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AN EXAMINATION OF THERMAL AREAS AT LAKE LOLORU, BOUGAINVILLE

by

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FEBRUARY - MARCH, 1955

with additional information from an aerial inspection on 29th June, 1955

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(M. A. Reynolds)

July, 1955.

AN EXAMINATION OF THERMAL AREAS AT LAKE LOLORU, BOUGAINVILLE. FEBRUARY - MARCH, 1955.

I. INTRODUCTION.

The monthly vulcanological report for January, 1955, from Kieta contained details of an increase in the size of one of the thermal areas in the vicinity of Lake Loloru. The writer left Rabaul with assistant Leslie Topue on 23rd February for Kieta, and reached Lake Loloru, accompanied by Cadet Patrol Officer B. O'Farrell, on 28th. After spending two days in the area, the party returned to Kieta, but owing to bad weather and consequent lack of transport, the writer and his assistant were not able to return to Rabaul until 15th March.

The first report of volcanic activity in this area was given by Father W.P. Fingleton, and an aerial inspection was conducted in May 1951 by G.A. Taylor who stated in a report, dated 17/5/51, to the Government Secretary: "These areas showed no evidence of recent extensions or rises of temperature. There were no indications of recent explosive activity." (reported earlier by Father Fingleton.) Reports of patrols to Lake Loloru, dated 18/5/51 and 27/5/51 by Cadet Patrol Officer B.B. Butcher and Patrol Officer A.K. Jackson respectively, had conclusions similar to those in Taylor's report, although Jackson suggested that volcanic activity had increased slightly. The area was visited during June 1951 by J.G. Best, whose report (6/7/51) concluded: "In the light of existing conditions it is considered that this volcano is in a dormant state, also that the possibility of an imminent eruption is remote. However, it must be borne in mind that this area is a potential danger point, and if an eruption should occur it is likely to be of the Pelean type."

As a result of natives' reports of increased activity, a further patrol was conducted by J.E. Norton (O.I.C., Sub-District Office, Buin) on 15th May, 1952, but it was "considered that the increased activity reported by the natives was aggravated by the heavy earth tremor of Saturday 10th May" and that no danger existed. A later report dated 8/9/52 by Patrol Officer Butcher stated that hot springs along the banks of the Piras River, approximately 6 miles south-east of Lake Loloru, were reported to have become very active after tremors on 10th May and 15th August, 1952. No further reports were received until that of January, 1955, investigated during February-March, 1955.

II. PHYSIOGRAPHY

Lake Loloru is situated within a crater which has a maximum width in a north-south direction of 1½ miles. The south-western portion of the crater rim is obscured by the lava dome which occupies almost all of the crater. The lake has formed in the depression between the eastern half of the crater rim and the eastern margin of the dome and is consequently arcuate in shape. The height of the lake level is estimated to be just under 5,000 feet above sea level.

Overflow from the lake at the north-western end runs into a small creek, which appears from aerial photographs to drain into a shallow depression near the north-western rim of the crater.

III. THERMAL AREAS

The three most active thermal areas are situated in the north-western portions of the crater and dome. These were referred to by Best (6/7/51) as the "lower, middle and upper fumarolic areas" and are called Zones A, B, and C in this report. Three other areas are known to exist in the vicinity of Lake Loloru, and these are referred to hereunder as Zones D, E, and F. Details of the Kekemona area are taken from the report by Patrol Officer A. K. Jackson (27/5/51) and of the Piras River area from that by Patrol Officer Butcher (8/9/52).

1. Zone A: An area about 100 yards wide where rocks have been altered by thermal activity exists about 400 yards west of the north-western limit of Lake Loloru and extends along the course of the creek through which the overflow from the lake passes.

In the north-eastern section there is a spring from which gas is escaping. The water is light blue-green in colour and has a milky appearance due to the fine white clay particles in suspension. The temperature of the water was 58°C. Fifty feet south of the spring are two vents from which steam and gas were escaping with a loud roar. The main gas noticed was sulphuretted hydrogen, and deposits of sulphur have formed at the mouths of the vents. The temperatures measured here were both 90°C. Temperatures were also taken about 30 feet south of these vents, where there was gas ebullition through the creek. Readings were constant at 88°C. Most rocks in the creek were coated with a milky white deposit.

