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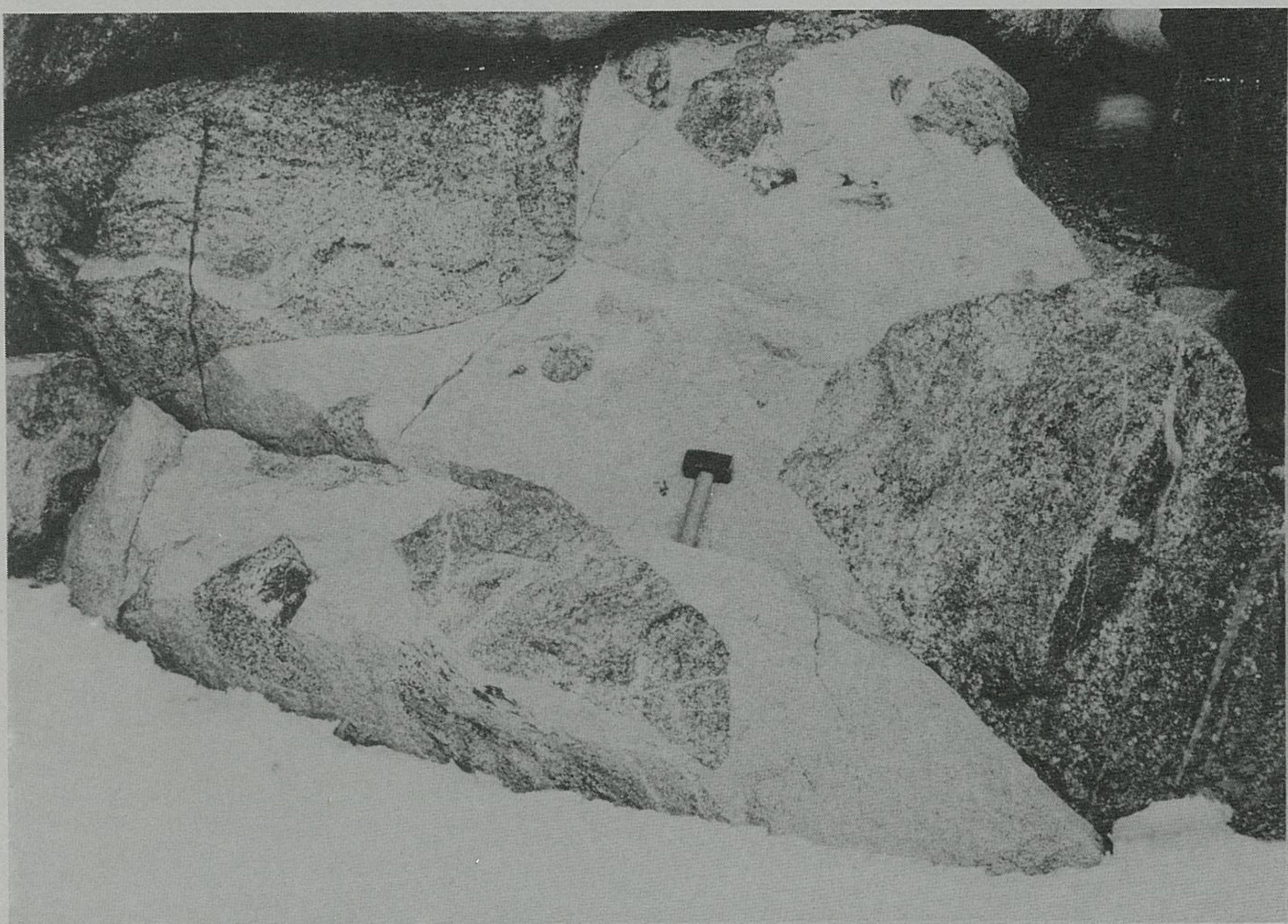
K. Palmer



Research School of Earth Sciences
Geology Board of Studies Publication No.5
Victoria University of Wellington
ISSN 0113-1168

Analytical Facility Contribution No.13
ISSN 0111-1337

Antarctic Data Series No.15
ISSN 0375-8192

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Cover photograph
Harker granite intruding gneiss of the Koettlitz Group, 3km S of Mt. Harker

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INTRODUCTION

This report presents analytical data on rocks collected whilst granitoid studies were been undertaken in the St. Johns Range (South Victoria Land) by event K043 (Basement Studies). It represents a more detailed follow-up of the regional compilation of granitoid analyses by Palmer (1987). This project utilised a field party of 4 personnel; K.Palmer (analyst/geologist) P.White (geologist) K.Woolfe (VUW assistant) and P.Dawkings (DSIR guide/assistant). The event took place during January 1986 under the auspices of Victoria University of Wellington Antarctic Expedition 30.

The St.Johns Range lies immediately to the north of the "dry valleys" area, between Victoria Valley and the Miller/Debenham Glaciers. It is an area of relatively low relief with an average altitude of around 1200m though some peaks attain over 1600m. The area is disected by a number of small coalescing alpine type glaciers presently in a state of stagnation or retreat (Gunn & Warren, 1962).

ROCK DESCRIPTIONS

GRANITOIDS

Harker Granite

The Harker Granite is named after Mount Harker, the summit of which is here defined as the type locality. This granite was mapped as Vida Granite by Allen & Gibson (1962) and is restricted to the SE part of the St. Johns Range. The Granite is usually pink, massive and medium to coarse - grained. The mineral assemblage comprises quartz, orthoclase, sodic oligoclase ($Or_2An_{12}Ab_{86}$), biotite (3.0-3.4wt.% TiO_2), strongly REE zoned euhedral allanite, magnetite, euhedral zircon and apatite. Mineral analyses are provided in Tables 4 and 5. The Harker Granite is metaluminous and strongly fractionated (for analyses see Table 8, 31644-31655). SiO_2 (73.18 - 76.77 wt.%) and K_2O (4.67 - 5.37 wt.%) are high. Several elements exhibit extremely wide variations, in particularly Ba (9 - 758 ppm) and Sr (14 - 259 ppm). Levels of Th, U, Pb and Rb are high and Rb/Sr are generally >1 in comparison with other granitoids in the region.

Swindon Granite

The Swindon Granite is of limited extent and trends NW - SE through the central St. Johns Range, it is named after Mount Swindon and the type locality is 1km N of the summit. This granite apparently resembles the Dais Granite (McKelvey & Webb, 1962) and was mapped as such by Allen & Gibson (1962). The Granite is pink or light grey, megacryst - bearing and generally massive, becoming more foliated to the NW. The most conspicuous features of the rock are large (<5cm) megacrysts of orthoclase ($Or_{74}An_0Ab_{26}$) and perthite. The balance is composed of quartz, oligoclase ($Or_2An_{24}Ab_{74}$), microperthite ($Or_{89}An_0Ab_{11}$), biotite (4.0-4.2wt.% TiO_2), hornblende, strongly REE - zoned euhedral allanite, sphene, magnetite, zircon and apatite, (for mineral analyses see Tables 4 and 5). The Swindon Granite is metaluminous and has lower SiO_2 when compared to the Harker and Vida Granites. In terms of trace elements it is markedly higher in Zr (199 - 394 ppm) and lower in Pb (18 - 22 ppm), Cr, V, Sc, Zn, Ga, Y, Ce and La are all slightly elevated. Whole rock analyses are given in Table 8, 31656-31659.

Vida Granite

The Vida Granite was initially named and described by McKelvey and Webb (1962) with an inferred type locality immediately south of Lake Vida. Granite in the western parts of the St.Johns Range were mapped as Vida Granite by Allen and Gibson (1962). Recent examination of hand specimens collected by these early workers (see Table 9.) suggests that the "Vida Granite" was represented by two or more different granitoid types including the Harker Granite of this work. The name Vida Granite is used here for the granite with the following description which outcrops extensively in the western parts of the St. Johns Range and around the Upper Victoria Glacier. The Vida Granite is a grey, sometimes pink, medium - grained, massive granite comprising quartz, oligoclase ($Or_2An_{17}Ab_{81}$), orthoclase, biotite (3.5 - 3.9% TiO_2), allanite, sphene, magnetite, zircon and apatite. Mineral analyses are given in Tables 4 and 5. The Vida Granite is weakly peraluminous and remarkably chemically homogeneous, especially in terms of the major elements, with a SiO_2 range of 71.48 - 74.15 wt.% (see whole rock analyses Table 8, 31660-31668). It is characterised by generally high levels of Sr (277 - 538 ppm) and Ba (511 - 1075 ppm).

Vida Granite, Marginal Phase

Where the Vida Granite can be seen intruding other rocks a distinct fine-grained, foliated marginal phase has formed. Within this phase wall rocks have been assimilated and drawn out by flow, producing a light-dark banding or foliation. In many places roof pendants of schist and gneiss occur within this phase, which also forms anastomosing dyke-like bodies throughout the metamorphic rocks. This marginal phase of the Vida Granite is thought to be equivalent to the Theseus "Granodiorite" mapped by Allen & Gibson (1962) and was described as forming "freely ramifying dyke - like bodies". The Theseus Granodiorite as used by them however probably included a number of other granitoids not found in The St. Johns Range. The Vida Granite Marginal Phase is fine to medium - grained, usually with a distinctive flow banding or foliation. It comprises quartz, oligoclase ($Or_2An_{25}Ab_{73}$), orthoclase, biotite, (3.7 - 4.0% TiO_2), allanite,sphene, magnetite, zircon and apatite, (see mineral analyses Tables 4 and 5). Small (<3mm) almandine garnets occur at a number of localities. Chemically, (see wholerock analyses Table 8, 31669-31882) the marginal phase is similar to the Vida Granite, however most elements exhibit wider variations. CaO is generally higher and probably reflects incorporation of marbles and calc - silicates from the schists.

DYKES

Lamprophyre dykes

The lamprophyre dykes are generally spessartite or kersanite types, they are however quite variable in appearance, mineralogy and chemistry. Groundmass comprises variable amounts of orthoclase, plagioclase, quartz, hornblende, biotite and ilmenite, myrmekite is common. Phenocrysts phases include andesine ($An_{40}Ab_{55}Or_5$ - $An_{47}Ab_{50}Or_3$), hornblende and biotite (3.56-4.56 wt.% TiO_2). Mineral analyses are provided in Tables 6 and 7. Alteration is extensive, with the formation of sericite, chlorite, epidote and calcite. The lamprophyre dykes have a wide range of compositions, and SiO_2 ranges from 51 - 66 wt.% (see wholerock analyses Table 8, 31726-31729, 31731, 31734, 31736-31744).

Quartz - Feldspar Porphyry (QFP) dykes

The quartz - feldspar porphyry dykes are quite variable in both appearance and composition. In the field they are distinguished readily from the lamprophyres by the presence of quartz and andesine ($An_{31}Ab_{65}Or_4$ - $An_{45}Ab_{52}Or_3$) phenocrysts. Groundmass comprises orthoclase, plagioclase, quartz, biotite (5.49 wt.% TiO_2), euhedral allanite, titanite, zircon and opaques (see mineral analyses Tables 6 and 7). Patches of myrmekite and graphic intergrowth of quartz and orthoclase are common. Alteration comprising sericite, epidote and chlorite is quite pervasive. The QFP dykes have SiO_2 contents >69 wt.% and are characterised by high levels of K_2O (>4 wt.%), Rb, Th and U. Wholerock analyses are given in Table 8, 31745-31753.

Granophyre dyke

The granophyre dyke is distinctively brick-red in appearance. Phenocrysts of microperthite and rounded, corroded quartz are set in a groundmass of orthoclase and quartz, exhibiting extensive granophyric texture, and minor myrmekite. Biotite, usually altering to epidote and chlorite is the only mafic mineral. The granophyre dyke is chemically similar (see wholerock analysis Table 8, 31755) to the QFP dykes, it does however have remarkably high levels of the transition elements Sc, V, Cr, Ni, Cu and Zn.

