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XRF ANALYSES OF GRANITOIDS AND ASSOCIATED ROCKS FROM SOUTH VICTORIA LAND, ANTARCTICA

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INTRODUCTION

The granitoid rocks of South Victoria Land are represented in some of the earliest geological studies of Antarctica. Indeed as early as 1841 granitoids were dredged from the sea-floor off Victoria Land on the voyages of the *Erebus* and *Terror*. Early workers such as Ferrar and Prior described granitoids collected *in situ* by members of the *Discovery* expedition (1901-1904). Some years later further granitoid descriptions and the occasional chemical analysis were presented by such workers as David, Priestly, Mawson and Smith.

In more recent times, samples collected by Gunn and Warren (1962) and analysed by the United States Geological Survey were presented in Harrington *et.al.* (1967). The first detailed study of granitoids in South Victoria Land was by Ghent & Henderson (1968) who, although examining only a small area in the lower Taylor Valley revealed for the first time the diverse range of granitoid types and emplacement processes in this region. This work was followed up by a relatively detailed major and trace element geochemical study, (Ghent,1970). In the early '70s, Murphy (1971) and Lopatin (1972) produced a small number of major element analyses of "augen" gneisses and other granitoids.

Increasingly, granitoids are being classified according to the nature of their source region. Precise and accurate analytical data are required for this purpose. Presently two major types are recognised, S-type (sedimentary) and I-type (igneous), as originally outlined by Chappell & White (1974) and more recently White & Chappell (1983). In addition subsets of I-types include A-types (anorogenic or alkalic), Loiselle & Wones (1979) and Collins *et.al.* (1982) and M-types (mantle), Whalen (1985). S-, I-, and M-types are found in orogenic regions whereas A-types are found in regions of crustal tension.

Despite a long history of examination, and in the last 20 years, readily available instrumental methods of analysis, very little analytical data has been produced. This has had unfortunate consequences, because without detailed major and trace element geochemical data it is not possible to map granitoids in detail, interpret their relationships, or propose petrogenetic and classification schemes.

This report presents major and trace element analyses (Tables 3 to 7) of 96 granitoid samples from South Victoria Land. The locations of the samples are shown on Maps 1 to 5 to enable quick reference (the last two digits of the VUW No. are shown on the maps). Most of the samples are part of a collection, made by P.G.Fitzgerald, for fission track studies. Although mainly granitoids, the samples also include gneisses, xenoliths and dykes, brief sample descriptions are provided in Tables 8 to 13. The rocks have been named and classified using the IUGS scheme (Streckeisen, 1973). However, the use of formational names (especially Larsen Granodiorite or Irizar Granite) has been abandoned because they are so poorly defined in the region. Appendix 1 presents some INAA REE analyses and Appendix 2 contains XRF data on an additional 24 samples from the Miers Valley area. This publication thus represents the first attempt to provide a comprehensive geochemical database from which it is hoped will stem a rational granitoid nomenclature and classification scheme for South Victoria Land.

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, weathered 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 analysis to be undertaken at a later date. 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 zip-top plastic 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

The instrumentation used for XRF analysis comprised a Siemens SRS-1 sequential automatic X-ray spectrometer fitted with a ten position sample changer. The X-ray tubes were operated from a K-700 generator. Pulse conditioning and counting utilised the "T" type electronics rack. Data reduction was on-line using a Hewlett-Packard HP-85 desk top computer and a Diablo printer.

Major elements

Fused glass disks were prepared using procedures modified from Norrish & Hutton (1969). David Brown Scientific "SIGMA Norrish Formula" X-ray flux was fused with .5000g of rock powder and .035g of AR ammonium nitrate in a covered Pt-5%Au crucible over a propane 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 correction program at run-time. Glass disks were pressed on a graphite die with 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.

Instrumental conditions for major element analysis are given in Table 1. The instrument was calibrated using the 11 international rock standards AGV-1, BCR-1, BE-N, AN-G, MA-N, NIM-G, NIM-L, NIM-S, BHVO-1, SDC-1 and STM-1. These standards were chosen to cover a wide range of values for each element and to cover the compositional spectrum of normal silicate rocks. Backgrounds were determined for each element using a disk prepared from "SPEX" SiO2. SPEX CaCO3 was used for the Si background. Seven samples were analysed in each analytical sequence, the other three positions in the changer being occupied by a master reference standard, an SiO2 background monitor disk and a selected international rock standard. Matrix correction factors were those of Norrish & Chappell (1977). Some additional interference corrections were applied (eg. Ca on P).

Trace elements

Trace elements were measured on undiluted, boric acid backed pressed powder pellets (Norrish & Hutton 1969). The pellets were 40mm diameter and contain 3.6g of rock powder. Instrumental conditions for trace element determinations are provided in Table 2. The instrument was calibrated against several international standard rocks selected from AGV-1, BCR-1, AN-G, BE-N, MA-N, JB-1, JG-1, the NIM-D to S series and the USGS III series. Only

Major Elements

Element	Crystal	Coll.	Aperture	Time(s)	R	LLD%	Bg%
Fe	LiF200	.4	S	20	1256	.008	.20
Mn	LiF220	.15	L	40	193	.022	.43
Ti	LiF200	.15	L	20	6756	.002	.07
Ca	LiF200	.15	S	20	2593	.004	.08
K	PET	.4	S	20	3941	.002	.02
P	PET	.4	L	40	199	.010	.08
Si	PET	.4	S	100	79	.020	.34
Al	PET	.4	S	100	70	.013	.13
Mg	TlAP	.4	L	100	46	.031	.46
Na	TlAP	.4	L	200	16	.068	1.62

Notes: All major element analyses were carried out, under vacuum using the Kα line and a Cr-anode X-ray tube (operated at 45kV and 40mA. A flow proportional counter using P10 gas (10% methane in argon) and fitted with a 1μm polypropylene window was used.

Coll. - fine (0.15mm) or coarse (0.40mm) primary collimator.

Aperture - large (L) or small (S) aperture over X-ray tube window.

R - count rate (counts/second/percent).

LLD% - lower level of detection, sensitivity, $(3/R\sqrt{B/T})$ where B represents counts/second, T is counting time.

Bg% - Apparent background in % obtained from a disc prepared from SPEX SiO_2 (SPEX $CaCO_3$ in the case of Si).

Table 1. XRF major element analytical conditions.

Trace Elements

Element	Line	X-ray tube Anode	Crystal	Counter	Vacuum	Peak time (sec)	Major Interferences
Ba	Lα	Au	200	Flow	Yes	100	TiKα
Ce	Lα	Au	220	Flow	Yes	200	BaLα
Cr	Kα	Au	220	Flow	Yes	100	VKβ
Cu	Kα	Au	200	Scint	No	100	Cu*
Ga	Kα	Mo	200	Scint	No	40	-
La	Lα	Au	220	Flow	Yes	200	-
Nb	Kα	Au	220	Scint	No	100	-
Ni	Kα	Au	200	Scint	No	100	Ni*
Pb	Lβ	Mo	220	Scint	No	100	-
Rb	Kα	Mo	220	Scint	No	100	Au*
Sc	Kα	Au	200	Flow	Yes	100	CaKβ
Sr	Kα	Mo	220	Scint	No	100	-
Th	Lα	Mo	220	Scint	No	200	-
U	Lα	Mo	220	Scint	No	200	-
V	Kα	Au	220	Flow	Yes	100	TiKβ
Y	Kα	Mo	220	Scint	No	40	RbKβ
Zn	Kα	Au	200	Scint	No	40	
Zr	Kα	Au	220	Scint	No	40	SrKβ

Notes: - Both X-ray tubes operated at 60kV/40mA.

- Large aperture and .15 collimator for all elements, except Zn, Cu and Ni for which small aperture and .4 collimator was used (to reduce internal interferences).

- Mo Kα Compton peak measured at -.41 degrees from peak to avoid Nb and Y interference.

* Interference originating from the X-ray tube and/or components within the spectrometer.

Table 2. XRF trace element analytical conditions.

those rocks with satisfactory literature values for any particular element were used in the calibration procedure.

Mass absorption corrections were applied to all trace element measurements simultaneously by monitoring the Au*Lb* or Mo*Ka* Compton peaks from the X-ray tubes. Normalised power curves were used for wavelengths between the Compton peak and the Fe absorption edge. Beyond the Fe absorption edge exponential curves were used to correct for Fe, Mn, Cr, and Ti in the matrix. Both types of curve were constructed using 30 standard rocks and synthetic mixtures and have correlation coefficients better than .98. Errors in determining mass absorptions are generally less than a few percent relative. Non-linear backgrounds resulting from tube contamination were determined from "SPECTROSIL" ultrapure SiO2 glass. All spectral interferences between elements in any particular analytical group were corrected using an iterative procedure. The actual interference factors were measured using 2000 and 5000 ppm doped quartz pellets.

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Table 3. Analytical data.

Wt.%	30801	30802	30803	30804	30805	30806	30807	30808	30809	30810
SIO2	73.70	71.02	72.27	75.83	68.53	73.54	73.31	70.09	72.26	69.84
TIO2	0.19	0.32	0.22	0.14	0.36	0.15	0.15	0.41	0.24	0.42
AL2O3	13.45	14.21	13.93	12.68	16.42	14.43	14.49	15.39	14.38	14.74
FE2O3	0.28	0.59	0.56	0.45	0.37	0.15	0.28	0.54	0.15	0.68
FEO	1.60	2.10	1.43	0.95	2.03	1.09	1.00	1.93	1.58	2.37
MNO	0.05	0.05	0.02	0.01	0.04	0.03	0.04	0.05	0.05	0.05
MGO	0.25	0.49	0.30	0.11	0.64	0.24	0.29	0.44	0.50	0.96
CAO	1.16	1.81	1.42	0.83	3.31	1.82	2.18	2.76	1.83	2.34
NA2O	3.57	3.71	3.33	3.20	4.17	3.92	3.74	4.42	3.40	3.30
K2O	4.98	4.68	5.35	5.37	3.19	3.98	3.64	3.18	4.64	4.38
P2O5	0.05	0.08	0.05	0.02	0.08	0.03	0.04	0.12	0.06	0.11
LOSS	0.79	0.75	0.84	0.41	0.63	0.63	0.70	0.64	0.66	0.67
TOTAL	100.07	99.81	99.72	100.00	99.77	100.01	99.86	99.97	99.75	99.86
ppm										
BA	335	538	533	199	1487	832	917	843	932	1028
CE	96	103	82	84	72	17	29	57	72	227
CR	6	6	4	3	6	5	4	6	8	9
CU	<	<	7	<	<	<	<	<	<	<
GA	21	20	19	18	18	19	18	20	19	20
LA	48	53	44	45	39	10	14	31	40	137
NB	17	17	13	9	9	11	9	13	10	15
NI	<	<	<	<	<	<	<	<	<	<
PB	27	26	29	26	23	32	32	23	27	27
RB	210	197	206	152	111	154	124	136	170	223
SC	<	4	2	<	2	<	<	5	4	2
SR	127	225	210	72	622	355	387	407	383	438
TH	20	21	15	12	18	6.4	8	13	11	73
U	2.8	<	<	<	<	<	2.1	4	<	<
V	6	13	9	<	15	6	3	25	12	25
Y	36	29	27	18	12	10	8	20	17	15
ZN	35	61	42	27	52	30	29	65	45	61
ZR	164	221	161	130	124	95	99	138	169	192

