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THE WELSFORD ANOROGENIC IGNEOUS COMPLEX, SOUTHERN NEW BRUNSWICK: RIFT-RELATED ACADIAN MAGMATISM

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ABSTRACT

The Welsford igneous complex, in southern New Brunswick, contains the association quartz syenite, alkali granite, porphyritic granite and granophyre. Minor quantities of hybrid and more basic rocks are also exposed. Mineralogical and geochemical data indicate that the suite is anorogenic and has not been reheated since its emplacement. The granite is peralkaline and locally enriched in Zr, Nb, Y and Rb. It seems to have formed by the fractionation of a ternay feldspar from a syenitic parental magma. The suite is considered to be Early Devonian in age and associated with Late Silurian ignimbritic felsic volcanic rocks that share some geochemical indications of a peralkaline affiliation. During devitrification, however, most samples underwent Na-for-K ion exchange that disturbed their primary mineralogy and composition. A Late Silurian-Early Devonian period of rift-related igneous activity may have followed a cycle of crustal shortening in the area.

SOMMAIRE

Le complexe igné de Welsford, dans le sud du Nouveau-Brunswick, contient l'association de syénite quartzifère, granite alcalin, granite porphyritique et granophyre. Leurs sont associées des roches hybrides et d'autres plus mafiques, en quantités moins importantes. Les données minéralogiques et géochimiques montrent que ces roches constituent une suite anorogénique qui n'a pas été réchauffée depuis sa mise en place. Le granite est hyperalcalin et localement enrichi en Zr, Nb, Y et Rb. Il semble avoir été formé par l'extraction d'un feldspath ternaire à partir d'un magma parental syénitique. Le complexe aurait été mis en place au début du Dévonien et serait associé à une suite felsique ignimbritique qui partage certains indices d'une filiation hyperalcaline. Au cours de la dévitrification de la plupart de ces roches, il y a eu échange ionique du Na pour K, ce qui a considérablement dérangé la minéralogie et le chimisme primaires. Une période d'extension tardi-Silurienne à Dévonienne inférieure pourrait avoir suivi un épisode de compression dans cette région.

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ACKNOWLEDGEMENTS

We are grateful to the officers of Range Control, Camp Gagetown, for access to the northern part of the Welsford igneous complex. Some of the petrographic observations were made by the late Myint Aung. Mr. Farid Shahzada provided able field assistance. Mr. S.R. McCutcheon, of the New Brunswick Department of Natural Resources, provided excerpts from the Annidale-Nerepis report in advance of publication. We acknowledge the assistance of Dr. M. Mackinnon and Mr. S.T. Ahmedali of McGill University, in connection with electron-microprobe and X-ray fluorescence analyses.

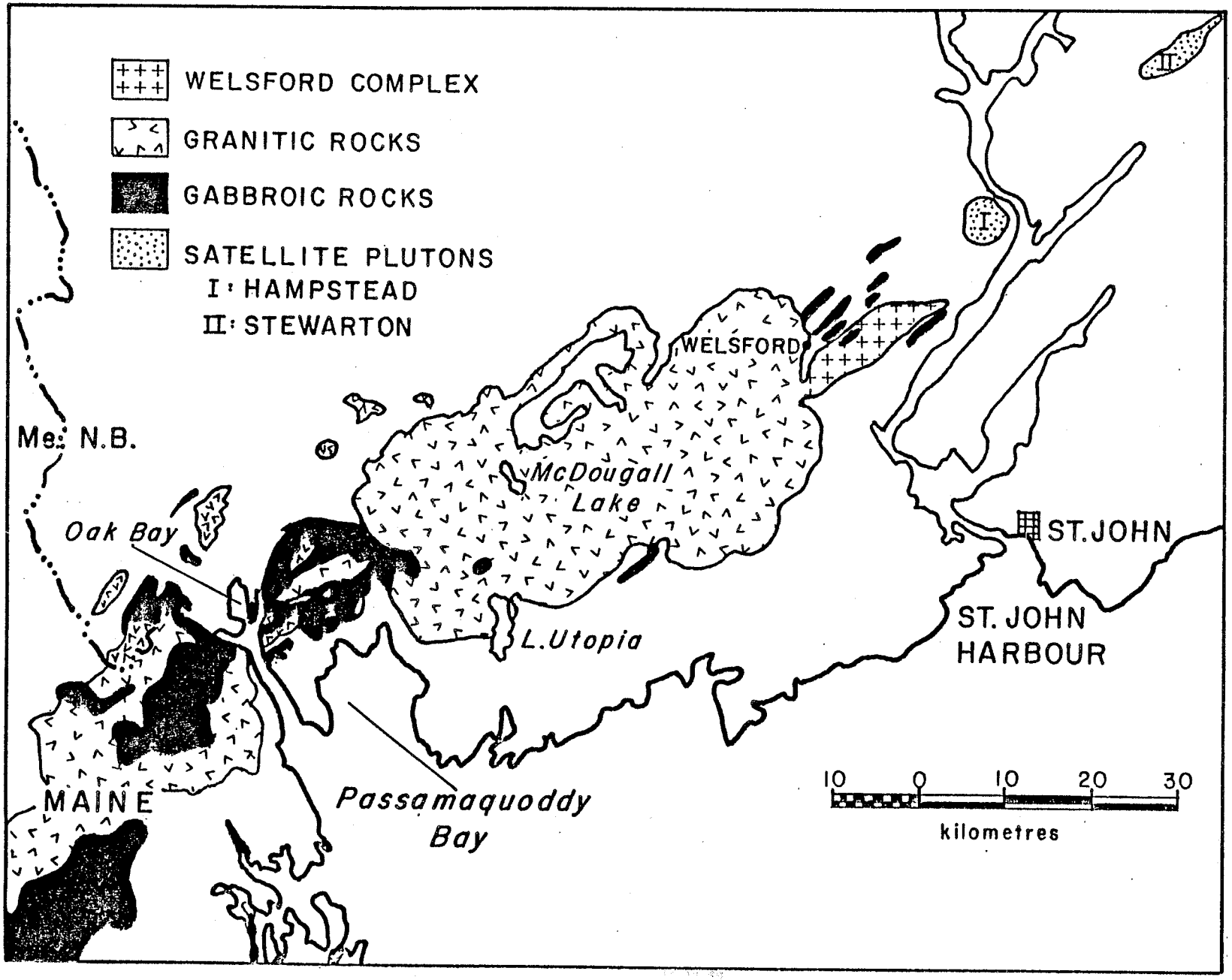
INTRODUCTION

The epizonal Welsford gabbro-syenite-granite complex, southern New Brunswick, has been interpreted as an elongate northeasterly trending appendage of the St. George granitic batholith (Fig. 1). Alcock (1941) considered the Welsford complex to be Middle Devonian, as do McCutcheon & Ruitenberg (in press); it intrudes locally fossiliferous rocks of the Jones Creek Formation (Upper Silurian). A preliminary Rb-Sr isochron for the Welsford rocks (R.F. Cormier, pers. comm.) indicates an age of emplacement in the Earliest Devonian (Gedinnian). As the eastern half of the St. George batholith is now known to be Early Carboniferous in age (Visean; R.F. Cormier, pers. comm.), the Welsford complex can no longer be considered to be closely related to the St. George batholith (cf. Cherry 1976).

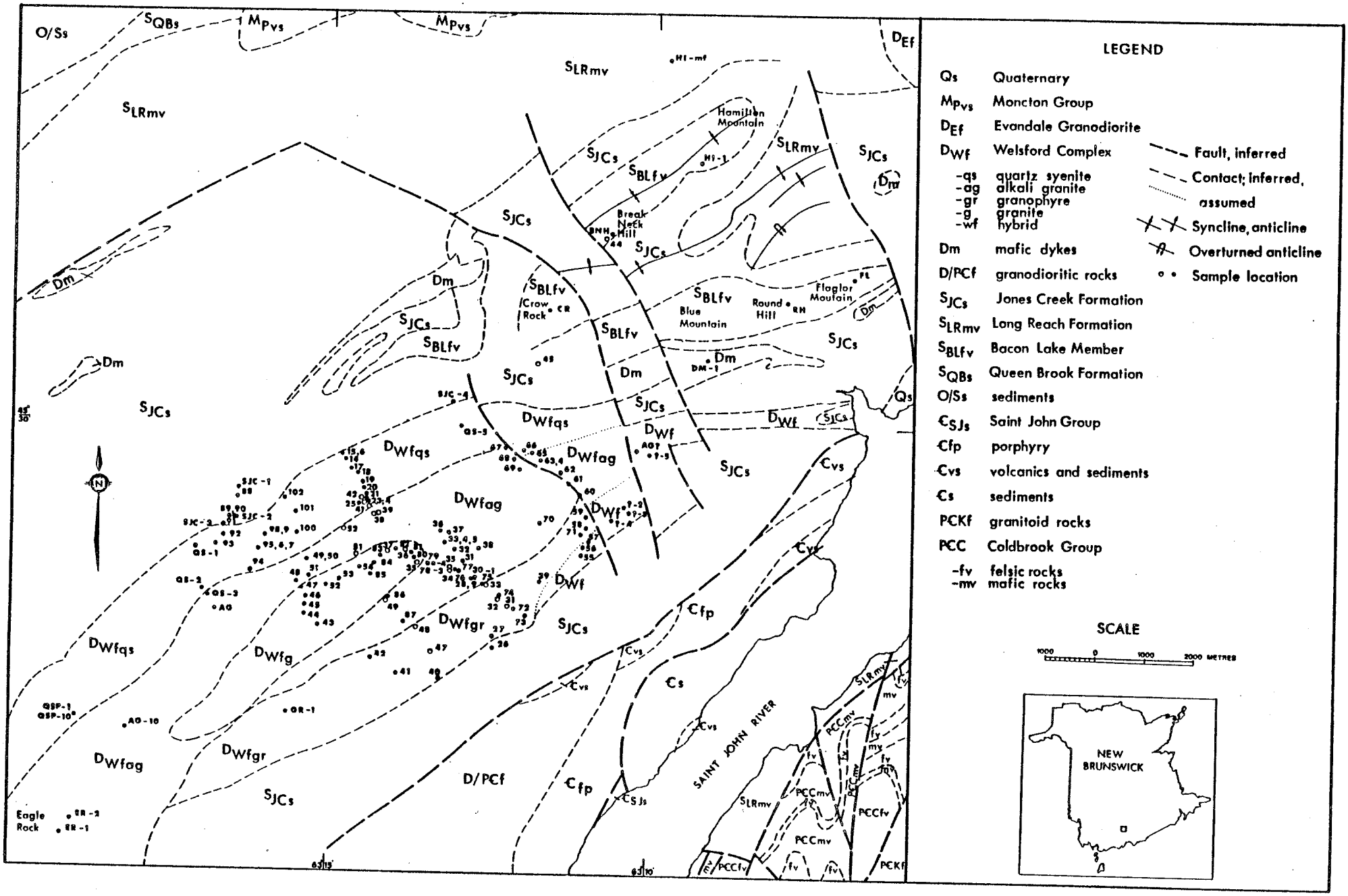
The Welsford complex differs from the adjacent batholith not only in age, but also in lithology. Both contain granitic rocks, but those in the Welsford complex are dominantly of alkaline affinity, whereas those of the eastern portion of the St. George are mildly peraluminous. In addition, the Welsford suite contains more basic rocks (e.g., syenite, diorite, gabbro), whereas the eastern St. George batholith is entirely granitic.

The purpose of this paper is to present information on the petrography, mineralogy and geochemistry of the Welsford complex. These data clearly establish it as a typical example of a differentiated anorogenic, rift-related complex.

The area was recently remapped by S.R. McCutcheon and A.A. Ruitenberg. Their report (in press) builds on the earlier work


WELSFORD COMPLEX
GRANITIC ROCKS
GABBROIC ROCKS
SATELLITE PLUTONS
I: HAMPSTEAD
II: STEWARTON
WELSFORD
Me. N.B.
McDougall Lake
Oak Bay
ST. JOHN
ST. JOHN HARBOUR
L. Utopia
MAINE
Passamaquoddy Bay
10 0 10 20 30
kilometres

of Sharpe (1958), Mackenzie (1964a, b), Jackson (1968), and Ruitenberg (1969). We have retained the five-fold subdivision of McCutcheon & Ruitenberg (Fig. 2): from south to north, in three bands roughly parallel to the outer contacts, 1) granophyric and fine-grained alkali granite (DWfgr), 2) alkali granite and alkali quartz syenite (DWfag), and 3) and alkali quartz syenite and alkali syenite (DWfqs). Also mapped are smaller, elongate bodies of 4) porphyritic granite (DWfg) and 5) hybrid and more basic rocks (DWf) that may be related to mafic dykes (Dm) in the area (Figs. 1, 2). Also included in this study are possible felsic volcanic equivalents of the Welsford epizonal complex. These occur on strike with the complex, to the northeast.



LEGEND

Qs	Quaternary	
M_{Pvs}	Moncton Group	
D_{Ef}	Evandale Granodiorite	
D_{Wf}	Welsford Complex	Fault, inferred
-qs	quartz syenite	Contact; inferred, assumed
-ag	alkali granite	
-gr	granophyre	
-g	granite	Syncline, anticline
-wf	hybrid	Overturned anticline
Dm	mafic dykes	Sample location
D/PCf	granodioritic rocks	
S_{JCs}	Jones Creek Formation	
S_{LRmv}	Long Reach Formation	
S_{BLfv}	Bacon Lake Member	
S_{QBs}	Queen Brook Formation	
O/Ss	sediments	
C_{SJs}	Saint John Group	
Cfp	porphyry	
Cvs	volcanics and sediments	
Cs	sediments	
PCKf	granitoid rocks	
PCC	Coldbrook Group	
-fv	felsic rocks	
-mv	mafic rocks	

SCALE

1000 0 1000 2000 METRES

THE HOST ROCKS

The plutonic rocks of the Welsford Complex cross-cut rocks of the Late Silurian Jones Creek Formation SJCs, Fig. 2). These rocks consist mostly of laminated siltstone and fine-grained sandstone, and are commonly fossil-bearing. The Bacon Lake Member (SBLfv, Fig. 2) of the Jones Creek Formation is of volcanic origin. Rocks of this map unit are described as dark grey to red, flow-banded dacite and associated flow breccia (McCutcheon & Ruitenberg, in press). They are preserved in two parallel synclinal structures, and define the following topographic highs, which were sampled (Fig. 2): 1) Break Neck Hill (BNH), Crow Rock (CR) and Hamilton Mountain (HI), and 2) Blue Mountain, Round Hill (RH) and Flaglor Mountain (FL). We included these samples in our survey to test our working hypothesis that rocks of the Bacon Lake Member are genetically related to the epizonal plutonic rocks of the Welsford complex.

PETROGRAPHY OF THE PLUTONIC ROCKS

Granophyric and fine-grained alkali granite (DWFgr)

Map unit DWfgr forms a 1-km-wide strip along the southern contact with the hornfelsed Jones Creek siltstones (Fig. 2). The rock is typically brick-red, fine-grained and apparently homogeneous. The grain size of the granophyric intergrowth of quartz and highly turbid alkali feldspar decreases as the southern contact is approached. Small (<2 mm), angular miarolitic cavities commonly contain fluorite. The rock is leucocratic, and none of the original mafic minerals has survived the hydrothermal overprint. Chlorite and hematite are typically the only dark minerals present. The rock is not amenable to modal analysis.

Alkali granite and alkali quartz syenite (DWfag)

The transition zone between the granophyric granite and the alkali granite shows a mottling of granophyric and fine-to medium-grained granite. No cross-cutting relationships were encountered. The rock typically is a medium-grained hypersolvus granite, locally with miarolitic cavities 2 or 3 mm across that are lined with euhedral α -quartz and feldspar crystals. Along the strip of granophyric granite, the alkali granite typically is pink to brick-red. In the centre of the unit and toward the northern contact, a cream or pale greenish color is prevalent.

The alkali granite contains, on average, perthite (64 vol. %), quartz (30%), alkali amphibole (3.5%), discrete albite as a rim on perthite grains (1.5%) and small quantities of zircon

(more prevalent than in the syenite), aegirine, aenigmatite, fluorite, opaque phases (magnetite, hematite and ilmenite), and rare calcite. This average is based on results of point counts of ten thin sections. As is common in anorogenic granites, the accessory minerals are clustered around the amphibole (or its breakdown products). Our detailed microprobe study of the clusters revealed several exotic species (described below).

The breakdown of the amphibole is correlated with the reddening of the perthite grains. The coloration of the feldspar is caused by finely dispersed hematite that fills cavities and lines the cleavages. The oxidation of the amphibole results in a hematite + magnetite + quartz pseudomorph.

In the least-altered specimens, the feldspar grains are simply twinned, cream-colored, and consist of string perthite. The presence of interstitial albite is usually associated with the localized development of patch perthite (disturbed string perthite). The turbidity of the alkali feldspar is not as striking as in the granophyric granite, and decreases with increasing freshness of the alkali amphibole. The quartz grains in these rocks are anhedral, equigranular, and variously strained. Veinlets of quartz 0.3 mm wide are typical in the intensely reddened samples.

In general, the alkali amphibole is interstitial, and shows evidence of crystallization after feldspar and quartz. On the southern flank of Mount Champlain, a facies containing acicular (locally cored) arfvedsonite (e.g., 74-78) is found to be completely gradational into the normal alkali granite. The sparse miarolitic cavities in this rock are filled with pale pink

elpidite $Na_2ZrSi_6O_{15}.3H_2O$. In the same area, a bluish mesocratic dyke 7 cm across and xenoliths of bluish porphyritic material can be found, but these bear no similarity to the hybrid granite exposed at the crest of Mount Champlain (unit DWfg, see below).

Alkali quartz syenite and syenite (DWfqs)

The northern strip, approximately 1 km wide (Fig. 2), consists of brown to green syenite. The contact with the hornfelsed Jones Creek argillaceous rocks is clearly intrusive. Stringers of syenite decrease from several cm to hairline width in the hornfels with increasing distance from the complex. Away from the contact area, the syenites are medium to coarse grained, and contain small (<1 to 2 mm) miarolitic cavities. The green syenites are scarcer, considerably harder and fresher than their brown counterparts. Fresh surfaces on samples of green syenite become drab brownish green within one day. The differences in color thus reflect the presence or absence of products of oxidation of a green pigment inferred to contain ferrous iron.

The more greenish the syenite, the more likely it is to contain fayalite + ferroaugite as the prominent assemblage of mafic minerals (12 - 14 vol.%). In contrast, ferro-edenitic hornblende is dominant in the brown syenites although, significantly, relics of fayalite and iron-rich pyroxene do occur along with clustered accessory secondary mafic minerals (e.g., iddingsite, annite and ferro-actinolite). The clinopyroxene is commonly molded onto the alkali feldspar, but also occurs as "droplets" inside the rim of zoned perthite grains, suggesting that it became supersaturated in the melt after nucleation of the

alkali feldspar. Quartz, showing strain, ranges from 2 to 4 vol.%; veinlets of quartz also may cut across the other minerals. Magnetite, apatite and zircon are the common accessories.

The alkali feldspar (typically between 70 and 80% of the rock) is mesoperthitic, and gives the rock a hypersolvus character. The disturbance of the exsolution texture, to give a patch perthite, and the development of a rim of albite on the interlocking grains of perthite, increase with increasing turbidity in the K-feldspar and hydration of the primary mafic minerals. The alkali feldspar does mantle lobate xenocrysts of plagioclase, but these are rare.

Most of the syenites are homogeneous, and free of signs of assimilation. The proposal made by Sharpe (1958), that the syenite formed by the assimilation of Jones Creek metasedimentary material by a granitic magma, is not substantiated by the petrographic observations presented.

The syenite also contains isolated xenoliths of more basic rocks (e.g., diorite) of possible hybrid character. Fayalite is absent and zircon is rare in the basic xenoliths, oligoclase is the dominant feldspar, and hornblende is the dominant mafic mineral. Pegmatitic pockets in the diorite contain augite, Fe-rich prehnite, apatite, epidote and titanite. These xenoliths are interpreted as roof pendants of "feldspathized" gabbro by McCutcheon and Ruitenberg (in press).

Porphyritic hiatal granite (DWfg)

Grey to pink porphyritic granite occurs in a central, lens-shaped unit (Fig. 2) that accounts for the highest point of the Nerepis Hills (e.g., Mount Champlain). Subhedral to anhedral phenocrysts up to 6 mm across account for up to 20% of the rock. Most consist of microperthitic K-feldspar of the same color as the groundmass. The original exsolution-related texture is highly disturbed by a patchy development of turbid K-feldspar and albite. Also present are anhedral white xenocrysts of sodic plagioclase mantled by perthite and strained phenocrysts of quartz (paramorphic after β -quartz). The plagioclase contains specks of epidote and sericite, suggesting that it once was more calcic than albite (see below). Poikilitic enclosure of early-formed minerals by intergrown perthite and quartz is widespread. The mafic minerals (5 vol.%) consist of subhedral hornblende (dominant) and straw yellow biotite. Magnetite and zircon are closely associated with these. Secondary biotite occurs around the hornblende, and may itself be transformed to chlorite.

Small, fine-grained lithic fragments occur sparsely in this unit. Although not examined in detail, these could be fragments of hornfelsed country-rock or, as in the syenite, of "feldspathized" gabbro that would represent a more basic member of the Welsford suite. The presence of xenocrystic plagioclase and the more mafic character of the unit suggest that the batch of granitic liquid responsible for unit DWfg was contaminated before reaching the present level of exposure.

Hybrid granitic rocks (Dwf)

McCutcheon & Ruitenberg (in press) have mapped small areas of hybrid granitic rocks in which they recognize the influence of metasedimentary country-rocks of the Jones Creek Formation (SJCs). Such rocks contain perthite and quartz, with interstitial amphibole (arfvedsonite and ferro-richterite) and aegirine. The rocks contain a complex suite of accessory minerals (see below).

Gabbro dykes (Dm)

Also sampled for this study are the dykes of medium-grained gabbro that typically strike parallel to the Welsford Complex itself, and that were emplaced in rocks of the Jones Creek Formation both to the north and south of the Complex (Fig. 2). These dyke rocks typically are homogeneous, although in the wider dykes, melting reactions involving the Jones Creek siltstone and hybridization with the gabbroic liquid have given rise to a suite of intermediate melt-compositions that are very heterogeneous and charged with unmelted residue. These merit further study.

PETROGRAPHY OF THE VOLCANIC ROCKS

McCutcheon & Ruitenberg (in press) described the Bacon Lake Member of the Jones Creek Formation as dominantly composed of flow-banded dacite and related flow breccia. Field evidence, thin section observations and chemical data (see below) indicate that these rocks are dominantly ash-flow tuffs of rhyolitic (BNH, CR) and rhyodacitic composition (RH, FL, HI). These ignimbritic tuffs are now completely devitrified; their textural development indicates that they can be considered slightly to moderately welded tuff (BNH) to granophyric (recrystallized?) tuff (RH). Breccias are mainly developed at BNH. Rare phenocrysts of pink albite and microlitic plagioclase laths are set in a black or dark pinkish grey matrix of quartz + K-feldspar + albite + chlorite + opaque phases, with minor zircon and calcite.

CONTACT-METAMORPHIC EFFECTS

The intensity of contact-metamorphic effects is not equivalent along the northern and southern contacts of the Welsford complex. To the south, the metasedimentary rocks are hornfelsic and flinty; the contact seems to be vertical and planar. There is no sign of anatexis. The aphanitic texture of the microgranite is consistent with rapid loss of heat by the intruding granitic magma.

In contrast, the northern contact-metamorphic zone was caused by the intrusion of a syenitic magma, inferred to have been significantly hotter than the granitic magma along the

southern contact. The dark hornfels has a pinkish cast, and consists dominantly of plagioclase (An_{20}), quartz, biotite and cordierite (identified by X-ray diffraction). Lighter- and darker-colored contorted zones suggest the incipient development of an anatectic liquid and a melanosome near the contact with the syenite. The stringers of fine-grained syenite differ in appearance from the leucosome that is developed, and no evidence of hybridization was found.

FELDSPAR MINERALOGY

X-ray diffraction data, K-feldspar

The cell dimensions of representative samples of the plutonic and volcanic rocks were obtained using the program of Appleman and Evans (1973). The raw data were obtained by X-ray diffraction analysis of a 1-mm^3 sample, either cleavage fragments of feldspar or, in the case of the volcanic rocks, an equivalent volume of the bulk rock. These data were corrected by comparison with a spinel internal standard (a 8.0833 Å, $CuK_{\alpha 1}$ radiation) and indexed by comparison with standard powder-diffraction patterns. The information on the nature of the K-rich feldspar is provided in terms of a plot of the cell dimensions b versus c (Fig. 3) and the interaxial angles α^* versus γ^* (Fig. 4). The raw data are presented in Appendix 1. Indicators of composition and degree of Al-Si order are presented in Table 1.

The five samples of syenite considered are hypersolvus rocks, and contain orthoclase mesoperthite. In one case, the powder pattern contains the most intense lines of intermediate microcline (short tie-line, Fig. 3). The data point labeled v represents a syenitic veinlet injected in the host rocks beyond the northern contact; it contains the most disordered orthoclase ($t_1 0$ 0.34; $t_1 0$ is 1.0 in ordered microcline, and 0.25 in high sanidine). In contrast, the six samples of alkali granite, which also provide good examples of the hypersolvus texture, contain intermediate microcline. In one case, the microcline coexists with orthoclase (long tie-line in Fig. 3). One of the granite samples contain microcline that plots significantly outside the b

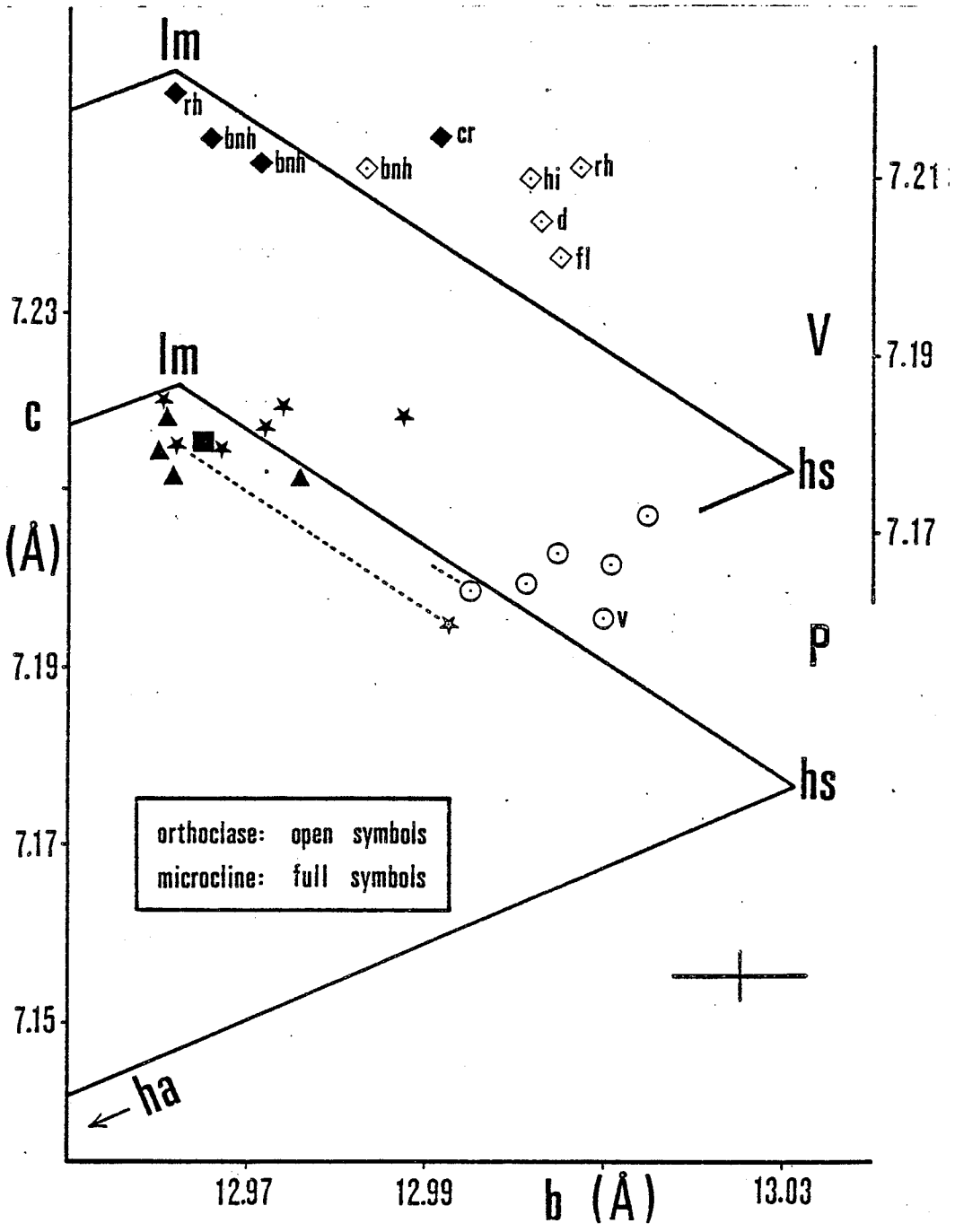


Figure 3. Mineralogy of the K-rich feldspar in selected plutonic (P) and volcanic rocks at Welsford, as determined by relative position of the data points in a plot of b versus c. Symbols: LM low microcline, HS high sanidine, HA high albite, triangle: granophyric microgranite, star: alkali granite, circle: quartz syenite, square: porphyritic hiatal granite, diamonds: volcanic suite. Other symbols are defined in the text.

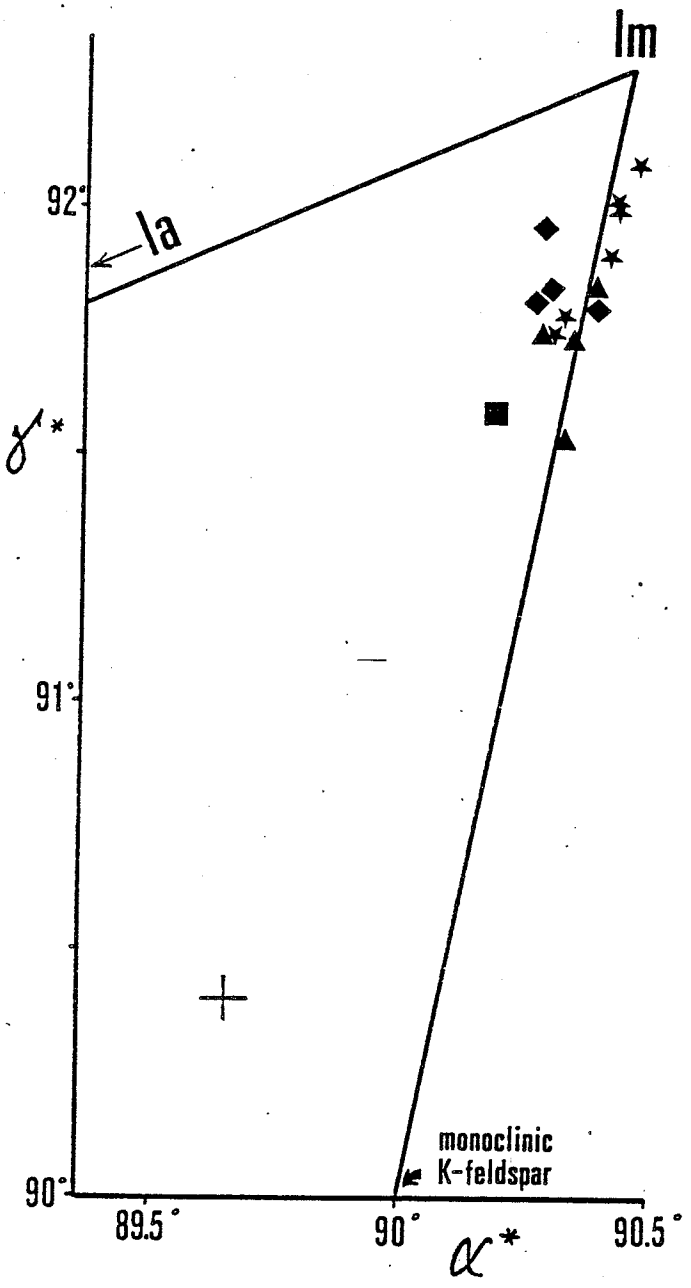


Figure 4. Mineralogy of the triclinic K-rich feldspar in selected plutonic and volcanic rocks at Welsford, as determined by relative position of the data points in a plot of α^* versus γ^*. Symbols are as in Figure 3.

TABLE 1. COMPOSITION AND DEGREE OF Al-Si ORDER IN THE K-FELDSPAR OF THE WELSFORD COMPLEX AND ASSOCIATED VOLCANIC ROCKS

			N_{Or}	t_1O+t_1m	t_1O-t_1m	t_1O
74-14	Syenite	OR	0.93	0.750	0	0.38
74-16	Syenite (v)	OR	1.00	0.686	0	0.34
74-17	Syenite	OR	0.94	0.738	0	0.37
74-19	Syenite	OR	0.96	0.727	0	0.36
74-20	Syenite	OR	0.98	0.755	0	0.38
74-22	Syenite	OR	0.96	0.754	0	0.38
74-41	Rhyolite (d)	OR	0.93	0.771	0	0.39
74-42	Granophyre	IM	1.00	0.925	0.752	0.84
74-47	Porphyritic granite	IM	0.93	0.947	0.723	0.84
74-71	Microgranite	IM	0.96	0.973	0.798	0.89
74-73	Granophyre	IM	0.95	0.947	0.774	0.86
74-74	Microgranite	IM	0.94	0.888	0.661	0.77
74-76	Granite	IM	1.00	0.941	0.876	0.91
74-78	Granite	IM	0.97	0.952	0.902	0.93
74-79	Granite	IM	0.96	0.909	0.824	0.87
74-81	Granite	OR	0.96	0.731	0	0.37
		IM	0.96	0.952	0.775	0.86
ER-1	Granite	IM	0.96	0.936	0.786	0.86
ER-2	Granite	IM	0.96	0.992	0.867	0.93
BNH-1	Obsidian	IM	0.92	0.901	0.813	0.86
BNH-2	Obsidian	IM	0.84	0.937	0.780	0.86
BNH-3	Obsidian	OR	1.02	0.866	0	0.43
CR-1	Obsidian	IM	0.97	0.869	0.881	0.88
FL-1	Obsidian	OR	0.98	0.737	0	0.37
HI-1	Obsidian	OR	0.96	0.809	0	0.41
RH-1	Obsidian	OR	0.98	0.802	0	0.40
RH-2	Obsidian	IM	0.96	0.983	0.797	0.89

Composition is calculated from cell volume using the equation of Kroll & Ribbe (1983) for intermediate degrees of order. Composition is expressed in terms of mole fraction N_{Or} (1.0 for pure $KAlSi_3O_8$). Degree of order, expressed as t_1O, the proportion of Al in the T_1O position, is calculated using the expressions of Blasi (1977). Error in N_{Or} and t_1O is estimated to be ± 0.015. Ordered microcline has a t_1O of $\pm .0$, whereas in high sanidine, t_1O is equal to 0.25. Symbols: v veinlet emplaced in hornfels, d dyke emplaced in granophyric granite, OR orthoclase, IM intermediate microcline. The word "obsidian" should not be taken literally; all the obsidian samples are fully devitrified.

- c quadrilateral, whereas one sample of syenite plots beyond one standard deviation in the b dimension. The four samples of granophyre and one of K-feldspar phenocryst from the porphyritic hiatal granite also contain intermediate microcline. All the samples examined contain a K-rich feldspar that is very close to the end-member composition, to judge from the proximity of the data points to the hs-lm sideline (Figs. 3, 4). On average, the K-feldspar in the plutonic rocks is Or_{96}, which coexists with albite. Figure 4 shows clearly the spread in degree of order attained in the microcline. Low (i.e., well-ordered) microcline is absent in the Welsford plutonic rocks.

Figures 3 and 4 show that the same comments apply to the K-feldspar in the felsic volcanic suite. The groundmass of these rocks, which was originally vitreous, now contains the association orthoclase + albite or intermediate microcline + albite. A rhyolitic dyke that cuts the granophyric granite (data point labeled d, Fig. 3) contains the same assemblage as the volcanic units. The composition of the K-feldspar is close to the end member (Table 1: Or_{95}), as in the plutonic rocks. In all cases, the K-rich feldspar coexists with albite.

Interpretation of the results

All the samples contain a metastable K-feldspar in terms of degree of Al-Si order. Low microcline is not expected in a near-surface anorogenic complex, because of the sluggish kinetics of the ordering reaction and of coarsening of the ordered domains. The magmatic assemblage in the hypersolvus rocks (i.e., prior to exsolution) consisted of sanidine solid solution. Nowhere is this material preserved in the Welsford complex. The sanidine ordered to orthoclase (and exsolved albite as it did so) relatively quickly, and achieved an intermediate degree of Al-Si order found in the syenitic and some volcanic samples ($\underline{t}_1$C in the range 0.34-0.39; Table 1). The syenitic magma probably was relatively dry, so that not much magmatic water was released when crystallization was complete. The ordering reaction requires water (Donnay et al. 1959); the rocks cooled relatively quickly through the interval 725 (solidus?) - 400°C, at which point the monoclinic K-feldspar entered the field of stability of low microcline. Cooling rate was too rapid and the proportion of pore fluid too small for nucleation of microcline to occur, so that the assemblage orthoclase + albite persisted. One can conclude that the area has not been significantly affected by a younger regional metamorphic event; such an event would have led to the conversion of the disordered (monoclinic) K-feldspar to the low microcline state, as seen in the Deloro anorogenic complex in the Grenville of southeastern Ontario, which has been reheated (Abdel-Rahman & Martin 1987). The persistence of the assemblage orthoclase + albite in some volcanic rocks also

reveals that the nearby intrusion of syenitic and granitic magma was likely not a separate vent, i.e., the emplacement of the volcanic and plutonic rocks resulted in a single thermal event. Any reheating of the volcanic rocks below 400°C should have eliminated the metastable forms of K-feldspar in favor of low microcline (absent in this suite), in view of the fineness of grain size of the rocks and the likelihood that any reheating would have set a hydrothermal fluid phase in circulation.

Somewhat slower cooling probably characterized the batches of more siliceous magma, which have a lower solidus than the syenitic magma. Also, if these batches of siliceous magma evolved from the syenitic magma by fractionation, they can be expected to have contained more dissolved water. The appearance of bubbles during crystallization is recorded by the presence of miarolitic cavities in the hypersolvus granite (unit DWfag) and in the granophyric granite (DWfgr). Finally, some batches of granitic magma were peralkaline. As a result of the three factors, slower cooling, a higher ratio of water to rock, and the peralkalinity of the system, the orthoclase did invert to microcline once the temperature dropped below 400°C in the granitic rocks and some volcanic rocks. As in the previous case, however, the degree of order falls short of that expected had equilibrium been attained during cooling, in a deeper suite, for example, or if the area had been reheated regionally. In fact, there is an unusual heterogeneity among the data points recorded in Figures 3 and 4.

Some points in Figure 3 plot outside the b - c quadrilateral. These may reflect the incorporation in the

structure of a relatively large tetrahedrally co-ordinated cation (e.g., Fe^{3+}). The departure is more important in the orthoclase; this could reflect the higher concentration of ferric iron in the higher-temperature structure, and should be confirmed by electron-microprobe analysis.

The coexistence of Or_{95} or Or_{96} and albite close to An_0 (see below) implies that even though structural equilibration was not possible, compositional equilibrium was attained to a temperature well below 300°C (Martin 1974). The composition of the most sodic orthoclase, Or_{84}, found in "obsidian" from Break Neck Hill, implies a temperature of equilibration near 500°C.

X-ray diffraction data, albite

The same technique was used to infer the composition and degree of Al-Si order in the sodic plagioclase. The best variables to use are β^* and γ^* (Smith 1974, Fig. 7-44). With few exceptions, the data points recorded in Figure 5 indicate a composition in the albite range, all quite close to the locus of ordered structures (OS). Found to be more calcic are the plagioclase in hornfelsed Jones Creek metasiltstone (An_{11}, encircled black star, Fig. 5), the phenocryst of plagioclase in the hybrid granite (An_{15}, square in Fig. 5). and the plagioclase in the country rock adjacent to the syenitic veinlet (An_{20}, slightly disordered; not shown in Fig. 5). Note that the albite in the hypersolvus granite and hypersolvus syenite is ultimately of exsolution origin, as is the non-phenocryst albite from the hybrid granite. The syenite typically contains albite in the

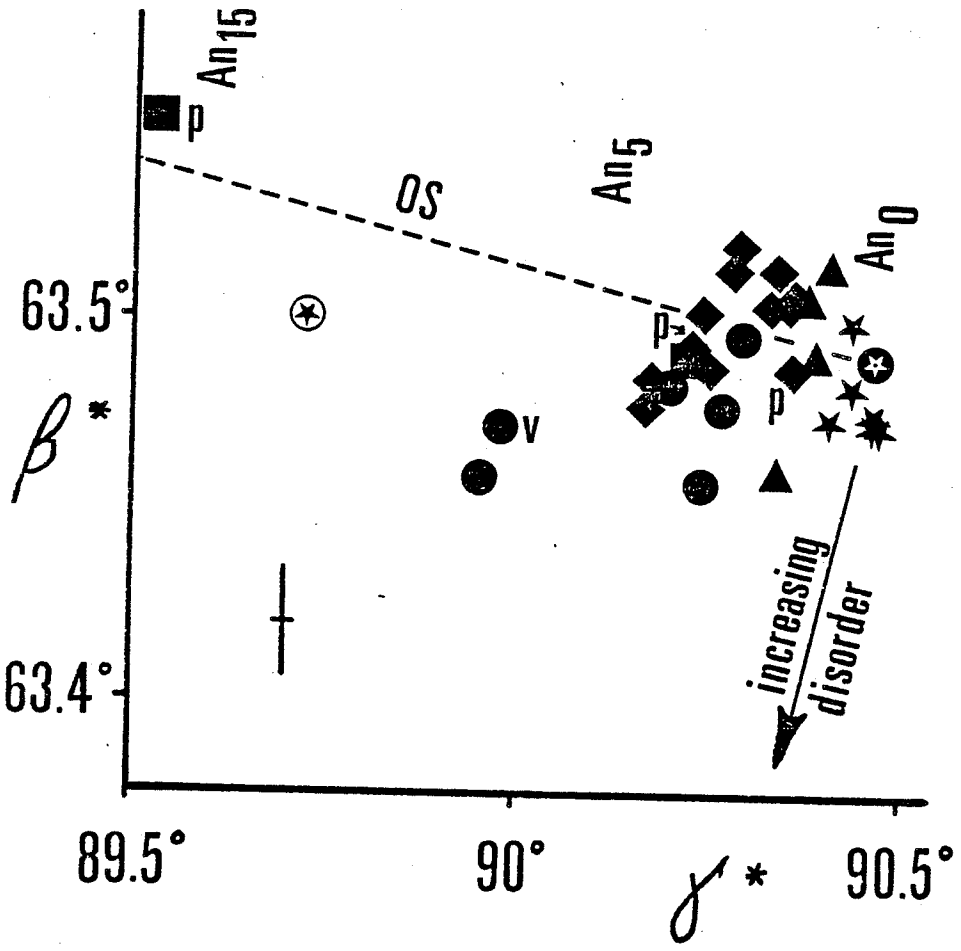


Figure 5. Mineralogy of the sodic plagioclase in selected plutonic and volcanic rocks at Welsford, as determined by relative position of the data points in a plot of β* versus γ*. Symbols are as in Figure 3; in addition, encircled star indicates host rock, OS indicates ordered series, p means phenocryst, v means vein.

range An_6 to An_3, whereas the alkali granite contains virtually An-free ordered albite. The departures from complete Al-Si order are small, and most important in syenite. This effect could reflect a residual disorder retained during albitization of oligoclase, say, that had exsolved from a ternary primary feldspar composition (e.g., Martin 1984; also, see below). The albite in the volcanic rocks presumably is largely of devitrification origin, although some of it could also be of exsolution or hydrothermal origin. In general, the albite in the granophyre is in the range An_1-An_2, whereas that in the volcanic suite is An_2-An_3. In the two cases where the volcanic rocks contain phenocrysts, these now consist of albite, An_1 in one case, An_3 in the other.

Interpretation of the results

From the point of view of the composition and degree of Al-Si order, the plutonic and volcanic rocks are very similar, which is consistent with (but does not prove) a genetic link. Almost all the points are close to ordered pure albite, which is the equilibrium phase below 400°C (Smith 1974). Points that are more calcic than An_1 may consist of an intergrowth of An_0 and a more calcic plagioclase (a peristeritic intergrowth) or are single phases preserved metastably below the reaction temperature, much like in the case of the K-feldspar. The An content of the albite in the plutonic and volcanic rocks can be used to "rank" the rocks, in terms of degree of "evolution", in the sequence 1) syenite, 2) volcanic suite, 3) granophyric granite, 4) alkali granite. This ranking assumes that whatever the extent of

postmagmatic albitization, it did not disturb the original sequence of decreasing An content with increasing differentiation index.

Electron-microprobe data

Selected coarse-grained samples were selected for study by electron-microprobe analysis (Cameca microprobe) using wavelength dispersion, an accelerating potential of 15 kV, a current of 8 nA. Data are tabulated for samples of syenite, granite, hybrid dioritic rocks and gabbro (unit Dm, Fig. 2) in Appendix 2. Most of the emphasis was placed on X-ray-diffraction studies of the feldspar because of the perthitic nature of the K-feldspar in this suite. As the intergrowth of orthoclase or intermediate microcline with albite probably occurs at a submicroscopic scale as well as at a coarser scale, and because the K-rich feldspar invariably is full of mineral particles (expressed by its turbidity), the electron microprobe was not judged to be the best tool with which to investigate the alkali feldspars. In particular, the electron microprobe was found to sample domains of K-rich and Na-rich feldspars simultaneously in some instances, so that spurious "intermediate" compositions were encountered.

A quick scan of the results in Appendix 2 confirms that the albite is virtually end-member $NaAlSi_3O_8$ in the alkali granite. In P1, the microcline has a composition in the range Or_{92} to Or_{94}. In P2, compositions in the range Or_{91} to Or_{96} correspond to the results obtained by X-ray diffraction. In P4, a composition in the range of Or_{92} to Or_{96} is credible. The hybrid rock of dioritic composition contains a K-rich feldspar in the

same general range of Or content (Or_{91} to Or_{96}), whereas the plagioclase seems to be An_8. The microprobe data for the K-rich feldspar in the quartz syenite are generally spurious. The X-ray diffraction results show that the syenites contain an assemblage only partly re-equilibrated; the spurious results indicate that these rocks contain cryptoperthite as well as mesoperthite. Lamellae of composition An_{17} have been found, indicating that the average values determined by X-ray diffraction, which are much more sodic, may well result from an albitization reaction, as mentioned earlier. The gabbro (unit Dm, Fig. 2) contains An_{56} (core) and An_{21} in the rim, the latter probably reflecting incipient albitization.

THE MAFIC MINERALS AND ACCESSORY MINERALS IN THE PLUTONIC ROCKS

The chemical composition of the mafic minerals and accessory phases in the plutonic members of the suite were obtained by electron microprobe analysis (Cameca Camebax instrument) using wavelength dispersion. The analyses were performed with an accelerating potential of 15 kV, a current of 8 nA, a counting time of 25 seconds on Si, Ti, Al, Fe, Mg, Mn, Ca, Na, K, P, F, Cl and U peaks, and 20 seconds on Zr, Nb, Ta, Th, Y, La, Ce, Nd, Sm. Concentrations of the rare earths obtained by microprobe were not corrected for peak overlap. According to Roeder (1985), peak overlap should not affect La and Ce concentrations, but may seriously bias the concentrations of the heavier elements, including Sm and Nd. The following standards were used: andradite (Fe, Ca), MnTi alloy (Mn, Ti), albite (Na), orthoclase (Si, Al, K), apatite (P, F), MgO (Mg), ZrO_2 (Zr), ThO_2 (Th), rare-earth standards (Y, La, Ce, Nd, Sm), and V, U, Nb and Ta using pure elements. Average compositions are provided unit by unit in Appendix 3; complete data-sets are presented in Appendix 4. Note that physical separation of the various minerals was not attempted. The accessory minerals have thus not been analyzed for Li, Be and B. These elements attain relatively high concentrations in some bulk samples, and thus must be concentrated in some of the accessory phases. Access to an ion microprobe will be required to assess the distribution of these elements.

Fayalite

Fayalite was found only in the quartz syenite, especially in the greenish samples. It occurs as relatively fresh crystals, typically associated with clinopyroxene and calcic amphibole. These mafic phases are typically clustered, and probably represent near-liquidus phases in the syenitic liquid. The fayalite is close to pure end-member in composition (Fig. 6), indicating that the syenitic magma is highly fractionated. The fayalite ranges from $(Mg_{8.8}Fe_{88.1}Mn_{3.1})_2SiO_4$ to $(Mg_{0.9}Fe_{95.4}Mn_{3.7})_2SiO_4$ in different samples; there is no evidence of zoning, such that enrichment in Fe and Mn provides a sensitive means of ranking the rocks in a fractionation sequence. Note that in the same samples, olivine with an analytical total close to 100% may coexist with olivine that gives a low total (96% or less). We tentatively suggest that such olivine contains Fe^{3+}, i.e., the defect-bearing laihunite component (ideal end-member composition close to $Fe^{2+}Fe^{3+}{}_2Si_2O_8$: Kitamura et al. 1984). A careful Mossbauer analysis will be required to document the extent of this sign of high-temperature oxidation. The expected product of lower-temperature alteration, reddish iddingsite, rims fayalite grains and lines internal cracks, or completely replaces fayalite grains. A survey of the compositions listed in Appendix 3 shows that the iddingsite contains Al, Ca, Na, K, Ta, F, Cl, and, presumably, OH or H_2O (or both; analytical total varies from 77.8 to 93.5%) in rather variable proportions. The bulk composition indicates that iddingsite is not simply a product of hydration of fayalite-rich

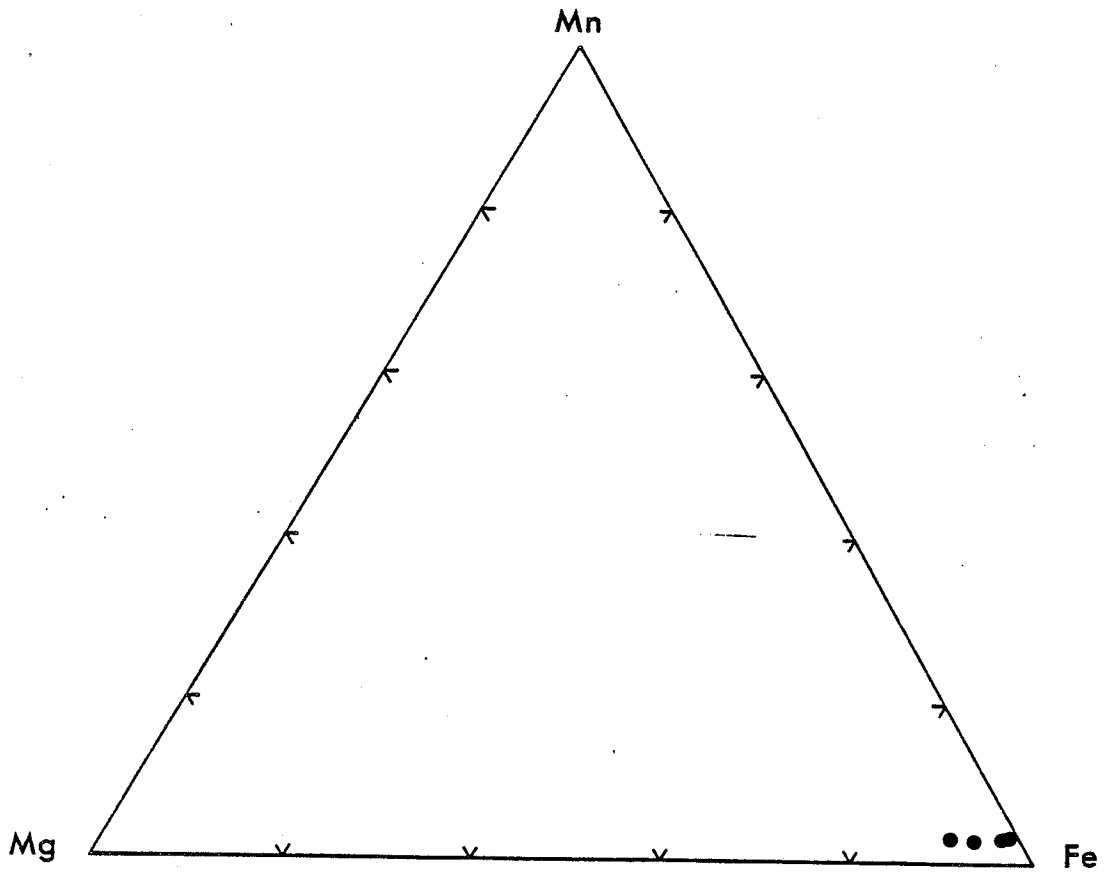


Figure 6. Bulk composition of fayalitic olivine, in terms of triangular Mn-Mg-Fe.

and laihunite-bearing olivine, as most of the above elements could not have been held in the olivine structure.

Fayalite is notably absent from the hybrid rocks (unit DWf) that resemble syenite but typically are richer in plagioclase, presumably owing to contamination by more basic rocks.

Clinopyroxene

The syenite contains a single pyroxene, generally ferro-augite (nomenclature follows Deer et al. 1978), but salite or augite in more mafic bulk-composition and hedenbergite in those that have reached a more evolved bulk-composition as a result of fractionation (Fig. 7). The clinopyroxene is usually rimmed by ferro-actinolite or ferro-hornblende. The pale green pyroxene is fresh in green syenite, but may be almost completely transformed to amphibole in the brownish samples, which shows that not all the calcic amphibole is primary. The ferro-augite typically contains crystallographically oriented inclusions of opaque minerals; these platelets are interpreted to reflect oxidation of these Fe^{2+}-rich primary compositions (equilibrated at conditions close to the quartz-fayalite-magnetite buffer, indicated by the presence of all three phases at the magmatic stage) during the cooling of the complex.

The alkali granite may contain two types of clinopyroxene, hedenbergite and aegirine (Figs. 7, 8). Light green hedenbergite invariably is rimmed by arfvedsonitic amphibole. Compositions intermediate between hedenbergite and aegirine are encountered, but are generally partly to completely replaced by arfvedsonite. The aegirine is very late, and presumably hydrothermal, as it

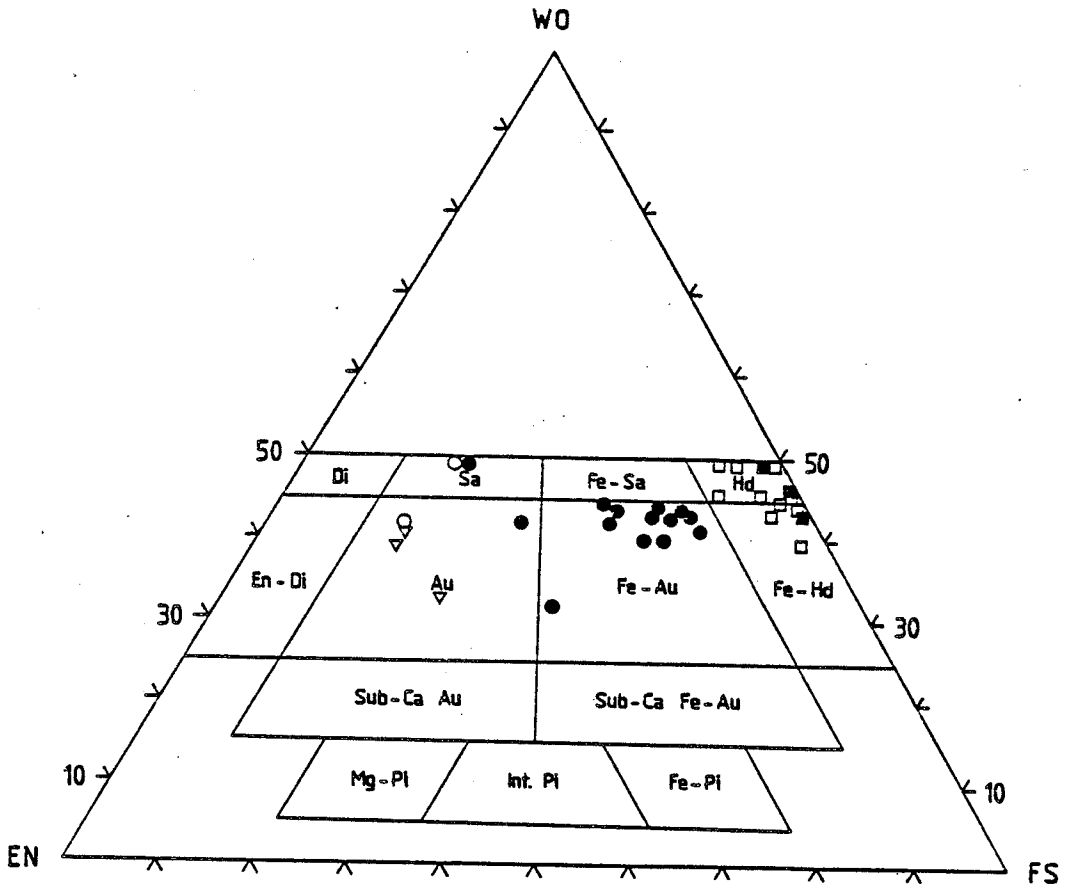


Figure 7. Bulk composition of the clinopyroxene, in terms of the three principal end-members Wo, En and Fs. The nomenclature is that of Deer et al. (1978). Symbols: black circles: quartz syenite, open circle: diorite (pegmatitic patch), black square: rocks taken from hybrid unit (DWf), open square: alkali granite, inverted triangle: gabbroic rock (unit Dm).

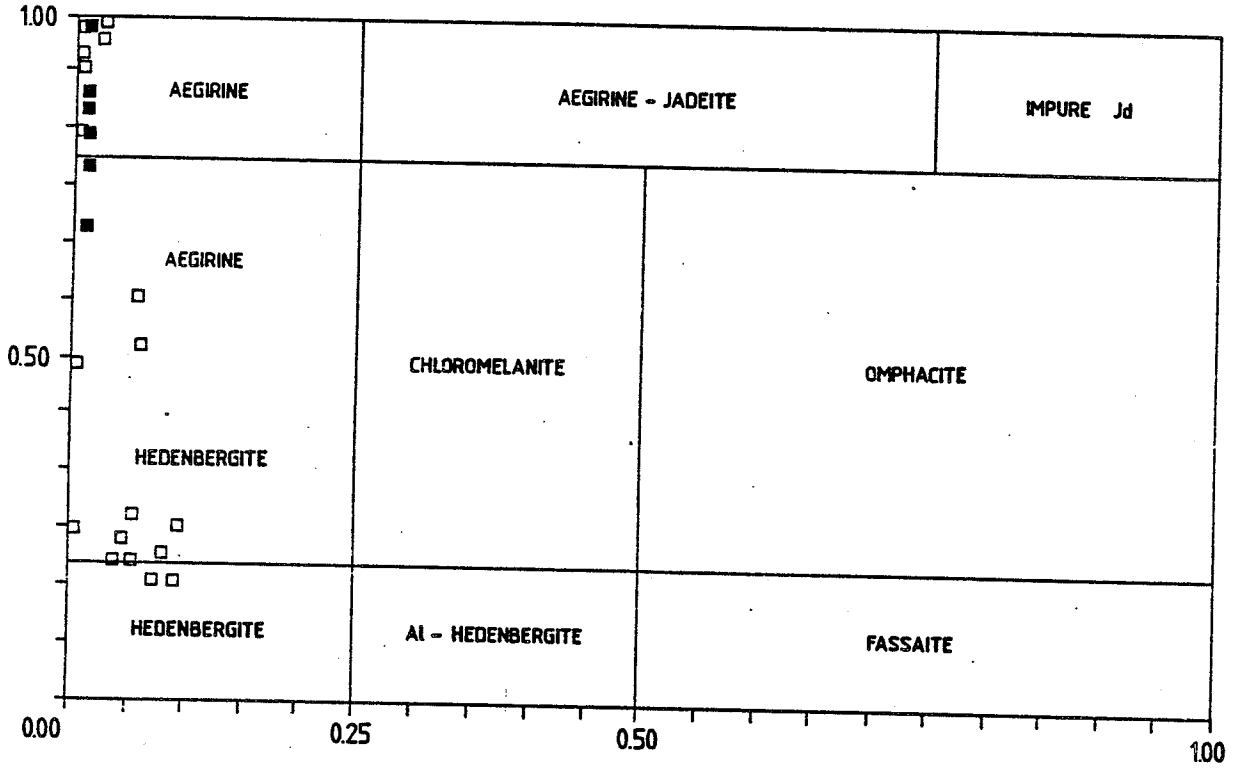


Figure 8. Bulk composition of clinopyroxene on the join hedenbergite - aegirine, in terms of Na/(Na + Ca) and Al (atoms per formula unit). Symbols as in Figure 7.

forms an overgrowth or a replacement rim on arfvedsonite. Aegirine is the only clinopyroxene present in the mesocratic peralkaline dyke that cross-cuts the alkali granite, and is found locally in the granophyric granite, wherever it has escaped conversion to iron oxides.

No clinopyroxene is found in the porphyritic hiatal granite. Some of the hybrid rocks (map unit DWf) contain pale yellowish to green to bright green interstitial aegirine. It may also occur as an overgrowth on arfvedsonite. In others, the clinopyroxene is ferro-augite similar to that found in samples of quartz syenite (map unit DWfqs).

All the clinopyroxene compositions are plotted in terms of Na, Mg and Fe^{2+}+Mn) in Figure 9. The resulting evolutionary trend reflects the progressive and efficient depletion in magnesium and enrichment in Fe^{2+} at the magmatic stage, followed by strong enrichment in Na and Fe^{3+} (over Fe^{2+}). Such a complete trend, reaching the aegirine end-member, is not commonly encountered; the trend in the Ilimaussaq complex, Greenland (Larsen 1976) is virtually identical. It is not even developed so extensively in pantelleritic volcanic complexes (Nicholls & Carmichael 1969), as illustrated in Figure 9. The question, as always, in the interpretation of such a complete trend, is: what is magmatic, and what is hydrothermal? On the basis of petrographic observations, Ike et al. (1984) proposed that all significant departure from the Mg-(Fe^{2+}+Mn) baseline toward $NaFe^{3+}Si_2O_6$ occurs at the hydrothermal stage. Our petrographic observations are consistent with this inference, as is the

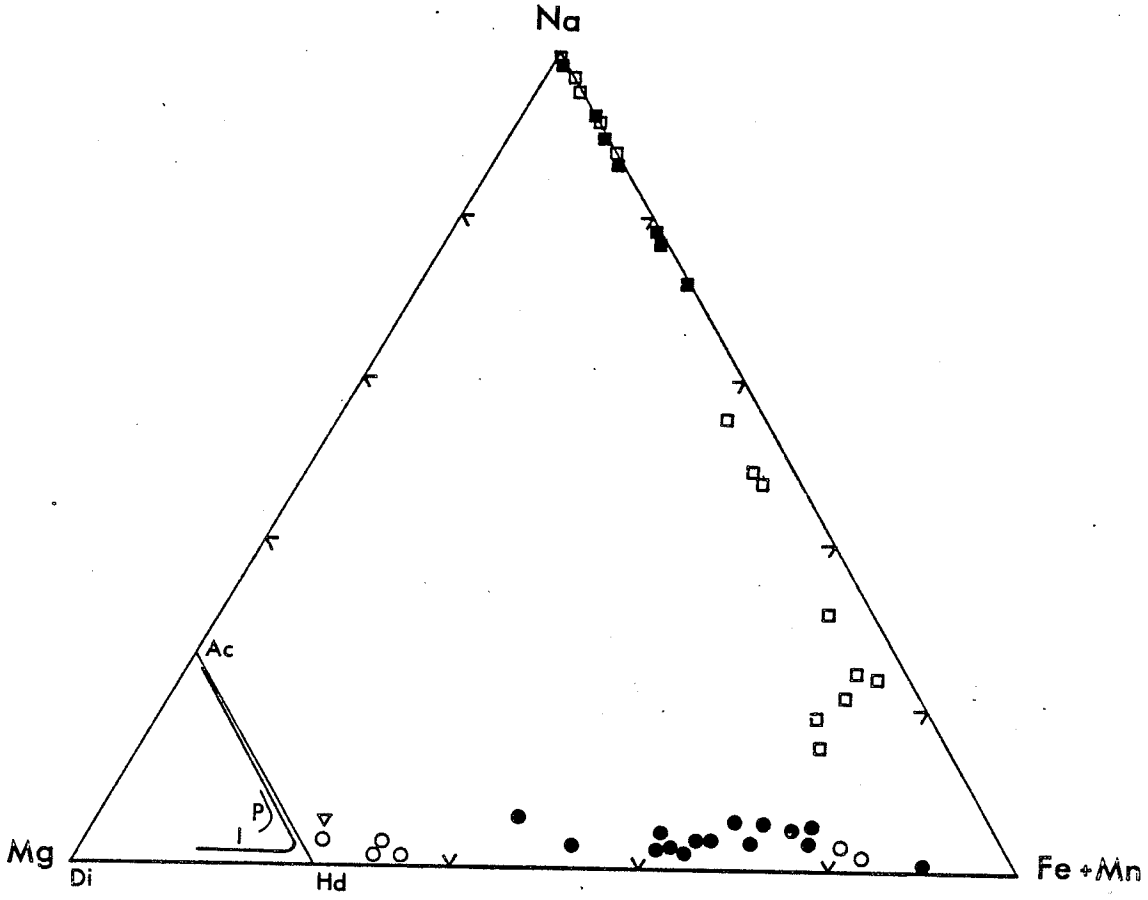


Figure 9. Bulk composition of clinopyroxene in terms of Na, Mg, and (Fe + Mn). Inset: pyroxene trends documented in pantellerite volcanic suites (Nicholls & Carmichael 1969) and in the Ilimaussaq complex (Larsen 1976).

absence of end-member aegirine in pantellerites, presumably quenched too quickly to allow the subsolidus growth of aegirine from a stronly peralkaline fluid medium that circulates in the deeper-seated rocks as they cool and contract.

Amphiboles

The rocks of the Welsford complex typically contain an amphibole, calcic or arfvedsonitic (Fig. 10). The syenites contain quite a variety of compositions of calcic amphibole, but two are more common: a more massive, locally patchy light brown to olive green ferro-edenite and a fibrous pale to bright bottle green ferro-actinolite, which may replace the ferro-edenite (nomenclature of Leake 1978). In turn, the ferro-actinolite may be rimmed and replaced by chlorite $\pm$ biotite. Ferro-hornblende is developed as a rim on ferro-augite.

The alkali granite characteristically contains green to blue-green to black, interstitial, locally poikilitic arfvedsonite. It rims hedenbergite, where the latter is present, and may be partly rimmed or replaced by aegirine, sometimes along fractures and cleavages, leading to the interpretation that the aegirine appears once the arfvedsonite has begun to crack, upon contraction, and thus is a hydrothermal mineral. In fact, the arfvedsonite itself may well be of hydrothermal origin, accounting for the poikilitic texture and an "infiltration" of arfvedsonite along the interface between exsolution lamellae in the mesoperthite. The timing of its appearance in the alkali granite may coincide with the deposition of the interstitial albite that "decorates" mesoperthite grains. Brown ferro-

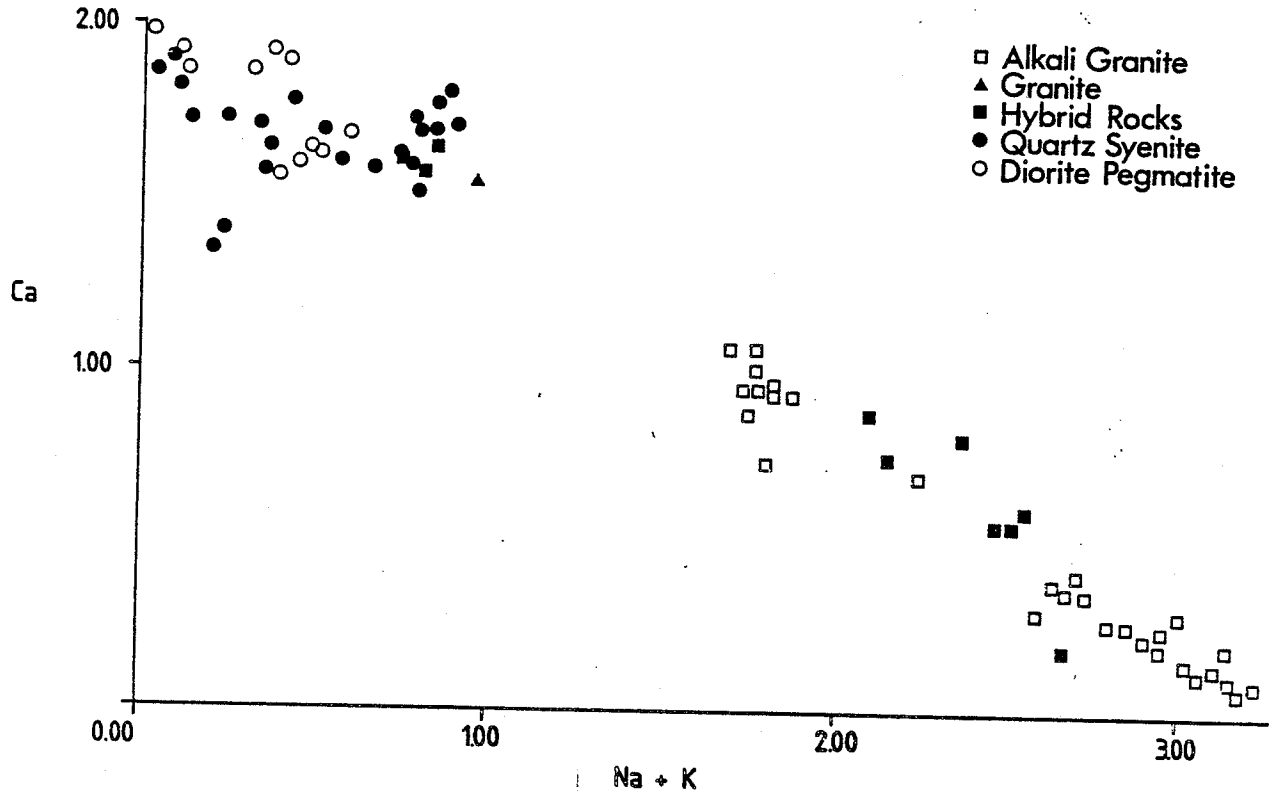


Figure 10. Bulk composition of the amphibole in plutonic rocks of the Welsford complex.

richterite also occurs in the alkali granite, but is rare compared to arfvedsonite. Both amphiboles contain numerous inclusions, zircon being the most common. Arfvedsonite is developed in stout, rather than interstitial, crystals in the mesocratic dyke that cuts the alkali granite (locality 78, road to Mount Champlain). We interpret this dyke rock as representative of a more mafic, more alkaline, more fluorine-rich magma whose solidus was lower than that of the alkali granite, and in which the arfvedsonite appeared on the liquidus. The value F/(F + OH) of the arfvedsonite is generally high in this suite (Appendix 3), and approaches 1.0 in this dyke rock. In contrast, chlorine content remains very low, and is presumably strongly partitioned into the alkaline fluid. The typically greater concentration of chlorine than fluorine in the calcic amphiboles (Appendix 3) may indicate that these formed largely from a magma that was water-undersaturated at the stage of amphibole growth.

The granophyric granite is considered to have contained an amphibole, but what typically remains is a pseudomorph of chlorite. The porphyritic hiatal granite contains interstitial hornblende, but it is typically altered to biotite and chlorite. The transformation to biotite may preserve a fibrous habit; could this be the "tourmaline" alteration of McCutcheon & Ruitenberg (in press)? No tourmaline was encountered in this study.

Some rocks considered to be hybrid contain brown to dark green arfvedsonite and ferro-richterite, in cases with numerous inclusions. The amphiboles may locally be replaced by or

overgrown with aegirine. They thus have an alkaline character. Other, more dioritic hybrid rocks contain green hornblende, edenite and actinolite, associated with numerous needles of apatite.

Magnetite and ilmenite

Magnetite is of more restricted occurrence than ilmenite; it is found in the quartz syenite, porphyritic hiatal granite, and the mafic rock. The proportion of Fe^{2+} and Fe^{3+} was calculated using the method of Carmichael (1967). Inferred proportions of the ulvospinel component Fe_2TiO_4 vary from 59.5% (in alkali granite 74-81) down to nil, reflecting the variable subsolidus re-equilibration of the magnetite.

Ilmenite is present in all units, either as irregular, interstitial grains or as rounded patches. It is generally closely associated with the mafic minerals. Data on a pegmatitic area in the alkali granite indicates a significant departure from $FeTiO_3$ toward the pyrophanite component (4.52% MnO, 9.6% pyrophanite). This degree of enrichment is surpassed in "alkaline" hybrid rock H-2 (unit DWf): 10.9% pyrophanite (Appendix 4). The proportion of Fe^{2+} and Fe^{3+} in the compositions tabulated in Appendices 3 and 4 is calculated using the method of Carmichael (1967). In most cases, the mole fraction of the Fe_2O_3 end-member (Appendix 4) is 0 or close to it, indicating that in most cases, the ilmenite likely has re-equilibrated at a low temperature.

Compositions of coexisting titaniferous magnetite and ilmenite in alkali granite WLD-36 give a temperature of 690°C and

$\log f(O_2)$ value of -18 (calibration of Spencer & Lindsley 1981), which are reasonable magmatic values. If the most ulvospinel-rich part of the magnetite in mafic rock DM-1 is assumed to have coexisted with the ilmenite in the same rock, the same temperature of equilibration is found. For a basic rock, 690°C is evidence for important subsolidus re-equilibration. As mentioned above, most of the magnetite in these rocks contains significantly less than 50 mol.% ulvospinel, indicating that re-equilibration is widespread.

Biotite

The biotite typically is a very minor constituent of the quartz syenite (<1 vol.%); the yellowish to yellowish green flakes form at the expense of pre-existing minerals (amphibole, titaniferous magnetite). Its composition is siderophyllitic and titaniferous (up to 4.75% TiO_2). In the porphyritic granite, it is closely associated with amphibole, and probably replaces it; it may be fibrous in habit. Bulk compositions of biotite in the hybrid unit contain 5% K_2O or less (instead of close to 9%), an indication of the extent of chloritization. In the hornfelsic country rocks, biotite was the main ferromagnesian mineral, but retrograde chloritization was extensive. The proportions of F and Cl seem to be highly variable.

Chlorite

Average compositions are provided for chlorite in syenite, porphyritic granite, hybrid rocks and gabbro (Appendix 3). The relative concentrations of Mg, Fe and Al are variable, and presumably mainly reflect the chemistry of the precursor mineral.

Epidote

Epidote occurs in relatively mafic hybrid rocks as a colorless to yellow to pale green secondary mineral, and in cavities in pegmatitic patches developed in locally contaminated quartz syenite. The epidote in the pegmatite (QSP-1P) contains 0.30% UO_2.

Titanite

Titanite is found in the same units as epidote, but is scarcer. Note that the titanite in hybrid rock H-6 (unit DWf) departs significantly from the ideal formula $CaTiSiO_5$ in containing 1.31%F and 5.45% Al_2O_3, presumably reflecting a coupled substitution of (OH,F) for O and Al for Si, i.e., the end-member $CaTiAlO_4(F,OH)$.

Prehnite

Prehnite was identified only in the pegmatitic pockets of the hybrid rocks in the syenitic unit. There, it occurs as the dominant "filling" in the central cavities. The composition is typical of Fe-prehnite (Zolotukhin et al. 1965).

Apatite

Apatite is abundant in quartz syenite and related hybrid rocks. Acicular prisms are generally abundant as inclusions in calcic amphibole and in feldspar. Its chemical composition is variable, but fluorine-rich apatite is dominant. Chlorine-rich apatite is dominant in hybrid rocks in the quartz syenite unit. The Ce content in some cases reaches 1.4%, and the total rare-earth content, including yttrium, reaches 2.25%.

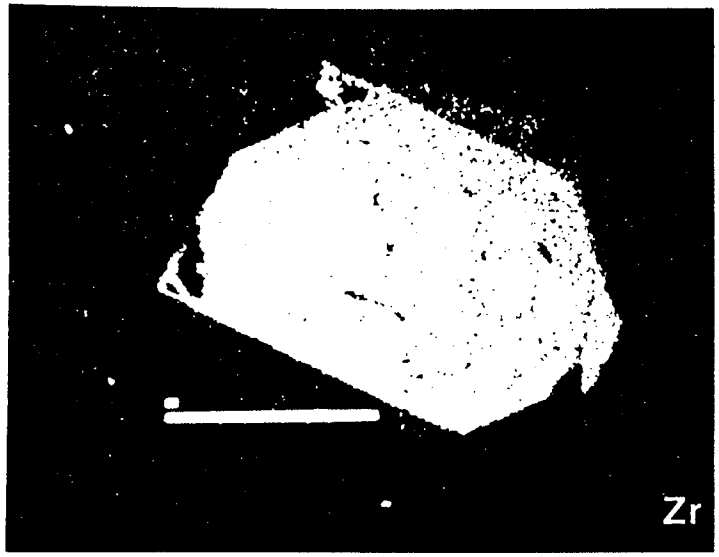
Zircon

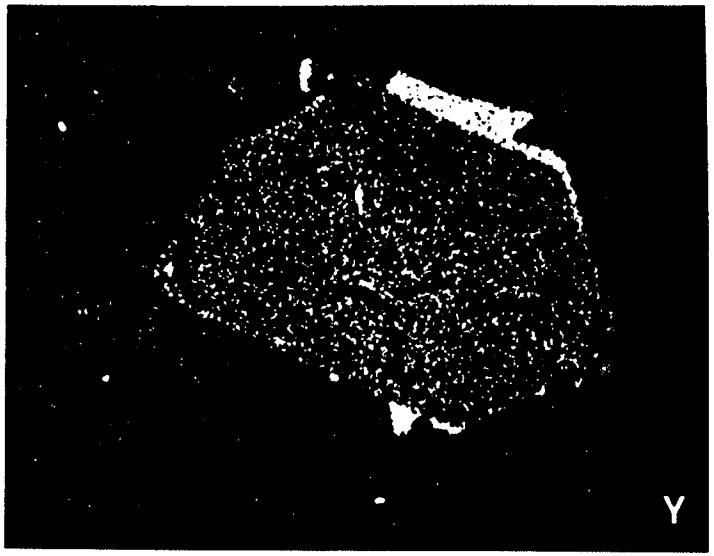
Zircon is the most common accesscry mineral, and is found in all map units. In the alkali granite, large euhedral crystals of zircon are commonly zoned; some zones may be metamict. Two generations of zircon seem to be present in some samples, clear, and brownish and turbid; some exhibit a turbid, brownish, complexly zoned core and a thick overgrowth of clear zircon, or a clear core with turbid zones; it may also contain numerous inclusions. Zircon is commonly close to or included in amphibole. In the porphyritic granite, the zircon grains are embedded in biotite, and surrounded by a halo of radiation-induced damage in the host. Zircon seems to be absent in hybrid rocks in the quartz syenite. The chemical composition is variable. Up to 2.9% FeO, 3.5% Y_2O_3 and 1.6*% ThO_2 are recorded in zircon in hybrid rock H-2; its low analytical total (89.7%) suggests that OH-for-O substitution is important. Figure 11 shows the X-ray distribution of zirconium, yttrium and iron in a zoned zircon grain from the hybrid unit (method adapted from Silver et al. 1984).

Figure 11A. The zirconium distribution shows the euhedral shape of the zircon grain (H-2, hybrid unit), but not its zonation; the outer half of the crystal is metamict, and the core is highly zoned. Zirconium is also present in much smaller concentration, on the upper right side; the crystal was not analyzed. The non-uniformity of the Zr distribution to the upper right area of the main grain is due to beam defocussing (Silver et al. 1984). Bar scale 100 μm.

Figure 11B. The yttrium distribution in the zircon shows a core slightly richer and rim somewhat poorer. The Y-rich "rim" at the upper right could be a partial overgrowth of xenotime(?) (the overgrowth was not analyzed).

Figure 11C. The iron distribution is erratic. At the edges, the small areas of concentration are oxide grains.





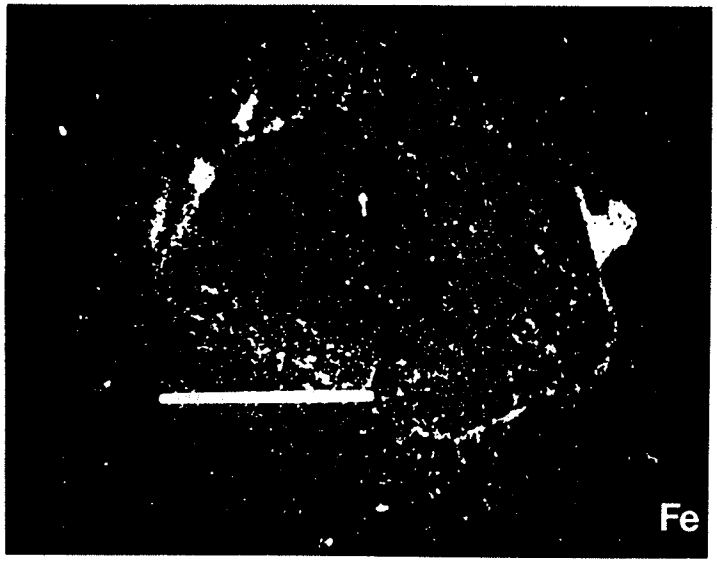


Figure 11

Astrophyllite

Astrophyllite has been recognized in both the alkali granite and geochemically related rocks in the hybrid unit (DWf). In the alkali granite, it forms prismatic yellow to orange crystals that are chemically zoned, as well as less well-formed yellow patches. It is associated with zircon, aenigmatite, chevkinite and chevkinite "alteration" in pegmatitic pockets and in aenigmatite-enriched areas in the alkali granite. In rocks of the hybrid unit, astrophyllite appears to have become unstable, and is in an arrested stage of breakdown to a series of opaque phases. Only yellow "islands" remain, completely surrounded by opaque grains.

The chemical composition of the astrophyllite resembles those reported by Macdonald & Saunders (1973), except for a slightly higher Ti content in the Welsford examples. Compared with astrophyllite from the Red Wine Complex, Labrador (Curtis & Currie 1981), the iron content is lower, and the relative proportions of Na and K are reversed (Red Wine: 5.2% Na_2O, 1.8% K_2O; Welsford: 2.2% Na_2O, 5.8% K_2O). Among the Welsford examples, however, there is variability in Na/K value and in Mn, Zr and Nb concentrations.

Allanite

Allanite is a rare mineral here; it has been identified only in the hybrid unit. It occurs as large interstitial patches that are color-zoned, from dark brown at the core to light brown-orange-yellow at the margin. The chemical composition is variable, probably owing to hydration, reflected in low

analytical totals (89-95%). Its composition resembles those reported by Ghent (1972), Morin (1977) and Campbell & Ethier (1984). Figure 12 shows the X-ray distribution of titanium, cerium, iron and lanthanum in an allanite patche.

Chevkinite

Chevkinite occurs in both the alkali granite and the peralkaline rocks of the hybrid unit as small, rare, dark red-brown crystals. These are rarely euhedral, and are commonly rimmed by red to orange to yellow concentric zones of alteration (see below). Its chemical composition is relatively constant in the two units. The Welsford chevkinite is generally enriched in Ti, Fe and Ce, and poorer in Ca and La, compared to that in the Little Chief granite, California (McDowell 1979). Chevkinite that is enriched in La rather than Ce and that is poorer in Ti also was reported from the Oslo peralkaline granites by Segalstad & Larsen (1978). Figure 13 shows the X-ray distribution of iron, titanium, cerium and lanthanum of a chevkinite grain (C) surrounded by a "chevkinite alteration" band partially rimmed by astrophyllite in the alkali granite.

Chevkinite alteration

The red to orange to yellow concentric bands, progressively paler toward the rim, often surround a chevkinite core (Fig. 13). Figure 14 shows the X-ray distribution of titanium, zirconium, cerium and lanthanum in a complex assemblage of accessory minerals (zircon, chevkinite core and chevkinite alteration and an unidentified La-rich mineral) in the granite unit. Small

Figure 12A. Titanium distribution in allanite (H-6, hybrid unit) in feldspar. In transmitted light, the grain shows clear alteration bands. The centre is dark brown and the edges gradually change from brown to orange yellow, their H_2O content increasing toward the edge. The alteration "bands" are unfortunately not as well represented in X-ray mapping, but the distribution of various elements still shows a depletion toward the edge of the grain (toward the right and upper left in picture). Bar scale 100 μm.

Figure 12B. The cerium (13% Ce_2O_3) shows Ce to be more concentrated at the centre of the grain (brown core; 10% Ce_2O_3 at the edges).

Figure 12C. The iron distribution shows a larger concentration at the base of the rounded black area. Iron is also a major component of the amphibole at the upper right corner, not visible on the other pictures. The lighter concentration at the upper right is due to beam defocussing (Silver et al. 1984).

Figure 12D. Lanthanum (7% La_2O_3) shows the same distribution as Ti and Ce.

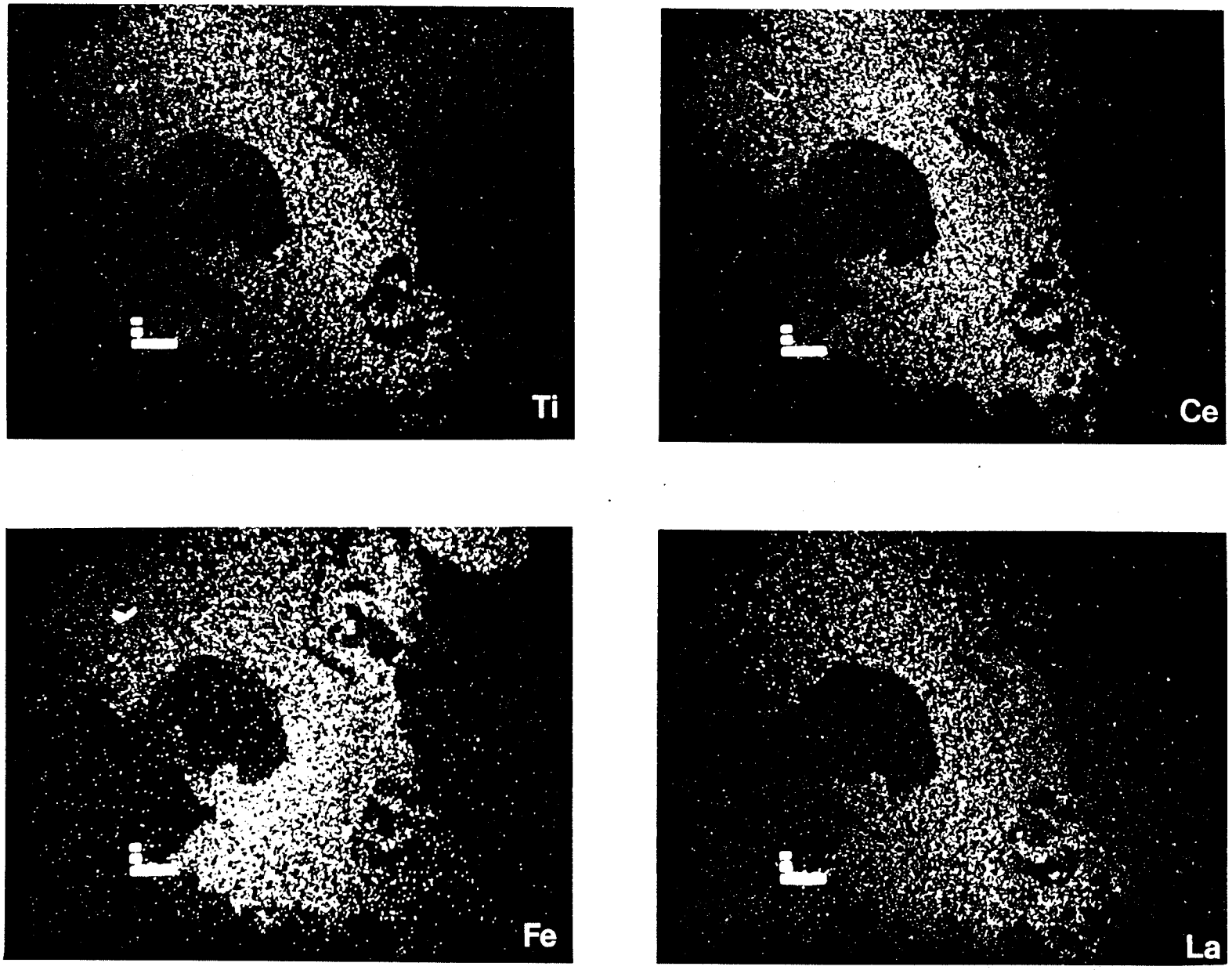


Figure 12

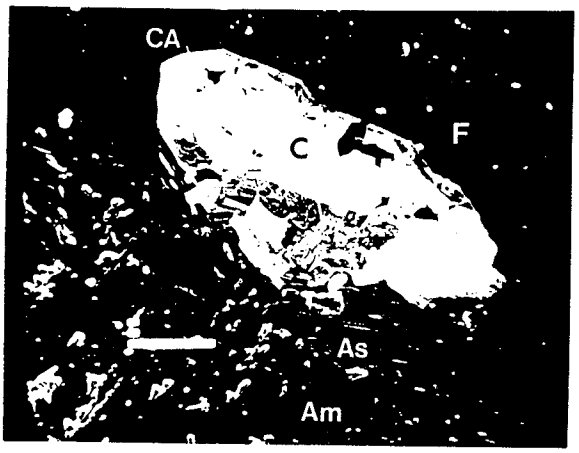
Figure 13A. Secondary electron image of a chevkinite grain (C) partially altered to "chevkinite alteration" (CA) and partly rimmed by astrophyllite (As) in feldspar (F; AG-P2, alkali granite, Appendix 4, p. 298, 300). The large dark grey grain at the bottom left is amphibole (Am; arfvedsonite). The decrease in concentration at the edges of the X-ray pictures (especially Fe and Ti) is due to beam defocussing (Silver et al. 1984). Bar scale 100 μm.

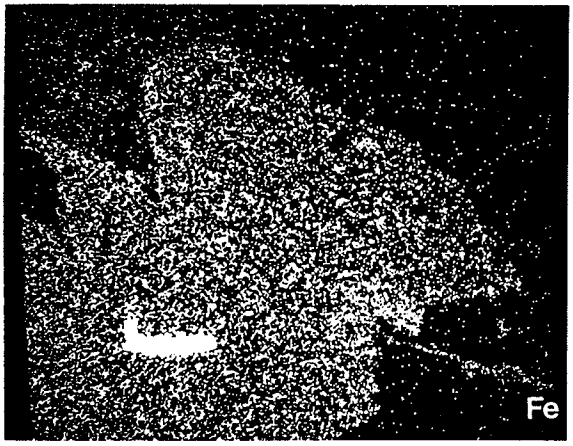
Figure 13B. The iron (11% FeO) distribution is uniform in the chevkinite "core" and its "alteration" (13% FeO); it is higher in the astrophyllite areas (As) (32% FeO) at the bottom-centre-right of the picture and at the upper left margin of the "alteration" zone. Fe is uniformly distributed in the amphibole and may be concentrated along cracks.

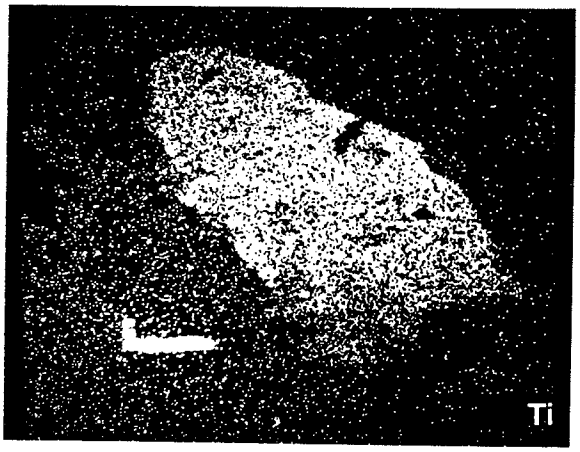
Figure 13C. The titanium (19% TiO_2) distribution is uniform in the main chevkinite grain (lighter at edges due to beam defocussing), but is more concentrated in the CA band (24-29% TiO_2), especially at the bottom left and upper right. Ti is uniform in the amphibole.

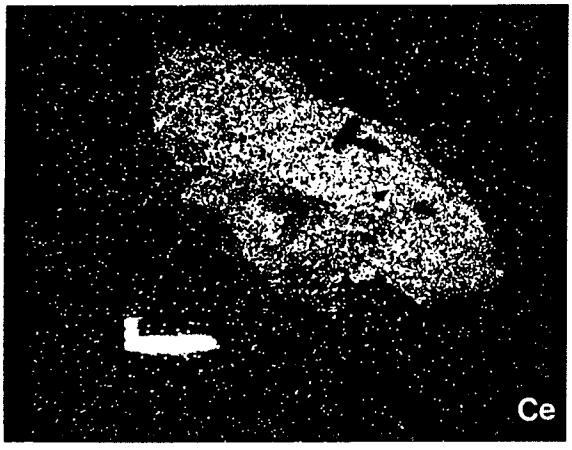
Figure 13D. The cerium distribution defines the outline of the chevkinite "core" better than Ti. Cerium shows a decrease from chevkinite (24% Ce_2O_3) to "chevkinite alteration" (11-20% Ce_2O_3) and is absent in astrophyllite.

Figure 13E. The lanthanum distribution (12% La_2O_3 in C; 2-6% La_2O_3 in CA) shows similar characteristics to that of cerium.









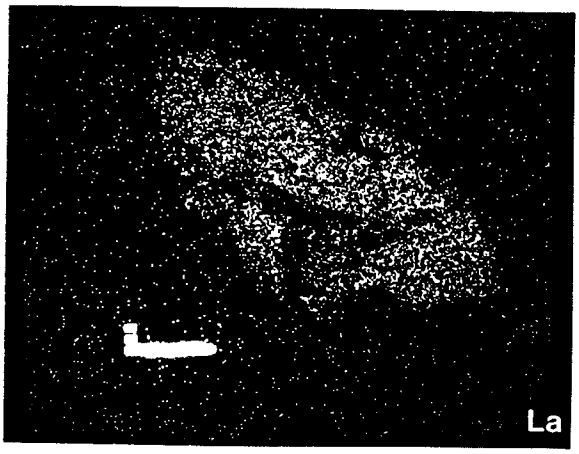


Figure 13

Figure 14A. Secondary electron image of zircon (Zr), magnetite (Mg), chevkinite (C), chevkinite alteration (yellow-orange crystals, dark grey around C), unidentified rare-earth mineral (R) in feldspar (F; WLD-85, granite unit). The very bright white spots in the feldspar background and on the upper zircon grain are dust specks. This picture is displaced to the left compared to the other four X-ray pictures. Bar scale 100 μm.

Figure 14B. Titanium is mostly concentrated in chevkinite and its "alteration", but is absent in the rare-earth mineral. Ti is present in magnetite, more concentrated in the middle of the grain. Ti is very rich in the grain at the left; this grain is an unidentified yellow crystal (Appendix 4, p. 306, #2, 3). The bright white blotch at the upper left of the grain, also present in the next 3 pictures, is a dust speck. P and Nb (not shown) are also concentrated in these grains (4% P_2O_5, 5% Nb_2O_5).

Figure 14C. The zirconium distribution shows the presence of six euhedral small zircon grains. It is also present in low concentrations in the yellow grain to the left and in the "chevkinite alteration" (<1% ZrO_2) grain.

Figure 14D. Cerium is concentrated in the chevkinite "core" (C) and in the grain to the left; it is present in lesser concentrations in the "chevkinite alteration" and in the rare-earth mineral.

Figure 14E. Lanthanum is similarly distributed to cerium, i.e., concentrated in the chevkinite "cores" and in the chevkinite "alteration"; it is, however, more concentrated in the unidentified rare-earth mineral (not analyzed). In transmitted light, these elongated rare-earth "laths" show a faint zonation (growth rim), which seems to be expressed here as a slighter La-enriched rim.

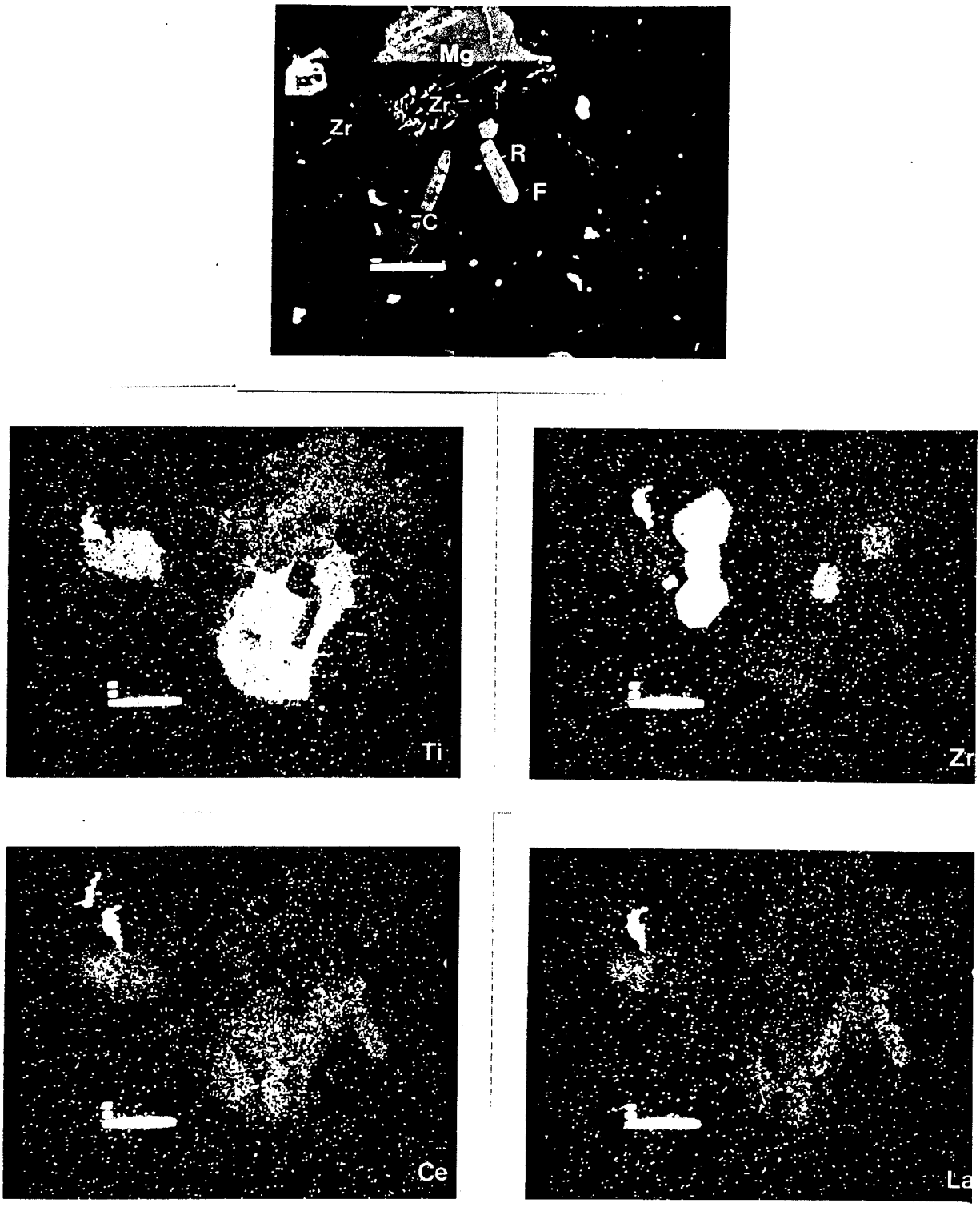


Figure 14

isolated grains of this unknown phase are also scattered in the feldspar grains (Figure 15 shows the X-ray distribution of titanium, iron, phosphorus, cerium and lanthanum in a cluster of euhedral yellow unidentified crystals from the hybrid unit). The chemical composition of the bands is variable, especially in the concentration of the rare earths (Appendix 4), but can be characterized as being very rich in Ti (20-42% TiO_2) and poor in Si and Fe, and probably water-bearing (totals are close to 85%). The relative concentration of cerium over lanthanum seems preserved during the alteration of the chevkinite. The same type of material occurs in the porphyritic granite; it is distinctly poorer in La and Ce. Figure 16 shows the X-ray distribution of lanthanum and cerium in an orange grain from the granite unit; it clearly shows the absence of rare-earths in damaged parts of the crystal. In rocks of the hybrid unit (H-2, H-6), it occurs as euhedral rectangular yellow crystals devoid of a chevkinite core. Figure 17 shows the titanium, cerium, lanthanum and thorium X-ray distribution of such a crystal.

Aenigmatite

Aenigmatite has been identified only in pegmatitic pockets and ill-defined areas of enrichment in the alkali granite. In the pockets, the aenigmatite is found as dark red patches, more rarely as well-formed crystals, usually associated with (or included in) arfvedsonitic amphibole. Where anomalously enriched in the granite, it may in fact replace the arfvedsonite and rim opaque phases and astrophyllite. Compositionally, the

Figure 15A. Titanium (28.5-42.1% TiO_2) is concentrated in the yellow unidentified crystals (H-2, hybrid unit; Appendix 4, p. 305, #1-5); it is also uniformly distributed in amphibole, to the left. Bar scale 100 µm.

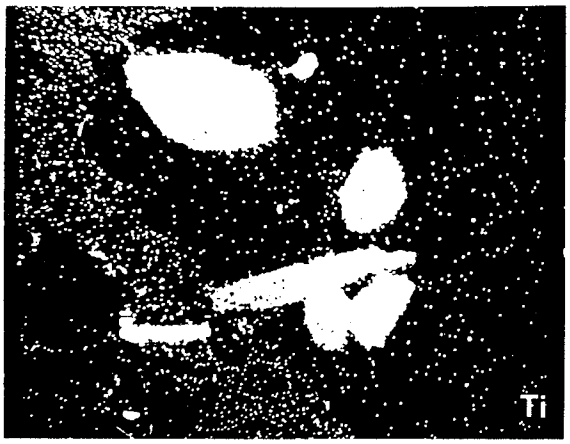
Figure 15B. Fe (9-11% FeO) is uniformly distributed in the unknown Ti-rich crystals, but is more concentrated in the amphibole (the uneven distribution to the upper left is due to beam defocussing).

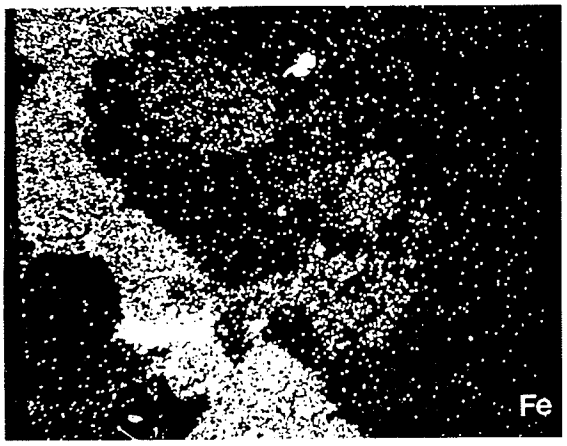
Figure 15C. Phosphorus is present in low concentration (<1.3% P_2O_5) in the Ti-rich crystals, but is mainly concentrated in small grains (not analyzed) of apatite(?) or xenotime(?). However, neither apatite nor xenotime were identified as common minerals.

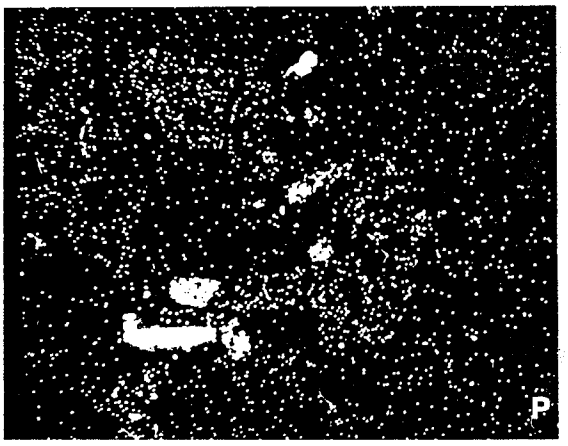
Figure 15D. Cerium (5.4-13.1% Ce_2O_3) is concentrated in the Ti-rich crystals, but is also present in other small grains, in which Ti seems absent.

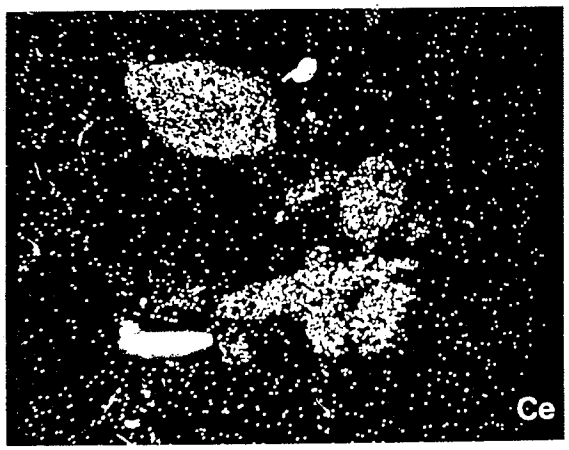
Figure 15E. The lanthanum (2.7-6.9% La_2O_3) distribution is similar to that of cerium.

These crystals are similar in appearance to those found in WLD-85, but the chemical compositions are different, those of H-2 being more rare-earth-rich in general, and poorer in Nb, Th and P.









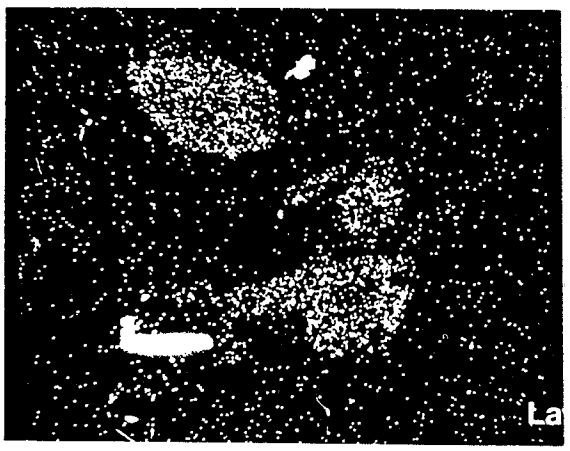
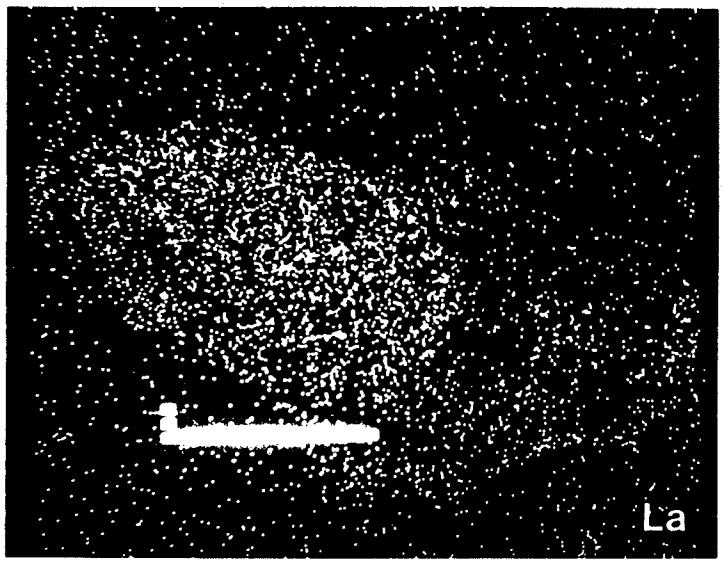


Figure 15

Figure 16A. Unidentified Ti-rich orange crystal enclosed in feldspar (WLD-85; granite unit; Appendix 4, p. 306, #5). The upper right part of the grain is broken up in small pieces. In transmitted light, the grain is orange-yellow, the bottom right edge is orange, and the grain is "surrounded" by a black border that does not show on the secondary electron image. Bar scale 100 μm.

