

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

REPORT 209

BMR MICROFORM MF76

CHEMICAL ANALYSES OF ROCKS FROM THE LATE CAINOZOIC
VOLCANOES OF NORTH-CENTRAL NEW BRITAIN AND THE
WITU ISLANDS, PAPUA NEW GUINEA

by

R.W. Johnson & B.W. Chappell*

*Department of Geology, Australian National University

DEPARTMENT OF NATIONAL DEVELOPMENT

Minister: The Hon. K.E. Newman, M.P.
Secretary: A.J. Woods

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Director: L.C. Noakes, O.B.E.
Assistant Director, Geological Branch: J.N. Casey

Published for the Bureau of Mineral Resources, Geology and
Geophysics by the Australian Government Publishing Service

CONTENTS

	<u>Page</u>
ABSTRACT	
INTRODUCTION	1
TABLES AND NUMBERING SYSTEM	3
THE ANALYSES	6
Major elements	6
Trace elements	6
Modal analyses	8
LOCALITY DESCRIPTIONS	9
ACKNOWLEDGEMENTS	11
REFERENCES	46

TABLES

	<u>Page</u>
E1. Mount Witori area	12
E2. Sulu Range	14
E3. Mount Galloseulo, and Hargy volcano	16
E4. Mount Bamus	18
E5. Mount Ulawun	20
E6. Mount Likuruanga area	23
F1. Mount Krummel area	25
F2. Mount Du Faure	26
F3. Mount Wago	27
F4. Cape Hoskins area	28
F5. Wulai Island	31
F6. Cape Reilnitz area	32
F7. Lolobau and Banban Islands	33
Gs1. Mounts Garbuna and Welcker	35
Gs2. Mount Bangum	36
Gs3. Garua Harbour area	37
Gn1. Northern half of Willaumez Peninsula	38
Gn2. Kimbe Island	40
H1. Unea Island	41
H2. Garove Island	43
H3. Narega, Wambu, Undaka, and Mundua Islands	45

FIGURE

1. Locality map	2
-----------------	---

ABSTRACT

Major and trace-element analyses for 210 island-arc rocks from volcanoes on New Britain and the Witu Islands are compiled in 21 Tables. Modal analyses (phenocryst abundances) and locality descriptions, including grid references, are also listed. Each sample is assigned an alphanumeric identification code that allows its chemical analysis to be found readily. The coding system is based on the grouping of New Britain and Witu Islands volcanoes into five zones, E to H, which overlie successively deeper parts of the New Britain Benioff zone.

INTRODUCTION

This data catalogue is a compilation of major and trace-element chemical analyses, locality descriptions, and modal analyses for 210 island-arc rocks collected from volcanoes on the north-central coast of New Britain, and from the volcanic Witu Islands north of New Britain (Fig. 1).

The analysed rocks are grouped into three series:

(1) BMR series: analyses of 157 rocks collected by joint field parties of the Bureau of Mineral Resources (BMR) and Geological Survey of Papua New Guinea (GSPNG) in 1969 and 1970. The major-element analyses of these rocks form the basis of an earlier report (Johnson, 1977) in which they are appended as a computer printout without locality descriptions and trace-element analyses.

Sixteen of the 157 major-element analyses were published by Johnson, Davies, & White (1972) in an account of the geology and petrology of Mount Ulawun volcano, and are listed again in this catalogue for completeness. Rb, Sr, and Ba values were also reported for seven of the 16 rocks, but these are superseded by new determinations presented here. Major-element analyses of ten rocks from the 1970 eruption of Mount Ulawun were also listed by Johnson & others (1972), and were considered in the discussion by Johnson (1977). However, as these analyses are similar to one another, and to those of other Ulawun rocks, only two rocks of the 1970 eruption (70400505, 70400504) were chosen for trace-element determinations and for presentation in this catalogue.

(2) VOR series: analyses of 13 rocks collected between 1973 and 1975 by volcanologists of the Volcanological Observatory at Rabaul (VOR, a section of GSPNG), during investigations of recently active volcanoes (Mounts Ulawun, Bamus, Garbuna, Malala, and the volcano inside Witori caldera). These rocks were not considered by Johnson (1977).

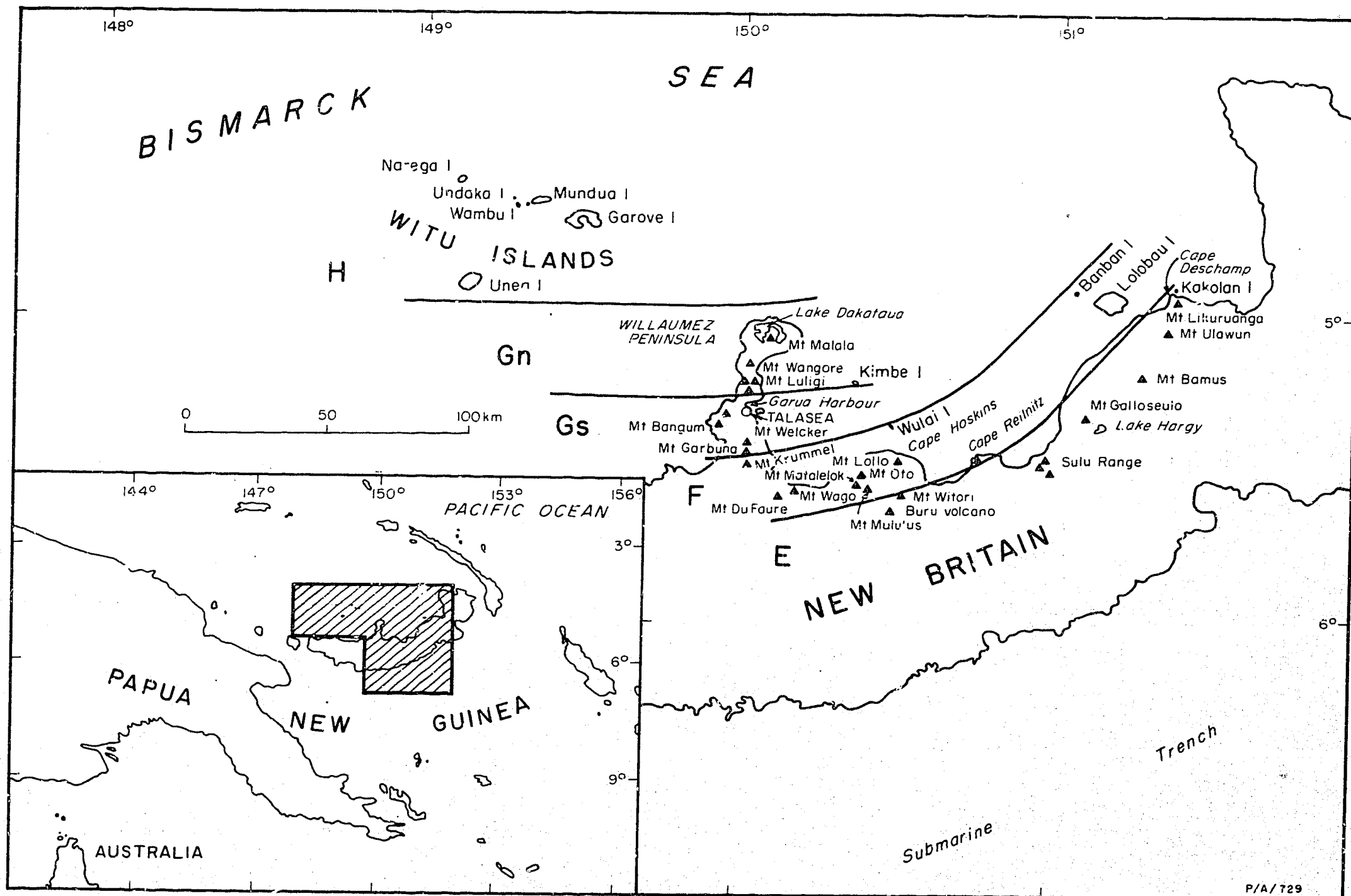


Figure 1. Locality map

(3) OAS (other analysed samples) series: analyses of 11 rocks from northern Willaumez Peninsula and the Garua Harbour area presented by Lowder & Carmichael (1970), and of 29 rocks from the Cape Hoskins area by Blake & Ewart (1974). These 40 major-element analyses were included in the discussion given by Johnson (1977).

TABLES AND NUMBERING SYSTEM

The volcanoes of central New Britain and the Witu Islands have been grouped into five zones - E, F, G-southern (Gs), G-northern (Gn), and H - which overlie successively deeper parts of the New Britain Benioff zone (Fig. 1). The accompanying 21 Tables of chemical analyses are coded using the same letters, E-H, as prefixes. Thus, Table F3, for example, refers to the third table of analyses of rocks from zone F, Table Gn2 to the second Table of zone G-northern rocks, and so on. Following is an index for the contents of each Table.

<u>Table</u>	<u>Volcanoes</u>	<u>Number of samples</u>	<u>Page</u>
E1	Mount Witori area	12	12-13
E2	Sulu Range	10	14-15
E3	Mount Galloseulo, and Hargy volcano	14	16-17
E4	Mount Bamus	12	18-19
E5	Mount Ulawun	22	20-22
E6	Mount Likuruanga area	14	23-24
Total		84	
F1	Mount Krummel area	7	25
F2	Mount Du Faure	8	26
F3	Mount Wago	2	27
F4	Cape Hoskins area	18	28-30
F5	Wulai Island	5	31
F6	Cape Reilnitz area	3	32
F7	Lolobau and Banban Islands	15	33-34
Total		58	
Gs1	Mounts Garbuna and Welcker	8	35
Gs2	Mount Bangum	7	36
Gs3	Garua Harbour area	4	37
Total		19	

Gn1	Northern half of Willaumez Peninsula	15	38-39
Gn2	Kimbe Island	5	40
Total		20	
H1	Unea Island	9	41-42
H2	Garove Island	12	43-44
H3	Narega, Wambu, Undaka, and Mundua Islands	8	45
Total		29	

Analyses within each table are numbered in order of increasing SiO_2 content, and each sample is coded by using the table notation followed by the number of the analysis in the table. For example: E3/2 is the second sample in the third table of zone E analyses; Gs1/6 is the sixth sample in the first table of zone G-southern analyses.

Two sets of alphanumerics follow the analysis number at the foot of each table; the derivation of the second set, a grid reference, is explained on page 9. The first set is the BMR registered sample number, except in Tables Gs3 and Gn1 where some numbers are for the analysed rocks of Lowder & Carmichael (1970). The sample numbers given by Blake & Ewart (1974) are the last two, three, or four alphanumerics of BMR registered numbers (D.H. Blake, pers. comm., 1978); these are presented in full in Tables E1 and F4, and may be recognised by 4 and 9 in the third and fourth positions (respectively) of the registered number. Analyses of all but two (E5/2 and E5/18) of the BMR-series rocks may be recognised by N and G in the third and fourth positions of the registered numbers, and those of VOR-series rocks have 7 and 1 in the third and fourth positions.

THE ANALYSES

Major elements

The Australian Mineral Development Laboratories (Amdel), Adelaide, supplied under contract the BMR and VOR-series major-element analyses, except for samples E3/2 and E3/7 and the BMR-series rocks from Mount Ulawun (Johnson & others, 1972), which A.J.R. White (pers. comm., 1971) analysed by mainly X-ray fluorescence spectrometric techniques at the Department of Geology, Australian National University (ANU).

Amdel analysed the BMR-series rocks between 1970 and 1973 by their most accurate available methods (a combination of conventional gravimetric, colorimetric, and photometric techniques). They analysed the VOR-series rocks between 1974 and 1978 by their H-3 method (mainly X-ray fluorescence spectrometry), although they used the lower-precision H-1 method for most oxide values for sample E5/8.

Trace elements

The abundances of sixteen trace elements in the BMR and VOR-series rocks have been determined by X-ray fluorescence spectrometry at the Department of Geology, ANU, except for Cr in several Mount Ulawun rocks, and for Rb, Sr, Zr, Nb, and Y in Mount Ulawun samples E5/4 and E5/9. Analytical methods are described by Norrish & Chappell (1977).

The OAS-series trace-element values reported here are those listed by Lowder & Carmichael (1970) and Blake & Ewart (1974). Trace-element values were not presented by Blake & Ewart (1974) for seven of their 29 samples (see Tables E1 and F4). The abundances of six trace elements obtained for the OAS-series rocks are not reported for the BMR and VOR-series rocks, as shown in the following table, where the crosses refer to the elements reported in the three different studies.

	<u>BMR and VOR samples</u>	<u>Lowder & Carmichael</u> <u>(1970)</u>	<u>Blake & Ewart</u> <u>(1974)</u>
Ba	x	x	x
Rb	x	x	x
Sr	x	x	x
Pb		x	x
Th		x	x
U			x
Zr	x	x	x
Nb	x	x	
Y	x	x	x
La	x	x	
Ce	x	x	
Pr		x	
Nd	x	x	
Sc	x		x
V	x	x	x
Cr	x	x	x
Co			x
Ni	x	x	x
Cu	x	x	x
Zn	x	x	x
Ga	x	x	x
B			x

Thirty-two BMR and VOR-series rocks have also been analysed for Cs, Pb, Th, U, Hf, and rare-earth elements (La-Yb) by spark-source mass spectrography (Taylor & Gorton, 1977) at the Research School of Earth Sciences, ANU. These results will be presented elsewhere (Johnson, Chappell, & Taylor, in prep.).

The value recorded against 'rest' for each sample in the tables is the sum of trace-element contents expressed as oxide percentages.

Modal analyses

Volume-percent phenocryst abundances for the analysed rocks are given at the foot of the tables at the end of each locality description. The following abbreviations are used:

<u>Abbreviation</u>	<u>Phenocryst mineral</u>
Plag	Plagioclase
Oliv	Olivine
Cpx	Clinopyroxene (including pigeonite)
Opx	Orthopyroxene
Amph	Amphibole
Biot	Biotite
Qtz	Quartz
FeTi	Opaque minerals (mainly iron-titanium oxides)

Modal analyses for 11 VOR-series samples were made by McKee (1977), and for the OAS-series rocks by Lowder & Carmichael (1970) and Blake & Ewart (1974). Modal analyses for the two other VOR-series rocks and for the BMR-series samples were calculated from observations of about 2000 points (excluding vesicles) on a 0.3 mm grid for each sample. No modal analyses were made for highly vesicular samples E1/9, F7/12, and Gn1/13; for a fine-grained ash sample E5/8; and for two aphyric obsidians Gs3/3 and Gs3/4. The modal analyses for coarse-grained samples Gs2/1, H1/1, and H2/7 are based on counts of all phases present, not just phenocrysts.

LOCALITY DESCRIPTIONS

Localities for the BMR-series rocks, except six from northern Willaumez Peninsula and the Garua Harbour area, are described and shown on sketch maps in a series of four unpublished BMR Records (Johnson, 1970a, 1970b, 1971; Johnson & Blake, 1972). Locality descriptions for the VOR-series rocks were supplied by C.O. McKee (pers. comm., 1978), and those for the OAS-series samples are taken from Lowder & Carmichael (1970) and Blake & Ewart (1974).

The second set of alphanumerics in the locality descriptions given at the foot of each table is a grid reference taken from one of the following maps, which are the most recent available at the given scales.

