COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF NATIONAL DEVELOPMENT.

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

RECORDS.

1955/75

NOTES ON VOLCANIC ACTIVITY AND THERMAL AREAS IN THE D'ENTRECASTEAUX ISLANDS

by

G. A. Taylor.

Canberra. August, 1955

NOTES ON VOLCANIC ACTIVITY AND THERMAL AREAS IN THE D'ENTRECASTEAUX ISLANDS

by

G. A. Taylor.

Records No.1955/75.

CONTENTS

NOTES ON VOLCANIC ACTIVITY AND THERMAL AREAS IN THE D'ENTRECASTEAUX ISLANDS.

INTRODUCTION

The following notes include information derived from two brief visits to the D'Entrecasteaux volcanic areas, one in June, 1951 and the other 28th - 30th June, 1955.

The D'Entrecasteaux Islands lie close to the north coast of eastern Papua. The three main islands, Goodenough, Fergusson, and Normanby, have a basement of regional metamorphic rocks intruded by minor igneous masses ranging in composition from gabbros to granites. These older pre-Eocene rocks are covered in many places by younger volcanic rocks to which a Pleistocene age has been attributed.

In the short known history of the islands there are no reports of volcanic eruption in the region. Nor is there any evidence of such an event in the legends of the local natives. Examination of the area, however, reveals volcanic cones in such a well preserved physiographic condition that it seems unwise to consider them extinct. They have obviously been active within very recent geological time and recent events in the Papuan volcanic arc, of which the D'Entrecasteaux volcanoes appear to form the eastern extension, suggest a new mobility in this zone, which focusses our attention on the possibility of reactivation in this group.

In 1943, a new vent was established by powerful explosive activity at the foot of the Goropu mountains. Less than 100 miles away and towards the north east end of the arc, Lamington erupted in 1951. These eruptions were preceded by three unusual major tectonic earthquakes, the epicentres of which appear to be along the plane of the volcanic arc. This suggests the possibility that the eruptions were triggered by special conditions of regional stress. The reports of further earthquakes around the D'Entrecasteaux Islands suggests that these stress conditions are persisting.

RECENTLY ACTIVE CENTRES

The most recently active volcanoes in the D'Entrecasteaux are located about the south eastern portion of Fergusson Island. They consist of a series of craters and cones beginning near Sebutuia Bay and extending south to Dobu Island. The most clearly defined and possibly the most recently active craters are:- Lamona crater south of Sebutuia Bay, Oiau crater in the centre of the peninsula, which for convenience we shall call the Numa Numa peninsula, and Dobu Island. Between Oiau and Lamona craters an area of broken country appears to be a complex volcanic pile consisting of numerous cones and lava flows.

Lamona Crater. Latitude 09° 36½'S, Longitude 150° 53½'E.

Lamona crater is erroneously marked on the military map as Numa Numa crater. The native name, Lamona, means cooking pot.

Access to the crater is gained by a rough track leading from a small coastal village east-south-east of it. About an hour's climb brings one to the top of the low rim on the southern side of the crater. A native track extends along the open grass-covered section of the rim on the south-eastern side of the crater. A good view of the interior of the crater can be obtained from this track.

The crater is a sheer-sided, almost circular, cavity set to the south-south-east of the summit of the cone. Thus it is dominated by the northern and north-western walls which

are several hundred feet higher than the south-east rim. The height of the cone is approximately 1,650 feet. The vertical walls facing the south-east rim have a curious massive unbedded appearance as if they were composed of a homogeneous rock. This structure suggested that present crater may have been formed by a powerful explosive eruption slightly eccentric to a massive plug which had completely sealed up the original crater of the volcano.

The floor of the crater is covered with dense vegetation. Rain forest is the predominant covering but near the base of the south-eastern wall is an open glade where a swamp has formed since it was last inspected in 1951.

No thermal points are evident in the crater.

The south eastern part of the cone appears to be made up essentially of fragmental material which is generally finely divided. On the top of the rim small angular blocks of a light coloured trachytic lava are common, but for the most part the ash is fine-grained and non-vesicular. On the lower slopes large blocks of black volcanic glass are common. These obsidian blocks appear to be an older lava. The trachytic lava is described in the appendix to this report.