Figure 16B. The lanthanum distribution shows the grain to be depleted in rare-earths toward the edge (bottom of the picture). Note that the area to the upper right is almost completely devoid of lanthanum. The background distribution of lanthanum is fairly high.

Figure 16C. The cerium distribution emphasizes the rare-earth depletion better than that of La. The Ce distribution emphasizes the location of the rare-earth-poor areas shown in grey in A. The titanium distribution (not shown) shows an opposite pattern; it increases toward the edge of the grain. The grain is rich in Nb (8.5% Nb_2O_5), Th (5.0% ThO_2) and P (2.6% P_2O_5). All the unidentified yellow grains analyzed in this sample are enriched in Nb (3.6-8.5% Nb_2O_5), Th (1.3-7.5% ThO_2) and P (1.5-4.1% P_2O_5).



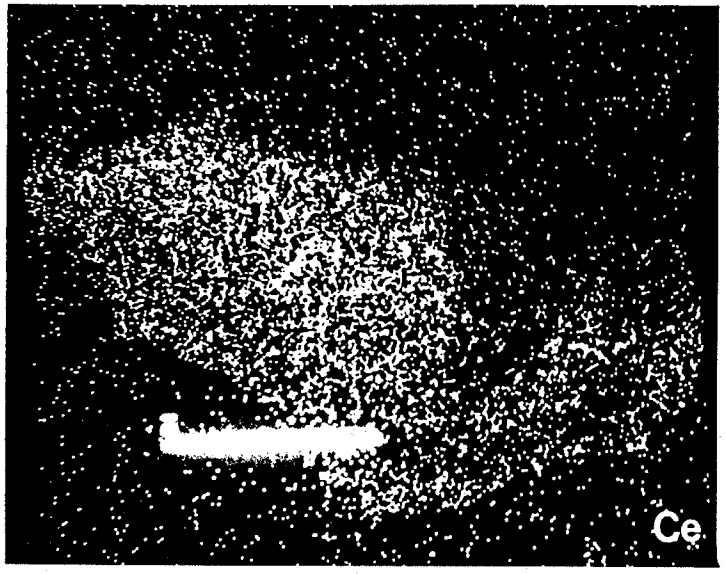


Figure 16

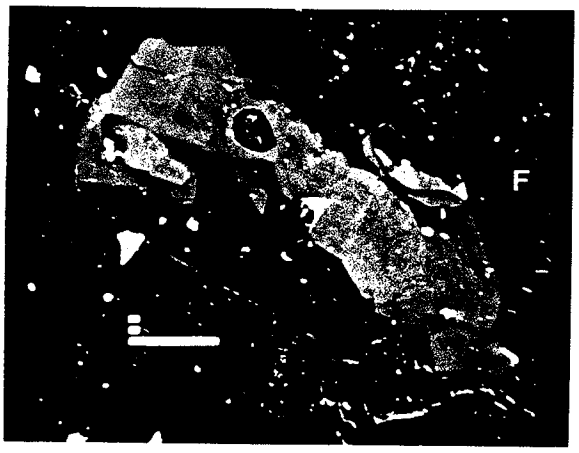
Figure 17A. Euhedral grain of unidentified Ti-rich mineral (Appendix 4, p. 300, #4, 7, 8) in feldspar (F; AG-P2, alkali granite). The pale grey middle zone is orange in color and the dark grey zones laterally change gradually to pale yellow. The apparent change in concentration at the edges of X-ray mapping pictures is due to beam defocussing (Silver et al. 1984). Secondary electron image. Bar scale 100 μm.

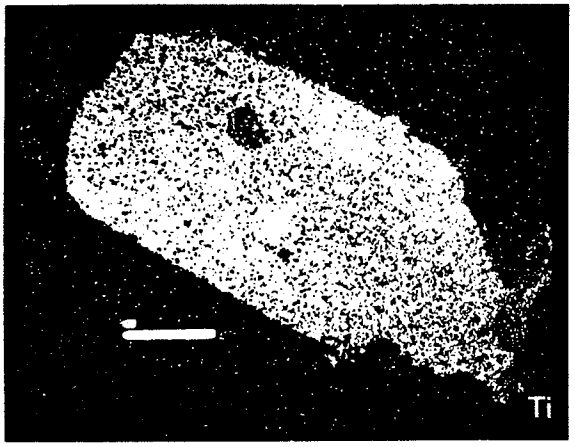
Figure 17B. The titanium distribution shows the outer "pale yellow" (dark grey on A) zones to contain more titanium (42-51% TiO_2) than the "orangy" (23% TiO_2; pale grey on A) zones.

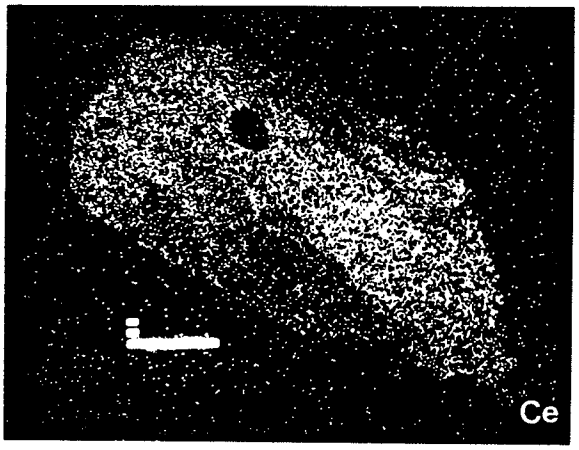
Figure 17C. The cerium distribution shows the rare-earth enrichment of the "core" and the depletion along its edges. The highest Ce concentration is found in the darker colored (orange to brown) bands.

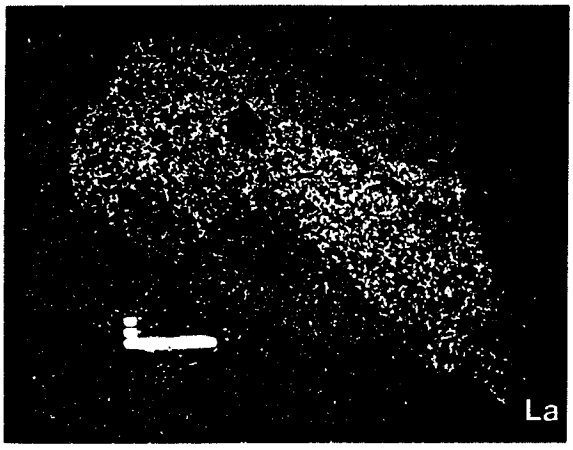
Figure 17D. The lanthanum distribution is similar to that of cerium.

Figure 17E. In contrast to the rare-earth elements, the thorium distribution (core: 0.3% ThO_2, edges: 1.4-3.0% ThO_2) seems to follow that of titanium, with more concentrated zones at the edge of the grain. The "chevkinite alteration" grains in this sample are also enriched in Nb (2.1-4.4% Nb_2O_5), Th (0.3-3.9% ThO_2), Zr (0.4-5.0% ZrO_2), but not in P^2 (0-0.5% P_2O_5).









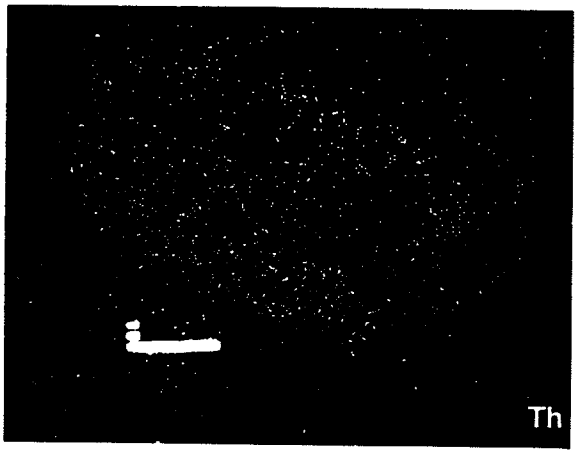


Figure 17

aenigmatite in the pockets resembles that from the Mt. Edziza pantellerite, British Columbia (Yagi & Souther 1974); it is only slightly richer in Ti and poorer in Fe than that in the Red Wine complex, Labrador (Curtis & Currie 1981) and in the Ilimaussaq complex, Greenland (Larsen 1977).

Pyrochlore

Niobates have been found only in the alkali granite unit, generally in the pegmatitic pockets. They occur as very small, isolated, yellow to green euhedral crystals, either very clear or turbid, with or without an altered rim (Figure 18 shows the X-ray distribution of niobium, lanthanum and cerium in a clear, green euhedral grain from the alkali granite. They may be confused with zircon. The chemical composition of the niobates is not consistent, even within a single thin section. The compositions listed in Appendix 3 mostly indicate the ceriopyrochlore member of the pyrochlore family (Hogarth 1977). Some grains in AG-P4 contain both Ca and Na, whereas others in the same rock (and in other samples) contain Ca and no Na. As a group, the compositions are particularly variable in Ca (0.3-7.5% CaO), Ti (7.9-12.1% TiO_2), Nb (49.4-66.8% Nb_2O_5), Ta (2.5-5.4% Ta_2O_5), and F (0-8.9%). Also, the analytical totals vary from 86.7 to 100.9%; the low totals may be due to major elements that were not determined, or to structurally bound water (or both). The pyrochlore in WLD-36 is relatively poor in the rare earths.

Figure 18A. Green euhedral grain of pyrochlore (rare-earth-rich variety) enclosed in feldspar (F; AG-P2, alkali granite; Appendix 4, p. 327, #1, 2, 3). A rim is clearly seen around the pyrochlore grain. Secondary electron image. Bar scale 100 μm.

Figure 18B. Niobium distribution in the pyrochlore grain. Nb (54% Nb_2O_5) is slightly more concentrated along one of the cracks.

Figure 18C. Lanthanum distribution. La is only present in concentrations of 2% La_2O_3.

Figure 18D. Cerium distribution. Ce (6% Ce_2O_3) shows a distribution similar to that of Nb, but is less concentrated along the "vertical" crack.

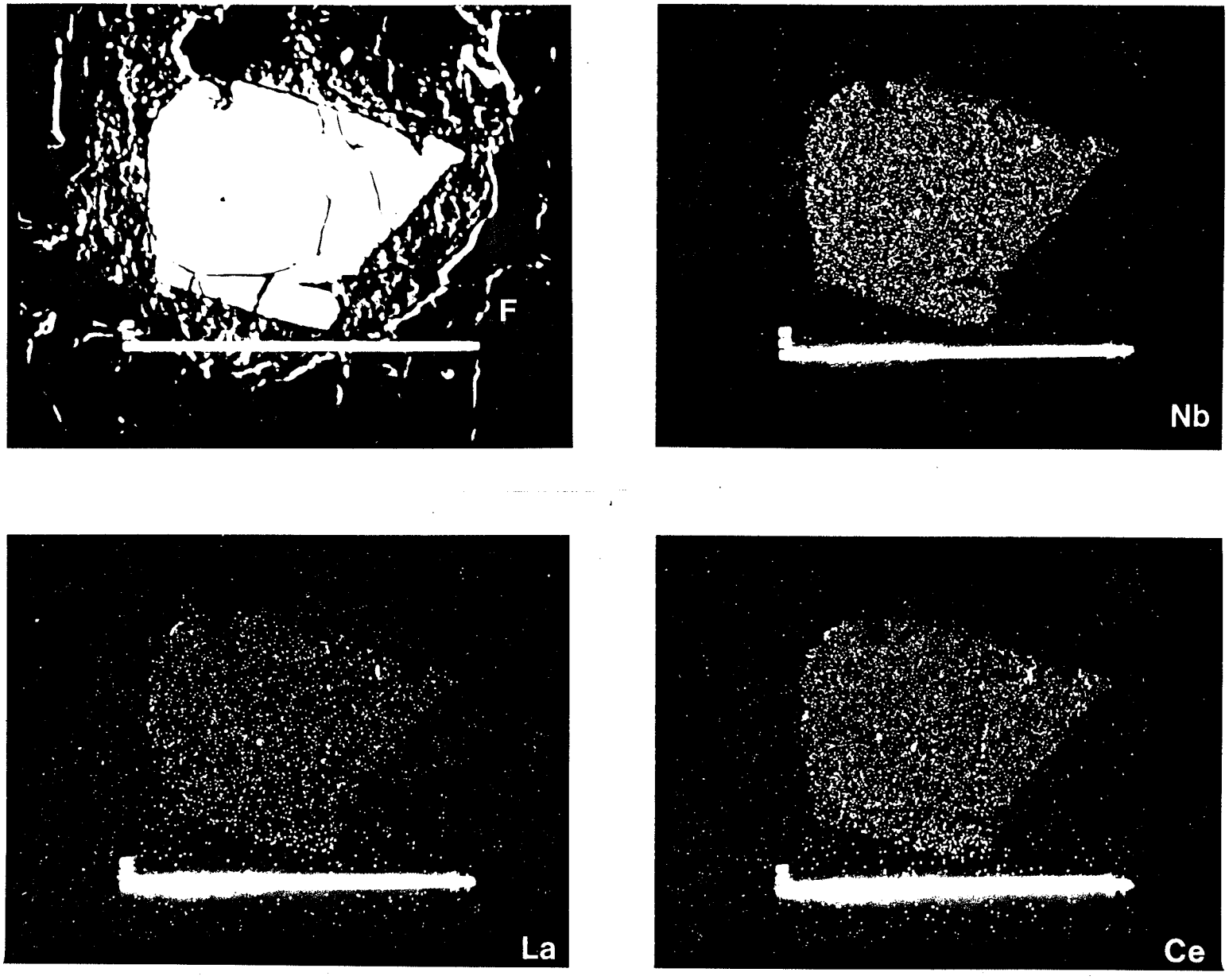


Figure 18

Thorite

Thorite has been identified only in a sample of the hybrid unit (H-6). It forms as a euhedral yellow mineral, similar to zircon. It has a reddish core rimmed by dark bright yellow to pale yellow zone, surrounded by a wide red alteration rim. Figure 19 shows the X-ray distribution of thorium, zirconium, uranium and yttrium in thorite (Th) and zircon (Zr) grains from the hybrid unit. Its chemical composition (Appendix 4) suggests that it may be hydrothorite.

Monazite(?)

Monazite(?) occurs as very rare, small, turbid, yellowish crystals associated with zircon and amphibole in specimen H-2, of the hybrid unit. However, its chemical composition (Appendix 4) departs significantly from that of ideal monazite.

Yttrium phosphate

This mineral occurs in alkali granite AG-P1 as a dark brown grain rimmed by a lighter brown unknown mineral. Its chemical composition (Appendix 4) suggests a Ca-free, Y-rich, britholite-like mineral (apatite family). The rim is much richer in yttrium (31-34% Y_2O_3) and phosphorus (17% P_2O_5), and poorer in sillica (6.2% SiO_2) and cerium (9.8-11.2% Ce_2O_3). No other rare-earth (of those that were analyzed for) is present in significant quantities. Figure 20 shows the X-ray distribution of phosphorus, thorium and yttrium in a grain from the alkali granite. The low analytical totals indicate that the mineral

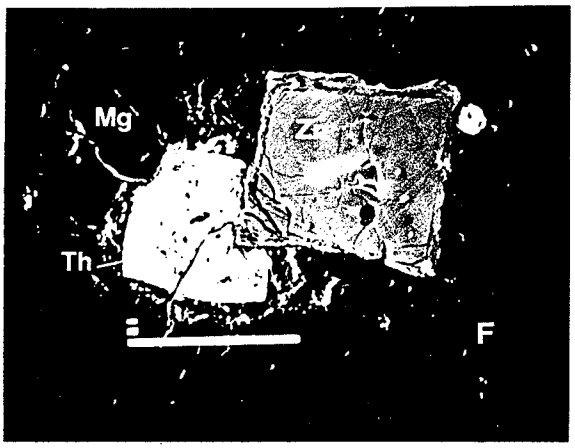
Figure 19A. Secondary electron image of a euhedral zoned thorite grain (Th), zircon (Zr) and ilmenite (Mg) in feldspar (F; H-6, hybrid unit). Note the radioactive damage rim around the thorite. Both thorite and zircon show growth zones; the overgrowth rim on thorite contains 54% ThO_2 (Appendix 4, p. 313). Fe (not shown) is concentrated in the core (10% FeO) and gradually decreases toward the rim (1.6% FeO). Bar scale 100 µm.

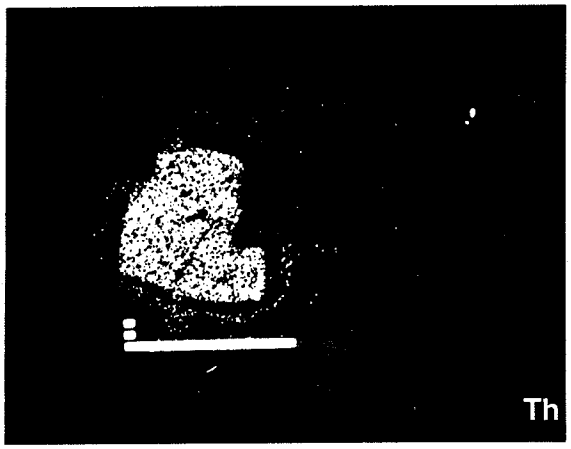
Figure 19B. The thorium concentration is slightly higher in the overgrowth rim, and in the corresponding white areas in A. Thorium is disseminated at the edge of the "damage rim", but absent in the zircon.

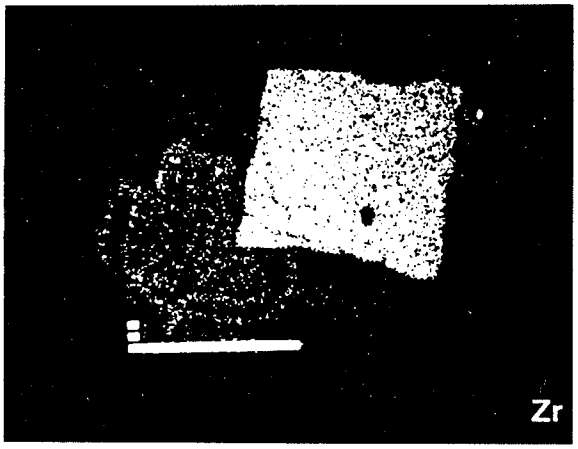
Figure 19C. The zirconium distribution outlines the zircon shape (lower concentration to the upper right due to beam defocussing). Zirconium is present in the thorite in concentrations of 2.3-3.3% ZrO_2; it is also present in the radioactive damage rim (6.7% ZrO_2).

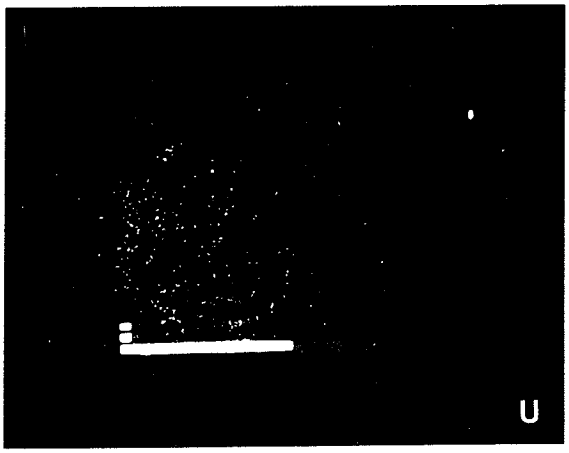
Figure 19D. Uranium is present in low concentrations in thorite, very low in the radioactive damage rim and absent in zircon.

Figure 19E. Yttrium is found in larger concentrations in the thorite overgrowth (3.8% Y_2O_3) than in the core (2.8% Y_2O_3). Yttrium is found in very low concentrations in the zircon (0-0.2% Y_2O_3; Appendix 4, p. 313).









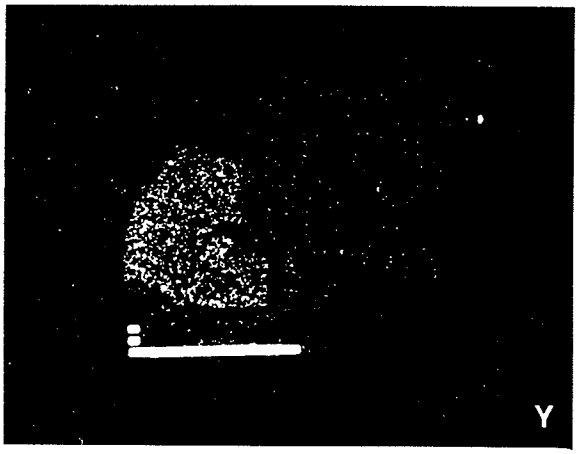


Figure 19

Figure 20A. Unidentified yttrium phosphate in quartz (Q) and feldspar (F; AG-P1, alkali granite). The secondary electron image clearly shows the euhedral shape and the sharp zonation of this grain. The dark grey grain in the middle was not analyzed. The black areas transversal to the bar scale are "missing", the mineral being badly polished. Bar scale 100 µm.

Figure 20B. The phosphorus (13.5%-17% P_2O_5) distribution clearly shows the zonation of the grain and several zones where phosphorus (and yttrium) are even more concentrated. The mineral is not xenotime, as evidenced by its chemical composition (Appendix 4, p. 333).

Figure 20C. Thorium (1.6-2.3% ThO_2) is abundant enough to outline the crystal and is mainly concentrated in the P- and Y-rich zones.

Figure 20D. The yttrium (19.1-33.6% Y_2O_3) distribution is similar to that of phosphorus. The mineral is probably also rich in the heavy rare-earth elements.

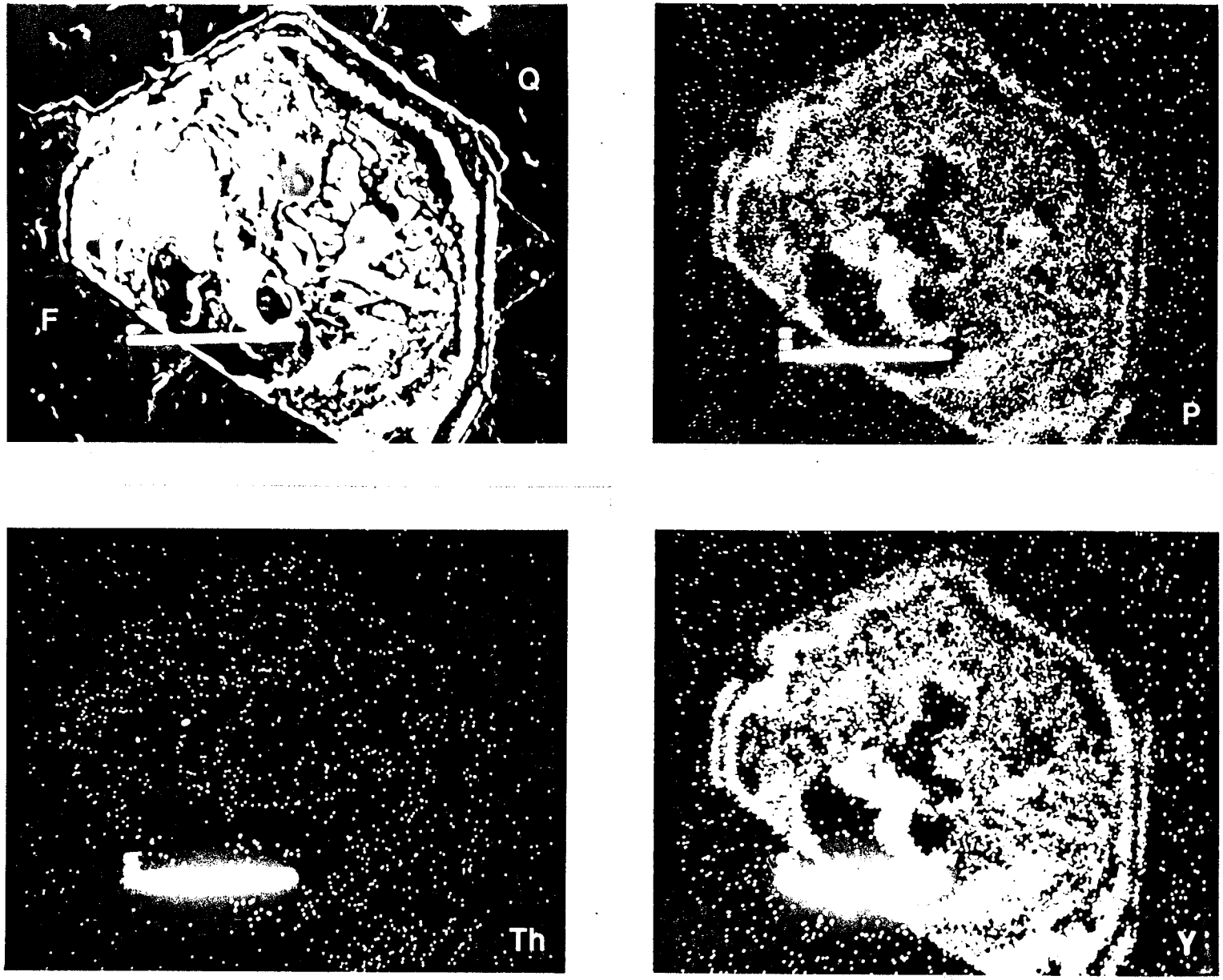


Figure 20

could contain carbonate, water, and other major elements not analyzed for.

Sphalerite

Sphalerite was positively identified in the quartz syenite. It occurs as a dark red euhedral crystal. An incomplete chemical composition is provided in Appendix 4. The presence of sulfur was confirmed in an energy-dispersion scan.

CHEMICAL COMPOSITION OF THE WELSFORD ROCKS

The bulk chemical composition of the granitic and syenitic plutonic rocks sampled (Fig. 2) has been determined by standard X-ray fluorescence techniques (Appendix 5). The data define an almost continuous population of data points in a triangular plot of normative quartz, albite and orthoclase (Fig. 21). The distribution of points corresponds to the low-temperature trough on the liquidus in the water-saturated haplogranite system at a low $P(H_2O)$ (taken to be equal to confining pressure) of 1 kilobar (Tuttle & Bowen 1958). Along this trend, Ca and Mg are uniformly low, so that the points are in fact close to the plane of the projection. One can tentatively conclude, from the distribution of data points, that a syenitic magma differentiated efficiently to a granitic magma by feldspar fractionation in the upper crust. The presence of pegmatitic pods and miarolitic cavities in the granites suggests that the granitic liquids achieved water saturation during their crystallization. The proximity of many points to the cotectic curve relevant to a confining pressure of 1 kilobar in the water-saturated system (Tuttle & Bowen 1958) is consistent with this proposal.

As in other examples of peralkaline granites that show evidence of late deposition of albite and arfvedsonite (e.g., Abdel-Rahman & Martin 1987), some points representing samples of unit DWfag (alkali granite) are offset from the magmatic trend in the direction of the albite corner (Fig. 21). Note that the data points for the porphyritic hiatal granite also plot away from the magmatic trend toward albite; in this case, however, this shift

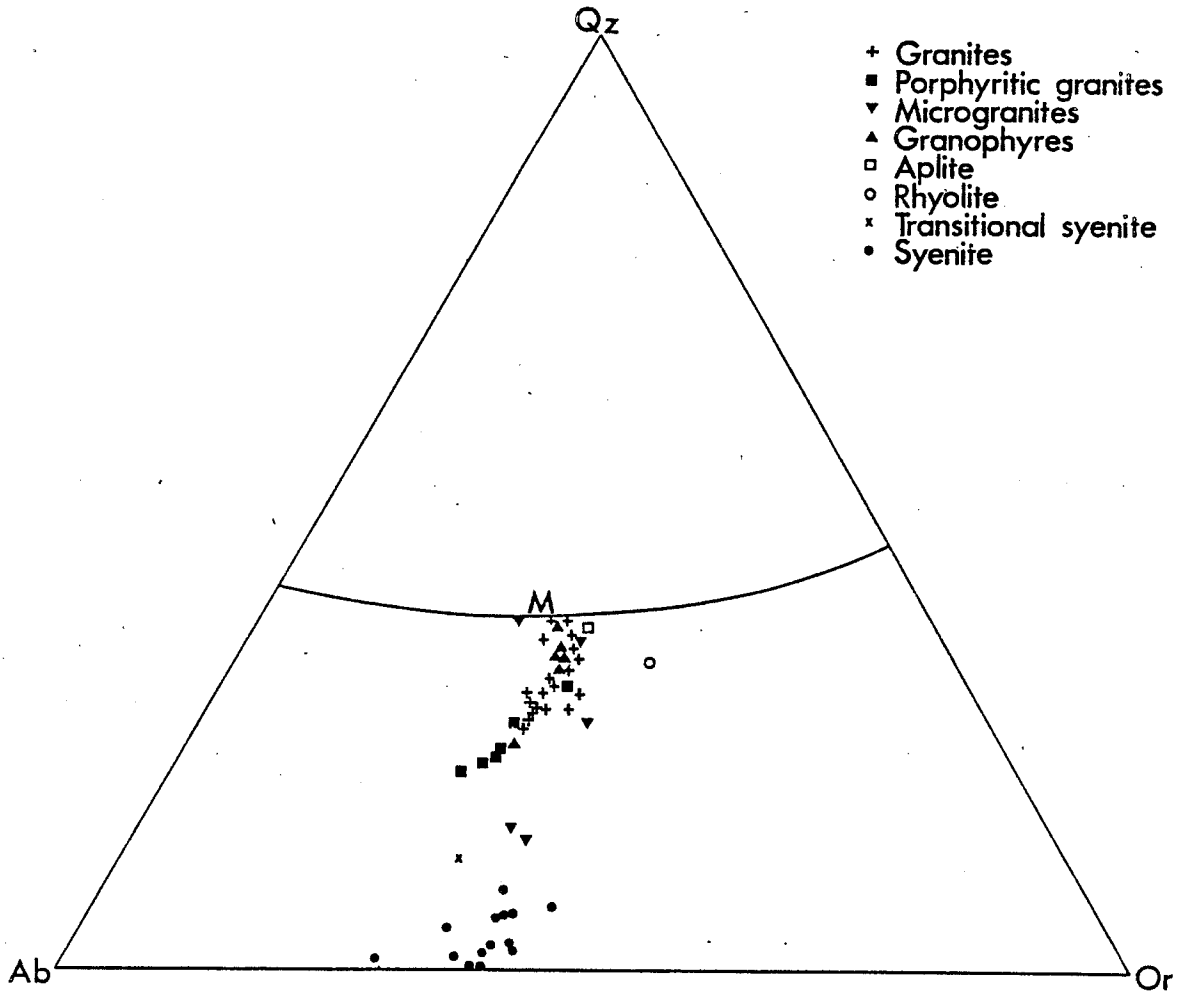


Figure 21. Bulk composition of representative samples of the various map-units in the Welsford igneous complex, plotted in terms of the normative constituents quartz, albite and orthoclase (weight %). The letter M represents the pseudoternary minimum along the cotectic separating the primary fields of quartz and alkali feldspar. Many points conform to the thermal trough on the liquidus, which suggests that many bulk compositions are, grosso modo, representative of the liquids from which they crystallized.

is an artifact of the projection into the Ca-free system; these bulk compositions are in fact more calcic than the rest, and may well have arisen by contamination or mixing of granitic and basic magmas, as revealed by aspects of the petrography of this unit.

How is it possible to evaluate the proposal that the fractionation of feldspar(s) was responsible for the trend displayed in Figure 21? A sensitive test can be made by studying the rare-earth geochemistry of representative members of the proposed fractionation sequence. The concentrations of the rare earths, determined by neutron-activation analysis, are listed in Table 2, and plotted in Figure 22, normalized with reference to concentrations in the Leedey chondrite (Masuda et al. 1973) divided by 1.2. The two syenites (74-96 and 74-100) are characterized by light-rare-earth enrichment and a minor europium anomaly (positive en 74-96, negative in 74-100). Conventional wisdom would suggest that 74-96 contains a component of accumulated feldspar, whereas 74-100, which is more evolved on the basis of its total concentration of rare earths, crystallized from a melt that had lost a portion of the liquidus crystals of feldspar that it had formed. Similar in profile but even more evolved is a sample of devitrified rhyolite (46) emplaced as a dyke in the granophyric granite. The four other rocks shown display a very prominent negative europium anomaly, the sign of the extraction of feldspar from a crystallizing magma and an amplification of the trend displayed by samples 74-100 and 46. The sample that is most evolved, in terms of enrichment in the light and heavy rare-earths and in the magnitude of the negative

TABLE 2. CONCENTRATION OF RARE-EARTH ELEMENTS, Th, U, AND Sc IN SELECTED SAMPLES OF THE WELSFORD IGNEOUS COMPLEX

	1	2	3	4	5	6	7	8	9	10
La (ppm)	77	60	38	29	87	43	77	75	58	92
Ce	154	134	94	65	202	112	170	184	165	216
Nd	89	87	65	45	110	98	94	107	98	119
Sm	11.9	12.5	7.8	5.5	15.8	12.3	12.3	14.2	15.0	13.4
Eu	1.0	3.2	2.4	2.2	0.4	2.6	0.9	0.3	0.2	0.3
Tb	2.3	2.4	1.5	0.8	3.6	2.5	2.6	3.1	3.4	2.5
Yb	10.9	13.0	5.7	3.3	15.7	7.2	12.5	14.5	20.9	11.5
Lu	1.7	2.1	0.9	0.6	2.4	1.2	1.8	2.0	2.9	1.7
Th	31	19	4.3	4.7	42	3.5	34	27	45	21
U	8.8	5.7	2.1	1.6	11.2	4.3	5.9	6.0	12.2	6.1
Sc	4.1	9.4	8.7	25	1.2	12.2	4.3	0.8	0.4	0.9

Concentrations were determined by neutron-activation analysis performed by X-ray Assay Laboratories, Don Mills, Ontario.
Samples analyzed:
1 porphyritic granite 37,
2 devitrified obsidian 46,
3 fayalite syenite 74-100,
4 diorite 74-96 in unit DWfqs,
5 granophyric microgranite 74-73,
6 dark syenite 74-19,
7 dark porphyritic granite 74-83,
8 red alkali granite 74-71,
9 arfvedsonite-bearing alkali granite 74-78,
10 cream-colored alkali granite BH7450 (same locality as 74-81).

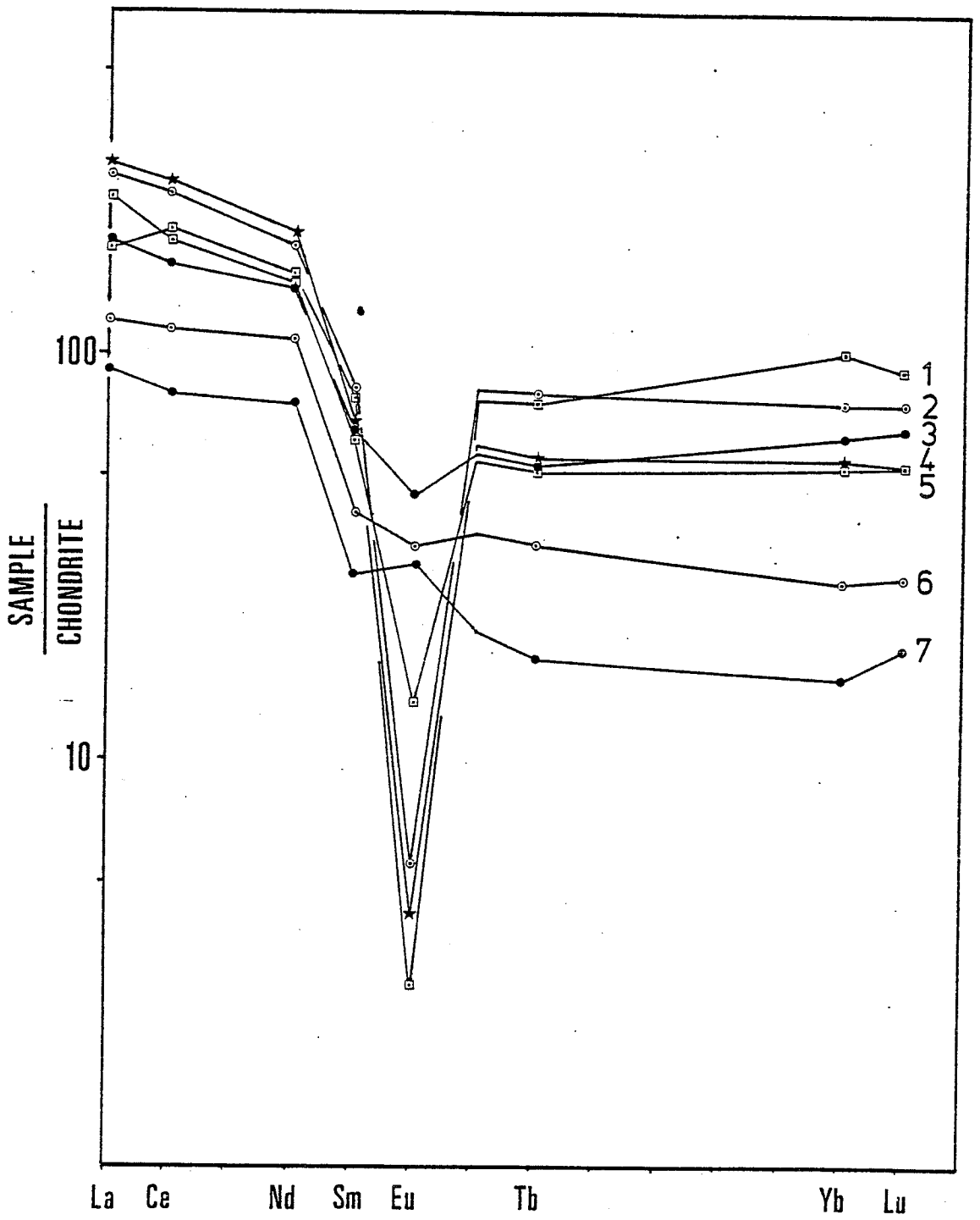


Figure 22. Chondrite-normalized plot of rare-earth concentration in selected samples of the Welsford igneous complex. Samples plotted: 1 arfvedsonite-bearing alkali granite 74-78, 2 granophyric microgranite 74-73, 3 devitrified obsidian 46, 4 cream-colored alkali granite BH7450 (same locality as 74-81), 5 porphyritic granite 37, 6 fayalite syenite 74-100, 7 diorite 74-96 in unit DWfqs.

europium anomaly, is 74-78, which is the elpidite-bearing arfvedsonite granite.

In Figure 23, the bulk composition of the nine analyzed samples of devitrified ignimbritic and tuffaceous volcanic rocks is plotted in terms of normative quartz, albite and orthoclase. Unlike Figure 21, Figure 23 is drawn on a molar basis. Two of the points (both samples are from Break Neck Hill) plot near the magmatic trend, in a central position on the diagram, but the others are significantly shifted toward the albite-quartz edge of the triangle. This shift is interpreted to reflect Na-for-K ion exchange which, in a molar plot, should lead to a trend parallel to the base, as Si is not involved in the reaction. The bulk composition of these volcanic rocks was most likely disturbed at the time of devitrification, a process that is catalyzed by water that circulates through the accumulation of volcanic ejecta. The Na enrichment of the rocks is viewed as being postmagmatic, and should not be considered in naming the rocks. These volcanic rocks are thus not dacitic, as inferred by McCutcheon & Ruitenberg (in press). If the lost potassium were to be restored, they would plot on the trend shown in Figure 21. Note that the rhyolite in the dyke that cuts the granophyric granite (46) has undergone the opposite (i.e., K-for-Na) reaction (Fig. 21).

The bulk-composition data are shown in a portion of the diagaram SiO_2 - Al_2O_3 - (Na_2O + K_2O) (Fig. 24). The vertical line in this plot reflects the equality (Na + K) = Al, which characterizes both $NaAlSi_3O_8$ and $KAlSi_3O_8$. It is immediately apparent that the syenitic bulk-compositions straddle the line,

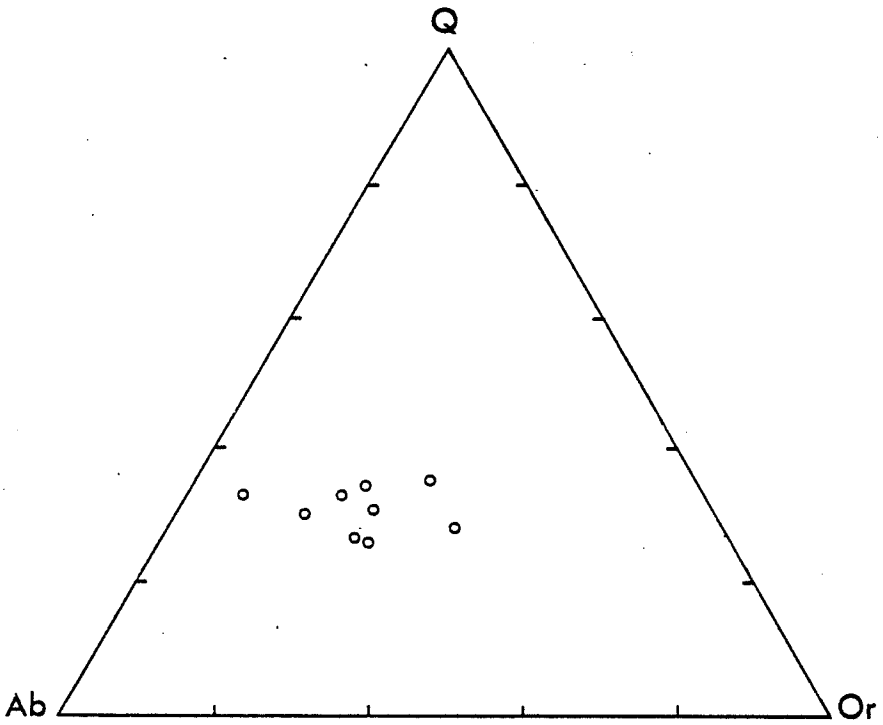


Figure 23. Bulk composition of selected volcanic members of the association, in terms of normative components quartz, albite and orthoclase, calculated on a molar basis.

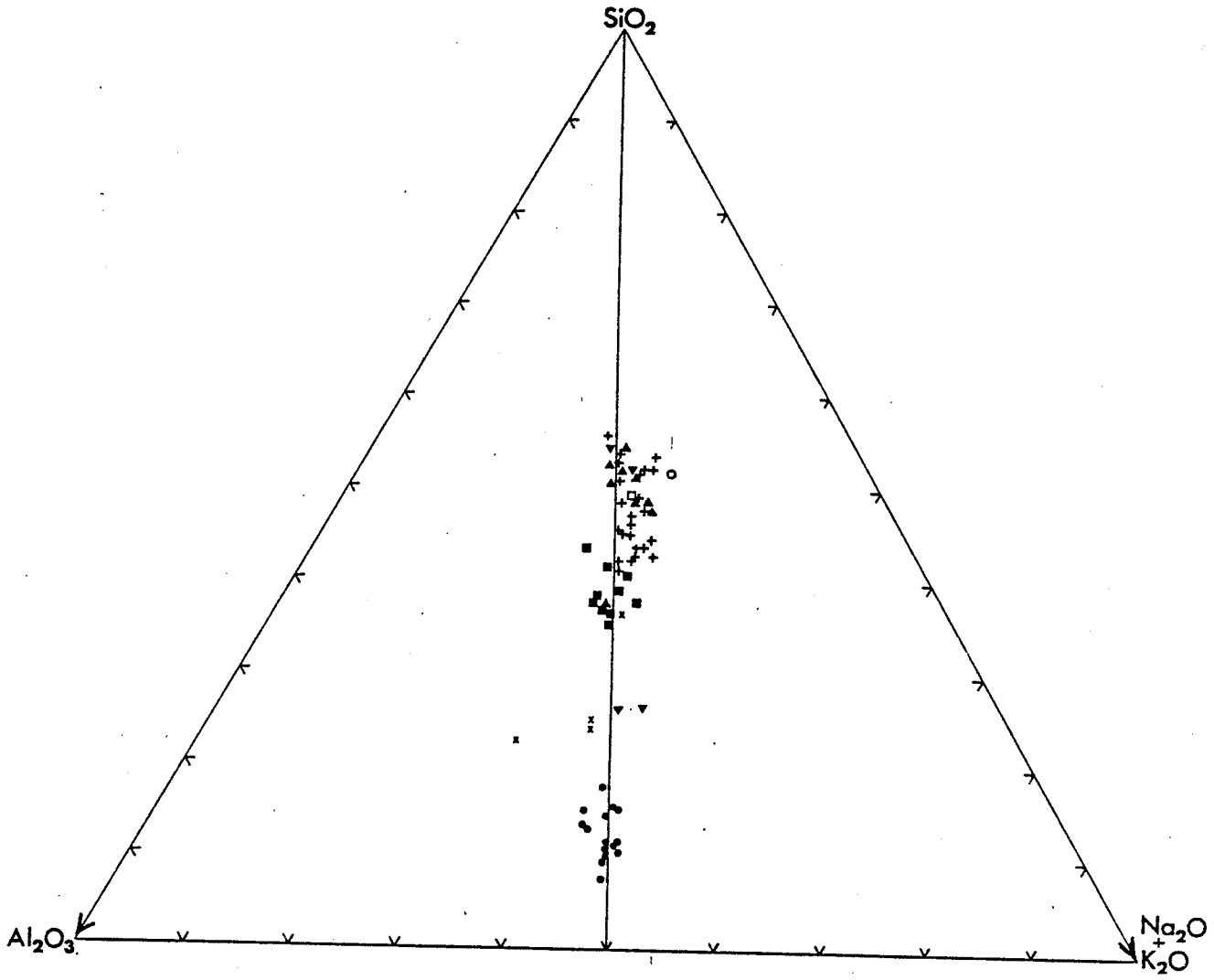


Figure 24. The same bulk compositions as shown in Figure 21 are here plotted in terms of molar proportions of SiO_2, Al_2O_3 and $Na_2O + K_2O$. The feldspars $NaAlSi_3O_8$ and $KAlSi_3O_8$ plot at the intersection of the base of the diagram with the vertical line, along which Na + K = Al. Note that most granitic rocks in the Welsford suite are peralkaline.

some being slightly aluminous, others slightly alkaline. Fractionation of sodic plagioclase or a ternary feldspar from a slightly aluminous primitive syenite can drive the bulk composition of the derivative liquid to the peralkaline side. On the other hand, the fractionation of a Ca-free alkali feldspar will keep the derivative liquids on the same side of the line as the parent magma. The bulk of the granites in the Welsford complex thus seem to be definitely peralkaline, and to have arisen owing to the plagioclase effect. The aluminous granites in Figure 24 may have become so by the preferential loss of alkalis at the hydrothermal stage, as has occurred in some Nigerian examples of anorogenic granites (Martin & Bowden 1981). Also, the porphyritic hiatal granites are not all peralkaline, owing to contamination or mixing with a subalkaline basic magma.

Among the peralkaline granites, the data points are scattered and do not define a single vector into the peralkaline field, as could perhaps have been expected. This scatter may indicate that the degree of peralkalinity in the granites is modified at an early postmagmatic stage via a gas phase of magmatic derivation (e.g., Ike et al. 1984). Peralkalinity is considered a property that characterized the granitic liquids that evolved by fractionation at Welsford, but the magmatic vapor that separated upon crystallization "back-reacted" with the hot silicates to enhance their alkalinity in many instances. This would in fact be the complementary reaction to that responsible for the slightly aluminous members of this suite. If some granites have lost alkalis during cooling, related rocks in other parts of the system may well have become enriched.

PETROGENESIS AND TECTONIC IMPLICATIONS

The Welsford plutonic complex, like the western part of the St. George (or Charlotte) batholith (known as the Bocabec complex: Fyffe et al. 1981), has been considered associated with the culmination of the Acadian orogeny. "The Acadian intrusive rocks of New Brunswick appear to be related to a single cycle which followed the closing of the Iapetus Ocean " (Fyffe et al. 1981). The problem is that the population of "Acadian intrusive rocks" is petrogenetically too broad to be treated as the product of one tectonic environment. Specifically, bona fide anorogenic granites are now recognized among the Acadian intrusive rocks (Martin 1970, Whalen 1986). This report, which amplifies on the preliminary account of Payette & Martin (1987), provides some information of the petrogenetic schemes important in the Welsford complex. Any thorough evaluation, however, will require data on the stable and radiogenic isotopes.

The petrogenesis of a dominantly peralkaline anorogenic syenite-granite association is still a topic of considerable disagreement. In the opinion of Whalen et al. (1987), A-type granites probably result mainly from the anatexis of F- and Cl-enriched dry, granulitic residue remaining in the lower crust after the extraction of an orogenic granite. They discounted claims that crystal fractionation and metasomatism played important roles. They also proposed that A-type granites do not necessarily indicate a rifting environment. What can we learn from the Welsford complex?

By analogy with petrologically similar suites in tectonically more straightforward terranes (Black et al. 1985), in Niger and Nigeria, for example (Bowden & Turner 1974), we contend that the tectonic setting at the time of emplacement, considered to have been in the Late Silurian to Early Devonian, was one of distension. Unlike the Nigerian magmatic centres, whose surface expressions are isolated or nested ring-complexes, the Welsford magmatic centre seems controlled by the same 70-km fissure that controls the location of the Stewarton gabbro-diorite complex and the Evandale granitic pluton, both assigned to the "mafic-felsic association" by Fyffe et al. (1981). Both are considered coeval, and seem to have been emplaced at a shallow level in the crust during an episode of regional extension in southern New Brunswick. Also, the strike of the Welsford complex parallels that of diabasic and gabbroic dykes (unit Dm) emplaced in the Silurian metasedimentary sequence in the area (Fig. 1), as well as the strike of Long Reach (St. John River), 5 km or so southeast of the complex, and whose trend follows the Belleisle Fault.

The period of extension indicated by the occurrence of alkaline magmatism may represent a time of relaxation soon after an episode of crustal compression. The Acadian orogeny, which caused deformation in the host rocks in the area, must have been relatively brief and must have waned by the time of the intrusion into the crust of mantle-derived basic magmas (e.g., Pajari et al. 1974). We contend that these basic liquids may have induced anatectic reactions in the middle to upper crust (i.e., not likely to have been granulitic), and seem to have still been

available during the fractionation of the Welsford magma. Mixing of such basic magma and the Welsford magma, or its derivatives, probably accounts for small batches of dioritic and plagioclase-bearing granitic liquids, which crystallized as a suite of hybrid and porphyritic rocks. What was the parental magma for the uncontaminated anorogenic rocks at Welsford? We have shown that the syenitic unit encloses some primitive rocks that contained a ternary feldspar (now exsolved to mesoperthite) and a cumulus component. The fractionation of a ternary feldspar caused this syenitic liquid to become more and more granitic, peralkaline, and strongly enriched in a host of highly incompatible elements. As is customary in such peralkaline suites, the importance of postmagmatic modifications, involving local metasomatism, is very important, owing to the corrosive character of the fluid phase that circulates through the igneous assemblage. As also is customary, the postmagmatic modifications have affected the fine-grained assemblages (volcanic suite, granophyric granite) most thoroughly. We have documented extensive re-equilibration and recrystallization of the primary minerals in all units of the Welsford complex. We have not found evidence to support the view of Sharpe (1958), that the syenitic unit owes its existence to a desilication reaction between an intruding granitic magma and the relatively cool carbonate-bearing country rock.

In summary, we contend that the uncontaminated Welsford rocks are interrelated by a fractionation process, that the postmagmatic stage of the petrogenetic story did involve localized metasomatic exchanges, and that the tectonic setting

was one of crustal extension, similar to the Basin-and-Range province in the western United States. Unfortunately, further study of the pluton to document its petrogenesis and postmagmatic evolution cannot be justified on the basis of its economic potential, as the level of enrichment of strategic metals is restricted to the alkali granite, and too restricted to generate much excitement (Ruitenberg & Fyffe 1982).

An accurate determination of the age of the complex, which, according to feldspar mineralogy, has not been reheated since its crystallization, clearly should be sought to provide a constraint on the timing of the inception of rifting in this area. An environment of rifting is widely accepted for the formation of the thick clastic wedges of Upper Devonian and Carboniferous age in New Brunswick. The hypothesis that rifting was in fact locally important in late Silurian time requires a re-evaluation of the nature of the Acadian event in this region. Certainly, not all "so-called" Acadian granites are calcalkaline!

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APPENDIX 1. CELL-DIMENSION DATA BEARING ON THE SODIUM-RICH AND POTASSIUM-RICH FELDSPARS PRESENT IN REPRESENTATIVE PLUTONIC MEMBERS OF THE WELSFORD COMPLEX AND ASSOCIATED FELSIC VOLCANIC ROCKS

Note of explanation: in order to reduce the overall thickness of this report, only the first two pages of output are included for each separate feldspar refined. The refinements were carried out using an IBM-PC version of the Appleman & Evans (1973) cell-parameter-refinement program. The top part of the first page of output in each case refers to the approximate cell-parameters fed into the program as trial values. The results of the actual refinement are labeled "Final values". Provided are parameters that relate to the direct cell and the reciprocal cell, followed by direct-cell and reciprocal-cell standard errors. Sample locations are indicated in Figure 2.

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
Department of CHEMISTRY
NORTH DAKOTA STATE UNIVERSITY
Fargo 58105 - 5516

WELSFORD SYENITE 74-14: ORTHOCLASE (AB)OR)IM) --) 1987/ 3/ 2 . * . * . 0:48

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5000000	12.9690000	7.1980000	90.00000	115.85000	90.00000	722.4864 A**3
Reciprocal CELL:	0.1292078	0.0771069	0.1543744	90.00000	64.15000	90.00000	0.001384109 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.6 Dmin = 1.428471 MONOC System
3 Conditions for non-Extinctions Called for Class Condition(s)
hkl h+k = 2n
h0l h = 2n
0k0 k = 2n

F I N A L V A L U E S for WELSFORD SYENITE 74-14: ORTHOCLASE (AB)OR)IM)
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5830881	12.9950071	7.1388773	90.00000	116.02897	90.00000	720.3874 A**3
Reciprocal CELL:	0.1296157	0.0770976	0.1546464	90.00000	63.97102	90.00000	0.001388142 A**-3
*-- Direct Cell	Corrections:						
	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$-- Direct Cell	Standard ERRorS						
	0.0024872	0.0086179	0.0014759	0.00000	0.01991	0.00000	0.765301
&-- Reciprocal Cell	Standard ERRorS						
	0.000030512	0.000017359	0.000040482	0.0000000	0.0198692	0.0000000	

WELSFORD SYENITE 74-14: ORTHOCLASE (AB)OR)IM) HKL Listing - *** Refers to FIXed, R to Rejects MONOC

N	H	K	L	D Calc	D Obs	Lambda	2- Theta.Calc	2- Theta Obs	2- Theta Diff	Weight
1	-1	1	0	6.630770		1.540560	13.34194			
***	0	2	0	6.485283	6.477557	1.540560	13.64265	13.6590	-0.01635	1.00000
3	0	0	1	6.466363		1.540560	13.68276			
4	-1	1	1	5.868069		1.540560	15.08555			
5	0	2	1	4.579084		1.540560	19.36834			
***	-2	0	1	4.230359	4.228032	1.540560	20.98232	20.9940	-0.01168	1.00000
***	1	1	1	3.944268	3.942617	1.540560	22.52345	22.5330	-0.00955	1.00000
8	2	0	0	3.857557		1.540560	23.03658			

***	1	3	0	3.771662	3.772554	1.540560	23.56865	23.5630	0.00565	1.00000
10	-1	3	1	3.613307		1.540560	24.61740			
11	-2	2	1	3.543187		1.540560	25.11244			
***	-1	1	2	3.467533	3.470935	1.540560	25.66959	25.6440	0.02559	1.00000
***	2	2	0	3.315385	3.319043	1.540560	26.86917	26.8390	0.03017	1.00000
***	-2	0	2	3.289985	3.290526	1.540560	27.08054	27.0760	0.00454	1.00000
***	0	4	0	3.242642	3.240285	1.540560	27.48362	27.5040	-0.02038	1.00000
16	0	0	2	3.233182		1.540560	27.56562			
***	1	3	1	2.990327	2.992216	1.540560	29.85428	29.8350	0.01928	1.00000
18	-2	2	2	2.934034		1.540560	30.44080			
***	0	4	1	2.898609	2.900814	1.540560	30.82201	30.7980	0.02401	1.00000
***	0	2	2	2.893532	2.894120	1.540560	30.87743	30.8710	0.00643	1.00000
21	2	0	1	2.813228		1.540560	31.78179			
22	-3	1	1	2.792851		1.540560	32.01989			
***	-1	3	2	2.765843	2.766350	1.540560	32.34109	32.3350	0.00609	1.00000
***	-3	1	2	2.607363	2.605601	1.540560	34.36603	34.3900	-0.02397	1.00000
25	2	2	1	2.580667		1.540560	34.73001			
***	-2	4	1	2.573567	2.572398	1.540560	34.83166	34.8480	-0.01634	1.00000
27	1	1	2	2.551185		1.540560	35.14716			
***	3	1	0	2.522599	2.521203	1.540560	35.55866	35.5790	-0.02034	1.00000
***	2	4	0	2.482180	2.484007	1.540560	36.15752	36.1300	0.02752	1.00000
30	-1	5	0	2.458841		1.540560	36.51276			
31	-1	5	1	2.413334		1.540560	37.22628			
***	-3	3	1	2.385302	2.385311	1.540560	37.68014	37.6800	0.00014	1.00000
33	-2	0	3	2.378748		1.540560	37.78788			
34	-1	1	3	2.324154		1.540560	38.71044			
35	-2	4	2	2.309450		1.540560	38.96682			
36	0	4	2	2.289542		1.540560	39.31954			
37	-3	3	2	2.266607		1.540560	39.73406			
38	-2	2	3	2.233260		1.540560	40.35295			
39	1	3	2	2.229409		1.540560	40.42570			
40	-3	3	0	2.210257		1.540560	40.79150			
41	1	5	1	2.198276		1.540560	41.02380			
42	-3	1	3	2.162621		1.540560	41.73143			
***	0	6	0	2.161761	2.160565	1.540560	41.74880	41.7730	-0.02420	1.00000
44	0	0	3	2.155454		1.540560	41.87665			
45	2	4	1	2.124973		1.540560	42.50631			
46	-4	0	1	2.121219		1.540560	42.58520			
47	-4	0	2	2.115180		1.540560	42.71273			
48	-1	5	2	2.104328		1.540560	42.94389			
49	-1	3	3	2.073103		1.540560	43.62359			
50	2	0	2	2.070173		1.540560	43.68851			
51	3	1	1	2.067606		1.540560	43.74554			
52	0	6	1	2.050226		1.540560	44.13578			
53	0	2	3	2.045440		1.540560	44.24451			
54	-4	2	1	2.016114		1.540560	44.92290			
55	-4	2	2	2.010927		1.540560	45.04513			
56	2	2	2	1.972134		1.540560	45.98144			
***	-3	3	3	1.956023	1.957626	1.540560	46.38219	46.3420	0.04019	1.00000
58	4	0	0	1.928779		1.540560	47.07654			
59	-2	6	1	1.924985		1.540560	47.17493			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
Department of CHEMISTRY
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Fargo 58105 - 5516

WELSFORD SYENITE 74-14: ALBITE (LA)OR)IM) —) 1987/ 3/ 2 . * . * . 0:25

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1380000	12.7890000	7.1560000	94.33300	116.56700	87.65000	564.2093 A**3
Reciprocal CELL:	0.1373912	0.0784189	0.1565611	86.32927	63.52584	90.46340	0.001505550 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.6 Dmin = 1.428471 TRICL Syst:
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD SYENITE 74-14: ALBITE (LA)OR)IM)
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1401414	12.7924860	7.1561486	94.26752	116.58713	87.63474	564.2637 A**3
Reciprocal CELL:	0.1373856	0.0784149	0.1565927	86.30978	63.49574	90.28738	0.001505331 A**-3

*— Direct Cell Corrections:
0.0000000 0.0000000 0.0000000 0.00000 0.00000 0.00000 0.000000

$— Direct Cell Standard ERRorS
0.0011990 0.0040072 0.0006513 0.01216 0.00874 0.00959 0.334993

£— Reciprocal Cell Standard ERRorS
0.000014640 0.000007711 0.000020112 0.0117215 0.0087386 0.0089471

WELSFORD SYENITE 74-14: ALBITE (LA)OR)IM) HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.752672		1.540560	6.92571			
2	1	0	0	7.278785		1.540560	12.14944			
3	-1	0	1	6.429632		1.540560	13.76130			
***	0	0	1	6.385995	6.385901	1.540560	13.85573	13.8560	-0.00021	1.00000
5	0	2	0	6.376335		1.540560	13.87689			
***	1	1	0	6.335254	6.334045	1.540560	13.96732	13.9700	-0.00268	1.00000
7	-1	1	0	6.307954		1.540560	14.02807			
***	-1	-1	1	5.907990	5.907610	1.540560	14.38303	14.3840	-0.00097	1.00000
9	0	-1	1	5.863161		1.540560	15.09825			
***	-1	1	1	5.587797	5.580083	1.540560	15.84695	15.8690	-0.02205	1.00000

11	0	1	1	5.568389		1.540560	15.90254			
12	1	2	0	4.808233		1.540560	18.43704			
13	-1	2	0	4.784386		1.540560	18.52974			
14	-1	-2	1	4.692834		1.540560	18.89451			
15	0	-2	1	4.664778		1.540560	19.00920			
16	-1	2	1	4.378449		1.540560	20.26502			
17	0	2	1	4.373607		1.540560	20.28763			
18	0	3	0	4.250891		1.540560	20.87984			
***	-2	0	1	4.029872	4.029139	1.540560	22.04448	22.0430	0.00148	1.00000
20	1	0	1	3.996722		1.540560	22.22405			
21	-2	-1	1	3.853689		1.540560	22.81993			
***	1	-1	1	3.855322	3.857654	1.540560	23.05012	23.0360	0.01412	1.00000
23	-2	1	1	3.791767		1.540560	23.44191			
***	1	1	1	3.773610	3.772554	1.540560	23.55631	23.5630	-0.00669	1.00000
***	1	3	0	3.678791	3.677968	1.540560	24.17252	24.1780	-0.00548	1.00000
***	-1	3	0	3.662755	3.663788	1.540560	24.27995	24.2730	0.00695	1.00000
27	-1	3	0	3.662755		1.540560	24.27995			
28	0	-3	1	3.648581		1.540560	24.37572			
29	2	0	0	3.639392		1.540560	24.43821			
30	-1	0	2	3.568089		1.540560	24.93435			
31	-1	-1	2	3.504431		1.540560	25.39477			
***	-1	-1	2	3.504431	3.502908	1.540560	25.39477	25.4060	-0.01123	1.00000
33	-2	1	0	3.495046		1.540560	25.46411			
***	-2	-2	1	3.479246	3.476934	1.540560	25.58170	25.5990	-0.01730	1.00000
35	1	-2	1	3.445144		1.540560	25.83929			
36	-1	3	1	3.438155		1.540560	25.89272			
37	0	3	1	3.438002		1.540560	25.89389			
***	-1	1	2	3.371668	3.368843	1.540560	26.41245	26.4350	-0.02255	1.00000
39	-2	2	1	3.337106		1.540560	26.69103			
40	1	2	1	3.330682		1.540560	26.74347			
41	-1	-2	2	3.217386		1.540560	27.70364			
***	-2	0	2	3.214816	3.215298	1.540560	27.72624	27.7220	0.00424	1.00000
***	0	3	2	3.192998	3.192160	1.540560	27.91552	27.9270	-0.00748	1.00000
***	0	4	0	3.188168	3.190368	1.540560	27.96268	27.9430	0.01968	1.00000
45	-2	-1	2	3.169741		1.540560	28.12857			
***	2	2	0	3.167627	3.167046	1.540560	28.14773	28.1530	-0.00527	1.00000
***	-2	2	0	3.153977	3.152238	1.540560	28.27208	28.2880	-0.01592	1.00000
48	0	-1	2	3.145453		1.540560	28.35029			
49	-2	1	2	3.067361		1.540560	29.08776			
50	0	1	2	3.051458		1.540560	29.24272			
51	-1	2	2	3.019492		1.540560	29.55932			
52	-2	-3	1	2.993996		1.540560	29.81685			
***	1	-3	1	2.967935	2.966569	1.540560	30.08482	30.0990	-0.01418	1.00000
***	-2	-2	2	2.953995	2.953248	1.540560	30.23017	30.2360	-0.00783	1.00000
55	-1	-4	1	2.938419		1.540560	30.39428			
56	0	-2	2	2.931581		1.540560	30.46689			
***	0	-4	1	2.928775	2.927911	1.540560	30.49673	30.5060	-0.00921	1.00000
58	1	4	0	2.925716		1.540560	30.52945			
59	-1	4	0	2.914950		1.540560	30.64497			
60	-2	3	1	2.859035		1.540560	31.25947			
61	1	3	1	2.858771		1.540560	31.26242			

*** -1 -3 2 2.837816 2.839507 1.540560 31.4Least Squares Unit Cell Refir
N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
Department of CHEMISTRY
NORTH DAKOTA STATE UNIVERSITY
Fargo 58105 - 5516

WELSFORD SYENITIC VEINLET 74-16: ORTHOCLASE —) 1987/ 2/ 7 . * . * . 1:58

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.6000000	12.9690000	7.1980000	90.00000	115.85000	90.00000	722.4864 A**3
Reciprocal CELL:	0.1292078	0.0771069	0.1543744	90.00000	64.15000	90.00000	0.001384109 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 MONOC System
3 Conditions for non-Extinctions Called for Class Condition(s)
hkl h+k = 2n
h0l h = 2n
0k0 k = 2n

F I N A L V A L U E S for WELSFORD SYENITIC VEINLET 74-16: ORTHOCLASE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5982354	13.0098370	7.1956252	90.00000	115.95555	90.00000	722.7718 A**3
Reciprocal CELL:	0.1293774	0.0769500	0.1545964	90.00000	64.04445	90.00000	0.001383563 A**-3

*— Direct Cell Corrections:
0.0000000 0.0000000 0.0000000 0.00000 0.00000 0.00000 0.000000

$— Direct Cell Standard ERRorS
0.0040222 0.0126505 0.0020282 0.00000 0.03121 0.00000 1.222244

£— Reciprocal Cell Standard ERRorS
0.000039650 0.000027264 0.000056761 0.0000000 0.0311756 0.0000000

WELSFORD SYENITIC VEINLET 74-16: ORTHOCLASE HKL Listing - *** Refers to FIXed, R to Rejects MONOC

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	-1	1	0	6.643114		1.540560	13.31703			
***	0	2	0	6.497722	6.487010	1.540560	13.61641	13.6390	-0.02259	1.00000
3	0	0	1	6.468457		1.540560	13.67831			
***	-1	1	1	5.868548	5.863545	1.540560	15.08431	15.0970	-0.01269	1.00000
5	0	2	1	4.584202		1.540560	19.34651			
***	-2	0	1	4.233086	4.223457	1.540560	20.96865	21.0170	-0.04835	1.00000
***	1	1	1	3.950268	3.941236	1.540560	22.48879	22.5410	-0.05221	1.00000
8	2	0	0	3.864662		1.540560	22.99366			

***	1	3	0	3.778827	3.783636	1.540560	23.52333	23.4330	0.03033	1.00000
***	-1	3	1	3.617717	3.620895	1.540560	24.58691	24.5650	0.02191	1.00000
***	-2	2	1	3.546816	3.548393	1.540560	25.08633	25.0750	0.01133	1.00000
***	-1	1	2	3.466616	3.469073	1.540560	25.67649	25.6580	0.01849	1.00000
***	2	2	0	3.321557	3.322324	1.540560	26.81830	26.8120	0.00630	1.00000
***	-2	0	2	3.288704	3.286595	1.540560	27.09129	27.1090	-0.01771	1.00000
***	0	4	0	3.248861	3.245030	1.540560	27.42998	27.4630	-0.03302	1.00000
***	0	0	2	3.234229	3.233713	1.540560	27.55652	27.5610	-0.00448	1.00000
***	1	3	1	2.995381	2.999192	1.540560	29.80275	29.7640	0.03875	1.00000
18	-2	2	2	2.934274		1.540560	30.43825			
***	0	4	1	2.903238	2.902101	1.540560	30.77165	30.7840	-0.01235	1.00000
20	0	2	2	2.895385		1.540560	30.85718			
21	2	0	1	2.818282		1.540560	31.72331			
22	-3	1	1	2.796213		1.540560	31.98036			
***	-1	3	2	2.767303	2.767599	1.540560	32.32355	32.3200	0.00355	1.00000
***	-3	1	2	2.607975	2.604793	1.540560	34.35772	34.4010	-0.04328	1.00000
25	2	2	1	2.585552		1.540560	34.66507			
26	-2	4	1	2.577289		1.540560	34.77975			
***	1	1	2	2.553985	2.552251	1.540560	35.10737	35.1320	-0.02463	1.00000
***	3	1	0	2.527252	2.528631	1.540560	35.49101	35.4710	0.02001	1.00000
29	-2	4	0	2.486862		1.540560	36.08709			
30	-1	5	0	2.463538		1.540560	36.44069			
***	-1	5	1	2.417212	2.416295	1.540560	37.16438	37.1790	-0.01462	1.00000
***	-3	3	1	2.388634	2.390569	1.540560	37.62560	37.5940	0.03160	1.00000
33	-2	0	3	2.377505		1.540560	37.80839			
***	-1	1	3	2.323766	2.325450	1.540560	38.71715	38.6880	0.02915	1.00000
35	-2	4	2	2.311250		1.540560	38.93526			
36	0	4	2	2.292101		1.540560	39.27384			
37	-3	3	2	2.268069		1.540560	39.70737			
38	-2	2	3	2.232737		1.540560	40.36281			
39	1	3	2	2.232288		1.540560	40.37129			
40	-3	3	0	2.214371		1.540560	40.71234			
41	1	5	1	2.202221		1.540560	40.94700			
42	0	6	0	2.165907		1.540560	41.66516			
43	-3	1	3	2.161918		1.540560	41.74564			
44	0	0	3	2.156152		1.540560	41.86258			
45	2	4	1	2.128901		1.540560	42.42409			
46	-4	0	1	2.124194		1.540560	42.52265			
47	-4	0	2	2.116543		1.540560	42.68387			
48	-1	5	2	2.106669		1.540560	42.89380			
49	-1	3	3	2.073638		1.540560	43.61175			
50	2	0	2	2.073238		1.540560	43.62060			
51	3	1	1	2.071503		1.540560	43.65902			
***	0	6	1	2.053829	2.053000	1.540560	44.05429	44.0730	-0.01871	1.00000
53	0	2	3	2.046426		1.540560	44.22206			
54	-4	2	1	2.019042		1.540560	44.85420			
55	-4	2	2	2.012469		1.540560	45.00873			
56	2	2	2	1.975134		1.540560	45.90760			
57	-3	3	3	1.956183		1.540560	46.37818			
***	4	0	0	1.932331	1.931625	1.540560	46.98479	47.0030	-0.01821	1.00000
59	-2	6	1	1.928169		1.540560	47.09233			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
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WELSFORD SYENITIC VEINLET 74-16: ALBITE —) 1987/ 2/ 7 . * . * . 1:36

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1380000	12.7890000	7.1560000	94.33300	116.56700	87.65000	664.2093 A**3
Reciprocal CELL:	0.1373912	0.0784189	0.1565611	86.32927	63.52584	90.46340	0.001505550 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD SYENITIC VEINLET 74-16: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1422343	12.7998336	7.1505244	94.25653	116.59270	88.11465	664.0094 A**3
Reciprocal CELL:	0.1373817	0.0783879	0.1567517	86.18196	63.47235	89.97830	0.001506003 A**-3

*— Direct Cell Corrections:

0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000

$— Direct Cell Standard ERRorS

0.0019532	0.0096939	0.0018201	0.02078	0.02226	0.02238	0.771242

£— Reciprocal Cell Standard ERRorS

0.000042763	0.000023097	0.000034831	0.0194733	0.0228925	0.0218515

WELSFORD SYENITIC VEINLET 74-16: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.757074		1.540560	6.92332			
2	1	0	0	7.278989		1.540560	12.14910			
3	-1	0	1	6.428282		1.540560	13.76420			
4	0	0	1	6.379515		1.540560	13.86994			
***	0	2	0	6.378537	6.373085	1.540560	13.87208	13.8840	-0.01192	1.00000
6	-1	1	0	6.323260		1.540560	13.99395			
7	1	1	0	6.321199		1.540560	13.99853			
8	-1	-1	1	5.901184		1.540560	15.00041			
***	0	-1	1	5.864210	5.863645	1.540560	15.09554	15.0970	-0.00146	1.00000
10	-1	1	1	5.592541		1.540560	15.83343			

11	0	1	1	5.559638		1.540560	15.92774			
12	-1	2	0	4.798160		1.540560	18.47608			
13	1	2	0	4.796360		1.540560	18.48308			
14	-1	-2	1	4.686974		1.540560	18.91835			
15	0	-2	1	4.668800		1.540560	18.99268			
16	-1	2	1	4.383800		1.540560	20.24003			
17	0	2	1	4.367559		1.540560	20.31609			
18	0	3	0	4.252358		1.540560	20.87255			
***	-2	0	1	4.029907	4.029861	1.540560	22.03875	22.0390	-0.00025	1.00000
20	1	0	1	3.993935		1.540560	22.23976			
21	-2	-1	1	3.889547		1.540560	22.84456			
***	1	-1	1	3.857876	3.851057	1.540560	23.03465	23.0760	-0.04135	1.00000
23	-2	1	1	3.797568		1.540560	23.40559			
***	1	1	1	3.766767	3.767825	1.540560	23.59972	23.5930	0.00672	1.00000
25	-1	3	0	3.672323		1.540560	24.21573			
***	-1	3	0	3.672323	3.671237	1.540560	24.21573	24.2230	-0.00727	1.00000
27	-1	-3	1	3.660865		1.540560	24.29258			
28	0	-3	1	3.652384		1.540560	24.34995			
29	2	0	0	3.639494		1.540560	24.43752			
30	-1	0	2	3.565343		1.540560	24.95387			
31	-1	-1	2	3.501830		1.540560	25.41396			
32	-2	1	0	3.500201		1.540560	25.42598			
33	2	1	0	3.499501		1.540560	25.43115			
34	-2	-2	1	3.472856		1.540560	25.62957			
35	1	-2	1	3.450760		1.540560	25.79651			
36	-1	3	1	3.442403		1.540560	25.86021			
37	0	3	1	3.434358		1.540560	25.92185			
38	-1	1	2	3.369512		1.540560	26.42966			
39	-2	2	1	3.344591		1.540560	26.63020			
40	1	2	1	3.323043		1.540560	26.80609			
41	-1	-2	2	3.215514		1.540560	27.72009			
***	-2	0	2	3.214141	3.212344	1.540560	27.73217	27.7480	-0.01583	1.00000
***	0	0	2	3.189757	3.191040	1.540560	27.94846	27.9370	0.01146	1.00000
44	0	4	0	3.189269		1.540560	27.95283			
45	-2	-1	2	3.167247		1.540560	28.15118			
46	-2	2	0	3.161630		1.540560	28.20222			
***	2	2	0	3.160600	3.159240	1.540560	28.21161	28.2240	-0.01239	1.00000
48	0	-1	2	3.144161		1.540560	28.36219			
49	-2	1	2	3.068575		1.540560	29.07600			
50	0	1	2	3.047104		1.540560	29.28544			
51	-1	2	2	3.018176		1.540560	29.57250			
52	-2	-3	1	2.987849		1.540560	29.87962			
53	1	-3	1	2.974065		1.540560	30.02136			
54	-2	-2	2	2.950592		1.540560	30.26588			
55	-1	-4	1	2.936098		1.540560	30.41888			
***	0	-4	1	2.931820	2.932228	1.540560	30.46434	30.4600	0.00434	1.00000
57	0	-4	1	2.931820		1.540560	30.46434			
58	-1	4	0	2.921584		1.540560	30.57368			
59	1	4	0	2.920771		1.540560	30.58240			
60	-2	3	1	2.866062		1.540560	31.18087			
61	1	3	1	2.852183		1.540560	31.33648			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
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Fargo 58105 - 5516

WELSFORD COUNTRY ROCK 74-16 MELANOSOME: PLAGIOCLASE --) 1987/ 3/ 2 . *. *. 2:39

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1540000	12.8470000	7.1300000	93.84600	116.46900	89.17300	567.0002 A**3
Reciprocal CELL:	0.1370207	0.0780266	0.1570367	86.11523	63.52574	89.00801	0.001499250 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD COUNTRY ROCK 74-16 MELANOSOME: PLAGIOCLASE (+ cordierite + qtz + bio)
* *
An_{20}, slightly disordered

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1534307	12.8478089	7.1309430	93.84287	116.47193	89.17409	567.0470 A**3
Reciprocal CELL:	0.1370340	0.0780238	0.1570203	86.11799	63.52286	89.00805	0.001499145 A**-3
*-- Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$-- Direct Cell Standard ERRorS	0.0010641	0.0049309	0.0010116	0.01646	0.01238	0.01452	0.415585
£-- Reciprocal Cell Standard ERRorS	0.000023027	0.000009737	0.000017497	0.0149622	0.0123529	0.0127621	

WELSFORD COUNTRY ROCK 74-16 MELANOSOME: PLAGIOCLASE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.816599		1.540560	6.89113			
2	1	0	0	7.297457		1.540560	12.11824			
3	-1	0	1	6.422036		1.540560	13.77766			
4	0	2	0	6.408300		1.540560	13.80733			
***	-1	1	0	6.389307	6.393707	1.540560	13.84858	13.8390	0.00958	1.00000
6	0	0	1	6.368603		1.540560	13.89382			
7	1	1	0	6.294883		1.540560	14.05735			
8	-1	-1	1	5.867566		1.540560	15.08685			
9	0	-1	1	5.863694		1.540560	15.09687			
***	-1	1	1	5.623378	5.617014	1.540560	15.74605	15.7640	-0.01795	1.00000
11	0	1	1	5.555387		1.540560	15.94000			

12	-1	2	0	4.857071		1.540560	18.25006			
13	1	2	0	4.774394		1.540560	18.56886			
14	0	-2	1	4.678392		1.540560	18.95338			
15	-1	-2	1	4.661495		1.540560	19.02272			
16	-1	2	1	4.420496		1.540560	20.07026			
17	0	2	1	4.371693		1.540560	20.29667			
18	0	3	0	4.272200		1.540560	20.77453			
***	-2	0	1	4.035840	4.040000	1.540560	22.00594	21.9830	0.02294	1.00000
20	1	0	1	3.996146		1.540560	22.22730			
21	-2	-1	1	3.875965		1.540560	22.92569			
***	1	-1	1	3.872618	3.873746	1.540560	22.94577	22.9390	0.00677	1.00000
23	-2	1	1	3.823565		1.540560	23.24423			
***	1	1	1	3.759893	3.762009	1.540560	23.64349	23.6300	0.01349	1.00000
***	-1	3	0	3.715004	3.716898	1.540560	23.93338	23.9210	0.01238	1.00000
***	1	3	0	3.659339	3.663193	1.540560	24.30296	24.2770	0.02596	1.00000
27	1	3	0	3.659339		1.540560	24.30296			
28	2	0	0	3.648729		1.540560	24.37472			
***	-1	-3	1	3.647347	3.646035	1.540560	24.38409	24.3930	-0.00891	1.00000
30	-1	0	2	3.557254		1.540560	25.01152			
31	-2	1	0	3.525399		1.540560	25.24124			
32	2	1	0	3.493400		1.540560	25.47631			
***	-1	-1	2	3.488618	3.489670	1.540560	25.51182	25.5040	0.00782	1.00000
34	-1	3	1	3.473096		1.540560	25.62777			
35	1	-2	1	3.472864		1.540560	25.62951			
36	-2	-2	1	3.452203		1.540560	25.78554			
37	0	3	1	3.441705		1.540560	25.86555			
38	-2	2	1	3.379020		1.540560	26.35395			
***	-1	1	2	3.369826	3.370847	1.540560	26.42715	26.4190	0.00815	1.00000
40	1	2	1	3.314429		1.540560	26.87706			
***	-2	0	2	3.211018	3.212571	1.540560	27.75969	27.7460	0.01369	1.00000
42	0	4	0	3.204150		1.540560	27.82039			
43	-1	-2	2	3.202862		1.540560	27.83180			
44	-2	2	0	3.154653		1.540560	27.90476			
***	0	0	2	3.184302	3.185118	1.540560	27.99732	27.9900	0.00732	1.00000
46	-2	-1	2	3.154440		1.540560	28.26784			
47	2	2	0	3.147442		1.540560	28.33200			
48	0	-1	2	3.140504		1.540560	28.39591			
49	-2	1	2	3.076526		1.540560	28.99921			
50	0	1	2	3.042523		1.540560	29.33052			
51	-1	2	2	3.025141		1.540560	29.50287			
***	1	-3	1	2.997146	2.996338	1.540560	29.78479	29.7930	-0.00821	1.00000
53	-2	-3	1	2.969191		1.540560	30.07180			
54	-1	4	0	2.952680		1.540560	30.24396			
***	0	-4	1	2.943426	2.942605	1.540560	30.34132	30.3500	-0.00868	1.00000
56	-2	-2	2	2.933783		1.540560	30.44345			
***	0	-2	2	2.931847	2.932040	1.540560	30.46406	30.4620	0.00206	1.00000
58	-1	-4	1	2.923850		1.540560	30.48533			
59	1	4	0	2.915264		1.540560	30.64137			
60	-2	3	1	2.899589		1.540560	30.81133			
***	1	3	1	2.845584	2.845763	1.540560	31.41103	31.4090	0.00203	1.00000
62	-1	-3	2	2.828735		1.540560	31.60301			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
Department of CHEMISTRY
NORTH DAKOTA STATE UNIVERSITY
Fargo 58105 - 5516

WELSFORD GREEN SYENITE 74-17: ORTHOCLASE —) 1987/ 2/14 . * . * . 0:11

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.6000000	12.9690000	7.1980000	90.00000	115.85000	90.00000	722.4864 A**3
Reciprocal CELL:	0.1292078	0.0771069	0.1543744	90.00000	64.15000	90.00000	0.001384109 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433514 MONOC System
3 Conditions for non-Extinctions Called for Class Condition(s)
hkl h+k = 2n
h0l h = 2n
0k0 k = 2n

F I N A L V A L U E S for WELSFORD GREEN SYENITE 74-17: ORTHOCLASE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5857938	13.0010126	7.1995589	90.00000	116.00197	90.00000	720.9241 A**3
Reciprocal CELL:	0.1296284	0.0770400	0.1545876	90.00000	63.99803	90.00000	0.001387109 A**-3

*— Direct Cell Corrections:
0.0000000 0.0000000 0.0000000 0.00000 0.00000 0.00000 0.000000

$— Direct Cell Standard ERRorS
0.0015330 0.0049662 0.0009257 0.00000 0.01206 0.00000 0.456762

£— Reciprocal Cell Standard ERRorS
0.000019172 0.000010982 0.000022390 0.0000000 0.0120385 0.0000000

WELSFORD GREEN SYENITE 74-17: ORTHOCLASE HKL Listing - *** Refers to FIXed, R to Rejects MONOC

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	-1	1	0	6.631586		1.540560	13.34029			
2	0	2	0	6.490135		1.540560	13.63240			
3	0	0	1	6.468824		1.540560	13.67753			
***	-1	1	1	5.867843	5.870391	1.540560	15.08614	15.0780	0.00814	1.00000
5	0	2	1	4.581665		1.540560	19.35732			
***	-2	0	1	4.228581	4.229427	1.540560	20.99124	20.9870	0.00424	1.00000
***	1	1	1	3.945797	3.945382	1.540560	22.51460	22.5170	-0.00240	1.00000

8	2	0	0	3.857180		1.540560	23.03887			
***	1	3	0	3.773720	3.773343	1.540560	23.55562	23.5580	-0.00238	1.00000
***	-1	3	1	3.614931	3.614665	1.540560	24.60616	24.6080	-0.00184	1.00000
***	-2	2	1	3.542932	3.545332	1.540560	25.11428	25.0970	0.01728	1.00000
***	-1	1	2	3.468081	3.469206	1.540560	25.66546	25.6570	0.00846	1.00000
***	2	2	0	3.315793	3.316617	1.540560	26.86580	26.8590	0.00580	1.00000
***	-2	0	2	3.289193	3.288619	1.540560	27.08719	27.0920	-0.00481	1.00000
***	0	4	0	3.245068	3.243871	1.540560	27.46267	27.4730	-0.01033	1.00000
***	0	0	2	3.234412	3.236131	1.540560	27.55493	27.5400	0.01493	1.00000
***	1	3	1	2.991945	2.992412	1.540560	29.83777	29.8330	0.00477	1.00000
18	-2	2	2	2.933921		1.540560	30.44200			
***	0	4	1	2.900563	2.899803	1.540560	30.80073	30.8090	-0.00827	1.00000
20	0	2	2	2.894845		1.540560	30.86308			
21	2	0	1	2.813864		1.540560	31.77442			
22	-3	1	1	2.791974		1.540560	32.03022			
***	-1	3	2	2.766874	2.767683	1.540560	32.32871	32.3190	0.00971	1.00000
***	-3	1	2	2.606441	2.606410	1.540560	34.37857	34.3790	-0.00043	1.00000
25	2	2	1	2.581663		1.540560	34.71895			
***	-2	4	1	2.574378	2.573543	1.540560	34.82033	34.8320	-0.01167	1.00000
27	1	1	2	2.552268		1.540560	35.13175			
28	-3	1	0	2.522433		1.540560	35.56108			
29	-2	4	0	2.483166		1.540560	36.14265			
30	-1	5	0	2.460469		1.540560	36.48775			
***	-1	5	1	2.414618	2.416859	1.540560	37.20257	37.1700	0.03257	1.00000
32	-3	3	1	2.385238		1.540560	37.68120			
33	-2	0	3	2.378711		1.540560	37.78850			
***	-1	1	3	2.324727	2.323429	1.540560	38.70052	38.7230	-0.02248	1.00000
35	-2	4	2	2.310052		1.540560	38.95626			
36	0	4	2	2.290833		1.540560	39.29647			
37	-3	3	2	2.266414		1.540560	39.73757			
38	-2	2	3	2.233427		1.540560	40.34980			
39	1	3	2	2.230526		1.540560	40.40457			
40	-3	3	0	2.210529		1.540560	40.78626			
***	1	5	1	2.199674	2.199137	1.540560	40.99654	41.0070	-0.01046	1.00000
***	0	6	0	2.163378	2.163484	1.540560	41.71614	41.7140	0.00214	1.00000
43	-3	1	3	2.162160		1.540560	41.74074			
44	0	0	3	2.156275		1.540560	41.86002			
45	2	4	1	2.125929		1.540560	42.48626			
46	-4	0	1	2.120558		1.540560	42.59911			
***	-4	0	2	2.114291	2.113328	1.540560	42.73158	42.7520	-0.02042	1.00000
48	-1	5	2	2.105445		1.540560	42.91998			
49	-1	3	3	2.073827		1.540560	43.60759			
50	2	0	2	2.070900		1.540560	43.67239			
51	3	1	1	2.067940		1.540560	43.73811			
***	0	6	1	2.051684	2.051143	1.540560	44.10276	44.1150	-0.01224	1.00000
53	0	2	3	2.046293		1.540560	44.22509			
54	-4	2	1	2.015692		1.540560	44.93281			
55	-4	2	2	2.010307		1.540560	45.05978			
***	2	2	2	1.972899	1.971989	1.540560	45.96259	45.9850	-0.02241	1.00000
57	-3	3	3	1.955948		1.540560	46.38409			
***	4	0	0	1.926590	1.928800	1.540560	47.08143	47.0760	0.00543	1.00000
59	-2	6	1	1.925959		1.540560	47.14964			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
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WELSFORD GREEN SYENITE 74-17: ALBITE --) 1987/ 2/11 . * . * . 3:13

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1380000	12.7890000	7.1560000	94.33300	116.56700	87.65000	664.2093 A**3
Reciprocal CELL:	0.1373912	0.0784189	0.1565611	86.32927	63.52584	90.46340	0.001505550 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD GREEN SYENITE 74-17: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1431267	12.8064525	7.1494169	94.16139	116.60462	88.18201	664.2882 A**3
Reciprocal CELL:	0.1373702	0.0783494	0.1567601	86.25430	63.45879	89.94952	0.001505371 A**-3
+-- Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$-- Direct Cell Standard ERRorS	0.0022896	0.0121132	0.0023013	0.02963	0.02722	0.02372	1.089570
£-- Reciprocal Cell Standard ERRorS	0.000050745	0.000015448	0.000037938	0.0317916	0.0271191	0.0267256	

WELSFORD GREEN SYENITE 74-17: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.763339		1.540560	6.91992			
2	1	0	0	7.279597		1.540560	12.14808			
3	-1	0	1	6.429284		1.540560	13.76205			
4	0	2	0	6.381670		1.540560	13.86523			
***	0	2	0	6.381670	6.377199	1.540560	13.86523	13.8750	-0.00977	1.00000
6	-1	1	0	6.325789		1.540560	13.98832			
7	1	1	0	6.320995		1.540560	13.99899			
8	-1	-1	1	5.898223		1.540560	15.00798			
9	0	-1	1	5.860739		1.540560	15.10453			
***	-1	1	1	5.597442	5.586379	1.540560	15.81947	15.8510	-0.03153	1.00000
11	0	1	1	5.562109		1.540560	15.92061			

12	-1	2	0	4.800863		1.540560	18.46559			
13	1	2	0	4.796672		1.540560	18.48186			
14	-1	-2	1	4.684241		1.540560	18.92950			
15	0	-2	1	4.666362		1.540560	19.00269			
16	-1	2	1	4.388714		1.540560	20.21712			
17	0	2	1	4.370829		1.540560	20.30072			
18	0	3	0	4.254446		1.540560	20.86219			
***	-2	0	1	4.030898	4.032933	1.540560	22.03326	22.0220	0.01126	1.00000
20	1	0	1	3.993329		1.540560	22.24318			
21	-2	-1	1	3.889049		1.540560	22.84752			
***	1	-1	1	3.856907	3.858645	1.540560	23.04052	23.0300	0.01052	1.00000
23	-2	1	1	3.800022		1.540560	23.39026			
24	1	1	1	3.766975		1.540560	23.59840			
***	-1	3	0	3.674550	3.675572	1.540560	24.20083	24.1940	0.00683	1.00000
26	1	3	0	3.671731		1.540560	24.21970			
***	-1	-3	1	3.659262	3.665275	1.540560	24.30348	24.2630	0.04048	1.00000
28	0	-3	1	3.651181		1.540560	24.35810			
29	2	0	0	3.639799		1.540560	24.43544			
30	-1	0	2	3.565210		1.540560	24.95481			
31	-2	1	0	3.501864		1.540560	25.41960			
32	-1	-1	2	3.500246		1.540560	25.42565			
***	-1	-1	2	3.500246	3.497763	1.540560	25.42565	25.4440	-0.01835	1.00000
34	-2	-2	1	3.471767		1.540560	25.63775			
35	1	-2	1	3.450011		1.540560	25.80220			
36	-1	3	1	3.446265		1.540560	25.83073			
37	0	3	1	3.437200		1.540560	25.90004			
***	-1	1	2	3.370931	3.371850	1.540560	26.41833	26.4110	0.00733	1.00000
39	-2	2	1	3.347604		1.540560	26.60579			
40	1	2	1	3.323900		1.540560	26.79905			
***	-2	0	2	3.214642	3.214615	1.540560	27.72777	27.7280	-0.00023	1.00000
42	-1	-2	2	3.213360		1.540560	27.73905			
***	0	0	2	3.189181	3.190032	1.540560	27.95362	27.9460	0.00762	1.00000
44	0	0	2	3.189181		1.540560	27.95362			
45	-2	-1	2	3.166475		1.540560	28.15818			
***	-2	2	0	3.162895	3.163633	1.540560	28.19071	28.1840	0.00671	1.00000
***	2	2	0	3.160497	3.158582	1.540560	28.21254	28.2300	-0.01746	1.00000
48	0	-1	2	3.142721		1.540560	28.37546			
49	-2	1	2	3.070324		1.540560	29.05907			
50	0	1	2	3.047580		1.540560	29.28076			
51	-1	2	2	3.020464		1.540560	29.54959			
52	-2	-3	1	2.986849		1.540560	29.88986			
53	1	-3	1	2.973708		1.540560	30.02504			
54	-2	-2	2	2.949112		1.540560	30.28143			
55	-1	-4	1	2.935269		1.540560	30.42768			
***	0	-4	1	2.931332	2.931007	1.540560	30.46954	30.4730	-0.00346	1.00000
57	0	-2	2	2.930370		1.540560	30.47979			
58	-1	4	0	2.923367		1.540560	30.55458			
59	1	4	0	2.921474		1.540560	30.57486			
60	-2	3	1	2.868940		1.540560	31.14879			
61	1	3	1	2.853317		1.540560	31.32372			
62	-1	-3	2	2.835834		1.540560	31.52183			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
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WELSFORD SYENITE 74-19: ORTHOCLASE --) 1987/ 3/ 8 . * . * . 0:14

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5000000	12.9690000	7.1980000	90.00000	115.85000	90.00000	722.4864 A**3
Reciprocal CELL:	0.1292078	0.0771069	0.1543744	90.00000	64.15000	90.00000	0.001384109 A**-3

I-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 MONOC System
3 Conditions for non-Extinctions Called for Class Condition(s)
hkl h+k = 2n
h0l h = 2n
0k0 k = 2n

F I N A L V A L U E S for WELSFORD SYENITE 74-19: ORTHOCLASE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5849794	13.0105038	7.2018354	90.00000	116.00129	90.00000	721.6205 A**3
Reciprocal CELL:	0.1296397	0.0769832	0.1545376	90.00000	63.99871	90.00000	0.001385770 A**-3
+-- Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$-- Direct Cell Standard ERRorS	0.0026329	0.0096902	0.0017356	0.00000	0.01936	0.00000	0.887917
&-- Reciprocal Cell Standard ERRorS	0.000038973	0.000016382	0.000038739	0.0000000	0.0193292	0.0000000	

WELSFORD SYENITE 74-19: ORTHOCLASE HKL Listing - *** Refers to FIXed, R to Rejects MONOC

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	-1	1	0	6.632431		1.540560	13.33858			
***	0	2	0	6.494920	6.503145	1.540560	13.62231	13.6050	0.01731	1.00000
3	0	0	1	6.470917		1.540560	13.67308			
***	-1	1	1	5.863517	5.878744	1.540560	15.08181	15.0580	0.02381	1.00000
5	0	2	1	4.584092		1.540560	19.34698			
***	-2	0	1	4.228366	4.229626	1.540560	20.99232	20.9860	0.00632	1.00000
***	1	1	1	3.946594	3.944691	1.540560	22.51000	22.5210	-0.01100	1.00000

8	2	0	0	3.856842		1.540560	23.04091			
***	1	3	0	3.775757	3.776030	1.540560	23.54273	23.5410	0.00173	1.00000
***	-1	3	1	3.616976	3.617125	1.540560	24.59203	24.5910	0.00103	1.00000
***	-2	2	1	3.543583	3.549368	1.540560	25.10559	25.0680	0.04159	1.00000
***	-1	1	2	3.469297	3.471334	1.540560	25.63631	25.6410	0.01531	1.00000
***	2	2	0	3.316216	3.318193	1.540560	26.86231	26.8460	0.01631	1.00000
***	-2	0	2	3.289750	3.291361	1.540560	27.08251	27.0690	0.01351	1.00000
***	0	4	0	3.247460	3.245261	1.540560	27.44205	27.4610	-0.01895	1.00000
***	0	0	2	3.235459	3.235786	1.540560	27.54584	27.5430	0.00284	1.00000
***	1	3	1	2.993230	2.991922	1.540560	29.82466	29.8380	-0.01334	1.00000
18	-2	2	2	2.934759		1.540560	30.43310			
***	0	4	1	2.902460	2.901641	1.540560	30.78010	30.7890	-0.00890	1.00000
20	0	2	2	2.896019		1.540560	30.85025			
21	2	0	1	2.814010		1.540560	31.77274			
22	-3	1	1	2.791796		1.540560	32.03232			
***	-1	3	2	2.768233	2.766849	1.540560	32.31241	32.3290	-0.01659	1.00000
***	-3	1	2	2.606583	2.605087	1.540560	34.37665	34.3970	-0.02035	1.00000
25	2	2	1	2.582076		1.540560	34.71322			
26	-2	4	1	2.575524		1.540560	34.80435			
27	1	1	2	2.552908		1.540560	35.12265			
28	-3	1	0	2.522290		1.540560	35.56316			
29	-2	4	0	2.484148		1.540560	36.12783			
30	-1	5	0	2.462076		1.540560	36.46309			
31	-1	5	1	2.416413		1.540560	37.17711			
***	-3	3	1	2.385601	2.386653	1.540560	37.67524	37.6580	0.01724	1.00000
33	-2	0	3	2.379379		1.540560	37.77749			
34	-1	1	3	2.325550		1.540560	38.68628			
35	-2	4	2	2.311108		1.540560	38.93775			
36	0	4	2	2.292046		1.540560	39.27482			
37	-3	3	2	2.266914		1.540560	39.72844			
38	-2	2	3	2.234175		1.540560	40.33570			
39	1	3	2	2.231342		1.540560	40.38915			
40	-3	3	0	2.210810		1.540560	40.78083			
41	1	5	1	2.200930		1.540560	40.97211			
***	0	6	0	2.164973	2.165369	1.540560	41.68398	41.6750	0.00798	1.00000
43	-3	1	3	2.162560		1.540560	41.73265			
44	0	0	3	2.156972		1.540560	41.84584			
45	2	4	1	2.126664		1.540560	42.47087			
46	-4	0	1	2.120318		1.540560	42.60417			
47	-4	0	2	2.114183		1.540560	42.73386			
48	-1	5	2	2.106697		1.540560	42.89321			
49	-1	3	3	2.074723		1.540560	43.58779			
50	2	0	2	2.071205		1.540560	43.66562			
51	3	1	1	2.067992		1.540560	43.73696			
***	0	5	1	2.053111	2.053310	1.540560	44.07050	44.0660	0.00450	1.00000
53	0	2	3	2.047039		1.540560	44.20811			
54	-4	2	1	2.015629		1.540560	44.93430			
55	-4	2	2	2.010357		1.540560	45.05861			
***	2	2	2	1.973297	1.973329	1.540560	45.95278	45.9520	0.00078	1.00000
57	-3	3	3	1.956506		1.540560	46.37008			
58	4	0	0	1.928421		1.540560	47.08580			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
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Fargo 58105 - 5516

WELSFORD SYENITE 74-19: ALBITE --) 1987/ 3/ 8 . * . * . 0:34

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1430000	12.7770000	7.1540000	94.20000	116.55000	87.91700	664.0379 A**3
Reciprocal CELL:	0.1372831	0.0784770	0.1565790	86.34477	63.52496	90.23193	0.001505938 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.2500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD SYENITE 74-19: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1453922	12.8062468	7.1634156	94.18998	116.61787	87.92072	665.6955 A**3
Reciprocal CELL:	0.1373390	0.0783527	0.1564828	86.37421	63.45738	90.23597	0.001502188 A**-3
*-- Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$-- Direct Cell Standard ERRorS	0.0017061	0.0051023	0.0010217	0.02271	0.01272	0.02018	0.428045
&-- Reciprocal Cell Standard ERRorS	0.000022375	0.000010435	0.000028436	0.0186634	0.0124912	0.0153883	

WELSFORD SYENITE 74-19: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.762759		1.540560	6.92021			
2	1	0	0	7.281250		1.540560	12.14531			
3	-1	0	1	6.437518		1.540560	13.74436			
***	0	2	0	6.381400	6.391869	1.540560	13.86582	13.8430	0.02282	1.00000
5	0	2	0	6.381400		1.540560	13.86582			
6	1	1	0	6.335697		1.540560	13.96634			
7	-1	1	0	6.313180		1.540560	14.01640			
8	-1	-1	1	5.910050		1.540560	14.97778			
9	0	-1	1	5.864590		1.540560	15.09455			
***	-1	1	1	5.598120	5.604649	1.540560	15.81754	15.7990	0.01854	1.00000

11	0	1	1	5.574798		1.540560	15.88414			
12	1	2	0	4.808994		1.540560	18.43409			
13	-1	2	0	4.789316		1.540560	18.51050			
14	-1	-2	1	4.692845		1.540560	18.89447			
15	0	-2	1	4.665462		1.540560	19.00639			
16	-1	2	1	4.386711		1.540560	20.22645			
17	0	2	1	4.379135		1.540560	20.26153			
18	0	3	0	4.254256		1.540560	20.86309			
***	-2	0	1	4.032462	4.038004	1.540560	22.02461	21.9940	0.03061	1.00000
20	1	0	1	3.997843		1.540560	22.21774			
21	-2	-1	1	3.895204		1.540560	22.81093			
***	1	-1	1	3.856295	3.852210	1.540560	23.04423	23.0690	-0.02477	1.00000
23	-2	1	1	3.796888		1.540560	23.40965			
24	1	1	1	3.775109		1.540560	23.54682			
***	1	3	0	3.679872	3.677968	1.540560	24.15531	24.1760	-0.01269	1.00000
***	-1	3	0	3.666637	3.665722	1.540560	24.25386	24.2600	-0.00614	1.00000
27	-1	-3	1	3.664614		1.540560	24.26745			
28	0	-3	1	3.649365		1.540560	24.37041			
29	2	0	0	3.640625		1.540560	24.42981			
30	-1	0	2	3.572858		1.540560	24.90620			
31	-1	-1	2	3.506697		1.540560	25.37809			
***	-1	-1	2	3.506697	3.504129	1.540560	25.37809	25.3970	-0.01891	1.00000
33	-2	1	0	3.497161		1.540560	25.44845			
34	-2	-2	1	3.479509		1.540560	25.57573			
35	1	-2	1	3.446213		1.540560	25.83113			
36	-1	3	1	3.444147		1.540560	25.84698			
37	0	3	1	3.442320		1.540560	25.86085			
***	-1	1	2	3.376723	3.374737	1.540560	26.37220	26.3880	-0.01580	1.00000
39	-2	2	1	3.342411		1.540560	26.64789			
40	1	2	1	3.332456		1.540560	26.72897			
41	-2	0	2	3.218759		1.540560	27.69159			
***	-2	0	2	3.218759	3.216777	1.540560	27.69159	27.7090	-0.01741	1.00000
43	0	0	2	3.195239		1.540560	27.89954			
***	0	4	0	3.190700	3.190256	1.540560	27.94004	27.9440	-0.00396	1.00000
45	-2	-1	2	3.172110		1.540560	28.10713			
***	2	2	0	3.167849	3.168148	1.540560	28.14572	28.1430	0.00272	1.00000
***	-2	2	0	3.156590	3.157596	1.540560	28.24819	28.2390	0.00919	1.00000
48	0	-1	2	3.146813		1.540560	28.33778			
49	-2	1	2	3.072347		1.540560	29.03951			
50	0	1	2	3.054406		1.540560	29.21387			
51	-1	2	2	3.024618		1.540560	29.50809			
52	-2	-3	1	2.993905		1.540560	29.81778			
***	1	-3	1	2.969114	2.970329	1.540560	30.07259	30.0600	0.01259	1.00000
***	-2	-2	2	2.955025	2.954489	1.540560	30.21939	30.2250	-0.00561	1.00000
55	-1	-4	1	2.938663		1.540560	30.39170			
***	0	-2	2	2.932295	2.933356	1.540560	30.45929	30.4480	0.01129	1.00000
57	0	-4	1	2.929662		1.540560	30.48733			
58	1	4	0	2.926877		1.540560	30.51705			
59	-1	4	0	2.917990		1.540560	30.61225			
60	-2	3	1	2.863740		1.540560	31.20680			
***	1	3	1	2.860591	2.859790	1.540560	31.24202	31.2510	-0.00898	1.00000

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
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WELSFORD BROWN SYENITE 74-20: ORTHOCLASE —) 1987/ 2/14 . * . * . 0:45

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.6000000	12.9690000	7.1980000	90.00000	115.85000	90.00000	722.4864 A**3
Reciprocal CELL:	0.1292078	0.0771069	0.1543744	90.00000	64.15000	90.00000	0.001384109 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 MONOC System
3 Conditions for non-Extinctions Called for

Class	Condition(s)
hkl	h+k = 2n
h0l	h = 2n
0k0	k = 2n

F I N A L V A L U E S for WELSFORD BROWN SYENITE 74-20: ORTHOCLASE

* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.6153686	13.0145020	7.2072710	90.00000	116.19374	90.00000	722.1108 A**3
Reciprocal CELL:	0.1294236	0.0771176	0.1547381	90.00000	63.80625	90.00000	0.001384829 A**-3

*— Direct Cell Corrections:

0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000

$— Direct Cell Standard ERRorS

0.0059073	0.0222325	0.0040655	0.00000	0.05316	0.00000	2.132883

&— Reciprocal Cell Standard ERRorS

0.000081673	0.000041937	0.000085760	0.0000000	0.0529707	0.0000000

WELSFORD BROWN SYENITE 74-20: ORTHOCLASE HKL Listing - *** Refers to FIXed, R to Rejects MONOC

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	-1	1	0	6.637584		1.540560	13.32818			
***	0	2	0	6.483605	6.481807	1.540560	13.64620	13.6500	-0.00380	1.00000
3	0	0	1	6.462533		1.540560	13.69091			
***	-1	1	1	5.881369	5.880685	1.540560	15.05124	15.0530	-0.00176	1.00000
5	0	2	1	4.577133		1.540560	19.37668			
***	-2	0	1	4.245445	4.236613	1.540560	20.90692	20.9510	-0.04408	1.00000
***	1	1	1	3.941370	3.941236	1.540560	22.54023	22.5410	-0.00077	1.00000

8	2	0	0	3.863282		1.540560	23.00198			
9	-1	3	0	3.772254		1.540560	23.56490			
10	-1	3	1	3.615823		1.540560	24.59999			
11	-2	2	1	3.551761		1.540560	25.05083			
***	-1	1	2	3.470852	3.464029	1.540560	25.64462	25.6960	-0.05138	1.00000
***	2	2	0	3.318792	3.322567	1.540560	26.84107	26.8100	0.03107	1.00000
***	-2	0	2	3.299590	3.298417	1.540560	27.00022	27.0100	-0.00978	1.00000
***	0	4	0	3.241803	3.244103	1.540560	27.49087	27.4710	0.01587	1.00000
***	0	0	2	3.231266	3.222935	1.540560	27.58229	27.6550	-0.07272	1.00000
17	1	3	1	2.988735		1.540560	29.87056			
18	-2	2	2	2.940684		1.540560	30.37030			
***	0	4	1	2.897664	2.902009	1.540560	30.83230	30.7850	0.04730	1.00000
***	0	2	2	2.892010	2.891379	1.540560	30.89409	30.9010	-0.00691	1.00000
21	2	0	1	2.812615		1.540560	31.78891			
22	-3	1	1	2.801111		1.540560	31.92294			
23	-1	3	2	2.767266		1.540560	32.32400			
***	-3	1	2	2.616348	2.616227	1.540560	34.24436	34.2460	-0.00164	1.00000
25	2	2	1	2.580287		1.540560	34.73805			
***	-2	4	1	2.576531	2.571754	1.540560	34.79031	34.8570	-0.06669	1.00000
27	1	1	2	2.548760		1.540560	35.18169			
28	-3	1	0	2.526176		1.540560	35.50663			
29	-2	4	0	2.483326		1.540560	36.14026			
30	-1	5	0	2.458639		1.540560	36.51586			
31	-1	5	1	2.413737		1.540560	37.21984			
32	-3	3	1	2.390274		1.540560	37.59882			
33	-2	0	3	2.382939		1.540560	37.71891			
***	-1	1	3	2.324971	2.324583	1.540560	38.69629	38.7030	-0.00671	1.00000
35	-2	4	2	2.312461		1.540560	38.91405			
36	0	4	2	2.288566		1.540560	39.33699			
***	-3	3	2	2.272357	2.274853	1.540560	39.62929	39.5840	0.04529	1.00000
38	-2	2	3	2.236658		1.540560	40.28898			
39	1	3	2	2.227654		1.540560	40.45894			
40	-3	3	0	2.212528		1.540560	40.74776			
41	1	5	1	2.197382		1.540560	41.04124			
42	-3	1	3	2.158743		1.540560	41.60815			
***	0	6	0	2.161202	2.161207	1.540560	41.76011	41.7600	0.00011	1.00000
44	0	0	3	2.154178		1.540560	41.90268			
45	-4	0	1	2.127061		1.540560	42.46255			
46	2	4	1	2.124472		1.540560	42.51681			
47	-4	0	2	2.122723		1.540560	42.55356			
48	-1	5	2	2.104725		1.540560	42.93539			
49	-1	3	3	2.073573		1.540560	43.61319			
***	3	1	1	2.067950	2.069025	1.540560	43.73790	43.7140	0.02390	1.00000
51	3	1	1	2.067950		1.540560	43.73790			
52	0	6	1	2.049627		1.540560	44.14936			
53	0	2	3	2.044296		1.540560	44.27057			
54	-4	2	1	2.021077		1.540560	44.80658			
55	-4	2	2	2.017355		1.540560	44.89377			
56	2	2	2	1.970685		1.540560	46.01719			
57	-3	3	3	1.960456		1.540560	46.27120			
58	4	0	0	1.931641		1.540560	47.00258			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
Department of CHEMISTRY
NORTH DAKOTA STATE UNIVERSITY
Fargo 58105 - 5516

