COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF NATIONAL DEVELOPMENT.

BUREAU OF MINERAL RESOURCES
GEOLOGY AND GEOPHYSICS.

RECORDS.

1959/39

NOTES ON SAVO VOLCANO,

BRITISH SOLOMON ISLANDS PROTECTORATE

by

G. A. Taylor

NOTES ON SAVO VOLCANO,

BRITISH SOLOMON ISLANDS PROTECTORATE.

- by -

G. A. TAYLOR.

RECORDS 1959/39.

CONTENTS.

Introduction.
The Crater.
External Thermal Areas.
- Vogala.
- Tavoka East.
- Reoka.
- Vutusuala.

Conclusions.
Routine Observations.
Acknowledgements.

ILLUSTRATIONS.

fig. 1 Map of Savo Volcano.
fig. 2 The major solfatara of Fishervogala.
fig. 3 Solfataric activity in the Vogala thermal area.
fig. 4 The site of the new vents in the Vogala thermal area.
fig. 5 Landslide on the southern side of Reoka thermal area.
fig. 6 Savo Volcano - the most active vents in Reoka thermal area.
fig. 7 Instrument house at Paebeta school.

INTRODUCTION.

Dr. N. H. Fisher recently drew attention to the fact that Savo volcano in the British Solomon Islands Protectorate has affinities with Mount Lamington in Papua and shows clear evidence of a capacity to produce eruptions of the lethal Pelean type. In common with Mount Lamington it has -

- (a) a central lava dome,
- (b) massive deposits of fragmental material typical of the material left by nuees ardentes,
- (c) a hornblende-bearing lava of the andesitic category.

In addition, a history of casualties from earlier eruptions of Savo supplies evidence which was lacking at Lamington, where the period of dormancy had been so long that the irregularly shaped and forest covered cone was not recognised as a volcano.

Dr. Fisher has made recommendations on an observation system to guard against eruption occurring without warning. He has suggested that my services as a vulcanologist be made available to the British Solomon Islands Protectorate in the event of any change of conditions at Savo. The Administrator of the Territory of Papua and New Guinea has given his consent to this arrangement. Following discussions with Mr. D. Cudmore of the B.S.I.P. Administration on an evacuation plan for Savo an inspection of the volcano was undertaken in late January 1959 with the object of gaining some familiarity with normal conditions of activity. A visit to the island, in the company of Mr. J. C. Grover, occupied three days during which the crater and the main thermal areas on the southern and western flanks of the volcano were examined.

This survey of Savo revealed a number of changes which, had they been associated with local seismic activity, would have been cause for concern. Fresh landslides were observed both in and outside the crater; temperatures had risen at a number of points; one of the most notable vents on the island has increased in activity, and vigorous vents were found in one area where activity had been slight previously. Such comparisons were made possible by Mr. Grover's previous study of the areas.

THE CRATER.

The well-timbered crater area is roughly half a mile in diameter and its limits are fairly well defined by an irregular rim which loses its identity on the eastern side, where a broad breach opens into the steep valleys draining onto the coast. The western side of the flat crater floor is occupied by a small lava dome which stands well back from the adjacent crater walls and rises to a height of about 150 feet.

A brief study of the dome brought to light features bearing on its mode of growth. The structure is oval in plan but clearly assymmetrical in east-west profile. Development has been greatest on the eastern side where the highest point is found. Something in the nature of a terrace or step exists on the low western side. Interestingly enough a marked difference in the texture of the mantle is evident on these respective sides of the dome. On the western side are found large boulders and coarse blocks; on the east, mostly ash lapilli with some small blocks. Observations at Lamington suggest that a mantle of fine material may be associated with endogenous growth, and exogenous growth produces coarse rock debris. There dome growth began with a piston-like upthrust of sub-plastic lava which built up a hemispherical rock body by endogenous processes. The surface of this structure was covered with a mantle of predominantly fine-grained material which represented explosive products previously occupying the top of the conduit. Then spines were thrust through the mantle on the southern side of the structure and their disintegration covered this sector with large boulders and coarse blocks. This endogenous growth remained localised to the southern side for several days. Thus at this early stage of the development of the Lamington dome there was an assymmetrically developed structure exhibiting characteristics very similar to those of the present dome of Savo. To give further emphasis to this picture, on the eastern side of the Savo dome is a summit mound made up of platy blocks which are a typical disintegration product of a terminal spine. It is concluded therefore that the Savo structure is a dome of arrested development in which the forces of extrusion were exhausted at an early stage of growth. It is probable that the limits of the underlying conduit are fairly closely defined by the dome margins. The related thermal points are all marginal to the dome.