Oisu Crater (Lat. 09°41¼'S. Long. 150° 51½'E)

Oisu crater is situated within the remnants of a ragged cone west of the Numa Numa mission station. The southern wall of the crater rises to a height of over 1200 feet and the remainder of the cone appears to consist of a group of hills and ridges on the northern side rising to a maximum height of about 800 feet. The exact location of the crater was not apparent until the structure was viewed from the air. Then it was surprising to find its position marked by what appeared to be a quite extensive lava field which seemed to be occupying the bowl of the crater. The surface of this dark mass of lava appeared to have little in the way of soil cover and the scattered vegetation was limited to scattered trees.

The state of preservation of this lava mass suggests a very recent origin.

Dobu Island (Lat 09°45' Long. 150°52')

This volcanic island appears to be made up of predominantly fragmental material originating from a vent in approximately the centre of the island. Like Oisu, it has a ragged ill-defined cone structure which has probably been produced by the destructive activity of either migrating vents or explosive eruptions of great violence or both. The north-eastern hills on Dobu seem to be the largest remnant of the old cone. It rises to about 900 feet.

The only part of Dobu examined in detail was a cliff section on the coast near the village of Murisis. It revealed massive deposits of fragmental material not unlike those around Vulcan at Rabaul. The rock types ranged from light coloured trachytic-looking lavas to black volcanic glass.

The very limited thermal points on Dobu Island are described below.

THERMAL AREAS ON FERGUSSON ISLAND

Fergusson island contains the most extensive thermal areas in the group. Deidei at the base of the Numa Numa peninsula and the Iamelele area on the western side of the island are the largest areas.

The Deidei Area

The Deidei area is reached by following a track along the western side of the Numa Numa peninsula. Just beyond the most northerly village, where the coastal mangroves begin, the track turns inland from Kedidia Bay and roughly follows the course of the Manawana Creek. Fifteen minutes' walk from the beach the track enters the thermal area. (see fig. 1 zone (1)).

Boiling springs, small geysers, hot pools, white sinter terraces, and mud pots are scattered over a sparsely vegetated area of grasses and stunted pandanus and paper-bark gum trees. The area covers several acres and appears to consist of two adjoining elongate zones orientated very roughly east-west. A headwater branch of the Manawana Creek appeared to form the northern boundary of the area. The natives said there was no activity beyond the stream. To check this statement would have required considerable time and careful exploration. Much of the ground is undermined and superficial crusts of siliceous material cover quagmires of hot mud.

All the boiling springs observed in the main active areas produced a clear saline water which was heavily charged with siliceous material. Sharp lips of sinter often form around the margin of bubbling pools and below them, with further falls in temperature, extensive terraces of white sinter are deposited. Scraps of vegetation lying around the pools are rapidly being replaced by silica and the spatter zones around the small geysers are usually covered with fanciful botryoidal and interlaced patterns of crystalline siliceous material.

Evidence of change in thermal area.

In the most northerly area situated between the headwater branches of the Manawana Creek some changes have taken place within the last two years. The main geyser is now defunct. The activity has moved into an adjacent fissure which has opened up on the southern side. Vigorous spasmodic ebullition proceeds from the fissure throughout about forty yards of its length. It trends roughly 255° Magnetic Bearing.

South of this fissure again, and crossing the access track to the northern area, is another fissure trending 280°M. Some movement appears to have also taken place here, but the evidence for it is less conclusive.

The opening of the fissure adjacent to the geyser seems to have taken place within the last two years. The main geyser was active in 1951 and the interpreter, who accompanied us on the inspection, claimed that it was active when he last visited the area with Mr. Justice Gore. The date of this visit is not known accurately but can easily be obtained from the Judge. It is possible that the very numerous earthquakes felt on the Numa Numa peninsula in October and December 1953 caused the fissuring. A vague report that fissuring had taken place in the Deidei area was received at Hea Ala in July, 1954.

Temperatures

Some of the temperatures recorded at Deidei were a little higher than any previously recorded at thermal areas of this type in the Territory. A temperature of 108°C was recorded at one point near the fissure and it was repeated at another point which looked as if it may have subterranean connections with the fissure. Some doubt exists as to whether such readings can be considered abnormal for geyser areas.

Seven points were marked with stakes and numbered. The final check readings are below.