WELSFORD BROWN SYENITE 74-20: ALBITE —) 1987/ 2/14 . * . * . 0:25

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1380000	12.7890000	7.1560000	94.33300	116.56700	87.65000	664.2093 A**3
Reciprocal CELL:	0.1373912	0.0784189	0.1565611	86.32927	63.52584	90.46340	0.001505550 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD BROWN SYENITE 74-20: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1353349	12.8068313	7.1591954	94.22003	116.59431	87.93851	664.8281 A**3
Reciprocal CELL:	0.1374761	0.0783325	0.1565367	86.31086	63.48321	90.19422	0.001504148 A**-3
*— Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$— Direct Cell Standard ERRorS	0.0014550	0.0048558	0.0007497	0.01799	0.01086	0.01484	0.417288
£— Reciprocal Cell Standard ERRorS	0.000015256	0.000010204	0.000024065	0.0173778	0.0107165	0.0140247	

WELSFORD BROWN SYENITE 74-20: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.766100		1.540560	6.91842			
2	1	0	0	7.273990		1.540560	12.15748			
3	-1	0	1	6.430821		1.540560	13.75875			
***	0	2	0	6.383050	6.387277	1.540560	13.86222	13.8530	0.00922	1.00000
5	0	2	0	6.383050		1.540560	13.86222			
6	1	1	0	6.329284		1.540560	13.98056			
***	-1	1	0	6.310855	6.316050	1.540560	14.02159	14.0100	0.01159	1.00000
8	-1	-1	1	5.906354		1.540560	14.98720			
9	0	-1	1	5.865961		1.540560	15.09101			
10	-1	1	1	5.593006		1.540560	15.83210			
11	0	1	1	5.571252		1.540560	15.89432			

12	1	2	0	4.805828		1.540560	18.44634			
13	-1	2	0	4.789703		1.540560	18.50899			
14	-1	-2	1	4.692067		1.540560	18.89763			
15	0	-2	1	4.668022		1.540560	18.99587			
16	-1	2	1	4.384175		1.540560	20.23827			
17	0	2	1	4.376731		1.540560	20.27306			
18	0	3	0	4.255367		1.540560	20.85763			
***	-2	0	1	4.027257	4.028958	1.540560	22.05343	22.0440	0.00943	1.00000
20	1	0	1	3.935966		1.540560	22.22831			
21	-2	-1	1	3.890466		1.540560	22.83909			
***	1	-1	1	3.855941	3.854517	1.540560	23.04637	23.0550	-0.00863	1.00000
23	-2	1	1	3.792758		1.540560	23.43570			
***	1	1	1	3.772452	3.771765	1.540560	23.56365	23.5680	-0.00435	1.00000
***	1	3	0	3.678449	3.677069	1.540560	24.17479	24.1840	-0.00921	1.00000
26	-1	3	0	3.667596		1.540560	24.24742			
27	-1	-3	1	3.664911		1.540560	24.26545			
28	0	-3	1	3.651640		1.540560	24.35499			
29	2	0	0	3.636995		1.540560	24.45457			
30	-1	0	2	3.569858		1.540560	24.92180			
***	-1	-1	2	3.505514	3.503722	1.540560	25.38680	25.4000	-0.01320	1.00000
32	2	1	0	3.500942		1.540560	25.42051			
33	-2	1	0	3.494694		1.540560	25.46672			
34	-2	-2	1	3.476232		1.540560	25.60426			
35	1	-2	1	3.447042		1.540560	25.82481			
36	-1	3	1	3.443013		1.540560	25.85555			
37	0	3	1	3.440890		1.540560	25.87178			
38	-1	1	2	3.374185		1.540560	26.39240			
39	-2	2	1	3.339858		1.540560	26.66863			
40	1	2	1	3.330003		1.540560	26.74902			
***	-2	0	2	3.215410	3.217232	1.540560	27.72101	27.7050	0.01601	1.00000
42	-2	0	2	3.215410		1.540560	27.72101			
***	0	0	2	3.194139	3.194065	1.540560	27.90935	27.9100	-0.00065	1.00000
44	0	4	0	3.191525		1.540560	27.93267			
45	-2	-1	2	3.169314		1.540560	28.13243			
***	2	2	0	3.164642	3.162533	1.540560	28.17483	28.1940	-0.01917	1.00000
47	-2	2	0	3.155427		1.540560	28.25881			
48	0	-1	2	3.146662		1.540560	28.33917			
49	-2	1	2	3.069155		1.540560	29.07038			
50	0	1	2	3.052715		1.540560	29.23042			
51	-1	2	2	3.022392		1.540560	29.53031			
52	-2	-3	1	2.991965		1.540560	29.83756			
***	1	-3	1	2.970419	2.971005	1.540560	30.05907	30.0530	0.00607	1.00000
***	-2	-2	2	2.953177	2.954298	1.540560	30.23875	30.2270	0.01175	1.00000
55	-1	-4	1	2.939241		1.540560	30.38557			
56	0	-2	2	2.932980		1.540560	30.45200			
***	0	-4	1	2.931462	2.929224	1.540560	30.46816	30.4920	-0.02384	1.00000
58	1	4	0	2.926238		1.540560	30.52386			
59	-1	4	0	2.918949		1.540560	30.60196			
60	-2	3	1	2.862375		1.540560	31.22205			
61	1	3	1	2.858719		1.540560	31.26300			
62	-1	-3	2	2.839741		1.540560	31.47733			
63	-2	2	2	2.796503		1.540560	31.97695			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
Department of CHEMISTRY
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Fargo 58105 - 5516

WELSFORD GREEN SYENITE 74-22: ORTHOCLASE —) 1987/ 2/ 3 . * . * . 0:22

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.6000000	12.9690000	7.1980000	90.00000	115.85000	90.00000	722.4864 A**3
Reciprocal CELL:	0.1292078	0.0771063	0.1543744	90.00000	64.15000	90.00000	0.001384109 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.6 Dmin = 1.430265 MONOC System
3 Conditions for non-Extinctions Called for Class Condition(s)
hkl h+k = 2n
h0l h = 2n
0k0 k = 2n

F I N A L V A L U E S for WELSFORD GREEN SYENITE 74-22: ORTHOCLASE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5808604	13.0045584	7.2031689	90.00000	115.97739	90.00000	721.4423 A**3
Reciprocal CELL:	0.1296692	0.0769990	0.1544700	90.00000	64.02261	90.00000	0.001386112 A**-3

\- Direct Cell Corrections:

0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000

$- Direct Cell Standard ERRorS

0.0018063	0.0076216	0.0017268	0.00000	0.01608	0.00000	0.657728

£- Reciprocal Cell Standard ERRorS

0.000040323	0.000014231	0.000026227	0.0000000	0.0160539	0.0000000

WELSFORD GREEN SYENITE 74-22: ORTHOCLASE HKL Listing - *** Refers to FIXed, R to Rejects MONOC

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	-1	1	0	6.630962		1.540560	13.34155			
***	0	2	0	6.493591	6.487484	1.540560	13.62511	13.6380	-0.01289	1.00000
3	0	0	1	6.473748		1.540560	13.66707			
***	-1	1	1	5.868356	5.861715	1.540560	15.08481	15.1020	-0.01719	1.00000
5	0	2	1	4.584631		1.540560	19.34468			
***	-2	0	1	4.226314	4.224252	1.540560	21.00263	21.0130	-0.01037	1.00000
***	1	1	1	3.947612	3.942444	1.540560	22.50412	22.5340	-0.02988	1.00000
8	2	0	0	3.855965		1.540560	23.04623			

***	1	3	0	3.774953	3.776346	1.540560	23.54775	23.5390	0.00875	1.00000
***	-1	3	1	3.616245	3.614086	1.540560	24.59708	24.6120	-0.01492	1.00000
11	-2	2	1	3.542150		1.540560	25.11985			
***	-1	1	2	3.469900	3.471068	1.540560	25.65178	25.6430	0.00878	1.00000
***	2	2	0	3.315481	3.312621	1.540560	26.86837	26.8920	-0.02363	1.00000
***	-2	0	2	3.289105	3.288977	1.540560	27.08793	27.0890	-0.00107	1.00000
15	0	4	0	3.246796		1.540560	27.44777			
***	0	0	2	3.236874	3.241557	1.540560	27.53356	27.4930	0.04056	1.00000
17	1	3	1	2.993413		1.540560	29.82279			
18	-2	2	2	2.934178		1.540560	30.43927			
***	0	4	1	2.902241	2.899895	1.540560	30.78248	30.8080	-0.02552	1.00000
20	0	2	2	2.896917		1.540560	30.84046			
21	2	0	1	2.814398		1.540560	31.76823			
22	-3	1	1	2.790520		1.540560	32.04735			
23	-1	3	2	2.768333		1.540560	32.31120			
***	-3	1	2	2.605507	2.604353	1.540560	34.39128	34.4070	-0.01572	1.00000
***	2	2	1	2.582293	2.583896	1.540560	34.71021	34.6880	0.02221	1.00000
***	-2	4	1	2.574729	2.575477	1.540560	34.81544	34.8050	0.01044	1.00000
27	1	1	2	2.553891		1.540560	35.10870			
28	-3	1	0	2.521718		1.540560	35.57148			
29	-2	4	0	2.483616		1.540560	36.13589			
30	-1	5	0	2.461567		1.540560	36.47090			
31	-1	5	1	2.415922		1.540560	37.18495			
32	-3	3	1	2.384674		1.540560	37.69044			
33	-2	0	3	2.379537		1.540560	37.77488			
***	-1	1	3	2.326248	2.326723	1.540560	38.67421	38.6660	0.00821	1.00000
35	-2	4	2	2.310644		1.540560	38.94587			
36	0	4	2	2.292315		1.540560	39.27001			
37	-3	3	2	2.266094		1.540560	39.74343			
***	-2	2	3	2.234252	2.235221	1.540560	40.33425	40.3160	0.01825	1.00000
***	1	3	2	2.231890	2.231826	1.540560	40.37880	40.3800	-0.00120	1.00000
40	-3	3	0	2.210321		1.540560	40.79027			
41	1	5	1	2.200796		1.540560	40.97471			
***	0	6	0	2.164530	2.164178	1.540560	41.69290	41.7000	-0.00710	1.00000
43	-3	1	3	2.162136		1.540560	41.74124			
44	0	0	3	2.157916		1.540560	41.82668			
45	2	4	1	2.126645		1.540560	42.47126			
46	-4	0	1	2.119409		1.540560	42.62332			
47	-4	0	2	2.113157		1.540560	42.75562			
48	-1	5	2	2.106560		1.540560	42.89614			
49	-1	3	3	2.075132		1.540560	43.57876			
50	2	0	2	2.071837		1.540560	43.65162			
51	3	1	1	2.068065		1.540560	43.73533			
***	0	6	1	2.052824	2.053222	1.540560	44.07700	44.0680	0.00900	1.00000
53	0	2	3	2.047804		1.540560	44.19073			
54	-4	2	1	2.014809		1.540560	44.95359			
55	-4	2	2	2.009435		1.540560	45.08041			
56	2	2	2	1.973806		1.540560	45.94025			
57	-3	3	3	1.956119		1.540560	46.37979			
58	4	0	0	1.927982		1.540560	47.09716			
59	-2	6	1	1.926557		1.540560	47.13412			
60	-3	5	1	1.921971		1.540560	47.25342			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
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WELSFORD GREEN SYENITE 74-22: ALBITE —) 1987/ 2/ 1 . * . * . 2:18

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1430000	12.7770000	7.1540000	94.20000	116.55000	87.91700	664.0379 A**3
Reciprocal CELL:	0.1372831	0.0784770	0.1565790	86.34477	63.52498	90.23193	0.001505938 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD GREEN SYENITE 74-22: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1393941	12.8019496	7.1529601	94.20615	116.60005	87.88352	664.2282 A**3
Reciprocal CELL:	0.1374178	0.0783662	0.1566860	86.35291	63.47668	90.26206	0.001505507 A**-3
*-- Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$-- Direct Cell Standard ERRorS	0.0010297	0.0044461	0.0007667	0.01028	0.00966	0.00951	0.385283
£-- Reciprocal Cell Standard ERRorS	0.000017286	0.000005700	0.000018068	0.0099924	0.0096120	0.0091110	

WELSFORD GREEN SYENITE 74-22: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.760598		1.540560	6.92141			
2	1	0	0	7.277076		1.540560	12.15231			
3	-1	0	1	6.428798		1.540560	13.76310			
***	0	2	0	6.380299	6.390490	1.540560	13.86823	13.8460	0.02223	1.00000
5	0	2	0	6.380299		1.540560	13.86823			
***	1	1	0	6.333883	6.329537	1.540560	13.97036	13.9800	-0.00964	1.00000
7	-1	1	0	6.308999		1.540560	14.02574			
***	-1	-1	1	5.905235	5.903692	1.540560	14.99006	14.9940	-0.00394	1.00000
9	0	-1	1	5.859120		1.540560	15.10873			
***	-1	1	1	5.590368	5.594094	1.540560	15.83962	15.8290	0.01062	1.00000
11	0	1	1	5.568125		1.540560	15.90330			

12	1	2	0	4.808375		1.540560	18.43649			
13	-1	2	0	4.786621		1.540560	18.52101			
14	-1	-2	1	4.691185		1.540560	18.90121			
15	0	-2	1	4.662964		1.540560	19.01667			
16	-1	2	1	4.381830		1.540560	20.24922			
17	0	2	1	4.375213		1.540560	20.28017			
18	0	3	0	4.253533		1.540560	20.86672			
***	-2	0	1	4.028838	4.028597	1.540560	22.04467	22.0460	-0.00133	1.00000
20	1	0	1	3.994491		1.540560	22.23662			
21	-2	-1	1	3.892772		1.540560	22.82538			
***	1	-1	1	3.853281	3.855507	1.540560	23.06250	23.0490	0.01350	1.00000
23	-2	1	1	3.792974		1.540560	23.43434			
24	1	1	1	3.772178		1.540560	23.56538			
25	1	3	0	3.679567		1.540560	24.16734			
***	-1	3	0	3.664932	3.664532	1.540560	24.26531	24.2680	-0.00269	1.00000
27	-1	-3	1	3.664077		1.540560	24.27106			
28	0	-3	1	3.648189		1.540560	24.37838			
29	2	0	0	3.638538		1.540560	24.44404			
30	-1	0	2	3.566678		1.540560	24.94438			
31	2	1	0	3.503301		1.540560	25.40311			
***	-1	-1	2	3.502256	3.501011	1.540560	25.41081	25.4200	-0.00919	1.00000
33	-2	1	0	3.494860		1.540560	25.46549			
34	-2	-2	1	3.478282		1.540560	25.58892			
35	1	-2	1	3.443972		1.540560	25.84823			
36	-1	3	1	3.441141		1.540560	25.86987			
37	0	3	1	3.439936		1.540560	25.87908			
***	-1	1	2	3.371516	3.370471	1.540560	26.41366	26.4220	-0.00834	1.00000
39	-2	2	1	3.339055		1.540560	26.67516			
40	1	2	1	3.330286		1.540560	26.74671			
41	-1	-2	2	3.215308		1.540560	27.72191			
***	-2	0	2	3.214399	3.214047	1.540560	27.72991	27.7330	-0.00309	1.00000
43	0	0	2	3.191096		1.540560	27.93650			
***	0	4	0	3.190150	3.189697	1.540560	27.94495	27.9490	-0.00405	1.00000
45	-2	-1	2	3.168568		1.540560	28.13919			
***	2	2	0	3.166942	3.165063	1.540560	28.15395	28.1710	-0.01705	1.00000
***	-2	2	0	3.154500	3.153985	1.540560	28.26729	28.2720	-0.00471	1.00000
48	0	-1	2	3.143178		1.540560	28.37124			
49	-2	1	2	3.067920		1.540560	29.08235			
50	0	1	2	3.050432		1.540560	29.25278			
51	-1	2	2	3.020341		1.540560	29.55082			
52	-2	-3	1	2.993389		1.540560	29.82304			
***	1	-3	1	2.967567	2.968111	1.540560	30.08864	30.0830	0.00564	1.00000
54	-2	-2	2	2.952618		1.540560	30.24461			
55	-1	-4	1	2.938463		1.540560	30.39380			
56	0	-2	2	2.929560		1.540560	30.48842			
***	0	-2	2	2.929560	2.928849	1.540560	30.48842	30.4960	-0.00758	1.00000
58	1	4	0	2.926657		1.540560	30.51940			
59	-1	4	0	2.916829		1.540560	30.62474			
60	-2	3	1	2.861148		1.540560	31.23579			
61	1	3	1	2.859072		1.540560	31.25905			
62	-1	-3	2	2.837383		1.540560	31.50417			
63	-2	2	2	2.795184		1.540560	31.99244			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
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WELSFORD 74-41 RHYOLITE PHENOCRYST: ALBITE —) 1987/ 1/29 . * . * . 2:13

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1430000	12.7770000	7.1540000	94.20000	116.55000	87.91700	664.0379 A**3
Reciprocal CELL:	0.1372831	0.0784770	0.1565790	86.34477	63.52498	90.23193	0.001505938 A** -3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD 74-41 RHYOLITE PHENOCRYST: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1429329	12.7891264	7.1548219	94.18299	116.58231	87.93201	664.2911 A**3
Reciprocal CELL:	0.1373305	0.0784290	0.1566138	86.35521	63.49204	90.22084	0.001505364 A**-3
*— Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$— Direct Cell Standard ERRorS	0.0011199	0.0059279	0.0011241	0.01515	0.01241	0.01534	0.482673
£— Reciprocal Cell Standard ERRorS	0.000026569	0.000012229	0.000020095	0.0152772	0.0125570	0.0157545	

WELSFORD 74-41 RHYOLITE PHENOCRYST: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.750379		1.540560	6.92696			
2	1	0	0	7.281703		1.540560	12.14456			
3	-1	0	1	6.430478		1.540560	13.75948			
***	0	2	0	6.375189	6.380402	1.540560	13.87940	13.8680	0.01140	1.00000
5	0	2	0	6.375189		1.540560	13.87940			
6	1	1	0	6.333713		1.540560	13.97074			
***	-1	1	0	6.312722	6.312464	1.540560	14.01742	14.0180	-0.00058	1.00000
***	-1	-1	1	5.903883	5.900562	1.540560	14.99351	15.0020	-0.00849	1.00000
9	0	-1	1	5.860360		1.540560	15.10551			
10	-1	1	1	5.592006		1.540560	15.83495			

11	0	1	1	5.569268		1.540560	15.90002			
12	1	2	0	4.805800		1.540560	18.44645			
13	-1	2	0	4.787474		1.540560	18.51768			
14	-1	-2	1	4.688162		1.540560	18.91352			
15	0	-2	1	4.662068		1.540560	19.02036			
16	-1	2	1	4.382046		1.540560	20.24821			
17	0	2	1	4.374549		1.540560	20.28328			
18	0	3	0	4.250126		1.540560	20.88364			
***	-2	0	1	4.030494	4.030041	1.540560	22.03549	22.0380	-0.00251	1.00000
20	1	0	1	3.997063		1.540560	22.22214			
21	-2	-1	1	3.893048		1.540560	22.82374			
***	1	-1	1	3.855738	3.854682	1.540560	23.04761	23.0540	-0.00639	1.00000
23	-2	1	1	3.794945		1.540560	23.42200			
***	1	1	1	3.773675	3.773501	1.540560	23.55590	23.5570	-0.00110	1.00000
***	1	3	0	3.676803	3.674226	1.540560	24.18578	24.2030	-0.01722	1.00000
***	-1	3	0	3.664484	3.664383	1.540560	24.26832	24.2690	-0.00068	1.00000
27	-1	-3	1	3.661036		1.540560	24.29153			
28	0	-3	1	3.646554		1.540560	24.38948			
29	2	0	0	3.640851		1.540560	24.42827			
30	-1	0	2	3.567735		1.540560	24.93687			
***	-1	-1	2	3.502693	3.505215	1.540560	25.40759	25.3890	0.01859	1.00000
32	-1	-1	2	3.502693		1.540560	25.40759			
33	-2	1	0	3.497362		1.540560	25.44697			
***	-2	-2	1	3.477137	3.478538	1.540560	25.59704	25.5870	0.01004	1.00000
35	1	-2	1	3.445428		1.540560	25.83712			
36	-1	3	1	3.440567		1.540560	25.87426			
37	0	3	1	3.438622		1.540560	25.88915			
***	-1	1	2	3.372534	3.370346	1.540560	26.40554	26.4230	-0.01746	1.00000
39	-2	2	1	3.340435		1.540560	26.66394			
40	1	2	1	3.330492		1.540560	26.74502			
***	-2	0	2	3.215239	3.215184	1.540560	27.72252	27.7230	-0.00048	1.00000
42	-1	-2	2	3.214883		1.540560	27.72565			
***	0	0	2	3.192568	3.192047	1.540560	27.92336	27.9280	-0.00464	1.00000
44	0	4	0	3.187595		1.540560	27.96781			
45	-2	-1	2	3.168709		1.540560	28.13792			
***	2	2	0	3.166857	3.167376	1.540560	28.15472	28.1500	0.00472	1.00000
***	-2	2	0	3.156361	3.156610	1.540560	28.25028	28.2480	0.00228	1.00000
48	0	-1	2	3.144417		1.540560	28.35983			
49	-2	1	2	3.068969		1.540560	29.07219			
50	0	1	2	3.051591		1.540560	29.24142			
51	-1	2	2	3.020891		1.540560	29.54531			
52	-2	-3	1	2.991617		1.540560	29.84112			
***	1	-3	1	2.968052	2.968111	1.540560	30.08362	30.0830	0.00062	1.00000
***	-2	-2	2	2.951941	2.951818	1.540560	30.25171	30.2530	-0.00129	1.00000
55	-1	-4	1	2.935820		1.540560	30.42184			
***	0	-2	2	2.930180	2.929411	1.540560	30.48181	30.4900	-0.00819	1.00000
57	0	-4	1	2.927294		1.540560	30.51253			
58	1	4	0	2.924209		1.540560	30.54556			
59	-1	4	0	2.915940		1.540560	30.63431			
60	-2	3	1	2.861807		1.540560	31.22841			
61	1	3	1	2.858452		1.540560	31.26600			
62	-1	-3	2	2.836342		1.540560	31.51604			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
Department of CHEMISTRY
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Fargo 58105 - 5516

WELSFORD RHYOLITE 74-41 MATRIX: ORTHOCLASE --) 1987/ 2/ 1 . * . * . 1:50

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.6000000	12.9690000	7.1980000	90.00000	115.85000	90.00000	722.4864 A**3
Reciprocal CELL:	0.1292078	0.0771069	0.1543744	90.00000	64.15000	90.00000	0.001384109 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 MONOC System
3 Conditions for non-Extinctions Called for Class Condition(s)
hkl h+k = 2n
h0l h = 2n
0k0 k = 2n

F I N A L V A L U E S for WELSFORD RHYOLITE 74-41 MATRIX: ORTHOCLASE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5802730	13.0026569	7.2049034	90.00000	116.05322	90.00000	720.3039 A**3
Reciprocal CELL:	0.1297822	0.0770721	0.1545568	90.00000	63.94678	90.00000	0.001388303 A**-3

*-- Direct Cell Corrections:

0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000

$-- Direct Cell Standard ERRorS

0.0026843	0.0099362	0.0023139	0.00000	0.02612	0.00000	0.933316

£-- Reciprocal Cell Standard ERRorS

0.000046591	0.000021462	0.000037266	0.0000000	0.0260654	0.0000000

WELSFORD RHYOLITE 74-41 MATRIX: ORTHOCLASE HKL Listing - *** Refers to FIXed, R to Rejects MONOC

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	-1	1	0	6.625054		1.540560	13.35350			
***	0	2	0	6.487433	6.489852	1.540560	13.63811	13.6330	0.00511	1.00000
3	0	0	1	6.470112		1.540560	13.67479			
***	-1	1	1	5.870069	5.873315	1.540560	15.08038	15.0720	0.00838	1.00000
5	0	2	1	4.581172		1.540560	19.35943			
6	-2	0	1	4.227243		1.540560	20.99796			
***	1	-1	1	3.942952	3.940373	1.540560	22.53106	22.5460	-0.01494	1.00000
***	2	0	0	3.852607	3.855012	1.540560	23.06659	23.0520	0.01459	1.00000

***	1	3	0	3.771454	3.773185	1.540560	23.56997	23.5590	0.01097	1.00000
10	-1	3	1	3.614517		1.540560	24.60902			
11	-2	2	1	3.541706		1.540560	25.12312			
***	-1	1	2	3.470335	3.471201	1.540560	25.64851	25.6420	0.00651	1.00000
13	-2	2	0	3.312527		1.540560	26.89278			
***	-2	0	2	3.291114	3.289453	1.540560	27.07107	27.0850	-0.01393	1.00000
***	0	4	0	3.243716	3.242482	1.540560	27.47434	27.4850	-0.01066	1.00000
16	0	0	2	3.235056		1.540560	27.54934			
***	1	3	1	2.990175	2.990844	1.540560	29.85584	29.8490	0.00684	1.00000
18	-2	2	2	2.935034		1.540560	30.43017			
***	0	4	1	2.899714	2.899987	1.540560	30.80997	30.8070	0.00297	1.00000
20	0	2	2	2.895066		1.540560	30.86066			
21	2	0	1	2.810918		1.540560	31.80860			
22	-3	1	1	2.789989		1.540560	32.05362			
***	-1	3	2	2.767598	2.770937	1.540560	32.32001	32.2800	0.04001	1.00000
***	-3	1	2	2.606602	2.607734	1.540560	34.37639	34.3610	0.01539	1.00000
25	2	2	1	2.579218		1.540560	34.75292			
26	-2	4	1	2.573402		1.540560	34.83397			
27	1	1	2	2.551259		1.540560	35.14611			
***	3	1	0	2.519515	2.518121	1.540560	35.60363	35.6240	-0.02037	1.00000
29	-2	4	0	2.481340		1.540560	36.17017			
30	-1	5	0	2.459252		1.540560	36.50644			
31	-1	5	1	2.414138		1.540560	37.21344			
32	-3	3	1	2.383732		1.540560	37.70589			
33	-2	0	3	2.380531		1.540560	37.75851			
***	-1	1	3	2.326065	2.325161	1.540560	38.67736	38.6930	-0.01564	1.00000
35	-2	4	2	2.310229		1.540560	38.95316			
36	0	4	2	2.290586		1.540560	39.30088			
37	-3	3	2	2.266289		1.540560	39.73986			
38	-2	2	3	2.234823		1.540560	40.32350			
39	1	3	2	2.229633		1.540560	40.42146			
40	-3	3	0	2.208351		1.540560	40.82826			
41	1	5	1	2.198550		1.540560	41.01845			
42	-3	1	3	2.163363		1.540560	41.71645			
***	0	6	0	2.162478	2.161702	1.540560	41.73433	41.7500	-0.01567	1.00000
44	0	0	3	2.156704		1.540560	41.85129			
45	2	4	1	2.124278		1.540560	42.52088			
46	-4	0	1	2.118655		1.540560	42.63924			
47	-4	0	2	2.113622		1.540560	42.74576			
48	-1	5	2	2.105395		1.540560	42.92106			
49	-1	3	3	2.074600		1.540560	43.59050			
50	2	0	2	2.069342		1.540560	43.70694			
51	3	1	1	2.065615		1.540560	43.78989			
52	0	6	1	2.050957		1.540560	44.11923			
53	0	2	3	2.046575		1.540560	44.21867			
54	-4	2	1	2.013977		1.540560	44.97317			
55	-4	2	2	2.009652		1.540560	45.07528			
56	2	2	2	1.971476		1.540560	45.99766			
57	-3	3	3	1.956690		1.540560	46.36547			
58	4	0	0	1.926304		1.540560	47.14068			
59	-2	6	1	1.925197		1.540560	47.16943			

Least Squares Unit Cell Refinement

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WELSFORD RHYOLITE 74-41 MATRIX: ALBITE —) 1987/ 1/31 . * . * . 1:7

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1380000	12.7890000	7.1560000	94.33300	116.55700	87.65000	664.2093 A**3
Reciprocal CELL:	0.1373912	0.0784189	0.1565611	86.32927	63.52584	90.46340	0.001505550 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD RHYOLITE 74-41 MATRIX: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1387711	12.7881659	7.1545746	94.13843	116.59242	87.92946	663.9102 A**3
Reciprocal CELL:	0.1373975	0.0784350	0.1566143	86.40679	63.48768	90.24555	0.001506228 A**-3
*— Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$— Direct Cell Standard ERRorS	0.0013593	0.0063889	0.0012107	0.01841	0.01405	0.01818	0.530461
&— Reciprocal Cell Standard ERRorS	0.000026522	0.000016564	0.000023113	0.0179049	0.0137782	0.0175937	

WELSFORD RHYOLITE 74-41 MATRIX: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.749408		1.540560	6.92749			
2	1	0	0	7.278154		1.540560	12.15050			
3	-1	0	1	6.429770		1.540560	13.76100			
***	0	2	0	6.374704	6.384984	1.540560	13.88046	13.8580	0.02246	1.00000
5	0	2	0	6.374704		1.540560	13.88046			
6	1	1	0	6.332445		1.540560	13.97355			
7	-1	1	0	6.309119		1.540560	14.02547			
8	-1	-1	1	5.901930		1.540560	14.99850			
9	0	-1	1	5.858030		1.540560	15.11156			
10	-1	1	1	5.592571		1.540560	15.83334			
11	0	1	1	5.571079		1.540560	15.89482			

12	1	2	0	4.805608		1.540560	18.44719			
13	-1	2	0	4.785236		1.540560	18.52642			
14	-1	-2	1	4.686385		1.540560	18.92075			
15	0	-2	1	4.659636		1.540560	19.03038			
16	-1	2	1	4.382735		1.540560	20.24500			
17	0	2	1	4.376233		1.540560	20.27539			
18	0	3	0	4.249803		1.540560	20.88524			
***	-2	0	1	4.028948	4.029319	1.540560	22.04406	22.0420	0.00206	1.00000
20	1	0	1	3.996047		1.540560	22.22785			
21	-2	-1	1	3.891527		1.540560	22.83277			
***	1	-1	1	3.853900	3.855012	1.540560	23.05874	23.0520	0.00674	1.00000
23	-2	1	1	3.793721		1.540560	23.42966			
***	1	1	1	3.773639	3.773185	1.540560	23.55613	23.5590	-0.00287	1.00000
***	1	3	0	3.676833	3.674375	1.540560	24.18558	24.2020	-0.01642	1.00000
***	-1	-3	1	3.659763	3.661856	1.540560	24.30010	24.2860	0.01410	1.00000
27	-1	-3	1	3.659763		1.540560	24.30010			
28	0	-3	1	3.644742		1.540560	24.40179			
29	2	0	0	3.639077		1.540560	24.44036			
30	-1	0	2	3.567902		1.540560	24.93568			
***	-1	-1	2	3.502084	3.503451	1.540560	25.41208	25.4020	0.01008	1.00000
32	-1	-1	2	3.502084		1.540560	25.41208			
33	-2	1	0	3.495370		1.540560	25.46171			
34	-2	-2	1	3.475983		1.540560	25.60613			
35	1	-2	1	3.443418		1.540560	25.85246			
36	-1	3	1	3.441064		1.540560	25.87045			
37	0	3	1	3.439793		1.540560	25.88018			
38	-1	1	2	3.373326		1.540560	26.39924			
39	-2	2	1	3.339610		1.540560	26.67065			
40	1	2	1	3.330996		1.540560	26.74090			
***	-2	0	2	3.214865	3.216094	1.540560	27.72563	27.7150	0.01063	1.00000
42	-1	-2	2	3.213788		1.540560	27.73528			
***	0	0	2	3.192556	3.192160	1.540560	27.92346	27.9270	-0.00354	1.00000
44	0	4	0	3.187352		1.540560	27.96998			
45	-2	-1	2	3.167951		1.540560	28.14479			
***	2	2	0	3.166222	3.164293	1.540560	28.16047	28.1780	-0.01753	1.00000
***	-2	2	0	3.154559	3.155297	1.540560	28.26675	28.2600	0.00675	1.00000
48	0	-1	2	3.143706		1.540560	28.36638			
49	-2	1	2	3.069015		1.540560	29.07174			
50	0	1	2	3.052195		1.540560	29.23551			
51	-1	2	2	3.021901		1.540560	29.53522			
52	-2	-3	1	2.990736		1.540560	29.85011			
***	1	-3	1	2.966295	2.967244	1.540560	30.10185	30.0920	0.00985	1.00000
***	-2	-2	2	2.950965	2.950104	1.540560	30.25195	30.2710	-0.00905	1.00000
55	-1	-4	1	2.934919		1.540560	30.43139			
***	0	-2	2	2.929015	2.929318	1.540560	30.49423	30.4910	0.00323	1.00000
57	0	-4	1	2.925998		1.540560	30.52643			
58	1	4	0	2.924259		1.540560	30.54503			
59	-1	4	0	2.915063		1.540560	30.64375			
60	-2	3	1	2.861273		1.540560	31.23439			
61	1	3	1	2.859082		1.540560	31.25893			
62	-1	-3	2	2.835140		1.540560	31.52975			
63	-2	2	2	2.796285		1.540560	31.97951			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
Department of CHEMISTRY
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Fargo 58105 - 5516

WELSFORD GRANOPHYRE 74-42: INTERMEDIATE MICROCLINE --) 1987/ 1/28 . * . * . 1:5

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5820000	12.9650000	7.2120000	90.40000	115.95000	88.35000	721.2287 A**3
Reciprocal CELL:	0.1296417	0.0771642	0.1542084	90.35817	64.05057	91.64036	0.001386523 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD GRANOPHYRE 74-42: INTERMEDIATE MICROCLINE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5940795	12.9616457	7.2112102	90.46853	115.89168	88.24423	722.7903 A**3
Reciprocal CELL:	0.1293867	0.0771408	0.1541386	90.33086	64.10914	91.72315	0.001383527 A**-3
*-- Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$-- Direct Cell Standard ERRorS	0.0019524	0.0061887	0.0020659	0.03249	0.01846	0.04093	0.767824
£-- Reciprocal Cell Standard ERRorS	0.000040729	0.000023827	0.000023805	0.0288924	0.0185199	0.0380952	

WELSFORD GRANOPHYRE 74-42: INTERMEDIATE MICROCLINE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.963305		1.540560	6.81305			
2	1	0	0	7.728770		1.540560	11.43964			
3	1	1	0	6.728047		1.540560	13.14818			
4	-1	0	1	6.580758		1.540560	13.44380			
5	-1	1	0	6.552356		1.540560	13.50235			
6	0	0	1	6.487669		1.540560	13.63761			
7	0	2	0	6.481653		1.540560	13.65033			
***	-1	-1	1	5.915293	5.922150	1.540560	14.96443	14.9470	0.01743	1.00000
***	-1	1	1	5.821736	5.828716	1.540560	15.20632	15.1880	0.01832	1.00000
10	0	1	1	5.815125		1.540560	15.22371			

11	0	-1	1	5.788308		1.540560	15.29466			
12	1	2	0	5.041564		1.540560	17.57682			
13	-1	2	0	4.894421		1.540560	18.10961			
14	-1	-2	1	4.664137		1.540560	19.01184			
15	0	2	1	4.598643		1.540560	19.28518			
16	-1	2	1	4.572935		1.540560	19.39464			
17	0	-2	1	4.572164		1.540560	19.39794			
18	0	3	0	4.321102		1.540560	20.53686			
***	-2	0	1	4.229333	4.230423	1.540560	20.98747	20.9820	0.00547	1.00000
20	1	0	1	4.155573		1.540560	21.36433			
21	-2	-1	1	4.055763		1.540560	21.89650			
22	-2	1	1	3.986638		1.540560	22.28099			
***	1	1	1	3.980274	3.973957	1.540560	22.31707	22.3530	-0.03593	1.00000
***	1	-1	1	3.934562	3.935721	1.540560	22.57974	22.5730	0.00674	1.00000
25	2	0	0	3.864385		1.540560	22.99533			
***	1	3	0	3.820904	3.825387	1.540560	23.26064	23.2330	0.02764	1.00000
27	2	1	0	3.734209		1.540560	23.80848			
***	-1	3	0	3.724243	3.723494	1.540560	23.87313	23.8780	-0.00487	1.00000
29	-2	1	0	3.673221		1.540560	24.20972			
30	-1	-3	1	3.645201		1.540560	24.39867			
31	0	3	1	3.606020		1.540560	24.66792			
32	-1	0	2	3.604708		1.540560	24.67704			
***	-2	-2	1	3.590206	3.591818	1.540560	24.77830	24.7670	0.01130	1.00000
34	0	-3	1	3.586856		1.540560	24.80181			
35	-1	3	1	3.579736		1.540560	24.85193			
36	1	2	1	3.530341		1.540560	25.20532			
37	-2	2	1	3.495669		1.540560	25.45949			
***	-1	-1	2	3.479779	3.475733	1.540560	25.57772	25.6080	-0.03028	1.00000
39	1	-2	1	3.467168		1.540560	25.67233			
40	-1	1	2	3.466139		1.540560	25.68009			
41	2	2	0	3.364023		1.540560	26.47356			
***	-2	0	2	3.290379	3.290049	1.540560	27.07724	27.0800	-0.00276	1.00000
43	-2	2	0	3.276178		1.540560	27.19686			
***	0	0	2	3.243835	3.245261	1.540560	27.47332	27.4610	0.01232	1.00000
45	0	4	0	3.240826		1.540560	27.49932			
46	-2	-1	2	3.204372		1.540560	27.81842			
47	-2	1	2	3.174334		1.540560	28.08703			
48	-1	-2	2	3.160530		1.540560	28.21224			
49	0	1	2	3.151098		1.540560	28.29845			
50	0	-1	2	3.142540		1.540560	28.37713			
51	-1	2	2	3.140168		1.540560	28.39901			
52	-2	-3	1	3.067538		1.540560	29.08605			
***	1	3	1	3.025425	3.025027	1.540560	29.50004	29.5040	-0.00396	1.00000
54	1	4	0	3.021285		1.540560	29.54138			
55	-2	3	1	2.979414		1.540560	29.96619			
***	1	-3	1	2.965948	2.967918	1.540560	30.10546	30.0850	0.02046	1.00000
57	-2	-2	2	2.957646		1.540560	30.19197			
58	-1	4	0	2.957165		1.540560	30.19700			
59	-1	-4	1	2.930413		1.540560	30.47932			
60	2	3	0	2.924548		1.540560	30.54194			
61	-2	2	2	2.910868		1.540560	30.68900			
62	0	2	2	2.907563		1.540560	30.72475			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
Department of CHEMISTRY
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Fargo 58105 - 5516

WELSFORD GRANOPHYRIC GRANITE 74-42: ALBITE —) 1987/ 1/31 . * . * . 0:44

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1380000	12.7890000	7.1560000	94.33300	116.56700	87.65000	664.2093 A**3
Reciprocal CELL:	0.1373912	0.0784189	0.1565611	86.32927	63.52584	90.46340	0.001505550 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD GRANOPHYRIC GRANITE 74-42: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1396647	12.7909012	7.1626627	94.21054	116.57620	87.75803	665.0954 A**3
Reciprocal CELL:	0.1373597	0.0784053	0.1564116	86.41216	63.51266	90.40292	0.001503544 A**-3

*— Direct Cell Corrections:
0.0000000 0.0000000 0.0000000 0.00000 0.00000 0.00000 0.000000

$— Direct Cell Standard ERRorS
0.0017740 0.0068524 0.0013166 0.02359 0.01683 0.02052 0.556674

£— Reciprocal Cell Standard ERRorS
0.000029697 0.000018548 0.000029453 0.0207541 0.0167298 0.0171954

WELSFORD GRANOPHYRIC GRANITE 74-42: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.754240		1.540560	6.92486			
2	1	0	0	7.280155		1.540560	12.14715			
3	-1	0	1	6.432793		1.540560	13.75451			
***	0	2	0	6.377120	6.391409	1.540560	13.87517	13.8440	0.03117	1.00000
5	0	2	0	6.377120		1.540560	13.87517			
6	1	1	0	6.341879		1.540560	13.95266			
7	-1	1	0	6.303593		1.540560	14.03783			
8	-1	-1	1	5.910338		1.540560	14.97705			
9	0	-1	1	5.864395		1.540560	15.09506			
10	-1	1	1	5.590225		1.540560	15.84003			
11	0	1	1	5.577399		1.540560	15.87669			

12	1	2	0	4.813799		1.540560	18.41553			
13	-1	2	0	4.780358		1.540560	18.54549			
14	-1	-2	1	4.694114		1.540560	18.88931			
15	0	-2	1	4.663299		1.540560	19.01529			
16	0	2	1	4.380087		1.540560	20.25736			
17	-1	2	1	4.379914		1.540560	20.25817			
18	0	3	0	4.251413		1.540560	20.87724			
***	-2	0	1	4.029038	4.035467	1.540560	22.04356	22.0080	0.03556	1.00000
20	1	0	1	4.000038		1.540560	22.20539			
21	-2	-1	1	3.895091		1.540560	22.81161			
22	1	-1	1	3.855779		1.540560	23.04736			
23	-2	1	1	3.790834		1.540560	23.44776			
***	1	1	1	3.778850	3.779671	1.540560	23.52318	23.5180	0.00518	1.00000
***	1	3	0	3.682553	3.682319	1.540560	24.14744	24.1490	-0.00156	1.00000
***	-1	3	0	3.660068	3.663937	1.540560	24.29805	24.2720	0.02605	1.00000
27	-1	3	0	3.660068		1.540560	24.29805			
28	0	-3	1	3.646941		1.540560	24.38685			
29	2	0	0	3.640078		1.540560	24.43354			
30	-1	0	2	3.571586		1.540560	24.90954			
***	-1	-1	2	3.506732	3.507253	1.540560	25.37784	25.3740	0.00384	1.00000
32	-1	-1	2	3.506732		1.540560	25.37784			
33	-2	1	0	3.493833		1.540560	25.47310			
***	-2	-2	1	3.481204	3.484967	1.540560	25.56707	25.5390	0.02807	1.00000
35	1	-2	1	3.443737		1.540560	25.85003			
36	0	3	1	3.442238		1.540560	25.86148			
37	-1	3	1	3.439069		1.540560	25.88572			
***	-1	1	2	3.375579	3.380525	1.540560	26.38130	26.3420	0.03930	1.00000
39	1	2	1	3.336024		1.540560	26.69985			
40	-2	2	1	3.335795		1.540560	26.70172			
***	-2	0	2	3.216397	3.218713	1.540560	27.71234	27.6920	0.02034	1.00000
42	-2	0	2	3.216397		1.540560	27.71234			
***	0	0	2	3.196693	3.200810	1.540560	27.88659	27.8500	0.03659	1.00000
44	0	4	0	3.188560		1.540560	27.95917			
45	-2	-1	2	3.171199		1.540560	28.11537			
***	2	2	0	3.170939	3.171019	1.540560	28.11772	28.1170	0.00072	1.00000
***	-2	2	0	3.151796	3.151692	1.540560	28.29204	28.2930	-0.00096	1.00000
48	0	-1	2	3.147576		1.540560	28.33077			
49	-2	1	2	3.068829		1.540560	29.07354			
50	0	1	2	3.056015		1.540560	29.19815			
51	-1	2	2	3.023032		1.540560	29.52392			
52	-2	-3	1	2.995894		1.540560	29.79752			
53	1	-3	1	2.965968		1.540560	30.10525			
***	-2	-2	2	2.955169	2.954775	1.540560	30.21788	30.2220	-0.00412	1.00000
55	-1	-4	1	2.938899		1.540560	30.38919			
***	0	-2	2	2.932198	2.931101	1.540560	30.46033	30.4720	-0.01167	1.00000
57	1	4	0	2.928285		1.540560	30.50201			
58	0	-4	1	2.927483		1.540560	30.51057			
59	-1	4	0	2.913189		1.540560	30.66394			
***	1	3	1	2.863284	2.861486	1.540560	31.21189	31.2320	-0.02011	1.00000
61	-2	3	1	2.857821		1.540560	31.27308			
62	-1	-3	2	2.839159		1.540560	31.48396			
63	-2	2	2	2.795113		1.540560	31.99328			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
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WELSFORD PORPHYRITIC GRANITE 74-47: INTERMEDIATE MICROCLINE —) 1987/ 1/28 . * . * . 0:38

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5820000	12.9650000	7.2120000	90.40000	115.95000	88.35000	721.2287 A**3
Reciprocal CELL:	0.1296417	0.0771642	0.1542084	90.35817	64.05057	91.64036	0.001386523 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

8	-2	2	0	R	3.266411	3.253745	1.540560	27.27975	27.38800	-0.10825	1.00000
8	-2	2	0	R	3.270071	3.253745	1.540560	27.24862	27.38800	-0.13938	1.00000
8	-2	2	0	R	3.270072	3.253745	1.540560	27.24861	27.38800	-0.13939	1.00000

F I N A L V A L U E S for WELSFORD PORPHYRITIC GRANITE 74-47: INTERMEDIATE MICROCLINE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5597564	12.9649269	7.2156360	90.57397	115.90105	88.31852	720.5278 A**3
Reciprocal CELL:	0.1299055	0.0771213	0.1540440	90.17793	64.10429	91.58965	0.001387872 A**-3

*— Direct Cell Corrections:

0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000

$— Direct Cell Standard ERRorS

0.0037509	0.0143489	0.0028615	0.04857	0.03430	0.05251	1.345312

£— Reciprocal Cell Standard ERRorS

0.000060396	0.000021149	0.000056671	0.0434191	0.0344493	0.0477279

WELSFORD PORPHYRITIC GRANITE 74-47: INTERMEDIATE MICROCLINE HKL Listing - *** Refers to FIXed, R to Rejects

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.966587		1.540560	6.81132			
2	1	0	0	7.697903		1.540560	11.48567			
3	1	1	0	6.701410		1.540560	13.20067			
4	-1	0	1	6.574704		1.540560	13.45624			
5	-1	1	0	6.540144		1.540560	13.52767			
6	0	0	1	6.491651		1.540560	13.62920			

***	0	2	0		6.483293	6.473312	1.540560	13.64686	13.6680	-0.02114	1.00000
***	-1	-1	1		5.913178	5.909178	1.540560	14.96981	14.9800	-0.01019	1.00000
9	-1	1	1		5.815962		1.540560	15.22151			
10	0	1	1		5.812041		1.540560	15.23183			
11	0	-1	1		5.797609		1.540560	15.26998			
12	1	2	0		5.028075		1.540560	17.62435			
13	-1	2	0		4.892454		1.540560	18.11696			
14	-1	-2	1		4.664526		1.540560	19.01024			
15	0	2	1		4.594472		1.540560	19.30285			
16	0	-2	1		4.580226		1.540560	19.36346			
17	-1	2	1		4.569656		1.540560	19.40869			
18	0	3	0		4.322196		1.540560	20.53161			
***	-2	0	1		4.214910	4.226042	1.540560	21.06011	21.0040	0.05611	1.00000
20	1	0	1		4.149550		1.540560	21.39570			
21	-2	-1	1		4.042300		1.540560	21.97034			
22	-2	1	1		3.975442		1.540560	22.34454			
***	1	1	1		3.971687	3.970450	1.540560	22.36594	22.3730	-0.00706	1.00000
***	1	-1	1		3.932820	3.933485	1.540560	22.58987	22.5860	0.00387	1.00000
25	2	0	0		3.848951		1.540560	23.08880			
***	1	3	0		3.814205	3.815830	1.540560	23.30206	23.2920	0.01006	1.00000
***	-1	3	0		3.724913	3.723187	1.540560	23.86877	23.8800	-0.01123	1.00000
28	2	1	0		3.718068		1.540560	23.91336			
29	-2	1	0		3.662214		1.540560	24.28359			
30	-1	-3	1		3.646214		1.540560	24.39179			
31	-1	0	2		3.607234		1.540560	24.65949			
32	0	3	1		3.602874		1.540560	24.68980			
33	0	-3	1		3.592566		1.540560	24.76177			
34	-2	-2	1		3.580462		1.540560	24.84666			
35	-1	3	1		3.578070		1.540560	24.86368			
36	1	2	1		3.522181		1.540560	25.26468			
37	-2	2	1		3.488845		1.540560	25.51014			
38	-1	-1	2		3.483860		1.540560	25.54725			
39	1	-2	1		3.468415		1.540560	25.66295			
40	-1	1	2		3.466724		1.540560	25.67568			
41	2	2	0		3.350705		1.540560	26.58072			
***	-2	0	2		3.287352	3.293272	1.540560	27.10264	27.0530	0.04964	1.00000
43	-2	2	0		3.270072		1.540560	27.24861			
***	-2	2	0	R	3.270072	3.253745	1.540560	27.24861	27.3880	-0.13939	1.00000
***	0	0	2		3.245825	3.245146	1.540560	27.45614	27.4620	-0.00586	1.00000
45	0	4	0		3.241647		1.540560	27.49222			
46	-2	-1	2		3.202252		1.540560	27.83721			
47	-2	1	2		3.171056		1.540560	28.11666			
48	-1	-2	2		3.165039		1.540560	28.17122			
49	0	1	2		3.150980		1.540560	28.29952			
50	0	-1	2		3.146373		1.540560	28.34182			
51	-1	2	2		3.139464		1.540560	28.40551			
52	-2	-3	1		3.061318		1.540560	29.14645			
***	1	3	1		3.019005	3.019424	1.540560	29.56419	29.5600	0.00419	1.00000
54	1	4	0		3.017649		1.540560	29.57778			
55	-2	3	1		2.975718		1.540560	30.00429			
***	1	-3	1		2.968336	2.969075	1.540560	30.08067	30.0730	0.00767	1.00000

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
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Fargo 58105 - 5516

WELSFORD PORPHYRITIC GRANITE 74-47 K-FELDSPAR PHENOCRYST: ALBITE —) 1987/ 2/ 1 . * . * . 1:23

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1380000	12.7890000	7.1560000	94.33300	116.56700	87.65000	664.2093 A**3
Reciprocal CELL:	0.1373912	0.0784189	0.1565611	86.32927	63.52584	90.46340	0.001505550 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

19	1	-1	2	R	2.506819	2.481352	1.540560	35.79003	36.17000	-0.37997	1.00000
19	1	-1	2	R	2.512209	2.481352	1.540560	35.71066	36.17000	-0.45934	1.00000
19	1	-1	2	R	2.512213	2.481352	1.540560	35.71060	36.17000	-0.45940	1.00000

F I N A L V A L U E S for WELSFORD PORPHYRITIC GRANITE 74-47 K-FELDSPAR PHENOCRYST: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1394846	12.7878490	7.1573748	94.16961	116.58862	87.94074	664.1960 A**3
Reciprocal CELL:	0.1373871	0.0784379	0.1565549	86.36639	63.49005	90.21756	0.001505580 A**-3

*-- Direct Cell Corrections:

0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000

$-- Direct Cell Standard ERRorS

0.0017437	0.0061940	0.0009867	0.01732	0.01333	0.01359	0.522835

&-- Reciprocal Cell Standard ERRorS

0.000021558	0.000013032	0.000029386	0.0176121	0.0132955	0.0138295

WELSFORD PORPHYRITIC GRANITE 74-47 K-FELDSPAR PHENOCRYST: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.748941		1.540560	6.92774			
2	1	0	0	7.278706		1.540560	12.14957			
3	-1	0	1	6.431197		1.540560	13.75794			
***	0	0	1	6.387536	6.386818	1.540560	13.85244	13.8540	-0.00156	1.00000
5	0	2	0	6.374470		1.540560	13.88097			
6	1	1	0	6.331414		1.540560	13.97584			
7	-1	1	0	6.310745		1.540560	14.02184			

8	-1	-1	1	5.903635		1.540560	14.99415			
9	0	-1	1	5.861549		1.540560	15.10243			
***	-1	1	1	5.592920	5.586029	1.540560	15.83235	15.8520	-0.01965	1.00000
11	0	1	1	5.571194		1.540560	15.89449			
12	1	2	0	4.804498		1.540560	18.45149			
13	-1	2	0	4.786449		1.540560	18.52168			
14	-1	-2	1	4.687493		1.540560	18.91624			
15	0	-2	1	4.662190		1.540560	19.01985			
16	-1	2	1	4.382581		1.540560	20.24571			
17	0	2	1	4.375528		1.540560	20.27869			
18	0	3	0	4.249647		1.540560	20.88602			
***	-2	0	1	4.029229	4.031668	1.540560	22.04250	22.0290	0.01350	1.00000
20	1	0	1	3.997075		1.540560	22.22206			
21	-2	-1	1	3.891642		1.540560	22.83209			
***	1	-1	1	3.855593	3.859472	1.540560	23.04848	23.0250	0.02348	1.00000
23	-2	1	1	3.794059		1.540560	23.42754			
***	1	1	1	3.773757	3.775081	1.540560	23.55538	23.5470	0.00838	1.00000
***	1	3	0	3.676818	3.674674	1.540560	24.19102	24.2000	-0.00898	1.00000
***	-1	3	0	3.663883	3.665424	1.540560	24.27236	24.2620	0.01036	1.00000
27	-1	-3	1	3.660389		1.540560	24.29588			
28	0	-3	1	3.646318		1.540560	24.39108			
29	2	0	0	3.639353		1.540560	24.43848			
30	-1	0	2	3.569171		1.540560	24.92667			
***	-1	-1	2	3.503771	3.504400	1.540560	25.39964	25.3950	0.00464	1.00000
32	2	1	0	3.503070		1.540560	25.40481			
33	-2	1	0	3.496055		1.540560	25.45664			
***	-2	-2	1	3.475947	3.472932	1.540560	25.60640	25.6290	-0.02260	1.00000
35	1	-2	1	3.445157		1.540560	25.83918			
36	-1	3	1	3.440815		1.540560	25.87235			
37	0	3	1	3.439062		1.540560	25.88577			
***	-1	1	2	3.373945	3.374737	1.540560	26.39430	26.3880	0.00630	1.00000
39	-2	2	1	3.339895		1.540560	26.66833			
40	1	2	1	3.330546		1.540560	26.74458			
***	-2	0	2	3.215599	3.217232	1.540560	27.71935	27.7050	0.01435	1.00000
42	-1	-2	2	3.215453		1.540560	27.72063			
***	0	0	2	3.193768	3.191823	1.540560	27.91265	27.9300	-0.01735	1.00000
44	0	4	0	3.187235		1.540560	27.97103			
***	2	2	0	3.165707	3.167376	1.540560	28.16515	28.1500	0.01515	1.00000
46	2	2	0	3.165707		1.540560	28.16515			
***	-2	2	0	3.155372	3.150601	1.540560	28.25931	28.3030	-0.04369	1.00000
48	0	-1	2	3.145379		1.540560	28.35097			
49	-2	1	2	3.069447		1.540560	29.06756			
50	0	1	2	3.052769		1.540560	29.22989			
51	-1	2	2	3.022009		1.540560	29.53414			
52	-2	-3	1	2.990626		1.540560	29.85123			
***	1	-3	1	2.967735	2.969075	1.540560	30.08690	30.0730	0.01390	1.00000
54	-2	-2	2	2.951817		1.540560	30.25301			
55	-1	-4	1	2.935282		1.540560	30.42754			
***	0	-2	2	2.930775	2.932134	1.540560	30.47547	30.4610	0.01447	1.00000
57	0	-4	1	2.926984		1.540560	30.51590			
58	1	4	0	2.923678		1.540560	30.55125			
59	-1	4	0	2.915531		1.540560	30.63871			
60	-2	3	1	2.861475		1.540560	31.23212			
61	1	3	1	2.858452		1.540560	31.26600			
***	-1	-3	2	2.836521	2.835644	1.540560	31.51400	31.5240	-0.01000	1.00000
63	-2	2	2	2.796460		1.540560	31.97746			
64	0	2	2	2.785597		1.540560	32.10552			
65	-1	4	1	2.782388		1.540560	32.14355			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
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WELSFORD PORPHYRITIC GRANITE 74-47 WHITE PHENOCRYST: ALBITE —) 1987/ 1/29 . * . * . 3:9

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1430000	12.7770000	7.1540000	94.20000	116.55000	87.91700	664.0379 A**3
Reciprocal CELL:	0.1372831	0.0784770	0.1565790	86.34477	63.52498	90.23193	0.001505938 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL Syste
0 Conditions for non-Extinctions Called for Class Condition(s)

50	-2	8	0	R	1.457201	1.468353	1.540560	63.82217	63.28100	0.54117	1.00000

F I N A L V A L U E S for WELSFORD PORPHYRITIC GRANITE 74-47 WHITE PHENOCRYST: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1611365	12.8178552	7.1439332	94.04373	116.48136	88.62140	667.3266 A**3
Reciprocal CELL:	0.1369143	0.0781905	0.1567266	86.17141	63.55198	89.52708	0.001498517 A**-3

*— Direct Cell Corrections:
0.0000000 0.0000000 0.0000000 0.00000 0.00000 0.00000 0.000000

$— Direct Cell Standard ERRorS
0.0018987 0.0072033 0.0011275 0.01978 0.01632 0.01772 0.627547

£— Reciprocal Cell Standard ERRorS
0.000024479 0.000012318 0.000031851 0.0199168 0.0163794 0.0178535

WELSFORD PORPHYRITIC GRANITE 74-47 WHITE PHENOCRYST: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.789281		1.540560	6.90586			
2	1	0	0	7.303841		1.540560	12.10761			
3	-1	0	1	6.428382		1.540560	13.76399			
4	0	2	0	6.394641		1.540560	13.83697			
***	0	2	0	6.394641	6.380860	1.540560	13.83697	13.8670	-0.03003	1.00000
6	-1	1	0	6.365098		1.540560	13.90151			
***	1	1	0	6.320007	6.322786	1.540560	14.00118	13.9950	0.00618	1.00000
***	-1	-1	1	5.887183	5.883794	1.540560	15.03629	15.0450	-0.00871	1.00000
9	0	-1	1	5.868142		1.540560	15.08536			
***	-1	1	1	5.610120	5.609235	1.540560	15.78350	15.7860	-0.00250	1.00000

11	0	1	1	5.562959		1.540560	15.91817			
12	-1	2	0	4.831027		1.540560	18.34929			
13	1	2	0	4.791661		1.540560	18.50136			
14	-1	-2	1	4.676077		1.540560	18.96285			
15	0	-2	1	4.675524		1.540560	18.96511			
16	-1	2	1	4.403356		1.540560	20.14919			
17	0	2	1	4.373033		1.540560	20.29038			
18	0	3	0	4.263094		1.540560	20.81940			
***	-2	0	1	4.038115	4.034562	1.540560	21.99339	22.0130	-0.01961	1.00000
20	1	0	1	4.002610		1.540560	22.19095			
21	-2	-1	1	3.887900		1.540560	22.85436			
***	1	-1	1	3.871472	3.867592	1.540560	22.95266	22.9760	-0.02334	1.00000
23	-2	1	1	3.814604		1.540560	23.29960			
***	1	1	1	3.770342	3.770818	1.540560	23.57702	23.5740	0.00302	1.00000
***	-1	3	0	3.695120	3.700133	1.540560	24.06409	24.0310	0.03309	1.00000
***	1	3	0	3.668658	3.673777	1.540560	24.24029	24.2060	0.03429	1.00000
***	-1	-3	1	3.655327	3.660965	1.540560	24.33005	24.2920	0.03805	1.00000
28	-1	-3	1	3.655327		1.540560	24.33005			
29	2	0	0	3.651921		1.540560	24.35309			
30	-1	0	2	3.562830		1.540560	24.97175			
31	-2	1	0	3.519243		1.540560	25.28612			
32	2	1	0	3.503938		1.540560	25.39841			
***	-1	-1	2	3.496510	3.498304	1.540560	25.45327	25.4400	0.01327	1.00000
34	-2	-2	1	3.466585		1.540560	25.67672			
***	-2	-2	1	3.466585	3.465089	1.540560	25.67672	25.6880	-0.01128	1.00000
36	-1	3	1	3.458509		1.540560	25.73771			
37	0	3	1	3.440156		1.540560	25.87740			
***	-1	1	2	3.371199	3.373858	1.540560	26.41619	26.3950	0.02119	1.00000
39	-2	2	1	3.364364		1.540560	26.47084			
40	1	2	1	3.324100		1.540560	26.79740			
***	-2	0	2	3.214191	3.218485	1.540560	27.73174	27.6940	0.03774	1.00000
42	-1	-2	2	3.210145		1.540560	27.76739			
***	0	4	0	3.197320	3.196310	1.540560	27.88101	27.8900	-0.00899	1.00000
***	0	0	2	3.190269	3.190592	1.540560	27.94389	27.9410	0.00289	1.00000
45	-2	2	0	3.182549		1.540560	28.01305			
46	-2	-1	2	3.162446		1.540560	28.19480			
***	2	2	0	3.160004	3.160666	1.540560	28.21704	28.2110	0.00604	1.00000
48	0	-1	2	3.145136		1.540560	28.35321			
49	-2	1	2	3.073944		1.540560	29.02410			
50	0	1	2	3.047982		1.540560	29.27682			
51	-1	2	2	3.022987		1.540560	29.52437			
***	1	-3	1	2.988050	2.989083	1.540560	29.87756	29.8670	0.01056	1.00000
53	-2	-3	1	2.981433		1.540560	29.94543			
54	-2	-2	2	2.943591		1.540560	30.33958			
55	0	-4	1	2.938180		1.540560	30.39681			
56	-1	4	0	2.937892		1.540560	30.39986			
***	0	-2	2	2.934071	2.934015	1.540560	30.44041	30.4410	-0.00059	1.00000
58	-1	-4	1	2.933844		1.540560	30.44282			
59	1	4	0	2.920129		1.540560	30.58929			
60	-2	3	1	2.884353		1.540560	30.97815			
***	1	3	1	2.852687	2.851162	1.540560	31.33081	31.3480	-0.01719	1.00000
***	-1	-3	2	2.833967	2.834329	1.540560	31.54314	31.5390	0.00414	1.00000

Least Squares Unit Cell Refinement

N D S U version Fargo '86.12 after Appleman and Evans (1973).
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WELSFORD HOST ROCK 74-56: PLAGIOCLASE —) 1987/ 3/ 8 . * . * . 1:0

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1480000	12.8030000	7.1450000	94.04700	116.52900	88.46200	665.2062 A**3
Reciprocal CELL:	0.1371745	0.0783030	0.1567653	86.24415	63.51081	89.65940	0.001503293 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD HOST ROCK 74-56: PLAGIOCLASE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1474079	12.8043289	7.1446037	94.05013	116.53655	88.43384	665.0977 A**3
Reciprocal CELL:	0.1371940	0.0783003	0.1567849	86.25137	63.50462	89.72197	0.001503539 A**-3
*-- Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$-- Direct Cell Standard ERRorS	0.0017596	0.0067747	0.0013560	0.02232	0.01459	0.02195	0.542553
&-- Reciprocal Cell Standard ERRorS	0.000030219	0.000021227	0.000027706	0.0198684	0.0145469	0.0194158	

WELSFORD HOST ROCK 74-56: PLAGIOCLASE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.771339		1.540560	6.91558			
2	1	0	0	7.288948		1.540560	12.13244			
3	-1	0	1	6.426864		1.540560	13.76726			
4	0	2	0	6.385670		1.540560	13.85550			
***	0	2	0	6.385670	6.380860	1.540560	13.85650	13.8670	-0.01050	1.00000
6	-1	1	0	6.343758		1.540560	13.94851			
7	1	1	0	6.317308		1.540560	14.00720			
***	-1	-1	1	5.888431	5.894311	1.540560	15.03308	15.0180	0.01508	1.00000
9	0	-1	1	5.861376		1.540560	15.10288			
***	-1	1	1	5.803996	5.807470	1.540560	15.80085	15.7910	0.00985	1.00000
11	0	1	1	5.562628		1.540560	15.91912			

12	-1	2	0	4.814739		1.540560	18.41191			
13	1	2	0	4.791634		1.540560	18.50146			
14	-1	-2	1	4.676154		1.540560	18.96253			
15	0	-2	1	4.667863		1.540560	18.99652			
16	-1	2	1	4.396461		1.540560	20.18112			
17	0	2	1	4.372038		1.540560	20.29505			
18	0	3	0	4.257113		1.540560	20.84898			
***	-2	0	1	4.032925	4.032933	1.540560	22.02205	22.0220	0.00005	1.00000
20	1	0	1	3.996899		1.540560	22.22306			
21	-2	-1	1	3.886085		1.540560	22.86518			
***	1	-1	1	3.862804	3.863444	1.540560	23.00486	23.0010	0.00365	1.00000
23	-2	1	1	3.806623		1.540560	23.34913			
***	1	1	1	3.767890	3.765936	1.540560	23.59258	23.6050	-0.01242	1.00000
***	-1	3	0	3.683850	3.683522	1.540560	24.13882	24.1410	-0.00218	1.00000
***	1	3	0	3.668313	3.671835	1.540560	24.24261	24.2190	0.02351	1.00000
***	-1	-3	1	3.654263	3.654002	1.540560	24.33724	24.3390	-0.00176	1.00000
28	0	-3	1	3.652840		1.540560	24.34685			
29	2	0	0	3.644474		1.540560	24.40361			
30	-1	0	2	3.563221		1.540560	24.96837			
31	-2	1	0	3.509070		1.540560	25.36065			
32	2	1	0	3.500895		1.540560	25.42676			
***	-1	-1	2	3.496710	3.494115	1.540560	25.45179	25.4710	-0.01921	1.00000
***	-2	-2	1	3.466584	3.469871	1.540560	25.67673	25.6520	0.02473	1.00000
35	1	-2	1	3.456468		1.540560	25.75317			
36	-1	3	1	3.452553		1.540560	25.78288			
37	0	3	1	3.438566		1.540560	25.88957			
***	-1	1	2	3.371024	3.372352	1.540560	26.41759	26.4070	0.01059	1.00000
39	-2	2	1	3.355764		1.540560	26.53391			
40	1	2	1	3.323383		1.540560	26.80329			
***	-2	0	2	3.213432	3.215184	1.540560	27.73842	27.7230	0.01542	1.00000
42	-1	-2	2	3.209599		1.540560	27.77221			
43	0	4	0	3.192835		1.540560	27.92097			
***	0	0	2	3.189083	3.190480	1.540560	27.95449	27.9420	0.01249	1.00000
45	-2	2	0	3.171879		1.540560	28.10922			
46	-2	-1	2	3.162743		1.540560	28.19209			
***	2	2	0	3.158654	3.159898	1.540560	28.22934	28.2180	0.01134	1.00000
48	0	-1	2	3.142751		1.540560	28.37518			
49	-2	1	2	3.071846		1.540560	29.04436			
50	0	1	2	3.047599		1.540560	29.28058			
51	-1	2	2	3.022021		1.540560	29.53402			
52	-2	-3	1	2.981795		1.540560	29.94170			
***	1	-3	1	2.979477	2.977394	1.540560	29.96554	29.9870	-0.02146	1.00000
54	-2	-2	2	2.944216		1.540560	30.33300			
55	0	-4	1	2.932871		1.540560	30.45317			
***	0	-2	2	2.930688	2.932228	1.540560	30.47640	30.4600	0.01640	1.00000
57	0	-2	2	2.930688		1.540560	30.47640			
58	-1	4	0	2.929791		1.540560	30.48596			
59	1	4	0	2.913359		1.540560	30.59755			
60	-2	3	1	2.876554		1.540560	31.06426			
61	1	3	1	2.852444		1.540560	31.33354			
***	-1	-3	2	2.832719	2.832316	1.540560	31.55740	31.5520	-0.00460	1.00000

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
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micro

WELSFORD RED GRANITE 74-71: INTERMEDIATE MICROCLINE —) 1987/ 2/ 7 . * . * . 0:59

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5820000	12.9650000	7.2120000	90.40000	115.95000	88.35000	721.2287 A**3
Reciprocal CELL:	0.1296417	0.0771642	0.1542084	90.35817	64.05857	91.64036	0.001386523 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for. Class Condition(s)

F I N A L V A L U E S for WELSFORD RED GRANITE 74-71: INTERMEDIATE MICROCLINE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5883268	12.9609141	7.2177933	90.47628	115.98694	88.13823	721.3582 A**3
Reciprocal CELL:	0.1296139	0.0772289	0.1541651	90.37833	64.01134	91.83989	0.001386274 A**-3
*-- Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$-- Direct Cell Standard ERRorS	0.0021229	0.0079439	0.0016390	0.02650	0.01814	0.03080	0.734891
£-- Reciprocal Cell Standard ERRorS	0.000032168	0.000020373	0.000031012	0.0249115	0.0181187	0.0293542	

WELSFORD RED GRANITE 74-71: INTERMEDIATE MICROCLINE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.948519		1.540560	6.82084			
2	1	0	0	7.715222		1.540560	11.45980			
3	1	1	0	6.723499		1.540560	13.15711			
4	-1	0	1	6.586739		1.540560	13.43154			
5	-1	1	0	6.536240		1.540560	13.53579			
6	0	0	1	6.486551		1.540560	13.63997			
***	0	2	0	6.474259	6.463898	1.540560	13.66599	13.6880	-0.02201	1.00000
8	-1	-1	1	5.920574		1.540560	14.95100			
9	-1	1	1	5.822296		1.540560	15.20485			
10	0	1	1	5.814940		1.540560	15.22420			
11	0	-1	1	5.784269		1.540560	15.30540			

12	1	2	0	5.039763		1.540560	17.58315			
13	-1	2	0	4.882835		1.540560	18.15295			
14	-1	-2	1	4.665802		1.540560	19.00499			
15	0	2	1	4.597536		1.540560	19.28986			
16	-1	2	1	4.570176		1.540560	19.40646			
17	0	-2	1	4.567278		1.540560	19.41889			
18	0	3	0	4.316173		1.540560	20.56057			
***	-2	0	1	4.228363	4.226042	1.540560	20.99234	21.0040	-0.01166	1.00000
20	1	0	1	4.149273		1.540560	21.39715			
21	-2	-1	1	4.056629		1.540560	21.89177			
22	-2	1	1	3.983333		1.540560	22.29971			
***	1	1	1	3.976272	3.975537	1.540560	22.33982	22.3440	-0.00418	1.00000
***	1	-1	1	3.926908	3.929364	1.540560	22.62433	22.6100	0.01433	1.00000
25	2	0	0	3.857611		1.540560	23.03626			
***	1	3	0	3.819410	3.817447	1.540560	23.26987	23.2820	-0.01213	1.00000
27	2	1	0	3.729950		1.540560	23.83607			
***	-1	3	0	3.716291	3.717511	1.540560	23.92497	23.9170	0.00797	1.00000
29	-2	1	0	3.664970		1.540560	24.26505			
30	-1	-3	1	3.644897		1.540560	24.40073			
31	-1	0	2	3.607670		1.540560	24.65646			
32	0	3	1	3.604360		1.540560	24.67946			
33	-2	-2	1	3.591371		1.540560	24.77013			
34	0	-3	1	3.582473		1.540560	24.83263			
35	-1	3	1	3.576337		1.540560	24.87592			
36	1	2	1	3.528023		1.540560	25.22216			
37	-2	2	1	3.491184		1.540560	25.49276			
***	-1	-1	2	3.482214	3.480143	1.540560	25.55953	25.5750	-0.01547	1.00000
***	-1	1	2	3.468431	3.472533	1.540560	25.66283	25.6320	0.03083	1.00000
40	1	-2	1	3.459787		1.540560	25.72804			
41	2	2	0	3.361750		1.540560	26.49179			
***	-2	0	2	3.293370	3.295064	1.540560	27.05218	27.0380	0.01418	1.00000
***	-2	2	0	3.268120	3.264151	1.540560	27.26520	27.2990	-0.03380	1.00000
***	0	0	2	3.243275	3.241788	1.540560	27.47815	27.4910	-0.01285	1.00000
45	0	4	0	3.237130		1.540560	27.53134			
46	-2	-1	2	3.207657		1.540560	27.78936			
47	-2	1	2	3.176076		1.540560	28.07131			
48	-1	-2	2	3.161752		1.540560	28.20111			
49	0	1	2	3.150995		1.540560	28.29939			
50	0	-1	2	3.141203		1.540560	28.38945			
51	-1	2	2	3.141197		1.540560	28.38951			
52	-2	-3	1	3.068224		1.540560	29.07940			
***	1	3	1	3.023889	3.023925	1.540560	29.51536	29.5150	0.00036	1.00000
54	1	4	0	3.013821		1.540560	29.55602			
55	-2	3	1	2.974881		1.540560	30.01293			
56	-2	-2	2	2.960287		1.540560	30.16439			
57	1	-3	1	2.959631		1.540560	30.17124			
58	-1	4	0	2.951407		1.540560	30.25732			
59	-1	-4	1	2.929343		1.540560	30.49073			
60	2	3	0	2.923267		1.540560	30.55565			
61	-2	2	2	2.911148		1.540560	30.68597			
62	0	2	2	2.907470		1.540560	30.72575			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
Department of CHEMISTRY
NORTH DAKOTA STATE UNIVERSITY
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WELSFORD RED GRANITE 74-71: ALBITE —) 1987/ 2/ 6 . * . * . 1:48

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1380000	12.7890000	7.1560000	94.33300	116.56700	87.65000	664.2093 A**3
Reciprocal CELL:	0.1373912	0.0784189	0.1565611	86.32927	63.52584	90.46340	0.001505550 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD RED GRANITE 74-71: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1365379	12.7951212	7.1548627	94.23683	116.62677	87.80004	663.5172 A**3
Reciprocal CELL:	0.1374971	0.0784277	0.1566786	86.36022	63.45883	90.33833	0.001507120 A**-3

*— Direct Cell Corrections:

0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000

$— Direct Cell Standard ERRorS

0.0017481	0.0085918	0.0013756	0.02012	0.01749	0.01813	0.706224

£— Reciprocal Cell Standard ERRorS

0.000033784	0.000015243	0.000032121	0.0186037	0.0177907	0.0167803

WELSFORD RED GRANITE 74-71: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.750592		1.540560	6.92684			
2	1	0	0	7.272878		1.540560	12.15935			
3	-1	0	1	6.429577		1.540560	13.76142			
***	0	2	0	6.375295	6.381776	1.540560	13.87916	13.8650	0.01416	1.00000
5	0	2	0	6.375296		1.540560	13.87916			
6	1	1	0	6.333553		1.540560	13.97109			
7	-1	1	0	6.301443		1.540560	14.04264			
***	-1	-1	1	5.907611	5.907610	1.540560	14.98400	14.9840	-0.00000	1.00000
9	0	-1	1	5.858181		1.540560	15.11116			
10	-1	1	1	5.587697		1.540560	15.84724			
11	0	1	1	5.567666		1.540560	15.90462			

12	1	2	0	4.808226		1.540560	18.43705				
13	-1	2	0	4.780160		1.540560	18.54627				
14	-1	-2	1	4.692268		1.540560	18.89682				
15	0	-2	1	4.660923		1.540560	19.02507				
16	-1	2	1	4.378201		1.540560	20.26618				
17	0	2	1	4.373864		1.540560	20.28649				
18	0	3	0	4.250197		1.540560	20.88328				
***	-2	0	1	4.027720	4.028778	1.540560	22.05086	22.0450	0.00586	1.00000	
20	1	0	1	3.993063		1.540560	22.24468				
21	-2	-1	1	3.893121		1.540560	22.82330				
***	1	-1	1	3.850842	3.851716	1.540560	23.07731	23.0720	0.00531	1.00000	
23	-2	1	1	3.790262		1.540560	23.45135				
***	1	1	1	3.771544	3.772712	1.540560	23.56940	23.5620	0.00740	1.00000	
***	1	3	0	3.679016	3.678718	1.540560	24.17100	24.1730	-0.00200	1.00000	
***	-1	-3	1	3.664067	3.664085	1.540560	24.27113	24.2710	0.00013	1.00000	
27	-1	3	0	3.660139		1.540560	24.29757				
28	0	-3	1	3.645994		1.540560	24.39328				
29	2	0	0	3.636439		1.540560	24.45837				
30	-1	0	2	3.567544		1.540560	24.93822				
***	-1	-1	2	3.503402	3.503044	1.540560	25.40236	25.4050	-0.00264	1.00000	
32	2	1	0	3.502459		1.540560	25.40931				
33	-2	1	0	3.491567		1.540560	25.48991				
***	-2	-2	1	3.479094	3.480143	1.540560	25.58284	25.5750	0.00784	1.00000	
35	1	-2	1	3.441011		1.540560	25.87085				
36	0	3	1	3.438341		1.540560	25.89129				
37	-1	3	1	3.437857		1.540560	25.89501				
***	-1	1	2	3.371587	3.366842	1.540560	26.41310	26.4510	-0.03790	1.00000	
39	-2	2	1	3.335633		1.540560	26.70303				
40	1	2	1	3.329885		1.540560	25.74999				
41	-1	-2	2	3.216127		1.540560	27.71471				
***	-2	0	2	3.214789	3.213820	1.540560	27.72648	27.7350	-0.00852	1.00000	
43	0	0	2	3.191246		1.540560	27.93516				
***	0	4	0	3.187648	3.189361	1.540560	27.96733	27.9520	0.01533	1.00000	
45	-2	-1	2	3.169642		1.540560	28.12946				
***	2	2	0	3.166776	3.167156	1.540560	28.15545	28.1520	0.00345	1.00000	
***	-2	2	0	3.150721	3.149293	1.540560	28.30190	28.3150	-0.01310	1.00000	
48	0	-1	2	3.143109		1.540560	28.37188				
49	-2	1	2	3.067345		1.540560	29.08792				
50	0	1	2	3.050484		1.540560	29.25227				
51	-1	2	2	3.019652		1.540560	29.55772				
52	-2	-3	1	2.994007		1.540560	29.81674				
***	1	-3	1	2.964642	2.965126	1.540560	30.11903	30.1140	0.00503	1.00000	
***	-2	-2	2	2.953805	2.953535	1.540560	30.23216	30.2350	-0.00284	1.00000	
55	-1	-4	1	2.937942		1.540560	30.39933				
***	0	-2	2	2.929090	2.928661	1.540560	30.49342	30.4980	-0.00458	1.00000	
57	0	-4	1	2.927003		1.540560	30.51570				
58	1	4	0	2.925896		1.540560	30.52752				
59	-1	4	0	2.913219		1.540560	30.66362				
***	1	3	1	2.858616	2.859165	1.540560	31.26416	31.2580	0.00616	1.00000	
61	-2	3	1	2.857781		1.540560	31.27353				
62	-1	-3	2	2.837678		1.540560	31.50081				
63	-2	2	2	2.793848		1.540560	32.00815				

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
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WELSFORD GRANOPHYRIC GRANITE 74-73: INTERMEDIATE MICROCLINE —) 1987/ 1/27 . * . * . 3:49

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5820000	12.9650000	7.2120000	90.40000	115.95000	88.35000	721.2287 A**3
Reciprocal CELL:	0.1296417	0.0771642	0.1542084	90.35817	64.05057	91.64036	0.001386523 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD GRANOPHYRIC GRANITE 74-73: INTERMEDIATE MICROCLINE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5830592	12.9680938	7.2138033	90.54766	115.94481	88.15616	721.2277 A**3
Reciprocal CELL:	0.1296254	0.0771933	0.1541695	90.26860	64.05764	91.73949	0.001386525 A**-3
*— Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$— Direct Cell Standard ERRorS	0.0043856	0.0144300	0.0027520	0.06460	0.04210	0.04691	1.322683
&— Reciprocal Cell Standard ERRorS	0.000058698	0.000036108	0.000061986	0.0637710	0.0418624	0.0460225	

WELSFORD GRANOPHYRIC GRANITE 74-73: INTERMEDIATE MICROCLINE HKL Listing - *** Refers to FIXed, R to Rejects

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.954491		1.540560	6.81769			
2	1	0	0	7.714535		1.540560	11.46082			
3	1	1	0	6.718517		1.540560	13.16691			
4	-1	0	1	6.581352		1.540560	13.44258			
5	-1	1	0	6.541529		1.540560	13.52480			
***	0	0	1	6.486366	6.483226	1.540560	13.64036	13.6470	-0.00664	1.00000
7	0	2	0	6.477246		1.540560	13.65966			
8	-1	-1	1	5.918300		1.540560	14.95678			
9	-1	1	1	5.818099		1.540560	15.21588			
10	0	1	1	5.810864		1.540560	15.23494			

11	0	-1	1	5.789093		1.540560	15.29257			
12	1	2	0	5.036460		1.540560	17.59477			
13	-1	2	0	4.888062		1.540560	18.13337			
14	-1	-2	1	4.666051		1.540560	19.00397			
15	0	2	1	4.594106		1.540560	19.30440			
16	0	-2	1	4.572620		1.540560	19.39599			
17	-1	2	1	4.568439		1.540560	19.41391			
18	0	3	0	4.318164		1.540560	20.55099			
***	-2	0	1	4.225337	4.226838	1.540560	21.00754	21.0000	0.00754	1.00000
20	1	0	1	4.150311		1.540560	21.39173			
21	-2	-1	1	4.053307		1.540560	21.90994			
***	1	1	1	3.974813	3.978526	1.540560	22.34812	22.3270	0.02112	1.00000
23	1	1	1	3.974813		1.540560	22.34812			
***	1	-1	1	3.930410	3.929364	1.540560	22.60390	22.6100	-0.00610	1.00000
25	2	0	0	3.857267		1.540560	23.03834			
***	1	3	0	3.817754	3.820036	1.540560	23.28010	23.2660	0.01410	1.00000
27	2	1	0	3.727950		1.540560	23.84904			
***	-1	3	0	3.720210	3.717358	1.540560	23.89939	23.9180	-0.01861	1.00000
29	-2	1	0	3.666551		1.540560	24.25443			
30	-1	-3	1	3.645932		1.540560	24.39370			
31	-1	0	2	3.605905		1.540560	24.66872			
***	-2	-2	1	3.588869	3.596392	1.540560	24.78768	24.7350	0.05268	1.00000
33	-2	-2	1	3.588869		1.540560	24.78768			
34	0	-3	1	3.586736		1.540560	24.80265			
35	-1	3	1	3.575897		1.540560	24.87903			
36	1	2	1	3.525590		1.540560	25.23985			
37	-2	2	1	3.491010		1.540560	25.49404			
***	-1	-1	2	3.481924	3.474665	1.540560	25.56170	25.6160	-0.05430	1.00000
39	-1	1	2	3.465811		1.540560	25.68256			
40	1	-2	1	3.464207		1.540560	25.69466			
41	2	2	0	3.359258		1.540560	26.51180			
***	-2	0	2	3.290676	3.291839	1.540560	27.07475	27.0650	0.00975	1.00000
***	-2	2	0	3.270754	3.267321	1.540560	27.24274	27.2720	-0.02926	1.00000
***	0	0	2	3.243183	3.242945	1.540560	27.47895	27.4810	-0.00205	1.00000
45	0	4	0	3.238623		1.540560	27.51840			
46	-2	-1	2	3.205599		1.540560	27.80756			
47	-2	1	2	3.173418		1.540560	28.09531			
48	-1	-2	2	3.162681		1.540560	28.19266			
49	0	1	2	3.149569		1.540560	28.31247			
50	0	-1	2	3.142620		1.540560	28.37638			
51	-1	2	2	3.138640		1.540560	28.41312			
52	-2	-3	1	3.066699		1.540560	29.09418			
53	1	3	1	3.021619		1.540560	29.53804			
***	1	3	1	3.021619	3.019224	1.540560	29.53804	29.5620	-0.02396	1.00000
55	-2	3	1	2.975465		1.540560	30.00690			
56	1	-3	1	2.963807		1.540560	30.12772			
57	-2	-2	2	2.959150		1.540560	30.17626			
58	-1	4	0	2.954320		1.540560	30.22677			
59	-1	-4	1	2.930494		1.540560	30.47846			
60	2	3	0	2.921091		1.540560	30.57897			
61	-2	2	2	2.909049		1.540560	30.70865			
62	0	2	2	2.905432		1.540560	30.74784			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
Department of CHEMISTRY
NORTH DAKOTA STATE UNIVERSITY
Fargo 58105 - 5516

WELSFORD GRANOPHYRE 74-73: ALBITE --) 1987/ 3/ 2 . * . * . 0:15

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1380000	12.7830000	7.1550000	94.33300	116.56700	87.65000	564.2093 A**3
Reciprocal CELL:	0.1373912	0.0784189	0.1565611	86.32927	63.52584	90.46340	0.001505550 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.7 Dmin = 1.427460 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD GRANOPHYRE 74-73: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1379946	12.7911187	7.1550665	94.22523	116.59750	87.76911	653.9189 A**3
Reciprocal CELL:	0.1374237	0.0784244	0.1566185	86.38949	63.49033	90.38132	0.001506208 A**-3
*— Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$— Direct Cell Standard ERRorS	0.0013236	0.0043468	0.0008790	0.01685	0.01095	0.01218	0.383619
£— Reciprocal Cell Standard ERRorS	0.000019467	0.000011881	0.000018793	0.0167293	0.0110854	0.0121768	

WELSFORD GRANOPHYRE 74-73: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.751133		1.540560	6.92655			
2	1	0	0	7.276765		1.540560	12.15283			
3	-1	0	1	6.428898		1.540560	13.76288			
4	0	0	1	6.384942		1.540560	13.85809			
***	0	2	0	6.375567	6.376284	1.540560	13.87857	13.8770	0.00157	1.00000
6	1	1	0	6.338234		1.540560	13.96072			
7	-1	1	0	6.302020		1.540560	14.04135			
***	-1	-1	1	5.907432	5.903301	1.540560	14.98445	14.9350	-0.01055	1.00000
9	0	-1	1	5.858795		1.540560	15.10957			
***	-1	1	1	5.587048	5.595148	1.540560	15.84909	15.8260	0.02309	1.00000

11	0	1	1	5.570481		1.540560	15.89653			
12	1	2	0	4.811256		1.540560	18.42535			
13	-1	2	0	4.779619		1.540560	18.54838			
14	-1	-2	1	4.692406		1.540560	18.89625			
15	0	-2	1	4.560642		1.540560	19.02623			
16	-1	2	1	4.377835		1.540560	20.26789			
17	0	2	1	4.375849		1.540560	20.27719			
18	0	3	0	4.250378		1.540560	20.88239			
***	-2	0	1	4.028090	4.028958	1.540560	22.04881	22.0440	0.00481	1.00000
20	1	0	1	3.995713		1.540560	22.22974			
21	-2	-1	1	3.894030		1.540560	22.81790			
***	1	-1	1	3.852395	3.854352	1.540560	23.06788	23.0560	0.01188	1.00000
23	-2	1	1	3.790068		1.540560	23.45256			
***	1	1	1	3.774580	3.776662	1.540560	23.55017	23.5370	0.01317	1.00000
***	1	3	0	3.680841	3.680218	1.540560	24.15885	24.1630	-0.00415	1.00000
***	-1	-3	1	3.664267	3.663342	1.540560	24.26978	24.2760	-0.00622	1.00000
27	-1	3	0	3.659566		1.540560	24.30144			
28	0	-3	1	3.645601		1.540560	24.39595			
29	2	0	0	3.638382		1.540560	24.44510			
30	-1	0	2	3.567708		1.540560	24.93705			
31	2	1	0	3.504899		1.540560	25.39133			
***	-1	-1	2	3.503346	3.503993	1.540560	25.40277	25.3980	0.00477	1.00000
33	-2	1	0	3.492612		1.540560	25.48216			
34	-2	-2	1	3.480175		1.540560	25.57476			
35	1	-2	1	3.441553		1.540560	25.86671			
36	0	3	1	3.439628		1.540560	25.88144			
37	-1	3	1	3.437675		1.540560	25.89640			
***	-1	1	2	3.371935	3.369469	1.540560	26.41032	26.4300	-0.01968	1.00000
39	-2	2	1	3.335179		1.540560	26.70674			
40	1	2	1	3.332545		1.540560	26.72824			
***	-2	0	2	3.214449	3.216890	1.540560	27.72947	27.7080	0.02147	1.00000
42	-2	0	2	3.214449		1.540560	27.72947			
***	0	0	2	3.192471	3.191599	1.540560	27.92422	27.9320	-0.00778	1.00000
44	0	4	0	3.187783		1.540560	27.96612			
45	-2	-1	2	3.169416		1.540560	28.13151			
***	2	2	0	3.169117	3.166825	1.540560	28.13422	28.1550	-0.02078	1.00000
***	-2	2	0	3.151010	3.150601	1.540560	28.29925	28.3030	-0.00375	1.00000
48	0	-1	2	3.143876		1.540560	28.36481			
49	-2	1	2	3.066975		1.540560	29.09150			
50	0	1	2	3.051937		1.540560	29.23803			
51	-1	2	2	3.020066		1.540560	29.55357			
52	-2	-3	1	2.994985		1.540560	29.80678			
***	1	-3	1	2.964640	2.965703	1.540560	30.11905	30.1080	0.01105	1.00000
***	-2	-2	2	2.953716	2.952581	1.540560	30.23310	30.2450	-0.01190	1.00000
55	-1	-4	1	2.938128		1.540560	30.39736			
***	0	-2	2	2.929398	2.929224	1.540560	30.49015	30.4920	-0.00185	1.00000
57	1	4	0	2.927060		1.540560	30.51508			
58	0	-4	1	2.926679		1.540560	30.51916			
59	-1	4	0	2.912776		1.540560	30.66840			
60	1	3	1	2.860672		1.540560	31.24112			
61	-2	3	1	2.857305		1.540560	31.27888			

*** -1 -3 2 2.837459 2.839419 1.540560 31.50Least Squares Unit Cell Refi

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
Department of CHEMISTRY
NORTH DAKOTA STATE UNIVERSITY
Fargo 58105 - 5516

WELSFORD MICROGRANITE 74-74: INTERMEDIATE MICROCLINE —) 1987/ 3/ 2 . * . * . 0:37

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5820000	12.9650000	7.2120000	90.40000	115.95000	88.35000	721.2287 A**3
Reciprocal CELL:	0.1296417	0.0771642	0.1542084	90.35817	64.05057	91.64036	0.001386523 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD MICROGRANITE 74-74: INTERMEDIATE MICROCLINE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5785690	12.9756852	7.2111827	90.39007	116.01039	88.45685	720.6398 A**3
Reciprocal CELL:	0.1297667	0.0771442	0.1543128	90.31955	63.99176	91.52775	0.001387655 A**-3

*-- Direct Cell Corrections:
0.0000000 0.0000000 0.0000000 0.00000 0.00000 0.00000 0.000000

$-- Direct Cell Standard ERRorS
0.0049954 0.0211633 0.0036440 0.04817 0.04701 0.05539 1.980680

@-- Reciprocal Cell Standard ERRorS
0.000080211 0.000025856 0.000079178 0.0439520 0.0469811 0.0517559

WELSFORD MICROGRANITE 74-74: INTERMEDIATE MICROCLINE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2-Theta Calc	2-Theta Obs	2-Theta Diff	Weight
1	0	1	0	12.962743		1.540560	6.81334			
2	1	0	0	7.706139		1.540560	11.47335			
3	1	1	0	6.702985		1.540560	13.19756			
4	-1	0	1	6.582167		1.540560	13.44091			
5	-1	1	0	6.547793		1.540560	13.51180			
6	0	2	0	6.481371		1.540560	13.65092			
***	0	2	0	6.481371	6.469072	1.540560	13.65092	13.6770	-0.02608	1.00000
***	-1	-1	1	5.909856	5.894311	1.540560	14.97827	15.0180	-0.03973	1.00000
9	-1	1	1	5.828787		1.540560	15.18781			
10	0	1	1	5.809352		1.540560	15.23893			
11	0	-1	1	5.783493		1.540560	15.30747			

12	1	2	0	5.026666		1.540560	17.62933			
13	-1	2	0	4.896327		1.540560	18.10251			
14	-1	-2	1	4.858256		1.540560	19.03606			
15	0	2	1	4.595491		1.540560	19.29853			
16	-1	2	1	4.579249		1.540560	19.36764			
17	0	-2	1	4.569932		1.540560	19.40750			
18	0	3	0	4.320914		1.540560	20.53776			
***	-2	0	1	4.224672	4.224053	1.540560	21.01089	21.0140	-0.00311	1.00000
20	1	0	1	4.144341		1.540560	21.42291			
21	-2	-1	1	4.047369		1.540560	21.94248			
22	-2	1	1	3.986782		1.540560	22.28017			
***	1	1	1	3.968163	3.958224	1.540560	22.38606	22.4430	-0.05694	1.00000
***	1	-1	1	3.927158	3.929536	1.540560	22.62287	22.6090	0.01387	1.00000
25	2	0	0	3.853070		1.540560	23.06378			
***	1	3	0	3.812490	3.816154	1.540560	23.31270	23.2900	0.02270	1.00000
***	-1	3	0	3.726736	3.733820	1.540560	23.85693	23.8110	0.04593	1.00000
28	2	1	0	3.720552		1.540560	23.89716			
29	-2	1	0	3.666762		1.540560	24.25302			
30	-1	-3	1	3.640833		1.540560	24.42839			
31	-1	0	2	3.604960		1.540560	24.67529			
32	0	3	1	3.604333		1.540560	24.67965			
33	0	-3	1	3.585824		1.540560	24.80906			
***	-1	3	1	3.584129	3.584655	1.540560	24.82098	24.8170	0.00398	1.00000
35	-2	-2	1	3.581389		1.540560	24.84027			
36	1	2	1	3.520297		1.540560	25.27843			
37	-2	2	1	3.498481		1.540560	25.43869			
***	-1	-1	2	3.478785	3.474665	1.540560	25.58515	25.5160	-0.03085	1.00000
39	-1	1	2	3.467549		1.540560	25.66947			
40	1	-2	1	3.463542		1.540560	25.69967			
41	2	2	0	3.351493		1.540560	26.57435			
***	-2	0	2	3.291083	3.292555	1.540560	27.07133	27.0590	0.01233	1.00000
***	-2	2	0	3.273897	3.266262	1.540560	27.21617	27.2640	-0.04783	1.00000
***	0	0	2	3.240172	3.241326	1.540560	27.50438	27.4950	0.00998	1.00000
45	0	0	2	3.240172		1.540560	27.50438			
46	-2	-1	2	3.202976		1.540560	27.83079			
47	-2	1	2	3.176944		1.540560	28.06348			
48	-1	-2	2	3.158855		1.540560	28.22751			
49	0	1	2	3.147590		1.540560	28.33064			
50	-1	2	2	3.142082		1.540560	28.38134			
51	0	-1	2	3.139341		1.540560	28.40664			
52	-2	-3	1	3.050153		1.540560	29.15780			
53	1	3	1	3.018084		1.540560	29.57343			
***	1	3	1	3.018084	3.013046	1.540560	29.57343	29.6240	-0.05057	1.00000
55	-2	3	1	2.982824		1.540560	29.93113			
56	1	-3	1	2.954568		1.540560	30.11980			
57	-1	4	0	2.959227		1.540560	30.17545			
58	-2	-2	2	2.954928		1.540560	30.22040			
59	-1	-4	1	2.927319		1.540560	30.51232			
60	2	3	0	2.914623		1.540560	30.64849			
61	-2	2	2	2.914394		1.540560	30.65096			
62	0	4	1	2.904954		1.540560	30.75302			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
Department of CHEMISTRY
NORTH DAKOTA STATE UNIVERSITY
Fargo 58105 - 5516

WELSFORD MICROGRANITE 74-74: ALBITE —) 1987/ 1/28 . * . * . 0:15

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1380000	12.7890000	7.1560000	94.33300	116.56700	87.65000	664.2093 A**3
Reciprocal CELL:	0.1373912	0.0784189	0.1565611	86.32927	63.52584	90.46340	0.001505550 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.6 Dmin = 1.428199 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD MICROGRANITE 74-74: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1370545	12.7919558	7.1565965	94.22335	116.58157	87.77985	664.2556 A**3
Reciprocal CELL:	0.1374160	0.0784058	0.1565581	86.38678	63.58570	90.37159	0.001505445 A**-3
*— Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$— Direct Cell Standard ERRorS	0.0010027	0.0051990	0.0010289	0.01153	0.01125	0.01117	0.437609
£— Reciprocal Cell Standard ERRorS	0.000023850	0.000008157	0.000017196	0.0115313	0.0113699	0.0113643	

WELSFORD MICROGRANITE 74-74: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.754157		1.540560	6.92491			
2	1	0	0	7.277173		1.540560	12.15214			
3	-1	0	1	6.428850		1.540560	13.76298			
4	0	0	1	6.387403		1.540560	13.85273			
***	0	2	0	6.377078	6.376284	1.540560	13.87526	13.8770	-0.00174	1.00000
6	1	1	0	6.338404		1.540560	13.96035			
7	-1	1	0	6.303114		1.540560	14.03890			
8	-1	-1	1	5.907334		1.540560	14.98470			
9	0	-1	1	5.861011		1.540560	15.10383			
***	-1	1	1	5.587575	5.584979	1.540560	15.84759	15.8550	-0.00741	1.00000

11	0	1	1	5.572350		1.540560	15.89116			
12	1	2	0	4.811612		1.540560	18.42398			
13	-1	2	0	4.780776		1.540560	18.54386			
14	-1	-2	1	4.692629		1.540560	18.89535			
15	0	-2	1	4.662210		1.540560	19.01977			
16	-1	2	1	4.378603		1.540560	20.26430			
17	0	2	1	4.377113		1.540560	20.27127			
18	0	3	0	4.251386		1.540560	20.87738			
***	-2	0	1	4.027587	4.028236	1.540560	22.05160	22.0480	0.00360	1.00000
20	1	0	1	3.997066		1.540560	22.22211			
21	-2	-1	1	3.893450		1.540560	22.82135			
***	1	-1	1	3.853803	3.855177	1.540560	23.05934	23.0510	0.00834	1.00000
23	-2	1	1	3.789925		1.540560	23.45346			
***	1	1	1	3.775694	3.771765	1.540560	23.54312	23.5680	-0.02488	1.00000
***	1	3	0	3.681272	3.680668	1.540560	24.15598	24.1600	-0.00402	1.00000
26	-1	-3	1	3.664646		1.540560	24.26723			
***	-1	3	0	3.660533	3.661411	1.540560	24.29492	24.2890	0.00592	1.00000
28	0	-3	1	3.646710		1.540560	24.38842			
29	2	0	0	3.638587		1.540560	24.44371			
30	-1	0	2	3.568503		1.540560	24.93142			
31	2	1	0	3.504985		1.540560	25.39069			
***	-1	-1	2	3.504090	3.504265	1.540560	25.39729	25.3960	0.00129	1.00000
33	-2	1	0	3.493012		1.540560	25.47919			
34	-2	-2	1	3.479793		1.540560	25.57761			
35	1	-2	1	3.442815		1.540560	25.85707			
36	0	3	1	3.440534		1.540560	25.87450			
37	-1	3	1	3.438414		1.540560	25.89074			
***	-1	1	2	3.372725	3.369344	1.540560	26.40403	26.4310	-0.02697	1.00000
39	-2	2	1	3.335377		1.540560	26.70512			
40	1	2	1	3.333402		1.540560	26.72124			
41	-1	-2	2	3.216603		1.540560	27.71053			
***	-2	0	2	3.214425	3.215298	1.540560	27.72968	27.7220	0.00768	1.00000
***	0	0	2	3.193702	3.191599	1.540560	27.91324	27.9320	-0.01876	1.00000
***	0	4	0	3.188539	3.188914	1.540560	27.95935	27.9560	0.00335	1.00000
45	-2	-1	2	3.169328		1.540560	28.13231			
***	2	2	0	3.169202	3.168148	1.540560	28.13345	28.1430	-0.00955	1.00000
***	-2	2	0	3.151557	3.153002	1.540560	28.29424	28.2810	0.01324	1.00000
48	0	-1	2	3.145103		1.540560	28.35351			
49	-2	1	2	3.067097		1.540560	29.09032			
50	0	1	2	3.053049		1.540560	29.22715			
51	-1	2	2	3.020880		1.540560	29.54623			
52	-2	-3	1	2.994841		1.540560	29.80824			
***	1	-3	1	2.965687	2.966184	1.540560	30.10816	30.1030	0.00516	1.00000
***	-2	-2	2	2.953667	2.956591	1.540560	30.23361	30.2030	0.03061	1.00000
55	-1	-4	1	2.938538		1.540560	30.39302			
***	0	-2	2	2.930505	2.929036	1.540560	30.47834	30.4940	-0.01566	1.00000
57	0	-4	1	2.927511		1.540560	30.51027			
58	1	4	0	2.927487		1.540560	30.51053			
59	-1	4	0	2.913562		1.540560	30.65993			
60	1	3	1	2.861339		1.540560	31.23365			
61	-2	3	1	2.857683		1.540560	31.27463			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
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Fargo 58105 - 5516

WELSFORD GRANITE 74-76: MICROCLINE —) 1987/ 2/ 6 . * . * . 1:26

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5850000	12.9650000	7.2180000	90.61700	115.93300	87.71700	721.9057 A**3
Reciprocal CELL:	0.1296235	0.0771941	0.1540592	90.42416	64.07060	92.23862	0.001385223 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD GRANITE 74-76: MICROCLINE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5957264	12.9717037	7.2173188	90.52092	115.97493	87.95540	722.7300 A**3
Reciprocal CELL:	0.1294961	0.0771747	0.1541145	90.41707	64.03037	92.02145	0.001383643 A**-3
*— Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$— Direct Cell Standard ERRorS	0.0030948	0.0122265	0.0019559	0.02958	0.02620	0.01833	1.112862
&— Reciprocal Cell Standard ERRorS	0.000047072	0.000018187	0.000046338	0.0312757	0.0261600	0.0208464	

WELSFORD GRANITE 74-76: MICROCLINE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.957618		1.540560	6.81604			
2	1	0	0	7.722243		1.540560	11.44934			
3	1	1	0	6.738902		1.540560	13.12691			
4	-1	0	1	6.588618		1.540560	13.42769			
5	-1	1	0	6.533004		1.540560	13.54253			
***	0	2	0	6.478809	6.488431	1.540560	13.65635	13.6360	0.02035	1.00000
7	0	2	0	6.478809		1.540560	13.65635			
***	-1	-1	1	5.927611	5.920575	1.540560	14.93315	14.9510	-0.01785	1.00000
9	-1	1	1	5.819864		1.540560	15.21124			
***	-1	1	1	5.819864	5.814635	1.540560	15.21124	15.2250	-0.01376	1.00000

11	0	-1	1	5.785048		1.540560	15.30333			
12	1	2	0	5.051853		1.540560	17.54074			
13	-1	2	0	4.879336		1.540560	18.16608			
14	-1	-2	1	4.672878		1.540560	18.97595			
15	0	2	1	4.601474		1.540560	19.27320			
16	0	-2	1	4.568100		1.540560	19.41536			
17	-1	2	1	4.567996		1.540560	19.41581			
18	0	3	0	4.319206		1.540560	20.54597			
***	-2	0	1	4.231078	4.230423	1.540560	20.97872	20.9820	-0.00328	1.00000
20	1	0	1	4.152102		1.540560	21.38240			
21	-2	-1	1	4.062932		1.540560	21.85739			
22	-2	1	1	3.982444		1.540560	22.30475			
***	1	1	1	3.981485	3.976943	1.540560	22.31020	22.3360	-0.02580	1.00000
***	1	-1	1	3.927194	3.939511	1.540560	22.62266	22.5510	0.07166	1.00000
25	2	0	0	3.861121		1.540560	23.01503			
***	1	3	0	3.827576	3.829289	1.540560	23.21353	23.2090	0.01053	1.00000
27	2	1	0	3.736576		1.540560	23.79318			
***	-1	3	0	3.714229	3.713839	1.540560	23.93845	23.9410	-0.00255	1.00000
29	-2	1	0	3.665126		1.540560	24.26401			
30	-1	-3	1	3.650407		1.540560	24.36334			
31	-1	0	2	3.608303		1.540560	24.65207			
***	-2	-2	1	3.598848	3.607304	1.540560	24.71786	24.6590	0.05886	1.00000
33	-2	-2	1	3.598848		1.540560	24.71786			
34	0	-3	1	3.583467		1.540560	24.82564			
***	-1	3	1	3.575194	3.574064	1.540560	24.88400	24.8920	-0.00800	1.00000
36	1	2	1	3.533936		1.540560	25.17926			
37	-2	2	1	3.488818		1.540560	25.51033			
***	-1	-1	2	3.483600	3.485503	1.540560	25.54919	25.5350	0.01419	1.00000
***	-1	1	2	3.468537	3.470002	1.540560	25.66203	25.6450	0.01703	1.00000
40	1	-2	1	3.458888		1.540560	25.73484			
***	2	2	0	3.369451	3.371850	1.540560	26.43014	26.4110	0.01914	1.00000
***	-2	0	2	3.294309	3.294347	1.540560	27.04432	27.0440	0.00032	1.00000
43	-2	2	0	3.266502		1.540560	27.27897			
***	0	0	2	3.244340	3.243524	1.540560	27.46895	27.4760	-0.00705	1.00000
45	0	4	0	3.239405		1.540560	27.51163			
46	-2	-1	2	3.210190		1.540560	27.76699			
47	-2	1	2	3.175573		1.540560	28.07585			
48	-1	-2	2	3.163666		1.540560	28.18370			
49	0	1	2	3.152602		1.540560	28.28466			
50	0	-1	2	3.141807		1.540560	28.38389			
51	-1	2	2	3.141196		1.540560	28.38952			
52	-2	-3	1	3.075063		1.540560	29.01331			
***	1	3	1	3.029275	3.029144	1.540560	29.46169	29.4630	-0.00131	1.00000
54	1	4	0	3.025523		1.540560	29.49906			
55	-2	3	1	2.972544		1.540560	30.03708			
56	-2	-2	2	2.963806		1.540560	30.12773			
***	1	-3	1	2.958600	2.958983	1.540560	30.18200	30.1780	0.00400	1.00000
58	-1	4	0	2.950329		1.540560	30.26863			
59	-1	-4	1	2.933523		1.540560	30.44623			
60	2	3	0	2.930414		1.540560	30.47931			
61	-2	2	2	2.909932		1.540560	30.69911			
62	0	2	2	2.909433		1.540560	30.70450			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
Department of CHEMISTRY
NORTH DAKOTA STATE UNIVERSITY
Fargo 58105 - 5516