Diorite and microdiorite dykes

The diorite and microdiorite dykes differ only in grainsize and and are comparitively rare. They consist of laths of zoned plagioclase ($An_{73}Ab_{26}Or_1$ - $An_{54}Ab_{44}Or_2$), quartz, hornblende, biotite (3.9-4.3 wt.% TiO_2), and ilmenite. Mineral analyses are provided in Tables 6 and 7. The alteration assemblage comprises chlorite, epidote, calcite and sericite. The SiO_2 content (53.87 wt.%) falls within the range of the more basic lamprophyres and the diorites (see wholerock analyses Table 8, 31732, 31733) are chemically indistinguishable from these.

XENOLITHS

Xenoliths (see wholerock analyses, Table 8, 31683-31696) and biotite clots are common in the granitoids and were also noted in several dykes. Xenoliths in the Vida Granite are mainly restricted to the marginal phase as might be expected. The great majority of xenoliths are derived from Koettlitz Group metasediments and are mafic to intermediate schistose types, as these are preferentially preserved in the metaluminous to weakly peraluminous granitoid melts. Several xenoliths with SiO2 >70wt.% have microgranite textures and are thought to represent reincorporated chilled margin fragments of the host or a prexisting granitoid. One xenolith (31683) from the Harker Granite has an unusual chemical composition, it is mafic (50.77wt.% SiO_2 and 20.14wt.% Fe_2O_3T) and has anomolously high Ga/Al, Nb, Y, Zn, Cr, Ni and Sc. These features are generally indicative of small degrees of partial melting and suggest the xenolith is cognate or related to a previous melting episode.

SCHISTS AND GNEISSES

The schists and gneisses, (see wholerock analyses, Table 8, 31697-31724) are metamorphosed equivalents of the Meserve Member, Hobbs Formation of the Koettlitz Group (Findlay et al., 1984) and trend across the area in a NW-SE direction. The schists (and gneisses to a lesser extent) analysed in this report should not be considered as being representative as only the more mafic varieties were sampled. The pelitic schists are characterised by the assemblage *biot+plag+qtz+kspar* and biotite occasionally forms mono-minerallic segregations (31713). The amphibolites, several of which (31714 - 31719) are considered to be meta-basites are characterised by a *plag+amph+biot±ilm±tit±qtz* assemblage. Preliminary examination of immobile element chemistry for the amphibolites with basalt - basaltic andesite compositions, tentatively suggests formation at a destructive plate margin, (probably an island arc). TiO_2 contents are too low for intraplate basalts or MORBs. The analysed gneisses comprise mafic lenticles (31697,31698) and mafic gneisses (31699, 31700) which also most likely represent meta-basites. The bulk of the gneisses are however of intermediate composition and range upto nearly 70wt.% SiO_2.

SAMPLE PREPARATION

Large (up to 10kg) unweathered samples were collected using a sledgehammer and packed in heavy duty plastic bags. The rock samples were processed using a *ROCKLABS* tungsten carbide hydraulic rock splitter - crusher. Using the splitter bars, exterior surfaces were first removed, the crusher plates were then used to reduce large pieces to a size (<1cm) suitable for placing in the swing mill. Approximately 2kg of this material was prepared for each sample, however in some cases, *eg*. xenoliths, much less material was available.

Powder for analytical purposes was prepared by a two stage milling process. The crushed material was ground to approximately sand size using a *TEMA* tungsten carbide swing mill. A small amount (100g) of material was retained for crushing in a chrome - steel mill to enable W and Co determinations to be undertaken at a later date if necessary. The coarsely powdered material (several *TEMA* loads) was blended by rolling on paper. Aliquots (two *TEMA* loads) of this powder were then milled for a further 40s each. These two loads of fine powder were then blended, stored in plastic zip-top bags and used for the analytical work presented in this report. The coarse powder was retained for future mineral separation procedures should they be undertaken.

ANALYTICAL PROCEDURES

XRF ANALYSIS

The instrumentation used for XRF analysis was a *PHILIPS PW1404* automatic sequential X-ray spectrometer fitted with *V1.3* firmware and a *PW1500* 72 position sample changer. The online computer comprised a *DEC Professional 350, VR-241* colour monitor and *LA210* printer. The operating system was *POS-V2.0A* running *V2.0 PHILIPS X-44* software.

Major Elements

Fused glass disks were prepared using procedures modified from Norrish & Hutton (1969). *SIGMA CHEMICALS* Norrish Formula X-ray flux was used with .5000g of rock powder and .040g of AR ammonium nitrate in a covered Pt-5%Au crucible over a muffled gas flame. The nominal amount of flux used was 2.6800g however this was adjusted according to the moisture content determined by duplicate ignition loss at the start of each weighing session. The exact weight of sample powder was recorded and entered into the computer at run-time. Glass disks were pressed on a graphite die using a polished Al plunger and annealed for several hours before being cooled, labelled and stored in plastic containers in a dessicator. Duplicate disks were prepared for each sample. Loss on ignition (LOI) was determined gravimetrically by heating each sample in an electric furnace at 1100°C for 1 hour using ceramic crucibles.

Instrumental conditions along with sensitivities, lower limits of detection and backgrounds for the major elements are given in Table 1. All major element determinations were carried out under vacuum using the K*a* line and Sc/Mo dual anode X-ray tube operated at 45KV/50mA. The detection system comprised a flow proportional counter fitted with a 1μm polypropylene window and using P10 gas (10% methane in argon). The coarse collimator and large aperture were used in all cases.

The instrument was calibrated using duplicate disks of international rock standards chosen to cover a wide range of values for each element and to cover the compositional spectrum of normal silicate rocks.

Regression lines were calculated using the *Philips* mathematical model, with loss eliminated empirical alphas calculated from factors provided by K. Norrish for the Sc tube.

Element	Crystal	Time(s)	S(cps/%)	LLD(%)	Bg(%)
Fe	LiF200	10	5923	.0052	.18
Mn	LiF220	20	5205	.0039	.17
Ti	LiF200	20	4972	.0073	.58
Ca	LiF200	10	12249	.0018	.05
P	Ge111	30	1331	.0043	.08
K	PET	10	28484	.0009	.03
Si	PET	40	514	.0131	.39
Al	PET	40	493	.0087	.17
Mg	PX-1*	50	417	.0140	.45
Na	PX-1*	80	199	.0328	1.89

*PX-1 is a synthetic multilayer with a 2d = 5.1nm

Table 1. Major element operating conditions.

Trace Elements

Trace elements were measured on undiluted, boric acid backed pressed powder pellets (Norrish & Hutton, 1969). The pellets are 40mm diameter overall and contain 4.0g of rock powder. Instrumental operating conditions along with sensitivities and lower limits of detection are provided in Table 2. The sensitivities and lower limits of detection are determined for an average rock matrix (AGV-1).

The instrument was calibrated using a wide range (20-30) of international rock standards. A number of synthetic trace element and matrix disks were also included to enable accurate determinations of line overlaps and absorption edge corrections. Regression lines were calculated using the *Philips* mathematical model. The internal ratio method using MoKa and AuLa Compton peaks was utilised for matrix correction. For the elements with wavelengths longer than the Fe absorption edge, empirically determined Alphas were calculated for the Fe, Mn, Cr and Ti edges where necessary.

El.	Line	Tube kV/mA	Cryst.	Det.	Coll.	Pk.Time(s)	S(c/s/ppm)	LLD(ppm)
Sc	Ka	Au60/40	200	FL	F	80	1.2	1.66
V	Ka	Au60/40	220	FL	F	80	2.0	1.39
Cr	Ka	Au60/40	200	FL	F	80	4.5	.37
Ni	Ka	Au60/40	200	SC	C	80	22.9	.28
Cu	Ka	Au60/40	200	SC	C	80	17.9	.44
Zn	Ka	Au60/40	200	SC	C	40	19.7	.57
Ga	Ka	Sc/Mo80/30	200	SC	F	60	3.0	1.45
As	Ka	Sc/Mo80/30	200	SC	F	80	18.5	.26
Rb	Ka	Sc/Mo80/30	220	SC	F	100	6.9	.51
Sr	Ka	Sc/Mo80/30	200	SC	F	80	15.0	.57
Y	Ka	Sc/Mo80/30	200	SC	F	40	22.6	.60
Zr	Ka	Au80/30	220	SC	F	80	6.4	1.18
Nb	Ka	Au80/30	220	SC	F	80	7.0	1.17
Ba	Lb	Au60/40	220	FL	C	160	1.4	3.33
La	La	Au60/40	220	FL	C	100	2.3	2.25
Ce	Lb	Au60/40	200	FL	F	160	.7	3.72
Pb	Lb	Sc/Mo80/30	200	SC	F	100	4.2	1.49
Th	La	Sc/Mo80/30	200	SC	F	150	5.9	1.12
U	La	Sc/Mo80/30	220	SC	F	200	3.2	1.13

Table 2. Trace element operating conditions.

EPMA MINERAL ANALYSES

The instrumentation used for mineral analysis comprised a *JEOL-733 Superprobe,* automatically controlled by a *DEC PDP-11/23* microcomputer and utilising an *Epson FX-1050* dot matrix printer. The procedures are essentially those of Watanabe *et al.* (1981) however considerable upgrading of hardware and the *JASCAL* software has taken place over the intervening years. Synthetic oxides and several natural minerals are used for calibration, a range of natural minerals are used for daily checks.

ACKNOWLEDGMENTS

The Officer in Charge and Deputy Officer in Charge at Scott Base are thanked for their assistance and hospitality. VXE-6 squadron of the U.S. Navy provided helicopter transport whilst in the field. Ken Woolfe assisted with crushing and powdering of the rock samples. Beatrice Mare assisted in the preparation of fused glass disks. John Carter prepared a representative collection of thin sections. Finally many thanks are extended to the members of the field party whose courage and devotion to duty in the face of overwhelming odds contributed to the success of the mission.

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Location Map. St Johns Range, South Victoria Land, Antarctica.

