | - | 0.01 | 0.14 | - |
| Total | 99 | 100 | 99 | 99 | 99 | 99 | 99 | 99 |
| | | | | | | | | |
| A | 72 | 82 | 77 | 84 | 81 | 88 | 88 | 87 |
| M | 5.86 | 1.69 | 1.83 | 0.70 | 0.80 | 1.72 | 1.72 | 1.90 |
| F | 22 | 17 | 21 | 15 | 18 | 10 | 9.88 | 11 |
| Q | 50 | 56 | 55 | 56 | 55 | 53 | 53 | 52 |
| M | 7.24 | 1.92 | 2.66 | 1.57 | 2.23 | 2.09 | 2.06 | 1.74 |
| L | 43 | 42 | 42 | 42 | 43 | 45 | 45 | 46 |
| PALI | 0.90 | 1.01 | 1.11 | 1.02 | 1.03 | 1.00 | 0.99 | 1.02 |
| PAKI | 1.01 | 1.02 | 1.12 | 1.03 | 1.05 | 1.04 | 1.03 | 1.04 |
| AI | 0.99 | 0.98 | 0.89 | 0.97 | 0.95 | 0.96 | 0.97 | 0.96 |
| PMI | 1.79 | 1.29 | 1.30 | 1.23 | 1.38 | 1.56 | 1.57 | 1.69 |

TABLE 5.6.5 cont...

| | 236 | 239 | 240 | 242 | 245 | 247 | 248 | 249 | 251 |
|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 63.97 | 64.92 | 68.03 | 67.22 | 57.79 | 57.94 | 58.24 | 58.39 | 58.27 |
| $TiO_2$ | 0.13 | 0.16 | 0.07 | 0.08 | 0.45 | 0.34 | 0.28 | 0.28 | 0.28 |
| $Al_2O_3$ | 17.25 | 16.87 | 15.60 | 16.02 | 17.71 | 17.93 | 18.19 | 18.19 | 18.31 |
| $Fe_2O_3$ | 0.62 | 0.85 | 0.46 | 0.31 | 2.95 | 1.58 | 1.46 | 1.45 | 1.39 |
| FeO | 0.33 | 0.45 | 0.25 | 0.32 | 0.27 | 0.84 | 0.68 | 0.77 | 0.74 |
| MnO | 0.04 | 0.03 | 0.02 | 0.02 | 0.09 | 0.07 | 0.06 | 0.05 | 0.05 |
| MgO | 0.26 | 0.17 | 0.22 | 0.22 | 2.07 | 0.96 | 0.89 | 0.74 | 0.82 |
| CaO | 0.63 | 0.63 | 0.36 | 0.39 | 1.49 | 2.02 | 1.78 | 1.74 | 1.81 |
| $Na_2O$ | 9.09 | 9.32 | 8.86 | 9.22 | 10.62 | 10.99 | 10.84 | 10.76 | 10.69 |
| $K_2O$ | 7.64 | 6.56 | 6.10 | 6.19 | 6.39 | 7.21 | 7.44 | 7.48 | 7.50 |
| $P_2O_5$ | 0.02 | 0.04 | 0.02 | 0.02 | 0.16 | 0.14 | 0.15 | 0.13 | 0.14 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | | | | | | | | | |
| Ap | 0.07 | 0.11 | 0.04 | 0.04 | 0.46 | 0.39 | 0.42 | 0.37 | 0.39 |
| Il | 0.36 | 0.44 | 0.19 | 0.23 | 0.99 | 0.93 | 0.78 | 0.76 | 0.77 |
| Mt | 0.99 | 1.35 | 0.83 | 0.65 | - | 2.39 | 1.95 | 2.30 | 2.15 |
| Or | 38 | 33 | 30 | 31 | 32 | 36 | 38 | 38 | 38 |
| Ab | 43 | 44 | 42 | 44 | 50 | 51 | 51 | 51 | 51 |
| An | 1.32 | 2.47 | 1.59 | 1.53 | 1.75 | - | - | - | 0.33 |
| Di | 1.18 | 0.29 | 0.06 | 0.24 | 3.49 | 4.30 | 4.00 | 3.32 | 3.69 |
| Hy | - | 0.12 | 0.25 | 0.30 | 1.54 | - | - | - | - |
| Ac | - | - | - | - | - | 1.10 | 0.37 | 0.20 | - |
| C | - | - | - | - | - | - | - | - | - |
| Q | 14 | 17 | 24 | 22 | 3.48 | 0.95 | 1.17 | 1.58 | 1.37 |
| Hm | 0.21 | 0.30 | 0.09 | - | 4.26 | 0.26 | 0.65 | 0.45 | 0.54 |
| Ru | - | - | - | - | 0.33 | - | - | - | - |
| Wo | 0.14 | - | - | - | - | 1.75 | 1.36 | 1.65 | 1.45 |
| Total | 99 | 99 | 99 | 100 | 99 | 99 | 99 | 99 | 99 |
| | | | | | | | | | |
| A | 88 | 84 | 89 | 91 | 63 | 74 | 76 | 76 | 77 |
| M | 1.46 | 0.94 | 1.43 | 1.40 | 8.40 | 4.19 | 3.97 | 3.31 | 3.70 |
| F | 11 | 15 | 9.35 | 7.89 | 28 | 22 | 20 | 20 | 20 |
| Q | 53 | 54 | 55 | 55 | 50 | 49 | 49 | 49 | 49 |
| M | 2.12 | 2.15 | 1.15 | 1.05 | 7.84 | 7.22 | 6.29 | 6.14 | 6.08 |
| L | 45 | 44 | 44 | 44 | 43 | 43 | 44 | 44 | 44 |
| PALI | 0.99 | 1.02 | 1.02 | 1.01 | 0.96 | 0.89 | 0.91 | 0.91 | 0.92 |
| PAKI | 1.03 | 1.06 | 1.04 | 1.04 | 1.04 | 0.99 | 1.00 | 1.00 | 1.01 |
| AI | 0.97 | 0.94 | 0.96 | 0.96 | 0.96 | 1.01 | 1.00 | 1.00 | 0.99 |
| PMI | 1.57 | 1.47 | 1.32 | 1.38 | 1.77 | 1.88 | 1.88 | 1.88 | 1.87 |

PALI = Peraluminous index $Al_2O_3$ / ( CaO + $Na_2O$ + $K_2O$ )
$>1$ = peraluminous, $<1$ = metaluminous

PAKI = Peralkaline index $Al_2O_3$ / ( $Na_2O$ + $K_2O$ )
$<1$ = peralkaline

AI = Agpaitic index ( $Na_2O$ + $K_2O$ ) / $Al_2O_3$
$>1$ = agpaitic

PMI = plumaskitic index 6 ( $Na_2O$ + $K_2O$ ) / $SiO_2$
$<1$ = plumaskitic, $>1$ = miaskitic

