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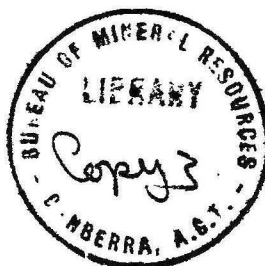
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DEPARTMENT OF NATIONAL DEVELOPMENT.  
BUREAU OF MINERAL RESOURCES  
GEOLOGY AND GEOPHYSICS.

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RECORDS.

1955/79



SUBMARINE VULCANISM EAST OF TULUMAN VOLCANO ST. ANDREW  
STRAIT ADMIRALTY ISLANDS OCTOBER-NOVEMBER, 1954.

by

M. A. Reynolds.

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(with additional information on Tulumán Volcano)

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1. INTRODUCTION:

As from 26th July, 1954, when activity at Tulumán Volcano was reported to be decreasing, there was a period of quiescence until 20th October, apart from one explosion on 3rd August. A signal received on 20th October from the Assistant District Officer, Baluan Patrol Post (Mr. E. G. Hicks) stated that submarine activity had commenced east of the Tulumán Volcano craters at 0910 hours, and that it consisted of considerable steam output with intermittent explosions and "ground rumblings". No change in the activity of the Tulumán craters was reported.

The writer departed Rabaul at 0700 hours on 23rd October and reached Baluan per Administration trawler "Poseidon" from Manus at midday on 24th October. Observations were maintained from the time of arrival until 7th November when the writer returned to Manus per workboat. Ground inspections on both Tulumán craters were conducted during this period, and some additional information on their condition is given in this report.

Previous activity in this area has been discussed in reports by Best,<sup>1</sup> and no further mention of it will be made here.

Negatives of photographs and Kodachrome transparencies obtained from the July and October 1954 investigations are kept at the Observatory, Rabaul.

11. LOCATION:

The point at which most of the extruded blocks appeared and explosions occurred was  $\frac{3}{4}$  to 1 mile east of the West Tulumán crater, and about  $\frac{1}{2}$  mile east-north-east of East Tulumán crater. The positions of West and East Tulumán craters and the position of the October-November activity were plotted on Chart Aus. 054 by the master of the "Poseidon" Mr. J. Kemsley. These locations are given hereunder:

	Lat. S.	Long. E.
West Tulumán Crater	002°26'25"	147°18'45"
East Tulumán Crater	002°26'50"	147°19'00"
Submarine Activity	002°26'25"	147°19'20"

These positions, however, are not in accordance with those determined with magnetic compass by Best and the writer during investigations in July and October respectively. Charts and maps of the area give different positions to the islands, and there are discrepancies in their outlines.

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1. "Report on Tulumán Volcano, St. Andrew Strait, Manus Sub-District," by J. G. Best.

Best <sup>1</sup> adopted the co-ordinates of the active focus of submarine activity determined by an officer of the M.V. "Bulold" in November 1953 as the co-ordinates of Tulumán Volcano. These were as follows:

Latitude 002°26.8'S., Longitude 147°19.1'E.

For the purposes of this report, a composite map has been constructed from Chart Aus. 054, "Admiralty Islands, Eastern Approaches" (March 1944), and map SL45-E14600/60x120, "Manus and Adjacent Islands," (scale: 1 inch equals 4 miles, prepared by the U.S. Army Corps of Engineers, 1944.) The positions of the Tulumán Volcano craters and submarine activity have been determined from magnetic compass bearings taken from Baluan Island and from West Tulumán crater.

Natives of Baluan Island stated that the submarine activity during October 1954 was in the same position as the original activity in June 1953; but this cannot be verified. Mr. Landman, A.D.O., Baluan, in July 1953 gave the position of the first outburst in a signal to the volcanologist as "approximately four miles north of Baluan in direction most southerly point Lou Island." This corresponds to the position of West Tulumán crater, and as the co-ordinates of submarine activity determined in November 1953 are approximately those of East Tulumán crater, it is more logical to assume that there has been a migration to the east of the centre of activity, and that the last eruption occurred in a new area.

#### 111. THE NATURE OF THE ACTIVITY:

The recrudescence of submarine vulcanism in St. Andrew Strait commenced at 0910 hours on the 20th October, 1954, at a point about  $\frac{1}{2}$  mile east-north-east of East Tulumán crater. At this time there was a succession of violent explosions with emissions of large volumes of steam and vapour. The initial activity was followed by similar explosions which decreased in intensity until the afternoon of 21st October when activity ceased. At 1500 hours on 22nd October activity of a mild nature recommenced, and continued until 5th November, when there was a decline in the intensity preceding the cessation on 6th November. It was during this second period that the writer made the observations recorded hereunder.