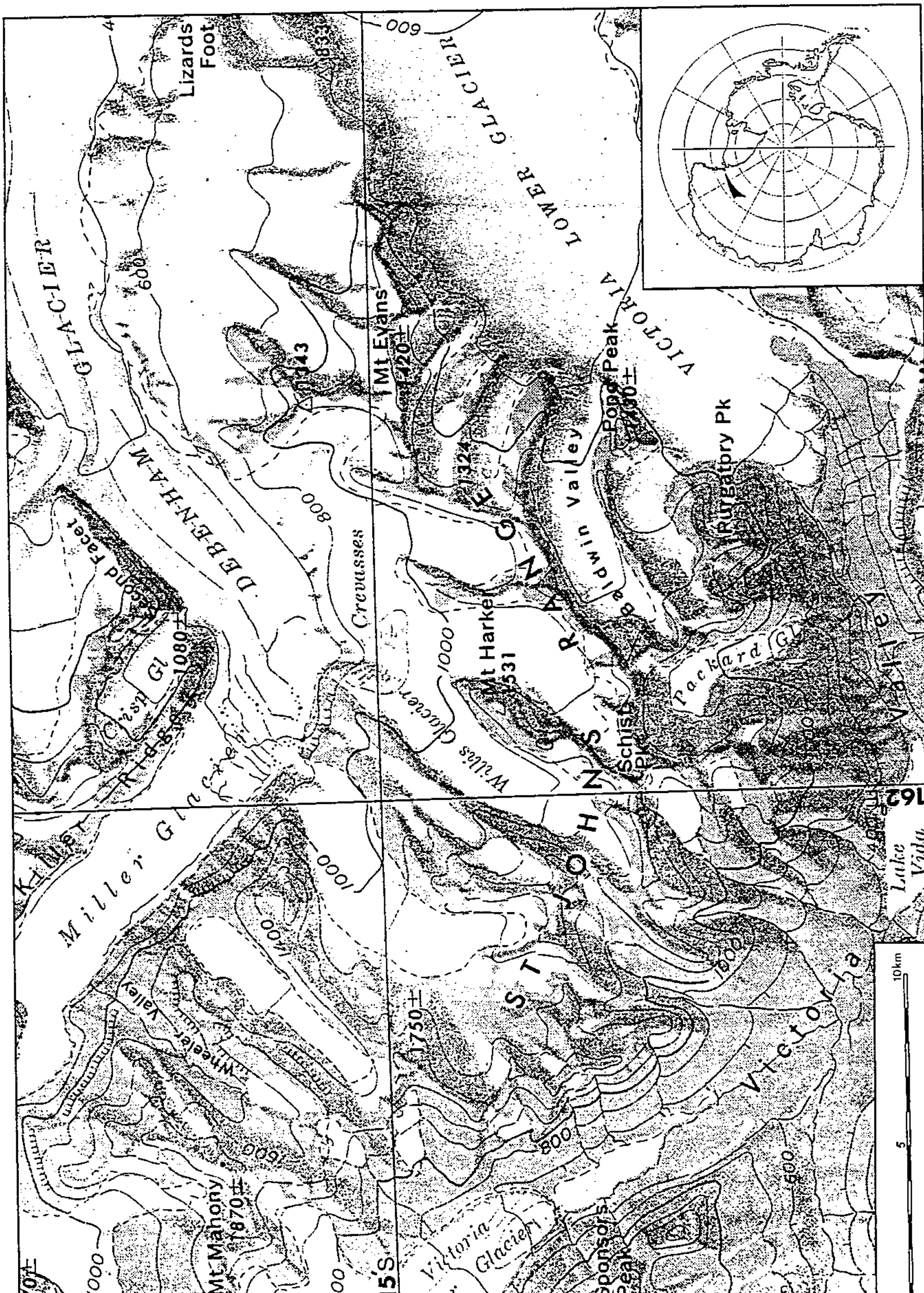

Table 3. Sample locations, St. Johns Range.

VUW No.	Field No.	Name	Latitude	Longitude	Location Description
31644	KP-119	Harker Granite	77°19.7'S	162°18.5'E	1.7km NNE of Purgatory Peak
31645	KP-42	Harker Granite	77°14.0'S	161°52.8'E	4.5km NE of campsite #1, above lower sill
31646	KP-93	Harker Granite	77°18.7'S	162°08.5'E	Saddle to Baldwin Valley, 3.2km E of Schist Peak
31647	KP-90	Harker Granite	77°16.3'S	162°08.0'E	1.3km NNE Mt. Harker
31648	KP-74	Harker Granite	77°16.7'S	162°06.9'E	300m NNE of Mt. Harker trig.
31649	KP-100	Harker Granite	77°17.2'S	162°20.1'E	Ridge 2.4km ENE of Mayewski Peak
31650	KP-71	Harker Granite	77°17.0'S	162°05.7'E	300m WSW of Mt. Harker trig.
31651	KP-89	Harker Granite	77°15.8'S	162°01.3'E	Ridge W of Willis Glacier, low point, 3km NW of Mt. Harker
31652	KP-69	Harker Granite	77°17.7'S	162°03.4'E	Near summit of small hill, 1.8km SW of Mt. Harker
31653	KP-44	Harker Granite	77°13.2'S	161°54.5'E	5.8km NW of campsite #1
31654	KP-109	Harker Granite	77°19.3'S	162°14.3'E	Low ridge, 3km NW of Purgatory Peak
31655	KP-66	Harker Granite	77°15.5'S	161°55.7'E	Ridge 1.9km NNE of Mt. Swinford
31656	KP-63	Swindon Granite	77°15.8'S	161°54.0'E	1km N of Mt. Swinford
31657	KP-48	Swindon Granite	77°13.8'S	161°48.0'E	Crest of ridge, 3.8km N of campsite #1
31658	KP-47	Swindon Granite	77°13.5'S	161°50.0'E	Crest of ridge, 4.5km NNE of campsite #1
31659	KP-65	Swindon Granite	77°15.7'S	161°54.3'E	Ridge 1.5km N of Mt. Swinford
31660	KP-26	Vida Granite	77°17.5'S	161°44.2'E	Below dolerite peak (.1498) 3km SSW of campsite #1
31661	KP-55	Vida Granite	77°15.9'S	161°41.9'E	Ridge 1.3km SSE of Lanyon Peak
31662	KP-21	Vida Granite	77°17.3'S	161°43.0'E	Below dolerite peak (.1498) 3km SSW of campsite #1
31663	KP-51	Vida Granite	77°17.2'S	161°36.8'E	2km E of Upper Victoria Glacier snout
31664	KP-17	Vida Granite	77°16.5'S	161°42.7'E	Ridge 2km SW of campsite #1
31665	KP-53	Vida Granite	77°15.6'S	161°38.8'E	Below dolerite contact, 1km SW of Lanyon Peak
31666	KP-52	Vida Granite	77°16.3'S	161°35.5'E	2.5km NE of Upper Victoria Glacier snout
31667	KP-32	Vida Granite	77°16.6'S	161°48.5'E	Knob at end of ridge, 2km SE of campsite #1
31668	KP-2	Vida Granite	77°15.4'S	161°43.9'E	Ridge to E. of Lanyon Peak
31669	KP-108	Vida (Marginal Phase)	77°20.3'S	162°14.2'E	1.4km WNW of Purgatory Peak
31670	KP-110	Vida (Marginal Phase)	77°20.9'S	162°20.5'E	Plateau area, 1.4km SE of Purgatory Peak
31671	KP-85	Vida (Marginal Phase)	77°17.2'S	161°56.7'E	Ridge W of Willis Glacier, prominent low saddle
31672	KP-106	Vida (Marginal Phase)	77°20.1'S	162°15.1'E	1.3km NW of Purgatory Peak
31673	KP-117	Vida (Marginal Phase)	77°20.1'S	162°15.9'E	1.2km NNW of Purgatory Peak
31674	KP-113	Vida (Marginal Phase)	77°18.8'S	162°26.1'E	Ridge crest 0.8km E of Pond Peak
31675	KP-98	Vida (Marginal Phase)	77°15.2'S	162°20.8'E	2.8km W of Mt. Evans
31676	KP-99	Vida (Marginal Phase)	77°15.5'S	162°22.4'E	2.2km W of Mt. Evans
31677	KP-97	Vida (Marginal Phase)	77°18.8'S	162°05.2'E	Crest of ridge, 1.9km E of Schist Peak
31678	KP-82	Vida (Marginal Phase)	77°18.3'S	161°58.8'E	End of ridge 1.5km NW of Schist Peak

Table 3. Continued

VUW No.	Field No.	Name	Latitude	Longitude	Location Description
31679	KP-101	Vida (Marginal Phase)	77°16.4'S	162°25.1'E	Tip of ridge 2km SW of Mt. Evans
31680	KP-84	Vida (Marginal Phase)	77°17.6'S	161°55.1'E	Ridge W of Willis Glacier, 2.5km S of Mt. Swinford
31681	KP-16	Vida (Marginal Phase)	77°14.6'S	161°47.0'E	Down ridge from crest, 2km NE of Lanyon Peak
31682	KP-49	Vida (Marginal Phase)	77°14.3'S	161°45.5'E	Crest of ridge, 3.2km N of campsite #1
31683	KP-72	Harker xenolith	77°16.9'S	162°06.4'E	100m SW of Mt. Harker trig.
31684	KP-29	Vida (MP) xenolith	77°17.7'S	161°46.1'E	Ridge 1.5km E of (.1498)
31685	KP-34	Vida (MP) xenolith	77°16.7'S	161°48.5'E	Knob at end of ridge, 2km SE of campsite #1
31686	KP-64	Swindon xenolith	77°15.8'S	161°54.0'E	1km N of Mt. Swinford
31687	KP-46	Harker xenolith	77°13.5'S	161°50.0'E	Crest of ridge, 4.5km NNE of campsite #1
31688	KP-64	Swindon xenolith	77°15.8'S	161°54.0'E	1km N of Mt. Swinford
31689	KP-64	Swindon xenolith	77°15.8'S	161°54.0'E	1km N of Mt. Swinford
31690	KP-64	Swindon xenolith	77°15.8'S	161°54.0'E	1km N of Mt. Swinford
31691	KP-33	Vida (MP) xenolith	77°16.7'S	161°48.5'E	Knob at end of ridge, 2km SE of campsite #1
31692	KP-64	Swindon xenolith	77°15.8'S	161°54.0'E	1km N of Mt. Swinford
31693	KP-64	Swindon xenolith	77°15.8'S	161°54.0'E	1km N of Mt. Swinford
31694	KP-92	Harker xenolith	77°18.4'S	162°08.7'E	300m up small ridge, 3km SSE of Mt. Harker
31695	KP-91	Harker xenolith	77°18.4'S	162°08.7'E	300m up small ridge, 3km SSE of Mt. Harker
31696	KP-72	Harker xenolith	77°16.9'S	162°06.4'E	100m SW of Mt. Harker trig.
31697	KP-94	Gneiss	77°18.6'S	162°05.8'E	300m up small ridge, 3.2km S of Mt. Harker
31698	KP-79	Gneiss	77°18.2'S	162°02.3'E	On ridge 1.4km NNE Schist Peak
31699	KP-86	Gneiss	77°16.6'S	161°58.0'E	Ridge W of Willis Glacier, 1.7km E of Mt.SWinford
31700	KP-95	Gneiss	77°18.6'S	162°05.8'E	300m up small ridge, 3.2km S of Mt. Harker
31701	KP-68	Gneiss	77°16.4'S	161°55.4'E	500m E of summit, Mt. Swinford
31702	KP-112	Gneiss	77°18.7'S	162°27.0'E	Ridge crest 1.1km E of Pond Peak
31703	KP-116	Gneiss	77°20.1'S	162°16.1'E	1.2km NNW of Purgatory Peak
31704	KP-87	Gneiss	77°16.6'S	161°58.1'E	100m down ridge from VUW31699
31705	KP-67	Gneiss	77°16.2'S	161°56.2'E	Eastern slopes 1km E of Mt. Swinford
31706	KP-103	Gneiss	77°20.7'S	162°19.4'E	0.9km E of Purgatory Peak
31707	KP-118	Gneiss	77°20.1'S	162°16.2'E	1.2km NNW of Purgatory Peak
31708	KP-78	Gneiss	77°18.2'S	162°02.3'E	On ridge 1.4km NNE Schist Peak
31709	KP-59	Gneiss	77°16.7'S	161°52.1'E	Tip of small ridge, 1km SW of Mt. Swinford
31710	KP-111	Gneiss	77°20.8'S	162°13.2'E	Ridge 1.8km NE of Packard Glacier snout
31711	KP-75	Gneiss	77°18.0'S	162°03.5'E	On saddle midway between Schist Peak and Mt. Harker
31712	KP-105	Gneiss	77°20.3'S	162°17.1'E	0.8km N of Purgatory Peak
31713	KP-37	Schist	77°16.7'S	161°48.5'E	Knob at end of ridge, 2km SE of campsite #1

