

Andesite from Rumble III Volcano, Kermadec Ridge, Southwest Pacific

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In a programme of marine acoustic research KIBBLEWHITE (1966) discovered the existence of an active underwater volcano at the southwestern end of the Kermadec Ridge in a position about 250 kilometres east-northeast of Auckland, New Zealand. A bathymetric survey of the noise source area revealed a group of five separate topographic features which rise from an ocean basin depth of some 2,000 metres to within 120 metres of the surface. From the acoustic data, Kibblewhite has interpreted the form of volcanism as a series of explosive eruptions interspersed with emission of lava flows.

Present day eruptive activity is centred on the seamount named Rumble III, which is the southernmost member of the group, and dredging on its flanks provided a sample of volcanic sediment made available by Dr Kibblewhite and described here.

The debris is unsorted and consists entirely of disrupted lava; fresh, sharply angular basaltic andesite fragments of all sizes up to 6 cm carry plagioclase feldspar and rare olivine set in a glassy mesostasis. Fluxional and vesicular structures are characteristic in the glass base of most of the larger chips, although a few fragments like the analysed sample are more crystalline, with distinct vitreous selvages.

Olivine in equant euhedra (up to 0.6 mm) has a composition of $FO_{76}Fa_{24}$. Plagioclase forms phenocrysts (4 mm) with normal zoning from An_{82} in cores to An_{63} in thin outer rims; discrete unzoned crystals lie in the same composition range, but slender laths in the glassy groundmass are as sodic as An_{51} . Diopsidic augite, with composition near to $Ca_{40}Fe_{22}Mg_{38}$ is common as very pale green prismatic microphenocrysts. The brown glass ($n = 1.577$) is peppered with tiny ores.

The degree of crystallinity varies greatly from one rock fragment

to another and a mode taken from the analysed sample (10417) is as follows:

olivine	= 0.9	plagioclase phenocrysts	= 8.9
clinopyroxene	= 21.0	plagioclase groundmass	= 27.0
glass	= 30.5	ores	= 11.7

In the table of chemical analyses the Rumble III specimen is compared with related rock from Raoul Island, an older volcano of probable late Quaternary age further north on the Kermadec Ridge, and from the 1954 lava of Ngauruhoe volcano which lies within the North Island of New Zealand and on an alignment with the Kermadec Ridge.

Current research on Raoul and Macauley Islands on the ridge shows that, in common with the major central volcanoes of the North Island, the main eruptive centres along the Kermadec line are characterized by large volumes of basaltic andesite. On Raoul, minor but important quantities of olivine basalt both precede and follow the listed analysed sample (7104), and acidic rocks make a late appearance in the stratigraphic sequence. An interesting feature is that explosive magmatic processes appear now to be confined to the south end of the Kermadec Ridge, in contrast with phreatic eruptions at Raoul Island (HEALY *et al.*, 1965) and hydrothermal activity at Curtis Island; even within the newly-discovered southern groups of seamounts the Rumble III active member is again the most southerly. The possibility seems real for migration of volcanic activity along the Kermadec Ridge towards New Zealand.

References

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- KIBBLEWHITE, A. C., 1966 - *The acoustic detection and location of an underwater volcano*. N.Z.J. Sci., 9, 178-199.
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TABLE 1 - Chemical analyses and norms for andesites from Raoul Island, Rumble III and Ngauruhoe.

	Rumble III (10417)	Raoul Island (7104)	Ngauruhoe (GREGG, 1960)	
SiO ₂	52.1	52.25	55.9	
TiO ₂	1.2	1.4	0.76	
Al ₂ O ₃	16.2	14.6	16.9	
Fe ₂ O ₃	1.2	3.50	2.1	
FeO	9.0	10.81	6.3	
MnO	0.2	0.18	0.15	
MgO	5.4	5.2	5.2	
CaO	9.2	9.8	8.4	
Na ₂ O	2.2	1.6	2.6	
K ₂ O	0.5	0.4	1.0	
P ₂ O ₅	tr	0.12	0.10	
H ₂ O ⁺	2.0	0.9	tr	
H ₂ O ⁻	0.6	— *	0.06	
	99.8	100.76	99.47	
	C.I.P.W. norms			
Q	6.30	9.78	9.30	
or	2.78	2.22	6.12	
ab	18.34	16.62	22.01	
an	33.08	31.41	31.41	
wo	5.22	6.84	3.94	
di	en	2.53	3.20	2.23
	fs	2.59	3.56	1.53
by	en	10.97	9.8	10.77
	fs	11.26	11.35	7.42
	il	2.28	2.74	1.37
	mt	1.86	5.10	3.02
	ap	—	0.34	0.34

* sample oven-dried at 105° before analysis.

10417 = basaltic andesite, fragment dredged from Rumble Seamount III located 35°42'S, 178°29'E (KIBBLEWHITE, 1966); analyst T. H. WILSON.

7104 = basaltic andesite, upper lava flow at south end of Denham Bay, Raoul Island; analyst T. H. WILSON.

Ngauruhoe = andesite, lava erupted from Ngauruhoe on 30 June, 1954 (GREGG, 1960).

Manuscript received Jan. 19, 1967