WELSFORD GRANITE 74-76: ALBITE —) 1987/ 1/28 . * . * . 0:22

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1380000	12.7890000	7.1560000	94.33300	116.56700	87.65000	664.2093 A**3
Reciprocal CELL:	0.1373912	0.0784189	0.1565611	86.32927	63.52584	90.46340	0.001505550 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD GRANITE 74-76: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1381568	12.7941876	7.1611282	94.28502	116.59170	87.69920	664.6695 A**3
Reciprocal CELL:	0.1374194	0.0784047	0.1564841	86.35771	63.49909	90.43022	0.001504507 A**-3
*— Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$— Direct Cell Standard ERRorS	0.0017636	0.0061551	0.0009201	0.01999	0.01305	0.01512	0.539473
£— Reciprocal Cell Standard ERRorS	0.000017608	0.000016163	0.000028557	0.0202054	0.0129831	0.0155452	

WELSFORD GRANITE 74-76: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.754342		1.540560	6.92481			
2	1	0	0	7.276995		1.540560	12.15244			
3	-1	0	1	6.431400		1.540560	13.75750			
***	0	2	0	6.377171	6.387736	1.540560	13.87506	13.8520	0.02306	1.00000
5	0	2	0	6.377171		1.540560	13.87506			
6	1	1	0	6.341118		1.540560	13.95434			
7	-1	1	0	6.300261		1.540560	14.04529			
8	-1	-1	1	5.912819		1.540560	14.97072			
9	0	-1	1	5.864545		1.540560	15.09467			
***	-1	1	1	5.586319	5.589533	1.540560	15.85117	15.8420	0.00917	1.00000

11	0	1	1	5.573357		1.540560	15.88828			
12	1	2	0	4.814058		1.540560	18.41453			
13	-1	2	0	4.778356		1.540560	18.55333			
14	-1	-2	1	4.697154		1.540560	18.87698			
15	0	-2	1	4.664610		1.540560	19.00989			
16	0	2	1	4.377131		1.540560	20.27118			
17	-1	2	1	4.376604		1.540560	20.27365			
18	0	3	0	4.251447		1.540560	20.87707			
***	-2	0	1	4.028023	4.028537	1.540560	22.04918	22.0460	0.00318	1.00000
20	1	0	1	3.997875		1.540560	22.21756			
21	-2	-1	1	3.895498		1.540560	22.80919			
***	1	-1	1	3.854237	3.858810	1.540560	23.05670	23.0290	0.02770	1.00000
23	-2	1	1	3.788774		1.540560	23.46069			
***	1	1	1	3.776658	3.780304	1.540560	23.53703	23.5140	0.02303	1.00000
25	1	3	0	3.682940		1.540560	24.14487			
26	-1	-3	1	3.667654		1.540560	24.24702			
***	-1	3	0	3.658928	3.661411	1.540560	24.30573	24.2890	0.01673	1.00000
28	0	-3	1	3.648165		1.540560	24.37855			
29	2	0	0	3.638497		1.540560	24.44432			
30	-1	0	2	3.570450		1.540560	24.91760			
31	-1	-1	2	3.506919		1.540560	25.37646			
***	-1	-1	2	3.506919	3.506030	1.540560	25.37646	25.3830	-0.00654	1.00000
33	-2	1	0	3.491998		1.540560	25.48671			
34	-2	-2	1	3.482445		1.540560	25.55781			
35	1	-2	1	3.442924		1.540560	25.85623			
36	0	3	1	3.440323		1.540560	25.87612			
37	-1	3	1	3.436778		1.540560	25.90328			
***	-1	1	2	3.373499	3.371850	1.540560	26.39786	26.4110	-0.01314	1.00000
39	1	2	1	3.334267		1.540560	26.71418			
40	-2	2	1	3.333568		1.540560	26.71989			
41	-1	-2	2	3.219558		1.540560	27.68458			
***	-2	0	2	3.215700	3.216890	1.540560	27.71846	27.7080	0.01046	1.00000
***	0	0	2	3.195213	3.194514	1.540560	27.89977	27.9060	-0.00623	1.00000
***	0	4	0	3.188585	3.190816	1.540560	27.95894	27.9390	0.01994	1.00000
45	-2	-1	2	3.171630		1.540560	28.11147			
***	2	2	0	3.170559	3.169804	1.540560	28.12116	28.1280	-0.00684	1.00000
***	-2	2	0	3.150131	3.152674	1.540560	28.30732	28.2840	0.02332	1.00000
48	0	-1	2	3.146914		1.540560	28.33685			
49	-2	1	2	3.067233		1.540560	29.08901			
50	0	1	2	3.054037		1.540560	29.21748			
51	-1	2	2	3.020736		1.540560	29.54687			
52	-2	-3	1	2.997294		1.540560	29.78328			
***	1	-3	1	2.965634	2.964164	1.540560	30.10871	30.1240	-0.01529	1.00000
54	-2	-2	2	2.956410		1.540560	30.20490			
55	-1	-4	1	2.940533		1.540560	30.37189			
56	0	-2	2	2.932273		1.540560	30.45953			
57	1	4	0	2.928618		1.540560	30.49846			
***	0	-4	1	2.928427	2.928380	1.540560	30.50050	30.5010	-0.00050	1.00000
59	-1	4	0	2.912495		1.540560	30.67143			
60	1	3	1	2.862017		1.540560	31.22606			
61	-2	3	1	2.855905		1.540560	31.29460			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
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WELSFORD ARFVEDSONITE GRANITE 74-78: MICROCLINE —) 1987/ 2/19 . * . * . 0:41

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5850000	12.9650000	7.2180000	90.61700	115.93300	87.71700	721.9057 A**3
Reciprocal CELL:	0.1296235	0.0771941	0.1540592	90.42416	64.07060	92.23862	0.001385223 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD ARFVEDSONITE GRANITE 74-78: MICROCLINE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5778570	12.9737272	7.2196408	90.50914	115.94874	87.89488	721.8789 A**3
Reciprocal CELL:	0.1297383	0.0771462	0.1540322	90.45834	64.05472	92.09372	0.001385274 A**-3
*-- Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$-- Direct Cell Standard ERRorS	0.0031018	0.0138861	0.0021519	0.02930	0.02898	0.03098	1.284939
&-- Reciprocal Cell Standard ERRorS	0.000047423	0.000019977	0.000050730	0.0272705	0.0288800	0.0291809	

WELSFORD ARFVEDSONITE GRANITE 74-78: MICROCLINE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.962394		1.540560	6.81353			
2	1	0	0	7.707827		1.540560	11.47083			
3	1	1	0	6.733999		1.540560	13.13651			
4	-1	0	1	6.583909		1.540560	13.43734			
5	-1	1	0	6.521225		1.540560	13.56710			
6	0	0	1	6.492148		1.540560	13.62816			
***	0	2	0	6.481197	6.479918	1.540560	13.65129	13.6540	-0.00271	1.00000
8	-1	-1	1	5.925811		1.540560	14.93822			
9	0	1	1	5.823473		1.540560	15.20176			
10	-1	1	1	5.816128		1.540560	15.22107			

11	0	-1	1	5.786287		1.540560	15.30004			
12	1	2	0	5.052331		1.540560	17.53907			
13	-1	2	0	4.873661		1.540560	18.18741			
14	-1	-2	1	4.673046		1.540560	18.97526			
15	0	2	1	4.605222		1.540560	19.25736			
16	0	-2	1	4.568529		1.540560	19.41352			
17	-1	2	1	4.566369		1.540560	19.42279			
18	0	3	0	4.320798		1.540560	20.53832			
***	-2	0	1	4.222888	4.223060	1.540560	21.01986	21.0190	0.00086	1.00000
20	1	0	1	4.158604		1.540560	21.39021			
21	-2	-1	1	4.057016		1.540560	21.88966			
22	1	1	1	3.981667		1.540560	22.30916			
23	-2	1	1	3.974630		1.540560	22.34917			
***	1	-1	1	3.924751	3.922173	1.540560	22.63693	22.6520	-0.01507	1.00000
25	2	0	0	3.853913		1.540560	23.05866			
***	1	3	0	3.829138	3.825874	1.540560	23.20992	23.2300	-0.02008	1.00000
27	2	1	0	3.731523		1.540560	23.82587			
***	-1	3	0	3.711612	3.709563	1.540560	23.95558	23.9650	-0.01342	1.00000
29	-2	1	0	3.657778		1.540560	24.31350			
30	-1	-3	1	3.651249		1.540560	24.35764			
31	0	3	1	3.610333		1.540560	24.63799			
32	-1	0	2	3.609421		1.540560	24.64431			
***	-2	-2	1	3.595870	3.597108	1.540560	24.73865	24.7300	0.00865	1.00000
34	0	-3	1	3.583788		1.540560	24.82338			
***	-1	3	1	3.574701	3.578025	1.540560	24.88749	24.8640	0.02349	1.00000
36	1	2	1	3.535310		1.540560	25.16931			
***	-1	-1	2	3.484538	3.486175	1.540560	25.54220	25.5300	0.01220	1.00000
38	-2	2	1	3.483085		1.540560	25.55303			
***	-1	1	2	3.469780	3.471068	1.540560	25.65268	25.6430	0.00968	1.00000
40	1	-2	1	3.456596		1.540560	25.75220			
41	2	2	0	3.367000		1.540560	26.44974			
***	-2	0	2	3.291954	3.291242	1.540560	27.06403	27.0700	-0.00597	1.00000
***	-2	2	0	3.260613	3.263582	1.540560	27.32920	27.3030	0.02620	1.00000
44	0	0	2	3.246074		1.540560	27.45399			
***	0	4	0	3.240598	3.242482	1.540560	27.50129	27.4850	0.01629	1.00000
46	-2	-1	2	3.208392		1.540560	27.78286			
47	-2	1	2	3.173235		1.540560	28.09696			
48	-1	-2	2	3.164457		1.540560	28.17651			
49	0	1	2	3.154794		1.540560	28.26461			
50	0	-1	2	3.142922		1.540560	28.37360			
51	-1	2	2	3.142442		1.540560	28.37803			
52	-2	-3	1	3.074041		1.540560	29.02317			
53	1	3	1	3.031048		1.540560	29.44407			
***	1	3	1	3.031048	3.026833	1.540560	29.44407	29.4860	-0.04193	1.00000
55	-2	3	1	2.968816		1.540560	30.07569			
56	-2	-2	2	2.962805		1.540560	30.13815			
***	1	-3	1	2.956889	2.957452	1.540560	30.19988	30.1940	0.00588	1.00000
58	-1	4	0	2.949073		1.540560	30.28183			
59	-1	-4	1	2.934466		1.540560	30.43621			
60	2	3	0	2.929738		1.540560	30.48651			
61	0	2	2	2.911737		1.540560	30.67962			
62	0	4	1	2.908770		1.540560	30.71168			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
Department of CHEMISTRY
NORTH DAKOTA STATE UNIVERSITY
Fargo 58105 - 5516

WELSFORD ARFVEDSONITE GRANITE 74-78: ALBITE --) 1987/ 2/14 . * . * . 1:18

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1380000	12.7890000	7.1560000	94.33300	116.56700	87.65000	664.2093 A**3
Reciprocal CELL:	0.1373912	0.0784189	0.1565611	86.32927	63.52584	90.46340	0.001505558 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.7 Dmin = 1.427188 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD ARFVEDSONITE GRANITE 74-78: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1389970	12.8016671	7.1601271	94.27634	116.61609	87.67475	664.7114 A**3
Reciprocal CELL:	0.1374385	0.0783779	0.1565439	86.37894	63.47626	90.45996	0.001504412 A**-3
*-- Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$-- Direct Cell Standard ERRorS	0.0011128	0.0057826	0.0008341	0.01145	0.01149	0.00705	0.492110
£-- Reciprocal Cell Standard ERRorS	0.000019950	0.000087216	0.000019917	0.0120712	0.0115308	0.0082267	

WELSFORD ARFVEDSONITE GRANITE 74-78: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.758705		1.540560	6.92243			
2	1	0	0	7.275982		1.540560	12.15414			
3	-1	0	1	6.432091		1.540560	13.75602			
4	0	0	1	6.387984		1.540560	13.85146			
***	0	2	0	6.379352	6.379944	1.540560	13.87029	13.8690	0.00129	1.00000
6	1	1	0	6.342406		1.540560	13.95149			
7	-1	1	0	6.298736		1.540560	14.04871			
***	-1	-1	1	5.914008	5.907218	1.540560	14.96770	14.9850	-0.01730	1.00000
9	0	-1	1	5.862170		1.540560	15.10082			
***	-1	1	1	5.586955	5.596202	1.540560	15.84936	15.8230	0.02636	1.00000

11	0	1	1	5.572883		1.540560	15.88964			
12	1	2	0	4.815948		1.540560	18.40724			
13	-1	2	0	4.777770		1.540560	18.55562			
14	-1	-2	1	4.698512		1.540560	18.87147			
15	0	-2	1	4.663595		1.540560	19.01407			
16	0	2	1	4.377810		1.540560	20.26801			
17	-1	2	1	4.377350		1.540560	20.27016			
18	0	3	0	4.252902		1.540560	20.86386			
***	-2	0	1	4.028631	4.030222	1.540560	22.04581	22.0370	0.00881	1.00000
20	1	0	1	3.996178		1.540560	22.22712			
21	-2	-1	1	3.896564		1.540560	22.80287			
***	1	-1	1	3.852259	3.851386	1.540560	23.06870	23.0740	-0.00530	1.00000
23	-2	1	1	3.789033		1.540560	23.45906			
***	1	1	1	3.775884	3.778245	1.540560	23.54192	23.5270	0.01492	1.00000
***	1	3	0	3.684590	3.683522	1.540560	24.13389	24.1410	-0.00711	1.00000
26	-1	-3	1	3.668872		1.540560	24.23886			
***	-1	3	0	3.658907	3.657406	1.540560	24.30588	24.3160	-0.01012	1.00000
28	0	-3	1	3.647969		1.540560	24.37987			
29	2	0	0	3.637991		1.540560	24.44777			
30	-1	0	2	3.569954		1.540560	24.92112			
***	-1	-1	2	3.506389	3.506709	1.540560	25.38036	25.3780	0.00236	1.00000
32	2	1	0	3.505977		1.540560	25.38339			
33	-2	1	0	3.491165		1.540560	25.49289			
34	-2	-2	1	3.483753		1.540560	25.54805			
35	1	-2	1	3.441359		1.540560	25.86819			
36	0	3	1	3.441265		1.540560	25.86892			
37	-1	3	1	3.437523		1.540560	25.89756			
***	-1	1	2	3.373294	3.372352	1.540560	26.39949	26.4070	-0.00751	1.00000
39	1	2	1	3.334342		1.540560	26.71357			
40	-2	2	1	3.333733		1.540560	26.71854			
41	-1	-2	2	3.219243		1.540560	27.68735			
***	-2	0	2	3.216045	3.215184	1.540560	27.71543	27.7230	-0.00757	1.00000
***	0	0	2	3.193992	3.192608	1.540560	27.91066	27.9230	-0.01234	1.00000
***	0	4	0	3.189676	3.189809	1.540560	27.94919	27.9480	0.00119	1.00000
***	2	2	0	3.171203	3.172014	1.540560	28.11534	28.1080	0.00734	1.00000
46	2	2	0	3.171203		1.540560	28.11534			
***	-2	2	0	3.149368	3.148640	1.540560	28.31431	28.3210	-0.00669	1.00000
48	0	-1	2	3.145531		1.540560	28.34957			
49	-2	1	2	3.067532		1.540560	29.08610			
50	0	1	2	3.053288		1.540560	29.22481			
51	-1	2	2	3.020858		1.540560	29.54565			
52	-2	-3	1	2.996590		1.540560	29.77012			
53	1	-3	1	2.964645		1.540560	30.11900			
54	-2	-2	2	2.957004		1.540560	30.19868			
55	-1	-4	1	2.941562		1.540560	30.36102			
56	0	-2	2	2.931085		1.540560	30.47217			
57	1	4	0	2.929958		1.540560	30.48418			
***	0	-4	1	2.926582	2.928099	1.540560	30.49885	30.5040	-0.00515	1.00000
59	-1	4	0	2.912710		1.540560	30.66911			
60	1	3	1	2.862548		1.540560	31.22012			
61	-2	3	1	2.856099		1.540560	31.29242			
62	-1	-3	2	2.840551		1.540560	31.46813			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
Implementation by Roy G Garvey
Department of CHEMISTRY
NORTH DAKOTA STATE UNIVERSITY
Fargo 58105 - 5516

WELSFORD HYPERSOLVUS GRANITE 74-79: MICROCLINE --) 1987/ 3/ 8 . * . * . 1:30

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5850000	12.9550000	7.2160000	90.61700	115.93200	87.71700	721.9857 A**3
Reciprocal CELL:	0.1296235	0.0771941	0.1540592	90.42416	64.07060	92.23862	0.001385223 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD HYPERSOLVUS GRANITE 74-79: MICROCLINE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5792650	12.9672683	7.2185822	90.48344	116.04944	88.07743	721.3292 A**3
Reciprocal CELL:	0.1298352	0.0771361	0.1541953	90.40290	63.95710	91.90567	0.001386330 A**-3
*-- Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.0000000
$-- Direct Cell Standard ERRorS	0.0025327	0.0035522	0.0015783	0.02232	0.02272	0.02250	0.320275
&-- Reciprocal Cell Standard ERRorS	0.000033704	0.000013353	0.000037727	0.0250052	0.0228512	0.0249996	

WELSFORD HYPERSOLVUS GRANITE 74-79: MICROCLINE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.964102		1.540560	6.81263			
2	1	0	0	7.702073		1.540560	11.47943			
***	1	1	0	6.720486	6.747554	1.540560	13.16304	13.1100	0.05304	1.00000
4	-1	0	1	6.588496		1.540560	13.42794			
5	-1	1	0	6.527000		1.540560	13.55504			
6	0	0	1	6.485282		1.540560	13.64265			
***	0	2	0	6.482051	6.483226	1.540560	13.64949	13.6470	0.00249	1.00000
***	-1	-1	1	5.924710	5.922544	1.540560	14.94051	14.9460	-0.00549	1.00000
9	-1	1	1	5.823621		1.540560	15.20137			
10	0	1	1	5.816423		1.540560	15.22029			
11	0	-1	1	5.783784		1.540560	15.30670			

12	1	2	0	5.042734		1.540560	17.57271			
13	-1	2	0	4.880126		1.540560	18.16311			
14	-1	-2	1	4.670686		1.540560	18.98494			
***	0	2	1	4.600849	4.603887	1.540560	19.27584	19.2630	0.01284	1.00000
16	-1	2	1	4.572240		1.540560	19.39751			
17	0	-2	1	4.568609		1.540560	19.41318			
18	0	3	0	4.321357		1.540560	20.53559			
***	-2	0	1	4.225307	4.225843	1.540560	21.00770	21.0050	0.00270	1.00000
20	1	0	1	4.144078		1.540560	21.42429			
21	-2	-1	1	4.055522		1.540560	21.89728			
22	-2	1	1	3.980080		1.540560	22.31817			
***	1	1	1	3.973191	3.974308	1.540560	22.35736	22.3510	0.00636	1.00000
24	1	-1	1	3.921931		1.540560	22.65342			
25	2	0	0	3.851036		1.540560	23.07613			
***	1	3	0	3.823352	3.825549	1.540560	23.24554	23.2320	0.01354	1.00000
27	2	1	0	3.725577		1.540560	23.86446			
***	-1	3	0	3.716338	3.717205	1.540560	23.92466	23.9150	0.00586	1.00000
29	-2	1	0	3.658544		1.540560	24.30803			
30	-1	-3	1	3.643284		1.540560	24.37095			
31	-1	0	2	3.609159		1.540560	24.64613			
32	0	3	1	3.607872		1.540560	24.65586			
33	-2	-2	1	3.593513		1.540560	24.76214			
34	0	-3	1	3.584534		1.540560	24.81813			
35	-1	3	1	3.578665		1.540560	24.85948			
36	1	2	1	3.527543		1.540560	25.22564			
37	-2	2	1	3.489132		1.540560	25.50800			
***	-1	-1	2	3.483923	3.484430	1.540560	25.54678	25.5430	0.00378	1.00000
***	-1	1	2	3.463988	3.470669	1.540560	25.65112	25.5460	0.00512	1.00000
40	1	-2	1	3.456583		1.540560	25.75230			
***	2	2	0	3.360243	3.360105	1.540560	26.50389	26.5050	-0.00111	1.00000
***	-2	0	2	3.294248	3.291958	1.540560	27.04483	27.0640	-0.01917	1.00000
***	-2	2	0	3.263500	3.267086	1.540560	27.30455	27.2740	0.03055	1.00000
***	0	0	2	3.242541	3.243177	1.540560	27.48363	27.4790	0.00463	1.00000
45	0	4	0	3.241025		1.540560	27.49760			
46	-2	-1	2	3.209141		1.540560	27.77625			
47	-2	1	2	3.176670		1.540560	28.06595			
48	-1	-2	2	3.163752		1.540560	28.18233			
49	0	1	2	3.150952		1.540560	28.29978			
50	-1	2	2	3.142971		1.540560	28.37314			
51	0	-1	2	3.140538		1.540560	28.39559			
52	-2	-3	1	3.070493		1.540560	29.05738			
53	1	3	1	3.025039		1.540560	29.50389			
***	1	3	1	3.025039	3.022723	1.540560	29.50389	29.5270	-0.02311	1.00000
55	-2	3	1	2.974074		1.540560	30.02126			
***	-2	-2	2	2.962355	2.963011	1.540560	30.14284	30.1360	0.00684	1.00000
***	1	-3	1	2.958121	2.958025	1.540560	30.18701	30.1880	-0.00099	1.00000
58	-1	4	0	2.952422		1.540560	30.24667			
59	-1	-4	1	2.933050		1.540560	30.45126			
60	2	3	0	2.923752		1.540560	30.55046			
61	-2	2	2	2.911811		1.540560	30.67882			
62	0	2	2	2.908211		1.540560	30.71772			
63	0	4	1	2.907337		1.540560	30.72719			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
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WELSFORD HYPERSOLVUS GRANITE 74-79: ALBITE —) 1987/ 1/31 . * . * . 0:21

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1380000	12.7890000	7.1560000	94.33300	116.56700	87.65000	664.2093 A**3
Reciprocal CELL:	0.1373912	0.0784189	0.1565611	86.32927	63.52584	90.46340	0.001505550 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD HYPERSOLVUS GRANITE 74-79: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1399344	12.7961501	7.1621231	94.25094	116.62029	87.68042	664.6709 A**3
Reciprocal CELL:	0.1374243	0.0784126	0.1565022	86.40442	63.47222	90.46601	0.001504504 A**-3
*— Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$— Direct Cell Standard ERRorS	0.0009911	0.0043476	0.0007245	0.01087	0.00956	0.00886	0.366654
£— Reciprocal Cell Standard ERRorS	0.000017175	0.000007956	0.000017143	0.0106165	0.0094713	0.0085388	

WELSFORD HYPERSOLVUS GRANITE 74-79: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.753054		1.540560	6.92551			
2	1	0	0	7.276734		1.540560	12.15288			
3	-1	0	1	6.433855		1.540560	13.75222			
4	0	0	1	6.389688		1.540560	13.84775			
***	0	2	0	6.376527	6.381776	1.540560	13.87647	13.8650	0.01147	1.00000
6	1	1	0	6.342507		1.540560	13.95127			
7	-1	1	0	6.298251		1.540560	14.04979			
8	-1	-1	1	5.913954		1.540560	14.96783			
9	0	-1	1	5.861864		1.540560	15.10161			
***	-1	1	1	5.588363	5.590936	1.540560	15.84534	15.8380	0.00734	1.00000
11	0	1	1	5.574467		1.540560	15.88509			

12	1	2	0	4.815211		1.540560	18.41009				
13	-1	2	0	4.776541		1.540560	18.56044				
14	-1	-2	1	4.697207		1.540560	18.87676				
15	0	-2	1	4.662073		1.540560	19.02034				
16	0	2	1	4.378340		1.540560	20.26553				
17	-1	2	1	4.377692		1.540560	20.26856				
18	0	3	0	4.251018		1.540560	20.87921				
***	-2	0	1	4.029326	4.032210	1.540560	22.04196	22.0260	0.01596	1.00000	
20	1	0	1	3.996838		1.540560	22.22340				
21	-2	-1	1	3.896853		1.540560	22.80115				
***	1	-1	1	3.852323	3.856167	1.540560	23.06831	23.0450	0.02331	1.00000	
23	-2	1	1	3.789626		1.540560	23.45534				
***	1	1	1	3.776645	3.778087	1.540560	23.53711	23.5280	0.00911	1.00000	
***	1	3	0	3.683638	3.681118	1.540560	24.14023	24.1570	-0.01677	1.00000	
26	-1	-3	1	3.667373		1.540560	24.24891				
***	-1	3	0	3.657631	3.657258	1.540560	24.31448	24.3170	-0.00252	1.00000	
28	0	-3	1	3.646322		1.540560	24.39105				
29	2	0	0	3.638367		1.540560	24.44521				
30	-1	0	2	3.571064		1.540560	24.91325				
31	-1	-1	2	3.506914		1.540560	25.37650				
***	-1	-1	2	3.506914	3.504400	1.540560	25.37650	25.3950	-0.01850	1.00000	
33	-2	1	0	3.491282		1.540560	25.49203				
***	-2	-2	1	3.483488	3.484430	1.540560	25.55003	25.5430	0.00703	1.00000	
35	0	3	1	3.441185		1.540560	25.86953				
36	1	-2	1	3.440808		1.540560	25.87241				
37	-1	3	1	3.437305		1.540560	25.89924				
***	-1	1	2	3.374491	3.375114	1.540560	26.38996	26.3850	0.00496	1.00000	
39	1	2	1	3.334804		1.540560	26.70980				
40	-2	2	1	3.333945		1.540560	26.71681				
41	-1	-2	2	3.219059		1.540560	27.68896				
***	-2	0	2	3.216928	3.217460	1.540560	27.70767	27.7030	0.00467	1.00000	
***	0	0	2	3.194844	3.192720	1.540560	27.90306	27.9220	-0.01894	1.00000	
***	0	4	0	3.188264	3.189585	1.540560	27.96182	27.9500	0.01182	1.00000	
45	-2	-1	2	3.172589		1.540560	28.10280				
***	2	2	0	3.171253	3.171019	1.540560	28.11488	28.1170	-0.00212	1.00000	
***	-2	2	0	3.149126	3.150819	1.540560	28.31654	28.3010	0.01554	1.00000	
48	0	-1	2	3.145929		1.540560	28.34592				
49	-2	1	2	3.068460		1.540560	29.07712				
50	0	1	2	3.054259		1.540560	29.21531				
51	-1	2	2	3.021754		1.540560	29.53669				
52	-2	-3	1	2.997973		1.540560	29.77638				
***	1	-3	1	2.963768	2.963011	1.540560	30.12812	30.1360	-0.00788	1.00000	
54	-2	-2	2	2.956977		1.540560	30.19896				
55	-1	-4	1	2.940199		1.540560	30.37543				
56	0	-2	2	2.930932		1.540560	30.47380				
***	0	-2	2	2.930932	2.929693	1.540560	30.47380	30.4870	-0.01320	1.00000	
58	0	-4	1	2.927117		1.540560	30.51448				
59	-1	4	0	2.911567		1.540560	30.68144				
***	1	3	1	2.862674	2.862291	1.540560	31.21872	31.2230	-0.00428	1.00000	
61	-2	3	1	2.855985		1.540560	31.29370				
***	-1	-3	2	2.839895	2.839419	1.540560	31.47558	31.4810	-0.00542	1.00000	
63	-2	2	2	2.794181		1.540560	32.00423				

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
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WELSFORD MIAROLITIC GRANITE 74-81: ORTHOCLASE —) 1987/ 2/11 . * . * . 3:0

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5000000	12.9650000	7.1980000	90.00000	115.85000	90.00000	722.4864 A**3
Reciprocal CELL:	0.1292078	0.0771069	0.1543744	90.00000	64.15000	90.00000	0.001384109 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 MONOC System
3 Conditions for non-Extinctions Called for Class Condition(s)
hkl h+k = 2n
h0l h = 2n
0k0 k = 2n

F I N A L V A L U E S for WELSFORD MIAROLITIC GRANITE 74-81: ORTHOCLASE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5841072	12.9923895	7.1950968	90.00000	115.90509	90.00000	721.3283 A**3
Reciprocal CELL:	0.1295216	0.0770125	0.1545257	90.00000	64.09491	90.00000	0.001386331 A**-3

+— Direct Cell Corrections:

0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000

$— Direct Cell Standard ERRorS

0.0020474	0.0101111	0.0017482	0.00000	0.01945	0.00000	0.952220

£— Reciprocal Cell Standard ERRorS

0.000038590	0.000010147	0.000031117	0.0000000	0.0194383	0.0000000

WELSFORD MIAROLITIC GRANITE 74-81: ORTHOCLASE HKL Listing - *** Refers to FIXed, R to Rejects MONOC

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	-1	1	0	6.636242		1.540560	13.33089			
2	0	2	0	5.492451		1.540560	13.62752			
3	0	0	1	6.471414		1.540560	13.67203			
4	-1	1	1	5.863216		1.540560	15.09811			
5	0	2	1	4.583400		1.540560	19.34993			
***	-2	0	1	4.226165	4.227037	1.540560	21.00338	20.9990	0.00438	1.00000
***	1	1	1	3.950347	3.950752	1.540560	22.48833	22.4860	0.00233	1.00000

8	2	0	0	3.860359		1.540560	23.01964			
9	-1	3	0	3.775488		1.540560	23.54442			
***	-1	3	1	3.614648	3.614231	1.540560	24.60812	24.6110	-0.00288	1.00000
11	-2	2	1	3.541887		1.540560	25.12181			
12	-1	1	2	3.466303		1.540560	25.67886			
***	2	2	0	3.318121	3.317587	1.540560	26.84660	26.8510	-0.00440	1.00000
14	-2	0	2	3.285634		1.540560	27.11708			
15	0	4	0	3.246225		1.540560	27.45269			
16	0	0	2	3.235707		1.540560	27.54369			
***	1	3	1	2.994382	2.992314	1.540560	29.81292	29.8340	-0.02108	1.00000
18	-2	2	2	2.931608		1.540560	30.46660			
***	0	4	1	2.901623	2.900997	1.540560	30.78919	30.7960	-0.00681	1.00000
***	0	2	2	2.895978	2.897325	1.540560	30.85070	30.8360	0.01470	1.00000
21	2	0	1	2.817475		1.540560	31.73263			
22	-3	1	1	2.791775		1.540560	32.03257			
***	-1	3	2	2.766329	2.765351	1.540560	32.33525	32.3470	-0.01175	1.00000
24	-3	1	2	2.604217		1.540560	34.40684			
25	2	2	1	2.584597		1.540560	34.67829			
26	-2	4	1	2.574411		1.540560	34.81988			
27	1	1	2	2.554783		1.540560	35.09604			
28	-3	1	0	2.524467		1.540560	35.53147			
29	-2	4	0	2.484533		1.540560	36.12209			
30	-1	5	0	2.461464		1.540560	36.47248			
31	-1	5	1	2.415211		1.540560	37.19630			
32	-3	3	1	2.385343		1.540560	37.67946			
33	-2	0	3	2.376705		1.540560	37.82160			
***	-1	1	3	2.324183	2.324526	1.540560	38.70993	38.7040	0.00593	1.00000
35	-2	4	2	2.309235		1.540560	38.97060			
36	0	4	2	2.291700		1.540560	39.28099			
37	-3	3	2	2.265148		1.540560	39.76072			
38	1	3	2	2.232393		1.540560	40.36931			
39	-2	2	3	2.231860		1.540560	40.37935			
40	-3	3	0	2.212081		1.540560	40.75637			
41	1	5	1	2.201003		1.540560	40.97068			
***	0	5	0	2.164150	2.164972	1.540560	41.70056	41.6840	0.01656	1.00000
43	-3	1	3	2.159907		1.540560	41.78632			
44	0	0	3	2.157138		1.540560	41.84248			
45	2	4	1	2.127611		1.540560	42.44686			
46	-4	0	1	2.120912		1.540560	42.59165			
47	-4	0	2	2.113083		1.540560	42.75721			
48	-1	5	2	2.105521		1.540560	42.91836			
49	-1	3	3	2.073591		1.540560	43.61279			
50	2	0	2	2.073456		1.540560	43.61578			
51	3	1	1	2.070434		1.540560	43.68272			
52	0	6	1	2.052425		1.540560	44.08601			
53	0	2	3	2.047103		1.540560	44.20666			
54	-4	2	1	2.016066		1.540560	44.92404			
55	-4	2	2	2.009337		1.540560	45.08273			
56	2	2	2	1.975174		1.540560	45.90662			
57	-3	3	3	1.954405		1.540560	46.42282			
58	4	0	0	1.930179		1.540560	47.04032			
59	-2	6	1	1.926275		1.540560	47.14144			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
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WELSFORD MIAROLITIC GRANITE 74-81: INTERMEDIATE MICROCLINE —) 1987/ 2/11 . * . * . 0:49

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5820000	12.9650000	7.2120000	90.40000	115.95000	88.35000	721.2287 A**3
Reciprocal CELL:	0.1296417	0.0771642	0.1542084	90.35817	64.05057	91.64036	0.001386523 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD MIAROLITIC GRANITE 74-81: INTERMEDIATE MICROCLINE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5783767	12.9619056	7.2152452	90.52689	115.92145	88.19427	721.4182 A**3
Reciprocal CELL:	0.1296657	0.0771644	0.1541025	90.29158	64.08031	91.75110	0.001386159 A**-3
*— Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$— Direct Cell Standard ERRorS	0.0025820	0.0110990	0.0017501	0.02245	0.02646	0.03102	1.031074
#— Reciprocal Cell Standard ERRorS	0.000037759	0.000017058	0.000042930	0.0204079	0.0263978	0.0296408	

WELSFORD MIAROLITIC GRANITE 74-81: INTERMEDIATE MICROCLINE HKL Listing - *** Refers to FIXed, R to Rejects

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.959348		1.540560	6.81513			
2	1	0	0	7.712139		1.540560	11.46440			
3	1	1	0	6.718220		1.540560	13.16750			
4	-1	0	1	6.579993		1.540560	13.44537			
5	-1	1	0	6.540130		1.540560	13.52770			
6	0	0	1	6.489188		1.540560	13.63440			
***	0	2	0	6.479674	6.470014	1.540560	13.65452	13.6750	-0.02048	1.00000
***	-1	-1	1	5.917212	5.911140	1.540560	14.95954	14.9750	-0.01546	1.00000
9	-1	1	1	5.818134		1.540560	15.21579			
10	0	1	1	5.814259		1.540560	15.22599			
11	0	-1	1	5.790615		1.540560	15.28853			

12	1	2	0	5.037448		1.540560	17.59130			
13	-1	2	0	4.888026		1.540560	18.13351			
14	-1	-2	1	4.665923		1.540560	19.00450			
15	0	2	1	4.596893		1.540560	19.29259			
16	0	-2	1	4.573559		1.540560	19.39197			
17	-1	2	1	4.569354		1.540560	19.40998			
18	0	3	0	4.319783		1.540560	20.54320			
***	-2	0	1	4.223052	4.227037	1.540560	21.01904	20.9990	0.02004	1.00000
20	1	0	1	4.151383		1.540560	21.38614			
21	-2	-1	1	4.051392		1.540560	21.92042			
22	-2	1	1	3.980038		1.540560	22.31841			
***	1	1	1	3.976318	3.973606	1.540560	22.33956	22.3550	-0.01544	1.00000
***	1	-1	1	3.931047	3.935205	1.540560	22.60019	22.5760	0.02419	1.00000
25	2	0	0	3.856069		1.540560	23.04560			
***	1	3	0	3.818918	3.820522	1.540560	23.27291	23.2630	0.00991	1.00000
27	2	1	0	3.727192		1.540560	23.85396			
***	-1	3	0	3.720665	3.717205	1.540560	23.89643	23.9190	-0.02257	1.00000
29	-2	1	0	3.665434		1.540560	24.26193			
30	-1	-3	1	3.646280		1.540560	24.39134			
31	-1	0	2	3.606672		1.540560	24.66339			
32	0	3	1	3.604369		1.540560	24.67940			
33	-2	-2	1	3.587817		1.540560	24.79506			
34	0	-3	1	3.587486		1.540560	24.79738			
***	-1	3	1	3.576971	3.576751	1.540560	24.87145	24.8730	-0.00155	1.00000
36	1	2	1	3.527229		1.540560	25.22792			
37	-2	2	1	3.490161		1.540560	25.50035			
***	-1	-1	2	3.482395	3.482151	1.540560	25.55818	25.5600	-0.00182	1.00000
***	-1	1	2	3.466855	3.468674	1.540560	25.67439	25.6610	0.01339	1.00000
40	1	-2	1	3.464641		1.540560	25.69138			
***	2	2	0	3.359110	3.357989	1.540560	26.51299	26.5220	-0.00901	1.00000
***	-2	0	2	3.289997	3.293152	1.540560	27.08044	27.0540	0.02644	1.00000
43	-2	2	0	3.270065		1.540560	27.24868			
***	0	0	2	3.244594	3.243755	1.540560	27.46676	27.4740	-0.00724	1.00000
45	0	4	0	3.239837		1.540560	27.50788			
46	-2	-1	2	3.204866		1.540560	27.81405			
47	-2	1	2	3.173053		1.540560	28.09860			
48	-1	-2	2	3.163010		1.540560	28.18966			
49	0	1	2	3.151227		1.540560	28.29726			
50	0	-1	2	3.143679		1.540560	28.36662			
51	-1	2	2	3.139883		1.540560	28.40164			
52	-2	-3	1	3.066344		1.540560	29.09762			
***	1	3	1	3.023145	3.026432	1.540560	29.52279	29.4900	0.03279	1.00000
54	1	4	0	3.020107		1.540560	29.55316			
55	-2	3	1	2.975251		1.540560	30.00911			
***	1	-3	1	2.964194	2.963011	1.540560	30.12369	30.1360	-0.01231	1.00000
57	-2	-2	2	2.958606		1.540560	30.18194			
58	-1	4	0	2.954899		1.540560	30.22070			
59	-1	-4	1	2.931000		1.540560	30.47307			
60	2	3	0	2.921372		1.540560	30.57596			
61	-2	2	2	2.909067		1.540560	30.70846			
62	0	2	2	2.907129		1.540560	30.72944			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
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WELSFORD MIAROLITIC GRANITE 74-81: ALBITE —) 1987/ 2/11 . * . * . 0:16

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1380000	12.7890000	7.1560000	94.33300	116.56700	87.65000	664.2093 A**3
Reciprocal CELL:	0.1373912	0.0784189	0.1565611	86.32927	63.52584	90.46340	0.001505550 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD MIAROLITIC GRANITE 74-81: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1394999	12.7997783	7.1618942	94.27107	116.61536	87.72579	664.8041 A**3
Reciprocal CELL:	0.1374315	0.0783903	0.1565070	85.35885	63.47397	90.40428	0.001504202 A**-3

*— Direct Cell Corrections:
0.0000000 0.0000000 0.0000000 0.00000 0.00000 0.00000 0.000000

$— Direct Cell Standard ERRorS
0.0009015 0.0035969 0.0006455 0.01130 0.00877 0.01023 0.299991

£— Reciprocal Cell Standard ERRorS
0.000014871 0.000008367 0.000014991 0.0102271 0.0085949 0.0089387

WELSFORD MIAROLITIC GRANITE 74-81: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.756684		1.540560	6.92353			
2	1	0	0	7.276353		1.540560	12.15352			
3	-1	0	1	6.433408		1.540560	13.75319			
4	0	0	1	6.389491		1.540560	13.84818			
***	0	2	0	6.378342	6.380860	1.540560	13.87250	13.8670	0.00550	1.00000
6	1	1	0	6.339736		1.540560	13.95740			
7	-1	1	0	6.301349		1.540560	14.04285			
8	-1	-1	1	5.913545		1.540560	14.96887			
9	0	-1	1	5.863996		1.540560	15.09609			
***	-1	1	1	5.588732	5.587780	1.540560	15.84429	15.8470	-0.00271	1.00000

11	0	1	1	5.572980		1.540560	15.88936			
12	1	2	0	4.813286		1.540560	18.41751			
13	-1	2	0	4.779734		1.540560	18.54793			
14	-1	-2	1	4.697334		1.540560	18.87625			
15	0	-2	1	4.664650		1.540560	19.00973			
16	-1	2	1	4.378481		1.540560	20.26487			
17	0	2	1	4.377256		1.540560	20.27060			
18	0	3	0	4.252228		1.540560	20.87320			
***	-2	0	1	4.029026	4.030041	1.540560	22.04362	22.0380	0.00562	1.00000
20	1	0	1	3.996723		1.540560	22.22405			
21	-2	-1	1	3.895877		1.540560	22.80694			
***	1	-1	1	3.853533	3.855177	1.540560	23.06097	23.0510	0.00997	1.00000
23	-2	1	1	3.790217		1.540560	23.45163			
***	1	1	1	3.775500	3.779195	1.540560	23.54435	23.5210	0.02335	1.00000
25	1	3	0	3.682632		1.540560	24.14692			
26	-1	-3	1	3.667764		1.540560	24.24629			
***	-1	3	0	3.660063	3.659482	1.540560	24.29808	24.3020	-0.00392	1.00000
28	0	-3	1	3.648444		1.540560	24.37665			
29	2	0	0	3.638177		1.540560	24.44650			
30	-1	0	2	3.570887		1.540560	24.91450			
***	-1	-1	2	3.507147	3.508341	1.540560	25.37479	25.3660	0.00879	1.00000
32	2	1	0	3.505200		1.540560	25.38911			
33	-2	1	0	3.492178		1.540560	25.48537			
***	-2	-2	1	3.482434	3.482151	1.540560	25.55789	25.5600	-0.00211	1.00000
35	1	-2	1	3.442749		1.540560	25.85757			
36	0	3	1	3.440624		1.540560	25.87382			
37	-1	3	1	3.438126		1.540560	25.89295			
***	-1	1	2	3.374119	3.373606	1.540560	26.39292	26.3970	-0.00408	1.00000
39	-2	2	1	3.335048		1.540560	25.70780			
40	1	2	1	3.333424		1.540560	26.72106			
41	-1	-2	2	3.219666		1.540560	27.68364			
***	-2	0	2	3.216704	3.217346	1.540560	27.70964	27.7040	0.00564	1.00000
***	0	0	2	3.194746	3.194851	1.540560	27.90394	27.9030	0.00094	1.00000
***	0	4	0	3.189171	3.191487	1.540560	27.95370	27.9330	0.02070	1.00000
***	2	2	0	3.169868	3.172124	1.540560	28.12742	28.1070	0.02042	1.00000
46	2	2	0	3.169868		1.540560	28.12742			
***	-2	2	0	3.150675	3.151474	1.540560	28.30233	28.2950	0.00733	1.00000
48	0	-1	2	3.146486		1.540560	28.34079			
49	-2	1	2	3.058434		1.540560	29.07736			
50	0	1	2	3.053677		1.540560	29.22100			
51	-1	2	2	3.021424		1.540560	29.53998			
52	-2	-3	1	2.997169		1.540560	29.78455			
53	1	-3	1	2.965790		1.540560	30.10710			
***	-2	-2	2	2.956773	2.958313	1.540560	30.20110	30.1850	0.01610	1.00000
55	-1	-4	1	2.940660		1.540560	30.37056			
56	0	-2	2	2.931998		1.540560	30.46245			
***	0	-4	1	2.928763	2.928849	1.540560	30.49692	30.4960	0.00092	1.00000
58	1	4	0	2.928539		1.540560	30.49931			
59	-1	4	0	2.913384		1.540560	30.66185			
60	1	3	1	2.861509		1.540560	31.23175			
61	-2	3	1	2.857202		1.540560	31.28003			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
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WELSFORD, EAGLE ROCK 1, RED HYPERSOLVUS GRANITE: INTERMEDIATE MICROCLINE —) 1987/ 4/10 . * . * . 0:37

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5820000	12.9650000	7.2120000	90.40000	115.35000	88.35000	721.2267 A**3
Reciprocal CELL:	0.1296417	0.0771642	0.1542084	90.35817	64.85057	91.64036	0.001386523 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD, EAGLE ROCK 1, RED HYPERSOLVUS GRANITE: INTERMEDIATE MICROCLINE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5851496	12.9670734	7.2148213	90.52040	115.97894	88.16776	721.3246 A**3
Reciprocal CELL:	0.1296450	0.0771822	0.1542086	90.31436	64.02285	91.78525	0.001386338 A**-3

*— Direct Cell Corrections:

0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000

$— Direct Cell Standard ERRorS

0.0048392	0.0135941	0.0027568	0.05098	0.04632	0.05387	1.349954

£— Reciprocal Cell Standard ERRorS

0.000052847	0.000035973	0.000068546	0.0521885	0.0460606	0.0551974

WELSFORD, EAGLE ROCK 1, RED HYPERSOLVUS GRANITE: INTERMEDIATE MICROCLINE HKL Listing - *** Refers to FIXed, R to F

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.956357		1.540560	6.81671			
2	1	0	0	7.713371		1.540560	11.46256			
***	1	1	0	6.720435	6.726100	1.540560	13.16314	13.1520	0.01114	1.00000
4	-1	0	1	6.583859		1.540560	13.43744			
5	-1	1	0	6.538822		1.540560	13.53042			
***	0	2	0	6.478179	6.482753	1.540560	13.65768	13.6480	0.00968	1.00000
7	0	2	0	6.478179		1.540560	13.65768			
***	-1	-1	1	5.919986	5.923332	1.540560	14.95249	14.9440	0.00849	1.00000
9	-1	1	1	5.820298		1.540560	15.21010			
10	0	1	1	5.811717		1.540560	15.23269			

11	0	-1	1	5.786248		1.540560	15.30014			
12	1	2	0	5.038620		1.540560	17.58717			
13	-1	2	0	4.886299		1.540560	18.13997			
14	-1	-2	1	4.666985		1.540560	19.00013			
15	0	2	1	4.595701		1.540560	19.29764			
16	0	-2	1	4.570555		1.540560	19.40483			
17	-1	2	1	4.563894		1.540560	19.40767			
18	0	3	0	4.318786		1.540560	20.54800			
***	-2	0	1	4.226735	4.230024	1.540560	21.00051	20.3840	0.01651	1.00000
20	1	0	1	4.148461		1.540560	21.40139			
21	-2	-1	1	4.055031		1.540560	21.90051			
22	-2	1	1	3.982580		1.540560	22.30398			
***	1	1	1	3.974340	3.970975	1.540560	22.35082	22.3700	-0.01918	1.00000
***	1	-1	1	3.927829	3.936410	1.540560	22.61895	22.5690	0.04995	1.00000
25	2	0	0	3.856686		1.540560	23.04186			
***	1	3	0	3.819379	3.825225	1.540560	23.27006	23.2340	0.03606	1.00000
27	2	1	0	3.728298		1.540560	23.84678			
***	-1	3	0	3.719242	3.719963	1.540560	23.90571	23.9010	0.00471	1.00000
29	-2	1	0	3.665306		1.540560	24.26280			
30	-1	-3	1	3.646512		1.540560	24.38976			
31	-1	0	2	3.606284		1.540560	24.66609			
32	0	3	1	3.603696		1.540560	24.68408			
33	-2	-2	1	3.590485		1.540560	24.77634			
34	0	-3	1	3.585498		1.540560	24.81135			
***	-1	3	1	3.576860	3.568561	1.540560	24.87223	24.9310	-0.05877	1.00000
36	1	2	1	3.526140		1.540560	25.23584			
37	-2	2	1	3.491393		1.540560	25.49120			
***	-1	-1	2	3.481835	3.481883	1.540560	25.56236	25.5620	0.00036	1.00000
***	-1	1	2	3.466642	3.472666	1.540560	25.67630	25.6310	0.04530	1.00000
40	1	-2	1	3.461819		1.540560	25.71268			
***	2	2	0	3.360217	3.355753	1.540560	26.50409	26.5400	-0.03591	1.00000
***	-2	0	2	3.291929	3.294228	1.540560	27.06424	27.0450	0.01924	1.00000
43	-2	2	0	3.269411		1.540560	27.25423			
***	0	0	2	3.242362	3.243524	1.540560	27.48604	27.4760	0.01004	1.00000
45	0	4	0	3.239089		1.540560	27.51436			
46	-2	-1	2	3.206686		1.540560	27.79795			
47	-2	1	2	3.174666		1.540560	28.08484			
48	-1	-2	2	3.162347		1.540560	28.19569			
49	0	1	2	3.149438		1.540560	28.31367			
50	0	-1	2	3.141310		1.540560	28.38847			
51	-1	2	2	3.139678		1.540560	28.40353			
52	-2	-3	1	3.068018		1.540560	29.08139			
***	1	3	1	3.022567	3.022823	1.540560	29.52856	29.5260	0.00256	1.00000
54	1	4	0	3.020235		1.540560	29.55188			
55	-2	3	1	2.975644		1.540560	30.00505			
56	1	-3	1	2.961968		1.540560	30.14687			
57	-2	-2	2	2.959993		1.540560	30.16746			
58	-1	4	0	2.953784		1.540560	30.23239			
59	-1	-4	1	2.930909		1.540560	30.47405			
60	2	3	0	2.922227		1.540560	30.56679			
***	-2	2	2	2.910149	2.908186	1.540560	30.69677	30.7180	-0.02123	1.00000

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
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NORTH DAKOTA STATE UNIVERSITY
Fargo 58105 - 5516

WELSFORD, EAGLE ROCK 1, RED HYPERSOLVUS GRANITE: ALBITE —) 1987/ 4/10 . * . * . 1:17

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1380000	12.7890000	7.1560000	94.33300	116.56700	87.65000	664.2093 A**3
Reciprocal CELL:	0.1373912	0.0784189	0.1565611	86.32927	63.52584	90.46340	0.001505550 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD, EAGLE ROCK 1, RED HYPERSOLVUS GRANITE: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1341103	12.7946949	7.1588051	94.22741	116.60815	87.72283	664.0067 A**3
Reciprocal CELL:	0.1375025	0.0784108	0.1565518	86.40992	63.48236	90.43127	0.001506009 A**-3
*— Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$— Direct Cell Standard ERRorS	0.0017254	0.0079378	0.0011955	0.01570	0.01663	0.01529	0.687137
£— Reciprocal Cell Standard ERRorS	0.000026516	0.000012013	0.000030940	0.0167044	0.0167174	0.0164144	

WELSFORD, EAGLE ROCK 1, RED HYPERSOLVUS GRANITE: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects TRIC

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.753473		1.540560	6.92528			
2	1	0	0	7.272593		1.540560	12.15983			
3	-1	0	1	6.430060		1.540560	13.76038			
***	0	0	1	6.387664	6.386818	1.540560	13.85216	13.8540	-0.00184	1.00000
5	0	2	0	6.376736		1.540560	13.87601			
***	1	1	0	6.338162	6.327285	1.540560	13.96088	13.9850	-0.02412	1.00000
7	-1	1	0	6.297236		1.540560	14.05207			
8	-1	-1	1	5.909509		1.540560	14.97916			
9	0	-1	1	5.860148		1.540560	15.10606			
10	-1	1	1	5.587210		1.540560	15.84863			

11	0	1	1	5.573324		1.540560	15.88837			
12	1	2	0	4.812653		1.540560	18.41996			
13	-1	2	0	4.776872		1.540560	18.55915			
14	-1	-2	1	4.694270		1.540560	18.88868			
15	0	-2	1	4.661173		1.540560	19.02404			
16	0	2	1	4.377918		1.540560	20.26751			
17	-1	2	1	4.377814		1.540560	20.26799			
18	0	3	0	4.251158		1.540560	20.87851			
***	-2	0	1	4.026563	4.029319	1.540560	22.05728	22.0420	0.01528	1.00000
20	1	0	1	3.995385		1.540560	22.23159			
21	-2	-1	1	3.893543		1.540560	22.82080			
***	1	-1	1	3.851349	3.849576	1.540560	23.07423	23.0850	-0.01077	1.00000
23	-2	1	1	3.788096		1.540560	23.46495			
***	1	1	1	3.775132	3.777770	1.540560	23.54668	23.5300	0.01668	1.00000
***	1	3	0	3.682218	3.682620	1.540560	24.14967	24.1470	0.00267	1.00000
26	-1	-3	1	3.665658		1.540560	24.26843			
***	-1	3	0	3.658147	3.659778	1.540560	24.31101	24.3000	0.01101	1.00000
28	0	-3	1	3.645894		1.540560	24.39396			
29	2	0	0	3.636296		1.540560	24.45934			
30	-1	0	2	3.569549		1.540560	24.92399			
***	-1	-1	2	3.505125	3.504808	1.540560	25.38967	25.3920	-0.00233	1.00000
32	2	1	0	3.503894		1.540560	25.39873			
33	-2	1	0	3.490013		1.540560	25.50145			
34	-2	-2	1	3.480560		1.540560	25.57188			
35	0	3	1	3.441060		1.540560	25.87048			
36	1	-2	1	3.440363		1.540560	25.87581			
37	-1	3	1	3.437708		1.540560	25.89615			
***	-1	1	2	3.373543	3.369845	1.540560	26.39751	26.4270	-0.02949	1.00000
39	1	2	1	3.333580		1.540560	26.71979			
40	-2	2	1	3.333442		1.540560	26.72092			
***	-2	0	2	3.215030	3.217345	1.540560	27.72435	27.7040	0.02035	1.00000
42	-2	0	2	3.215030		1.540560	27.72435			
***	0	0	2	3.193832	3.193056	1.540560	27.91208	27.9190	-0.00692	1.00000
***	0	4	0	3.188368	3.190032	1.540560	27.96088	27.9460	0.01488	1.00000
***	2	2	0	3.169081	3.169633	1.540560	28.13455	28.1290	0.00555	1.00000
46	2	2	0	3.169081		1.540560	28.13455			
***	-2	2	0	3.148618	3.150383	1.540560	28.32120	28.3050	0.01620	1.00000
48	0	-1	2	3.144909		1.540560	28.35530			
49	-2	1	2	3.067249		1.540560	29.08885			
50	0	1	2	3.053435		1.540560	29.22337			
51	-1	2	2	3.021322		1.540560	29.54100			
52	-2	-3	1	2.995758		1.540560	29.79890			
***	1	-3	1	2.963654	2.964068	1.540560	30.12931	30.1250	0.00431	1.00000
***	-2	-2	2	2.954755	2.954966	1.540560	30.22222	30.2200	0.00222	1.00000
55	-1	-4	1	2.939161		1.540560	30.38642			
56	0	-2	2	2.930074		1.540560	30.48294			
***	0	-2	2	2.930074	2.928661	1.540560	30.48294	30.4980	-0.01506	1.00000
58	0	-4	1	2.926907		1.540560	30.51673			
59	-1	4	0	2.912023		1.540560	30.67653			
***	1	3	1	2.861793	2.863981	1.540560	31.22856	31.2050	0.02356	1.00000
61	-2	3	1	2.856017		1.540560	31.29334			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
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WELSFORD, EAGLE ROCK 2, CREAM HYPERSOLVUS GRANITE: INTERMEDIATE MICROCLINE —) 1987/ 4/12 . * . * . 0:51

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5820000	12.9650000	7.2120000	90.40000	115.95000	88.35000	721.2287 A**3
Reciprocal CELL:	0.1296417	0.0771642	0.1542084	90.35817	64.05057	91.64036	0.001386523 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD, EAGLE ROCK 2, CREAM HYPERSOLVUS GRANITE: INTERMEDIATE MICROCLINE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5816039	12.9602556	7.2202345	90.50589	115.93528	87.97781	721.6066 A**3
Reciprocal CELL:	0.1296618	0.0772004	0.1540484	90.42000	64.06130	92.00198	0.001385797 A**-3
*— Direct Cell	Corrections:						
	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$— Direct Cell	Standard ERRorS						
	0.0018112	0.0061319	0.0011963	0.01857	0.01336	0.02075	0.574472
£— Reciprocal Cell	Standard ERRorS						
	0.000024160	0.000011434	0.000027133	0.0193497	0.0132005	0.0215569	

WELSFORD, EAGLE ROCK 2, CREAM HYPERSOLVUS GRANITE: INTERMEDIATE MICROCLINE HKL Listing - *** Refers to FIXed, R t

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.953305		1.540560	6.81831			
2	1	0	0	7.712418		1.540560	11.46398			
3	1	1	0	6.730937		1.540560	13.14251			
4	-1	0	1	6.583681		1.540560	13.43780			
5	-1	1	0	6.527256		1.540560	13.55451			
6	0	0	1	6.491468		1.540560	13.62959			
***	0	2	0	6.476652	6.483226	1.540560	13.66092	13.6470	0.01392	1.00000
8	-1	-1	1	5.922914		1.540560	14.94506			
9	0	1	1	5.820603		1.540560	15.20930			
10	-1	1	1	5.816722		1.540560	15.21950			
11	0	-1	1	5.786523		1.540560	15.29941			

12	1	2	0	5.047381		1.540560	17.55640			
13	-1	2	0	4.876564		1.540560	18.17649			
14	-1	-2	1	4.669632		1.540560	18.98926			
15	0	2	1	4.601811		1.540560	19.27177			
16	0	-2	1	4.568201		1.540560	19.41493			
17	-1	2	1	4.566225		1.540560	19.42341			
18	0	3	0	4.317768		1.540560	20.55289			
***	-2	0	1	4.224465	4.225047	1.540560	21.01193	21.0090	0.00293	1.00000
20	1	0	1	4.151738		1.540560	21.38429			
21	-2	-1	1	4.056541		1.540560	21.89225			
22	1	1	1	3.980906		1.540560	22.31348			
***	1	1	1	3.980906	3.977998	1.540560	22.31348	22.3300	-0.01652	1.00000
***	1	-1	1	3.926895	3.931939	1.540560	22.62441	22.5950	0.02941	1.00000
25	2	0	0	3.856209		1.540560	23.04475			
***	1	3	0	3.824923	3.826849	1.540560	23.23586	23.2240	0.01186	1.00000
27	2	1	0	3.731738		1.540560	23.82448			
***	-1	3	0	3.712637	3.712463	1.540560	23.94886	23.9500	-0.00114	1.00000
29	-2	1	0	3.661092		1.540560	24.29115			
30	-1	-3	1	3.648216		1.540560	24.37819			
31	-1	0	2	3.608642		1.540560	24.64972			
32	0	3	1	3.607338		1.540560	24.65877			
***	-2	-2	1	3.593848	3.596106	1.540560	24.75279	24.7370	0.01579	1.00000
34	0	-3	1	3.583032		1.540560	24.82870			
***	-1	3	1	3.574843	3.575477	1.540560	24.89215	24.8820	0.01015	1.00000
36	1	2	1	3.533176		1.540560	25.18477			
***	-1	-1	2	3.483655	3.485772	1.540560	25.54878	25.5330	0.01578	1.00000
38	-1	-1	2	3.483655		1.540560	25.54878			
***	-1	1	2	3.468919	3.469206	1.540560	25.65916	25.6570	0.00216	1.00000
40	1	-2	1	3.458525		1.540560	25.73759			
***	2	2	0	3.365469	3.366342	1.540560	26.46199	26.4550	0.00699	1.00000
***	-2	0	2	3.291841	3.294108	1.540560	27.06498	27.0460	0.01898	1.00000
***	-2	2	0	3.263628	3.264972	1.540560	27.30346	27.2920	0.01146	1.00000
***	0	0	2	3.245734	3.243524	1.540560	27.45692	27.4760	-0.01908	1.00000
***	0	4	0	3.238326	3.238207	1.540560	27.52097	27.5220	-0.00103	1.00000
46	-2	-1	2	3.207621		1.540560	27.78967			
47	-2	1	2	3.173510		1.540560	28.09447			
48	-1	-2	2	3.163395		1.540560	28.18616			
49	0	1	2	3.153856		1.540560	28.27318			
50	0	-1	2	3.142973		1.540560	28.37313			
51	-1	2	2	3.141416		1.540560	28.38749			
52	-2	-3	1	3.071480		1.540560	29.04790			
***	1	3	1	3.028462	3.028440	1.540560	29.46978	29.4700	-0.00022	1.00000
54	1	4	0	3.023753		1.540560	29.51672			
55	-2	3	1	2.978254		1.540560	30.06078			
56	-2	-2	2	2.961457		1.540560	30.15219			
***	1	-3	1	2.958170	2.958983	1.540560	30.18649	30.1780	0.00849	1.00000
58	-1	4	0	2.949245		1.540560	30.28003			
59	-1	-4	1	2.931952		1.540560	30.46294			
60	2	3	0	2.927408		1.540560	30.51137			
61	0	2	2	2.910302		1.540560	30.69512			
***	0	4	1	2.906291	2.907447	1.540560	30.73852	30.7250	0.01252	1.00000

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
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WELSFORD, EAGLE ROCK 2, CREAM HYPERSOLVUS GRANITE: ALBITE —) 1987/ 4/12 . * . * . 1:32

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1380000	12.7890000	7.1560000	94.33300	116.56700	87.65000	664.2093 A**3
Reciprocal CELL:	0.1373912	0.0784189	0.1565611	86.32927	63.52584	90.46340	0.001505550 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD, EAGLE ROCK 2, CREAM HYPERSOLVUS GRANITE: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1397202	12.7934268	7.1609133	94.23261	116.61905	87.69598	664.4432 A**3
Reciprocal CELL:	0.1374234	0.0784267	0.1565235	86.41722	63.47292	90.45788	0.001505020 A**-3
*— Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$— Direct Cell Standard ERRorS	0.0015547	0.0051512	0.0009635	0.01844	0.01220	0.01257	0.426701
£— Reciprocal Cell Standard ERRorS	0.000023314	0.000009328	0.000025185	0.0173058	0.0120979	0.0106663	

WELSFORD, EAGLE ROCK 2, CREAM HYPERSOLVUS GRANITE: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects TRI

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.750757		1.540560	6.92675			
2	1	0	0	7.276780		1.540560	12.15280			
3	-1	0	1	6.433253		1.540560	13.75352			
***	0	0	1	6.388818	6.386818	1.540560	13.84964	13.8540	-0.00436	1.00000
5	0	2	0	6.375379		1.540560	13.87898			
6	1	1	0	6.341868		1.540560	13.95268			
7	-1	1	0	6.298383		1.540560	14.04950			
***	-1	-1	1	5.912427	5.909963	1.540560	14.97172	14.9780	-0.00628	1.00000
9	0	-1	1	5.860465		1.540560	15.10524			
***	-1	1	1	5.588476	5.597608	1.540560	15.84502	15.8190	0.02602	1.00000

11	0	1	1	5.574131		1.540560	15.88606			
12	1	2	0	4.814392		1.540560	18.41325			
13	-1	2	0	4.776402		1.540560	18.56099			
14	-1	-2	1	4.695681		1.540560	18.88295			
15	0	-2	1	4.660779		1.540560	19.02567			
16	0	2	1	4.378108		1.540560	20.26661			
17	-1	2	1	4.377804		1.540560	20.26804			
18	0	3	0	4.250252		1.540560	20.88301			
***	-2	0	1	4.029264	4.028417	1.540560	22.04231	22.0470	-0.00469	1.00000
20	1	0	1	3.996572		1.540560	22.22490			
21	-2	-1	1	3.896485		1.540560	22.80381			
***	1	-1	1	3.851965	3.854517	1.540560	23.07049	23.0550	0.01549	1.00000
23	-2	1	1	3.789816		1.540560	23.45415			
***	1	1	1	3.776414	3.776504	1.540560	23.53857	23.5380	0.00057	1.00000
***	1	3	0	3.682919	3.682169	1.540560	24.14501	24.1500	-0.00499	1.00000
26	-1	-3	1	3.666176		1.540560	24.25695			
***	-1	3	0	3.657372	3.658444	1.540560	24.31624	24.3090	0.00724	1.00000
28	0	-3	1	3.645313		1.540560	24.39791			
***	2	0	0	3.638390	3.634736	1.540560	24.44505	24.4700	-0.02495	1.00000
30	-1	0	2	3.570548		1.540560	24.91690			
31	2	1	0	3.506139		1.540560	25.38220			
***	-1	-1	2	3.506097	3.504943	1.540560	25.38251	25.3910	-0.00849	1.00000
33	-2	1	0	3.491384		1.540560	25.49127			
34	-2	-2	1	3.482793		1.540560	25.55521			
35	0	3	1	3.440948		1.540560	25.87134			
36	1	-2	1	3.440377		1.540560	25.87571			
37	-1	3	1	3.437298		1.540560	25.89929			
***	-1	1	2	3.374264	3.373605	1.540560	25.39177	26.3970	-0.00523	1.00000
39	1	2	1	3.334558		1.540560	25.71180			
40	-2	2	1	3.334156		1.540560	26.71509			
41	-1	-2	2	3.218100		1.540560	27.69738			
***	-2	0	2	3.216626	3.217004	1.540560	27.71032	27.7070	0.00332	1.00000
***	0	0	2	3.194409	3.195075	1.540560	27.90694	27.9010	0.00594	1.00000
***	0	4	0	3.187689	3.190480	1.540560	27.96696	27.9420	0.02496	1.00000
45	-2	-1	2	3.172089		1.540560	28.10805			
***	2	2	0	3.170934	3.170135	1.540560	28.11777	28.1250	-0.00723	1.00000
***	-2	2	0	3.149191	3.152347	1.540560	28.31593	28.2870	0.02893	1.00000
48	0	-1	2	3.145323		1.540560	28.35149			
49	-2	1	2	3.068398		1.540560	29.07771			
50	0	1	2	3.053990		1.540560	29.21794			
51	-1	2	2	3.021680		1.540560	29.53743			
52	-2	-3	1	2.997232		1.540560	29.78391			
***	1	-3	1	2.963323	2.963011	1.540560	30.13276	30.1360	-0.00324	1.00000
54	-2	-2	2	2.956213		1.540560	30.20695			
55	-1	-4	1	2.939283		1.540560	30.38513			
56	0	-2	2	2.930233		1.540560	30.48125			
***	0	-2	2	2.930233	2.928942	1.540560	30.48125	30.4950	-0.01375	1.00000
58	0	-4	1	2.926338		1.540560	30.52280			
59	-1	4	0	2.911283		1.540560	30.68452			
***	1	3	1	2.862412	2.862827	1.540560	31.22165	31.2170	0.00465	1.00000
61	-2	3	1	2.856118		1.540560	31.29221			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
Department of CHEMISTRY
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Fargo 58105 - 5516

WELSFORD BNH-1 PHENOCRYST IN OBSIDIAN: ALBITE —) 1986/12/29 . * . * . 2:5

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1380000	12.7890000	7.1560000	94.33300	116.56700	87.65000	664.2093 A**3
Reciprocal CELL:	0.1373912	0.0784189	0.1565611	86.32927	63.52584	90.46340	0.001505550 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD BNH-1 PHENOCRYST IN OBSIDIAN: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1356456	12.7928531	7.1548015	94.22643	116.59910	87.79246	663.7504 A**3
Reciprocal CELL:	0.1374678	0.0784163	0.1566293	86.37651	63.48728	90.35443	0.001506590 A**-3
*— Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$— Direct Cell Standard ERRorS	0.0020822	0.0097111	0.0014663	0.02389	0.01911	0.01551	0.809717
£— Reciprocal Cell Standard ERRorS	0.000035557	0.000019894	0.000035274	0.0239882	0.0191219	0.0169540	

WELSFORD BNH-1 PHENOCRYST IN OBSIDIAN: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.752457		1.540560	6.92583			
2	1	0	0	7.274433		1.540560	12.15674			
3	-1	0	1	6.428175		1.540560	13.76444			
***	0	2	0	6.376228	6.381318	1.540560	13.87712	13.8660	0.01112	1.00000
5	0	2	0	6.376228		1.540560	13.87712			
6	1	1	0	6.335572		1.540560	13.96662			
***	-1	1	0	6.301927	6.315153	1.540560	14.04156	14.0120	0.02956	1.00000
***	-1	-1	1	5.906532	5.903692	1.540560	14.98675	14.9940	-0.00725	1.00000
9	0	-1	1	5.859140		1.540560	15.10868			
10	-1	1	1	5.587082		1.540560	15.84899			
11	0	1	1	5.569822		1.540560	15.89842			

12	1	2	0	4.809744		1.540560	18.43119			
13	-1	2	0	4.780338		1.540560	18.54557			
14	-1	-2	1	4.691918		1.540560	18.89824			
15	0	-2	1	4.661288		1.540560	19.02357			
16	-1	2	1	4.378204		1.540560	20.26617			
17	0	2	1	4.375458		1.540560	20.27902			
18	0	3	0	4.250819		1.540560	20.88019			
***	-2	0	1	4.027054	4.028597	1.540560	22.05455	22.0460	0.00855	1.00000
20	1	0	1	3.994899		1.540560	22.23432			
21	-2	-1	1	3.892699		1.540560	22.82581			
***	1	-1	1	3.852148	3.851057	1.540560	23.06938	23.0760	-0.00662	1.00000
23	-2	1	1	3.789638		1.540560	23.45526			
***	1	1	1	3.773508	3.773817	1.540560	23.55696	23.5550	0.00196	1.00000
***	1	3	0	3.680071	3.680518	1.540560	24.16397	24.1610	0.00297	1.00000
26	-1	-3	1	3.664079		1.540560	24.27104			
***	-1	3	0	3.660292	3.660075	1.540560	24.29654	24.2980	-0.00146	1.00000
28	0	-3	1	3.646199		1.540560	24.39189			
29	2	0	0	3.637217		1.540560	24.45306			
30	-1	0	2	3.567583		1.540560	24.93795			
31	2	1	0	3.503451		1.540560	25.40200			
***	-1	-1	2	3.503275	3.501146	1.540560	25.40329	25.4190	-0.01571	1.00000
33	-2	1	0	3.492037		1.540560	25.48642			
***	-2	-2	1	3.478997	3.478671	1.540560	25.58357	25.5850	-0.00243	1.00000
35	1	-2	1	3.441773		1.540560	25.86503			
36	0	3	1	3.439455		1.540560	25.88276			
37	-1	3	1	3.438076		1.540560	25.89333			
***	-1	1	2	3.371835	3.371348	1.540560	26.41112	26.4150	-0.00388	1.00000
39	-2	2	1	3.335229		1.540560	26.70633			
40	1	2	1	3.331590		1.540560	26.73604			
41	-1	-2	2	3.215962		1.540560	27.71616			
***	-2	0	2	3.214088	3.214161	1.540560	27.73265	27.7320	0.00065	1.00000
43	0	0	2	3.192251		1.540560	27.92618			
***	0	0	2	3.192251	3.189809	1.540560	27.92618	27.9480	-0.02182	1.00000
***	2	2	0	3.167786	3.169804	1.540560	28.14629	28.1280	0.01829	1.00000
46	2	2	0	3.167786		1.540560	28.14629			
***	-2	2	0	3.150964	3.148966	1.540560	28.29968	28.3180	-0.01832	1.00000
48	0	-1	2	3.143857		1.540560	28.36498			
49	-2	1	2	3.066811		1.540560	29.09309			
50	0	1	2	3.051607		1.540560	29.24127			
51	-1	2	2	3.020034		1.540560	29.55389			
52	-2	-3	1	2.994123		1.540560	29.81555			
***	1	-3	1	2.965867	2.965992	1.540560	30.11461	30.1050	0.00961	1.00000
***	-2	-2	2	2.953266	2.952676	1.540560	30.23782	30.2440	-0.00618	1.00000
55	-1	-4	1	2.938087		1.540560	30.39780			
56	0	-2	2	2.929570		1.540560	30.48831			
57	0	-4	1	2.927170		1.540560	30.51391			
***	0	-4	1	2.927170	2.926694	1.540560	30.51391	30.5190	-0.00509	1.00000
59	-1	4	0	2.913378		1.540560	30.66191			
60	1	3	1	2.859960		1.540560	31.24909			
61	-2	3	1	2.857581		1.540560	31.27577			
62	-1	-3	2	2.837560		1.540560	31.50216			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
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WELSFORD BNH-1 MATRIX OF OBSIDIAN: INTERMEDIATE MICROCLINE —) 1986/12/29 . * . * . 1:59

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5820000	12.9650000	7.2120000	90.40000	115.95000	88.35000	721.2287 A**3
Reciprocal CELL:	0.1296417	0.0771642	0.1542084	90.35817	64.05057	91.64036	0.001386523 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD BNH-1 MATRIX OF OBSIDIAN: INTERMEDIATE MICROCLINE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5792995	12.9713408	7.2115036	90.60082	116.03069	88.10575	719.9301 A**3
Reciprocal CELL:	0.1298062	0.0772001	0.1543661	90.25749	63.97179	91.81635	0.001389024 A**-3

*— Direct Cell Corrections:

0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000

$— Direct Cell Standard ERRorS

0.0023326	0.0114699	0.0026264	0.03228	0.02420	0.02782	0.974095

£— Reciprocal Cell Standard ERRorS

0.000061591	0.000017030	0.000033081	0.0291469	0.0241025	0.0242027

WELSFORD BNH-1 MATRIX OF OBSIDIAN: INTERMEDIATE MICROCLINE HKL Listing - *** Refers to FIXed, R to Rejects

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.953349		1.540560	6.81829			
2	1	0	0	7.703790		1.540560	11.47686			
3	1	1	0	6.715464		1.540560	13.17292			
4	-1	0	1	6.582203		1.540560	13.44084			
5	-1	1	0	6.530951		1.540560	13.54680			
6	0	0	1	6.478105		1.540560	13.65784			
7	0	2	0	6.476675		1.540560	13.66087			
8	-1	-1	1	5.922159		1.540560	14.94698			
9	-1	1	1	5.815407		1.540560	15.22297			
10	0	1	1	5.804382		1.540560	15.25205			

11	0	-1	1	5.783549		1.540560	15.30732			
12	1	2	0	5.036748		1.540560	17.59376			
13	-1	2	0	4.881842		1.540560	18.15667			
14	-1	-2	1	4.669423		1.540560	18.99012			
15	0	2	1	4.590532		1.540560	19.31957			
16	0	-2	1	4.569949		1.540560	19.40743			
17	-1	2	1	4.565449		1.540560	19.42675			
18	0	3	0	4.317783		1.540560	20.55282			
***	-2	0	1	4.224537	4.226042	1.540560	21.01157	21.0040	0.00757	1.00000
20	1	0	1	4.142430		1.540560	21.43291			
21	-2	-1	1	4.054567		1.540560	21.90304			
22	-2	1	1	3.979169		1.540560	22.32335			
***	1	1	1	3.968585	3.967823	1.540560	22.38365	22.3880	-0.00435	1.00000
24	1	-1	1	3.922979		1.540560	22.64729			
25	2	0	0	3.851895		1.540560	23.07091			
***	1	3	0	3.818507	3.821170	1.540560	23.27545	23.2590	0.01645	1.00000
27	2	1	0	3.724508		1.540560	23.87141			
***	-1	3	0	3.716617	3.712922	1.540560	23.92284	23.9470	-0.02416	1.00000
29	-2	1	0	3.660546		1.540560	24.29483			
30	-1	-3	1	3.648196		1.540560	24.37833			
31	-1	0	2	3.604441		1.540560	24.67889			
32	0	3	1	3.600331		1.540560	24.70751			
33	-2	-2	1	3.591061		1.540560	24.77231			
34	0	-3	1	3.585428		1.540560	24.81184			
35	-1	3	1	3.573606		1.540560	24.89524			
36	1	2	1	3.521682		1.540560	25.26832			
37	-2	2	1	3.487918		1.540560	25.51703			
38	-1	-1	2	3.481359		1.540560	25.56592			
39	-1	1	2	3.463725		1.540560	25.69828			
40	1	-2	1	3.458567		1.540560	25.73727			
41	2	2	0	3.357732		1.540560	26.52407			
***	-2	0	2	3.291101	3.290765	1.540560	27.07118	27.0740	-0.00282	1.00000
43	-2	2	0	3.265476		1.540560	27.28771			
***	0	0	2	3.239052	3.240170	1.540560	27.51468	27.5050	0.00968	1.00000
45	0	4	0	3.238337		1.540560	27.52087			
46	-2	-1	2	3.207039		1.540560	27.79482			
47	-2	1	2	3.172751		1.540560	28.10133			
48	-1	-2	2	3.162789		1.540560	28.19168			
49	0	1	2	3.145630		1.540560	28.34866			
50	0	-1	2	3.138983		1.540560	28.40995			
51	-1	2	2	3.136475		1.540560	28.43314			
52	-2	-3	1	3.068858		1.540560	29.07326			
53	1	4	0	3.019700		1.540560	29.55724			
***	1	3	1	3.019407	3.019124	1.540560	29.56017	29.5630	-0.00283	1.00000
55	-2	3	1	2.972691		1.540560	30.03556			
56	-2	-2	2	2.961079		1.540560	30.15613			
57	1	-3	1	2.959982		1.540560	30.16841			
58	-1	4	0	2.952067		1.540560	30.25039			
59	-1	-4	1	2.931983		1.540560	30.46261			
60	2	3	0	2.920714		1.540560	30.58301			
61	-2	2	2	2.907703		1.540560	30.72322			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
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WELSFORD BNH-1 MATRIX OF OBSIDIAN: ALBITE —) 1986/12/29 . * . * . 3:44

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1380000	12.7890000	7.1560000	94.33300	116.56700	87.65000	664.2093 A**3
Reciprocal CELL:	0.1373912	0.0784189	0.1565611	86.32927	63.52584	90.46340	0.001505550 A** -3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.6 Dmin = 1.428783 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD BNH-1 MATRIX OF OBSIDIAN: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1378589	12.7945460	7.1559906	94.19304	116.58133	87.81365	664.4385 A**3
Reciprocal CELL:	0.1373984	0.0783876	0.1565668	86.40384	63.50457	90.34892	0.001505030 A**-3
+— Direct Cell	Corrections:						
	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$— Direct Cell	Standard ERRorS						
	0.0013037	0.0050734	0.0010490	0.01776	0.01217	0.01146	0.432803
Σ— Reciprocal Cell	Standard ERRorS						
	0.000024601	0.000008850	0.000020767	0.0177243	0.0120819	0.0115110	

WELSFORD BNH-1 MATRIX OF OBSIDIAN: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.757114		1.540560	6.92330			
2	1	0	0	7.278106		1.540560	12.15058			
3	-1	0	1	6.429072		1.540560	13.76251			
4	0	0	1	6.387050		1.540560	13.85350			
***	0	2	0	6.378557	6.379486	1.540560	13.87203	13.8700	0.00203	1.00000
6	1	1	0	6.338291		1.540560	13.96059			
***	-1	1	0	6.305151	6.309777	1.540560	14.03434	14.0240	0.01034	1.00000
***	-1	-1	1	5.906134	5.899780	1.540560	14.98776	15.0040	-0.01624	1.00000
9	0	-1	1	5.860260		1.540560	15.10577			
10	-1	1	1	5.589381		1.540560	15.84243			

***	-1	1	1	5.589381	5.575894	1.540560	15.84243	15.8810	-0.03857	1.00000
12	1	2	0	4.811561		1.540560	18.42417			
13	-1	2	0	4.782601		1.540560	18.53672			
14	-1	-2	1	4.691634		1.540560	18.89939			
15	0	-2	1	4.661880		1.540560	19.02113			
16	-1	2	1	4.380510		1.540560	20.25539			
17	0	2	1	4.378114		1.540560	20.26659			
18	0	3	0	4.252371		1.540560	20.87249			
***	-2	0	1	4.028102	4.028417	1.540560	22.04875	22.0470	0.00175	1.00000
20	1	0	1	3.997149		1.540560	22.22165			
21	-2	-1	1	3.893268		1.540560	22.82243			
***	1	-1	1	3.853986	3.855012	1.540560	23.05822	23.0520	0.00622	1.00000
23	-2	1	1	3.791105		1.540560	23.44606			
***	1	1	1	3.775814	3.776821	1.540560	23.54237	23.5360	0.00637	1.00000
***	1	3	0	3.681391	3.683522	1.540560	24.15519	24.1410	0.01419	1.00000
26	-1	-3	1	3.664125		1.540560	24.27074			
***	-1	3	0	3.661912	3.661114	1.540560	24.28563	24.2910	-0.00537	1.00000
28	0	-3	1	3.646714		1.540560	24.38839			
29	2	0	0	3.639053		1.540560	24.44053			
30	-1	0	2	3.568345		1.540560	24.93253			
31	2	1	0	3.505094		1.540560	25.38989			
***	-1	-1	2	3.503491	3.501959	1.540560	25.40170	25.4130	-0.01130	1.00000
33	-2	1	0	3.493851		1.540560	25.47296			
***	-2	-2	1	3.479322	3.476801	1.540560	25.58113	25.6000	-0.01887	1.00000
35	1	-2	1	3.443140		1.540560	25.85459			
36	0	3	1	3.441466		1.540560	25.86738			
37	-1	3	1	3.439956		1.540560	25.87893			
***	-1	1	2	3.373103	3.371348	1.540560	26.40101	26.4150	-0.01399	1.00000
39	-2	2	1	3.336799		1.540560	26.69353			
40	1	2	1	3.333625		1.540560	26.71942			
41	-1	-2	2	3.215887		1.540560	27.71682			
***	-2	0	2	3.214536	3.214843	1.540560	27.72870	27.7260	0.00270	1.00000
***	0	0	2	3.193525	3.195973	1.540560	27.91482	27.8930	0.02182	1.00000
***	0	4	0	3.189278	3.190256	1.540560	27.95274	27.9440	0.00874	1.00000
***	2	2	0	3.169146	3.170135	1.540560	28.13396	28.1250	0.00896	1.00000
46	-2	-1	2	3.168965		1.540560	28.13560			
***	-2	2	0	3.152576	3.152783	1.540560	28.28491	28.2830	0.00191	1.00000
48	0	-1	2	3.144742		1.540560	28.35683			
49	-2	1	2	3.067702		1.540560	29.08446			
50	0	1	2	3.053151		1.540560	29.22615			
51	-1	2	2	3.021517		1.540560	29.53906			
52	-2	-3	1	2.994400		1.540560	29.81274			
***	1	-3	1	2.966094	2.969171	1.540560	30.10394	30.0720	0.03194	1.00000
***	-2	-2	2	2.953067	2.953821	1.540560	30.23990	30.2320	0.00790	1.00000
55	-1	-4	1	2.938317		1.540560	30.39536			
***	0	-2	2	2.930130	2.929411	1.540560	30.48234	30.4900	-0.00766	1.00000
57	1	4	0	2.927689		1.540560	30.50837			
58	0	-4	1	2.927668		1.540560	30.50860			
59	-1	4	0	2.914610		1.540560	30.64863			
***	1	3	1	2.861635	2.863364	1.540560	31.23033	31.2110	0.01933	1.00000
61	-2	3	1	2.859033		1.540560	31.25948			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
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Fargo 58105 - 5516

WELSFORD BREAK-NECK HILL BNH-2 MATRIX: INTERMEDIATE MICROCLINE —) 1986/12/30 . * . * . 1:1

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5820000	12.9650000	7.2120000	90.40000	115.95000	88.35000	721.2287 A*
Reciprocal CELL:	0.1296417	0.0771642	0.1542084	90.35817	64.05057	91.64036	0.001386523 A**

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD BREAK-NECK HILL BNH-2 MATRIX: INTERMEDIATE MICROCLINE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5531578	12.9656667	7.2144754	90.46055	116.08010	88.18069	716.9590 A**3
Reciprocal CELL:	0.1302719	0.0772748	0.1543842	90.37951	63.91901	91.80291	0.001394780 A**-3

*— Direct Cell Corrections:
0.0000000 0.0000000 0.0000000 0.00000 0.00000 0.00000 0.000000

$— Direct Cell Standard ERRorS
0.0130675 0.0596016 0.0099252 0.14966 0.12705 0.06521 5.800511

£— Reciprocal Cell Standard ERRorS
0.000217538 0.000067545 0.000175651 0.1743379 0.1292908 0.1071742

WELSFORD BREAK-NECK HILL BNH-2 MATRIX: INTERMEDIATE MICROCLINE HKL Listing - *** Refers to FIXed, R to Rejects

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.940833		1.540560	6.82489			
2	1	0	0	7.676253		1.540560	11.51817			
3	1	1	0	6.695193		1.540560	13.21298			
4	-1	0	1	6.579323		1.540560	13.44675			
5	-1	1	0	6.512808		1.540560	13.58472			
6	0	0	1	6.477346		1.540560	13.65945			
7	0	2	0	6.470417		1.540560	13.67415			
8	-1	-1	1	5.913402		1.540560	14.96924			
9	-1	1	1	5.817475		1.540560	15.21752			
10	0	1	1	5.807691		1.540560	15.24331			

11	0	-1	1	5.776978		1.540560	15.32484			
12	1	2	0	5.025864		1.540560	17.63216			
13	-1	2	0	4.872354		1.540560	18.19233			
14	-1	-2	1	4.660698		1.540560	19.02600			
15	0	2	1	4.592960		1.540560	19.30927			
16	-1	2	1	4.567314		1.540560	19.41874			
17	0	-2	1	4.562638		1.540560	19.43883			
18	0	3	0	4.313611		1.540560	20.57291			
***	-2	0	1	4.214132	4.230622	1.540560	21.06404	20.9810	0.08304	1.00000
20	1	0	1	4.134168		1.540560	21.47625			
21	-2	-1	1	4.043178		1.540560	21.96551			
22	-2	1	1	3.971818		1.540560	22.36519			
***	1	1	1	3.962486	3.954918	1.540560	22.41855	22.4620	-0.04345	1.00000
24	1	-1	1	3.914140		1.540560	22.69911			
25	2	0	0	3.838127		1.540560	23.15482			
26	1	3	0	3.812109		1.540560	23.31506			
27	2	1	0	3.711668		1.540560	23.95521			
28	-1	3	0	3.710997		1.540560	23.95960			
29	-2	1	0	3.648532		1.540560	24.37605			
30	-1	-3	1	3.641361		1.540560	24.42479			
31	-1	0	2	3.606070		1.540560	24.66757			
32	0	3	1	3.601345		1.540560	24.70045			
33	-2	-2	1	3.581091		1.540560	24.84237			
34	0	-3	1	3.579401		1.540560	24.85429			
35	-1	3	1	3.574388		1.540560	24.88970			
36	1	2	1	3.517734		1.540560	25.29715			
37	-2	2	1	3.483386		1.540560	25.55078			
38	-1	-1	2	3.480395		1.540560	25.57312			
***	-1	1	2	3.467090	3.465222	1.540560	25.67292	25.6870	-0.01408	1.00000
40	1	-2	1	3.450785		1.540560	25.79632			
41	2	2	0	3.347597		1.540560	26.60585			
***	-2	0	2	3.289661	3.289811	1.540560	27.08326	27.0820	0.00126	1.00000
43	-2	2	0	3.256404		1.540560	27.36521			
***	0	0	2	3.238673	3.240632	1.540560	27.51796	27.5010	0.01696	1.00000
45	0	4	0	3.235208		1.540560	27.54801			
46	-2	-1	2	3.203780		1.540560	27.82367			
47	-2	1	2	3.172961		1.540560	28.09944			
48	-1	-2	2	3.159882		1.540560	28.21815			
49	0	1	2	3.146689		1.540560	28.33892			
50	-1	2	2	3.140042		1.540560	28.40017			
51	0	-1	2	3.136887		1.540560	28.42934			
52	-2	-3	1	3.061018		1.540560	29.14937			
***	1	3	1	3.016799	3.020323	1.540560	29.58631	29.5510	0.03531	1.00000
54	1	4	0	3.015400		1.540560	29.60035			
55	-2	3	1	2.969844		1.540560	30.06504			
56	-2	-2	2	2.956701		1.540560	30.20185			
57	1	-3	1	2.953643		1.540560	30.23386			
58	-1	4	0	2.948237		1.540560	30.29063			
59	-1	-4	1	2.926757		1.540560	30.51832			
60	2	3	0	2.913277		1.540560	30.66299			
61	-2	2	2	2.908737		1.540560	30.71203			

eoj .. WELSFORD BNH-2 BREAK-NECK Least Squares Unit Cell Refinement
N D S U version Fargo 86.12 after Appleman and Evans (1973).
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WELSFORD BNH-2 BREAK-NECK HILL MATRIX: ALBITE —) 1986/12/29 . * . * . 3:6

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1430000	12.7770000	7.1540000	94.20000	116.55000	87.91700	664.0379 A**3
Reciprocal CELL:	0.1372831	0.0784770	0.1565790	86.34477	63.52498	90.23193	0.001505938 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD BNH-2 BREAK-NECK HILL MATRIX: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1385754	12.7887894	7.1511409	94.19154	116.56672	87.82988	663.8641 A**3
Reciprocal CELL:	0.1373743	0.0784141	0.1566604	86.39712	63.51374	90.33240	0.001506332 A**-3
*— Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$— Direct Cell Standard ERRorS	0.0012949	0.0044355	0.0009732	0.01734	0.01067	0.01436	0.366212
£— Reciprocal Cell Standard ERRorS	0.000022406	0.000010632	0.000019957	0.0155475	0.0108891	0.0122108	

WELSFORD BNH-2 BREAK-NECK HILL MATRIX: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.752805		1.540560	6.92564			
2	1	0	0	7.279383		1.540560	12.14844			
3	-1	0	1	6.426093		1.540560	13.76892			
***	0	2	0	6.376402	6.385901	1.540560	13.87674	13.8560	0.02074	1.00000
5	0	2	0	6.376402		1.540560	13.87674			
6	1	1	0	6.337818		1.540560	13.96164			
7	-1	1	0	6.306236		1.540560	14.03191			
***	-1	-1	1	5.903209	5.893921	1.540560	14.99524	15.0190	-0.02376	1.00000
9	0	-1	1	5.857332		1.540560	15.11337			
***	-1	1	1	5.587221	5.584279	1.540560	15.84860	15.8570	-0.00840	1.00000
11	0	1	1	5.569748		1.540560	15.89864			

12	1	2	0	4.810316		1.540560	18.42898			
13	-1	2	0	4.782731		1.540560	18.53621			
14	-1	-2	1	4.689430		1.540560	18.90836			
15	0	-2	1	4.659996		1.540560	19.02889			
16	-1	2	1	4.379024		1.540560	20.26233			
17	0	2	1	4.375823		1.540560	20.27731			
18	0	3	0	4.250935		1.540560	20.87962			
***	-2	0	1	4.028026	4.027334	1.540560	22.04916	22.0530	-0.00384	1.00000
20	1	0	1	3.996415		1.540560	22.22578			
21	-2	-1	1	3.892841		1.540560	22.82497			
***	1	-1	1	3.853512	3.855342	1.540560	23.06110	23.0500	0.01110	1.00000
23	-2	1	1	3.791147		1.540560	23.44579			
***	1	1	1	3.774800	3.772238	1.540560	23.54878	23.5650	-0.01622	1.00000
25	1	3	0	3.680161		1.540560	24.16338			
26	-1	-3	1	3.662519		1.540560	24.28154			
***	-1	3	0	3.661613	3.659037	1.540560	24.28764	24.3050	-0.01736	1.00000
28	0	-3	1	3.645414		1.540560	24.39722			
29	2	0	0	3.639691		1.540560	24.43617			
30	-1	0	2	3.565846		1.540560	24.95029			
31	2	1	0	3.505309		1.540560	25.38831			
***	-1	-1	2	3.501090	3.499792	1.540560	25.41941	25.4290	-0.00959	1.00000
33	-2	1	0	3.494592		1.540560	25.46748			
***	-2	-2	1	3.478586	3.474532	1.540560	25.58664	25.6170	-0.03036	1.00000
35	1	-2	1	3.442762		1.540560	25.85747			
36	0	3	1	3.439841		1.540560	25.87981			
37	-1	3	1	3.438851		1.540560	25.88739			
***	-1	1	2	3.370863	3.371348	1.540560	26.41887	26.4150	0.00387	1.00000
39	-2	2	1	3.336746		1.540560	26.69396			
40	1	2	1	3.332501		1.540560	26.72860			
***	-2	0	2	3.213047	3.213934	1.540560	27.74181	27.7340	0.00781	1.00000
42	-2	0	2	3.213047		1.540560	27.74181			
***	0	0	2	3.191616	3.190816	1.540560	27.93185	27.9390	-0.00715	1.00000
44	0	4	0	3.188201		1.540560	27.96238			
45	2	2	0	3.168909		1.540560	28.13611			
***	2	2	0	3.168909	3.166385	1.540560	28.13611	28.1590	-0.02289	1.00000
***	-2	2	0	3.153118	3.151474	1.540560	28.27994	28.2950	-0.01506	1.00000
48	0	-1	2	3.142991		1.540560	28.37297			
49	-2	1	2	3.066400		1.540560	29.09708			
50	0	1	2	3.051300		1.540560	29.24427			
51	-1	2	2	3.019700		1.540560	29.55723			
52	-2	-3	1	2.993544		1.540560	29.82145			
***	1	-3	1	2.965719	2.965992	1.540560	30.10783	30.1050	0.00283	1.00000
***	-2	-2	2	2.951604	2.950580	1.540560	30.25525	30.2660	-0.01075	1.00000
55	-1	-4	1	2.937097		1.540560	30.40828			
56	0	-2	2	2.928666		1.540560	30.49795			
***	0	-4	1	2.926686	2.927537	1.540560	30.51909	30.5100	0.00909	1.00000
58	1	4	0	2.926628		1.540560	30.51970			
59	-1	4	0	2.914176		1.540560	30.65331			
60	1	3	1	2.860558		1.540560	31.24239			
61	-2	3	1	2.858851		1.540560	31.26153			
62	-1	-3	2	2.835847		1.540560	31.52168			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
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Fargo 58105 - 5516

WELSFORD BNH-3 BREAK-NECK HILL MATRIX: ORTHOCLASE —) 1987/ 1/ 4 . * . * . 0:28

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.6000000	12.9690000	7.1980000	90.00000	115.85000	90.00000	722.4864 A**3
Reciprocal CELL:	0.1292078	0.0771069	0.1543744	90.00000	64.15000	90.00000	0.001384109 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 MONOC System
3 Conditions for non-Extinctions Called for

Class	Condition(s)
hkl	h+k = 2n
h0l	h = 2n
0k0	k = 2n

F I N A L V A L U E S for WELSFORD BNH-3 BREAK-NECK HILL MATRIX: ORTHOCLASE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.6031157	12.9831322	7.2109219	90.00000	115.93235	90.00000	723.5849 A**3
Reciprocal CELL:	0.1292725	0.0770895	0.1542308	90.00000	64.06764	90.00000	0.001382008 A**-3
*— Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$— Direct Cell Standard ERRorS	0.0078802	0.0311798	0.0056869	0.00000	0.07854	0.00000	3.069169
£— Reciprocal Cell Standard ERRorS	0.000114630	0.000057180	0.000108448	0.0000000	0.0784744	0.0000000	

WELSFORD BNH-3 BREAK-NECK HILL MATRIX: ORTHOCLASE HKL Listing - *** Refers to FIXed, R to Rejects MONOC

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	-1	1	0	6.643944		1.540560	13.31536			
2	0	2	0	6.485968		1.540560	13.64120			
***	0	0	1	6.483791	6.480390	1.540560	13.64581	13.6530	-0.00719	1.00000
4	-1	1	1	5.873099		1.540560	15.07256			
5	0	2	1	4.585502		1.540560	19.34097			
***	-2	0	1	4.235907	4.227435	1.540560	20.95453	20.9970	-0.04247	1.00000
***	1	1	1	3.956204	3.944518	1.540560	22.45461	22.5220	-0.06739	1.00000
8	2	0	0	3.867799		1.540560	22.97475			

***	-1	3	0	3.774351	3.773028	1.540560	23.55162	23.5600	-0.00838	1.00000
10	-1	3	1	3.614717		1.540560	24.60764			
11	-2	2	1	3.546557		1.540560	25.08819			
12	-1	1	2	3.473094		1.540560	25.62779			
13	-2	2	0	3.321972		1.540560	26.81489			
***	-2	0	2	3.293442	3.293988	1.540560	27.05157	27.0470	0.00457	1.00000
15	0	4	0	3.242984		1.540560	27.48067			
***	0	0	2	3.241895	3.240054	1.540560	27.49007	27.5060	-0.01593	1.00000
17	1	-3	1	2.995654		1.540560	29.79997			
18	-2	2	2	2.936550		1.540560	30.41409			
19	0	4	1	2.900418		1.540560	30.80230			
***	0	4	1	2.900418	2.898242	1.540560	30.80230	30.8260	-0.02370	1.00000
21	2	0	1	2.822417		1.540560	31.67560			
22	-3	1	1	2.797470		1.540560	31.96560			
23	-1	3	2	2.768769		1.540560	32.30597			
24	-3	1	2	2.610043		1.540560	34.32965			
25	2	2	1	2.587999		1.540560	34.63126			
26	-2	4	1	2.574986		1.540560	34.81185			
27	1	1	2	2.559035		1.540560	35.03584			
***	3	1	0	2.529052	2.533125	1.540560	35.46490	35.4060	0.05890	1.00000
29	-2	4	0	2.485056		1.540560	36.11423			
30	-1	5	0	2.459735		1.540560	36.49902			
31	-1	5	1	2.413895		1.540560	37.21731			
32	-3	3	1	2.388246		1.540560	37.63194			
33	-2	0	3	2.382109		1.540560	37.73256			
***	-1	1	3	2.328809	2.330781	1.540560	38.62999	38.5960	0.03399	1.00000
35	-2	4	2	2.310769		1.540560	38.94368			
36	0	4	2	2.292751		1.540560	39.26225			
37	-3	3	2	2.268425		1.540560	39.70087			
38	-2	2	3	2.236068		1.540560	40.30007			
39	1	3	2	2.234698		1.540560	40.32586			
40	-3	3	0	2.214648		1.540560	40.70703			
41	1	5	1	2.200496		1.540560	40.98054			
42	-3	1	3	2.164837		1.540560	41.68672			
***	0	6	0	2.161989	2.162939	1.540560	41.74419	41.7250	0.01919	1.00000
44	0	0	3	2.161264		1.540560	41.75887			
45	2	4	1	2.129021		1.540560	42.42157			
46	-4	0	1	2.125407		1.540560	42.49720			
47	-4	0	2	2.117954		1.540560	42.65405			
48	-1	5	2	2.105709		1.540560	42.91432			
49	2	0	2	2.077057		1.540560	43.53631			
50	-1	3	3	2.076449		1.540560	43.54969			
51	3	1	1	2.073980		1.540560	43.60419			
52	0	6	1	2.050974		1.540560	44.11883			
53	0	2	3	2.050423		1.540560	44.13130			
54	-4	2	1	2.019730		1.540560	44.83818			
***	-4	2	2	2.013330	2.012669	1.540560	44.98841	45.0040	-0.01559	1.00000
56	2	2	2	1.978102		1.540560	45.83479			
57	-3	3	3	1.957700		1.540560	46.34015			
58	4	0	0	1.933900		1.540560	46.94439			
59	-2	6	1	1.925668		1.540560	47.15719			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
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WELSFORD BREAK-NECK HILL BNH-3 MATRIX: ALBITE —) 1986/12/30 . * . * . 1:17

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1430000	12.7770000	7.1540000	94.20000	116.55000	87.91700	664.0379 A**3
Reciprocal CELL:	0.1372831	0.0784770	0.1565790	86.34477	63.52498	90.23193	0.001505938 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.6 Dmin = 1.428822 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD BREAK-NECK HILL BNH-3 MATRIX: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1395284	12.7950140	7.1549635	94.23837	116.57581	87.81815	664.4036 A**3
Reciprocal CELL:	0.1373806	0.0783887	0.1566022	86.35029	63.50427	90.32129	0.001505109 A**-3
#— Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$— Direct Cell Standard ERRorS	0.0016360	0.0063496	0.0011390	0.01983	0.01500	0.01149	0.554228
&— Reciprocal Cell Standard ERRorS	0.000027150	0.000010341	0.000025870	0.0199898	0.0150133	0.0121223	

WELSFORD BREAK-NECK HILL BNH-3 MATRIX: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.756934		1.540560	6.92340			
2	1	0	0	7.279050		1.540560	12.14900			
3	-1	0	1	6.428509		1.540560	13.76372			
4	0	0	1	6.385605		1.540560	13.85665			
5	0	2	0	6.378467		1.540560	13.87223			
6	1	1	0	6.337568		1.540560	13.96220			
7	-1	1	0	6.307047		1.540560	14.03010			
***	-1	-1	1	5.907018	5.904084	1.540560	14.98551	14.9930	-0.00749	1.00000
9	0	-1	1	5.861480		1.540560	15.10261			
10	-1	1	1	5.587862		1.540560	15.84677			

11	0	1	1	5.570022		1.540560	15.89785			
12	1	2	0	4.810637		1.540560	18.42774			
13	-1	2	0	4.783969		1.540560	18.53137			
14	-1	-2	1	4.692721		1.540560	18.89497			
15	0	-2	1	4.663654		1.540560	19.01383			
16	-1	2	1	4.379211		1.540560	20.26146			
17	0	2	1	4.375659		1.540560	20.27808			
18	0	3	0	4.252311		1.540560	20.87278			
***	-2	0	1	4.028507	4.027875	1.540560	22.04650	22.0500	-0.00350	1.00000
20	1	0	1	3.996888		1.540560	22.22312			
21	-2	-1	1	3.893705		1.540560	22.81983			
***	1	-1	1	3.854715	3.853198	1.540560	23.05380	23.0630	-0.00920	1.00000
23	-2	1	1	3.791367		1.540560	23.44441			
***	1	1	1	3.774680	3.773028	1.540560	23.54954	23.5600	-0.01046	1.00000
***	1	3	0	3.680696	3.674076	1.540560	24.15982	24.2040	-0.04418	1.00000
26	-1	-3	1	3.664941		1.540560	24.26525			
***	-1	-3	1	3.664941	3.661262	1.540560	24.26525	24.2900	-0.02475	1.00000
28	0	-3	1	3.648109		1.540560	24.37892			
29	2	0	0	3.639525		1.540560	24.43731			
30	-1	0	2	3.567538		1.540560	24.93827			
***	-1	-1	2	3.503505	3.504672	1.540560	25.40160	25.3930	0.00860	1.00000
32	-1	-1	2	3.503505		1.540560	25.40160			
33	-2	1	0	3.494709		1.540560	25.46661			
***	-2	-2	1	3.479678	3.483625	1.540560	25.57847	25.5490	0.02947	1.00000
35	1	-2	1	3.444339		1.540560	25.84543			
36	0	3	1	3.439779		1.540560	25.88029			
37	-1	3	1	3.439045		1.540560	25.88590			
***	-1	1	2	3.371720	3.373606	1.540560	26.41204	26.3970	0.01504	1.00000
39	-2	2	1	3.336921		1.540560	26.69254			
40	1	2	1	3.332210		1.540560	26.73098			
41	-1	-2	2	3.216494		1.540560	27.71149			
***	-2	0	2	3.214254	3.213025	1.540560	27.73118	27.7420	-0.01082	1.00000
***	0	0	2	3.192802	3.194738	1.540560	27.92126	27.9040	0.01726	1.00000
***	0	4	0	3.189233	3.190256	1.540560	27.95314	27.9440	0.00914	1.00000
45	-2	-1	2	3.169106		1.540560	28.13432			
***	2	2	0	3.168784	3.168700	1.540560	28.13724	28.1380	-0.00076	1.00000
***	-2	2	0	3.153523	3.152783	1.540560	28.27623	28.2830	-0.00677	1.00000
48	0	-1	2	3.144777		1.540560	28.35651			
49	-2	1	2	3.067079		1.540560	29.09049			
50	0	1	2	3.051852		1.540560	29.23887			
51	-1	2	2	3.020014		1.540560	29.55409			
52	-2	-3	1	2.994650		1.540560	29.81019			
***	1	-3	1	2.967290	2.968304	1.540560	30.09151	30.0810	0.01051	1.00000
***	-2	-2	2	2.953509	2.952009	1.540560	30.23527	30.2510	-0.01573	1.00000
55	-1	-4	1	2.938887		1.540560	30.38932			
56	0	-2	2	2.930740		1.540560	30.47584			
***	0	-2	2	2.930740	2.928942	1.540560	30.47584	30.4950	-0.01916	1.00000
58	1	4	0	2.927194		1.540560	30.51366			
59	-1	4	0	2.915152		1.540560	30.64280			
60	1	3	1	2.860334		1.540560	31.24498			
61	-2	3	1	2.859069		1.540560	31.25908			

eoj .. WELSFORD BNH-5 PINK FRAGMENLeast Squares Unit Cell Refinement
N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
Department of CHEMISTRY
NORTH DAKOTA STATE UNIVERSITY
Fargo 58105 - 5516

WELSFORD BNH-5 PINK FRAGMENTS:, ALBITE —) 1987/ 1/ 8 . * . * . 0:37

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1380000	12.7890000	7.1560000	94.33300	116.56700	87.65000	664.2093 A**3
Reciprocal CELL:	0.1373912	0.0784189	0.1565611	86.32927	63.52584	90.46340	0.001505550 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD BNH-5 PINK FRAGMENTS: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1414424	12.7942031	7.1536529	94.17687	116.56242	87.87988	664.7544 A**3
Reciprocal CELL:	0.1373112	0.0783745	0.1565875	86.38951	63.51989	90.28439	0.001504315 A**-3
*— Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$— Direct Cell Standard ERRorS	0.0014095	0.0062419	0.0010355	0.01651	0.01294	0.01245	0.523406
£— Reciprocal Cell Standard ERRorS	0.000025120	0.000009865	0.000024246	0.0157013	0.0129934	0.0114882	

WELSFORD BNH-5 PINK FRAGMENTS: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.759251		1.540560	6.92214			
2	1	0	0	7.282726		1.540560	12.14284			
3	-1	0	1	6.428403		1.540560	13.76395			
***	0	0	1	6.386204	6.385901	1.540560	13.85534	13.8560	-0.00066	1.00000
5	0	2	0	6.379626		1.540560	13.86970			
6	1	1	0	6.338502		1.540560	13.96013			
***	-1	1	0	6.311471	6.307986	1.540560	14.02022	14.0280	-0.00778	1.00000
***	-1	-1	1	5.903949	5.895482	1.540560	14.99334	15.0150	-0.02166	1.00000
9	0	-1	1	5.860428		1.540560	15.10534			
***	-1	1	1	5.590715	5.585679	1.540560	15.83863	15.8530	-0.01437	1.00000