Table 3 Continued

VUW No.	Field No.	Name	Latitude	Longitude	Location Description
31714	KP-1	Schist	77°15.4'S	161°44.2'E	Foot of ridge to E. of Lanyon Peak
31715	KP-36	Schist	77°16.7'S	161°48.5'E	Knob at end of ridge, 2km SE of campsite #1
31716	KP-81	Schist	77°18.7'S	162°01.0'E	On ridge 0.5km N of Schist Peak
31717	KP-11	Schist	77°14.7'S	161°45.2'E	Between saddle and crest of ridge to NE of Lanyon Peak
31718	KP-80	Schist	77°18.5'S	162°01.2'E	On ridge 0.8km N of Schist Peak
31719	KP-12	Schist	77°14.7'S	161°45.2'E	Between saddle and crest of ridge to NE of Lanyon Peak
31720	KP-76	Schist	77°18.0'S	162°03.5'E	On saddle midway between Schist Peak and Mt. Harker
31721	KP-61	Schist	77°16.4'S	161°53.8'E	100m W of Mt. Swinford summit
31722	KP-62	Schist	77°16.0'S	161°53.8'E	Saddle 0.8km N of Mt. Swinford
31723	KP-7	Schist	77°14.8'S	161°44.0'E	Ridge to NE of Lanyon Peak
31724	KP-11	Schist	77°18.8'S	162°26.1'E	Ridge crest 0.8km E of Pond Peak
31725	KP-57	Hornblendite dyke	77°15.9'S	161°42.4'E	Ridge 1.3km SSE of Lanyon Peak
31726	KP-31	Dyke	77°16.6'S	161°48.5'E	Knob at end of ridge, 2km SE of campsite #1
31727	KP-19	Dyke	77°16.6'S	161°42.8'E	Ridge 2km SW of campsite #1
31728	KP-25	Dyke	77°17.5'S	161°44.2'E	Below dolerite peak (.1498) 3km SSW of campsite #1
31729	KP-88	Dyke	77°16.5'S	161°58.5'E	Ridge W of Willis Glacier, 1.9km E of Mt. Swinford
31730	KP-27	Ferrar Basalt dyke	77°17.8'S	161°44.3'E	Ridge E of (.1498), just below dolerite
31731	KP-13	Dyke	77°14.7'S	161°45.5'E	Between saddle and crest of ridge to NE of Lanyon Peak
31732	KP-14	Diorite dyke	77°14.7'S	161°46.3'E	Down ridge from crest, 2km NE of Lanyon Peak
31733	KP-23	Microdiorite dyke	77°17.3'S	161°43.5'E	Below dolerite peak (.1498) 3km SSW of campsite #1
31734	KP-104	Dyke	77°20.8'S	162°20.3'E	1.2km E of Purgatory Peak
31735	KP-70	Ferrar Basalt dyke	77°17.1'S	162°05.1'E	600m WSW of Mt. Harker trig.
31736	KP-107	Dyke	77°20.3'S	162°14.2'E	1.4km WNW of Purgatory Peak
31737	KP-96	Dyke	77°18.8'S	162°05.5'E	Crest of ridge, 2km E of Schist Peak
31738	KP-115	Dyke	77°20.1'S	162°16.4'E	1.2km NNW of Purgatory Peak
31739	KP-41	Dyke	77°16.8'S	161°53.1'E	Halfway down small ridge, 1km S of Mt. Swinford
31740	KP-8	Dyke	77°14.8'S	161°44.0'E	Ridge to NE of Lanyon Peak
31741	KP-39	Dyke	77°17.7'S	161°50.4'E	Saddle just E of dolerite knob, 3.5km SE of campsite #1
31742	KP-3	Dyke	77°15.4'S	161°43.9'E	Ridge to E. of Lanyon Peak
31743	KP-56	Dyke	77°15.9'S	161°41.9'E	Ridge 1.3km SSE of Lanyon Peak
31744	KP-9	Dyke	77°14.8'S	161°44.4'E	Ridge to NE of Lanyon Peak
31745	KP-60	Q.F.P dyke	77°16.8'S	161°54.1'E	Ridge, 0.6km S of Mt. Swinford
31746	KP-24	Q.F.P dyke	77°17.4'S	161°44.1'E	Below dolerite peak (.1498) 3km SSW of campsite #1
31747	KP-102	Q.F.P dyke	77°20.1'S	162°20.3'E	Summit of hill, 1.5km NE of Purgatory Peak
31748	KP-50	Q.F.P dyke	77°17.2'S	161°39.0'E	500m from saddle, 4km E of Upper Victoria Glacier snout

Table 3. Continued

VUW No.	Field No.	Name	Latitude	Longitude	Location Description
31749	KP-58	Q.F.P dyke	77°15.9'S	161°43.2'E	Tip of ridge 1.5km SE of Lanyon Peak
31750	KP-10	Q.F.P dyke	77°14.8'S	161°44.8'E	100m past saddle on ridge to NE of Lanyon Peak
31751	KP-40	Q.F.P dyke	77°17.1'S	161°53.8'E	Ridge 1.2km S of Mt. Swinford
31752	KP-38	Q.F.P dyke	77°17.0'S	161°48.7'E	Halfway up ridge, SE of campsite #1
31753	KP-28	Q.F.P dyke	77°17.8'S	161°45.7'E	Ridge 1km E of (.1498)
31754	KP-45	Aplite dyke	77°13.3'S	161°54.3'E	5.7km NE of campsite #1
31755	KP-30	Granophyre dyke	77°17.6'S	161°46.5'E	Ridge 1.8km E of (.1498)
31756	KP-77	Aplite dyke	77°18.2'S	162°02.6'E	On ridge 1.5km NNE Schist Peak
31757	KP-18	Aplite dyke	77°16.5'S	161°42.7'E	Ridge 2km SW of campsite #1
31758	KP-73	Aplite dyke	77°16.7'S	162°06.9'E	300m NNE of Mt. Harker trig.
31759	KP-43	Ferrar Dolerite	77°13.1'S	161°55.0'E	6km NE of campsite #1, overlooking Miller Glacier

Table 4. E.P.M.A. analyses of feldspars in granitoids, St. Johns Range.

Wt.%	1	2	3	4	5	6	7	8
SiO_2	65.51	66.24	66.24	64.71	67.00	65.38	65.72	64.80
TiO_2	-	-	-	-	-	-	-	-
Al_2O_3	17.93	18.33	18.30	18.31	18.50	17.77	18.04	18.28
FeO	-	-	-	-	-	-	-	-
MnO	-	-	-	-	-	-	-	-
MgO	-	-	-	-	-	-	-	-
CaO	-	-	.08	-	-	-	-	.09
Na_2O	.13	1.59	2.05	2.94	1.20	1.21	1.01	1.73
K_2O	16.21	13.44	14.20	12.67	13.82	15.45	15.51	14.43
Total	99.78	99.60	100.87	98.63	100.52	99.81	100.28	99.33
Cations based on 8 oxygens								
Si	3.026	3.028	3.011	2.997	3.033	3.020	3.018	2.998
Al	.976	.988	.981	1.000	.987	.967	.977	.997
Ca	-	-	.004	-	-	-	-	.004
Na	.012	.141	.181	.264	.105	.108	.090	.155
K	.955	.784	.824	.749	.798	.910	.909	.852
Total	4.969	4.941	5.001	5.010	4.923	5.005	4.994	5.006

Wt.%	9	10	11	12	13	14	15	16
SiO_2	65.07	65.41	61.69	62.25	67.83	63.53	61.30	60.81
TiO_2	-	-	-	-	-	-	-	-
Al_2O_3	21.39	21.07	23.08	23.14	19.84	22.64	23.69	23.86
FeO	-	-	-	-	-	-	-	-
MnO	-	-	-	-	-	-	-	-
MgO	-	-	-	-	-	-	-	-
CaO	3.06	2.68	5.18	5.19	1.13	3.81	5.25	5.90
Na_2O	10.41	10.76	8.99	8.92	11.87	10.37	8.63	8.37
K_2O	.66	.40	.41	.62	.29	.29	.33	.37
Total	100.59	100.32	99.35	100.12	100.96	100.64	99.20	99.31
Cations based on 8 oxygens								
Si	2.864	2.881	2.761	2.766	2.955	2.801	2.744	2.726
Al	1.110	1.094	1.218	1.212	1.019	1.177	1.250	1.261
Ca	.144	.126	.248	.247	.053	.180	.252	.283
Na	.888	.919	.780	.769	1.003	.887	.749	.727
K	.037	.022	.023	.035	.016	.016	.019	.021
Total	5.043	5.042	5.030	5.029	5.046	5.061	5.014	5.018

1-3 orthoclase, Harker Granite (31648)
4 orthoclase megacryst, Swindon Granite (31659)
5,6 orthoclase phase, perthite megacryst, Swindon Granite (31659)
7 orthoclase, Vida Granite (31663)
8 orthoclase, marginal phase, Vida Granite (31674)
9,10 plagioclase, Harker Granite (31648)
11,12 plagioclase, Swindon Granite (31659)
13 albite phase with No.5, Swindon Granite (31659)
14 plagioclase, Vida Granite (31663)
15,16 plagioclase, marginal phase, Vida Granite (31674)

Table 5. E.P.M.A. analyses of biotite and hornblende in granitoids, St. Johns Range.

Wt.%	1	2	3	4	5	6	7	8
SiO_2	34.75	34.59	35.81	35.22	35.81	35.09	35.61	35.35
TiO_2	3.14	3.48	4.22	4.08	4.12	3.84	3.66	3.57
Al_2O_3	13.98	13.64	12.85	12.48	12.53	14.91	14.78	14.88
FeO	30.23	30.60	28.36	28.30	28.58	26.94	26.84	26.97
MnO	.95	1.09	.54	.55	.64	.68	.70	.57
MgO	3.94	3.26	4.95	5.53	5.44	5.07	4.95	5.15
CaO	.54	.22	-	-	-	-	-	-
Na_2O	.17	-	-	-	-	-	-	-
K_2O	7.98	8.88	8.91	9.26	8.82	9.35	9.38	9.16
Cl	.13	.17	.25	.14	.21	-	-	.05
Total	95.81	95.93	95.89	95.56	96.15	95.88	95.92	95.70
Cations based on 22 oxygens								
Si	5.586	5.597	5.703	5.654	5.695	5.556	5.625	5.596
Ti	.380	.424	.505	.493	.493	.457	.435	.425
Al	2.649	2.602	2.412	2.362	2.349	2.783	2.752	2.777
Fe	4.064	4.141	3.777	3.799	3.801	3.567	3.546	3.570
Mn	.129	.149	.073	.075	.086	.091	.094	.076
Mg	.944	.786	1.175	1.323	1.289	1.196	1.165	1.215
Ca	.093	.038	-	-	-	-	-	-
Na	.053	-	-	-	-	-	-	-
K	1.637	1.833	1.810	1.896	1.790	1.889	1.890	1.850
Cl	.035	.047	.067	.038	.057	-	-	.013
Total	15.571	15.618	15.524	15.640	15.560	15.539	15.508	15.522

Wt.%	9	10	11	12	13	14	15	16
SiO_2	35.36	34.92	35.59	35.58	35.22	42.33	41.39	41.79
TiO_2	3.85	3.48	3.83	3.73	3.71	1.32	1.46	1.33
Al_2O_3	16.50	16.30	16.31	16.82	16.53	8.21	8.85	8.93
FeO	23.08	23.82	22.93	22.62	23.09	26.27	26.02	26.29
MnO	.39	.36	.40	.47	.41	.70	.62	.99
MgO	7.05	7.00	7.56	7.31	7.26	4.70	5.01	4.47
CaO	-	-	-	-	-	10.82	11.11	10.50
Na_2O	-	-	-	-	-	2.01	2.08	2.01
K_2O	9.27	9.20	9.37	9.64	9.55	1.21	1.15	1.23
Cl	.41	.41	.42	.42	.42	.27	.26	.30
Cations based on 22 oxygens (biotite) and 23 oxygens (hornblende)								
Si	5.475	5.457	5.479	5.465	5.450	6.702	6.554	6.624
Ti	.448	.409	.443	.431	.432	.157	.174	.159
Al	3.012	3.003	2.960	3.045	3.015	1.532	1.652	1.669
Fe	2.989	3.113	2.952	2.906	2.988	3.478	3.446	3.485
Mn	.051	.048	.052	.061	.054	.094	.083	.133
Mg	1.627	1.630	1.735	1.673	1.674	1.109	1.182	1.056
Ca	-	-	-	-	-	1.836	1.885	1.783
Na	-	-	-	-	-	.617	.639	.618
K	1.831	1.834	1.840	1.889	1.885	.244	.232	.249
Cl	.108	.109	.110	.109	.110	.072	.070	.081
Total	15.540	15.603	15.572	15.580	15.608	15.842	15.916	15.856

1,2 biotite, Harker Granite (31648)
3-5 biotite, Swindon Granite (31659)
6-8 biotite, Vida Granite (31663)
9-13 biotite, marginal phase, Vida Granite (31663)
14-16 hornblende, Swindon Granite (31659)

Table 6. E.P.M.A. analyses of feldspars in dykes, St. Johns Range.