Wt.%	30811	30812	30813	30814	30815	30816	30817	30818	30819	30820
SIO2	71.08	68.71	71.34	69.01	68.23	61.86	72.11	57.01	72.70	70.41
TIO2	0.30	0.37	0.29	0.36	0.39	0.96	0.23	0.47	0.17	0.32
AL2O3	14.46	16.09	15.04	16.04	16.58	17.64	14.25	19.83	14.38	15.17
FE2O3	0.46	0.43	0.44	0.66	0.53	0.84	0.49	0.65	0.32	0.39
FEO	2.11	1.93	1.46	1.54	1.97	3.94	1.81	3.27	1.08	1.94
MNO	0.06	0.03	0.04	0.03	0.03	0.08	0.06	0.10	0.03	0.05
MGO	0.65	0.63	0.51	0.62	0.48	1.59	0.35	2.76	0.35	0.54
CAO	2.07	2.68	2.12	2.70	2.86	4.77	1.48	8.14	1.66	2.23
NA2O	3.59	3.94	3.68	3.91	4.30	4.35	3.90	4.77	3.60	3.42
K2O	4.52	4.02	4.27	3.91	3.71	2.78	4.62	1.76	4.60	4.49
P2O5	0.07	0.10	0.06	0.09	0.10	0.31	0.07	0.24	0.04	0.07
LOSS	0.62	1.15	0.53	0.82	0.58	0.68	0.56	0.96	1.10	0.97
TOTAL	99.99	100.08	99.78	99.69	99.76	99.80	99.93	99.96	100.03	100.00
ppm										
BA	755	1378	853	1560	1311	1332	515	335	880	1525
CE	88	57	69	60	76	73	71	25	46	99
CR	8	8	7	6	7	16	5	27	4	5
CU	<	<	<	<	<	12	<	<	<	<
GA	18	21	21	21	21	28	22	26	18	21
LA	51	33	37	32	42	30	40	14	28	58
NB	11	7	11	8	11	19	14	9	12	9
NI	<	<	<	<	<	5	<	12	<	<
PB	23	22	26	21	20	14	23	17	30	24
RB	161	118	157	114	124	97	152	101	142	129
SC	3	4	2	3	3	6	2	12	<	<
SR	281	694	477	719	707	741	193	808	394	586
TH	12	11	9	9.7	11	8.3	12	5.1	9.7	14
U	<	<	<	2.1	<	2.2	2	<	<	<
V	18	16	12	14	16	59	8	86	5	10
Y	21	12	23	11	13	22	30	17	12	11
ZN	51	50	61	50	47	105	55	67	31	52
ZR	165	212	179	207	216	295	186	89	124	224

Notes: 1 "<" Indicates below detection limit
2 "LOSS" is loss on ignition at 1000 deg.C, corrected for Fe++ to Fe+++ oxidation
3 Sample numbers refer to VUW Geology Department collection

Table 4. Analytical data (continued).

Wt.%	30821	30822	30823	30824	30825	30826	30827	30828	30829	30830
SIO2	66.13	75.00	63.41	71.69	62.96	49.07	56.27	68.57	66.31	71.40
TIO2	0.57	0.08	0.60	0.23	0.81	1.68	1.28	0.42	0.50	0.18
AL2O3	15.92	12.95	16.76	14.12	16.47	18.97	17.07	15.51	15.83	15.17
FE2O3	0.74	0.73	0.89	0.48	1.03	2.11	1.19	0.38	0.73	0.06
FEO	3.39	0.72	3.63	1.82	3.79	7.91	6.46	2.11	3.24	1.09
MNO	0.08	0.02	0.08	0.05	0.08	0.19	0.18	0.04	0.09	0.02
MGO	1.33	0.02	1.79	0.35	1.80	3.78	3.13	0.89	0.89	0.58
CAO	3.66	0.74	4.11	1.51	4.05	6.71	5.27	2.64	3.16	2.19
NA2O	3.60	4.12	3.59	4.01	3.78	4.66	4.13	3.74	3.79	3.19
K2O	3.59	4.77	3.81	4.51	3.66	2.56	2.74	4.63	3.86	5.25
P2O5	0.15	0.01	0.18	0.06	0.19	0.53	0.28	0.13	0.14	0.09
LOSS	0.88	0.82	1.00	0.76	1.23	1.76	1.45	0.72	0.92	0.57
TOTAL	100.04	99.98	99.85	99.59	99.85	99.93	99.45	99.78	99.46	99.79
ppm										
BA	786	27	807	494	669	244	316	985	907	1013
CE	93	82	76	75	99	83	64	93	87	23
CR	13	2	14	5	23	25	13	8	6	6
CU	<	<	<	<	6	36	14	<	<	<
GA	21	24	23	22	27	33	23	19	23	17
LA	54	39	41	42	57	31	37	53	51	10
NB	17	20	19	14	19	32	20	14	15	12
NI	<	<	3	<	7	15	4	<	<	<
PB	23	21	27	23	23	15	14	27	20	34
RB	147	178	150	139	191	214	253	199	150	220
SC	7	<	12	3	10	17	14	4	7	2
SR	390	8	420	189	455	464	397	404	388	367
TH	20	18	19	12	24	7.5	14	35	13	35
U	2.1	3.8	3	<	<	2.6	<	3.3	<	2.3
V	40	<	57	8	56	122	134	26	25	12
Y	30	54	45	32	41	63	19	20	29	11
ZN	73	40	77	62	84	162	147	38	69	27
ZR	183	208	191	206	236	265	184	170	234	144

Wt.%	30831	30832	30833	30834	30835	30836	30837	30838	30839	30840
SIO2	57.05	70.72	68.46	67.96	70.35	70.86	70.56	71.02	71.06	71.36
TIO2	0.64	0.31	0.47	0.48	0.33	0.32	0.33	0.27	0.28	0.29
AL2O3	10.29	14.57	14.83	15.17	14.46	14.30	14.15	14.42	16.11	14.13
FE2O3	0.90	0.62	0.72	0.72	0.96	0.65	0.72	0.60	0.21	0.46
FEO	5.06	2.15	2.40	2.61	2.03	2.19	2.25	2.05	1.34	2.00
MNO	0.16	0.06	0.07	0.06	0.06	0.06	0.07	0.05	0.04	0.05
MGO	9.10	0.51	1.06	1.22	0.57	0.56	0.55	0.41	0.42	0.54
CAO	9.21	2.05	3.13	2.93	2.09	1.97	1.93	1.92	3.75	1.94
NA2O	1.72	3.69	3.22	3.26	3.62	3.71	3.61	3.77	5.16	3.63
K2O	4.24	4.56	4.07	4.74	4.30	4.19	4.34	4.52	0.99	4.41
P2O5	0.14	0.08	0.13	0.13	0.09	0.09	0.09	0.07	0.12	0.08
LOSS	1.50	0.74	1.10	0.78	0.95	0.98	1.28	0.78	0.55	0.66
TOTAL	100.01	100.06	99.66	100.06	99.81	99.88	99.88	99.88	100.03	99.55
ppm										
BA	678	741	694	762	672	650	669	732	101	696
CE	40	68	57	117	60	65	66	71	166	65
CR	68	5	14	16	5	4	6	8	5	5
CU	4	<	<	<	<	<	8	13	<	<
GA	14	20	19	21	20	20	20	21	23	20
LA	11	36	30	67	32	35	37	39	98	36
NB	16	12	12	16	12	12	12	12	7	12
NI	23	<	5	6	<	<	<	<	<	<
PB	13	29	24	27	23	24	23	27	19	26
RB	291	169	142	200	165	168	163	172	63	174
SC	13	5	7	10	5	3	3	3	3	4
SR	225	254	429	365	270	273	263	231	498	262
TH	11	14	17	36	12	12	10	13	36	14
U	2.1	2.1	2.4	2	<	<	<	2.2	5.8	<
V	108	14	34	38	16	15	17	12	14	16
Y	30	28	25	23	27	25	24	28	15	23
ZN	136	57	43	50	59	55	61	57	45	55
ZR	174	182	159	164	180	178	177	190	285	160

Notes: 1 "<" Indicates below detection limit
2 "LOSS" is loss on ignition at 1000 deg.C, corrected for Fe++ to Fe+++ oxidation
3 Sample numbers refer to VUW Geology Department collection

Table 5. Analytical data (continued).

Wt.%	30841	30842	30843	30844	30845	30846	30847	30848	30849	30850
SIO2	67.20	63.72	67.33	59.05	54.44	58.24	70.20	74.00	58.67	73.72
TIO2	0.67	0.53	0.53	0.80	0.92	0.86	0.31	0.16	0.44	0.21
AL2O3	15.49	8.79	15.30	18.06	19.15	17.99	14.51	13.92	12.17	14.17
FE2O3	0.69	0.56	0.38	0.87	1.46	1.32	0.49	0.09	1.22	0.10
FEO	2.99	3.32	2.85	5.11	5.18	5.07	2.15	1.17	3.53	1.20
MNO	0.07	0.10	0.05	0.11	0.14	0.13	0.06	0.03	0.09	0.04
MGO	1.32	8.51	1.39	1.52	1.70	1.60	0.51	0.29	6.11	0.34
CAO	3.32	8.75	2.96	4.47	5.03	4.71	1.99	1.71	5.66	2.05
NA2O	4.03	1.85	3.57	3.84	4.55	3.87	3.60	3.47	2.48	3.56
K2O	2.85	2.48	3.97	4.17	4.08	3.92	4.85	4.31	4.57	3.88
P2O5	0.16	0.12	0.13	0.23	0.28	0.27	0.10	0.06	0.26	0.04
LOSS	0.88	1.21	0.89	1.25	2.29	1.26	0.99	0.69	4.02	0.52
TOTAL	99.67	99.94	99.35	99.48	99.22	99.24	99.76	99.90	99.22	99.83
ppm										
BA	423	505	1082	2241	2485	2064	872	719	1000	755
CE	106	45	53	117	103	73	88	46	98	33
CR	22	58	20	13	12	13	5	5	437	8
CU	2	23	9	4	5	5	<	<	19	<
GA	24	12	19	25	25	24	20	19	16	20
LA	64	20	30	71	56	37	51	24	52	25
NB	16	11	14	16	18	17	12	12	10	8
NI	3	23	3	6	5	5	<	<	114	<
PB	18	11	21	20	21	18	30	52	34	37
RB	181	126	157	124	141	132	182	136	166	131
SC	5	11	6	9	11	10	3	<	13	<
SR	393	190	486	707	800	736	296	356	483	357
TH	35	7.5	14.5	9	9	7.6	17	12	23	7.4
U	2.2	<	2.4	<	2.1	2.6	3.1	<	5.9	2.3
V	41	78	49	47	54	52	15	3	85	6
Y	11	25	12	28	28	25	24	11	27	10
ZN	74	78	67	101	138	96	53	43	53	33
ZR	130	161	130	397	461	399	194	103	148	129