1. Explosions and emissions of large volumes of vapour were coincident with the arrival at the surface of the sea of large blocks of lava.
2. Although only a small portion of the lava mass was visible above the surface, it was noticed that the volume of emitted steam appeared to be proportional to its size.
3. Preceding the arrival of a lava mass at the surface there was an upwelling of water. Coincident with its arrival there was sometimes an explosion, when dust and rock fragments were ejected to heights of generally less than 100 feet above sea level. The noise which accompanied the explosion was comparable with the rumbling of thunder.
4. Although the arrival of the largest masses at the surface did not always have a regular periodicity, it was discovered that their appearance could usually be anticipated at intervals of about 10 minutes.

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1. op. cit.

5. Steam and gas escaping from the lava mass formed a white cumulose cloud which was carried away by the prevailing wind, while the mass itself slowly submerged. When most of the gas content had been freed, the mass disappeared below the surface. The time required for this procedure varied according to the gas content of the mass, but it was rarely more than 10 minutes.

6. Seismic activity was noted only when the writer was on either East or West Tulumán craters, and these tremors coincided with the explosions at the surface. There were no marks on the records of the shock recorder which was installed at Baluan which could be attributed to seismic activity.

7. There was very little evidence of gases other than steam in the vicinity of the submarine activity. The fact that the masses were approached only from the windward side did not favour such observations. It was considered that there was a faint smell of burning tar on the occasion when the area was visited on the "Poseidon", and during the same trip patches of yellow froth were noticed in the vicinity of Tulumán volcano. It is not known whether the froth, presumably formed by volatiles of sulphur or its compounds, emanated from the volcano or from the area of submarine activity. The gases sulphuretted hydrogen and sulphur dioxide were detected among gases from East Tulumán crater, but only in very small amounts.

8. Temperatures were measured at the thermal area on the south-west side of Baluan during the October, 1954 investigation. The maximum on this occasion was  $94^{\circ}\text{C}.$ , which is  $7^{\circ}$  above the maximum recorded by Best in July 1953. The temperature at the thermal area on Lou Island had also increased according to the natives who used this ground for cooking purposes (verbal report from Mr. F. Kleckham, Lorengau.)

Temperatures on West Tulumán crater, however, had decreased. Those measured at sea level on the inside of the southern rim of the crater were  $44^{\circ}\text{C}.$ ,  $47^{\circ}\text{C}.$ , and  $62^{\circ}\text{C}.$ , the latter being  $14^{\circ}$  lower than the maximum recorded by Best in July 1954. As it was not possible to induce the natives to take their canoe over the areas where gas ebullition was greatest, it was only possible to obtain sea temperatures at the northern and eastern edges of the East Tulumán crater. These were  $52^{\circ}\text{C}.$  and  $53^{\circ}\text{C}.$

The conclusion drawn from these observations is that lava was being extruded from a new centre of activity or from a vent on the eastern side of Tulumán Volcano. The lava, suddenly chilled, broke up into masses which were highly charged with gas and floated to the surface. That these masses reached the surface at red heat was evident from watching the area at night. At the surface, with the sudden reduction of external pressure, the gases escaped, sometimes with explosive violence. The gases, predominantly steam, were intermixed with the steam formed as a result of the reaction between red-hot lava and sea water, to form white cumulose clouds. As the gas escaped the lava mass lost its buoyancy and eventually sank. Pumice was probably produced independently of these masses at the point of emergence of the lava, and floated to the surface, to be carried for long distances by the sea.

#### IV. ADDITIONAL INFORMATION ON TULUMAN VOLCANO:

(a) West Tulumán crater: Lava flows which were at high temperatures during the July 1954 investigation had cooled to normal by October, and the temperatures at points of gas ebullition were less. It was noted that green algae (?) had already attached itself to rock surfaces on the southern outer edge of the crater.

(b) East Tulumán crater: This crater was inspected during October, and a sketch map is included with this report. The western and northern limits of the crater are made up of two small islands composed of lava, the southern and eastern limits are bounded by a much larger island which is made up of lava and pumice as indicated on the map. A ground inspection of the latter island revealed that lava flows were essentially the same as those on West Tulumán crater, and that strong peripheral cracking, convex to the south-east, had developed. Smaller minor fractures had formed across this section of the island, and were generally set at right angles to the direction of major cracking. The elongate arm which stretches to the east from the northern limit of the lava is composed of horizontally bedded pumiceous deposits. It is considered that this deposit has been laid down by the sea on lava flows which have sunk during cooling and contraction.

The highest point on these islands is at the south-east corner, and was about 10 feet high at the time of the investigation. The positions of thermal areas are shown on the map, but it was not possible to obtain temperatures in any of these positions.