Wt.%	1	2	3	4	5	6	7	8
SiO_2	49.28	53.90	64.72	55.30	59.18	55.88	58.74	64.26
TiO_2	-	-	-	-	-	-	-	-
Al_2O_3	31.54	28.30	19.37	27.53	24.78	27.02	26.36	18.41
FeO	-	-	-	-	-	.34	.27	-
MnO	-	-	-	-	-	-	-	-
MgO	.12	-	-	-	-	-	-	-
CaO	15.25	11.06	.22	9.59	6.77	9.77	8.26	.06
Na_2O	3.03	4.96	1.55	6.20	7.81	5.71	6.29	1.12
K_2O	.16	.39	13.16	.48	.66	.51	.77	15.27
Total	99.38	98.61	99.02	99.10	99.20	99.23	100.69	99.12
Cations based on 8 oxygens								
Si	2.267	2.468	2.979	2.515	2.668	2.538	2.614	2.990
Al	1.711	1.528	1.051	1.477	1.318	1.447	1.383	1.010
Fe	-	-	-	-	-	.013	.010	-
Mg	.008	-	-	-	-	-	-	-
Ca	.752	.543	.011	.468	.327	.476	.394	.003
Na	.270	.440	.138	.547	.683	.503	.543	.101
K	.009	.023	.773	.028	.038	.030	.044	.906
Total	5.018	5.001	4.952	5.035	5.034	5.006	4.988	5.010

1,2 plagioclase in diorite dyke (31732)
3 orthoclase, groundmass, QFP dyke (31747)
4,5 plagioclase phenocrysts, QFP dyke (31747)
6,7 plagioclase phenocrysts, lamprophyre dyke (31739)
8 orthoclase, groundmass, lamprophyre dyke (31739)

Table 7. E.P.M.A. analyses of biotite and hornblende in dykes, St. Johns Range.

Wt.%	1	2	3	4	5	6	7	8
SiO_2	36.13	36.28	43.26	43.47	35.52	42.90	37.04	35.22
TiO_2	4.34	3.92	2.28	2.07	5.49	1.41	3.56	4.52
Al_2O_3	14.20	14.31	9.92	9.68	13.80	8.05	13.29	13.50
FeO	21.28	21.67	16.18	16.76	25.46	24.35	24.88	26.49
MnO	.57	.43	.36	.38	.62	.52	.40	.48
MgO	10.18	10.05	11.72	11.41	6.47	7.89	7.48	6.40
CaO	-	-	10.56	10.45	-	10.11	-	-
Na_2O	.18	.15	2.25	2.21	.15	1.66	-	-
K_2O	9.33	8.99	.88	.86	8.95	.97	8.84	9.11
Cl	.07	.08	-	-	.19	.12	.14	.11
Total	96.21	95.80	97.41	97.29	96.46	97.86	95.49	95.72
Cations based on 22 oxygens (biotite) and 23 oxygens (hornblende)								
Si	5.540	5.577	6.509	6.560	5.542	6.676	5.785	5.574
Ti	.500	.453	.258	.235	.644	.165	.418	.538
Al	2.568	2.594	1.760	1.723	2.539	1.477	2.448	2.519
Fe	2.729	2.786	2.036	2.115	3.322	3.169	3.250	3.506
Mn	.074	.056	.046	.049	.082	.069	.053	.064
Mg	2.327	2.303	2.629	2.567	1.505	1.830	1.741	1.510
Ca	-	-	1.703	1.691	-	1.687	-	-
Na	.054	.045	.656	.647	.045	.501	-	-
K	1.825	1.763	.169	.166	1.781	.193	1.761	1.839
Total	15.617	15.578	15.767	15.751	15.460	15.768	15.456	15.550

1,2 biotite, diorite dyke (31732)
3,4 hornblende, diorite dyke (31732)
5 biotite, QFP dyke (31747)
6 hornblende, QFP dyke (31747)
7,8 biotite, lamprophyre dyke (31739)

Table 8. X.R.F. whole rock analyses.

Wt.%	31644	31645	31646	31647	31648	31649	31650	31651	31652	31653
SIO2	73.18	74.40	75.16	75.51	75.73	76.08	76.19	76.32	76.44	76.46
TIO2	0.24	0.13	0.15	0.11	0.10	0.08	0.03	0.07	0.05	0.03
AL2O3	13.68	13.05	12.84	12.63	12.77	12.77	12.85	12.82	12.67	12.67
FE2O3T	2.09	1.62	1.65	1.43	1.26	1.21	1.23	1.19	1.18	0.92
MNO	0.04	0.05	0.05	0.05	0.04	0.03	0.05	0.07	0.05	0.05
MGO	0.32	0.21	0.24	0.16	0.14	0.10	0.09	0.11	0.09	0.10
CAO	1.35	1.08	1.05	0.96	0.93	0.85	0.84	0.78	0.70	0.60
NA2O	2.99	3.30	3.13	3.34	3.18	3.02	3.47	3.70	3.58	3.72
K2O	5.37	4.79	5.05	4.85	5.13	5.26	5.00	4.67	4.88	4.67
P2O5	0.03	0.04	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
LOI	0.58	0.68	0.59	0.96	0.53	0.59	0.46	0.56	0.65	0.46
TOTAL	99.87	99.35	99.92	100.01	99.82	100.00	100.22	100.30	100.30	99.69
ppm										
BA	758.0	402.3	361.3	183.9	184.8	99.3	43.6	95.7	18.9	32.0
CE	85.6	58.7	57.4	43.4	42.1	32.0	15.8	28.2	28.4	16.2
CR	1.1	<	0.5	<	<	<	<	<	<	<
CU	1.2	0.8	1.2	2.0	0.3	1.5	0.8	1.5	0.4	0.2
GA	16.7	17.5	15.6	16.9	17.1	15.5	16.2	18.5	16.6	18.0
LA	52.4	38.1	34.7	24.8	25.4	19.0	9.1	15.2	13.8	8.6
NB	10.9	16.1	13.4	12.6	10.3	9.0	7.8	18.3	12.7	20.3
NI	2.6	4.5	2.4	2.4	1.4	2.6	2.2	4.4	2.6	4.8
PB	22.9	34.0	29.6	30.7	30.8	30.0	36.2	34.7	33.3	40.4
RB	146.4	232.4	176.0	192.1	180.2	167.8	185.9	257.4	216.1	301.1
SC	1.2	1.7	1.1	0.9	0.7	0.5	0.9	0.7	0.9	1.2
SR	258.8	128.6	119.8	81.8	81.3	70.5	38.7	39.5	19.7	17.0
TH	14.4	33.0	15.6	16.4	14.6	12.8	11.7	20.1	15.5	21.8
U	1.1	4.8	2.3	2.1	1.9	2.2	1.9	3.3	3.9	3.4
V	12.0	8.2	8.7	7.1	6.8	4.8	4.7	6.2	5.0	4.6
Y	17.4	22.7	20.7	19.7	15.2	11.8	13.2	23.2	19.7	27.1
ZN	35.5	44.8	38.5	31.2	32.5	20.5	35.1	30.1	24.9	28.9
ZR	186.1	145.0	122.9	107.2	102.1	91.0	73.4	83.1	80.9	66.6

Wt.%	31654	31655	31656	31657	31658	31659	31660	31661	31662	31663
SIO2	76.57	76.77	64.31	70.27	71.53	72.33	71.48	72.20	72.37	72.58
TIO2	0.06	0.04	0.49	0.29	0.29	0.31	0.21	0.18	0.19	0.18
AL2O3	12.45	12.67	16.41	14.76	13.80	13.89	14.98	14.71	14.44	14.56
FE2O3T	1.08	0.98	5.00	2.85	2.65	2.70	1.74	1.58	1.58	1.58
MNO	0.05	0.04	0.12	0.05	0.06	0.06	0.03	0.04	0.03	0.03
MGO	0.12	0.05	0.89	0.46	0.58	0.56	0.36	0.43	0.29	0.30
CAO	0.73	0.58	2.65	1.66	1.63	1.73	1.91	1.67	1.77	1.70
NA2O	3.08	3.73	4.29	3.59	3.20	3.59	3.87	3.74	3.59	3.50
K2O	4.91	4.77	4.30	4.94	4.55	4.23	4.10	4.32	4.37	4.47
P2O5	0.00	0.01	0.12	0.08	0.08	0.06	0.04	0.04	0.04	0.03
LOI	0.56	0.58	0.80	0.46	1.01	0.80	0.98	1.05	1.23	0.40
TOTAL	99.61	100.22	99.38	99.41	99.38	100.26	99.70	99.96	99.90	99.33
ppm										
BA	77.4	8.8	1501.9	797.2	668.0	655.2	1075.2	1013.6	1006.2	914.2
CE	23.5	16.1	104.0	83.3	63.6	73.7	52.4	50.5	58.1	51.3
CR	<	<	3.4	1.5	1.6	1.7	1.0	1.1	1.0	1.3
CU	0.6	<	2.6	3.3	2.6	1.7	5.5	1.5	1.8	1.9
GA	15.3	19.3	22.2	19.0	19.7	19.1	17.1	18.7	16.5	17.6
LA	13.8	6.8	58.1	55.1	37.0	43.6	32.3	30.3	36.2	33.9
NB	8.6	21.2	16.9	12.3	13.8	14.7	8.9	11.7	7.9	10.3
NI	2.2	5.1	5.2	4.5	4.3	3.2	1.6	2.8	2.1	2.4
PB	33.7	42.5	19.9	20.5	22.4	18.1	36.5	23.9	30.7	26.0
RB	189.7	324.4	160.5	160.5	178.0	149.1	105.2	149.7	114.1	144.4
SC	0.3	1.5	6.0	3.3	2.4	2.2	1.9	2.0	2.0	1.3
SR	51.9	14.4	370.2	247.0	206.6	227.2	538.0	436.0	461.6	415.9
TH	12.6	26.8	10.8	12.5	15.3	15.2	7.9	8.8	8.1	9.2
U	2.2	4.0	1.6	1.8	1.6	1.9	0.5	0.7	0.9	1.2
V	5.0	4.1	23.1	13.5	15.7	16.6	10.7	9.5	9.1	9.2
Y	12.9	26.1	44.2	26.0	24.7	26.1	6.3	14.1	6.6	14.1
ZN	27.9	15.4	88.2	47.4	54.4	51.2	58.2	37.5	43.2	40.0
ZR	85.9	68.9	393.7	209.6	199.2	216.7	166.3	148.1	151.2	145.2

Notes: 1 "<" Indicates below detection limit
2 "LOI" is loss on ignition at 1000 Deg.C
3 Sample numbers refer to VUW Geology Department collection
4 All major and trace element analyses performed on duplicate disks and pellets

Table 8. Continued.