Wt.%	30851	30852	30853	30854	30855	30856	30857	30858	30859	30860
SIO2	72.24	75.00	70.79	71.42	75.14	74.37	68.14	71.33	73.75	64.25
TIO2	0.22	0.12	0.21	0.24	0.18	0.19	0.40	0.35	0.13	0.63
AL2O3	14.21	13.10	15.90	15.30	12.86	13.14	15.57	14.51	14.40	16.50
FE2O3	0.54	0.40	0.05	0.10	0.30	0.62	0.54	0.45	0.09	0.82
FEO	1.60	1.12	1.25	1.36	1.18	1.21	2.54	1.77	0.90	3.69
MNO	0.05	0.06	0.03	0.03	0.03	0.03	0.05	0.04	0.03	0.10
MGO	0.34	0.12	0.44	0.40	0.22	0.31	0.86	0.48	0.35	1.53
CAO	1.41	0.51	2.94	2.33	1.09	1.24	2.76	1.82	2.39	4.02
NA2O	3.74	4.10	4.28	3.52	3.10	3.14	3.72	3.37	3.54	3.90
K2O	4.77	4.51	2.93	4.39	5.23	4.89	4.29	5.17	3.86	3.69
P2O5	0.06	0.02	0.06	0.04	0.04	0.04	0.11	0.07	0.02	0.17
LOSS	0.80	0.78	0.71	0.56	0.81	0.71	0.88	0.80	0.57	0.97
TOTAL	99.98	99.84	99.59	99.69	100.18	99.89	99.86	100.16	100.03	100.27
ppm										
BA	479	180	1049	1432	475	434	1084	974	1282	824
CE	62	61	16	19	72	85	77	106	29	108
CR	5	2	4	4	5	7	11	9	6	15
CU	<	<	<	<	<	<	<	<	<	5
GA	22	21	20	16	15	17	22	22	16	21
LA	35	28	8	7	44	50	45	59	14	66
NB	16	20	7	6	9	10	12	13	7	17
NI	<	<	<	<	<	<	<	<	<	2
PB	26	32	25	28	28	29	22	30	33	23
RB	159	171	95	111	158	162	135	226	116	151
SC	<	<	2	<	<	<	5	2	<	9
SR	191	56	626	550	158	173	467	275	463	431
TH	14	19	3.4	<	17	16	9.6	18	7.7	19
U	2.5	2.8	<	<	<	<	<	<	<	<
V	9	<	5	5	5	8	19	16	5	48
Y	33	39	8	5	16	16	21	19	7	29
ZN	60	57	32	35	31	39	57	55	34	77
ZR	181	137	136	109	128	149	220	258	67	230

Notes: 1 "<" Indicates below detection limit
2 "LOSS" is loss on ignition at 1000 deg.C, corrected for Fe++ to Fe+++ oxidation
3 Sample numbers refer to VUW Geology Department collection

Table 6. Analytical data (continued).

Wt.%	30861	30862	30863	30864	30865	30866	30867	30868	30869	30870
SIO2	73.91	68.02	67.99	61.47	64.53	66.85	60.63	70.60	68.37	66.38
TIO2	0.21	0.49	0.42	0.70	0.25	0.55	0.86	0.28	0.41	0.46
AL2O3	13.72	15.82	15.41	17.44	20.34	17.14	17.03	14.44	15.17	15.68
FE2O3	0.25	0.51	0.58	0.74	0.17	0.36	1.05	0.68	0.82	0.87
FEO	1.09	2.29	2.44	3.98	1.46	2.73	4.62	1.96	2.35	2.77
MNO	0.02	0.05	0.06	0.07	0.02	0.04	0.09	0.06	0.08	0.08
MGO	0.30	1.01	1.02	2.00	0.72	0.95	2.45	0.58	0.89	1.07
CAO	1.31	2.50	2.89	4.72	4.89	3.49	5.27	1.88	2.56	2.83
NA2O	2.72	3.20	3.50	4.20	5.76	5.04	3.47	3.70	3.63	3.76
K2O	5.98	5.50	4.56	3.08	1.58	2.18	2.74	4.70	4.44	4.74
P2O5	0.04	0.16	0.14	0.20	0.07	0.17	0.22	0.07	0.12	0.14
LOSS	0.55	0.63	0.92	1.18	0.44	0.69	1.48	1.15	1.29	1.21
TOTAL	100.10	100.18	99.93	99.78	100.23	100.19	99.91	100.10	100.13	99.99
ppm										
BA	613	1115	946	695	404	1320	793	723	844	1142
CE	103	170	71	52	31	82	63	78	98	115
CR	4	12	16	13	12	7	34	8	18	15
CU	4	<	<	<	<	<	<	<	2	2
GA	19	19	22	24	23	22	24	19	20	19
LA	52	96	41	25	16	49	31	47	57	67
NB	5	11	11	23	6	11	18	11	14	11
NI	<	<	<	<	5	<	7	<	<	<
PB	33	27	36	17	24	12	18	32	29	27
RB	187	164	178	150	53	52	100	163	164	147
SC	<	3	5	9	5	6	13	2	6	5
SR	263	426	443	494	961	814	525	263	342	455
TH	30	29	16	12	4	7	10	16	17	16
U	3	<	<	<	<	<	3	<	<	<
V	7	26	23	45	21	24	81	14	24	25
Y	11	15	18	33	15	9	36	19	24	21
ZN	23	53	61	86	32	75	90	59	63	66
ZR	152	303	183	215	95	241	234	193	242	282

Wt.%	30871	30872	30873	30874	30875	30876	30877	30878	30879	30880
SIO2	72.90	64.57	67.93	68.35	60.50	61.92	65.74	69.62	62.09	67.66
TIO2	0.24	0.60	0.45	0.63	1.02	0.95	0.69	0.50	0.87	0.53
AL2O3	13.67	16.72	15.13	15.34	16.64	16.64	15.51	14.66	16.24	15.59
FE2O3	0.51	0.64	0.68	0.51	0.85	0.97	0.75	0.44	1.00	0.64
FEO	1.52	3.30	2.09	3.10	5.14	4.89	3.53	2.32	4.46	2.65
MNO	0.02	0.03	0.02	0.06	0.11	0.10	0.07	0.05	0.10	0.03
MGO	0.44	1.51	1.09	1.32	2.40	1.76	1.64	0.92	2.12	1.31
CAO	1.77	4.20	2.32	3.69	5.33	5.09	3.75	2.57	4.47	3.21
NA2O	3.48	3.57	3.40	3.51	3.77	3.89	3.12	3.04	3.88	3.46
K2O	4.36	3.70	5.19	2.34	2.54	2.69	4.11	4.44	3.60	3.63
P2O5	0.05	0.15	0.14	0.14	0.26	0.23	0.17	0.10	0.18	0.14
LOSS	1.07	1.15	1.53	1.07	1.23	1.14	0.84	1.31	1.13	1.37
TOTAL	100.03	100.14	99.97	100.06	99.79	100.27	99.92	99.97	100.14	100.22
ppm										
BA	1170	1255	996	1063	517	459	1158	976	707	786
CE	66	113	95	78	103	97	140	79	80	99
CR	8	17	10	9	18	19	15	11	26	11
CU	<	<	29	<	<	5	2	<	5	9
GA	18	20	20	19	22	22	20	18	22	19
LA	40	61	59	47	58	54	76	44	40	53
NB	10	16	13	10	15	15	10	10	16	12
NI	<	<	<	<	<	2	4	<	8	3
PB	25	19	47	15	13	15	22	24	20	21
RB	123	117	166	121	129	121	146	162	164	141
SC	2	10	5	5	15	13	10	3	13	7
SR	311	541	369	547	484	484	523	476	433	552
TH	8	14	18	14	17	25	37	21	15	21
U	<	<	4	<	2	2	<	<	<	<
V	8	45	24	39	85	76	53	28	74	33
Y	15	40	18	14	27	33	30	15	43	33
ZN	48	62	56	60	90	93	64	45	92	57
ZR	151	230	236	151	233	215	181	151	211	191

Notes: 1 "<" Indicates below detection limit
2 "LOSS" is loss on ignition at 1000 deg.C, corrected for Fe++ to Fe+++ oxidation
3 Sample numbers refer to VUW Geology Department collection.

Table 7. Analytical data (continued).

Wt.%	30881	30882	30883	30884	30885	30886	30887	30888	30889	30890
SIO2	71.40	55.56	60.13	57.99	62.48	66.69	60.67	52.58	73.53	69.49
TIO2	0.26	0.98	0.90	0.81	0.53	0.72	0.85	2.30	0.10	0.38
AL2O3	14.48	19.76	16.83	18.62	17.27	15.49	18.19	16.65	14.21	15.64
FE2O3	0.43	1.04	0.83	1.19	0.75	0.94	0.79	1.19	0.18	0.45
FEO	1.77	5.22	4.56	4.28	3.59	3.14	4.60	7.28	0.80	1.81
MNO	0.02	0.09	0.08	0.08	0.07	0.06	0.09	0.15	0.03	0.02
MGO	0.46	1.92	2.73	1.65	1.01	1.41	1.88	4.92	0.22	0.98
CAO	1.77	6.01	5.09	4.74	3.20	3.42	5.31	8.84	1.70	2.98
NA2O	3.78	4.69	3.73	4.10	4.14	3.39	3.84	3.07	3.81	3.73
K2O	5.06	3.00	3.88	4.80	5.15	3.83	2.83	1.05	3.99	3.85
P2O5	0.06	0.33	0.24	0.24	0.15	0.17	0.21	0.34	0.02	0.09
LOSS	0.76	1.29	0.88	0.96	0.75	0.75	1.04	1.63	0.59	0.66
TOTAL	100.25	99.89	99.88	99.46	99.09	100.01	100.30	100.00	99.18	100.08
ppm										
BA	659	1275	1024	2185	1060	968	922	244	775	1248
CE	121	85	94	169	172	138	101	48		54
CR	7	18	45	15	12	14	19	22	4	19
CU	<	7	12	4	4	<	4	15	<	<
GA	20	32	24	26	26	20	26	22	19	19
LA	72	46	54	111	98	85	61	24	6	30
NB	19	21	19	17	22	12	15	14	8	7
NI	<	4	10	5	4	<	4	12	<	<
PB	28	18	24	25	26	19	15	7	28	23
RB	275	112	126	127	129	162	106	25	153	93
SC	2	8	11	7	4	8	11	32	<	3
SR	304	1459	666	1270	690	469	568	728	363	640
TH	28	9	7	14	15	20	14	2	2	5
U	2	<	<	<	<	<	<	<	<	<
V	7	40	69	34	21	46	59	211	<	19
Y	25	37	27	16	34	26	32	21	10	10
ZN	49	128	89	104	109	68	95	97	33	47
ZR	195	546	254	540	441	252	262	78	78	146

Wt.%	30891	30892	30893	30894	30895	30896
SIO2	74.74	59.04	49.83	73.48	62.53	62.51
TIO2	0.12	0.61	1.53	0.09	0.83	0.53
AL2O3	13.64	19.78	17.82	14.69	16.40	17.63
FE2O3	0.30	0.55	1.05	0.13	0.61	0.84
FEO	0.88	3.58	8.25	0.68	4.45	3.44
MNO	0.02	0.16	0.19	0.01	0.09	0.07
MGO	0.25	1.35	4.06	0.14	2.02	0.94
CAO	1.45	3.39	8.00	1.70	4.46	2.71
NA2O	3.39	4.37	3.54	4.20	3.73	4.14
K2O	4.70	5.54	2.55	4.21	3.57	5.99
P2O5	0.02	0.26	0.55	0.01	0.20	0.12
LOSS	0.58	1.31	2.46	0.47	1.02	1.17
TOTAL	100.09	99.94	99.83	99.81	99.91	100.09
BA	541	1294	1453	1031	840	1589
CE	31	165	101	27	87	236
CR	5	13	21	3	17	12
CU	<	2	14	<	2	3
GA	18	26	28	17	21	22
LA	16	99	52	13	51	138
NB	7	11	18	5	12	18
NI	<	<	9	<	9	3
PB	30	44	13	26	19	31
RB	136	136	109	140	165	148
SC	2	13	15	<	10	7
SR	249	682	1054	426	469	600
TH	5	16	7.6	4	21	18
U	<	2	2.6	<	<	<
V	2	20	89	3	69	24
Y	7	63	39	8	24	38
ZN	28	47	153	19	82	78
ZR	85	696	125	104	215	436

Notes: 1 "<" Indicates below detection limit
2 "LOSS" is loss on ignition at 1000 deg.C, corrected for Fe++ to Fe+++ oxidation
3 Sample numbers refer to VUW Geology Department collection

Table 8. Sample descriptions.