No. 1	102°C	105°C	102°C	
No. 2	102°C	105°C	100°C	102°C
3	108°C	100°C	102°C	
4	80°C			
5	90°C			
6	102°C	105°C	102°C	
7	102°C			

The irregularity in the readings is probably due to the fact that ebullition rate is spasmodic and the more vigorous release of gas from the vents produces a higher temperature reading.

Atunapora (see fig. 1 point (2)).

At the head of Numa Numa Bay near the end of the beach running along the eastern side of the peninsula, a series of hot springs emerge from the base of an old lava flow. The natives use them for cooking. The water is clear and no discoloration is produced in the sea. Temperatures of 95°C were recorded at the main cooking spring and 98°C at a small spring emerging from a hole in a nearby rock.

A small stream which crosses the beach nearby had a temperature of 40°C. The native name for the stream is Gemwal'o ulo'u.

Iabuir. R. (see fig. 1 point (3)).

Further south a larger stream enters a lagoon formed at the mouth of the Iabuir. Temperatures in this stream were 46°C.

Northern extensions of the Deidei area.

On departing from Esa Ala the Catalina pilot was requested to extend his take-off circuit so as to fly over the base of the Numa Numa peninsula. This brief glimpse of the country north of the peninsula revealed widespread extensions of the Deidei area which have hitherto been unreported. The largest thermal points appeared to lie roughly north-east of the Deidei area (see fig. 1 point (6)). Other thermal points were seen in the hills north of Atunapora (point (4)), and one point was situated near the summit of one of the mountains north-east of Atunapora (point (5)). Positions of these points on the accompanying map are very approximate. The whole thermal region has been roughly outlined on the small scale map and called the Deidei thermal area.

Close inspection of this area will undoubtedly reveal other areas.

Wade.

Near Wade on the south coast of Fergusson Island, natives report the existence of warm springs.

Iamalele

The extensive Iamalele thermal area is situated near the margin of Seymour Bay on the western coast of Fergusson. Very numerous solfataras, hot springs, mud pots and small lakes cover an area of about a square mile. Edwards (1950) found evidence to suggest that the activity was due to an underlying magma which had originally produced fissure flows of lava in the area. He could find no crater or evidence of recent explosive activity.

Kalo Kalo

A thermal area is reported near Didisu, about two hours walk east of Kalo Kalo on the north-west coast of Fergusson Island. Sulphur and other solfataric materials are said to be deposited in the area.

THERMAL AREA ON GOODENOUGH ISLAND

Bolu Bolu

A warm spring and gas ebullition point is reported on the beach east of Bolu Bolu. It is covered at high tide.

THERMAL AREA ON NORMANBY ISLAND

The only thermal point reported on this island is south of Sewataitai on the north coast. Here the Bwasiaia River which descends from the Bwebweso or Lemumu mountain is said to contain hot and cold water.

THERMAL AREAS ON DOBU ISLAND

Two small warm springs on the beach a few hundred yards east of Muriaia village were the only thermal points examined on Dubu. (see fig. 1 point (7)). The village natives did not know of any others. Further enquiry by Mr. Groves brought to light the fact that an ebullition point exists in the sea off the point west of Dewisia village (6). Mr. Groves was also informed by a missionary on Dobu that a thermal area existed on a hillside near Wagomoi. The natives used it for cooking. The location of Wagomoi is not shown on the military map so its position is not plotted on the accompanying map.

SEISMIC ACTIVITY

When compared with other areas in the Territory the eastern end of Papua appears to be relatively dead from the seismic point of view. The available material from international seismic bulletins reveals very limited tectonic movement over the last 40 years. Major earthquakes whose epicentres are close to the Papuan volcanic arc are as follows:-

Date	Epicentre	
	Lat. S.	Long. E.
21. 5.13	8.5	149.0
11.10.13	9.0	147.5
29.10.17	8.5	149.0
21. 3.19	8.5	149.0
10.11.39	9.4	148.9
7. 6.40	9.7	151.5
24. 9.41	9.0	153
22.10.47	10.0	151.5
5.10.53	9.3	152.5

On the assumption that these epicentres are reasonably correct the broad picture suggested by these events is first a build-up of critical stress conditions at the western, Mount Lamington end of the arc during the 1913-1919 period, then a hiatus for 20 years. In 1939 tectonic movement began again, this time in the centre of the arc near the Mt. Victory area and in the following two years the earthquakes foci moved east through the D'Entrecasteaux end of the arc. The unusual movement in the eastern end of the arc is persisting.