The Bitívogala thermal area is a narrow zone at the foot of the south-western margin of the dome, extending to the western flank where it widens to include the inside of the adjacent crater wall (fig. 1). The ground is gently steaming in the south-western sector; no sublimation products are evident on the surface. Where the dark layer of soil and rotted vegetation is removed the underlying material is white and sandy in texture. On the western flank the thermal area is solfataric. Crystalline sulphur is deposited around the mouths of the many small vents and in some places deposition in an environment of loose ash has lifted the surface of the ground to form small "sulphur domes".

Temperatures taken at nine points in the Bitivogala area were, with one exception, 99°C. This represents a rise of 3°C on the measurements of August 1956. The temperatures still fall in the "normal" category for a dormant crater of this elevation.

On the crater wall facing the northern side of the dome many steam vents emerge from fractures in massive lava. Mr. Grover has named this area Fishervogala. Superficial sulphur is deposited around the vent orifices, and temperatures range from 97°C to 98°C (fig. 2).

West of this area where the crater wall changes to fragmental material and friable rock, heavy land slides have taken place in a narrow gorge incised into the crater rim. Subsequent rains have been instrumental in carrying material out onto the crater floor where a broad flat fan of boulders, sand, silt and mud has been deposited. Many small trees encompassed by this fan are dying off. Although the vegetation in this area generally seems inhibited by the presence of underlying hot ground the current dying off of vegetation is probably due to excessive moisture.

Another small thermal area occurs opposite Fishervogala at the base of the dome. It is a nonsolfataric area which extends a short way up the northern flank and gave temperatures of 97°C and 98°C.

<u>EXTERNAL THERMAL AREAS</u>.

The more important thermal areas examined on the southern and eastern slopes include Vogala, Tavoka East, Reoka and Vutusuala (fig. 1).

VOGALA.

The extensive Vogala area is situated in a steeply incised gorge which forms a headwater branch of Kurala Creek and is very close to the southern rim of the crater. Sulphur-depositing steam vents line the flanks of the gorge (fig. 3) and on the floor of the upper northerly branch (fig. 4) are vigorous pressurized vents ejecting gas and water. An unusual feature of these vents is the fact that stones near the orifices are black, a superficial colour produced by the action of the gas on the minerals in the stones. Prevailing temperatures are 100°C. Mr. Grover noted that some of these vents are new; they were not present in 1956. Temperatures in the solfataric area is 98°C.

The drainage from this thermal area forms a hot stream which descends towards the coast in a narrow gorge. Steaming waterfalls break the continuity of the stream in its upper reaches, and a landslide had temporarily blocked the flow on the day of the inspection of the area. At the junction of the Vogala and Pipilomata tributaries temperatures were checked and found to be 53°C and 45°C respectively as compared with 48°C for both streams in August 1956.

TAVOKA EAST.

Tavoka East is a much smaller area in which minor solfataric activity is evident. It is situated at the head of Vurala creek. Here thermal emanations have saturated steep banks of tuff and agglomerate converting the material into a soft grey rock of clayey texture. Strong pyritisation is present. The bed of the stream descending from this locality is lined with a yellow deposit which may be limonite.

Temperatures are 99°C in the steaming banks and 94°C in the bubbling vents on the floor of the valley.