11	0	1	1	5.572108		1.540560	15.89186			
12	1	2	0	4.810642		1.540560	18.42772			
13	-1	2	0	4.787030		1.540560	18.51941			
14	-1	-2	1	4.689915		1.540560	18.90638			
15	0	-2	1	4.662587		1.540560	19.01822			
16	-1	2	1	4.382179		1.540560	20.24759			
17	0	2	1	4.377676		1.540560	20.26864			
18	0	3	0	4.253084		1.540560	20.86895			
***	-2	0	1	4.029550	4.030041	1.540560	22.04072	22.0380	0.00272	1.00000
20	1	0	1	3.998425		1.540560	22.21447			
21	-2	-1	1	3.893379		1.540560	22.82177			
***	1	-1	1	3.856061	3.856663	1.540560	23.04564	23.0420	0.00364	1.00000
23	-2	1	1	3.793531		1.540560	23.43085			
***	1	1	1	3.776125	3.773343	1.540560	23.54040	23.5580	-0.01760	1.00000
***	1	3	0	3.680628	3.679168	1.540560	24.16026	24.1700	-0.00974	1.00000
26	-1	3	0	3.664751		1.540560	24.26652			
***	-1	3	0	3.664751	3.663788	1.540560	24.26652	24.2730	-0.00648	1.00000
28	0	-3	1	3.647449		1.540560	24.38340			
29	2	0	0	3.641363		1.540560	24.42478			
30	-1	0	2	3.567278		1.540560	24.94011			
31	2	1	0	3.506153		1.540560	25.38209			
***	-1	-1	2	3.502264	3.502908	1.540560	25.41075	25.4060	0.00475	1.00000
33	-2	1	0	3.496980		1.540560	25.44979			
***	-2	-2	1	3.478635	3.474399	1.540560	25.58627	25.6180	-0.03173	1.00000
35	1	-2	1	3.445368		1.540560	25.83758			
36	-1	3	1	3.441345		1.540560	25.86830			
37	0	3	1	3.441338		1.540560	25.86836			
***	-1	1	2	3.372474	3.371098	1.540560	26.40603	26.4170	-0.01097	1.00000
39	-2	2	1	3.339361		1.540560	26.67268			
40	1	2	1	3.333389		1.540560	26.72134			
***	-2	0	2	3.214201	3.217118	1.540560	27.73164	27.7060	0.02564	1.00000
42	-2	0	2	3.214201		1.540560	27.73164			
***	0	0	2	3.193102	3.194851	1.540560	27.91859	27.9030	0.01559	1.00000
***	0	4	0	3.189813	3.191487	1.540560	27.94796	27.9330	0.01496	1.00000
44	0	4	0	3.189813		1.540560	27.94796			
45	2	2	0	3.169251		1.540560	28.13301			
***	2	2	0	3.169251	3.168369	1.540560	28.13301	28.1410	-0.00799	1.00000
***	-2	2	0	3.155735	3.157048	1.540560	28.25599	28.2440	0.01199	1.00000
48	0	-1	2	3.144560		1.540560	28.35851			
49	-2	1	2	3.067967		1.540560	29.08189			
50	0	1	2	3.052637		1.540560	29.23118			
51	-1	2	2	3.021317		1.540560	29.54106			
52	-2	-3	1	2.993528		1.540560	29.82162			
***	1	-3	1	2.968050	2.969654	1.540560	30.08363	30.0670	0.01663	1.00000
***	-2	-2	2	2.951975	2.952295	1.540560	30.25136	30.2480	0.00336	1.00000
55	-1	-4	1	2.937745		1.540560	30.40142			
56	0	-2	2	2.930214		1.540560	30.48145			
***	0	-2	2	2.930214	2.928755	1.540560	30.48145	30.4970	-0.01555	1.00000
58	1	4	0	2.927181		1.540560	30.51380			
59	-1	4	0	2.916522		1.540560	30.62805			
60	-2	3	1	2.861263		1.540560	31.23450			
61	1	3	1	2.861250		1.540560	31.23464			
62	-1	-3	2	2.836703		1.540560	31.51192			
63	-2	2	2	2.795357		1.540560	31.99041			
64	0	2	2	2.786054		1.540560	32.10011			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
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Fargo 58105 - 5516

WELSFORD CR-1 MATRIX OF OBSIDIAN: INTERMEDIATE MICROCLINE —) 1987/ 1/ 4 . * . * . 2:5

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5820000	12.9650000	7.2120000	90.40000	115.95000	88.35000	721.2287 A**3
Reciprocal CELL:	0.1296417	0.0771642	0.1542084	90.35817	64.05057	91.64036	0.001386523 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD CR-1 MATRIX OF OBSIDIAN: INTERMEDIATE MICROCLINE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5863695	12.9915169	7.2144568	90.65709	116.01673	87.94704	721.9969 A**3
Reciprocal CELL:	0.1296942	0.0770772	0.1542968	90.27186	63.98470	91.96531	0.001385047 A**-3
+— Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$— Direct Cell Standard ERRorS	0.0035603	0.0178084	0.0039419	0.04274	0.03895	0.05801	1.588706
2— Reciprocal Cell Standard ERRorS	0.000081571	0.000023884	0.000051482	0.0564582	0.0387483	0.0589026	

WELSFORD CR-1 MATRIX OF OBSIDIAN: INTERMEDIATE MICROCLINE HKL Listing - *** Refers to FIXed, R to Rejects TRI

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.974012		1.540560	6.80742			
2	1	0	0	7.710444		1.540560	11.46692			
3	1	1	0	6.730428		1.540560	13.14351			
4	-1	0	1	6.584677		1.540560	13.43576			
5	-1	1	0	6.530615		1.540560	13.54751			
6	0	2	0	6.487006		1.540560	13.63901			
***	0	0	1	6.481015	6.474255	1.540560	13.65168	13.6660	-0.01432	1.00000
***	-1	-1	1	5.930590	5.928460	1.540560	14.92561	14.9310	-0.00539	1.00000
9	-1	1	1	5.814582		1.540560	15.22514			
10	0	1	1	5.808896		1.540560	15.24013			
11	0	-1	1	5.786900		1.540560	15.29841			

12	1	2	0	5.049951		1.540560	17.54740			
13	-1	2	0	4.882077		1.540560	18.15579			
14	-1	-2	1	4.678748		1.540560	18.95192			
15	0	2	1	4.595802		1.540560	19.29721			
16	0	-2	1	4.574047		1.540560	19.38987			
17	-1	2	1	4.565630		1.540560	19.42597			
18	0	3	0	4.324671		1.540560	20.51973			
***	-2	0	1	4.227233	4.231021	1.540560	20.99802	20.9790	0.01902	1.00000
20	1	0	1	4.145404		1.540560	21.41735			
21	-2	-1	1	4.060765		1.540560	21.86920			
22	-2	1	1	3.979019		1.540560	22.32420			
***	1	1	1	3.973556	3.974659	1.540560	22.35529	22.3490	0.00629	1.00000
***	1	-1	1	3.924379	3.920465	1.540560	22.63910	22.6620	-0.02290	1.00000
25	2	0	0	3.855222		1.540560	23.05073			
26	1	3	0	3.828320		1.540560	23.21495			
27	2	1	0	3.730624		1.540560	23.83170			
28	-1	3	0	3.717860		1.540560	23.91472			
29	-2	1	0	3.661388		1.540560	24.28915			
30	-1	-3	1	3.656043		1.540560	24.32521			
31	-1	0	2	3.605575		1.540560	24.67101			
32	0	3	1	3.605227		1.540560	24.67344			
33	-2	-2	1	3.598904		1.540560	24.71746			
34	0	-3	1	3.589465		1.540560	24.78350			
35	-1	3	1	3.574838		1.540560	24.88652			
36	1	2	1	3.527635		1.540560	25.22498			
37	-2	2	1	3.487006		1.540560	25.52382			
38	-1	-1	2	3.483604		1.540560	25.54916			
***	-1	1	2	3.464317	3.470802	1.540560	25.69383	25.6450	0.04883	1.00000
40	1	-2	1	3.459541		1.540560	25.72991			
41	2	2	0	3.365214		1.540560	26.46403			
***	-2	0	2	3.292338	3.292316	1.540560	27.06081	27.0610	-0.00019	1.00000
43	-2	2	0	3.265307		1.540560	27.28914			
***	0	0	2	3.240507	3.243640	1.540560	27.50208	27.4750	0.02708	1.00000
45	0	0	2	3.240507		1.540560	27.50208			
46	-2	-1	2	3.209974		1.540560	27.76890			
47	-2	1	2	3.172734		1.540560	28.10149			
48	-1	-2	2	3.165992		1.540560	28.16257			
49	0	1	2	3.147438		1.540560	28.33204			
50	0	-1	2	3.140423		1.540560	28.39665			
51	-1	2	2	3.137191		1.540560	28.42652			
52	-2	-3	1	3.076512		1.540560	28.99934			
53	1	4	0	3.027084		1.540560	29.48350			
54	1	3	1	3.025244		1.540560	29.50184			
55	-2	3	1	2.972122		1.540560	30.04145			
56	-2	-2	2	2.965295		1.540560	30.11224			
57	1	-3	1	2.961014		1.540560	30.15682			
58	-1	4	0	2.953750		1.540560	30.23274			
59	-1	-4	1	2.938301		1.540560	30.39553			
60	2	3	0	2.928088		1.540560	30.50411			
61	-2	2	2	2.907291		1.540560	30.72769			
62	0	4	1	2.906065		1.540560	30.74098			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
Department of CHEMISTRY
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WELSFORD CR-1 MATRIX OF OBSIDIAN: ALBITE —) 1987/ 1/ 3 . * . * . 0:37

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1380000	12.7890000	7.1560000	94.33300	116.56700	87.65000	664.2093 A**3
Reciprocal CELL:	0.1373912	0.0784189	0.1565611	86.32927	63.52584	90.46340	0.001505550 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD CR-1 MATRIX OF OBSIDIAN: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1389109	12.7919280	7.1567745	94.19393	116.57950	87.80641	664.4912 A**3
Reciprocal CELL:	0.1373775	0.0784019	0.1565461	86.40652	63.50682	90.35675	0.001504911 A**-3

*— Direct Cell Corrections:
0.0000000 0.0000000 0.0000000 0.00000 0.00000 0.00000 0.000000

$— Direct Cell Standard ERRorS
0.0018340 0.0074902 0.0011826 0.01889 0.01570 0.01425 0.620294

£— Reciprocal Cell Standard ERRorS
0.000029001 0.000014229 0.000031649 0.0189032 0.0157552 0.0144341

WELSFORD CR-1 MATRIX OF OBSIDIAN: ALBITE HKL Listing — *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.754791		1.540560	6.92456			
2	1	0	0	7.279211		1.540560	12.14873			
3	-1	0	1	6.429719		1.540560	13.76111			
***	0	0	1	6.387894	6.391409	1.540560	13.85166	13.8440	0.00766	1.00000
5	0	2	0	6.377396		1.540560	13.87457			
6	1	1	0	6.339112		1.540560	13.95878			
***	-1	1	0	6.305220	6.299497	1.540560	14.03419	14.0470	-0.01281	1.00000
***	-1	-1	1	5.906599	5.897435	1.540560	14.98658	15.0100	-0.02342	1.00000
9	0	-1	1	5.860579		1.540560	15.10494			
***	-1	1	1	5.589447	5.584279	1.540560	15.84225	15.8570	-0.01475	1.00000

11	0	1	1	5.573479		1.540560	15.88793			
12	1	2	0	4.811711		1.540560	18.42360			
13	-1	2	0	4.782102		1.540560	18.53867			
14	-1	-2	1	4.691617		1.540560	18.89946			
15	0	-2	1	4.661646		1.540560	19.02209			
16	-1	2	1	4.380181		1.540560	20.25692			
17	0	2	1	4.378100		1.540560	20.26665			
18	0	3	0	4.251597		1.540560	20.87633			
***	-2	0	1	4.028583	4.030764	1.540560	22.04608	22.0340	0.01208	1.00000
20	1	0	1	3.997773		1.540560	22.21814			
21	-2	-1	1	3.893779		1.540560	22.81939			
***	1	-1	1	3.854366	3.857984	1.540560	23.05592	23.0340	0.02192	1.00000
23	-2	1	1	3.791314		1.540560	23.44475			
***	1	1	1	3.776388	3.777928	1.540560	23.53874	23.5290	0.00974	1.00000
***	1	3	0	3.681252	3.681418	1.540560	24.15611	24.1550	0.00111	1.00000
26	-1	-3	1	3.663887		1.540560	24.27233			
***	-1	3	0	3.661341	3.661708	1.540560	24.28947	24.2870	0.00247	1.00000
28	0	-3	1	3.646304		1.540560	24.39117			
29	2	0	0	3.639686		1.540560	24.43675			
30	-1	0	2	3.568731		1.540560	24.92980			
***	-1	-1	2	3.503825	3.506981	1.540560	25.39924	25.3760	0.02324	1.00000
32	-1	-1	2	3.503825		1.540560	25.39924			
33	-2	1	0	3.494167		1.540560	25.47063			
***	-2	-2	1	3.479647	3.480678	1.540560	25.57870	25.5710	0.00770	1.00000
35	1	-2	1	3.443192		1.540560	25.85419			
36	0	3	1	3.441253		1.540560	25.86901			
37	-1	3	1	3.439531		1.540560	25.88219			
***	-1	1	2	3.373370	3.371348	1.540560	26.39889	26.4150	-0.01611	1.00000
39	-2	2	1	3.336727		1.540560	26.69412			
40	1	2	1	3.333970		1.540560	26.71660			
***	-2	0	2	3.214860	3.218257	1.540560	27.72585	27.6960	0.02985	1.00000
42	-2	0	2	3.214860		1.540560	27.72585			
***	0	0	2	3.193947	3.194626	1.540560	27.91106	27.9050	0.00606	1.00000
***	0	4	0	3.188698	3.191823	1.540560	27.95793	27.9300	0.02793	1.00000
44	0	4	0	3.188698		1.540560	27.95793			
45	2	2	0	3.169556		1.540560	28.13025			
***	2	2	0	3.169556	3.169141	1.540560	28.13025	28.1340	-0.00375	1.00000
***	-2	2	0	3.152610	3.152019	1.540560	28.28459	28.2900	-0.00541	1.00000
48	0	-1	2	3.145077		1.540560	28.35375			
49	-2	1	2	3.067896		1.540560	29.08257			
50	0	1	2	3.053518		1.540560	29.22256			
51	-1	2	2	3.021605		1.540560	29.53818			
52	-2	-3	1	2.994521		1.540560	29.81150			
***	1	-3	1	2.965929	2.968979	1.540560	30.10566	30.0740	0.03166	1.00000
***	-2	-2	2	2.953299	2.953821	1.540560	30.23747	30.2320	0.00547	1.00000
55	-1	-4	1	2.938020		1.540560	30.39850			
***	0	-2	2	2.930289	2.929224	1.540560	30.48064	30.4920	-0.01136	1.00000
57	1	4	0	2.927460		1.540560	30.51082			
58	0	-4	1	2.927247		1.540560	30.51310			
59	-1	4	0	2.914092		1.540560	30.65421			
***	1	3	1	2.861770	2.863006	1.540560	31.22883	31.2150	0.01383	1.00000

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
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WELSFORD FL-1 FLAGLOR MOUNTAIN MATRIX: ORTHOCLASE —) 1987/ 1/11 . * . * . 2:42

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.6000000	12.9690000	7.1980000	90.00000	115.85000	90.00000	722.4864 A**3
Reciprocal CELL:	0.1292078	0.0771059	0.1543744	90.00000	64.15000	90.00000	0.001384109 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.6 Dmin = 1.429679 MONOC System
3 Conditions for non-Extinctions Called for Class Condition(s)
hkl h+k = 2n
h0l h = 2n
0k0 k = 2n

F I N A L V A L U E S for WELSFORD FL-1 FLAGLOR MOUNTAIN MATRIX: ORTHOCLASE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5954437	13.0049366	7.2010447	90.00000	116.00571	90.00000	722.0441 A**3
Reciprocal CELL:	0.1294880	0.0770198	0.1545618	90.00000	63.99429	90.00000	0.001384957 A**-3
+— Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$— Direct Cell Standard ERRorS	0.0025606	0.0079139	0.0016975	0.00000	0.02241	0.00000	0.715406
?— Reciprocal Cell Standard ERRorS	0.000034568	0.000021188	0.000036361	0.0000000	0.0223737	0.0000000	

WELSFORD FL-1 FLAGLOR MOUNTAIN MATRIX: ORTHOCLASE HKL Listing - *** Refers to FIXed, R to Rejects MONOC

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	-1	1	0	6.637352		1.540560	13.32865			
***	0	2	0	6.491837	6.483226	1.540560	13.62881	13.6470	-0.01819	1.00000
3	0	0	1	6.469903		1.540560	13.67524			
***	-1	1	1	5.870713	5.865576	1.540560	15.07872	15.0920	-0.01328	1.00000
5	0	2	1	4.582648		1.540560	19.35314			
***	-2	0	1	4.232949	4.230423	1.540560	20.96934	20.9820	-0.01266	1.00000
***	1	1	1	3.947843	3.949711	1.540560	22.50279	22.4920	0.01079	1.00000

8	2	0	0	3.861362		1.540560	23.01357			
***	1	3	0	3.775451	3.772238	1.540560	23.54466	23.5650	-0.02034	1.00000
***	-1	3	1	3.616150	3.619009	1.540560	24.59746	24.5780	0.01946	1.00000
***	-2	2	1	3.545777	3.540751	1.540560	25.09380	25.1300	-0.03620	1.00000
***	-1	1	2	3.468774	3.470004	1.540560	25.66025	25.6510	0.00925	1.00000
***	2	2	0	3.318676	3.315405	1.540560	26.84202	26.8690	-0.02698	1.00000
***	-2	0	2	3.290993	3.289930	1.540560	27.07209	27.0810	-0.00891	1.00000
***	0	4	0	3.245919	3.247001	1.540560	27.45533	27.4460	0.00933	1.00000
***	0	0	2	3.234952	3.236823	1.540560	27.55024	27.5340	0.01624	1.00000
***	1	3	1	2.993170	2.995454	1.540560	29.82527	29.8020	0.02327	1.00000
18	-2	2	2	2.935356		1.540560	30.42676			
***	0	4	1	2.901268	2.902285	1.540560	30.79306	30.7820	0.01106	1.00000
20	0	2	2	2.895382		1.540560	30.85721			
21	2	0	1	2.816002		1.540560	31.74967			
22	-3	1	1	2.795040		1.540560	31.99414			
***	-1	3	2	2.767490	2.769100	1.540560	32.32132	32.3020	0.01932	1.00000
***	-3	1	2	2.608640	2.611050	1.540560	34.34870	34.3160	0.03270	1.00000
25	2	2	1	2.583421		1.540560	34.69458			
***	-2	4	1	2.575788	2.575405	1.540560	34.80066	34.8060	-0.00534	1.00000
27	1	1	2	2.553179		1.540560	35.11881			
28	-3	1	0	2.525089		1.540560	35.52242			
29	-2	4	0	2.484663		1.540560	36.12013			
30	-1	5	0	2.461320		1.540560	36.47469			
31	-1	5	1	2.415544		1.540560	37.19098			
32	-3	3	1	2.387318		1.540560	37.64713			
33	-2	0	3	2.379403		1.540560	37.77709			
***	-1	1	3	2.325066	2.324468	1.540560	38.69464	38.7050	-0.01036	1.00000
35	-2	4	2	2.310983		1.540560	38.93994			
36	0	4	2	2.291324		1.540560	39.28770			
37	-3	3	2	2.268004		1.540560	39.70854			
38	-2	2	3	2.234069		1.540560	40.33770			
39	1	3	2	2.231272		1.540560	40.39046			
40	-3	3	0	2.212451		1.540560	40.74925			
41	1	5	1	2.200426		1.540560	40.98191			
***	0	6	0	2.163946	2.163881	1.540560	41.70469	41.7060	-0.00131	1.00000
43	-3	1	3	2.163326		1.540560	41.71719			
44	0	0	3	2.156634		1.540560	41.85271			
45	2	4	1	2.127090		1.540560	42.46195			
46	-4	0	1	2.123012		1.540560	42.54748			
47	-4	0	2	2.116474		1.540560	42.68533			
48	-1	5	2	2.105949		1.540560	42.90921			
49	-1	3	3	2.074179		1.540560	43.59981			
50	2	0	2	2.072027		1.540560	43.64740			
51	3	1	1	2.069692		1.540560	43.69918			
52	0	6	1	2.052202		1.540560	44.09104			
53	0	2	3	2.046653		1.540560	44.21688			
54	-4	2	1	2.017850		1.540560	44.88213			
55	-4	2	2	2.012235		1.540560	45.01425			
56	2	2	2	1.973921		1.540560	45.93742			
57	-3	3	3	1.956904		1.540560	46.36009			
***	4	0	0	1.930681	1.931509	1.540560	47.02736	47.0060	0.02136	1.00000

23 Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
Department of CHEMISTRY
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Fargo 58105 - 5516

WELSFORD FL-1 FLAGLOR MOUNTAIN MATRIX: ALBITE —) 1987/ 1/11 . * . * . 2:9

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1430000	12.7770000	7.1540000	94.20000	116.55000	87.91700	664.0379 A**3
Reciprocal CELL:	0.1372831	0.0784770	0.1565790	86.34477	63.52498	90.23193	0.001505938 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD FL-1 FLAGLOR MOUNTAIN MATRIX: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1396046	12.7927247	7.1535567	94.20781	116.59351	87.97041	663.8433 A**3
Reciprocal CELL:	0.1374121	0.0784215	0.1566704	86.30784	63.47775	90.16429	0.001506380 A**-3
*— Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$— Direct Cell Standard ERRorS	0.0015840	0.0048087	0.0010531	0.01944	0.01101	0.01384	0.439667
&— Reciprocal Cell Standard ERRorS	0.000017850	0.000019643	0.000020428	0.0208908	0.0110766	0.0160541	

WELSFORD FL-1 FLAGLOR MOUNTAIN MATRIX: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.751608		1.540560	6.92629			
2	1	0	0	7.277381		1.540560	12.15180			
3	-1	0	1	6.429175		1.540560	13.76228			
***	0	0	1	6.382826	6.379944	1.540560	13.86271	13.8690	-0.00629	1.00000
5	0	2	0	6.375804		1.540560	13.87805			
6	1	1	0	6.328327		1.540560	13.98269			
7	-1	1	0	6.312723		1.540560	14.01742			
***	-1	-1	1	5.902949	5.913889	1.540560	14.99590	14.9680	0.02790	1.00000
9	0	-1	1	5.860784		1.540560	15.10441			
***	-1	1	1	5.591292	5.593041	1.540560	15.83698	15.8320	0.00498	1.00000
11	0	1	1	5.566045		1.540560	15.90928			

12	1	2	0	4.802467		1.540560	18.45937			
13	-1	2	0	4.788835		1.540560	18.51237			
14	-1	-2	1	4.687854		1.540560	18.91477			
15	0	-2	1	4.663515		1.540560	19.01440			
16	-1	2	1	4.381871		1.540560	20.24903			
17	0	2	1	4.372267		1.540560	20.29397			
18	0	3	0	4.250536		1.540560	20.88160			
***	-2	0	1	4.028967	4.029680	1.540560	22.04395	22.0400	0.00395	1.00000
20	1	0	1	3.994813		1.540560	22.23481			
21	-2	-1	1	3.891068		1.540560	22.83551			
***	1	-1	1	3.854954	3.857984	1.540560	23.05235	23.0340	0.01835	1.00000
23	-2	1	1	3.794295		1.540560	23.42607			
***	1	1	1	3.770687	3.772238	1.540560	23.57484	23.5650	0.00984	1.00000
25	1	3	0	3.674930		1.540560	24.19829			
***	-1	3	0	3.665763	3.667956	1.540560	24.25972	24.2450	0.01472	1.00000
27	-1	-3	1	3.661024		1.540560	24.29161			
28	0	-3	1	3.647894		1.540560	24.38038			
29	2	0	0	3.638690		1.540560	24.44300			
30	-1	0	2	3.566992		1.540560	24.94214			
31	-1	-1	2	3.502452		1.540560	25.40936			
***	-1	-1	2	3.502452	3.501417	1.540560	25.40936	25.4170	-0.00764	1.00000
33	-2	1	0	3.496379		1.540560	25.45424			
34	-2	-2	1	3.475405		1.540560	25.61046			
35	1	-2	1	3.445801		1.540560	25.83427			
36	-1	3	1	3.440612		1.540560	25.87391			
37	0	3	1	3.437211		1.540560	25.89995			
***	-1	1	2	3.371541	3.370972	1.540560	26.41347	26.4180	-0.00453	1.00000
39	-2	2	1	3.340462		1.540560	26.66372			
40	1	2	1	3.327729		1.540560	26.76764			
***	-2	0	2	3.214587	3.215753	1.540560	27.72825	27.7180	0.01025	1.00000
42	-2	0	2	3.214587		1.540560	27.72825			
***	0	0	2	3.191413	3.191487	1.540560	27.93367	27.9330	0.00067	1.00000
44	0	4	0	3.187902		1.540560	27.96586			
45	-2	-1	2	3.168090		1.540560	28.14353			
***	2	2	0	3.164163	3.163743	1.540560	28.17918	28.1830	-0.00382	1.00000
***	-2	2	0	3.156361	3.157377	1.540560	28.25027	28.2410	0.00927	1.00000
48	0	-1	2	3.143977		1.540560	28.36388			
49	-2	1	2	3.068432		1.540560	29.07738			
50	0	1	2	3.050010		1.540560	29.25692			
51	-1	2	2	3.019946		1.540560	29.55477			
52	-2	-3	1	2.990265		1.540560	29.85492			
***	1	-3	1	2.968917	2.969750	1.540560	30.07464	30.0660	0.00864	1.00000
***	-2	-2	2	2.951475	2.952104	1.540560	30.25661	30.2500	0.00661	1.00000
55	-1	-4	1	2.935913		1.540560	30.42085			
***	0	-2	2	2.930392	2.929787	1.540560	30.47955	30.4860	-0.00645	1.00000
57	0	-4	1	2.928352		1.540560	30.50130			
58	1	4	0	2.923105		1.540560	30.55738			
59	-1	4	0	2.916951		1.540560	30.62343			
60	-2	3	1	2.862147		1.540560	31.22460			
61	1	3	1	2.856284		1.540560	31.29034			
62	-1	-3	2	2.836786		1.540560	31.51098			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
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WELSFORD HI-1 HAMILTON MOUNTAIN MATRIX: ORTHOCLASE --) 1986/12/20 . * . * . 0:48

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.6000000	12.9690000	7.1980000	90.00000	115.85000	90.00000	722.4654 A**3
Reciprocal CELL:	0.1292078	0.0771069	0.1543744	90.00000	64.15000	90.00000	0.001384109 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.6 Dmin = 1.429211 MONOC System
3 Conditions for non-Extinctions Called for

Class	Condition(s)
hkl	h+k = 2n
h0l	h = 2n
0k0	k = 2n

F I N A L V A L U E S for WELSFORD HI-1 HAMILTON MOUNTAIN MATRIX: ORTHOCLASE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5947882	13.0015492	7.2099149	90.00000	116.07581	90.00000	721.6009 A**3
Reciprocal CELL:	0.1295955	0.0770980	0.1544881	90.00000	63.92319	90.00000	0.001385808 A**-3
*-- Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$-- Direct Cell Standard ERRorS	0.0050258	0.0182104	0.0046225	0.00000	0.04703	0.00000	1.592355
£-- Reciprocal Cell Standard ERRorS	0.000092948	0.000050959	0.000071782	0.0000000	0.0469174	0.0000000	

WELSFORD HI-1 HAMILTON MOUNTAIN MATRIX: ORTHOCLASE HKL Listing - *** Refers to FIXed, R to Rejects

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	-1	1	0	6.631524		1.540560	13.34042			
***	0	2	0	6.485254	6.479918	1.540560	13.64271	13.6540	-0.01129	1.00000
3	0	0	1	6.472989		1.540560	13.66868			
4	-1	1	1	5.875216		1.540560	15.06710			
5	0	2	1	4.581425		1.540560	19.35835			
***	-2	0	1	4.234258	4.231021	1.540560	20.96278	20.9790	-0.01622	1.00000
***	1	1	1	3.945422	3.949711	1.540560	22.51677	22.4920	0.02477	1.00000
8	2	0	0	3.858157		1.540560	23.03235			

***	1	3	0	3.771789	3.772870	1.540560	23.56785	23.5610	0.00685	1.00000
10	-1	3	1	3.614963		1.540560	24.60594			
11	-2	2	1	3.545472		1.540560	25.09599			
***	-1	1	2	3.472420	3.473865	1.540560	25.63285	25.6220	0.01085	1.00000
***	2	2	0	3.315762	3.311050	1.540560	26.86605	26.9050	-0.03895	1.00000
***	-2	0	2	3.295029	3.291719	1.540560	27.03830	27.0660	-0.02770	1.00000
***	0	0	2	3.236495	3.241094	1.540560	27.53685	27.4970	0.03985	1.00000
16	0	0	2	3.236495		1.540560	27.53685			
***	1	3	1	2.990825	2.995258	1.540560	29.84920	29.8040	0.04520	1.00000
18	-2	2	2	2.937608		1.540560	30.40287			
***	0	4	1	2.899194	2.900814	1.540560	30.81563	30.7980	0.01763	1.00000
20	0	2	2	2.895903		1.540560	30.85152			
21	2	0	1	2.813639		1.540560	31.77704			
22	-3	1	1	2.794436		1.540560	32.00124			
***	-1	3	2	2.768317	2.764935	1.540560	32.31140	32.3520	-0.04060	1.00000
***	-3	1	2	2.610398	2.617042	1.540560	34.32485	34.2350	0.08985	1.00000
25	2	2	1	2.581182		1.540560	34.72564			
26	-2	4	1	2.574437		1.540560	34.81952			
***	1	1	2	2.552580	2.552462	1.540560	35.12732	35.1290	-0.00168	1.00000
***	3	1	0	2.522976	2.520380	1.540560	35.55317	35.5910	-0.03783	1.00000
29	-2	4	0	2.482333		1.540560	36.15521			
30	-1	5	0	2.458870		1.540560	36.51231			
31	-1	5	1	2.413821		1.540560	37.21849			
32	-3	3	1	2.386287		1.540560	37.66401			
33	-2	0	3	2.382529		1.540560	37.72566			
34	-1	1	3	2.327268		1.540560	38.65658			
35	-2	4	2	2.311188		1.540560	38.93635			
36	0	4	2	2.290712		1.540560	39.29862			
37	-3	3	2	2.268596		1.540560	39.69774			
38	-2	2	3	2.236385		1.540560	40.29409			
39	1	3	2	2.230337		1.540560	40.40813			
40	-3	3	0	2.210508		1.540560	40.78666			
41	1	5	1	2.198469		1.540560	41.02004			
42	-3	1	3	2.165844		1.540560	41.66643			
***	0	6	0	2.161751	2.161108	1.540560	41.74900	41.7620	-0.01300	1.00000
44	0	0	3	2.157663		1.540560	41.83181			
45	2	4	1	2.125145		1.540560	42.50269			
46	-4	0	1	2.122167		1.540560	42.56524			
47	-4	0	2	2.117129		1.540560	42.67148			
48	-1	5	2	2.105413		1.540560	42.92067			
***	-1	3	3	2.075310	2.076072	1.540560	43.57481	43.5580	0.01681	1.00000
50	2	0	2	2.070841		1.540560	43.67368			
51	3	1	1	2.067811		1.540560	43.74098			
52	0	6	1	2.050428		1.540560	44.13119			
53	0	2	3	2.047326		1.540560	44.20159			
54	-4	2	1	2.016927		1.540560	44.90380			
55	-4	2	2	2.012601		1.540560	45.00562			
56	2	2	2	1.972711		1.540560	45.96721			
57	-3	3	3	1.958405		1.540560	46.32248			
58	4	0	0	1.929079		1.540560	47.06878			
59	-2	6	1	1.925345		1.540560	47.16558			

Least Squares Unit Cell Refinement

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WELSFORD HI-1 HAMILTON MOUNTAIN MATRIX: ALBITE (1.18) --) 1986/12/20 . * . * . 1:3

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1430000	12.7770000	7.1540000	94.20000	116.55000	87.91700	664.0379 A**3
Reciprocal CELL:	0.1372831	0.0784770	0.1555790	86.34477	63.52498	90.23193	0.001505938 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.6 Dmin = 1.429211 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD HI-1 HAMILTON MOUNTAIN MATRIX: ALBITE (1.18)
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1361263	12.7943351	7.1523148	94.20276	116.57307	87.91085	663.8848 A**3
Reciprocal CELL:	0.1374339	0.0783905	0.1566555	86.34396	63.50214	90.23543	0.001506285 A**-3
*-- Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$-- Direct Cell Standard ERRorS	0.0016006	0.0065476	0.0010817	0.02019	0.01381	0.01251	0.554630
&-- Reciprocal Cell Standard ERRorS	0.000026253	0.000010908	0.000026532	0.0198747	0.0139301	0.0122983	

WELSFORD HI-1 HAMILTON MOUNTAIN MATRIX: ALBITE (1.18) HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.756642		1.540560	6.92356			
2	1	0	0	7.276226		1.540560	12.15373			
3	-1	0	1	6.426443		1.540560	13.76816			
4	0	0	1	6.383433		1.540560	13.86138			
***	0	2	0	6.378321	6.375370	1.540560	13.87255	13.8790	-0.00645	1.00000
6	1	1	0	6.331573		1.540560	13.97548			
7	-1	1	0	6.309219		1.540560	14.02525			
***	-1	-1	1	5.902407	5.897044	1.540560	14.99728	15.0110	-0.01372	1.00000
9	0	-1	1	5.860103		1.540560	15.10618			
10	-1	1	1	5.589006		1.540560	15.84350			
11	0	1	1	5.568273		1.540560	15.90288			

12	1	2	0	4.806176		1.540560	18.44500			
13	-1	2	0	4.786637		1.540560	18.52095			
14	-1	-2	1	4.688871		1.540560	18.91063			
15	0	-2	1	4.663084		1.540560	19.01617			
16	-1	2	1	4.380943		1.540560	20.25336			
17	0	2	1	4.374638		1.540560	20.28286			
18	0	3	0	4.252214		1.540560	20.87327			
***	-2	0	1	4.027078	4.029861	1.540560	22.05442	22.0350	0.01542	1.00000
20	1	0	1	3.995385		1.540560	22.23159			
21	-2	-1	1	3.890604		1.540560	22.83827			
22	1	-1	1	3.854375		1.540560	23.05586			
23	-2	1	1	3.791835		1.540560	23.44148			
***	1	1	1	3.772453	3.772870	1.540560	23.56364	23.5610	0.00254	1.00000
***	1	3	0	3.677859	3.674974	1.540560	24.17873	24.1980	-0.01927	1.00000
***	-1	3	0	3.664716	3.666466	1.540560	24.26676	24.2550	0.01176	1.00000
27	-1	-3	1	3.662360		1.540560	24.28261			
28	0	-3	1	3.647882		1.540560	24.38046			
29	2	0	0	3.638113		1.540560	24.44694			
30	-1	0	2	3.566406		1.540560	24.94630			
31	2	1	0	3.502411		1.540560	25.40966			
32	-1	-1	2	3.501876		1.540560	25.41361			
33	-2	1	0	3.494828		1.540560	25.46572			
34	-2	-2	1	3.475160		1.540560	25.60480			
35	1	-2	1	3.444805		1.540560	25.84187			
36	-1	3	1	3.440444		1.540560	25.87519			
37	0	3	1	3.439187		1.540560	25.88482			
***	-1	1	2	3.371251	3.370972	1.540560	25.41578	26.4180	-0.00222	1.00000
39	-2	2	1	3.338362		1.540560	26.68081			
40	1	2	1	3.330005		1.540560	25.74900			
***	-2	0	2	3.213221	3.215525	1.540560	27.74027	27.7200	0.02027	1.00000
42	-2	0	2	3.213221		1.540560	27.74027			
***	0	0	2	3.191717	3.191375	1.540560	27.93095	27.9340	-0.00305	1.00000
44	0	4	0	3.189160		1.540560	27.95380			
***	2	2	0	3.165787	3.167046	1.540560	28.16443	28.1530	0.01143	1.00000
46	2	2	0	3.165787		1.540560	28.16443			
***	-2	2	0	3.154610	3.154422	1.540560	28.26629	28.2680	-0.00171	1.00000
48	0	-1	2	3.143837		1.540560	28.36517			
49	-2	1	2	3.067013		1.540560	29.09114			
50	0	1	2	3.050806		1.540560	29.24911			
51	-1	2	2	3.020019		1.540560	29.55404			
52	-2	-3	1	2.991568		1.540560	29.84161			
***	1	-3	1	2.968034	2.967822	1.540560	30.08379	30.0860	-0.00221	1.00000
***	-2	-2	2	2.951203	2.950770	1.540560	30.25945	30.2640	-0.00455	1.00000
55	-1	-4	1	2.937164		1.540560	30.40757			
56	0	-2	2	2.930052		1.540560	30.48318			
***	0	-4	1	2.928568	2.927724	1.540560	30.49900	30.5080	-0.00900	1.00000
58	1	4	0	2.925338		1.540560	30.53349			
59	-1	4	0	2.916513		1.540560	30.62815			
60	-2	3	1	2.860575		1.540560	31.24109			
61	1	3	1	2.858508		1.540560	31.26537			
62	-1	-3	2	2.836789		1.540560	31.51094			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
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WELSFORD RH-1 MATRIX OF DEVITRIFIED OBSIDIAN: ORTHOCLASE --) 1987/ 1/11 . * . * . 1:9

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.6000000	12.9690000	7.1980000	90.00000	115.85000	90.00000	722.4864 A**3
Reciprocal CELL:	0.1292078	0.0771069	0.1543744	90.00000	64.15000	90.00000	0.001384109 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 MONOC System
3 Conditions for non-Extinctions Called for Class Condition(s)
hkl h+k = 2n
h0l h = 2n
0k0 k = 2n

F I N A L V A L U E S for WELSFORD RH-1 MATRIX OF DEVITRIFIED OBSIDIAN: ORTHOCLASE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5898171	13.0070557	7.2111002	90.00000	116.04051	90.00000	722.1642 A**3
Reciprocal CELL:	0.1296206	0.0770356	0.1544032	90.00000	63.95949	90.00000	0.001384727 A**-3
*-- Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$-- Direct Cell Standard ERRorS	0.0064861	0.0237026	0.0037546	0.00000	0.05336	0.00000	2.284008
£-- Reciprocal Cell Standard ERRorS	0.000073160	0.000045956	0.000094537	0.0000000	0.0532554	0.0000000	

WELSFORD RH-1 MATRIX OF DEVITRIFIED OBSIDIAN: ORTHOCLASE HKL Listing - *** Refers to FIXed, R to Rejects MO

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	-1	1	0	6.631980		1.540560	13.33949			
***	0	2	0	6.490502	6.488431	1.540560	13.63163	13.6360	-0.00437	1.00000
3	0	0	1	6.476550		1.540560	13.66113			
***	-1	1	1	5.874687	5.863645	1.540560	15.06846	15.0970	-0.02854	1.00000
5	0	2	1	4.584537		1.540560	19.34508			
***	-2	0	1	4.231647	4.230622	1.540560	20.97586	20.9810	-0.00514	1.00000
***	1	1	1	3.947387	3.944518	1.540560	22.50542	22.5220	-0.01658	1.00000

8	2	0	0	3.857413		1.540560	23.03746			
9	-1	3	0	3.773937		1.540560	23.55424			
10	-1	3	1	3.616657		1.540560	24.59423			
11	-2	2	1	3.544795		1.540560	25.10087			
***	-1	1	2	3.473235	3.470935	1.540560	25.62673	25.6440	-0.01727	1.00000
***	2	2	0	3.315990	3.310930	1.540560	26.86417	26.9060	-0.04183	1.00000
***	-2	0	2	3.293969	3.292435	1.540560	27.04716	27.0600	-0.01284	1.00000
15	0	4	0	3.245251		1.540560	27.46109			
***	0	0	2	3.238275	3.240632	1.540560	27.52141	27.5010	0.02041	1.00000
***	1	3	1	2.992710	2.999783	1.540560	29.82996	29.7580	0.07196	1.00000
18	-2	2	2	2.937344		1.540560	30.40567			
***	0	4	1	2.901390	2.903481	1.540560	30.79173	30.7690	0.02273	1.00000
20	0	2	2	2.897646		1.540560	30.83250			
21	2	0	1	2.814412		1.540560	31.76807			
22	-3	1	1	2.793060		1.540560	32.01743			
***	-1	3	2	2.769546	2.771272	1.540560	32.29666	32.2760	0.02066	1.00000
***	-3	1	2	2.609054	2.612453	1.540560	34.34308	34.2970	0.04608	1.00000
25	2	2	1	2.582110		1.540560	34.71276			
26	-2	4	1	2.575162		1.540560	34.80940			
27	1	1	2	2.554055		1.540560	35.10638			
***	3	1	0	2.522585	2.521614	1.540560	35.55886	35.5730	-0.01414	1.00000
29	-2	4	0	2.483311		1.540560	36.14048			
30	-1	5	0	2.460609		1.540560	36.48559			
31	-1	5	1	2.415408		1.540560	37.19315			
32	-3	3	1	2.385951		1.540560	37.66950			
33	-2	0	3	2.382547		1.540560	37.72535			
34	-1	1	3	2.328123		1.540560	38.64182			
35	-2	4	2	2.311771		1.540560	38.92612			
36	0	4	2	2.292269		1.540560	39.27084			
***	-3	3	2	2.268162	2.266610	1.540560	39.70565	39.7340	-0.02834	1.00000
38	-2	2	3	2.236617		1.540560	40.28976			
39	1	3	2	2.231748		1.540560	40.38147			
40	-3	3	0	2.210660		1.540560	40.78373			
41	1	5	1	2.200035		1.540560	40.98951			
42	-3	1	3	2.165216		1.540560	41.67909			
***	0	6	0	2.163501	2.162048	1.540560	41.71367	41.7430	-0.02933	1.00000
44	0	0	3	2.158850		1.540560	41.80774			
45	2	4	1	2.126217		1.540560	42.48023			
***	-4	0	1	2.121137	2.120563	1.540560	42.58693	42.5990	-0.01207	1.00000
47	-4	0	2	2.115824		1.540560	42.69910			
48	-1	5	2	2.106672		1.540560	42.89375			
49	-1	3	3	2.076260		1.540560	43.55386			
50	2	0	2	2.071807		1.540560	43.65228			
51	3	1	1	2.068170		1.540560	43.73299			
52	0	6	1	2.052035		1.540560	44.09483			
53	0	2	3	2.048505		1.540560	44.17481			
54	-4	2	1	2.016200		1.540560	44.92088			
***	-4	2	2	2.011636	2.013178	1.540560	45.02839	44.9920	0.03639	1.00000
56	2	2	2	1.973693		1.540560	45.94302			
57	-3	3	3	1.958229		1.540560	46.32689			
58	4	0	0	1.928706		1.540560	47.07841			
59	-2	6	1	1.926335		1.540560	47.13988			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
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WELSFORD RH-1 MATRIX OF DEVITRIFIED OBSIDIAN: ALBITE --) 1987/ 1/11 . * . * . 0:41

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1430000	12.7770000	7.1540000	94.20000	116.55000	87.91700	664.0379 A**3
Reciprocal CELL:	0.1372831	0.0784770	0.1565790	86.34477	63.52498	90.23193	0.001505938 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD RH-1 MATRIX OF DEVITRIFIED OBSIDIAN: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1351734	12.8028947	7.1579316	94.17338	116.58670	87.98045	664.5772 A**3
Reciprocal CELL:	0.1374702	0.0783497	0.1565556	86.34161	63.48486	90.17094	0.001504716 A**-3
*-- Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$-- Direct Cell Standard ERRorS	0.0027927	0.0104309	0.0015706	0.03257	0.02114	0.02204	0.872902
£-- Reciprocal Cell Standard ERRorS	0.000036191	0.000027145	0.000045211	0.0316688	0.0211460	0.0210656	

WELSFORD RH-1 MATRIX OF DEVITRIFIED OBSIDIAN: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.763298		1.540560	6.91994			
2	1	0	0	7.274384		1.540560	12.15695			
3	-1	0	1	6.430246		1.540560	13.75998			
4	0	0	1	6.387506		1.540560	13.85250			
***	0	2	0	6.381649	6.379029	1.540560	13.86528	13.8710	-0.00572	1.00000
6	1	1	0	6.328042		1.540560	13.98332			
***	1	1	0	6.328042	6.319641	1.540560	13.98332	14.0020	-0.01868	1.00000
***	-1	-1	1	5.903431	5.917820	1.540560	14.99467	14.9580	0.03667	1.00000
***	0	-1	1	5.863818	5.863645	1.540560	15.09655	15.0970	-0.00045	1.00000
***	-1	1	1	5.594261	5.603239	1.540560	15.82852	15.8030	0.02552	1.00000

11	0	1	1	5.571599		1.540560	15.89332			
12	1	2	0	4.804351		1.540560	18.45206			
13	-1	2	0	4.790161		1.540560	18.50721			
14	-1	-2	1	4.689083		1.540560	18.90977			
15	0	-2	1	4.665890		1.540560	19.00463			
16	-1	2	1	4.385340		1.540560	20.23284			
17	0	2	1	4.377090		1.540560	20.27138			
18	0	3	0	4.254433		1.540560	20.86226			
***	-2	0	1	4.027274	4.030222	1.540560	22.05333	22.0370	0.01633	1.00000
20	1	0	1	3.995830		1.540560	22.22908			
21	-2	-1	1	3.889517		1.540560	22.84474			
***	1	-1	1	3.855631	3.858149	1.540560	23.04825	23.0330	0.01525	1.00000
23	-2	1	1	3.793520		1.540560	23.43092			
***	1	1	1	3.772370	3.773501	1.540560	23.56417	23.5570	0.00717	1.00000
***	1	3	0	3.677234	3.674076	1.540560	24.18290	24.2040	-0.02110	1.00000
26	-1	3	0	3.667685		1.540560	24.24682			
***	-1	3	0	3.667685	3.664383	1.540560	24.24682	24.2690	-0.02218	1.00000
28	0	-3	1	3.649984		1.540560	24.36621			
29	2	0	0	3.637152		1.540560	24.45350			
30	-1	0	2	3.569355		1.540560	24.92537			
31	-1	-1	2	3.504248		1.540560	25.39612			
***	-1	-1	2	3.504248	3.501553	1.540560	25.39612	25.4160	-0.01988	1.00000
33	-2	1	0	3.495149		1.540560	25.46335			
***	-2	-2	1	3.474753	3.476667	1.540560	25.61535	25.6010	0.01435	1.00000
35	1	-2	1	3.446575		1.540560	25.82837			
36	-1	3	1	3.443738		1.540560	25.85002			
37	0	3	1	3.441047		1.540560	25.87058			
***	-1	1	2	3.374361	3.373104	1.540560	26.39099	26.4010	-0.01001	1.00000
39	-2	2	1	3.340789		1.540560	26.66106			
40	1	2	1	3.329870		1.540560	26.75011			
41	-1	-2	2	3.216517		1.540560	27.71128			
***	-2	0	2	3.215123	3.214502	1.540560	27.72354	27.7290	-0.00546	1.00000
43	0	0	2	3.193753		1.540560	27.91278			
***	0	0	2	3.193753	3.191264	1.540560	27.91278	27.9350	-0.02222	1.00000
45	-2	-1	2	3.168316		1.540560	28.14148			
***	2	2	0	3.164021	3.161764	1.540560	28.18047	28.2010	-0.02053	1.00000
***	-2	2	0	3.155910	3.153767	1.540560	28.25440	28.2740	-0.01960	1.00000
48	0	-1	2	3.145858		1.540560	28.34657			
49	-2	1	2	3.069484		1.540560	29.06720			
50	0	1	2	3.052699		1.540560	29.23057			
51	-1	2	2	3.022877		1.540560	29.52547			
52	-2	-3	1	2.990439		1.540560	29.85314			
***	1	-3	1	2.969893	2.970040	1.540560	30.06452	30.0630	0.00152	1.00000
***	-2	-2	2	2.951716	2.952104	1.540560	30.25408	30.2500	0.00408	1.00000
55	-1	-4	1	2.937555		1.540560	30.40343			
***	0	-2	2	2.931909	2.931476	1.540560	30.46340	30.4680	-0.00460	1.00000
57	0	-4	1	2.930209		1.540560	30.48150			
58	1	4	0	2.925281		1.540560	30.53410			
59	-1	4	0	2.918867		1.540560	30.60283			
60	-2	3	1	2.863156		1.540560	31.21332			
61	1	3	1	2.858523		1.540560	31.26521			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
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WELSFORD RH-2 MATRIX OF DEVITRIFIED OBSIDIAN: INTERMEDIATE MICROCLINE —) 1987/ 1/10 . * . * . 2:40

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5820000	12.9650000	7.2120000	90.40000	115.95000	88.35000	721.2287 A**3
Reciprocal CELL:	0.1296417	0.0771642	0.1542084	90.35817	64.05057	91.64036	0.001386523 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD RH-2 MATRIX OF DEVITRIFIED OBSIDIAN: INTERMEDIATE MICROCLINE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.5940057	12.9616880	7.2195190	90.46972	116.03614	88.14166	721.2984 A**3
Reciprocal CELL:	0.1295958	0.0772646	0.1542687	90.38635	63.96252	91.84068	0.001386389 A**-3
+— Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$— Direct Cell Standard ERRorS	0.0042865	0.0158212	0.0041714	0.05344	0.03470	0.04851	1.484303
£— Reciprocal Cell Standard ERRorS	0.000084893	0.000038529	0.000049388	0.0550048	0.0340432	0.0506954	

WELSFORD RH-2 MATRIX OF DEVITRIFIED OBSIDIAN: INTERMEDIATE MICROCLINE HKL Listing - *** Refers to FIXed, R to Rejec

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.942542		1.540560	6.82399			
2	1	0	0	7.716300		1.540560	11.45819			
3	1	1	0	6.723449		1.540560	13.15721			
4	-1	0	1	6.591337		1.540560	13.42212			
5	-1	1	0	6.536058		1.540560	13.53617			
6	0	0	1	6.484720		1.540560	13.64384			
7	0	2	0	6.471271		1.540560	13.67233			
8	-1	-1	1	5.923032		1.540560	14.94476			
9	-1	1	1	5.825220		1.540560	15.19717			
10	0	1	1	5.813419		1.540560	15.22820			
11	0	-1	1	5.782104		1.540560	15.31117			

12	1	2	0	5.038715		1.540560	17.58684			
13	-1	2	0	4.881769		1.540560	18.15695			
14	-1	-2	1	4.666015		1.540560	19.00412			
15	0	2	1	4.596150		1.540560	19.29574			
16	-1	2	1	4.570942		1.540560	19.40318			
17	0	-2	1	4.565261		1.540560	19.42755			
18	0	3	0	4.314181		1.540560	20.57017			
***	-2	0	1	4.231659	4.232817	1.540560	20.97580	20.9700	0.00580	1.00000
20	1	0	1	4.147502		1.540560	21.40639			
21	-2	-1	1	4.059272		1.540560	21.87734			
22	-2	1	1	3.985992		1.540560	22.28464			
***	1	1	1	3.974664	3.974835	1.540560	22.34897	22.3480	0.00097	1.00000
24	1	-1	1	3.925121		1.540560	22.63477			
25	2	0	0	3.858150		1.540560	23.03300			
26	1	3	0	3.818201		1.540560	23.27734			
27	2	1	0	3.730319		1.540560	23.83367			
***	-1	3	0	3.715102	3.718890	1.540560	23.93274	23.9080	0.02474	1.00000
29	-2	1	0	3.665273		1.540560	24.26302			
30	-1	-3	1	3.644260		1.540560	24.40507			
31	-1	0	2	3.608439		1.540560	24.65112			
32	0	3	1	3.603128		1.540560	24.68803			
33	-2	-2	1	3.592764		1.540560	24.76038			
34	0	-3	1	3.580788		1.540560	24.84451			
35	-1	3	1	3.576142		1.540560	24.87730			
36	1	2	1	3.526623		1.540560	25.23233			
37	-2	2	1	3.492674		1.540560	25.48169			
38	-1	-1	2	3.482654		1.540560	25.55625			
39	-1	1	2	3.469134		1.540560	25.65754			
40	1	-2	1	3.458142		1.540560	25.74049			
41	2	2	0	3.361724		1.540560	26.49200			
***	-2	0	2	3.295669	3.297219	1.540560	27.03295	27.0200	0.01295	1.00000
***	-2	2	0	3.266029	3.266146	1.540560	27.26598	27.2820	-0.01602	1.00000
***	0	0	2	3.242360	3.244914	1.540560	27.48606	27.4640	0.02206	1.00000
45	0	4	0	3.235636		1.540560	27.54430			
46	-2	-1	2	3.209592		1.540560	27.77227			
47	-2	1	2	3.178145		1.540560	28.05267			
48	-1	-2	2	3.161719		1.540560	28.20141			
49	0	1	2	3.150178		1.540560	28.30688			
50	-1	2	2	3.141562		1.540560	28.38614			
51	0	-1	2	3.140179		1.540560	28.39890			
52	-2	-3	1	3.068658		1.540560	29.07519			
53	1	3	1	3.022682		1.540560	29.52742			
54	1	4	0	3.018780		1.540560	29.56726			
55	-2	3	1	2.975473		1.540560	30.00682			
56	-2	-2	2	2.961516		1.540560	30.15158			
57	1	-3	1	2.958193		1.540560	30.18626			
58	-1	4	0	2.950310		1.540560	30.26884			
59	-1	-4	1	2.928491		1.540560	30.49982			
60	2	3	0	2.922919		1.540560	30.55938			
61	-2	2	2	2.912610		1.540560	30.67019			
62	0	2	2	2.906710		1.540560	30.73399			

Least Squares Unit Cell Refinement

N D S U version Fargo 86.12 after Appleman and Evans (1973).
implementation by Roy G Garvey
Department of CHEMISTRY
NORTH DAKOTA STATE UNIVERSITY
Fargo 58105 - 5516

WELSFORD RH-2 MATRIX OF DEVITRIFIED OBSIDIAN: ALBITE —) 1987/ 1/10 . * . * . 0:38

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1430000	12.7770000	7.1540000	94.20000	116.55000	87.91700	664.0379 A**3
Reciprocal CELL:	0.1372831	0.0784770	0.1565790	86.34477	63.52498	90.23193	0.001505938 A**-3

1-Theta Angles Thtmx = 20.0 Ncyc = 2 Tolmn = 0.0500 Tolmx = 0.2500 Themx = 32.5 Dmin = 1.433614 TRICL System
0 Conditions for non-Extinctions Called for Class Condition(s)

F I N A L V A L U E S for WELSFORD RH-2 MATRIX OF DEVITRIFIED OBSIDIAN: ALBITE
* *

	A	B	C	Alpha	Beta	Gamma	Volume
Direct CELL:	8.1396562	12.7959861	7.1555891	94.21860	116.56399	87.87082	664.6943 A**3
Reciprocal CELL:	0.1373607	0.0783727	0.1565683	86.34652	63.51335	90.27316	0.001504451 A**-3
*— Direct Cell Corrections:	0.0000000	0.0000000	0.0000000	0.00000	0.00000	0.00000	0.000000
$— Direct Cell Standard ERRorS	0.0018733	0.0086603	0.0013174	0.01983	0.01740	0.01343	0.743308
&— Reciprocal Cell Standard ERRorS	0.000032020	0.000011208	0.000032505	0.0200021	0.0172924	0.0135973	

WELSFORD RH-2 MATRIX OF DEVITRIFIED OBSIDIAN: ALBITE HKL Listing - *** Refers to FIXed, R to Rejects TRICL

N	H	K	L	D Calc	D Obs	Lambda	2- Theta Calc	2- Theta Obs	2- Theta Diff	Weight
1	0	1	0	12.759552		1.540560	6.92197			
2	1	0	0	7.280105		1.540560	12.14723			
3	-1	0	1	6.428713		1.540560	13.76328			
4	0	0	1	6.386989		1.540560	13.85363			
***	0	2	0	6.379776	6.382692	1.540560	13.86937	13.8630	0.00637	1.00000
6	1	1	0	6.336279		1.540560	13.96505			
7	-1	1	0	6.310326		1.540560	14.02277			
***	-1	-1	1	5.905667	5.912710	1.540560	14.98896	14.9710	0.01796	1.00000
9	0	-1	1	5.862901		1.540560	15.09893			
10	-1	1	1	5.589715		1.540560	15.84148			
11	0	1	1	5.571076		1.540560	15.89482			

12	1	2	0	4.809485		1.540560	18.43219			
13	-1	2	0	4.786807		1.540560	18.52028			
14	-1	-2	1	4.691547		1.540560	18.89974			
15	0	-2	1	4.664802		1.540560	19.00911			
16	-1	2	1	4.381142		1.540560	20.25243			
17	0	2	1	4.376446		1.540560	20.27439			
18	0	3	0	4.253184		1.540560	20.86845			
***	-2	0	1	4.028618	4.029861	1.540560	22.04589	22.0390	0.00689	1.00000
20	1	0	1	3.997867		1.540560	22.21761			
21	-2	-1	1	3.892838		1.540560	22.82498			
***	1	-1	1	3.856212	3.856993	1.540560	23.04473	23.0400	0.00473	1.00000
23	-2	1	1	3.792490		1.540560	23.43737			
***	1	1	1	3.775059	3.773975	1.540560	23.54714	23.5540	-0.00686	1.00000
***	1	3	0	3.680042	3.679168	1.540560	24.16417	24.1700	-0.00583	1.00000
***	-1	3	0	3.664790	3.665722	1.540560	24.26626	24.2600	0.00626	1.00000
27	-1	-3	1	3.664269		1.540560	24.26976			
28	0	-3	1	3.648988		1.540560	24.37296			
29	2	0	0	3.640052		1.540560	24.43371			
30	-1	0	2	3.567966		1.540560	24.93523			
31	2	1	0	3.504809		1.540560	25.39199			
***	-1	-1	2	3.503616	3.501688	1.540560	25.40078	25.4150	-0.01422	1.00000
33	-2	1	0	3.496004		1.540560	25.45702			
***	-2	-2	1	3.478475	3.478270	1.540560	25.58747	25.5890	-0.00153	1.00000
35	1	-2	1	3.445952		1.540560	25.83312			
36	-1	3	1	3.440586		1.540560	25.87411			
37	0	3	1	3.440398		1.540560	25.87554			
***	-1	1	2	3.372440	3.372352	1.540560	26.40629	26.4070	-0.00071	1.00000
39	-2	2	1	3.338483		1.540560	26.67982			
40	1	2	1	3.332257		1.540560	26.73059			
***	-2	0	2	3.214356	3.216890	1.540560	27.73028	27.7080	0.02228	1.00000
42	-2	0	2	3.214356		1.540560	27.73028			
***	0	0	2	3.193494	3.192272	1.540560	27.91509	27.9260	-0.01091	1.00000
44	0	4	0	3.189888		1.540560	27.94729			
45	-2	-1	2	3.168698		1.540560	28.13802			
***	2	2	0	3.168139	3.166495	1.540560	28.14308	28.1580	-0.01492	1.00000
***	-2	2	0	3.155163	3.155407	1.540560	28.26123	28.2590	0.00223	1.00000
48	0	-1	2	3.145507		1.540560	28.34980			
49	-2	1	2	3.067700		1.540560	29.08448			
50	0	1	2	3.052465		1.540560	29.23287			
51	-1	2	2	3.020859		1.540560	29.54563			
52	-2	-3	1	2.993579		1.540560	29.82111			
***	1	-3	1	2.968736	2.969847	1.540560	30.07651	30.0650	0.01151	1.00000
***	-2	-2	2	2.952833	2.953153	1.540560	30.24235	30.2390	0.00335	1.00000
55	-1	-4	1	2.938547		1.540560	30.39292			
56	0	-2	2	2.931450		1.540560	30.46828			
***	0	-2	2	2.931450	2.929693	1.540560	30.46828	30.4870	-0.01872	1.00000
58	1	4	0	2.926859		1.540560	30.51724			
59	-1	4	0	2.916618		1.540560	30.62701			
60	-2	3	1	2.860612		1.540560	31.24179			
61	1	3	1	2.860289		1.540560	31.24541			
62	-1	-3	2	2.838186		1.540560	31.49503			
63	-2	2	2	2.794857		1.540560	31.99629			

APPENDIX 2. CHEMICAL COMPOSITION OF THE SODIUM-RICH AND POTASSIUM-RICH FELDSPARS IN REPRESENTATIVE SAMPLES OF ALKALI GRANITE AND QUARTZ SYENITE, AND OF THE PLAGIOCLASE IN DIORITIC HYBRID ROCKS, WELSFORD COMPLEX, AND A GABBROIC ROCK SAMPLED NEAR THE COMPLEX (UNIT Dm)

Note that the sample locations are plotted in Figure 2. See the text for details concerning the acquisition of the electron-microprobe data.

ALKALI GRANITE

AG-P1

	1	2	3	4	5	6	7	8	9
SiO2	70.18	70.92	69.84	66.12	66.29	66.66	66.75	71.23	69.05
Al2O3	19.43	19.26	19.14	17.77	18.28	17.96	17.75	18.72	18.40
TiO2	0.16	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.05
Fe2O3	0.52	0.69	0.52	0.46	0.32	0.40	0.39	0.78	0.55
MgO	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CaO	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Na2O	10.96	10.63	10.50	0.94	0.65	1.76	1.40	10.81	11.34
K2O	0.05	0.05	0.10	15.66	16.10	15.03	15.65	0.13	0.14
Total	101.32	101.56	100.10	100.95	101.64	101.85	101.94	101.67	99.54
Si	12.208	12.346	12.326	12.105	12.064	12.035	12.062	12.380	12.177
Al	3.984	3.952	3.981	3.834	3.921	3.822	3.781	3.835	3.824
FE3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ti	0.021	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.007
Fe2	0.076	0.100	0.077	0.070	0.049	0.060	0.059	0.113	0.081
Mg	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ca	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
Na	3.697	3.588	3.593	0.334	0.229	0.616	0.491	3.643	3.877
K	0.011	0.011	0.023	3.657	3.738	3.462	3.608	0.029	0.031
OXYG	32.367	32.523	32.509	32.026	32.041	31.912	31.904	32.462	32.142
Ab	99.601	99.691	99.377	8.360	5.781	15.109	11.969	99.215	99.196
An	0.100	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008
Or	0.299	0.309	0.623	91.640	94.219	84.891	88.031	0.785	0.805

ALKALI GRANITE

AG-P2

	1	2	3	4	5	6	7	8
SiO2	67.36	72.28	68.20	67.38	70.59	66.18	67.40	71.81
Al203	17.66	18.66	17.71	18.04	19.21	17.84	18.25	19.15
TiO2	0.00	0.00	0.00	0.00	0.00	0.04	0.05	0.00
Fe203	0.51	0.78	0.49	0.53	0.83	0.39	0.34	0.55
MgO	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00
CaO	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00
Na20	0.49	9.11	0.32	0.90	9.43	0.41	1.89	9.02
K20	15.39	0.20	15.71	14.60	0.13	15.18	13.77	0.13
Total	101.41	101.06	102.43	101.45	100.19	100.04	101.71	100.66
Si	12.339	12.807	12.384	12.312	12.563	12.287	12.202	12.767
Al	3.813	3.897	3.790	3.885	4.030	3.904	3.894	4.013
FE3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ti	0.000	0.000	0.000	0.000	0.000	0.006	0.007	0.000
Fe2	0.078	0.116	0.074	0.081	0.124	0.061	0.051	0.082
Mg	0.000	0.003	0.000	0.000	0.000	0.000	0.003	0.000
Ca	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000
Na	0.174	3.129	0.113	0.319	3.254	0.148	0.663	3.109
K	3.596	0.045	3.639	3.403	0.030	3.595	3.180	0.029
OXYG	32.360	33.168	32.403	32.393	32.936	32.373	32.234	33.204
Ab	4.616	98.458	3.003	8.566	99.101	3.943	17.260	99.061
An	0.000	0.119	0.000	0.000	0.000	0.000	0.000	0.000
Or	95.384	1.422	96.997	91.434	0.899	96.057	82.740	0.939

ALKALI GRANITE

AG-P4

	1	2	3	4	5	6	7
SiO2	65.90	71.57	66.65	66.27	70.14	70.61	67.01
Al2O3	17.88	19.09	17.99	17.84	18.42	18.62	18.00
TiO2	0.00	0.00	0.00	0.00	0.02	0.05	0.00
Fe2O3	0.25	0.84	0.61	0.85	1.03	1.06	0.63
MgO	0.01	0.00	0.01	0.00	0.01	0.02	0.00
CaO	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Na2O	0.66	9.32	0.50	0.86	7.62	9.13	3.66
K2O	16.21	0.29	15.88	15.97	3.08	0.14	11.81
Total	100.91	101.11	101.64	101.79	100.32	99.64	101.11
Si	12.074	12.644	12.162	12.044	12.587	12.677	12.083
Al	3.861	3.975	3.869	3.821	3.896	3.940	3.826
FE3	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ti	0.000	0.000	0.000	0.000	0.003	0.007	0.000
Fe2	0.038	0.124	0.093	0.129	0.155	0.159	0.095
Mg	0.003	0.000	0.003	0.000	0.003	0.005	0.000
Ca	0.000	0.000	0.000	0.000	0.000	0.002	0.000
Na	0.234	3.192	0.177	0.303	2.651	3.178	1.280
K	3.789	0.065	3.696	3.702	0.705	0.032	2.717
OXYG	31.993	33.002	32.160	31.952	32.860	33.049	31.998
Ab	5.828	97.994	4.567	7.565	78.992	98.942	32.020
An	0.000	0.000	0.000	0.000	0.000	0.060	0.000
Or	94.172	2.006	95.433	92.435	21.008	0.998	67.980

ALKALI GRANITE

AG-P4

					WLD-49		
	8	9	10	11	1	2	3
SiO2	70.89	66.70	70.42	65.57	70.77	72.23	66.39
Al2O3	18.85	18.16	19.12	17.82	18.99	19.59	17.83
TiO2	0.03	0.00	0.00	0.00	0.18	0.04	0.09
Fe2O3	0.78	0.48	0.27	0.69	0.58	0.36	0.25
MgO	0.00	0.00	0.00	0.00	0.00	0.01	0.00
CaO	0.00	0.00	0.01	0.00	0.01	0.00	0.00
Na2O	10.82	0.41	7.49	0.88	6.28	8.55	0.64
K2O	0.12	16.16	3.43	16.08	5.12	1.13	15.43
Total	101.49	101.91	100.74	101.04	101.93	101.91	100.63
Si	12.338	12.137	12.565	11.991	12.582	12.707	12.226
Al	3.867	3.895	4.021	3.841	3.979	4.062	3.870
FE3	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ti	0.004	0.000	0.000	0.000	0.024	0.005	0.012
Fe2	0.114	0.073	0.040	0.106	0.086	0.053	0.039
Mg	0.000	0.000	0.000	0.000	0.000	0.003	0.000
Ca	0.000	0.000	0.002	0.000	0.002	0.000	0.000
Na	3.651	0.145	2.591	0.312	2.165	2.916	0.229
K	0.027	3.751	0.781	3.751	1.161	0.254	3.625
OXYG	32.436	32.136	32.890	31.879	32.933	33.159	32.247
Ab	99.276	3.713	76.802	7.679	65.049	92.000	5.930
An	0.000	0.000	0.057	0.000	0.057	0.000	0.000
Or	0.724	96.287	23.141	92.321	34.894	8.000	94.070

ALKALI GRANITE							GRANITE	
WLD-36					AG-DYKE		WLD-85	G-1
	1	2	3	4	1	2	1	1
SiO2	66.43	71.46	65.93	65.45	66.05	72.51	71.54	68.45
Al2O3	17.71	19.19	17.77	16.42	17.66	19.68	19.89	18.63
TiO2	0.00	0.05	0.01	0.00	0.02	0.02	0.12	0.00
Fe2O3	0.31	0.71	0.26	0.68	0.72	0.77	0.09	0.34
MgO	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00
CaO	0.01	0.02	0.00	0.00	0.01	0.01	0.01	0.12
Na2O	1.90	8.85	0.19	0.11	0.84	9.70	10.15	3.93
K2O	14.86	0.19	17.00	16.78	15.31	0.17	0.04	10.57
Total	101.23	100.48	101.16	99.44	100.61	102.87	101.84	102.04
Si	12.053	12.744	12.080	12.235	12.158	12.565	12.454	12.232
Al	3.787	4.034	3.838	3.618	3.831	4.020	4.081	3.924
FE3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ti	0.000	0.007	0.001	0.000	0.003	0.003	0.016	0.000
Fe2	0.047	0.106	0.040	0.106	0.111	0.112	0.013	0.051
Mg	0.003	0.003	0.000	0.000	0.000	0.003	0.000	0.000
Ca	0.002	0.004	0.000	0.000	0.002	0.002	0.002	0.023
Na	0.668	3.060	0.067	0.040	0.300	3.259	3.426	1.362
K	3.439	0.043	3.974	4.001	3.595	0.038	0.009	2.409
OXYG	31.893	33.216	31.980	32.023	32.129	32.929	32.793	32.308
Ab	16.263	98.486	1.670	0.987	7.693	98.804	99.687	35.887
An	0.047	0.123	0.000	0.000	0.051	0.056	0.054	0.606
Or	83.689	1.391	98.330	99.013	92.256	1.139	0.258	63.507

HYBRID UNIT

H-2						H-6
	1	2	3	4	5	1
SiO2	73.21	67.47	66.67	67.00	68.30	69.53
Al2O3	19.78	17.83	18.08	18.51	18.17	21.06
TiO2	0.04	0.03	0.04	0.00	0.04	0.00
Fe2O3	0.50	0.34	0.59	0.28	0.30	0.18
MgO	0.00	0.00	0.00	0.01	0.00	0.00
CaO	0.00	0.00	0.00	0.00	0.00	1.45
Na2O	9.34	0.67	1.00	0.47	0.78	9.27
K2O	0.15	15.27	16.05	15.98	16.00	0.23
Total	103.02	101.61	102.43	102.25	103.59	101.72
Si	12.702	12.315	12.022	12.142	12.205	12.164
Al	4.045	3.836	3.842	3.954	3.827	4.342
FE3	0.000	0.000	0.000	0.000	0.000	0.000
Ti	0.005	0.004	0.005	0.000	0.005	0.000
Fe2	0.073	0.052	0.089	0.042	0.045	0.026
Mg	0.000	0.000	0.000	0.003	0.000	0.000
Ca	0.000	0.000	0.000	0.000	0.000	0.272
Na	3.142	0.237	0.350	0.165	0.270	3.144
K	0.033	3.556	3.692	3.694	3.647	0.051
OXYG	33.142	32.341	31.928	32.189	32.165	32.737
Ab	98.954	6.252	8.650	4.279	6.898	90.681
An	0.000	0.000	0.000	0.000	0.000	7.838
Or	1.046	93.748	91.350	95.721	93.102	1.480

QUARTZ SYENITE

QS-1				QS-3		WLD-100
	1	2 AMP	3	1	2	1
SiO2	65.38	65.59	68.08	68.26	68.26	72.37
Al2O3	18.58	18.15	20.27	17.93	18.79	19.82
TiO2	0.00	0.01	0.00	0.00	0.00	0.01
Fe2O3	0.06	0.11	0.03	0.17	0.12	0.38
MgO	0.00	0.00	0.01	0.00	0.00	0.01
CaO	0.08	0.06	1.04	0.13	0.20	0.05
Na2O	2.02	1.14	7.04	6.02	7.58	7.04
K2O	14.98	16.18	5.16	8.24	6.34	2.24
Total	101.10	101.24	101.63	100.75	101.29	101.92
Si	11.840	11.926	12.012	12.205	12.028	12.851
Al	3.966	3.890	4.215	3.779	3.902	4.148
FE3	0.000	0.000	0.000	0.000	0.000	0.000
Ti	0.000	0.001	0.000	0.000	0.000	0.001
Fe2	0.009	0.017	0.004	0.025	0.018	0.056
Mg	0.000	0.000	0.003	0.000	0.000	0.003
Ca	0.016	0.012	0.197	0.025	0.038	0.010
Na	0.709	0.402	2.408	2.087	2.590	2.424
K	3.461	3.753	1.161	1.879	1.425	0.507
OXYG	31.738	31.795	32.334	32.111	31.972	33.461
Ab	16.946	9.646	63.943	52.287	63.902	82.422
An	0.371	0.281	5.220	0.624	0.932	0.323
Or	82.683	90.074	30.837	47.089	35.166	17.255

QUARTZ SYENITE						QUARTZ SYENITE HYBRID (DIOR.			
QS-5						QS-10			
	1	2	3	4	5	1	2	3	4 ?
SiO2	69.27	66.39	65.19	66.00	65.12	64.18	68.78	68.90	58.52
Al2O3	19.86	18.78	22.05	22.02	22.40	22.42	23.86	23.01	27.88
TiO2	0.01	0.02	0.00	0.03	0.01	0.00	0.00	0.14	0.22
Fe2O3	0.13	0.20	0.13	0.20	0.16	0.16	0.08	0.19	1.80
MgO	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.38
CaO	0.62	0.02	3.59	3.09	3.66	4.36	1.31	1.30	0.58
Na2O	8.64	0.47	9.38	8.86	9.27	8.32	7.88	8.21	3.47
K2O	3.23	16.24	0.39	0.55	0.46	0.68	1.95	0.95	6.72
Total	101.76	102.12	100.73	100.75	101.08	100.12	103.91	102.75	99.57
Si	12.118	12.032	11.455	11.647	11.410	11.419	11.837	11.995	10.685
Al	4.095	4.011	4.567	4.580	4.626	4.702	4.840	4.721	6.000
FE3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ti	0.001	0.003	0.000	0.004	0.001	0.000	0.000	0.018	0.030
Fe2	0.019	0.030	0.019	0.030	0.023	0.024	0.012	0.028	0.275
Mg	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.013	0.103
Ca	0.116	0.004	0.676	0.584	0.687	0.831	0.242	0.242	0.113
Na	2.930	0.165	3.196	3.031	3.149	2.870	2.629	2.771	1.228
K	0.721	3.755	0.087	0.124	0.103	0.154	0.428	0.211	1.565
OXYG	32.341	32.081	32.097	32.363	32.099	32.258	32.728	32.883	32.318
Ab	77.783	4.209	80.719	81.065	79.947	74.440	79.701	85.937	42.255
An	3.085	0.099	17.072	15.624	17.443	21.557	7.322	7.520	3.903
Or	19.132	95.692	2.208	3.311	2.610	4.003	12.977	6.543	53.842

QUARTZ SYENITE HYBRID (PEGMATITE IN DIORITE)

QSP-1 PEGMATITE						QSP-1	
	1	2	3	4	5	1	2
SiO2	70.46	71.19	70.72	70.88	70.61	65.25	66.35
Al2O3	20.13	19.75	19.45	19.20	19.28	18.21	17.88
TiO2	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Fe2O3	0.04	0.04	0.03	0.00	0.07	0.09	0.14
MgO	0.01	0.00	0.00	0.00	0.01	0.00	0.02
CaO	0.29	0.06	0.06	0.08	0.09	0.00	0.00
Na2O	10.62	9.72	10.48	10.72	10.79	0.10	0.16
K2O	0.08	0.06	0.06	0.02	0.02	16.56	17.11
Total	101.63	100.82	100.81	100.90	100.87	100.21	101.66
Si	12.229	12.546	12.392	12.391	12.339	12.071	12.096
Al	4.118	4.102	4.017	3.956	3.971	3.971	3.842
FE3	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ti	0.000	0.000	0.001	0.000	0.000	0.000	0.000
Fe2	0.006	0.006	0.004	0.000	0.010	0.014	0.021
Mg	0.003	0.000	0.000	0.000	0.003	0.000	0.005
Ca	0.054	0.011	0.011	0.015	0.017	0.000	0.000
Na	3.574	3.321	3.560	3.633	3.656	0.036	0.057
K	0.018	0.013	0.013	0.004	0.004	3.908	3.979
OXYG	32.492	32.930	32.615	32.550	32.495	32.085	31.999
Ab	98.035	99.258	99.312	99.468	99.420	0.909	1.401
An	1.479	0.339	0.314	0.410	0.458	0.000	0.000
Or	0.486	0.403	0.374	0.122	0.121	99.091	98.599

MAFICS

DM-1

	1 CO	2 IN	3 RI	4 LA	5 LAC
SiO2	57.45	61.18	64.90	56.51	54.66
Al2O3	25.77	24.62	22.61	26.50	28.87
TiO2	0.13	0.12	0.06	0.08	0.17
Fe2O3	0.30	0.29	0.31	0.55	0.44
MgO	0.05	0.04	0.00	0.04	0.05
CaO	8.95	7.02	4.41	9.64	11.57
Na2O	6.31	7.37	8.42	5.66	4.91
K2O	0.22	0.31	0.88	0.25	0.17
Total	99.18	100.95	101.59	99.23	100.84
Si	10.412	10.848	11.383	10.280	9.814
Al	5.505	5.145	4.674	5.682	6.109
FE3	0.000	0.000	0.000	0.000	0.000
Ti	0.018	0.016	0.008	0.011	0.023
Fe2	0.045	0.043	0.045	0.084	0.066
Mg	0.014	0.011	0.000	0.011	0.013
Ca	1.738	1.334	0.829	1.879	2.226
Na	2.217	2.534	2.863	1.996	1.709
K	0.051	0.070	0.197	0.058	0.039
OXYG	32.048	32.135	32.198	32.104	32.018
Ab	55.347	64.348	73.627	50.754	43.011
An	43.383	33.871	21.310	47.771	56.009
Or	1.270	1.781	5.063	1.475	0.980

Co core
In intermediate
Ri rim
La lath
Lac lath core

APPENDIX 3. AVERAGE CHEMICAL COMPOSITION OF MAFIC MINERALS AND ACCESSORY PHASES, AS DETERMINED BY ELECTRON-MICROPROBE ANALYSIS, LISTED BY UNIT

Order of listing:

- Amphibole
  - Calcic amphibole
  - Sodic amphibole
  - Sodi-calcic amphibole
- Clinopyroxene
- Magnetite
- Ilmenite
- Biotite
- Chlorite
- Fayalite
- Iddingsite
- Titanite
- Epidote
- Prehnite
- Apatite
- Zircon
- Astrophyllite
- Allanite
- Chevkinite
- Aenigmatite
- Pyrochlore

Average mineral composition by unit

Amphiboles Hornblende (Calcic amphiboles)

	Syenite hybrid						Quartz syenite		
	QSP-1P MG-HBL (3)	QSP-1P ACT-HB (1)	QSP-1P FE-ACH (2)	QSP-1 AC-HBL (1)	QS-10 ACT-HB (1)	QS-10 MG-HBL (4)	74-101 FE-ACH (1)	74-101 FE-HBL (1)	74-101 FE-EDH (1)
SiO2	48.56	49.16	46.69	49.86	50.83	48.39	47.18	44.79	42.20
TiO2	1.49	1.63	0.17	1.05	1.04	1.44	0.39	0.80	1.48
Al2O3	4.95	4.71	5.56	4.08	4.05	5.54	3.26	3.81	4.05
FeO	13.07	14.89	23.09	13.24	13.20	13.61	27.65	26.29	25.29
Fe2O3	6.58	2.91	1.69	5.38	5.08	4.62	8.10	9.18	7.62
MgO	11.10	11.54	6.37	11.96	12.43	11.31	1.85	1.82	2.49
MnO	0.36	0.32	0.22	0.34	0.33	0.30	0.76	0.73	0.61
CaO	10.31	10.67	11.49	9.92	10.61	10.77	9.95	9.71	9.80
Na2O	1.36	1.24	0.94	1.15	1.04	1.34	1.19	1.34	2.17
K2O	0.51	1.31	0.59	0.31	0.40	0.56	0.47	0.58	1.04
P2O5	-	-	-	-	-	-	-	-	-
ZrO2	-	-	-	-	-	-	-	-	-
La2O3	-	-	-	-	-	-	-	-	-
Ce2O3	-	-	-	-	-	-	-	-	-
Nd2O3	-	-	-	-	-	-	-	-	-
Sm2O3	-	-	-	-	-	-	-	-	-
Y2O3	-	-	-	-	-	-	-	-	-
Nb2O5	-	-	-	-	-	-	-	-	-
Ta2O5	-	-	-	-	-	-	-	-	-
ThO2	-	-	-	-	-	-	-	-	-
UO2	-	-	-	-	-	-	-	-	-
F	0.07	0.03	0.05	0.09	0.07	0.06	0.44	0.44	1.04
Cl	0.32	0.00	0.68	0.30	0.26	0.37	-	-	0.00
O=F,Cl	0.10	0.01	0.18	0.11	0.09	0.11	0.19	0.19	0.44
Total	98.58	98.40	97.36	97.57	99.25	98.20	100.24	98.38	100.24

Average mineral composition by unit

Amphiboles Hornblende (Calcic amphiboles)

	Syenite									
	QS-5 FE-HBL (2)	WLD-100 FE-HBL (2)	WLD-100 FE-ACH (1)	QS-3 FE-HBL (1)	QS-3 FE-ACH (1)	QS-1 FE-ACH (1)	QS-1 FE-EDH (1)	74-17 FE-HBL (2)	74-17 FE-EDH (1)	74-14 FE-HB (2)
SiO2	46.25	45.77	47.48	45.69	47.02	45.61	43.43	44.60	42.47	44.31
TiO2	0.68	1.27	0.79	0.94	1.08	0.01	2.27	1.65	1.97	1.27
Al2O3	5.00	4.69	3.49	4.76	3.96	4.17	6.78	6.48	7.36	5.43
FeO	22.71	24.20	25.38	26.90	22.25	27.96	22.43	22.35	22.25	28.10
Fe2O3	8.33	6.67	4.85	4.47	6.08	6.99	4.35	6.92	7.09	6.71
MgO	4.41	4.11	4.02	2.83	5.53	0.94	5.44	4.94	4.54	1.51
MnO	0.61	0.47	0.53	0.49	0.40	1.36	0.62	0.51	0.50	0.63
CaO	10.01	9.64	9.80	9.54	9.14	10.07	10.28	10.06	9.98	9.70
Na2O	1.45	1.88	1.49	1.88	2.08	0.82	2.18	1.91	2.17	1.91
K2O	0.66	0.77	0.52	0.85	0.89	0.42	1.03	0.97	1.09	0.95
P2O5	-	-	-	-	-	-	-	-	-	-
ZrO2	-	-	-	-	-	-	-	-	-	-
La2O3	-	-	-	-	-	-	-	-	-	-
Ce2O3	-	-	-	-	-	-	-	-	-	-
Nd2O3	-	-	-	-	-	-	-	-	-	-
Sm2O3	-	-	-	-	-	-	-	-	-	-
Y2O3	-	-	-	-	-	-	-	-	-	-
Nb2O5	-	-	-	-	-	-	-	-	-	-
Ta2O5	-	-	-	-	-	-	-	-	-	-
ThO2	-	-	-	-	-	-	-	-	-	-
UO2	-	-	-	-	-	-	-	-	-	-
F	0.13	0.42	0.34	0.24	0.59	0.11	0.46	0.30	0.31	0.61
Cl	0.54	0.36	0.35	0.40	0.23	0.40	0.45	0.00	0.00	0.00
O=F,Cl	0.18	0.26	0.22	0.19	0.30	0.14	0.30	0.13	0.13	0.26
Total	100.60	99.32	98.82	98.80	98.95	98.72	99.42	100.56	99.60	100.87

Average mineral composition by unit

Amphiboles Ferro-edenite (Calcic amphiboles)

	Syenite			Granite
	QS-5 FE-ED (2)	QS-5 FE-ED[1] (1)	QS-1 FE-ED (3)	WLD-85 FE-ED (1)
SiO2	43.24	42.72	43.74	45.61
TiO2	1.95	1.83	1.64	1.42
Al2O3	6.79	7.13	6.76	4.09
FeO	25.10	24.61	23.22	27.01
Fe2O3	2.03	2.19	3.20	1.55
MgO	4.57	4.88	5.22	3.36
MnO	0.50	0.51	0.46	0.93
CaO	10.54	10.73	10.27	9.02
Na2O	2.04	2.12	2.05	2.50
K2O	1.09	1.14	1.01	0.92
P2O5	-	-	-	-
ZrO2	-	-	-	-
La2O3	-	-	-	-
Ce2O3	-	-	-	-
Nd2O3	-	-	-	-
Sm2O3	-	-	-	-
Y2O3	-	-	-	-
Nb2O5	-	-	-	-
Ta2O5	-	-	-	-
ThO2	-	-	-	-
UO2	-	-	-	-
F	0.26	0.22	0.26	0.78
Cl	0.61	0.60	0.47	0.36
O=F,Cl	0.25	0.23	0.22	0.41
Total	98.47	98.45	98.08	97.14

1 ferro-edenitic hornblende

Average mineral composition by unit

Amphiboles **Actinolite** **Hornblende (Calcic amphiboles)**

	Syenite hybrid	Syenite				Hybrid		Syenite hybrid			
	QSP-1P FE-AC (4)	QS-5 FE-AC (1)	WLD-100 FE-AC (1)	QS-3 FE-AC (1)	QS-1 FE-AC (3)	H-6 FE-HB (3)	H-6 MG-HB (1)	QSP-1P MG-HB (3)	QSP-1P AC-HB (1)	QSP-1P FE-ACH (2)	QSP-1F AC-HE (1)
SiO2	51.17	50.17	51.32	48.62	49.94	45.73	48.19	48.56	49.16	46.69	49.86
TiO2	0.03	0.03	0.00	0.43	0.13	1.83	0.70	1.49	1.63	0.17	1.05
Al2O3	1.99	1.83	0.38	2.31	2.59	5.63	4.88	4.95	4.71	5.56	4.08
FeO	24.71	27.27	32.33	30.96	25.33	20.53	16.29	13.07	14.89	23.09	13.24
Fe2O3	0.46	3.86	0.00	2.36	1.67	4.33	4.61	6.58	2.91	1.69	5.38
MgO	6.79	4.58	2.58	2.27	6.10	6.83	9.79	11.10	11.54	6.37	11.96
MnO	0.25	0.78	1.36	0.83	0.72	0.46	0.50	0.36	0.32	0.22	0.34
CaO	11.62	10.54	10.96	9.20	11.21	9.73	10.06	10.31	10.67	11.49	9.92
Na2O	0.31	0.62	0.23	0.86	0.22	2.22	2.14	1.36	1.24	0.94	1.15
K2O	0.30	0.26	0.14	0.45	0.12	0.87	0.66	0.51	1.31	0.59	0.31
P2O5	-	-	-	-	-	-	-	-	-	-	-
ZrO2	-	-	-	-	-	-	-	-	-	-	-
La2O3	-	-	-	-	-	-	-	-	-	-	-
Ce2O3	-	-	-	-	-	-	-	-	-	-	-
Nd2O3	-	-	-	-	-	-	-	-	-	-	-
Sm2O3	-	-	-	-	-	-	-	-	-	-	-
Y2O3	-	-	-	-	-	-	-	-	-	-	-
Nb2O5	-	-	-	-	-	-	-	-	-	-	-
Ta2O5	-	-	-	-	-	-	-	-	-	-	-
ThO2	-	-	-	-	-	-	-	-	-	-	-
UO2	-	-	-	-	-	-	-	-	-	-	-
F	0.01	0.07	0.04	0.20	0.08	0.59	0.85	0.07	0.03	0.05	0.09
Cl	0.60	0.17	0.04	0.22	0.05	0.38	0.19	0.32	0.00	0.68	0.30
O=F,Cl	0.14	0.07	0.02	0.13	0.05	0.34	0.40	0.10	0.01	0.18	0.11
Total	98.10	100.11	99.36	98.58	98.11	98.79	98.46	98.58	98.40	97.36	97.05

Average mineral composition by unit

Amphiboles Arfvedsonite (Sodic amphiboles)

	Alkali granite					Granophyre		
	AG-P1 ARF (7)	AG-P4 ARF (10)	WLD-49 ARF (3)	AG-DY ARF (5)	AG-P2 ARF (7)	74-70 ARF (6)	74-78 ARF (8)	Hybrid H-2 ARF (4)
SiO2	50.22	50.73	49.82	51.48	51.08	50.06	49.83	49.94
TiO2	2.09	1.81	1.91	1.44	0.73	1.29	1.37	2.11
Al2O3	0.77	0.80	0.81	0.50	1.91	0.60	0.60	1.06
FeO	32.18	31.24	32.26	29.65	31.68	30.46	31.25	31.28
Fe2O3	0.90	0.70	0.18	2.21	0.35	3.45	2.35	1.46
MgO	0.29	0.11	0.34	0.03	0.15	0.32	0.09	0.31
MnO	0.87	0.74	0.83	0.60	0.62	0.83	0.68	0.72
CaO	1.78	0.95	2.16	0.54	0.99	1.59	0.67	2.72
Na2O	7.94	8.60	7.63	8.73	8.73	7.59	8.57	7.22
K2O	1.48	1.69	1.51	1.70	1.66	1.55	1.71	1.53
P2O5	-	-	-	-	-	-	-	-
ZrO2	-	-	-	-	-	-	-	-
La2O3	-	-	-	-	-	-	-	-
Ce2O3	-	-	-	-	-	-	-	-
Nd2O3	-	-	-	-	-	-	-	-
Sm2O3	-	-	-	-	-	-	-	-
Y2O3	-	-	-	-	-	-	-	-
Nb2O5	-	-	-	-	-	-	-	-
Ta2O5	-	-	-	-	-	-	-	-
ThO2	-	-	-	-	-	-	-	-
UO2	-	-	-	-	-	-	-	-
F	0.88	1.15	1.02	1.54	1.14	2.06	2.30	0.73
Cl	0.01	0.03	0.05	0.03	0.03	-	-	0.05
O=F,Cl	0.37	0.49	0.44	0.65	0.49	0.87	0.97	0.32
Total	98.96	98.06	98.08	97.80	98.59	98.93	98.45	98.81

Average mineral composition by unit

Amphiboles Ferro-richterite (Sodi-calcic amphiboles)

	Alkali granite WLD-49 (1)	WLD-36 (11)	74-81 (7)	74-81[1] (1)	74-63[2] (1)	74-63[3] (1)	74-63[4] (3)	Hybrid H-2 (3)
SiO2	48.53	47.76	47.76	50.80	45.87	47.84	46.65	48.43
TiO2	2.20	1.87	1.76	0.23	1.92	1.72	1.70	2.19
Al203	1.69	1.96	1.84	0.65	1.83	1.80	2.01	1.62
FeO	32.30	30.75	29.68	27.60	27.24	27.59	26.92	33.21
Fe203	0.00	1.97	3.86	8.60	7.82	6.94	7.82	0.16
MgO	0.53	1.23	1.24	0.79	1.56	1.65	1.68	0.35
MnO	0.66	0.84	0.70	0.39	0.68	0.61	0.62	0.88
CaO	4.06	5.45	4.84	2.84	5.88	5.95	6.50	4.51
Na20	6.31	4.90	5.16	5.67	4.06	3.67	3.19	6.28
K20	1.33	1.27	1.28	0.87	1.19	1.14	1.17	1.29
P205	-	-	-	-	-	-	-	-
Zr02	-	-	-	-	-	-	-	-
La203	-	-	-	-	-	-	-	-
Ce203	-	-	-	-	-	-	-	-
Nd203	-	-	-	-	-	-	-	-
Sm203	-	-	-	-	-	-	-	-
Y203	-	-	-	-	-	-	-	-
Nb205	-	-	-	-	-	-	-	-
Ta205	-	-	-	-	-	-	-	-
Th02	-	-	-	-	-	-	-	-
U02	-	-	-	-	-	-	-	-
F	0.62	0.82	1.23	0.59	0.90	1.69	0.65	0.83
Cl	0.11	0.11	0.00	-	-	-	-	0.08
O=F,Cl	0.29	0.37	0.52	0.25	0.38	0.71	0.27	0.37
Total	98.05	98.56	98.83	98.78	98.57	99.89	98.64	99.46

1 riebeckite
2 katophorite
3 ferro-winchite
4 ferro-barroisite

Average mineral composition by unit

Pyroxenes Ferrohedenbergite Hedenbergite

	Alkali granite				Syenite
	AG-P1 (4)	WLD-49 (1)	WLD-36 (4)	WLD-36 (1)	74-101 (1)
SiO2	49.52	50.23	50.14	49.47	49.86
TiO2	0.37	0.18	0.19	0.34	0.05
Al2O3	0.16	0.57	0.22	0.24	0.06
FeO	25.36	21.75	21.66	20.31	25.51
Fe2O3	4.29	5.59	5.00	7.30	0.11
MgO	0.90	0.56	1.81	1.79	2.81
MnO	0.92	0.90	0.77	0.75	1.01
CaO	16.79	16.85	17.28	17.20	20.94
Na2O	2.20	3.23	2.66	2.84	0.28
ZrO2	0.06	-	-	-	-
Total	100.56	99.66	99.73	100.23	100.63

Pyroxenes Aegirine-augite

	Alkali granite		
	AG-P1 (2)	WLD-49 (1)	74-81 (1)
SiO2	50.62	51.14	49.92
TiO2	0.31	0.35	0.18
Al2O3	0.44	0.29	0.26
FeO	14.00	14.83	19.16
Fe2O3	15.50	12.47	10.46
MgO	0.75	0.48	0.87
MnO	0.69	0.64	0.66
CaO	11.49	12.14	15.08
Na2O	6.51	6.38	4.13
ZrO2	0.18	-	-
Total	100.47	98.72	100.73

Average mineral composition by unit

Pyroxenes Aegirine

	Alkali granite							
	AG-P1 (1)	AG-P2 (3)	AG-P4 (5)	WLD-49 (1)	WLD-49 (1)	WLD-36 (1)	WLD-36 (2)	AG-DYKE (1)
SiO2	51.62	52.81	52.73	53.07	52.47	51.92	52.66	53.36
TiO2	1.82	1.55	1.39	2.23	0.36	0.30	1.78	1.31
Al2O3	0.00	0.32	0.20	0.42	0.06	0.64	0.34	0.53
FeO	0.00	0.00	2.29	1.23	2.54	12.23	0.56	0.18
Fe2O3	30.16	30.41	28.85	29.18	28.94	16.05	30.81	30.94
MgO	0.00	0.01	0.01	0.06	0.00	0.80	0.06	0.00
MnO	0.00	0.06	0.21	0.27	0.34	0.78	0.07	0.33
CaO	0.38	0.71	1.49	0.69	4.41	9.89	0.28	0.34
Na2O	14.03	14.05	12.91	13.58	11.76	7.60	13.69	13.81
ZrO2	1.92	0.00	-	-	-	-	-	-
Total	99.93	99.92	100.08	100.73	100.88	100.21	100.24	100.80

Pyroxenes Aegirine

	Hybrid			Granophyre
	H-2 (2)	H-2 (4)	H-2 (2)	74-78 (8)
SiO2	53.04	52.32	51.85	52.13
TiO2	0.53	0.92	1.07	1.59
Al2O3	0.97	0.20	0.18	0.82
FeO	0.19	3.85	7.45	0.88
Fe2O3	30.80	26.94	22.11	30.48
MgO	0.00	0.07	0.07	0.05
MnO	0.07	0.36	0.37	0.39
CaO	0.21	3.69	6.45	0.27
Na2O	13.93	11.72	10.09	13.50
ZrO2	-	-	-	-
Total	99.74	100.07	99.64	100.11

Average mineral composition by unit

Pyroxenes Salite Augite

	Syenite hybrid		Syenite			Mafics	
	QSP-1 (1)	QS-10 (2)	QSP-1P (1)	WLD-100 (1)	74-101 (1)	DM-1 (3)	DM-1 (1)
SiO2	53.09	53.27	51.80	51.11	48.91	50.86	53.92
TiO2	0.00	0.01	1.04	0.61	0.07	1.69	0.04
Al2O3	0.06	0.20	2.41	1.38	0.22	3.38	2.82
FeO	9.56	10.13	8.12	14.89	23.59	8.61	10.57
Fe2O3	0.00	0.00	0.00	0.00	2.22	0.08	0.00
MgO	11.51	11.56	13.78	9.71	2.97	13.91	11.57
MnO	0.35	0.23	0.30	0.65	1.00	0.19	0.58
CaO	24.33	23.69	21.12	20.15	20.95	20.46	18.53
Na2O	0.14	0.17	0.55	0.61	0.39	0.43	0.57
ZrO2	-	-	-	-	-	-	-
Total	99.04	99.26	99.12	99.11	100.32	99.61	98.60

Pyroxenes Ferroaugite

	Syenite						Hybrid
	QS-5 (2)	WLD-100 (6)	QS-3 (5)	QS-3 (1)	QS-1 (3)	74-17 (1)	H-6 (1)
SiO2	50.47	50.16	50.74	51.30	50.38	50.00	51.79
TiO2	0.31	0.17	0.23	0.19	0.35	0.07	0.18
Al2O3	0.59	0.29	0.30	0.61	0.57	0.32	0.54
FeO	20.99	23.56	23.60	19.19	19.80	19.66	16.71
Fe2O3	0.00	0.00	0.00	0.00	0.50	2.23	0.00
MgO	5.90	4.28	4.73	6.77	6.72	6.57	8.62
MnO	0.64	0.67	0.73	0.58	0.88	0.75	0.79
CaO	20.72	19.99	19.32	19.73	20.35	20.41	20.06
Na2O	0.34	0.45	0.54	0.61	0.37	0.34	0.43
ZrO2	-	-	-	-	-	-	0.95
Total	99.96	99.57	100.19	99.78	99.92	100.34	99.12

Average mineral composition by unit

Magnetite

	Alkali granite					Syenite		Granite	
	WLD-36 (1)	WLD-36 (3)	74-81 (1)	74-81 (1)	74-81 (2) Hm?*	WLD-100 (1)	QS-3 (1)	G-1 (8)	WLD-85 (3)
Al203	0.07	0.05	0.04	0.02	0.00	0.32	2.95	0.23	0.17
Ti02	2.49	15.31	9.06	20.39	0.00	8.56	0.26	2.03	3.19
FeO	34.61	12.76	39.42	48.35	27.66	39.37	30.93	32.21	31.93
Fe203	67.23	75.37	52.71	27.28	61.46	53.87	63.29	63.34	58.31
MgO	0.00	0.01	0.00	0.00	0.00	0.00	0.05	0.00	0.02
MnO	0.16	0.97	0.61	0.60	0.08	0.48	0.00	0.09	0.12
Total	104.56	104.42	101.84	96.63	89.12	102.60	97.48	97.90	93.74

	Hybrid H-6		Mafics DM-1
	(1)	(2)	(2)
Al203	0.00	0.31	1.27
Ti02	0.65	3.82	15.18
FeO	30.29	33.00	43.27
Fe203	64.72	58.09	35.29
MgO	0.00	0.00	0.02
MnO	0.00	0.22	0.76
Total	95.65	95.44	95.79

Magnetite (analyses with total 99-101)

	Granite		Hybrid
	G-1 (1)	G-1 (1)	H-6 (1)
Al203	0.46	0.42	0.44
Ti02	0.81	10.44	4.97
FeO	31.52	40.21	35.79
Fe203	66.29	47.73	59.27
MgO	0.00	0.00	0.00
MnO	0.08	0.33	0.12
Total	99.16	99.13	100.59

* recalculated as magnetite

Average mineral composition by unit

Ilmenite

	Syenite QSP-1P (5)	Hybrid QSP-1 (2)	QS-10 (4)	Syenite QS-1 (3)	QS-3 (3)	QS-5 (3)	WLD-100 (5)	74-101 (1)	74-14 (1)
Al2O3	0.01	0.02	0.02	0.00	0.02	0.00	0.01	0.00	0.00
TiO2	51.48	53.07	51.61	54.03	54.16	53.47	52.93	52.41	53.13
FeO	43.92	44.23	44.26	44.52	44.36	45.58	45.81	45.31	46.47
Fe2O3	1.40	0.00	1.64	0.00	0.84	0.10	0.83	2.03	0.07
MgO	0.06	0.09	0.07	0.03	0.02	0.04	0.05	0.03	0.01
MnO	1.45	1.38	1.40	2.82	1.56	1.78	1.59	1.74	1.27
Total	98.32	98.79	99.00	101.40	100.96	100.97	101.22	101.52	100.95

Ilmenite (analyses with total 99-101)

	Syenite QSP-1P (1)	hybrid QS-10 (2)	Syenite QS-1 (1)	QS-3 (2)	QS-5 (1)	WLD-100 (2)	74-14 (1)
Al2O3	0.00	0.01	0.00	0.03	0.00	0.00	0.00
TiO2	51.84	51.17	52.97	53.53	52.83	52.48	53.13
FeO	44.87	44.34	44.11	44.26	45.70	45.70	46.47
Fe2O3	0.82	2.99	0.00	1.26	0.31	0.71	0.07
MgO	0.07	0.05	0.01	0.02	0.02	0.09	0.01
MnO	1.60	1.57	3.13	1.74	1.75	1.32	1.27
Total	99.20	100.13	100.22	100.84	100.61	100.30	100.95

Average mineral composition by unit

Ilmenite

	Alkali granite	Granite		Hybrid		Mafics
	AG-P1 (1)	G-1 (2)	74-63 (1)	H-2 (3)	H-6 (6)	DM-1 (1)
Al203	0.00	0.03	0.00	0.01	0.00	0.01
Ti02	57.30	52.06	42.80	55.35	52.36	49.53
FeO	38.45	44.78	38.12	42.09	43.51	42.66
Fe203	0.00	1.32	9.94	0.00	0.52	3.69
MgO	0.01	0.00	0.03	0.01	0.02	0.08
MnO	4.52	2.01	0.31	3.14	1.89	1.71
Total	100.28	100.20	91.20	100.60	98.30	97.68

Ilmenite (analyses with total 99-101)

	Alkali granite	Granite	Hybrid	
	AG-P1 (1)	G-1 (2)	H-2 (2)	H-6 (1)
Al203	0.00	0.03	0.01	0.00
Ti02	57.30	52.06	55.43	51.40
FeO	38.45	44.78	41.26	43.35
Fe203	0.00	1.32	0.00	3.09
MgO	0.01	0.00	0.01	0.02
MnO	4.52	2.01	3.57	2.80
Total	100.28	100.20	100.28	100.66

Average mineral composition by unit

Biotite

	Syenite					Syenite hybrid			Granite		
	QS-1 (3)	QS-3 (2)	QS-3 (4)	QS-5 (2)	WLD-100 (5)	74-17 (1)	QS-10 (1)	QS-10 (1)	G-1 (8)	Hybrid H-6 (1)	??? (3)
SiO2	35.89	37.00	35.00	33.85	35.00	34.04	33.24	33.61	36.82	34.62	34.32
TiO2	4.36	3.76	2.89	4.75	3.68	2.05	11.45	4.62	4.45	2.41	0.56
Al2O3	11.73	10.75	10.83	11.56	11.07	11.69	11.69	13.76	11.13	13.58	11.65
FeO	27.14	28.76	36.20	33.46	35.74	37.74	21.59	25.67	26.53	22.88	37.97
MgO	6.63	6.65	1.39	2.20	1.77	1.90	8.57	9.91	1.16	12.68	1.45
MnO	0.11	0.14	0.27	0.17	0.23	0.30	0.08	0.07	0.27	0.27	0.45
CaO	0.08	0.02	0.01	0.08	0.03	0.00	4.90	0.04	0.00	0.04	0.02
Na2O	0.07	0.12	0.01	0.07	0.05	0.11	0.09	0.08	0.14	0.10	0.26
K2O	9.84	9.28	9.46	8.95	9.15	8.36	4.53	5.73	9.68	5.15	8.6
P2O5	-	-	-	-	-	-	-	-	-	-	-
ZrO2	-	-	-	-	-	-	-	-	-	-	-
La2O3	-	-	-	-	-	-	-	-	-	-	-
Ce2O3	-	-	-	-	-	-	-	-	-	-	-
Nd2O3	-	-	-	-	-	-	-	-	-	-	-
Sm2O3	-	-	-	-	-	-	-	-	-	-	-
Y2O3	-	-	-	-	-	-	-	-	-	-	-
Nb2O5	-	-	-	-	-	-	-	-	-	-	-
Ta2O5	-	-	-	-	-	-	-	-	-	-	-
ThO2	-	-	-	-	-	-	-	-	-	-	-
UO2	-	-	-	-	-	-	-	-	-	-	-
F	0.25	0.92	0.04	0.08	0.08	0.24	0.12	0.04	1.17	0.74	0.03
Cl	0.24	0.43	0.97	0.89	0.80	-	0.22	0.38	0.58	0.31	-
O=F,Cl	0.16	0.49	0.24	0.23	0.21	0.10	0.10	0.10	0.62	0.38	0.01
Total	96.18	97.34	96.83	95.83	97.39	96.33	96.38	93.81	91.31	92.39	95.33

Average mineral composition by unit

Chlorite

	Mafics		Syenite	Granite	Hybrid				Hybrid syenite	
	DM-1 (2)	DM-1 (1)	QS-1 (?)	G-1 (?)	H-6 (2)	H-6 (2)	H-6 (1)	H-6 (1)?	QSP-1 (1)	QS-10 (4)
SiO2	29.70	27.53	28.21	35.27	28.15	25.49	27.98	32.31	31.34	25.93
TiO2	0.06	0.04	0.05	2.75	0.07	0.03	0.00	1.37	2.89	0.06
Al2O3	16.36	12.51	15.09	11.17	17.35	18.49	16.76	14.65	13.70	19.77
FeO	23.36	18.70	40.05	29.86	30.15	36.42	33.44	23.62	25.88	31.28
MgO	17.09	16.76	4.45	1.05	11.00	5.80	6.79	13.46	12.20	9.58
MnO	0.22	0.16	0.63	0.23	0.26	0.30	0.25	0.21	0.02	0.15
CaO	0.07	3.70	0.17	0.06	0.08	0.02	0.33	0.07	0.22	0.06
Na2O	0.00	0.01	0.01	0.08	0.00	0.01	0.05	0.00	0.00	0.02
K2O	0.00	0.00	0.86	5.78	0.01	0.02	0.04	2.37	1.25	0.01
P2O5	0.00	2.89	0.04	0.00	0.00	0.00	0.04	0.03	-	-
ZrO2	-	-	-	-	-	-	-	-	-	-
La2O3	-	-	-	-	-	-	-	-	-	-
Ce2O3	-	-	-	-	-	-	-	-	-	-
Nd2O3	-	-	-	-	-	-	-	-	-	-
Sm2O3	-	-	-	-	-	-	-	-	-	-
Y2O3	-	-	-	-	-	-	-	-	-	-
Nb2O5	-	-	-	-	-	-	-	-	-	-
Ta2O5	-	-	-	-	-	-	-	-	-	-
ThO2	-	-	-	-	-	-	-	-	-	-
UO2	-	-	-	-	-	-	-	-	-	-
F	0.00	0.44	0.00	0.61	0.02	0.00	0.00	0.74	0.07	-
Cl	0.00	0.03	0.00	0.46	0.00	0.01	0.02	0.22	0.10	-
OH	11.44	10.96	-	-	-	-	-	-	11.32	-
O=F,Cl	0.00	0.19	0.00	0.36	0.01	0.00	0.00	0.36	0.05	-
Total	98.30	93.54	89.56	86.96	87.08	86.59	85.70	88.69	98.94	86.86

Average mineral composition by unit

Fayalite

	Syenite						
	QS-5 (2)	QS-5 (2)	QS-3 (2)	QS-3 (3)	74-101 (4)	74-101 (2)	74-14 (1)
SiO2	30.82	30.79	31.18	30.72	30.86	27.94	30.82
TiO2	0.10	0.04	0.01	0.08	0.00	0.09	0.01
Al2O3	0.01	0.02	0.02	0.02	0.03	0.02	0.02
FeO	62.72	61.36	66.86	60.66	66.92	62.33	68.11
MgO	3.19	3.24	2.63	2.61	1.32	1.28	0.76
MnO	2.24	2.19	1.99	1.89	2.51	2.34	2.42
CaO	0.09	0.14	0.09	0.09	0.17	0.18	0.13
Na2O	0.02	0.00	0.01	0.02	0.07	0.09	0.00
K2O	0.00	0.01	0.00	0.01	0.03	0.02	0.00
P2O5	0.02	0.02	0.04	0.01	-	-	-
ZrO2	-	-	-	-	-	-	-
La2O3	-	-	-	-	-	-	-
Ce2O3	-	-	-	-	-	-	-
Nd2O3	-	-	-	-	-	-	-
Sm2O3	-	-	-	-	-	-	-
Y2O3	-	-	-	-	-	-	-
Nb2O5	-	-	-	-	-	-	-
Ta2O5	-	-	-	-	-	-	-
ThO2	-	-	-	-	-	-	-
UO2	-	-	-	-	-	-	-
F	-	-	-	-	-	-	-
Cl	-	-	-	-	-	-	-
O=F,Cl	-	-	-	-	-	-	-
Total	99.21	97.78	102.83	96.11	101.91	94.29	102.27

Average mineral composition by unit

Iddingsite?