It was observed earlier in the report that the regional stress conditions indicated by the three 1939-41 earthquakes may bear some relationship to the eruptions at

Coropu and Lamington. The above data are obviously slender material on which to base such a conclusion; nevertheless many examples of the validity of such a relationship in other areas can be cited. Moreover there were features about the pre-eruption conditions in the Coropu area which may be relevant to an appreciation of the conditions at present obtaining in the D'Entrecasteaux Islands.

The above list includes essentially the major earthquakes for the period; earthquakes strong enough to be recorded at a number of world seismic stations. The list does not include the lesser tectonic shocks, particularly poorly transmitted shocks of shallow focus origin. We are dependent on the reports of local people for this information. The late Father Taylor of the Anglican Mission was living on the coast near Wanigella during the years immediately before the Coropu eruption of 1943. He stated that numerous earthquakes were felt in the area during the two years before the eruption. Whether these earthquakes were of tectonic or volcanic origin is a matter of conjecture but the fact that they were felt as far afield as Kubuna and on the Kusa suggests a tectonic origin for many of them. Mr. Marsh of District Services informed me that on the Kusa the tremors and sharp rapid movements and frequently occurred throughout the day and night.

The possibility of a similarity between pre-eruption conditions in the Tufi area and the seismic activity around Esa Ala is worthy of consideration. Earthquakes reported from Esa Ala over the last two years are as follows:-

Date	Intensity	Type of Movement	Felt at	Remarks
6.10.53	?	-	Esa Ala	Strong shock with numerous aftershock
9.10.53	?	-	Esa Ala	Strong shock.
25.12.53	?	-	Dudoia	
26.12.53	1?	-	Sebulugomma	Numerous slight tremors- 10 to 12 per day occurring over last fortnight Some strong enough to be felt when walking about.
30.5.54	4	east west	Esa Ala Sebulugomma	
	3	vertical	Esa Ala	
31.5.54	3	vertical	Esa Ala	
18.6.54	3	sharp	Salamo Esa Ala	
	1?	-	Esa Ala	numerous aftershocks
19.6.54	4	sharp vertical	Esa Ala	
26.8.54	3	settling quiver	Esa Ala	
1.9.54	3	settling	Esa Ala	
	3	settling	Esa Ala	
	3	settling	Esa Ala	
3.10.54	3	shudder W → E	Esa Ala	

Date	Intensity	Type of Movement	Felt at	Remarks
8.10.54	5	-	Sewataitai	
	6	-	Bwagaoia	
14.12.54	2-3	sharp	Esa Ala	
	2-3	sharp	Esa Ala	
	1?	-	Esa Ala	Numerous aftershocks
15.12.54	3	sharp	Esa Ala	
17.12.54	3	sharp	Esa Ala	
	1?	-	Esa Ala	Numerous aftershocks
19.12.54	2	sharp	Budoia Dobu Island	
9.3.55	5	sharp	Esa Ala Salamo	
10.3.55	1	-	Esa Ala	Numerous foreshocks
	4	sharp	Esa Ala Salamo Sebulugomwa Ubuia Sewataitai	
24.3.55	3	sharp	Esa Ala	
6.4.55	1	slight	Esa Ala	
	2	short sharp	Esa Ala	
7.4.55	2	short sharp	Esa Ala	
	2	short sharp	Esa Ala	
16.4.55	-	-	Esa Ala	
19.4.55	-	-	Esa Ala	
31.7.55	4	-	Esa Ala	32 smaller shocks
	4	-	Esa Ala	
	4	-	Esa Ala	
	4	-	Esa Ala	
2.8.55	2	-	Esa Ala	24 hours ending 0800 hrs. 13 shocks up to intensity 2.
3.8.55	3	-	Esa Ala	24 hours ending 0800 19 shocks up to intensity 3.
7.8.55	-	-	Esa Ala	10 shocks
8.8.55	-	-	Esa Ala	23 shocks.

On the rather doubtful assumption that the majority of these earthquakes are not being felt elsewhere in the group, the movements, which are causing most of these shocks, appear to be originating from foci around the south eastern end of Fergusson. Some support to this view is given by the description of the type of movement as sharp, short sharp and vertical, for these characteristics are typical of the very local shock.