TABLE 5.7.1 : REPRESENTATIVE WHOLE ROCK MAJOR & TRACE ELEMENT GEOCHEMISTRY NIGER-NIGERIAN ALKALINE RING COMPLEXES

| | KW6[1] | KW15[1] | RN91[1] | RN89[1] | NG9[1] | NG18[1] | AMN24[2] | MD333[2] | T15A[2] |
|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 59.70 | 65.50 | 75.90 | 74.30 | 71.90 | 71.10 | 72.60 | 75.40 | 74.30 |
| $TiO_2$ | 0.96 | 0.56 | 0.10 | 0.13 | 0.37 | 0.58 | 0.29 | 0.10 | 0.08 |
| $Al_2O_3$ | 15.20 | 14.24 | 12.71 | 11.47 | 12.24 | 12.56 | 14.07 | 13.33 | 11.74 |
| $Fe_2O_3$ | 1.83 | 2.47 | 0.39 | 1.89 | 1.83 | 2.56 | 0.90 | 0.01 | 0.33 |
| FeO | 6.74 | 3.71 | 1.12 | 0.83 | 1.61 | 0.92 | 1.73 | 0.96 | 0.89 |
| MnO | 0.17 | 0.20 | 0.03 | 0.01 | 0.07 | 0.08 | 0.07 | 0.02 | 0.02 |
| MgO | 1.26 | 0.47 | 0.01 | 0.08 | 0.12 | 0.08 | 0.43 | 0.04 | 0.01 |
| CaO | 4.11 | 1.58 | 0.16 | 0.32 | 0.87 | 1.09 | 1.01 | 0.34 | 0.26 |
| $Na_2O$ | 4.63 | 4.09 | 3.72 | 5.28 | 4.00 | 3.66 | 3.36 | 4.26 | 3.88 |
| $K_2O$ | 3.97 | 5.33 | 4.50 | 4.38 | 5.69 | 5.69 | 5.74 | 4.53 | 4.59 |
| $P_2O_5$ | 0.47 | 0.12 | 0.01 | 0.02 | 0.05 | 0.03 | 0.07 | 0.01 | 0.01 |
| LOI | na | na | na | na | na | na | 0.35 | 0.20 | 0.64 |
| TOTAL | 99.04 | 98.27 | 98.65 | 98.71 | 98.75 | 98.35 | 100.69 | 99.20 | 96.75 |
| | | | | | | | | | |
| V | 15 | 2 | na | na | na | na | 9 | nd | 3 |
| Cu | na | 6 | 110 | 103 | na | na | na | 9 | 7 |
| Pb | 17 | 19 | 21 | 485 | 26 | 35 | na | na | na |
| Zn | 91 | 138 | 292 | 968 | 85 | 130 | 61 | 68 | 61 |
| Rb | 50 | 78 | 628 | 1450 | 115 | 134 | 185 | 620 | 502 |
| Sr | 300 | 76 | na | na | 58 | 54 | 100 | nd | 1 |
| Y | 51 | 94 | 75 | 414 | 72 | 78 | 63 | 139 | 86 |
| Zr | 617 | 732 | 230 | 3073 | 538 | 662 | 246 | 129 | 166 |
| Nb | 43 | 97 | 183 | 1494 | 63 | 72 | 57 | 78 | 132 |
| Ba | 1108 | 476 | na | na | 339 | 450 | 362 | na | na |
| La | 131 | 257 | 48 | 90 | 133 | 128 | 59 | 28 | 166 |
| Ce | 202 | 450 | 113 | 193 | 245 | 231 | 144 | 79 | 153 |
| Nd | 63 | 304 | 38 | 243 | 124 | 143 | na | na | na |
| Th | 7 | 8 | 78 | 318 | 27 | 26 | 27 | 66 | 69 |

Major elements wt.%, trace elements p.p.m.
na = no analysis , nd = not detected

[1] Bowden (1985)
KW6 Augite syenite
KW15 Quartz syenite
NG9 Quartz feldspar porphyry
NG18 Granite porphyry
RN91 Biotite granite
RN89 Arfvedsonite albite granite

[2] Bowden et al (1987)
AMN24 Biotite granite
MD333 Biotite granite
T15A Biotite granite

TABLE 5.7.2 : REPRESENTATIVE WHOLE ROCK MAJOR & TRACE ELEMENT ANALYSES RAS ED DOM MIGRATING RING COMPLEX, SUDAN

| | 1014 | 236 | 1028 | 1077 | 1057 | 10738 | R80A | 186A | 187 |
|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 59.59 | 60.84 | 62.94 | 65.85 | 66.73 | 67.18 | 67.03 | 73.33 | 70.11 |
| $TiO_2$ | 1.17 | 0.96 | 0.60 | 0.40 | 0.31 | 0.35 | 0.39 | 0.25 | 0.51 |
| $Al_2O_3$ | 15.82 | 16.29 | 16.75 | 14.96 | 15.18 | 15.06 | 14.88 | 11.71 | 12.07 |
| $Fe_2O_3$ | 4.93 | 3.01 | 4.44 | 3.50 | 2.26 | 2.42 | 2.27 | 2.53 | 5.73 |
| FeO | 3.21 | 3.59 | 1.48 | 2.65 | 2.56 | 2.34 | 2.78 | 2.41 | 0.85 |
| MnO | 0.19 | 0.16 | 0.16 | 0.12 | 0.11 | 0.12 | 0.13 | 0.09 | 0.07 |
| MgO | 1.50 | 1.22 | 0.32 | 0.25 | 0.24 | 0.15 | 0.22 | 0.07 | 0.08 |
| CaO | 2.80 | 2.55 | 1.34 | 1.45 | 1.30 | 0.73 | 0.95 | 0.27 | 0.59 |
| $Na_2O$ | 6.40 | 6.91 | 6.30 | 5.11 | 5.77 | 5.99 | 5.74 | 4.74 | 5.11 |
| $K_2O$ | 3.89 | 4.04 | 5.53 | 5.63 | 5.49 | 5.63 | 5.54 | 4.76 | 4.84 |
| $P_2O_5$ | 0.49 | 0.42 | 0.14 | 0.07 | 0.05 | 0.04 | 0.07 | 0.03 | 0.03 |
| TOTAL | 99.99 | 99.99 | 100.00 | 99.99 | 100.00 | 100.01 | 100.00 | 100.19 | 99.99 |
| Ga | 40 | 41 | 45 | 49 | 49 | 50 | 46 | 49 | 53 |
| Rb | 50 | 49 | 57 | 101 | 84 | 84 | 89 | 93 | 94 |
| Sr | 266 | 270 | 57 | 39 | 27 | 11 | 48 | 1 | 5 |
| Y | 56 | 48 | 37 | 64 | 74 | 56 | 55 | 67 | 49 |
| Zr | 664 | 414 | 265 | 780 | 1288 | 861 | 576 | 949 | 1211 |
| Nb | 93 | 75 | 24 | 103 | 153 | 121 | 93 | 114 | 78 |
| Ba | 718 | 715 | 427 | 139 | 28 | 6 | 176 | nd | 31 |
| La | 79 | 63 | 55 | 81 | 167 | 139 | 86 | 98 | 56 |
| Ce | 179 | 149 | 108 | 181 | 353 | 287 | 188 | 214 | 123 |
| Nd | 90 | 72 | 72 | 89 | 141 | 117 | 91 | 103 | 65 |

Major elements wt.%, trace elements p.p.m.
nd = not detected

All analyses from O'Halloran (1985).