	VUW 30801	VUW 30802
NAME	GRANITE	GRANITE
TYPE	COARSE-GRAINED,MASSIVE,BIOTITE	COARSE-GRAINED,MASSIVE,BIOTITE
SHEET	FRANKLIN ISLAND	FRANKLIN ISLAND
SHEET NO.	ST57-60/2	ST57-60/2
LONGITUDE	162°58'E	162°41'E
LATITUDE	76°49.0'S	76°49.8'S
LOCATION	GREGORY ISLAND	LONG BLUFFS, W OF CAPE ARCHER

	VUW 30803	VUW 30804
NAME	GRANITE	GRANITE
TYPE	COARSE-GRAINED,MASSIVE,BIOTITE	MEDIUM-GRAINED,MASSIVE,BIOTITE-HORNBLENDE
SHEET	FRANKLIN ISLAND	FRANKLIN ISLAND
SHEET NO.	ST57-60/2	ST57-60/2
LONGITUDE	162°51'E	162°34'E
LATITUDE	76°51.2'S	76°51.4'E
LOCATION	CAPE ARCHER	LION ISLAND

	VUW 30805	VUW 30806
NAME	GRANODIORITE	GRANITE
TYPE	MEDIUM-GRAINED,SL.FOLIATED.BIOTITE	MEDIUM-GRAINED,SL.FOLIATED,BIOTITE
SHEET	FRANKLIN ISLAND	FRANKLIN ISLAND
SHEET NO.	ST57-60/2	ST57-60/2
LONGITUDE	162°34'E	162°29'E
LATITUDE	76°51.4'S	76°53.1'S
LOCATION	LION ISLAND	DREIKANTER HEAD - 460M

	VUW 30807	VUW 30808
NAME	GRANITE	GRANODIORITE
TYPE	MEDIUM-GRAINED,SL.FOLIATED,BIOTITE	MEDIUM-GRAINED,MASSIVE,BIOTITE-HORNBLENDE
SHEET	FRANKLIN ISLAND	FRANKLIN ISLAND
SHEET NO.	ST57-60/2	ST57-60/2
LONGITUDE	162°32'E	162°24'E
LATITUDE	76°52.7'S	76°54.6'S
LOCATION	DREIKANTER HEAD - 15M	KAR PLATEAU - NW CORNER

	VUW 30809	VUW 30810
NAME	GRANITE	GRANODIORITE
TYPE	MEDIUM-GRAINED,MASSIVE,BIOTITE	MEDIUM-GRAINED,MASSIVE,BIOTITE
SHEET	FRANKLIN ISLAND	FRANKLIN ISLAND
SHEET NO.	ST57-60/2	ST57-60/2
LONGITUDE	162°16'E	162°22'E
LATITUDE	76°57.3'S	76°59.5'S
LOCATION	KAR PLATEAU - W END	CUFF CAPE

	VUW 30811	VUW 30812
NAME	GRANITE	GRANODIORITE
TYPE	MEDIUM-GRAINED,MASSIVE,BIOTITE	MED-GRAINED,MASSIVE,K-FELDSPAR PHENOX,BIOTITE
SHEET	FRANKLIN ISLAND	TAYLOR GLACIER
SHEET NO.	ST57-60/2	ST57-60/5
LONGITUDE	162°17'E	161°39'E
LATITUDE	76°59.6'S	77°02.5'S
LOCATION	CUFF CAPE - LOW RIDGE TO W	MOUNT SUESS

	VUW 30813	VUW 30814
NAME	GRANODIORITE	GRANODIORITE
TYPE	MEDIUM-GRAINED,MASSIVE,BIOTITE	MED-GRAINED,MASSIVE,K-FELDSPAR PHENOX,BIOTITE
SHEET	TAYLOR GLACIER	TAYLOR GLACIER
SHEET NO.	ST57-60/5	ST57-60/5
LONGITUDE	161°58'E	161°41'E
LATITUDE	77°04.3'S	77°04.9'S
LOCATION	REDCLIFF NUNATAK - NUNATAK TO S OF	SPERM BLUFF, N FLANK

	VUW 30815	VUW 30816
NAME	GRANODIORITE	XENOLITH
TYPE	MEDIUM-GRAINED,MASSIVE,BIOTITE	MEDIUM-GRAINED,FOLIATED,IGNEOUS
SHEET	TAYLOR GLACIER	TAYLOR GLACIER
SHEET NO.	ST57-60/5	ST57-60/5
LONGITUDE	161°43'E	161°43'E
LATITUDE	77°05.1'S	77°05.9'S
LOCATION	SPERM BLUFF - N FLANK	SPERM BLUFF - S SIDE, E BIG BAY

Table 9. Sample descriptions (continued).

	VUW 30817	VUW 30818
NAME	GRANITE	QTZ DIORITE
TYPE	CSE-GRAINED,MASSIVE,MAFIC CLOTS,BIOT-HBLENDE	MEDIUM-GRAINED,SL.FOLIATED,HBLNDE-BIOT-SALITE
SHEET	TAYLOR GLACIER	TAYLOR GLACIER
SHEET NO.	ST57-60/5	ST57-60/5
LONGITUDE	161°55'E	161°39'E
LATITUDE	77°07.7'S	77°06.8'S
LOCATION	KILLER RIDGE - N END	SPERM BLUFF - S FLANK

	VUW 30819	VUW 30820
NAME	MICROGRANITE	GRANITE
TYPE	FINE-GRAINED,SL.FOLIATED,BIOTITE	MED-GRNED,MSIVE,K-FELD PHENOX,MAFIC CLTS,BIOT
SHEET	TAYLOR GLACIER	TAYLOR GLACIER
SHEET NO.	ST57-60/5	ST57-60/5
LONGITUDE	161°16'E	161°32'E
LATITUDE	77°07.4'S	77°08.3'S
LOCATION	CLARE RANGE	COTTON GLACIER

	VUW 30821	VUW 30822
NAME	GRANODIORITE	GRANOPHYRE
TYPE	CSE-GRAINED,MSIVE,K-FELD MEGAX,HBLENDE-BIOT	DYKE,FINE-GRAINED,QUARTZ & K-FELDSPAR PHENOX
SHEET	TAYLOR GLACIER	TAYLOR GLACIER
SHEET NO.	ST57-60/5	ST57-60/5
LONGITUDE	161°45'E	161°40'E
LATITUDE	77°07.7'S	77°09.3'S
LOCATION	QUEER MOUNTAIN - N RIDGE	MILLER GLACIER - W SIDE, NEAR QUEER MNT.

	VUW 30823	VUW 30824
NAME	GRANODIORITE	GRANITE
TYPE	COARSE-GRAINED,FOLIATED,BIOTITE-HORNBLENDE	COARSE-GRAINED,MASSIVE,HORNBLENDE-BIOTITE
SHEET	TAYLOR GLACIER	ROSS ISLAND
SHEET NO.	ST57-60/5	ST57-60/6*
LONGITUDE	161°40'E	162°01'E
LATITUDE	77°09.3'S	77°02.3'S
LOCATION	MILLER GLACIER - W SIDE, NEAR QUEER MNT.	REDCLIFF NUNATAK

	VUW 30825	VUW 30826
NAME	GRANODIORITE	XENOLITH
TYPE	CSE-GRAINED,MSIVE,K-FELD PHENOX,BIOT-HBLENDE	FINE-GRAINED,FOLIATED,IGNEOUS
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	162°25'E	162°25'E
LATITUDE	77°00.4'S	77°00.4'S
LOCATION	FINGER POINT	FINGER POINT

	VUW 30827	VUW 30828
NAME	XENOLITH	GRANODIORITE
TYPE	FINE-GRAINED,FOLIATED,IGNEOUS	MED-GRAINED,SL.FOLIATED,K-FELD MEGAX,BIOTITE
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	162°38'E	162°38'E
LATITUDE	77°00.1'S	77°00.1'S
LOCATION	DISCOVERY BLUFF	DISCOVERY BLUFF

	VUW 30829	VUW 30830
NAME	GRANODIORITE	GRANITE
TYPE	MED-GRND,MSVE,K-FLD PHNOX,MAF CLTS,HBLND-BIOT	COARSE-GRAINED,SL.FOLIATED,BIOTITE
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	162°22'E	162°22'E
LATITUDE	77°01.1'S	77°01.1'S
LOCATION	DEVILS PUNCHBOWL	DEVILS PUNCHBOWL

	VUW 30831	VUW 30832
NAME	XENOLITH	GRANITE
TYPE	MEDIUM-GRAINED,FOLIATED,GNEISSIC	MED-GRAINED,MASSIVE,MAFIC CLOTS,HBLENDE-BIOT
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	162°22'E	162°21'E
LATITUDE	77°01.1'S	77°02.2'S
LOCATION	DEVILS PUNCHBOWL	MINIHAHA ICEFALLS - W OF

Table 10. Sample descriptions (continued).

	VUW 30833	VUW 30834
NAME	GRANODIORITE	GRANODIORITE
TYPE	COARSE-GRAINED,SL.FOLIATED,HORNBLENDE-BIOTITE	COARSE-GRAINED,SL.FOLIATED,HORNBLENDE-BIOTITE
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	162°27'E	162°27'E
LATITUDE	77°01.4'S	77°01.2'S
LOCATION	MOUNT ENGLAND - N FACE, 107M	MOUNT ENGLAND - N FACE, 31M

	VUW 30835	VUW 30836
NAME	GRANITE	GRANITE
TYPE	COARSE-GRAINED,MASSIVE,HORNBLENDE-BIOTITE	COARSE-GRAINED,MASSIVE,HORNBLENDE-BIOTITE
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	162°26'E	162°27'E
LATITUDE	77°01.7'S	77°01.8'S
LOCATION	MOUNT ENGLAND - CENTRAL SPUR, 76M	MOUNT ENGLAND - CENTRAL SPUR, 222M

	VUW 30837	VUW 30838
NAME	GRANITE	GRANITE
TYPE	COARSE-GRAINED,MASSIVE,HORNBLENDE-BIOTITE	MEDIUM-GRAINED,MASSIVE,HORNBLENDE-BIOTITE
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	162°27'E	162°27'E
LATITUDE	77°01.9'S	77°01.9'S
LOCATION	MOUNT ENGLAND - CENTRAL SPUR, 358M	MOUNT ENGLAND - CENTRAL SPUR, 477M

	VUW 30839	VUW 30840
NAME	TONALITE	GRANITE
TYPE	MEDIUM-GRAINED,FLOW BANDED,	COARSE-GRAINED,MASSIVE,BIOTITE-HORNBLENDE
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	162°28'E	162°27'E
LATITUDE	77°00.9'S	77°02.3'S
LOCATION	MOUNT ENGLAND - EAST RIDGE, BASE	MOUNT ENGLAND - N FACE, 792M

	VUW 30841	VUW 30842
NAME	GRANODIORITE	XENOLITH
TYPE	COARSE-GRAINED,SL.FOLIATED	MEDIUM-GRAINED,GNEISSIC,QUARTZ-FELDSPAR AUGEN
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	162°27'E	162°27'E
LATITUDE	77°01.6'S	77°01.6'S
LOCATION	MOUNT ENGLAND - N FACE, 200M	MOUNT ENGLAND - N FACE, 200M

	VUW 30843	VUW 30844
NAME	GRANODIORITE	QTZ-MNZODIORITE
TYPE	COARSE-GRAINED,FOLIATED,BIOTITE-HORNBLENDE	MEDIUM-GRAINED,MASSIVE,HORNBLENDE-BIOTITE
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	162°29'E	162°44'E
LATITUDE	77°02.7'S	77°01.2'S
LOCATION	MOUNT ENGLAND - SUMMIT	AVALANCHE BAY

	VUW 30845	VUW 30846
NAME	QTZ-MNZODIORITE	QTZ-MNZODIORITE
TYPE	MEDIUM-GRAINED,MASSIVE,HIGHLY ALTERED	MEDIUM-GRAINED,MASSIVE,HORNBLENDE-BIOTITE
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	162°48'E	162°48'E
LATITUDE	77°01.0'S	77°01.0'S
LOCATION	COULOIR CLIFFS - W END	COULOIR CLIFFS - W END

	VUW 30847	VUW 30848
NAME	GRANITE	GRANITE
TYPE	MEDIUM-GRAINED,MASSIVE,BIOTITE-HORNBLENDE	MEDIUM-GRAINED,FOLIATED,BIOTITE
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	162°57'E	163°02'E
LATITUDE	77°01.3'S	77°01.3'S
LOCATION	COULOIR CLIFFS - E END, HIDDEN POINT	FIRST VIEW POINT

Table 11. Sample descriptions (continued).

