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INVESTIGATION OF ERUPTIVE ACTIVITY AT MT. BAGANA, BOUGAINVILLE

MARCH 1952.

by

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INVESTIGATION OF ERUPTIVE ACTIVITY

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AT MT. BAGANA, BOUGAINVILLE - MARCH 1952

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Mt. Bagana, an active volcano 5700 feet high, is situated approximately half way along the central mountain chain of the island of Bougainville. Twenty miles to the north-west lies the massive volcanic pile (10,000 feet) of Mt. Balbi while forty miles to the south-east is the crater lake and dome of Lake Lolaru, both these may be classified as active volcanoes although no record exists of recent eruptive activity at either of these centres.

At the time of the writer's visit the volcano was extremely active, and had been so, more or less continuously, for the previous two years.

Prior to that explosive activity appears to have been sporadic. Mrs. Wallace Brown, resident of Torokina and before the war resident at Kieta, states that she remembers witnessing from Kieta an eruption at Bagana in 1937. As far as she could remember that was the only eruption for a considerable number of years.

From aerial photos taken in 1945 steam emission appears to have been fairly intense, however Mr. Wallace Brown, who was in the Torokina area for a considerable period during the war years states that little explosive activity was manifest.

Towards the end of 1948, spasmodic explosive activity commenced and prevailed for about twelve months. At the end of this period the frequency and violence of the emissions increased appreciably and continued thus till about the end of October 1950; the months June to September witnessing the strongest activity of that period.

In November 1950 Mr. G.A. Taylor visited the area with the intention of studying the eruptive activity; however he was unfortunate in that he arrived at a period when the volcano was dormant.

Early in 1951 a recrudescence of somewhat intense activity occurred which declined with the advent of the South East season (about April) but continued with diminished intensity until about the end of the year. The beginning of 1952 again witnessed an intensification of activity manifest during the writer's stay in the area was the greatest exhibited up to that time.

The writer spent six days camped about three miles from the base of the crater on the western side. The camp site was located about one mile outside a clearly defined blast zone which extended westwards from the base of the mountain for about two miles. Subsequent discussion with Mr. Taylor revealed that this zone was in evidence at the time of his visit, but appeared to be fairly new at that time. Within this larger blast zone at the time of the writer's visit was a very much smaller one (it extended out about a half mile from the base of the mountain on the western side) and was obviously of very recent origin. All vegetation had been completely stripped and flattened and the only regeneration were from wild bananas which carried green shoots about a foot long. At Mount Lamington the writer noticed similar growth of bananas about ten days after the destructive blast.

During the writer's stay in the area many "glowing cloud" type eruptions were witnessed, most of which descended only part way down the mountain.

Photographs taken during the period of the observations proved, without exception, to be most unsatisfactory. This failure is attributed to the fact that it was necessary to use a camera loaded with paper backed film, the writer's 35 m.m. camera being U.S. at that time.

(J.G. Best)

DIARY OF VULCANOLOGICAL OBSERVATIONS

MT. BAGANA. BOUGAINVILLE

18th - 31st March 1952

TUESDAY, 18th MARCH, 1952

- 1400 hours Arrived camp site on banks of Torokina River about 3 miles from base of mountain.
- 1421 " Rumbling sound commenced - crest of mountain covered by cloud. Brownish white cloud drifting to north west above cloud level.
- 1426 " Rumbling ceased.
- 1512 " Small glowing cloud descended down western avalanche valley and dissipated about 2500 feet below the crest.
- 1516 " Noise heard, somewhat like a train passing across a steel bridge - continued for about 30 seconds.
- 1528 " Steam plume arose in lower end of western avalanche valley. Probably hot ash meeting water.
- 1547 " Distinct rumbling heard, greyish white cloud climbed rapidly above crest and mushroomed at top. Greyish white ball detached itself from top of column and drifted in a southerly direction. Trail of ash descended from base of cloud, looked very like rain.
- 1558 " Small "Glowing Cloud" descended south of western avalanche valley. Through binoculars new whitish ash deposit appeared to contain some large boulders.
- 1631 " "Glowing Cloud" descended down northern spur, dissipated about 2000 feet below the crest. Billowing cloud ejected vertically which rose to about 7000-8000 feet, mushroomed and spread to the north. Fine ash descended from cloud.
- 1730 " Crest of mountain fairly clear. Translucent column ascending and mushrooming at about 10,000 feet. Pale blue-grey vapour spilling over crater rim on north west side.
- 1815 " (Almost dark) Glowing dull red to bright red blocks of lava clearly visible tumbling down western avalanche valley. No appreciable dust cloud accompanying this activity - so it is not a "Glowing Cloud" type emission.
- 2005 " Incandescent material still being expelled. It appears to be escaping through vents in what appears