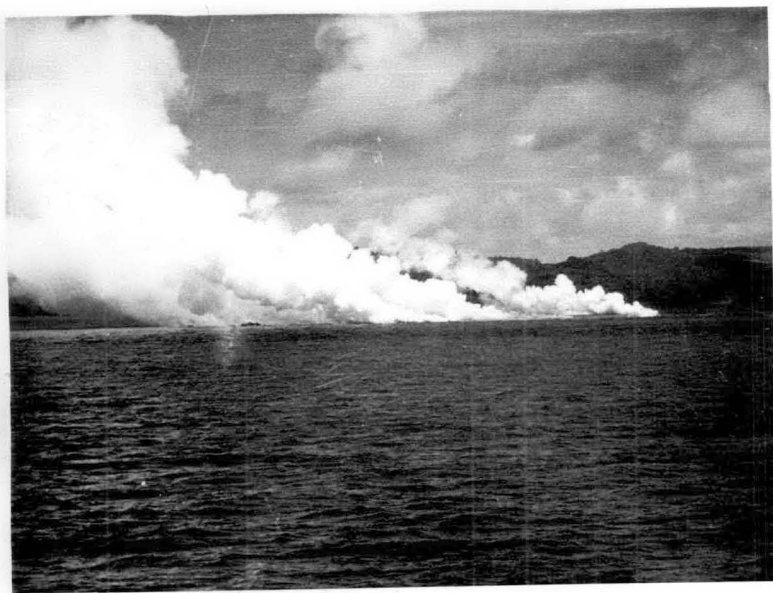


Fig. 1: Vapour clouds from blocks of floating lava. Taken from about 200 yards south-east of active centre. Lou Island in background. 27/10/54.

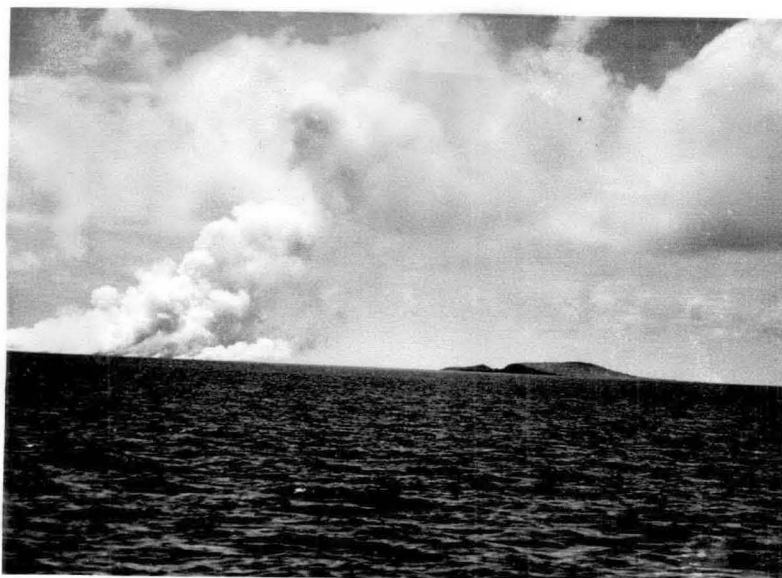


Fig. 2: Vapour clouds as above taken from north-east and showing West Tulumán crater. 27/10/54

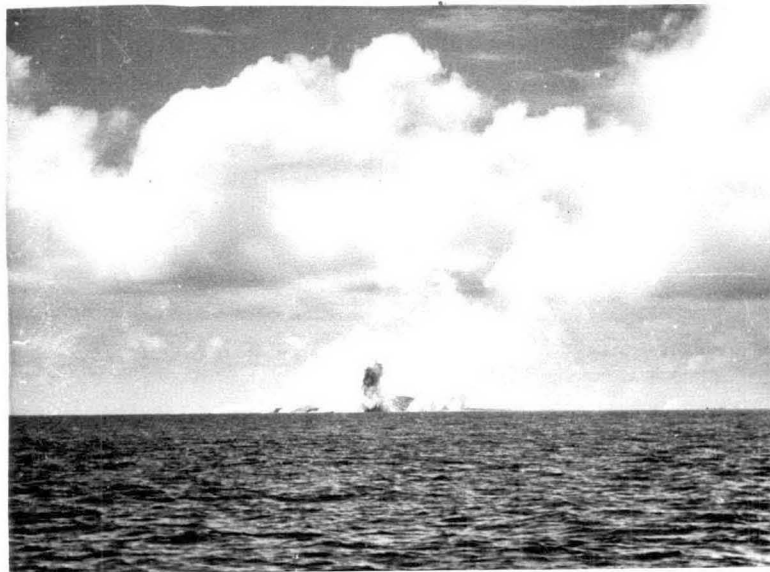


Fig. 3: An explosion at 1310 hours, 27/10/54. This photograph is taken from the east, and West Tulumán crater may be seen due west of the active center.