	Syenite					
	QS-5 (2)	QS-5 (2)	QS-1 (2)	WLD-100 (2)	74-17 (2)	74-14 (1)
SiO2	41.88	42.57	37.05	40.07	47.26	40.11
TiO2	0.18	0.08	0.12	0.06	0.00	0.05
Al2O3	1.44	0.02	5.01	1.89	2.83	2.73
FeO	35.47	31.25	33.90	39.37	37.28	45.05
MgO	1.17	0.60	2.44	1.01	1.08	0.11
MnO	0.66	0.43	0.35	0.49	1.49	0.21
CaO	0.93	2.10	1.97	0.45	0.34	0.28
Na2O	0.62	0.10	0.15	0.02	0.23	3.31
K2O	0.04	0.13	0.12	0.03	0.26	1.67
P2O5	0.00	0.02	0.03	0.06	-	-
ZrO2	0.07	0.00	-	-	-	-
La2O3	0.02	0.06	-	-	-	-
Ce2O3	0.08	0.04	-	-	-	-
Nd2O3	0.00	0.00	-	-	-	-
Sm2O3	0.00	0.03	-	-	-	-
Y2O3	0.00	0.00	-	-	-	-
Nb2O5	0.01	0.00	-	-	-	-
Ta2O5	0.24	0.31	-	-	-	-
ThO2	0.06	0.07	-	-	-	-
UO2	-	-	-	-	-	-
F	0.04	0.02	0.02	0.04	0.00	0.00
Cl	0.00	0.02	0.07	0.02	-	-
O=F,Cl	0.02	0.01	0.02	0.02	0.00	0.00
Total	82.89	77.84	81.21	83.49	90.77	93.52

Average mineral composition by unit

	Titanite			Epidote			Prehnite-Fe Prehnite	
	Syenite QSP-1 (2)	hybrid QS-10 (2)	Hybrid H-6 (2)	Syenite QSP-1P (7)	hybrid QS-10 (2)	Hybrid H-6 (1)	Syenite QSP-1P (4)	hybrid QSP-1 (1)
SiO2	30.71	30.66	31.44	38.23	38.91	38.55	44.27	44.69
TiO2	40.51	40.31	35.11	0.03	0.12	0.00	0.07	0.06
Al2O3	0.87	1.76	5.45	22.82	26.02	22.65	19.15	23.61
FeO	0.75	0.98	0.79	11.42	7.21	11.57	5.85	0.87
MgO	0.00	0.00	0.00	0.00	0.02	0.00	0.10	0.00
MnO	0.00	0.06	0.04	0.10	0.15	0.14	0.05	0.02
CaO	27.76	27.89	28.22	22.54	22.82	22.52	24.83	25.32
Na2O	0.01	0.02	0.00	0.01	0.01	0.02	0.00	0.00
K2O	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.01
P2O5	0.08	0.01	0.04	0.04	0.06	0.00	0.03	0.01
ZrO2	-	-	-	0.00	-	-	-	-
La2O3	-	-	-	-	-	-	-	-
Ce2O3	-	-	-	-	-	-	-	-
Nd2O3	-	-	-	-	-	-	-	-
Sm2O3	-	-	-	-	-	-	-	-
Y2O3	-	-	-	-	-	-	-	-
Nb2O5	-	-	-	-	-	-	-	-
Ta2O5	-	-	-	-	-	-	-	-
ThO2	-	-	-	-	-	-	-	-
UO2	-	-	-	0.30	-	-	-	-
F	0.07	0.12	1.31	0.00	0.00	0.00	-	-
Cl	0.00	0.03	0.00	0.00	0.02	0.00	-	-
O=F,Cl	0.03	0.06	0.55	0.00	0.00	0.00	-	-
Total	100.76	101.78	101.86	95.49	95.34	95.45	94.36	94.59

Average mineral composition by unit

Apatite

	Syenite hybrid QSP-1P F (4)	QSP-1P Cl (1)	QSP-1 Amp (2)	QS-10 Grd (2)	QS-10 Amp (1)
SiO2	0.12	0.18	0.17	0.19	0.24
TiO2	0.03	0.01	0.00	0.00	0.00
Al2O3	0.01	0.01	0.01	0.01	0.02
FeO	0.05	0.29	0.23	0.09	0.30
MgO	0.00	0.00	0.00	0.00	0.00
MnO	0.02	0.14	0.03	0.07	0.06
CaO	55.03	52.72	54.53	55.45	54.15
Na2O	0.01	0.17	0.06	0.10	0.07
K2O	0.00	0.00	0.00	0.00	0.00
P2O5	42.58	40.80	38.89	41.66	40.28
ZrO2	0.00	0.00	-	-	-
La2O3	-	-	-	-	-
Ce2O3	-	-	-	-	-
Nd2O3	-	-	-	-	-
Sm2O3	-	-	-	-	-
Y2O3	-	-	-	-	-
Nb2O5	-	-	-	-	-
Ta2O5	-	-	-	-	-
ThO2	-	-	-	-	-
UO2	-	-	-	-	-
F	1.98	1.13	1.18	1.18	1.22
Cl	0.40	2.53	2.31	1.74	3.08
O=F,Cl	0.92	1.06	1.03	0.90	1.22
Total	99.31	96.92	96.38	99.59	98.20

Average mineral composition by unit

Apatite

	Mafics	Hybrid				Syenite				
	DM-1	H-6	H-6	H-6	H-6	QS-5	QS-5	QS-5	QS-5	74-101
		Amp	Grd		TOAV	Ilm	Amp	Grd	TOAV	
	(2)	(1)	(1)	(1)	(3)	(1)	(1)	(2)	(4)	(1)
SiO2	0.20	0.53	0.69	0.42	0.55	0.28	0.32	0.33	0.32	0.55
TiO2	0.02	0.03	0.00	0.03	0.02	0.24	0.00	0.01	0.07	0.02
Al2O3	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00
FeO	0.66	0.46	0.24	0.10	0.27	0.42	0.12	0.11	0.19	0.34
MgO	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
MnO	0.07	0.06	0.00	0.03	0.03	0.13	0.11	0.03	0.07	0.05
CaO	54.86	54.86	55.30	53.60	54.59	56.26	54.12	55.32	55.43	53.90
Na2O	0.11	0.25	0.08	0.16	0.17	0.14	0.10	0.16	0.14	0.13
K2O	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
P2O5	42.97	42.28	42.71	41.38	42.13	42.90	41.42	43.00	42.58	40.89
ZrO2	-	-	-	-	-	0.00	0.08	0.00	0.00	-
La2O3	-	-	-	0.28	-	-	0.11	-	-	-
Ce2O3	-	-	-	0.56	-	-	0.36	-	-	-
Nd2O3	-	-	-	0.19	-	-	0.21	-	-	-
Sm2O3	-	-	-	0.04	-	-	0.05	-	-	-
Y2O3	-	-	-	-	-	-	0.05	-	-	-
Nb2O5	-	-	-	-	-	-	0.00	-	-	-
Ta2O5	-	-	-	-	-	-	0.00	-	-	-
ThO2	-	-	-	-	-	-	0.00	-	-	-
UO2	-	-	-	-	-	-	-	-	-	-
F	2.37	3.13	3.09	4.38	3.54	2.68	3.54	2.64	2.88	3.74
Cl	0.77	0.14	0.08	0.13	0.11	0.11	0.17	0.19	0.17	-
O=F,Cl	1.17	1.35	1.32	1.87	1.51	1.13	1.49	1.15	1.25	1.57
Total	100.99	100.34	100.88	99.43	99.91	102.04	99.27	100.64	100.60	98.06

Average mineral composition by unit

Apatite

	Syenite QS-1 Amp (2)	QS-1 Op (1)	QS-1 TOAV (3)	QS-3 Amp (1)	QS-3 Red (1)	QS-3 Grd (2)	QS-3 TOAV (4)	Syenite WLD-100 Amp (2)	WLD-100 Grd (4)	WLD-100 TOAV (6)
SiO2	0.43	0.44	0.44	0.66	0.27	0.45	0.39	0.27	0.78	0.61
TiO2	0.02	0.00	0.01	0.00	0.11	0.03	0.04	0.04	0.05	0.04
Al2O3	0.02	0.02	0.02	0.00	0.01	0.01	0.01	0.02	0.02	0.02
FeO	0.34	0.16	0.28	0.54	0.48	0.17	0.31	0.34	0.22	0.26
MgO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MnO	0.09	0.02	0.06	0.04	0.09	0.06	0.04	0.03	0.04	0.04
CaO	52.70	52.43	52.61	53.95	54.51	53.31	53.70	54.10	52.92	53.31
Na2O	0.07	0.12	0.09	0.21	0.18	0.22	0.21	0.21	0.21	0.21
K2O	0.00	0.02	0.01	0.02	0.08	0.00	0.04	0.01	0.08	0.05
P2O5	41.66	41.32	41.55	41.36	42.70	41.70	41.87	43.25	41.58	42.14
ZrO2	-	-	-	-	-	0.00	-	0.00	0.00	-
La2O3	-	-	-	-	-	0.38	-	0.18	0.33	0.28
Ce2O3	-	-	-	-	-	0.98	-	0.59	0.88	0.78
Nd2O3	-	-	-	-	-	0.48	-	0.30	0.57	0.48
Sm2O3	-	-	-	-	-	0.14	-	0.08	0.15	0.12
Y2O3	-	-	-	-	-	0.27	-	0.20	0.33	0.29
Nb2O5	-	-	-	-	-	0.09	-	0.00	0.00	0.00
Ta2O5	-	-	-	-	-	0.00	-	0.05	0.02	0.02
ThO2	-	-	-	-	-	0.00	-	0.00	0.02	0.03
UO2	-	-	-	-	-	-	-	-	-	-
F	3.47	3.91	3.62	4.21	3.46	3.98	3.91	3.59	3.52	3.55
Cl	0.17	0.17	0.17	0.03	0.02	0.03	0.03	0.07	0.07	0.07
O=F,Cl	1.46	1.68	1.56	1.78	1.46	1.68	1.65	1.52	1.49	1.51
Total	97.51	96.93	97.30	99.24	100.45	100.62	98.90	101.98	100.30	100.79

Average mineral composition by unit

Zircon

	Granite		Hybrid			Alkali Granite				
	G-1 (1)	WLD-85 (3)	H-2 (8)	H-2 (1)	H-6 (6)	AG-P1 (2)	AG-P2 (2)	AG-P4 (2)	WLD-49 (7)	WLD-36 (1)
SiO2	31.43	31.51	31.63	28.05	31.78	31.72	32.16	31.96	32.45	32.12
TiO2	0.02	0.03	0.07	0.20	0.02	0.02	0.02	0.09	0.06	0.00
Al2O3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FeO	0.11	0.07	0.05	2.87	0.17	0.29	0.05	0.01	0.22	0.02
MgO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MnO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CaO	0.04	0.01	0.02	0.41	0.20	0.01	0.01	0.01	0.17	0.00
Na2O	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.00
K2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P2O5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ZrO2	63.97	56.75	63.16	52.19	62.48	61.05	63.63	65.23	64.07	58.45
La2O3	0.05	0.05	0.03	0.02	0.01	0.22	0.03	0.00	0.09	0.06
Ce2O3	0.12	0.06	0.04	0.04	0.02	0.38	0.06	0.10	0.14	0.00
Nd2O3	0.05	0.05	0.07	0.17	0.06	0.14	0.01	0.02	0.14	0.15
Sm2O3	0.07	0.04	0.04	0.00	0.01	0.11	0.00	0.06	0.05	0.00
Y2O3	0.72	0.49	1.05	3.52	0.15	1.75	0.01	0.66	0.14	0.31
Nb2O5	0.00	0.00	0.00	0.57	0.00	0.00	0.00	0.00	0.03	0.00
Ta2O5	0.08	0.02	0.01	0.05	0.05	0.00	0.16	0.11	0.07	0.02
ThO2	0.38	0.24	0.17	1.60	0.07	0.45	0.01	0.09	0.12	0.21
UO2	-	-	-	-	-	-	-	-	-	-
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
O=F,Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	97.04	89.32	96.34	89.69	95.03	96.14	96.15	98.34	97.77	91.34

Average mineral composition by unit

	Astrophyllite						Allanite	
	Alkali granite					Hybrid	Hybrid	
	AG-P1 (4)	AG-P1 (3)	AG-P2 (1)	AG-P4 (2)	WLD-49 (1)	H-2 (1)	H-6 BROWN (4)	H-6 ORANGE* (2)
SiO2	36.12	35.33	34.18	35.68	40.72	35.80	30.06	30.19
TiO2	11.03	11.23	11.01	12.92	10.27	11.48	2.98	4.72
Al2O3	0.57	0.61	0.14	0.40	0.34	0.46	9.18	8.63
FeO	34.34	30.27	33.44	32.04	31.10	31.51	16.12	13.29
MgO	0.03	0.07	0.01	0.00	0.23	0.00	0.57	0.58
MnO	2.13	1.43	1.77	2.78	0.95	2.18	0.22	0.26
CaO	1.07	1.00	0.55	0.42	1.26	0.87	9.28	6.95
Na2O	2.41	2.20	1.70	3.09	4.45	2.77	0.02	0.07
K2O	5.78	5.83	6.03	5.80	4.60	5.98	0.00	0.01
P2O5	0.01	0.03	0.00	0.03	0.00	0.03	0.01	0.08
ZrO2	1.79	-	1.66	1.09	0.00	-	0.00	0.00
La2O3	-	-	0.03	0.00	0.00	-	6.83	5.91
Ce2O3	-	-	0.33	0.00	0.00	-	12.93	10.52
Nd2O3	-	-	0.13	0.06	0.05	-	4.27	3.45
Sm2O3	-	-	0.09	0.11	0.15	-	1.92	1.63
Y2O3	-	-	-	0.00	0.00	-	0.22	0.23
Nb2O5	2.14	-	1.61	0.97	0.08	1.87	0.00	0.00
Ta2O5	-	-	0.31	0.38	0.30	-	0.23	0.26
ThO2	-	-	0.37	0.09	0.11	-	0.08	0.72
UO2	0.76	-	-	-	-	-	-	-
F	0.71	0.76	0.79	1.03	0.59	0.61	0.24	0.27
Cl	0.01	0.02	0.01	0.02	0.02	0.03	0.00	0.06
O=F,Cl	0.30	0.32	0.33	0.44	0.25	0.26	0.10	0.13
Total	98.60	88.46	93.83	96.47	94.97	93.33	95.06	87.70

* altered allanite

Average mineral composition by unit

Chevkinite **Aenigmatite**

	Alkali granite			Hybrid	Alkali granite			
	AG-P1 (9)	AG-P2 (3)	WLD-36 (3)	H-6 (4)	AG-P1 (5)	AG-P2 (5)	AG-P4 (1)	WLD-49 (8)
SiO2	19.59	19.17	19.53	19.45	41.89	42.00	41.10	41.61
TiO2	19.68	18.82	20.44	20.60	10.26	10.14	10.46	10.34
Al2O3	0.03	0.00	0.15	0.41	0.37	0.31	0.72	0.39
FeO	11.47	11.48	10.48	9.17	40.92	39.64	39.67	38.45
MgO	0.00	0.00	0.09	0.35	0.03	0.01	0.00	0.05
MnO	0.15	0.13	0.17	0.06	1.34	1.17	1.22	0.94
CaO	1.68	1.13	2.23	2.59	0.09	0.07	0.17	0.16
Na2O	0.03	0.14	0.02	0.01	7.88	7.85	7.36	7.62
K2O	0.00	0.00	0.02	0.00	0.00	0.01	0.03	0.02
P2O5	0.00	0.00	0.01	0.09	0.02	0.01	0.01	0.01
ZrO2	0.24	0.36	0.36	0.34	0.02	-	-	-
La2O3	12.32	12.37	11.41	10.48	-	-	-	-
Ce2O3	23.21	23.65	21.96	20.83	-	-	-	-
Nd2O3	7.58	7.77	8.24	7.93	-	-	-	-
Sm2O3	3.39	3.52	3.42	3.39	-	-	-	-
Y2O3	0.33	0.38	0.89	0.84	-	-	-	-
Nb2O5	1.13	1.76	0.91	0.57	-	-	-	-
Ta2O5	-	0.16	0.17	0.16	-	-	-	-
ThO2	0.38	0.43	0.66	1.51	-	-	-	-
UO2	-	-	-	-	-	-	-	-
F	0.43	0.42	0.47	0.44	0.01	0.01	0.01	0.03
Cl	0.18	0.18	0.05	0.18	0.01	0.01	0.03	0.04
O=F,Cl	0.22	0.22	0.21	0.23	0.01	0.01	0.01	0.02
Total	101.60	101.23	101.20	99.17	102.83	101.22	100.77	99.64

Average mineral composition by unit

Pyrochlore

	Alkali granite							
	AG-P4 (4)	AG-P4 (4)	AG-P4 (1)	AG-P4 (3)	AG-P2 (1)	AG-P2 (3)	AG-P2 (1)	WLD-36 (2)
SiO2	0.00	1.69	0.15	0.44	2.18	0.56	3.88	0.00
TiO2	8.51	9.59	7.91	9.17	9.91	10.76	12.13	10.64
Al2O3	0.00	0.09	0.00	0.00	0.54	0.04	0.01	0.00
FeO	0.01	1.53	0.32	0.07	1.74	0.79	4.68	0.42
MgO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MnO	0.01	0.10	0.00	0.00	0.02	0.21	0.32	0.71
CaO	5.97	4.16	7.34	6.27	7.51	4.12	0.30	4.45
Na2O	5.73	0.03	0.02	0.00	0.00	0.01	0.04	0.00
K2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P2O5	0.05	0.04	0.00	0.09	0.07	0.06	0.03	0.05
ZrO2	0.85	1.34	0.11	1.21	0.95	1.08	1.39	0.16
La2O3	2.13	1.60	1.97	2.25	1.33	1.66	1.19	0.73
Ce2O3	6.66	5.94	6.55	6.25	4.91	5.44	4.39	2.99
Nd2O3	3.24	3.10	3.81	3.03	2.57	2.46	2.26	0.65
Sm2O3	1.33	1.34	1.23	1.22	1.11	1.05	0.94	0.10
Y2O3	1.26	0.97	0.58	1.03	1.29	1.84	1.30	1.10
Nb2O5	58.37	53.25	66.77	59.44	49.36	54.78	50.46	61.24
Ta2O5	3.11	3.36	2.52	3.46	2.46	2.79	2.84	5.41
ThO2	1.09	1.58	0.67	0.60	0.55	0.78	0.91	2.85
UO2	-	-	-	-	-	-	-	-
F	4.36	0.65	0.00	8.90	0.23	0.50	0.38	0.00
Cl	0.00	0.00	0.00	0.05	0.02	0.01	0.01	0.00
O=F,Cl	1.83	0.27	0.00	3.75	0.10	0.23	0.16	0.00
Total	100.85	90.09	99.95	99.73	86.65	88.71	87.30	91.50

APPENDIX 4. COMPLETE LISTING, UNIT BY UNIT, OF THE CHEMICAL COMPOSITION OF MAFIC AND ACCESSORY MINERALS IN THE WELSFORD COMPLEX (ELECTRON-MICROPROBE DATA)

Order of listing:

- Amphibole
- Clinopyroxene
- Aenigmatite
- Allanite
- Apatite
- Astrophyllite
- Biotite
- Chevkinite
- Chevkinite alteration
- Chlorite
- Epidote
- Titanite
- Fayalite
- Fluorite
- Thorite
- Iddingsite
- Ilmenite
- Magnetite
- Prehnite
- Pyrochlore
- Zircon
- Yttrium phosphate
- Monazite(?)
- Unidentified phases
- Sphalerite

ALKALI GRANITE

AG-P1

Arfvedsonite

	1	2	3	4	5	6	7
SiO2	50.25	49.35	51.05	50.73	49.62	50.40	50.16
Al2O3	0.78	1.59	0.57	0.63	0.73	0.54	0.57
TiO2	1.06	1.71	2.10	2.04	3.05	2.28	2.40
FeOTot	33.41	33.86	32.66	32.85	32.52	33.11	32.54
FeOL	31.63	31.51	32.39	31.56	32.52	33.11	32.54
Fe2O3L	1.98	2.61	0.30	1.43	0.00	0.00	0.00
MnO	0.88	0.87	0.88	0.90	0.90	0.73	0.94
MgO	0.89	0.50	0.12	0.17	0.16	0.10	0.11
CaO	2.27	2.26	1.55	1.77	2.03	1.30	1.28
Na2O	7.67	7.67	8.11	7.49	7.84	8.47	8.34
K2O	1.48	1.40	1.55	1.46	1.57	1.41	1.50
F	0.99	0.90	0.90	0.78	0.78	0.77	1.03
Cl	0.00	0.00	0.00	0.01	0.00	0.00	0.05
O=F,Cl	0.42	0.38	0.38	0.33	0.33	0.32	0.45
Total	99.27	99.74	99.12	98.50	98.86	98.78	98.48

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	7.968	7.794	8.139	8.093	7.967	8.069	8.069
AlZ	0.032	0.206	0.000	0.000	0.033	0.000	0.000
Fe3Z	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AlY	0.114	0.091	0.106	0.119	0.105	0.101	0.108
Ti	0.126	0.203	0.252	0.245	0.368	0.275	0.290
Fe2	4.194	4.162	4.318	4.210	4.366	4.433	4.378
Fe3Y	0.236	0.310	0.036	0.172	0.000	0.000	0.000
Mn	0.119	0.117	0.119	0.121	0.123	0.098	0.128
Mg	0.210	0.117	0.029	0.039	0.039	0.024	0.027
XOct	0.000	-0.000	0.000	0.000	0.000	0.000	-0.000
Ca	0.386	0.383	0.265	0.303	0.349	0.223	0.221
NaM4	1.614	1.617	1.735	1.697	1.651	1.777	1.779
NaA	0.744	0.732	0.773	0.620	0.789	0.851	0.823
K	0.300	0.283	0.316	0.297	0.321	0.288	0.308
F	0.497	0.447	0.454	0.393	0.395	0.388	0.526
Cl	0.000	0.000	0.000	0.003	0.000	0.000	0.013
Total	16.044	16.015	16.088	15.917	16.109	16.139	16.131
OXYG	23.000	23.000	23.139	23.093	23.132	23.075	23.089
Al/Al+Si	0.018	0.037	0.013	0.015	0.017	0.012	0.013
Na/Na+Ca	0.859	0.860	0.904	0.885	0.875	0.922	0.922
NaA+K	1.044	1.015	1.088	0.917	1.109	1.139	1.131
AlY+Fe3+Ti	0.477	0.605	0.395	0.536	0.473	0.376	0.398
Mg/Fe2++Mg	0.048	0.027	0.007	0.009	0.009	0.005	0.006
Fe/Fe+Mg	0.955	0.975	0.993	0.991	0.991	0.995	0.994
Mn/Mn+Fe	0.026	0.025	0.027	0.027	0.027	0.022	0.028

ALKALI GRANITE

AG-P2

Arfvedsonite

	1	2	3	4	5	6
SiO2	51.58	51.48	51.14	49.95	51.25	51.13
Al2O3	0.85	0.52	0.84	1.29	0.83	0.44
TiO2.	1.76	1.83	2.13	2.15	1.59	1.99
FeOToT	32.97	33.31	31.88	31.58	31.74	31.20
FeOL	32.35	32.58	31.88	31.58	31.02	31.20
Fe2O3L	0.68	0.81	0.00	0.00	0.80	0.00
MnO	0.62	0.78	0.55	0.63	0.56	0.58
MgO	0.24	0.11	0.15	0.25	0.13	0.06
CaO	0.75	1.27	0.92	1.45	0.85	1.11
Na2O	8.95	8.55	8.61	8.45	8.69	8.89
K2O	1.74	1.57	1.67	1.46	1.70	1.59
F	1.08	1.03	1.33	1.02	1.18	1.18
Cl	0.03	0.03	0.02	0.03	0.04	0.01
O=F,Cl	0.46	0.44	0.57	0.43	0.51	0.50
Total	100.09	100.04	98.68	97.83	98.06	97.68

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	8.143	8.147	8.200	8.077	8.262	8.328
AlZ	0.000	0.000	0.000	0.000	0.000	0.000
Fe3Z	0.000	0.000	0.000	0.000	0.000	0.000
AlY	0.159	0.096	0.158	0.246	0.158	0.084
Ti	0.208	0.218	0.257	0.262	0.193	0.244
Fe2	4.272	4.313	4.274	4.269	4.182	4.250
Fe3Y	0.081	0.096	0.000	0.000	0.097	0.000
Mn	0.083	0.104	0.074	0.086	0.077	0.080
Mg	0.055	0.026	0.036	0.061	0.032	0.014
XOct	0.000	0.000	0.000	0.000	0.000	0.000
Ca	0.127	0.216	0.158	0.252	0.146	0.194
NaM4	1.873	1.784	1.842	1.748	1.854	1.806
NaA	0.867	0.840	0.835	0.901	0.863	1.000
K	0.350	0.317	0.342	0.302	0.350	0.331
F	0.538	0.516	0.676	0.519	0.602	0.610
Cl	0.008	0.009	0.006	0.007	0.010	0.001
Total	16.217	16.157	16.177	16.203	16.213	16.331
OXYG	23.143	23.147	23.204	23.189	23.262	23.376
Al/Al+Si	0.019	0.012	0.019	0.030	0.019	0.010
Na/Na+Ca	0.956	0.924	0.944	0.913	0.949	0.935
NaA+K	1.217	1.157	1.177	1.203	1.213	1.331
AlY+Fe3+Ti	0.448	0.410	0.416	0.508	0.447	0.328
Mg/Fe2++Mg	0.013	0.006	0.008	0.014	0.008	0.003
Fe/Fe+Mg	0.987	0.994	0.992	0.986	0.993	0.997
Mn/Mn+Fe	0.019	0.023	0.017	0.020	0.018	0.018

ALKALI GRANITE

AG-P2

Arfvedsonite

	7	8	9	10	11
SiO2	51.04	50.15	49.97	50.20	50.34
Al2O3	0.37	0.60	0.75	1.41	0.71
TiO2	1.97	1.70	1.53	2.17	2.16
FeOToT	31.30	30.88	29.87	30.41	29.36
FeOL	31.13	30.88	29.87	30.41	29.36
Fe2O3L	0.18	0.00	0.00	0.00	0.00
MnO	0.64	0.61	0.60	0.42	0.54
MgO	0.06	0.06	0.07	0.27	0.16
CaO	0.56	1.03	1.18	0.74	0.65
Na2O	8.96	8.49	8.45	8.64	8.81
K2O	1.90	1.77	1.69	1.72	1.67
F	1.14	1.02	1.14	0.79	1.13
Cl	0.01	0.03	0.03	0.04	0.02
O=F,Cl	0.48	0.44	0.49	0.34	0.48
Total	97.46	95.92	94.78	96.47	95.05

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	8.319	8.298	8.373	8.189	8.385
AlZ	0.000	0.000	0.000	0.000	0.000
Fe3Z	0.000	0.000	0.000	0.000	0.000
AlY	0.072	0.118	0.147	0.271	0.140
Ti	0.241	0.211	0.193	0.267	0.270
Fe2	4.244	4.273	4.186	4.149	4.090
Fe3Y	0.023	0.000	0.000	0.000	0.000
Mn	0.088	0.086	0.085	0.058	0.076
Mg	0.014	0.014	0.017	0.067	0.039
XOct	0.000	0.000	-0.000	0.000	0.000
Ca	0.098	0.183	0.211	0.130	0.115
NaM4	1.902	1.817	1.789	1.870	1.885
NaA	0.929	0.908	0.957	0.863	0.961
K	0.395	0.374	0.362	0.357	0.354
F	0.588	0.535	0.604	0.406	0.597
Cl	0.001	0.009	0.008	0.011	0.004
Total	16.325	16.283	16.319	16.220	16.315
OXYG	23.319	23.302	23.405	23.266	23.441
Al/Al+Si	0.009	0.014	0.017	0.032	0.016
Na/Na+Ca	0.966	0.937	0.929	0.955	0.961
NaA+K	1.325	1.283	1.319	1.220	1.315
AlY+Fe3+Ti	0.335	0.329	0.340	0.537	0.410
Mg/Fe2++Mg	0.003	0.003	0.004	0.016	0.010
Fe/Fe+Mg	0.997	0.997	0.996	0.984	0.990
Mn/Mn+Fe	0.020	0.020	0.020	0.014	0.018

ALKALI GRANITE

AG-P4

Arfvedsonite

	1	2	3	4	5	6	7
SiO2	50.09	50.34	50.96	51.00	50.87	51.00	51.38
Al2O3	0.68	0.82	0.45	0.61	1.05	1.16	0.34
TiO2	1.71	2.08	1.55	1.38	2.04	2.09	1.56
FeOToT	32.68	33.20	32.19	31.98	31.30	30.80	30.87
FeOL	32.68	33.20	31.05	29.97	31.30	30.80	29.11
Fe2O3L	0.00	0.00	1.26	2.23	0.00	0.00	1.95
MnO	0.72	0.78	0.66	0.73	0.67	0.60	0.66
MgO	0.09	0.11	0.06	0.06	0.07	0.28	0.06
CaO	1.72	1.59	0.64	0.55	0.77	0.79	0.41
Na2O	8.57	8.21	8.91	8.52	8.72	8.79	8.65
K2O	1.53	1.58	1.75	1.97	1.57	1.80	2.01
F	1.17	1.05	1.09	1.18	1.00	1.26	1.19
Cl	0.04	0.03	0.03	0.01	0.01	0.00	0.02
O=F,Cl	0.50	0.45	0.47	0.50	0.43	0.53	0.51
Total	98.49	99.32	97.81	97.49	97.64	98.03	96.64

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	8.115	8.035	8.259	8.265	8.216	8.224	8.411
AlZ	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fe3Z	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AlY	0.129	0.153	0.085	0.117	0.200	0.220	0.065
Ti	0.209	0.250	0.189	0.168	0.248	0.253	0.192
Fe2	4.427	4.431	4.209	4.062	4.228	4.154	3.986
Fe3Y	0.000	0.000	0.154	0.272	0.000	0.000	0.241
Mn	0.099	0.105	0.090	0.101	0.092	0.082	0.091
Mg	0.021	0.026	0.015	0.015	0.016	0.068	0.014
XOct	0.000	-0.000	0.000	0.000	-0.000	0.000	0.000
Ca	0.298	0.271	0.111	0.096	0.133	0.136	0.072
NaM4	1.702	1.729	1.889	1.904	1.867	1.864	1.928
NaA	0.989	0.810	0.910	0.772	0.863	0.885	0.818
K	0.316	0.321	0.362	0.406	0.323	0.370	0.420
F	0.600	0.531	0.560	0.607	0.513	0.644	0.616
Cl	0.011	0.009	0.008	0.002	0.004	0.000	0.007
Total	16.304	16.131	16.272	16.178	16.185	16.256	16.239
OXYG	23.190	23.063	23.259	23.265	23.223	23.283	23.411
Al/Al+Si	0.016	0.019	0.010	0.014	0.024	0.026	0.008
Na/Na+Ca	0.900	0.903	0.962	0.965	0.954	0.953	0.975
NaA+K	1.304	1.131	1.272	1.178	1.185	1.256	1.239
AlY+Fe3+Ti	0.338	0.403	0.428	0.558	0.448	0.473	0.498
Mg/Fe2++Mg	0.005	0.006	0.003	0.004	0.004	0.016	0.003
Fe/Fe+Mg	0.995	0.994	0.997	0.996	0.996	0.984	0.997
Mn/Mn+Fe	0.022	0.023	0.020	0.023	0.021	0.019	0.021

ALKALI GRANITE

AG-P4

Arfvedsonite

	8	9	10	11	12	13	14
SiO2	50.84	51.14	50.98	51.16	50.27	51.22	49.80
Al2O3	0.66	0.35	0.44	0.44	0.67	1.25	0.99
TiO2	1.62	1.53	1.72	1.66	1.54	2.21	1.87
FeOToT	32.30	30.97	31.21	31.17	31.80	31.16	32.10
FeOL	31.02	29.11	29.46	29.66	30.66	31.16	32.10
Fe2O3L	1.43	2.08	1.95	1.68	1.27	0.00	0.00
MnO	0.77	1.06	0.77	0.74	0.61	0.65	0.74
MgO	0.07	0.04	0.03	0.02	0.03	0.16	0.18
CaO	1.13	0.36	0.64	0.58	0.69	0.74	1.24
Na2O	8.31	8.73	8.47	8.77	8.64	8.79	8.42
K2O	1.56	1.97	1.67	1.56	1.68	1.63	1.56
F	1.15	1.40	1.24	1.22	1.16	1.13	1.07
Cl	0.05	0.02	0.02	0.02	0.03	0.04	0.07
O=F,Cl	0.49	0.60	0.52	0.52	0.50	0.49	0.47
Total	97.96	96.99	96.65	96.83	96.62	98.50	97.57

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	8.200	8.356	8.328	8.349	8.233	8.200	8.082
AlZ	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fe3Z	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AlY	0.125	0.067	0.084	0.084	0.130	0.237	0.188
Ti	0.196	0.188	0.211	0.204	0.189	0.265	0.228
Fe2	4.184	3.977	4.025	4.048	4.199	4.172	4.357
Fe3Y	0.173	0.255	0.239	0.207	0.157	0.000	0.000
Mn	0.106	0.147	0.106	0.103	0.084	0.088	0.102
Mg	0.016	0.011	0.007	0.005	0.008	0.037	0.042
XOct	-0.000	-0.000	-0.000	-0.000	0.000	0.000	0.000
Ca	0.195	0.064	0.111	0.101	0.121	0.127	0.216
NaM4	1.805	1.936	1.889	1.899	1.879	1.873	1.784
NaA	0.794	0.829	0.795	0.876	0.863	0.856	0.864
K	0.321	0.410	0.348	0.324	0.350	0.333	0.323
F	0.586	0.724	0.638	0.630	0.603	0.572	0.551
Cl	0.012	0.007	0.004	0.005	0.007	0.012	0.020
Total	16.114	16.239	16.143	16.200	16.214	16.189	16.187
OXYG	23.200	23.356	23.328	23.349	23.233	23.242	23.106
Al/Al+Si	0.015	0.008	0.010	0.010	0.016	0.028	0.023
Na/Na+Ca	0.930	0.978	0.960	0.965	0.958	0.956	0.925
NaA+K	1.114	1.239	1.143	1.200	1.214	1.189	1.187
AlY+Fe3+Ti	0.494	0.510	0.535	0.495	0.476	0.502	0.417
Mg/Fe2++Mg	0.004	0.003	0.002	0.001	0.002	0.009	0.010
Fe/Fe+Mg	0.996	0.997	0.998	0.999	0.998	0.991	0.990
Mn/Mn+Fe	0.024	0.034	0.024	0.024	0.019	0.021	0.023

ALKALI GRANITE

WLD-49

Arfvedsonite

	1	2	3	4	5	6	7	8*
SiO2	49.78	48.87	50.81	50.13	50.35	48.00	50.42	48.53
Al2O3	0.64	1.29	0.51	0.55	0.54	2.79	0.85	1.69
TiO2	2.00	1.94	1.80	1.98	1.54	0.04	1.15	2.20
FeOToT	33.01	32.58	31.68	32.03	31.01	30.45	30.62	32.30
FeOL	32.90	32.58	31.30	31.28	29.87	27.47	29.80	32.30
Fe2O3L	0.13	0.00	0.41	0.84	1.26	3.30	0.91	0.00
MnO	0.87	0.77	0.85	0.66	0.68	0.85	0.78	0.66
MgO	0.30	0.36	0.36	0.10	0.32	1.91	0.43	0.53
CaO	1.96	2.40	2.13	1.37	1.80	2.59	1.56	4.06
Na2O	7.71	7.67	7.51	7.98	7.56	7.40	7.90	6.31
K2O	1.47	1.45	1.60	1.48	1.53	1.48	1.79	1.33
F	1.07	0.86	1.13	1.10	1.16	0.79	1.01	0.62
Cl	0.05	0.07	0.04	0.04	0.04	0.04	0.06	0.11
O=F,Cl	0.46	0.37	0.48	0.47	0.50	0.34	0.44	0.29
Total	98.39	97.88	97.91	96.96	96.02	95.99	96.11	98.06

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	8.006	7.912	8.204	8.170	8.273	7.766	8.278	7.833
AlZ	0.000	0.088	0.000	0.000	0.000	0.234	0.000	0.167
Fe3Z	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AlY	0.121	0.159	0.096	0.106	0.105	0.298	0.165	0.155
Ti	0.242	0.236	0.218	0.242	0.190	0.005	0.141	0.267
Fe2	4.424	4.412	4.227	4.262	4.105	3.717	4.091	4.360
Fe3Y	0.016	0.000	0.050	0.103	0.155	0.402	0.113	0.000
Mn	0.119	0.106	0.117	0.092	0.094	0.116	0.108	0.091
Mg	0.072	0.087	0.087	0.025	0.078	0.461	0.104	0.128
XOct	0.000	0.000	-0.000	0.000	0.000	-0.000	-0.000	0.000
Ca	0.337	0.416	0.369	0.239	0.317	0.448	0.275	0.703
NaM4	1.663	1.584	1.631	1.761	1.683	1.552	1.725	1.297
NaA	0.741	0.823	0.719	0.760	0.723	0.770	0.791	0.678
K	0.301	0.300	0.329	0.307	0.320	0.305	0.374	0.273
F	0.542	0.438	0.575	0.567	0.601	0.402	0.523	0.315
Cl	0.014	0.018	0.010	0.012	0.012	0.010	0.017	0.031
Total	16.042	16.123	16.048	16.068	16.043	16.075	16.164	15.951
OXYG	23.006	23.041	23.204	23.170	23.273	23.000	23.278	23.088
Al/Al+Si	0.015	0.030	0.012	0.013	0.012	0.064	0.020	0.040
Na/Na+Ca	0.877	0.853	0.864	0.914	0.884	0.838	0.901	0.738
NaA+K	1.042	1.123	1.048	1.068	1.043	1.075	1.164	0.951
AlY+Fe3+Ti	0.379	0.395	0.365	0.451	0.450	0.705	0.419	0.422
Mg/Fe2++Mg	0.016	0.019	0.020	0.006	0.019	0.110	0.025	0.029
Fe/Fe+Mg	0.984	0.981	0.980	0.994	0.982	0.899	0.976	0.971
Mn/Mn+Fe	0.026	0.023	0.027	0.021	0.022	0.027	0.025	0.020

* ferro-richterite

ALKALI GRANITE

WLD-36

Ferro-richterite

	1	2	3	4	5	6 RI
SiO2	48.71	48.41	48.57	47.04	46.93	46.35
Al2O3	1.84	1.95	1.82	2.08	2.03	2.36
TiO2	2.12	2.03	2.17	1.95	2.06	2.07
FeOToT	33.13	33.05	32.79	32.60	32.84	31.30
FeOL	30.80	30.88	31.83	31.33	30.74	31.27
Fe2O3L	2.59	2.42	1.07	1.41	2.33	0.03
MnO	0.72	0.75	0.67	0.76	0.76	1.77
MgO	1.06	1.26	1.25	1.28	1.11	0.82
CaO	5.08	5.49	5.39	6.15	5.59	6.06
Na2O	4.86	4.84	5.12	4.64	4.82	4.78
K2O	1.31	1.28	1.29	1.23	1.27	1.22
F	0.69	0.67	0.63	1.08	0.99	1.13
Cl	0.10	0.10	0.09	0.11	0.11	0.11
O=F,Cl	0.31	0.30	0.29	0.48	0.44	0.50
Total	99.30	99.53	99.51	98.45	98.06	97.45

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	7.689	7.638	7.681	7.570	7.566	7.572
AlZ	0.311	0.362	0.319	0.395	0.385	0.428
Fe3Z	0.000	0.000	0.000	0.036	0.048	0.000
AlY	0.031	0.001	0.020	0.000	0.000	0.026
Ti	0.252	0.240	0.258	0.236	0.250	0.255
Fe2	4.065	4.074	4.209	4.217	4.145	4.272
Fe3Y	0.308	0.287	0.128	0.135	0.235	0.004
Mn	0.096	0.100	0.090	0.104	0.104	0.244
Mg	0.248	0.297	0.295	0.308	0.266	0.199
XOct	0.000	0.000	0.000	-0.000	-0.000	0.000
Ca	0.860	0.928	0.914	1.061	0.966	1.060
NaM4	1.140	1.072	1.086	0.939	1.034	0.940
NaA	0.346	0.408	0.482	0.510	0.472	0.574
K	0.264	0.257	0.260	0.251	0.261	0.254
F	0.344	0.334	0.316	0.550	0.504	0.582
Cl	0.026	0.027	0.023	0.029	0.030	0.030
Total	15.609	15.665	15.742	15.762	15.733	15.829
OXYG	23.000	23.000	23.000	23.000	23.000	23.000
Al/Al+Si	0.043	0.045	0.042	0.050	0.048	0.057
Na/Na+Ca	0.633	0.615	0.632	0.577	0.609	0.588
NaA+K	0.609	0.665	0.742	0.762	0.733	0.829
AlY+Fe3+Ti	0.590	0.528	0.406	0.371	0.485	0.284
Mg/Fe2++Mg	0.058	0.068	0.066	0.068	0.060	0.044
Fe/Fe+Mg	0.946	0.936	0.936	0.934	0.943	0.956
Mn/Mn+Fe	0.022	0.022	0.020	0.023	0.023	0.054

RI rim

ALKALI GRANITE

WLD-36

Ferro-richterite

	7	8	9	10	11
SiO2	49.77	47.20	47.29	47.55	47.57
Al2O3	0.86	2.18	2.32	2.16	1.97
TiO2	0.31	1.91	1.91	2.12	1.88
FeOToT	33.81	32.43	32.35	31.28	32.19
FeOL	29.90	30.79	29.93	30.72	30.10
Fe2O3L	4.35	1.82	2.68	0.62	2.32
MnO	0.82	0.74	0.69	0.70	0.80
MgO	0.62	1.22	1.90	1.56	1.43
CaO	4.17	5.31	5.91	5.43	5.38
Na2O	4.96	5.17	4.93	4.99	4.85
K2O	1.29	1.29	1.26	1.28	1.34
F	0.57	0.66	1.08	0.77	0.83
Cl	0.14	0.08	0.11	0.13	0.12
O=F,Cl	0.27	0.30	0.48	0.36	0.37
Total	97.05	97.89	99.27	97.62	97.97

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	7.996	7.597	7.504	7.653	7.631
AlZ	0.004	0.403	0.434	0.347	0.369
Fe3Z	0.000	0.000	0.062	0.000	0.000
AlY	0.158	0.010	0.000	0.063	0.004
Ti	0.038	0.231	0.228	0.257	0.227
Fe2	4.018	4.145	3.972	4.135	4.038
Fe3Y	0.526	0.220	0.258	0.075	0.280
Mn	0.111	0.101	0.092	0.096	0.109
Mg	0.149	0.292	0.449	0.374	0.343
XOct	-0.000	-0.000	-0.000	0.000	0.000
Ca	0.718	0.916	1.004	0.937	0.925
NaM4	1.282	1.084	0.996	1.063	1.075
NaA	0.263	0.529	0.522	0.496	0.433
K	0.264	0.265	0.255	0.262	0.273
F	0.287	0.338	0.541	0.394	0.419
Cl	0.039	0.022	0.030	0.036	0.032
Total	15.526	15.794	15.778	15.758	15.706
OXYG	23.000	23.000	23.000	23.000	23.000
Al/Al+Si	0.020	0.052	0.055	0.051	0.047
Na/Na+Ca	0.683	0.638	0.602	0.624	0.620
NaA+K	0.526	0.794	0.778	0.758	0.706
AlY+Fe3+Ti	0.722	0.461	0.486	0.395	0.511
Mg/Fe2++Mg	0.036	0.066	0.102	0.083	0.078
Fe/Fe+Mg	0.968	0.937	0.905	0.918	0.926
Mn/Mn+Fe	0.024	0.023	0.021	0.022	0.025

ALKALI GRANITE

AG-DYKE

Arfvedsonite

	1	2	3	4	5	6
SiO2	51.67	51.44	51.15	51.55	51.59	51.13
Al2O3	0.47	0.44	0.52	0.52	0.46	0.61
TiO2	1.49	1.30	1.30	1.17	1.61	1.62
FeOToT	32.05	31.72	31.80	31.86	31.08	31.47
FeOL	30.82	29.35	29.38	29.03	29.56	29.49
Fe2O3L	1.37	2.63	2.69	3.15	1.68	2.20
MnO	0.51	0.70	0.55	0.58	0.58	0.61
MgO	0.04	0.02	0.01	0.02	0.04	0.01
CaO	0.54	0.59	0.58	0.55	0.53	0.49
Na2O	9.06	8.71	8.57	8.64	8.83	8.40
K2O	1.77	1.59	1.64	1.58	1.64	1.92
F	1.61	1.58	1.43	1.55	1.53	1.45
Cl	0.03	0.03	0.01	0.03	0.02	0.04
O=F,Cl	0.68	0.67	0.61	0.66	0.65	0.62
Total	98.55	97.44	96.97	97.39	97.25	97.13

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	8.330	8.351	8.332	8.355	8.397	8.316
AlZ	0.000	0.000	0.000	0.000	0.000	0.000
Fe3Z	0.000	0.000	0.000	0.000	0.000	0.000
AlY	0.090	0.084	0.100	0.099	0.087	0.117
Ti	0.180	0.158	0.160	0.143	0.196	0.198
Fe2	4.155	3.985	4.003	3.934	4.024	4.012
Fe3Y	0.166	0.321	0.329	0.384	0.206	0.270
Mn	0.069	0.096	0.076	0.080	0.079	0.084
Mg	0.009	0.005	0.001	0.005	0.009	0.003
XOct	-0.000	-0.000	-0.000	0.000	-0.000	0.000
Ca	0.093	0.103	0.101	0.095	0.093	0.085
NaM4	1.907	1.897	1.899	1.905	1.907	1.915
NaA	0.926	0.845	0.809	0.809	0.880	0.733
K	0.363	0.330	0.341	0.327	0.341	0.399
F	0.822	0.813	0.738	0.796	0.786	0.744
Cl	0.007	0.008	0.003	0.007	0.006	0.012
Total	16.290	16.175	16.150	16.136	16.221	16.132
OXYG	23.330	23.351	23.332	23.355	23.397	23.316
Al/Al+Si	0.011	0.010	0.012	0.012	0.010	0.014
Na/Na+Ca	0.968	0.964	0.964	0.966	0.968	0.969
NaA+K	1.290	1.175	1.150	1.136	1.221	1.132
AlY+Fe3+Ti	0.436	0.564	0.589	0.627	0.490	0.585
Mg/Fe2++Mg	0.002	0.001	0.000	0.001	0.002	0.001
Fe/Fe+Mg	0.998	0.999	1.000	0.999	0.998	0.999
Mn/Mn+Fe	0.016	0.022	0.017	0.018	0.018	0.019

ALKALI GRANITE

74-81

Ferro-richterite

	1	2	3	4	5	6	7 RIM	8 RPX	9 RPX
SiO2	47.27	48.21	48.01	47.36	48.72	46.85	47.86	47.46	47.42
Al2O3	1.60	1.40	1.46	1.79	1.67	1.65	1.51	2.42	2.46
TiO2	1.98	1.91	1.75	1.71	1.44	1.22	1.74	1.97	1.60
FeOToT	33.46	33.11	32.49	32.74	33.94	32.69	32.88	32.76	33.16
FeOL	29.20	30.13	29.02	29.07	30.55	29.38	30.57	28.46	29.77
Fe2O3L	4.73	3.31	3.86	4.09	3.78	3.68	2.56	4.78	3.76
MnO	0.76	0.73	0.86	0.76	0.66	0.68	0.68	0.69	0.62
MgO	1.12	1.16	1.17	1.29	0.92	0.91	1.01	1.64	1.51
CaO	4.62	4.65	4.58	4.75	4.74	4.49	4.56	5.25	5.30
Na2O	5.20	5.23	4.92	5.09	5.19	5.13	5.30	4.80	5.29
K2O	1.23	1.24	1.20	1.29	1.29	1.33	1.39	1.26	1.27
F	1.37	1.14	0.58	1.09	0.95	0.76	1.56	1.10	1.38
Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
O=F,Cl	0.58	0.48	0.24	0.46	0.40	0.32	0.66	0.46	0.58
Total	98.02	98.31	96.77	97.41	99.13	95.39	97.82	98.89	99.42

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	7.593	7.706	7.734	7.629	7.715	7.711	7.728	7.505	7.515
AlZ	0.302	0.263	0.266	0.339	0.285	0.289	0.272	0.450	0.459
Fe3Z	0.105	0.031	0.000	0.032	0.000	0.000	0.000	0.045	0.026
AlY	0.000	0.000	0.012	0.000	0.027	0.031	0.014	0.000	0.000
Ti	0.239	0.230	0.212	0.207	0.172	0.151	0.211	0.234	0.190
Fe2	3.923	4.027	3.910	3.916	4.046	4.043	4.128	3.764	3.946
Fe3Y	0.467	0.367	0.468	0.464	0.450	0.456	0.311	0.523	0.423
Mn	0.103	0.099	0.117	0.104	0.089	0.095	0.093	0.093	0.083
Mg	0.268	0.277	0.282	0.310	0.217	0.223	0.242	0.386	0.357
XOct	-0.000	0.000	-0.000	0.000	-0.000	-0.000	-0.000	-0.000	0.000
Ca	0.796	0.796	0.791	0.819	0.804	0.792	0.789	0.889	0.900
NaM4	1.204	1.204	1.209	1.181	1.196	1.208	1.211	1.111	1.100
NaA	0.415	0.418	0.327	0.410	0.398	0.429	0.448	0.361	0.524
K	0.251	0.254	0.246	0.265	0.261	0.279	0.287	0.254	0.257
F	0.697	0.576	0.293	0.557	0.474	0.394	0.798	0.551	0.690
Cl	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	15.666	15.671	15.573	15.675	15.660	15.708	15.734	15.615	15.781
OXYG	23.000	23.000	23.000	23.000	23.000	23.000	23.000	23.000	23.000
Al/Al+Si	0.038	0.033	0.035	0.043	0.039	0.040	0.036	0.057	0.058
Na/Na+Ca	0.670	0.671	0.660	0.660	0.665	0.674	0.678	0.624	0.643
NaA+K	0.666	0.671	0.573	0.675	0.660	0.708	0.734	0.615	0.781
AlY+Fe3+Ti	0.706	0.597	0.691	0.670	0.649	0.638	0.537	0.757	0.613
Mg/Fe2++Mg	0.064	0.064	0.067	0.073	0.051	0.052	0.055	0.093	0.083
Fe/Fe+Mg	0.944	0.941	0.940	0.934	0.954	0.953	0.948	0.918	0.925
Mn/Mn+Fe	0.022	0.022	0.026	0.023	0.019	0.021	0.020	0.021	0.019

RPX rim of pyroxene

ALKALI GRANITE

74-81

	Riebeckite	
	1	2
SiO2	50.50	50.80
Al2O3	0.60	0.65
TiO2	0.21	0.23
FeOToT	36.00	35.34
FeOL	27.60	27.60
Fe2O3L	9.34	8.60
MnO	0.45	0.39
MgO	0.14	0.79
CaO	2.69	2.84
Na2O	5.56	5.67
K2O	0.53	0.87
F	0.41	0.59
Cl	0.00	0.00
O=F,Cl	0.17	0.25
Total	96.92	97.91

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	7.999	7.976
AlZ	0.001	0.024
Fe3Z	0.000	0.000
AlY	0.111	0.096
Ti	0.025	0.027
Fe2	3.657	3.624
Fe3Y	1.113	1.017
Mn	0.061	0.052
Mg	0.034	0.184
XOct	0.000	-0.000
Ca	0.457	0.478
NaM4	1.543	1.522
NaA	0.165	0.205
K	0.106	0.174
F	0.205	0.295
Cl	0.000	0.000
Total	15.271	15.379
OXYG	23.000	23.000
Al/Al+Si	0.014	0.015
Na/Na+Ca	0.789	0.783
NaA+K	0.271	0.379
AlY+Fe3+Ti	1.249	1.139
Mg/Fe2++Mg	0.009	0.048
Fe/Fe+Mg	0.993	0.962
Mn/Mn+Fe	0.013	0.011

ALKALI GRANITE OR GRANOPHYRE

74-70

Arfvedsonite

	1	2	3	4	5	6*	7	8	9
SiO2	49.87	50.47	47.93	49.89	51.39	51.45	51.08	48.41	49.60
Al2O3	0.66	0.62	0.64	0.19	0.49	0.16	0.49	0.62	0.68
TiO2	1.69	1.65	1.51	3.45	0.54	2.56	0.54	1.87	1.81
FeOToT	33.82	32.85	34.11	33.07	33.55	33.86	33.55	33.03	33.52
FeOL	33.01	32.35	30.89	26.00	27.11	24.70	26.47	31.04	32.94
Fe2O3L	0.90	0.55	3.58	7.85	7.16	10.18	7.87	2.20	0.64
MnO	0.68	0.77	0.76	0.35	1.14	0.40	0.81	0.73	0.84
MgO	0.29	0.48	0.32	0.01	0.36	0.07	0.20	0.41	0.28
CaO	1.89	2.31	2.10	0.05	0.76	0.02	0.41	2.13	2.08
Na2O	7.88	7.49	7.32	6.80	7.63	6.84	7.52	7.03	7.71
K2O	1.46	1.50	1.56	0.17	1.59	0.26	1.71	1.51	1.48
F	1.68	2.21	1.93	0.00	2.46	0.10	1.65	1.24	2.40
Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
O=F,Cl	0.71	0.93	0.81	0.00	1.04	0.04	0.70	0.52	1.01
Total	99.20	99.40	97.37	93.97	98.87	95.68	97.27	96.45	99.40
L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method									
Si	7.984	8.074	7.840	8.039	8.154	8.124	8.188	7.927	7.968
AlZ	0.016	0.000	0.123	0.000	0.000	0.000	0.000	0.073	0.032
Fe3Z	0.000	0.000	0.037	0.000	0.000	0.000	0.000	0.000	0.000
AlY	0.108	0.116	0.000	0.037	0.092	0.031	0.093	0.046	0.096
Ti	0.203	0.199	0.186	0.418	0.064	0.304	0.065	0.230	0.219
Fe2	4.419	4.329	4.226	3.505	3.597	3.262	3.548	4.251	4.426
Fe3Y	0.109	0.066	0.404	0.952	0.855	1.210	0.950	0.271	0.077
Mn	0.093	0.104	0.106	0.048	0.154	0.053	0.110	0.102	0.115
Mg	0.068	0.113	0.078	0.003	0.085	0.017	0.047	0.099	0.068
XOct	0.000	-0.000	-0.000	0.000	0.000	-0.000	-0.000	0.000	-0.000
Ca	0.325	0.397	0.368	0.008	0.129	0.004	0.070	0.373	0.359
NaM4	1.675	1.603	1.632	1.992	1.871	1.996	1.930	1.627	1.641
NaA	0.772	0.719	0.690	0.132	0.475	0.096	0.408	0.605	0.760
K	0.297	0.305	0.326	0.036	0.321	0.053	0.349	0.316	0.303
F	0.850	1.116	0.999	0.000	1.236	0.051	0.838	0.641	1.221
Cl	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	16.069	16.024	16.016	15.168	15.796	15.149	15.757	15.921	16.063
OXYG	23.000	23.074	23.000	23.039	23.154	23.124	23.188	23.000	23.000
Al/Al+Si	0.015	0.014	0.015	0.005	0.011	0.004	0.011	0.015	0.016
Na/Na+Ca	0.883	0.854	0.863	0.996	0.948	0.998	0.971	0.857	0.870
NaA+K	1.069	1.024	1.016	0.168	0.796	0.149	0.757	0.921	1.063
AlY+Fe3+Ti	0.419	0.381	0.590	1.406	1.011	1.544	1.107	0.548	0.392
Mg/Fe2++Mg	0.015	0.025	0.018	0.001	0.023	0.005	0.013	0.023	0.015
Fe/Fe+Mg	0.985	0.975	0.984	0.999	0.981	0.996	0.990	0.979	0.985
Mn/Mn+Fe	0.020	0.023	0.022	0.011	0.033	0.012	0.024	0.022	0.025

* riebeckite

ALKALI GRANITE

74-63

Ferro-barroisite

	1[1]	2	3	4[2]	5	6	7	8
SiO2	45.87	46.41	47.03	47.84	45.28	46.50	45.14	44.85
Al2O3	1.83	1.80	2.42	1.80	2.32	1.80	2.11	1.94
TiO2	1.92	1.77	1.53	1.72	1.28	1.79	2.01	1.85
FeOToT	34.28	33.94	34.38	33.83	33.96	33.55	32.95	33.58
FeOL	27.24	27.02	26.45	27.59	27.85	27.29	26.83	25.34
Fe2O3L	7.82	7.70	8.81	6.94	6.79	6.95	6.80	9.15
MnO	0.68	0.66	0.63	0.61	0.58	0.56	0.56	0.63
MgO	1.56	1.62	1.69	1.65	1.42	1.72	1.67	1.99
CaO	5.88	6.27	6.88	5.95	6.83	6.35	6.68	6.05
Na2O	4.06	3.37	2.77	3.67	3.39	3.43	3.05	3.65
K2O	1.19	1.25	1.16	1.14	1.02	1.11	1.11	1.21
F	0.90	0.54	0.70	1.69	0.32	0.70	0.32	1.33
Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
O=F,Cl	0.38	0.23	0.29	0.71	0.14	0.29	0.14	0.56
Total	97.78	97.40	98.89	99.19	96.27	97.21	95.46	96.51

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method.

Si	7.359	7.428	7.381	7.537	7.360	7.457	7.367	7.279
AlZ	0.346	0.340	0.447	0.334	0.444	0.341	0.406	0.372
Fe3Z	0.295	0.232	0.172	0.129	0.196	0.202	0.227	0.349
AlY	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ti	0.232	0.213	0.181	0.204	0.156	0.216	0.246	0.225
Fe2	3.655	3.617	3.472	3.636	3.785	3.661	3.662	3.439
Fe3Y	0.650	0.695	0.869	0.693	0.635	0.636	0.607	0.769
Mn	0.092	0.090	0.084	0.081	0.080	0.076	0.077	0.086
Mg	0.373	0.386	0.395	0.386	0.344	0.411	0.407	0.481
XOct	-0.000	0.000	0.000	0.000	-0.000	0.000	0.000	0.000
Ca	1.010	1.076	1.157	1.005	1.206	1.091	1.168	1.052
NaM4	0.990	0.924	0.843	0.995	0.794	0.909	0.832	0.948
NaA	0.274	0.121	0.000	0.127	0.274	0.157	0.134	0.199
K	0.244	0.255	0.231	0.229	0.212	0.227	0.231	0.251
F	0.457	0.271	0.346	0.844	0.165	0.353	0.167	0.682
Cl	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	15.518	15.376	15.231	15.356	15.486	15.384	15.365	15.450
OXYG	23.000	23.000	23.000	23.000	23.000	23.000	23.000	23.000
Al/Al+Si	0.045	0.044	0.057	0.042	0.057	0.044	0.052	0.049
Na/Na+Ca	0.556	0.493	0.422	0.528	0.469	0.494	0.452	0.522
NaA+K	0.518	0.376	0.231	0.356	0.486	0.384	0.365	0.450
AlY+Fe3+Ti	0.881	0.908	1.050	0.897	0.791	0.852	0.854	0.994
Mg/Fe2++Mg	0.093	0.096	0.102	0.096	0.083	0.101	0.100	0.123
Fe/Fe+Mg	0.925	0.922	0.919	0.920	0.931	0.916	0.917	0.905
Mn/Mn+Fe	0.020	0.019	0.018	0.018	0.017	0.017	0.017	0.019

1 katophorite
2 ferro-winchite

GRANOPHYRE

74-78

Arfvedsonite

	1	2	3	4	5	6	7	8
SiO2	50.16	50.38	49.74	49.75	51.08	48.67	50.11	48.72
Al2O3	0.48	0.67	0.55	0.28	0.32	0.63	1.07	0.78
TiO2	1.37	1.11	1.11	2.03	1.67	1.20	1.53	0.97
FeOToT	33.10	34.01	33.18	32.88	32.73	33.69	32.89	34.43
FeOL	30.12	30.77	32.12	31.40	30.23	31.65	32.15	31.55
Fe2O3L	3.32	3.60	1.17	1.65	2.78	2.26	0.82	3.20
MnO	0.88	0.75	0.67	0.65	0.62	0.67	0.56	0.64
MgO	0.16	0.07	0.04	0.11	0.05	0.04	0.23	0.03
CaO	0.60	0.65	0.90	0.44	0.48	0.91	0.48	0.87
Na2O	8.35	8.39	8.86	8.51	8.51	8.41	8.92	8.65
K2O	1.69	1.70	1.73	1.95	1.81	1.49	1.86	1.43
F	1.77	2.29	1.26	1.62	2.91	2.34	4.10	2.13
Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
O=F,Cl	0.74	0.97	0.53	0.68	1.22	0.99	1.73	0.90
Total	97.82	99.05	97.50	97.55	98.97	97.07	100.02	97.75

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	8.108	8.067	8.124	8.102	8.230	7.996	8.058	7.943
AlZ	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.057
Fe3Z	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AlY	0.091	0.126	0.106	0.053	0.061	0.118	0.204	0.093
Ti	0.167	0.133	0.136	0.249	0.202	0.149	0.185	0.119
Fe2	4.071	4.121	4.387	4.276	4.073	4.349	4.324	4.301
Fe3Y	0.403	0.434	0.144	0.203	0.337	0.279	0.099	0.392
Mn	0.121	0.102	0.093	0.090	0.085	0.094	0.077	0.089
Mg	0.039	0.016	0.010	0.027	0.011	0.011	0.054	0.007
XOct	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ca	0.104	0.112	0.157	0.077	0.083	0.160	0.083	0.151
NaM4	1.896	1.888	1.843	1.923	1.917	1.840	1.917	1.849
NaA	0.720	0.716	0.961	0.764	0.742	0.838	0.862	0.886
K	0.348	0.347	0.360	0.405	0.373	0.312	0.382	0.298
F	0.903	1.161	0.650	0.835	1.482	1.216	2.085	1.098
Cl	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	16.068	16.062	16.320	16.169	16.114	16.150	16.244	16.184
OXYG	23.108	23.067	23.124	23.102	23.230	23.000	23.058	23.000
Al/Al+Si	0.011	0.015	0.013	0.007	0.007	0.015	0.025	0.019
Na/Na+Ca	0.962	0.959	0.947	0.972	0.970	0.944	0.971	0.948
NaA+K	1.068	1.062	1.320	1.169	1.114	1.150	1.244	1.184
AlY+Fe3+Ti	0.661	0.693	0.387	0.505	0.600	0.546	0.488	0.604
Mg/Fe2++Mg	0.009	0.004	0.002	0.006	0.003	0.002	0.012	0.002
Fe/Fe+Mg	0.991	0.996	0.998	0.994	0.997	0.998	0.988	0.999
Mn/Mn+Fe	0.026	0.022	0.020	0.020	0.019	0.020	0.017	0.019

GRANITE

G-1

Ferro-edenite?

	1*	2	3**	4	5**	6	7	8 ?
SiO2	48.25	43.31	44.25	42.50	44.20	42.36	42.76	51.30
Al2O3	2.58	6.68	6.06	6.68	5.90	6.74	6.51	0.83
TiO2	0.34	1.54	1.83	1.46	1.83	1.45	1.26	0.01
FeOToT	27.23	24.69	24.16	25.47	24.87	25.07	25.21	26.59
FeOL	27.23	24.69	24.16	25.47	24.87	25.07	25.21	26.59
Fe2O3L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MnO	0.53	0.75	0.71	0.64	0.71	0.65	0.67	0.40
MgO	0.80	1.05	1.00	0.82	0.87	0.91	0.89	0.91
CaO	10.73	10.11	9.92	10.35	9.98	10.29	10.20	11.45
Na2O	0.88	2.38	2.24	2.24	2.33	2.26	2.23	0.41
K2O	0.50	1.15	0.83	1.16	0.86	1.22	1.14	0.08
F	0.37	1.11	0.91	0.86	0.85	1.25	1.07	0.00
Cl	0.31	0.48	0.46	0.57	0.45	0.52	0.64	0.00
O=F,Cl	0.23	0.57	0.49	0.49	0.46	0.64	0.59	0.00
Total	92.30	92.67	91.90	92.25	92.38	92.05	91.97	91.98

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	8.258	7.490	7.662	7.412	7.638	7.416	7.476	8.751
AlZ	0.000	0.510	0.338	0.588	0.362	0.584	0.524	0.000
Fe3Z	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AlY	0.520	0.850	0.899	0.785	0.840	0.807	0.818	0.166
Ti	0.044	0.200	0.238	0.191	0.237	0.191	0.166	0.001
Fe2	3.898	3.571	3.499	3.716	3.593	3.670	3.686	3.793
Fe3Y	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mn	0.077	0.110	0.105	0.095	0.104	0.096	0.099	0.058
Mg	0.203	0.270	0.259	0.214	0.225	0.237	0.231	0.231
XOct	0.000	0.000	0.000	-0.000	0.000	0.000	-0.000	-0.000
Ca	1.967	1.874	1.840	1.934	1.848	1.929	1.911	2.093
NaM4	0.033	0.126	0.160	0.066	0.152	0.071	0.089	0.000
NaA	0.259	0.672	0.594	0.692	0.627	0.695	0.666	0.137
K	0.109	0.255	0.184	0.258	0.189	0.272	0.255	0.017
F	0.202	0.606	0.501	0.472	0.466	0.692	0.590	0.000
Cl	0.090	0.139	0.136	0.169	0.130	0.155	0.189	0.001
Total	15.368	15.926	15.777	15.950	15.816	15.967	15.921	15.247
OXYG	23.730	23.770	23.827	23.732	23.808	23.750	23.729	24.005
Al/Al+Si	0.059	0.154	0.139	0.156	0.136	0.158	0.152	0.019
Na/Na+Ca	0.129	0.299	0.290	0.282	0.297	0.284	0.283	0.061
NaA+K	0.368	0.926	0.777	0.950	0.816	0.967	0.921	0.154
AlY+Fe3+Ti	0.565	1.050	1.137	0.976	1.078	0.997	0.984	0.167
Mg/Fe2++Mg	0.050	0.070	0.069	0.054	0.059	0.061	0.059	0.057
Fe/Fe+Mg	0.950	0.930	0.931	0.946	0.941	0.939	0.941	0.943
Mn/Mn+Fe	0.019	0.030	0.029	0.025	0.028	0.025	0.026	0.015

* ferro-actinolite?
** silicic ferro-edenite?

GRANITE

G-1

	Ferro-edenite						WLD-85		
	9	10*	11	12	13*	14	1**	2**	3
SiO2	43.51	43.97	43.17	43.34	44.44	42.87	45.72	45.75	45.61
Al2O3	6.68	6.22	6.98	6.66	6.03	6.67	3.89	3.94	4.09
TiO2	1.71	2.00	1.19	1.73	1.68	1.51	1.87	1.27	1.42
FeOToT	25.47	24.59	26.94	25.70	26.40	25.84	28.95	28.76	28.40
FeOL	25.47	24.59	26.94	25.70	26.40	25.84	28.13	26.34	27.01
Fe2O3L	0.00	0.00	0.00	0.00	0.00	0.00	0.90	2.68	1.55
MnO	0.69	0.71	0.64	0.64	0.68	0.60	0.58	0.99	0.93
MgO	0.99	1.04	0.81	1.03	0.85	0.89	2.79	3.19	3.36
CaO	10.28	10.00	10.26	10.20	10.05	9.99	8.49	8.54	9.02
Na2O	2.30	2.36	2.18	2.34	2.27	2.31	2.52	2.52	2.50
K2O	1.15	0.82	1.23	1.17	0.87	1.12	1.06	1.06	0.92
F	0.83	1.13	1.15	1.19	0.72	0.87	0.58	0.74	0.78
Cl	0.42	0.45	0.64	0.48	0.46	0.39	0.25	0.26	0.36
O=F,Cl	0.45	0.58	0.63	0.61	0.41	0.45	0.30	0.37	0.41
Total	93.58	92.72	94.54	93.87	94.04	92.60	96.39	96.66	96.99
L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method									
Si	7.440	7.569	7.330	7.407	7.529	7.400	7.377	7.343	7.316
AlZ	0.560	0.431	0.670	0.593	0.471	0.600	0.623	0.657	0.684
Fe3Z	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AlY	0.786	0.830	0.726	0.749	0.733	0.757	0.117	0.088	0.089
Ti	0.219	0.259	0.152	0.222	0.214	0.197	0.227	0.153	0.172
Fe2	3.642	3.540	3.825	3.673	3.741	3.730	3.797	3.536	3.623
Fe3Y	0.000	0.000	0.000	0.000	0.000	0.000	0.109	0.324	0.187
Mn	0.100	0.103	-0.092	0.092	0.097	0.088	0.080	0.135	0.126
Mg	0.252	0.268	0.205	0.264	0.214	0.228	0.670	0.764	0.804
XOct	0.000	0.000	0.000	0.000	-0.000	0.000	0.000	0.000	0.000
Ca	1.883	1.844	1.866	1.868	1.825	1.847	1.468	1.469	1.550
NaM4	0.117	0.156	0.134	0.132	0.175	0.153	0.532	0.531	0.450
NaA	0.644	0.633	0.585	0.641	0.571	0.621	0.257	0.253	0.326
K	0.250	0.181	0.266	0.255	0.187	0.246	0.217	0.217	0.189
F	0.450	0.612	0.617	0.643	0.386	0.472	0.297	0.374	0.397
Cl	0.122	0.131	0.184	0.139	0.132	0.114	0.068	0.072	0.099
Total	15.894	15.814	15.850	15.896	15.759	15.867	15.474	15.470	15.515
OXYG	23.721	23.787	23.538	23.682	23.637	23.632	23.000	23.000	23.000
Al/Al+Si	0.153	0.143	0.160	0.153	0.138	0.155	0.091	0.092	0.096
Na/Na+Ca	0.288	0.300	0.278	0.293	0.290	0.295	0.350	0.348	0.334
NaA+K	0.894	0.814	0.850	0.896	0.759	0.867	0.474	0.470	0.515
AlY+Fe3+Ti	1.006	1.089	0.878	0.971	0.947	0.953	0.453	0.566	0.447
Mg/Fe2++Mg	0.065	0.070	0.051	0.067	0.054	0.058	0.150	0.178	0.182
Fe/Fe+Mg	0.935	0.930	0.949	0.933	0.946	0.942	0.854	0.835	0.826
Mn/Mn+Fe	0.027	0.028	0.023	0.025	0.025	0.023	0.020	0.034	0.032

* silicic ferro-edenite
** ferro-actinolitic hornblende

HYBRID UNIT

H-2

Arfvedsonite

	1	2	3	4	5	6
SiO2	51.91	51.50	49.81	52.71	51.54	47.93
Al2O3	0.53	0.57	0.83	0.16	0.39	2.79
TiO2	0.73	0.93	2.45	1.10	1.77	0.02
FeOToT	32.49	32.41	31.02	32.45	30.22	29.88
FeOL	27.23	27.87	31.02	25.87	28.20	27.24
Fe2O3L	5.84	5.05	0.00	7.31	2.24	2.94
MnO	0.55	0.60	0.70	0.26	0.95	0.85
MgO	0.33	0.32	0.24	0.00	0.49	1.91
CaO	1.03	1.03	1.60	0.08	1.23	2.06
Na2O	7.67	7.68	7.65	8.15	7.59	7.77
K2O	1.39	1.52	1.81	1.28	1.96	1.48
F	0.65	0.67	0.64	0.56	1.06	0.79
Cl	0.03	0.04	0.01	0.01	0.06	0.04
O=F,Cl	0.28	0.29	0.27	0.24	0.46	0.34
Total	97.03	96.98	96.48	96.53	96.78	95.17

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	8.309	8.269	8.143	8.450	8.362	7.808
AlZ	0.000	0.000	0.000	0.000	0.000	0.192
Fe3Z	0.000	0.000	0.000	0.000	0.000	0.000
AlY	0.101	0.108	0.160	0.031	0.075	0.344
Ti	0.088	0.112	0.301	0.132	0.216	0.003
Fe2	3.645	3.742	4.242	3.469	3.826	3.711
Fe3Y	0.704	0.610	0.000	0.882	0.273	0.360
Mn	0.075	0.081	0.097	0.036	0.130	0.117
Mg	0.078	0.077	0.058	0.000	0.118	0.464
XOct	0.000	0.000	0.000	-0.000	-0.000	0.000
Ca	0.178	0.178	0.280	0.014	0.213	0.360
NaM4	1.822	1.822	1.720	1.986	1.787	1.640
NaA	0.558	0.568	0.704	0.546	0.602	0.814
K	0.284	0.311	0.378	0.263	0.405	0.307
F	0.329	0.339	0.329	0.285	0.542	0.405
Cl	0.007	0.012	0.002	0.004	0.015	0.010
Total	15.842	15.879	16.082	15.809	16.007	16.121
OXYG	23.309	23.269	23.205	23.450	23.362	23.000
Al/Al+Si	0.012	0.013	0.019	0.004	0.009	0.064
Na/Na+Ca	0.931	0.931	0.896	0.994	0.918	0.872
NaA+K	0.842	0.879	1.082	0.809	1.007	1.121
AlY+Fe3+Ti	0.893	0.831	0.460	1.045	0.564	0.707
Mg/Fe2++Mg	0.021	0.020	0.013	0.000	0.030	0.111
Fe/Fe+Mg	0.982	0.983	0.987	1.000	0.972	0.898
Mn/Mn+Fe	0.017	0.018	0.022	0.008	0.031	0.028

HYBRID UNIT

H-2

Ferro-richterite

	1	2	3*	4*	5	6*
SiO2	49.08	48.10	49.25	48.68	48.10	49.90
Al2O3	1.33	1.81	1.36	1.48	1.73	0.88
TiO2	2.48	2.10	2.57	2.54	1.99	2.59
FeOToT	32.88	33.70	32.50	33.08	33.50	32.32
FeOL	32.88	33.70	32.50	33.08	33.06	32.32
Fe2O3L	0.00	0.00	0.00	0.00	0.48	0.00
MnO	0.84	0.88	0.77	0.81	0.93	0.75
MgO	0.38	0.41	0.31	0.29	0.27	0.29
CaO	4.10	5.06	3.47	3.23	4.36	3.16
Na2O	6.68	6.00	7.19	6.96	6.16	7.07
K2O	1.50	1.19	1.61	1.51	1.18	1.61
F	0.82	0.80	0.85	0.64	0.87	0.78
Cl	0.05	0.11	0.04	0.07	0.07	0.04
O=F,Cl	0.36	0.36	0.37	0.28	0.38	0.34
Total	99.79	99.79	99.54	98.99	98.77	99.03

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	7.849	7.687	7.897	7.802	7.735	8.011
AlZ	0.151	0.313	0.103	0.198	0.265	0.000
Fe3Z	0.000	0.000	0.000	0.000	0.000	0.000
AlY	0.100	0.027	0.154	0.081	0.063	0.166
Ti	0.298	0.252	0.310	0.306	0.241	0.312
Fe2	4.397	4.504	4.358	4.435	4.447	4.339
Fe3Y	0.000	0.000	0.000	0.000	0.058	0.000
Mn	0.114	0.118	0.104	0.110	0.126	0.102
Mg	0.092	0.099	0.074	0.068	0.065	0.070
XOct	0.000	0.000	-0.000	0.000	0.000	-0.000
Ca	0.702	0.867	0.595	0.555	0.751	0.543
NaM4	1.298	1.133	1.405	1.445	1.249	1.457
NaA	0.772	0.726	0.829	0.719	0.670	0.742
K	0.306	0.242	0.329	0.308	0.241	0.329
F	0.413	0.402	0.433	0.322	0.442	0.394
Cl	0.014	0.029	0.011	0.018	0.019	0.012
Total	16.078	15.969	16.158	16.027	15.911	16.071
OXYG	23.162	23.027	23.212	23.038	23.000	23.213
Al/Al+Si	0.031	0.042	0.032	0.035	0.041	0.020
Na/Na+Ca	0.747	0.682	0.790	0.796	0.719	0.802
NaA+K	1.078	0.969	1.158	1.027	0.911	1.071
AlY+Fe3+Ti	0.398	0.279	0.464	0.387	0.362	0.478
Mg/Fe2++Mg	0.020	0.021	0.017	0.015	0.015	0.016
Fe/Fe+Mg	0.980	0.979	0.983	0.985	0.986	0.984
Mn/Mn+Fe	0.025	0.026	0.023	0.024	0.027	0.023

* arfvedsonite

HYBRID UNIT

H-6

Ferro-hornblende

	1	2	3	4	5*
SiO2	45.80	45.34	46.05	45.21	46.60
Al2O3	5.64	5.69	5.56	5.65	4.76
TiO2	1.88	1.97	1.64	1.80	1.06
FeOToT	25.31	24.23	23.74	22.09	22.03
FeOL	20.36	19.31	21.93	20.66	21.53
Fe2O3L	5.50	5.47	2.01	1.60	0.55
MnO	0.46	0.49	0.42	0.45	0.38
MgO	6.68	7.02	6.79	6.94	6.68
CaO	9.69	9.55	9.95	9.56	9.84
Na2O	2.21	2.20	2.25	2.26	1.57
K2O	0.85	0.84	0.92	0.74	0.59
F	0.61	0.55	0.60	0.75	0.40
Cl	0.32	0.41	0.40	0.37	0.28
O=F,Cl	0.33	0.32	0.34	0.40	0.23
Total	99.12	97.96	97.98	95.43	93.94

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	6.974	6.961	7.113	7.130	7.415
AlZ	1.013	1.030	0.887	0.870	0.585
Fe3Z	0.014	0.009	0.000	0.000	0.000
AlY	0.000	0.000	0.126	0.180	0.307
Ti	0.216	0.227	0.190	0.214	0.127
Fe2	2.593	2.480	2.833	2.725	2.866
Fe3Y	0.617	0.623	0.234	0.189	0.066
Mn	0.059	0.063	0.055	0.060	0.051
Mg	1.516	1.606	1.562	1.631	1.583
XOct	0.000	0.000	0.000	-0.000	-0.000
Ca	1.581	1.571	1.646	1.616	1.677
NaM4	0.419	0.429	0.354	0.384	0.323
NaA	0.233	0.225	0.319	0.307	0.160
K	0.165	0.165	0.181	0.149	0.121
F	0.295	0.268	0.295	0.375	0.200
Cl	0.084	0.106	0.105	0.099	0.074
Total	15.398	15.390	15.500	15.456	15.281
OXYG	23.000	23.000	23.000	23.000	23.000
Al/Al+Si	0.127	0.129	0.125	0.128	0.107
Na/Na+Ca	0.292	0.294	0.290	0.300	0.224
NaA+K	0.398	0.390	0.500	0.456	0.281
AlY+Fe3+Ti	0.832	0.850	0.550	0.584	0.500
Mg/Fe2++Mg	0.369	0.393	0.355	0.374	0.356
Fe/Fe+Mg	0.680	0.660	0.663	0.641	0.649
Mn/Mn+Fe	0.018	0.020	0.018	0.020	0.017

* ferro-actinolitic hornblende

HYBRID UNIT

H-6

	6[1]	7[2]	8[3]	9[4]	10[5]	11[2]
SiO2	48.19	47.18	48.63	48.98	48.04	48.16
Al2O3	4.88	5.04	4.22	3.99	4.47	4.54
TiO2	0.70	0.79	0.14	1.13	0.63	0.33
FeOToT	20.44	20.29	18.52	18.29	18.11	18.94
FeOL	16.29	18.61	14.69	18.29	18.11	18.09
Fe2O3L	4.61	1.87	4.25	0.00	0.00	0.94
MnO	0.50	0.37	0.45	0.38	0.42	0.45
MgO	9.79	9.06	10.68	9.57	9.00	9.33
CaO	10.06	10.50	9.98	11.62	10.60	10.06
Na2O	2.14	1.90	1.93	1.71	1.74	1.98
K2O	0.66	0.74	0.59	0.58	0.63	0.61
F	0.85	0.75	1.05	0.65	0.63	0.83
Cl	0.19	0.24	0.17	0.20	0.20	0.15
O=F,Cl	0.40	0.37	0.48	0.32	0.31	0.38
Total	98.00	96.49	95.88	96.76	94.17	94.99

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	7.236	7.258	7.395	7.544	7.552	7.464
AlZ	0.764	0.742	0.605	0.456	0.448	0.536
Fe3Z	0.000	0.000	0.000	0.000	0.000	0.000
AlY	0.099	0.171	0.152	0.267	0.380	0.293
Ti	0.079	0.092	0.016	0.131	0.075	0.038
Fe2	2.046	2.394	1.868	2.356	2.381	2.345
Fe3Y	0.521	0.216	0.487	0.000	0.000	0.109
Mn	0.063	0.049	0.058	0.049	0.056	0.060
Mg	2.191	2.078	2.420	2.197	2.108	2.155
XOct	0.000	-0.000	0.000	0.000	0.000	-0.000
Ca	1.618	1.730	1.626	1.917	1.785	1.671
NaM4	0.382	0.270	0.374	0.083	0.215	0.329
NaA	0.240	0.296	0.194	0.428	0.316	0.266
K	0.127	0.145	0.115	0.114	0.127	0.121
F	0.403	0.365	0.503	0.319	0.313	0.405
Cl	0.048	0.063	0.044	0.052	0.054	0.040
Total	15.366	15.441	15.309	15.542	15.443	15.387
OXYG	23.000	23.000	23.000	23.266	23.155	23.000
Al/Al+Si	0.107	0.112	0.093	0.088	0.099	0.100
Na/Na+Ca	0.278	0.246	0.259	0.211	0.229	0.263
NaA+K	0.366	0.441	0.309	0.542	0.443	0.387
AlY+Fe3+Ti	0.700	0.480	0.654	0.398	0.455	0.440
Mg/Fe2++Mg	0.517	0.465	0.564	0.483	0.470	0.479
Fe/Fe+Mg	0.540	0.557	0.493	0.517	0.530	0.532
Mn/Mn+Fe	0.024	0.018	0.024	0.020	0.023	0.024

1 magnesio-hornblende
2 ferro-actinolitic hornblende
3 actinolitic hornblende
4 silicic ferro-edenite
5 ferro-actinolite

QUARTZ SYENITE

QS-1

Ferro-actinolite

	1 RPX	2	3[1]	4[2]	5[3]?	6[3]	7[3]
SiO2	50.00	48.28	45.61	43.43	43.94	44.20	43.01
Al2O3	3.27	3.58	4.17	6.78	6.19	6.84	6.87
TiO2	0.16	0.22	0.01	2.27	1.85	0.78	1.96
FeOToT	23.62	29.17	34.25	26.34	27.12	25.98	26.24
FeOL	22.24	26.91	27.96	22.43	24.80	21.23	25.39
Fe2O3L	1.54	2.52	6.99	4.35	2.58	5.28	0.95
MnO	0.56	0.77	1.36	0.62	0.56	0.44	0.41
MgO	7.60	4.53	0.94	5.44	4.52	5.88	4.38
CaO	11.76	10.38	10.07	10.24	10.31	10.28	10.43
Na2O	0.24	0.33	0.82	2.12	2.00	1.95	1.96
K2O	0.10	0.21	0.42	1.03	0.85	1.06	1.02
F	0.12	0.00	0.11	0.46	0.31	0.23	0.00
Cl	0.02	0.07	0.40	0.45	0.41	0.48	0.46
O=F,Cl	0.05	0.02	0.14	0.30	0.22	0.20	0.10
Total	97.40	97.51	98.02	98.90	97.82	97.92	96.63

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	7.613	7.526	7.271	6.738	6.923	6.864	6.868
AlZ	0.387	0.474	0.729	1.239	1.077	1.136	1.132
Fe3Z	0.000	0.000	0.000	0.023	0.000	0.000	0.000
AlY	0.200	0.185	0.054	0.000	0.072	0.115	0.162
Ti	0.019	0.025	0.001	0.265	0.219	0.092	0.236
Fe2	2.832	3.508	3.728	2.911	3.268	2.757	3.391
Fe3Y	0.176	0.295	0.839	0.485	0.305	0.618	0.114
Mn	0.073	0.101	0.184	0.081	0.075	0.058	0.056
Mg	1.725	1.053	0.223	1.258	1.061	1.361	1.041
XOct	0.024	0.168	0.029	0.000	-0.000	0.000	0.000
Ca	1.918	1.733	1.720	1.702	1.740	1.711	1.785
NaM4	0.058	0.099	0.252	0.298	0.260	0.289	0.215
NaA	0.013	0.000	0.000	0.340	0.351	0.299	0.392
K	0.020	0.041	0.086	0.205	0.170	0.210	0.207
F	0.056	0.000	0.056	0.227	0.153	0.112	0.000
Cl	0.004	0.020	0.109	0.119	0.110	0.126	0.124
Total	15.032	15.041	15.086	15.545	15.521	15.509	15.600
OXYG	23.000	23.000	23.000	23.000	23.000	23.000	23.000
Al/Al+Si	0.072	0.080	0.097	0.155	0.142	0.154	0.159
Na/Na+Ca	0.036	0.054	0.128	0.273	0.260	0.256	0.254
NaA+K	0.032	0.041	0.086	0.545	0.521	0.509	0.600
AlY+Fe3+Ti	0.395	0.505	0.894	0.750	0.597	0.824	0.512
Mg/Fe2++Mg	0.379	0.231	0.056	0.302	0.245	0.331	0.235
Fe/Fe+Mg	0.636	0.783	0.953	0.731	0.771	0.713	0.771
Mn/Mn+Fe	0.024	0.026	0.039	0.023	0.020	0.017	0.016

RPX rim pyroxene
1 ferro-actinolitic hornblende
2 ferro-edenitic hornblende
3 ferro-edenite

QUARTZ SYENITE

QS-1

	Ferro-edenite			
	8	9	10?[1]	11 CO[1]
SiO2	43.08	43.56	51.54	49.62
Al2O3	7.26	6.52	0.92	1.72
TiO2	2.28	2.19	0.00	0.23
FeOToT	25.19	24.90	27.71	27.62
FeOL	23.62	24.33	26.85	27.62
Fe2O3L	1.74	0.63	0.95	0.00
MnO	0.38	0.52	0.82	0.82
MgO	5.27	5.20	6.18	4.38
CaO	10.22	10.37	11.48	11.27
Na2O	2.21	2.00	0.10	0.17
K2O	1.12	1.04	0.05	0.15
F	0.66	0.23	0.12	0.00
Cl	0.51	0.49	0.06	0.09
O=F,Cl	0.39	0.21	0.06	0.02
Total	97.78	96.83	98.91	96.03

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	6.781	6.913	7.873	7.872
AlZ	1.219	1.087	0.127	0.128
Fe3Z	0.000	0.000	0.000	0.000
AlY	0.128	0.132	0.038	0.193
Ti	0.270	0.262	0.000	0.027
Fe2	3.110	3.230	3.431	3.664
Fe3Y	0.206	0.075	0.109	0.000
Mn	0.050	0.070	0.106	0.110
Mg	1.237	1.231	1.407	1.036
XOct	0.000	0.000	0.091	0.030
Ca	1.723	1.764	1.879	1.917
NaM4	0.277	0.236	0.030	0.053
NaA	0.397	0.381	0.000	0.000
K	0.226	0.212	0.010	0.030
F	0.327	0.117	0.056	0.000
Cl	0.137	0.130	0.016	0.023
Total	15.623	15.592	15.010	15.030
OXYG	23.000	23.000	23.000	23.048
Al/Al+Si	0.166	0.150	0.021	0.039
Na/Na+Ca	0.281	0.259	0.016	0.027
NaA+K	0.623	0.592	0.010	0.030
AlY+Fe3+Ti	0.604	0.469	0.147	0.220
Mg/Fe2++Mg	0.285	0.276	0.291	0.220
Fe/Fe+Mg	0.728	0.729	0.716	0.780
Mn/Mn+Fe	0.015	0.021	0.029	0.029

CO core
1 ferro-actinolite

QUARTZ SYENITE

QS-3

Ferro-hornblende

	1 PX	2[1]	3	4[2]	5[3]	6[1]
SiO2	45.75	47.02	45.69	48.62	45.97	46.26
Al2O3	5.16	3.96	4.76	2.31	4.38	3.94
TiO2	1.31	1.08	0.94	0.43	1.26	1.40
FeOToT	30.47	27.72	30.92	33.08	25.49	25.60
FeOL	23.02	22.25	26.90	30.96	25.44	24.64
Fe2O3L	18.27	6.08	4.47	2.36	0.05	1.06
MnO	0.56	0.40	0.49	0.83	0.57	0.56
MgO	4.61	5.53	2.83	2.27	5.22	5.23
CaO	9.51	9.14	9.54	9.20	10.05	9.62
Na2O	2.30	2.08	1.88	0.86	1.99	1.91
K2O	0.91	0.89	0.85	0.45	0.95	0.96
F	0.81	0.59	0.24	0.20	0.62	0.96
Cl	0.32	0.23	0.40	0.22	0.31	0.00
O=F,Cl	0.41	0.30	0.19	0.13	0.33	0.40
Total	101.29	98.35	98.35	98.34	96.47	96.03

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	6.945	7.254	7.199	7.681	7.317	7.366
AlZ	0.923	0.721	0.801	0.319	0.683	0.634
Fe3Z	0.132	0.026	0.000	0.000	0.000	0.000
AlY	0.000	0.000	0.083	0.111	0.140	0.106
Ti	0.149	0.125	0.111	0.051	0.151	0.167
Fe2	2.923	2.870	3.545	4.091	3.387	3.282
Fe3Y	0.812	0.680	0.530	0.280	0.006	0.127
Mn	0.072	0.052	0.066	0.111	0.077	0.076
Mg	1.044	1.272	0.665	0.535	1.239	1.242
XOct	0.000	-0.000	-0.000	0.179	0.000	0.000
Ca	1.546	1.510	1.611	1.557	1.714	1.641
NaM4	0.454	0.490	0.389	0.264	0.286	0.359
NaA	0.223	0.132	0.185	0.000	0.328	0.230
K	0.176	0.174	0.170	0.091	0.192	0.195
F	0.389	0.289	0.118	0.098	0.310	0.482
Cl	0.083	0.061	0.107	0.059	0.083	0.000
Total	15.399	15.306	15.355	15.091	15.521	15.425
OXYG	23.000	23.000	23.000	23.000	23.000	23.000
Al/Al+Si	0.117	0.090	0.109	0.053	0.101	0.091
Na/Na+Ca	0.305	0.291	0.263	0.145	0.264	0.264
NaA+K	0.399	0.306	0.355	0.091	0.521	0.425
AlY+Fe3+Ti	0.961	0.805	0.724	0.442	0.297	0.400
Mg/Fe2++Mg	0.263	0.307	0.158	0.116	0.268	0.275
Fe/Fe+Mg	0.787	0.738	0.860	0.891	0.732	0.733
Mn/Mn+Fe	0.018	0.014	0.016	0.025	0.022	0.022

PX replacing pyroxene
1 ferro-actinolitic hornblende
2 ferro-actinolite
3 ferro-edenite

QUARTZ SYENITE

QS-5

Ferro-hornblende

	1	2	3[1]	4[2]	5[2]	6[3]
SiO2	45.28	47.22	50.17	42.76	43.71	42.72
Al2O3	5.59	4.40	1.83	6.75	6.82	7.13
TiO2	0.68	0.67	0.03	1.73	2.17	1.83
FeOToT	30.49	29.93	30.74	27.60	26.25	26.58
FeOL	21.69	23.73	27.27	24.44	25.76	24.61
Fe2O3L	9.77	6.89	3.86	3.52	0.54	2.19
MnO	0.58	0.64	0.78	0.49	0.51	0.51
MgO	4.21	4.61	4.58	4.46	4.68	4.88
CaO	9.79	10.23	10.54	10.45	10.63	10.73
Na2O	1.42	1.47	0.62	2.03	2.04	2.12
K2O	0.75	0.57	0.26	1.07	1.11	1.14
F	0.10	0.15	0.07	0.20	0.31	0.22
Cl	0.62	0.46	0.17	0.64	0.58	0.60
O=F,Cl	0.18	0.16	0.07	0.23	0.26	0.23
Total	99.34	100.17	99.72	97.95	98.55	98.23

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	6.954	7.192	7.676	6.766	6.868	6.738
AlZ	1.013	0.790	0.324	1.234	1.132	1.262
Fe3Z	0.034	0.018	0.000	0.000	0.000	0.000
AlY	0.000	0.000	0.007	0.025	0.131	0.063
Ti	0.079	0.077	0.003	0.205	0.257	0.217
Fe2	2.786	3.023	3.489	3.234	3.386	3.246
Fe3Y	1.095	0.772	0.444	0.419	0.064	0.260
Mn	0.076	0.082	0.101	0.066	0.067	0.068
Mg	0.964	1.046	1.044	1.051	1.095	1.146
XOct	0.000	0.000	0.088	-0.000	-0.000	0.000
Ca	1.611	1.669	1.728	1.771	1.790	1.814
NaM4	0.389	0.331	0.184	0.229	0.210	0.186
NaA	0.035	0.103	0.000	0.394	0.411	0.462
K	0.147	0.110	0.051	0.215	0.223	0.229
F	0.051	0.071	0.036	0.100	0.153	0.110
Cl	0.161	0.117	0.043	0.173	0.155	0.160
Total	15.182	15.214	15.051	15.609	15.634	15.692
OXYG	23.000	23.000	23.000	23.000	23.000	23.000
Al/Al+Si	0.127	0.099	0.041	0.157	0.155	0.164
Na/Na+Ca	0.208	0.207	0.096	0.260	0.258	0.263
NaA+K	0.182	0.214	0.051	0.609	0.634	0.692
AlY+Fe3+Ti	1.174	0.849	0.453	0.649	0.452	0.540
Mg/Fe2++Mg	0.257	0.257	0.230	0.245	0.244	0.261
Fe/Fe+Mg	0.803	0.785	0.790	0.776	0.759	0.754
Mn/Mn+Fe	0.019	0.021	0.025	0.018	0.019	0.019

1 ferro-actinolite
2 ferro-edenite
3 ferro-edenitic hornblende

QUARTZ SYENITE

WLD-100

Ferro-hornblende

	1	2	3[1]	4[2]	5 ?	6 ?
SiO2	44.96	46.57	51.32	47.48	49.42	49.36
Al2O3	5.32	4.05	0.38	3.49	1.18	1.08
TiO2	1.54	1.00	0.00	0.79	0.12	0.25
FeOToT	28.80	31.61	32.33	29.75	35.15	36.86
FeOL	22.99	25.42	32.33	25.38	35.15	36.86
Fe2O3L	6.46	6.88	0.00	4.85	0.00	0.00
MnO	0.50	0.44	1.36	0.53	0.85	1.03
MgO	4.66	3.56	2.58	4.02	2.40	1.96
CaO	9.64	9.65	10.96	9.80	8.04	7.71
Na2O	1.95	1.81	0.23	1.49	0.60	0.54
K2O	0.94	0.60	0.14	0.52	0.19	0.15
F	0.49	0.35	0.04	0.34	0.06	0.00
Cl	0.34	0.38	0.04	0.35	0.20	0.20
O=F,Cl	0.28	0.23	0.02	0.22	0.07	0.05
Total	98.85	99.77	99.34	98.33	98.13	99.10

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	6.971	7.190	8.070	7.392	8.094	8.099
AlZ	0.973	0.737	0.000	0.608	0.000	0.000
Fe3Z	0.057	0.073	0.000	0.000	0.000	0.000
AlY	0.000	0.000	0.070	0.033	0.227	0.209
Ti	0.179	0.116	0.000	0.092	0.015	0.031
Fe2	2.981	3.282	4.252	3.305	4.815	5.059
Fe3Y	0.697	0.726	0.000	0.569	0.000	0.000
Mn	0.066	0.057	0.182	0.069	0.118	0.144
Mg	1.078	0.818	0.606	0.933	0.586	0.480
XOct	-0.000	0.000	0.180	-0.000	0.856	1.021
Ca	1.601	1.596	1.847	1.634	1.412	1.356
NaM4	0.399	0.404	0.000	0.366	0.000	0.000
NaA	0.187	0.138	0.070	0.085	0.191	0.170
K	0.186	0.118	0.027	0.103	0.040	0.031
F	0.238	0.168	0.018	0.168	0.033	0.000
Cl	0.088	0.100	0.010	0.093	0.055	0.056
Total	15.373	15.256	15.123	15.187	15.498	15.578
OXYG	23.000	23.000	23.181	23.000	23.605	23.712
Al/Al+Si	0.122	0.093	0.009	0.080	0.027	0.025
Na/Na+Ca	0.268	0.253	0.036	0.216	0.119	0.112
NaA+K	0.373	0.256	0.097	0.187	0.231	0.201
AlY+Fe3+Ti	0.876	0.842	0.070	0.693	0.241	0.240
Mg/Fe2++Mg	0.266	0.200	0.125	0.220	0.109	0.087
Fe/Fe+Mg	0.776	0.833	0.875	0.806	0.891	0.913
Mn/Mn+Fe	0.017	0.014	0.041	0.018	0.024	0.028

1 ferro-actinolite
2 ferro-actinolitic hornblende

SYENITE

	74-17			74-14	
	Ferro-hornblende			Ferro-hornblende	
	1	2	3*	1	2
SiO2	45.08	44.11	42.47	44.09	44.52
Al2O3	6.10	6.86	7.36	5.68	5.17
TiO2	1.58	1.72	1.97	1.33	1.21
FeOToT	28.39	28.74	28.63	33.92	34.37
FeOL	21.72	22.97	22.25	27.70	28.50
Fe2O3L	7.42	6.41	7.09	6.91	6.52
MnO	0.50	0.52	0.50	0.62	0.64
MgO	5.23	4.65	4.54	1.60	1.41
CaO	10.02	10.10	9.98	9.65	9.75
Na2O	1.79	2.03	2.17	1.94	1.88
K2O	0.91	1.02	1.09	0.99	0.91
F	0.14	0.45	0.31	0.63	0.58
Cl	0.00	0.00	0.00	0.00	0.00
O=F,Cl	0.06	0.19	0.13	0.27	0.25
Total	99.68	100.01	98.88	100.18	100.20

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	6.862	6.755	6.591	6.901	6.980
AlZ	1.094	1.238	1.346	1.047	0.956
Fe3Z	0.045	0.007	0.063	0.052	0.064
AlY	0.000	0.000	0.000	0.000	0.000
Ti	0.180	0.198	0.229	0.157	0.142
Fe2	2.764	2.941	2.888	3.626	3.738
Fe3Y	0.805	0.732	0.766	0.763	0.705
Mn	0.064	0.067	0.066	0.082	0.085
Mg	1.186	1.061	1.051	0.373	0.330
XOct	0.000	0.000	0.000	0.000	0.000
Ca	1.634	1.658	1.659	1.619	1.638
NaM4	0.366	0.342	0.341	0.381	0.362
NaA	0.163	0.261	0.311	0.206	0.210
K	0.176	0.198	0.215	0.198	0.182
F	0.066	0.216	0.151	0.313	0.289
Cl	0.000	0.000	0.000	0.000	0.000
Total	15.339	15.459	15.526	15.404	15.392
OXYG	23.000	23.000	23.000	23.000	23.000
Al/Al+Si	0.137	0.155	0.170	0.132	0.120
Na/Na+Ca	0.245	0.267	0.282	0.266	0.259
NaA+K	0.339	0.459	0.526	0.404	0.392
AlY+Fe3+Ti	0.986	0.930	0.995	0.919	0.848
Mg/Fe2++Mg	0.300	0.265	0.267	0.093	0.081
Fe/Fe+Mg	0.753	0.776	0.780	0.922	0.932
Mn/Mn+Fe	0.018	0.018	0.018	0.018	0.018

* ferro-edenitic hornblende

QUARTZ SYENITE

74-101

	1[1]	2[2]	3[3]	4?[4]
SiO2	47.18	44.79	42.20	49.11
Al2O3	3.26	3.81	6.94	0.69
TiO2	0.39	0.80	1.48	0.00
FeOToT	34.94	34.55	32.16	31.66
FeOL	27.65	26.29	25.29	30.86
Fe2O3L	8.10	9.18	7.62	0.88
MnO	0.76	0.73	0.61	0.74
MgO	1.85	1.82	2.49	2.73
CaO	9.95	9.71	9.80	11.10
Na2O	1.19	1.34	2.17	0.14
K2O	0.47	0.58	1.04	0.05
F	0.44	0.44	1.04	0.05
Cl	0.00	0.00	0.00	0.00
O=F,Cl	0.19	0.19	0.44	0.02
Total	100.24	98.38	99.49	96.24

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	7.308	7.092	6.641	7.899
AlZ	0.596	0.711	1.287	0.101
Fe3Z	0.097	0.197	0.072	0.000
AlY	0.000	0.000	0.000	0.029
Ti	0.045	0.095	0.176	0.000
Fe2	3.581	3.481	3.329	4.152
Fe3Y	0.848	0.897	0.831	0.107
Mn	0.100	0.098	0.081	0.101
Mg	0.426	0.429	0.584	0.654
XOct	0.000	-0.000	0.000	0.042
Ca	1.652	1.646	1.653	1.913
NaM4	0.348	0.354	0.347	0.045
NaA	0.010	0.057	0.315	0.000
K	0.092	0.117	0.209	0.010
F	0.217	0.221	0.517	0.025
Cl	0.000	0.000	0.000	0.000
Total	15.103	15.174	15.524	15.010
OXYG	23.000	23.000	23.000	23.000
Al/Al+Si	0.075	0.091	0.162	0.016
Na/Na+Ca	0.179	0.200	0.286	0.023
NaA+K	0.103	0.174	0.524	0.010
AlY+Fe3+Ti	0.893	0.992	1.006	0.136
Mg/Fe2++Mg	0.106	0.110	0.149	0.136
Fe/Fe+Mg	0.914	0.914	0.879	0.867
Mn/Mn+Fe	0.022	0.021	0.019	0.023

1 ferro-actinolitic hornblende
2 ferro-hornblende
3 ferro-edenitic hornblende
4 ferro-actinolite

QUARTZ SYENITE HYBRID (DIORITE)

QS-10

Actinolitic hornblende

	1	2[1]	3[1]	4	5[1]	6[1]	7[2]	8[2]	9[2]
SiO2	50.83	48.01	48.30	48.58	48.64	48.61	42.79	42.64	43.95
Al2O3	4.05	5.55	5.66	5.98	5.50	5.45	8.60	8.90	8.52
TiO2	1.04	1.38	1.54	0.45	1.52	1.31	1.25	0.12	0.55
FeOToT	17.77	18.29	18.54	17.90	16.47	17.78	21.08	22.32	20.37
FeOL	13.20	15.39	14.17	17.50	12.15	12.74	21.08	21.02	20.37
Fe2O3L	5.08	3.22	4.86	0.44	4.80	5.60	0.00	1.44	0.00
MnO	0.33	0.31	0.28	0.11	0.23	0.37	0.21	0.14	0.14
MgO	12.43	10.71	11.06	10.33	12.23	11.23	7.08	6.54	7.41
CaO	10.61	11.22	10.82	11.90	10.69	10.35	11.45	11.39	11.66
Na2O	1.04	1.14	1.42	0.94	1.44	1.34	1.38	1.40	1.34
K2O	0.40	0.54	0.57	0.34	0.58	0.55	1.45	1.27	0.97
F	0.07	0.08	0.07	0.07	0.00	0.07	0.00	0.02	0.03
Cl	0.26	0.42	0.39	0.33	0.26	0.41	1.71	1.51	1.04
O=F,Cl	0.09	0.13	0.12	0.10	0.06	0.12	0.39	0.35	0.25
Total	98.72	97.51	98.54	96.81	97.50	97.34	96.62	95.89	95.74

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	7.372	7.165	7.107	7.308	7.148	7.186	6.766	6.781	6.916
AlZ	0.628	0.835	0.893	0.692	0.852	0.814	1.234	1.219	1.084
Fe3Z	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AlY	0.065	0.142	0.088	0.368	0.101	0.136	0.367	0.448	0.497
Ti	0.114	0.155	0.171	0.051	0.167	0.145	0.149	0.015	0.065
Fe2	1.601	1.921	1.743	2.202	1.493	1.575	2.787	2.795	2.681
Fe3Y	0.555	0.362	0.538	0.050	0.531	0.623	0.000	0.173	0.000
Mn	0.040	0.039	0.035	0.014	0.028	0.046	0.029	0.018	0.019
Mg	2.686	2.382	2.425	2.315	2.679	2.475	1.669	1.551	1.737
XOct	0.060	0.000	-0.000	0.000	-0.000	0.000	-0.000	0.000	0.000
Ca	1.648	1.795	1.706	1.917	1.683	1.640	1.940	1.940	1.966
NaM4	0.292	0.205	0.294	0.083	0.317	0.360	0.060	0.060	0.034
NaA	0.000	0.124	0.111	0.191	0.094	0.022	0.364	0.371	0.375
K	0.073	0.102	0.108	0.064	0.108	0.103	0.292	0.258	0.195
F	0.031	0.038	0.031	0.032	0.000	0.035	0.000	0.010	0.016
Cl	0.063	0.106	0.097	0.083	0.066	0.103	0.458	0.407	0.277
Total	15.073	15.227	15.219	15.255	15.202	15.125	15.656	15.628	15.570
OXYG	23.000	23.000	23.000	23.000	23.000	23.000	23.013	23.000	23.040
Al/Al+Si	0.086	0.120	0.121	0.127	0.118	0.117	0.191	0.197	0.186
Na/Na+Ca	0.150	0.155	0.192	0.125	0.196	0.189	0.179	0.182	0.172
NaA+K	0.073	0.227	0.219	0.255	0.202	0.125	0.656	0.628	0.570
AlY+Fe3+Ti	0.733	0.658	0.797	0.469	0.800	0.904	0.516	0.636	0.563
Mg/Fe2++Mg	0.627	0.554	0.582	0.513	0.642	0.611	0.375	0.357	0.393
Fe/Fe+Mg	0.445	0.489	0.485	0.493	0.430	0.470	0.625	0.657	0.607
Mn/Mn+Fe	0.018	0.017	0.015	0.006	0.014	0.021	0.010	0.006	0.007

1 magnesio-hornblende
2 ferro-edenite

QUARTZ SYENITE HYBRID (DIORITE PEGMATITE)

QSP-1, PEGMATITE

Magnesio-hornblende

	1	2	3[1] CORE	4 CORE	5[1]	6[1]
SiO2	47.89	49.13	48.63	48.67	49.87	49.16
Al2O3	5.27	4.57	4.59	5.00	4.23	4.71
TiO2	1.71	1.33	1.08	1.44	1.37	1.63
FeOToT	19.59	18.89	18.65	18.47	17.45	17.50
FeOL	13.12	12.50	12.61	13.58	13.64	14.89
Fe2O3L	7.19	7.11	6.71	5.44	4.23	2.91
MnO	0.36	0.36	0.31	0.35	0.44	0.32
MgO	10.81	11.51	10.97	10.98	11.36	11.54
CaO	10.38	10.20	10.32	10.36	10.69	10.67
Na2O	1.42	1.30	1.28	1.37	1.03	1.24
K2O	0.56	0.44	0.02	0.52	0.00	1.31
F	0.10	0.08	0.06	0.04	0.05	0.03
Cl	0.38	0.31	0.45	0.27	0.55	0.00
O=F,Cl	0.13	0.11	0.12	0.08	0.14	0.01
Total	98.34	98.02	96.24	97.38	96.89	98.09

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	7.060	7.210	7.260	7.210	7.389	7.260
AlZ	0.916	0.790	0.740	0.790	0.611	0.740
Fe3Z	0.024	0.001	0.000	0.000	0.000	0.000
AlY	0.000	0.000	0.069	0.084	0.127	0.079
Ti	0.189	0.146	0.121	0.160	0.153	0.180
Fe2	1.618	1.534	1.575	1.682	1.691	1.838
Fe3Y	0.774	0.784	0.754	0.606	0.472	0.323
Mn	0.045	0.045	0.040	0.044	0.055	0.040
Mg	2.375	2.518	2.442	2.424	2.510	2.539
XOct	0.000	0.027	0.000	0.000	0.008	-0.000
Ca	1.639	1.604	1.650	1.644	1.697	1.689
NaM4	0.361	0.369	0.350	0.356	0.295	0.311
NaA	0.044	0.000	0.020	0.037	0.000	0.042
K	0.105	0.083	0.004	0.097	0.000	0.247
F	0.047	0.039	0.026	0.018	0.024	0.016
Cl	0.094	0.077	0.113	0.069	0.137	0.000
Total	15.149	15.083	15.025	15.135	15.000	15.289
OXYG	23.000	23.000	23.000	23.000	23.000	23.000
Al/Al+Si	0.115	0.099	0.100	0.108	0.091	0.101
Na/Na+Ca	0.198	0.187	0.183	0.193	0.148	0.173
NaA+K	0.149	0.083	0.025	0.135	0.000	0.289
AlY+Fe3+Ti	0.963	0.930	0.943	0.850	0.752	0.582
Mg/Fe2++Mg	0.595	0.621	0.608	0.590	0.598	0.580
Fe/Fe+Mg	0.504	0.479	0.488	0.486	0.463	0.460
Mn/Mn+Fe	0.018	0.019	0.017	0.019	0.025	0.018