to be a vertical force several hundred feet below the crest. At irregular intervals a sudden increase in incandescence occurs at varying centres on this fact - each increase is followed by expulsion of lava which, however, appears to be solid as the red glowing blocks (readily discernible with the aid of binoculars) bounce erratically down the western avalanche valley. White column rising above crest - fairly clearly visible, appears to be reflecting light - (Is the light source within the crater or is it the incandescent material on the west face?).

2025 hours Loud rumbling - whole crest of mountain belched incandescent material which appeared to descend mainly down northern and north eastern flanks. Dark inverted cone shaped column of smoke rose swiftly and vertically to possibly 20,000 feet.

2047 " Distinct rumblings audible, increased discharge of incandescent material from high up on face.

WEDNESDAY - 19th MARCH, 1952.

0530 " Just pre dawn - incandescent blocks still visible cascading down avalanche valley.

0710 " Muffled reverberations, brownish white cloud ascended and drifted in a southerly direction. Boulders (black) seen descending western avalanche valley.

0855 " Dense grey white column of ash ejected accompanied by loud prolonged reverberating sound (duration $\frac{1}{2}$ to 1 minute). Columns ascended in inverted cone formation. Internal wreathing and writhing plainly visible within mass of ejected vapour and solids.

0902 " Slight ash fall at camp.

0920 " Much diminished volume of material being ejected, much lighter in colour appears to consist predominantly of steam.

0922 " Small "Glowing Cloud" flowed down south side of western avalanche valley, dissipated at approximately 2000 feet below the crest.

1022 $\frac{1}{2}$ " Increased vertical discharge from crest accompanying rumble audible at camp at 1023.

1026 " Further greyish white vertical discharge.

1026 $\frac{1}{2}$ " Rumble audible at camp.

1137 " Distinct rumblings audible, no activity visible due to cloud over.

1435 " Dense grey white cloud thrown vertically up from crest - pronounced rumbling distinctly audible.

1445 " Small explosion, faint rumble audible, pale greyish white cloud forced up to mingle with material ejected at 1435.

1930 " Incandescent activity visible on western face - does

not appear to be as brilliant as last night.

- 1955 hours Intensification of light from incandescent area below crest.
- 2000 " Decrease in activity of above region.
- 2035 " Strong explosion from crest. Incandescent material ejected violently upwards and descended around upper portion of cone. Time lag between light and sound arriving at camp site - approximately 12 seconds. (Note - this makes camp less than $2\frac{1}{2}$ miles from the crest - obviously wrong - thus is noise generation contemporaneous with or subsequent to expulsion of ash etc?).
- 2045 " Ejected material appears to be drifting in a westerly direction.
- 2115 " Fine white gritty material deposited at camp site.
- 2120 " Deposition ceased - thickness of ash deposit about 1 mm.
- 2140 " Incandescent centres near crest again visible.

THURSDAY - 20th MARCH, 1952

- 0530 " Incandescent activity at head of western avalanche valley still persisting.
- 0750 " Depart camp site.
- 0834 " Approximately half a mile from the foot of the mountain. "Glowing Cloud" descended down south western avalanche valley. Dissipated about 2,500 feet below the crest.
- 1110 " Rumbling sound audible - no appreciable vertical discharge, probably "Glowing Cloud" (I could not see the direction of discharge as I was then about 1500 feet up on the southern side of the cone endeavouring to climb up and sample the "Glowing Cloud" deposit of 0834 - decided not to persist after getting to about 3,000 feet as it was obvious that some large boulders had recently landed in that area - before departing this area I sampled an AA flow which was still hot and steaming).
- 1620 " Returned to camp site - long deposit of whitish material seen occupying depression just west of the northern spur. Probably deposited by the explosion of 1110.
- Evening Building activity continued - incandescent material cascading down western avalanche valley.
- 2025 hours Explosion at crest - activity not as violent as last night - most of the ejectment appeared to be directed to the north east side. Thick dark column ascended quickly.
- 2045 " Slight seismic activity, duration 15 - 20 seconds strength less than 1.

