COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF NATIONAL DEVELOPMENT.

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

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REPORT ON INVESTIGATION OF SULPHUR DEPOSITS IAMELELE - FAGULULU DISTRICT FERGUSSON ISLAND

WITH APPENDIX

CLAYS RESULTING FROM HYDROTHERMAL DECOMPOSITION OF VOLCANIC FLOW ROCKS

by

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Bureau of Mineral Resources,

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INTRODUCTION :

The writer left Port Moresby, accompanied by Mr. I. MacDougall who is interested in these deposits by Catalina on June 28th, arriving Esa'ala on the same day. Thence the Administration workboat, "Erlo," brought the party to Fagululu landing, arriving at midday on June 29th. Camp was made at the Government Rest house and an examination of the deposits commenced.

Very heavy rains hampered the work, but it was possible to make a careful examination of the volcanic areas, also to gain a general idea of the geological conditions. Some mapping was carried out by compass-pace methods but it is evident that more detailed surveying, with the use of aerial photographs, in order to produce a geological map of the D'Entrecasteaux group, would be worth while.

The writer is aware that some geological work has been done, years ago by the late Evan R. Stanley, and has also heard rumors of a report produced by two Americans during the late war. Neither of these reports is at present available to the writer. Reports have been received of the presence of mica of economical value on Fergusson, and this is possible since pegmatite dikes are undoubtedly present. Also there is a report of piezo-electric quartz crystal, also possibly present.

The party left Esa'ala on July 13th, and after an overnight stay at Losuia, returned to Port Moresby on July 14th.

GENERAL GEOLOGICAL NOTES :

II

The Western half of Fergusson Island appears to consist of two large masses of igneous and Metamorphic rocks,

(GENERAL GEOLOGICAL NOTES - Continued).

one to the north and one to the south. Types of rocks noted and named from Megascopic examination only include gneissic granodiorite, hornblende granite, and quartz-mica schist, also a dense granulite rich in red garnet, and containing a green mineral which may be a pyroxene. This rock appears to be included as masses within the more acid rocks. Pegmatite dikes occur, and minerals found in the stream detritus include a pale blue Kyanite, also fragments of quartz broken from crystals of sufficient size for the cutting of piezo-electric quartz plates.

Coarse boulder beds with boulders of dimensions up to several feet form a piedmont plain some 2-300 feet above sea level and these are intruded by dikes feeding relatively recent flows of glassy and stony lavas forming the lower hills and ridges near the coast. There is no defined crater in this area and the lavas appear to be of slightly different ages and are of fissure type with no evidence of explosive activity. Some tuffaceous beds were observed, but these appeared to be older than the boulder beds mentioned above.

Depressions between lava tongues, also some clearly due to collapse of flow surfaces by hydrothermal decomposition and removal of flowrock now form wide valley and lake areas with floors of micaceous sand clearly derived from the older igneous rocks, scattered fragments of volcanic glass, some clayey patches and siliceous encrustations. Innumerable fumaroles, boiling springs, small pits of boiling muds, small mud volcanoes, small cones and terraces of amorphous silica, issue from shattered parts of the flows and in the floors of the flat sandy areas, indicating the presence of still-hot lavas beneath.

(GENERAL GOLOGICAL NOTES - Continued)

At Mapamoiwa there is clear evidence of recent elevation in coral reefs reaching a height of at least 25 feet above sea level, and the writer considers that recent elevation of the coastline of Seymour Bay in the Iamelele vicinity to the extent of some 10-15 feet is probable.

VEGETATION :

III

A belt of mangroves some 600-700 feet wide borders most of the coastline at the head of the bay. These are remarkably straight trees, and could provide an enormous number of 40 ft. lengths with minimum diameter of 6 inches.

The younger, or at least hotter flows where hydrothermal activity continues support scattered trees the dominant type being a species of paper-bark gum. Some pandanus grows in suprisingly hot places. Undergrowth includes spear grasses, some kunai in places, and various ferns.

The lava flows with no thermal activity, also the areas of igneous rock support the usual rain-forest vegetation, some areas of grass at least marking old garden areas. Clearing of steep slopes for gardens is practised in many areas and these areas appear not to regenerate trees because of either the resultant loss of soil due to erosion, or periodical burning off of grass.

