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DEPARTMENT OF NATIONAL DEVELOPMENT  
BUREAU OF MINERAL RESOURCES  
GEOLOGY AND GEOPHYSICS

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RECORDS:

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1968/34



RESIDENT GEOLOGISTS - TERRITORY OF PAPUA AND NEW GUINEA  
ANNUAL SUMMARY OF ACTIVITIES  
January 1st, 1967 - December 31st, 1967.

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The information contained in this report has been obtained by the Department of National Development, as part of the policy of the Commonwealth Government, to assist in the exploration and development of mineral resources. It may not be published in any form or used in a company prospectus without the permission in writing of the Director, Bureau of Mineral Resources, Geology and Geophysics.

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January 1st 1967 - December 31st 1967.

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Prepared in the Office of  
the Senior Resident Geologist  
Department of Lands, Surveys and Mines.  
Port Moresby

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# RESIDENT GEOLOGISTS - TERRITORY OF PAPUA AND NEW GUINEA

## ANNUAL SUMMARY OF ACTIVITIES

January 1st 1967 - December 31st 1967

### INTRODUCTION

Although there have been some shortfalls in meeting programme targets during the year, the advantages of programming major activities have again been apparent.

The principal lesson to be learned from the shortfall is that programming has, as in previous years, been too ambitious. This conclusion has been reached after a careful review of both the circumstances and the reasons associated with the failure to meet targets. Another important reason is the need to deal with unforeseeable ad hoc problems.

The principal organizational developments during the year have been the rationalization of policy with regard to the functions of the Branch, especially in relation to the activities of Bureau of Mineral Resources Field Parties, and the determination by the Minister for Territories which established the Branch as a separate entity within the Department for Lands, Survey, and Mines and, at the same time, considerably increased its establishment.

Once again, progress is described for the most part in terms of Investigations and Projects begun, continued, or completed.

### HEADQUARTERS & ADMINISTRATION

The Senior Resident Geologist was forced to reduce his field visits and other inspections because of the need to attend Statutory Board and other committee meetings and to deal with important organizational and administrative matters.

However, field activities and outstation services have been satisfactorily maintained. Nevertheless, the need for support at a senior level has been apparent, and the full work potential of the Branch cannot be realized until this is available.

By determining that the Branch should be established as a separate entity within the Department of Lands, Surveys, and Mines and by creating 29 new supporting staff positions, the Minister for Territories both acknowledged the need for effective geological and volcanological services and provided a satisfactory establishment for their immediate development. When these newly created positions are filled, the Branch will be able to operate effectively and to fulfil its established functions for the next two years, providing that the necessary professional positions are also created and filled. In this latter respect, two new positions have been created, and one has been filled, during the year: those of an Engineering Geologist, Class I, and a Seismologist, Class I.

Other activities of the Senior Resident Geologist included many consultations with representatives of mining and petroleum exploration companies; the programming of the Rabaul Crustal Study Project; the editing of results of investigations and projects; the supervision of Branch activities; and advisory functions in connexion with Bureau of Mineral Resources activities and other individual research projects in the Territory. At the same time, a close liaison was maintained with the University of Papua and New Guinea and also with other Government Departments. Preparations for the proposed meeting of ANZAAS in 1970 have also been undertaken.

Distinguished visitors during the year included Professor Maurice Ewing, Director of the Lamont Geological Observatory, University of Columbia, New York, who offered assistance in the form of oceanographic research vessels and post-graduate research students in the field of volcanology and its relation to seismology.

The Senior Resident Geologist served throughout the year as a member of the Mining Advisory Board, the Petroleum Advisory Board, the Science Faculty of the University of Papua and New Guinea, the Council of the Scientific Society of Papua and New Guinea, and as Chairman of the Advisory Committee on Seismology and Earthquake Engineering.

## REGIONAL MAPPING AND MINERAL INVESTIGATION SECTION

### INTRODUCTION

During the year the professional staff consisted of R.P. Macnab and R.J. Tingey (from 6th January), in the Port Moresby office, and R.G. Horne and J.A.J. Smit (from 20th June) in the Wau office. Macnab proceeded to Canberra on 9th November on a five week duty visit, before commencing leave. Horne commenced recreation leave on 30th November, and Tingey on 13th December. Smit resumed duty on 20th June after a duty visit to Canberra (January) and recreation leave.

The section carried out work in areas of the Central District of Papua (Port Moresby, Mori River), and the Western Highlands (Porgera), Eastern Highlands (Kainantu), Morobe (Wau) and East New Britain (Gazelle Peninsula) Districts of New Guinea. Staff members also joined Canberra-based field parties for varying lengths of time. Smit joined H.L. Davies (Papuan Ultramafic Belt) for two weeks at the end of June, in the Morobe District, and the Sepik River field party from mid-July to early October. Macnab joined the Sepik River field party for five weeks starting early in September, and spent one week with Davies in the Mt. Suckling area of eastern Papua, in mid-October. Tingey spent several weeks in the field with Davies in early October, in the Mt. Suckling area. Much of the work carried out by Tingey in the Port Moresby area was directed towards problems of engineering geology, and he joined the Engineering Geology unit for field mapping of part of the proposed Ramu Hydro-electric Scheme, from mid-June to early July.