TABLE 6.1 : GEARLESS WELL REPRESENTATIVE FELDSPAR ANALYSES

| | GW-3 003 | | GW-1 004 | |
|---|---|---|---|---|
| wt% | RIM | CORE | RIM | CORE |
| $SiO_2$ | 60.16 | 62.04 | 62.37 | 63.75 |
| $Al_2O_3$ | 19.08 | 18.97 | 18.48 | 18.61 |
| FeO(total) | 0.23 | 0.24 | 0.97 | 0.76 |
| MnO | - | - | - | - |
| MgO | - | - | - | - |
| CaO | - | - | - | - |
| $Na_2O$ | - | - | - | - |
| $K_2O$ | 13.39 | 14.41 | 14.74 | 14.35 |
| Other | 0.34 | 0.15 | 0.14 | - |
| TOTAL | 93.19 | 95.80 | 96.70 | 97.47 |
| | Structural formulae on the basis of 32(O) | | | |
| Si | 11.796 | 11.874 | 11.894 | 11.986 |
| Al | 4.411 | 4.780 | 4.155 | 4.125 |
| $Fe^{2+}$ | .038 | .038 | .155 | .120 |
| Mn | - | - | - | - |
| Mg | - | - | - | - |
| Ca | - | - | - | - |
| Na | - | - | - | - |
| K | 3.350 | 3.519 | 3.586 | 3.442 |
| Other | .053 | .023 | .021 | - |

Structural formulae calculated on Ba-free basis. Low analysis totals due to presence of 1-2.5 % Ba and minor alteration of original crystals.

TABLE 6.2 : GEARLESS WELL REPRESENTATIVE AMPHIBOLE ANALYSES

| | GW-3 003 | | GW-3 003 | | GW-1 004 | |
|---|---|---|---|---|---|---|
| | MATRIX | | AGG.FRAGS | | MATRIX | |
| | CORE | RIM | CORE | RIM | CORE | RIM |
| $SiO_2$ | 57.12 | 52.73 | 53.76 | 55.76 | 56.43 | 57.49 |
| $TiO_2$ | - | 0.13 | - | - | - | - |
| $Al_2O_3$ | 1.21 | 3.88 | 2.19 | 1.34 | 0.56 | 0.56 |
| FeO | 9.05 | 3.33 | 8.23 | 9.37 | 7.92 | 8.31 |
| $Fe_2O_3$ | 0.56 | 8.33 | 2.84 | 0.30 | 0.19 | 0.32 |
| MnO | 0.29 | 0.18 | - | - | - | - |
| MgO | 18.65 | 17.11 | 16.71 | 17.71 | 18.65 | 19.25 |
| CaO | 12.60 | 10.14 | 12.64 | 12.86 | 12.14 | 12.38 |
| $Na_2O$ | - | 0.32 | 0.32 | 0.18 | 0.45 | 0.36 |
| $K_2O$ | 0.30 | 2.04 | 0.08 | - | 0.08 | - |
| $Cr_2O_3$ | - | 0.30 | - | - | 0.41 | 0.12 |
| TOTAL | 99.78 | 98.49 | 96.77 | 97.52 | 96.83 | 98.79 |

Structural formulae on the basis of 23 (O)
(Recalculated to cation total of 15)

| | | | | | | |
|---|---|---|---|---|---|---|
| Si | 7.899 | 7.432 | 7.714 | 7.896 | 7.989 | 7.979 |
| Ti | - | .014 | - | - | - | - |
| Al | .198 | .645 | .370 | .224 | .093 | .092 |
| $Fe^{2+}$ | 1.046 | .393 | .988 | 1.110 | .938 | .964 |
| $Fe^{3+}$ | .883 | .058 | .307 | .032 | .020 | .033 |
| Mn | .034 | .021 | - | - | - | - |
| Mg | 3.844 | 3.594 | 3.574 | 3.739 | 3.934 | 3.982 |
| Ca | 1.868 | 1.532 | 1.943 | 1.951 | 1.841 | 1.840 |
| Na | - | .086 | .090 | .048 | .123 | .096 |
| K | .054 | .367 | .014 | - | .015 | - |
| Cr | - | .033 | - | - | .046 | .014 |

TABLE 6.3 : GEARLESS WELL REPRESENTATIVE BIOTITE ANALYSES

| | GW-3 003 | | GW-3 003 | | GW-1 004 | |
|---|---|---|---|---|---|---|
| | MATRIX | | AGG.FRAGS | | MATRIX | |
| | RIM | CORE | RIM | CORE | RIM | CORE |
| $SiO_2$ | 39.50 | 38.63 | 38.96 | 37.84 | 38.68 | 39.18 |
| $TiO_2$ | 0.72 | 0.95 | 0.81 | 1.93 | 1.08 | 1.81 |
| $Al_2O_3$ | 13.45 | 13.55 | 13.79 | 13.48 | 11.78 | 12.31 |
| FeO(tot) | 15.62 | 16.09 | 16.13 | 16.93 | 14.31 | 13.51 |
| MgO | 15.49 | 15.26 | 15.17 | 13.92 | 16.66 | 16.96 |
| CaO | 0.19 | - | - | - | - | - |
| $Na_2O$ | - | - | - | - | 0.28 | - |
| $K_2O$ | 9.61 | 9.53 | 9.63 | 9.68 | 9.11 | 9.72 |
| $Cr_2O_3$ | - | - | 0.19 | 0.71 | 0.17 | 0.75 |
| TOTAL | 94.58 | 94.01 | 94.69 | 94.49 | 92.27 | 92.24 |

Structural formulae on the basis of 22 (O)

| | | | | | | |
|---|---|---|---|---|---|---|
| Si | 5.938 | 5.865 | 5.871 | 5.768 | 5.969 | 5.887 |
| Ti | .081 | .108 | .092 | .221 | .124 | .204 |
| $Al^{IV}$ | 2.062 | 2.135 | 2.129 | 2.233 | 2.031 | 2.114 |
| $Al^{VI}$ | .321 | .289 | .320 | .190 | .102 | .042 |
| Fe | 1.964 | 2.042 | 2.033 | 2.158 | 1.837 | 1.696 |
| Mg | 3.472 | 3.452 | 3.408 | 3.162 | 3.812 | 3.903 |
| Ca | .031 | - | - | - | - | - |
| Na | - | - | - | - | .082 | - |
| K | 1.843 | 1.846 | 1.851 | 1.881 | 1.785 | 1.852 |
| Cr | - | - | .023 | .086 | .020 | .037 |

