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VOLCANIC ACTIVITY AT LAKE DAKATAUA CALDERA, NEW BRITAIN.

by

C.D. Branch



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SUMMARY

Lake Dakataua, at the northern end of Willaumez Peninsula, New Britain, is a complex volcanic area consisting of an outer caldera about seven miles across, an inner caldera four miles across, and a basaltic shield volcano-Mount Makalia. An explosion crater complex of at least eleven craters has torn out the south-western side of the shield volcano. The most recent eruption, 70 to 80 years ago, was a lava flow from an apical ash crater on Mount Makalia. Thermal areas in the crater range in temperature from 50°C to 58°C, and thermal areas at the foot of Mount Makalia range from 35°C to 42°C.

INTRODUCTION

Location

Lake Dakataua is a fresh water caldera lake 6½ miles in diameter, at the northern end of the Willaumez Peninsula on the central north coast of New Britain (Pl. 1). The Peninsula is built of overlapping volcanic cones of which Mount Garbuna, near the base of the Peninsula, is the only one showing clear signs of activity, but the activity is mild and restricted to fumaroles with a maximum temperature of 101°C (Fisher, 1957). Boiling mud pools and fumaroles are found around Garua Harbour, particularly at Talasea, and have been described by Reynolds (1954) and Branch (Vulcanological Observatory Monthly Report, October, 1963).

The Lake Dakataua area was examined from the 22nd to 25th October, 1963. The village of Bulu Murli at the northern tip of Willaumez Peninsula was reached by Government trawler in about four hours from Talasea. From the village it is a twenty-minute walk to the shore of the Lake where natives keep a few canoes for hunting crocodiles and pigs, and to travel to gardens on Lalala Peninsula inside the Lake. A traverse by canoe was made around Lalala Peninsula, and Mount Makalia, the most recently active crater, was climbed.

Topography

As seen from the sea, the northern end of Willaumez Peninsula is a low, tree-covered cone, about 13 miles across and with a maximum elevation of 800 to 1000 feet above sea level (Fig. 1). However, from the air it is seen that much of the area of the cone is occupied by a large crater lake, seven miles across - Lake Dakataua. Projecting into the lake from the southern shore is Lalala Peninsula, 2½ miles wide at the base and five miles long, comprising a complex of young lava cones and explosion craters.

The water level in the lake is 155 feet above sea level, and the cliffs around the lake mostly rise 200 to 500 feet above this (Fig. 2). Mount Langalanga on the southern rim of the caldera is the highest point, about 1000 feet above sea level. The most prominent feature on the peninsula within the lake is Mount Makalia, 870 feet high (incorrectly named Benda crater in Fisher, 1957). The mountain is tree covered (Fig. 3) except on the eastern side where ropy basalt flows extend from the summit almost to the lake shore.

Population

Only two villages are known in the area; Bulu Murli on the north-east coast with a population of about 100, and Bulu Daba on the west coast reported to be about the same size.

PREVIOUS VOLCANIC ACTIVITY

No eruptions from the Lake Dakatau Caldera have been reported since Europeans came to the Territory, but the ropy, vesicular basalt flow down the eastern face of Mount Makalia probably was erupted between 1880 and 1890: the fathers of old men in the village of Bulu Murli sacrificed pigs to try and stop the eruption. One man, about 50, remembers that in his youth Mount Makalia was bare of vegetation and children rolled down the 'sandy' slopes.

A legend is extant that once a huge mountain used to stand where Lake Dakatau now is, and that it was an island divided from the mainland by a treacherous strait. Many people were drowned crossing the strait in their canoes, and the mountain became sorry for them. In order to help the people, the mountain one day subsided, forming Lake Dakatau, and rose again in the strait, filling it and joining Lake Dakatau to the mainland. This new mountain is Mount Bola, 3818 feet high, a symmetrical cone adjacent to the southern side of Lake Dakatau.