REOKA.

The Reoka area begins less than half a mile up Kolika creek where a bench of altered agglomerate strikes across the course of the stream. Mildly active thermal points here ranged in temperature from 92°C to 100°C and the rocks are encrusted with sulphur and white and green hydrothermal products. Bulika is the native name for this area. Numerous points are encountered on the way upstream to the main thermal area which is situated near the junction of the two principal headwater branches of the creek. Here the southern flank of the valley is covered with a mass of debris from recent landslides (fig. 5). Steam vents occur in the floor of the valley and mild solfataric activity is present (fig. 6). The highest temperature recorded is 99°C.

Many small hot springs are distributed along the course of the main northern tributary. The water in this stream is heavily charged with hydrothermal products, for the bed is coated with a thick layer of travertine which welds the assorted stream debris into solid rock and forms terraces.

VUTUSUALA.

The relatively small Vutusuala thermal area was examined with particular interest because a vent here had been measured previously at a temperature of 103°C. This vent which is situated on the floor of a small stream and near the lower end of the thermal area was a point of mild steam exhalation when Mr. Grover saw it last. Now it expels a noisy jet of steam and water to a height of about 12 feet. The temperature however had fallen to 100°C. Damming back the water of the stream so that it did not pass over the vent had no effect on the temperature or the nature of the emission.

Above this vent on the northern bank of the stream a small gully or embayment contains many thermal points. The margins are actively solfataric and on the floor are a bubbling spring and vigorous gas vents which emerge from a mass of mud and rotten logs. Temperatures in the bubbling spring and the largest gas vent are 97°C and 99°C respectively.

Natives at the nearby village on the coast claim that fluctuation in activity is a normal thing at Vutusuala. The pattern is said to be that after rain the lower (noisy) vent becomes very active and the points in the gully above become less active. During dry periods the process is reversed.

CONCLUSIONS.

The thermal areas of Savo are typical of those of a dormant volcano, and the degree of activity is comparable with that of some of the New Guinea centres. It is a notable point that the gases emitted from the vents have no obvious content of SO_2 or HCl. Sulphuretted hydrogen is faintly discernible in some areas and perhaps SO_2 is present in small proportion. A common prelude to renewed activity is a rise in the content of acid gases. The presence of pronounced concentrations of SO_2 causes burning or choking respiratory effects and HCl usually causes watering of the eyes.

Temperatures generally fall into the category of "normal" levels for a volcano of this type. Recent changes seem attributable to heavy rains and a consequent influx of ground water which enables better transfer of heat from depth. Similar changes have been observed in one of the thermal areas of New Guinea. Landslides are a common aftermath of exceptionally heavy rains and have been a widespread feature of January weather conditions.

Although attention is very properly drawn to the importance of an increase in thermal activity it is well to remember that a notable decline in thermal activity, which is not associated with a climatic factor, may be indicative of a rising volcanic potential. A moving magma may cut off the feeding conduits to a thermal area. The seriousness of such development is recognised in popular philosophy by the belief that a volcano is not dangerous while its "safety valves" are open.

The nature and range of variation of common warning phenomena has been fully presented by Dr. N. H. Fisher in his recommendations on Savo.

ROUTINE OBSERVATIONS.

A small instrument station has been constructed near Paebeta school and is operated by the native school teacher, Morris, who acts as local observer (fig. 7). The station is equipped with a low-magnification earthquake recorder and a pedal radio transceiver for keeping in touch with Honiara.

Although the site of the instrument station is a necessary concomitant to the compromise on Dr. Fisher's recommendations it should be pointed out that the choice is not a very happy one. It is situated in an old channel of Rembokala Creek which descends from the breach in the eastern wall of the crater. In event of renewed activity this area could be expected to receive the first of the nuees ardentes and mudflows. Perhaps at a later date it will be practicable to appoint a full time native observer and move the station to a less vulnerable site.

The area between Sesepi and Reko villages is considered one of the safest.