Map name and number	Description
Riebeck 8887	1:100 000-scale maps of Royal Australian Survey Corps (RASC), published in 1975 (series T601, edition 1, Universal Grid)
Dagi 8986	
Talasea 8987	
Ania 9086	
Bangula 9087	
Ulawun 9187	
Lolobau 9188	
Vitu Island S400-E14830/60X90	1-inch-to-4-miles-scale map of United States Army, published in 1944 (strategic map series, edition 2, 10 000 Meter Modified British Grid)

All but one of these maps were published after the samples were collected, so most sample sites have had to be relocated. Most grid references are probably to within 100 m of the sites originally identified in the field, though several sites (particularly inland ones) were difficult to locate with this accuracy in the first place. Grid references for the samples of Blake & Ewart (1974) were obtained by consulting the original field maps of D.H. Blake (pers. comm. 1978), and those for the VOR-series and Lowder & Carmichael (1970) samples were provided by C.O. McKee and G.G. Lowder respectively (pers. comms., 1978).

Place names given on the maps cited above are regarded as definitive, though they may differ from the names used on older maps. On the RASC maps, the named volcanoes are referred to as 'Mounts'; for those that are not named, the names adopted here are those used in the Records referred to above, but without the 'Mount' prefix (e.g. Hargy volcano, Buru volcano).

The volcano names used by Johnson & Blake (1972) and Blake & Ewart (1974) unfortunately do not correspond with the peaks named on the 1975 RASC maps of the Cape Hoskins area, as shown by the following:

<u>Blake usage</u>	<u>RASC usage</u>
Mululus	Matalelok
Oto	Mululus
Mataleloch	Oto

Also, although the eruptive source of the early-20th century lava flow inside Witori caldera in the Cape Hoskins area is generally known as Pago volcano, the name Mount Pago is used on the IASC maps for a prominent pinnacle of older rocks 4 km east-southeast of Mount Witori, and the young volcano, which is higher than the pinnacle, is unnamed.

The heights above sea level given in parenthesis for many inland sample localities are those recorded by hand-held pocket altimeters, and are not necessarily accurate.

ACKNOWLEDGEMENTS

R.A. Davies, P. Diambari, M.A. Gilfillan, R.P. Macnab, P.E. Pieters, and R.J. Ryburn contributed substantially to the collection of the rock-sample suite on which this data catalogue is based. C.O. McKee and R.J.S. Cooke also generously made available the major-element analyses and powders of the 13 rocks of the VOR-series, which were collected from localities not sampled by the 1969-70 BMR field parties and from the products of the 1973 eruption of Ulawun. We gratefully acknowledge the co-operation of all these colleagues.

We also thank R. Freeman for technical assistance with the trace-element determinations; A.J.R. White for providing the two previously unpublished major-element analyses of samples E3/2 and E3/7; D.H. Blake for lending his original locality maps of the Cape Hoskins area; and E. Byrne for typing the descriptive details at the foot of each table.

-12-
TABLE E1. Mount Witori area

	1	2	3	4	5	6	7	8
SiO ₂	57.33	61.0	62.2	65.80	66.2	66.26	66.28	66.43
TiO ₂	0.61	0.53	0.58	0.48	0.48	0.38	0.48	0.47
Al ₂ O ₃	17.58	15.1	15.4	14.63	14.3	14.60	15.00	15.13
Fe ₂ O ₃	3.27	2.85	3.35	1.71	1.24	2.49	1.91	2.74
FeO	5.75	5.10	4.50	4.35	4.05	2.19	4.22	3.48
MnO	0.16	0.13	0.15	0.15	0.12	0.13	0.14	0.14
MgO	2.81	3.25	2.35	1.57	1.55	1.36	1.47	1.36
CaO	8.41	6.80	6.15	5.31	7.30	4.46	5.15	5.24
Na ₂ O	3.20	3.30	3.50	3.75	3.70	3.71	3.94	3.96
K ₂ O	0.51	1.01	0.84	0.88	0.93	1.13	0.88	0.90
P ₂ O ₅	0.16	0.10	0.14	0.15	0.14	0.13	0.16	0.14
S				0.01				
H ₂ O _r	0.02	0.54	1.04	0.36	0.17	2.38	0.12	0.25
H ₂ O-				0.02				
CO ₂				0.10				
rest	0.15			0.11		0.10	0.11	0.11
O=S								
Total	99.96	99.71	100.20	99.38	100.18	99.34	99.86	100.35
Trace elements								
Ba	130			160		210	205	180
Rb	6.1			13.0		14	12	13
Sr	420			355		310	330	370
Zr	34			59		48	50	58
Nb				<1				
Y	19			15		19	20	21
La				6				
Ce				14				
Nd				8				
Sc	26			21		17	22	20
V	240			80		56	97	94
Cr	9			5		2	<2	3
Ni	10			<1		<2	<2	<2
Cu	75			9		14	17	15
Zn	86			84		70	76	86
Ga	19			15.0		16	18	16

Sample 4 and its major-element analysis supplied by VOR. All other data from Blake & Ewart (1974) - their loss-on-ignition values are given as H₂O+.

68490025. KU247860. Lava flow at base of northern wall of Witori caldera (200 m above sea level). Plag 20, Cpx 3, Opx < 1, FeTi < 1.
- 70490548A. KU288802. Boulder in agglomerate at base of southeastern wall of Witori caldera (60 m above sea level). Plag 3, Cpx < 1, Opx 1, FeTi < 1.
- 70490579B. KU241861. Lava flow in northern wall of Witori caldera (330 m above sea level). Plag 6, Cpx 1, Opx 1, FeTi < 1.
75710021. KU249833. Early 20th-century lava flow near source west of Mount Pago. Plag 6.5, Cpx 1, Opx < 0.5, Fe-Ti < 0.5.
70490557. KU244790. Edge of lava flow south-southwest of Mount Pago (45 m above sea level). Plag 8, Cpx < 1, Opx < 1, FeTi < 1.
68490138. KU322312. Pumice clast from youngest coarse tephra layer on northeastern flank of Mount Witori at coast (1 m above sea level). No modal analysis.
68490031. KU255832. Early 20th-century lava flow from, and to east of, source west of Mount Pago (400 m above sea level). Plag 6, Cpx 1, Opx 1, FeTi < 1.
68490033. KU251841. Early 20th-century lava flow from, and to northeast of, source west of Mount Pago (380 m above sea level). Plag 6, Cpx < 1, Opx 1, FeTi < 1.

continued on next frame.

TABLE E1. Mount Witori area (continued)

	9	10	11	12
SiO ₂	66.8	69.1	69.44	75.16
TiO ₂	0.43	0.35	0.40	0.30
Al ₂ O ₃	14.8	15.2	14.74	12.84
Fe ₂ O ₃	2.55	1.13	1.73	0.84
FeO	2.23	2.60	2.71	1.25
MnO	0.12	0.11	0.12	0.09
MgO	1.41	1.03	1.10	0.26
CaO	4.80	4.35	4.38	2.30
Na ₂ O	3.75	3.70	4.11	4.52
K ₂ O	1.01	1.11	1.03	1.34
P ₂ O ₅	0.13	0.15	0.16	0.07
S				
H ₂ O+	1.68	0.98	0.33	0.42
H ₂ O-				
CO ₂				
rest			0.09	0.09
O=S				
Total	99.71	99.81	100.34	99.48
Trace elements				
Ba			190	240
Rb			14	19
Sr			310	250
Zr			58	82
Nb				
Y			16	20
La				
Ce				
Nd				
Sc			15	11
V			43	9
Cr			<2	3
Ni			<2	<2
Cu			9	5
Zn			67	52
Ga			15	12

9. 70490517. KU323852. Pumic clast from youngest coarse tephra layer on eastern flank of Mount Witori (10 m above sea level). No modal analysis.
10. 70490558E. KU231785. Pitchstone boulder in pyroclastic-flow deposit on northeastern flank of Buru volcano (130 m above sea level). Plag 13, Cpx 1, Opx 1, FeTi 1.
11. 68490030. KU257829. Lava dome forming Mount Pago (pinnacle inside Witori caldera). Plag 7, Cpx < 1, Opx < 1, FeTi < 1.
12. 68490036F. KU242860. Boulder in welded tuff exposed in stream on northern flank of Mount Witori (300 m above sea level). Plag 3, Cpx < 1, Opx < 1, FeTi < 1.

TABLE E2. Sulu Range

	1	2	3	4	5	6	7	8
SiO ₂	53.1	53.2	54.8	55.0	55.1	55.8	56.8	68.6
TiO ₂	0.30	0.33	0.61	0.38	0.43	0.64	0.45	0.22
Al ₂ O ₃	14.7	15.7	18.9	15.7	17.2	18.6	16.5	12.5
Fe ₂ O ₃	1.91	1.95	2.25	1.94	2.20	2.40	4.40	0.64
FeO	6.90	6.60	6.90	6.45	6.50	6.80	3.80	1.29
MnO	0.16	0.17	0.16	0.16	0.16	0.17	0.15	0.07
MgO	9.20	8.35	3.00	7.05	5.15	2.80	4.95	0.73
CaO	10.9	10.7	9.70	10.0	9.85	9.40	8.95	3.40
Na ₂ O	1.58	1.79	2.65	2.10	2.30	2.50	2.45	3.15
K ₂ O	0.28	0.20	0.28	0.36	0.46	0.35	0.59	1.06
P ₂ O ₅	0.03	0.04	0.05	0.06	0.05	0.06	0.05	0.04
S								
H ₂ O+	0.30	0.49	0.38	0.38	0.58	0.13	0.35	5.45
H ₂ O-	0.22	0.24	0.07	0.19	0.14	0.08	0.24	2.75
CO ₂	0.04	0.10	0.28	0.10	0.07	0.10	0.06	0.15
rest	0.14	0.14	0.13	0.14	0.12	0.13	0.11	0.08
O=S								
Total	99.76	100.00	100.16	100.01	100.31	99.96	99.85	100.13
Trace elements								
Ba	30	35	40	70	80	45	85	210
Rb	2.6	1.8	5.0	5.8	6.4	5.2	8.0	19.4
Sr	167	177	256	224	224	251	217	204
Zr	14	15	25	31	32	26	37	78
Nb	<1	<1	<1	<1	<1	<1	<1	<1
Y	6	7	11	10	11	11	11	12
La	1	1	<1	2	5	<1	4	4
Ce	<1	2	5	6	4	4	5	11
Nd	1	<1	3	4	4	5	4	6
Sc	42	37	35	36	34	35	30	7
V	188	187	275	197	205	253	189	30
Cr	283	276	20	208	22	7	28	5
Ni	88	87	10	43	19	4	24	1
Cu	97	100	128	114	129	202	97	8
Zn	68	66	80	68	69	82	69	29
Ga	11.0	12.5	17.0	12.0	14.0	16.5	13.5	10.5

1. 51NG0217F. KU721953. Block on western flank of Mount Ruckenberg. Plag 2, Oliv 5, Cpx 7, FeTi < 1.
2. 51NG0217B. KU721953. Block on western flank of Mount Ruckenberg. Plag 10, Oliv 4, Cpx 10, FeTi < 1.
3. 51NG2649. KU759972. Block on road 750 m north of Malasi village. Plag 31, Cpx 1, Opx < 1.
4. 51NG3039B. KU687950. Lava flow in coastal outcrop south of Lava Point. Plag 14, Oliv 1, Cpx 14, Opx 5.
5. 51NG 3038G. KU703934. Block in prominent gully on western flank of range. Plag 17, Oliv < 1, Cpx 5, Opx 2.
6. 51NG3028. KU717968. Lava flow in coastal outcrop northwest of Mount Ruckenberg. Plag 29, Cpx < 1, Opx 2, FeTi < 1.
7. 51NG3035. KU684956. Lava flow in coastal outcrop south of Lava Point. Plag 7, Oliv 1, Cpx 2, Opx 1.
8. 51NG3038B. KU703934. Block in prominent gully on western flank of range. Plag 22, Cpx < 1, Opx < 1, Amph 1, Qtz 9, FeTi < 1.

continued on next frame.

TABLE E2. Sulu Range (continued)

	9	10
SiO ₂	71.2	72.4
TiO ₂	0.31	0.31
Al ₂ O ₃	13.8	13.4
Fe ₂ O ₃	1.04	0.88
FeO	1.65	1.48
MnO	0.08	0.07
MgO	0.86	0.81
CaO	3.20	2.75
Na ₂ O	3.95	4.05
K ₂ O	1.64	1.64
P ₂ O ₅	0.03	0.03
S		
H ₂ O+	2.10	1.98
H ₂ O-	0.13	0.11
CO ₂	0.07	0.04
rest	0.09	0.08
O=S		
Total	100.15	100.03

Trace elements

Ba	240	230
Rb	24.5	23.0
Sr	208	200
Zr	86	84
Nb	<1	1
Y	14	14
La	5	4
Ce	11	9
Nd	6	5
Sc	9	9
V	34	30
Cr	6	6
Ni	<1	<1
Cu	12	8
Zn	35	35
Ga	11.5	11.5

-
9. 51NG3032C. KU692962. Block on beach east of Lava Point. Plag 18, Cpx < 1, Opx < 1, Amph 1, Qtz 4, FeTi < 1.
10. 51NG3032A. KU692962. Block on beach east of Lava Point. Plag 20, Cpx < 1, Opx < 1, Amph 2, Qtz 13, FeTi 1.

TABLE E3. Mount Galloseulo and Hargy volcano

	1	2	3	4	5	6	7	8
SiO ₂	55.6	55.78	55.9	56.8	57.5	57.8	57.97	58.3
TiO ₂	0.39	0.60	0.35	0.51	0.42	0.46	0.40	0.49
Al ₂ O ₃	15.1	17.50	17.3	16.4	18.6	17.2	19.27	18.3
Fe ₂ O ₃	2.25	3.63	3.00	3.00	2.30	2.30	1.99	1.75
FeO	6.65	5.75	5.70	5.65	4.35	5.90	4.95	5.50
MnO	0.17	0.14	0.16	0.16	0.12	0.16	0.11	0.11
MgO	7.45	3.57	5.10	4.70	2.80	3.40	2.51	2.20
CaO	9.70	9.19	9.00	9.35	8.95	8.65	9.35	8.75
Na ₂ O	1.89	2.58	2.15	2.10	2.70	2.65	2.61	2.65
K ₂ O	0.22	0.59	0.40	0.53	0.67	0.57	0.60	0.70
P ₂ O ₅	0.05	0.10	0.05	0.07	0.06	0.06	0.08	0.06
S								
H ₂ O+	0.41	0.49	0.39	0.29	0.77	0.32	0.22	0.68
H ₂ O-	0.09	0.28	0.39	0.14	0.44	0.25	0.22	0.30
CO ₂	0.06	0.13	<0.05	<0.05	<0.05	0.12	0.08	0.05
rest	0.15	0.14	0.11	0.13	0.11	0.12	0.11	0.12
O=S								
Total	100.18	100.47	100.00	99.83	99.79	99.96	100.47	99.96
Trace elements								
Ba	60	125	70	80	100	90	105	100
Rb	6.0	7.0	6.8	7.4	8.8	6.8	8.8	9.8
Sr	221	296	256	249	284	268	293	285
Zr	25	36	22	33	32	31	31	36
Nb	<1	<1	<1	<1	<1	<1	<1	<1
Y	8	12	9	11	11	10	10	11
La	<1	3	2	2	2	1	3	3
Ce	5	9	<1	6	8	4	8	7
Nd	3	5	3	3	4	4	4	4
Sc	36	33	34	34	25	31	23	22
V	226	275	209	236	185	211	178	219
Cr	259		50	60	20	23		14
Ni	56	17	19	22	9	11	10	6
Cu	79	105	60	74	58	62	98	96
Zn	69	83	72	76	63	74	61	66
Ga	12.5	16.0	14.0	13.5	16.0	14.0	15.5	14.5

1. 51NG0205. KV927114. Lava flow in western bank of Lobo River near falls. Plag 20, Oliv 2, Cpx 10, Opx 9, FeTi < 1.
2. 51NG0115. KV900063. Block on southwestern rim of Hargy caldera (430 m above sea level). Plag 13.
3. 51NG0202. KV938085. Lava flow in escarpment on northern shore of Lake Hargy. Plag 25, Cpx 4, Opx 9, FeTi < 1.
4. 51NG0122. KV923124. Block in tributary of Lobo River. Plag 14, Oliv 1, Cpx 4, Opx 3, FeTi < 1.
5. 51NG0201. KV937085. Block derived from escarpment on northern shore of Lake Hargy. Plag 40, Cpx 1, Opx 1, FeTi < 1.
6. 51NG0199. KV934086. Lava flow in escarpment where Lobo River exits from Lake Hargy. Plag 23, Cpx 1, Opx 6, FeTi < 1.
7. 51NG0117. KV933093. Block on eastern bank of Lobo River, probably derived from escarpment above. Plag 41, Cpx 1, Opx 2, FeTi < 1.
8. 51NG0208. KV911143. Lava flow in western bank of Lobo River about 300 m south of falls at breach in Hargy caldera wall. Plag 25, Cpx 2, Opx 2, FeTi < 1.

continued on next frame.