Wt.%	31664	31665	31666	31667	31668	31669	31670	31671	31672	31673
SIO2	72.62	72.97	73.38	73.42	74.15	62.83	68.70	70.30	71.28	71.75
TIO2	0.18	0.15	0.14	0.21	0.11	0.82	0.12	0.46	0.22	0.30
AL2O3	14.58	14.41	13.95	14.24	13.87	16.97	18.20	15.06	15.37	14.40
FE2O3T	1.51	1.41	1.31	1.61	1.15	4.97	0.92	2.62	1.67	2.48
MNO	0.04	0.04	0.04	0.03	0.03	0.07	0.02	0.04	0.03	0.05
MGO	0.29	0.40	0.39	0.34	0.18	1.88	0.21	0.59	0.38	0.58
CAO	1.69	0.87	1.30	1.66	1.31	4.70	3.38	2.02	2.26	2.11
NA2O	3.82	3.70	3.32	3.31	3.46	4.12	5.16	3.67	3.60	3.33
K2O	4.21	4.70	4.86	4.83	4.50	2.19	2.71	4.62	4.25	4.11
P2O5	0.03	0.04	0.01	0.01	0.02	0.25	0.01	0.11	0.01	0.06
LOI	0.65	0.99	0.87	0.43	0.58	0.48	0.33	0.71	0.57	0.84
TOTAL	99.62	99.68	99.57	100.09	99.36	99.28	99.76	100.20	99.64	100.01
ppm										
BA	895.1	848.6	948.8	1033.3	511.1	795.9	979.3	1092.6	1174.2	725.5
CE	55.7	41.9	48.4	65.6	30.4	51.6	24.3	87.3	52.0	52.8
CR	1.1	1.3	0.9	1.3	<	8.4	0.3	1.2	1.4	1.1
CU	1.9	2.6	1.1	2.7	1.8	12.6	3.8	3.2	1.6	2.2
GA	18.4	17.2	17.6	17.9	18.0	22.2	19.9	23.8	19.4	19.0
LA	33.8	24.6	28.5	41.9	17.8	27.8	16.8	48.8	32.2	32.7
NB	10.3	13.2	11.0	11.2	12.4	14.0	7.5	17.8	7.8	11.3
NI	3.0	3.3	2.1	4.5	2.5	7.3	1.3	2.9	2.1	3.0
PB	28.3	28.8	28.8	24.4	31.2	15.3	22.5	23.5	24.2	20.9
RB	148.7	183.9	160.7	141.3	164.5	82.5	79.7	134.7	109.4	126.7
SC	2.2	1.8	1.3	1.0	1.8	6.6	2.0	1.5	2.5	1.6
SR	455.4	361.2	335.5	433.3	276.8	718.1	853.3	418.7	518.4	335.6
TH	7.8	9.4	8.3	11.9	7.8	6.4	3.0	8.9	10.3	7.2
U	1.3	1.8	1.4	1.0	1.4	0.7	0.7	1.1	1.6	1.5
V	9.5	9.4	8.2	10.7	7.5	61.8	7.2	20.5	11.4	17.9
Y	13.4	17.3	13.2	10.8	13.7	14.4	4.7	11.9	8.5	16.2
ZN	36.5	26.2	35.0	36.9	21.0	81.3	16.4	67.4	33.2	40.8
ZR	144.8	123.9	128.5	158.9	96.9	177.7	108.8	266.7	149.4	151.4

Wt.%	31674	31675	31676	31677	31678	31679	31680	31681	31682	31683
SIO2	72.29	72.54	72.87	73.03	73.37	73.55	74.83	74.91	75.07	50.77
TIO2	0.18	0.19	0.19	0.13	0.07	0.17	0.12	0.05	0.09	0.71
AL2O3	15.28	14.59	14.42	14.80	15.29	14.08	13.50	13.84	13.90	12.72
FE2O3T	1.48	1.71	1.74	1.07	0.53	1.79	1.09	0.89	1.13	20.14
MNO	0.05	0.04	0.05	0.03	0.01	0.04	0.03	0.05	0.03	0.98
MGO	0.39	0.30	0.31	0.22	0.15	0.27	0.33	0.11	0.28	2.53
CAO	2.53	1.95	1.81	1.73	2.34	1.59	1.22	1.13	1.24	6.25
NA2O	3.80	3.52	3.54	3.96	4.25	3.29	3.33	3.59	3.53	3.07
K2O	3.37	4.18	4.25	4.02	3.42	4.59	4.77	4.86	4.50	1.11
P2O5	0.05	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.01	0.18
LOI	0.78	0.72	0.85	0.60	0.66	0.74	0.92	0.43	0.58	1.22
TOTAL	100.20	99.75	100.04	99.60	100.10	100.13	100.15	99.88	100.36	99.68
ppm										
BA	925.2	1055.2	955.0	935.9	1271.7	877.2	855.1	241.6	571.8	83.9
CE	30.2	49.6	43.4	19.0	18.7	51.8	28.4	19.1	30.3	96.5
CR	1.4	1.2	1.5	0.4	0.9	1.1	<	<	<	194.8
CU	2.9	1.8	2.1	1.6	1.9	2.1	1.2	0.9	1.1	3.7
GA	17.9	17.0	19.0	16.6	14.7	17.4	17.9	18.3	18.9	32.1
LA	20.1	31.0	23.8	11.1	12.7	31.2	17.2	11.4	20.6	27.0
NB	12.8	9.9	10.6	9.0	2.6	9.9	12.9	17.0	18.2	45.4
NI	1.1	2.1	1.7	1.4	<	2.8	1.5	2.4	2.5	36.1
PB	29.1	22.1	23.4	27.1	20.9	24.7	27.6	34.4	33.2	17.9
RB	96.1	125.4	134.9	120.0	80.4	155.8	129.4	182.6	158.6	66.3
SC	1.8	2.0	2.4	1.6	0.8	1.9	1.4	1.2	2.1	26.1
SR	469.3	447.4	426.9	479.2	628.7	357.6	295.8	115.5	190.7	50.4
TH	6.2	5.4	5.9	3.3	2.7	7.8	8.1	4.6	6.0	4.5
U	1.5	1.2	1.0	0.7	0.5	1.3	1.8	1.7	1.6	4.4
V	11.3	10.3	11.0	9.2	7.3	9.7	7.0	5.1	7.1	101.9
Y	9.2	8.8	10.6	5.8	1.8	12.0	8.1	18.2	13.6	232.3
ZN	25.2	44.1	36.8	27.1	15.6	37.1	33.9	32.0	21.5	415.0
ZR	146.7	151.6	144.2	106.3	89.3	148.5	110.6	98.2	93.9	119.9

Notes: 1 "<" Indicates below detection limit
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3 Sample numbers refer to VUW Geology Department collection
4 All major and trace element analyses performed on duplicate disks and pellets

Table 8. Continued.

Wt.%	31684	31685	31686	31687	31688	31689	31690	31691	31692	31693
SIO2	51.79	57.31	57.77	60.09	60.09	61.58	62.60	63.22	63.52	67.23
TIO2	1.35	1.06	1.00	1.03	0.82	0.94	0.76	0.68	0.76	0.57
AL2O3	20.15	19.48	16.77	16.87	16.11	16.19	15.89	18.19	16.10	15.33
FE2O3T	8.14	5.78	9.57	6.85	8.76	7.34	7.39	4.49	6.12	4.17
MNO	0.13	0.16	0.23	0.14	0.22	0.18	0.17	0.10	0.15	0.10
MGO	2.41	1.60	2.35	1.84	2.28	1.71	1.72	1.09	1.77	1.06
CAO	8.01	5.79	3.53	3.31	3.49	2.86	2.64	4.15	3.40	2.62
NA2O	4.94	6.05	4.67	4.73	4.39	3.82	4.60	5.62	4.51	3.63
K2O	1.32	1.63	2.43	2.36	2.61	3.59	2.53	1.46	2.25	4.58
P2O5	0.48	0.46	0.36	0.39	0.25	0.32	0.23	0.24	0.21	0.16
LOI	1.01	0.71	1.68	1.82	0.97	1.09	0.91	0.61	1.08	0.73
TOTAL	99.73	100.03	100.36	99.43	99.99	99.62	99.44	99.85	99.87	100.18
ppm										
BA	302.7	237.7	434.0	505.6	470.8	568.6	449.0	276.9	493.9	769.7
CE	61.7	45.9	64.4	80.8	53.9	66.4	54.2	69.6	59.2	70.7
CR	6.4	2.6	4.3	2.4	19.0	4.6	14.3	1.4	9.5	5.9
CU	13.5	8.1	4.8	3.1	3.4	3.4	2.8	3.9	3.1	2.9
GA	26.8	28.0	29.1	26.7	23.8	25.8	24.6	27.0	23.5	21.1
LA	33.9	25.1	31.4	42.0	37.3	33.6	27.4	40.8	31.2	46.7
NB	8.4	26.0	26.1	20.5	21.0	21.6	22.6	23.9	15.4	15.0
NI	6.4	6.2	10.2	7.3	13.6	8.8	13.2	4.0	9.4	7.9
PB	11.7	16.4	12.9	17.2	16.3	18.7	15.5	15.0	15.0	24.2
RB	45.5	85.0	245.9	198.6	236.9	265.9	253.9	87.9	216.1	226.2
SC	12.3	14.2	8.9	4.9	10.8	9.3	6.3	4.7	7.0	4.6
SR	1213.1	671.3	307.2	295.2	270.6	331.5	250.2	661.1	346.1	294.3
TH	4.5	4.1	11.0	12.9	8.6	10.2	10.9	6.5	9.4	12.3
U	0.4	1.1	2.0	3.0	1.5	1.6	2.2	1.1	1.7	2.1
V	111.4	54.3	99.5	59.7	91.7	71.8	70.2	38.0	61.9	34.0
Y	16.7	35.3	62.2	45.5	64.6	57.4	52.2	34.1	36.2	36.4
ZN	113.3	161.3	192.9	154.1	184.7	157.3	162.7	113.1	127.6	78.2
ZR	198.1	129.6	214.8	250.5	197.3	225.5	231.2	304.3	244.0	252.0

Wt.%	31694	31695	31696	31697	31698	31699	31700	31701	31702	31703
SIO2	70.40	71.22	71.91	48.20	48.62	49.46	52.20	57.90	60.22	60.37
TIO2	0.29	0.32	0.32	1.33	1.26	1.26	0.93	1.02	0.81	1.02
AL2O3	14.26	13.82	13.87	13.55	19.99	19.18	14.26	17.21	17.67	16.74
FE2O3T	3.90	3.61	2.80	11.91	10.39	9.83	9.95	6.84	6.07	6.70
MNO	0.09	0.13	0.07	0.34	0.18	0.17	0.18	0.10	0.10	0.12
MGO	0.44	0.41	0.41	7.96	4.30	4.69	8.61	3.66	1.97	3.00
CAO	1.75	1.28	1.30	11.61	7.99	8.10	6.82	6.12	4.80	5.89
NA2O	3.60	3.68	3.20	1.83	3.42	3.72	2.26	4.31	3.62	3.50
K2O	4.00	4.46	4.99	2.27	2.36	2.15	3.39	1.74	3.79	1.92
P2O5	0.08	0.07	0.06	0.11	0.41	0.30	0.18	0.28	0.22	0.25
LOI	1.00	1.04	1.33	0.90	1.41	1.14	1.28	0.98	0.52	0.67
TOTAL	99.81	100.04	100.26	100.01	100.33	100.00	100.06	100.16	99.79	100.18
ppm										
BA	477.5	539.3	654.8	134.3	466.1	586.7	559.5	703.7	1094.1	692.7
CE	64.9	90.5	93.3	24.6	55.7	75.6	54.2	40.2	97.0	58.5
CR	2.1	3.0	1.4	262.8	8.7	21.2	43.6	65.9	11.9	27.1
CU	2.0	2.4	1.5	7.8	12.1	10.5	20.9	14.1	11.1	3.9
GA	19.6	20.8	17.9	20.6	25.6	25.9	21.9	23.0	24.4	23.2
LA	38.6	55.8	56.5	11.5	23.3	29.4	24.1	18.5	54.0	31.2
NB	15.3	14.5	11.8	6.4	17.0	16.9	13.5	11.2	20.0	18.8
NI	3.8	5.3	3.3	91.5	12.2	15.8	38.0	38.6	10.0	9.2
PB	28.6	27.6	26.2	9.8	12.8	11.6	10.7	11.6	19.7	9.8
RB	142.9	191.1	176.0	192.6	164.1	123.6	178.5	64.4	148.7	60.8
SC	4.2	1.9	1.4	33.1	18.2	21.8	23.1	11.4	11.5	12.5
SR	132.0	108.6	178.7	199.0	633.4	649.6	469.5	661.7	502.5	573.5
TH	9.9	10.4	11.8	2.6	2.7	4.6	9.5	4.1	16.1	6.4
U	1.2	1.2	2.3	1.7	1.7	1.2	1.1	0.2	2.2	1.4
V	15.9	19.0	15.8	197.0	113.8	152.6	129.5	107.7	67.5	100.4
Y	21.6	21.3	13.2	48.0	42.2	49.4	40.9	17.0	44.1	21.6
ZN	72.2	78.7	65.8	186.8	142.2	125.1	132.3	103.0	84.5	89.7
ZR	205.5	215.3	200.9	96.5	235.3	257.6	148.1	185.1	276.3	161.6

Notes: 1 "<" Indicates below detection limit
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3 Sample numbers refer to VUW Geology Department collection
4 All major and trace element analyses performed on duplicate disks and pellets

Table 8. Continued.