A vulcanological interpretation of this legend is that the large cone of Mount Bola was built up concurrently with the eruption that produced the Lake Dakatau caldera; a plausible hypothesis.

STRUCTURE OF LAKE DAKATAUA CALDERA

The caldera structure is complex (Pl. 1) and has passed through at least five phases in its development, as outlined below.

5. Mount Makalia apical crater.
4. Explosion crater complex.
3. Mount Makalia shield ~~complex~~ volcano.
2. Inner caldera.
1. Outer caldera.

Outer caldera

The outer caldera is oval, with an easterly diameter of eight miles and a northerly diameter of six miles. The steep sides of the caldera descend unbroken to the lake and the water appears deep close inshore. Natives report that a naval party - possibly German - took a sounding in the lake, but the sounding is not shown on admiralty charts of the area. The profile of the outer slopes of the caldera suggests that the volcano in which it formed was between 6000 and 9000 feet high.

The outer caldera wall appears to be composed mainly of lavas. A specimen collected from a flow at the lake edge on the northern side is vesicular quartz-augite andesite containing rare phenocrysts of plagioclase and augite in a pilotaxitic groundmass. These data suggest that the original volcano was a huge andesite strato-volcano.

Inner caldera

Remnants of a caldera inside the outer caldera exist across the base of the peninsula in the lake, along the north-eastern side of the peninsula (Mount Benda), and on the western side of Lake Dakataua (Mount Doko, Fig. 2). The inner caldera is oval, with the major axis $4\frac{1}{2}$ miles long, and the minor axis $3\frac{1}{2}$ miles long. Along the southern side the shape of the caldera is irregular and it is possible that another caldera overlapped the main one on the south-eastern side.

Vesicular augite basalt flows are exposed in the inner caldera wall near Mount Benda, interbedded with volcanic ash containing basalt bombs. Hence the volcano in which the inner caldera formed was probably a basaltic strato-volcano.

Mount Makalia shield volcano

A basaltic shield volcano fills the eastern half of the inner caldera, and forms the lower two-thirds of Mount Makalia. The volcano is $2\frac{1}{2}$ miles in diameter, and about 500 feet high above the lake (Fig. 3).

Explosion crater complex

The southern and south-western sides of the shield volcano have been torn out by violent explosions to form an explosion crater complex. At least eleven craters are preserved in the complex, ranging from a few hundreds of feet to half a mile across. Possibly concurrently with this, basaltic ash cones were constructed between the inner and outer caldera walls on the northern side (Lalala Peninsula), and outside the outer caldera, on the eastern slopes of the original volcano.

Mount Malalia apical crater

The top 200 feet of Mount Makalia consists of an ash cone built above the shield volcano. A crater 300 feet across and 100 feet deep in the apex of the cone is breached on the eastern side, and the most recent lava has flowed through the breach and one mile down the eastern side of Mount Makalia. The lava issued from a fissure trending north-north-east across the floor of the crater and built a ridge of viscous lava along the line. Only a little lava flowed into the back of the crater. The lava is blocky and is an augite basalt containing microphenocrysts of augite and labrodorite in a dark brown glass.

Three small cones were built above the flow, inside the main crater. The first, near the back of the crater, is a lava dome 100 feet high and 60 feet across on top.

A small flow from the top of the dome flowed down the western flank and a little way around the north-western side of the main crater. The second cone is built of ash above the fissure from which the main lava flowed. It is about 100 feet high and contains a crater 40 feet across and 20 feet deep at the top. The third cone is between the other two and a little to the north-west, and has a shallow crater 20 feet across.

PRESENT MANIFESTATIONS OF VOLCANIC ACTIVITY

Present volcanic activity is limited to a mildly active solfatara in the apical crater of Mount Makalia, and to warm springs in the lake at either side of the foot of the mountain.

Thermal areas in the apical crater of Mount Makalia

Thermal areas are restricted to a shallow depression in the summit of the lava dome inside the main apical crater. In the depression slaggy basalt that resembles the cooled crust on a lava lake has mostly been altered to a red clay by fumarole activity. Hot gases rise through small fissures in the basalt and temperatures range from 50°C near the rim of the depression to 58°C at the centre.