	VUW 30849	VUW 30850
NAME	LAMPROPHYRE	GRANITE
TYPE	DYKE,FINE-GRAINED,PORPHYRITIC	MEDIUM-GRAINED,FOLIATED
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	163°02'E	163°11'E
LATITUDE	77°01.3'S	77°02.3'S
LOCATION	FIRST VIEW POINT	CAPE ROBERTS

	VUW 30851	VUW 30852
NAME	GRANITE	GRANITE
TYPE	COARSE-GRAINED,MASSIVE,BIOTITE-HORNBLENDE	HIGHLY ALTERED,BRICK RED COLOUR
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	162°06'E	162°07'E
LATITUDE	77°05.0'S	77°05.7'S
LOCATION	RED RIDGE - 481M	RED RIDGE

	VUW 30853	VUW 30854
NAME	GRANODIORITE	MICROGRANITE
TYPE	MEDIUM-GRAINED,SL.FOLIATED,BIOTITE	FINE-GRAINED,FOLIATED,BIOTITE
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	163°28'E	163°19'E
LATITUDE	77°14.0'S	77°17.4'S
LOCATION	DUNLOP ISLAND	HANSON RIDGE

	VUW 30855	VUW 30856
NAME	GRANITE	GRANITE
TYPE	COARSE-GRAINED,MASSIVE,BIOTITE	COARSE-GRAINED,MASSIVE,BIOTITE
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	162°26'E	162°25'E
LATITUDE	77°18.9'S	77°18.9'S
LOCATION	POND PEAK - 1100M	POND PEAK - 1200M

	VUW 30857	VUW 30858
NAME	GRANODIORITE	MICRO-GRANITE
TYPE	MEDIUM-GRAINED,SL.FOLIATED,HORNBLENDE-BIOTITE	MASSIVE,K-FELDSPAR PORPHYRY,BIOT.-HORNBLENDE
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	162°50'E	163°03'E
LATITUDE	77°19.9'S	77°19.3'S
LOCATION	STAEFFLER RIDGE	STAEFFLER RIDGE - BLESSING BLUFF

	VUW 30859	VUW 30860
NAME	GRANODIORITE	GRANODIORITE
TYPE	FINE-GRAINED,FOLIATED,BIOTITE	GNEISSIC,K-FELDSPAR AUGEN,BIOTITE-HORNBLENDE
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	162°43'E	162°12'E
LATITUDE	77°20.8'S	77°24.0'S
LOCATION	STAEFFLER RIDGE	ROBERTSON RIDGE

	VUW 30861	VUW 30862
NAME	GRANITE	GRANITE
TYPE	MEDIUM-GRAINED,FOLIATED,BIOTITE	GNEISSIC,K-FELDSPAR AUGEN,BIOTITE
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	162°31'E	162°34'E
LATITUDE	77°23.9'S	77°23.2'S
LOCATION	MOUNT TERMINATION	MOUNT DOORLY - 4.5KM W OF

	VUW 30863	VUW 30864
NAME	GRANODIORITE	QTZ.MNZODIORITE
TYPE	MED-GRAINED,SL.FOL,K-FELD PHENOX,HBLENDE-BIOT	GNEISSIC,BIOTITE-HORNBLENDE
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	162°48'E	162°04'E
LATITUDE	77°23.3'S	77°24.6'S
LOCATION	MOUNT DOORLY - E SPUR	OLYMPUS RANGE - N WALL, 650M

Table 12. Sample descriptions (continued).

	VUW 30865	VUW 30866
NAME	QUARTZ DIORITE	GRANODIORITE
TYPE	MEDIUM-GRAINED,FOLIATED,BIOTITE	FINE-GRAINED,FOLIATED,BIOTITE
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	162°07'E	162°07'E
LATITUDE	77°24.5'S	77°24.8'S
LOCATION	ROBERTSON RIDGE - S END	ROBERTSON RIDGE

	VUW 30867	VUW 30868
NAME	TONALITE	GRANITE
TYPE	GNEISSIC,BIOTITE	MEDIUM-GRAINED,FOLIATED,BIOTITE-HORNBLENDE
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	162°44'E	162°47'E
LATITUDE	77°30.0'S	77°29.3'S
LOCATION	MOUNT NEWALL - 1670M	MOUNT NEWALL - 1400M

	VUW 30869	VUW 30870
NAME	GRANODIORITE	GRANODIORITE
TYPE	CSE-GRAINED,MASSIVE,K-FELD MEGAX,HBLENDE-BIOT	CSE-GRAINED,MASSIVE,K-FELD MEGAX,HBLENDE-BIOT
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	162°51'E	162°51'E
LATITUDE	77°29.0'S	77°29.1'S
LOCATION	MOUNT NEWALL - N RIDGE, 961M	MOUNT NEWALL - N RIDGE, 861M

	VUW 30871	VUW 30872
NAME	GRANITE	GRANODIORITE
TYPE	COARSE-GRAINED,SL.FOLIATED,BIOTITE-HORNBLENDE	GNEISSIC,K-FELDSPAR AUGEN,BIOTITE-HORNBLENDE
SHEET	TAYLOR GLACIER	ROSS ISLAND
SHEET NO.	ST57-60/5	ST57-60/6*
LONGITUDE	161°57'E	162°17'E
LATITUDE	77°26.0'S	77°30.5'S
LOCATION	OLYMPUS RANGE - N WALL	WRIGHT VALLEY - LOWER, NEAR MESERVE HUT

	VUW 30873	VUW 30874
NAME	MICRO-GRANITE	GRANODIORITE
TYPE	PORPHYRITIC,QUARTZ & K-FELDSPAR PHENOCRYSTS	COARSE-GRAINED,FOLIATED,BIOTITE-HORNBLENDE
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	162°44'E	162°51'E
LATITUDE	77°30.1'S	77°45.1'S
LOCATION	MOUNT NEWALL - 1820M	KUKRI HILLS - BELOW .1880, 636M

	VUW 30875	VUW 30876
NAME	GRANODIORITE	GRANODIORITE
TYPE	COARSE-GRAINED,FOLIATED,BIOTITE-HORNBLENDE	MEDIUM-GRAINED,FOLIATED,BIOTITE-HORNBLENDE
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	162°51'E	162°25'E
LATITUDE	77°45.4'S	77°48.0'S
LOCATION	KUKRI HILLS - BELOW .1880, 299M	KUKRI HILLS - BELOW SENTINAL PEAK, 991M

	VUW 30877	VUW 30878
NAME	GRANODIORITE	GRANITE
TYPE	COARSE-GRAINED,SL.FOLIATION,HORNBLENDE-BIOT.	CSE-GRAINED,MASSIVE,K-FELD MEGAX,BIOT-HBLENDE
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	162°25'E	162°30'E
LATITUDE	77°48.2'S	77°51.1'S
LOCATION	KUKRI HILLS - BELOW SENTINAL PEAK, 706M	CATHEDRAL ROCKS - IONIC

	VUW 30879	VUW 30880
NAME	GRANODIORITE	GRANODIORITE
TYPE	MEDIUM-GRAINED,SL.FOLIATION,BIOT.-HORNBLENDE	CSE-GRAINED,MASSIVE,K-FELD MEGAX,BIOT-HBLENDE
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	162°39'E	162°41'E
LATITUDE	77°51.5'S	77°51.1'S
LOCATION	CATHEDRAL ROCKS - GOTHIC, 1188M	CATHEDRAL ROCKS - GOTHIC, 843M

Table 13. Sample descriptions (continued).

	VUW 30881	VUW 30882
NAME	GRANITE	QUARTZ DIORITE
TYPE	MED-GRAINED,MASSIVE,K-FELD MEGAX,BIOT-HBLENDE	MEDIUM-GRAINED,SL.FOLIATION,HORNBLENDE-BIOT.
SHEET	ROSS ISLAND	ROSS ISLAND
SHEET NO.	ST57-60/6*	ST57-60/6*
LONGITUDE	163°28'E	163°35'E
LATITUDE	77°53.0'S	77°58.5'S
LOCATION	BLUE GLACIER - GRANITE KNOLLS	BLUE GLACIER - W OF WILLIAMS PEAK

	VUW 30883	VUW 30884
NAME	QTZ.MNZODIORITE	QTZ.MNZODIORITE
TYPE	FINE-GRAINED,MASSIVE,BIOTITE-HORNBLENDE	COARSE-GRAINED,MASSIVE,HORNBLENDE-BIOTITE
SHEET	MOUNT DISCOVERY	MOUNT DISCOVERY
SHEET NO.	ST57-60/10	ST57-60/10
LONGITUDE	163°35'E	163°40'E
LATITUDE	78°05.0'S	78°05.0'S
LOCATION	MOUNT LAMA - SUMMIT OF KNOB TO WEST	MOUNT LAMA - SUMMIT

	VUW 30885	VUW 30886
NAME	QTZ.MNZODIORITE	GRANODIORITE
TYPE	COARSE-GRAINED.MASSIVE.HORNBLENDE-BIOTITE	COARSE-GRAINED,SL.FOLIATED,BIOTITE-HORNBLENDE
SHEET	MOUNT DISCOVERY	MOUNT DISCOVERY
SHEET NO.	ST57-60/10	ST57-60/10
LONGITUDE	163°23'E	163°07'E
LATITUDE	78°05.0'S	78°06.0'S
LOCATION	BLUE GLACIER - S RIDGE OF .1430	SALIENT GLACIER - END OF RIDGE TO S