1 actinolitic hornblende

QUARTZ SYENITE HYBRID (DIORITE PEGMATITE)

QSP-1 PEGMATITE

Ferro-actinolite

	8	9	10[1]	11[2]	12	13 RI	14 RI	15 RI	16 C[2]
SiO2	52.45	51.13	45.71	46.45	50.76	49.20	50.35	50.23	46.93
Al2O3	0.39	2.02	6.02	5.64	2.54	3.36	3.01	3.04	5.4
TiO2	0.00	0.10	0.03	0.07	0.00	0.01	0.02	0.14	0.2
FeOToT	27.03	24.67	26.25	26.11	26.34	24.54	22.46	22.26	23.10
FeOL	27.03	23.02	24.94	24.79	26.34	24.54	22.46	22.26	21.3
Fe2O3L	0.00	1.84	1.45	1.47	0.00	0.00	0.00	0.00	1.9
MnO	0.19	0.23	0.31	0.22	0.34	0.27	0.25	0.29	0.21
MgO	5.92	7.64	5.06	5.32	5.69	6.13	7.92	7.80	7.4
CaO	11.94	11.56	11.55	11.53	11.57	12.54	11.41	11.48	11.4
Na2O	0.09	0.38	1.00	0.90	0.24	0.50	0.51	0.61	0.98
K2O	0.02	0.09	0.56	0.52	0.21	0.00	0.87	0.30	0.65
F	0.02	0.00	0.00	0.07	0.03	0.00	0.00	0.05	0.0
Cl	0.00	0.10	0.59	0.51	0.13	0.00	2.17	0.31	0.8
O=F,Cl	0.01	0.02	0.13	0.14	0.04	0.00	0.49	0.09	0.20
Total	98.03	97.89	96.93	97.18	97.79	96.55	98.48	96.42	97.1

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	8.076	7.751	7.196	7.266	7.828	7.700	7.728	7.736	7.25
AlZ	0.000	0.249	0.804	0.734	0.172	0.300	0.272	0.264	0.747
Fe3Z	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AlY	0.071	0.113	0.312	0.306	0.289	0.321	0.272	0.288	0.24
Ti	0.000	0.011	0.003	0.008	0.000	0.001	0.002	0.016	0.03
Fe2	3.481	2.919	3.284	3.243	3.396	3.212	2.882	2.867	2.763
Fe3Y	0.000	0.210	0.172	0.172	0.000	0.000	0.000	0.000	0.22
Mn	0.025	0.030	0.041	0.029	0.045	0.036	0.032	0.038	0.02
Mg	1.358	1.727	1.188	1.241	1.307	1.430	1.811	1.791	1.709
XOct	0.011	0.009	-0.000	-0.000	0.037	0.000	0.000	0.000	0.00
Ca	1.969	1.878	1.947	1.932	1.911	2.103	1.877	1.894	1.89
NaM4	0.019	0.113	0.053	0.068	0.052	0.000	0.123	0.106	0.103
NaA	0.006	0.000	0.253	0.205	0.020	0.152	0.027	0.075	0.19
K	0.003	0.016	0.113	0.103	0.041	0.000	0.170	0.058	0.12
F	0.008	0.000	0.000	0.032	0.013	0.000	0.000	0.024	0.01
Cl	0.000	0.024	0.156	0.135	0.034	0.000	0.565	0.082	0.221
Total	15.009	15.016	15.366	15.307	15.061	15.255	15.197	15.133	15.31
OXYG	23.106	23.000	23.000	23.000	23.063	23.190	23.039	23.042	23.00
Al/Al+Si	0.009	0.045	0.134	0.125	0.056	0.075	0.066	0.067	0.12
Na/Na+Ca	0.013	0.057	0.136	0.124	0.036	0.068	0.074	0.087	0.13
NaA+K	0.009	0.016	0.366	0.307	0.061	0.152	0.197	0.133	0.318
AlY+Ee3+Ti	0.071	0.334	0.487	0.487	0.289	0.322	0.274	0.304	0.50
Mg/Fe2++Mg	0.281	0.372	0.266	0.277	0.278	0.308	0.386	0.384	0.38
Fe/Fe+Mg	0.719	0.644	0.744	0.733	0.722	0.692	0.614	0.616	0.636
Mn/Mn+Fe	0.007	0.009	0.012	0.008	0.013	0.011	0.011	0.013	0.009

CO core
RI rim

1 ferro-hornblende
2 ferro-actinolitic hornblende

QUARTZ SYENITE HYBRID (DIORITE)

QSP-1

Magnesio-hornblende

	1	2[1]	3	4[1]RI	5	6	7[2]	8[3]	9[3]
SiO2	47.70	49.86	48.13	49.55	48.29	49.02	44.82	45.06	45.91
Al2O3	5.40	4.08	5.38	4.60	5.61	4.68	8.02	7.90	7.10
TiO2	1.54	1.05	1.21	1.15	1.44	1.58	1.85	0.38	0.51
FeOToT	17.22	18.08	17.20	16.39	15.57	19.56	18.55	20.28	20.28
FeOL	14.63	13.24	13.67	11.93	12.40	14.32	18.55	20.28	20.28
Fe2O3L	2.88	5.38	3.91	4.95	3.53	5.82	0.00	0.00	0.00
MnO	0.25	0.34	0.28	0.17	0.21	0.40	0.28	0.23	0.19
MgO	10.82	11.96	11.26	12.22	11.95	10.73	8.79	7.71	7.32
CaO	10.65	9.92	10.66	10.48	10.48	10.39	11.29	11.78	11.65
Na2O	1.35	1.15	1.39	1.18	1.43	1.21	1.68	1.23	1.02
K2O	0.44	0.31	0.48	0.38	0.46	0.56	0.92	0.72	.59
F	0.01	0.09	0.00	0.07	0.01	0.11	0.02	0.05	0.00
Cl	0.42	0.30	0.43	0.12	0.19	0.43	0.74	0.66	0.39
O=F,Cl	0.10	0.11	0.10	0.06	0.05	0.14	0.17	0.17	0.09
Total	95.69	97.05	96.31	96.25	95.60	98.52	96.78	95.84	94.87

L Proportion of Fe^{2+} and Fe^{3+} calculated using Laird's method

Si	7.214	7.364	7.210	7.329	7.216	7.217	6.894	7.032	7.216
AlZ	0.786	0.636	0.790	0.671	0.784	0.783	1.106	0.968	0.784
Fe3Z	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AlY	0.176	0.075	0.159	0.131	0.204	0.030	0.348	0.485	0.532
Ti	0.175	0.117	0.137	0.127	0.162	0.175	0.214	0.045	0.061
Fe2	1.850	1.635	1.713	1.476	1.549	1.764	2.386	2.647	2.667
Fe3Y	0.328	0.598	0.441	0.551	0.397	0.644	0.000	0.000	0.000
Mn	0.032	0.043	0.035	0.022	0.026	0.049	0.036	0.030	0.025
Mg	2.439	2.633	2.514	2.695	2.661	2.354	2.015	1.794	1.716
XOct	0.000	0.101	0.000	0.001	0.000	0.016	-0.000	-0.000	-0.000
Ca	1.726	1.570	1.710	1.660	1.679	1.640	1.860	1.969	1.962
NaM4	0.274	0.329	0.290	0.338	0.321	0.345	0.140	0.031	0.038
NaA	0.122	0.000	0.114	0.000	0.093	0.000	0.360	0.342	0.271
K	0.084	0.058	0.092	0.072	0.088	0.105	0.181	0.143	0.119
F	0.007	0.041	0.000	0.032	0.007	0.052	0.010	0.026	0.000
Cl	0.107	0.076	0.109	0.030	0.048	0.108	0.192	0.175	0.103
Total	15.206	15.058	15.206	15.072	15.181	15.105	15.541	15.485	15.390
OXYG	23.000	23.000	23.000	23.000	23.000	23.000	23.036	23.030	23.110
Al/Al+Si	0.118	0.088	0.116	0.099	0.120	0.101	0.174	0.171	0.154
Na/Na+Ca	0.187	0.173	0.191	0.169	0.198	0.174	0.212	0.159	0.136
NaA+K	0.206	0.058	0.206	0.072	0.181	0.105	0.541	0.485	0.390
AlY+Fe3+Ti	0.679	0.790	0.737	0.809	0.763	0.849	0.562	0.529	0.592
Mg/Fe2++Mg	0.569	0.617	0.595	0.646	0.632	0.572	0.458	0.404	0.392
Fe/Fe+Mg	0.472	0.459	0.461	0.429	0.422	0.506	0.542	0.596	0.608
Mn/Mn+Fe	0.014	0.019	0.016	0.011	0.013	0.020	0.015	0.011	0.009

1 actinolitic hornblende
2 ferro-edenite
3 ferro-hornblende

ALKALI GRANITE

AG-P1

	Ferrohedenbergite				Aegirine			
	1	2	3	4	5	6	7	8
SiO2	49.79	49.27	49.64	49.38	52.51	52.54	51.70	51.57
Al2O3	0.17	0.14	0.15	0.16	0.17	0.15	0.20	0.21
Fe2O3	2.52	4.42	5.58	4.52	22.96	23.19	25.42	25.82
TiO2	0.51	0.42	0.15	0.42	1.28	1.11	1.18	1.37
Cr2O3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MgO	0.74	0.83	1.04	0.97	0.08	0.12	0.07	0.04
FeO	27.52	26.12	23.67	24.21	7.69	7.78	5.84	5.42
MnO	0.97	0.90	0.93	0.89	0.36	0.40	0.32	0.29
ZrO2	0.07	0.04	0.03	0.11	1.08	1.19	0.72	1.02
CaO	16.49	16.84	17.03	16.80	4.99	4.90	4.73	4.33
Na2O	1.96	1.99	2.42	2.40	10.78	10.75	10.99	11.25
Total	100.74	100.97	100.65	99.85	101.90	102.12	101.17	101.32

Recalculated on the basis of 4 cations with Fe3+ estimated assuming 6 oxygen atoms

Si	2.018	1.994	2.001	2.007	2.008	2.007	1.990	1.982
AlTET	0.000	0.006	0.000	0.000	0.000	0.000	0.009	0.010
AlOCT	0.008	0.001	0.007	0.008	0.008	0.007	0.000	0.000
Fe3	0.077	0.135	0.169	0.138	0.661	0.667	0.736	0.747
Ti	0.016	0.013	0.005	0.013	0.037	0.032	0.034	0.040
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mg	0.045	0.050	0.062	0.059	0.005	0.007	0.004	0.002
Fe2	0.933	0.884	0.798	0.823	0.246	0.248	0.188	0.174
Mn	0.033	0.031	0.032	0.031	0.012	0.013	0.010	0.009
Zr	0.001	0.001	0.001	0.002	0.020	0.022	0.014	0.019
Ca	0.716	0.730	0.736	0.731	0.204	0.201	0.195	0.178
Na	0.154	0.156	0.189	0.189	0.799	0.796	0.820	0.838
Oxyg	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000
Mg Number	0.046	0.054	0.073	0.067	0.018	0.027	0.021	0.013

End members calculated according to Lindsley (1983)

Acmite	0.0769	0.1346	0.1694	0.1381	0.6610	0.6667	0.7362	0.7469
Jadeite	0.0081	0.0005	0.0071	0.0077	0.0077	0.0068	0.0000	0.0000
Fe3cats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Crcats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Alcats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Wo	0.3964	0.4324	0.4525	0.4348	0.4327	0.4336	0.4656	0.4626
En	0.0276	0.0304	0.0398	0.0377	0.0103	0.0152	0.0112	0.0070
Fs	0.5760	0.5372	0.5077	0.5275	0.5569	0.5512	0.5232	0.5304

ALKALI GRANITE

AG-P1

	Aegirine							Aeg.-augite	
	1	2	3	4	5	6	7	8	9
SiO2	52.40	52.65	51.39	52.26	51.66	52.06	51.62	50.58	50.66
Al2O3	0.08	0.46	0.28	0.25	0.27	0.25	0.00	0.26	0.62
Fe2O3	27.72	28.79	18.70	20.25	21.31	22.85	30.16	16.26	14.75
TiO2	1.44	1.24	0.23	0.44	0.60	0.94	1.82	0.22	0.39
Cr2O3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MgO	0.03	0.03	0.75	0.21	0.14	0.09	0.00	0.78	0.72
FeO	0.14	0.00	9.00	7.89	7.32	6.16	0.00	13.38	14.61
MnO	0.51	0.30	0.37	0.31	0.21	0.28	0.00	0.76	0.61
ZrO2	0.00	0.00	0.00	0.00	0.00	0.00	1.92	0.13	0.22
CaO	2.17	0.64	9.40	5.91	5.83	4.83	0.38	11.91	11.06
Na2O	13.04	13.74	8.39	10.08	10.15	10.85	14.03	6.46	6.55
Total	97.53	97.85	98.51	97.60	97.48	98.31	99.93	100.74	100.20
Recalculated on the basis of 4 cations with Fe3+ estimated assuming 6 oxygen atoms									
Si	2.042	2.036	2.030	2.066	2.048	2.042	1.981	1.991	2.001
AlTET	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.000
AlOCT	0.004	0.021	0.013	0.012	0.013	0.012	0.000	0.003	0.029
Fe3	0.813	0.838	0.556	0.603	0.636	0.674	0.871	0.481	0.439
Ti	0.042	0.036	0.007	0.013	0.018	0.028	0.053	0.007	0.012
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mg	0.002	0.002	0.044	0.012	0.008	0.005	0.000	0.046	0.042
Fe2	0.005	0.000	0.297	0.261	0.243	0.202	0.000	0.440	0.483
Mn	0.017	0.010	0.012	0.010	0.007	0.009	0.000	0.025	0.020
Zr	0.000	0.000	0.000	0.000	0.000	0.000	0.036	0.002	0.004
Ca	0.091	0.027	0.398	0.250	0.248	0.203	0.016	0.502	0.468
Na	0.985	1.030	0.643	0.773	0.780	0.825	1.044	0.493	0.502
Oxyg	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000
Mg Number	0.277	1.000	0.129	0.045	0.033	0.025	-	0.094	0.081
End members calculated according to Lindsley (1983)									
Acmite	0.8129	0.8381	0.5560	0.6025	0.6357	0.6745	0.8710	0.4815	0.4386
Jadeite	0.0037	0.0210	0.0130	0.0116	0.0126	0.0116	0.0000	0.0028	0.0289
Fe3cats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Crcats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Alcats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Wo	0.4517	0.4323	0.4769	0.4264	0.4416	0.4387	0.4433	0.4918	0.4534
En	0.1518	0.5677	0.0676	0.0260	0.0184	0.0143	-	0.0478	0.0441
Fs	0.3964	0.0000	0.4555	0.5476	0.5399	0.5470	-	0.4603	0.5025

ALKALI GRANITE

AG-P2

Aegirine

	1	2	3	4
SiO2	53.13	52.92	51.97	52.37
Al2O3	0.35	0.37	0.13	0.25
Fe2O3	29.99	30.51	25.07	30.74
TiO2	1.97	1.52	2.10	1.16
Cr2O3	0.00	0.00	0.00	0.00
MgO	0.01	0.01	0.02	0.01
FeO	0.00	0.00	3.37	0.00
MnO	0.07	0.06	0.26	0.06
ZrO2	0.00	0.00	0.00	0.00
CaO	0.38	0.29	3.07	1.45
Na2O	14.07	14.20	12.17	13.87
Total	99.98	99.88	98.16	99.91

Recalculated on the basis of 4 cations with Fe3+ estimated assuming 6 oxygen atoms

Si	2.017	2.009	2.028	1.992
AlTET	0.000	0.000	0.000	0.008
AlOCT	0.016	0.017	0.006	0.003
Fe3	0.857	0.872	0.736	0.880
Ti	0.056	0.043	0.062	0.033
Cr	0.000	0.000	0.000	0.000
Mg	0.001	0.001	0.001	0.001
Fe2	0.000	0.000	0.110	0.000
Mn	0.002	0.002	0.009	0.002
Zr	0.000	0.000	0.000	0.000
Ca	0.015	0.012	0.128	0.059
Na	1.036	1.045	0.921	1.023
Oxyg	6.000	6.000	6.000	6.000
Mg Number	1.000	1.000	0.010	1.000

End members calculated according to Lindsley (1983)

Acmite	0.8570	0.8715	0.7361	0.8797
Jadeite	0.0157	0.0166	0.0060	0.0028
Fe3cats	0.0000	0.0000	0.0000	0.0000
Crcats	0.0000	0.0000	0.0000	0.0000
Alcats	0.0000	0.0000	0.0000	0.0000
Wo	0.4362	0.4417	0.4322	0.4694
En	0.5638	0.5583	0.0059	0.5306
Fs	0.0000	0.0000	0.5618	0.0000

ALKALI GRANITE

AG-P4

Aegirine

	1	2	3	4	5	6
SiO2	53.14	52.69	53.12	52.71	52.87	52.59
Al2O3	0.30	0.18	0.28	0.17	0.25	0.39
Fe2O3	30.96	28.29	31.64	27.82	32.06	31.65
TiO2	1.33	0.98	1.89	1.33	1.35	1.19
Cr2O3	0.00	0.00	0.00	0.00	0.00	0.00
MgO	0.00	0.02	0.07	0.01	0.01	0.02
FeO	1.50	3.75	0.00	2.82	0.00	0.00
MnO	0.15	0.24	0.16	0.20	0.19	0.14
ZrO2	0.00	0.00	0.00	0.00	0.00	0.00
CaO	1.14	1.81	0.13	1.54	1.29	1.12
Na2O	13.29	12.41	14.31	12.77	13.29	13.97
Total	101.81	100.36	101.60	99.37	101.21	101.07

Recalculated on the basis of 4 cations with Fe3+ estimated assuming 6 oxygen atoms

Si	2.002	2.021	1.989	2.031	2.002	1.981
AlTET	0.000	0.000	0.011	0.000	0.000	0.017
AlOCT	0.013	0.008	0.002	0.008	0.011	0.000
Fe3	0.878	0.816	0.892	0.807	0.884	0.897
Ti	0.038	0.028	0.053	0.039	0.038	0.034
Cr	0.000	0.000	0.000	0.000	0.000	0.000
Mg	0.000	0.001	0.004	0.001	0.001	0.001
Fe2	0.047	0.120	0.000	0.091	0.030	0.000
Mn	0.005	0.008	0.005	0.007	0.006	0.004
Zr	0.000	0.000	0.000	0.000	0.000	0.000
Ca	0.046	0.074	0.005	0.064	0.052	0.045
Na	0.971	0.923	1.039	0.954	0.976	1.020
Oxyg	6.000	6.000	6.000	6.000	6.000	6.000
Mg Number	0.000	0.009	1.000	0.006	0.018	1.000

End members calculated according to Lindsley (1983)

Acmite	0.8777	0.8164	0.8917	0.8067	0.8836	0.8971
Jadeite	0.0133	0.0081	0.0018	0.0077	0.0112	0.0000
Fe3cats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Crcats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Alcats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Wo	0.4619	0.4454	0.4485	0.4351	0.4680	0.4712
En	0.0000	0.0052	0.5515	0.0035	0.0098	0.5288
Fs	0.5381	0.5494	0.0000	0.5613	0.5222	0.0000

ALKALI GRANITE

AG-P4

Aegirine

	7	8	9	10	11	12
SiO2	52.94	52.51	52.65	52.95	52.66	52.94
Al2O3	0.28	0.34	0.11	0.32	0.19	0.35
Fe2O3	31.66	32.30	28.33	30.60	30.42	29.38
TiO2	1.42	1.43	1.35	1.76	1.79	1.48
Cr2O3	0.00	0.00	0.00	0.00	0.00	0.00
MgO	0.00	0.01	0.01	0.01	0.00	0.00
FeO	0.00	0.00	2.69	0.58	0.91	1.30
MnO	0.06	0.17	0.21	0.15	0.21	0.23
ZrO2	0.00	0.00	0.00	0.00	0.00	0.00
CaO	1.05	1.09	1.99	1.36	1.18	0.94
Na2O	13.84	13.83	12.66	13.46	13.36	13.35
Total	101.25	101.68	100.00	101.19	100.72	99.96

Recalculated on the basis of 4 cations with Fe3+ estimated assuming 6 oxygen atoms

Si	1.994	1.974	2.020	2.001	2.002	2.022
AlTET	0.006	0.015	0.000	0.000	0.000	0.000
AlOCT	0.007	0.000	0.005	0.014	0.009	0.016
Fe3	0.898	0.913	0.818	0.870	0.870	0.844
Ti	0.040	0.040	0.039	0.050	0.051	0.043
Cr	0.000	0.000	0.000	0.000	0.000	0.000
Mg	0.000	0.001	0.001	0.001	0.000	0.000
Fe2	0.000	0.000	0.086	0.018	0.029	0.041
Mn	0.002	0.005	0.007	0.005	0.007	0.007
Zr	0.000	0.000	0.000	0.000	0.000	0.000
Ca	0.042	0.044	0.082	0.055	0.048	0.038
Na	1.011	1.008	0.942	0.986	0.985	0.988
Oxyg	6.000	6.000	6.000	6.000	6.000	6.000
Mg Number	-	1.000	0.007	0.030	0.000	0.000

End members calculated according to Lindsley (1983)

Acmite	0.8976	0.9134	0.8181	0.8701	0.8702	0.8442
Jadeite	0.0069	0.0000	0.0050	0.0143	0.0085	0.0158
Fe3cats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Crcats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Alcats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Wo	0.4700	0.4786	0.4500	0.4626	0.4591	0.4413
En	-	0.5214	0.0036	0.0161	0.0000	0.0000
Fs	-	0.0000	0.5464	0.5213	0.5409	0.5587

ALKALI GRANITE

WLD-49

	Aegirine			Ferrohedenbergite			
	1	2 RIM	3	4	5	6	7*
SiO2	53.07	53.20	52.47	50.23	49.60	48.23	51.14
Al2O3	0.42	0.50	0.06	0.37	0.25	1.46	0.29
Fe2O3	29.18	29.50	28.94	5.59	5.42	0.00	12.47
TiO2	2.23	0.49	0.36	0.18	0.14	0.37	0.35
Cr2O3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MgO	0.06	0.13	0.00	0.56	0.61	5.54	0.48
FeO	1.23	0.83	2.54	21.75	21.77	20.17	14.83
MnO	0.27	0.10	0.34	0.90	0.72	0.58	0.64
ZrO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CaO	0.69	0.52	4.41	16.85	16.33	17.19	12.14
Na2O	13.58	13.42	11.76	3.23	3.22	0.76	6.38
Total	100.73	98.70	100.88	99.66	98.05	94.30	98.72

Recalculated on the basis of 4 cations with Fe3+ estimated assuming 6 oxygen atoms

Si	2.010	2.048	2.008	2.027	2.034	2.015	2.042
AlTET	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AlOCT	0.019	0.023	0.003	0.018	0.012	0.072	0.014
Fe3	0.832	0.855	0.833	0.170	0.167	0.000	0.375
Ti	0.064	0.014	0.010	0.005	0.004	0.012	0.011
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mg	0.003	0.007	0.000	0.034	0.037	0.345	0.029
Fe2	0.039	0.027	0.081	0.734	0.747	0.705	0.495
Mn	0.009	0.003	0.011	0.031	0.025	0.021	0.022
Zr	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ca	0.028	0.021	0.181	0.729	0.718	0.770	0.519
Na	0.997	1.002	0.873	0.253	0.256	0.062	0.494
Oxyg	6.000	6.000	6.000	6.000	6.000	6.032	6.000
Mg Number	0.080	0.218	0.000	0.044	0.048	0.329	0.055

End members calculated according to Lindsley (1983)

Acmite	0.8316	0.8547	0.8333	0.1698	0.1671	0.0000	0.3748
Jadeite	0.0187	0.0227	0.0027	0.0176	0.0121	0.0616	0.0136
Fe3cats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Crcats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Alcats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Wo	0.4298	0.4381	0.5070	0.4492	0.4423	0.3796	0.4471
En	0.0455	0.1225	0.0000	0.0242	0.0265	0.2039	0.0302
Fs	0.5247	0.4394	0.4930	0.5266	0.5311	0.4165	0.5227

* Aegirine-augite

ALKALI GRANITE

WLD-36

	1 CO[1]	2 CO[2]	3[1]	4[1]	5 CO[2]	6[1]	7 AMP[1]	8[2]
SiO2	50.72	50.80	50.29	49.71	49.47	49.85	50.15	49.93
Al2O3	0.16	0.14	0.27	0.26	0.24	0.19	0.23	0.29
Fe2O3	5.35	6.25	4.84	6.45	7.30	13.36	6.71	2.59
TiO2	0.15	0.22	0.15	0.22	0.34	0.25	0.23	0.35
Cr2O3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MgO	1.52	1.93	2.26	1.00	1.79	2.47	1.60	2.66
FeO	22.00	21.07	21.28	21.34	20.31	22.02	19.43	21.36
MnO	0.76	0.78	0.78	0.83	0.75	0.69	0.73	0.85
ZrO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CaO	17.28	17.11	17.44	16.05	17.20	18.33	15.72	19.00
Na2O	2.84	2.96	2.55	3.26	2.84	1.99	3.67	1.88
Total	100.78	101.26	99.87	99.12	100.23	99.15	98.46	98.91

Recalculated on the basis of 4 cations with Fe3+ estimated assuming 6 oxygen atoms

Si	2.021	2.011	2.015	2.017	1.984	2.015	2.029	2.017
AlTET	0.000	0.000	0.000	0.000	0.011	0.000	0.000	0.000
AlOCT	0.008	0.007	0.013	0.012	0.000	0.009	0.011	0.014
Fe3	0.160	0.186	0.146	0.197	0.220	0.102	0.204	0.079
Ti	0.004	0.007	0.005	0.007	0.010	0.008	0.007	0.011
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mg	0.090	0.114	0.135	0.060	0.107	0.149	0.097	0.160
Fe2	0.733	0.697	0.713	0.724	0.681	0.744	0.657	0.721
Mn	0.026	0.026	0.026	0.029	0.025	0.024	0.025	0.029
Zr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ca	0.738	0.726	0.749	0.698	0.739	0.794	0.682	0.822
Na	0.219	0.227	0.198	0.256	0.221	0.156	0.288	0.147
Oxyg	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000
Mg Number	0.110	0.140	0.159	0.077	0.136	0.167	0.128	0.182

End members calculated according to Lindsley (1983)

Acmite	0.1604	0.1861	0.1460	0.1969	0.2202	0.1021	0.2042	0.0788
Jadeite	0.0075	0.0065	0.0128	0.0124	0.0000	0.0091	0.0110	0.0138
Fe3cats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Crcats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Alcats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Wo	0.4491	0.4559	0.4474	0.4473	0.4797	0.4479	0.4429	0.4505
En	0.0604	0.0764	0.0879	0.0426	0.0706	0.0920	0.0713	0.0998
Fs	0.4905	0.4678	0.4647	0.5101	0.4496	0.4601	0.4858	0.4497

CO core
AMP in amphibole
1 ferrohedenbergite
2 hedenbergite

ALKALI GRANITE

WLD-36

	AG-DYKE 74-81						74-70
	Aegirine				Aeg.-augite		PX?
	9*	10	11	1	1 CO	2 CO	1
SiO2	51.92	52.41	52.91	53.36	48.66	49.92	48.38
Al2O3	0.64	0.43	0.25	0.53	0.25	0.26	0.30
Fe2O3	16.05	31.35	30.26	30.94	10.85	10.46	0.00
TiO2	0.30	2.00	1.56	1.31	0.18	0.18	0.07
Cr2O3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MgO	0.80	0.06	0.06	0.00	0.84	0.87	0.05
FeO	12.23	0.01	1.10	0.18	17.65	19.16	35.33
MnO	0.78	0.08	0.06	0.33	0.79	0.66	1.52
ZrO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CaO	9.89	0.29	0.27	0.34	15.46	15.08	8.86
Na2O	7.60	13.78	13.60	13.81	4.01	4.13	1.51
Total	100.21	100.41	100.07	100.80	98.69	100.73	96.02

Recalculated on the basis of 4 cations with Fe3+ estimated assuming 6 oxygen atoms

Si	2.028	1.993	2.018	2.017	1.981	1.991	2.101
AlTET	0.000	0.007	0.000	0.000	0.012	0.009	0.000
AlOCT	0.029	0.012	0.011	0.024	0.000	0.003	0.015
Fe3	0.472	0.897	0.869	0.880	0.332	0.314	0.000
Ti	0.009	0.057	0.045	0.037	0.006	0.005	0.002
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mg	0.047	0.003	0.003	0.000	0.051	0.052	0.003
Fe2	0.399	0.000	0.035	0.006	0.601	0.639	1.283
Mn	0.026	0.003	0.002	0.011	0.027	0.022	0.056
Zr	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ca	0.414	0.012	0.011	0.014	0.674	0.644	0.412
Na	0.576	1.016	1.006	1.012	0.316	0.319	0.127
Oxyg	6.000	6.000	6.000	6.000	6.000	6.000	6.047
Mg Number	0.104	0.880	0.089	0.000	0.078	0.075	0.003

End members calculated according to Lindsey (1983)

Acmite	0.4719	0.8968	0.8687	0.8801	0.3165	0.3141	0.0000
Jadeite	0.0295	0.0119	0.0112	0.0236	0.0000	0.0034	0.0154
Fe3cats	0.0000	0.0000	0.0000	0.0000	0.0158	0.0000	0.0000
Crcats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Alcats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Wo	0.4429	0.4543	0.4399	0.4469	0.4874	0.4793	0.2061
En	0.0582	0.4800	0.0497	0.0000	0.0401	0.0390	0.0020
Fs	0.4989	0.0657	0.5104	0.5531	0.4725	0.4818	0.7919

* aegirine-augite
CO core

ALKALI GRANITE

74-78

Aegirine

	1	2	3	4	5	6	7
SiO2	52.69	52.32	50.30	51.53	52.85	52.33	52.33
Al2O3	0.22	0.25	0.29	0.74	1.39	1.15	1.43
Fe2O3	31.99	28.96	31.19	28.18	30.91	30.64	30.41
TiO2	1.63	1.40	2.50	2.68	1.25	1.39	1.45
Cr2O3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MgO	0.02	0.01	0.03	0.00	0.07	0.06	0.07
FeO	0.66	2.97	0.33	1.56	0.00	0.00	0.00
MnO	0.18	0.06	0.12	0.19	0.60	0.71	0.63
ZrO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CaO	0.49	0.71	0.90	1.02	0.05	0.06	0.03
Na2O	13.58	12.91	13.10	13.15	13.93	13.68	14.03
Total	101.45	99.59	98.75	99.04	101.05	100.02	100.38

Recalculated on the basis of 4 cations with Fe3+ estimated assuming 6 oxygen atoms

Si	1.991	2.016	1.958	1.988	1.988	1.992	1.977
AlTET	0.009	0.000	0.013	0.012	0.012	0.008	0.023
AlOCT	0.001	0.011	0.000	0.022	0.049	0.044	0.041
Fe3	0.910	0.840	0.913	0.818	0.875	0.878	0.865
Ti	0.046	0.041	0.073	0.078	0.035	0.040	0.041
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mg	0.001	0.001	0.002	0.000	0.004	0.003	0.004
Fe2	0.021	0.096	0.011	0.050	0.000	0.000	0.000
Mn	0.006	0.002	0.004	0.006	0.019	0.023	0.020
Zr	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ca	0.020	0.029	0.038	0.042	0.002	0.002	0.001
Na	0.995	0.965	0.989	0.984	1.016	1.010	1.028
Oxyg	6.000	6.000	6.000	6.000	6.000	6.000	6.000
Mg Number	0.051	0.006	0.141	0.000	1.000	1.000	1.000

End members calculated according to Lindsley (1983)

Acmite	0.9098	0.8397	0.9135	0.8181	0.8747	0.8778	0.8646
Jadeite	0.0013	0.0114	0.0000	0.0218	0.0492	0.0439	0.0410
Fe3cats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Crcats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Alcats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Wo	0.4648	0.4345	0.4755	0.4302	0.4383	0.4401	0.4329
En	0.0275	0.0034	0.0740	0.0000	0.5617	0.5599	0.5671
Fs	0.5077	0.5621	0.4505	0.5698	0.0000	0.0000	0.0000

GRANOPHYRE

74-78

Aegirine

	8	9	10	11	12
SiO2	52.97	52.51	51.21	52.72	51.86
Al2O3	1.25	0.97	0.31	0.54	0.45
Fe2O3	29.73	29.63	33.62	33.47	32.68
TiO2	1.64	1.26	1.30	1.34	1.56
Cr2O3	0.00	0.00	0.00	0.00	0.00
MgO	0.06	0.04	0.05	0.03	0.09
FeO	0.94	1.54	0.00	0.00	0.00
MnO	0.54	0.50	0.23	0.10	0.22
ZrO2	0.00	0.00	0.00	0.00	0.00
CaO	0.02	0.11	0.16	0.18	0.08
Na2O	13.63	13.30	13.48	13.89	13.82
Total	100.78	99.86	100.36	102.27	100.76

Recalculated on the basis of 4 cations with Fe3+ estimated assuming 6 oxygen atoms

Si	2.002	2.009	1.962	1.974	1.969
AlTET	0.000	0.000	0.014	0.024	0.020
AlOCT	0.056	0.044	0.000	0.000	0.000
Fe3	0.846	0.853	0.969	0.943	0.934
Ti	0.047	0.036	0.037	0.038	0.045
Cr	0.000	0.000	0.000	0.000	0.000
Mg	0.003	0.002	0.003	0.002	0.005
Fe2	0.030	0.049	0.000	0.000	0.000
Mn	0.017	0.016	0.007	0.003	0.007
Zr	0.000	0.000	0.000	0.000	0.000
Ca	0.001	0.005	0.007	0.007	0.003
Na	0.999	0.986	1.001	1.009	1.017
Oxyg	6.000	6.000	6.000	6.000	6.000
Mg Number	0.103	0.044	1.000	1.000	1.000

End members calculated according to Lindsley (1983)

Acmite	0.8457	0.8530	0.9690	0.9434	0.9338
Jadeite	0.0557	0.0437	0.0000	0.0000	0.0000
Fe3cats	0.0000	0.0000	0.0000	0.0000	0.0000
Crcats	0.0000	0.0000	0.0000	0.0000	0.0000
Alcats	0.0000	0.0000	0.0000	0.0000	0.0000
Wo	0.4233	0.4288	0.4878	0.4753	0.4685
En	0.0591	0.0254	0.5122	0.5247	0.5315
Fs	0.5176	0.5459	0.0000	0.0000	0.0000

GRANITE

G-1

Ferrohedenbergite

	1
SiO2	51.30
Al2O3	0.83
Fe2O3	0.00
TiO2	0.01
Cr2O3	0.00
MgO	0.91
FeO	26.59
MnO	0.40
ZrO2	0.00
CaO	11.45
Na2O	0.41
Total	91.90

Recalculated on the basis of 4 cations with Fe3+ estimated assuming 6 oxygen atoms

Si	2.298
AlTET	0.000
AlOCT	0.044
Fe3	0.000
Ti	0.000
Cr	0.000
Mg	0.061
Fe2	0.996
Mn	0.015
Zr	0.000
Ca	0.550
Na	0.036
Oxyg	6.303

Mg Number 0.057

End members calculated according to Lindsley (1983)

Acmite	0.0000
Jadeite	0.0356
Fe3cats	0.0000
Crcats	0.0000
Alcats	0.0082
Wo	0.2707
En	0.0419
Fs	0.6874

HYBRID UNIT

H-2

Aegirine

	1	2	3	4 ?	5	6*	7	8	9
SiO2	53.70	53.84	53.37	52.71	53.17	51.38	52.17	51.53	51.46
Al2O3	0.84	0.39	1.74	0.19	0.50	0.21	0.18	0.17	0.22
Fe2O3	32.10	28.63	30.19	31.41	31.97	15.02	23.08	21.13	22.70
TiO2	0.49	3.17	0.22	0.83	0.90	0.29	1.39	0.75	0.80
Cr2O3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MgO	0.00	0.00	0.00	0.00	0.17	0.19	0.10	0.04	0.08
FeO	0.00	2.35	0.00	0.37	0.00	15.26	6.86	8.03	7.13
MnO	0.11	0.23	0.03	0.14	0.00	0.52	0.28	0.45	0.29
ZrO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CaO	0.22	0.15	0.03	0.38	0.06	11.94	5.30	7.60	6.02
Na2O	14.36	13.90	14.32	13.54	14.25	6.53	10.68	9.49	10.13
Total	101.82	102.67	99.91	99.57	101.02	101.33	100.04	99.19	98.83

Recalculated on the basis of 4 cations with Fe3+ estimated assuming 6 oxygen atoms

Si	2.000	2.003	2.011	2.022	1.998	2.013	2.020	2.023	2.022
AlTET	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000
AlOCT	0.037	0.017	0.077	0.009	0.020	0.010	0.008	0.008	0.010
Fe3	0.900	0.802	0.856	0.907	0.904	0.443	0.673	0.624	0.671
Ti	0.014	0.089	0.006	0.024	0.025	0.009	0.040	0.022	0.024
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mg	0.000	0.000	0.000	0.000	0.010	0.011	0.006	0.002	0.005
Fe2	0.000	0.073	0.000	0.012	0.000	0.500	0.222	0.263	0.234
Mn	0.003	0.007	0.001	0.005	0.000	0.017	0.009	0.015	0.010
Zr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ca	0.009	0.006	0.001	0.016	0.002	0.501	0.220	0.320	0.253
Na	1.037	1.003	1.046	1.007	1.038	0.496	0.802	0.722	0.772
Oxyg	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000
Mg Number	-	0.000	-	0.000	1.000	0.022	0.025	0.009	0.020

End members calculated according to Lindsley (1983)

Acmite	0.8997	0.8017	0.8564	0.9067	0.9042	0.4428	0.6726	0.6243	0.6711
Jadeite	0.0369	0.0171	0.0773	0.0086	0.0202	0.0097	0.0082	0.0079	0.0102
Fe3cats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Crcats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Alcats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Wo	0.4542	0.4039	0.4288	0.4612	0.4533	0.4720	0.4462	0.4720	0.4622
En	-	0.0000	-	0.0000	0.5467	0.0115	0.0140	0.0046	0.0105
Fs	-	0.5961	-	0.5388	0.0000	0.5165	0.5398	0.5234	0.5272

* aegirine-augite

HYBRID UNIT

H-2

Aegirine

	10	12 RI	13	14	15	16	17	18
SiO2	53.33	51.87	52.35	52.29	52.76	52.65	51.12	50.36
Al2O3	0.29	0.19	0.22	0.19	0.19	0.27	0.00	0.00
Fe2O3	24.89	28.57	27.20	28.79	23.19	26.62	30.71	29.48
TiO2	2.48	0.66	0.56	0.58	1.87	1.64	1.03	0.49
Cr2O3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MgO	0.06	0.03	0.07	0.09	0.09	0.04	0.00	0.00
FeO	4.89	2.11	3.96	2.83	6.50	4.09	0.00	0.30
MnO	0.31	0.25	0.39	0.24	0.54	0.27	0.00	0.00
ZrO2	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.13
CaO	2.82	3.45	4.14	2.79	4.36	3.58	0.44	2.26
Na2O	12.31	12.03	11.50	12.13	11.21	11.95	13.66	12.41
Total	101.37	99.16	100.39	99.92	100.71	101.11	97.22	95.42

Recalculated on the basis of 4 cations with Fe3+ estimated assuming 6 oxygen atoms

Si	2.020	2.012	2.014	2.015	2.024	2.007	2.003	2.020
AlTET	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AlOCT	0.013	0.009	0.010	0.009	0.009	0.012	0.000	0.000
Fe3	0.709	0.834	0.787	0.835	0.670	0.763	0.905	0.890
Ti	0.071	0.019	0.016	0.017	0.054	0.047	0.030	0.015
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mg	0.003	0.002	0.004	0.005	0.005	0.002	0.000	0.000
Fe2	0.155	0.068	0.127	0.091	0.208	0.130	0.000	0.010
Mn	0.010	0.008	0.013	0.008	0.018	0.009	0.000	0.000
Zr	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.003
Ca	0.114	0.143	0.171	0.115	0.179	0.146	0.018	0.097
Na	0.904	0.905	0.858	0.906	0.834	0.883	1.038	0.965
Oxyg	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000
Mg Number	0.021	0.025	0.031	0.054	0.024	0.017	-	0.000

End members calculated according to Lindsley (1983)

Acmite	0.7094	0.8339	0.7874	0.8346	0.6696	0.7634	0.9054	0.8899
Jadeite	0.0129	0.0087	0.0100	0.0086	0.0086	0.0121	0.0000	0.0000
Fe3cats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Crcats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Alcats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Wo	0.4119	0.4886	0.4790	0.4749	0.4244	0.4548	0.4619	0.4935
En	0.0126	0.0126	0.0159	0.0282	0.0139	0.0093	-	0.0000
Fs	0.5755	0.4987	0.5050	0.4969	0.5618	0.5359	-	0.5065

RI rim

HYBRID UNIT

H-6

Ferro-augite

	1	2	3 CO	4
SiO2	51.79	50.71	49.55	49.54
Al2O3	0.54	0.28	2.93	3.12
Fe2O3	0.00	0.00	0.42	0.00
TiO2	0.18	0.08	0.80	0.37
Cr2O3	0.00	0.00	0.00	0.00
MgO	8.62	6.21	8.97	9.53
FeO	16.71	18.01	16.75	16.09
MnO	0.79	0.58	0.40	0.52
ZrO2	0.00	0.00	0.00	0.00
CaO	20.06	19.07	16.09	15.51
Na2O	0.43	0.35	1.34	1.14
Total	99.12	95.29	97.25	95.82

Recalculated on the basis of 4 cations with Fe3+ estimated assuming 6 oxygen atoms

Si	2.023	2.091	1.953	1.973
AlTET	0.000	0.000	0.047	0.027
AlOCT	0.025	0.014	0.089	0.120
Fe3	0.000	0.000	0.013	0.000
Ti	0.005	0.002	0.024	0.011
Cr	0.000	0.000	0.000	0.000
Mg	0.502	0.382	0.527	0.566
Fe2	0.546	0.621	0.552	0.536
Mn	0.026	0.020	0.013	0.018
Zr	0.000	0.000	0.000	0.000
Ca	0.840	0.842	0.680	0.662
Na	0.033	0.028	0.102	0.088
Oxyg	6.025	6.086	6.000	6.014
Mg Number	0.479	0.381	0.488	0.514

End members calculated according to Lindsley (1983)

Acmite	0.0000	0.0000	0.0126	0.0000
Jadeite	0.0249	0.0136	0.0893	0.0880
Fe3cats	0.0000	0.0000	0.0000	0.0000
Crcats	0.0000	0.0000	0.0000	0.0000
Alcats	0.0000	0.0000	0.0000	0.0316
Wo	0.4199	0.4212	0.3460	0.3151
En	0.2779	0.2203	0.3194	0.3517
Fs	0.3022	0.3585	0.3346	0.3332

CO core in amphibole

QUARTZ SYENITE

QS-1

QS-3

Ferro-augite

	1	2	3	4	5	6	1*	2	3 AMP
SiO2	50.04	50.44	50.65	50.24	50.63	50.80	49.05	49.56	49.83
Al2O3	0.55	0.64	0.52	0.37	0.43	0.63	0.24	0.30	0.23
Fe2O3	1.06	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TiO2	0.30	0.54	0.22	0.02	0.19	0.43	0.14	0.31	0.25
Cr2O3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MgO	6.89	6.83	6.43	5.96	6.44	7.72	2.88	4.88	4.91
FeO	19.40	19.61	20.40	20.27	19.29	16.88	23.96	21.30	22.31
MnO	0.83	0.93	0.87	0.80	0.70	0.69	0.89	0.66	0.73
ZrO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CaO	20.26	20.36	20.44	20.43	20.90	20.87	19.70	19.44	19.60
Na2O	0.35	0.43	0.34	0.26	0.32	0.37	0.75	0.55	0.52
Total	99.69	100.20	99.87	98.35	98.90	98.39	97.61	97.00	98.38

Recalculated on the basis of 4 cations with Fe3+ estimated assuming 6 oxygen atoms

Si	1.976	1.979	1.999	2.018	2.013	2.009	2.021	2.029	2.016
AlTET	0.024	0.021	0.001	0.000	0.000	0.000	0.000	0.000	0.000
AlOCT	0.002	0.009	0.023	0.018	0.020	0.029	0.012	0.014	0.011
Fe3	0.032	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ti	0.009	0.016	0.007	0.001	0.006	0.013	0.004	0.010	0.008
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mg	0.406	0.399	0.378	0.357	0.382	0.455	0.177	0.298	0.296
Fe2	0.641	0.643	0.673	0.681	0.641	0.558	0.826	0.729	0.755
Mn	0.028	0.031	0.029	0.027	0.024	0.023	0.031	0.023	0.025
Zr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ca	0.857	0.856	0.864	0.879	0.890	0.884	0.870	0.853	0.849
Na	0.027	0.033	0.026	0.020	0.025	0.028	0.060	0.044	0.041
Oxyg	6.000	6.000	6.004	6.017	6.016	6.022	6.001	6.024	6.008
Mg Number	0.388	0.383	0.360	0.344	0.373	0.449	0.176	0.290	0.282

End members calculated according to Lindsley (1983)

Acmite	0.0268	0.0126	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Jadeite	0.0000	0.0089	0.0228	0.0175	0.0201	0.0284	0.0117	0.0145	0.0110
Fe3cats	0.0047	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Crcats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Alcats	0.0015	0.0000	0.0000	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000
Wo	0.4388	0.4343	0.4321	0.4396	0.4451	0.4416	0.4348	0.4264	0.4247
En	0.2175	0.2167	0.2043	0.1927	0.2070	0.2508	0.0997	0.1663	0.1621
Fs	0.3437	0.3490	0.3636	0.3677	0.3479	0.3076	0.4655	0.4073	0.4132

AMP in amphibole

* ferrohedenbergite

QUARTZ SYENITE

QS-3

Ferro-augite

	4 CO	5	6	7 RI	8	9	10 CO
SiO2	50.80	50.68	50.20	49.49	51.11	50.90	51.30
Al2O3	0.19	0.43	0.28	0.29	0.50	0.11	0.61
Fe2O3	0.00	0.00	0.03	0.00	0.00	0.00	0.00
TiO2	0.08	0.42	0.15	0.24	0.42	0.10	0.19
Cr2O3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MgO	3.86	5.33	3.88	4.71	5.78	4.79	6.77
FeO	24.99	23.75	25.11	23.54	22.20	21.96	19.99
MnO	0.78	0.65	0.76	0.68	0.82	0.64	0.58
ZrO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CaO	19.31	18.74	19.26	18.24	18.76	20.53	19.73
Na2O	0.55	0.55	0.58	0.58	0.60	0.44	0.61
Total	100.56	100.55	100.25	97.77	100.19	99.47	99.78

Recalculated on the basis of 4 cations with Fe3+ estimated assuming 6 oxygen atoms

Si	2.029	2.007	2.011	2.021	2.021	2.036	2.016
AlTET	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AlOCT	0.009	0.020	0.013	0.014	0.023	0.005	0.028
Fe3	0.000	0.000	0.001	0.000	0.000	0.000	0.000
Ti	0.002	0.013	0.005	0.007	0.012	0.003	0.006
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mg	0.230	0.315	0.232	0.287	0.341	0.286	0.397
Fe2	0.835	0.787	0.841	0.804	0.734	0.735	0.657
Mn	0.026	0.022	0.026	0.024	0.027	0.022	0.019
Zr	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ca	0.826	0.795	0.827	0.798	0.795	0.880	0.831
Na	0.043	0.042	0.045	0.046	0.046	0.034	0.046
Oxyg	6.014	6.008	6.000	6.012	6.022	6.025	6.013
Mg Number	0.216	0.286	0.216	0.263	0.317	0.280	0.376

End members calculated according to Lindsley (1983)

Acmite	0.0000	0.0000	0.0009	0.0000	0.0000	0.0000	0.0000
Jadeite	0.0089	0.0201	0.0132	0.0140	0.0233	0.0052	0.0283
Fe3cats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Crcats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Alcats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Wo	0.4132	0.3976	0.4138	0.3990	0.3974	0.4399	0.4154
En	0.1267	0.1721	0.1266	0.1580	0.1910	0.1568	0.2201
Fs	0.4602	0.4303	0.4596	0.4430	0.4116	0.4033	0.3646

CO core
RI rim

QUARTZ SYENITE

QS-5

Ferro-augite

	1	2	3	4
SiO2	50.41	50.52	49.94	49.63
Al2O3	0.58	0.59	0.44	0.58
Fe2O3	0.00	0.00	0.00	0.15
TiO2	0.35	0.26	0.12	0.32
Cr2O3	0.00	0.00	0.00	0.00
MgO	6.00	5.79	5.56	6.21
FeO	20.85	21.13	20.84	19.74
MnO	0.61	0.66	0.68	0.65
ZrO2	0.00	0.00	0.00	0.00
CaO	20.59	20.85	20.46	20.90
Na2O	0.35	0.33	0.32	0.30
Total	99.74	100.13	98.36	98.47

Recalculated on the basis of 4 cations with Fe3+ estimated assuming 6 oxygen atoms

Si	1.997	1.996	2.010	1.986
AlTET	0.003	0.004	0.000	0.014
AlOCT	0.024	0.023	0.021	0.013
Fe3	0.000	0.000	0.000	0.004
Ti	0.010	0.008	0.004	0.010
Cr	0.000	0.000	0.000	0.000
Mg	0.354	0.341	0.334	0.370
Fe2	0.691	0.698	0.701	0.661
Mn	0.020	0.022	0.023	0.022
Zr	0.000	0.000	0.000	0.000
Ca	0.874	0.883	0.882	0.896
Na	0.027	0.025	0.025	0.023
Oxyg	6.007	6.005	6.012	6.000
Mg Number	0.339	0.328	0.322	0.359

End members calculated according to Lindsley (1983)

Acmite	0.0000	0.0000	0.0000	0.0044
Jadeite	0.0236	0.0233	0.0209	0.0135
Fe3cats	0.0000	0.0000	0.0000	0.0000
Crcats	0.0000	0.0000	0.0000	0.0000
Alcats	0.0000	0.0000	0.0000	0.0000
Wo	0.4369	0.4413	0.4412	0.4503
En	0.1909	0.1833	0.1801	0.1975
Fs	0.3722	0.3754	0.3788	0.3522

QUARTZ SYENITE

WLD-100

Ferro-augite

	1*	2	3	4 CO	5	6	7	8	9
SiO2	51.11	50.60	50.51	50.15	50.35	49.65	49.96	50.53	49.96
Al2O3	1.38	0.46	0.17	0.24	0.51	0.21	0.22	0.22	0.38
Fe2O3	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TiO2	0.61	0.41	0.09	0.24	0.38	0.11	0.00	0.06	0.35
Cr2O3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MgO	9.71	5.07	3.98	4.96	5.26	3.76	3.94	4.09	4.67
FeO	14.89	23.16	24.32	21.51	22.10	24.59	24.15	23.29	22.92
MnO	0.65	0.56	0.78	0.67	0.57	0.73	0.71	0.66	0.5[illegible]
ZrO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CaO	20.15	20.24	20.15	20.26	20.10	19.63	19.87	20.11	20.0[illegible]
Na2O	0.61	0.47	0.43	0.44	0.49	0.46	0.41	0.40	0.4[illegible]
Total	99.11	101.07	100.43	98.47	99.76	99.14	99.26	99.36	99.4[illegible]

Recalculated on the basis of 4 cations with Fe3+ estimated assuming 6 oxygen atoms

Si	1.976	1.994	2.018	2.024	2.003	2.012	2.019	2.036	2.004
AlTET	0.024	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AlOCT	0.039	0.015	0.008	0.011	0.024	0.010	0.010	0.010	0.01[illegible]
Fe3	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ti	0.018	0.012	0.003	0.007	0.011	0.003	0.000	0.002	0.01[illegible]
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mg	0.560	0.298	0.237	0.298	0.312	0.227	0.237	0.246	0.279
Fe2	0.482	0.763	0.812	0.726	0.735	0.833	0.816	0.785	0.769
Mn	0.021	0.019	0.026	0.023	0.019	0.025	0.024	0.023	0.020
Zr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ca	0.835	0.854	0.862	0.876	0.857	0.852	0.860	0.868	0.862
Na	0.046	0.036	0.033	0.034	0.038	0.036	0.032	0.031	0.038
Oxyg	6.003	6.000	6.008	6.020	6.008	6.003	6.008	6.027	6.004
Mg Number	0.538	0.281	0.226	0.291	0.298	0.214	0.225	0.238	0.266

End members calculated according to Lindsley (1983)

Acmite	0.0000	0.0030	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Jadeite	0.0392	0.0150	0.0080	0.0114	0.0239	0.0100	0.0105	0.0104	0.0180
Fe3cats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Crcats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Alcats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Wo	0.4174	0.4287	0.4312	0.4380	0.4285	0.4262	0.4302	0.4340	0.4308
En	0.3132	0.1603	0.1284	0.1637	0.1702	0.1229	0.1284	0.1349	0.151[illegible]
Fs	0.2694	0.4110	0.4403	0.3983	0.4013	0.4509	0.4414	0.4311	0.417[illegible]

CO core (in amphibole)
* augite

SYENITE

74-17				74-14		
	Ferro-augite			Ferro-hedenbergite		
	1	2	3 OPX	1	2	3
SiO2	50.98	50.00	50.33	50.19	49.89	50.35
Al2O3	0.42	0.32	0.21	0.18	0.17	0.07
Fe2O3	0.36	2.23	0.00	0.00	0.00	0.00
TiO2	0.21	0.07	0.02	0.10	0.08	0.02
Cr2O3	0.00	0.00	0.00	0.00	0.00	0.00
MgO	5.87	6.57	2.81	1.50	1.33	1.53
FeO	23.32	19.66	44.57	29.16	28.49	27.97
MnO	0.76	0.75	1.45	0.91	0.94	0.97
ZrO2	0.00	0.00	0.00	0.00	0.00	0.00
CaO	19.53	20.41	0.39	20.06	20.56	20.90
Na2O	0.34	0.34	0.09	0.32	0.32	0.22
Total	101.79	100.34	99.87	102.42	101.78	102.03

Recalculated on the basis of 4 cations with Fe3+ estimated assuming 6 oxygen atoms

Si	1.992	1.970	2.145	2.008	2.008	2.019
AlTET	0.008	0.015	0.000	0.000	0.000	0.000
AlOCT	0.011	0.000	0.011	0.008	0.008	0.003
Fe3	0.011	0.066	0.000	0.000	0.000	0.000
Ti	0.006	0.002	0.001	0.003	0.002	0.001
Cr	0.000	0.000	0.000	0.000	0.000	0.000
Mg	0.342	0.386	0.178	0.089	0.080	0.091
Fe2	0.762	0.648	1.588	0.976	0.959	0.938
Mn	0.025	0.025	0.052	0.031	0.032	0.033
Zr	0.000	0.000	0.000	0.000	0.000	0.000
Ca	0.818	0.862	0.018	0.860	0.886	0.898
Na	0.026	0.026	0.007	0.025	0.025	0.017
Oxyg	6.000	6.000	6.147	6.003	6.002	6.013
Mg Number	0.310	0.373	0.101	0.084	0.077	0.089

End members calculated according to Lindsley (1983)

Acmite	0.0105	0.0260	0.0000	0.0000	0.0000	0.0000
Jadeite	0.0111	0.0000	0.0074	0.0085	0.0081	0.0033
Fe3cats	0.0000	0.0401	0.0000	0.0000	0.0000	0.0000
Crcats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Alcats	0.0000	0.0000	0.0031	0.0000	0.0000	0.0000
Wo	0.4140	0.4239	0.0073	0.4299	0.4432	0.4489
En	0.1815	0.2151	0.1003	0.0479	0.0428	0.0490
Fs	0.4045	0.3611	0.8924	0.5222	0.5140	0.5021

OPX orthoferrosilite

QUARTZ SYENITE

74-101

	1 [1]	2 [2]	3 [3]	4 [4]
SiO2	50.65	48.91	49.86	49.11
Al2O3	0.60	0.22	0.06	0.58
Fe2O3	0.00	2.22	0.11	3.27
TiO2	0.07	0.07	0.05	0.12
Cr2O3	0.00	0.00	0.00	0.00
MgO	2.65	2.97	2.81	2.72
FeO	32.30	23.59	25.51	24.52
MnO	0.79	1.00	1.01	1.00
ZrO2	0.00	0.00	0.00	0.00
CaO	11.40	20.95	20.94	20.18
Na2O	0.17	0.39	0.28	0.56
Total	98.63	100.32	100.63	102.06

Recalculated on the basis of 4 cations with Fe3+ estimated assuming 6 oxygen atoms

Si	2.120	1.974	2.006	1.955
AlTET	0.000	0.010	0.000	0.027
AlOCT	0.030	0.000	0.003	0.000
Fe3	0.000	0.067	0.003	0.098
Ti	0.002	0.002	0.002	0.004
Cr	0.000	0.000	0.000	0.000
Mg	0.165	0.179	0.169	0.161
Fe2	1.130	0.796	0.858	0.817
Mn	0.028	0.034	0.034	0.034
Zr	0.000	0.000	0.000	0.000
Ca	0.511	0.906	0.903	0.861
Na	0.014	0.031	0.022	0.043
Oxyg	6.130	6.000	6.000	6.000
Mg Number	0.128	0.183	0.164	0.165

End members calculated according to Lindsley (1983)

Acmite	0.0000	0.0305	0.0034	0.0432
Jadeite	0.0138	0.0000	0.0028	0.0000
Fe3cats	0.0000	0.0369	0.0000	0.0547
Crcats	0.0000	0.0000	0.0000	0.0000
Alcats	0.0158	0.0000	0.0000	0.0000
Wo	0.2477	0.4498	0.4531	0.4247
En	0.0960	0.1008	0.0898	0.0950
Fs	0.6564	0.4494	0.4571	0.4803

1 sub-calcic augite
2 ferro-augite
3 hedenbergite
4 ferro-hedenbergite

QUARTZ SYENITE HYBRID (DIORITE)

QS-10

	1*	2 CO[1]	3[1]	4*	5[1]
SiO2	51.15	53.03	53.50	51.88	52.81
Al2O3	3.85	0.28	0.12	2.06	0.14
Fe2O3	0.00	0.00	0.00	0.00	0.00
TiO2	0.43	0.00	0.02	0.78	0.00
Cr2O3	0.00	0.00	0.00	0.00	0.00
MgO	13.72	11.40	11.71	13.10	11.65
FeO	16.22	10.71	9.55	8.99	9.12
MnO	0.35	0.16	0.30	0.28	0.21
ZrO2	0.00	0.00	0.00	0.00	0.00
CaO	9.68	23.23	24.15	20.45	24.15
Na2O	0.93	0.20	0.13	0.53	0.10
Total	96.33	99.01	99.48	98.07	98.18

Recalculated on the basis of 4 cations with Fe3+ estimated assuming 6 oxygen atoms

Si	1.996	2.026	2.029	1.974	2.027
AlTET	0.004	0.000	0.000	0.026	0.000
AlOCT	0.173	0.013	0.005	0.067	0.006
Fe3	0.000	0.000	0.000	0.000	0.000
Ti	0.013	0.000	0.001	0.022	0.000
Cr	0.000	0.000	0.000	0.000	0.000
Mg	0.798	0.649	0.662	0.743	0.667
Fe2	0.529	0.342	0.303	0.286	0.293
Mn	0.012	0.005	0.010	0.009	0.007
Zr	0.000	0.000	0.000	0.000	0.000
Ca	0.405	0.951	0.981	0.834	0.993
Na	0.070	0.015	0.010	0.039	0.007
Oxyg	6.062	6.024	6.027	6.023	6.026
Mg Number	0.601	0.655	0.686	0.722	0.695

End members calculated according to Lindsley (1983)

Acmite	0.0000	0.0000	0.0000	0.0000	0.0000
Jadeite	0.0704	0.0126	0.0054	0.0391	0.0063
Fe3cats	0.0000	0.0000	0.0000	0.0000	0.0000
Crcats	0.0000	0.0000	0.0000	0.0000	0.0000
Alcats	0.1029	0.0000	0.0000	0.0275	0.0000
Wo	0.1509	0.4753	0.4906	0.4031	0.4966
En	0.5105	0.3436	0.3495	0.4309	0.3498
Fs	0.3386	0.1811	0.1599	0.1659	0.1536

CO core
* augite
1 salite

QUARTZ SYENITE HYBRID (DIORITE)

QSP-1 PEGMATITE

	Augite			QSP-1 Salite	
	1	2	3	1 CO	2 CO
SiO2	51.80	50.31	51.77	53.09	53.76
Al2O3	2.41	4.57	2.54	0.06	0.28
Fe2O3	0.00	0.00	0.00	0.00	0.00
TiO2	1.04	1.88	1.14	0.00	0.14
Cr2O3	0.00	0.00	0.00	0.00	0.00
MgO	13.78	13.92	12.53	11.51	13.07
FeO	8.12	9.45	9.21	9.56	7.96
MnO	0.30	0.23	0.29	0.35	0.24
ZrO2	0.00	0.00	0.00	0.00	0.00
CaO	21.12	16.14	20.07	24.33	22.67
Na2O	0.55	1.03	0.49	0.14	0.21
Total	99.12	97.53	98.04	99.04	98.33

Recalculated on the basis of 4 cations with Fe3+ estimated assuming 6 oxygen atoms

Si	1.942	1.912	1.978	2.023	2.043
AlTET	0.058	0.088	0.022	0.000	0.000
AlOCT	0.048	0.117	0.092	0.003	0.013
Fe3	0.000	0.000	0.000	0.000	0.000
Ti	0.029	0.054	0.033	0.000	0.004
Cr	0.000	0.000	0.000	0.000	0.000
Mg	0.770	0.789	0.714	0.654	0.740
Fe2	0.255	0.300	0.294	0.305	0.253
Mn	0.010	0.007	0.009	0.011	0.008
Zr	0.000	0.000	0.000	0.000	0.000
Ca	0.848	0.657	0.822	0.994	0.923
Na	0.040	0.076	0.036	0.010	0.015
Oxyg	6.004	6.030	6.050	6.020	6.046
Mg Number	0.752	0.724	0.708	0.682	0.745

End members calculated according to Lindsley (1983)

Acmite	0.0000	0.0000	0.0000	0.0000	0.0000
Jadeite	0.0400	0.0759	0.0363	0.0027	0.0125
Fe3cats	0.0000	0.0000	0.0000	0.0000	0.0000
Crcats	0.0000	0.0000	0.0000	0.0000	0.0000
Alcats	0.0084	0.0409	0.0559	0.0000	0.0000
Wo	0.4200	0.3082	0.3828	0.4968	0.4616
En	0.4359	0.5010	0.4370	0.3433	0.4013
Fs	0.1441	0.1908	0.1802	0.1600	0.1371

CO core

MAFICS

DM-1

	Augite				
	1	2	3	4	5 CHL
SiO2	50.00	52.30	50.28	50.91	53.92
Al2O3	4.14	1.89	4.12	2.85	2.82
Fe2O3	0.25	0.00	0.00	0.00	0.00
TiO2	2.02	1.23	1.81	1.24	0.04
Cr2O3	0.00	0.00	0.00	0.00	0.00
MgO	13.62	14.53	13.57	13.58	11.57
FeO	8.69	8.94	8.21	7.95	10.57
MnO	0.17	0.28	0.13	0.17	0.58
ZrO2	0.00	0.00	0.00	0.00	0.00
CaO	20.63	19.86	20.88	20.86	18.53
Na2O	0.44	0.37	0.47	0.42	0.57
Total	99.95	99.40	99.47	97.98	98.60

Recalculated on the basis of 4 cations with Fe3+ estimated assuming 6 oxygen atoms

Si	1.865	1.958	1.880	1.932	2.058
AlTET	0.135	0.042	0.120	0.068	0.000
AlOCT	0.047	0.042	0.061	0.060	0.127
Fe3	0.007	0.000	0.000	0.000	0.000
Ti	0.057	0.035	0.051	0.035	0.001
Cr	0.000	0.000	0.000	0.000	0.000
Mg	0.757	0.811	0.756	0.768	0.658
Fe2	0.271	0.280	0.257	0.252	0.337
Mn	0.005	0.009	0.004	0.005	0.019
Zr	0.000	0.000	0.000	0.000	0.000
Ca	0.824	0.797	0.836	0.848	0.758
Na	0.032	0.027	0.034	0.031	0.042
Oxyg	6.000	6.021	6.005	6.016	6.101
Mg Number	0.736	0.743	0.747	0.753	0.661

End members calculated according to Lindsley (1983)

Acmite	0.0070	0.0000	0.0000	0.0000	0.0000
Jadeite	0.0248	0.0269	0.0341	0.0309	0.0422
Fe3cats	0.0000	0.0000	0.0000	0.0000	0.0000
Crcats	0.0000	0.0000	0.0000	0.0000	0.0000
Alcats	0.0219	0.0150	0.0274	0.0286	0.0847
Wo	0.4047	0.3909	0.4045	0.4098	0.3365
En	0.4384	0.4528	0.4446	0.4443	0.4386
Fs	0.1569	0.1563	0.1509	0.1459	0.2248

CHL in chlorite

AENIGMATITE (ALKALI GRANITE)

AG-P1

	1	2	3	4	5
SiO2	42.97	41.24	42.25	41.49	41.48
Al2O3	0.13	0.59	0.22	0.60	0.29
TiO2	10.42	9.71	10.48	10.37	10.30
ZrO2	0.04	0.00	0.00	0.03	0.04
Nb2O3	0.00	0.00	0.00	0.00	0.00
MgO	0.04	0.03	0.03	0.02	0.03
FeO	41.01	40.67	40.94	41.79	40.17
MnO	1.30	1.28	1.37	1.45	1.32
CaO	0.03	0.17	0.04	0.15	0.07
Na2O	7.75	7.85	7.91	7.84	8.03
K2O	0.01	0.01	0.00	0.00	0.00
Cl	0.00	0.00	0.00	0.04	0.00
F	0.03	0.01	0.00	0.00	0.01
O=F,Cl	0.01	0.00	0.00	0.01	0.00
Total	103.72	101.56	103.24	103.77	101.74

Recalculated on the basis of 14 cations with Fe3+ estimated assuming 20 oxygen atoms

Si	5.926	5.786	5.844	5.718	5.808
Al	0.021	0.098	0.036	0.097	0.048
Fe3	0.033	0.420	0.217	0.407	0.342
Ti	1.081	1.024	1.090	1.075	1.085
Zr	0.003	0.000	0.000	0.002	0.003
Nb	0.000	0.000	0.000	0.000	0.000
Mg	0.008	0.006	0.006	0.004	0.006
Fe2	4.697	4.352	4.519	4.410	4.362
Mn	0.152	0.152	0.161	0.169	0.157
Ca	0.004	0.026	0.006	0.022	0.011
Na	2.072	2.135	2.121	2.095	2.180
K	0.002	0.002	0.000	0.000	0.000
Cl	0.000	0.000	0.000	0.009	0.000
F	0.013	0.004	0.000	0.000	0.004
Si+Al	5.948	5.883	5.880	5.816	5.856

AENIGMATITE (ALKALI GRANITE)

	AG-P2					AG-P4
	1	2	3	4	5	1
SiO2	42.09	41.63	42.06	41.88	42.32	41.10
Al2O3	0.48	0.55	0.35	0.14	0.02	0.72
TiO2	9.63	10.45	9.60	10.74	10.29	10.46
ZrO2	0.00	0.00	0.00	0.00	0.00	0.00
Nb2O3	0.00	0.00	0.00	0.00	0.00	0.00
MgO	0.03	0.02	0.02	0.00	0.00	0.00
FeO	40.91	41.26	41.69	37.67	36.66	39.67
MnO	0.95	1.23	1.03	1.13	1.52	1.22
CaO	0.12	0.13	0.08	0.03	0.00	0.17
Na2O	7.63	7.92	7.81	7.90	7.98	7.36
K2O	0.02	0.02	0.00	0.00	0.00	0.03
Cl	0.00	0.00	0.00	0.03	0.00	0.03
F	0.00	0.00	0.00	0.00	0.05	0.01
O=F,Cl	0.00	0.00	0.00	0.01	0.02	0.01
Total	101.86	103.21	102.64	99.51	98.82	100.76

Recalculated on the basis of 14 cations with Fe3+ estimated assuming 20 oxygen atoms

Si	5.898	5.757	5.848	5.987	6.077	5.841
Al	0.079	0.090	0.057	0.024	0.003	0.121
Fe3	0.172	0.350	0.344	0.000	0.000	0.000
Ti	1.015	1.087	1.004	1.155	1.111	1.118
Zr	0.000	0.000	0.000	0.000	0.000	0.000
Nb	0.000	0.000	0.000	0.000	0.000	0.000
Mg	0.006	0.004	0.004	0.000	0.000	0.000
Fe2	4.623	4.422	4.504	4.504	4.402	4.715
Mn	0.113	0.144	0.121	0.137	0.185	0.147
Ca	0.018	0.019	0.012	0.005	0.000	0.026
Na	2.073	2.124	2.105	2.190	2.222	2.028
K	0.004	0.004	0.000	0.000	0.000	0.005
Cl	0.000	0.000	0.000	0.007	0.000	0.007
F	0.000	0.000	0.000	0.000	0.023	0.004
Si+Al	5.977	5.847	5.906	6.011	6.080	5.961

AENIGMATITE (ALKALI GRANITE)

WLD-49

	1	2	3	4	5	6	7	8 AMP
SiO2	42.44	41.61	41.63	41.27	42.01	40.71	41.29	41.96
Al2O3	0.06	0.38	0.23	0.57	0.30	1.03	0.39	0.20
TiO2	10.32	10.43	9.90	10.64	10.62	10.31	10.19	10.35
ZrO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nb2O3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MgO	0.02	0.06	0.05	0.05	0.02	0.16	0.00	0.04
FeO	38.80	39.14	39.10	39.07	38.63	37.41	37.94	37.50
MnO	1.19	0.99	1.12	1.05	0.45	0.76	0.95	0.99
CaO	0.00	0.15	0.10	0.25	0.08	0.39	0.16	0.13
Na2O	7.54	7.70	7.83	7.94	7.60	7.41	7.28	7.70
K2O	0.00	0.00	0.08	0.01	0.01	0.01	0.02	0.01
Cl	0.03	0.01	0.27	0.00	0.01	0.01	0.01	0.00
F	0.02	0.02	0.06	0.00	0.00	0.05	0.02	0.06
O=F,Cl	0.02	0.01	0.09	0.00	0.00	0.02	0.01	0.03
Total	100.40	100.48	100.28	100.85	99.73	98.23	98.24	98.91

Recalculated on the basis of 14 cations with Fe3+ estimated assuming 20 oxygen atoms

Si	6.040	5.905	5.919	5.821	6.008	5.897	6.005	6.036
Al	0.010	0.064	0.039	0.095	0.051	0.176	0.067	0.034
Fe3	0.000	0.019	0.179	0.179	0.000	0.000	0.000	0.000
Ti	1.104	1.113	1.059	1.129	1.142	1.123	1.115	1.120
Zr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Nb	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mg	0.004	0.013	0.011	0.011	0.004	0.035	0.000	0.009
Fe2	4.618	4.626	4.471	4.430	4.620	4.532	4.615	4.512
Mn	0.143	0.119	0.135	0.125	0.055	0.093	0.117	0.121
Ca	0.000	0.023	0.015	0.038	0.012	0.061	0.025	0.020
Na	2.080	2.119	2.159	2.171	2.107	2.081	2.053	2.148
K	0.000	0.000	0.015	0.002	0.002	0.002	0.004	0.002
Cl	0.007	0.002	0.065	0.000	0.002	0.002	0.002	0.000
F	0.009	0.009	0.027	0.000	0.000	0.023	0.009	0.027
Si+Al	6.050	5.969	5.958	5.916	6.058	6.073	6.072	6.070

ALLANITE (HYBRID UNIT)

H-6

	1	2	3 BR	4 OR	5 OR	6 BR	7 BRO	8 OR
SiO2	29.78	30.44	30.15	29.61	30.76	29.88	29.56	29.55
TiO2	2.65	2.57	3.71	4.23	5.20	2.98	4.03	4.49
Al2O3	9.77	9.15	8.54	8.45	8.80	9.25	-	8.64
FeO	16.17	16.78	15.94	13.81	12.76	15.59	14.97	15.98
MgO	0.42	0.54	0.73	0.55	0.60	0.59	-	0.51
MnO	0.30	0.17	0.21	0.21	0.30	0.19	-	0.23
CaO	9.08	9.49	9.33	7.21	6.68	9.22	7.79	7.43
Na2O	0.00	0.05	0.02	0.06	0.07	0.00	0.12	0.12
K2O	0.00	0.01	0.01	0.01	0.01	0.00	-	0.04
La2O3	6.93	6.20	7.23	5.79	6.03	6.95	6.68	-
Ce2O3	12.94	12.72	13.44	10.37	10.67	12.63	11.11	-
Nd2O3	4.41	4.71	3.99	3.49	3.41	3.98	3.52	-
Sm2O3	1.77	1.89	1.90	1.57	1.69	2.12	1.73	-
Y2O3	0.31	0.35	0.09	0.13	0.33	0.11	0.24	-
Nb2O5	0.00	0.00	0.00	0.00	0.00	0.01	0.04	-
Ta2O5	0.21	0.19	0.28	0.24	0.27	0.25	0.27	-
ThO2	0.03	0.11	0.08	0.56	0.88	0.08	0.18	-
ZrO2	0.00	0.00	0.06	0.00	0.00	0.00	0.05	-
P2O5	0.00	0.02	0.00	0.03	0.13	0.01	-	0.03
F	0.31	0.20	0.26	0.27	0.27	0.18	-	0.06
Cl	0.00	0.00	0.01	0.04	0.07	0.00	-	0.03
O=F,Cl	0.13	0.08	0.11	0.12	0.13	0.08	-	0.03
Total	94.95	95.51	95.87	86.51	88.80	93.94	80.29	67.08

Recalculated on the basis of 13 oxygen atoms

Si	2.927	2.965	2.970	3.119	3.169	2.968	3.663	3.185
Ti	0.196	0.188	0.275	0.335	0.403	0.223	0.376	0.364
Al	1.132	1.050	0.991	1.049	1.068	1.083	0.000	1.098
Fe	1.329	1.367	1.313	1.216	1.099	1.295	1.551	1.440
Mg	0.062	0.078	0.107	0.086	0.092	0.087	0.000	0.082
Mn	0.025	0.014	0.018	0.019	0.026	0.016	0.000	0.021
Ca	0.956	0.990	0.985	0.814	0.737	0.981	1.034	0.858
La	0.251	0.223	0.263	0.225	0.229	0.255	0.305	0.000
Ce	0.466	0.454	0.485	0.400	0.402	0.459	0.504	0.000
Nd	0.155	0.164	0.140	0.131	0.125	0.141	0.156	0.000
Sm	0.060	0.063	0.064	0.057	0.060	0.073	0.074	0.000
Y	0.016	0.018	0.005	0.007	0.018	0.006	0.016	0.000
Ta	0.006	0.005	0.008	0.007	0.008	0.007	0.009	0.000
Th	0.001	0.002	0.002	0.013	0.021	0.002	0.005	0.000
Zr	0.000	0.000	0.003	0.000	0.000	0.000	0.003	0.000
P	0.000	0.002	0.000	0.003	0.011	0.001	0.000	0.003
Cats	7.580	7.583	7.627	7.481	7.469	7.597	7.695	7.050

BR brown
OR orange

Apatite

	Syenite WLD-100					QS-3			QS-5 (AMP)	
			(AMP)		(AMP)					
SiO2	0.59	0.69	0.33	0.51	0.21	1.31	0.29	0.61	0.32	0.29
TiO2	0.01	0.14	0.07	0.04	0.01	0.00	0.07	0.00	0.00	0.15
Al2O3	0.00	0.00	0.02	0.02	0.02	0.06	0.01	0.01	0.00	0.00
FeO	0.04	0.47	0.39	0.28	0.29	0.08	0.25	0.09	0.12	0.35
MgO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MnO	0.04	0.04	0.06	0.01	0.01	0.07	0.09	0.03	0.11	0.13
CaO	52.48	52.83	53.74	54.42	54.46	51.95	53.92	52.70	54.12	54.89
Na2O	0.25	0.19	0.21	0.20	0.21	0.20	0.22	0.21	0.10	0.13
K2O	0.02	0.00	0.01	0.09	0.02	0.20	0.00	0.00	0.00	0.01
Y2O3	0.27	0.30	0.23	0.20	0.17	0.56	0.05	0.49	0.05	0.00
La2O3	0.27	0.27	0.21	0.19	0.15	0.58	0.34	0.41	0.11	0.21
Ce2O3	0.83	0.69	0.64	0.62	0.53	1.38	0.69	1.27	0.36	0.46
Nd2O3	0.42	0.29	0.34	0.53	0.26	1.02	0.30	0.67	0.21	0.20
Sm2O3	0.00	0.14	0.00	0.16	0.14	0.29	0.05	0.24	0.05	0.10
Ta2O5	0.00	0.00	0.08	0.00	0.02	0.00	0.00	0.00	0.00	0.01
Nb2O5	0.00	0.00	0.00	0.00	0.00	0.02	0.12	0.07	0.00	0.00
P2O5	41.65	41.03	42.31	43.05	44.19	40.61	42.70	41.64	41.42	42.90
ThO2	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
ZrO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00
UO2	-	-	-	-	-	-	-	-	0.04	0.00
F	3.65	3.83	3.63	2.99	3.56	3.63	3.46	3.84	3.54	2.68
Cl	0.12	0.08	0.10	0.05	0.05	0.04	0.02	0.03	0.17	0.11
O=F,Cl	1.56	1.63	1.55	1.27	1.51	1.53	1.46	1.62	1.53	1.15
Total	99.08	99.43	100.82	102.09	102.79	100.47	101.12	100.70	99.27	101.47

AMP in amphibole

Apatite

	Syenite QS-1 (AMP)	(AMP)	(OP)	QS-3 (AMP)	(RED)		QS-5		(ILM)	
SiO2	0.41	0.46	0.44	0.66	0.27	0.38	0.30	0.36	0.28	0.33
TiO2	0.01	0.02	0.00	0.00	0.11	0.07	0.03	0.00	0.24	0.00
Al203	0.02	0.02	0.02	0.00	0.01	0.03	0.01	0.00	0.00	0.00
FeO	0.34	0.35	0.16	0.54	0.48	0.10	0.12	0.09	0.42	0.11
MgO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MnO	0.11	0.06	0.02	0.04	0.09	0.00	0.04	0.03	0.13	0.11
CaO	52.28	53.12	52.43	53.95	54.51	52.48	55.15	55.49	56.26	54.81
Na20	0.08	0.07	0.12	0.22	0.18	0.26	0.14	0.18	0.14	0.11
K20	0.01	0.00	0.02	0.02	0.08	0.08	0.01	0.00	0.01	0.00
La203	-	-	-	-	-	-	-	-	-	-
Ce203	-	-	-	-	-	-	-	-	-	-
Nd203	-	-	-	-	-	-	-	-	-	-
Sm203	-	-	-	-	-	-	-	-	-	-
P205	41.70	41.61	41.32	41.36	42.70	41.77	43.01	42.98	42.90	41.42
F	3.09	3.86	3.91	4.21	3.46	4.12	2.63	2.66	2.68	3.54
Cl	0.12	0.21	0.17	0.03	0.02	0.02	0.21	0.17	0.11	0.17
O=F,Cl	1.33	1.67	1.68	1.78	1.46	1.74	1.15	1.16	1.15	1.53
Total	96.84	98.11	96.93	99.25	100.45	97.57	100.50	100.80	102.02	99.07

OP in opaque ILM in ilmenite AMP in amphibole

Apatite

	Syenite hybrid QSP-1P (F)	(F)	(Cl) (AMP)			QS-10 (AMP)	(GRD)	(GRD)	QSP-1 (AMP)	(AMP)
SiO2	0.04	0.05	0.18	0.31	0.08	0.24	0.23	0.16	0.12	0.23
TiO2	0.04	0.09	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Al203	0.02	0.00	0.01	0.03	0.00	0.02	0.00	0.02	0.00	0.01
FeO	0.02	0.05	0.29	0.07	0.05	0.30	0.07	0.10	0.23	0.24
MgO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MnO	0.02	0.02	0.14	0.03	0.00	0.06	0.01	0.13	0.02	0.03
CaO	54.77	54.65	52.72	54.00	56.71	54.15	55.61	55.29	54.68	54.37
Na20	0.01	0.01	0.17	0.01	0.02	0.07	0.07	0.13	0.10	0.02
K20	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
P205	42.71	42.12	40.80	41.70	43.79	40.28	41.70	41.62	40.73	37.05
F	1.79	1.97	1.13	2.45	1.71	1.22	1.10	1.27	0.93	1.43
Cl	0.00	0.86	2.53	0.23	0.52	3.08	1.98	1.51	3.40	1.22
O=F,Cl	0.75	1.03	1.06	1.08	0.84	1.22	0.92	0.88	1.17	0.88
Total	98.67	98.79	96.92	97.75	102.05	98.20	99.85	99.35	99.04	93.72

GRD in groundmass F F-apatite Cl Cl-apatite

Apatite

	Hybrid H-6 (GRD)	(AMP)		Mafics DM-1		Syenite 74-101
SiO2	0.69	0.53	0.42	0.20	0.20	0.55
TiO2	0.00	0.03	0.03	0.04	0.00	0.02
Al203	0.01	0.01	0.00	0.00	0.00	0.00
FeO	0.24	0.46	0.10	0.63	0.69	0.34
MgO	0.00	0.00	0.00	0.16	0.08	0.01
MnO	0.00	0.06	0.03	0.11	0.02	0.05
CaO	55.30	54.86	53.60	54.75	54.97	53.90
Na20	0.08	0.25	0.16	0.07	0.15	0.13
K20	0.00	0.00	0.00	0.01	0.00	0.00
La203	-	-	0.28	-	-	-
Ce203	-	-	0.56	-	-	-
Nd203	-	-	0.19	-	-	-
Sm203	-	-	0.04	-	-	-
P205	42.71	42.28	41.39	43.10	42.83	40.89
F	3.09	3.13	4.38	2.49	2.26	3.74
Cl	0.08	0.14	0.13	0.82	0.72	-
O=F,Cl	1.32	1.35	1.87	1.23	1.11	1.57
Total	100.88	100.40	99.44	101.15	100.81	98.06

GRD in groundmass
AMP in amphibole

Astrophyllite

	Alkali granite AG-P1 YELLO			YELLO		ORAN	YELLO	ORAN	
SiO2	35.57	41.84	36.72	35.99	36.18	35.19	36.23	34.57	34.76
TiO2	12.47	7.82	11.33	9.87	10.45	9.98	10.07	13.63	9.84
Al2O3	1.02	0.50	0.36	0.50	0.39	0.51	0.25	1.08	-
FeO	35.06	33.02	34.21	33.71	34.38	30.13	30.90	29.76	33.42
MgO	0.04	0.04	0.06	0.02	0.01	0.07	0.05	0.10	-
MnO	2.08	1.36	1.97	2.17	2.29	1.41	1.59	1.29	-
CaO	1.42	0.67	1.04	0.78	0.80	0.95	0.76	1.29	0.94
Na2O	1.92	6.08	2.51	2.60	2.61	2.51	2.73	1.35	2.46
K2O	5.62	4.04	5.85	5.71	5.96	6.19	5.90	5.41	-
P2O5	0.01	0.05	0.01	0.02	0.00	0.00	0.00	0.10	-
Nb2O5	1.87	2.41	2.41	1.87	2.41	-	-	-	1.14
UO2	3.03	0.00	0.00	0.00	0.00	-	-	-	-
ZrO2	0.59	1.08	1.44	2.66	2.48	-	-	-	2.71
F	0.72	0.59	0.79	0.63	0.71	0.95	0.98	0.35	-
Cl	0.00	0.02	0.00	0.02	0.00	0.02	0.01	0.03	-
O=F,Cl	0.30	0.25	0.33	0.27	0.30	0.40	0.41	0.15	-
Total	101.11	100.27	98.37	96.28	98.37	87.51	89.06	88.81	85.27

Astrophyllite

	Alkali granite AG-P2 YELRI	YELLO	(?)	AG-P4 YELLO		WLD-49		HYBRID H-2 YELLO	
SiO2	36.26	32.09	35.57	35.33	36.02	42.17	39.26	35.80	40.71
TiO2	12.86	9.15	11.79	13.09	12.75	9.69	10.85	11.48	10.27
Al2O3	0.14	-	3.21	0.40	0.40	0.34	-	0.46	0.34
FeO	31.92	34.95	32.95	32.29	31.79	31.76	30.44	31.51	31.01
MgO	0.01	-	0.00	0.00	0.00	0.23	-	0.00	0.23
MnO	1.77	-	0.22	2.87	2.69	0.95	-	2.18	0.95
CaO	0.81	0.29	0.72	0.39	0.44	1.28	1.24	0.87	1.26
Na2O	3.03	0.36	2.95	3.20	2.97	4.49	4.41	2.77	4.45
K2O	6.03	-	0.67	5.80	5.80	4.60	-	5.98	4.60
P2O5	0.00	-	0.24	0.03	0.03	0.00	-	0.03	0.00
Nb2O5	-	1.61	1.35	0.97	-	-	0.08	1.87	0.08
Ta2O5	-	0.31	0.37	0.38	-	-	0.30	-	0.30
La2O3	-	0.03	0.04	0.00	-	-	0.00	-	0.00
Ce2O3	-	0.33	0.00	0.00	-	-	0.00	-	0.00
Sm2O3	-	0.09	0.10	0.11	-	-	0.15	-	0.15
Nd2O3	-	0.13	0.07	0.06	-	-	0.05	-	0.05
ThO2	-	0.37	0.04	0.09	-	-	0.11	-	0.11
ZrO2	-	1.66	1.29	1.09	-	-	0.00	-	0.00
F	0.79	-	0.09	1.03	1.03	0.59	-	0.61	0.59
Cl	0.01	-	0.30	0.02	0.02	0.02	-	0.03	0.02
O=F,Cl	0.33	-	0.11	0.44	0.44	0.25	-	0.26	0.25
Total	93.30	81.37	91.86	96.71	93.50	95.87	86.89	93.33	94.87

BIOTITE

GRANITE G-1

	1	2	3	4	5	6	7	8	9 ?	10 ?
SiO2	37.28	37.02	36.76	36.79	36.95	37.05	36.54	36.18	35.27	33.66
Al2O3	11.23	10.87	11.20	11.15	11.04	11.27	11.27	11.02	11.17	11.57
TiO2	4.31	4.85	4.15	4.61	4.65	4.53	4.51	4.01	2.75	2.73
FeOTOT	27.81	26.71	27.01	25.50	26.09	25.80	26.41	26.92	29.86	28.14
FeO	27.81	26.71	27.01	25.50	26.09	25.80	26.41	26.92	29.86	28.14
Fe2O3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MnO	0.27	0.27	0.21	0.22	0.23	0.32	0.32	0.35	0.23	0.22
MgO	1.17	1.18	1.20	1.22	1.18	1.19	1.12	1.03	1.05	0.92
CaO	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.06	0.05
Na2O	0.12	0.18	0.10	0.14	0.15	0.14	0.16	0.15	0.08	0.01
K2O	9.71	9.45	9.55	9.78	9.80	9.81	9.65	9.72	5.78	6.27
F	1.01	1.34	0.78	1.20	1.19	1.51	1.13	1.22	0.61	0.40
Cl	0.61	0.60	0.55	0.54	0.54	0.52	0.56	0.72	0.46	0.78
O=F,Cl	0.56	0.70	0.45	0.63	0.62	0.75	0.60	0.68	0.36	0.34
Total	92.94	91.76	91.07	90.51	91.19	91.42	91.07	90.63	86.98	84.40
All FeO calculated on the basis of 22 oxygen atoms										
Si	3.097	3.107	3.103	3.115	3.113	3.114	3.089	3.096	3.104	3.059
AlZ	0.903	0.893	0.897	0.885	0.887	0.886	0.911	0.904	0.896	0.941
Fe3Z	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Z	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000
AlY	0.196	0.182	0.217	0.228	0.209	0.231	0.212	0.207	0.262	0.299
TiY	0.269	0.306	0.264	0.294	0.295	0.286	0.286	0.258	0.182	0.186
Fe3Y	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Y	0.465	0.488	0.481	0.521	0.504	0.517	0.499	0.465	0.445	0.485
MgX	0.144	0.147	0.151	0.154	0.148	0.149	0.141	0.131	0.138	0.125
FeX	1.932	1.875	1.907	1.805	1.838	1.814	1.867	1.927	2.198	2.139
MnX	0.019	0.019	0.015	0.016	0.017	0.023	0.023	0.025	0.017	0.017
NaX	0.019	0.029	0.017	0.022	0.024	0.023	0.027	0.024	0.000	0.000
X	2.115	2.070	2.090	1.997	2.026	2.009	2.057	2.107	2.353	2.280
K	1.028	1.012	1.028	1.056	1.053	1.052	1.040	1.061	0.649	0.727
NaA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.002
CaA	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.006	0.005
A	1.029	1.012	1.029	1.056	1.053	1.053	1.040	1.061	0.669	0.734
F	0.265	0.355	0.209	0.321	0.316	0.401	0.302	0.330	0.170	0.115
Cl	0.086	0.085	0.079	0.077	0.077	0.075	0.080	0.105	0.069	0.120
Oxyg	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000
Catio	7.609	7.570	7.599	7.575	7.583	7.579	7.596	7.633	7.466	7.500
Fe/Fe+Mg	0.930	0.927	0.927	0.921	0.926	0.924	0.930	0.936	0.941	0.945
Mn/Mn+Fe	0.010	0.010	0.008	0.009	0.009	0.012	0.012	0.013	0.008	0.008
Mg/Mg+Fe2+	0.070	0.073	0.073	0.079	0.074	0.076	0.070	0.064	0.059	0.055

? chloritized biotite?

BIOTITE

QUARTZ SYENITE

	QS-1			QS-3					
	1	2	3	1 ?	2	3 ?	4?	5	6
SiO2	36.77	36.12	34.79	35.31	36.54	37.45	35.51	34.55	34.61
Al2O3	11.40	11.63	12.17	10.79	10.67	10.83	10.79	10.89	10.83
TiO2	3.85	4.10	5.12	3.40	3.53	3.99	1.59	2.61	3.97
FeOTOT	25.96	26.86	28.60	37.61	28.22	29.30	37.93	34.97	34.28
FeO	25.96	26.86	28.60	37.61	28.22	29.30	37.93	34.97	34.28
Fe2O3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MnO	0.10	0.14	0.09	0.22	0.17	0.11	0.37	0.36	0.12
MgO	7.65	7.49	4.75	1.92	6.68	6.61	1.35	1.22	1.07
CaO	0.19	0.03	0.00	0.01	0.04	0.00	0.01	0.01	0.01
Na2O	0.05	0.06	0.10	0.04	0.11	0.12	0.01	0.00	0.00
K2O	9.65	9.87	9.99	9.29	9.05	9.50	9.02	9.71	9.82
F	0.23	0.41	0.11	0.07	1.01	0.83	0.00	0.00	0.07
Cl	0.13	0.41	0.18	1.02	0.35	0.50	0.94	0.83	1.10
O=F,Cl	0.13	0.27	0.09	0.26	0.50	0.46	0.21	0.19	0.28
Total	95.87	96.87	95.81	99.40	95.87	98.77	97.30	94.97	95.60
All FeO calculated on the basis of 22 oxygen atoms									
Si	2.908	2.856	2.807	2.872	2.937	2.929	2.952	2.926	2.907
AlZ	1.063	1.084	1.157	1.034	1.011	0.998	1.048	1.074	1.072
Fe3Z	0.030	0.060	0.036	0.095	0.052	0.073	0.000	0.000	0.021
Z	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000
AlY	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.014	0.000
TiY	0.229	0.244	0.311	0.208	0.213	0.235	0.100	0.167	0.251
Fe3Y	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Y	0.229	0.244	0.311	0.208	0.213	0.235	0.109	0.180	0.251
MgX	0.902	0.883	0.571	0.233	0.800	0.770	0.167	0.154	0.133
FeX	1.687	1.717	1.894	2.463	1.844	1.843	2.637	2.477	2.387
MnX	0.007	0.009	0.006	0.015	0.012	0.008	0.026	0.026	0.009
NaX	0.000	0.007	0.016	0.000	0.000	0.000	0.000	0.001	0.000
X	2.596	2.616	2.487	2.711	2.656	2.620	2.830	2.658	2.529
K	0.974	0.995	1.028	0.964	0.927	0.947	0.957	1.050	1.052
NaA	0.008	0.002	0.000	0.006	0.017	0.018	0.001	0.000	0.000
CaA	0.016	0.003	0.000	0.001	0.003	0.000	0.001	0.001	0.001
A	0.998	1.000	1.028	0.970	0.947	0.965	0.959	1.051	1.053
F	0.057	0.104	0.029	0.017	0.257	0.206	0.000	0.000	0.019
Cl	0.018	0.054	0.025	0.140	0.047	0.066	0.132	0.119	0.156
Oxyg	11.015	11.030	11.018	11.047	11.026	11.037	11.000	11.000	11.011
Cations	7.823	7.860	7.826	7.888	7.816	7.820	7.899	7.889	7.833
Fe/Fe+Mg	0.656	0.668	0.772	0.917	0.703	0.713	0.940	0.941	0.948
Mn/Mn+Fe	0.004	0.005	0.003	0.006	0.006	0.004	0.010	0.010	0.004
Mg/Mg+Fe2+	0.348	0.340	0.232	0.086	0.302	0.295	0.060	0.059	0.053

BIOTITE

QUARTZ SYENITE

QS-5			WLD-100					74-17
	1	2	1	2	3	4	5	1
SiO2	33.75	33.95	34.97	35.28	34.58	34.87	35.30	34.04
Al2O3	11.69	11.43	11.07	11.49	11.25	11.30	10.24	11.69
TiO2	4.73	4.78	3.53	3.81	3.93	4.16	2.96	2.05
FeOTOT	34.12	32.80	35.90	35.21	35.43	34.73	37.43	37.74
FeO	34.12	32.80	35.90	35.21	35.43	34.73	37.43	37.74
Fe2O3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MnO	0.19	0.14	0.23	0.21	0.24	0.20	0.26	0.30
MgO	2.13	2.28	1.89	2.33	1.75	1.93	0.93	1.90
CaO	0.10	0.07	0.06	0.00	0.00	0.02	0.05	0.00
Na2O	0.06	0.08	0.05	0.04	0.05	0.08	0.04	0.11
K2O	8.78	9.13	9.11	9.43	8.97	8.92	9.31	8.36
F	0.05	0.10	0.15	0.10	0.10	0.04	0.00	0.24
Cl	0.90	0.87	0.74	0.29	1.46	0.36	1.15	0.00
O=F,Cl	0.23	0.24	0.23	0.11	0.37	0.10	0.26	0.10
Total	96.28	95.38	97.48	98.08	97.38	96.51	97.40	96.33

All FeO calculated on the basis of 22 oxygen atoms

Si	2.793	2.825	2.875	2.859	2.856	2.866	2.940	2.838
AlZ	1.140	1.121	1.073	1.097	1.095	1.095	1.005	1.148
Fe3Z	0.067	0.054	0.052	0.044	0.049	0.040	0.055	0.013
Z	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000
AlY	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TiY	0.294	0.299	0.218	0.232	0.244	0.257	0.185	0.129
Fe3Y	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Y	0.294	0.299	0.218	0.232	0.244	0.257	0.185	0.129
MgX	0.262	0.283	0.232	0.282	0.215	0.237	0.116	0.236
FeX	2.295	2.228	2.417	2.342	2.399	2.347	2.551	2.619
MnX	0.014	0.010	0.016	0.015	0.017	0.014	0.018	0.021
NaX	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X	2.571	2.520	2.665	2.638	2.632	2.598	2.685	2.876
K	0.927	0.969	0.956	0.975	0.946	0.935	0.988	0.890
NaA	0.010	0.012	0.008	0.006	0.008	0.012	0.007	0.018
CaA	0.009	0.006	0.006	0.000	0.000	0.002	0.004	0.000
A	0.946	0.987	0.969	0.981	0.953	0.949	1.000	0.908
F	0.014	0.027	0.038	0.025	0.025	0.011	0.000	0.062
Cl	0.127	0.123	0.102	0.040	0.204	0.051	0.162	0.000
Oxyg	11.033	11.027	11.026	11.022	11.024	11.020	11.028	11.007
Cations	7.811	7.806	7.852	7.851	7.829	7.804	7.870	7.913
Fe/Fe+Mg	0.900	0.890	0.914	0.894	0.919	0.910	0.957	0.918
Mn/Mn+Fe	0.006	0.004	0.007	0.006	0.007	0.006	0.007	0.008
Mg/Mg+Fe2+	0.103	0.113	0.088	0.107	0.082	0.092	0.043	0.083

BIOTITE

QUARTZ SYENITE HYBRID			HYBRID UNIT			
QS-10	chloritized?		H-6	???		
	1	2	1	1	2	3
SiO2	33.24	33.61	34.62	33.81	34.88	34.26
Al2O3	11.69	13.76	13.58	11.48	11.37	11.55
TiO2	11.45	4.62	2.41	1.63	0.04	0.00
FeOTOT	21.59	25.67	22.88	38.29	36.74	38.87
FeO	21.59	25.67	22.88	38.29	36.74	38.87
Fe2O3	0.00	0.00	0.00	0.00	0.00	0.00
MnO	0.08	0.07	0.27	0.47	0.43	0.46
MgO	8.57	9.91	12.68	1.34	1.57	1.43
CaO	4.90	0.04	0.04	0.03	0.04	0.00
Na2O	0.09	0.08	0.10	0.40	0.16	0.27
K2O	4.53	5.73	5.15	8.14	8.79	8.90
F	0.12	0.04	0.74	0.10	0.00	0.00
Cl	0.22	0.38	0.31	0.00	0.00	0.00
O=F,Cl	0.10	0.10	0.38	0.04	0.00	0.00
Total	96.36	93.79	92.39	95.64	94.03	95.73

All FeO calculated on the basis of 22 oxygen atoms

Si	2.548	2.668	2.749	2.852	2.971	2.901
AlZ	1.056	1.287	1.251	1.141	1.029	1.099
Fe3Z	0.396	0.044	0.000	0.006	0.000	0.000
Z	4.000	4.000	4.000	4.000	4.000	4.000
AlY	0.000	0.000	0.019	0.000	0.112	0.054
TiY	0.660	0.276	0.144	0.103	0.003	0.000
Fe3Y	0.000	0.000	0.000	0.000	0.000	0.000
Y	0.660	0.276	0.162	0.103	0.114	0.054
MgX	0.979	1.173	1.501	0.169	0.200	0.181
FeX	0.988	1.660	1.519	2.695	2.617	2.753
MnX	0.005	0.005	0.018	0.033	0.031	0.033
NaX	0.000	0.000	0.000	0.000	0.000	0.005
X	1.973	2.837	3.038	2.897	2.848	2.972
K	0.443	0.580	0.521	0.876	0.955	0.961
NaA	0.014	0.012	0.016	0.066	0.026	0.039
CaA	0.402	0.003	0.003	0.002	0.003	0.000
A	0.859	0.596	0.541	0.944	0.984	1.000
F	0.029	0.010	0.185	0.027	0.000	0.000
Cl	0.028	0.051	0.041	0.000	0.000	0.000
Oxyg	11.198	11.022	11.000	11.003	11.000	11.000
Cations	7.492	7.708	7.741	7.944	7.947	8.025
Fe/Fe+Mg	0.586	0.592	0.503	0.941	0.929	0.938
Mn/Mn+Fe	0.004	0.003	0.012	0.012	0.012	0.012
Mg/Mg+Fe2+	0.498	0.414	0.497	0.059	0.071	0.062

CHEVKINITE

ALKALI GRANITE

AG-P1

	1	2	3	4	5	6	7	8	9
SiO2	19.54	19.36	19.34	19.66	19.37	19.58	19.94	20.11	19.4
TiO2	20.04	19.36	20.07	19.18	19.03	19.34	20.21	19.99	19.9
Al2O3	0.01	0.01	0.01	0.03	-	-	0.06	0.06	-
FeO	11.87	11.61	11.63	11.73	12.08	11.71	10.95	10.90	10.7
MgO	0.00	0.00	0.00	0.01	-	-	0.00	0.00	-
MnO	0.33	0.33	0.33	0.20	0.00	0.00	0.10	0.10	0.0
CaO	1.08	1.06	1.49	1.31	1.40	1.55	3.09	2.83	1.3
Na2O	0.03	0.00	0.03	0.06	0.08	0.00	0.01	0.01	0.0
K2O	0.00	0.00	0.00	0.00	-	-	0.01	0.01	-
Y2O3	0.16	0.24	0.27	0.23	0.33	0.21	0.67	0.75	0.1
La2O3	12.94	13.38	12.61	12.55	12.40	12.62	10.58	10.73	13.0
Ce2O3	24.63	24.06	24.23	22.23	23.02	24.06	21.21	21.14	24.2
Nd2O3	7.58	7.65	7.84	7.43	7.39	7.63	7.72	7.44	7.5
Sm2O3	3.17	3.36	2.90	3.61	3.05	3.42	3.64	3.49	3.8
Nb2O5	0.83	1.01	0.78	1.29	1.42	1.51	0.93	1.28	1.1
Ta2O5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
ThO2	0.25	0.13	0.27	0.51	0.32	0.49	0.61	0.48	0.3
ZrO2	0.11	0.11	0.15	0.17	0.12	0.23	0.56	0.58	0.1
P2O5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
F	0.40	0.40	0.40	0.50	-	-	0.45	0.45	-
Cl	0.00	0.00	0.00	0.01	-	-	0.00	0.00	-
O=F,Cl	0.17	0.17	0.17	0.21	-	-	0.19	0.19	-
Total	102.80	101.90	102.18	100.50	100.01	102.35	100.55	100.16	101.8

Recalculated on the basis of 22 oxygen atoms

Si	4.290	4.316	4.262	4.372	4.315	4.321	4.345	4.388	4.365
Ti	3.308	3.246	3.326	3.207	3.188	3.209	3.312	3.280	3.363
Fe	2.179	2.164	2.143	2.181	2.251	2.161	1.995	1.989	2.013
Mn	0.061	0.062	0.062	0.038	0.000	0.000	0.018	0.018	0.000
Ca	0.224	0.223	0.310	0.275	0.294	0.322	0.635	0.582	0.279
Na	0.013	0.000	0.013	0.026	0.035	0.000	0.004	0.004	0.009
Y	0.019	0.028	0.032	0.027	0.039	0.025	0.078	0.087	0.018
La	1.048	1.100	1.025	1.029	1.019	1.027	0.850	0.864	1.082
Ce	1.980	1.964	1.955	1.810	1.877	1.944	1.692	1.689	1.996
Nd	0.594	0.609	0.617	0.590	0.588	0.601	0.601	0.580	0.603
Sm	0.240	0.258	0.220	0.277	0.234	0.260	0.273	0.262	0.299
Nb	0.082	0.102	0.078	0.130	0.143	0.151	0.092	0.126	0.114
Ta	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Th	0.012	0.007	0.014	0.026	0.016	0.025	0.030	0.024	0.017
Zr	0.012	0.012	0.016	0.018	0.013	0.025	0.060	0.062	0.014
P	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cats	14.062	14.091	14.072	14.005	14.012	14.071	13.985	13.957	14.172

CHEVKINITE

ALKALI GRANITE

HYBRID UNIT

AG-P2

WLD-36

H-6

	1	2	3	1 CO	2 CO	3 CO	1	2 CO	3 CO	4 CO
SiO2	19.40	18.93	19.19	19.61	19.12	19.85	19.53	19.17	19.46	19.64
TiO2	19.34	18.68	18.43	19.96	20.36	20.99	20.44	20.16	20.82	20.99
Al2O3	0.00	0.00	0.00	0.16	0.16	0.11	0.44	0.41	0.39	0.42
FeO	11.57	11.67	11.21	10.33	10.16	10.94	8.26	8.51	10.10	9.79
MgO	0.00	0.00	0.00	0.14	0.14	0.01	0.31	0.36	0.35	0.38
MnO	0.13	0.13	0.13	0.17	0.17	0.16	0.00	0.00	0.12	0.11
CaO	1.32	1.04	1.01	2.69	1.38	2.61	2.56	2.52	2.70	2.57
Na2O	0.15	0.11	0.15	0.01	0.06	0.00	0.01	0.01	0.01	0.00
K2O	0.00	0.00	0.00	0.03	0.03	0.00	0.01	0.00	0.01	0.00
Y2O3	0.54	0.23	0.38	0.79	1.10	0.79	0.87	0.83	0.74	0.93
La2O3	11.93	12.39	12.80	11.14	11.81	11.28	10.50	10.36	10.46	10.59
Ce2O3	23.10	24.12	23.72	22.08	22.63	21.18	21.52	22.02	19.78	20.02
Nd2O3	7.71	7.81	7.78	7.84	8.14	8.74	8.02	7.90	7.82	7.97
Sm2O3	3.81	3.50	3.25	3.49	3.74	3.03	3.74	3.17	3.40	3.24
Nb2O5	1.99	1.19	2.11	1.01	0.96	0.77	0.68	0.47	0.47	0.65
Ta2O5	0.12	0.15	0.22	0.18	0.13	0.19	0.19	0.10	0.19	0.18
ThO2	0.38	0.54	0.37	0.88	0.63	0.46	1.46	1.47	1.46	1.64
ZrO2	0.46	0.24	0.39	0.38	0.17	0.53	0.33	0.25	0.48	0.32
P2O5	0.00	0.00	0.00	0.00	0.00	0.04	0.11	0.09	0.08	0.06
F	0.42	0.42	0.42	0.44	0.44	0.54	0.54	0.49	0.37	0.35
Cl	0.00	0.00	0.00	0.06	0.06	0.03	0.02	0.03	0.02	0.01
O=F,Cl	0.18	0.18	0.18	0.20	0.20	0.23	0.23	0.20	0.16	0.15
Total	102.19	100.97	101.38	101.19	101.19	102.02	99.31	98.12	99.07	99.71

Recalculated on the basis of 22 oxygen atoms

Si	4.289	4.286	4.333	4.350	4.338	4.306	4.501	4.464	4.353	4.392
Ti	3.216	3.181	3.129	3.330	3.474	3.424	3.543	3.530	3.502	3.530
Fe	2.139	2.210	2.117	1.917	1.928	1.985	1.592	1.657	1.889	1.831
Mn	0.024	0.025	0.025	0.032	0.033	0.029	0.000	0.000	0.023	0.021
Ca	0.275	0.222	0.215	0.563	0.295	0.534	0.556	0.553	0.569	0.542
Na	0.064	0.048	0.066	0.004	0.026	0.000	0.004	0.005	0.004	0.000
Y	0.064	0.028	0.046	0.093	0.133	0.091	0.107	0.103	0.088	0.111
La	0.973	1.035	1.066	0.912	0.988	0.903	0.893	0.890	0.863	0.873
Ce	1.870	1.999	1.961	1.793	1.880	1.682	1.816	1.877	1.620	1.639
Nd	0.609	0.632	0.627	0.621	0.660	0.677	0.660	0.657	0.625	0.637
Sm	0.290	0.273	0.253	0.267	0.292	0.227	0.297	0.254	0.262	0.250
Nb	0.199	0.122	0.215	0.101	0.098	0.076	0.071	0.049	0.048	0.066
Ta	0.007	0.009	0.014	0.011	0.008	0.011	0.012	0.006	0.012	0.011
Th	0.019	0.028	0.019	0.044	0.033	0.023	0.077	0.078	0.074	0.083
Zr	0.050	0.026	0.043	0.041	0.019	0.056	0.037	0.028	0.052	0.035
P	0.000	0.000	0.000	0.000	0.000	0.007	0.021	0.018	0.015	0.011
Cats	14.089	14.124	14.127	14.079	14.205	14.031	14.187	14.171	14.000	14.031