TABLE E3. Mount Galloseulo and Hargy volcano (continued)

	9	10	11	12	13	14
SiO ₂	58.7	59.5	60.4	64.8	65.1	65.2
TiO ₂	0.50	0.53	0.56	0.67	0.66	0.67
Al ₂ O ₃	18.1	16.2	16.6	14.0	14.3	13.9
Fe ₂ O ₃	2.20	1.85	1.96	1.78	1.50	2.30
FeO	4.90	6.40	6.10	6.10	6.35	5.60
MnO	0.11	0.12	0.14	0.13	0.14	0.12
MgO	2.15	2.75	2.30	1.75	1.69	1.68
CaO	9.00	8.40	7.90	5.70	5.70	5.30
Na ₂ O	2.65	2.50	2.55	3.30	3.15	3.35
K ₂ O	0.64	0.81	0.77	1.16	0.67	1.11
P ₂ O ₅	0.07	0.08	0.06	0.11	0.12	0.12
S						
H ₂ O ⁺	0.52	0.39	0.19	0.63	0.65	0.30
H ₂ O ⁻	0.12	0.11	0.13	0.09	0.13	0.20
CO ₂	0.06	0.05	<0.05	0.05	<0.05	0.05
rest	0.12	0.13	0.13	0.13	0.12	0.12
O=S						
Total	99.84	99.82	99.79	100.41	100.28	100.02
Trace elements						
Ba	105	105	125	155	155	160
Rb	9.8	11.4	12.4	17.2	17.4	16.8
Sr	298	271	284	256	255	256
Zr	36	41	45	61	62	63
Nb	<1	<1	<1	<1	<1	<1
Y	11	12	12	16	16	17
La	1	2	3	4	4	3
Ce	4	3	7	8	8	9
Nd	3	3	4	6	5	5
Sc	24	30	27	25	23	24
V	223	258	246	182	181	166
Cr	13	14	12	5		
Ni	7	12	7	3	2	1
Cu	101	85	118	104	90	67
Zn	64	77	71	83	85	79
Ga	15.5	14.0	15.0	14.5	13.0	13.0

-
9. 51NGO209. KV911142. Lava flow in western bank of, and about 15 m above, Lobu River at breach in Hargy caldera wall. Plag 25, Cpx 1, Opx 1, FeTi < 1.
10. 51NGO213. KV895131. Lava flow in tributary of Aburi stream below northwestern wall of Hargy caldera. Plag 12, Cpx 1, Opx < 1.
11. 51NGO123. KV931086. Block near northwestern shore of Lake Hargy. Plag 20, Cpx < 1, Opx 2, FeTi < 1.
12. 51NGO116. KV910063. Block in stream draining southern flank of Mount Galloseulo. Plag 4, Cpx 1, Opx < 1, FeTi < 1.
13. 51NGO113. KV884092. Lava flow on western flank of Mount Galloseulo (785 m above sea level). Plag 5, Cpx 1, Opx 1, FeTi < 1.
14. 51NGO111. KV887095. Block in stream on western flank of Mount Galloseulo. Plag 3, Cpx < 1, Opx < 1, FeTi < 1.

TABLE E4. Mount Bamus

	1	2	3	4	5	6	7	8
SiO ₂	53.9	54.3	55.2	55.44	55.7	56.7	56.8	56.8
TiO ₂	0.41	0.62	0.90	0.76	0.61	0.63	0.75	0.64
Al ₂ O ₃	13.8	18.5	18.4	17.93	17.9	17.9	18.7	19.9
Fe ₂ O ₃	2.80	4.20	2.85	3.27	2.80	2.20	2.50	1.91
FeO	6.05	4.50	6.35	4.85	5.90	5.55	5.15	5.25
MnO	0.15	0.14	0.15	0.21	0.15	0.15	0.15	0.14
MgO	10.1	3.90	4.30	4.74	4.30	4.50	3.35	2.45
CaO	8.80	8.80	8.95	8.21	8.80	8.70	8.55	8.80
Na ₂ O	2.70	2.80	1.86	3.73	2.70	2.55	2.85	2.75
K ₂ O	0.46	0.33	0.37	0.37	0.46	0.44	0.44	0.45
P ₂ O ₅	0.09	0.09	0.06	0.05	0.09	0.09	0.12	0.09
S				0.03				
H ₂ O ⁺	0.66	1.09	1.00	0.14	0.28	0.31	0.28	0.40
H ₂ O ⁻	0.30	0.47	0.16	0.06	0.14	0.17	0.12	0.34
CO ₂	0.05	0.05	0.05	0.05	0.05	<0.05	<0.05	<0.05
rest	0.21	0.13	0.12	0.10	0.11	0.11	0.10	0.10
				99.94				
O=S				0.01				
Total	100.48	99.92	100.72	99.93	99.99	100.00	99.86	100.02
Trace elements								
Ba	60	95	70	70	75	80	80	85
Rb	4.6	1.0	4.0	5.6	6.4	7.0	6.8	7.4
Sr	176	260	252	220	224	258	277	241
Zr	33	46	45	42	52	46	54	52
Nb	<1	<1	<1	<1	<1	<1	<1	<1
Y	10	18	20	12	16	13	14	16
La	2	2	3	1	2	<1	2	2
Ce	5	8	5	6	11	8	10	6
Nd	3	5	6	4	5	5	5	5
Sc	35	31	30	28	31	23	21	24
V	222	242	213	203	204	167	159	165
Cr	590	57	6	19	10	63	12	8
Ni	170	20	8	7	9	17	6	5
Cu	64	77	102	39	64	44	37	75
Zn	74	80	84	73	72	61	65	60
Ga	12.0	16.5	18.0	15.0	16.0	14.0	15.5	15.5

Samples 4 and 12 and their major-element analyses supplied by VOR.

1. 51NG3006. KV973246. Lava flow in Bia River about 200 m above sea level. Plag 1, Oliv 2, Cpx 6, Opx 12.
2. 51NG0193. LV017245. Lava flow in gully parallel to, and a few 100 m north of, much deeper gorge near break in slope of western flank. Plag 27, Cpx 1, Opx 4, FeTi < 1.
3. 51NG2604. LV009187. Lava flow in tributary of Balima River. Plag 25, Cpx < 1, Opx 1, FeTi < 1.
4. 75710019. LV049251. Lava 100 m northeast of top of summit tholoid. Plag 19, FeTi < 1.
5. 51NG3020. KV994249. Lava flow in Bia River about 400 m above sea level. Plag 21, Oliv < 1, Cpx 2, Opx 8, FeTi < 1.
6. 51NG0174A. LV046252. Block beneath lava flow in western wall of summit crater. Plag 29, Ol < 1, Cpx 2, Opx 8, FeTi 1.
7. 51NG0166. LV049254. Lava flow in northern wall of summit crater. Plag 29, Cpx 2, Opx 7, FeTi 1.
8. 51NG0191A. LV018243. Block beneath precipitous fall just above head wall of deep gorge marking break in slope of western flank. Plag 36, Cpx < 1, Opx 3, FeTi 1.

continued on next frame.

TABLE E4. Mount Bamus (continued)

	9	10	11	12
SiO ₂	57.0	57.3	58.3	58.40
TiO ₂	0.62	0.58	0.72	0.63
Al ₂ O ₃	19.8	18.1	19.5	17.95
Fe ₂ O ₃	1.78	2.55	1.70	2.62
FeO	5.30	5.55	4.55	5.05
MnO	0.13	0.15	0.12	0.17
MgO	2.40	2.90	1.86	3.38
CaO	8.90	8.80	9.35	8.03
Na ₂ O	2.70	2.70	2.80	2.90
K ₂ O	0.45	0.34	0.53	0.47
P ₂ O ₅	0.09	0.09	0.09	0.12
S				0.01
H ₂ O+	0.56	0.42	0.21	0.14
H ₂ O-	0.25	0.28	0.08	0.04
CO ₂	<0.05	<0.05	<0.05	0.05
rest	0.11	0.13	0.10	0.09
O=S				
Total	100.09	99.89	99.91	100.05
Trace elements				
Ba	85	95	95	85
Rb	7.4	3.6	8.2	8.2
Sr	239	257	276	262
Zr	50	51	47	58
Nb	<1	<1	<1	<1
Y	15	15	15	14
La	3	2	2	3
Ce	8	13	3	7
Nd	5	4	4	6
Sc	22	29	21	18
V	161	259	144	118
Cr	9	26	6	18
Ni	4	15	4	4
Cu	100	100	64	24
Zn	59	78	55	63
Ga	15.5	16.5	15.5	14.0

9. 51NG0195X. LV017243. Lava flow in northern side of head wall of deep gorge marking break in slope of western flank. Plag 33, Cpx 1, Opx 5, FeTi 1.
10. 51NG0195M. LV017243. Lava flow in northern side of head wall of deep gorge marking break in slope of western flank. Plag 14, Cpx < 1, Opx 1.
11. 51NG0171. LV045247. Lava making up knoll southwest of summit tholoid. Plag 28, Cpx < 1, Opx < 1, FeTi < 1.
12. 75710020. LV047251. Lava 100 m northwest of top of summit tholoid. Plag 25, Cpx 6.5, Opx 3.5, FeTi 1.5.

TABLE E5. Mount Ulawan

	1	2	3	4	5	6	7	8
SiO ₂	51.31	51.41	51.63	51.79	51.84	51.92	51.98	52.0
TiO ₂	0.94	0.95	0.88	0.74	0.77	0.78	0.72	1.1
Al ₂ O ₃	17.17	17.44	17.01	18.06	17.13	16.37	20.37	17.1
Fe ₂ O ₃	3.16	3.30	3.30	2.51	2.92	3.77	2.16	6.22
FeO	7.02	7.03	7.20	7.25	7.50	6.70	6.23	6.75
MnO	0.19	0.19	0.20	0.17	0.20	0.19	0.15	0.10
MgO	5.64	5.74	5.54	5.85	6.32	6.56	3.87	4.6
CaO	10.70	11.00	10.85	10.98	10.77	10.66	11.17	10.0
Na ₂ O	2.32	2.27	2.15	2.19	2.20	2.16	2.56	2.7
K ₂ O	0.33	0.32	0.32	0.32	0.33	0.34	0.37	0.45
P ₂ O ₅	0.09	0.09	0.10	0.09	0.08	0.08	0.10	<0.1
S			0.01					
H ₂ O+	0.26	0.14	0.15	0.16	0.26	0.73	0.29	0.13
H ₂ O-	0.05	0.04	0.01	0.07	0.08	0.03	0.08	0.03
CO ₂	0.76	0.04	0.10	0.08	0.05	<0.02	0.06	
rest	0.14	0.14	0.14	0.10	0.14	0.14	0.13	0.17
O=S								
Total	100.08	100.08	99.59	100.36	100.59	100.43	100.24	101.35
Trace elements								
Ba	70	70	80	100	65	75	80	95
Rb	4.8	5.2	4.8		4.6	4.6	4.8	6.8
Sr	266	267	258		314	284	336	272
Zr	24	24	24		19	21	22	32
Nb	<1	<1	<1		<1	<1	<1	<1
Y	16	15	14		12	14	13	19
La	2	2	3	2	3	3	3	2
Ce	8	7	6	5	6	5	5	6
Nd	4	4	5	5	3	4	4	5
Sc	38	37	36	37	38	44	27	40
V	326	329	316	295	312	333	250	389
Cr			57					81
Ni	19	20	19	15	25	38	14	18
Cu	73	81	77	94	73	91	79	113
Zn	89	86	84	89	87	93	70	98
Ga	17.0	16.0	16.5		17.0	15.5	17.5	17.5

Samples 3, 8, 10, 13, 17, and 19 and their major-element analyses supplied by VOR. All other major-element analyses from Johnson & others (1972).

1. 51NG0059. LV148414. Core of bomb on western rim of summit crater in 1969 (2130 m above sea level). Plag 7, Oliv < 1, Cpx 1.
2. 70400505. LV129445. Clast from centre of 1970 nuée ardente deposit 1 km from northern limit of area of complete devastation on northwestern flank. Plag 11, Oliv < 1, Cpx 1.5.
3. 75710027. LV151413. Block ejected in October 1973 onto eastern side of summit area. Plag 8.5, Oliv < 0.5, Cpx 1.5, Opx 0.5, FeTi 0.5.
4. 51NG0098. LV130445. Lava flow in Northwestern Valley in 1969 (570 m above sea level). Plag 33, Oliv 5, Cpx 4.
5. 51NG0158. LV135435. Lava flow in gully on northern side of Northwestern Valley in 1969 (980 m above sea level). Plag 24, Oliv 3.5, Cpx 2.5, Opx < 1.
6. 51NG0077. LV118400. Boulder in bed of Western Valley (855 m above sea level). Plag 19, Oliv 1.5, Cpx 6, Opx 4.5.
7. 51NG0822. LV061460. Lava flow 1 km southeast of Ulaona Mission. Plag 35, Cpx 1.5, Opx 1.5.
8. 73710012. LV055468. Ash from 1973 eruption collected at Ulaona Mission. No modal analysis.

continued on next frame.