SULPHUR DEPOSITS :

IV

1 LOCATION AND ACCESS

All the deposits investigated were located within 1-1½ miles of the coastline of Seymour Bay, in areas of up to a few thousand square feet scattered over an area of about ½ square mile.

The whole area is readily accessible over fairly flat

sandy plains, relatively well drained. A 57 foot vessel anchored within 100 feet of the shore and it is believed that much larger ships could also do this. Anchorages near Iamelele are usually avoided since the hydrogen sulphide gas concentration is often so high as to damage severely the paintwork on the vessels and the atmosphere could be, in the writer's opinion, dangerous to health. Anchorage in Seymour Bay is at all times protected and safe.

2. NATURE AND EXTENT

Sulphur has been and is being deposited by hot volcanic gases from fumaroles in loose heaps of lava fragments, on sides of pits of boiling mud, and, in more significant amount in the sands of the flat areas, and as fantastic shapes above all these localities of emanation. Sulphur is also being deposited in pools of boiling, hot, and even cold water, as thin films in sinter terraces, and in the channels of small streams flowing from the springs.

(1) DEPOSITS IN HEAPS OF VOLCANIC GLASS BY FUMAROLES.

In many places disintegration of glassy flows has resulted in ridges of loose boulders and fragments of all sizes, finer materials being washed out. Gaseous emanations through these deposit sulphur on the surfaces of the fragments in thicknesses up to an inch or so. Movement breaks off the sulphur layers resulting in heaps of mixed sulphur and glass lumps. The sulphur is generally fairly clean, but in small amount since though there are many vents, the deposits have only a small surface area and depth.

(2) DEPOSITS IN SANDS OF FLAT PLAIN AREAS BY FUMAROLES.

Fumaroles are at present in operation in groups scattered over a large area forming groups of domal and elongate mounds, the cappings of which consist of cemented sands, much cracked, above which at the localities of emanation are built fantastic shapes of pure crystalline sulphur. Similar mounds with no present activity are also

common. These mounds are formed by the growth of sulphur masses beneath the surface. The central portion of each deposit consists of an irregular core of clean sulphur which is surrounded by a halo of sulphur sand mixture, sulphur content slowly fading out away from the core. Sulphur extends to a depth of no more than 4-5 feet below the surface of the dome, and the bases may be related to a thick clay layer which occurs about 2 feet below the general surface level. This type contains the bulk of the sulphur of the area.

(3) DEPOSITS IN POOLS.

Large quantities of mud occur in pools through which hydrogen sulphide bubbles. The temperature of the water varies greatly from pool to pool, as does its depth and clarity, and the mud varies from cream to light chocolate in colour. All the muds contain sulphur in a fine state of division, some being nearly pure sulphur. A curious feature is the presence in the cooler pools - nevertheless hotter than 100° F, of many living mosquito larvae.

(4) AMOUNT OF SULPHUR DEPOSITS.

Owing to a number of factors, some of which are : extreme irregularity in shape of any given mass, extreme irregularity in amount of detrital mineral impurity, and the fact that some chemical process converts elemental sulphur into some compound, it is extremely difficult to estimate the amount of sulphur actually present.

The amount estimated by the writer to be present in the area examined by him and indicated in the accompanying sketch map is 4000 tons. This was arrived at by measuring the area, and estimating the thickness and percent of sulphur, in the case of the fumarole deposits. No effort has been made to estimate the amount of sulphur in the muds. Of the 4000 tons approximately 1000 tons would be clean sulphur, the remainder requiring treatment before shipping to remove such impurities as quartz sand, mica, and clay.

(5) POSSIBILITY OF ALLUVIAL, CHEMICALLY OR BIOCHEMICALLY PRECIPITATED SULPHUR DEPOSITS OF ECONOMIC VALUE.

It is possible that such deposits could occur in old or present lake areas. It is certain, however, that any such deposits would be either admixed with or thinly interbedded with other detrital mineral material. No thick beds of sulphur of economic value could occur.

Moreover, examination of the muds spread out by older, now extinct hot springs reveals negligible amounts of sulphur though it is contained in all the muds of the present springs and pools.