PORT MORESBY UNIT

PROGRESS ON PROJECTS AND INVESTIGATIONS

Copper Deposits in the Upper Warangoi Area, East New Britain (66201)

Late last year it was decided that no benefit would be gained from further work by the Administration in this area, and in January a completion report for the investigation was prepared (R.P.M.)

Subsequently the Reservation was revoked by the Administrator, and a Prospecting Authority was applied for by a syndicate comprising Mr. O.I. Ashton, M.H.A., and five natives from Arumbum village. A preliminary examination of the area was carried out by Asarco, who decided not to proceed because of unfavourable results.

Most of the diorite host rock to the mineralization is entirely barren, the mineralization being uncommon and localized; the host rock is invariably fresh and there is no suggestion of large scale alteration and, although quite extensive shearing has taken place, the mineralization pre-dates this, and there is no ore concentration in shear zones. There is no zone of secondary enrichment of copper ore inferable from surface observations.

Gazelle Peninsula Reconnaissance Mapping (67101)

Field work was carried out (R.P.M.) between mid-February and late May in the Gazelle Peninsula, initially in the North Baining Mountains, and then in the Central and South Bainings. D.B. Dow (B.M.R., Canberra) provided field supervision for part of the fieldwork in the Central Bainings in mid-April. Fieldwork was confined largely to the "basement" areas of the Peninsula.

The oldest rocks in the Gazelle Peninsula are indurated Eocene marine volcanic greywackes, volcanic conglomerates, agglomerates and some interbedded lavas. They were deformed and intruded by (basic-) intermediate - acid plutonic rocks and more extensive basic hypabyssal rocks, before the Lower Miocene.

In the North Baining Mountains, the Eocene "basement" is overlain by generally sub-horizontal Lower and Middle Miocene limestones and calcareous shales- Upper Miocene limestones form the Ranengit Range on the north coast, but the stratigraphic relationship is not known.

In the Mt Sinewit area of the Central Baining Mountains, a considerable thickness of massively bedded tuffaceous sedimentary rocks crop out; these form prominent cliffs from Mt. Sinewit to the Toriu River. Ash flow tuffs crop out on the divide between the Nengmukta and Mevlo Rivers, below the soft tuffaceous sediments of Mt Sinewit. The age of these rocks is not known, but they are probably Upper Miocene-Pliocene. Regularly bedded, undeformed, tuffaceous carbonaceous sediments (derived from rhyolitic and andesitic volcanic detritus) which crop out for more than a mile along the middle Nenginukta River are possibly older.

In the headwaters of the Kavavas River, and forming the ranges between the Kavavas and the east coast, are Upper Miocene to Pliocene volcanics (lava flows, agglomerates and tuffs), interbedded with marine tuffaceous sediments. These rocks are strongly faulted and are often quite steeply dipping. In the vicinity of Simbum village, inclined marine sediments of the succession are overlain by a thin veneer of sub-horizontal Pleistocene limestone.

A considerable thickness of marine volcanic rocks cropping out in the middle Merai River, is similar to the Eocene volcanics, but has a Lower Miocene "e" stage age. These cannot be correlated with either the Eocene or the Upper Miocene - Pliocene successions.

Gently dipping sediments in the Wide Bay area are tuffaceous, and quite similar to some facies of the east coast volcanics, to which they may be related.

Geological maps of the Gazelle Peninsula and a draft report of traverse and laboratory results (including the study of several hundred thin sections), have been prepared.

#### Port Moresby 1:50,000 Map Sheet Area. (R.J.T.)

This project is designed to provide a geological map of Port Moresby and environs, with special consideration being given to problems of engineering geology, principally the location of aggregate material, and suitability of rock for building foundations.

Fieldwork is continuing as weather and time permit. This includes the collection of material containing micro-fossils (to be forwarded to B.M.R. Canberra), and the collection of structural data. From this it is hoped to produce a clear picture of the stratigraphy and structure of the Port Moresby area.

#### Mori River Traverse (R.J.T.)

In mid-October a short traverse was carried out in the Mori River, above Ianu village. The traverse had to be terminated because of lack of co-operation from the local people.

River float and outcrop showed that the Wavera Volcanics (equivalent to part of the Urere Metamorphics of the Musa Valley area) extend over the mountain range onto the south fall. The rocks are latered and epidotised submarine lava, and minor altered limestone and calcareous sediment. They are quite strongly jointed. Fresh andesite porphyries intrude the succession, and altered gabbro is present in the float. Analysis of a small number of stream sediment samples shows a quite high background value of about 90 p.p.m. copper for the volcanic rocks. Pyrite mineralization occurs in the float, and minor chalcopyrite is present in one specimen.