TABLE E5. Mount Ulawun (continued)

	9	10	11	12	13	14	15	16
SiO ₂	52.10	52.3	52.32	52.33	52.4	52.43	52.47	52.50
TiO ₂	0.75	0.94	0.76	0.73	0.89	0.77	0.75	0.76
Al ₂ O ₃	16.78	18.6	18.66	17.71	18.4	17.80	19.16	18.80
Fe ₂ O ₃	3.07	3.35	3.22	4.05	4.20	3.32	3.40	3.29
FeO	7.32	6.40	6.05	6.33	5.65	6.55	5.82	5.92
MnO	0.19	0.17	0.17	0.20	0.17	0.18	0.17	0.16
MgO	6.52	4.60	4.69	5.54	4.60	5.17	4.90	4.79
CaO	10.84	10.6	10.60	10.43	10.6	10.61	10.76	10.67
Na ₂ O	2.19	2.45	2.48	2.44	2.45	2.35	2.48	2.48
K ₂ O	0.32	0.38	0.32	0.32	0.38	0.36	0.32	0.35
P ₂ O ₅	0.09	0.09	0.08	0.07	0.09	0.08	0.09	0.10
S		<0.01			0.01			
H ₂ O+	0.20	0.04	0.33	0.22	<0.01	0.19	0.14	0.18
H ₂ O-	0.03	<0.01	0.07	0.05	0.02	0.07	0.03	0.10
CO ₂	0.11	0.05	0.05	<0.02	0.05	0.05	0.05	0.07
rest	0.10	0.15	0.13	0.14	0.15	0.14	0.13	0.13

O=S

Total	100.61	100.12	99.93	100.56	100.06	100.07	100.67	100.20
-------	--------	--------	-------	--------	--------	--------	--------	--------

Trace elements

Ba	65	80	75	70	85	75	75	75
Rb		5.8	4.6	4.0	6.0	5.0	4.2	4.6
Sr		287	297	321	296	309	301	290
Zr		28	21	18	28	22	21	22
Nb		<1	<1	<1	<1	<1	<1	<1
Y		16	13	12	16	13	13	12
La	<1	2	3	3	4	4	2	2
Ce	6	6	5	6	7	7	7	5
Nd	3	4	4	4	5	5	4	4
Sc	41	33	33	39	30	39	33	35
V	319	312	290	319	309	322	294	301
Cr		91			67			
Ni	38	20	21	21	19	20	22	18
Cu	84	93	81	53	95	69	80	81
Zn	89	82	81	87	84	85	82	78
Ga		16.0	17.0	17.0	19.0	16.5	17.5	16.5

9. 51NG0089. LV144408. Bomb on southwestern flank of younger cone (1930 m above sea level). Plag 14, Oliv 3, Cpx 4, Opx < 1, FeTi < 1.
10. 74710023. LV112401. Terminus of 1973 lava flow in Western Valley. Plag 25.5, Oliv 1, Cpx < 0.5, Opx 0.5, FeTi < 0.5.
11. 51NG0065B. LV122401. Lava flow in Western Valley (920 m above sea level). Plag 7, Oliv < 1, Cpx < 1, Opx < 1, FeTi < 1.
12. 51NG0091. LV143407. Lava flow on southwestern flank of younger cone in 1969 (1840 m above sea level). Plag 13, Oliv < 1, Cpx 2, Opx < 1, FeTi < 1.
13. 74710022. LV112401. Terminus of 1973 lava flow in Western Valley. Plag 25.5, Oliv 0.5, Cpx 1.5, Opx 0.5.
14. 51NG0156. LV132441. Lava flow in Northwestern Valley in 1969 (710 m above sea level). Plag 26, Oliv 2, Cpx < 1, Opx 1.
15. 51NG0079. LV117400. Lava flow (possibly a sill) in Western Valley (810 m above sea level). Plag 18, Oliv < 1, Cpx < 1, Opx < 1, FeTi < 1.
16. 51NG0066. LV124400. Lava flow in Western Valley (970 m above sea level). Plag 16, Oliv < 1, Cpx 1, Opx < 1, FeTi < 1.

continued on next frame.

TABLE E5. Mount Ulawun (continued)

	17	18	19	20	21	22
SiO ₂	52.5	52.51	52.7	53.47	54.95	55.48
TiO ₂	0.90	0.94	0.85	0.86	0.49	0.52
Al ₂ O ₃	18.3	17.51	18.6	16.67	17.05	17.85
Fe ₂ O ₃	3.70	3.10	3.35	2.17	3.17	3.30
FeO	6.15	7.00	6.35	8.04	6.34	4.75
MnO	0.17	0.18	0.16	0.19	0.18	0.14
MgO	4.50	5.30	4.55	4.90	5.47	4.75
CaO	10.7	10.50	10.6	9.78	9.82	10.00
Na ₂ O	2.40	2.40	2.40	2.49	2.39	2.53
K ₂ O	0.40	0.38	0.40	0.44	0.34	0.39
P ₂ O ₅	0.10	0.10	0.10	0.10	0.05	0.06
S	<0.01		0.01			
H ₂ O+	0.08	0.22	0.05	0.19	0.22	0.35
H ₂ O-	<0.01	0.04	0.03	0.06	0.08	0.11
CO ₂	<0.05	0.09	0.05	0.02	0.04	0.03
rest	0.15	0.14	0.15	0.14	0.13	0.14

O=S

Total	100.05	100.41	100.35	99.52	100.71	100.40
-------	--------	--------	--------	-------	--------	--------

Trace elements

Ba	90	85	85	95	80	110
Rb	5.6	5.6	6.8	6.4	5.0	5.6
Sr	288	270	294	288	289	333
Zr	29	29	31	28	21	27
Nb	<1	<1	<1	<1	<1	<1
Y	16	16	16	16	10	11
La	2	3	2	3	2	2
Ce	5	7	6	8	6	4
Nd	5	5	4	5	3	3
Sc	32	39	32	35	36	29
V	317	338	320	289	261	282
Cr	66		70			
Ni	19	24	18	15	21	41
Cu	102	91	85	94	104	99
Zn	84	91	85	88	78	67
Ga	17.0	16.5	18.5	17.0	15.5	14.5

17. 74710021. LV165394. Near terminus of 1973 lava flow on southeastern side of younger cone. Plag 30.5, Oliv 1, Cpx 3.5, Opx 1, FeTi < 0.5.
18. 70400504. LV129445. Clast from centre of 1970 nuée ardente deposit 1 km from northern limit of area of complete devastation on northwestern flank. Plag 20.5, Oliv 1.5, Cpx < 1, Opx < 1.
19. 74710020. LV165394. Near terminus of 1973 lava flow on southeastern side of younger cone. Plag 30.5, Oliv < 0.5, Cpx 1.5, Opx 1.
20. 51NG0095. LV129413. Bomb on western flank of younger cone (1350 m above sea level). Plag 40, Cpx 3.5, Opx 6.5, FeTi < 1.
21. 51NG0150. LV127460. Lava flow in Northwestern Valley (360 m above sea level). Plag 21, Oliv < 1, Cpx 4, Opx 2.
22. 51NG0094. LV117405. Lava flow in scarp on northern side of Western Valley (910 m above sea level). Plag 16, Oliv < 1, Cpx < 1, Opx 2.5, FeTi < 1.

TABLE E6. Mount Likuruanga area

	1	2	3	4	5	6	7	8
SiO ₂	51.2	53.1	53.8	53.9	54.1	54.5	54.6	54.6
TiO ₂	0.48	0.50	0.67	0.67	0.69	0.48	0.61	0.44
Al ₂ O ₃	15.7	16.9	18.7	18.5	16.8	18.4	17.3	18.2
Fe ₂ O ₃	2.50	3.10	3.10	2.95	3.40	3.75	3.40	3.15
FeO	6.20	6.10	5.55	5.70	6.00	4.95	5.0	5.55
MnO	0.17	0.18	0.15	0.15	0.18	0.15	0.17	0.15
MgO	9.95	6.30	3.85	3.90	5.65	4.95	5.05	4.25
CaO	11.2	10.6	10.1	9.70	9.55	9.40	9.55	9.65
Na ₂ O	1.53	2.10	2.35	2.50	2.45	2.40	2.55	2.50
K ₂ O	0.21	0.27	0.44	0.36	0.19	0.27	0.24	0.34
P ₂ O ₅	0.04	0.05	0.07	0.07	0.06	0.06	0.06	0.06
S								
H ₂ O+	0.48	0.56	0.66	0.86	0.42	0.31	0.43	0.42
H ₂ O-	0.27	0.24	0.29	0.48	0.39	0.38	0.45	0.46
CO ₂	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
rest	0.18	0.15	0.15	0.14	0.14	0.16	0.13	0.15
O=S								
Total	100.11	100.15	99.88	99.88	100.02	100.16	99.84	99.92
Trace elements								
Ba	65	100	110	115	80	115	80	110
Rb	2.8	4.4	5.6	5.8	1.0	2.6	2.2	4.6
Sr	245	348	358	351	302	354	329	378
Zr	12	19	24	23	21	18	28	19
Nb	<1	<1	<1	<1	<1	<1	<1	<1
Y	8	10	11	21	12	9	18	10
La	2	3	4	4	2	3	2	4
Ce	3	6	9	8	7	5	7	4
Nd	3	3	3	6	2	3	5	2
Sc	38	34	28	30	35	33	29	24
V	234	270	264	261	278	282	252	231
Cr	374	68	22	22	71	42	24	27
Ni	100	28	14	13	26	30	14	14
Cu	83	104	146	99	49	157	46	180
Zn	63	70	71	67	77	73	87	69
Ga	11.5	15.0	15.0	16.5	14.5	15.0	15.5	15.0

1. 53NG0871E. LV211499. Boulder in stream draining southern flank of Mount Likuruanga. Plag 10, Oliv 7, Cpx 14, Opx < 1, FeTi < 1.
2. 53NG0871D. LV211499. Boulder in stream draining southern flank of Mount Likuruanga. Plag 19, Oliv 2.5, Cpx 10, Opx 1.5, FeTi < 1.
3. 53NG0850B. LV170532. Lava flow in coastal outcrop on western side of Mount Likuruanga. Plag 25, Oliv < 1, Cpx < 1, Opx 1.5.
4. 53NG0852A. LV170538. Boulder on slope above sea-shore on western flank of Mount Likuruanga. Plag 27, Oliv < 1, Opx 1.
5. 53NG2517. LV225540. Lava flow on ridge joining Mount Likuruanga and subsidiary hill on northeastern flank. Plag 29, Cpx 14, Opx 7, FeTi < 1.
6. 53NG2514A. LV221548. Boulder in stream on western edge of subsidiary hill on northeastern flank of Mount Likuruanga. Plag 11, Cpx < 1.
7. 53NG1014. LV183569. Lava flow in coastal outcrop on western side of Kakolan Island. Plag 27, Oliv < 1, Cpx 8, Opx 4, FeTi 1.
8. 53NG2514C. LV221548. Boulder in stream on western edge of subsidiary hill on northeastern flank. Plag 33, Cpx 1.5, Opx 6.5, FeTi < 1.

continued on next frame.

TABLE E6. Mount Likuruanga area (continued)

	9	10	11	12	13	14
SiO ₂	55.2	55.3	58.9	63.1	64.3	64.7
TiO ₂	0.59	0.50	0.57	0.47	0.46	0.48
Al ₂ O ₃	16.2	17.9	15.6	16.9	16.7	15.7
Fe ₂ O ₃	6.05	3.35	2.90	3.75	2.30	3.65
FeO	3.20	5.00	5.30	1.36	2.80	1.95
MnO	0.17	0.15	0.14	0.14	0.13	0.13
MgO	4.25	4.25	4.05	2.55	2.40	1.95
CaO	7.25	9.30	8.05	5.05	5.80	5.20
Na ₂ O	2.85	2.75	2.80	3.75	3.75	3.50
K ₂ O	0.55	0.46	0.71	0.63	0.71	0.93
P ₂ O ₅	0.06	0.07	0.10	0.08	0.08	0.07
S						
H ₂ O+	1.62	0.43	0.49	0.42	0.42	0.76
H ₂ O-	1.74	0.37	0.23	0.51	0.19	0.88
CO ₂	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
rest	0.13	0.14	0.18	0.11	0.11	0.11
O=S						
Total	99.86	99.97	100.02	99.82	100.15	100.01
Trace elements						
Ba	160	140	185	210	210	240
Rb	7.2	4.6	11.0	5.4	7.8	13.2
Sr	259	372	384	298	319	308
Zr	28	26	34	60	60	55
Nb	<1	<1	<1	<1	<1	<1
Y	15	12	12	14	12	15
La	3	4	3	4	4	5
Ce	7	10	10	12	12	10
Nd	4	4	5	6	5	4
Sc	23	26	28	16	14	17
V	187	230	340	92	116	103
Cr	9	29	34	15	13	9
Ni	9	19	23	7	5	4
Cu	172	111	163	33	27	52
Zn	52	68	80	58	52	49
Ga	14.5	15.0	14.5	14.0	13.0	13.0

9. 53NG0857B. LV168567. Xenolith in lava flow represented by sample 6. Plag 25, Cpx 4, Opx 1, FeTi 2.
10. 53NG0850A. LV170532. Lava flow in coastal outcrop on western side of Mount Likuruanga. Plag 26, Cpx < 1, Opx 2.
11. 53NG1037. LV210538. Dyke in northeastern wall of crater of Mount Likuruanga (380 m above sea level). Plag 9, Cpx < 1, Opx 2.
12. 53NG1010B. LV193572. Block on eastern coast of Kakolan Island. Plag 28, Cpx 4, Opx 1, FeTi 1.
13. 53NG1015. LV186575. Block on northwestern coast of Kakolan Island. Plag 30, Cpx 4, Opx 1, FeTi 1.
14. 53NG0857A. LV168567. Lava flow in coastal outcrop south-southwest of Cape Deschamp, on northern side of satellite cone. Plag 22, Cpx 4.5, Opx 2, FeTi 1.5.

TABLE F1. Mount Krummel area

	1	2	3	4	5	6	7
SiO ₂	53.0	53.5	53.7	54.5	54.5	54.8	55.2
TiO ₂	0.50	0.62	0.38	0.36	0.45	0.43	0.44
Al ₂ O ₃	16.6	17.1	17.0	18.0	18.5	17.6	18.3
Fe ₂ O ₃	4.20	4.05	4.00	3.15	3.85	3.85	2.60
FeO	5.25	5.10	4.85	5.40	4.70	5.40	5.60
MnO	0.21	0.15	0.15	0.15	0.15	0.16	0.15
MgO	6.20	5.45	6.65	4.95	4.85	4.90	4.60
CaO	9.30	10.4	10.4	9.55	9.55	9.20	9.45
Na ₂ O	1.81	2.10	1.83	2.15	2.30	2.10	2.05
K ₂ O	0.43	0.44	0.23	0.42	0.41	0.41	0.34
P ₂ O ₅	0.10	0.11	0.07	0.08	0.09	0.07	0.07
S							
H ₂ O+	2.10	0.37	0.36	0.73	0.47	1.06	0.46
H ₂ O-	0.10	0.33	0.42	0.15	0.42	0.20	0.40
CO ₂	<0.05	0.05	0.03	0.03	<0.05	0.05	0.13
rest	0.15	0.16	0.15	0.15	0.15	0.15	0.13
O=S							
Total	99.95	99.93	100.22	99.77	100.39	100.38	99.92
Trace elements							
Ba	125	100	65	85	90	85	80
Rb	5.2	6.6	2.4	4.4	4.4	5.0	4.0
Sr	335	439	361	424	452	369	350
Zr	35	33	21	22	25	25	25
Nb	<1	<1	<1	<1	<1	<1	<1
Y	15	14	9	11	11	14	12
La	3	4	3	4	3	4	4
Ce	10	12	6	10	7	10	8
Nd	5	5	3	4	6	5	5
Sc	37	36	36	32	30	34	33
V	245	269	231	243	253	256	210
Cr	56	54	126	71	53	45	40
Ni	24	25	48	31	29	25	24
Cu	107	103	89	98	61	97	96
Zn	83	81	71	76	73	81	70
Ga	14.0	14.5	14.0	15.0	15.5	15.5	14.5

1. 51NG0269. JU752944. Lava flow in stream running between north-south ridges east of Mount Krummel (200 m above sea level). Plag 19, Oliv 3, Cpx 8, Opx 2.
2. 51NG0270B. JU751944. Boulder in stream running between north-south ridges east of Mount Krummel (215 m above sea level). Plag 11, Oliv < 1, Cpx 2, Opx < 1.
3. 51NG0277. JU702936. Lava flow in gully on southern flank of Mount Krummel (410 m above sea level). Plag 14, Oliv 1, Cpx 6, Opx 3.
4. 51NG0276. JU702936. Boulder in gully on southern flank of Mount Krummel (420 m above sea level). Plag 27, Cpx 5, Opx 7.
5. 51NG0279. JU704937. Boulder in gully on southern flank of Mount Krummel (425 m above sea level). Plag 24, Oliv < 1, Cpx 3, Opx 3.
6. 51NG0274. JU701935. Lava flow in gully on southern flank of Mount Krummel (335 m above sea level). Plag 28, Cpx 7, Opx 7.
7. 51NG0283. JU699916. Lava flow near thermal area south of Mount Krummel (75 m above sea level). Plag 29, Cpx 2, Opx 5.