The fact that many quite mild shocks are followed by very numerous aftershocks seems a rather unusual feature for normal tectonic earthquakes. The most striking example of this characteristic is the series of small earthquakes which occurred at Sebulugomwa on the end of the Kumu Kumu peninsula during the fortnight ending 26th December, 1953. Even the most recent earthquakes beginning on 31st July have some similarity in the general features of their pattern, for the main shock peak, characteristic of the normal tectonic earthquake, is supplemented by a series of relatively minor shocks.

CONCLUSION AND RECOMMENDATIONS.

Both regional and local seismic developments in recent years suggest the possibility of volcanic reactivation in the D'Entrecasteaux Islands. However, volcanic eruptions do not invariably follow "seismic storms" of this type, and evidence of developments at a specific centre seems necessary before considering that an eruption is imminent.

It is suggested that Mr. Groves should seek the closest co-operation with local Europeans in reporting earthquake phenomena. Volcanic earthquakes are usually transmitted through a very limited section of the earth's crust and are rarely felt more than a few miles from their focus. Detailed reporting of the frequency and intensity of local earthquakes would assist in localising the source of the disturbances.

The installation of an earthquake recorder at Esa Ala would produce records which could be used as a basis to assess the importance of earthquake reports from other parts of the district.

The composition of the lava and the nature of the ejecta in the area indicates that should an eruption occur it will be violently explosive. The long period of dormancy would suggest an outburst of major proportions.

In assessing the importance of local seismic activity the possibility of a new vent developing should not be neglected, especially in the area between Oiau Crater and Dobu Island.

REFERENCES

Edwards A.R.M. Report on Investigation of sulphur deposits Iamelele-Pagululu District - Fergusson Island B.M.R. Records 1950/29.

Marsh D.R. Separate Report on volcanic disturbance inland Collingwood Bay, Tufi District. ANGAU Report 9/1/44.

Patrol Report 12 of 43/44 Tufi.

DISTRIBUTION

Assistant Administrator, Port Moresby,

Vulcanological Observatory, RABAUL

Chief Geologist, Bureau of Mineral Resources, Canberra.

District Commissioner, Samarai

Senior Geologist, Dept. Lands, Mines & Surveys Port Moresby

Specimen F.5152. From Ikurani Volcano

QUARTZ TRACHYTE.

A porphyritic, trachytic rock containing phenocrysts of orthoclase, green pyroxene and rare plagioclase set in a finely felted groundmass of orthoclase, several species of amphibole and interstitial quartz.

The phenocrysts of orthoclase average about 1.5mm long and are stumpy-prismatic to elongated-tabular in outline. Many of these crystals have suffered varying degrees of magmatic corrosion from a mere rounding off of interfacial angles to considerable resorption and embayment. Cleavage, (001) and (010), is often well developed, and simple (Carlsbad) twinning is common. The feldspar is optically (-) with 2V= moderate.

The pyroxene is a pale green aegirite forming microphenocrysts about 0.4mm across, though occasionally reaching up to 1.2mm. The crystals are euhedral, stumpy-prismatic, and exhibit little or no evidence of alteration. One of the larger crystals has been irregularly resorbed and lies in contact with a potash feldspar crystal in such a manner that the feldspar has partly infilled an embayment in the pyroxene; clear proof that the pyroxene preceeded the feldspar in crystallisation.

The porphyritic plagioclase is an albite-oligoclase in corroded, but originally euhedral crystals up to 1.5mm long. It is unaltered and possesses close polysynthetic twinning of albite type.

Feldspathic material constitutes the major portion of the groundmass, the remainder of which consists of interstitial quartz, amphibole and pyroxene. The amphibole is normally a brown oxyhornblende with

X = pale brownish,
Y = bright yellowish brown,
Z = deep brown,

and having a maximum extinction angle of 11°. It is often zoned, passing outwards into a rim of blue sodic amphibole with

X = pale brownish, (straw-coloured),
Y = greenish brown,
Z = blue.