WAU UNIT

Prospecting Investigations, Waruwari Hill Area,  
Porgera River Goldfield (65302, R.G.H.)

Following <sup>2</sup>preliminary investigations and mapping at a scale of 1 inch to 80 feet, which were summarised by an Interim Note, further mapping and channel sampling were carried out (December, 1966) in the Rambari Valley to the north of Waruwari Hill (the principal area of gold shed). Part of the drill core previously recovered by Bulolo Gold Dredging Ltd., was also logged.

During the year an Investigation Note was completed compiling the results of fieldwork, laboratory study and assays.

In the Waruwari Hill area the results can be summarised as follows:-

- (1) The early Tertiary Lagaip Beds, composed largely of fine grained black shale, have been intruded by diorite, followed by andesite porphyry.
- (2) Gold, of fineness 713 to 791 is associated with the intrusions of andesite porphyry. It occurs with very finely crystalline pyrites along the margins of thin quartz stringers. These stringers form local stockworks both in the shale, and in the andesite porphyry.
- (3) Most of the channel samples collected have a low gold content ranging from 0 to 3.0 dwt/ton. Sample values exceeding 5.0dwt/ton Au, generally occur on or near the andesite porphyry intrusions. No large potential lode occurrences were located.
- (4) It is probable that the alluvial gold which has been recovered from the surrounding streams, accumulated over a considerable period of time from the rapid denudation of small stockworks.
- (5) Geochemical determinations showed that the principal metallic element relationships are similar to those associated with the acidic intrusions of the Morobe Goldfield. The related elements are:- gold, silver, copper, lead, zinc and manganese: this relationship is reflected in the mineral assemblage of the auriferous veins.

Recommendations include:-

- (1) Further prospecting and mapping around the andesite porphyry intrusions.
- (2) Prospecting along the main range of hills to the north-west. (carried out by Carpentaria Exploration Ltd.).
- (3) Additional pitting to bedrock above area of current alluvial mining.
- (4) Further drilling to delineate the extent of the auriferous body located by Bulolo Gold Dredging Ltd.



Geochemical Orientation Survey, Wau Area (65105, R.G.H.)

During the year, element concentration sheets and graphs were prepared, and a completion report compiled.

From the investigation it was concluded that:-

- (1) The predominant pathfinder metallic elements for gold are silver and arsenic. These two elements have a known established relationship with gold.
- (2) Other elements related by origin to this association are:- copper, lead, zinc, manganese, nickel, chromium and cadmium.
- (3) The correspondence of anomalous concentration recordings for these elements indicated that they were introduced during the same or related phases of mineralization, namely those which introduced the gold. From the work of Dr Fisher, the gold is known to have been introduced over a period of time, but was derived from a single magmatic source.
- (4) Vanadium appears to have had an earlier origin. It was not concentrated in the residual metalliferous fraction of the magmatic rocks.
- (5) No outstanding associations were recorded between specific elements and any of the rock types in the area.
- (6) Background concentrations were comparable with the averages given in the literature consulted, for similar rock types.
- (7) Streams draining the area of acid porphyry intrusions, carry a significantly higher concentration of metallic elements than those which drain an area of related granodiorite. Time, and mode of emplacement are possible controlling factors.

Recommendations include grid pattern sampling of selected areas, and linear sampling along the base of steep slopes.

Gas Vent, Koranga Opencut Workings, Wau (R.G.H.)

The gas vent was first reported at the end of May: a visit was made on the 28th of that month, and a brief report prepared. Instrumentation and chemical studies were then initiated by Mr. G.A.M. Taylor. Surveillance of the vent, including seismic, tiltmeter, temperature and gas emission recordings, were continued for the next four months, concurrently with sampling, surveying, mapping and visits to local hot springs.

Temperatures exceeding 600° C. were recorded until the 13th August, 1967, after the removal of surface debris. On the following day the gas emission had ceased owing to the movement of surface talus. This movement continued extensively for the next two weeks. From the 30th August to the 1st September a hole was excavated at the last site of the vent, but no direct evidence of its previous existence was apparent. A survey of the hole showed that its base was 20 feet below the last surface position of the vent three weeks earlier.

Instrument and chemical studies produced no conclusive evidence supporting a volcanic source for the vent. Considerable further work possibly including drilling, would be necessary to determine the actual origin of the vent.

Bilimoia Prospect, Kainantu (66302, R.G.H.)

This prospect was visited briefly in order to assess the progress of a core drilling programme. In all, four holes were completed.

Kennecott Explorations (Aust.) Pty.Ltd., are understood to have negotiated an option with the leaseholder, Mr. K. Rehder.