## TABLE 6.4 : GEARLESS WELL REPRESENTATIVE TITANITE & APATITE ANALYSES

| | TITANITE | | | | | APATITE | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 003 MATRIX | | | 004 MATRIX | | 003 MATRIX | | | 004 MATRIX | |
| wt% | RIM | CORE | RIM | RIM | CORE | RIM | CORE | CORE | RIM | CORE |
| $SiO_2$ | 30.38 | 30.27 | 31.08 | 29.79 | 30.97 | 9.46 | 0.50 | 1.46 | 0.80 | 0.47 |
| $TiO_2$ | 37.55 | 36.54 | 34.35 | 38.06 | 38.42 | - | - | - | - | - |
| $Al_2O_3$ | 1.14 | 1.07 | 1.98 | 0.66 | 1.15 | 2.64 | - | 0.29 | - | - |
| $Fe_2O_3$ | - | - | - | - | - | 0.45 | 3.76 | 1.63 | 0.10 | 0.23 |
| FeO | 1.45 | 1.73 | 3.08 | 1.49 | 1.10 | - | - | - | - | - |
| CaO | 28.96 | 28.31 | 28.85 | 29.75 | 29.11 | 49.04 | 55.77 | 54.88 | 55.55 | 55.79 |
| $K_2O$ | 0.07 | 0.15 | - | - | 0.08 | 2.43 | 0.33 | 0.37 | - | - |
| $P_2O_5$ | - | - | 0.21 | - | - | 36.44 | 41.04 | 40.41 | 41.15 | 41.41 |
| Other | 0.61 | 0.36 | 0.77 | 0.00 | 0.25 | - | - | - | - | - |
| TOTAL | 100.17 | 100.45 | 100.32 | 99.76 | 101.07 | 100.45 | 98.34 | 98.34 | 97.86 | 98.06 |
| | Structural formulae calculated on the basis of: | | | | | | | | | |
| | 18 (O) | | | | | 25 (O) | | | | |
| Si | 3.592 | 3.527 | 3.678 | 3.549 | 3.615 | 1.522 | 0.084 | 0.244 | 0.135 | 0.079 |
| Ti | 3.338 | 3.202 | 3.057 | 3.409 | 3.372 | - | - | - | - | - |
| Al | 0.159 | 0.147 | 0.277 | 0.093 | 0.158 | 0.501 | - | 0.057 | - | - |
| $Fe^{3+}$ | - | - | - | - | - | 0.055 | 0.473 | 0.205 | 0.012 | 0.030 |
| $Fe^{2+}$ | 0.143 | 0.168 | 0.304 | 0.148 | 0.107 | - | - | - | - | - |
| Ca | 3.667 | 3.534 | 3.659 | 3.797 | 3.641 | 8.459 | 9.991 | 9.812 | 9.982 | 10.001 |
| K | 0.011 | 0.022 | - | - | 0.012 | 0.499 | 0.070 | 0.079 | - | - |
| P | - | - | 0.021 | - | - | 4.966 | 5.809 | 5.709 | 5.843 | 5.870 |
| Other | 0.058 | 0.199 | 0.048 | - | 0.024 | - | - | - | - | - |

TABLE 6.5 : GEARLESS WELL WHOLE ROCK MAJOR AND TRACE ELEMENT GEOCHEMISTRY

| | 003 | 003H | 004 | 004H | 005 | 0979 | 0980 | 5227 | 5228 | 5231 |
|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 55.28 | 55.54 | 58.03 | 56.00 | 57.84 | 60.60 | 58.20 | 56.60 | 55.80 | 56.50 |
| $TiO_2$ | 0.92 | 0.94 | 0.91 | 1.03 | 0.94 | 0.78 | 0.83 | 1.01 | 1.13 | 0.88 |
| $Al_2O_3$ | 12.11 | 11.69 | 12.49 | 11.86 | 10.78 | 11.20 | 12.00 | 11.80 | 11.80 | 11.50 |
| $Fe_2O_3$ | 3.59 | 8.81 | 4.17 | 8.82 | 4.57 | 7.89 | 8.38 | 8.88 | 9.25 | 8.63 |
| FeO | 4.65 | na | 3.27 | na | 3.34 | na | na | na | na | na |
| MnO | 0.12 | 0.11 | 0.08 | 0.11 | 0.12 | 0.08 | 0.08 | 0.11 | 0.09 | 0.10 |
| MgO | 6.76 | 6.78 | 4.95 | 5.74 | 5.06 | 6.21 | 6.42 | 5.30 | 5.44 | 6.71 |
| CaO | 5.51 | 5.73 | 4.12 | 5.33 | 5.53 | 3.28 | 3.61 | 6.73 | 5.47 | 4.17 |
| $Na_2O$ | 3.61 | 3.67 | 2.96 | 3.16 | 3.09 | 2.42 | 2.47 | 1.93 | 2.19 | 2.58 |
| $K_2O$ | 4.96 | 4.76 | 6.75 | 5.54 | 5.09 | 5.94 | 6.29 | 6.38 | 7.05 | 7.32 |
| $P_2O_5$ | 0.68 | 0.64 | 0.41 | 1.07 | 1.08 | 0.55 | 0.58 | 0.80 | 1.14 | 0.73 |
| LOI | 1.50 | 0.92 | 0.91 | 0.62 | 2.00 | 0.48 | 0.65 | 0.45 | 0.47 | 0.40 |
| TOTAL | 99.70 | 99.51 | 99.06 | 99.22 | 99.44 | 99.43 | 99.51 | 99.99 | 99.83 | 99.52 |
| Sc | 24 | 24.6 | 20.3 | 19.8 | 19.1 | na | na | na | na | na |
| V | 162 | 170 | 114 | 141 | 131 | na | na | na | na | na |
| Cr | 334 | 363 | 107 | 215 | 188 | na | na | na | na | na |
| Ni | 137 | 146 | 110 | 138 | 124 | na | na | na | na | na |
| Cu | 48 | 36 | 57 | 131 | 69 | na | na | na | na | na |
| Pb | 32 | 29 | 40 | 35 | 35 | na | na | na | na | na |
| Zn | 84 | 84 | 73 | 92 | 90 | na | na | na | na | na |
| Ga | 17 | 16 | 14 | 17 | 17 | na | na | na | na | na |
| Rb | 254 | 234 | 198 | 183 | 232 | 243 | 227 | 255 | 269 | 283 |
| Sr | 476 | 432 | 330 | 500 | 730 | 274 | 311 | 245 | 225 | 284 |
| Y | 21.8 | 23.1 | 19.9 | 23.9 | 21.2 | 34 | 49 | 22 | 22 | 32 |
| Zr | 185 | 170 | 263 | 242 | 219 | 324 | 334 | 413 | 316 | 341 |
| Nb | 6.9 | 6.2 | 9.4 | 9.2 | 8.3 | 5 | 5 | 13 | 21 | 5 |
| Ba | 2708 | 2950 | 4873 | 4159 | 3077 | 4430 | 4330 | 2190 | 2430 | 4450 |
| La | 59 | 54 | 46 | 75 | 66 | na | na | na | na | na |
| Ce | 87 | 76 | 76 | 112 | 106 | na | na | na | na | na |
| Nd | 34 | 29 | 15 | 37 | 33 | na | na | na | na | na |
| Th | 15 | 14 | 20 | 19 | 20 | na | na | na | na | na |

Major elements wt.%, trace elements p.p.m.
na = no analysis , nd = not detected.