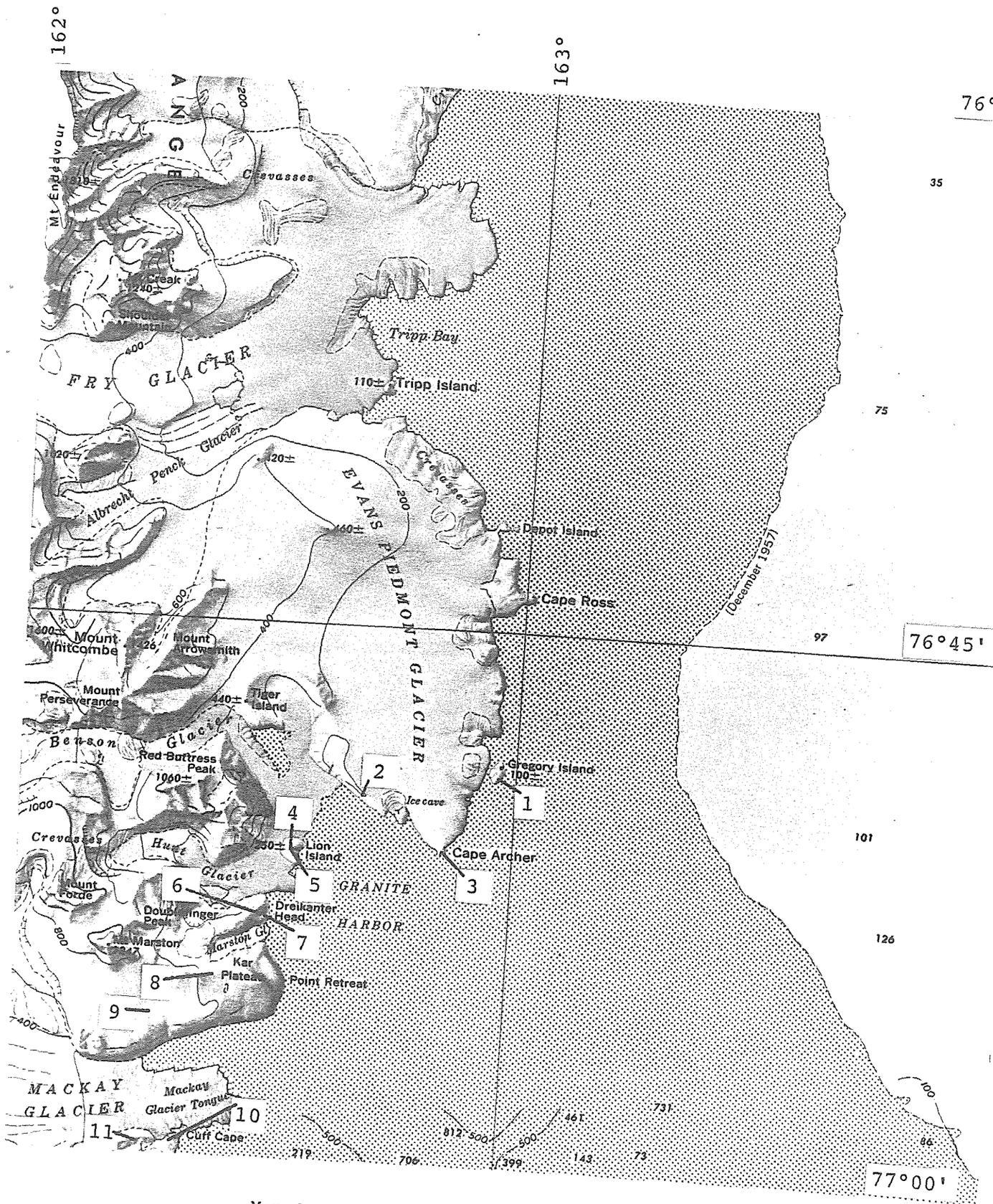
	VUW 30887	VUW 30888
NAME	GRANODIORITE	MICRODIORITE
TYPE	GNEISSIC,K-FELDSPAR AUGENS,HORNBLENDE-BIOTITE	FINE-GRAINED,MASSIVE,HORNBLENDE-BIOTITE
SHEET	MOUNT DISCOVERY	MOUNT DISCOVERY
SHEET NO.	ST57-60/10	ST57-60/10
LONGITUDE	163°05'E	163°15'E
LATITUDE	78°07.0'S	78°07.0'S
LOCATION	SALIENT GLACIER - RIDGE ABOVE S END	BLUE GLACIER - NUNATAK AT HEAD

	VUW 30889	VUW 30890
NAME	GRANODIORITE	GRANODIORITE
TYPE	FINE-GRAINED,MASSIVE.BIOTITE	MEDIUM-GRAINED,FLOW BANDED,BIOTITE-HORNBLENDE
SHEET	MOUNT DISCOVERY	MOUNT DISCOVERY
SHEET NO.	ST57-60/10	ST57-60/10
LONGITUDE	163°12'E	163°227E
LATITUDE	78°08.0'S	78°07.0'S
LOCATION	BLUE GLACIER - E FACE OF .1890, BASE	ADAMS GLACIER

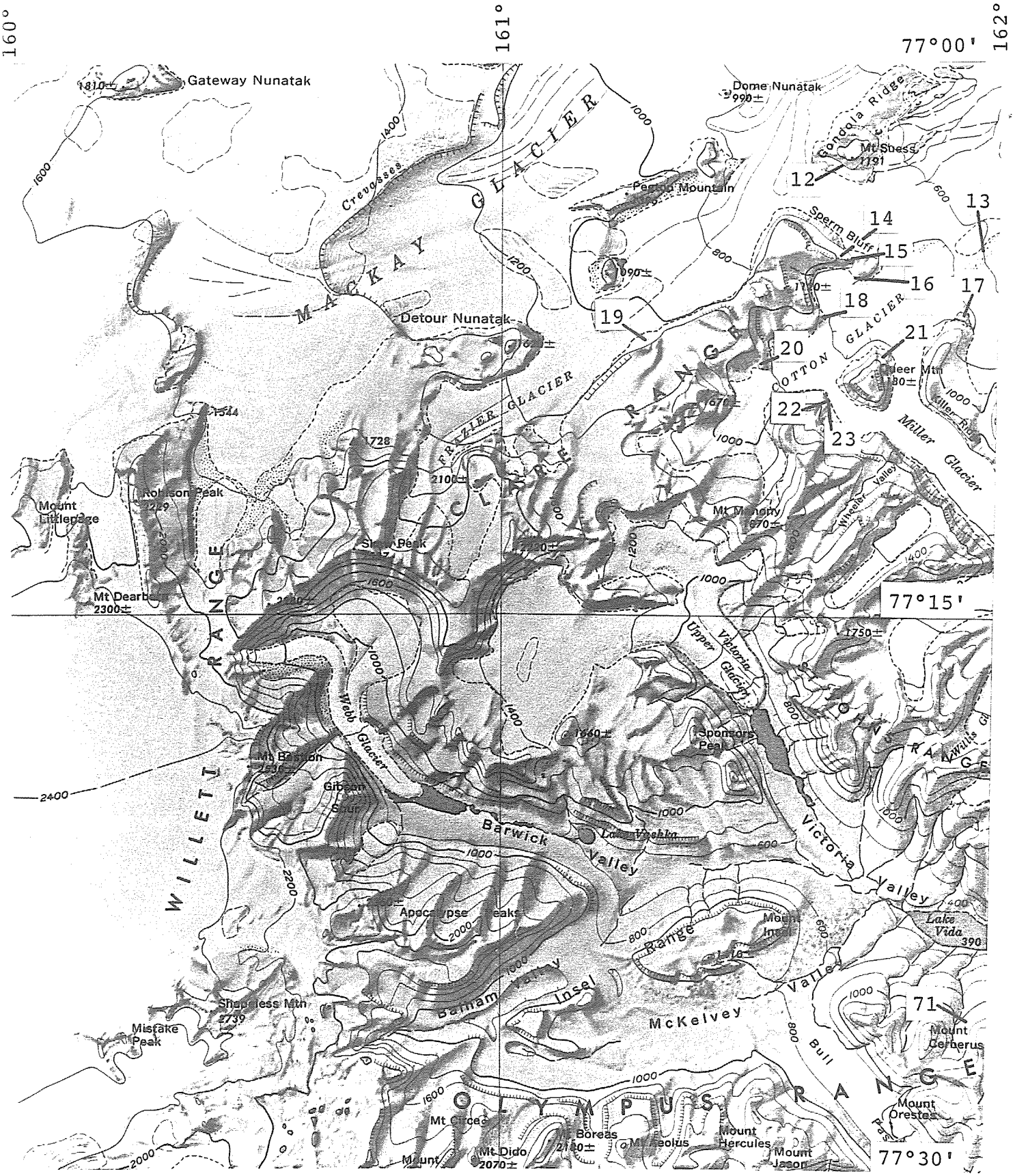
	VUW 30891	VUW 30892
NAME	GRANITE	QTZ.MNZODIORITE
TYPE	MEDIUM-GRAINED,MASSIVE,BIOTITE	COARSE-GRAINED,SL.FOLIATION,BIOTITE-ALMANDINE
SHEET	MOUNT DISCOVERY	MOUNT DISCOVERY
SHEET NO.	ST57-60/10	ST57-60/10
LONGITUDE	163°30'E	163°46'E
LATITUDE	78°07.5'S	78°05.6'S
LOCATION	ARMITAGE COL - SMALL KNOB E OF	MIERS VALLEY - N WALL

	VUW 30893	VUW 30894
NAME	DIORITE	GRANODIORITE
TYPE	MEDIUM-GRAINED,MASSIVE,HORNBLENDE-BIOTITE	FINE-GRAINED,MASSIVE,FELSIC DYKE.BIOTITE
SHEET	MOUNT DISCOVERY	TAYLOR GLACIER
SHEET NO.	ST57-60/10	ST57-60/5
LONGITUDE	163°59'E	161°40'E
LATITUDE	78°05.9'S	77°31.5'S
LOCATION	MIERS VALLEY - BELOW SURVEYORS PEAK	VANDA STATION

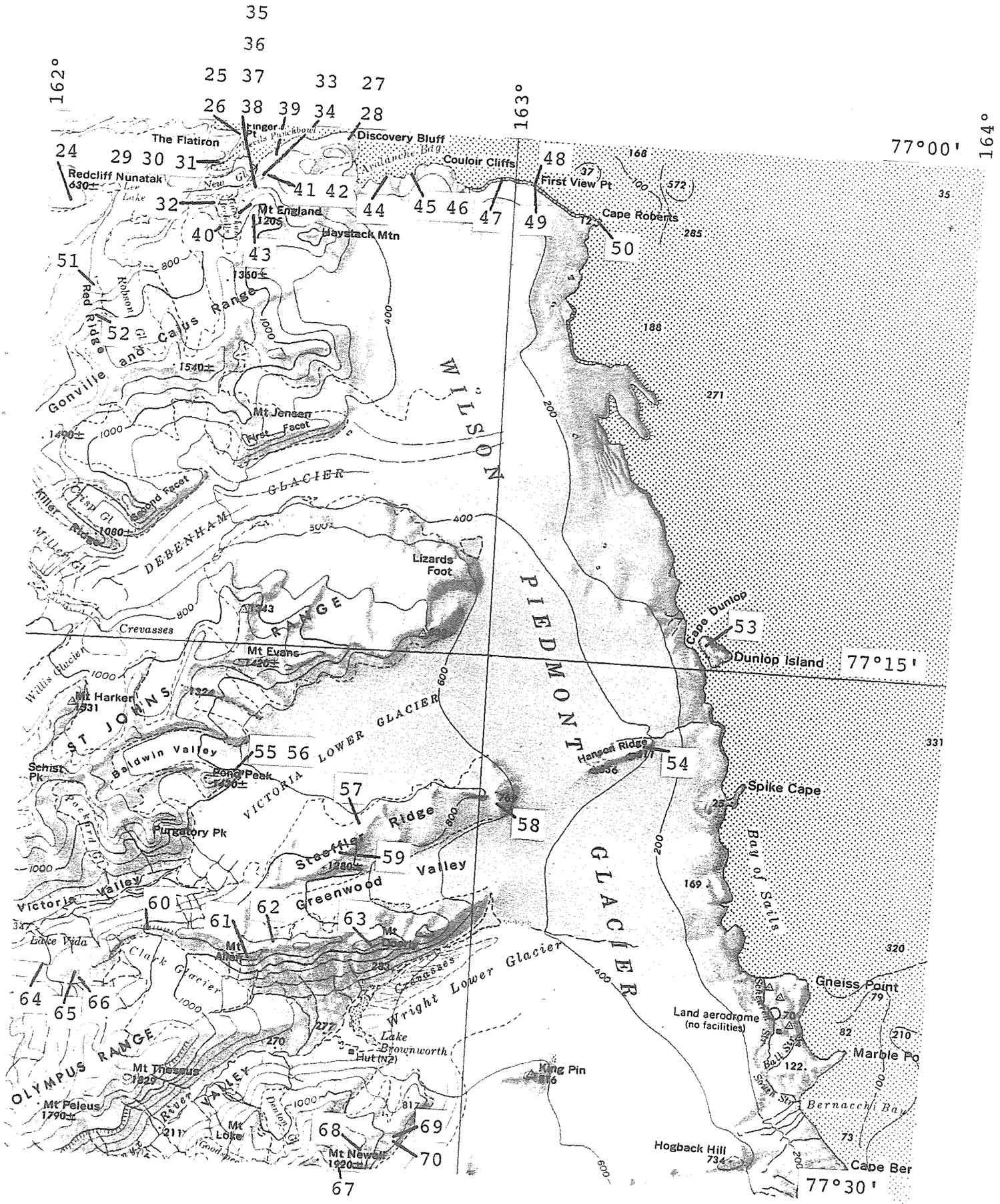
	VUW 30895	VUW 30896
NAME	GRANODIORITE	QTZ. MONZONITE
TYPE	COARSE-GRAINED,SL.FOLIATED,HORNBLENDE-BIOTITE	MEDIUM-GRAINED,MASSIVE,HORNBLENDE-BIOTITE
SHEET	TAYLOR GLACIER	TAYLOR GLACIER
SHEET NO.	ST57-60/5	ST57-60/5
LONGITUDE	161°40'E	161°25'E
LATITUDE	77°31.5'S	77°49.9'S
LOCATION	VANDA STATION	CAVANDISH ROCKS