TABLE F2. Mount Du Faure

	1	2	3	4	5	6	7	8
SiO ₂	57.2	57.5	58.0	58.3	59.0	62.6	62.8	63.4
TiO ₂	0.57	0.46	0.53	0.46	0.45	0.50	0.38	0.37
Al ₂ O ₃	17.9	15.4	15.7	15.9	19.9	17.7	16.3	16.3
Fe ₂ O ₃	3.90	3.20	3.10	3.65	1.42	3.30	2.65	3.80
FeO	4.00	4.40	3.25	3.75	3.35	1.71	2.15	1.73
MnO	0.14	0.14	0.12	0.13	0.12	0.08	0.10	0.10
MgO	3.75	5.25	4.80	4.70	3.10	1.81	2.80	2.40
CaO	7.45	8.40	8.75	8.15	7.20	5.90	5.90	6.00
Na ₂ O	2.75	2.50	2.85	2.85	3.20	3.45	3.15	3.05
K ₂ O	0.66	0.84	1.11	0.88	0.80	1.10	1.24	1.15
P ₂ O ₅	0.10	0.09	0.18	0.13	0.10	0.13	0.10	0.10
S								
H ₂ O+	0.60	0.95	0.69	0.45	0.41	0.62	1.02	0.76
H ₂ O-	0.60	0.67	0.75	0.47	0.97	0.74	1.27	0.71
CO ₂	0.03	0.07	0.03	0.04	0.18	0.07	0.20	0.05
rest	0.14	0.17	0.18	0.15	0.15	0.14	0.14	0.14
O=S								
Total	99.79	100.14	100.04	100.01	100.35	99.85	100.20	100.06
Trace elements								
Ba	115	140	155	140	150	185	180	190
Rb	9.2	11.2	12.8	11.8	11.8	17.2	17.6	17.6
Sr	477	429	625	441	560	499	484	480
Zr	43	45	59	49	50	71	54	57
Nb	<1	<1	2	<1	<1	2	<1	<1
Y	23	50	13	13	9	14	8	9
La	7	9	12	6	5	7	5	7
Ce	12	14	29	11	13	20	13	15
Nd	10	21	15	8	6	8	5	7
Sc	25	30	25	25	20	15	18	16
V	203	184	190	177	180	113	155	136
Cr	9	127	66	96	13	13	13	15
Ni	7	24	23	19	13	7	7	7
Cu	77	76	83	71	57	86	42	42
Zn	64	74	63	65	62	59	52	57
Ga	16.0	14.0	15.0	14.5	16.5	16.0	13.5	14.5

1. 51NG2683E. JU803860. Boulder in stream on northern flank. Plag 24, Oliv < 1, Cpx 5, Opx 4, FeTi 1.
2. 51NG2699. JU825830. Boulder in stream on eastern flank. Plag 22, Oliv < 1, Cpx 13, Opx 3, FeTi 1.
3. 51NG2685A. JU827852. Boulder in Tuveni Creek behind Kimbe. Plag 23, Oliv < 1, Cpx 10, Opx 2, FeTi 1.
4. 51NG2685B. JU827852. Boulder in Tuveni Creek behind Kimbe. Plag 23, Cpx 11, Opx 3, FeTi 1.
5. 51NG2683D. JU803860. Boulder in stream on northern flank. Plag 18, Cpx 1, Opx 2, FeTi < 1.
6. 51NG2682. JU802852. Lava flow in stream on northern flank. Plag 26, Cpx 2, Opx 2, FeTi < 1.
7. 51NG2683C. JU803860. Boulder in stream on northern flank. Plag 33, Opx 3, Amph 8, Qtz 2, FeTi 2.
8. 51NG2683A. JU803860. Boulder in stream on northern flank. Plag 34, Cpx < 1, Opx 2, Amph 8, Qtz 3, FeTi 1.

TABLE F3. Mount Waga

	1	2
SiO ₂	53.5	57.2
TiO ₂	0.66	0.65
Al ₂ O ₃	16.9	16.3
Fe ₂ O ₃	4.00	4.05
FeO	4.95	4.65
MnO	0.15	0.13
MgO	5.70	3.90
CaO	9.75	8.15
Na ₂ O	2.30	2.65
K ₂ O	0.35	0.90
P ₂ O ₅	0.10	0.16
S		
H ₂ O+	0.61	0.70
H ₂ O-	0.71	0.30
CO ₂	0.06	0.06
rest	0.17	0.19
O=S		
Total	99.91	99.99

Trace elements

Ba	95	175
Rb	2.2	13.8
Sr	390	442
Zr	41	67
Nb	<1	<1
Y	73	41
La	19	8
Ce	14	17
Nd	20	11
Sc	32	28
V	265	289
Cr	91	51
Ni	35	30
Cu	107	165
Zn	79	75
Ga	16.0	15.5

1. 51NG3062A. JU881834. Boulder on southern flank. Plag 20, Oliv 1, Cpx 6, Opx 2.
2. 51NG2686. JU883864. Boulder on headland at coast on northern flank. Plag 14, Oliv < 1, Cpx < 1, Opx < 1.

TABLE F4. Cape Hoskins area

	1	2	3	4	5	6	7	8
SiO ₂	52.78	53.85	54.56	54.74	54.93	55.00	55.48	57.13
TiO ₂	0.48	0.52	0.49	0.51	0.50	0.52	0.52	0.58
Al ₂ O ₃	17.76	17.30	17.79	17.26	17.59	17.26	17.48	17.92
Fe ₂ O ₃	3.34	3.68	2.91	5.26	4.68	3.37	2.84	2.66
FeO	6.39	5.53	5.96	3.80	4.64	5.75	5.76	5.86
MnO	0.18	0.15	0.15	0.12	0.17	0.16	0.15	0.15
MgO	5.69	4.82	5.12	3.75	4.34	5.42	4.31	2.97
CaO	10.33	9.45	9.94	8.68	8.96	9.41	8.87	8.40
Na ₂ O	2.23	2.55	2.61	2.66	2.67	2.78	2.96	3.21
K ₂ O	0.24	0.56	0.30	0.50	0.49	0.46	0.47	0.56
P ₂ O ₅	0.17	0.12	0.12	0.15	0.17	0.17	0.14	0.15
S								
H ₂ O+	0.45	0.72	0.19	2.17	0.79		0.20	0.39
H ₂ O-								
CO ₂								
rest	0.16	0.15	0.15	0.14	0.15	0.15	0.16	0.15
O=S								
Total	100.20	99.40	100.29	99.74	100.08	100.45	99.34	100.13
Trace elements								
Ba	100	125	100	120	130	105	145	140
Pb	1.1	8.3	2.1	6.5	5.7	5.2	4.9	6.2
Sr	380	410	400	420	410	380	400	435
Zr	21	38	27	37	27	28	27	35
Nb								
Y	18	16	15	13	14	16	19	18
La								
Ce								
Nd								
Sc	39	31	26	27	28	26	31	24
V	285	230	240	185	230	225	275	250
Cr	58	54	70	14	37	76	<2	5
Ni	21	22	35	13	15	34	27	12
Cu	105	71	89	93	130	88	115	115
Zn	77	74	71	74	80	76	74	76
Ga	14	14	15	15	15	15	18	16

All data from Blake & Ewart (1974) - their loss-on-ignition values are given as H₂O+ values. See text for comment on confusion over locality names given below.

1. 68490151. KU147873. Lava flow on northeastern flank of Mount Mululus (245 m above sea level). Plag 26, Oliv < 1, Cpx 2, Opx 5.
2. 68490077. KU125917. Boulder in stream on eastern flank of Mount Oto (90 m above sea level). Plag 29, Cpx 4, Opx 5, FeTi < 1.
3. 68490003. KU235948. Lava flow on southwestern flank of Mount Lollo (435 m above sea level). Plag 26, Oliv < 1, Cpx 3, Cpx 5.
4. 68490171B. KU080835. Lava flow on southern flank of Ko volcano (75 m above sea level). Plag 6, Cpx 1, Opx 1.
5. 68490152B. KU144866. Lava flow on northeastern flank of Mount Mululus (315 m above sea level). Plag 26, Oliv < 1, Cpx 3, Opx 3, FeTi < 1.
6. 68490102. KU249956. Lava flow on eastern flank of Mount Lollo (170 m above sea level). Plag 23, Cpx 2, Opx 3.
7. 68490047. KU228973. Lava flow on northeastern flank of Mount Kapberg (130 m above sea level). Plag 27, Cpx 2, Opx 4, FeTi < 1.
8. 68490013. KU226940. Lava flow on southwestern flank of Mount Lollo (170 m above sea level). Plag 22, Cpx < 1, Opx 1, FeTi < 1.

continued on next frame.

TABLE F4. Cape Hoskins area (continued)

	9	10	11	12	13	14	15	16
SiO ₂	57.26	57.5	59.96	61.24	63.31	64.50	65.28	66.99
TiO ₂	0.54	0.50	0.44	0.52	0.40	0.47	0.42	0.41
Al ₂ O ₃	16.37	16.6	16.20	16.99	15.41	16.00	16.44	15.36
Fe ₂ O ₃	3.83	2.95	3.06	3.37	2.08	2.64	2.81	2.61
FeO	4.59	5.00	4.56	3.25	3.48	3.37	1.97	2.23
MnO	0.14	0.13	0.14	0.14	0.12	0.13	0.13	0.13
MgO	3.85	3.85	4.28	2.28	3.66	1.88	1.34	1.41
CaO	8.33	7.70	7.77	6.19	6.73	5.62	5.05	4.83
Na ₂ O	2.93	2.95	2.77	3.94	3.23	3.75	4.07	4.06
K ₂ O	0.83	0.76	0.86	0.88	1.05	1.12	1.35	1.05
P ₂ O ₅	0.17	0.10	0.12	0.24	0.13	0.18	0.21	0.18
S								
H ₂ O+	1.07	1.62	0.03	0.90	0.02	0.54	0.68	0.26
H ₂ O-								
CO ₂								
rest	0.14		0.15	0.13	0.13	0.13	0.11	0.11
O=S								
Total	100.05	99.66	100.34	100.07	99.75	100.33	99.86	99.63
Trace elements								
Ba	150		155	215	195	215	220	240
Rb	13		12	9.2	13	16	14	11
Sr	390		305	430	330	385	355	375
Zr	58		53	50	60	72	66	63
Nb								
Y	19		16	23	15	23	23	25
La								
Ce								
Nd								
Sc	24		26	20	20	19	15	20
V	190		190	135	140	120	76	79
Cr	18		52	5	71	5	2	<2
Ni	13		25	3	19	3	<2	<2
Cu	100		165	56	46	53	13	20
Zn	72		68	67	54	68	64	57
Ga	15		14	19	13	16	16	18

9. 68490174. KU083837. Lava flow on southern flank of Ko volcano (115 m above sea level). Plag 23, Cpx 4, Opx 3, FeTi 1.
10. 68490134C. KU070880. Boulder in stream on western flank of Mount Matalelok (70 m above sea level). Plag 18, Cpx 3, Opx 1, FeTi < 1.
11. 68490162. KU116891. Lava dome on eastern flank of Mount Matalelok (270 m above sea level). Plag 10, Oliv 1, Cpx 2, Opx 1, Qtz 1, FeTi < 1.
12. 68490108. KU231969. Lava flow on northwestern flank of Mount Lollo (70 m above sea level). Plag 18, Oliv < 1, Cpx 2, Opx 2, FeTi 1.
13. 68490159A. KU128895. Boulder in stream on eastern flank of Mount Matalelok (125 m above sea level). Plag 21, Oliv < 1, Cpx 5, Opx 1, Qtz 2, FeTi < 1.
14. 68490154. KU144864. Youngest lava flow on northeastern flank of Mount Mululus (430 m above sea level). Plag 19, Cpx 4, Opx 2, FeTi 1.
15. 68490092B. KU084903. Boulder in stream on northwestern flank of Mount Matalelok (305 m above sea level). Plag 21, Cpx 2, Opx 1, FeTi 1.
16. 68490153. KU146866. Lava dome on northeastern flank of Mount Mululus (390 m above sea level). Plag 18, Cpx 2, Opx 1, FeTi 1.

continued on next frame.

TABLE F4. Cape Hoskins area (continued)

	17	18
SiO ₂	68.16	69.1
TiO ₂	0.40	0.37
Al ₂ O ₃	15.20	14.3
Fe ₂ O ₃	2.99	1.32
FeO	1.37	1.89
MnO	0.10	0.08
MgO	1.43	1.03
CaO	4.05	3.60
Na ₂ O	3.96	3.95
K ₂ O	1.41	1.54
P ₂ O ₅	0.15	0.08
S		
H ₂ O ⁺	0.96	2.41
H ₂ O ⁻		
CO ₂		
rest	0.12	

O=S

Total 100.30 99.67

Trace elements

Ba	280
Rb	18
Sr	330
Zr	83
Nb	
Y	19
La	
Ce	
Nd	
Sc	15
V	76
Cr	4
Ni	2
Cu	25
Zn	44
Ga	16

17. 68490164. KU127884. Lava dome on eastern flank of Mount Matalelok (240 m above sea level). Plag 24, Cpx 3, Opx 1, FeTi 1.

18. 68490147B. KU116872. Boulder in stream on northern flank of Mount Mululus (320 m above sea level). Plag 16, Cpx < 1, Opx < 1, FeTi < 1.

TABLE F5. Wulai Island

	1	2	3	4	5
SiO ₂	52.2	52.5	55.1	56.4	56.7
TiO ₂	0.49	0.49	0.56	0.50	0.53
Al ₂ O ₃	18.6	17.9	18.4	17.8	18.8
Fe ₂ O ₃	4.10	4.05	3.25	3.15	3.40
FeO	5.35	5.45	4.95	5.00	4.10
MnO	0.17	0.16	0.15	0.14	0.14
MgO	5.55	5.60	5.00	4.35	3.05
CaO	9.85	10.2	8.65	8.25	7.90
Na ₂ O	2.20	2.15	3.00	2.80	3.05
K ₂ O	0.26	0.48	0.43	0.49	0.63
P ₂ O ₅	0.08	0.08	0.08	0.09	0.10
S					
H ₂ O+	0.53	0.41	0.20	0.80	1.42
H ₂ O-	0.36	0.16	0.45	0.16	0.06
CO ₂	<0.05	<0.05	0.10	0.04	0.02
rest	0.15	0.16	0.15	0.14	0.13

O=S

Total	99.89	99.79	100.48	100.11	100.03
-------	-------	-------	--------	--------	--------

Trace elements

Ba	75	75	100	90	120
Rb	3.4	4.2	5.8	5.8	6.0
Sr	409	403	413	413	433
Zr	23	24	35	38	40
Nb	<1	<1	<1	<1	<1
Y	11	10	12	15	13
La	3	4	6	5	4
Ce	6	9	11	9	13
Nd	4	5	6	6	6
Sc	33	35	32	28	24
V	260	266	253	205	177
Cr	56	59	42	32	16
Ni	28	30	24	14	9
Cu	102	159	43	85	31
Zn	71	70	71	69	62
Ga	16.0	15.5	16.5	16.5	16.5

1. 51NG0241. KV220077. Boulder on headland on northeastern coast. Plag 30, Oliv 4, Cpx 5.
2. 51NG0239. KV219079. Lava flow in coastal outcrop on headland on northern side of island. Plag 28, Oliv 4, Cpx 3.
3. 51NG0236. KV214078. Lava flow in coastal outcrop near northwestern tip of island. Plag 24, Oliv < 1, Cpx 5, Opx 10, FeTi < 1.
4. 51NG0225. KV219067. Lava flow in coastal outcrop at southern end of bay on eastern side of island. Plag 36, Cpx 2, Opx 4, FeTi 1.
5. 51NG0233. KV215071. Lava flow showing strong fissility in coastal outcrop on western side of island. Plag 27, Oliv 1, Cpx 1, Opx 2, FeTi < 1.