Thermal areas at the foot of Mount Makalia

Along the lake shore on the south-western side of Mount Makalia the water is 35°C, which is slightly warmer than the average lake temperature of 30°C. There is no evidence of bubbling or an unusual taste or encrustations in the area.

Natives report that warm water rises through a sandy beach on the eastern shore of Twunumuri, a small crater lake south of Mount Makalia. The area was not visited.

Warm springs on the eastern shore of Mount Makalia range in temperature from 40°C to 42°C. The area is a shallow embayment in the snout of an old vesicular basalt flow. The springs issue just below the water line around the embayment, and the nearby rocks are encrusted with a white powder.

GEOLOGICAL HISTORY

The original volcanic structure appears to have been a large andesite strato-volcano, in the summit of which the main, outer caldera formed, about 7 miles across. A basaltic strato-volcano grew within the caldera and collapsed to form an inner caldera 4 miles across. Basalt lavas erupted inside the inner caldera built a shield volcano which now forms the lower two-thirds of Mount Makalia. Violent explosions tore out the south-eastern side of the shield volcano to form an explosion crater complex and at least eleven craters are preserved in this complex. Other ash cones formed Lalala Peninsula, and small craters were built east of the outer caldera. Finally, about 70 to 80 years ago, a basaltic lava flow was erupted from an apical ash cone on Mount Makalia. Future eruptions would be expected to be similar to this last eruption and should not prove dangerous to the present population.

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Fig. 1. The northern end of Willaumez Peninsula from the sea. (Neg. G/7263).



Fig. 2. Mount Doko, part of the inner caldera, with the wall of the outer caldera in the background, from Lalala Peninsula. (Neg. G/7262).



Fig. 3. The north-western side of Mount Makalia.
(Neg. G/7264).

TAUWALI REEF

CAPE HOLLMAN

BISMARCK

CAPE MONTS

SEA

BULU DABA

BULU MURLI

TAUWALI BAY

CAPE KNORR

CAPE CAMPBELL

NDAWA

BAY

Beeded 15 TAURE I.

CAPE HEUSSNER

KAPEPA I.

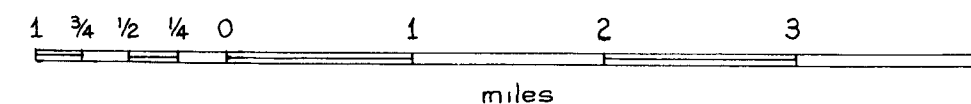
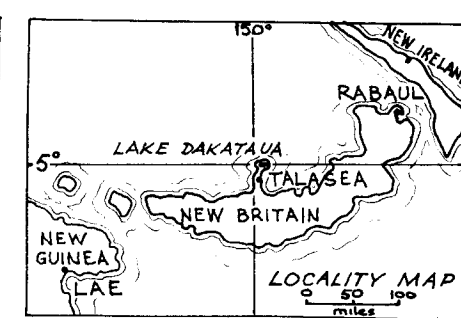
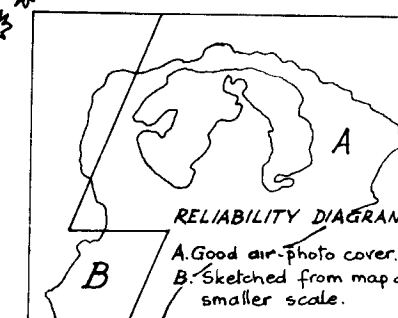
WANGORE

BAY

CAPE GOLTZ

WILLAUMEZ PENINSULA

Compiled and Drawn by C.D. Branch, November, 1963.
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GEOLOGICAL AND TOPOGRAPHICAL MAP LAKE DAKATAUA AREA

NEW BRITAIN

- Basalt lava flow
- Thermal area
- Ridge

- Village
- Track
- Reef