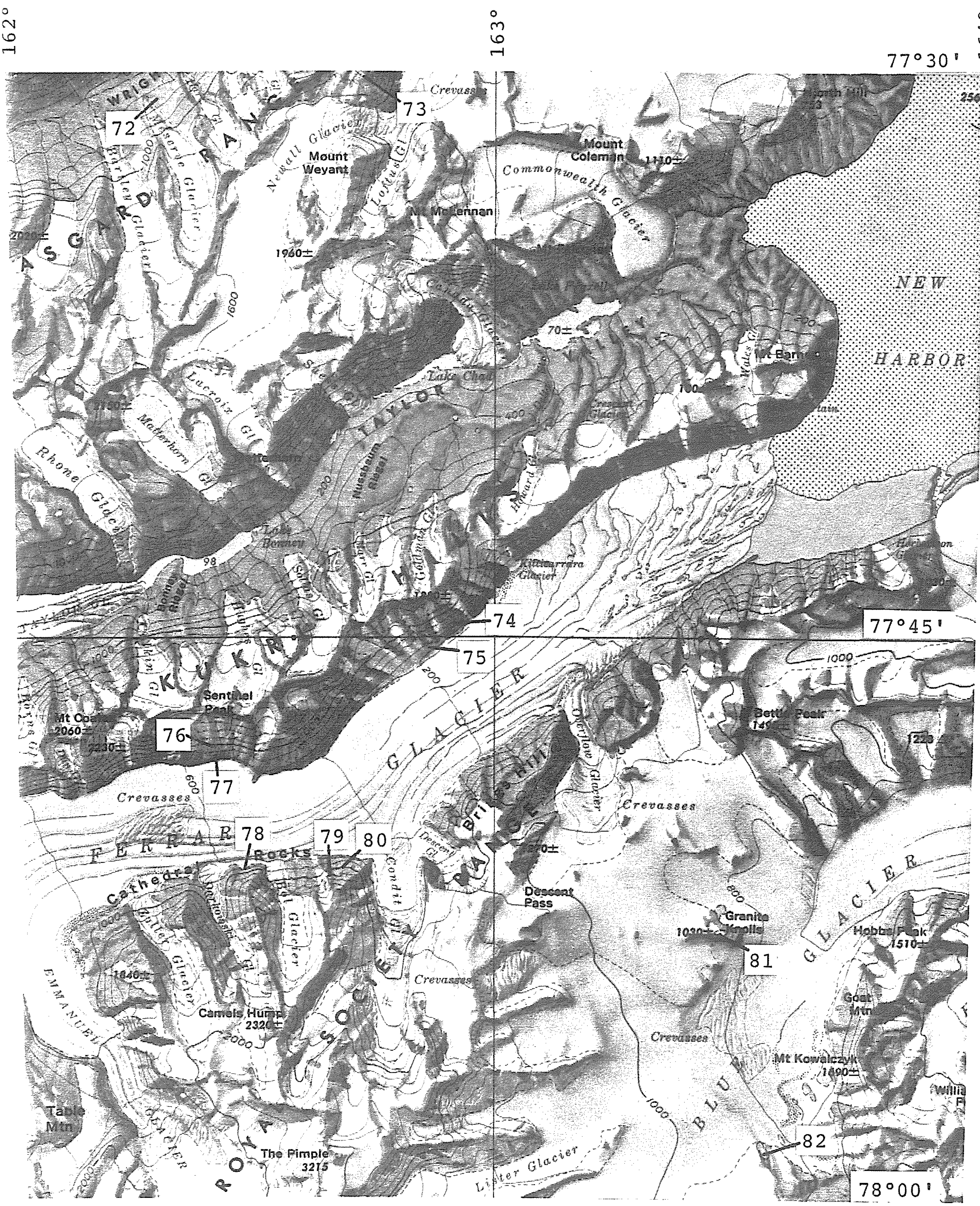
Map 1. Granite Harbour area.



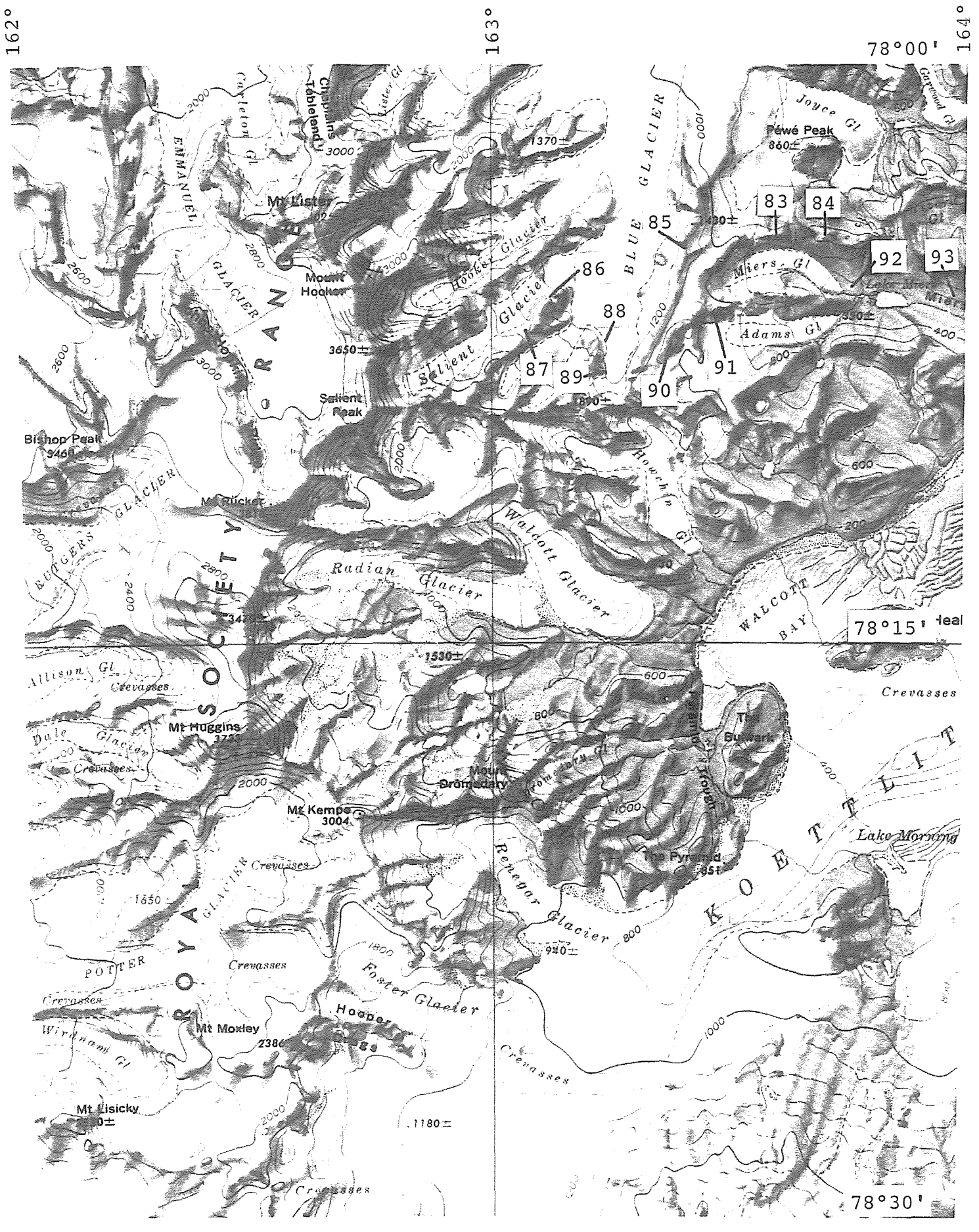
Map 2. Cotton Glacier area.



Map 3. Wilson Piedmont Glacier area.



Map 4. Ferrar Glacier area.



Map 5. Blue Glacier area.

APPENDIX 1

Twelve granitoid samples were selected for instrumental neutron activation analysis for REE (Rare earth elements) and a number of trace elements (Cs, Ta, Hf) not readily determined using XRF. Th, U and Sc results are also presented and are in good agreement with the XRF values. A description of the procedure is given in Gamble & Kyle (1987). Precision is better than 2% for La, Sm, Sc; 5% for Ce, Eu, Tb, Hf, Ta, Th and 10% for Nd, Yb, Lu and U.

ppm	30802	30833	30835	30844	30850	30851	30860	30872	30884	30893	30894	30896
Sc	3.02	7.29	3.37	8.94	2.10	2.06	7.61	9.54	5.75	14.51	0.94	7.48
Cs	2.61	2.64	2.63	2.65	5.37	1.30	5.52	1.34	2.12	4.57	1.37	2.05
La	62.7	32.9	42.8	68.7	17.5	39.4	64.2	60.6	119.9	53.3	15.2	177.0
Ce	128.3	70.4	86.4	128.5	37.1	80.3	125.8	123.6	209.7	121.8	29.1	328.1
Nd	47.8	26.1	30.9	52.9	10.7	31.6	43.7	50.0	69.9	57.6	9.8	113.7
Sm	8.02	5.43	5.71	8.54	2.22	6.32	7.46	9.51	8.38	11.47	1.64	16.68
Eu	.746	1.070	.875	2.095	.777	.642	1.213	1.467	2.464	2.452	.468	2.108
Tb	.87	.65	.69	.93	.29	.93	.89	1.22	.64	1.31	.19	1.57
Yb	2.80	2.18	2.64	2.32	1.17	3.28	2.59	3.29	1.43	2.79	.74	3.11
Lu	.424	.322	.382	.346	.210	.489	.391	.470	.204	.414	.112	.437
Ta	1.71	1.31	1.41	.90	1.52	1.49	1.30	1.19	.78	1.11	.68	.93
Hf	7.94	5.72	6.14	11.67	4.20	6.22	7.38	6.88	13.80	4.80	3.25	11.93
Th	20.51	16.62	13.65	7.91	7.38	13.11	19.93	12.85	11.86	6.80	3.28	17.48
U	1.8	3.1	1.5	.9	1.8	2.4	1.9	1.1	1.7	2.5	.5	1.4

Table 14. Instrumental neutron activation results for REE in twelve selected granitoids.