TABLE F6. Cape Reilnitz area

	1	2	3
SiO ₂	55.6	56.5	71.4
TiO ₂	0.56	0.47	0.46
Al ₂ O ₃	15.7	16.5	14.3
Fe ₂ O ₃	2.55	2.40	2.55
FeO	7.40	5.65	0.61
MnO	0.16	0.15	0.08
MgO	4.85	5.35	0.50
CaO	9.10	8.50	2.75
Na ₂ O	2.20	2.40	3.90
K ₂ O	0.52	0.62	1.72
P ₂ O ₅	0.06	0.10	0.12
S			
H ₂ O+	0.62	0.94	0.83
H ₂ O-	0.34	<0.01	0.69
CO ₂	0.03	0.06	0.06
rest	0.13	0.15	0.11

O=S

Total	99.82	99.79	100.08
-------	-------	-------	--------

Trace elements

Ba	85	115	300
Pb	7.2	7.6	28.5
Sr	263	358	276
Zr	30	31	100
Nb	<1	<1	<1
Y	21	11	26
La	3	3	6
Ce	4	9	14
Nd	5	4	11
Sc	39	28	14
V	285	211	24
Cr	22	84	4
Ni	16	37	<1
Cu	81	94	8
Zn	83	72	56
Ga	16.0	15.0	13.0

1. 51NG0218B. KU572970. Boulder near lumber jetty southeast of Bakoba Point. Plag < 1, Cpx < 1, Opx < 1.
2. 51NG3052B. KU495953. Boulder on beach south of Rock Point. Plag 2, Oliv 1, Cpx < 1.
3. 51NG0220A. KU515970. Lava flow in coastal outcrop just east of Cape Reilnitz. Plag 8, Cpx 1, Opx 1, FeTi 1.

TABLE F7. Lolobau and Barban Islands

	1	2	3	4	5	6	7	8
SiO ₂	50.9	53.5	53.6	54.4	54.7	55.9	59.9	60.7
TiO ₂	0.58	0.59	0.61	0.60	0.57	0.68	0.83	0.84
Al ₂ O ₃	17.6	17.1	15.9	19.0	16.8	18.2	14.5	15.1
Fe ₂ O ₃	2.80	2.70	3.50	2.70	6.15	2.75	3.20	7.40
FeO	8.15	6.65	5.55	5.80	3.35	5.35	5.45	1.97
MnO	0.20	0.17	0.17	0.16	0.17	0.15	0.16	0.16
MgO	5.50	5.75	6.70	3.70	5.20	3.20	2.50	2.65
CaO	10.8	10.6	10.6	9.80	9.80	9.25	6.25	6.70
Na ₂ O	1.79	2.05	2.10	2.65	2.40	2.90	3.40	3.20
K ₂ O	0.19	0.37	0.39	0.41	0.40	0.56	0.84	0.83
P ₂ O ₅	0.05	0.06	0.09	0.10	0.09	0.09	0.15	0.16
S								
H ₂ O ⁺	0.64	0.35	0.43	0.43	0.34	0.56	1.86	0.10
H ₂ O ⁻	0.69	0.14	0.08	0.29	0.08	0.17	0.66	0.29
CO ₂	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
rest	0.14	0.14	0.15	0.14	0.14	0.14	0.16	0.17
O=S								
Total	100.03	100.17	99.87	100.18	100.19	99.90	99.86	100.27
Trace elements								
Ba	50	100	100	100	95	140	220	225
Rb	1.8	4.8	4.6	6.2	6.0	8.0	14.4	12.6
Sr	250	259	296	325	302	303	292	296
Zr	15	25	30	32	32	39	72	71
Nb	<1	<1	<1	<1	<1	<1	<1	<1
Y	10	12	15	15	14	16	26	24
La	<1	3	3	3	4	3	6	5
Ce	5	8	6	8	8	10	13	15
Nd	3	3	5	4	4	5	8	8
Sc	43	35	38	29	32	24	28	32
V	347	256	282	265	278	255	257	301
Cr	18	85	123	19	35	23	7	8
Ni	16	25	37	14	18	14	6	7
Cu	146	114	55	101	96	90	143	186
Zn	82	68	73	76	77	72	93	88
Ga	15.5	14.5	14.0	15.5	15.0	17.0	14.5	14.5

1. 53NG0839A. LV015542. Block in gully, southern flank of Giwu Peak, Lolobau Island. Plag 22, Oliv 5, Cpx 5, Opx < 1, FeTi < 1.
2. 53NG0827A. KV992524. Boulder from volcanic rudite in caldera wall on southern shore of Namor Lake. Plag 26, Oliv 1, Cpx 13, Opx 1, FeTi < 1.
3. 53NG2523C. KV962561. Block in southern part of Hulu Crater (Mount Lolobau). Plag 15, Oliv 1.5, Cpx 8, Opx 1.
4. 53NG0832. KV920569. Lava flow in coastal outcrop on western side of Lolobau Island. Plag 27, Cpx < 1, Opx 1.
5. 53NG0814B. KV906556. Lava flow in coastal outcrop on northwestern side of hill southwest of Lolobau Plantation. Plag 24, Cpx 2, Opx 7.
6. 53NG0835G. LV004585. Boulder from volcanic rudite on northeastern coast of Lolobau Island. Plag 25, Cpx < 1, Opx < 1, FeTi < 1.
7. 53NG0846. KV992588. Lava flow in coastal outcrop on northern side of Lolobau Island. Plag 2, Oliv < 1, Cpx 1, Opx < 1, FeTi < 1.
8. 53NG1047C. LV006554. Block derived from eastern wall of Lolobau caldera. Plag 4, Cpx < 1, Opx 1, FeTi < 1.

continued on next frame.

TABLE F7. Lolobau and Banban Islands (continued)

	9	10	11	12	13	14	15
SiO ₂	62.2	63.9	65.9	68.5	68.8	69.2	69.4
TiO ₂	0.91	0.80	0.67	0.70	0.41	0.74	0.69
Al ₂ O ₃	14.5	14.5	15.5	13.9	15.8	13.7	14.3
Fe ₂ O ₃	2.20	1.81	1.96	1.43	2.50	0.99	1.18
FeO	5.45	5.35	3.50	3.20	1.01	4.20	3.40
MnO	0.16	0.15	0.14	0.13	0.11	0.14	0.15
MgO	2.20	1.95	1.53	0.96	1.14	1.10	1.13
CaO	5.85	5.70	4.55	3.10	4.35	3.80	3.75
Na ₂ O	4.00	3.60	4.15	3.90	4.05	4.15	4.35
K ₂ O	0.97	0.99	1.05	1.60	1.05	1.28	1.20
P ₂ O ₅	0.24	0.18	0.18	0.20	0.09	0.24	0.22
S							
H ₂ O+	0.95	0.54	0.40	1.72	0.42	0.46	0.36
H ₂ O-	0.15	0.09	0.26	0.33	0.17	0.04	0.03
CO ₂	<0.05	<0.05	<0.05	0.04	<0.05	<0.05	<0.05
rest	0.12	0.15	0.12	0.12	0.11	0.12	0.11
O=S							
Total	99.90	99.91	99.91	99.83	100.01	100.16	100.27
Trace elements							
Ba	235	255	275	335	285	320	315
Rb	15.2	16.2	16.0	22.5	12.2	21.0	20.5
Sr	300	278	279	246	320	255	267
Zr	82	85	88	118	59	111	110
Nb	<1	1	<1	2	<1	1	?
Y	28	26	27	34	16	33	33
La	6	6	7	8	5	8	6
Ce	14	16	17	20	15	24	21
Nd	9	8	9	11	6	11	11
Sc	27	23	20	17	13	19	18
V	92	193	82	21	48	38	19
Cr	<1	8	2	2	4	2	2
Ni	1	4	<1	<1	<1	<1	<1
Cu	4	106	21	4	19	9	5
Zn	102	82	75	95	47	83	95
Ga	15.5	14.5	13.5	13.5	13.5	13.5	13.5

9. 53NG1054. LV036561. Outer part of bomb in pyroclastic succession at eastern end of Lolobau Island. Plag < 1, Cpx < 1, FeTi < 1.
10. 53NG1049. KV991535. Boulder alongside southern edge of early 20th-century lava flow on northern shore of Namor Lake. Plag 14, Cpx 2, Opx 1, FeTi 1.
11. 53NG0819B. KV955522. Boulder from volcanic rudite on southern coast of Lolobau Island. Plag 9, Cpx 2, Opx 1, FeTi 1.
12. 53NG0814C. KV906556. Pumice layer overlying sample F7/5. No modal analysis.
13. 53NG1058A. KV837581. Lava in gully on eastern side of Banban Island. Plag 14, Cpx 2, Opx < 1, FeTi 1.
14. 53NG1051. KV985585. Block on northern tip of Lolobau caldera rim where it disappears beneath Mount Lolobau. Plag 5, Cpx 1, Opx < 1, FeTi < 1.
15. 53NG2526A. KV981565. Block on Malo cinder cone on Lolobau caldera floor east of Mount Lolobau. Plag 7, Cpx 1, Opx < 1, FeTi < 1.

TABLE Gsl. Mounts Garbuna and Welcker

	1	2	3	4	5	6	7	8
SiO ₂	57.25	59.6	61.5	61.6	62.7	67.0	68.5	68.62
TiO ₂	0.60	0.44	0.47	0.50	0.49	0.55	0.54	0.40
Al ₂ O ₃	16.52	15.3	15.5	15.7	15.3	14.9	14.6	14.09
Fe ₂ O ₃	4.36	2.95	3.25	3.15	2.75	2.90	1.80	1.34
FeO	4.45	4.00	3.20	3.55	3.40	1.85	2.15	2.50
MnO	0.18	0.13	0.12	0.13	0.12	0.09	0.09	0.09
MgO	3.75	4.15	3.45	3.30	3.20	1.48	1.27	1.62
CaO	7.78	7.40	6.70	6.55	6.20	4.00	3.60	3.75
Na ₂ O	2.96	2.65	2.80	2.75	2.90	3.50	3.75	3.57
K ₂ O	1.40	1.62	1.91	1.85	1.90	2.75	2.80	2.68
P ₂ O ₅	0.13	0.10	0.13	0.13	0.11	0.16	0.16	0.10
S	0.02							0.01
H ₂ O+	0.40	1.20	0.34	0.22	0.03	0.35	0.07	0.13
H ₂ O-	0.10	0.30	0.20	0.16	0.53	0.37	0.19	0.05
CO ₂	0.05	0.10	<0.05	0.02	0.05	<0.05	<0.05	0.15
rest	0.16	0.16	0.16	0.16	0.16	0.16	0.15	0.14
	100.11							
O=S	0.01							
Total	100.10	100.10	99.73	99.77	99.84	100.06	99.67	99.24
Trace elements								
Ba	210	235	275	270	295	365	390	380
Rb	15.0	21.5	26.5	25.0	28.0	37.0	41.0	36.0
Sr	565	412	430	447	393	430	406	335
Zr	45	67	79	77	84	106	117	108
Nb	<1	<1	<1	2	1	2	1	1
Y	14	20	16	16	18	22	20	18
La		10	8	9	10	10	11	10
Ce	16	22	20	23	21	29	29	25
Nd	8	10	10	11	11	12	13	11
Sc	22	26	21	23	21	14	12	11
V	186	175	157	168	149	92	60	61
Cr	15	49	42	32	31	6	5	26
Ni	9	16	15	13	11	4	<1	6
Cu	70	80	69	66	74	65	24	26
Zn	60	64	58	60	59	61	56	40
Ga	15.0	14.0	13.0	13.5	13.5	12.0	13.0	12.0

Samples 1 and 8 and their major-element analyses supplied by VOR.

1. 75710022. JU704974. Fine-grained lava (possibly a xenolith) in lava represented by sample Gsl/8, at southern edge of modern coulée on Mount Garbuna. Plag 34.5, Oliv < 0.5, Cpx 13.5, Opx 2, FeTi 4.5.
2. 51NG4004C. HQ285002. Boulder in stream close to road south of Garu village near coast, west of Mount Welcker. Plag 26, Oliv < 1, Cpx 5, Opx 1, FeTi 1.
3. 51NG3063. JU765997. Lava flow in coastal outcrop north of Kilu village, east of Mount Welcker. Plag 26, Oliv < 1, Cpx 10, Opx 4, FeTi 1.
4. 51NG0145B. JU709974. Boulder in thermal area east of summit of Mount Garbuna. Plag 28, Cpx 6, Opx 3, FeTi 1.
5. 51NG3065. JV740050. Lava flow in coastal outcrop southeast of Garili village, northeast of Mount Welcker. Plag 23, Oliv < 1, Cpx 5, Opx 2, FeTi 1.
6. 51NG0262. JV705004. Boulder on eastern rim of summit crater of Mount Welcker. Plag 8, Cpx 1, Opx < 1, FeTi < 1.
7. 51NG3064. JV752033. Lava flow in coastal outcrop north of Patanga village northeast of Mount Welcker. Plag 7, Cpx < 1, Opx < 1, Amph < 1, FeTi < 1.
8. 75710023. JU704974. Lava at southern edge of modern coulée on Mount Garbuna. Plag 18.5, Oliv 0.5, Cpx 3, Opx 1, Amph 0.5, Qtz < 0.5, FeTi 1.