Figure A



An explosion at 1250 hours, 27/10/54 taken from north-east and showing to the west East Tulumán crater and south-eastern portion of West Tulumán crater.

Fig. 5a.



Fig. 5b.



Fig. 5c.

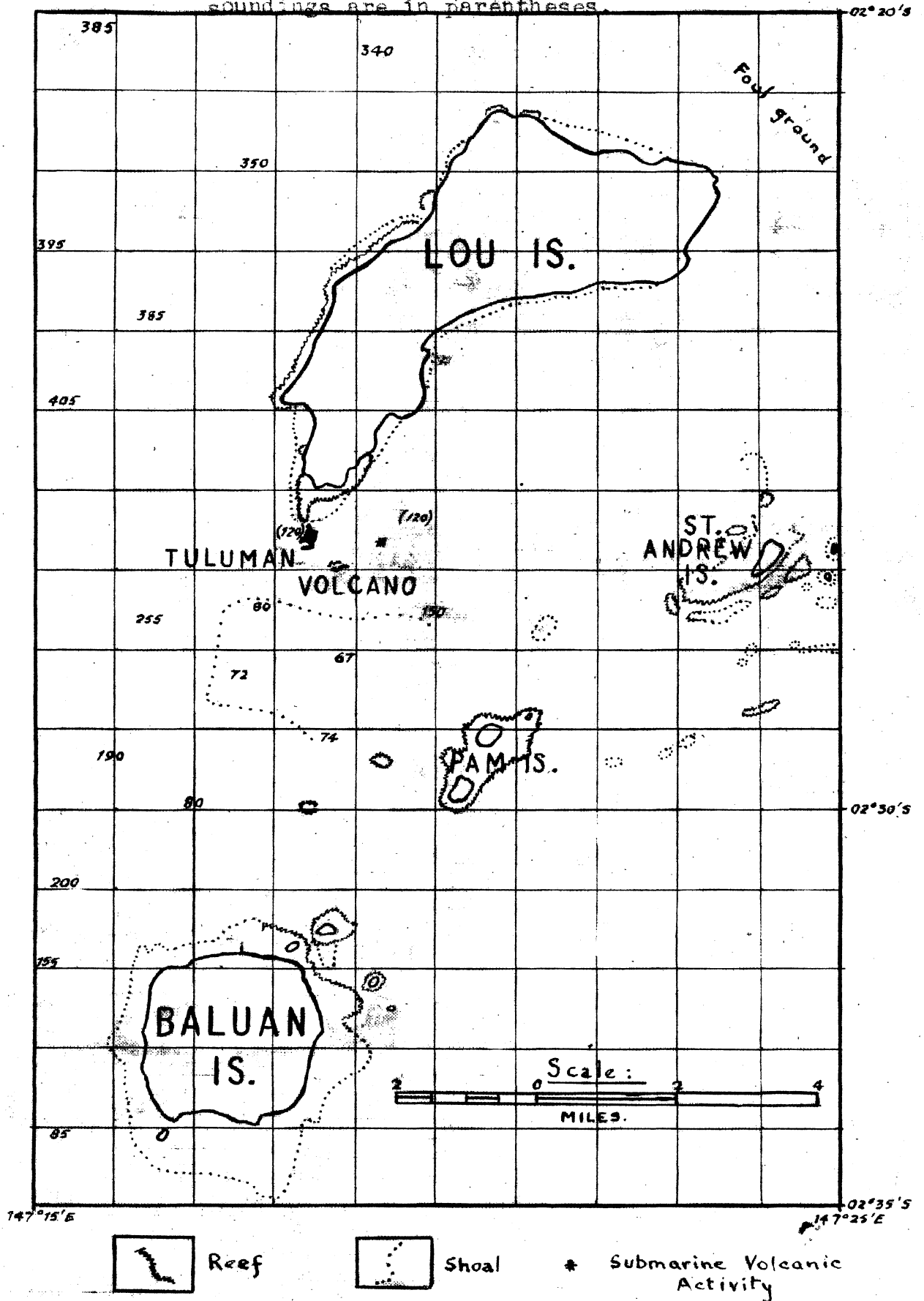


Fig. 5a was taken from north-east and shows vapour formation from two blocks which arrived at one surface simultaneously. Fig. 5b, taken a few seconds later shows the arrival of a third block at the surface, Fig. 5c shows the vapour cloud at  $\frac{1}{2}$  minute later. 27/10/54.

ST. ANDREW STRAIT,

ADMIRALTY ISLANDS.

Soundings (1944) are given in fathoms.  
Where there has been alteration due to vulcanism, the soundings are in parentheses.



# SKETCH MAP OF EAST TULUMAN CRATER

OCTOBER 1954