Kathnel Gold Mine, Kainantu (65309, J.A.J.S.)

An Investigation Note was written on this mine and recommendations for drilling were made. Drilling was carried out by the Division of Mines under the subsidized drilling programme but, unfortunately, the core recovery was so poor that conclusions could not be drawn from it.

ENGINEERING GEOLOGY SECTION

INTRODUCTION

The following professional staff changes occurred during the year:

Mr. J.P. MacGregor resigned from the Commonwealth Public Service on July, 28th.

Mr. J.R.L. Read commenced leave on November 13th, and at the end of the year tendered his resignation from the Commonwealth Public Service.

Mr. J.C. Braybrooke was on loan to the Section from Canberra in April-July and joined the Section on September 11th.

Mr. P.E. Pieters joined the Section on December 11th as hydro-geologist, a position created earlier in the year.

Mr. I.S. Cumming continued as site geologist for the Rouna No. 2 project until December 31st after which he will join the Section.

Apart from miscellaneous investigations, 22 projects and investigations were carried out by the Section. Five Bureau of Mineral Resources Records have been issued and six Records are in final preparation. Fourteen Resident Geological Branch Notes were issued. A paper on groundwater investigations in the Territory was submitted for publication in the Journal of Engineering Geology.

The work of the Section is divided under three headings:  
(1) Major hydro-electric schemes, (2) Water Supplies, (3) miscellaneous engineering investigations. During 1967, 40% of the work time was spent on (1), 40% on (2) and 20% on (3).

#### MAJOR HYDRO-ELECTRIC SCHEMES

##### Upper Ramu Hydro-Electric Scheme (65403)

Detailed geological investigations for the Upper Ramu Hydro-electric Scheme were completed during the year. The design report is being edited for issue as a Bureau Record.

##### Lower Warangoi Hydro-electric Scheme. (65409)

Geological investigation of the Lower Warangoi Hydro-electric Scheme was completed during the year. Owing to the occurrence of several unfavourable geological features, particularly the permeability of the abutments and the presence of an extensive bed of permeable sand and gravel in the reservoir, it was concluded that construction of the scheme would be uneconomic and further investigation has been abandoned.

The report on the investigation was prepared for issue as a Bureau Record.

##### Upper Ramu Hydro-electric Scheme, Stage 2 Development, (67409)

Following a proposal from the World Bank to investigate the possibility of further developing the proposed Upper Ramu Hydro-Electric Scheme so as to utilize the full hydraulic head available in the Ramu Gorge, geological mapping was carried out in the Ramu Gorge area during June and July.

The area mapped consists largely of a body of granodiorite intruded into hornfelsed shale, siltstone, greywacke and marble of the Omaura Greywacke. Geologically, any proposal for the development of hydro-electric power in the gorge is considered feasible although, because of the high level of seismic and landslide activity, a subsurface layout is preferred.

A report on the geological investigation is being edited for issue as a Bureau Record.

##### Raising of Sirinumu Dam. (67410)

Geological investigations for the raising of Sirinumu Dam commenced in May. Work includes the geological mapping of the dam and spillway sites, erodability tests and diamond drilling.

Supervision of the geological investigation was maintained by the Rouna No. 2 Project site geologist, Mr. I.S. Cumming.

Lauis River Dam, Manus Island (67416)

C.D.W. Port Moresby asked for a geological survey of a site on the Lauis River for a hydro-electric scheme to supply power to the east end of the Island.

WATER SUPPLIES

Water Supply - Daru Township. (65414)

The Note on the investigation of the water supply for the township of Daru carried out between 1962 and 1966 was distributed and later issued as a Bureau Record.

Water Supply - Administrative College. Waigani. (65423)

Two more bores were drilled at the Administrative College at Waigani. Neither bore is capable of producing the amount of water required by the College and the project will probably be abandoned.

Village Water Supply - East and West Sepik Districts. (66405)

The village water supply survey in the East and West Sepik Districts was completed in December, 1966. In all 142 places were visited and 123 recommendations for supplies of drinking water prepared.

A Note which includes all the recommendations was distributed to all departments and local government councils concerned. The Note was later issued by the Bureau as a Record.

Water Supply - Quarantine Stations, Western District. (66407)

A survey was conducted in November, 1966, along the West Irian Border in the Western District to examine the suitability of water supplies at sites chosen for quarantine purposes in case of an outbreak of an infection of epidemic proportions.

Eleven border stations and quarantine sites were visited. A Note containing recommendations for the development of the water supplies was distributed and later issued as a Bureau Record.

Water Supply - Resettlement Areas, Cape Hoskins. (66409)

An investigation to locate suitable water supplies for the resettlement areas of Tabai-Rikau and Lavilelo, Cape Hoskins, West New Britain District, was carried out in November, 1966. It was concluded that groundwater should occur at a depth of about 100 feet and seven bore-holes were sited. Subsequent drilling at these sites has so far been successful. A Note was distributed.