APPENDIX 2

This appendix contains analytical data for 24 granitoid samples from the Miers, Marshall and Garwood Valley areas of South Victoria Land (Tables 15 and 16). The samples were collected by Frank Reid (Event 015, Basement Studies, VUWAE 25) in the 1980-81 season, they provide an adjunct to the report by Mortimer (1981). Unfortunately many of the samples collected by Reid were unsuitable for analysis, so the results presented herein should not be taken as representative of the distribution of granitoids from this area.

The samples are perhaps biased in favour of finer-grained basic rocks primarily because these appear to be less subject to weathering. Due to confusion over geological nomenclature and interpretation in this region no attempt is made here to assign samples to any particular mapped units. The rock types incorporate granites, granodiorites, tonalites, quartz monzodiorites, monzodiorites and diorites. Massive, foliated and gneissic varieties are represented.

Sample Descriptions

VUW30897 Microgranite, leucocratic, hornblende and biotite bearing Loc: Knoll, south side of Marshall Valley (78°04.4'S,164°05'E).

VUW30898 Granite gneiss, large K-feldspar phenocrysts (<3 cm). Loc: North side of Garwood Peak, east side of Garwood Glacier (77°59.3'S, 163°58'E).

VUW30899 Granite, massive, medium-grained with greenish K-feldspar phenocrysts (<2 cm), biotite and hornblende. Loc: South side of Marshall Valley, halfway along (78°04.5'S,164°15'E).

VUW30900 Granite, massive, medium-grained with cream K-feldspar phenocrysts (<2 cm), biotite and hornblende. Loc: North wall of Miers Valley, east end (78°05.5'S,164°11'E).

VUW30901 Microgranite, leucocratic, fine-grained, containing hornblende, biotite and occasional small (<1 cm) K-feldspar phenocrysts. Loc: Lower Garwood Valley, south side.

VUW30902 Microgranite, leucocratic, fine-grained, containing hornblende and biotite. Loc: Miers Valley.

VUW30903 Microgranodiorite, containing hornblende and biotite. Mafic xenoliths in outcrop. Loc: Marshall Valley (78°03.9'S,164°08'E).

VUW30904 Microgranodiorite, containing hornblende and biotite, slightly porhyritic texture with K-feldspar phenocrysts (<1 cm). Loc: Garwood, south side (78°02.5' S,164°00'E)

VUW30905 Microtonalite, fine-grained with occasional K-feldspar phenocrysts (<1 cm) and "spotted" with biotite and hornblende. Loc: Miers Valley, two-thirds way up north wall, east end (78°05.9'S,164°12'E).

VUW30906 Tonalite, medium-grained, strongly foliated, containing hornblende and biotite. Loc: Ridge, west of Mount Lama (78°04.1'S,163°40'E).

VUW30907 Gneissic tonalite, medium-grained, with large hornblende crystals (<2 cm) and patches of finer-grained material. Loc: Garwood Valley, south face.

VUW30908 Tonalite, coarse-grained, slightly foliated, contains hornblende and biotite. Loc: Miers Valley, lower slopes of the Heart (78°05.7'S,163°40'E).

VUW30909 Micro-quartz monzodiorite, contains hornblende and biotite. Loc: East of snout of Rivard Glacier (78°03.8'S,164°03'E).

VUW30910 Micro-quartz monzodiorite, contains hornblende and biotite, slightly porphyritic with K-feldspar phenocrysts (<1 cm). Loc: Garwood Valley, south face.

VUW30911 Monzodiorite, medium-grained contains hornblende and biotite. Loc: East of snout of Rivard Glacier (78°03.8'S,164°03'E).

VUW30912 Micro-monzodiorite, hornblende bearing. Loc: Miers Valley, saddle on north wall, east end (78°05.3'S,164°11'E).

VUW30913 Microdiorite, hornblende and biotite bearing. Loc: Miers Valley.

VUW30914 Xenolith, mafic, hornblende, biotite and plagioclase bearing. Loc: Lake Oid (78°04'S,163°46'E).

VUW30915 Microdiorite, hornblende and biotite bearing. Loc: Miers Valley, above inlet to lake, halfway up north wall (78°05'S,163°47'E).

VUW30916 Diorite, medium-grained, hornblende and biotite bearing. Loc: Garwood Valley, south face (78°02.4'S,163°53'E).

VUW30917 Microdiorite, foliated, hornblende and biotite bearing. Loc: Garwood Valley, south face (78°02.1'S,164°02'E).

VUW30918 Hornblendite. Loc: Miers Valley, 2Km south of east end of lake (78°06.5'S,163°53'E).

VUW30919 Amphibolite with quartzo-feldspathic bands. Loc: Garwood Valley, south face.

VUW30920 Microdiorite, hornblende and biotite bearing. Loc: Marshall Valley, south- east ridge (78°04.5'S,164°21'E).

Table 15. Analytical data.

Wt.%	30897	30898	30899	30900	30901	30902	30903	30904	30905	30906	30907	30908
SIO2	74.29	65.08	66.80	67.09	69.42	65.45	63.51	62.56	56.99	59.63	51.18	63.12
TIO2	0.13	0.66	0.37	0.49	0.28	0.49	0.49	0.55	0.97	1.01	0.69	0.86
AL2O3	14.01	15.95	15.92	15.12	15.51	16.63	16.87	16.13	16.65	17.17	20.20	16.54
FE2O3	0.01	0.48	0.56	0.33	0.28	0.53	0.50	0.91	0.90	1.03	2.68	0.86
FEO	0.76	3.13	2.04	3.00	1.79	2.97	3.62	3.72	6.50	4.70	5.95	4.46
MNO	0.02	0.06	0.06	0.07	0.03	0.06	0.08	0.09	0.14	0.12	0.22	0.08
MGO	0.14	1.46	0.59	0.94	0.53	0.76	1.27	1.51	2.49	2.38	0.12	2.00
CAO	1.23	3.09	2.66	2.70	2.47	3.11	4.09	4.51	7.00	5.37	4.85	4.92
NA2O	3.11	3.11	3.51	3.90	3.68	3.87	4.06	3.58	2.98	4.13	5.30	3.93
K2O	5.79	4.99	5.34	4.98	4.54	4.86	3.76	3.74	2.75	2.35	6.00	1.81
P2O5	0.01	0.20	0.10	0.16	0.09	0.17	0.19	0.20	0.46	0.26	0.11	0.21
LOSS	0.47	0.86	1.67	0.94	0.88	1.13	1.31	2.15	2.05	1.40	2.69	1.15
TOTAL	99.97	99.07	99.62	99.72	99.50	100.03	99.75	99.65	99.88	99.55	99.99	99.94
ppm												
BA	691	1251	990	820	899	1179	1114	1069	769	356	1273	383
CE	47	38	81	104	42	108	79	57	60	110	27	117
CR	5	19	12	10	7	5	11	15	12	28	6	19
CU	<	5	2	<	<	<	<	<	8	4	3	5
GA	22	22	23	24	24	24	24	23	24	26	19	26
LA	34	17	49	59	24	61	47	32	28	63	11	61
NB	7	13	21	16	16	18	14	13	13	16	15	16
NI	<	4	<	<	<	<	4	4	<	8	4	7
PB	36	25	38	28	38	37	26	23	33	17	16	13
RB	200	164	188	157	174	188	135	152	90	133	133	106
SC	<	4	2	4	2	2	5	7	11	12	2	12
SR	344	454	758	580	594	738	750	714	630	636	1830	534
TH	18	6	30	11	12	24	13	9.6	7.8	23	2.5	19
U	2.5	<	3.6	2.8	<	2.3	2.2	2.8	2.4	<	<	<
V	<	46	12	16	8	11	27	40	48	81	5	68
Y	4	19	21	24	10	23	19	21	32	35	18	36
ZN	20	68	66	70	50	83	88	81	125	86	123	95
ZR	79	490	255	265	164	243	237	199	157	245	109	248

Notes: 1 "<" Indicates below detection limit
2 "LOSS" is loss on ignition at 1000 deg.C, corrected for Fe++ to Fe+++ oxidation
3 Sample numbers refer to VUW Geology Department collection

Table 16. Analytical data (continued).

Wt.%	30909	30910	30911	30912	30913	30914	30915	30916	30917	30918	30919	30920
SIO2	56.04	55.52	55.61	52.60	49.48	46.66	50.05	47.77	46.64	43.88	51.00	51.81
TIO2	0.94	0.89	0.89	1.15	1.51	1.85	1.39	1.67	2.08	1.09	1.07	1.11
AL2O3	17.92	17.79	19.22	20.07	17.38	17.86	18.66	17.97	20.85	16.72	16.08	14.48
FE2O3	0.84	0.73	0.67	0.93	1.13	1.54	1.25	1.06	1.31	1.89	1.16	0.94
FEO	6.20	6.35	4.68	6.06	8.98	9.09	7.47	7.13	7.78	8.60	7.58	7.23
MNO	0.13	0.14	0.12	0.13	0.19	0.17	0.17	0.14	0.12	0.18	0.17	0.14
MGO	2.31	2.94	1.64	2.16	4.01	4.38	3.73	5.30	3.54	9.07	6.37	7.72
CAO	6.31	6.72	7.00	7.12	8.38	8.87	8.17	9.25	8.33	13.82	8.43	8.54
NA2O	3.61	3.27	4.67	3.90	3.32	3.12	3.90	2.65	3.36	1.73	3.06	2.67
K2O	3.59	3.37	3.29	3.65	3.30	3.18	2.86	2.75	2.66	0.68	1.63	1.63
P2O5	0.41	0.31	0.28	0.43	0.54	0.66	0.50	0.62	0.81	0.14	0.28	0.22
LOSS	1.40	1.48	1.42	1.17	1.38	2.36	1.69	3.12	2.02	1.76	2.52	2.85
TOTAL	99.70	99.51	99.49	99.37	99.60	99.74	99.84	99.43	99.50	99.56	99.35	99.34
ppm												
BA	1056	1126	1403	1348	2333	1494	1110	1100	1659	59	522	456
CE	80	79	133	156	81	131	100	89	107	11	50	43
CR	7	9	11	9	13	11	10	54	13	370	214	485
CU	2	<	2	21	28	16	28	8	20	6	16	6
GA	28	23	30	32	28	28	28	28	34	20	22	23
LA	44	44	82	76	38	53	52	42	49	9	23	23
NB	17	15	21	29	24	24	21	19	22	13	10	9
NI	<	<	8	7	11	10	11	20	6	215	35	59
PB	21	16	20	20	12	9.3	12	14	9.5	4	10	7.3
RB	144	120	113	114	108	116	114	94	94	25	63	44
SC	7	12	8	12	17	21	13	18	14	31	25	30
SR	820	738	1368	1168	1327	1131	1202	1153	1603	317	638	666
TH	8.8	10	14	6.5	<	<	3.7	5.1	3	<	3.4	3.2
U	2.1	<	3.4	2.2	<	<	<	2	<	<	<	<
V	49	76	31	45	122	140	83	84	60	199	130	157
Y	23	30	25	53	27	57	35	35	36	15	35	31
ZN	122	113	109	133	189	157	155	135	150	92	113	119
ZR	273	261	674	461	112	163	399	225	540	74	198	168

Notes: 1 "<" Indicates below detection limit
2 "LOSS" is loss on ignition at 1000 deg.C, corrected for Fe++ to Fe+++ oxidation
3 Sample numbers refer to VUW Geology Department collection