003 - UODC GW-3 32.8-35.6m, -60 MESH SPLIT FROM TOTAL CRUSHINGS
003H - UODC GW-3 32.8-35.6m, UNVEINED MATERIAL HANDPICKED PRIOR TO CRUSHING
004 - UODC GW-1 64.1-67.9m, -60 MESH SPLIT FROM TOTAL CRUSHINGS
004H - UODC GW-1 64.1-67.9m, UNVEINED MATERIAL HANDPICKED PRIOR TO CRUSHING
005 - UODC GW-1 67.9-69.8m, UNSIZED SPLIT FROM TOTAL CRUSHINGS
0979 - BHP CGW-1 DRILL CUTTINGS
0980 - BHP CGW-8 DRILL CUTTINGS
5227 - BHP CGW-4 DRILL CUTTINGS
5228 - BHP CGW-5 DRILL CUTTINGS
5231 - SAMIN Y-1 DRILL CUTTINGS

TABLE 6.5 cont...

| | 003TR | 004TR | 005TR | 003-1 | 003-6 | 003-11 | 004-3 | 004-5 | 004-10 | 004-12 |
|---|---|---|---|---|---|---|---|---|---|---|
| Sc | 23.5 | 20.5 | 18.6 | 25.6 | 25 | 24.7 | 20.9 | 22.1 | 20.3 | 21 |
| V | 165 | 137 | 127 | 169 | 160 | 157 | 146 | 146 | 140 | 151 |
| Cr | 306 | 186 | 190 | 342 | 359 | 333 | 190 | 191 | 197 | 197 |
| Ni | 117 | 161 | 142 | 144 | 152 | 181 | 135 | 140 | 145 | 146 |
| Cu | 47 | 150 | 71 | 78 | 69 | 37 | 155 | 104 | 118 | 17 |
| Pb | 30 | 44 | 35 | 50 | 37 | 18 | 27 | 56 | 51 | 26 |
| Zn | 86 | 95 | 94 | 83 | 75 | 92 | 101 | 91 | 92 | 110 |
| Ga | 18 | 17 | 18 | 18 | 14 | 15 | 18 | 18 | 17 | 15 |
| Rb | 263 | 232 | 224 | 238 | 244 | 216 | 208 | 233 | 228 | 269 |
| Sr | 480 | 490 | 738 | 434 | 515 | 357 | 568 | 383 | 502 | 475 |
| Y | 17.6 | 20.2 | 20 | 22.2 | 18.9 | 21.2 | 20.9 | 21.7 | 21.9 | 22.8 |
| Zr | 190 | 253 | 230 | 199 | 170 | 198 | 251 | 251 | 246 | 252 |
| Nb | 8 | 10.1 | 7.6 | 8.5 | 6.4 | 7.8 | 9.3 | 9.3 | 10.2 | 9.1 |
| Ba | 2678 | 4630 | 2971 | 2432 | 4836 | 2010 | 2947 | 4876 | 5218 | 5161 |
| La | 57 | 65 | 62 | 56 | 42 | 52 | 75 | 73 | 76 | 76 |
| Ce | 88 | 107 | 96 | 88 | 76 | 85 | 110 | 113 | 119 | 121 |
| Nd | 30 | 22 | 32 | 33 | 17 | 36 | 46 | 36 | 32 | 31 |
| Th | 13 | 20 | 18 | 14 | 13 | 12 | 20 | 20 | 19 | 21 |

Trace elements p.p.m.

003TR - UODC GW-3 32.8-35.6m, -60 MESH SPLIT FROM Rb-Sr WHOLE ROCK SAMPLE
004TR - UODC GW-1 64.1-67.9m, -60 MESH SPLIT FROM Rb-Sr WHOLE ROCK SAMPLE
005TR - UODC GW-1 67.9-69.8m, SPLIT FROM UNSIZED Rb-Sr WHOLE ROCK SAMPLE
003-1 - UODC GW-3 33.18-33.20m, SPLIT FROM HANDPICKED UNVEINED Rb-Sr SAMPLE
003-6 - UODC GW-3 34.31-34.33m, SPLIT FROM HANDPICKED UNVEINED Rb-Sr SAMPLE
003-11- UODC GW-3 35.49-35.53m, SPLIT FROM HANDPICKED UNVEINED Rb-Sr SAMPLE
004-3 - UODC GW-1 64.69-64.72m, SPLIT FROM HANDPICKED UNVEINED Rb-Sr SAMPLE
004-5 - UODC GW-1 65.45-65.47m, SPLIT FROM HANDPICKED UNVEINED Rb-Sr SAMPLE
004-10- UODC GW-1 67.07-67.10m, SPLIT FROM HANDPICKED UNVEINED Rb-Sr SAMPLE
004-12- UODC GW-1 67.71-67.73m, SPLIT FROM HANDPICKED UNVEINED Rb-Sr SAMPLE

TABLE 6.5 cont...

| | 004-15 | 5334 | 5335 | 5336 | 5337 | 5338 | 5339 |
|---|---|---|---|---|---|---|---|
| Sc | 21 | na | na | na | na | na | na |
| V | 141 | 110 | 160 | 150 | 150 | 100 | 90 |
| Cr | 187 | 120 | 120 | 210 | 160 | 150 | 170 |
| Mn | na | 680 | 490 | 390 | 310 | 330 | 330 |
| Co | na | 15 | 20 | 15 | 15 | 20 | 20 |
| Mo | na | <4 | 4 | <4 | 4 | 4 | <4 |
| Ni | 139 | 65 | 85 | 85 | 70 | 190 | 210 |
| Cu | 42 | 130 | 55 | 50 | 22 | 18 | 12 |
| Pb | 67 | 60 | 100 | 42 | 38 | 18 | 22 |
| Zn | 92 | 80 | 85 | 46 | 46 | 60 | 60 |
| Ga | 16 | na | na | na | na | na | na |
| Rb | 251 | na | na | na | na | na | na |
| Sr | 426 | 1000 | 720 | 580 | 330 | 400 | 360 |
| Y | 22.8 | 22 | 16 | 22 | 18 | 12 | 10.00 |
| Zr | 244 | 280 | 260 | 230 | 200 | 230 | 220 |
| Nb | 9.6 | 32 | 14 | 24 | 14 | 6 | 8 |
| Ba | 5003 | 4700 | 3300 | 2700 | 1900 | 2350 | 2650 |
| La | 80 | 70 | 70 | 50 | 70 | 60 | 30 |
| Ce | 114 | na | na | na | na | na | na |
| Nd | 32 | na | na | na | na | na | na |
| Th | 18 | na | na | na | na | na | na |
| U | na | 8 | 6 | 6 | 4 | 4 | 6 |
| Au | na | .05 | .10 | .05 | .15 | .05 | .05 |
| As | na | <2 | <2 | <2 | <2 | <2 | <2 |
| Sn | na | <4 | 4 | 4 | 4 | <4 | 4 |
| W | na | 10 | <10 | <10 | <10 | <10 | 10 |
| Ta | na | <10 | <10 | <10 | <10 | <10 | <10 |

Trace elements p.p.m, samples 5334-5339 I.C.P. ANALYSES.