Water Supply - Margarida Patrol Post. (67401)

A brief visit was made to Margarida Patrol Post, Central District, in January and new sites recommended for the station water supply. A Note was distributed.

Village Water Supply - Gulf District. (67402)

The third village water supply survey was carried out during April, May and June in the Gulf District. 204 places were visited and 178 recommendations for supplies of drinking water prepared by the survey team.

A Note including all recommendations has been prepared for distribution to all departments and local government councils concerned. The Note will be submitted for issue as a Bureau Record.

Water Supplies - Resettlement Area. Mt. Hagen. (67407)

An investigation of water supplies for the resettlement areas of Kondepina, Kindeng and Avi near Mt. Hagen in the Western Highlands District was undertaken in April. The areas are situated on the alluvial flats of the Wahgi Valley where adequate supplies of groundwater occur close to the surface. Recommendations were made for extensive development of standard sanitary wells. A Note was distributed.

Groundwater School, Adelaide. 1967 (67408)

During May Mr. J.R.L. Read attended the 1967 Groundwater School held in Adelaide by the Australian Water Resources Council. Mr. Read presented a paper on village water supply investigations in the Territory of Papua and New Guinea describing the work carried out in the Territory by the village water supply survey team. The paper, which was prepared jointly by Mr. J.P. MacGregor and Mr. Read was later issued as a Bureau Record and was submitted for publication in the Journal of Engineering Geology. A Note on the Adelaide visit was submitted to the Department of the Administrator and the Overseas Travel Committee of the Public Service Board (T.P.N.G.).

Village Water Supply - Western District. (67413)

The remaining area of the Western District was visited by the village water supply survey team between October 16th and November 4th. A Note is being prepared and will be issued as a Bureau Record.

Water Supply - Port Moresby. (67414)

Information of bores in the Port Moresby township area is being collected and examined. The investigation is to determine the supply of groundwater available during an emergency.

Water Supplies - Miscellaneous

Advice on water supplies were given to villages, private landholders and other departments. Sites for bores were selected at Barakau Farm, Merigida Farm, Daumagini Primary T School, the Port Moresby Rugby Union Ground, Nebiri Quarry and the Waigani sewerage depot. Advice on the siting and development of wells was given to Gidobada and Poribada villages.

Water Analyses

In the past, analyses of water samples collected in the Territory have been carried out by the laboratory of the Department of Agriculture, Stock and Fisheries and also by the Queensland Government Laboratory. However, since the appointment of a chemist to the Mines Division, Lands Department, many analyses have been carried out in the Mines Division Laboratory.

The use of a Tectron salinity bridge during village water supply surveys has given a useful indication of total soluble salt content under conditions where detailed sampling and laboratory testing have previously been impossible.

MISCELLANEOUS ENGINEERING INVESTIGATIONS.

Aggregate - Jacksons Airport, Port Moresby. (66408)

Investigations to locate aggregate suitable for use in Portland and bituminous concrete and to produce fine crushed rock for construction of flexible pavements were continued throughout the year by Mr. I.S. Cumming and Mr. R.J. Tingey. The most likely source appears to be fresh Sadowa Gabbro occurring near the Goldie River Army Camp.

An interim report was prepared by Mr. Cumming and a Note has been prepared by Mr. Tingey.

Landslides - Bona Area, Chimbu District (67403)

In February a visit was made to the Bona Area of the Chim Valley to assist the Mt. Wilhelm local government council to apply a rule introduced by the council prohibiting cultivation and grazing within a declared landslide area. A Note was distributed.

Limestone Caves - Chimbu and Eastern Highlands Districts. (67404)

In February a quick survey was carried out to determine the tourist potential of limestone caves in the Chimbu and Eastern Highlands Districts. Three main sets of caves were visited but none were found to be suitable for development. A Note was distributed.

Engineering Geological Investigation for C.R.A. Bougainville (67405)

An investigation to assess the nature and extent of the engineering geological problems associated with the development of the C.R.A. mining lease at Panguna Flat, Bougainville Island, was carried out in March. It was concluded that a detailed investigation would be required to determine the distribution, classification and strength of rock types, and the nature and distribution of persistent weak zones. An analysis of the regional hydraulic conditions and an evaluation of alternative road alignments and port sites would also be necessary. The Note on the investigation was later issued as a Bureau Record.

Minj - Wahgi River Roadway (67406)

A Geological investigation was carried out in April along the proposed alignment of the Highlands Highway between Minj and the Wahgi River. The sections inspected traverse extensive alluvial deposits of clay, silt, sand and gravel within the Wahgi Valley and it was concluded that, apart from one or two areas, construction of a permanent alignment should present few major geological problems. A Note was distributed and submitted to the Bureau for issue as a Record.