Wt.%	31704	31705	31706	31707	31708	31709	31710	31711	31712	31713
SIO2	61.28	63.14	64.82	64.85	65.86	66.03	68.94	68.96	69.88	45.52
TIO2	0.77	0.71	0.38	0.65	0.55	0.59	0.42	0.81	0.43	2.17
AL2O3	17.19	16.92	16.75	16.35	15.84	15.43	15.52	13.18	15.13	9.88
FE2O3T	5.76	5.16	3.42	4.76	3.93	5.72	2.76	5.02	3.17	10.94
MNO	0.10	0.09	0.07	0.08	0.07	0.12	0.04	0.05	0.06	0.17
MGO	2.13	1.71	0.99	1.67	1.49	1.83	1.10	2.08	0.81	14.23
CAO	4.81	4.23	2.29	4.17	3.73	3.77	2.98	2.90	2.64	12.00
NA2O	3.80	3.63	2.86	3.28	3.27	4.05	2.87	2.19	3.55	1.21
K2O	3.07	3.73	7.46	3.65	3.83	1.93	4.95	3.22	3.85	1.24
P2O5	0.19	0.18	0.09	0.16	0.12	0.15	0.10	0.01	0.08	0.27
LOI	1.08	0.61	0.65	0.52	1.70	0.39	0.31	1.84	0.49	1.12
TOTAL	100.18	100.11	99.78	100.14	100.39	100.01	99.99	100.26	100.09	98.75
ppm										
BA	858.3	1017.7	1881.0	980.1	884.6	404.2	946.9	753.5	760.0	170.8
CE	85.2	110.8	64.1	67.6	96.8	85.3	137.4	17.7	52.7	33.4
CR	12.0	9.8	8.0	9.2	7.5	13.2	5.3	41.0	3.8	752.9
CU	7.0	5.3	4.9	5.4	2.7	2.3	5.5	34.2	10.8	3.2
GA	23.9	21.8	17.4	21.2	19.7	23.6	17.4	18.7	19.8	17.9
LA	45.0	61.6	33.9	40.6	57.9	46.0	88.3	7.9	28.1	13.0
NB	15.4	16.4	12.4	14.2	13.3	20.9	8.7	20.1	18.7	26.4
NI	8.6	8.3	6.6	7.0	6.6	8.6	4.6	17.6	4.9	180.0
PB	34.6	17.0	30.5	16.6	21.8	11.8	21.7	14.7	21.5	4.1
RB	118.9	132.2	207.8	127.5	150.0	112.4	147.4	140.3	164.9	34.1
SC	10.2	7.6	7.8	8.7	6.8	17.1	2.1	4.7	4.3	56.3
SR	476.6	491.6	491.8	460.9	422.3	438.7	434.1	317.5	349.6	218.2
TH	15.7	14.0	12.8	12.1	20.9	9.4	27.6	3.5	15.9	3.3
U	1.8	1.8	1.6	1.8	1.6	1.3	0.9	0.8	1.6	1.1
V	68.5	56.8	35.8	54.6	46.9	59.9	35.8	82.2	28.4	300.9
Y	40.5	35.2	33.2	30.6	26.6	45.9	12.4	6.5	24.5	25.5
ZN	97.9	69.4	54.9	62.3	58.2	121.3	38.6	78.4	51.0	108.6
ZR	228.0	245.8	141.3	198.1	172.7	180.7	186.8	313.6	161.1	116.7

Wt.%	31714	31715	31716	31717	31718	31719	31720	31721	31722	31723
SIO2	51.14	51.23	52.20	54.61	54.76	54.77	55.56	56.19	57.37	58.94
TIO2	0.76	1.02	1.04	0.96	0.61	0.96	0.60	0.64	0.64	0.55
AL2O3	11.73	14.12	14.20	11.90	9.39	12.30	13.41	10.11	10.05	9.06
FE2O3T	6.79	7.54	13.87	7.00	4.90	7.26	7.23	5.31	5.19	4.13
MNO	0.10	0.11	0.33	0.10	0.11	0.13	0.22	0.13	0.14	0.08
MGO	11.46	10.31	5.25	8.71	12.77	8.40	2.87	11.24	11.01	10.90
CAO	11.54	7.18	7.89	8.52	14.09	9.93	17.57	10.26	10.62	10.37
NA2O	1.09	2.37	2.76	0.88	1.56	1.54	1.17	1.15	1.23	0.66
K2O	2.45	3.35	1.41	4.18	1.45	2.67	0.32	3.32	2.59	2.70
P2O5	0.16	0.20	0.14	0.17	0.10	0.23	0.13	0.10	0.10	0.13
LOI	2.13	2.04	1.11	2.42	0.81	1.47	1.28	1.57	1.26	1.86
TOTAL	99.35	99.47	100.20	99.45	100.55	99.66	100.36	100.02	100.20	99.38
ppm										
BA	536.2	490.2	262.3	699.7	460.6	818.1	42.3	650.2	542.7	948.5
CE	106.5	172.8	12.3	55.7	46.5	71.3	80.5	48.7	47.6	40.6
CR	69.5	84.0	37.4	71.8	48.8	75.4	42.5	52.0	51.7	43.8
CU	25.0	25.3	18.2	35.0	25.4	3.5	3.8	18.8	10.5	24.9
GA	17.2	21.1	17.2	16.2	14.0	19.1	28.7	14.2	14.4	11.7
LA	67.9	116.3	<	26.5	22.7	41.3	42.0	30.2	26.7	18.6
NB	15.6	20.0	1.1	16.4	12.3	18.3	31.0	13.6	13.8	11.3
NI	72.1	57.9	17.1	39.9	29.3	51.2	25.9	47.0	29.3	25.6
PB	31.4	16.5	8.8	21.2	8.5	17.0	6.2	19.6	43.6	15.4
RB	132.8	197.5	85.3	166.0	79.3	114.1	29.9	140.3	118.8	102.1
SC	17.7	21.7	47.2	18.8	12.4	18.7	13.6	14.2	12.5	10.9
SR	256.8	199.5	124.8	182.7	220.9	196.3	411.1	203.9	176.7	217.5
TH	11.6	11.4	0.9	11.4	10.0	10.5	18.4	10.7	9.8	10.1
U	2.9	2.6	1.1	2.5	2.2	3.1	13.3	3.1	2.8	2.7
V	131.3	169.2	297.8	139.4	90.0	166.0	71.6	93.0	108.5	75.9
Y	44.0	54.5	32.3	44.0	28.7	45.2	75.5	37.4	36.2	29.0
ZN	123.2	150.5	194.0	97.7	110.2	99.5	130.0	256.3	231.5	68.7
ZR	155.2	185.2	43.9	202.1	163.5	194.9	221.4	176.6	166.0	174.5

Notes: 1 "<" Indicates below detection limit
2 "LOI" is loss on ignition at 1000 Deg.C
3 Sample numbers refer to VUW Geology Department collection
4 All major and trace element analyses performed on duplicate disks and pellets

Table 8. Continued.

Wt.%	31724	31725	31726	31727	31728	31729	31730	31731	31732	31733
SIO2	65.35	48.12	51.85	51.95	53.10	53.32	53.53	53.72	53.87	53.87
TIO2	0.67	1.08	1.15	1.07	1.08	1.66	0.62	1.18	1.22	1.20
AL2O3	15.80	13.92	16.80	16.78	15.57	16.98	14.60	17.88	17.45	16.14
FE2O3T	5.38	9.33	9.25	9.12	9.54	9.39	9.95	9.11	8.67	8.49
MNO	0.09	0.15	0.15	0.15	0.16	0.13	0.17	0.16	0.13	0.13
MGO	3.06	10.52	5.13	4.80	7.13	4.15	6.73	4.16	4.07	5.15
CAO	2.63	9.68	7.72	7.80	8.82	6.76	10.70	7.33	7.72	7.60
NA2O	2.66	2.46	3.00	2.65	2.17	3.57	1.73	2.91	3.08	2.80
K2O	3.33	1.70	2.40	1.19	0.83	2.02	0.48	1.98	1.58	1.58
P2O5	0.13	0.37	0.35	0.20	0.23	0.45	0.07	0.28	0.26	0.26
LOI	0.98	2.86	2.28	3.72	1.39	1.74	1.61	1.11	1.36	2.41
TOTAL	100.08	100.11	100.08	99.43	100.02	100.17	100.19	99.82	99.41	99.63
ppm										
BA	370.6	741.2	10.9	507.0	428.5	952.5	122.1	717.3	637.1	626.2
CE	47.7	60.7	24.9	47.1	46.0	77.4	24.7	47.2	51.8	54.9
CR	51.9	678.0	<	50.5	256.4	26.1	139.1	23.5	62.8	153.5
CU	16.5	29.4	0.4	4.9	25.6	14.2	79.1	8.9	8.9	15.5
GA	22.1	17.4	21.0	19.8	19.4	24.0	15.2	21.4	21.9	20.4
LA	25.1	26.3	12.9	21.7	16.9	36.8	8.7	21.1	21.6	22.6
NB	14.4	10.7	18.3	8.1	8.3	13.5	3.6	8.9	10.8	10.5
NI	29.0	205.2	5.3	13.7	31.5	25.1	76.8	11.6	15.5	30.0
PB	18.6	9.3	10.1	12.3	24.7	8.8	7.7	28.0	6.6	9.6
RB	158.9	72.2	81.0	39.5	47.9	74.0	22.9	121.6	50.5	41.6
SC	11.8	26.6	1.2	25.8	28.4	13.1	37.7	22.1	22.8	21.8
SR	190.2	250.1	756.6	505.6	511.7	759.6	118.4	593.3	579.8	597.3
TH	9.6	6.1	4.6	2.5	1.7	4.6	5.0	2.7	4.4	1.9
U	3.3	0.9	0.4	1.2	0.6	1.6	0.6	0.4	<	0.8
V	84.5	141.7	4.6	151.1	161.7	140.1	217.3	142.9	155.1	118.7
Y	35.6	26.5	33.9	31.5	31.9	27.4	22.1	40.1	36.3	28.0
ZN	88.3	99.8	10.8	116.3	121.7	157.1	73.4	164.0	98.2	103.9
ZR	148.5	166.4	75.8	174.6	161.7	242.9	90.9	185.1	182.0	176.4