004-15- UODC GW-1 65.10-65.14m, SPLIT FROM HANDPICKED UNVEINED Rb-Sr SAMPLE
5334 - UODC GW-1 66.1m, TRACHYANDESITE WITH THIN CARBONATE VEINS
5335 - UODC GW-1 69.0m, TRACHYANDESITE
5336 - UODC GW-2 62.5m, FOLIATED TRACHYANDESITE
5337 - UODC GW-3 35.2m, FOLIATED TRACHYANDESITE
5338 - UODC GW-4 51.8m, META MAFIC AGGLOMERATE
5339 - UODC GW-4 52.2m, META MAFIC AGGLOMERATE 1-2% CARBONATE VEINS

TABLE 6.6 : GEARLESS WELL CIPW NORMS

| | 003 | 003H | 004 | 004H | 005 | 0979 | 0980 | 5227 | 5228 | 5231 |
|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 51.75 | 51.67 | 54.81 | 52.52 | 55.38 | 56.85 | 54.48 | 53.15 | 52.35 | 52.56 |
| $TiO_2$ | 0.65 | 0.66 | 0.65 | 0.73 | 0.68 | 0.55 | 0.58 | 0.71 | 0.80 | 0.62 |
| $Al_2O_3$ | 13.36 | 12.82 | 13.90 | 13.11 | 12.17 | 12.38 | 13.24 | 13.06 | 13.05 | 12.61 |
| $Fe_2O_3$ | 2.53 | 3.08 | 2.96 | 3.11 | 3.29 | 2.78 | 2.95 | 3.14 | 3.27 | 3.02 |
| FeO | 3.64 | 3.81 | 2.58 | 3.84 | 2.67 | 3.44 | 3.65 | 3.87 | 4.03 | 3.73 |
| MnO | 0.09 | 0.09 | 0.06 | 0.09 | 0.10 | 0.06 | 0.06 | 0.09 | 0.07 | 0.08 |
| MgO | 9.43 | 9.40 | 6.97 | 8.03 | 7.22 | 8.68 | 8.96 | 7.42 | 7.61 | 9.31 |
| CaO | 5.52 | 5.71 | 4.17 | 5.35 | 5.67 | 3.30 | 3.62 | 6.77 | 5.50 | 4.16 |
| $Na_2O$ | 6.56 | 6.61 | 5.43 | 5.75 | 5.73 | 4.40 | 4.48 | 3.51 | 3.98 | 4.65 |
| $K_2O$ | 5.92 | 5.64 | 8.14 | 6.62 | 6.21 | 7.11 | 7.51 | 7.64 | 8.44 | 8.69 |
| $P_2O_5$ | 0.54 | 0.51 | 0.33 | 0.85 | 0.88 | 0.44 | 0.46 | 0.64 | 0.91 | 0.57 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | | | | | | | | | | |
| Ap | 1.50 | 1.41 | 0.91 | 2.42 | 2.41 | 1.27 | 1.34 | 1.78 | 2.56 | 1.63 |
| Il | 1.75 | 1.79 | 1.77 | 2.02 | 1.82 | 1.56 | 1.66 | 1.94 | 2.19 | 1.70 |
| Mt | 5.22 | 6.39 | 6.16 | 6.57 | 6.73 | 6.02 | 6.41 | 6.51 | 6.85 | 4.82 |
| Or | 29 | 28 | 41 | 34 | 30 | 37 | 39 | 38 | 42 | 44 |
| Ab | 31 | 31 | 25 | 27 | 26 | 21 | 22 | 16 | 19 | 19 |
| An | 2.17 | 1.40 | 0.85 | 1.86 | 0.54 | 2.26 | 3.24 | 4.73 | 1.57 | - |
| Di | 18 | 20 | 15 | 16 | 18 | 9.67 | 10 | 21 | 16 | 14 |
| Hy | 3.44 | 4.36 | 4.69 | 7.03 | 4.09 | 9.61 | 9.97 | 4.90 | 6.40 | 6.41 |
| Ol | 6.95 | 4.64 | - | - | - | - | - | - | - | 4.49 |
| Ac | - | - | - | - | - | - | - | - | - | 3.07 |
| Q | - | - | 3.06 | 1.58 | 8.01 | 10 | 4.97 | 4.21 | 1.63 | - |
| Total | 99 | 99 | 99 | 98 | 98 | 99 | 99 | 99 | 99 | 99 |
| | | | | | | | | | | |
| A | 36 | 34 | 43 | 36 | 38 | 36 | 36 | 35 | 37 | 38 |
| M | 28 | 27 | 22 | 24 | 23 | 27 | 26 | 23 | 22 | 26 |
| F | 36 | 39 | 35 | 40 | 39 | 38 | 38 | 42 | 41 | 37 |
| Q | 48 | 48 | 49 | 48 | 50 | 51 | 49 | 49 | 48 | 48 |
| M | 22 | 23 | 18 | 20 | 20 | 17 | 18 | 21 | 21 | 21 |
| L | 30 | 29 | 33 | 32 | 30 | 32 | 32 | 30 | 31 | 30 |
| PALI | 0.74 | 0.71 | 0.78 | 0.74 | 0.69 | 0.84 | 0.85 | 0.73 | 0.73 | 0.72 |
| PAKI | 1.07 | 1.05 | 1.03 | 1.06 | 1.02 | 1.08 | 1.10 | 1.17 | 1.05 | 0.95 |
| AI | 0.93 | 0.96 | 0.98 | 0.94 | 0.98 | 0.93 | 0.91 | 0.85 | 0.95 | 1.06 |
| PMI | 1.45 | 1.42 | 1.49 | 1.41 | 1.29 | 1.22 | 1.32 | 1.26 | 1.42 | 1.52 |

PALI = Peraluminous index $Al_2O_3$ / ( CaO + $Na_2O$ + $K_2O$ )
>1 = peraluminous, <1 = metaluminous

PAKI = Peralkaline index $Al_2O_3$ / ( $Na_2O$ + $K_2O$ )
<1 = peralkaline

AI = Agpaitic index ( $Na_2O$ + $K_2O$ ) / $Al_2O_3$
>1 = agpaitic

PMI = plumaskitic index 6 ( $Na_2O$ + $K_2O$ ) / $SiO_2$
<1 = plumaskitic, >1 = miaskitic