Popondetta - Kokoda Road. (67411)

The alignment of the proposed roadway between Popondetta and Kokoda was examined during July. The investigation included an appraisal of the stability of the Oivi Hill section, an examination of the large boulders preserved in the alluvium in the Luwuni and Yadda Valleys and a search for possible sources of base-course and binder materials. A Note, which will later be issued as a Bureau Record, was distributed.

Slope Stability - Naval Fuel Tank Excavation, Port Moresby. (67412)

Rock falls on one side of the excavation for the Naval Fuel tank have caused some damage to the installation. The excavation was inspected by Mr. Tingey and a Note distributed.

Mt. Hagen - Mendi Road (67415)

Public Works Department have asked for a geological survey of the Kaugel Gorge section of the new road alignment. This investigation will be carried out as soon as access to the area is restored.

Miscellaneous

Advice was given on foundations for several buildings in Port Moresby and at the Institute of Higher Technology, Lae. Drill core from the Tua River bridge site and terminal building site at Jacksons Airport was logged. Two possible sources of silica sand for a glassmaking industry based in Lae were disproved.

Advisory Committee on Seismology and Earthquake Engineering

Quarterly meetings of the committee and meetings of the sub-committees were attended.

In August Mr. I. Skinner of the N.Z.D.S.I.R. toured the Territory and recommended locations for the installation of strong motion recording instruments. During Mr. Skinner's visit members of the committee inspected damage caused by earthquakes which occurred on August 14 in the Gazelle Peninsula region of the East New Britain District.

VOLCANOLOGICAL SECTION

INTRODUCTION

The professional staff comprised Dr. G.W. D'Addario, Mr. R.F. Heming and Mr. I.E. Smith, and the senior technical staff consisted of Mr. N.O. Myers, Mr. M.F. Gill (until 22nd September) and Mr. R.J. Conway (from 6th December).

Dr. D'Addario undertook a study tour in Europe between 19th April and 28th September to familiarize himself with the latest developments in gas analysis as a means of volcanic surveillance. During his absence Heming acted as Volcanologist-in-Charge and Mr. I.E. Smith was attached from the B.M.R. Canberra, as a Volcanologist.



Highlights of the year's activities were the completion, to the stage of operational testing, of the Rabaul Volcanological Warning Network and the completion of the field phase of the Rabaul Crustal Study Project.

The unusually high seismic activity felt in Rabaul during the last quarter of the year placed a considerable strain on the professional, technical and supporting staff.

#### PROGRESS ON SPECIAL PROJECTS AND INVESTIGATIONS

##### Revision of New Guinea Earthquake Epicentres (66502)

Progress on this project, which is a long term investigation, has been sporadic throughout the year due to the lack of experienced Seismogram readers.

Teleseisms and large Regional earthquakes have been revised using U.S.C.G.S. data for the months of May and June 1966. The revision of the preliminary analysis for later months has continued as time permitted. The revised analyses were entered in I.S.C. cards and despatched to Edinburgh for final analysis and processing.

##### An Investigation into the Design and Development of Power and Timing Equipment for Seismic Installation. (66504)

This project has been completed and an Investigation Note has been prepared.

##### Structure and Geology of Blanche Bay and Adjacent Areas (66509)

Work on this project has been carried out as time permitted. A number of lava samples have been collected from the eastern side of the Caldera, and the detailed mapping of the ash layers on the western side of the Caldera, along the Kokopo road and along the Tomaringa road was begun and, already, a number of marker horizons have been found. The thicker ash beds which were originally thought to be monotonous are very complex and better sampling and grading techniques will have to be used to determine their full significance.

There is a large range of lava types within the Blanche Bay Caldera; from the basaltic scoria found on the Mother Volcano through andesites in the Caldera wall behind Tavurvur volcano, to possible dacites in Rabalanakaia crater and on the North Daughter.

In road sections, a number of "extinct" vents have been found as well as old soil surfaces and beds of basaltic lapilli which can be used as marker horizons.

Analysis of Seismogram Records from Rabaul Observatory in conjunction with the Preliminary Geophysical Survey of Blanche Bay. (66510)

A number of maps were drawn on which the shot positions were located. The results of the analysis with the maps were sent to the Geophysical Branch in Canberra.

Rabaul Crustal Study Project (67101)

This Project was based on a pilot study which took place in 1966.

The objects were to determine:

- (a) the crustal structure of the Rabaul area;
- (b) the seismic velocities which occur within the crust of the area;
- (c) the general geologic structure of the area.

The information to be obtained is essential to a full interpretation of the records obtained from the Rabaul Volcanological Warning Network, and to an understanding of volcanic and tectonic mechanisms in the area.

The Administration's training ship m.v. "ARCTURUS" was made available as the shooting ship, and another Administration vessel, m.v. "LAHARA", was used for transport and supply duties. A third ship for use as a recording station was chartered by the B.M.R.