TABLE Gs2. Mount Bagum

	1	2	3	4	5	6	7
SiO ₂	50.9	59.0	60.6	61.7	61.8	62.0	62.4
TiO ₂	0.52	0.51	0.59	0.51	0.50	0.51	0.52
Al ₂ O ₃	15.6	16.9	15.7	15.3	15.1	15.1	15.4
Fe ₂ O ₃	5.20	3.15	3.35	2.95	3.10	2.05	3.05
FeO	4.85	3.90	3.65	3.75	3.65	3.80	3.25
MnO	0.18	0.13	0.13	0.13	0.12	0.11	0.11
MgO	6.90	3.40	3.25	3.40	3.40	2.95	2.85
CaO	11.7	6.70	6.80	6.80	6.55	6.15	6.10
Na ₂ O	1.69	2.90	3.00	2.90	2.95	2.85	3.00
K ₂ O	0.62	1.34	1.90	1.77	2.05	2.10	2.05
P ₂ O ₅	0.11	0.14	0.15	0.13	0.14	0.13	0.13
S							
H ₂ O+	0.82	1.07	0.09	0.20	0.29	1.55	0.91
H ₂ O-	0.48	0.59	0.47	0.32	0.15	0.26	0.45
CO ₂	0.05	0.05	0.05	0.05	0.06	0.09	<0.05
rest	0.18	0.17	0.17	0.16	0.16	0.15	0.16
O=S							
Total	99.80	99.95	99.90	100.07	100.02	99.80	100.38
Trace elements							
Ba	130	365	320	280	275	290	310
Rb	8.6	8.8	25.5	25.0	25.5	26.0	28.0
Sr	560	488	500	465	466	431	453
Zr	31	83	73	77	78	83	86
Nb	<1	1	2	1	<1	2	1
Y	13	18	15	16	17	16	18
La	6	10	8	10	9	9	9
Ce	15	26	17	22	20	24	23
Nd	9	11	9	10	11	10	11
Sc	42	17	20	23	22	19	20
V	269	129	166	162	166	137	153
Cr	69	17	24	27	29	20	18
Ni	34	8	13	11	13	6	7
Cu	68	71	28	75	79	45	48
Zn	67	53	60	58	61	53	58
Ga	13.5	15.5	13.5	13.5	13.5	13.0	14.0

1. 51NG2707A. HQ216093. Coarse-grained xenolith in lava flow represented by sample Gs2/6 at Cape Schellong on western flank. Total grain count: Plag 38, Oliv < 1, Cpx 36, Opx 1, FeTi 2, interstitial material 23.
2. 51NG2708. HQ222097. Lava flow in coastal outcrop on western flank, northeast of Cape Schellong. Plag 26, Cpx 10, Opx 2, FeTi 2.
3. 51NG2709. HQ231111. Lava flow in coastal outcrop on northwestern flank, south of Minda village. Plag 23, Cpx 9, Opx 2, Qtz < 1, FeTi 2.
4. 51NG2713C. HQ225080. Boulder in stream draining western flank, southeast of Bagum village. Plag 20, Oliv < 1, Cpx 8, Opx 7, FeTi 2.
5. 51NG2713A. HQ225080. Boulder in stream draining western flank, southeast of Bagum village. Plag 26, Oliv < 1, Cpx 7, Opx 2, FeTi 1.
6. 51NG2707B. HQ216093. Lava flow in coastal outcrop at Cape Schellong on western flank. Plag 27, Oliv < 1, Cpx 7, Opx 1, FeTi 1.
7. 51NG2714C. HQ238129. Boulder at coast on northwestern flank. Plag 22, Cpx 7, Opx 2, FeTi 1.

TABLE Gs3. Garua Harbour area

	1	2	3	4
SiO ₂	57.1	72.19	75.33	75.6
TiO ₂	0.50	0.33	0.27	0.27
Al ₂ O ₃	13.2	12.62	12.58	12.8
Fe ₂ O ₃	3.50	3.14	1.58	0.33
FeO	3.85	1.12	0.88	0.84
MnO	0.14	0.05	0.07	0.07
MgO	7.35	0.58	0.24	0.26
CaO	9.05	2.07	1.25	1.22
Na ₂ O	2.35	3.45	4.02	3.95
K ₂ O	1.26	3.70	3.82	3.85
P ₂ O ₅	0.11	0.02	0.02	0.03
S				
H ₂ O+	0.45	0.56	0.31	0.56
H ₂ O-	0.79	0.24	0.09	0.02
CO ₂	0.10			<0.05
rest	0.21	0.16	0.16	0.12

G=S

Total	99.96	100.23	100.62	99.92
-------	-------	--------	--------	-------

Trace elements

Ba	215	575	645	480
Rb	17.4	60	55	55
Sr	394	245	200	206
Zr	54	160	150	150
Nb	<1	10	<5	2
Y	16	20	20	21
La	6	20	20	13
Ce	16	35	50	30
Nd	9	15	20	14
Sc	32			5
V	185	30	35	6
Cr	387	5	5	4
Ni	83	30	40	<1
Cu	74	25	20	3
Zn	63	35	40	38
Ga	11.5	10	10	10.5

Analyses for samples 2 and 3 from Lowder & Carmichael (1970).

1. 51NG0255. JV723127. Lava flow on headland east of wharf at Talasea. Plag 8, Oliv 4, Cpx 10, Opx 1, Qtz < 1, FeTi < 1.
2. 279B. JV767200. Lava from cumulodome making up Little Malumalu Island, southeast of Mount Lotomgan. Plag 10, Cpx < 1, Opx < 1, Amph 2, Biot < 1, Qtz < 1, FeTi < 1.
3. 343. JV699139. Lava in roadside outcrop 3 km west of Talasea. Obsidian virtually free of visible crystals.
4. 51NG0271. JV709134. Lava in roadside outcrop near Bitokara. Obsidian virtually free of visible crystals.

TABLE Gnl. Northern half of Willaumez Peninsula

	1	2	3	4	5	6	7	8
SiO ₂	51.40	51.57	52.42	53.5	53.83	58.22	58.56	58.60
TiO ₂	0.75	0.80	0.73	0.71	1.01	0.94	0.87	0.89
Al ₂ O ₃	16.87	15.91	14.91	15.8	15.42	15.62	15.09	15.38
Fe ₂ O ₃	6.35	2.74	2.30	3.55	5.00	2.15	2.16	2.22
FeO	3.74	7.04	7.16	5.80	6.74	6.80	6.75	6.71
MnO	0.14	0.17	0.18	0.18	0.20	0.19	0.19	0.18
MgO	6.42	6.73	7.42	6.05	4.36	3.12	3.10	3.22
CaO	10.88	11.74	10.84	10.8	8.83	7.05	6.95	7.02
Na ₂ O	2.25	2.41	2.36	2.40	2.99	3.70	3.70	3.84
K ₂ O	0.70	0.44	0.80	0.51	0.92	1.35	1.33	1.46
P ₂ O ₅	0.24	0.11	0.17	0.14	0.21	0.25	0.25	0.25
S						0.02	0.01	
H ₂ O+	0.54	0.35	0.73	0.34	0.44	0.23	0.14	0.30
H ₂ O-	0.07	0.10	0.14	0.17	0.10	0.03	0.02	0.07
CO ₂				0.16		0.05	0.05	
rest	0.21	0.19	0.23	0.17	0.22	0.17	0.17	0.20
						99.89		
O=S						0.01		
Total	100.56	100.30	100.39	100.28	100.27	99.88	99.34	100.34
Trace elements								
Ba	220	150	255	100	245	210	210	345
Rb	5	5	15	5.2	15	15.2	16.0	15
Sr	540	355	300	446	480	414	412	395
Zr	30	30	40	31	55	76	78	75
Nb	<5	<5	<5	<1	5	1	<1	5
Y	10	5	20	15	25	29	28	20
La	10	15	20	5	20	9	8	25
Ce	40	35	40	12	40	22	23	45
Nd	20	15	20	8	20	12	12	25
Sc				35		25	26	
V	305	275	340	285	300	222	227	235
Cr	90	125	305	55	<5	15	15	15
Ni	75	100	105	38	55	9	10	70
Cu	140	175	155	140	235	122	130	155
Zn	75	80	75	75	115	96	99	100
Ga	10	15	10	14.5	15	15.5	16.0	15

Analyses for samples 1-3, 5, 8, 10-12, and 14, from Lowder & Carmichael (1970). Samples 6 and 7 and their major-element analyses supplied by VOR.

1. 263. JV735255. Lava flow on northern flank of Mount Luligi. Plag 26, Oliv 1, Cpx 5.
2. 311. JV772373. Lava flow on southern slope of wedge of ancestral mountain, north of Mount Langalanga. Plag 3, Cpx 3.
3. 296B. JV794425. Lava flow on western scarp of Mount Benda about 50 m above and to the east of shoreline of Lake Dakataua. Plag 5, Oliv 2, Cpx 5.
4. 51NG0259. JV820378. Boulder from southern wall of the more easterly of the breached twin craters at southeastern corner of Lake Dakataua. Plag 9, Oliv 1, Cpx 7.
5. 339. JV751458. Lava flow in coastal outcrop forming small peninsula 3 km west of Cape Hollmann. Plag < 1, Cpx < 1, Opx < 1, FeTi < 1.
6. 75710026. JV791403. Late 19th-century lava flow from Mount Malala, about 500 m east of source area. Plag 17.5, Cpx 6, Opx 1, FeTi 0.5.
7. 75710018. JV787404. Lava at source area of late 19th-century lava flow from Mount Malala. Plag 18.5, Cpx 4, Opx 0.5, FeTi 1.
8. 114. JV799397. Late 19th-century lava flow from Mount Malala, from front of southeastern lobe. Plag 20, Cpx 3, Opx 3, FeTi 2.

continued on next frame.

TABLE Gnl. Northern half of Willaumez Peninsula (continued)

	9	10	11	12	13	14	15
SiO ₂	58.8	58.93	63.39	66.34	66.7	66.91	67.2
TiO ₂	0.86	0.62	0.74	0.71	0.73	0.53	0.68
Al ₂ O ₃	15.6	16.87	15.15	14.63	14.6	14.50	14.4
Fe ₂ O ₃	2.35	2.71	2.12	1.63	1.98	1.04	1.45
FeO	6.50	4.51	4.48	3.77	3.15	4.04	3.53
MnO	0.18	0.16	0.14	0.14	0.14	0.14	0.13
MgO	3.15	2.92	2.22	1.48	1.46	1.29	1.31
CaO	6.90	6.87	5.33	4.04	3.75	3.76	3.75
Na ₂ O	3.70	3.68	4.07	4.50	4.40	4.65	4.50
K ₂ O	1.26	1.63	1.89	2.14	2.00	2.22	2.15
P ₂ O ₅	0.25	0.20	0.21	0.21	0.25	0.11	0.24
S							
H ₂ O+	<0.01	0.86	0.32	0.35	0.75	0.58	0.08
H ₂ O-	0.22	0.15	0.06	0.12	0.17	0.06	0.18
CO ₂	0.05				0.14		0.05
rest	0.17	0.18	0.15	0.14	0.13	0.14	0.13
O=S							
Total	99.99	100.29	100.27	100.20	100.35	99.97	99.80
Trace elements							
Ba	205	320	350	350	300	335	305
Rb	15.4	20	20	25	28.0	25	28.0
Sr	409	525	285	270	279	275	280
Zr	75	70	90	115	123	130	127
Nb	1	5	<5	<5	1	<5	2
Y	28	15	20	25	35	30	36
La	9	15	25	15	11	15	11
Ce	23	30	40	35	28	35	30
Nd	13	20	15	20	17	25	16
Sc	26				16		15
V	233	200	125	40	52	65	49
Cr	14	<5	5	5	21	<5	2
Ni	8	30	50	75	<1	45	2
Cu	130	80	90	70	21	35	26
Zn	97	75	75	90	87	90	87
Ga	16.5	10	15	15	14.0	15	14.5

9. 51NG0257. JV801391. Late 19th-century lava flow from Mount Malala, from end of southeastern lobe at lake level. Plag 22, Cpx 6, Opx 2, FeTi 1.
10. 341. HQ323316. Lava flow in coastal outcrop at Cape Goltz on western flank of Mount Wangore (Bola). Plag 28, Cpx 5, Opx 5, FeTi 3.
11. 308. JV745426. Lava flow at northern end of island off western shore of Lake Dakataua. Plag 10, Cpx 3, Opx 2, FeTi 1.
12. 306. JV741411. Lava flow at southern end of island off western shore of Lake Dakataua. Plag 2, Cpx 1.
13. 51NG0258A. JV818784. Highly vesicular clast from volcanic rudite in northern wall of the more easterly of the breached twin craters at southeastern corner of Lake Dakataua. No modal analysis.
14. 319. JV817383. Lava flow in northern wall of the more easterly of the breached twin craters at southeastern corner of Lake Dakataua. Plag 6, Cpx 1, Opx < 1, Biot < 1, FeTi < 1.
15. 51NG0256. JV808383. Lava flow in lakeside outcrop at western end of peninsula extending westwards into Lake Dakataua. Plag 4, Cpx 2, Opx < 1, FeTi < 1.

TABLE Gn2. Kimbe Island

	1	2	3	4	5
SiO ₂	49.2	51.1	51.1	52.6	66.1
TiO ₂	0.52	0.67	0.69	0.76	0.51
Al ₂ O ₃	15.3	18.5	18.5	18.6	15.1
Fe ₂ O ₃	2.55	3.80	3.60	3.60	3.35
FeO	6.70	5.50	6.10	5.75	1.78
MnO	0.18	0.16	0.16	0.15	0.11
MgO	10.1	5.75	5.15	4.50	1.79
CaO	13.0	10.6	10.5	9.85	4.75
Na ₂ O	1.51	2.25	2.35	2.75	4.05
K ₂ O	0.19	0.43	0.42	0.40	1.03
P ₂ O ₅	0.06	0.07	0.07	0.09	0.12
S					
H ₂ O+	0.60	0.60	0.27	0.21	0.55
H ₂ O-	0.23	0.34	0.17	0.61	0.51
CO ₂	<0.05	0.06	<0.05	0.10	0.06
rest	0.19	0.15	0.15	0.15	0.12

O=S

Total	100.33	99.98	100.03	100.12	99.93
-------	--------	-------	--------	--------	-------

Trace elements

Ba	30	65	70	85	180
Rb	1.2	4.0	3.4	3.8	10.0
Sr	228	382	385	400	286
Zr	21	20	23	30	102
Nb	<1	<1	<1	<1	1
Y	13	11	12	14	31
La	1	4	4	4	6
Ce	4	6	7	11	19
Nd	4	4	5	4	11
Sc	42	36	36	31	16
V	258	284	277	258	93
Cr	386	59	59	23	14
Ni	119	30	31	17	12
Cu	127	66	87	102	27
Zn	65	74	73	70	86
Ga	12.5	17.0	15.5	17.0	15.0

1. 51NG0246. KV090238. Boulder on western coast of island. Plag < 1, Oliv < 1, Cpx < 1, Opx < 1, FeTi < 1.
2. 51NG0248. KV089240. Boulder on northwestern coast of island. Plag 29, Oliv 3, Cpx 6, Opx < 1, FeTi < 1.
3. 51NG0250A. KV093240. Boulder on northeastern coast of island. Plag 35, Oliv 1, Cpx 4, Opx 2, FeTi < 1.
4. 51NG0242. KV093236. Boulder on southeastern coast of island. Plag 29, Oliv 1, Cpx 2, Opx 2, FeTi < 1.
5. 51NG0245A. KV090236. Boulder on southwestern coast of island. Plag 14, Cpx 1, Opx < 1, FeTi < 1.