FRIDAY - 21st MARCH, 1952

0515 hours Incandescent material still descending western avalanche valley.

0814 " Explosion at crest. Greyish white billowing cloud ejected first, followed shortly after by a similar shaped cloud much lighter in colour. Ejected material borne in a north to north easterly direction. Height attained about 15,000 feet.

0820 " Further explosion at crest, ejected material pale brownish grey in colour.

0915 " Loud reverberation - explosion? Activity not visible due to dense cloud cover.

1144 " Explosion at crest ejected material drifted to the north east.

1205 " Heavy rain commenced.

1645 " Rain diminishing, mountain again visible.

1725 " Light rain still falling, minor explosion at crest. Ejected material drifted in a north westerly direction.
(Note - Continuous crater activity has been evident ever since observations commenced. This appears to consist mainly of the emission of volatiles, probably mostly steam, and is naturally more intense after rain. Explosions are superimposed on this activity.)

1800 " Dense column of steam rising from north west corner of crest, it has been in evidence ever since rain lifted - remainder of crest very quiet.

1800 30 hours Most violent explosion to date - as was observed in last recording only one portion of crest evidenced activity and this was assumed to be steam activity. Suddenly a band of incandescent material shot into view above the crest, hung suspended for a very short time and then was ejected to higher altitudes. Dense "smoke" poured out accompanying the incandescent material. At a spot about the western extremity of the crest, incandescent material was seen to belch out as from a vertically directed blast furnace. The incandescent material reached heights of 500 - 1000 feet above the crest in a few seconds and then fell back around the upper portions of the cone. "Smoke" and steam billowed up to about 10 - 15,000 feet.

1820 hours Glow in evidence at crest. Thick whitish column still rising slowly.

1850 " Mountain obscured by cloud -(rain or dust?).

1903 " Mountain again visible.

2005 " Strong glow at crest - fairly strong emission of vapour continues.

2020 hours Crater glow died.
2025 " Crater glow recommenced, it has more height
 but is not as intense as at 2005.
2045 " Crater glow died again.

SATURDAY - 22nd MARCH, 1952.

0230 " Mild explosion at crest.
0525 " Moderate explosion at crest.
0630 " Dense column of steam still rising.
0756 " Violent explosion, greater than that of last
 night. Dark thick column ejected vertically.
 In addition "Glowing Clouds" flowed down all
 visible sides of mountain. In general these
 clouds dissipated about half way down the mountain.
 However one descended right to the foot of the
 mountain via the western avalanche valley. Area
 visited on Thursday completely covered by ash
 deposited from "Glowing Cloud".
0945 " Departed camp site.
1010 " Arrived edge of outer blast area (old one).
1041 " Arrived tow of ash deposit from recent "Glowing
 Cloud" right at the foot of the avalanche valley.
 Ash deposit still hot - 90°C. Larger fragments
 immediately evaporated rain spots which fell on
 them.
 (Material deposited from "Glowing Cloud", in this
 vicinity anyway, appears to consist of two primary
 sizes - boulders (1 foot and upwards in diameter)
 and ash. The size range between the boulders and
 ash is not represented.)
1210 " Departed foot of avalanche valley, heavy rain commenced
 shortly after.
1310 " Arrived camp.
1645 " Rain almost finished, mountain again visible.
1705 " Fairly strong explosion at crest. Ejected material
 borne to south south east as dark grey billowing
 clouds.
Evening Building activity still continuing incandescent
 blocks still being expelled from face high up on
 western side.
2041 hours Fairly strong explosion at the crest. Fragmental
 material hurled mainly to northern and western
 sides. Lightning effects noticed for first time
 in ejected cloud.

SUNDAY - 23rd MARCH, 1952

0400 " Mild explosion at crest.