Over 40 shots, representing a total of 15 tons of explosive, were fired. The resultant shocks were recorded at 11 portable stations and at the five stations which form the Rabaul network. Two of the stations were supplied and manned by the University of Hawaii, two by the University of Brisbane in conjunction with the Queensland Geological Survey; five by the Bureau of Mineral Resources; and two by the Branch.

The position of each recording station and the position of the ship at the time of each shot were determined by officers of the Survey Division, Department of Lands, Surveys and Mines.

The value of careful planning and thorough briefing, coupled with an effective communication system, was evidenced by the very high proportion of shots recorded by each station.

The field phase of the Project was carried out in October and November. The majority of first arrival times had been picked by the end of the year, and plans have been made for the early publication of preliminary results.

Thermal Areas of Papua and New Guinea (67502)

Water samples were collected from Blanche Bay, Dei Dei, Iamelele, Talasea and Pangalu and Levigi, and samples were sent to Canberra for analysis. The results have been included in a paper describing the present state of knowledge of the Territory's thermal areas which was submitted for inclusion in the Symposium on the Genesis of Thermal and Mineral Waters to be presented at the XXIII International Geological Congress in Prague, 1968.

## ROUTINE ACTIVITIES

### SEISMOLOGICAL

Seismograms have been regularly obtained at Rabaul and the preliminary analysis of Rabaul seismograms and those from other stations have been incorporated in the weekly preliminary bulletin.

The earthquake analyses have been entered on a card index together with data from other stations, results from U.S.C.G.S., I.S.C., and revised analyses based on published records.

The U.S.C.G.S. data centre was closed in July owing to lack of funds, and they have requested all stations co-operating in the W.W.S.S. Programme to hold all original copies of seismograms until further notice. Daily telegrams to U.S.C.G.S. containing arrival times, amplitude and period measurements have been regularly despatched.

Mark Sense Cards up to May 1966 have been despatched to the International Seismological research Centre in Edinburgh and consideration is being given to installing card punching equipment.

### Seismic Activity During 1967

Notable seismic events which occurred in the New Guinea Islands region during the year were a seismic storm in the Solomon Islands during April and two earthquakes centred off the eastern Gazelle Peninsula in August. From the 9th to the 11th April, Buin and Aropa in Southern Bougainville experienced thirteen felt shocks ranging in intensity from I to IV (M.M. Scale). The epicentres subsequently determined by U.S.C.G.S. all lay in the region to the south-west of the Shortland Islands in the northern Solomon Islands.

On the 14th August the eastern Gazelle Peninsula was shaken by two severe earthquakes which caused considerable damage to property in the Kokopo district, and were felt widely in the Gazelle Peninsula and Southern New Ireland. The main shocks were followed by a number of aftershocks which were still being felt in the Kokopo area two weeks later.

General seismic activity throughout New Guinea was high during April and August 1967.

### OBSERVATORIES

#### Rabaul Harbour Network

Three of the five stations have been brought into full operation during the year. These are Wanliss Street, Rabalanakaia and Sulphur Creek. Taviliu Station has been completed and the final installation of the equipment took place in October, 1967, but there have been difficulties with the V.H.F. equipment.

Tavurvur B was installed on a temporary basis and the permanent station will be completed early in the new year. All the stations were working satisfactorily before the beginning of the Crustal Study Programme.

A period of testing and modification will be necessary before the whole network is on a full operational basis.

#### Kerevat Station

This station began operation on the 18th November, 1966. The records were changed daily by a Volcanological Assistant from Rabaul. This arrangement proved unsatisfactory however, and the station was closed down for most of the year pending the appointment of a part-time observer. The site is not ideal and an alternative one is being investigated with a view to a more permanent installation in 1968.

#### Ulamona Field Station: (Mt. Ulawun)

After the January eruption of Mt. Ulawun a request was made to the District Commissioner for West New Britain for funds to construct a small shed with a seismometer pier near the Catholic Mission at Ulamona.

The station was completed in May and the portable tiltmeters were installed on the 17th July. Brother Kleinlanghorst has been appointed part-time observer, and the tiltmeter readings and volcanological reports are sent to Rabaul.

#### Piva Field Station: (Mt. Bagana)

Regular tiltmeter readings and observations of the main crater were carried out regularly by a part-time observer.

#### Esa 'Ala Observatory

The permanent installation has been in operation for almost one year and a number of faults have become apparent. These have been corrected during visits by Technical Officers, and modifications have been made to the control equipment to facilitate the automatic recording of broadcast radio time signals. The fundamental fault lies in the unreliability of the air-conditioning plant and until this is rectified it is impossible to keep the seismic and other equipment fully operational.

Tiltmeter readings were maintained and temperature readings at thermal areas on Oia Peninsula, Fergusson Island and Dobu Island were carried out regularly.