TABLE H1. Unea Island

	1	2	3	4	5	6	7	8
SiO ₂	50.4	50.5	53.7	53.7	56.1	57.5	58.0	59.5
TiO ₂	0.80	0.68	0.58	1.07	0.90	1.14	0.53	0.80
Al ₂ O ₃	19.5	15.4	15.3	16.1	16.6	15.6	16.6	15.4
Fe ₂ O ₃	2.70	3.60	2.35	5.30	4.15	5.15	3.05	3.70
FeO	6.60	5.60	6.00	5.00	4.60	4.25	4.10	4.05
MnO	0.16	0.17	0.15	0.18	0.16	0.13	0.18	0.17
MgO	4.45	8.55	6.95	4.80	3.40	2.40	4.00	2.80
CaO	11.2	12.1	10.2	9.20	7.35	5.75	7.35	5.65
Na ₂ O	2.65	2.05	2.75	3.05	3.85	3.75	3.65	4.00
K ₂ O	0.59	0.41	1.12	0.93	1.64	1.78	1.72	2.30
P ₂ O ₅	0.15	0.09	0.17	0.23	0.28	0.40	0.23	0.28
S								
H ₂ O+	0.54	0.37	0.30	0.15	0.32	0.77	0.03	0.50
H ₂ O-	0.18	0.17	0.02	0.31	0.28	1.04	0.15	0.52
CO ₂	0.05	<0.05	<0.05	0.07	0.05	0.03	<0.05	0.05
rest	0.16	0.17	0.18	0.20	0.17	0.18	0.17	0.16
O=S								
Total	100.13	99.76	99.77	100.29	99.85	99.87	99.76	99.88
Trace elements								
Ba	80	60	115	115	175	205	175	230
Rb	8.6	4.8	17.6	14.8	17.8	26.0	30.5	34.5
Sr	520	319	406	358	416	404	465	325
Zr	48	40	76	88	113	130	113	163
Nb	2	1	2	3	4	4	3	5
Y	18	16	19	27	32	42	23	40
La	6	4	9	9	12	17	13	16
Ce	17	10	22	23	29	37	29	38
Nd	9	6	11	13	17	22	14	20
Sc	25	41	28	35	28	28	19	20
V	241	252	198	316	235	247	161	147
Cr	15	201	194	23	11	5	44	20
Ni	18	75	57	25	9	4	19	9
Cu	77	82	76	354	106	86	108	58
Zn	70	64	61	93	86	108	61	74
Ga	17.0	13.5	14.5	16.0	17.0	17.0	15.5	16.5

1. 48NG0022. H485615. Boulder on northern side of Duaga Island (islet off east-northeastern coast). Total grain count: Plag 61, Oliv 3, Cpx 11, FeTi 1, interstitial material 24.
2. 48NG0006. H464626. Block on northeastern rim of caldera. Plag 12, Oliv 9, Cpx 13.
3. 48NG0500. H433571. Lava flow in coastal outcrop at Bali Harbour wharf. Plag 17, Oliv 3, Cpx 14, Opx 1, FeTi 1.
4. 48NG0013. H408597. Lava flow in coastal outcrop on western side of island. Plag 1, Cpx < 1, FeTi < 1.
5. 48NG0509. H467590. Boulder on southeastern flank of Tamangoni volcano. Plag 7, Oliv < 1, Cpx 2, Opx < 1, FeTi < 1.
6. 48NG0020. H469626. Lava flow in coastal outcrop on northeastern side of island. Plag < 1, Cpx < 1, FeTi < 1.
7. 48NG0505. H451605. Lava flow on eastern flank of Kumbu volcano. Plag 28, Oliv 1, Cpx 7, Opx 1, FeTi 1.
8. 48NG0520. H459577. Lava flow in coastal outcrop on southeastern side of island. Plag 19, Oliv < 1, Cpx 6, Opx 1, FeTi 1.

continued on next frame.

TABLE H1. Unea Island (continued)

	9
SiO ₂	60.1
TiO ₂	0.36
Al ₂ O ₃	16.4
Fe ₂ O ₃	3.15
FeO	3.30
MnO	0.14
MgO	3.15
CaO	6.25
Na ₂ O	4.00
K ₂ O	1.91
P ₂ O ₅	0.25
S	
H ₂ O+	0.27
H ₂ O-	0.27
CO ₂	0.05
rest	0.16

O=S

Total 99.76

Trace elements

Ba	200
Pb	34.5
Sr	468
Zr	126
Nb	4
Y	25
La	15
Ce	33
Nd	15
Sc	16
V	128
Cr	32
Ni	13
Cu	75
Zn	56
Ga	15.0

9. 48NG0523. H438618. Lava flow just inland from Tamk ram Bay. Plag 31, Oliv 1, Cpx 5, Opx 1, FeTi < 1.

TABLE H2. Garove Island

	1	2	3	4	5	6	7	8
SiO ₂	49.7	52.6	52.6	53.7	54.9	55.2	55.4	63.4
TiO ₂	0.85	1.42	1.43	1.54	1.75	1.55	1.38	1.29
Al ₂ O ₃	16.5	15.7	16.3	15.1	15.0	15.6	16.4	15.0
Fe ₂ O ₃	1.55	2.10	1.80	3.95	4.90	2.95	3.00	1.80
FeO	7.65	8.10	8.45	7.95	6.70	8.10	6.10	5.30
MnO	0.18	0.20	0.20	0.24	0.23	0.21	0.20	0.17
MgO	7.95	5.50	5.30	4.15	3.80	3.45	4.35	1.79
CaO	12.9	10.5	9.80	7.90	7.35	7.30	8.10	4.40
Na ₂ O	2.00	3.05	3.00	3.60	3.80	4.10	3.80	4.95
K ₂ O	0.20	0.41	0.41	0.45	0.51	0.88	0.53	1.29
P ₂ O ₅	0.08	0.16	0.16	0.19	0.25	0.22	0.17	0.39
S								
H ₂ O+	0.01	0.07	0.04	0.43	0.03	0.20	<0.01	0.13
H ₂ O-	0.33	0.19	0.20	0.55	0.31	0.20	0.16	0.21
CO ₂	0.05	<0.05	0.05	<0.05	0.05	0.03	0.10	0.02
rest	0.13	0.14	0.14	0.16	0.15	0.15	0.13	0.12
O=S								
Total	100.08	100.14	99.88	99.91	99.73	100.14	99.82	100.26
Trace elements								
Ba	30	60	55	70	85	100	95	150
Rb	3.0	6.0	6.2	5.4	6.4	7.0	7.6	16.0
Sr	211	203	213	231	245	257	210	184
Zr	42	97	98	106	120	120	130	264
Nb	2	3	4	3	5	5	4	10
Y	17	30	30	34	42	41	37	65
La	4	6	7	7	8	7	9	15
Ce	10	16	15	19	21	25	27	43
Nd	5	12	10	12	14	14	14	24
Sc	37	36	32	37	34	34	24	16
V	261	301	294	351	325	306	194	49
Cr	96	50	38	9	7	5	22	<1
Ni	61	27	24	12	5	4	18	<1
Cu	60	56	50	127	20	51	25	5
Zn	67	90	89	105	114	109	87	104
Ga	14.0	17.0	17.5	17.5	19.5	19.0	18.5	19.0

1. 48NG0572. H886797. Block in volcanic rudite in coastal outcrop at Island Cape. Plag < 1, Oliv < 1.
2. 48NG0033. H790815. Lava flow in coastal outcrop at Langu Anchorage. Plag 5, Oliv 1, Cpx 1, Opx < 1, FeTi < 1.
3. 48NG0036. H780851. Lava flow in coastal outcrop on northeastern side of Papua Bay. Plag 7, Oliv < 1, Cpx 3.
4. 48NG0537. H813833. Dyke on southwestern shore of Johann Albrecht Harbour. Plag < 1, Cpx < 1.
5. 48NG0556. H854810. Lava flow in coastal outcrop at East Entrance Cape. Plag < 1, Oliv < 1, Cpx < 1, FeTi < 1.
6. 48NG0538. H810838. Block on western shore of Johann Albrecht Harbour, derived from lava flow in upper part of caldera wall. Plag < 1, Cpx < 1, FeTi < 1.
7. 48NG0559. H838818. Coarse-grained xenolith in lava flow in coastal outcrop north-northeast of West Entrance Cape. Total grain count: Plag 74, Oliv < 1, Cpx + Opx 21, FeTi 3, interstitial material 2.
8. 48NG0549. H851835. Lava flow at eastern end of island off eastern shore of Johann Albrecht Harbour. Plag 9, Cpx 1, Opx 1, FeTi < 1.

continued on next frame.

TABLE H2. Garove Island (continued)

	9	10	11	12
SiO ₂	63.9	64.6	64.9	70.3
TiO ₂	1.28	1.20	1.25	0.66
Al ₂ O ₃	14.3	14.6	14.3	13.4
Fe ₂ O ₃	1.25	1.60	1.40	0.90
FeO	5.60	4.80	4.75	3.00
MnO	0.19	0.19	0.20	0.15
MgO	1.69	1.85	1.51	0.73
CaO	4.50	4.10	4.05	2.60
Na ₂ O	5.15	5.10	5.50	5.70
K ₂ O	1.21	1.25	1.21	1.68
P ₂ O ₅	0.39	0.27	0.34	0.14
S				
H ₂ O+	<0.01	<0.01	<0.01	0.11
H ₂ O-	0.19	0.30	0.19	0.25
CO ₂	<0.05	<0.05	<0.05	<0.05
rest	0.13	0.13	0.13	0.12
O=S				
Total	99.78	99.99	99.73	99.74

Trace elements

Ba	165	160	160	215
Rb	20.0	20.5	19.2	26.0
Sr	170	163	177	129
Zr	298	273	286	307
Nb	11	10	11	12
Y	69	50	67	62
La	15	14	14	17
Ce	44	40	44	48
Nd	28	23	26	25
Sc	17	13	16	13
V	52	66	42	11
Cr	<1	11	1	1
Ni	<1	5	<1	<1
Cu	9	17	6	4
Zn	106	86	104	83
Ga	19.0	18.5	19.0	16.0

9. 48NG0034. H828809. Lava flow in coastal outcrop just west of West Entrance Cape. Plag 3, Cpx 1, Opx < 1, FeTi < 1.
10. 48NG0526. H818827. Lava flow on southwestern shore of Johann Albrecht Harbour. Plag 16, Oliv < 1, Cpx 3, Opx 1, FeTi 2.
11. 48NG0028. H836813. Lava flow in coastal outcrop north-northeast of West Entrance Cape. Plag 8, Cpx 1, Opx < 1, FeTi < 1.
12. 48NG0532. H826823. Lava flow on southwestern shore of Johann Albrecht Harbour. Plag 14, Cpx 1, Opx < 1, FeTi < 1.

TABLE H3. Narega, Wambu, Undaka, and Mundua Islands

	1	2	3	4	5	6	7	8
SiO ₂	47.5	48.6	49.2	49.2	49.6	49.9	51.7	51.8
TiO ₂	0.95	1.91	1.15	1.14	1.11	1.01	0.99	1.03
Al ₂ O ₃	18.4	15.9	14.4	15.0	15.9	16.6	16.9	17.2
Fe ₂ O ₃	6.20	2.40	1.40	3.45	2.30	2.30	2.95	2.95
FeO	3.80	8.85	8.10	6.05	6.85	6.30	5.75	5.85
MnO	0.19	0.19	0.18	0.18	0.18	0.17	0.18	0.18
MgO	5.80	7.35	10.8	11.3	10.3	9.15	6.45	5.95
CaO	12.6	11.0	11.4	10.8	10.8	11.1	10.9	10.6
Na ₂ O	2.30	2.65	2.15	2.20	2.35	2.40	2.50	2.55
K ₂ O	0.72	0.16	0.19	0.25	0.24	0.21	0.75	0.83
P ₂ O ₅	0.37	0.21	0.11	0.11	0.12	0.10	0.18	0.19
S								
H ₂ O+	0.37	0.52	0.28	<0.01	0.18	0.17	0.35	0.36
H ₂ O-	0.39	0.25	0.20	0.27	0.12	0.33	0.15	0.16
CO ₂	0.05	0.30	0.05	0.05	<0.05	<0.05	0.05	<0.05
rest	0.20	0.19	0.21	0.23	0.20	0.18	0.16	0.16
O=S								
Total	99.84	100.48	99.82	100.23	100.25	99.92	99.96	99.81
Trace elements								
Ba	80	45	30	30	35	25	90	100
Rb	6.6	2.8	2.4	3.6	3.0	3.0	12.6	14.2
Sr	730	213	187	174	198	189	346	375
Zr	64	123	69	68	67	58	71	72
Nb	1	6	3	3	3	1	3	3
Y	18	31	21	21	20	21	21	21
La	21	9	4	3	6	3	6	8
Ce	54	25	12	10	11	11	19	17
Nd	26	14	8	7	8	6	10	10
Sc	23	36	33	34	33	35	31	29
V	276	323	230	234	228	225	246	247
Cr	20	237	535	635	457	381	59	31
Ni	31	89	196	227	170	152	50	38
Cu	116	74	86	81	88	73	128	116
Zn	68	90	71	70	67	68	66	69
Ga	18.0	19.0	15.5	14.5	15.5	15.0	15.5	16.0

1. 48NG0048A. H405987. Lava flow in coastal outcrop on northwestern side of Narega Island. Plag 40, Oliv 3, Cpx 4, FeTi < 1.
2. 48NG0042. H614877. Lava flow in coastal outcrop on southern side of Wambu Island. Plag 7, Oliv 4, FeTi < 1.
3. 48NG0038A. H610905. Block in volcanic rudite at southeastern end of Undaka Island. Plag < 1, Oliv 7.
4. 48NG0582. H706909. Lava flow in coastal outcrop on northern coast at eastern end of Mundua Island. Oliv 10.
5. 48NG0044. H605887. Lava flow on islet off northeastern coast of Wambu Island. Oliv 9, FeTi < 1.
6. 48NG0592. H691894. Lava flow in coastal outcrop on southern coast of Mundua Island. Plag 13, Oliv 7, Cpx 2, FeTi < 1.
7. 48NG0605. H668905. Lava flow in coastal outcrop on northern coast at western end of Mundua Island. Plag 14, Oliv 1, Cpx 8.
8. 48NG0601. H660894. Lava flow in coastal outcrop on southern coast at western end of Mundua Island. Plag 6, Oliv 1, Cpx < 1.

REFERENCES

- BLAKE, D.H., & EWART, A., 1974 - Petrography and geochemistry of the Cape Hoskins volcanoes, New Britain, Papua New Guinea. Journal of the Geological Society of Australia, 21, 319-31.
- JOHNSON, R.W., 1970a - Ulawun volcano, New Britain: geology, petrology, and eruptive history between 1915 and 1967. Bureau of Mineral Resources, Australia, Record 1970/21 (unpublished).
- JOHNSON, R.W., 1970b - Likuruanga volcano, Lolobau Island, and associated volcanic centres, New Britain: geology and petrology. Bureau of Mineral Resources, Australia, Record 1970/42 (unpublished).
- JOHNSON, R.W., 1971 - Bamus volcano, Lake Hargy area, and Sulu Range, New Britain: volcanic geology and petrology. Bureau of Mineral Resources, Australia, Record 1971/55 (unpublished).
- JOHNSON, R.W., 1977 - Distribution and major-element chemistry of late Cainozoic volcanoes at the southern margin of the Bismarck Sea, Papua New Guinea. Bureau of Mineral Resources, Australia, Report 188.
- JOHNSON, R.W., & BLAKE, D.H., 1972 - The Cape Hoskins area, southern Willaumez Peninsula, the Witu Islands, and associated volcanic centres, New Britain: volcanic geology and petrology. Bureau of Mineral Resources, Australia, Record 1972/133 (unpublished).
- JOHNSON, R.W., DAVIES, R.A., & WHITE, A.J.R., 1972 - Ulawun volcano, New Britain. Bureau of Mineral Resources, Australia, Bulletin 142.

- JOHNSON, R.W., CHAPPELL, B.W., & TAYLOR, S.R., in prep. -
Volcanic rocks of the New Britain island arc: their trace
element geochemistry and petrogenetic significance.
- LOWDER, G.G., & CARMICHAEL, I.S.E., 1970 - The volcanoes and
caldera of Talasea, New Britain: geology and petrology.
Bulletin of the Geological Society of America, 81,
17-38.
- McKEE, C.O., 1977 - Petrography and optical mineralogy of recent
lavas from some volcanoes in Papua New Guinea. Geological
Survey of Papua New Guinea, Report 77/9 (unpublished).
- NORRISH, K., & CHAPPELL, B.W., 1977 - X-ray fluorescence
spectrometry. In ZUSSMAN, J., (Editor) - PHYSICAL METHODS
OF DETERMINATIVE MINERALOGY, 2nd edition. Academic Press,
London, 201-272.
- TAYLOR, S.R., & GORTON, M.P., 1977 - Geochemical application
of spark source mass spectrography - III. Element sensit-
ivity, precision and accuracy. Geochimica et Cosmochimica
Acta, 41, 1375-80.