Wt.%	31734	31735	31736	31737	31738	31739	31740	31741	31742	31743
SIO2	54.39	54.39	55.13	55.42	56.27	60.35	60.49	61.85	64.59	66.27
TIO2	1.57	0.63	1.27	1.14	1.15	0.92	0.82	0.76	0.65	0.54
AL2O3	16.41	14.83	16.76	16.08	16.54	17.12	16.28	15.99	15.82	15.32
FE2O3T	8.81	9.85	8.09	8.21	7.79	6.66	6.41	5.81	5.37	4.63
MNO	0.13	0.18	0.11	0.14	0.13	0.12	0.11	0.09	0.10	0.09
MGO	4.36	7.04	4.74	5.02	4.67	1.62	2.43	1.91	0.86	0.63
CAO	6.85	10.91	7.25	7.16	7.06	4.29	4.51	3.73	2.94	2.13
NA2O	3.59	1.76	3.20	3.53	2.89	3.75	3.08	2.69	4.08	4.40
K2O	2.16	0.75	2.08	2.00	2.16	3.17	3.11	4.50	3.93	4.33
P2O5	0.41	0.05	0.29	0.28	0.24	0.29	0.18	0.20	0.19	0.13
LOI	1.37	0.10	0.99	1.03	1.08	1.07	1.96	1.98	0.84	1.34
TOTAL	100.05	100.49	99.91	100.01	99.98	99.36	99.38	99.51	99.37	99.81
ppm										
BA	1047.2	190.8	747.9	667.6	676.5	998.5	875.2	1095.1	1125.3	1212.8
CE	70.8	25.3	52.2	56.3	56.3	73.7	65.7	78.7	95.5	81.4
CR	70.6	101.9	86.6	157.6	148.4	4.7	10.5	8.6	2.6	2.0
CU	4.5	74.5	4.8	4.9	13.5	5.3	6.3	11.6	6.3	3.8
GA	23.1	16.4	21.6	21.0	20.9	21.9	21.1	22.5	22.8	20.4
LA	35.3	9.8	25.0	24.4	24.8	35.9	33.5	39.6	49.0	42.3
NB	14.2	5.9	11.9	11.2	11.7	16.1	11.0	13.2	18.9	20.4
NI	39.0	73.4	23.2	31.1	18.3	7.0	5.5	7.1	5.6	5.4
PB	6.9	6.8	4.8	8.2	10.9	9.9	13.5	13.1	21.6	21.9
RB	63.3	29.9	62.2	73.9	70.9	114.8	113.0	132.5	113.3	117.6
SC	14.9	34.7	18.9	21.3	19.4	12.7	15.0	11.1	10.2	8.5
SR	840.0	120.9	693.3	616.3	601.3	533.1	381.4	475.5	384.3	280.6
TH	5.6	3.3	2.1	3.2	2.8	6.6	8.2	8.8	10.7	9.6
U	1.6	1.1	0.7	0.8	0.5	1.4	1.3	1.7	2.0	1.5
V	141.4	201.5	142.3	126.4	131.0	55.3	93.3	62.2	24.1	13.1
Y	20.2	23.0	28.4	29.2	29.4	45.0	33.9	38.1	50.3	50.0
ZN	107.6	76.8	62.1	109.7	86.7	116.4	78.0	85.0	89.1	87.9
ZR	194.9	89.5	184.7	196.5	193.3	262.8	189.5	279.2	336.7	359.4

Notes: 1 "<" Indicates below detection limit
2 "LOI" is loss on ignition at 1000 Deg.C
3 Sample numbers refer to VUW Geology Department collection
4 All major and trace element analyses performed on duplicate disks and pellets

Table 8. Continued.

Wt.%	31744	31745	31746	31747	31748	31749	31750	31751	31752	31753
SIO2	66.33	69.87	70.45	70.88	71.09	71.50	72.88	73.15	73.28	73.92
TIO2	0.50	0.34	0.31	0.38	0.27	0.29	0.19	0.10	0.09	0.10
AL2O3	15.28	15.02	14.16	14.38	13.87	14.08	14.25	13.69	13.05	13.13
FE2O3T	4.65	3.16	2.65	2.80	2.55	2.58	1.78	1.10	1.69	1.70
MNO	0.07	0.06	0.04	0.05	0.05	0.05	0.04	0.01	0.04	0.05
MGO	0.88	0.66	0.63	0.58	0.47	0.52	0.49	0.36	0.06	0.07
CAO	0.92	2.31	1.41	1.79	1.76	1.91	1.36	0.71	0.51	0.64
NA2O	4.11	3.67	2.86	3.36	3.45	3.46	3.29	3.66	4.07	4.26
K2O	5.48	4.01	5.71	4.87	4.46	4.42	4.55	5.48	4.79	4.83
P2O5	0.12	0.11	0.07	0.09	0.07	0.08	0.05	0.01	0.01	0.01
LOI	1.15	0.54	1.42	0.85	1.28	0.98	1.12	1.07	1.58	0.90
TOTAL	99.49	99.75	99.71	100.03	99.32	99.87	100.00	99.34	99.17	99.61
ppm										
BA	1492.8	754.6	1145.8	702.3	641.7	626.5	916.5	254.4	49.3	40.2
CE	85.8	74.6	92.5	93.4	74.5	60.2	57.5	94.8	91.0	82.2
CR	2.3	2.3	2.1	2.7	1.8	1.1	1.1	<	<	<
CU	3.9	2.2	2.3	2.6	2.1	2.4	2.0	4.5	3.3	0.4
GA	20.7	18.8	17.1	20.0	18.1	17.8	17.5	17.3	21.1	22.2
LA	42.9	43.9	51.3	54.7	45.3	34.9	30.2	52.8	49.7	43.3
NB	21.6	13.1	13.9	17.3	11.9	12.4	11.0	20.6	21.4	22.3
NI	5.3	4.1	5.8	4.8	4.1	4.0	2.9	4.9	5.0	4.5
PB	22.0	19.6	24.4	26.4	22.0	22.8	28.0	15.0	18.0	21.2
RB	155.2	131.4	213.7	180.5	165.7	162.5	147.0	174.4	195.1	166.7
SC	9.2	3.4	3.0	1.8	2.7	2.2	1.8	2.5	3.6	2.5
SR	302.3	393.7	226.8	325.0	228.4	250.1	349.1	67.1	13.9	17.5
TH	10.1	11.6	12.0	18.6	17.4	16.6	10.3	18.4	17.8	16.9
U	2.0	2.3	1.8	2.6	1.9	2.2	1.2	2.9	2.7	2.8
V	14.7	18.1	18.2	15.2	15.8	15.4	12.2	8.0	4.3	5.3
Y	49.0	22.5	31.7	25.3	25.9	26.5	14.0	51.8	48.5	49.8
ZN	85.7	74.6	49.2	49.7	45.3	50.7	50.7	15.8	69.3	77.9
ZR	367.1	205.0	261.5	243.3	178.5	182.6	145.9	279.8	255.8	258.1

Wt.%	31754	31755	31756	31757	31758	31759
SIO2	76.33	76.38	76.68	76.92	77.01	51.40
TIO2	0.03	0.04	0.07	0.04	0.03	0.36
AL2O3	12.78	12.56	12.52	12.61	12.57	16.84
FE2O3T	0.87	1.08	0.92	0.85	0.83	7.67
MNO	0.05	0.02	0.02	0.02	0.06	0.14
MGO	0.09	0.07	0.13	0.09	0.06	8.27
CAO	0.50	0.47	0.37	0.69	0.64	12.79
NA2O	3.85	3.76	3.19	3.60	3.79	1.32
K2O	4.82	4.80	5.59	4.92	4.72	0.37
P2O5	0.10	0.01	0.01	0.01	0.01	0.03
LOI	0.40	0.50	0.63	0.29	0.52	0.39
TOTAL	99.82	99.69	100.13	100.04	100.24	99.58
ppm						
BA	4.6	1086.3	331.6	14.3	7.4	109.9
CE	13.7	64.8	17.7	21.4	9.0	12.8
CR	<	83.7	<	0.4	<	231.4
CU	0.4	23.0	2.5	0.6	0.5	54.6
GA	21.3	18.2	14.8	18.6	19.1	15.1
LA	5.8	27.8	10.8	9.2	3.9	2.9
NB	33.9	11.0	14.6	20.0	14.2	1.7
NI	7.0	20.6	3.5	5.6	5.0	100.7
PB	48.2	15.7	29.0	14.0	44.6	5.0
RB	352.3	295.0	218.6	306.8	274.1	16.4
SC	1.3	19.5	1.0	0.5	1.1	29.2
SR	6.5	17.5	120.3	20.3	12.5	118.0
TH	25.0	23.3	8.8	23.3	30.0	2.5
U	5.0	3.8	2.3	2.5	4.5	0.4
V	4.0	158.9	6.0	6.0	4.4	147.1
Y	43.7	27.0	17.2	29.6	35.4	11.1
ZN	33.9	112.0	17.5	8.6	25.0	50.5
ZR	34.6	185.9	91.3	76.1	52.4	45.5

Notes: 1 "<" Indicates below detection limit
2 "LOI" is loss on ignition at 1000 Deg.C
3 Sample numbers refer to VUW Geology Department collection
4 All major and trace element analyses performed on duplicate disks and pellets

Table 9. XRF analyses of granitoids selected from samples collected by McKelvey & Webb (1962) and Allen & Gibson (1962).

VUW No.	10699	10317	10318	10319	10320	10702	10703
Wt.%							
SiO_2	71.61	71.88	72.93	72.63	71.99	76.19	72.61
TiO_2	.29	.19	.14	.14	.17	.04	.22
Al_2O_3	14.11	14.50	14.29	13.87	14.62	12.63	13.91
Fe_2O_3T	2.90	1.90	1.23	1.79	1.69	.88	2.08
MnO	.05	.03	.02	.03	.03	.05	.03
MgO	.58	.42	.20	.22	.35	.04	.34
CaO	1.49	2.26	.41	.99	1.77	.37	1.86
Na_2O	3.88	3.54	3.28	3.31	3.48	3.79	3.26
K_2O	4.15	3.74	6.36	5.10	4.37	4.97	4.49
P_2O_5	.08	.05	.03	.03	.04	.01	.05
LOI	.77	.91	.79	1.29	.90	.55	.93
Total	99.91	99.42	99.68	99.40	99.41	99.52	99.78
Trace elements (ppm)							
Ga	20	17	14	18	17	19	17
Pb	21	19	32	31	25	36	20
Rb	161	125	205	159	149	362	106
Sr	217	397	136	195	406	10	342
Th	15.9	6.4	9.0	8.5	7.1	26.7	7.2
U	2.8	1.2	2.2	1.0	0.7	3.3	1.2
Y	31	7	19	14	9	45	11
As	<1	<1	2	1	<1	<1	<1
Sc	2	4	3	1	3	1	3
V	11	12	14	7	8	5	10
Cr	1	2	10	<1	2	<1	2
Ba	591	815	1096	673	1089	13	1248
La	48	25	6	27	29	13	37
Ce	79	44	17	51	50	26	67
Ni	2	2	4	2	2	2	2
Cu	1	<1	8	1	<1	<1	<1
Zn	55	42	4	21	38	11	43
Zr	217	137	118	113	135	81	148
Nb	16	7	11	9	9	26	8

The following sample descriptions are those given on the card accompanying the rock specimen. The comments in italics are those of this writer.

10699 Porphyritic granite (Dais) - ridge S of Willis Glacier *(Swindon Granite in this work)*

10317 Vida Granite - southern wall, Wright Valley *(The southern wall of the Victoria Valley is given in the book entry and is more likely correct)*

10318 Vida Granite - southern wall, Victoria Valley *(Pink, medium to coarse grained)*

10319 Vida Granite - southern wall, Victoria Valley *(Brick red, medium to coarse grained, altered)*

10320 Vida Granite - southern wall, Wright Valley *(more likely means Victoria Valley! grey, medium - grained)*

10702 Vida Granite - grey variety, ridge south of Willis Glacier *(Harker Granite in this work)*

10703 Vida Granite - typical pink colour, NE of Lake Vida, Victoria Valley.