2. Zone B: This is the largest of the three most active zones. The numerous vents and points of vapour and gas emission are concentrated along the walls and base of a gully formed by a creek whose course runs to the north-west to join the creek mentioned in Zone A. The lower portions of Zone B are 450 feet above the level of Zone A and the upper limit of dead vegetation and rock alteration by thermal activity is between 350 and 400 feet higher.

The south-western section of this zone encompasses a small steep-sided chasm formed by fluvial action and is separated from the rest of the area at the southern end by a narrow ridge along which vegetation composed predominantly of bracken continues to grow. The trunks and branches of dead trees still stand among the dense bracken undergrowth. Temperatures taken in the lower, middle and upper sections of this chasm were 93°, 88°, 93°C. respectively.

Immediately east of the ridge is an area which has been denuded of live vegetation and only dead trees remain. The emission of steam and gas from some vents within this area was quite strong and sulphur dioxide was occasionally encountered. The maximum temperature recorded was 93°C.

The northern half of Zone B contained some bare areas generally narrow and situated along rock outcrops in the steepest portions of the valley wall. The larger portion, however, was covered by dense vegetation composed mainly of bracken. It was in this northern half of Zone B that a large proportion of the vegetation had recently died. Vapour could be seen rising from some places in areas of live vegetation; this feature was also noted by Best during his visit in 1951 and in many places on thedome. The highest temperature measured in this section was 93°C.

3. Zone C: The base of this shallow, crater-like area was estimated by barometer to be between 850 and 900 feet above Zone A. Due to thermal activity the surface of this depression was white and almost entirely devoid of live vegetation. Dead trees, some still standing, were common and it was noticed that portions of collapsed trees had been altered to charcoal. There was a sibilant escape of gas from a vent in the western side of this area and a thick deposit of sulphur had formed at the mouth. Among the escaping gases, a faint trace of sulphur dioxide was discernible. Temperatures taken here and at positions 40 and 70 feet to the south were 102°, 91°and 93°C. respectively.

4. Zone D: This is situated on the north side of the dome between Zone B and the north-western end of Lake Loloru. There are two denuded areas but only very small volumes of vapour were seen to emanate from them. No temperatures were taken in this zone.

5. Zone E: An area in which rocks have been altered by thermal activity and which is clearly visible in aerial photographs exists on the outer, south-eastern flank of the Lake Loloru crater. This was not visited since natives who had been to this area claimed that it was not active.

6. Zone F: This area was investigated by Patrol Officer A. K. Jackson in 1951 and its position was marked on a map included with his report (27/5/51) as "Point 2." Natives who accompanied him stated that there had been no increase in activity. The position of Zone F is considered to be in the bed of a creek which originates immediately south-west of Zone A. It is estimated that the thermal area is approximately 1½ miles south-west of and 1,500 feet lower than Zone A.

7. Kekemona: A spring situated about 600 yards to the west of Kekemona was reported also by Patrol Officer Jackson (27/5/51) who stated: "Natives claim that it enlarged considerably during June, 1950. At present it is in a completely quiescent state, the temperature of the water being only 69 degrees Fahrenheit, whilst in periods of activity it is said to boil."

8. Piras River: The following extract is taken from the report of Patrol Officer Butcher (8/9/52): "Within a distance of five hundred yards approximately thirty springs of various sizes were inspected, the largest being as big as a bucket. All these springs were bubbling and it was noticed that one of these springs had a thick layer of sulphur on its surface. Three sections of the road alongside this river have landslided. These landslides have taken place recently."

This area is located between the villages of Pagui and Oria, and it has been estimated from the Army Survey map (Mt. Taroka, 1 inch equal 1 mile series) that it is approximately 6 miles south-east of Lake Loloru.

Both the Kekemona and Piras River positions are shown on the map of Southern Bougainville included with this report.