Current observations could be improved first and foremost by the early establishment at Honiara of the seismograph station. This will assist in locating seismic disturbances of regional and volcanic origin and enable a much better appreciation of the significance of reports from Savo.

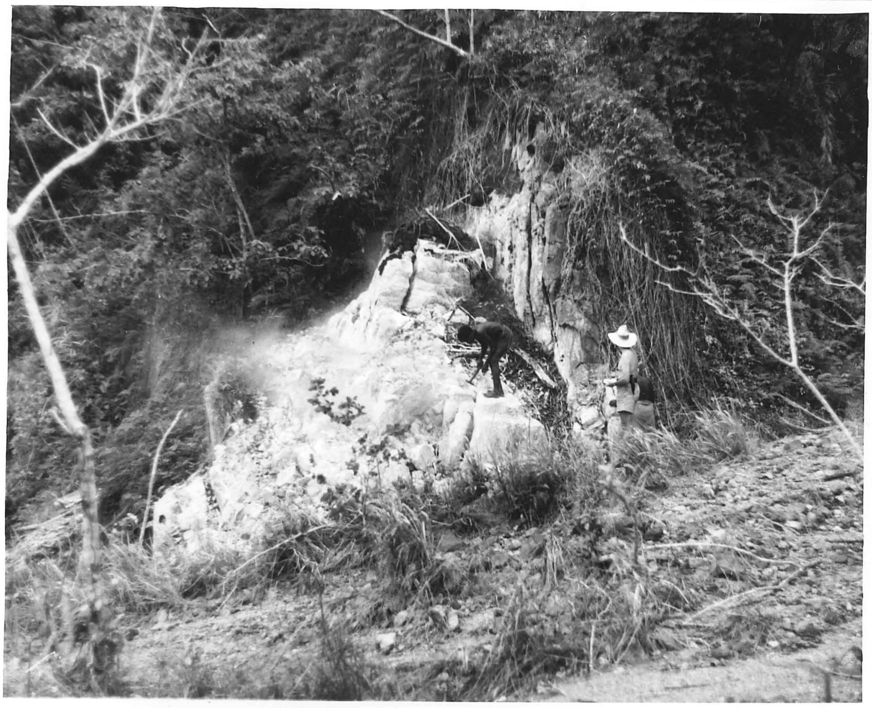
Deep-seated movements frequently cause tumescence or slow distortion of the volcanic edifice as a prelude to eruption. These changes in level are normally no more than a fraction of a minute and can only be detected by instruments of appropriate sensitivity. It has been recommended that a pair of bubble-type tiltmeters be installed on Savo.

Other requirements which have been discussed with Mr. Grover are the provision of spare clockwork motors for the earthquake recorder and the purchase of maximum registering thermometers for temperature observations.

ACKNOWLEDGEMENTS.

The ready assistance and kind hospitality of members of the Protectorate Administration during my visit to the area is most gratefully acknowledged.

SAVO ISLAND
SCALE
0 1/4 1/2 3/4 1 Mile
Panueli
Sadailolo
Ravirongo
Tanakola
Lebon
Plantation
Bonala
Shock Recorder Station
Paebeta School
Pokolauka
Bulai
Birasu
Kaungele
Relonga
Gareka
Sesepi
Reko
Koaela
Bokiaka
Simbera School
Kuila
Tuluka
Bazo
Kosikosilamata
Rembokola
TA'OKOMATA
BITIVOGALA
FISHER VOGALA
Lava Dome
99°C
98°C
100°C
Pipilomata
Vogala
VOGALA
VUTUSUALA
REOKA
Kolika
BULIKA
Tagomba
TAVOKA WEST
TAVOKA EAST
Kurala
Solomata
Varala
Votuka
LEVUSAGATA
TAGABA
PAGALULA
8°
True North
Magnetic North
Thermal Area
Peak, hill
Coral reef
Beach
Village
Coconut plantation
Bureau of Mineral Resources, Geology and Geophysics. May, 1959.
F 39-6 F.J.R.