3. DESTRUCTION OF SULPHUR DEPOSITS.

The probable cause is oxidation by atmospheric oxygen in the presence of water. All surface waters flowing from the thermal areas contain sulphuric acid which would result from such oxidation. In this area as in New Britain it is a fairly rapid process, only the areas in which deposition of sulphur is now occurring or has obviously occurred just recently containing much sulphur.

A curious feature is that thin encrustations preserve their form, although the sulphur is oxidised, and the colour changes from yellow through brown to grey as the process advances.

The writer at first concluded that replacement by a relatively insoluble sulphate was involved, but sulphate could not be detected by examination of some of the grey crusts, which appear to be a form of amorphous silica.

Whatever the nature of the processes involved, the significant result is that no very considerable accumulation of sulphur can be expected, at least where oxidation is possible. The fact that the gaseous inter action of hydrogen sulphide with sulphur dioxide, resulting in deposition of sulphur can probably only occur effectively

on reduction of temperature of the emergent gases precludes any great depth of deposit.

V. SUMMARY AND CONCLUSIONS :

Fumaroles scattered over a large area are at present depositing Sulphur in innumerable small masses. The total amount of Sulphur present is estimated to be approximately 4000 tons, of which 1000 tons is clean sulphur which could be selected by hand. All deposits are being oxidised rather rapidly, probably by atmospheric oxygen in the presence of water. It is also possible that the volcanic gases include oxygen.

Sulphur is also being deposited in hot pools and in small stream channels as a fine powder by oxidation of H_2S in the presence of water. Such deposits are contaminated by more or less clayey material, and no attempt has been made to estimate the amounts recoverable, but they are probably insignificant.

The possibility of the occurrence of useful detrital or chemically (biochemically) deposited sulphur is not considered good.

Access to the areas is relatively good, but the small amount of sulphur present renders the deposit of little national importance. However, the sulphur could possibly be produced at a profit using simple methods and it would appear desirable that its production should be encouraged.

APPENDIX

Clays resulting from Hydrothermal action upon Volcanic flow rocks.

In the vicinity of fumaroles, the flow rocks are completely decomposed into a clay-like material. In the field this is a cheese-like material becoming wetter on manipulation and is white. No gritty constituents are present, except that siliceous incrustations occur on decomposed lumps. The boiling muds are of similar type sometimes lightly coloured and used by the natives as paints on houses, where they possess suprising tenacity under the action of the weather. When dried all these clays crumble and the fragments adhere strongly to the tongue.

The following tests, with indicated results, have been carried out:

1. Benzidine test. No blue coloration, indicating absence of Montmarillonite.
2. Sadler's Test for Bentonite: No gelatinisation - not swelling Bentonite.
3. Acidity or Alkalinity of water-extract pH 7.

The material is thus probably Kaolin, little or no iron being present.

Where volcanic rocks are decomposed by sub-aerial agents only, the result is a red-brown clay also greatly sought by natives as a pigment. It is in general mixed with lava fragments.

Large quantities of these clays are present in easily accessible localities.

(SGD) A.K.M. Edwards.
1/8/50.

SULPHUR DEPOSITS OF THE FAGULULU - IAMELELE AREA. FERGUSSON ISLAND.

MAP BASED ON VERTICAL AERIAL PHOTOGRAPHS AND COMPASS - PACE TRAVERSES.

HEIGHTS ARE APPROXIMATE ONLY - CALCULATED FROM VERTICAL AERIAL PHOTOGRAPHS.

FORM LINES SKETCHED UNDER STEREOSCOPE

SCALE: 3" = 1 MILE (APPROX)

0 1/4 1/2 3/4 1 MILE

0 1000 2000 3000 4000 5000 6000 FEET

IAMELELE VILLAGES

SEYMOUR BAY.

FAGULULU

TRUE NORTH

APPROX 6°30'

MAGNETIC NORTH

LEGEND

- AREAS OF SIGNIFICANT SULPHUR
- HYDROTHERMAL AREAS WITH SCATTERED SULPHUR DEPOSITS
- STREAMS
- LAKE
- FORM LINES
- BEACH SANDS
- MANGROVES
- FOOT TRACKS
- NATIVE VILLAGE
- SCHOONER ANCHORAGE