IV. SEISMIC ACTIVITY

In a paper on the relationship between tectonic earthquakes and volcanic activity on Bougainville, the writer (Reynolds, July, 1955) reached the following conclusions regarding the Lake Loloru crater: "Although seismic activity cannot be directly associated with the original report of increased thermal activity in 1951, later reports of increased activity at Lake Loloru and at the Piras River thermal area correspond with strong earthquakes No. 24 on 9/5/52 and No. 25 on 14/8/52 respectively. It is considered that the latter reports, originating from indigenes, were based on the earthquakes rather than any significant alteration in thermal activity." There have been no reports of seismic activity from the area which cannot be related to tectonic earthquakes.

V. CONCLUSIONS

The reports referred to earlier, aerial photographs (not dated, but thought to have been taken during the war) and photographs taken by Taylor have been compared with the writer's own observations and photographic records in an attempt to detemine whether there has been any alteration in thermal activity in the vicinity of Lake Loloru. The results of this analysis indicate that:

a. Although there has been no increase in the areas denuded by thermal activity in Zone B, a large proportion of the bracken undergrowth in the northern half of this area has recently died. There was no noticeable increase in any of the other areas.

b. Apart from the reading of 102°C. (equivalent to a temperature of approximately 108°C. at sea level) in Zone C, the maximum temperature in any area during the recent visit was 93°C., which is 2° lower than the maximum obtained in 1951. The fact that portions of some dead trees in Zone C have been converted to charcoal is evidence that temperatures here have been higher in the past.

c. The volume of sulphur dioxide gas being emitted has not altered to any extent since 1951.

The recent dying-off of vegetation in Zone B appears to be the only criterion, therefore, for assuming an increase in the extent of thermal activity in the Lake Loloru crater area. Manifestation of impending volcanic activity could be anticipated to be more pronounced than this phenomenon which could possibly be due to physiological processes. It is intended, however, to conduct periodical aerial inspections of the area until such time as it appears positive that there is no danger of an eruption.

Natives in villages which would be affected if there were an eruption of the Lake Loloru crater have been advised of the nature of phenomena likely to precede an eruption, and those interviewed during February--arch 1955 were fully conversant with the type of premonitory warnings to be expected and with their movements in the event of an emergency.

VI. ADDITIONAL INFORMATION FROM AN AERIAL INSPECTION ON 29th JUNE, 1955

The Cataline aircraft which departed Rabaul on 29th June 1955 was diverted between Kieta and Buin to inspect the Lake Loloru thermal areas. Owing to the cloudy conditions, it was not possible to immediately locate the dome or crater, but by skilful manoeuvering between cloud masses by the pilot (Captain Robertson) whose assistance is acknowledged, a circuit of the crater was eventually accomplished. Under the unfavourable circumstances and since more cloud was accumulating, it was considered that a second attempt to circle the crater would be futile and dangerous.

Two of the three zones examined during the ground inspection were seen for a period too brief to assess whether there had been any appreciable change. Two other zones, E and F, were noticed during the circuit. Fortunately the four photographs taken, using Kodachrome film, were successful,and transparencies have been received of two views of Zone B, one of Zone E and one of Zone F. The first three, when compared with the photographs taken by G. A. Taylor during the aerial inspection in 1951, show that there has been no alteration in areas of denudation in Zones B and E. The fourth transparency indicates that a portion of the area of Zone F has recently been overgrown with kunai grass.

It is considered that the next aerial inspection should take place later this year at the beginning of the North-west season when it should be possible to obtain a better view of the thermal areas. By this time the significance of the dead vegetation in Zone B should also be obvious.

MAP SHOWING LAKE ROTORUA THERMAL AREAS.

Scale: 1 inch = $\frac{1}{4}$ mile.

Prepared from Army Map (1 inch = 1 mile Series),
No. 3327 "Mt. Taroka".