- 0945 hours Strong explosion at crest. Ejected material darkish grey in colour and attained a height of about 20,000 feet as wreathing and writhing clouds. "Glowing Cloud" descended down northern spur to about 3000 feet below crest.
- 1230 " Rain commenced.
- 1300 " Heavy rain set in.
- 1650 " Rain ceased at camp.
- 1708 " Explosion at crest - difficult to see due to rain on mountain. Three definite "Glowing Clouds" - one down northern spur, one down depression just west of it and one down western avalanche valley. (Rain does not appear to have any affect on the "Glowing Clouds".)
- 1802 " Mild explosion at crest - billowing grey clouds ejected vertically and drifted to the south south west.
- 1900 " Extrusion of incandescent lava at head of western avalanche valley, greatest for several nights.
- 2017 " Violent explosion at crest - most violent so far witnessed. Incandescent fragmented material hurled up to possible 1000 feet above the crest and land back on the cone as much as 3000 feet below the crest. Vivid lightning noticed in lower portion of cloud (i.e. that portion below the crest). Diffused lightning visible in that portion of the cloud above the crest. Distribution of fragmental material mainly towards north and south. Still raining.

MONDAY - 24th MARCH, 1952

- 0637 " Explosion at crest - two "Glowing Clouds" - one down gully to west of northern spur, and descended to about 1500 feet from the crest. The other followed a small gully just north of the western avalanche valley and descended to about 2000 feet below the crest. Greyish billowing clouds ascended rapidly to about 20,000 feet (vertical component of explosion).
- 0730 " Departed camp to return to Torokina.
- 0845 " (Just west of Kowakakat village) Explosion at crest - billowing column ejected (not as voluminous as that accompanying "Glowing Cloud" ejections). Ejected cloud ascended to about 15,000 feet in three minutes. The noise was considerably louder here than at the camp site.
- 1125 " Arrived Torokina.

TUESDAY -25th MARCH, 1952

Mountain covered for most of day by cloud - noise accompanying eruptions heard several times during day.

WEDNESDAY - 26th MARCH, 1952

- 0800 " Fairly strong explosion at crest, mountain only partly visible due to intervening vegetation.
- 0918 " Spectacular explosion - biggest "Glowing Cloud" type of expulsion seen to date. Three distinct nuees visible, one down north east gully, one down north west gully and one down western avalanche valley. Activity viewed from Torokina beach.
- 1000 " Fairly strong eruption - material ejected vertically no accompanying nuees.
- 1045 " Further vertical explosion.
- 1400 " Vertical explosion.
- 1645 " Vertical explosion.
- 2000 " Vertical explosion.
- 2315 " Prolonged reverberation (about 45 seconds) too dark to see anything, but it must have been quite spectacular.

THURSDAY - 27th MARCH, 1952

Awoke to find area covered in fine ash about 0.5 mm. deep.

- 0800 " Explosion - dark column ejected vertically quite narrow to about 8000 - 9000 feet where it mushroomed out.
- 0956 " Explosion - billowing column (very wide - over-lapped mountain) brownish grey in colour. Ash cloud drifted to south west and about half an hour after explosion ash commenced to fall at Torokina - continued for about one hour. About 0.5 mm. of ash accumulated during that period.
- 2020 " Explosion audible - too dark to see anything.

FRIDAY - 28th MARCH, 1952

- 0942 " Colossal blow - reathing and writhing billows shot rapidly skywards attained a height probably in excess of 30,000 feet. Mrs. Wallace Brown states it is the most violent she has ever seen from Bagana - no accompanying "Glowing Clouds" with this explosion.
- 0952 " Thunder heard from cloud - no lightning visible. Mountain cloud capped for rest of the day.

SATURDAY - 29th MARCH, 1952

Mountain obscured by cloud all day - explosions audible at 0820 hours and 2130 hours.

SUNDAY - 30th MARCH, 1952

Mountain again obscured by cloud.

1120 hours Explosion - Grey writhing ash cloud shot into
view above cloud cover, quickly ascended to
about 20,000 feet, not much noise associated with
this explosion.

1305 " Explosion - cloud emitted very similar to that of
1120. Explosion audible.

1415 " Explosion - ejection very similar to previous
two, height attained by ash cloud appeared to
have been somewhat greater. Noise barely
audible at Torokina.

MONDAY - 31st MARCH, 1952

2240 " Explosion audible at Torokina - nothing visible
due to darkness and rain.

TUESDAY - 1st. APRIL, 1952

Returned Rabaul.