TABLE 6.7 : Rb, Sr and isotope ratio measurements, Gearless Well

| Sample[1] | Rb (ppm) | Sr (ppm) | $^{87}Rb/^{86}Sr$ | $^{87}Sr/^{86}Sr$[2] |
|---|---|---|---|---|
| GW-3 003 TR | 239.6 | 451.7 | 1.54277 | 0.76008 |
| 003(1) | 216.6 | 405.7 | 1.55209 | 0.75883 |
| 003(6) | 222.4 | 486.1 | 1.33008 | 0.75755 |
| 003(11) | 201.3 | 335.2 | 1.74731 | 0.76432 |
| GW-1 004 TR | 217.1 | 467.7 | 1.34854 | 0.74825 |
| 004(3) | 189.0 | 524.4 | 1.04619 | 0.74015 |
| 004(5) | 216.5 | 360.8 | 1.74434 | 0.75734 |
| 004(10) | 210.8 | 467.2 | 1.31032 | 0.74708 |
| 004(12) | 247.8 | 446.4 | 1.61328 | 0.75407 |
| 004(15) | 234.4 | 401.6 | 1.69661 | 0.75678 |
| 005 TR | 205.7 | 687.1 | 0.86870 | 0.73510 |
| 004 BIOT | 745.7 | 96.7 | 23.95786 | 1.46020 |
| 005 BIOT | 784.9 | 82.8 | 29.97838 | 1.65628 |

1 TR = Total rock, BIOT= Biotite.

2 $^{87}Sr/^{86}Sr$ for E & A std = 0.7080496 ± 0.0000096 (1 sigma).

TABLE 6.8 : Results of regression analyses and whole rock-biotite ages

| Regression | Samples | MSWD | Age (Ma) | IR | Model |
|---|---|---|---|---|---|
| GW-3 - all whole rock samples | 4 | 89.19 | 1048 ± 1340 | .73706 ± .02895 | 2 |
| GW-1 - all whole rocks minus 005 TR | 6 | 4.26 | 1727 ± 110 | .71437 ± .00218 | 2 |
| GW-1 - all whole rocks | 7 | 6.64 | 1767 ± 97 | .71344 ± .00190 | 4 |
| All whole rocks | 11 | 384.39 | 2080 ± 588 | .70969 ± .01116 | 2 |
| 004TR-004BIOT | 2 | | 2183 ± 15 | .70578 ± .0001 | |
| 005TR-005BIOT | 2 | | 2194 ± 15 | .70761 ± .0001 | |
| Pooled WR-Biot Age | | | 2188 ± 11 | | |

**TABLE 7.1 : FELSIC ALKALINE SUITE REPRESENTATIVE GARNET ANALYSES**

| | 052-1 | 052-1 | 052-1 | 033-3 | 033-3 | 033-5 | 203-4 | 203-4 | 119-8 | 119-8 | 234-5 | 234-5 | 234-5 | 234-5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| wt% | | ** | | | | | | | ** | ** | RIM | CORE | RIM | CORE |
| $SiO_2$ | 34.48 | 35.56 | 35.59 | 35.27 | 35.50 | 35.82 | 40.09 | 38.77 | 34.91 | 35.32 | 34.40 | 34.77 | 34.73 | 34.01 |
| $TiO_2$ | 0.34 | 0.37 | 0.34 | 0.15 | 0.12 | - | - | - | 1.67 | 1.42 | 0.54 | 0.75 | 0.45 | 0.42 |
| $Al_2O_3$ | 1.47 | 1.41 | 1.38 | 0.50 | 0.68 | 0.86 | 21.66 | 22.50 | 2.05 | 1.93 | 1.39 | 1.71 | 1.36 | 1.35 |
| $Fe_2O_3$ | - | 30.80 | - | - | - | - | - | - | 25.57 | 27.06 | - | - | - | - |
| FeO | 26.74 | .08 | 27.80 | 27.61 | 28.03 | 27.60 | 12.23 | 12.57 | 1.15 | 0.60 | 26.63 | 26.53 | 27.20 | 27.19 |
| MnO | 1.46 | 1.29 | 1.29 | 1.58 | 1.38 | 2.03 | 0.27 | 0.36 | 0.32 | 0.22 | 0.32 | 0.21 | 0.23 | 0.29 |
| MgO | - | - | - | - | - | - | - | 0.12 | 0.18 | 0.12 | 0.47 | 0.48 | 0.59 | 0.38 |
| CaO | 31.32 | 32.19 | 32.47 | 32.21 | 32.79 | 32.47 | 21.49 | 21.52 | 32.35 | 32.63 | 32.51 | 32.70 | 32.42 | 31.99 |
| $Na_2O$ | 2.92 | 0.29 | - | - | - | - | - | - | - | 0.15 | 0.69 | 0.85 | 0.93 | 0.69 |
| $K_2O$ | 0.22 | - | - | - | - | - | 0.10 | 0.12 | - | - | - | - | - | - |
| $P_2O_5$ | - | - | - | - | - | - | - | - | - | - | 0.12 | 0.15 | 0.27 | - |
| Other | - | - | - | - | - | 0.15 | 0.18 | - | - | 0.14 | - | - | - | - |
| TOTAL | 98.95 | 101.97 | 98.87 | 97.32 | 98.50 | 98.93 | 96.02 | 95.96 | 98.20 | 99.60 | 97.07 | 98.15 | 98.18 | 96.32 |

Structural formulae on the basis of 24(O)

| | 052-1 | 052-1 | 052-1 | 033-3 | 033-3 | 033-5 | 203-4 | 203-4 | 119-8 | 119-8 | 234-5 | 234-5 | 234-5 | 234-5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ** | | | | | | | ** | ** | | | | |
| Si | 6.259 | 5.892 | 6.409 | 6.466 | 6.449 | 6.408 | 6.320 | 6.144 | 5.943 | 5.933 | 6.299 | 6.276 | 6.287 | 6.302 |
| Ti | .047 | .043 | .046 | .020 | .016 | - | - | - | .213 | .179 | .075 | .101 | .062 | .058 |
| Al | .315 | .269 | .293 | .109 | .146 | .183 | .025 | 4.203 | .412 | .383 | .301 | .364 | .290 | .294 |
| $Fe^{3+}$ | - | 3.840 | - | - | - | - | - | - | 3.276 | 3.420 | - | - | - | - |
| $Fe^{2+}$ | 4.059 | .012 | 4.187 | 4.233 | 4.259 | 4.167 | .612 | 1.666 | .164 | .084 | 4.077 | 4.005 | 4.118 | 4.213 |
| Mn | .225 | .197 | .198 | .245 | .212 | .310 | .036 | .048 | .046 | .031 | .050 | .033 | .036 | .046 |
| Mg | - | - | - | - | - | - | - | .028 | .045 | .030 | .129 | .128 | .160 | .105 |
| Ca | 6.092 | 5.763 | 6.264 | 6.385 | 6.381 | 6.281 | .630 | 3.654 | 5.901 | 5.873 | 6.377 | 6.325 | 6.288 | 6.351 |
| Na | 1.029 | .095 | - | - | - | - | - | - | - | .047 | .245 | .299 | .325 | .248 |
| K | .051 | - | - | - | - | - | .020 | .025 | - | - | - | - | - | - |
| P | - | - | - | - | - | - | - | - | - | - | .018 | .024 | .042 | - |
| Other | - | - | - | - | - | .022 | .023 | - | - | .019 | - | - | - | - |

** cation total recalculated to 16, recalculation for other analyses inapplicable. FeO = total iron for all other analyses.