MT TAROKA

ZONE "A"

ZONE "D"

ZONE "B"

ZONE "C"

LAKE
LOLORU

ZONE "E"

ZONE "F"

06°30'S

06°31'S

06°32'S

155°36'E

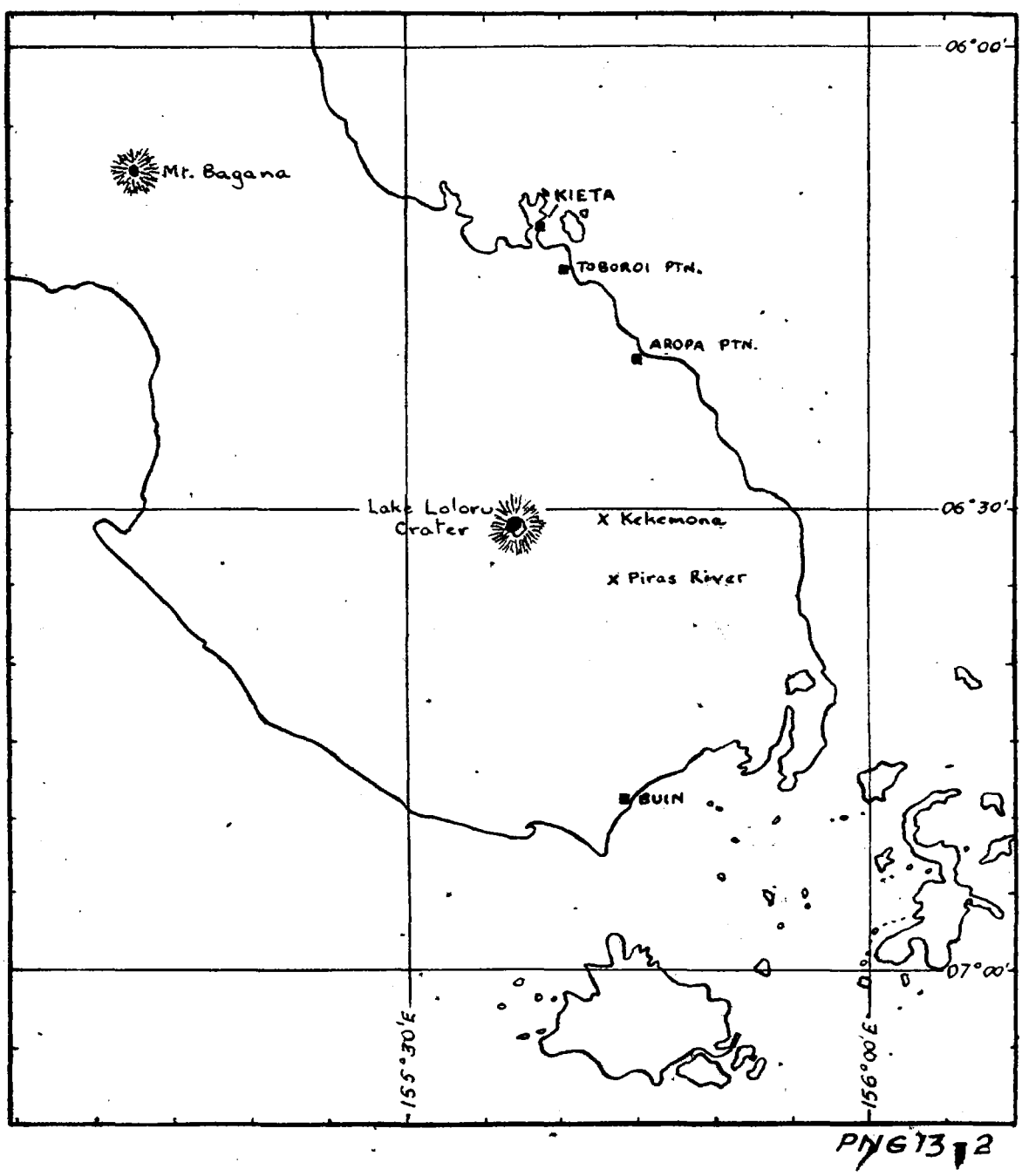
155°37'E

155°38'E

PNG 13-6

SOUTHERN BOUGAINVILLE.

Approximate Scale: 1 Inch = 12½ Miles



PNG 13 2