Agenahambo Station: (Mt. Lamington)

Seismograms and tiltmeter readings were received throughout most of the year. The equipment was damaged by an electrical storm in January. The damaged parts were sent to Rabaul for repair and the station was operational by the 25th February. Excepting minor failures the station was fully operational until a failure of the seismic equipment late in September which necessitated a major overhaul which will not be completed until early in 1968.

An alternative site is being investigated as the present one has certain disadvantages, both technological and administrative.

VOLCANOLOGICAL ACTIVITY

Both Mt. Langila and Mt. Ulawun have been active this year. Very little activity has occurred at other volcanoes in the Territory, although Bagana continued in mild activity following the 1966 eruption, and Manam remained in a state of mild activity.

Mt. Langila

An eruptive cycle began on the 18th January from the No. 2 crater of Mt. Langila. Clouds of brownish ash were erupted from this crater and some of it was blown over the Cape Gloucester Patrol Post and Kalingi Mission. The parasitic cone which has developed on the western slopes of the No. 1 crater was steaming vigorously.

Another eruptive phase began in June and there was a large eruption on the 20th June, accompanied by a sound like a thunder clap and followed by rumbling noises. A number of smaller eruptions followed.

When the volcano was visited in July, activity was continuing. There were a number of eruptions each day which sent brownish clouds up to 2000 feet above the crater before they were caught by the wind and dispersed. All eruptions were from the No. 2 crater and though the parasitic cone on the western flank was steaming vigorously no change in its activity was noticed during eruptions.

The majority of eruptions were quite small, noiseless events which deposited dust in the immediate environs of the crater only. There were a few larger eruptions during August, and dust clouds rising to 20,000 feet were reported.

No new lava material was recorded as being ejected during these eruptions. Many of the eruptions could do no more than lift very fine dust above the crater rim, while the larger ones ejected small pieces of old lava which fell on the slopes of the crater.

Further considerable activity was reported in December, with the usual ejection of boulders, ash laden vapour and steam. Lava flows of recent origin were discovered in the course of a ground inspection at the end of the year.

A report on the eruptive activity during 1967 is being prepared.

#### Mt. Ulawun: (The Father Volcano)

Ulawun erupted on the 20th January 1967 after a glow had been observed over the crater from Ula Mona for the previous five nights. Explosions sent ash and lapilli to 15,000 ft. above the crater and it was carried as far as Lolobau Island fifteen miles north of Mt. Ulawun. A few hot fragments were thrown out on the 22nd when the eruption reached a climax. No more eruptions were observed after this and the only activity was the continuous emission of white vapour with the occasional ejection of dark vapour.

The crater was considerably altered in shape mainly by the slumping inwards of the walls of the crater. When the crater was inspected in July, fumarolic activity was confined chiefly to the crater rim. Occasionally the emission of vapour increased for short periods, but the total emission was usually small.

#### Bagana Volcano

The volcano was visited by G.W. D'Addario, G.A.M. Taylor and R.F. Heming during October 1966.

Two lava flows were noted, one on the south-west flank and one on the western flank. The nuee deposit had cooled considerably by October and only a few secondary vents remained.

An aerial inspection during April showed that the lava flows were still moving slowly down the flanks of the volcano. A report that ashes were being emitted from Bagana was received in May, but this was not followed by an increase in activity. Further mild activity was reported in November.

#### Manam Island

The volcano was visited in November 1966 when the only activity was the emission of gas and vapour from the main and southern vents.

Emission of ash laden vapour from the main vent has been observed during most of 1967, especially during February and from the end of April onwards. Explosions have been noted during July and August, and some fine dust fell over Tabele and Yassa during this period.

### TECHNICAL DEVELOPMENTS

The installation and testing of the Harbour Network Equipment and preparations for the Rabaul Crustal Study Project have involved most of the Technical Officers' time this year.

Mr. P. Watt from the University of Tasmania visited Rabaul in late May and early June for the final installation and testing of the equipment for the Rabaul Harbour Network Stations. Prior to this, various units which had been specially manufactured at the Australian National University were assembled and tested in Rabaul. Four of the five stations were successfully subjected to acceptance tests during early June.

Work for the Rabaul Crustal Study Project included preparation of Willmore seismographs and ancilliary field gear, including aerials, for the two field parties from the Central Observatory. A considerable amount of modification was carried out on the charging equipment and the seismographs. The drum speed of the seismograph was increased to thirty-two revolutions per minute by installing a new motor.

Type B timing and control equipment was developed. This equipment provides accurate timing to  $\pm 20$  milliseconds per 24 hours, frequency regulated power for recorder motors, voltage regulated power for recorder lamps, and automatic recording of broadcast radio time signals.

Modifications were carried out to the Esa'Ala control equipment to enable broadcast radio time signals to be automatically recorded.