These rims of sodic amphibole are always small and accurate determination is therefore difficult, but it appears to be an arfvedsonitic type and, at all events, certainly a sodic variety. Other areas of very deep brown, almost opaque amphibole sometimes take the place of the sodic type as rims on the oxyhornblende. Similar, deeply coloured amphibole forms abundant minute grains scattered throughout the groundmass and in many cases has been completely altered to hematite. Minute crystals of greenish clinopyroxene are also abundant in the groundmass but could not be satisfactorily identified.

(R.D.Stevens).

FIG. 1.

FERGUSSON & DOBU ISLANDS showing RECENTLY ACTIVE CRATERS & THERMAL AREAS

O = Thermal points described in text

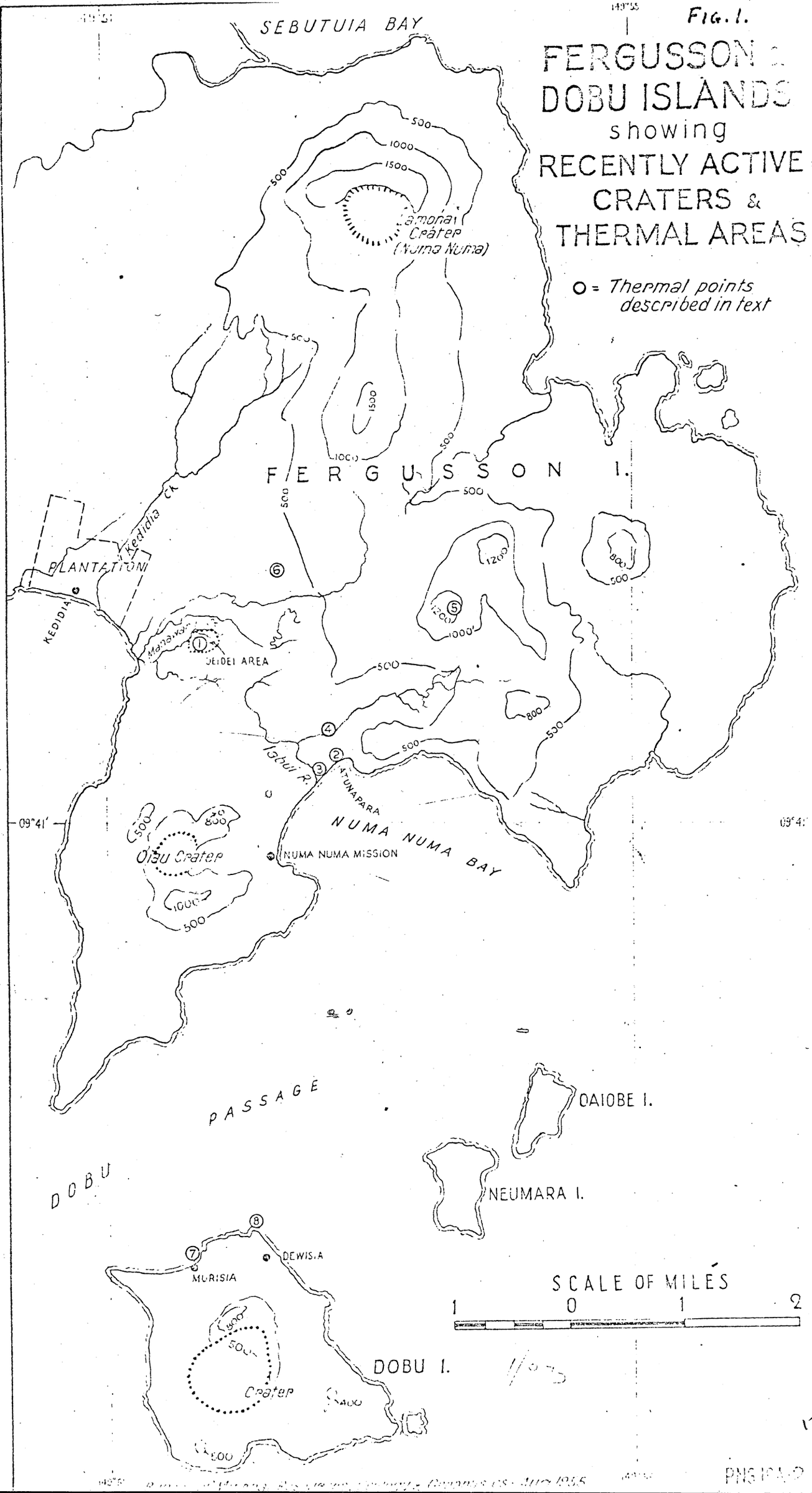
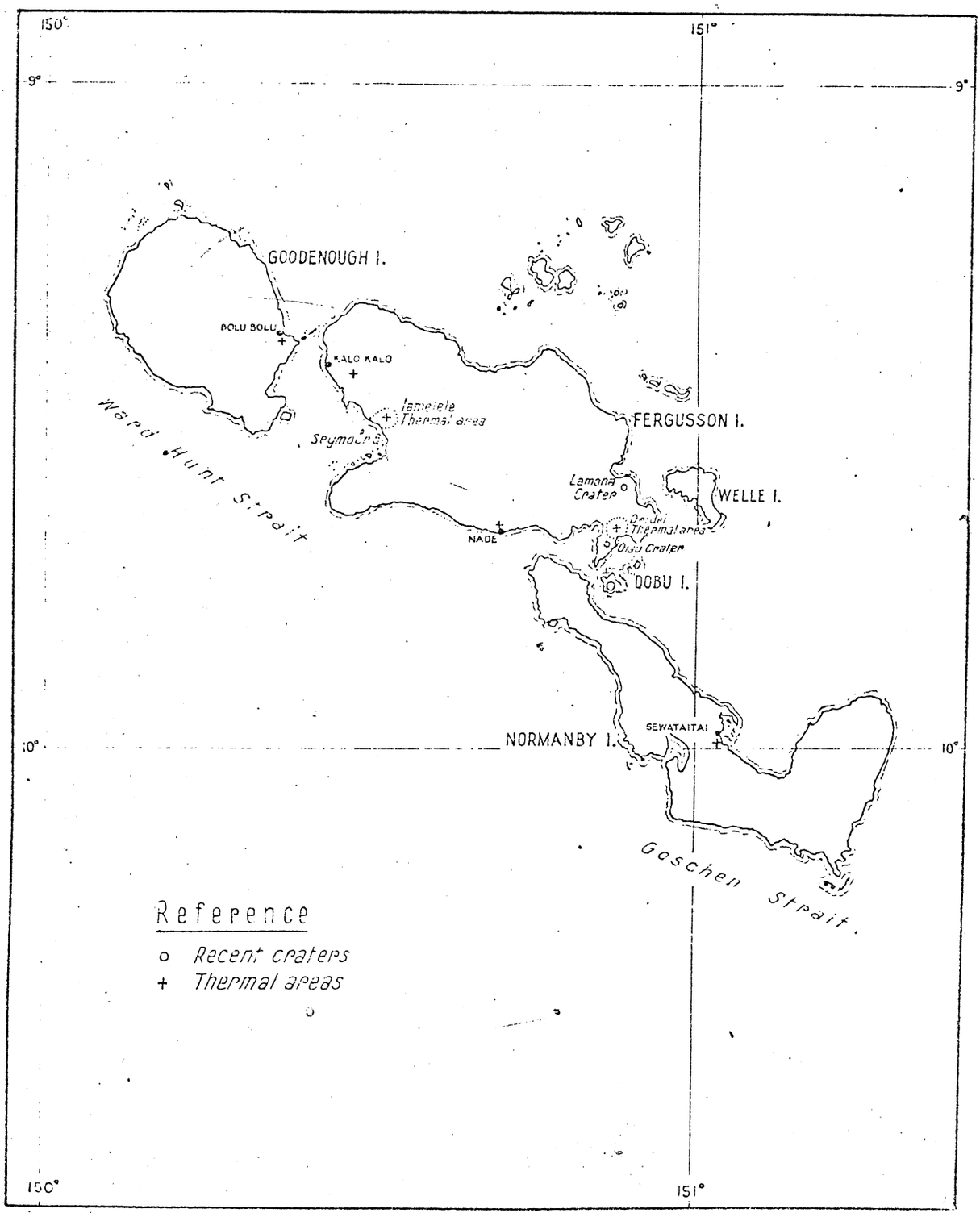


FIG. 2.

D'ENTRECASTEAUX ISLANDS
showing
RECENT CRATERS AND THERMAL AREAS

SCALE OF MILES
10 0 10 20 30



13

Bureau of Mineral Resources, Geology and Geophysics · Aug 1953

PNG-16A-1