052 - Lake Cowan syenite, Widgiemooltha
033 - Cardunia Rocks qtz syenite/alkali granite, Kurnalpi
203 - McAuliffe Well qtz syenite, Edjudina
119 - Red Hill syenite, Sir Samuel
234 - Teague Ring Stucture syenite, Nabberu

TABLE 7.2 : GEOCHRONOLOGICAL SUMMARY, FELSIC ALKALINE SUITE

| Locality & lithology | Age (Ma) | IR | Type | Significance |
| --- | --- | --- | --- | --- |
| Gilgarna Rock | | | | |
| Medium phase syenite | 2627 ± 41 | 0.70076 ± .00027 | WR+Min | Crystallisation |
| Coarse phase syenite | 2542 ± 14 | 0.70145 ± .0009 | WR+Min | Crystallisation |
| Binneringie syenite | 2470 ± 77 | 0.70117 ± .0001 | WR+Min | Minimum |
| Red Hill Group 1 syenite | 2471 ± 30 | 0.70191 ± .0008 | WR+Min | Minimum |
| Fitzgerald Peaks Group 1 syenite | 2350 ± 140 | 0.70138 ± .0010 | WR+Min | Minimum |
| 12 Mile Well syenite | 2489 ± 82 | *0.70133 ± .0003 | WR | Crystallisation |
| Woorana Well syenite | 2520 ± 113 | *0.70153 ± .0017 | WR | Crystallisation |

* Data from Libby & De Laeter (1981).
Normalised to the E & A std value of this study.

TABLE 7.3 : RESULTS OF EVOLUTIONARY MODELLING USING Sr ISOTOPES

| Locality | Age, T (Ma) | Bulk Earth $^{87}Sr/^{86}Sr$ at Age T | Measured initial $^{87}Sr/^{86}Sr$ ratio | [1]Minimum age of separation from Bulk Earth (Ma) | $\epsilon Sr_{BE}$ |
|---|---|---|---|---|---|
| Gilgarna | | | | | |
| Medium | 2627 | 0.70143 | 0.70076 | 3161 | -9.55 |
| Coarse | 2542 | 0.70154 | 0.70145 | 2616 | -1.28 |
| Binneringie | 2470 | 0.70163 | 0.70117 | 2838 | -6.56 |
| Red Hill | | | | | |
| Gp 1 syen | 2471 | 0.70163 | 0.70191 | 2251 | 3.99 |
| Fitz. Peaks | | | | | |
| Gp 1 syen | 2350 | 0.70178 | 0.70138 | 2671 | -5.70 |
| [2]Twelve Mile Well | 2489 | 0.70161 | 0.70133 | 2711 | -3.99 |
| [2]Woorana Well | 2520 | 0.70157 | 0.70153 | 2552 | -0.57 |

Sr evolution curve constructed from:
$I^{0}(BE) = 0.70469$, $I^{4.55Ga}(BE) = 0.69898$, $(^{87}Rb/^{86}Sr)^{0}(BE) = 0.0856$.

[1] Assumes Rb content of the product = 0

[2] Data from Libby & De Laeter (1981).

## TABLE 7.4 : BEST FITTED LEAST SQUARES MASS BALANCE CALCULATION

WEIGHTED INPUT DATA

| | PARENT | DIOP | FELDSP | QTZ | BIOT | DAUGHTER |
|---|---|---|---|---|---|---|
| $SiO_2$ | 46.23 | 51.94 | 68.15 | 99.02 | 37.57 | 64.73 |
| $TiO_2$ | 1.70 | 0.92 | 0.00 | 0.00 | 3.17 | 0.29 |
| $Al_2O_3$ | 12.51 | 8.06 | 19.72 | 0.00 | 14.76 | 17.20 |
| FeO | 15.61 | 4.02 | 0.00 | 0.00 | 30.53 | 2.25 |
| MnO | 0.44 | 0.06 | 0.00 | 0.00 | 0.06 | 0.09 |
| MgO | 9.66 | 12.33 | 0.00 | 0.00 | 4.27 | 0.74 |
| CaO | 10.83 | 20.32 | 0.59 | 0.00 | 0.17 | 2.14 |
| $Na_2O$ | 1.70 | 1.86 | 9.15 | 0.00 | 0.15 | 7.64 |
| $K_2O$ | 0.15 | 0.49 | 1.39 | 0.00 | 8.34 | 3.80 |
| $P_2O_5$ | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.14 |

SOLUTION

| | | |
|---|---|---|
| PARENT | 1.000 | |
| DIOP | -0.700 | 23.796 |
| FELDSP | -1.633 | 55.490 |
| QTZ | -0.038 | 1.286 |
| BIOT | -1.943 | 19.427 |

RESIDUAL (R SQUARED) = 0.186

| | PARENT ANALYSIS | DAUGHT. ANALYSIS | DAUGHT. CALC. | WEIGHTED RESIDUAL |
|---|---|---|---|---|
| $SiO_2$ | 46.23 | 64.73 | 64.73 | 0.00 |
| $TiO_2$ | 1.70 | 0.29 | 0.37 | -0.08 |
| $Al_2O_3$ | 12.51 | 17.20 | 17.26 | -0.06 |
| FeO | 15.61 | 2.25 | 2.25 | 0.00 |
| MnO | 0.44 | 0.09 | -0.19 | 0.28 |
| MgO | 9.66 | 0.74 | 0.63 | 0.11 |
| CaO | 10.83 | 2.14 | 2.19 | -0.05 |
| $Na_2O$ | 1.70 | 7.64 | 7.51 | 0.13 |
| $K_2O$ | 0.15 | 3.80 | 3.72 | 0.07 |
| $P_2O_5$ | 0.20 | 0.14 | -0.10 | 0.24 |

PARENT COMPOSITION - ANTARCTIC GRANULITE, (D.F. BLIGHT, UNPUBLISHED DATA).

DAUGHTER COMPOSITION - MEDIUM GRAINED SYENITE #006, GILGARNA ROCK.

DIOP = DIOPSIDE, FELDSP = PLAGIOCLASE, QTZ = QUARTZ, BIOT = BIOTITE.

FeO = all iron as FeO.