The major solfatara at Fishervogala

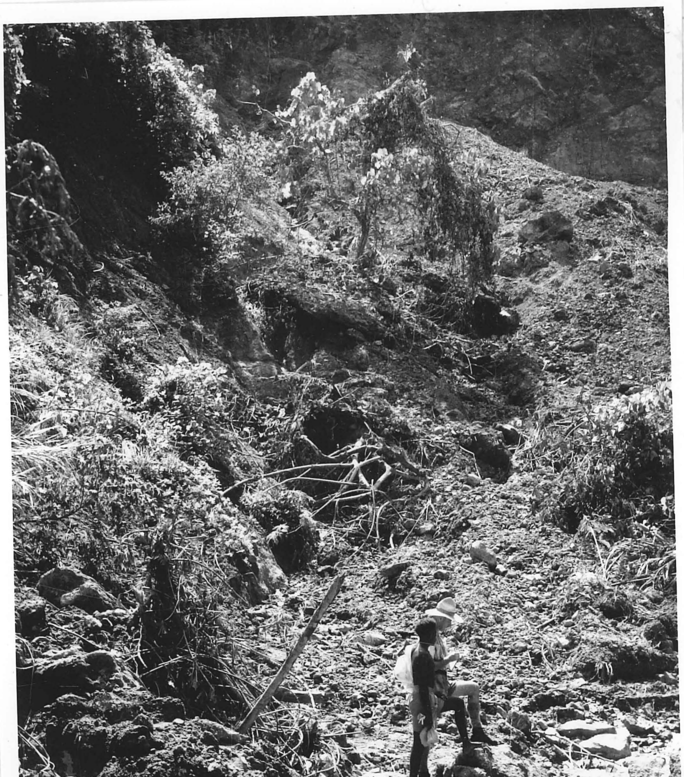
fig. 2

Solfataric activity in the Vogala Thermal Area

fig. 3

The site of the new vents in the Vogala thermal area

fig. 4

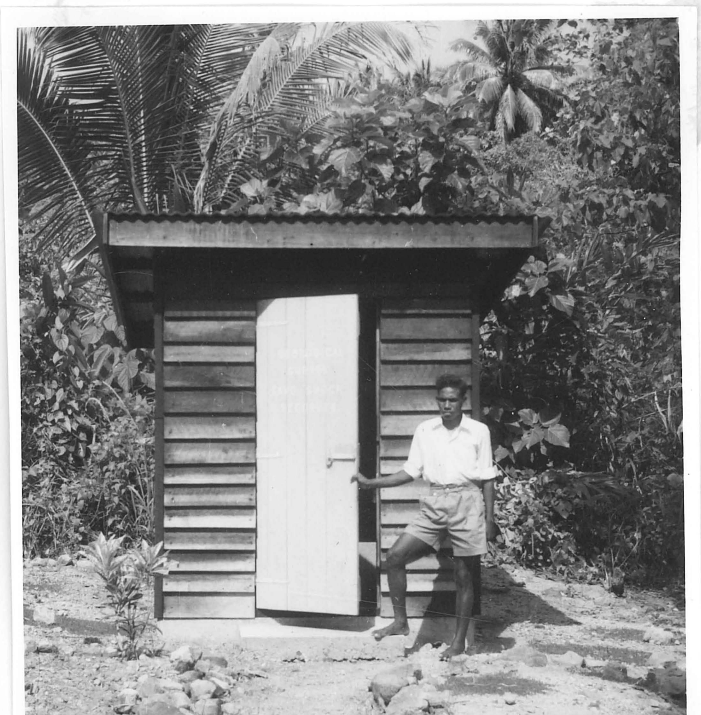


Landslide on the southern side of Reoka thermal area

fig. 5

Savo volcano - The most active vents in the Reoka thermal area

fig. 6



Instrument house at Paebeta school

fig. 7