CHEVKINITE ALTERATION

ALKALI GRANITE

AG-P1

	1	2	3	4	5	6	7	8
SiO2	9.42	15.79	13.06	14.07	13.44	13.99	14.67	10.48
TiO2	38.82	30.87	42.42	33.65	33.09	33.93	28.62	40.87
Al2O3	1.54	-	-	-	-	-	-	0.89
FeO	20.35	12.10	12.69	11.39	14.71	13.47	15.10	11.29
MgO	0.00	-	-	-	-	-	-	0.00
MnO	0.02	-	-	-	-	-	-	0.06
CaO	0.24	0.46	0.39	0.32	0.43	0.43	0.74	0.36
Na2O	0.14	0.05	0.08	0.11	0.03	0.01	0.05	0.08
K2O	0.03	-	-	-	-	-	-	0.07
Y2O3	0.17	0.42	0.23	0.40	0.41	0.53	0.36	0.44
La2O3	1.95	4.87	2.49	3.14	3.36	4.28	3.88	2.56
Ce2O3	3.91	9.94	5.02	10.19	7.98	7.93	11.79	5.29
Nd2O3	1.73	4.01	2.19	2.61	3.19	3.38	3.27	2.48
Sm2O3	0.67	1.40	0.98	1.83	1.70	1.53	1.91	1.26
Nb2O5	2.81	1.89	2.39	3.42	2.69	3.09	1.84	3.08
Ta2O5	0.00	-	-	-	-	-	-	-
ThO2	1.47	1.24	1.93	1.83	1.51	1.43	1.98	1.78
ZrO2	0.60	0.70	1.69	0.83	1.00	0.70	0.75	1.12
P2O5	1.46	-	-	-	-	-	-	1.54
UO2	0.27	-	-	-	-	-	-	-
F	0.17	-	-	-	-	-	-	0.21
Cl	0.14	-	-	-	-	-	-	0.07
O=F,Cl	0.10	-	-	-	-	-	-	0.10
Total	85.81	83.74	85.56	83.79	83.54	84.70	84.96	83.83

Recalculated on the basis of 22 oxygen atoms

Si	1.953	3.601	2.780	3.241	3.014	3.128	3.304	2.362
Ti	6.053	5.294	6.791	5.829	5.580	5.705	4.848	6.928
Fe	3.529	2.307	2.259	2.194	2.758	2.519	2.844	2.128
Mn	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.011
Ca	0.053	0.112	0.089	0.079	0.103	0.103	0.179	0.087
Na	0.056	0.022	0.033	0.049	0.013	0.004	0.022	0.035
Y	0.019	0.051	0.026	0.049	0.049	0.063	0.043	0.053
La	0.149	0.410	0.196	0.267	0.278	0.353	0.322	0.213
Ce	0.297	0.830	0.391	0.859	0.655	0.649	0.972	0.437
Nd	0.128	0.327	0.167	0.215	0.255	0.270	0.263	0.200
Sm	0.048	0.110	0.072	0.145	0.131	0.118	0.148	0.098
Nb	0.263	0.195	0.230	0.356	0.273	0.312	0.187	0.314
Ta	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Th	0.069	0.064	0.093	0.096	0.077	0.073	0.101	0.091
Zr	0.061	0.078	0.175	0.093	0.109	0.076	0.082	0.123
P	0.256	0.000	0.000	0.000	0.000	0.000	0.000	0.294
Cats	12.938	13.400	13.303	13.472	13.296	13.374	13.317	13.373

CHEVKINITE ALTERATION

ALKALI GRANITE

AG-P2

	1 ORF	2 YE	3 ORF	4 LOR	5 OR	6 LOR	7 DOC	8
SiO2	7.91	17.09	11.87	12.72	18.09	17.99	17.65	8.28
TiO2	24.21	27.29	29.09	42.17	28.52	27.94	23.13	50.60
Al2O3	-	-	-	-	0.42	0.42	0.21	0.83
FeO	12.21	12.96	13.50	10.13	12.31	11.38	13.90	7.28
MgO	-	-	-	-	0.00	0.00	0.00	0.00
MnO	-	-	-	-	0.10	0.10	0.15	0.00
CaO	0.23	0.90	0.48	0.35	0.54	0.57	1.03	0.33
Na2O	0.06	0.11	0.25	0.05	0.00	0.00	0.04	0.05
K2O	-	-	-	-	0.00	0.00	0.03	0.05
Y2O3	0.49	0.54	0.09	0.29	0.29	0.26	0.35	0.35
La2O3	2.26	6.55	5.25	4.03	7.60	7.60	9.72	1.07
Ce2O3	20.73	14.07	11.50	8.20	14.63	15.18	18.22	3.22
Nd2O3	2.02	4.39	3.54	2.46	5.16	5.00	6.23	1.22
Sm2O3	3.07	2.16	1.33	1.35	2.23	1.96	2.53	0.77
Nb2O5	3.52	3.01	4.26	3.87	2.43	2.40	2.11	4.39
Ta2O5	0.15	0.21	0.17	0.22	0.35	0.16	0.33	0.13
ThO2	3.85	1.24	1.50	1.43	0.65	0.44	0.33	3.04
ZrO2	3.77	0.38	1.61	3.30	1.24	1.41	0.37	5.00
P2O5	-	-	-	-	0.06	0.06	0.31	0.46
UO2	-	-	-	-	-	-	-	-
F	-	-	-	-	0.34	0.34	0.41	0.07
Cl	-	-	-	-	0.09	0.09	0.05	0.27
O=F,Cl	-	-	-	-	0.16	0.16	0.18	0.09
Total	84.48	90.90	84.27	90.57	94.89	93.14	96.92	87.32

Recalculated on the basis of 22 oxygen atoms

Si	2.147	3.751	2.824	2.734	3.866	3.931	3.833	1.850
Ti	4.942	4.505	5.204	6.817	4.583	4.591	3.777	8.502
Fe	2.772	2.379	2.686	1.821	2.200	2.079	2.524	1.360
Mn	0.000	0.000	0.000	0.000	0.018	0.019	0.028	0.000
Ca	0.067	0.212	0.122	0.081	0.124	0.133	0.240	0.079
Na	0.032	0.047	0.115	0.021	0.000	0.000	0.017	0.022
Y	0.071	0.063	0.011	0.033	0.033	0.030	0.040	0.042
La	0.226	0.530	0.461	0.320	0.599	0.612	0.779	0.088
Ce	2.060	1.131	1.002	0.645	1.145	1.214	1.449	0.263
Nd	0.196	0.344	0.301	0.189	0.394	0.390	0.483	0.097
Sm	0.287	0.163	0.109	0.100	0.164	0.148	0.189	0.059
Nb	0.432	0.299	0.458	0.376	0.235	0.237	0.207	0.443
Ta	0.011	0.013	0.011	0.013	0.020	0.010	0.019	0.008
Th	0.238	0.062	0.081	0.070	0.032	0.022	0.016	0.155
Zr	0.499	0.041	0.187	0.346	0.129	0.150	0.039	0.545
P	0.000	0.000	0.000	0.000	0.011	0.011	0.057	0.087
Cats	13.979	13.538	13.571	13.565	13.553	13.577	13.697	13.600

ORF orange fibers YE yellow
LOR light orange DOC dark orange core

CHEVKINITE ALTERATION

ALKALI GRANITE

WLD-36

	1 O	2 OR	3 DAC	4 BR	5 O	6 OR	7 B	8
SiO2	18.79	11.43	17.76	18.76	15.27	20.03	19.71	18.51
TiO2	25.98	24.83	26.98	25.81	35.52	27.96	33.42	34.92
Al2O3	0.55	0.57	0.59	0.49	0.67	0.56	0.37	0.37
FeO	9.49	12.18	13.65	9.04	8.24	8.52	10.44	11.06
MgO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MnO	0.12	0.00	0.02	0.05	0.01	0.01	0.01	0.01
CaO	1.26	1.26	1.08	1.02	0.43	0.76	1.44	1.02
Na2O	0.05	0.06	0.02	0.00	0.03	0.01	0.03	0.01
K2O	0.06	0.02	0.02	0.00	0.00	0.02	0.05	0.05
Y2O3	1.61	0.93	0.72	1.64	1.31	1.30	0.54	0.74
La2O3	5.41	5.94	5.74	5.13	3.24	4.37	5.67	4.37
Ce2O3	11.11	13.74	11.44	13.03	8.60	13.12	11.15	8.45
Nd2O3	4.55	4.21	4.82	5.24	3.82	4.10	4.54	4.00
Sm2O3	1.76	2.17	2.12	2.34	1.53	2.28	1.82	1.62
Nb2O5	2.18	1.72	1.93	2.78	2.92	2.28	1.34	1.77
Ta2O5	0.12	0.02	0.16	0.03	0.20	0.13	0.16	0.24
ThO2	1.30	0.91	1.15	1.72	2.83	1.66	0.82	1.50
ZrO2	1.37	0.24	0.90	0.74	0.61	0.38	1.21	1.43
P2O5	0.67	1.33	0.76	0.72	1.20	1.14	0.53	0.53
UO2	-	-	-	-	-	-	-	-
F	0.57	0.77	0.43	0.50	0.60	0.38	0.42	0.42
Cl	0.06	0.08	0.06	0.07	0.08	0.06	0.10	0.10
O=F,Cl	0.25	0,34	0.19	0.23	0.27	0.17	0.20	0.20
Total	86.76	82.07	90.16	88.88	86.84	88.90	93.57	90.92

Recalculated on the basis of 22 oxygen atoms

Si	4.225	2.898	3.802	4.251	3.452	4.394	4.011	3.806
Ti	4.393	4.735	4.344	4.398	6.039	4.612	5.114	5.399
Fe	1.784	2.583	2.444	1.713	1.558	1.563	1.777	1.902
Mn	0.023	0.000	0.004	0.010	0.002	0.002	0.002	0.002
Ca	0.304	0.342	0.248	0.248	0.104	0.179	0.314	0.225
Na	0.022	0.029	0.008	0.000	0.013	0.004	0.012	0.004
Y	0.193	0.125	0.082	0.198	0.158	0.152	0.058	0.081
La	0.449	0.556	0.453	0.429	0.270	0.354	0.426	0.331
Ce	0.915	1.276	0.897	1.081	0.712	1.054	0.831	0.636
Nd	0.365	0.381	0.369	0.424	0.308	0.321	0.330	0.294
Sm	0.136	0.190	0.156	0.183	0.119	0.172	0.128	0.115
Nb	0.222	0.197	0.187	0.285	0.298	0.226	0.123	0.165
Ta	0.007	0.001	0.009	0.002	0.012	0.008	0.009	0.013
Th	0.067	0.053	0.056	0.089	0.146	0.083	0.038	0.070
Zr	0.150	0.030	0.094	0.082	0.067	0.041	0.120	0.143
P	0.128	0.286	0.138	0.138	0.230	0.212	0.091	0.092
Cats	13.381	13.682	13.290	13.530	13.490	13.376	13.383	13.277

O orange B brown
R rim DAC dark core

CHEVKINITE ALTERATION

ALKALI GRANITE

WLD-36

	1 O I	2 OR	3 CO	4 REB	5 O	6
SiO2	12.37	17.93	16.93	13.71	16.33	10.65
TiO2	41.71	28.94	34.40	35.88	40.40	20.54
Al203	-	0.45	0.69	0.46	0.46	-
FeO	15.78	8.11	12.10	9.81	10.64	8.39
MgO	-	0.00	0.00	0.00	0.00	-
MnO	-	0.06	0.04	0.06	0.06	-
CaO	0.26	0.81	0.77	0.10	0.09	0.19
Na20	0.02	0.01	0.00	0.02	0.04	0.00
K20	-	0.04	0.05	0.01	0.01	-
Y203	0.72	2.23	0.64	-	0.52	0.27
La203	1.75	4.48	4.75	-	1.09	1.44
Ce203	3.75	10.32	9.47	-	2.81	3.34
Nd203	2.08	4.31	4.10	-	1.73	1.55
Sm203	0.88	1.90	1.55	-	0.65	0.67
Nb205	2.12	3.48	1.74	-	5.38	1.97
Ta205	0.15	0.24	0.21	-	0.55	0.18
ThO2	2.29	2.65	1.34	-	4.23	1.21
ZrO2	0.55	0.96	0.79	-	0.32	0.16
P205	-	0.87	0.80	1.39	1.39	-
UO2	-	-	-	-	-	-
F	-	0.36	0.53	0.24	0.24	-
Cl	-	0.05	0.06	0.14	0.14	-
O=F,Cl	-	0.16	0.24	0.13	0.13	-
Total	84.43	88.04	90.72	61.69	86.95	50.56

Recalculated on the basis of 22 oxygen atoms

Si	2.607	4.052	3.549	3.445	3.356	3.715
Ti	6.611	4.918	5.423	6.781	6.244	5.387
Fe	2.781	1.533	2.121	2.062	1.829	2.447
Mn	0.000	0.011	0.007	0.013	0.010	0.000
Ca	0.059	0.196	0.173	0.027	0.020	0.071
Na	0.008	0.004	0.000	0.010	0.016	0.000
Y	0.081	0.268	0.071	0.000	0.057	0.050
La	0.136	0.373	0.367	0.000	0.083	0.185
Ce	0.289	0.854	0.727	0.000	0.211	0.426
Nd	0.157	0.348	0.307	0.000	0.127	0.193
Sm	0.064	0.148	0.112	0.000	0.046	0.081
Nb	0.202	0.356	0.165	0.000	0.500	0.311
Ta	0.009	0.015	0.012	0.000	0.031	0.017
Th	0.110	0.136	0.064	0.000	0.198	0.096
Zr	0.057	0.106	0.081	0.000	0.032	0.027
P	0.000	0.166	0.142	0.296	0.242	0.000
Cats	13.170	13.486	13.320	12.633	13.001	13.007

O orange RE reddish
CO core OR orange rim

CHEVKINITE ALTERATION

ALKALI GRANITE

WLD-49

	1 OR	2 AMP	3 DC	4 LR	5 O	6 O
SiO2	20.06	18.22	19.55	18.74	15.38	17.44
TiO2	24.90	26.60	26.55	24.99	39.60	26.19
Al2O3	0.46	0.28	0.41	-	0.73	0.45
FeO	7.73	7.33	10.93	8.83	12.55	8.79
MgO	0.00	0.01	0.00	-	0.00	0.00
MnO	0.18	0.35	0.31	0.00	0.10	0.31
CaO	2.17	1.05	1.83	1.94	0.85	0.95
Na2O	0.07	0.07	0.01	0.00	0.05	0.04
K2O	0.03	0.01	0.00	-	0.06	0.02
Y2O3	0.73	0.69	0.52	0.66	0.30	0.50
La2O3	7.59	7.13	7.54	6.67	3.03	7.18
Ce2O3	14.87	18.73	15.88	15.42	5.88	18.31
Nd2O3	6.00	5.09	6.02	4.90	2.59	5.23
Sm2O3	2.62	2.94	2.63	2.44	1.03	2.75
Nb2O5	3.34	3.11	2.35	2.58	2.49	4.64
Ta2O5	0.20	0.06	0.16	0.00	0.10	0.18
ThO2	1.28	0.99	0.65	0.59	1.46	2.19
ZrO2	2.18	0.64	1.40	1.59	1.83	1.73
P2O5	0.63	0.56	0.59	0.00	0.42	0.59
UO2	-	-	-	-	-	-
F	0.52	0.59	0.52	-	0.29	0.45
Cl	0.07	0.11	0.07	-	0.28	0.15
O=F,Cl	0.23	0.27	0.23	-	0.19	0.23
Total	95.40	94.29	97.69	89.35	88.83	97.86

Recalculated on the basis of 22 oxygen atoms

Si	4.350	4.146	4.069	4.259	3.162	3.868
Ti	4.060	4.552	4.155	4.271	6.122	4.369
Fe	1.402	1.395	1.902	1.678	2.157	1.631
Mn	0.033	0.067	0.055	0.000	0.017	0.058
Ca	0.504	0.256	0.408	0.472	0.187	0.226
Na	0.029	0.031	0.004	0.000	0.020	0.017
Y	0.084	0.084	0.058	0.080	0.033	0.059
La	0.607	0.598	0.579	0.559	0.230	0.587
Ce	1.180	1.561	1.210	1.283	0.443	1.487
Nd	0.465	0.414	0.447	0.398	0.190	0.414
Sm	0.196	0.231	0.189	0.191	0.073	0.210
Nb	0.327	0.320	0.221	0.265	0.231	0.465
Ta	0.012	0.004	0.009	0.000	0.006	0.011
Th	0.063	0.051	0.031	0.031	0.068	0.111
Zr	0.230	0.071	0.142	0.176	0.183	0.187
P	0.116	0.108	0.104	0.000	0.073	0.111
Cats	13.659	13.889	13.582	13.662	13.195	13.811

AMP in amphibole
DC dark orange core
O orange
LR light orange rim

CHEVKINITE ALTERATION

HYBRID UNIT

H-2

	1 YE	2 YE	3 YE	4 YE	5 YE	6 YE
SiO2	18.45	19.16	17.02	18.76	19.17	12.80
TiO2	25.04	29.00	27.58	31.06	33.79	22.45
Al2O3	0.54	-	-	0.89	0.89	-
FeO	10.35	8.42	7.42	7.77	6.89	4.25
MgO	0.00	-	-	0.00	0.00	-
MnO	0.14	0.00	0.00	0.07	0.07	0.00
CaO	1.52	1.63	1.11	1.27	1.20	1.91
Na2O	0.18	0.08	0.22	0.04	0.05	0.06
K2O	0.02	-	-	0.97	0.97	-
Y2O3	0.50	0.51	0.75	0.36	0.32	0.46
La2O3	8.08	6.83	5.05	6.68	5.45	10.61
Ce2O3	15.31	13.39	9.14	13.28	9.99	18.64
Nd2O3	6.34	5.11	5.09	5.43	4.22	7.10
Sm2O3	2.32	2.23	3.12	2.00	1.57	2.82
Nb2O5	1.21	1.30	0.02	1.48	1.43	1.01
Ta2O5	0.11	0.10	0.00	0.15	0.19	0.08
ThO2	1.90	2.05	0.02	2.14	2.88	2.37
ZrO2	1.45	1.47	1.29	0.69	1.53	0.73
P2O5	0.58	0.00	0.00	1.12	1.12	0.00
UO2	-	-	-	-	-	-
F	0.44	-	-	0.25	0.25	-
Cl	0.13	-	-	0.02	0.02	-
O=F,Cl	0.21	-	-	0.11	0.11	-
Total	94.40	91.28	77.83	94.32	91.89	85.29

Recalculated on the basis of 22 oxygen atoms

Si	4.058	4.218	4.250	4.068	4.099	3.696
Ti	4.142	4.801	5.179	5.065	5.434	4.875
Fe	1.904	1.550	1.549	1.409	1.232	1.026
Mn	0.026	0.000	0.000	0.013	0.013	0.000
Ca	0.358	0.384	0.297	0.295	0.275	0.591
Na	0.077	0.034	0.107	0.017	0.021	0.034
Y	0.059	0.060	0.100	0.042	0.036	0.071
La	0.655	0.555	0.465	0.534	0.430	1.130
Ce	1.233	1.079	0.836	1.054	0.782	1.970
Nd	0.498	0.402	0.454	0.421	0.322	0.732
Sm	0.176	0.169	0.268	0.149	0.116	0.281
Nb	0.120	0.129	0.002	0.145	0.138	0.132
Ta	0.007	0.006	0.000	0.009	0.011	0.006
Th	0.095	0.103	0.001	0.106	0.140	0.156
Zr	0.156	0.158	0.157	0.073	0.160	0.103
P	0.108	0.000	0.000	0.206	0.203	0.000
Cats	13.671	13.648	13.665	13.604	13.412	14.802

YE yellow

CHEVKINITE ALTERATION

HYBRID UNIT

H-2	1 DY	2 DY	3 DY	4 YE	5 YE	6	H-6 1 YE	2 R
SiO2	14.36	15.83	18.39	19.23	18.14	18.71	18.47	8.00
TiO2	42.05	35.31	33.32	28.51	29.87	26.22	31.62	47.63
Al2O3	0.74	0.74	-	-	-	0.54	-	1.25
FeO	9.68	11.20	9.05	8.98	9.97	9.82	4.71	13.69
MgO	0.00	0.00	-	-	-	0.00	-	0.03
MnO	0.17	0.17	0.00	0.00	0.00	0.14	0.00	0.01
CaO	0.65	0.79	1.29	1.77	1.06	1.64	1.18	0.14
Na2O	0.00	0.01	0.06	0.05	0.02	0.11	0.04	0.04
K2O	0.02	0.02	-	-	-	0.02	-	0.06
Y2O3	0.45	0.57	0.55	0.49	0.39	0.47	0.83	0.09
La2O3	2.70	4.09	5.80	6.88	5.51	7.85	4.40	0.80
Ce2O3	5.41	8.05	10.84	13.10	10.32	15.24	8.83	1.40
Nd2O3	2.49	3.40	4.54	5.31	4.28	5.77	4.68	1.13
Sm2O3	0.91	1.29	1.68	1.74	1.54	2.40	1.76	0.31
Nb2O5	1.92	1.78	1.88	1.48	1.85	1.24	0.91	1.22
Ta2O5	0.03	0.17	0.09	0.18	0.15	0.00	0.13	0.13
ThO2	2.09	2.76	2.11	2.48	2.04	1.89	2.96	3.83
ZrO2	1.26	0.67	0.89	1.29	0.77	1.34	0.92	0.47
P2O5	0.64	0.64	0.00	0.00	0.00	0.58	0.00	1.58
UO2	-	-	-	-	-	-	-	-
F	0.40	0.40	-	-	-	0.44	-	0.12
Cl	0.06	0.06	-	-	-	0.13	-	0.04
O=F,Cl	0.18	0.18	-	-	-	0.21	-	0.06
Total	85.85	87.77	90.49	91.49	85.91	94.34	81.44	81.91

Recalculated on the basis of 22 oxygen atoms

Si	3.094	3.427	3.963	4.205	4.064	4.088	4.442	1.759
Ti	6.813	5.749	5.400	4.688	5.032	4.308	5.719	7.876
Fe	1.744	2.028	1.631	1.642	1.868	1.794	0.947	2.518
Mn	0.031	0.031	0.000	0.000	0.000	0.026	0.000	0.002
Ca	0.150	0.183	0.298	0.415	0.254	0.384	0.304	0.033
Na	0.000	0.004	0.025	0.021	0.009	0.047	0.019	0.017
Y	0.052	0.066	0.063	0.057	0.046	0.055	0.106	0.011
La	0.215	0.327	0.461	0.555	0.455	0.633	0.390	0.065
Ce	0.427	0.638	0.855	1.049	0.846	1.219	0.777	0.113
Nd	0.192	0.263	0.349	0.415	0.342	0.450	0.402	0.089
Sm	0.068	0.096	0.125	0.131	0.119	0.181	0.146	0.023
Nb	0.187	0.174	0.183	0.146	0.187	0.122	0.099	0.121
Ta	0.002	0.010	0.005	0.011	0.009	0.000	0.009	0.008
Th	0.102	0.136	0.103	0.123	0.104	0.094	0.162	0.192
Zr	0.132	0.071	0.094	0.138	0.084	0.143	0.108	0.050
P	0.117	0.117	0.000	0.000	0.000	0.107	0.000	0.294
Cats	13.325	13.320	13.555	13.596	13.421	13.650	13.630	13.171

DY dark yellow YE yellow
R rim

CHEVKINITE ALTERATION

GRANITE

G-1

	WLD-85								
	1 RE	2 RE	1 RE	2 OR	3 OR	4 OR	5 OY	6 YE	7 YI
SiO2	11.56	14.61	12.56	13.42	10.68	16.86	14.07	11.75	17.[illegible]
TiO2	37.39	32.02	30.07	40.35	43.62	27.99	31.24	30.02	27.[illegible]
Al2O3	1.20	1.20	3.35	3.86	3.86	1.45	2.87	-	-
FeO	17.89	13.36	13.62	7.69	8.33	8.64	8.33	5.56	9.12
MgO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	-
MnO	0.04	0.04	0.04	0.05	0.05	0.10	0.06	0.00	0.[illegible]
CaO	0.52	0.95	0.65	0.06	0.05	1.63	0.79	0.63	1.85
Na2O	0.03	0.00	0.03	5.34	0.02	0.08	0.01	0.03	0.[illegible]
K2O	0.00	0.00	0.00	0.01	0.01	0.02	0.00	-	-
Y2O3	0.14	0.31	0.62	0.26	0.29	0.78	1.39	0.73	0.95
La2O3	2.23	4.79	3.15	0.82	0.94	5.98	2.71	1.55	5.[illegible]
Ce2O3	5.25	9.03	6.32	2.04	2.61	13.24	6.67	3.36	12.[illegible]
Nd2O3	2.11	3.76	2.72	1.10	0.95	5.03	2.41	1.68	5.14
Sm2O3	0.74	1.11	1.16	0.53	0.69	2.07	1.40	0.63	2.29
Nb2O5	2.80	2.34	5.58	4.58	5.16	3.94	8.54	5.45	3.[illegible]
Ta2O5	0.20	0.18	0.04	0.21	0.16	0.07	0.47	0.47	0.[illegible]
ThO2	1.21	1.02	3.18	2.17	2.94	1.43	5.04	7.51	1.27
ZrO2	1.55	1.26	1.31	0.56	0.71	0.63	0.70	1.01	0.[illegible]
P2O5	1.05	1.05	2.59	4.13	4.13	1.46	2.59	2.99	1.[illegible]
UO2	-	-	-	-	-	-	-	-	-
F	0.35	0.35	0.38	0.21	0.21	0.28	0.48	-	-
Cl	0.07	0.07	0.10	0.13	0.13	0.02	0.07	-	-
O=F,Cl	0.16	0.16	0.18	0.12	0.12	0.12	0.22	-	-
Total	86.17	87.29	87.29	87.40	85.42	91.58	89.62	73.37	91.0

Recalculated on the basis of 22 oxygen atoms

Si	2.408	3.187	2.788	2.673	2.339	3.773	3.177	3.074	3.88[illegible]
Ti	5.856	5.253	5.019	6.044	7.184	4.711	5.305	5.906	4.470
Fe	3.116	2.438	2.528	1.281	1.526	1.617	1.573	1.216	1.65
Mn	0.007	0.007	0.008	0.008	0.009	0.019	0.011	0.000	0.02
Ca	0.116	0.222	0.155	0.013	0.012	0.391	0.191	0.177	0.429
Na	0.012	0.000	0.013	2.062	0.008	0.035	0.004	0.015	0.02[illegible]
Y	0.016	0.036	0.073	0.028	0.034	0.093	0.167	0.102	0.10
La	0.171	0.385	0.258	0.060	0.076	0.494	0.226	0.150	0.47[illegible]
Ce	0.400	0.721	0.514	0.149	0.209	1.085	0.551	0.322	0.990
Nd	0.157	0.293	0.216	0.078	0.074	0.402	0.194	0.157	0.39[illegible]
Sm	0.053	0.083	0.089	0.036	0.052	0.160	0.109	0.057	0.17[illegible]
Nb	0.264	0.231	0.560	0.412	0.511	0.399	0.872	0.645	0.352
Ta	0.011	0.011	0.002	0.011	0.010	0.004	0.029	0.033	0.00
Th	0.057	0.051	0.161	0.098	0.147	0.073	0.259	0.447	0.06
Zr	0.157	0.134	0.142	0.054	0.076	0.069	0.077	0.129	0.102
P	0.185	0.194	0.487	0.696	0.766	0.277	0.495	0.662	0.32[illegible]
Cats	12.987	13.247	13.009	13.706	13.033	13.599	13.242	13.091	13.47

RE red OR orange
OY orangy YE yellowish

CHLORITE

GRANITE

G-1

HYBRID UNIT

H-6

	1	1	2	3	4	5	6
SiO2	35.27	28.03	28.27	25.49	25.48	27.98	32.31
Al2O3	11.17	17.66	17.03	18.14	18.83	16.76	14.65
TiO2	2.75	0.10	0.04	0.00	0.06	0.00	1.37
FeO	29.86	31.57	28.73	36.60	36.25	33.44	23.62
MnO	0.23	0.32	0.20	0.37	0.24	0.25	0.21
MgO	1.05	10.22	11.78	5.62	5.99	6.79	13.46
CaO	0.06	0.11	0.06	0.03	0.00	0.33	0.07
Na2O	0.08	0.01	0.00	0.00	0.02	0.05	0.00
K2O	5.78	0.02	0.01	0.01	0.02	0.04	2.37
Total	86.27	88.03	86.12	86.25	86.89	85.62	88.06
Si	7.901	6.062	6.159	5.831	5.762	6.302	6.744
AlZ	0.099	1.938	1.841	2.169	2.238	1.698	1.256
AlY	2.850	2.564	2.531	2.723	2.782	2.752	2.347
Ti	0.463	0.016	0.007	0.000	0.010	0.000	0.215
Fe2	5.594	5.711	5.234	7.002	6.854	6.299	4.123
Fe3Y	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mn	0.043	0.058	0.037	0.071	0.046	0.048	0.037
Mg	0.352	3.293	3.824	1.918	2.017	2.278	4.187
Ca	0.015	0.025	0.014	0.007	0.000	0.078	0.015
Na	0.034	0.003	0.000	0.000	0.010	0.021	0.000
K	1.653	0.004	0.002	0.003	0.006	0.012	0.632
Ysite	11.004	11.675	11.649	11.724	11.725	11.490	11.555
Oxyg	28.000	28.000	28.000	28.000	28.000	28.000	28.000

CHLORITE

QUARTZ SYENITE — QUARTZ SYENITE HYBRID

QS-1 — QS-10

	1 ?	1	2	3 AMP	4 FIB
SiO2	28.21	25.45	26.50	26.29	25.47
Al2O3	15.09	20.05	19.31	19.65	20.06
TiO2	0.05	0.08	0.14	0.00	0.00
FeO	40.05	32.97	30.42	30.44	31.28
MnO	0.63	0.09	0.12	0.19	0.21
MgO	4.45	8.61	11.01	9.77	8.93
CaO	0.17	0.05	0.04	0.10	0.03
Na2O	0.01	0.02	0.04	0.00	0.01
K2O	0.86	0.00	0.00	0.02	0.00
P2O5	-	-	-	-	-
F	-	-	-	-	-
Cl	-	-	-	-	-
Total	89.52	87.30	87.58	86.46	86.00
Si	6.340	5.610	5.734	5.768	5.655
AlZ	1.660	2.390	2.266	2.232	2.345
AlY	2.337	2.820	2.660	2.850	2.905
Ti	0.009	0.012	0.023	0.000	0.000
Fe2	7.528	6.078	5.506	5.586	5.809
Fe3Y	0.000	0.000	0.000	0.000	0.000
Mn	0.120	0.017	0.023	0.035	0.039
Mg	1.492	2.830	3.551	3.195	2.957
Ca	0.041	0.012	0.009	0.023	0.007
Na	0.006	0.006	0.016	0.000	0.006
K	0.246	0.001	0.000	0.005	0.000
Ysite	11.779	11.776	11.788	11.694	11.723
Oxyg	28.000	28.000	28.000	28.000	28.000

AMP in amphibole
FIB fibrous
? chlorite?

CHLORITE

QUARTZ SYENITE (HYBRID)		MAFICS		
QSP-1		DM-1		
	1	1	2	3
SiO2	31.34	30.62	28.78	27.53
Al2O3	13.70	15.17	17.54	12.51
TiO2	2.89	0.04	0.08	0.04
FeO	25.88	23.16	23.55	18.70
MnO	0.02	0.18	0.26	0.16
MgO	12.20	17.71	16.47	16.76
CaO	0.22	0.07	0.07	3.70
Na2O	0.00	0.00	0.00	0.01
K2O	1.25	0.00	0.02	0.00
P2O5	0.00	0.01	0.00	2.89
F	0.07	0.00	0.03	0.44
Cl	0.10	0.00	0.00	0.03
OH	11.32	11.48	11.40	10.96
Total	98.99	98.44	98.20	93.73
Si	6.636	6.392	6.048	6.017
Al	3.419	3.732	4.345	3.224
Ti	0.460	0.007	0.012	0.007
Fe	4.583	4.043	4.139	3.419
Mn	0.003	0.031	0.047	0.029
Mg	3.851	5.509	5.158	5.462
Ca	0.051	0.017	0.015	0.867
Na	0.001	0.000	0.000	0.005
K	0.339	0.000	0.004	0.001
P	0.000	0.001	0.000	0.534
F	0.044	0.000	0.019	0.304
Cl	0.034	0.000	0.000	0.010
OH	8.000	8.000	8.000	8.000
	27.429	27.732	37.787	27.877
Fm	0.544	0.425	0.448	0.387

Epidote

Syenite hybrid
QSP-1P

SiO2	37.84	38.00	39.12	37.97	38.63	38.30	37.73
TiO2	0.00	0.03	0.03	0.07	0.00	0.04	0.00
Al2O3	21.69	19.74	24.67	21.47	24.24	25.28	22.64
FeO	12.50	14.77	9.77	13.40	9.88	8.23	11.43
MgO	0.00	0.00	0.00	0.02	0.00	0.00	0.00
MnO	0.10	0.01	0.02	0.00	0.03	0.30	0.24
CaO	22.34	22.43	22.70	22.56	23.31	22.34	22.13
Na2O	0.00	0.00	0.00	0.00	0.00	0.01	0.05
K2O	0.01	0.00	0.00	0.00	0.01	0.00	0.00
P2O5	0.03	0.05	0.00	0.02	0.03	0.14	0.04
UO2	0.00	0.00	2.13	0.00	0.00	-	0.00
F	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00
O=F,Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	94.51	95.03	98.44	95.51	96.13	94.65	94.26

Cations

Si	3.31	3.35	3.27	3.30	3.27
Ti	0.00	0.00	0.00	0.00	0.00
Al	2.24	2.05	2.43	2.20	2.42
Fe	0.91	1.09	0.68	0.97	0.70
Mg	0.00	0.00	0.00	0.00	0.00
Mn	0.00	0.00	0.00	0.00	0.00
Ca	2.09	2.12	2.03	2.10	2.12
Na	0.00	0.00	0.00	0.00	0.00
K	0.00	0.00	0.00	0.00	0.00
P	0.00	0.00	0.00	0.00	0.00
U	0.00	0.00	0.04	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00
Cl	0.00	0.00	0.00	0.00	0.00
OH	1.00	1.00	1.00	1.00	1.00

Epidote

	Syenite hybrid QS-10		Hybrid unit H-6
SiO2	38.92	38.90	38.55
TiO2	0.17	0.06	0.00
Al2O3	25.26	26.77	22.65
FeO	8.34	6.07	11.57
MgO	0.04	0.00	0.00
MnO	0.26	0.03	0.14
CaO	22.45	23.19	22.52
Na2O	0.00	0.02	0.02
K2O	0.01	0.00	0.00
P2O5	0.08	0.03	0.00
UO2	-	-	-
F	0.00	0.00	0.00
Cl	0.02	0.01	0.00
O=F,Cl	0.00	0.00	0.00
Total	95.55	95.08	95.45

Titanite

	Syenite hybrid QSP-1			QS-10		Hybrid H-6	(RIM)
SiO2	30.81	30.73	30.68	30.69	30.63	31.45	31.43
TiO2	41.74	40.99	40.03	40.89	39.72	35.02	35.21
Al2O3	0.52	0.54	1.19	1.54	1.98	5.64	5.26
FeO	0.37	0.44	1.05	0.98	0.98	0.61	0.97
MgO	0.01	0.00	0.00	0.00	0.00	0.00	0.00
MnO	0.02	0.00	0.00	0.00	0.01	0.02	0.07
CaO	27.72	27.98	27.54	28.02	27.76	28.20	28.25
Na2O	0.00	0.00	0.02	0.01	0.04	0.00	0.00
K2O	0.00	0.00	0.00	0.01	0.00	0.01	0.01
P2O5	0.10	0.04	0.12	0.01	0.01	0.08	0.00
F	0.04	0.06	0.07	0.07	0.18	1.65	0.97
Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00
O=F,Cl	0.02	0.03	0.03	0.03	0.08	0.69	0.41
Total	101.31	100.75	100.67	102.19	101.23	101.99	101.76

Fayalite

	Syenite QS-5				QS-3 Iddingsite?				
			Alt.	Alt.					
SiO2	30.84	30.80	30.73	30.79	31.46	30.90	30.95	30.67	30.54
TiO2	0.07	0.12	0.06	0.02	0.00	0.02	0.05	0.03	0.17
Al2O3	0.00	0.02	0.02	0.01	0.00	0.03	0.00	0.05	0.01
FeO	62.82	62.62	61.38	61.34	67.09	66.63	61.09	60.30	60.59
MgO	3.18	3.19	3.03	3.44	2.66	2.60	2.82	2.94	2.07
MnO	2.24	2.23	2.23	2.15	1.93	2.04	1.85	1.71	2.10
CaO	0.08	0.10	0.10	0.17	0.10	0.08	0.08	0.07	0.11
Na2O	0.02	0.02	0.00	0.00	0.00	0.02	0.00	0.05	0.00
K2O	0.00	0.00	0.00	0.02	0.01	0.00	0.01	0.03	0.00
P2O5	0.03	0.00	0.03	0.00	0.00	0.08	0.00	0.00	0.03
Total	99.28	99.10	97.58	97.94	103.25	102.40	96.85	95.85	95.62

Fayalite

	Syenite 74-101						74-14	
					Alt.			
SiO2	31.00	31.27	30.10	31.06	26.97	28.90	30.98	30.65
TiO2	0.00	0.00	0.00	0.00	0.11	0.07	0.01	0.00
Al2O3	0.02	0.05	0.03	0.03	0.03	0.00	0.03	0.02
FeO	66.21	66.75	67.24	67.46	63.46	61.19	68.12	68.09
MgO	1.25	1.34	0.34	1.33	1.22	1.34	0.74	0.76
MnO	2.44	2.44	2.61	2.53	2.39	2.28	2.42	2.42
CaO	0.15	0.19	0.17	0.18	0.17	0.18	0.13	0.13
Na2O	0.00	0.10	0.06	0.11	0.18	0.00	0.00	0.01
K2O	0.03	0.04	0.02	0.01	0.00	0.04	0.00	0.01
F	0.00	0.00	0.00	0.16	0.00	0.08	0.00	0.00
Total	101.10	102.18	100.57	102.87	94.53	94.08	102.43	102.09
Fo	3.13	3.34	3.30	3.27	3.18	3.62	1.83	1.90
Fa	96.87	96.66	96.70	96.73	96.82	96.38	98.17	98.10

Alt. altered

	Fluorite	Thorite (?) (hydrothorite)			
	Granophyre 74-78	Hybrid H-6 RED CO	CORE	RIM	ALTRIM
SiO2	0.06	15.56	19.24	15.88	22.03
TiO2	0.01	1.61	1.18	1.20	3.00
Al2O3	0.01	-	-	0.61	-
FeO	0.78	10.34	7.02	1.59	13.76
MgO	0.00	-	-	0.01	-
MnO	0.04	-	-	0.09	-
CaO	69.47	0.31	0.39	0.26	0.91
Na2O	0.41	0.03	0.00	0.00	0.07
K2O	0.06	-	-	0.00	-
Y2O3	-	1.94	2.81	3.77	1.26
La2O3	-	0.15	0.28	0.28	0.37
Ce2O3	-	0.36	0.64	0.54	0.36
Nd2O3	-	0.66	1.32	1.18	0.58
Sm2O3	-	0.47	0.58	0.44	0.15
Ta2O5	-	0.17	0.11	0.02	0.12
Nb2O5	-	0.24	0.07	0.14	0.14
P2O5	0.05	-	-	1.86	-
ThO2	-	35.83	49.19	54.28	9.33
ZrO2	-	3.29	2.69	2.31	6.68
UO2	-	-	-	-	-
F	56.45	-	-	0.42	-
Cl	-	-	-	0.06	-
O=F,Cl	23.71	-	-	0.19	-
Total	103.63	70.96	85.52	84.75	58.76

CO core
ALTRIM altered rim

Fayalite **Iddingsite**

	QS-5 red	yell	yell	red	QS-1 red	red	WLD-100 oran	oran	74-17		74-14
SiO2	41.91	42.61	42.53	41.85	37.32	36.77	41.99	38.14	49.69	44.82	40.11
TiO2	0.02	0.07	0.09	0.34	0.16	0.08	0.00	0.11	0.01	0.00	0.05
Al2O3	1.39	0.02	0.02	1.48	4.30	5.71	2.77	1.01	3.05	2.61	2.73
FeO	37.17	32.65	29.85	33.77	32.11	35.69	36.31	42.42	37.94	36.62	45.05
MgO	1.26	0.69	0.51	1.07	1.46	3.42	1.12	0.89	1.07	1.08	0.11
MnO	0.77	0.37	0.49	0.54	0.45	0.25	0.67	0.31	1.41	1.56	0.21
CaO	0.76	1.92	2.28	1.10	2.14	1.80	0.36	0.53	0.34	0.34	0.28
Na2O	0.00	0.12	0.09	1.24	0.11	0.17	0.04	0.00	0.37	0.08	3.13
K2O	0.06	0.14	0.11	0.02	0.14	0.10	0.02	0.03	0.32	0.20	1.67
Y2O3	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-
La2O3	0.03	0.03	0.08	0.00	-	-	-	-	-	-	-
Ce2O3	0.00	0.07	0.00	0.16	-	-	-	-	-	-	-
Nd2O3	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-
Sm2O3	0.00	0.01	0.04	0.00	-	-	-	-	-	-	-
Ta2O5	0.21	0.23	0.39	0.26	-	-	-	-	-	-	-
Nb2O5	0.02	0.00	0.00	0.00	-	-	-	-	-	-	-
P2O5	0.00	0.01	0.02	0.00	0.07	0.00	0.03	0.09	0.00	0.02	0.02
ThO2	0.08	0.00	0.13	0.04	-	-	-	-	-	-	-
ZrO2	0.00	0.00	0.00	0.14	-	-	-	-	-	-	-
UO2	-	-	-	-	-	-	-	-	-	-	-
F	0.07	0.03	0.00	0.00	0.03	0.00	0.08	0.00	0.05	0.00	0.00
Cl	0.00	0.03	0.01	0.00	0.00	0.13	0.02	0.01	-	-	-
O=F,Cl	0.03	0.02	0.00	0.00	0.01	0.03	0.04	0.00	0.02	0.00	0.00
Total	83.72	78.98	76.64	82.01	78.28	84.09	83.37	83.54	94.23	87.33	93.36

yell yellow
oran orange

ILMENITE

QUARTZ SYENITE

	QS-1			QS-3					74-14
	1	2	3	1	2	3	4	5	1
Al203	0.00	0.00	0.00	0.00	0.01	0.03	0.02	0.02	0.00
Ti02	53.93	52.97	55.19	51.04	53.01	51.86	55.43	55.20	53.13
FeO	44.19	44.11	45.26	50.35	49.90	47.60	44.57	43.17	46.53
MnO	3.89	3.13	1.44	1.35	0.76	1.21	1.19	2.27	1.27
MgO	0.00	0.01	0.07	0.03	0.16	0.04	0.02	0.00	0.01
NiO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V203	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cr203	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	102.01	100.22	101.96	102.77	103.84	100.74	101.23	100.66	100.94
Calculated Fe203 following Carmichael (1967)									
Fe203	0.00	0.00	0.00	6.53	3.65	2.52	0.00	0.00	0.07
FeO	44.19	44.11	45.26	44.47	46.61	45.34	44.57	43.17	46.47
TOTAL	102.01	100.22	101.96	103.42	104.21	100.99	101.23	100.66	100.95
Structural formula based on 3 oxygen atoms									
Al	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.000
Ti	1.003	1.002	1.019	0.940	0.967	0.976	1.027	1.028	0.999
Fe3+	0.000	0.000	0.000	0.120	0.067	0.047	0.000	0.000	0.001
Fe2+	0.914	0.928	0.929	0.911	0.945	0.949	0.919	0.895	0.972
Mn	0.081	0.067	0.030	0.028	0.016	0.026	0.025	0.048	0.027
MG	0.000	0.000	0.003	0.001	0.006	0.001	0.001	0.000	0.000
Ni	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
V	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cats	1.997	1.998	1.981	2.000	2.000	2.000	1.972	1.971	2.000
Molecular percentage of end members									
FeTi03	94.10	93.87	101.47	93.93	98.45	95.75	102.65	99.98	98.15
MnTi03	8.27	6.66	3.06	2.87	1.62	2.57	2.53	4.83	2.70
MgTi03	0.00	0.03	0.21	0.09	0.48	0.12	0.06	0.00	0.03
Fe203/ (Fe203+FeTi03)	0.00	0.00	0.00	6.20	3.41	2.44	0.00	0.00	0.06

ILMENITE

QUARTZ SYENITE

QS-5				WLD-100					74-101
	1	2	3	1	2	3	4	5	1
Al203	0.01	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00
Ti02	53.84	52.83	53.73	52.59	52.60	52.35	53.61	53.52	52.41
FeO	45.75	45.98	45.29	47.92	46.70	45.95	46.19	46.02	47.14
MnO	1.61	1.75	1.98	1.58	1.54	1.09	2.10	1.63	1.74
MgO	0.02	0.02	0.07	0.06	0.04	0.14	0.00	0.02	0.03
NiO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V203	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cr203	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	101.23	100.58	101.07	102.15	100.88	99.53	101.94	101.19	101.32
Calculated Fe203 following Carmichael (1967)									
Fe203	0.00	0.31	0.00	2.60	1.15	0.26	0.12	0.00	2.03
FeO	45.75	45.70	45.29	45.58	45.67	45.72	46.08	46.02	45.31
TOTAL	101.23	100.61	101.07	102.41	101.00	99.56	101.95	101.19	101.52
Structural formula based on 3 oxygen atoms									
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
Ti	1.007	0.997	1.006	0.976	0.989	0.998	0.998	1.003	0.981
Fe3+	0.000	0.006	0.000	0.048	0.022	0.005	0.002	0.000	0.038
Fe2+	0.951	0.959	0.943	0.941	0.955	0.969	0.954	0.959	0.943
Mn	0.034	0.037	0.042	0.033	0.033	0.023	0.044	0.034	0.037
MG	0.001	0.001	0.003	0.002	0.001	0.005	0.000	0.001	0.001
Ni	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
V	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cats	1.993	2.000	1.994	2.000	2.000	2.000	2.000	1.997	2.000
Molecular percentage of end members									
FeTi03	98.73	96.52	97.54	96.27	96.45	96.56	97.32	98.08	95.70
MnTi03	3.42	3.72	4.21	3.36	3.27	2.32	4.47	3.47	3.70
MgTi03	0.06	0.06	0.21	0.18	0.12	0.42	0.00	0.06	0.09
Fe203/ (Fe203+FeTi03)	0.00	0.31	0.00	2.50	1.12	0.25	0.12	0.00	1.98

ILMENITE

QUARTZ SYENITE HYBRID (DIORITE PEGMATITE)

QSP-1 PEGMATITE						QSP-1	
	1	2	3	4	5	1	2
Al203	0.03	0.00	0.01	0.00	0.01	0.02	0.02
Ti02	49.05	51.84	50.91	52.90	52.69	53.20	52.94
FeO	47.14	45.61	45.29	43.73	44.14	43.95	44.50
MnO	1.38	1.60	1.27	1.61	1.41	1.53	1.22
MgO	0.06	0.07	0.12	0.05	0.01	0.06	0.12
NiO	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V203	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cr203	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	97.66	99.12	97.60	98.29	98.26	98.76	98.80
Calculated Fe203 following Carmichael (1967)							
Fe203	5.04	0.82	1.12	0.00	0.00	0.00	0.00
FeO	42.60	44.87	44.28	43.73	44.14	43.95	44.50
TOTAL	98.17	99.20	97.71	98.29	98.26	98.76	98.80
Structural formula based on 3 oxygen atoms							
Al	0.001	0.000	0.000	0.000	0.000	0.001	0.001
Ti	0.951	0.992	0.989	1.015	1.013	1.015	1.011
Fe3+	0.098	0.016	0.022	0.000	0.000	0.000	0.000
Fe2+	0.918	0.955	0.957	0.933	0.943	0.933	0.945
Mn	0.030	0.034	0.028	0.035	0.031	0.033	0.026
MG	0.002	0.003	0.005	0.002	0.000	0.002	0.005
Ni	0.000	0.000	0.000	0.000	0.000	0.000	0.000
V	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cats	2.000	2.000	2.000	1.985	1.987	1.984	1.988
Molecular percentage of end members							
FeTi03	89.98	94.77	93.52	96.83	97.01	97.54	97.48
MnTi03	2.93	3.40	2.70	3.42	3.00	3.25	2.59
MgTi03	0.18	0.21	0.36	0.15	0.03	0.18	0.36
Fe203/ (Fe203+FeTi03)	5.06	0.82	1.13	0.00	0.00	0.00	0.00

ILMENITE

QUARTZ SYENITE HYBRID (DIORITE)					MAFICS
QS-10					DM-1
	1	2	3	4	1
Al203	0.00	0.02	0.03	0.04	0.01
Ti02	50.77	51.56	51.78	52.31	49.53
FeO	46.71	47.33	45.63	43.28	45.98
MnO	1.46	1.68	1.26	1.19	1.71
MgO	0.04	0.05	0.11	0.09	0.08
NiO	0.00	0.00	0.00	0.00	0.00
V203	0.00	0.00	0.00	0.00	0.00
Cr203	0.00	0.00	0.00	0.00	0.00
Total	98.98	100.64	98.81	96.91	97.31
Calculated Fe203 following Carmichael (1967)					
Fe203	2.90	3.07	0.60	0.00	3.69
FeO	44.10	44.57	45.09	43.28	42.66
TOTAL	99.27	100.95	98.87	96.91	97.68
Structural formula based on 3 oxygen atoms					
Al	0.000	0.001	0.001	0.001	0.000
Ti	0.972	0.971	0.994	1.017	0.964
Fe3+	0.056	0.058	0.012	0.000	0.072
Fe2+	0.939	0.933	0.962	0.935	0.923
Mn	0.031	0.036	0.027	0.026	0.037
MG	0.002	0.002	0.004	0.003	0.003
Ni	0.000	0.000	0.000	0.000	0.000
V	0.000	0.000	0.000	0.000	0.000
Cr	0.000	0.000	0.000	0.000	0.000
Cats	2.000	2.000	2.000	1.983	2.000
Molecular percentage of end members					
FeTi03	93.15	94.14	95.23	96.46	90.11
MnTi03	3.10	3.57	2.68	2.53	3.64
MgTi03	0.12	0.15	0.33	0.27	0.24
Fe203/ (Fe203+FeTi03)	2.87	3.00	0.60	0.00	3.74

ILMENITE

GRANITE			ALKALI GRANITE		
G-1			AG-P1	WLD-36	74-63
	1	2	1	2	1
Al2O3	0.05	0.00	0.00	0.02	0.00
TiO2	52.28	51.84	57.30	51.10	42.80
FeO	46.12	45.79	38.45	47.56	47.06
MnO	1.88	2.13	4.52	2.17	0.31
MgO	0.01	0.00	0.01	0.03	0.03
NiO	0.00	0.00	0.00	0.00	0.00
V2O3	0.00	0.00	0.00	0.00	0.00
Cr2O3	0.00	0.00	0.00	0.00	0.00
Total	100.34	99.76	100.28	100.88	90.20
Calculated Fe2O3 following Carmichael (1967)					
Fe2O3	1.15	1.48	0.00	4.29	9.94
FeO	45.09	44.46	38.45	43.70	38.12
TOTAL	100.45	99.91	100.28	101.31	91.20
Structural formula based on 3 oxygen atoms					
Al	0.001	0.000	0.000	0.001	0.000
Ti	0.988	0.986	1.058	0.959	0.896
Fe3+	0.022	0.028	0.000	0.081	0.208
Fe2+	0.948	0.940	0.790	0.912	0.887
Mn	0.040	0.046	0.094	0.046	0.007
MG	0.000	0.000	0.000	0.001	0.001
Ni	0.000	0.000	0.000	0.000	0.000
V	0.000	0.000	0.000	0.000	0.000
Cr	0.000	0.000	0.000	0.000	0.000
Cats	2.000	2.000	1.942	2.000	2.000
Molecular percentage of end members					
FeTiO3	95.23	93.90	99.12	92.29	80.51
MnTiO3	4.00	4.53	9.61	4.61	0.66
MgTiO3	0.03	0.00	0.03	0.09	0.09
Fe2O3/ (Fe2O3+FeTiO3)	1.13	1.48	0.00	4.23	10.50

ILMENITE

HYBRID UNIT

	H-2			H-6					
	1	2	3	1	2	3	4	5	6
Al203	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.02	0.01
TiO2	53.41	55.20	57.45	51.40	51.99	52.37	53.09	51.96	53.35
FeO	44.16	43.76	38.36	46.13	44.56	43.47	44.00	43.90	41.75
MnO	2.00	2.28	5.14	2.80	1.62	1.95	1.71	1.61	1.64
MgO	0.02	0.01	0.00	0.02	0.00	0.02	0.01	0.03	0.02
NiO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V203	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cr203	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	99.59	101.25	100.97	100.35	98.17	97.81	98.81	97.52	96.77
Calculated Fe203 following Carmichael (1967)									
Fe203	0.00	0.00	0.00	3.09	0.00	0.00	0.00	0.00	0.00
FeO	44.16	43.76	38.36	43.35	44.56	43.47	44.00	43.90	41.75
TOTAL	99.59	101.25	100.97	100.66	98.17	97.81	98.81	97.52	96.77
Structural formula based on 3 oxygen atoms									
Al	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.000
Ti	1.013	1.024	1.055	0.971	1.004	1.012	1.014	1.008	1.032
Fe3+	0.000	0.000	0.000	0.058	0.000	0.000	0.000	0.000	0.000
Fe2+	0.931	0.903	0.783	0.910	0.957	0.934	0.935	0.947	0.898
Mn	0.043	0.048	0.106	0.060	0.035	0.042	0.037	0.035	0.036
MG	0.001	0.000	0.000	0.001	0.000	0.001	0.000	0.001	0.001
Ni	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
V	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cats	1.987	1.976	1.945	2.000	1.996	1.988	1.986	1.992	1.968
Molecular percentage of end members									
FeTiO3	97.08	99.92	98.11	91.55	95.27	95.21	97.13	95.12	97.74
MnTiO3	4.25	4.85	10.93	5.95	3.44	4.15	3.64	3.42	3.49
MgTiO3	0.06	0.03	0.00	0.06	0.00	0.06	0.03	0.09	0.06
Fe203/ (Fe203+FeTiO3)	0.00	0.00	0.00	3.11	0.00	0.00	0.00	0.00	0.00

MAGNETITE

QUARTZ SYENITE			MAFICS		GRANITE		
QS-3		WLD-100	DM-1		WLD-85		
	1	1	1	2	1	2	3
Al203	0.26	0.32	0.68	1.86	0.17	0.17	0.17
Ti02	2.95	8.56	18.05	12.31	1.27	4.90	3.40
FeO	87.88	87.84	74.88	75.16	87.34	82.00	83.86
MnO	0.05	0.48	1.05	0.47	0.10	0.11	0.15
MgO	0.00	0.00	0.04	0.00	0.01	0.02	0.03
NiO	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V203	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cr203	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	91.14	97.20	94.70	89.80	88.89	87.20	87.61
Calculated Fe203 following Carmichael (1967)							
Fe203	61.08	53.87	31.91	38.67	63.02	54.25	57.67
FeO	32.92	39.37	46.16	40.37	30.64	33.19	31.97
TOTAL	97.26	102.60	97.90	93.67	95.20	92.63	93.39
Structural formula based on 4 oxygen atoms							
Al	0.012	0.014	0.031	0.088	0.008	0.008	0.008
Ti	0.087	0.239	0.522	0.372	0.039	0.152	0.105
Fe3+	1.813	1.507	0.924	1.168	1.915	1.687	1.782
Fe2+	1.086	1.224	1.486	1.356	1.035	1.147	1.098
Mn	0.002	0.015	0.034	0.016	0.003	0.004	0.005
MG	0.000	0.000	0.002	0.000	0.001	0.001	0.002
Ni	0.000	0.000	0.000	0.000	0.000	0.000	0.000
V	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cats	3.000	3.000	3.000	3.000	3.000	3.000	3.000
Molecular percentage of end members							
Fe2Ti04	8.18	23.20	48.75	33.71	3.37	13.48	9.19
Fe304	88.56	78.10	46.27	56.06	91.37	78.65	83.61
MnTi04	0.08	0.75	1.64	0.73	0.16	0.17	0.23
100*Fe2Ti04 (Fe2Ti04+Fe304)	8.73	23.52	52.17	38.37	3.68	15.08	10.22

MAGNETITE

GRANITE

G-1

	1	2	3	4	5	6	7	8
Al203	0.10	0.36	0.46	0.42	0.21	0.05	0.03	0.16
Ti02	1.26	1.13	0.81	10.44	0.77	0.05	0.22	1.58
FeO	90.64	90.24	91.17	83.16	90.26	90.72	87.18	90.23
MnO	0.07	0.09	0.08	0.33	0.05	0.00	0.00	0.12
MgO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
NiO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V203	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cr203	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	92.07	91.82	92.52	94.35	91.29	90.82	87.43	92.10
Calculated Fe203 following Carmichael (1967)								
Fe203	65.48	65.23	66.29	47.73	65.78	67.12	64.28	64.77
FeO	31.72	31.54	31.52	40.21	31.07	30.32	29.34	31.95
TOTAL	98.63	98.36	99.16	99.13	97.88	97.54	93.87	98.59
Structural formula based on 4 oxygen atoms								
Al	0.005	0.017	0.021	0.019	0.010	0.002	0.001	0.007
Ti	0.037	0.033	0.024	0.301	0.023	0.001	0.007	0.046
Fe3+	1.922	1.917	1.932	1.378	1.945	1.995	1.985	1.900
Fe2+	1.035	1.030	1.021	1.291	1.021	1.001	1.007	1.042
Mn	0.002	0.003	0.003	0.011	0.002	0.000	0.000	0.004
MG	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
Ni	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
V	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cats	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000
Molecular percentage of end members								
Fe2Ti04	3.42	3.02	2.14	28.70	2.08	0.14	0.62	4.20
Fe304	94.94	94.58	96.11	69.21	95.37	97.32	93.20	93.90
MnTi04	0.11	0.14	0.13	0.52	0.08	0.00	0.00	0.19
100*Fe2Ti04 (Fe2Ti04+Fe304)	3.59	3.20	2.25	30.04	2.20	0.15	0.68	4.43

MAGNETITE

ALKALI GRANITE

HYBRID UNIT

WLD-36

74-81

H-6

	1	2	3	4	1	2	1	2	3
Al203	0.07	0.02	0.06	0.07	0.04	0.02	0.44	0.18	0.0(
Ti02	2.49	18.41	12.90	14.62	9.06	20.39	4.97	2.66	0.6!
FeO	95.10	79.12	82.34	78.32	86.85	72.89	89.13	81.41	88.5:
MnO	0.16	1.19	0.52	1.21	0.61	0.60	0.12	0.31	0.0(
MgO	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.0(
NiO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0(
V203	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0(
Cr203	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0(
Total	97.82	98.76	95.83	94.22	96.56	93.90	94.66	84.56	89.1:
Calculated Fe203 following Carmichael (1967)									
Fe203	67.23	35.00	44.19	39.42	52.71	27.28	59.27	56.91	6[illegible].7:
FeO	34.61	47.63	42.58	42.85	39.42	48.35	35.79	30.20	30.2!
TOTAL	104.56	102.27	100.26	98.17	101.84	96.63	100.60	90.26	95.6!
Structural formula based on 4 oxygen atoms									
Al	0.003	0.001	0.003	0.003	0.002	0.001	0.020	0.009	0.00(
Ti	0.069	0.512	0.369	0.425	0.255	0.599	0.142	0.085	0.02(
Fe3+	1.859	0.975	1.261	1.147	1.487	0.802	1.696	1.821	1.96]
Fe2+	1.064	1.474	1.351	1.385	1.236	1.579	1.138	1.074	1.02(
Mn	0.005	0.037	0.017	0.040	0.019	0.020	0.004	0.011	0.00[illegible]
MG	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.00(
Ni	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00(
V	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00(
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00(
Cats	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.00(
Molecular percentage of end members									
Fe2Ti04	6.72	49.59	35.25	39.01	24.39	56.11	13.72	6.96	1.8[illegible]
Fe304	97.47	50.75	64.07	57.15	76.43	39.55	85.94	82.52	93.8[illegible]
MnTi04	0.25	1.86	0.81	1.89	0.95	0.94	0.19	0.48	0.0(
100*Fe2Ti04 (Fe2Ti04+Fe304)	6.66	50.30	36.30	41.41	24.84	59.50	14.19	8.03	1.97

Prehnite (Fe-rich)					Prehnite
	Syenite hybrid QSP-1				QSP-1
SiO2	44.22	43.46	45.11	44.28	44.69
TiO2	0.00	0.02	0.20	0.05	0.06
Al2O3	17.06	18.68	21.17	19.68	23.61
FeO	8.55	6.79	3.40	4.65	0.87
MgO	0.40	0.00	0.00	0.00	0.00
MnO	0.14	0.00	0.03	0.04	0.02
CaO	24.38	25.63	24.56	24.76	25.32
Na2O	0.00	0.00	0.00	0.01	0.00
K2O	0.00	0.01	0.03	0.00	0.01
P2O5	0.05	0.05	0.02	0.01	0.01
Total	94.80	94.64	94.52	93.48	94.59

PYROCHLORE (ALKALI GRANITE)

AG-P4

	1 GR	2 GR	3 BR	4 BR	5 GR	6 GR	7 YE	8 YE
SiO2	0.00	0.00	0.67	0.81	0.00	0.00	3.64	1.62
Al2O3	0.00	0.00	0.02	0.02	0.00	0.00	0.33	0.00
TiO2	9.52	7.87	8.76	10.52	8.22	8.42	9.17	9.91
FeO	0.00	0.00	1.12	0.86	0.03	0.00	2.60	1.52
MgO	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00
MnO	0.01	0.01	0.13	0.13	0.00	0.00	0.13	0.00
CaO	5.79	5.60	3.11	5.14	6.54	5.96	3.35	5.05
Na2O	5.99	5.89	0.04	0.03	5.51	5.53	0.03	0.00
K2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Y2O3	1.47	1.21	1.09	0.79	1.15	1.19	1.16	0.82
La2O3	2.23	2.18	1.75	1.83	2.17	1.92	1.09	1.71
Ce2O3	6.67	7.10	6.25	6.38	6.50	6.35	4.88	6.26
Nd2O3	3.28	3.50	2.88	3.19	3.07	3.12	2.77	3.54
Sm2O3	1.42	1.38	1.48	1.37	1.29	1.24	1.10	1.42
Nb2O5	57.43	56.03	49.89	54.17	62.02	58.01	53.42	55.52
Ta2O5	2.94	3.34	3.13	3.33	2.77	3.37	3.50	3.46
ThO2	1.36	1.29	0.99	0.85	1.05	0.65	2.59	1.87
ZrO2	0.70	1.10	2.43	1.47	0.31	1.30	0.70	0.76
P2O5	0.06	0.06	0.01	0.01	0.04	0.04	0.14	0.00
F	4.53	4.53	0.79	0.79	4.18	4.18	0.36	0.00
Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
O=F,Cl	1.90	1.90	0.33	0.33	1.75	1.75	0.15	0.00
Total	101.50	99.19	84.22	91.38	103.10	99.53	90.81	93.48

Recalculated on the basis of 6 oxygen atoms

Si	0.000	0.000	0.065	0.069	0.000	0.000	0.311	0.137
Al	0.000	0.000	0.002	0.002	0.000	0.000	0.033	0.000
Ti	0.527	0.454	0.638	0.677	0.452	0.477	0.588	0.630
Mn	0.001	0.001	0.011	0.009	0.000	0.000	0.009	0.000
Ca	0.456	0.460	0.323	0.471	0.512	0.481	0.306	0.458
Na	0.854	0.876	0.008	0.005	0.781	0.807	0.005	0.000
Y	0.058	0.049	0.056	0.036	0.045	0.048	0.053	0.037
La	0.061	0.062	0.062	0.058	0.059	0.053	0.034	0.053
Ce	0.180	0.199	0.222	0.200	0.174	0.175	0.152	0.194
Nd	0.086	0.096	0.100	0.098	0.080	0.084	0.084	0.102
Sm	0.036	0.036	0.049	0.040	0.033	0.032	0.032	0.041
Nb	1.910	1.944	2.184	2.096	2.050	1.975	2.061	2.123
Ta	0.059	0.070	0.082	0.078	0.055	0.069	0.081	0.080
Th	0.023	0.023	0.022	0.017	0.017	0.011	0.050	0.036
Zr	0.025	0.041	0.115	0.061	0.011	0.048	0.029	0.031
P	0.004	0.004	0.001	0.001	0.002	0.003	0.010	0.000
Cats	4.279	4.316	3.939	3.919	4.272	4.262	3.840	3.927

Gr green
Br brown
Ye yellow

PYROCHLORE (ALKALI GRANITE)

AG-P4		AG-P2	WLD-36		WLD-49
	1 YE	1	1 Br	2	1
SiO2	0.15	2.18	0.00	0.00	3.77
Al2O3	-	0.54	0.00	0.00	0.35
TiO2	7.91	9.91	10.94	10.34	12.67
FeO	0.32	1.74	0.41	0.43	1.11
MgO	-	0.00	0.00	0.00	0.00
MnO	-	0.02	0.71	0.71	1.72
CaO	7.34	7.51	4.80	4.10	4.58
Na2O	0.02	0.00	0.00	0.00	0.00
K2O	-	0.00	0.00	0.00	0.09
Y2O3	0.58	1.29	1.07	1.12	2.20
La2O3	1.97	1.33	0.81	0.64	1.23
Ce2O3	6.55	4.91	2.97	3.01	3.23
Nd2O3	3.81	2.57	0.53	0.77	0.95
Sm2O3	1.23	1.11	0.07	0.12	0.64
Nb2O5	66.77	49.36	61.04	61.43	61.35
Ta2O5	2.52	2.46	5.53	5.29	2.31
ThO2	0.67	0.55	2.93	2.76	2.58
ZrO2	0.11	0.95	0.22	0.10	1.82
P2O5	0.00	0.07	0.05	0.05	0.08
F	-	0.23	0.00	0.00	0.28
Cl	-	0.02	0.00	0.00	0.00
O=F,Cl	-	0.10	0.00	0.00	0.12
Total	99.95	86.65	92.08	90.87	100.84
Recalculated on the basis of 6 oxygen atoms					
Si	0.012	0.182	0.000	0.000	0.263
Al	0.000	0.053	0.000	0.000	0.029
Ti	0.476	0.624	0.682	0.663	0.665
Mn	0.000	0.001	0.050	0.051	0.102
Ca	0.629	0.673	0.426	0.374	0.343
Na	0.003	0.000	0.000	0.000	0.000
Y	0.025	0.057	0.047	0.051	0.082
La	0.058	0.041	0.025	0.020	0.032
Ce	0.192	0.150	0.090	0.094	0.083
Nd	0.109	0.077	0.016	0.023	0.024
Sm	0.034	0.032	0.002	0.004	0.015
Nb	2.415	1.868	2.287	2.367	1.936
Ta	0.055	0.056	0.125	0.123	0.044
Th	0.012	0.010	0.055	0.054	0.041
Zr	0.004	0.039	0.009	0.004	0.062
P	0.000	0.005	0.004	0.004	0.005
Cats	4.024	3.870	3.817	3.831	3.724

Ye yellow
Br brown

PYROCHLORE (ALKALI GRANITE)

	AG-P2					AG-P4		
	1 GR	2 GR	3 GR	4 GR	5 GR	1 YE	2	3
SiO2	1.58	1.54	0.00	0.14	3.88	0.36	0.04	0.92
Al2O3	0.06	0.06	0.06	0.01	0.01	0.00	0.00	0.00
TiO2	12.81	10.41	10.85	11.01	12.13	9.45	9.04	9.01
FeO	1.18	0.37	0.58	1.42	4.68	0.20	0.00	0.02
MgO	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
MnO	0.16	0.16	0.16	0.32	0.32	0.00	0.00	0.00
CaO	2.03	5.50	3.02	3.84	0.30	6.41	6.09	6.32
Na2O	0.00	0.01	0.00	0.03	0.04	0.00	0.00	0.00
K2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Y2O3	3.02	1.58	2.31	1.64	1.30	1.00	1.01	1.09
La2O3	2.07	1.55	1.98	1.44	1.19	2.41	2.34	1.99
Ce2O3	6.11	5.28	5.10	5.95	4.39	6.66	6.28	5.82
Nd2O3	2.83	2.38	2.38	2.63	2.26	3.07	2.97	3.04
Sm2O3	1.38	0.95	1.05	1.15	0.94	1.23	1.24	1.19
Nb2O5	54.40	54.05	59.08	51.21	50.46	57.88	60.52	59.91
Ta2O5	3.13	2.66	2.99	2.72	2.84	3.45	3.51	3.42
ThO2	1.87	0.67	0.85	0.82	0.91	0.77	0.55	0.49
ZrO2	0.62	1.53	0.50	1.22	1.39	1.23	1.18	1.23
P2O5	0.07	0.07	0.07	0.03	0.03	0.09	0.09	0.09
F	0.56	0.56	0.56	0.38	0.38	8.90	8.90	8.90
Cl	0.01	0.01	0.01	0.01	0.01	0.05	0.05	0.05
O=F,Cl	0.23	0.23	0.23	0.16	0.16	3.75	3.75	3.75
Total	93.67	89.12	91.33	85.81	87.30	99.41	100.06	99.74
Recalculated on the basis of 6 oxygen atoms								
Si	0.134	0.129	0.000	0.013	0.345	0.030	0.003	0.075
Al	0.006	0.006	0.006	0.001	0.001	0.000	0.000	0.000
Ti	0.814	0.657	0.718	0.761	0.810	0.591	0.570	0.554
Mn	0.011	0.011	0.012	0.025	0.024	0.000	0.000	0.000
Ca	0.184	0.494	0.285	0.378	0.029	0.571	0.548	0.554
Na	0.000	0.002	0.000	0.005	0.007	0.000	0.000	0.000
Y	0.136	0.071	0.108	0.080	0.061	0.044	0.045	0.047
La	0.065	0.048	0.064	0.049	0.039	0.074	0.038	0.060
Ce	0.189	0.162	0.164	0.200	0.143	0.203	0.193	0.174
Nd	0.086	0.071	0.075	0.086	0.072	0.091	0.089	0.089
Sm	0.040	0.027	0.032	0.036	0.029	0.035	0.036	0.034
Nb	2.079	2.050	2.350	2.129	2.027	2.176	2.296	2.216
Ta	0.072	0.061	0.072	0.068	0.069	0.078	0.080	0.076
Th	0.036	0.013	0.017	0.017	0.018	0.015	0.011	0.009
Zr	0.026	0.063	0.021	0.055	0.060	0.050	0.048	0.049
P	0.005	0.005	0.005	0.002	0.002	0.006	0.006	0.006
Cats	3.882	3.870	3.929	3.907	3.736	3.963	3.964	3.945

Gr green
Ye yellow

Zircon

	Alkali granite AG-P1				AG-P2		AG-P4			WLD-36
			CO	RI						
SiO2	32.11	31.34	31.52	32.43	32.13	32.18	31.69	32.22	31.90	32.12
TiO2	0.03	0.00	0.00	0.05	0.04	0.00	0.00	0.18	0.00	0.00
Al2O3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00
FeO	0.04	0.54	0.04	0.05	0.05	0.05	0.00	0.02	0.02	0.02
MgO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00
MnO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00
CaO	0.00	0.02	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00
Na2O	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
K2O	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	-	0.00
Y2O3	0.00	3.51	-	-	0.01	0.01	1.31	0.00	0.68	0.31
La2O3	0.41	0.02	-	-	0.00	0.06	0.00	0.00	0.00	0.06
Ce2O3	0.76	0.00	-	-	0.00	0.12	0.20	0.00	0.12	0.00
Nd2O3	0.25	0.03	-	-	0.02	0.00	0.00	0.04	0.14	0.15
Sm2O3	0.21	0.02	-	-	0.00	0.00	0.12	0.00	0.09	0.00
Ta2O5	0.00	0.00	-	-	0.16	0.17	0.15	0.08	0.27	0.02
Nb2O5	0.00	0.00	-	-	0.00	0.00	0.00	0.00	0.00	0.00
P2O5	0.00	0.00	0.32	0.14	0.00	0.00	0.00	0.00	-	0.00
ThO2	0.11	0.79	-	-	0.02	0.17	0.18	0.00	0.42	0.21
ZrO2	63.56	58.54	57.40	59.27	64.01	63.26	63.89	66.58	63.99	58.45
UO2	-	-	-	-	-	-	-	-	-	-
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00
Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00
O=F,Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00
Total	97.48	94.81	89.32	91.94	96.44	96.03	97.55	99.12	97.81	91.34

CO core
Ri rim

Zircon

	Alkali granite WLD-49						
		BROWN				ZONED	ORAN (AMP)
SiO2	32.88	31.43	32.83	31.86	32.87	32.47	32.82
TiO2	0.00	0.00	0.07	0.26	0.02	0.03	0.04
Al2O3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FeO	0.03	0.53	0.09	0.08	0.11	0.05	0.64
MgO	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MnO	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CaO	0.00	1.04	0.03	0.09	0.03	0.05	0.00
Na2O	0.00	0.15	0.00	0.00	0.00	0.00	0.00
K2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Y2O3	0.38	0.31	0.00	0.00	0.00	0.00	0.28
La2O3	0.00	0.01	0.15	0.18	0.10	0.11	0.09
Ce2O3	0.00	0.05	0.10	0.60	0.03	0.18	0.00
Nd2O3	0.02	0.28	0.07	0.37	0.23	0.00	0.00
Sm2O3	0.00	0.09	0.00	0.19	0.04	0.03	0.02
Ta2O5	0.00	0.00	0.03	0.11	0.09	0.16	0.07
Nb2O5	0.00	0.00	0.00	0.00	0.00	0.18	0.00
P2O5	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ThO2	0.08	0.35	0.00	0.20	0.00	0.13	0.06
ZrO2	65.63	62.95	65.13	62.19	64.23	63.45	64.91
UO2	-	-	-	-	-	-	-
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00
O=F,Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	99.02	97.19	98.50	96.13	97.75	96.84	98.93

AMP in amphibole

Zircon

	Hybrid H-6 CORE	RIM	CORE	RIM	RIM	
SiO2	32.38	29.37	32.25	32.37	32.27	32.02
TiO2	0.02	0.06	0.05	0.00	0.00	0.00
Al2O3	0.00	0.00	0.00	0.00	0.00	0.00
FeO	0.09	0.56	0.02	0.03	0.27	0.06
MgO	0.00	0.00	0.00	0.00	0.00	0.00
MnO	0.00	0.00	0.00	0.00	0.00	0.00
CaO	0.02	1.16	0.00	0.02	0.01	0.00
Na2O	0.00	0.06	0.00	0.00	0.00	0.00
K2O	0.00	0.00	0.00	0.00	0.00	0.00
Y2O3	0.00	0.21	0.07	0.00	0.23	0.08
La2O3	0.00	0.00	0.00	0.01	0.01	0.00
Ce2O3	0.00	0.00	0.06	0.00	0.00	0.05
Nd2O3	0.08	0.00	0.13	0.02	0.00	0.00
Sm2O3	0.00	0.02	0.00	0.04	0.02	0.00
Ta2O5	0.07	0.15	0.01	0.07	0.00	0.00
Nb2O5	0.00	0.02	0.00	0.00	0.00	0.00
P2O5	0.00	0.00	0.00	0.00	0.00	0.00
ThO2	0.00	0.17	0.00	0.00	0.04	0.02
ZrO2	66.13	58.83	64.34	62.29	61.94	61.35
UO2	-	-	-	-	-	-
F	0.00	0.00	0.00	0.00	0.00	0.00
Cl	0.00	0.00	0.00	0.00	0.00	0.00
O=F,Cl	0.00	0.00	0.00	0.00	0.00	0.00
Total	98.79	90.61	96.93	94.85	94.79	93.58

Zircon

	Hybrid H-2				ZOCO	RIM	CORE		RED
SiO2	32.45	28.05	31.27	31.95	30.99	31.25	31.50	31.34	32.28
TiO2	0.00	0.20	0.00	0.09	0.06	0.02	0.05	0.10	0.02
Al2O3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FeO	0.03	2.87	0.08	0.14	0.00	0.02	0.07	0.00	0.03
MgO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MnO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CaO	0.01	0.41	0.00	0.00	0.00	0.01	0.03	0.05	0.04
Na2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
K2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Y2O3	0.00	3.52	1.72	0.00	1.61	1.89	1.21	1.90	0.08
La2O3	0.00	0.02	0.04	0.07	0.00	0.00	0.06	0.04	0.00
Ce2O3	0.00	0.04	0.08	0.03	0.06	0.00	0.00	0.07	0.09
Nd2O3	0.19	0.17	0.00	0.00	0.06	0.09	0.07	0.00	0.17
Sm2O3	0.13	0.00	0.04	0.07	0.00	0.02	0.08	0.00	0.03
Ta2O5	0.00	0.05	0.04	0.00	0.05	0.00	0.00	0.00	0.00
Nb2O5	0.00	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P2O5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ThO2	0.02	1.60	0.11	0.09	0.09	0.27	0.29	0.53	0.00
ZrO2	64.59	52.19	62.05	64.70	62.35	61.34	63.13	61.34	65.79
UO2	-	-	-	-	-	-	-	-	-
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
O=F,Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	97.42	98.69	95.43	97.14	95.27	94.91	96.49	95.37	98.53

ZOCO zoned core

Zircon

	Granite G-1	WLD-85 CORE	WLD-85 RIM		Syenite QS-5	
SiO2	31.43	31.30	31.68	31.57	33.42	33.49
TiO2	0.02	0.01	0.06	0.03	0.11	0.00
Al2O3	0.00	0.00	0.00	0.00	0.00	0.00
FeO	0.11	0.11	0.10	0.01	0.00	0.01
MgO	0.00	0.00	0.00	0.00	0.01	0.00
MnO	0.00	0.00	0.00	0.00	0.00	0.01
CaO	0.04	0.00	0.02	0.00	0.01	0.00
Na2O	0.00	0.00	0.00	0.00	0.00	0.00
K2O	0.00	0.00	0.00	0.00	0.00	0.01
Y2O3	0.72	0.93	0.25	0.29	-	-
La2O3	0.05	0.00	0.12	0.03	-	-
Ce2O3	0.12	0.12	0.05	0.00	-	-
Nd2O3	0.05	0.00	0.00	0.14	-	-
Sm2O3	0.07	0.00	0.10	0.01	-	-
Ta2O5	0.08	0.06	0.00	0.00	-	-
Nb2O5	0.00	0.00	0.00	0.00	-	-
P2O5	0.00	0.00	0.00	0.00	-	-
ThO2	0.38	0.39	0.10	0.23	-	-
ZrO2	63.97	56.67	56.54	57.05	66.04	65.53
UO2	-	-	-	-	-	-
F	0.00	0.00	0.00	0.00	0.00	0.00
Cl	0.00	0.00	0.00	0.00	0.00	0.00
O=F,Cl	0.00	0.00	0.00	0.00	0.00	0.00
Total	97.04	89.59	89.02	89.36	99.59	99.05

	Y-phosphate				(?)Monazite		(?)		
	Alkali granite AG-P1				Hybrid unit H-2		Alkali granite WLD-36		
	CORE	INTER	RIM	INTER	YELLO	YELLO	CORE	RIM	RIM
SiO2	17.67	6.20	6.24	14.94	0.66	0.13	45.30	0.59	2.91
TiO2	0.17	0.17	0.00	0.04	0.06	0.00	0.28	0.14	0.14
Al2O3	6.63	0.79	0.79	-	0.20	-	8.92	0.60	0.60
FeO	2.18	1.35	1.44	1.46	0.67	0.12	19.21	0.34	0.24
MgO	0.00	0.00	0.00	-	0.00	-	0.85	0.00	0.00
MnO	0.00	0.00	0.00	-	0.00	-	0.01	0.00	0.00
CaO	0.19	0.13	0.13	0.20	0.21	0.37	0.63	1.70	1.64
Na2O	0.04	0.02	0.04	0.04	0.07	0.02	0.10	0.09	0.00
K2O	0.00	0.00	0.00	-	0.00	-	0.17	0.01	0.01
Y2O3	19.13	33.59	30.78	26.79	3.59	4.22	0.19	5.39	8.89
La2O3	0.10	0.15	0.18	0.00	10.83	10.69	0.78	18.13	11.93
Ce2O3	11.66	9.77	11.24	14.33	12.64	10.68	1.66	3.29	15.57
Nd2O3	0.87	0.75	1.11	1.01	17.46	18.42	0.58	18.76	11.82
Sm2O3	2.13	2.02	2.38	2.61	3.88	3.69	0.18	1.60	3.31
Ta2O5	0.00	0.00	0.00	0.00	0.07	0.16	0.30	0.01	0.0
Nb2O5	0.08	0.00	0.15	0.18	0.04	0.00	0.05	0.05	0.15
P2O5	13.50	17.28	17.28	-	25.25	-	0.02	7.97	7.97
ThO2	1.59	1.88	2.24	2.31	2.96	1.86	0.00	1.55	7.42
ZrO2	0.39	0.47	0.29	0.07	0.00	0.00	0.00	0.00	0.00
UO2	0.06	0.75	0.75	-	-	-	-	-	-
F	2.66	2.92	2.92	-	1.38	-	0.00	5.05	5.05
Cl	0.04	0.03	0.03	-	0.12	-	0.04	0.11	0.11
O=F,Cl	1.13	1.23	1.23	-	0.61	-	0.01	2.15	2.15
Total	77.96	77.04	76.76	63.98	79.47	50.36	79.26	63.23	75.62

INTER intermediate

Unidentified minerals

	Alkali granite				
	WLD-49		AG-P4	WLD-36	AG-P2
	Dred	Dred	RED	red	pyal
SiO2	3.01	2.58	32.83	44.71	40.79
TiO2	0.03	0.00	3.57	1.50	0.84
Al2O3	0.24	0.24	4.39	10.63	-
FeO	2.24	1.77	19.65	11.21	26.55
MgO	0.00	0.00	0.13	1.42	-
MnO	0.04	0.04	0.90	0.01	-
CaO	1.13	0.96	1.07	0.50	0.53
Na2O	0.29	0.12	0.16	0.11	0.65
K2O	0.05	0.05	0.23	0.11	-
Y2O3	1.46	0.93	0.77	0.22	0.01
La2O3	5.70	5.73	0.49	0.48	0.10
Ce2O3	13.90	15.42	1.65	0.98	0.42
Nd2O3	6.08	6.57	0.59	0.37	0.00
Sm2O3	2.46	2.26	0.29	0.19	0.05
Ta2O5	0.00	0.00	0.21	0.20	0.41
Nb2O5	0.18	0.22	6.67	0.14	3.32
P2O5	15.23	15.23	0.03	0.03	-
ThO2	2.19	4.66	11.00	0.05	0.24
ZrO2	0.05	0.24	1.75	0.00	0.80
UO2	-	-	-	-	-
F	1.17	1.17	0.36	0.06	-
Cl	0.29	0.29	1.29	0.08	-
O=F,Cl	0.56	0.56	0.45	0.04	-
Total	55.18	57.92	87.58	72.94	74.42

Dred dark red
pyal alteration rim around pyrochlore

Unidentified minerals

	Syenite hybrid QS-10	QSP-1	red	red	ralr	QS-10	
	Ep?	Ep?	Hm?	Chl?	Hm?	Py?	Hm?
SiO2	39.55	33.54	18.62	30.89	3.38	4.42	3.07
TiO2	0.75	0.26	0.02	7.39	0.16	6.64	0.00
Al2O3	27.71	17.37	0.05	13.16	0.00	0.45	0.02
FeO	0.65	11.18	53.95	23.25	70.14	56.95	71.72
MgO	0.04	0.20	0.00	9.15	0.10	0.00	0.07
MnO	0.02	0.11	0.00	0.01	0.00	0.00	0.00
CaO	19.82	16.49	0.28	3.12	0.28	3.38	0.13
Na2O	0.27	0.02	0.13	0.03	0.05	0.03	0.02
K2O	0.29	0.00	0.16	2.39	0.00	0.00	0.01
Y2O3	-	-	-	-	-	-	-
La2O3	-	-	-	-	-	-	-
Ce2O3	-	-	-	-	-	-	-
Nd2O3	-	-	-	-	-	-	-
Sm2O3	-	-	-	-	-	-	-
Ta2O5	-	-	-	-	-	-	-
Nb2O5	-	-	-	-	-	-	-
P2O5	0.05	0.03	0.72	0.00	0.02	0.03	0.01
ThO2	-	-	-	-	-	-	-
ZrO2	-	-	-	-	-	-	-
UO2	-	-	-	-	-	-	-
F	0.00	0.08	0.04	0.00	0.00	0.13	0.00
Cl	0.00	0.00	0.04	0.21	0.05	0.01	0.01
O=F,Cl	0.00	0.03	0.03	0.05	0.01	0.00	0.00
Total	89.15	79.25	73.98	89.55	74.17	71.98	75.04

ralr red alteration rim
py pyrite
ep epidote
hm hematite
chl chlorite

Unidentified minerals

	Syenite QS-1 falt	WLD-100 falt				whfi	74-101 red	red	green
	Amp?	Amp? Stilp?	Pyr	Hm?	Hm?	Amp?			
SiO2	50.64	50.12	0.01	12.49	17.74	49.76	40.05	39.75	42.40
TiO2	0.04	0.10	0.00	0.00	0.05	0.11	0.01	0.03	0.00
Al2O3	0.13	1.23	0.00	1.22	0.02	0.59	2.64	2.20	2.19
FeO	37.67	30.14	47.05	64.90	64.31	37.83	38.87	37.05	39.35
MgO	5.12	5.16	0.02	0.06	0.05	2.89	0.41	0.48	3.71
MnO	2.10	1.25	0.01	0.15	0.00	1.21	1.02	2.03	1.23
CaO	0.56	6.67	0.02	0.43	0.10	4.34	0.81	1.50	0.66
Na2O	0.07	0.40	0.00	0.00	0.00	0.33	0.14	0.11	1.17
K2O	0.00	0.08	0.00	0.02	0.03	0.08	0.28	0.06	0.00
Y2O3	-	-	-	0.13	0.00	-	-	-	-
La2O3	-	-	-	0.01	0.00	-	-	-	-
Ce2O3	-	-	-	0.09	0.00	-	-	-	-
Nd2O3	-	-	-	0.14	0.00	-	-	-	-
Sm2O3	-	-	-	0.07	0.07	-	-	-	-
Ta2O5	-	-	-	0.11	0.17	-	-	-	-
Nb2O5	-	-	-	0.00	0.00	-	-	-	-
P2O5	0.00	0.04	0.00	3.60	0.00	0.00	0.07	0.03	0.00
ThO2	-	-	-	0.07	0.00	-	-	-	-
ZrO2	-	-	-	0.00	0.08	-	-	-	-
UO2	-	-	-	-	-	-	-	-	-
F	0.00	0.00	0.02	0.00	0.01	0.03	0.04	0.14	0.93
Cl	0.02	0.07	0.01	0.12	0.01	0.08	-	-	-
O=F,Cl	0.00	0.02	0.01	0.03	0.00	0.03	0.02	0.06	0.39
Total	96.35	95.24	47.13	83.58	82.70	97.22	84.33	83.32	91.25

amp amphibole?
stilp stilpnomelane?
pyr pyrite
hm hematite?
falt fibrous alteration
whfi white fibers

Unidentified minerals

	Granite G-1 redb	redb	brown	red	brown	red	Calcite
	Bio? Chl?	Bio? Chl?	Bio? Chl?	Bio? Chl?	Stilp?	Hm?	
SiO2	34.64	32.40	33.66	32.75	48.49	11.58	0.28
TiO2	3.76	0.63	2.73	1.88	0.04	0.00	0.09
Al2O3	12.64	12.64	11.57	12.64	10.62	7.79	-
FeO	29.15	29.40	28.14	31.81	19.61	61.81	0.26
MgO	1.20	1.20	0.92	1.20	0.47	0.30	-
MnO	0.31	0.31	0.22	0.31	0.02	0.25	-
CaO	0.00	0.05	0.05	0.02	0.31	0.08	54.25
Na2O	0.08	0.04	0.01	0.02	0.03	0.00	0.00
K2O	4.08	4.08	6.27	4.08	0.15	0.02	-
Y2O3	0.00	0.00	-	-	0.00	-	0.25
La2O3	0.00	0.13	-	-	0.44	-	0.00
Ce2O3	0.05	0.06	-	-	0.64	-	0.10
Nd2O3	0.04	0.15	-	-	0.40	-	0.16
Sm2O3	0.07	0.14	-	-	0.07	-	0.25
Ta2O5	0.23	0.22	-	-	0.35	-	0.02
Nb2O5	0.00	0.05	-	-	0.03	-	0.00
P2O5	0.00	0.00	0.00	0.00	0.01	0.03	-
ThO2	0.00	0.00	-	-	0.00	-	0.00
ZrO2	0.00	0.05	-	-	0.00	-	0.00
UO2	-	-	-	-	-	-	-
F	0.31	0.31	0.40	0.31	0.00	0.08	-
Cl	0.56	0.56	0.78	0.56	0.02	0.00	-
O=F,Cl	0.26	0.26	0.35	0.26	0.01	0.03	-
Total	86.86	82.16	84.40	85.32	81.68	81.91	55.66

redb red brown
bio biotite
chl chlorite
stilp stilpnomelane
hm hematite

Unidentified minerals

	Granite G-1				WLD-85			Hybrid H-6		
		gref	yelf	yelf	brown	red	yell	red	red	red
	Chl?	Chl?	Chl?	Chl?				Hm?	Hm?	Hm?
SiO2	27.31	26.30	26.28	24.47	47.78	38.81	4.61	4.20	13.58	3.78
TiO2	0.00	0.00	0.00	0.10	0.38	0.38	16.84	0.03	1.59	0.00
Al2O3	15.53	16.53	16.34	15.38	12.18	9.08	-	-	1.02	-
FeO	37.80	36.17	35.30	36.12	18.10	25.06	6.39	70.56	60.30	74.54
MgO	1.15	1.11	1.12	1.18	9.19	6.53	-	-	0.03	-
MnO	0.35	0.50	0.57	0.44	0.02	0.06	-	-	0.08	-
CaO	0.01	0.02	0.00	0.03	0.71	0.53	0.35	0.03	0.20	0.00
Na2O	0.00	0.03	0.00	0.00	0.12	0.07	0.02	0.02	0.03	0.07
K2O	0.14	0.04	0.02	0.02	0.13	0.07	-	-	0.09	-
Y2O3	-	-	-	0.00	0.06	0.04	0.31	0.00	-	0.00
La2O3	-	-	-	0.07	0.18	0.43	1.09	0.00	-	0.04
Ce2O3	-	-	-	0.05	0.07	0.22	2.08	0.04	-	0.08
Nd2O3	-	-	-	0.14	0.13	0.23	1.50	0.00	-	0.11
Sm2O3	-	-	-	0.11	0.00	0.00	0.74	0.00	-	0.02
Ta2O5	-	-	-	0.13	0.25	0.29	0.15	0.00	-	0.03
Nb2O5	-	-	-	0.00	0.10	0.00	4.73	0.00	-	0.01
P2O5	0.00	0.04	0.01	0.02	0.13	0.06	-	-	0.02	-
ThO2	-	-	-	0.07	0.00	0.00	2.60	0.06	-	0.00
ZrO2	-	-	-	0.00	0.00	0.00	0.57	0.00	-	0.04
UO2	-	-	-	-	-	-	-	-	-	-
F	0.03	0.02	0.07	0.06	0.08	0.05	-	-	0.00	-
Cl	0.02	0.02	0.03	0.05	0.05	0.10	-	-	0.11	-
O=F,Cl	0.02	0.01	0.04	0.03	0.04	0.04	-	-	0.03	-
Total	82.32	80.77	79.70	78.38	89.62	81.95	41.98	74.96	77.23	78.73

gref green fibers
yelf yellow fibers
yell yellow
chl chlorite?
hm hematite?

Unidentified minerals

	Hybrid H-2 mica	yello	red	red	red	Alkali granite WLD-49 orang	paorf	paorf	
	Chl?			Hm?	Hm?	Chl?	Chl?	Chl?	Chl?
SiO2	49.09	50.12	1.01	3.76	3.39	44.54	28.75	28.42	29.08
TiO2	0.07	0.44	29.56	0.40	0.02	0.49	0.39	0.40	0.38
Al2O3	7.95	-	-	-	0.85	7.71	9.44	9.44	-
FeO	19.60	29.16	1.44	69.47	71.66	24.75	39.13	40.37	37.89
MgO	1.54	-	-	-	0.17	0.19	1.65	1.65	-
MnO	0.00	-	-	-	0.10	1.04	0.51	0.51	-
CaO	0.34	0.20	0.50	0.09	0.08	0.40	0.19	0.16	0.21
Na2O	0.09	0.22	0.04	0.04	0.00	0.35	0.11	0.09	0.12
K2O	2.73	-	-	-	0.01	6.59	0.18	0.18	-
Y2O3	-	0.00	0.87	0.02	0.00	0.16	0.17	-	0.17
La2O3	-	0.07	4.36	0.07	0.00	0.09	0.24	-	0.24
Ce2O3	-	0.17	8.13	0.00	0.00	0.06	0.24	-	0.24
Nd2O3	-	0.21	3.27	0.04	0.02	0.20	0.27	-	0.27
Sm2O3	-	0.06	1.17	0.00	0.15	0.00	0.06	-	0.06
Ta2O5	-	0.40	0.06	0.08	0.00	0.25	0.14	-	0.14
Nb2O5	-	0.26	1.83	0.12	0.00	0.00	0.12	-	0.12
P2O5	0.05	-	-	-	0.03	0.06	0.04	0.04	-
ThO2	-	0.08	0.72	0.00	0.04	0.05	0.02	-	0.02
ZrO2	-	0.08	0.58	0.41	0.00	0.13	0.02	-	0.02
UO2	-	-	-	-	-	-	-	-	-
F	0.01	-	-	-	0.01	0.00	0.20	0.20	-
Cl	0.08	-	-	-	0.01	0.07	0.14	0.14	-
O=F,Cl	0.02	-	-	-	0.00	0.02	0.12	0.12	0.04
Total	81.53	81.48	53.54	74.50	76.53	87.11	81.89	81.48	68.96

paorf pale orange fibers
chl chlorite?
hm hematite?

Unidentified minerals

	QS-3 red	oran	oran	yell	fib		oran	QS-5	
	Sphalerite				Amp? Opx?	Amp? Stil?		AMP? chl	AMP? chl
SiO2	0.07	48.09	69.90	35.10	51.38	49.20	48.77	48.78	49.29
TiO2	0.03	0.07	0.13	0.07	0.00	0.05	0.00	0.02	0.00
Al2O3	0.00	1.07	2.54	2.35	0.18	4.09	3.68	0.68	0.39
FeO	12.78	31.55	26.31	23.34	42.05	26.91	31.29	38.68	41.68
MgO	0.00	0.62	0.56	0.58	2.02	0.89	0.62	2.07	1.83
MnO	0.02	0.52	0.55	0.25	1.92	0.36	0.44	1.61	1.93
CaO	0.04	0.77	1.17	1.34	1.12	1.46	0.64	3.49	1.22
Na2O	3.33	0.17	0.27	0.04	0.09	1.02	1.48	0.14	0.09
K2O	0.00	0.14	0.12	0.17	0.03	1.27	0.58	0.06	0.00
Y2O3	0.01	0.00	0.00	0.00	-	-	-	-	-
La2O3	0.00	0.04	0.06	0.00	-	-	-	-	-
Ce2O3	0.11	0.00	0.02	0.02	-	-	-	-	-
Nd2O3	0.12	0.00	0.05	0.07	-	-	-	-	-
Sm2O3	0.00	0.00	0.11	0.00	-	-	-	-	-
Ta2O5	0.01	0.23	0.25	0.23	-	-	-	-	-
Nb2O5	0.04	0.12	0.00	0.00	-	-	-	-	-
P2O5	0.01	0.01	0.01	0.04	0.00	0.03	0.05	-	0.00
ThO2	0.00	0.03	0.00	0.00	-	-	-	-	-
ZrO2	0.03	0.00	0.07	0.17	-	-	-	0.00	0.00
UO2	-	-	-	-	-	-	-	-	-
F	0.03	0.05	0.03	0.00	0.00	0.00	0.01	0.03	0.05
Cl	0.02	0.12	0.08	0.18	0.02	0.09	0.11	0.12	0.08
O=F,Cl	0.02	0.05	0.03	0.04	0.00	0.02	0.03	0.04	0.04
Total	16.64	83.54	72.20	63.88	98.81	85.34	87.63	95.64	96.52

amp amphibole?
opx orthoferrosilite?
stil stilpnomelane?
chl chlorite?
fib fibrous

APPENDIX 5. LISTING OF BULK COMPOSITIONS OF REPRESENTATIVE SAMPLES OF THE WELSFORD COMPLEX, OF FELSIC VOLCANIC ROCKS THAT ARE CONSIDERED RELATED, AND OF THE HOST ROCKS (JONES CREEK FORMATION)

BULK-ROCK COMPOSITIONS

VOLCANIC ROCKS (BACON LAKE MEMBER; S_{BLfv})

	BNH-1	BNH-2	BNH-3	BNH-4	BNH-5
SiO2	73.56	72.02	73.17	72.13	68.25
TiO2	0.20	0.20	0.19	0.23	0.20
Al2O3	12.39	13.44	12.69	11.91	14.15
Fe2O3	3.35	2.95	2.98	3.59	7.74
MnO	0.07	0.06	0.05	0.06	0.09
MgO	0.14	0.13	0.14	0.14	0.70
CaO	0.95	0.58	0.78	1.12	0.06
Na2O	5.11	3.84	4.83	3.65	4.38
K2O	3.08	5.81	3.95	4.59	3.24
P2O5	0.03	0.02	0.02	0.03	0.02
L.O.I.	1.04	0.67	0.87	1.21	1.46
Total	99.97	99.82	99.75	98.73	100.34
Trace elements (ppm)					
Ba	437	1069	664	719	628
V	19	0	0	0	0
Nb	19	19	19	16	27
Zr	523	566	521	616	524
Y	112	134	106	134	100
Sr	78	95	83	114	63
Rb	89	176	120	140	97
Pb	16	12	11	57	6
Th	12	13	13	8	14
U	7	5	9	2	9
Ni	0	10	0	0	0
Cr	0	0	0	0	0
Sb	-	2	-	-	-
Bi	-	2	-	-	-
La	-	63	-	-	-
B	-	4	-	-	-
Li	-	17	-	-	-
Be	-	16	-	-	-
F	-	200	-	-	-

BULK-ROCK COMPOSITIONS

VOLCANIC ROCKS (BACON LAKE MEMBER; S_{BLfv}) MAFICS

	RH-1	RH-2	FL-1	CR-1	HI-1 (S_{BLfv})	HIMF-2 (S_{LRmv})	DM-1 (D_m)
SiO2	69.25	73.94	70.91	73.81	69.25	59.66	46.56
TiO2	0.29	0.27	0.22	0.21	0.32	1.22	1.91
Al2O3	13.56	12.69	13.27	13.05	13.19	15.10	16.35
Fe2O3	4.94	4.61	3.72	2.85	5.30	10.21	12.63
MnO	0.12	0.03	0.09	0.04	0.12	0.18	0.19
MgO	0.07	0.06	0.04	0.01	0.09	1.72	7.13
CaO	1.15	0.11	0.93	0.61	1.48	3.22	9.45
Na2O	4.93	6.61	5.23	5.91	4.74	5.55	3.18
K2O	4.08	1.11	3.89	2.66	4.01	1.30	0.72
P2O5	0.04	0.03	0.02	0.01	0.04	0.53	0.23
L.O.I.	1.25	0.45	1.08	0.74	0.84	1.57	2.47
Total	99.75	99.95	99.46	99.95	99.49	100.29	100.91
Trace elements (ppm)							
Ba	683	142	635	491	641	116	321
V	6	19	0	0	0	42	288
Nb	17	18	17	20	18	20	10
Zr	744	713	602	577	824	390	123
Y	119	107	122	112	121	86	35
Sr	94	66	52	75	104	350	386
Rb	134	37	125	70	135	55	32
Pb	17	28	17	9	27	23	6
Th	9	4	10	11	11	2	0
U	5	10	3	10	4	11	13
Ni	16	2	0	61	48	98	0
Cr	0	4	0	159	166	36	0
Sb	2	-	2	2	-	-	-
Bi	4	-	6	5	-	-	-
La	55	-	51	36	-	-	-
B	10	-	15	15	-	-	-
Li	15	-	13	10	-	-	-
Be	11	-	11	3	-	-	-
F	960	-	1200	120	-	-	-

BULK-ROCK COMPOSITIONS

	QUARTZ SYENITE (D_{Wfqs})					(HYBRID) (D_{Wfqs})	
	QS-1	QS-2	QS-3	QS-5	MQS-1	QS-10	QSP-1
SiO2	63.04	63.21	64.49	61.83	55.75	48.08	47.28
TiO2	0.56	0.45	0.75	0.69	2.02	2.73	2.98
Al2O3	17.61	17.14	14.95	17.19	14.48	14.04	13.04
Fe2O3	4.52	4.30	6.63	5.55	11.07	14.26	15.74
MnO	0.12	0.07	0.15	0.14	0.16	0.20	0.21
MgO	0.42	0.25	0.43	0.39	3.15	5.43	5.87
CaO	1.56	1.15	1.92	2.27	6.22	9.41	9.80
Na2O	5.76	5.15	5.55	5.53	4.76	3.46	3.18
K2O	6.10	7.14	4.84	5.46	1.92	1.13	1.10
P2O5	0.12	0.18	0.17	0.18	0.25	0.32	0.28
L.O.I.	0.38	0.54	0.32	0.62	0.42	1.42	1.27
Total	100.24	99.62	100.22	99.94	100.23	100.56	100.84
Trace elements (ppm)							
Ba	493	365	306	878	80	176	57
V	17	22	0	28	257	405	485
Nb	16	10	24	23	27	19	19
Zr	67	1272	455	535	418	208	224
Y	24	57	71	42	65	46	47
Sr	59	43	62	88	219	283	278
Rb	56	75	81	62	63	50	50
Pb	11	7	12	11	17	21	22
Th	0	0	3	0	3	1	0
U	8	7	5	9	10	10	13
Ni	0	0	0	0	9	79	48
Cr	0	0	0	0	26	153	100
Sb	-	-	2	-	-	2	-
Bi	-	-	4	-	-	2	-
La	-	-	56	-	-	12	-
B	-	-	10	-	-	16	-
Li	-	-	19	-	-	39	-
Be	-	-	5	-	-	1	-
F	-	-	600	-	-	440	-

BULK-ROCK COMPOSITIONS

	ALKALI GRANITE (D_{Wfag})					GRANITE (D_{Wfg})	GRANOPHYRE (D_{Wfgr})
	ER-1	ER-2	AG	AG-4	AG-10	G-1	GR-1
SiO2	75.41	74.52	74.61	75.47	73.08	72.72	75.13
TiO2	0.22	0.23	0.16	0.13	0.29	0.26	0.16
Al203	11.72	11.73	10.21	10.88	12.89	13.14	11.75
Fe203	3.11	3.37	5.27	3.60	3.10	2.61	2.04
MnO	0.06	0.07	0.09	0.06	0.06	0.04	0.01
MgO	0.00	0.00	0.00	0.00	0.12	0.27	0.00
CaO	0.48	0.39	0.08	0.13	0.53	0.86	0.07
Na20	3.51	4.45	5.04	4.41	4.70	4.63	3.04
K20	4.77	4.79	4.09	4.63	4.81	4.76	5.49
P205	0.02	0.02	0.01	0.01	0.04	0.04	0.02
L.O.I.	1.11	0.52	0.37	0.32	0.52	0.48	1.22
Total	100.38	100.07	99.88	99.54	100.16	99.85	98.86
Trace elements (ppm)							
Ba	118	96	0	29	101	253	112
V	3	0	0	1	13	32	11
Nb	55	44	53	71	26	25	78
Zr	662	644	612	600	703	355	653
Y	99	63	26	35	51	60	146
Sr	35	22	4	17	29	48	21
Rb	165	165	357	314	137	205	236
Pb	16	19	18	26	19	22	16
Th	19	17	7	18	13	22	29
U	0	5	0	0	5	1	0
Ni	5	4	0	3	0	0	9
Cr	0	0	0	0	0	0	0
Sb	2	-	-	3	2	2	2
Bi	2	-	-	3	3	4	3
La	83	-	-	18	80	34	99
B	9	-	-	20	5	11	15
Li	45	-	-	334	42	95	12
Be	19	-	-	36	13	13	26
F	140	-	-	1600	480	120	680

BULK-ROCK COMPOSITIONS

HYBRID (D_{Wf})

	H-1	H-2	H-3	H-4	H-5	H-6
SiO2	73.90	74.52	74.84	74.19	75.06	67.69
TiO2	0.23	0.23	0.20	0.20	0.22	0.76
Al2O3	11.78	11.62	13.10	13.01	11.71	13.87
Fe2O3	3.57	3.32	2.27	2.63	3.35	5.34
MnO	0.07	0.06	0.04	0.03	0.08	0.10
MgO	0.00	0.00	0.00	0.00	0.00	0.87
CaO	0.32	0.23	0.31	0.18	0.22	1.92
Na2O	4.59	4.46	3.88	3.81	4.06	4.81
K2O	4.80	4.65	4.96	4.78	4.96	4.11
P2O5	0.02	0.02	0.07	0.07	0.02	0.12
L.O.I.	0.56	0.49	0.78	1.26	0.76	0.57
Total	99.84	99.57	100.49	100.21	100.39	100.18
Trace elements (ppm)						
Ba	48	39	588	607	105	156
V	15	11	0	5	6	45
Nb	75	67	25	26	61	42
Zr	884	886	260	259	745	615
Y	149	97	70	76	120	76
Sr	20	7	78	62	19	107
Rb	202	177	189	144	216	142
Pb	26	21	21	20	38	15
Th	32	17	18	19	11	21
U	4	3	4	9	0	8
Ni	6	0	5	1	8	7
Cr	0	0	0	0	0	0
Sb	3	3	-	-	-	2
Bi	4	2	-	-	-	2
La	100	31	-	-	-	51
B	15	9	-	-	-	6
Li	180	139	-	-	-	27
Be	25	21	-	-	-	8
F	1500	770	-	-	-	980

BULK-ROCK COMPOSITIONS

JONES CREEK FORMATION (S_{JCs})

	SJC-2	SJC-3	SJC-4
SiO2	62.49	63.12	62.27
TiO2	0.95	0.95	0.87
Al2O3	17.47	17.31	18.29
Fe2O3	7.21	7.11	7.41
MnO	0.10	0.09	0.10
MgO	2.34	2.38	2.58
CaO	1.23	1.05	0.99
Na2O	1.65	1.64	1.49
K2O	3.77	3.39	4.26
P2O5	0.11	0.11	0.09
L.O.I.	2.56	3.23	2.00
Total	99.57	100.48	100.46

Trace elements (ppm)

Ba	52	459	560
V	114	104	107
Nb	20	21	20
Zr	231	226	197
Y	38	40	36
Sr	150	128	129
Rb	159	143	173
Pb	27	14	26
Th	9	10	7
U	6	6	5
Ni	45	131	71
Cr	107	114	104